

## Appendix C5. Shaft Siting Study (Final Draft)

### 1. Introduction and Purpose

This technical memorandum (TM) was initially prepared to document supported details for the Delta Conveyance Project (Project) Engineering Project Reports, (DCA, 2022a and 2022b). At that time of submittal in 2022, the Delta Conveyance Authority (DCA) prepared two Engineering Project Reports, one report with the Central Corridor and Eastern Corridor and one report with the Bethany Reservoir Alternative. In December 2023, the Environmental Impact Report (EIR) (DWR, 2023) was released and stated that the Bethany Reservoir Alternative would be the selected Project and renamed the Bethany Reservoir Alignment.

In September 2024, this appendix, a part of the Concept Engineering Report (CER), was updated to describe the Project selected by DWR, the Bethany Reservoir Alignment. No technical changes are presented since Final Draft Submittal in 2023. This appendix presents the results of the tunnel shaft siting studies for the Central Corridor, Eastern Corridor (or East Corridor), and Bethany Reservoir Alignment. Although the Central Corridor is no longer part of the Delta Conveyance Project, the conditions considered for the Central Corridor influenced the locations of tunnel shafts evaluated for the Eastern Corridor and Bethany Reservoir Alignment. With respect to the Eastern Corridor, the siting evaluations for the tunnel shafts from Twin Cities Complex to Lower Roberts Island were used specifically for the Bethany Reservoir Alignment. Therefore, information for the siting studies for the Central and Eastern corridors were included in this appendix.

#### 1.1 Purpose

The Delta Conveyance Project (Project) would include intakes along the Sacramento River between the confluences with American River and Sutter Slough and a tunnel between the intakes and the Bethany Reservoir Pumping Plant (BRPP), which would pump the water directly into the existing Bethany Reservoir through a tunnel with launch, reception and maintenance shafts between the intakes and the BRPP. The BRPP would discharge flow through the Bethany Reservoir Aqueduct (Aqueduct), comprised of four large-diameter pipelines connecting to the Bethany Reservoir.

Prior to the development of the Bethany Reservoir Alignment, two other tunnel alignments were considered, Central and Eastern corridors. Portions of the initially considered Eastern Corridor were incorporated into the Bethany Reservoir Alignment. The purpose of this technical memorandum (TM) is to document methods used to identify and evaluate potential shaft sites, the criteria used for the evaluation, and recommendations for the launch, maintenance, and reception shaft sites for the Bethany Reservoir Alignment and the Central and Eastern corridors.

### 2. Organization

This TM is organized as follows:

- Introduction and Purpose
- Organization
- Initial Launch Shaft Siting Study for the Central and Eastern Corridors
- Initial Maintenance and Reception Shaft Siting Study for the Central and Eastern Corridors

- Bethany Reservoir Alignment Shaft Siting Study
- Conclusions and Recommendations
- References
- Attachment 1 – Launch Shaft Siting Criteria
- Attachment 2 – Launch Shaft Siting Results
- Attachment 3 – Maintenance and Reception Shaft Siting Criteria
- Attachment 4 – Maintenance and Reception Shaft Siting Results
- Attachment 5 – Recommended Maintenance and Reception Shaft Locations
- Attachment 6 - Maintenance and Reception Shaft Siting for the Bethany Reservoir Alignment
- Launch Shaft Siting Study – presents the methods and analysis used for identifying and evaluating potential launch shaft sites and recommends preferred sites for each corridor.
- Maintenance and Reception Shaft Siting Study – presents the methods and analysis used for identifying and evaluating potential maintenance and reception shaft sites and recommends preferred sites along each corridor.

### **3. Initial Launch Shaft Siting Study for the Central and Eastern Corridors**

#### **3.1 Purpose and Introduction**

The purpose of this section of the TM is to present the identification, evaluation, and recommendation of preferred sites for the Project launch shafts along the Central and Eastern corridors.

##### **3.1.1 Background**

The launch shafts would be used as launch points for the Tunnel Boring Machines (TBM). The general locations considered for siting the launch shafts were constrained by the limits of the Central and Eastern corridors and by a maximum TBM drive distance between launch and reception shafts of approximately 15 miles. It was assumed that the Southern Forebay would serve as a TBM launch site for both of the potential corridors. It was also assumed that the intakes would not serve as launch sites in order to reduce the overall construction impact at the intakes.

##### **3.1.2 Summary of Results**

Four general locations were considered as preferred areas for siting the tunnel launch shafts along the Central and Eastern corridors based on an evaluation of logistical constraints and access requirements for major construction activities that would occur at tunnel launch sites. In general, these sites were evaluated as northern (Site A) and southern (Site B) launch sites recognizing that tunnel drive lengths may require multiple drive locations for each corridor. These sites are in addition to the tunnel launch sites at the Southern Forebay.

For the Central Corridor, Glanville Tract (Central Site A) and Bouldin Island (Central Site B) were considered as potential locations for the northern and southern tunnel launch shaft sites, respectively. For the Eastern Corridor New Hope Tract, Canal Ranch Tract, and Brack Tract (Eastern Site A) were considered for the northern tunnel launch shaft and Lower Roberts Island and Lower Jones Tract (Eastern Site B) were considered for the southern tunnel launch shaft. Central Site A was also considered

as a potential location for the Eastern Corridor northern launch shaft site, as it is compatible with both corridors.

These general areas were then divided into smaller areas representing sites large enough to include the tunnel launch shaft and adjacent areas for equipment and material. These sites were sized between 250 and 400 acres each and generally followed existing physical boundaries (roads, ditches, water bodies, etc.) and property boundaries. Each of the sites were then evaluated considering four general criteria. The criteria and sub-criteria are as follows:

- Construction Considerations – Proximity to and quality of existing roads, rail, and barge routes, condition of existing levees, and proximity to existing high voltage power.
- Geotechnical Considerations – Geologic unit(s) and peat/organics thickness.
- Property and Land Use – Number of landowners, future development, farmland designations, conservation land, refuges, preservers, and critical vernal pool habitat.
- Existing Infrastructure – Presence of existing structures (houses, barns, schools, etc.) powerlines, gas pipelines, aqueducts, water supply wells, gas wells, and oil production fields.
- Relative Cost – This criterion was only used in the evaluation of options in this TM.

After completion of this initial screening, a small subset (noted as scenarios) of sites was selected as the most favorable for siting the launch shaft for each of the general shaft locations. Each of the scenarios was then assigned a rating of favorable, acceptable, or undesirable (represented by green, yellow, and red, respectively) for each evaluation category and the results compared. The results of the evaluations are summarized in Sections 3.1.2.1 to 3.1.2.4 with further detailed discussion in the sections that follow.

### 3.1.2.1 Central Corridor – North Launch Site

Results of the Central Corridor North Launch Site evaluations are summarized in Figure 1 and Table 3.1.2-1.



Figure 1. Potential Central Corridor North Launch Sites

**Table 3.1.2-1. Central Corridor North Launch Shaft Siting Analysis with Qualitative Score**

Criterion	Potential Site CA-A	Potential Site CA-B	Potential Site CA-C
Construction Considerations	Undesirable	Acceptable	Favorable
Geotechnical/Geological Conditions	Favorable	Favorable	Favorable
Property and Land Use	Favorable	Favorable	Acceptable
Existing Infrastructure	Acceptable	Favorable	Favorable
Relative Cost	Acceptable	Acceptable	Acceptable

Potential Site CA-C is recommended as the preferred site for the Central Corridor North Launch Site. This potential site is located adjacent to the Union Pacific Railroad (UPRR) which would allow for incorporation of a new rail spur within the site. The soil and foundation conditions at this location are also better (more consolidated, less organics) than at locations west of Interstate 5 (I-5). CA-C is also closest to high-voltage power infrastructure required to power the TBMs compared to sites west of I-5.

**3.1.2.2 Central Corridor – South Launch Site**

Results of the Central Corridor South Launch Site evaluations are summarized below in Figure 2 and Table 3.1.2-2.



**Figure 2. Potential Central Corridor South Launch Sites**

**Table 3.1.2-2. Central Corridor South Launch Shaft Siting Analysis with Qualitative Score**

Criterion	Potential Site CB-A	Potential Site CB-B	Potential Site CB-C
Construction Considerations	Acceptable	Acceptable	Undesirable
Geotechnical/Geological Conditions	Undesirable	Undesirable	Undesirable
Property and Land Use	Favorable	Favorable	Favorable
Existing Infrastructure	Favorable	Favorable	Favorable
Relative Cost	Acceptable	Acceptable	Acceptable

Potential site CB-B is recommended as the preferred site for the Central Corridor South Launch Site. This potential site was found to be most compatible with the Central Corridor and the site location is centrally located between State Route 12 and any potential barge landings that are constructed on the southern perimeter of Bouldin Island. Potential Sites CB-B and CB-C also appear to have thinner peat layers than Potential Site CB-A based on existing information.

### 3.1.2.3 Eastern Corridor – North Launch Site

Potential Eastern Corridor North Launch Sites were evaluated on New Hope Tract, Canal Ranch Tract, and Brack Tract. However, Potential Site CA-C evaluated for the Central Corridor (see Section 3.1.2.1) is recommended as the preferred site for the Eastern Corridor North Launch Site based on logistical and access advantages compared to Eastern Site North Launch Site areas on New Hope Tract, Canal Ranch Tract, and Brack Tract.

### 3.1.2.4 Eastern Corridor – South Launch Site

Results of the Eastern Corridor South Launch Site evaluations are summarized below in Figure 3 and Table 3.1.2-3.

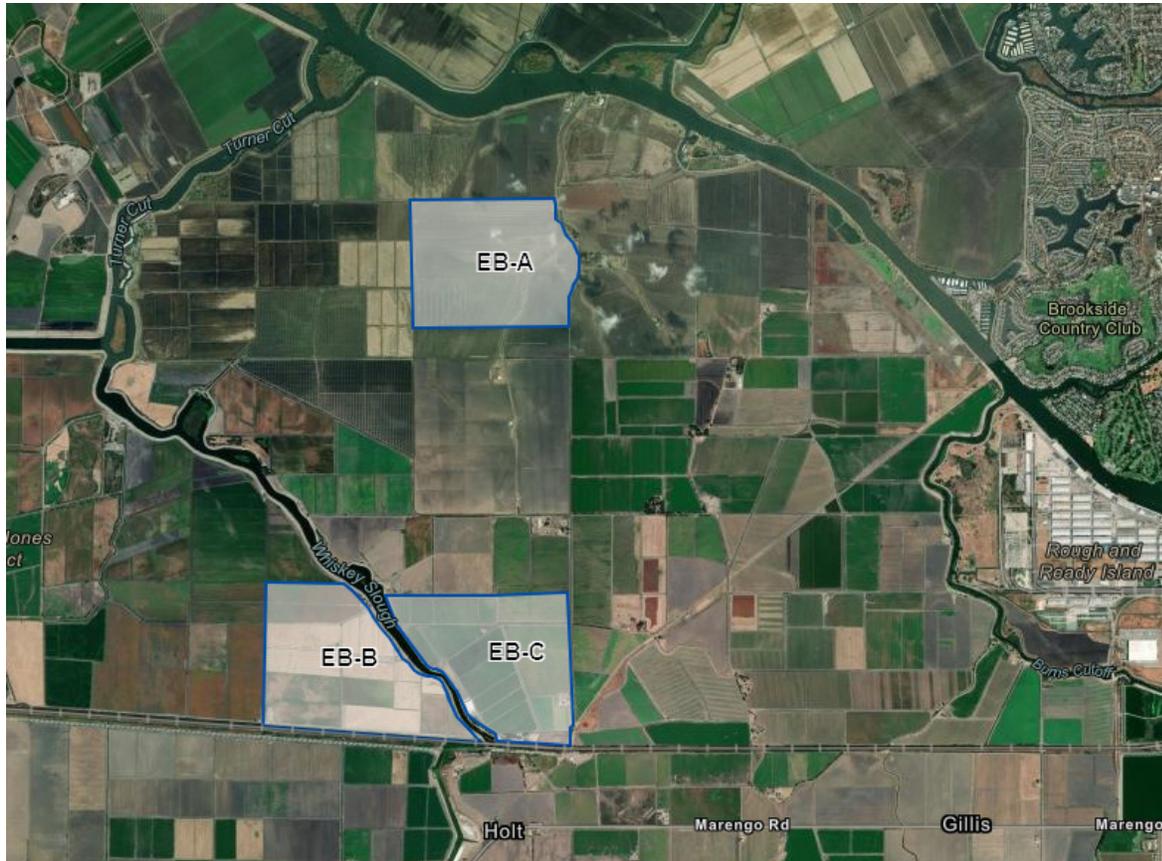


Figure 3. Potential Eastern Corridor South Launch Sites

Table 3.1.2-3. Eastern Corridor South Launch Shaft Siting Analysis with Qualitative Score

Criterion	Potential Site EB-A	Potential Site EB-B	Potential Site EB-C
Construction Considerations	Acceptable	Acceptable	Acceptable
Geotechnical/Geological Conditions	Acceptable	Acceptable	Acceptable
Property and Land Use	Favorable	Acceptable	Acceptable
Existing Infrastructure	Favorable	Favorable	Undesirable
Relative Cost	Acceptable	Acceptable	Acceptable

Potential Site EB-A is recommended as the preferred site for the Eastern Corridor South Launch Site. This site was selected because of its proximity to a high-ranking barge route (San Joaquin River to the north of the site), it lacked significant existing infrastructure, and had only one existing landowner. This site’s northern location on Lower Roberts Island also results in a shorter tunnel length versus the other sites considered.

### 3.2 Methodology

The methodology used to identify potentially suitable locations for the launch shaft sites included the following tasks:

- Identification of evaluation criteria
- Identification of general site areas along the Central and Eastern corridors

- Development of specific launch shaft site areas in each general area
- Evaluation of site areas
- Development of specific potential sites from initial screening
- Evaluation and comparison of final potential sites
- Recommendation of preferred launch shaft sites for each general location

The following assumptions were made for the launch shaft siting evaluation:

- The sites should avoid being in areas of sensitive habitat, such as wildlife preserves or refuges.
- One tunnel launch shaft site would be located at the Southern Forebay given the site’s logistical and access advantages and potential use of reusable tunnel material (RTM) at the Southern Forebay site.
- The intakes would not serve as launch sites in order to reduce the overall construction impact at the intakes.
- Up to two launch shaft sites could be required between the Southern Forebay and the intakes for both corridors, due to the distance between the Southern Forebay launch site and the intakes being greater than 30 miles and the maximum drive distance between launch and reception shafts being approximately 15 miles.
- Each site must be accessible by at least two modes of transportation among the options of road, rail, and barge to support the multi-year construction effort associated with a tunnel drive location. Single-mode access (i.e. road access) was considered only if the capacity of the road could be shown capable of handling all required Project construction traffic under current conditions or improved as part of the Project.
- A site size of 250 to 400 acres was considered for the size constraint. This site size was estimated to be large enough for the launch shaft and adjacent areas for equipment to drill the shaft, cranes and appurtenant items to move equipment into and out of the tunnel shaft, equipment holding areas, and areas to receive, process, and manage the RTM. The tunnel launch shaft site also would include areas for tunnel liner segment storage, aggregate storage, concrete and grout batch plants, electrical substation and electrical building, emergency generator and fuel tank with spill prevention facilities, workshops, offices, water treatment tanks, access roads, conveyor cassettes storage, and RTM handling. For tunnel drives in both directions from a single shaft, the site size could double in size.

### 3.3 Identification of Evaluation Criteria

The criteria and sub-criteria and scoring system used to evaluate each potential launch shaft location are listed and defined in Attachment 1. The basis and source information for each of the criteria and sub-criteria are described in Table 3.3-1.

**Table 3.3-1. Launch Shaft Siting Criteria Summary and Definitions**

Criterion	Definition
<b>Construction Considerations:</b> Access Suitability for Launch Shaft Construction	Used to rule out potential launch shaft sites not accessible by multiple modes of transportation. Sites that were located on isolated islands with no public road access were ruled out from consideration as potential launch shaft sites, even if they were accessible via barge. This criterion was made a “rule-out” criterion since a significant amount of importing or materials/equipment and exporting of RTM is expected from the launch shaft site and will require substantial use of multiple modes of transportation to do so efficiently.

Criterion	Definition
<b>Construction Considerations:</b> Proximity to Existing or New/Improved Roads	Considers the advantages of the site being located near existing roads for access during construction. Sites near existing roads with easy access to existing highways were considered favorable versus sites located away from existing roads. The quality of the existing roads was also taken into consideration in determining the relative favorability of each of the sites and sites near high quality roads were ranked more favorably than sites near roads with moderate or low qualities.
<b>Construction Considerations:</b> Proximity to Existing Railroad	Considers the advantages of the site being located near existing railroads for access during construction. Sites located adjacent to existing railroads were ranked most favorably and sites located far from existing railroads were ranked less favorably. For sites not immediately adjacent to existing railroads, the relative difficulty required to cross obstacles (highways, protected land, sensitive habitat, etc.) to provide rail access to the sites was also considered. The quality and suitability of rail sections for potential access were also considered.
<b>Construction Considerations:</b> Proximity to Barge Routes	Considers the location of the launch sites relative to existing barge routes. Barge routes within the proximity of the launch site could provide another means of site access and equipment/material import/export. Relative proximity of the sites to existing barge routes was considered for this criterion, as well as the quality of the barge route. The suitability of the existing riverbanks/levees for barge landings was also considered in the evaluation for this criterion.
<b>Construction Considerations:</b> Proximity to Existing High Voltage Power	Considers the advantages of the site being located near existing high voltage substations or transmission lines due to the power required for the TBMs during construction. Sites located within close proximity to existing high voltage substations and/or high voltage power lines capable of powering the TBMs (assumed 35 kV required for single TBM) were ranked more favorably than those further away from existing high voltage power. For sites not located immediately adjacent to suitable existing power sources, the relative difficulty required to construct a new line from the existing power sources was considered. This evaluation considered the difficulties associated with new lines crossing obstacles such as highways, protected land, sensitive habitat, and water bodies.
<b>Construction Considerations:</b> Condition of Existing Levees	Considers the condition of the levees protecting the island or tract at a given shaft site and the disadvantages associated with constructing the shaft site in areas protected by levees with poor conditions. Sites were ranked based on the percentage of levees protecting the area that meet the Public Law 84-99 (PL 84-99) levee geometry standard, as described in the CER Appendix F2 <i>Levee Vulnerability Assessment</i> . Levee cross sections were analyzed using LiDAR data at 500-foot spacing in the assessment. Sites within areas that do not require protection from levees, or which are protected by levees that were analyzed and found to meet regional geometry standards were ranked more favorably than sites in areas protected by levees that were analyzed and found to have geometry deficiencies.
<b>Geotechnical / Geological Conditions:</b> Geologic Unit	Considers the surface geology presented in the geologic map created by Atwater in 1982 (Atwater, 1982). Sites located on older, consolidated deposits were considered more favorable than sites that contained soft, poorly or normally consolidated deposits.

Criterion	Definition
<b>Geotechnical / Geological Conditions:</b> Peat Thickness	Considers the disadvantages of having significant thicknesses of peat and/or soils with high organic content at each site. It is understood that significant thicknesses of peat would require substantial construction efforts to avoid significant settlement of the shaft pad and appurtenant facilities. Contours of organics/peat thickness were previously developed and digitized for the Delta Risk Management Strategy (URS, 2008) and were used in this assessment. Areas identified as being underlain by less than 5-feet of peat were ranked most favorable while areas modeled with greater peat thicknesses were ranked less favorably.
<b>Property and Land Use:</b> Number of Landowners	Considers how many landowners exist within a given area being considered for siting a launch shaft. It is understood that acquiring land for construction would be easier if the land was owned by few owners versus many. As such, areas which had only one to two landowners were ranked more favorably than areas with four or more landowners.
<b>Property and Land Use:</b> Future Development	Considers the location of each potential shaft site relative to the spheres of influence of the major surrounding cities. Preferably, the shaft sites will be located outside of the spheres of influence of the surrounding cities to reduce disruption to existing or future developments. Therefore, sites located within surrounding cities’ spheres of influence were ranked less favorably than sites located outside of them. Spheres of influence for cities in Sacramento, San Joaquin, and Contra Costa counties were considered for this evaluation.
<b>Property and Land Use:</b> Farmland Designation	Considers the type of farmland and the relative difficulty associated with relocating or restoring this type of farmland. Each potential site was evaluated for the amount of land listed as Williamson Act Farmland Security Zone land, Prime/Unique Farmland, and Farmland of Local or Statewide Importance. In general, sites with substantial areas of Williamson Act Farmland Security Zone Land were ranked less favorably than sites with land designated as Prime/Unique Farmland, Farmland of Local or Statewide Importance, or with no farmland designations.
<b>Property and Land Use:</b> Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat	Considers if a site is within, or contains within it, protected conservation land, refuges, preserves, and/or vernal pool critical habitat. Sites which were on protected conservation land were ranked less favorably than sites which contained little to no conservation land.

**Notes:**

**Existing Infrastructure:** Considers existing, readily identifiable infrastructure that may be disrupted or require relocation as part of construction of the shafts. The major existing infrastructure considered in the evaluation included linear infrastructure (aqueducts, electrical lines, gas lines, etc.), water supply wells, structures (houses, barns, schools, cemeteries, airports, landfills, solar, communication towers, etc.), and active/idle gas wells. Potential sites which included the above-mentioned structures were ranked less favorably than sites which did not include this infrastructure.

**Relative Cost:** To compare the potential shaft sites, the relative costs were determined qualitatively via the construction complexity and logistical complexity. No cost estimate was prepared for this effort. The following items were considered in the relative cost analysis:

- Constructability costs associated with existing ground conditions and requirements for levee improvements.
- Logistical costs related to access constraints (road, rail, barge), power access, and space constraints.
- Costs associated with existing land-use and the cost for relocating/restoring these lands.
- Note that the relative cost analysis was only completed for potential launch shaft sites and not for each site evaluated in the preliminary evaluation.

### 3.4 Analysis and Evaluation

#### 3.4.1 Identification of Potential Launch Shaft Areas

Existing available data were used to determine the general launch shaft site areas along each of the corridors following the assumptions summarized above. Four general locations were considered as preferred locations for siting the tunnel launch shafts along the Central and Eastern corridors. For the Central corridor, Glanville Tract was considered as a potential location for the northern tunnel launch shaft site (Central Site A). Bouldin Island was considered as potential locations for the southern tunnel launch shaft site (Central Site B). For the Eastern corridor New Hope Tract, Canal Ranch Tract, and Brack Tract were considered as a potential location for the northern tunnel launch shaft (Eastern Site A) and Lower Roberts Island, and Lower Jones Tract were considered for the southern tunnel launch shaft (Eastern Site B). Central Site A was also considered as a potential location for an Eastern corridor northern tunnel launch shaft as it is compatible with both corridors. Figures 4 and 5 show the general launch shaft site areas selected for the Central and Eastern corridors, respectively.

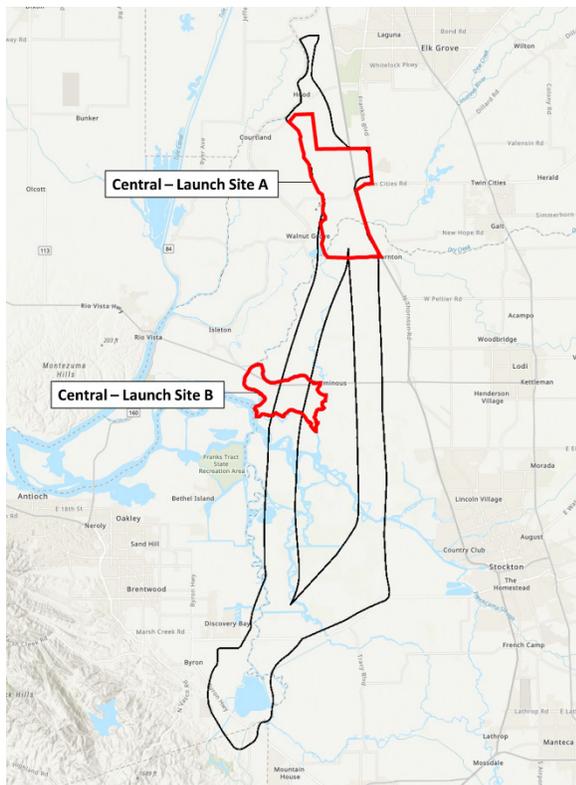


Figure 4. General Launch Shaft Site Areas for Central Corridor

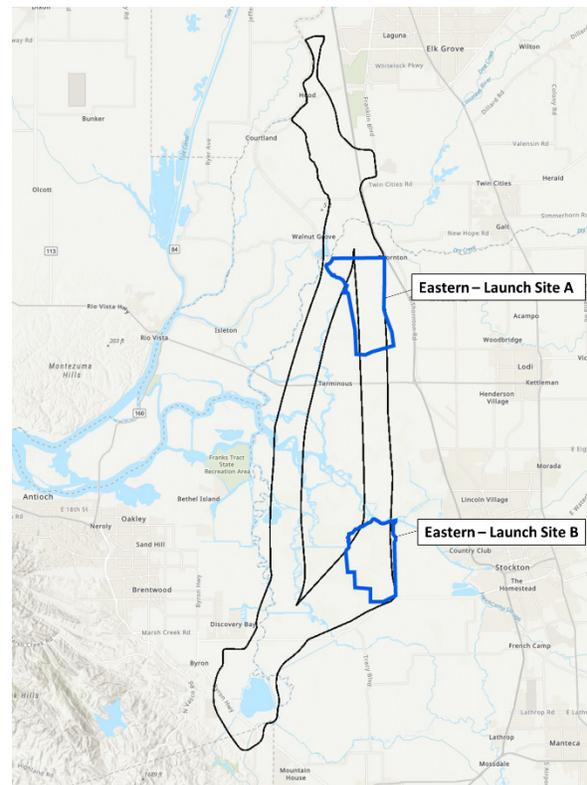


Figure 5. General Launch Shaft Site Areas for Eastern Corridor

#### 3.4.2 Initial Screening and Evaluation of Potential Launch Shaft sites

Existing and available data were used to evaluate each of the potential shaft sites using the evaluation criteria described in Section 3.3. Rankings were assigned to each of the sites for each sub-criterion using the system summarized in Table 3.4.2-1. Detailed explanations of the rankings specific to each of the sub-criteria are included in Attachment 1.

**Table 3.4.2-1. Site Ranking Legend**

Ranking	Description of Ranking
1	Unfavorable
2	Somewhat Unfavorable
3	Neutral
4	Somewhat Favorable
5	Favorable

Importance factors were then assigned to each of the sub-criteria to provide a weighting based on each sub-criterion's relative importance. Each ranking was then multiplied by the respective importance factor resulting in an adjusted ranking. The range and description of the importance factors used in this siting study are summarized in Table 3.4.2-2. The importance factors assigned to each sub-criterion are included in Attachment 1.

**Table 3.4.2-2. Importance Factor Legend**

Importance Factor	Description
1	Little Importance
2	Somewhat Important
3	Neutral
4	Important
5	Very Important

The adjusted rankings for each of the sites were then added resulting in a total adjusted score for each site. A higher number indicates a more favorable site while a lower number indicates a less favorable site. The results were divided into three groups using a percentile-based approach as described in Table 3.4.2-3.

**Table 3.4.2-3. Distribution of Potential Launch Shaft Site Rankings**

Overall Ranking	Theoretical Range	Minimum Ranking	Maximum Ranking
<b>More Favorable</b>	> 67 <sup>th</sup> Percentile	196.7	230.0
<b>Acceptable</b>	33 <sup>rd</sup> to 67 <sup>th</sup> Percentile	179.3	196.7
<b>Less Favorable</b>	< 33 <sup>rd</sup> Percentile	141.0	179.3
<b>Poor for Launch Shaft Site</b>	N/A – Based on Rule-Out Criteria	N/A – Based on Rule-Out Criteria	N/A – Based on Rule-Out Criteria

Note that a fourth group (poor for launch shaft site) was also included. This ranking resulted when a site was located on an island or with no or limited bridge access, if the site was located on protected conservation land, refuge, preserve, or critical vernal pool habitat, or if the site had the presence of a cemetery, landfill, airport flight path, or communication towers. The rankings for ruled out sites were not included in the statistical analysis of the rankings.

Maps showing the resulting site rankings for the Central Corridor are included as Attachments 2.1 through 2.3. The site ranking results for the Eastern Corridor are included as Attachments 2.4 through 2.6. The completed ranking matrix for launch shafts is included as Attachment 2.7.

### 3.4.3 Identification of Potential Launch Sites

Conceptual potential sites were developed for each of the general launch shaft site locations using the results of the initial screening. Three conceptual potential sites were identified for each general launch shaft site area and were evaluated and compared to each other, as described in the sections below. Recommended launch shaft sites are described in Section 3.5 Conclusions and Recommendations.

#### 3.4.3.1 Central Corridor – North Launch Site

The three potential conceptual launch shaft sites CA-A, CA-B, and CA-C are shown in Figure 6. These potential sites were further evaluated and compared as described in the following sections.



Figure 6. Potential Central Corridor North Launch Sites

#### Potential Site CA-A

Potential Site CA-A is located south of Lambert Road and west of I-5. Further evaluation of Potential Site CA-A is presented below, which includes a rating of favorable, acceptable, or undesirable considering each of the main criterion described in Section 3.3.

#### Construction Considerations: **Undesirable**

- Access Suitability for Launch Shaft Construction: **Acceptable** - The site is accessible via road and can be accessed via rail from the existing UPRR railroad along Franklin Boulevard; however, the new rail spur would require an access road crossing over I-5.

- Proximity to New/Improved Road: **Acceptable** – The site can be accessed via the existing Lambert Road (moderate ranking) with a distance of approximately 4.5 miles to the nearest I-5 exit on Twin Cities Road via Franklin Boulevard. Access from the site to I-5 would be greatly improved if a new exit was constructed on Lambert Road.
- Proximity to Existing Rail: **Acceptable** - Access via rail is possible; however, a new spur would be required to create a rail route from the existing UPRR railroad along Franklin Boulevard. The new rail spur would need to cross I-5 (likely at the Dierssen Road overpass) and then run north along I-5 to reach the site. Alternatively, trucks and/or conveyors could be used to transport materials between a rail spur on the east side of I-5 and the launch shaft site on the west side of I-5, which would also likely require major modification to the Dierssen Road overpass.
- Proximity to Barge Routes: **Undesirable** – The site cannot be accessed via existing barge routes without significant construction of new access roads.
- Proximity to Existing High Voltage Power: **Acceptable** - Connection to existing power for construction and TBMs can be provided via the 230-kV line to the east (Western Area Power Administration [WAPA] or Pacific Gas & Electric Company [PG&E]) of this site. New lines will be required to reach the site which will include crossing I-5.
- Condition of Existing Levees: **Undesirable** – 50% to 75% of the analyzed levee sections meet PL84-99 geometry standards.
- Boundary flexibility: **Favorable** - Adequate space for proper setbacks and flexibility with the exact location of the launch shaft and surrounding construction staging areas.
- Construction staging: **Favorable** - Additional area for construction staging and RTM stockpiles exists to the south and southwest of the site. The site could not be expanded to the north due to the Stone Lakes Wildlife Refuge, or to the east due to I-5.
- Community Impacts: **Undesirable** - Impacts to the community and traffic are expected for this site due to its close proximity to the neighborhood located to the northeast on Lourence and Point Pleasant Roads. Construction routes from the existing I-5 exit at Hood Franklin Road would result in additional traffic near the town of Franklin, including Franklin Elementary School.

**Geotechnical/Geological Conditions: **Favorable****

- Geologic Unit: **Favorable** – A combination of younger and older Pleistocene Riverbank formation deposits exist at the site.
- Peat Thickness: **Favorable** – Available data indicates no peat is present beneath the site.
- Foundation conditions: **Favorable** - Organic soils were not encountered in historic borings performed in the vicinity of this site and no organic soils were identified beneath this site. The soil profile generally consists of low to high plasticity clays and some low plasticity silts, clayey sands, poorly graded sands, and silty sands. Blow counts were generally greater than 30 blows per foot for the full soil profile.

**Property and Land Use: **Favorable****

- Number of Landowners: **Favorable** - Permanent acquisition of 6 parcels from 2 landowners is required; however, approximately 95% of the site is owned by a single owner. Adjacent property to the south and southwest of the site that may potentially be used as a laydown or stockpile area is also owned by the landowner who owns the majority of the site land.
- Future Development: **Favorable** – Site is not within spheres of influence of surrounding cities.

- Farmland Designation: **Acceptable** – Land at the site is considered Farmland of Statewide Importance, Unique Farmland, and Prime Farmland. Permanent disruption of these land types may pose challenges due to the costs related to relocating this type of farmland.
- Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat: **Favorable** – No known areas exist within the site.

**Existing Infrastructure: Acceptable**

- Linear Infrastructure: **Acceptable** - 12 kV overhead power lines exist within the east half of the site and a small portion of the south edge of the site. Some or all of these power lines would likely require relocation.
- Water Supply Wells: **Favorable** - One domestic well exists at the northeast corner of the site. Disruption of these wells is not considered to be significant.
- Structures: **Acceptable** - Two houses currently exist within the site, one along Lambert Road at the north of the site and another near the southeast corner of the site. An additional small structure exists at the southwest corner of the site.
- Active/Idle Gas Wells: **Favorable** - Two gas wells listed as “plugged” exist within the southeast corner of the site. These wells were assumed to be inactive and are not expected to have a significant impact on construction.
- Canals: **Favorable** - One small agricultural ditch running north to south through the center of the site may require relocation. Other existing drainage ditches within the area would be rerouted for continued function.

**Potential Site CA-B**

Potential Site CA-B is located west of I-5 and immediately south of Dierssen Road. Further evaluation of Potential Site CA-B is presented below, which includes a rating of favorable, acceptable, or undesirable considering each of the main criterion described in Section 3.3.

**Construction Considerations: Acceptable**

- Access Suitability for Launch Shaft Construction: **Acceptable** - The site is accessible via road and can be accessed via rail from the existing UPRR railroad along Franklin Boulevard; however, the new rail spur would require crossing I-5.
- Proximity to New/Improved Road: **Acceptable** – The site can be accessed via the existing Dierssen Road (low road ranking) with a distance of approximately 3 miles to the nearest I-5 exit on Twin Cities Road via Franklin Boulevard. Upgrades to Dierssen Road, including the existing overpass over I-5 would likely be required should this route be chosen as a primary access route.
- Proximity to Existing Rail: **Acceptable** - Access via rail is possible; however, a new spur would be required to create a rail route from the existing UPRR railroad along Franklin Boulevard. The new rail spur would need to cross I-5 (likely at the Dierssen Road overpass) to reach the site. Alternatively, trucks and/or conveyors could be used to transport materials between a rail spur on the east side of I-5 and the launch shaft site on the west side of I-5, which would also likely require major modification to the Dierssen Road overpass.
- Proximity to Barge Routes: **Undesirable** – The site cannot be accessed via existing barge routes without significant construction of new access roads.

- Proximity to Existing High Voltage Power: **Acceptable** - Connection to existing power for construction and TBMs can be provided via the 230-kV line to the east (WAPA or PG&E) of this site. New lines will be required to be constructed to reach the site which will include crossing I-5.
- Condition of Existing Levees: **Undesirable** – 50% to 75% of the analyzed levee sections meet PL84-99 geometry standards.
- Boundary flexibility: **Favorable** - Adequate space for proper setbacks and flexibility with the exact location of the launch shaft and surrounding construction staging areas.
- Construction staging: **Favorable** - Additional area for construction staging and RTM stockpiles exists to the north, west, and south of the site.
- Community Impacts: **Favorable** – No major impacts to the community are expected from this site location. No substantial neighborhoods within close vicinity to the site.

**Geotechnical Conditions: Favorable**

- Geologic Unit: **Favorable** – A combination of younger Pleistocene Riverbank deposits and Holocene flood basin deposits exist at the site.
- Peat Thickness: **Favorable** – Available data indicates that less than 5 feet of peat is present beneath the site.
- Foundation conditions: **Favorable** – Geologic mapping and historic borings within the vicinity of the site indicate that highly organic soils are generally limited to the upper five feet for majority of this site. Approximately 70% of the site consists of Qry deposits, described as upper Riverbank Pleistocene formations (Atwater 1982), while the other 30% consists of Qb, described as Holocene flood basin deposits. The soil profile generally consists of low to high plasticity clays, clayey sands, poorly graded sands, and silty sands and some low to high plasticity silts. Blow counts were generally greater than 25 blows per foot for the full soil profile.
- Neighboring feature issues: **Favorable** - No levees or sloughs are immediately adjacent to the launch shaft site.

**Property and Land Use: Favorable**

- Number of Landowners: **Acceptable** - Permanent acquisition of 7 parcels from 3 landowners is required. Adjacent property to the south and west of the site that may potentially be used as a laydown or stockpile area.
- Future Development: **Favorable** – Site is not within spheres of influence of surrounding cities.
- Farmland Designation: **Acceptable** – Majority of land at the site is considered Unique Farmland, Prime Farmland and Farmland of Local Importance. Permanent disruption of these land types may pose challenges due to the costs related to relocating this type of farmland.
- Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat: **Favorable** – No known areas exist within the site.

**Existing Infrastructure: Favorable**

- Linear Infrastructure: **Acceptable** - 12 kV overhead power lines exist within the majority of the site. Some or all of these power lines would likely require relocation.
- Water Supply Wells: **Favorable** - One irrigation well exists within the site along the east edge, near I-5 and is not expected to be disrupted during construction.

- Structures: **Favorable** - No identifiable existing structures exist within the footprint of this site.
- Active/Idle Gas Wells: **Favorable** - No existing gas wells were documented within this site.
- Canals: **Favorable** - No significant canals within this site are expected to require relocation. Existing drainage ditches within the area would be rerouted for continued function.

### Potential Site CA-C

Potential Site CA-C is located between I-5 and Franklin Boulevard and is bisected by Dierssen Road. Further evaluation of Potential Site CA-C is presented below, which includes a rating of favorable, acceptable, or undesirable considering each of the main criterion described in Section 3.3.

#### **Construction Considerations: Favorable**

- Access Suitability for Launch Shaft Construction: **Favorable** - The site is accessible via road and can be accessed via rail from the existing UPRR railroad along Franklin Boulevard.
- Proximity to New/Improved Road: **Favorable** - The site can be accessed via the existing Twin Cities Road (high road ranking) and Franklin Boulevard (moderate road ranking) with a distance of less than 1 mile to the nearest I-5 exit on Twin Cities Road.
- Proximity to Existing Rail: **Favorable** - Access via rail is via the UPRR located immediately to the east of the site and Franklin Boulevard.
- Proximity to Barge Routes: **Undesirable** - The site cannot be accessed via existing barge routes without significant construction of new access roads.
- Proximity to Existing High Voltage Power: **Acceptable** - Connection to existing power for construction and TBMs can be provided via the 230-kV line to the east (WAPA or PG&E) of this site. New lines will be required to be constructed to reach the site. This site is considered slightly more favorable than the potential sites located to the west of I-5 since new lines will not require crossing I-5 to reach the site.
- Condition of Existing Levees: **Undesirable** - 50% to 75% of the analyzed levee sections meet PL84-99 geometry standards.
- Boundary flexibility: **Acceptable** - Adequate space for proper setbacks and flexibility of the exact location of the launch shaft within the boundaries of this site; however, potential for use of the surrounding areas for construction staging of RTM stockpiles is limited due to the Swainsons Hawk habitat to the north and surrounding roads to the east, south, and west.
- Construction staging: **Acceptable** - Additional area for construction staging and RTM stockpiles is very limited to the north due to Swainsons Hawk habitat; however, land south of Dierssen Rd may be available for use.
- Community Impacts: **Favorable** - No major impacts to the community are expected from this site location. No substantial neighborhoods within close vicinity to the site.

#### **Geotechnical Conditions: Favorable**

- Geologic Unit: **Favorable** - Younger Pleistocene Riverbank formation deposits.
- Peat Thickness: **Favorable** - Available data indicates that no peat is present beneath the site.
- Foundation conditions: **Favorable** - Available data indicates that no highly organic soils exist within the site footprint. No historic borings were located within the footprint of this site. However, Qry

deposits, described as upper Pleistocene deposits (Atwater 1982), were mapped beneath the entire footprint of this site, and are considered to be Favorable. Historic borings located within the same formation but closer to Potential Site CA-B have favorable geologic conditions, as described above.

- Neighboring feature issues: **Favorable** – UPRR embankment to the east of the site serves as an existing levee. No other levees or sloughs are immediately adjacent to the launch shaft site.

**Property and Land Use: **Acceptable****

- Number of Landowners: **Acceptable** - Permanent acquisition of 8 parcels from 3 landowners is required. Options for expansion are generally limited to the south.
- Future Development: **Favorable** - The site location is not within existing sphere of influence of surrounding cities.
- Farmland Designation: **Acceptable** - Approximately 85% of the site is considered Farmland of Statewide Importance. Permanently acquiring this type of farmland may pose challenges due to the difficulties related to relocating this type of land.
- Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat: **Favorable** – No known areas exist within the site.

**Existing Infrastructure: **Favorable****

- Linear Infrastructure: **Favorable** - Overhead power lines exist along Dierssen road which borders the site at the south. Construction of the launch shaft won't likely require the relocation of these power lines.
- Water Supply Wells: **Favorable** - No water supply wells exist within the site.
- Structures: **Favorable** - No identifiable structures exist within this site.
- Active/Idle Gas Wells: **Favorable** - No existing gas wells were documented within this site.
- Canals: **Favorable** - No significant canals within this site are expected to require relocation. Existing drainage ditches within the area would be rerouted for continued function.

**Relative Cost Comparison**

A qualitative cost comparison was conducted between the three potential sites in consideration of the following:

- Length of tunnels required
- Necessary logistics improvements
- Routing of new power
- High value farmland mitigation
- Ground improvement
- Levee improvements

The relative costs associated with relocating high value farmland, required levee improvements/flood risk mitigation, and ground improvement are expected to be similar for all of the potential sites considered at this location.

**Potential Site CA-A Relative Cost: **Acceptable****

- Tunneling costs are expected to be slightly higher than Potential Site CA-B, since the tunnel would have to curve east sharply after rounding the Stone Lakes National Wildlife Refuge resulting in a longer tunnel.
- Cost for logistics expected to be high because a large area is required to provide rail access to site via new UPRR rail spur. New rail spur immediately east of this site location is not feasible due to protected Swainsons Hawk habitat east of I-5. Spur would likely need to be located within the area of Potential Site CA-C, near Dierssen Road. Additional logistics costs are expected to be high to upgrade Dierssen Road (including I-5 bridge) for routing rail directly to the site or establishing a logistical connection between a rail spur east of I-5 and launch site west of I-5.
- Cost for providing power for construction and TBM from existing 230 kV lines to the east is expected to be high. New lines will need to be constructed from existing 230 kV and will include crossing I-5.

**Potential Site CA-B Relative Cost: **Acceptable****

- Tunneling cost is expected to be the lowest of all potential sites at this location.
- Cost for logistics expected to be similar to Potential Site CA-A and are related to challenges providing rail access to the site from east of I-5.
- Cost for providing power for construction and TBM from existing 230 kV lines to the east is expected to be high, but similar to Potential Site CA-A. New lines will need to be constructed from existing 230 kV and will include crossing I-5.

**Potential Site CA-C Relative Cost: **Acceptable****

- Tunneling cost is highest of the potential sites at this location due to the location being furthest east relative to the other potential sites, resulting in approximately 0.5-miles of additional tunnel length.
- Cost for providing power for construction and TBM from existing 230 kV lines to the east is expected to be moderate, and lower than the other potential sites. New lines will need to be constructed from existing 230 kV but will not need to cross I-5.
- Cost for logistics is expected to be favorable relative to the other potential sites due to proximity to the existing UPRR railroad along Franklin Boulevard.

**Summary of Evaluation**

The evaluation of Central Corridor North Launch Sites is summarized in Table 3.4.3-1. Potential Sites CA-B and CA-C rank the highest among the sites and have similar overall rankings; however, incorporating a new rail spur at Potential Site CA-B would require significantly greater logistical elements to either cross I-5 with the rail spur or establish road and/conveyor connections over I-5. A launch shaft within the Potential Site CA-C site results in a longer tunnel alignment but would allow the tunnel launch shaft and all appurtenant facilities to be positioned on one site.

**Table 3.4.3-1. Central Corridor North Launch Shaft Siting Analysis with Qualitative Score**

Criterion	Potential Site CA-A	Potential Site CA-B	Potential Site CA-C
Construction Considerations	Undesirable	Acceptable	Favorable
Geotechnical/Geological Conditions	Favorable	Favorable	Favorable
Property and Land Use	Favorable	Favorable	Acceptable

Criterion	Potential Site CA-A	Potential Site CA-B	Potential Site CA-C
Existing Infrastructure	Acceptable	Favorable	Favorable
Relative Cost	Acceptable	Acceptable	Acceptable

Alternatively, if the shaft pad, rail spur, and other site features are too large to fit within the single perimeter of Potential Site CA-C, the site could be split into two parts. If that is required, it is recommended the launch shaft be positioned within the Potential Site CA-B site, west of I-5, due to its better compatibility with the tunnel alignment. Potential Site CA-C could then be used for the new rail spur and for RTM and other material storage; but, a new road and/or conveyor connection over I-5 would be required.

Locating the launch shaft within Potential Site CA-C as illustrated in Figure 7 would eliminate the need for a new bridge over I-5, eliminate truck traffic and construction activities associated with shaft and conveyor construction adjacent to the Stone Lakes National Wildlife Refuge, and would allow for more efficient construction logistics by locating all tunneling operations on a single site. The cost savings associated with the I-5 bridge and conveyor system, coupled with the construction-related benefits associated with locating the launch shaft east of I-5, outweigh the 0.5-mile additional tunnel drive length. The single site footprint east of I-5 is the recommended north launch shaft site.

Because the high ranking of Site CA-C was influenced by its proximity to the existing UPRR, a sensitivity analysis was performed to determine if Site CA-C would still rank the highest if rail was removed as a mode of material transport from the Project. For this sensitivity analysis, the “proximity to rail” sub-criterion was removed from the siting analysis. As a result, sites CA-14 and CA-21 changed from More Favorable to Acceptable; however, Sites CA-8, CA-16, and CA-22 remained as More Favorable. Additionally, Sites CA-16 and CA-22 (the sites that make up Potential Site CA-C) remained the highest ranked sites among the sites considered for the Central Corridor North Launch Site. Figure 7 shows the resulting Central Corridor north launch site rankings for the sensitivity analysis with rail removed as a factor in the siting analysis.



### 3.4.3.2 Central Corridor – South Launch Site

The three potential launch shaft sites CB-A, CB-B, and CB-C are shown below in Figure 8. These potential sites were further evaluated and compared as described in the following sections.



**Figure 8. Potential Central Corridor South Launch Sites**

#### Potential Site CB-A

Potential Site CB-A is located at the northwest region of Bouldin Island and south of Highway 12. Further evaluation of Potential Site CB-A is presented below, which includes a rating of favorable, acceptable, or undesirable considering each of the main criterion described in Section 3.3.

#### **Construction Considerations: Acceptable**

- Access Suitability for Launch Shaft Construction: **Acceptable** - The site is accessible via road and can be accessed via barge to the south via Potato Slough.
- Proximity to New/Improved Road: **Favorable** – The site can be accessed via the existing State Route 12 (high ranking) immediately to the north.
- Proximity to Existing Rail: **Undesirable** – No rail lines exist on Bouldin Island.
- Proximity to Barge Routes: **Acceptable** – Barge access can be provided to the site via the San Joaquin River (high ranking barge route, barge landing requiring potential levee enhancements) or Potato Slough (moderate ranking barge route, barge landing requiring potential levee enhancements). Approximately 1.5 to 2.0 miles of new access road would be required to provide access between the site and a new barge landing at these locations.

- Proximity to Existing High Voltage Power: **Acceptable** - Connection to existing power for construction and TBMs can be provided via the 60-kV line to the east of this site (PG&E). However, approximately 8 miles of new lines will be required to be constructed to reach the site along State Route 12.
- Condition of Existing Levees: **Undesirable** – 50% to 75% of the analyzed levee sections meet PL84-99 geometry standards.
- Boundary flexibility: **Favorable** - Adequate space for proper setbacks and flexibility of the exact location of the launch shaft and surrounding construction staging areas.
- Construction staging: **Favorable** - Additional area for construction staging and RTM stockpiles exists to the southeast and northwest of the site. The site could not be expanded to the northeast due to State Route 12, or to the southwest due to the Mokelumne River.
- Community Impacts: **Undesirable** - Impacts to the community and traffic are expected for this site due to its close proximity to the Terminus neighborhood located approximately 3.5 miles to the east on State Route 12. Additionally, construction may be disruptive to the multiple marinas, RV parks, and resorts to the southwest of this site, across the Mokelumne River.

**Geotechnical/Geological Conditions: Undesirable**

- Geologic Unit: **Undesirable** – Peat and mud of tidal wetlands and waterways (Holocene) exist at the site.
- Peat Thickness: **Undesirable** – Available data indicates that 10 to 20 feet of peat is present beneath the majority of the site and that the southern portion of the site may contain between 20 and 25 feet.
- Foundation conditions: **Undesirable** – Borings from near this site indicate very soft peat thicknesses ranging from approximately 15 to 20 feet below ground surface. Low plasticity silts and clays with typical blow counts of less than 5 exist below the peat to depths of 35 to 45 feet. Poorly graded sand with blow counts ranging between 15 and 30 exist below the silts and clays.

**Property and Land Use: Favorable**

- Number of Landowners: **Favorable** - Permanent acquisition of 2 parcels from San Joaquin County is required. Surrounding property is also owned by the county.
- Future Development: **Favorable** – Site is not within spheres of influence of surrounding cities.
- Farmland Designation: **Acceptable** – Land at the site is considered Prime Farmland. Permanent disruption of these land types may pose challenges due to the costs related to relocating this type of farmland.
- Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat: **Favorable** – No known areas exist within the site.

**Existing Infrastructure: Favorable**

- Linear Infrastructure: **Favorable** – No known existing linear infrastructure exists at the site.
- Water Supply Wells: **Favorable** - One domestic well is shown within the west portion of the site; however, the exact location of this well is not known. The presence of this well is not anticipated to be significant.
- Structures: **Favorable** – No known structures exist within the site.

- Active/Idle Gas Wells: **Favorable** – No known gas wells exist within the site.
- Canals: **Acceptable** - One large agricultural ditch running northwest to southeast through the center of the site may require relocation. Multiple smaller agricultural ditches exist within the southwest half of the site. Other existing drainage ditches within the area would be rerouted for continued function.

### Potential Site CB-B

Potential Site CB-B is centrally located on Bouldin Island, approximately 0.8 miles south of State Route 12. Further evaluation of Potential Site CB-B is presented below, which includes a rating of favorable, acceptable, or undesirable considering each of the main criterion described in Section 3.3.

#### **Construction Considerations: Acceptable**

- Access Suitability for Launch Shaft Construction: **Acceptable** - The site is accessible via road and can be accessed via barge to the south via Potato Slough.
- Proximity to New/Improved Road: **Acceptable** – The site can be accessed via the existing State Route 12 (high ranking) to the north; however, a new access road will be required.
- Proximity to Existing Rail: **Undesirable** – No rail lines exist on Bouldin Island.
- Proximity to Barge Routes: **Acceptable** – Barge access can be provided to the site via Potato Slough (moderate ranking), approximately 0.5 to 1.0 miles to the south; however, a new access road will be required.
- Proximity to Existing High Voltage Power: **Acceptable** - Connection to existing power for construction and TBMs can be provided via the 60-kV line to the east (PG&E) of this site. However, approximately 7 miles of new lines will be required to be constructed to reach the site along State Route 12.
- Condition of Existing Levees: **Undesirable** – 50% to 75% of the analyzed levee sections meet PL84-99 geometry standards.
- Boundary flexibility: **Favorable** - Adequate space for proper setbacks and flexibility of the exact location of the launch shaft and surrounding temporary construction staging areas.
- Construction staging: **Favorable** - Additional area for construction staging and RTM stockpiles exists around all sides of the site, if required.
- Community Impacts: **Acceptable** - Impacts to the community and traffic are expected for this site due to its close proximity to the Terminous neighborhood located approximately 1.5 miles to the east on State Route 12. However, use of a barge landing on Potato Slough could significantly reduce public road traffic.

#### **Geotechnical/Geological Conditions: Undesirable**

- Geologic Unit: **Undesirable** – Peat and mud of tidal wetlands and waterways (Holocene) exist at the site.
- Peat Thickness: **Acceptable** – Available data indicates that approximately 10 feet of peat is present beneath the site.

- Foundation conditions: **Undesirable** – Several borings at this site indicate approximately 10 feet of very soft peat and organic fines at the surface. Below the peat is typically low plasticity clay with sand, silty sand, and sandy silt all with blow counts ranging from 10 to 20.

**Property and Land Use: Favorable**

- Number of Landowners: **Favorable** - Permanent acquisition of 2 parcels from San Joaquin County is required. Surrounding property is also owned by the county.
- Future Development: **Favorable** – Site is not within spheres of influence of surrounding cities.
- Farmland Designation: **Acceptable** – Land at the site is considered Farmland of Statewide Importance and Prime Farmland. Permanent disruption of these land types may pose challenges due to the costs related to relocating this type of farmland.
- Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat: **Favorable** – No known areas exist within the site.

**Existing Infrastructure: Favorable**

- Linear Infrastructure: **Acceptable** – Multiple low voltage overhead power lines exist within the center and west portion of the site. Some of these power lines would likely require relocation.
- Water Supply Wells: **Favorable** – No known wells exist within the site.
- Structures: **Favorable** – No known structures exist within the site.
- Active/Idle Gas Wells: **Favorable** - Two gas wells listed as “plugged” exist within the site. These wells were assumed to be inactive and are not expected to have a significant impact on construction.
- Canals: **Acceptable** - One agricultural ditch runs east to west through the center of the site may require relocation. Existing drainage ditches within the area would be rerouted for continued function.

**Potential Site CB-C**

Potential Site CB-C is located on the southeast corner of Bouldin Island, west of Little Potato Slough, and east of Potato Slough. Further evaluation of Potential Site CB-C is presented below, which includes a rating of favorable, acceptable, or undesirable considering each of the main criterion described in Section 3.3.

**Construction Considerations: Undesirable**

- Access Suitability for Launch Shaft Construction: **Acceptable** - The site is accessible via road and can be accessed via barge to the west via Potato Slough or to the east via Little Potato Slough.
- Proximity to New/Improved Road: **Acceptable** – The site can be accessed via the existing Highway 12 (high ranking) to the north; however, a new access road will be required.
- Proximity to Existing Rail: **Undesirable** – No rail lines exist on Bouldin Island.
- Proximity to Barge Routes: **Acceptable** – Barge access can be provided to the site via Potato Slough or Little Potato Slough (both moderate ranking barge routes, both barge landings requiring potential levee enhancements) located immediately to the west and east of the site, respectively.
- Proximity to Existing High Voltage Power: **Acceptable** - Connection to existing power for construction and TBMs can be provided via the 60-kV line to the east (PG&E) of this site. However,

approximately 7 miles of new lines will be required to be constructed to reach the site along State Route 12.

- Condition of Existing Levees: **Undesirable** – 50% to 75% of the analyzed levee sections meet PL84-99 geometry standards.
- Boundary flexibility: **Acceptable** - Space for proper setbacks and flexibility of the exact location of the launch shaft and surrounding temporary construction staging areas is available but limited to the north.
- Construction staging: **Acceptable** - Additional area for construction staging and RTM stockpiles exists to the north only.
- Community Impacts: **Acceptable** - Impacts to the community and traffic are expected for this site due to its close proximity to the Terminous neighborhood located approximately 3.0 miles to the northeast on State Route 12. However, use of a barge landing on Potato Slough or Little Potato Slough could significantly reduce public road traffic.

**Geotechnical/Geological Conditions: **Undesirable****

- Geologic Unit: **Undesirable** – Peat and mud of tidal wetlands and waterways (Holocene) exist at the site.
- Peat Thickness: **Acceptable** – Available data indicates 5 to 15 feet of peat is present beneath the site.
- Foundation conditions: **Undesirable** – Available existing boring data was limited to borings performed through the levees adjacent to this site and typically only were performed to depths between 20 and 40 feet below the levee crest elevation. These borings indicate peat thicknesses ranging from 15 to 20 feet below ground surface (inland ground surface), with low plasticity clays and silts and silty sands underlying the peat. Blow count data was very limited in this area.

**Property and Land Use: **Favorable****

- Number of Landowners: **Favorable** - Permanent acquisition of 2 parcels from San Joaquin County is required. Surrounding property is also owned by the county.
- Future Development: **Favorable** – Site is not within spheres of influence of surrounding cities.
- Farmland Designation: **Acceptable** – Land at the site is considered Prime Farmland. Permanent disruption of these land types may pose challenges due to the costs related to relocating this type of farmland.
- Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat: **Favorable** – No known areas exist within the site.

**Existing Infrastructure: **Favorable****

- Linear Infrastructure: **Favorable** – A short section of 22 kV overhead power lines exist at the northwest portion of the site but are not expected to require relocation.
- Water Supply Wells: **Favorable** – No known wells exist within the site.
- Structures: **Acceptable** – Only one irrigation canal pumping structure exists along the west perimeter of the site at Potato Slough may require relocation.

- Active/Idle Gas Wells: **Favorable** – No known gas wells exist within the site.
- Canals: **Acceptable**– Two large agricultural ditches run through the center of the site and may require relocation. Other existing drainage ditches within the area would be rerouted for continued function.

### Relative Cost Comparison

A qualitative cost comparison was conducted between the three potential sites in consideration of the following:

- Length of tunnels required
- Necessary logistics improvements
- Routing of new power
- High value farmland mitigation
- Ground improvement
- Levee improvements

The relative costs associated with routing new power, relocating high value farmland, a new barge landing, and required levee improvements are expected to be similar for all of the potential sites considered on Bouldin Island.

#### **Potential Site CB-A Relative Cost: **Undesirable****

- Tunneling cost is expected to be highest among the Bouldin Island potential sites since the alignment would be required to deviate further west, resulting in a longer tunnel length.
- Cost for logistics expected to be moderate because a new access road will be required to provide access from the site to the new barge landing which would likely be located south of the site on either the San Joaquin River or Potato Slough.
- Ground improvement costs are expected to be higher relative to the other Bouldin Island potential sites as the peat was thickest beneath this site.

#### **Potential Site CB-B Relative Cost: **Acceptable****

- Tunneling cost is expected to be the lowest of the three Bouldin Island potential sites as the site is located within the center of the corridor and would not require the tunnel alignment to deviate to the east or west.
- Cost for logistics expected to be higher than Potential Site CB-A and similar to Potential Site CB-C as this site will require a new barge route with new access road to the south and a new access road to allow access to State Route 12 to the north.
- Ground improvement costs are expected to be lower than Potential Site CB-A since the peat is expected to be thinner at this location.

#### **Potential Site CB-C Relative Cost: **Acceptable****

- Like Potential Site CB-A, tunneling cost is expected to be slightly higher than Potential Site CB-B, since the alignment would be required to deviate further east, resulting in slightly longer tunnel length.
- Cost for logistics is expected to be similar to Potential Site CB-B since the site will require new access roads to provide access from State Route 12 to the site. Access to a new barge landing could

potentially be short if a barge landing is constructed adjacent to the site on Potato Slough or Little Potato Slough.

**Summary of Evaluation**

The evaluation of Central Corridor South Launch Sites is summarized in Table 3.4.3-2. Potential Site CB-B was found to be most compatible with the Central Corridor. Potential Site CB-B and CB-C both have similar peat thicknesses of approximately 10 feet, which would likely require ground improvements for the shaft and appurtenant structures. The peat thicknesses at Potential Site CB-A appear greater based on available information and would likely require more costly ground improvement. Potential Site CB-B also has the most options for expansion, if required and is roughly equidistant from high quality roads and barge access. The low voltage power lines within Potential Site CB-B will likely require relocation; however, this is not anticipated to be significant.

**Table 3.4.3-2. Central Corridor South Launch Shaft Siting Analysis with Qualitative Score**

Criterion	Potential Site CB-A	Potential Site CB-B	Potential Site CB-C
Construction Considerations	Acceptable	Acceptable	Undesirable
Geotechnical/Geological Conditions	Undesirable	Undesirable	Undesirable
Property and Land Use	Favorable	Favorable	Favorable
Existing Infrastructure	Favorable	Favorable	Favorable
Relative Cost	Undesirable	Acceptable	Acceptable

**3.4.3.3 Eastern Corridor – North Launch Site**

The Eastern Corridor North Launch Site was selected to be the same as the Central Corridor North Launch Site based on logistical and access characteristics. Therefore, the comparison of potential sites described in Section 3.4.3.1 is applicable to the Eastern Corridor North Launch Site.

**3.4.3.4 Eastern Corridor – South Launch Site**

The three conceptual launch shaft sites EB-A, EB-B, and EB-C are shown below in Figure 9. These potential sites were further evaluated and compared as described in the following sections.

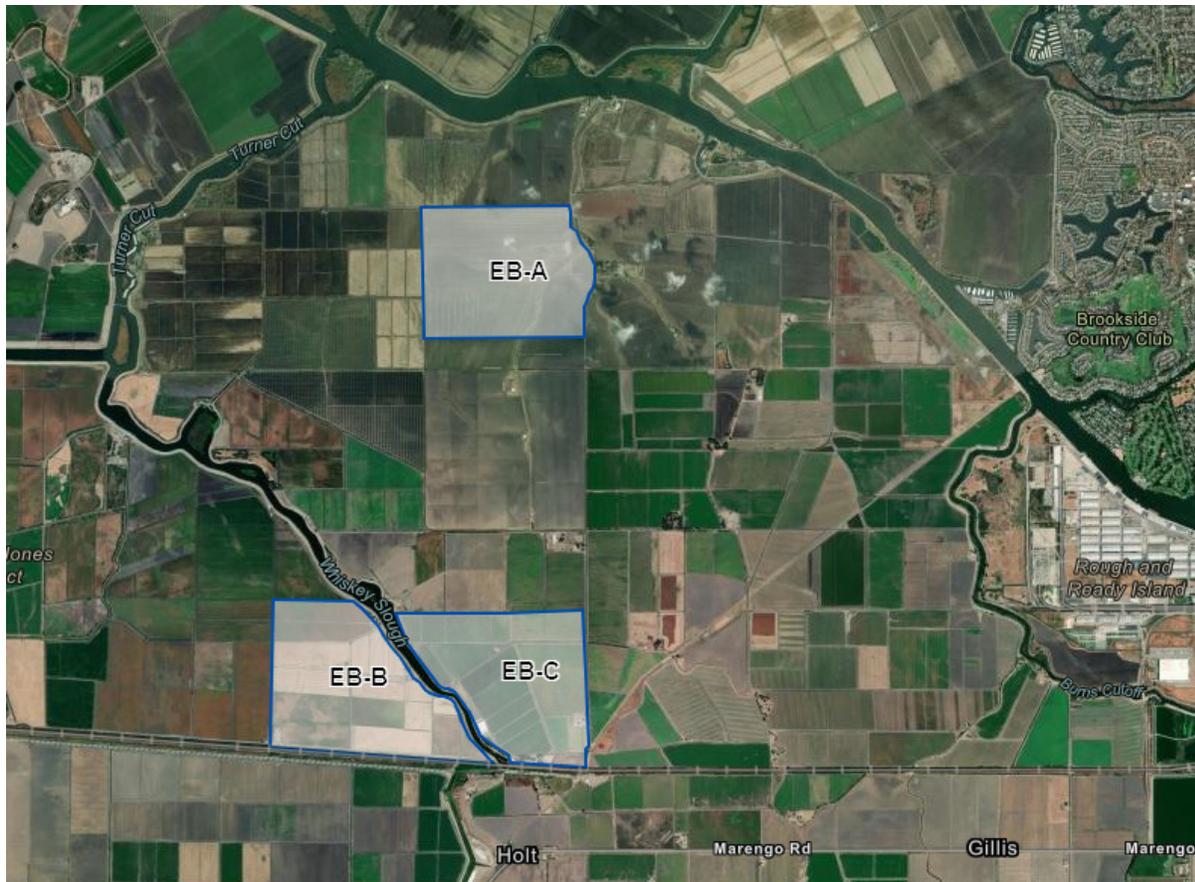


Figure 9. Potential Eastern Corridor South Launch Sites

#### Potential Site EB-A

Potential Site EB-A is located on northwest Lower Roberts Island, approximately 1.0 mile south of the San Joaquin River on Holt Road. Further evaluation of Potential Site EB-A is presented below, which includes a rating of favorable, acceptable, or undesirable considering each of the main criterion described in Section 3.3.

#### Construction Considerations: **Acceptable**

- Access Suitability for Launch Shaft Construction: **Acceptable** - The site is accessible via road and can be accessed via barge to the north and east via the San Joaquin River, as well as, rail from the Port of Stockton.
- Proximity to New/Improved Road: **Acceptable** – The site can be accessed via the existing Holt Road (moderate ranking) immediately east of the site.
- Proximity to Existing Rail: **Undesirable** – No rail lines exist within approximately 3 miles of the site. Providing rail access to the site would require a new spur extending to the site from Rough and Ready Island, including crossing Burns Cutoff.
- Proximity to Barge Routes: **Acceptable** – Barge access can be provided to the site via the San Joaquin River 1 mile to the north (high route ranking, poor barge landing ranking) or 2 miles to the east (high route ranking, barge access with potential levee enhancements). A new access road will be required.

- Proximity to Existing High Voltage Power: **Acceptable** - Connection to existing power for construction and TBMs can be provided via the 230 kV lines to the east (WAPA and PG&E) of this site. However, approximately 3 miles of new lines will be required to be constructed to reach the site.
- Condition of Existing Levees: **Favorable** – 90% to 100% of the analyzed levee sections meet PL84-99 geometry standards.
- Boundary flexibility: **Favorable** - Adequate space for proper setbacks and flexibility of the exact location of the launch shaft and surrounding temporary construction staging areas.
- Construction staging: **Favorable** - Additional area for construction staging and RTM stockpiles exists around all sides of the site, if required.
- Community Impacts: **Favorable** – No major impacts to the community are expected from this site location. No substantial neighborhoods within close vicinity to the site.

***Geotechnical/Geological Conditions: Acceptable***

- Geologic Unit: **Acceptable** – Alluvial flood plain deposits (Holocene) exist at the site.
- Peat Thickness: **Acceptable** – Available data indicates that 10 to 15 feet peat is present beneath the site.
- Foundation conditions: **Acceptable** – Available borings from near this site indicate approximately 10 feet of peat and organic clays. The soil profile generally consists of poorly graded sands, silty sands, and low plasticity clays below the peat. Blow counts were generally less than 10 to a depth of approximately 20 feet, and between 20 and 40 between depths of 20 and 50 feet.

***Property and Land Use: Favorable***

- Number of Landowners: **Favorable** - Permanent acquisition of 1 parcel from 1 owner is required. Options for expansion available to south, west, and north.
- Future Development: **Favorable** – Site is not within spheres of influence of surrounding cities.
- Farmland Designation: **Acceptable** – Land at the site is considered Prime Farmland. Permanent disruption of these land types may pose challenges due to the costs related to relocating this type of farmland.
- Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat: **Favorable** – No known areas exist within the site.

***Existing Infrastructure: Favorable***

- Linear Infrastructure: **Favorable** – Low voltage overhead power lines exist along N Holt Road to the east of the site but are not expected to affect construction or require relocation.
- Water Supply Wells: **Favorable** – No known wells exist within the site.
- Structures: **Favorable** – No known structures exist within the site.
- Active/Idle Gas Wells: **Favorable** – No known wells exist within the site.
- Canals: **Acceptable** - One agricultural ditch runs north to south through the east portion of the site and may require relocation. Other existing drainage ditches within the area would be rerouted for continued function.

**Potential Site EB-B**

Potential Site EB-B is located on east Lower Jones Tract and is bordered by Whiskey Slough to the northeast and the existing Burlington Northern Santa Fe (BNSF) railroad to the south. Further evaluation of Potential Site EB-B is presented below, which includes a rating of favorable, acceptable, or undesirable considering each of the main criterion described in Section 3.3.

**Construction Considerations: Acceptable**

- Access Suitability for Launch Shaft Construction: **Favorable** - The site is accessible via road and can be accessed via rail using the existing BNSF railroad immediately to the south of the site.
- Proximity to New/Improved Road: **Acceptable** – The site can be accessed via the existing West Lower Jones Road (moderate ranking) immediately south of the site. However, access to the site via this road would require crossing BNSF and the existing Mokelumne Aqueduct which may require a new bridge.
- Proximity to Existing Rail: **Acceptable** – Access via rail using the BNSF railroad (moderate ranking) located immediately to the south of the site.
- Proximity to Barge Routes: **Acceptable** – Barge access can be provided to the site via Whiskey slough immediately east (moderate barge route ranking, barge landing may require levee enhancements).
- Proximity to Existing High Voltage Power: **Undesirable** – Connection to existing power for construction and TBMs can be provided via the 230 kV lines to the east (WAPA) of this site. However, approximately 2 miles of new lines will be required to be constructed to reach the site and will include crossing Whiskey Slough.
- Condition of Existing Levees: **Undesirable** – 50% to 75% of the analyzed levee sections meet PL84-99 geometry standards.
- Boundary flexibility: **Favorable** - Adequate space for proper setbacks and flexibility of the exact location of the launch shaft and surrounding temporary construction staging areas.
- Construction staging: **Favorable** - Additional area for construction staging and RTM stockpiles exists to the north and west of the site, if required.
- Community Impacts: **Undesirable** – Impacts to the community and traffic are expected for this site due to its close proximity to the community of Holt located approximately 1 mile to the southeast.

**Geotechnical/Geological Conditions: Acceptable**

- Geologic Unit: **Acceptable** – Alluvial flood plain deposits (Holocene) exist at the site.
- Peat Thickness: **Acceptable** – Available data indicates that 5 to 15 feet peat is present beneath the site.
- Foundation conditions: **Acceptable** – Available borings from near this site indicate approximately 5 feet of peat. The soil profile generally consists of low plasticity silts and clays, silty sands, and some fat clays below the peat. Blow counts generally ranged between 15 and 30 within the full soil profile (to a depth of approximately 50 feet).

**Property and Land Use: Acceptable**

- Number of Landowners: **Acceptable** - Permanent acquisition of 4 parcels from 3 landowners is required. Options for expansion available to north and west.
- Future Development: **Favorable** – Site is not within spheres of influence of surrounding cities.
- Farmland Designation: **Acceptable** – Land at the site is considered Prime Farmland. Permanent disruption of these land types may pose challenges due to the costs related to relocating this type of farmland.
- Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat: **Favorable** – No known areas exist within the site.

**Existing Infrastructure: Favorable**

- Linear Infrastructure: **Favorable** – Low voltage overhead power lines exist along West Lower Jones Road to the east and along BNSF to the south but are not expected to affect construction or require relocation.
- Water Supply Wells: **Favorable** – No known wells exist within the site.
- Structures: **Acceptable** – Multiple storage structures exist within the site along the northeast border.
- Active/Idle Gas Wells: **Favorable** – One gas well listed as “plugged” exists within the northeast corner of the site. This well was assumed to be inactive and is not expected to have a significant impact on construction.
- Canals: **Acceptable** – Multiple small agricultural ditches are present within the site and may require relocation. Other existing drainage ditches within the area would be rerouted for continued function.

**Potential Site EB-C**

Potential Site EB-C is located on Lower Roberts Island, near the community of Holt and is bordered by Whiskey Slough to the west, South Holt Road to the east, and the existing BNSF railroad to the south. Further evaluation of Potential Site EB-C is presented below, which includes a rating of favorable, acceptable, or undesirable considering each of the main criterion described in Section 3.3.

**Construction Considerations: Acceptable**

- Access Suitability for Launch Shaft Construction: **Favorable** - The site is accessible via road and can be accessed via rail using the existing BNSF railroad immediately to the south of the site.
- Proximity to New/Improved Road: **Acceptable** – The site can be accessed via the existing West Lower Jones Road (moderate ranking) immediately south of the site. However, access to the site via this road would require crossing BNSF and the existing Mokelumne Aqueduct which may require a new bridge.
- Proximity to Existing Rail: **Acceptable** – Access via rail using the BNSF (moderate ranking) located immediately to the south of the site.
- Proximity to Barge Routes: **Acceptable** – Barge access can be provided to the site via Whiskey slough immediately east (moderate barge route ranking, barge landing may require levee enhancements).

- Proximity to Existing High Voltage Power: **Acceptable** – Connection to existing power for construction and TBMs can be provided via the 230 kV lines to the east (WAPA) of this site. However, approximately 1.5 miles of new lines will be required to be constructed to reach the site.
- Condition of Existing Levees: **Favorable** – 90% to 100% of the analyzed levee sections meet PL84-99 geometry standards.
- Boundary flexibility: **Favorable** - Adequate space for proper setbacks and flexibility of the exact location of the launch shaft and surrounding temporary construction staging areas.
- Construction staging: **Favorable** - Additional area for construction staging and RTM stockpiles exists to the north and east of the site, if required.
- Community Impacts: **Undesirable** – Impacts to the community and traffic are expected for this site due to its close proximity to the community of Holt located approximately 1 mile to the south.

**Geotechnical/Geological Conditions: Acceptable**

- Geologic Unit: **Acceptable** – Alluvial flood plain deposits (Holocene) exist at the site.
- Peat Thickness: **Acceptable** – Available data indicates that 5 to 15 feet peat is present beneath the site.
- Foundation conditions: **Acceptable** – Available borings from near this site indicate approximately 5 feet of peat. The soil profile generally consists of low plasticity silts and clays, poorly graded sands, silty sands, and some fat clays below the peat. Blow counts were generally lower than the other two potential sites ranging from 5 to 15 within the upper 40 feet and increasing below this depth.

**Property and Land Use: Acceptable**

- Number of Landowners: **Undesirable** – Permanent acquisition of 7 parcels from 5 landowners is required. Options for expansion available to north and east.
- Future Development: **Favorable** – Site is not within spheres of influence of surrounding cities.
- Farmland Designation: **Acceptable** – Land at the site is considered Prime Farmland. Permanent disruption of these land types may pose challenges due to the costs related to relocating this type of farmland.
- Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat: **Favorable** – No known areas exist within the site.

**Existing Infrastructure: Undesirable**

- Linear Infrastructure: **Undesirable** – Low voltage overhead power lines exist along the southern border of the site and gas transmission lines bisect the site from north to south. These features would likely require relocation during construction at this location.
- Water Supply Wells: **Acceptable** – Two domestic wells exist at the southeast corner of the site and one domestic well exists at the northeast corner of the site. All of these wells exist near the site boundaries and therefore may not require relocation during construction.
- Structures: **Undesirable** – One large storage structure exists at the southwest corner of the site, one house exists at the south border of the site, and one home with multiple surrounding structures exists near the southeast corner of the site. Although these structures are located near the site boundaries, disruption to some or all of them during construction is likely.

- Active/Idle Gas Wells: **Acceptable** – Three gas wells listed as “plugged” exist within the north portion of the site and approximately 20 acres of the site at the northeast corner overlaps an existing gas oil production field. These wells are assumed to be inactive and are not expected to have a significant impact on construction.
- Canals: **Acceptable** – Multiple small agricultural ditches are present within the site and will likely require relocation. Other existing drainage ditches within the area would be rerouted for continued function.

### Relative Cost Comparison

A qualitative cost comparison was conducted between the three potential sites in consideration of the following:

- Length of tunnels required
- Necessary logistics improvements
- Routing of new power
- High value farmland mitigation
- Ground improvement
- Levee improvements

The relative costs associated with relocating high value farmland, a new barge landing and required ground improvement are expected to be similar for all of the potential sites considered on at this location. The required tunnel length was also estimated to be roughly similar for all three potential sites.

#### **Potential Site EB-A Relative Cost: **Acceptable****

- The costs for providing rail access to the site is expected to be highest among the potential sites considered for this location. Providing rail access from BNSF to the south would require approximately 3 miles of new rail and multiple road crossings. Alternatively, providing rail from Rough and Ready Island would require a new bridge over Burns Cutoff.
- Cost for providing power for construction and TBM from existing 230 kV lines to the east is expected to be moderate and slightly greater than Potential Site EB-C. A new line would be approximately 2.5 miles long; however, it would not require any over-water crossings.
- Costs for flood risk mitigation at this site are expected to be relatively low. The large majority of levee sections analyzed met PL84-99 geometry standards. Some levee sections may require repair; however, the extent of repairs is expected to be less than that required at Potential Site EB-B.

#### **Potential Site EB-B Relative Cost: **Undesirable****

- Cost for providing power for construction and TBM from existing 230 kV lines to the east is expected to be highest among the potential sites since the new lines will require crossing Whiskey Slough.
- A new bridge over the BNSF rail and above-ground portion of the Mokelumne Aqueduct may be required to provide road access to the site. The same may also be required to access Potential Site EB-C.
- Costs for flood risk mitigation at this site are expected to be highest among the Eastern Corridor South Launch Site potential sites. A significant portion of the levee sections analyzed at this site did not meet PL84-99 geometry standards and would likely require repair to provide sufficient flood risk mitigation.

**Potential Site EB-C Relative Cost: Acceptable**

- A new bridge over the BNSF rail and above-ground portion of the Mokelumne Aqueduct may be required to provide road access to the site. The same may also be required to access Potential Site EB-C.
- Cost for providing power for construction and TBM from existing 230 kV lines to the east is expected to be moderate and lowest for the potential sites considered at this location. A new line would be approximately 1.5 miles long; however, it would not require any over-water crossings.
- Costs for flood risk mitigation at this site are expected to be relatively low and equal to that of Potential Site EB-A. The large majority of levee sections analyzed met PL84-99 geometry standards. Some levee sections may require repair; however, the extent of repairs is expected to be less than that required at Potential Site EB-B.

**Summary of Evaluation**

The evaluation of Eastern Corridor South Launch Sites is summarized in Table 3.4.3-3. Potential Site EB-A ranks the highest among the three potential sites, mainly due to the lack of existing infrastructure within the site, single landowner, and the conditions of the existing levee protecting Lower Roberts Island compared to Lower Jones Tract. Additionally, the San Joaquin River to the north of Potential Site EB-A is a higher-ranking barge route than Whiskey Slough, adjacent to the other two potential sites.

**Table 3.4.3-3. Eastern Corridor South Launch Shaft Siting Analysis**

Criterion	Potential Site EB-A	Potential Site EB-B	Potential Site EB-C
Construction Considerations	Acceptable	Acceptable	Acceptable
Geotechnical/Geological Conditions	Acceptable	Acceptable	Acceptable
Property and Land Use	Favorable	Acceptable	Acceptable
Existing Infrastructure	Favorable	Favorable	Undesirable
Relative Cost	Acceptable	Undesirable	Acceptable

A potentially less-impactful alternative to locating both the launch shaft and RTM processing area within the footprint for the Potential Site EB-A as shown in Figure 9 would include separating the RTM processing area from the shaft to an area further to the east. This would also shorten the required rail spur and significantly reduce the size of the site within Williamson Act Farmland since the RTM processing area would be shifted to land outside of Williamson Act Farmland.

**3.5 Conclusions and Recommendations**

**3.5.1 Central Corridor – North Launch Site**

Potential Site CA-C is recommended for the north launch site for the Central Corridor. This site had significant logistical advantages versus the other potential sites including close access to I-5 and the UPRR. The launch shaft should be positioned within the western portion of the area to maintain compatibility with the tunnel alignment entering the area from the northwest. A recommended conceptual layout of the site is shown in Figure 10, below.



**Figure 10. Recommended Central Corridor North Launch Site**

As discussed in Section 3.4.3.1, if the shaft pad, rail spur, and other site features are too large to fit within the single perimeter of Potential Site CA-C, the site could be split into two parts. In that case, it is recommended that the launch shaft be positioned within the Potential Site CA-B site, west of I-5, due to its better compatibility with the tunnel alignment and potential Site CA-C be used for the new rail spur and for RTM and other material storage. However, considering the cost and complexities of an RTM conveyor and new bridge over I-5, and other impacts related to a launch site west of I-5, it is recommended that Potential Site CA-C be used for the north launch shaft site and related supporting features and that the site be efficiently configured to fit the required facilities on the site.

Additionally, a sensitivity analysis performed to determine if Site CA-C would still rank the highest if rail was removed as a mode of material transport from the Project indicated that Site CA-C remained the highest-ranking site.

### 3.5.2 Central Corridor – South Launch Site

Potential Site CB-B is recommended for the Central Corridor South Launch Site due to this location's compatibility with the Central tunnel alignment and the central location between Highway 12 and any potential barge landings which would likely be located to the southwest of the site on Potato Slough or the San Joaquin River. Additionally, the peat thickness at this site location is less than at Potential Site CB-A, although similar to Potential Site CB-C. Potential Site CB-B also has the most options for expansion relative to the other potential sites. A recommended conceptual layout of the site is shown in Figure 11.



Figure 11. Recommended Central Corridor South Launch Site

### 3.5.3 Eastern Corridor – North Launch Site

Potential tunnel launch sites for Eastern Site A were evaluated on New Hope Tract, Canal Ranch Tract, and Brack Tract. However, Potential Site CA-C is recommended as the preferred site for the Eastern Corridor’s North Launch Site as summarized in Section 3.5.1 above based on logistical and access advantages compared to Eastern Site A areas.

### 3.5.4 Eastern Corridor – South Launch Site

Potential Site EB-A is recommended for the Eastern Corridor South Launch Site within the site, as shown in Figure 12, mainly due to this location’s proximity to a high-ranking barge route (San Joaquin River to the north of the site), single landowner, and lack of existing infrastructure. This site’s northern location on Lower Roberts Island also results in a shorter tunnel length versus the other potential sites which would require the tunnel alignment to extend further south before turning west towards the Southern Forebay. To reduce the site size within Williamson Act Farmland, the RTM processing area could be separated from the shaft to an area further to the east.

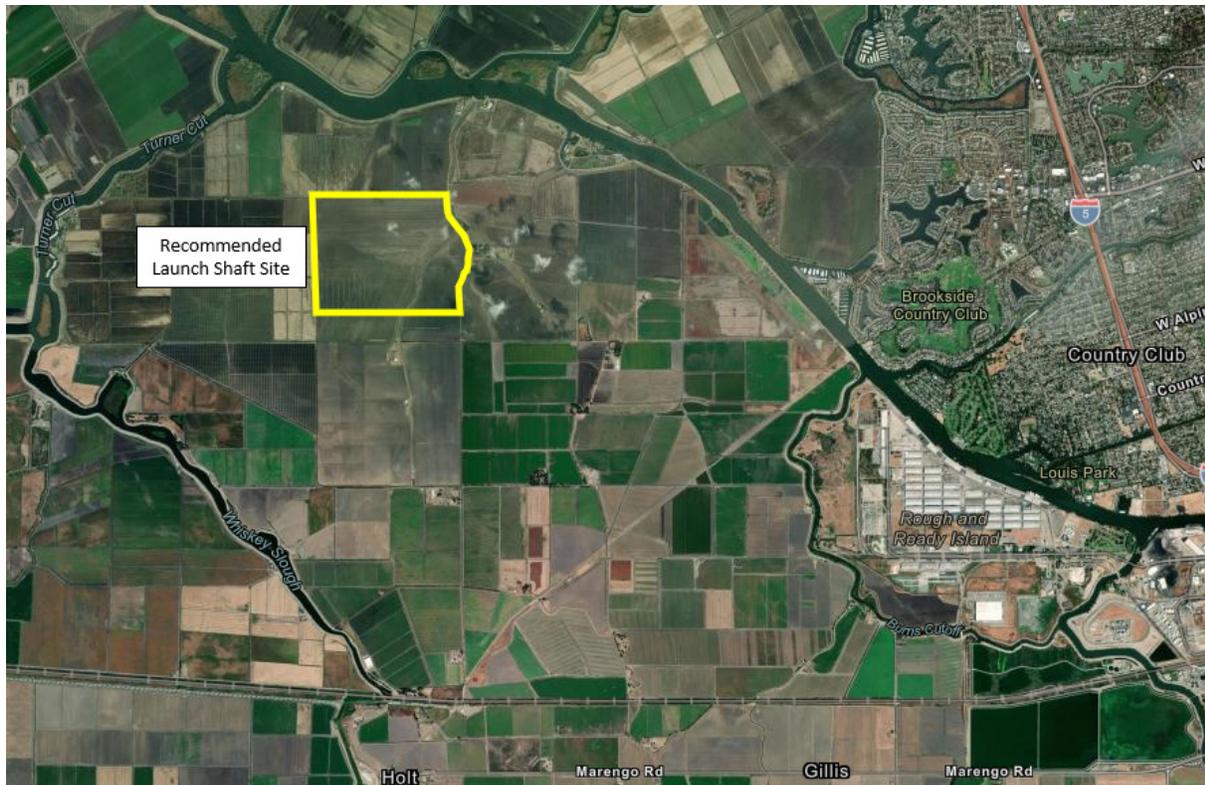


Figure 12. Recommended Eastern Corridor South Launch Site

## 4. Initial Maintenance and Reception Shaft Siting Study for Central and Eastern Corridors

### 4.1 Purpose and Introduction

The purpose of this section of the TM is to present the identification, evaluation, and recommendations for maintenance and reception shafts along the Central and Eastern corridors. The goal of this analysis is to identify suitable locations for maintenance and reception shafts and to also identify exclusion areas that should be avoided. This analysis should be considered a guide for locating shafts since final shaft locations may be outside of the specific sites evaluated provided they are not within the exclusion areas identified in this TM.

#### 4.1.1 Background

Tunnel reception shafts would be used as receiving points for the TBM and may be located up to 15 miles from Launch Shafts. Tunnel maintenance shafts would be spaced approximately every 4 to 6 miles along the tunnel alignment as directed by DWR staff. This maintenance shaft spacing allows for inspection and/or repair of TBM components which could not be conducted from within the tunnel. Maintenance shafts would also provide ventilation and closer tunnel exits to improve worker safety in case of an emergency.

Both the maintenance and reception shafts would require construction of a built-up pad around the shaft to provide protection from flood events. Each maintenance and reception shaft site would include areas for equipment to drill the shaft, cranes, and appurtenant items to move equipment into and out of the tunnel shaft. Each maintenance and reception shaft site also would include areas for storage,

equipment handling, and contractor offices during shaft construction. These shafts would not need an electrical substation, since power would be supplied by mobile generators. The maintenance and reception shaft sites could be approximately 10 acres in size.

Because both the maintenance and reception shaft sites would be expected to be the same size and have the same general features and requirements, all of the sites evaluated herein are considered as potential sites for either type of shaft.

#### 4.1.2 Summary of Results

A siting study was performed using existing available data to identify suitable sites for maintenance and reception shafts along each of the corridors. Each of the sites were then ranked and evaluated using criteria associated with 1) Construction Considerations, 2) Geotechnical Considerations, 3) Property and Land Use, and 4) Existing Infrastructure. Detailed explanations of the rankings specific to each of the sub-criteria for siting maintenance and reception shafts are included in Attachment 3. Attachment 4.1 show the overall rankings of each of the sites on the Central and Eastern Corridors, respectively. Attachment 4.2 includes the completed ranking matrix for the maintenance and reception shaft sites.

Maintenance and reception shaft site locations were then recommended based on the assumed final launch shaft locations recommended in Section 3.5, maximum TBM drive lengths, recommended maintenance site spacing, and the results of this siting evaluation.

#### 4.2 Methodology

The methodology used to identify preferred locations for the tunnel maintenance and reception shafts included the following tasks:

- Identification of guiding principles
- Identification of evaluation criteria
- Identification of general siting locations along Central and Eastern corridors
- Evaluation of site locations
- Summary of preferred tunnel maintenance and reception shaft sites

The following assumptions were made for the tunnel maintenance and reception shaft siting evaluation:

- All sites are should generally be proximal to either the Central or Eastern corridors.
- One tunnel launch shaft site would be located near the junction of Twin Cities Road and I-5.
- One tunnel launch shaft site would be located at the Southern Forebay given the site's logistical and access advantages and potential reuse of RTM at the Southern Forebay site.
- One (Eastern corridor) tunnel launch shaft site would be located on Lower Roberts Island.
- One (Central corridor) tunnel launch shaft site would be located on Bouldin Island.
- A site size of 10 acres was considered for the size constraint. This area was estimated to be large enough for the tunnel shaft and adjacent areas for equipment to drill the shaft, cranes, and appurtenant items to move equipment into and out of the tunnel shaft.

- Tunnel maintenance and reception shafts will not require an electrical substation or permanent connection to the existing power.
- Access to tunnel maintenance and reception shaft sites via road will be sufficient during construction. Rail and barge routes were not considered in this evaluation.

**4.3 Guiding Principles and Evaluation Criteria**

The following guiding principles were used to establish potential maintenance and reception shaft sites for evaluation:

- Within 1/8-mile from existing roads (excluding levee crown roads)
- At least 1/4-mile from existing houses
- At least 1/2-mile from existing schools
- At least 1/4-mile from conservation land, refuges, preserves, or critical vernal pool habitats

Sites satisfying these requirements were evaluated along the entire length of the Central and Eastern corridors to allow flexibility in their siting to best fit the final locations of the launch shafts. Areas beyond 1/8-mile from existing roads, but otherwise satisfying the above criteria were also considered as potential sites for maintenance or reception shafts, as needed.

The criteria and sub-criteria used to evaluate each of the potential tunnel maintenance and reception shaft sites are listed in Attachment 3. Each of the sub-criteria are described in more detail in the following sections.

**Table 5-1. Maintenance and Reception Shaft Siting Criteria Summary and Definitions**

Criterion	Definition
<b>Construction</b> <b>Considerations:</b> Access Suitability	Used to focus evaluations to potential sites within approximately 1/8-mile of an existing road. Areas beyond 1/8-mile from existing roads, but otherwise satisfying the evaluation criteria were considered as potential sites for maintenance or reception shafts, as needed.
<b>Construction</b> <b>Considerations:</b> Quality of Adjacent Road	Considers the advantages of the site being located near existing roads for access during construction. Sites near roads in good condition were ranked more favorably than sites near roads in poor condition.
<b>Construction</b> <b>Considerations:</b> Access Constraints	Access to the maintenance and reception shaft sites was evaluated for several categories including road widths, tight widths, visibility, bridges, pavement quality, levees/levee roads, intersections, towns/cities, and infrastructure. The access constraints identified near proposed maintenance/reception shaft sites were evaluated and ranked based on a combination of the cost and time required to remedy the constraints, if any.
<b>Construction</b> <b>Considerations:</b> Concrete Source	Considers the haul distance from the nearest Redi-Mix concrete facility. Sites with multiple route options and shorter distances from existing Redi-Mix facilities were ranked more favorably than those with fewer route options and/or longer distances to existing plants. Sites greater than 1.5 hours away from existing Redi-Mix plants may require onsite concrete batch plants and were considered the least favorable in this criterion.

Criterion	Definition
<b>Construction Considerations:</b> Condition of Existing Levees	Considers the condition of the levees protecting the island or tract at a given shaft site and the disadvantages associated with constructing the shaft site in areas protected by levees with poor conditions. Sites were ranked based on the percentage of levees protecting the area that meet the Public Law 84-99 (PL 84-99) levee geometry standard, as described in the CER Appendix F2. Levee cross sections were analyzed using LiDAR data at 500-foot spacing in the assessment. Sites within areas that do not require protection from levees, or which are protected by levees that were analyzed and found to meet regional geometry standards were ranked more favorably than sites in areas protected by levees that were analyzed and found to have geometry deficiencies.
<b>Geotechnical / Geological Conditions:</b> Geologic Unit	Considers the surface geology presented in the geologic map created by Atwater in 1982 (Atwater, 1982). Sites located on older, consolidated deposits were considered more favorable than sites that contained soft, poorly or normally consolidated deposits.
<b>Geotechnical / Geological Conditions:</b> Peat Thickness	Considers the disadvantages of having significant thicknesses of peat and/or soils with high organic content at each site. It is understood that significant thicknesses of peat would require substantial construction efforts to avoid significant settlement of the shaft pad and appurtenant facilities. Contours of organics/peat thickness were previously developed and digitized for the Delta Risk Management Strategy (URS, 2008) and were used in this assessment. Areas identified as being underlain by less than 5-feet of peat were ranked most favorable while areas modeled with greater peat thicknesses were ranked less favorably.
<b>Property and Land Use:</b> Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat	Potential maintenance and reception shaft sites were not considered or evaluated if they were within ¼-mile of conservation land, refuges, preserves, or vernal pool critical habitats.
<b>Property and Land Use:</b> Number of Landowners	Considers how many landowners exist within a given area being considered for siting a maintenance/reception shaft. It is understood that acquiring land for construction may be facilitated by having a single owner versus many. As such, areas which had only one to two landowners were ranked more favorably than areas with four or more landowners.
<b>Property and Land Use:</b> Future Development	Considers the location of each potential shaft site relative to the spheres of influence of the major surrounding cities. Preferably, the shaft sites will be located outside of the spheres of influence of the surrounding cities to reduce disruption to existing or future developments. Therefore, sites located within surrounding cities' spheres of influence were ranked less favorably than sites located outside of them. Spheres of influence for cities in Sacramento, San Joaquin, and Contra Costa counties were considered for this evaluation.

Criterion	Definition
<b>Property and Land Use:</b> Farmland Designation	Considers the type of farmland and the relative difficulty associated with relocating or restoring this type of farmland. Each potential site was evaluated for the amount of land listed as Williamson Act Farmland Security Zone land, Prime/Unique Farmland, and Farmland of Local or Statewide Importance. In general, sites with substantial areas of Williamson Act Farmland Security Zone Land were ranked less favorably than sites with land designated as Prime/Unique Farmland, Farmland of Local or Statewide Importance, or with no farmland designations.

Note:

Existing Infrastructure: Considers existing, readily identifiable infrastructure that may be disrupted or require relocation as part of construction of the shafts. The major existing infrastructure considered in the evaluation included linear infrastructure (aqueducts, electrical lines, gas lines, etc.), water supply wells, structures (barns, schools, cemeteries, airports, landfills, solar, communication towers, etc.), and active/idle gas wells. Potential sites which included the above-mentioned structures were ranked less favorably than sites which did not include this infrastructure. Potential maintenance/reception shaft sites were not considered or evaluated if they were within ¼-mile of an existing, occupied house or within ½-mile of an existing school or hospital, as previously discussed above.

## 4.4 Analysis and Evaluation

### 4.4.1 Identification of Potential Maintenance and Reception Shaft Sites

Existing available data was used to determine potential sites for maintenance and reception shafts along each of the corridors following the guiding principles described in Section 4.3. The selected site locations made up long strips on either side of existing roads within each corridor. In many instance, additional sites beyond 1/8-mile from existing roads were evaluated based on Project requirements. For instance, maintenance and reception shafts on Mandeville Island, Bacon Island, and Byron Tract would require construction of new access roads since existing roads suitable for construction that avoid hauling on existing levee crowns do not exist.

### 4.4.2 Evaluation of Potential Maintenance and Reception Shaft Sites

Existing available data was then used to evaluate each of the potential shaft sites using the evaluation criteria described in Section 4.3. Rankings were assigned to each of the zones for each sub-criterion using the system summarized in Table 4.4.2-1. Detailed explanations of the rankings specific to each of the sub-criteria are included in Attachment 3.

**Table 4.4.2-1. Site Ranking Legend**

Ranking	Description of Ranking
1	Unfavorable
2	Somewhat Unfavorable
3	Neutral
4	Somewhat Favorable
5	Favorable

Importance factors were then assigned to each of the sub-criteria to provide a weighting based on each sub-criterion's relative importance. Each ranking was then multiplied by the respective importance factor resulting in an adjusted ranking. The range and description of the importance factors used in this

siting study are summarized in Table 4.4.2-2. The importance factors assigned to each sub-criterion are included in Attachment 3.

**Table 4.4.2-2. Importance Factor Legend**

Importance Factor	Description
1	Little Importance
2	Somewhat Important
3	Neutral
4	Important
5	Very Important

The adjusted rankings for each of the sites were then summed resulting in a total adjusted score for each site. A higher number indicates a more favorable site while a lower number indicates a less favorable site. The results were divided into two groups using a percentile-based approach as described in Table 4.4.2-3.

**Table 4.4.2-3. Distribution of Potential Maintenance/Reception Shaft Site Rankings**

Overall Ranking	Theoretical Range
More Favorable	> 50th Percentile
Less Favorable	< 50th Percentile

Maps showing the resulting site rankings for the Central and Eastern corridors are included as Attachment 4.1. The completed ranking matrix for maintenance and reception shafts is included as Attachment 4.2.

## 5. Bethany Reservoir Alignment Shaft Siting Study

Following completion of the Central and Eastern corridors siting studies, DWR identified an alternative method to connect the DCP conveyance with the existing State Water Project facilities. This alternative method included the BRPP and the Bethany Reservoir Aqueduct to convey water from the tunnel to the existing Bethany Reservoir without the need for the Southern Complex. The new Bethany Reservoir Alignment would use the intakes and northern shaft locations identified for the Eastern Corridor, including Twin Cities Complex launch shaft; reception shaft on Terminous Tract, and maintenance shafts on New Hope Tract, Canal Ranch Tract, and King Island. The shaft on Lower Roberts Island would be a double launch shaft site that would extend the tunnels to the reception shafts on Terminous Tract and the BRPP at the Bethany Reservoir Complex. The maintenance tunnel shaft on Upper Jones Tract would be located in a different place than the along the Eastern Corridor and a maintenance shaft would be constructed on Union Island.

The Bethany Reservoir Aqueduct alignment is described in a separate appendix, CER Appendix D5 *Conceptual Development of Aqueduct and Discharge Structure*.

### 5.1 Launch Siting

Tunnel launch shaft locations for the Bethany Reservoir Alignment were selected using the same methods discussed in Section 3 above.

The Glanville Tract site (referred to as the “Twin Cities Complex”) east of Interstate 5 (between Twin Cities Road and Dierssen Road) was adopted from the Eastern corridor as the preferred site for the northernmost double launch shaft site for the Bethany Reservoir Alignment, as discussed above. The Lower Roberts Island site was also selected as a preferred tunnel launch shaft site for the Bethany Reservoir Alignment; however, the site would be reconfigured to a double-launch site, as opposed to a combination launch and reception shaft for the Eastern corridor. The Eastern corridor would also include a tunnel launch site for the main tunnel originating at the Southern Complex, which would be received at Lower Roberts Island. The tunnel launch from the Southern Complex was desirable for the Eastern corridor so reusable tunnel material (RTM) would be generated locally for use in constructing the Southern Forebay. Since RTM is not needed for embankment construction for the Project, configuring the Lower Roberts Island site to launch TBMs in both the north and south directions would remove the need for an additional tunnel launch shaft near the southern end of the Project plus the supporting infrastructure. The double-launch configuration at Lower Roberts Island was determined to be preferable to having an additional tunnel launch site in the South Delta, similar to the Southern Complex, due to logistical advantages at the Lower Roberts Island site (that is, proximity to major roads and railroads from the adjacent Port of Stockton versus the anticipated logistical challenges associated with a tunnel launch shaft around the CCF).

## 5.2 Maintenance and Reception Shaft Siting

Tunnel reception and maintenance shaft locations for the Bethany Reservoir Alignment were selected using the same methods discussed in the Section 4 above. Reception and maintenance shafts between the Intakes and Lower Roberts Island were adopted from the Eastern corridor.

Additional tunnel reception and maintenance shaft sites were considered for a modified tunnel alignment from Lower Roberts Island to Bethany Reservoir as part of the Bethany Reservoir Alignment, which included considering shafts on Lower Roberts Island, Lower Jones Tract, Upper Jones Tract, Victoria Island, Union Island, and in the area between the CCF and Bethany Reservoir. The additional sites were ranked and are shown (along with the Central and Eastern corridor reception and maintenance shafts) in Attachment 4.

Due to the reconfiguration of the Lower Roberts Island launch site to include a tunnel launch in the southern direction, a reception shaft would be required at the southern end of the tunnel. The location of the southern reception shaft was considered as a factor in siting the Bethany Reservoir Pumping Plant (BRPP) and Surge Basin features, since the reception shaft would ideally be repurposed to connect with the pumping plant inlet conduit and wet well, as well as connect to the adjacent Surge Basin (refer to CER Appendix D1 *Facilities Siting Study*). The primary consideration related to the reception shaft was that it be located no greater than 15 miles from the Lower Roberts Island launch shaft and best satisfy the siting criteria summarized above. As Attachment 5 shows, the preferred reception shaft site is located south of Byron Highway, east of the Jones Pumping Plant, and adjacent to Mountain House Road. This reception shaft would be located within the Surge Basin structure, discussed more in the CER Appendix D1.

Once the reception shaft location was established for the tunnel drive from Lower Roberts Island, potential maintenance shaft locations were evaluated to target an approximate 4- to 6-mile spacing along the tunnel alignment while applying the siting study considerations summarized and further described above. As Attachment 5 shows, the selected tunnel maintenance shaft locations for the tunnel alignment between Lower Roberts Island and the Surge Basin reception shaft would be on Upper Jones Tract and Union Island. Both locations are accessible from existing public roads while minimizing the overall tunnel length.

## 6. Conclusions and Recommendations

The evaluation findings of suitable maintenance and reception shaft sites was used to identify recommended locations for each of the shafts along the Central and Eastern Corridors. Sites were recommended based on the following assumptions:

- Maximum TBM drive distance (measured from launch shaft to reception shaft): 15 miles
- Recommended maintenance shaft spacing: 4 to 6 miles
- Launch Shaft Locations and Drive Direction
  - Central Corridor
    - Twin Cities/Glanville Tract (North and South)
    - Bouldin Island (South)
    - Southern Forebay (North)
  - Eastern Corridor
    - Twin Cities/Glanville Tract (North and South)
    - Lower Roberts Island (North)
    - Southern Forebay (North)
  - Bethany Reservoir Alignment
    - Twin Cities/Glanville Tract (North and South)
    - Lower Roberts Island (North)

It was also assumed that Intake C-E-5 would serve as a maintenance shaft for both the Central and Eastern Corridors for the Project design capacity. Intake C-E-5, located the furthest south of the three potential intakes, is located approximately 5.6 miles from the proposed Twin Cities launch shaft on Glanville Tract. Using Intake C-E-5 as a maintenance shaft would eliminate the need for an additional maintenance shaft north of the Twin Cities launch shaft (i.e. along Lambert Road). Elimination of this additional maintenance shaft would eliminate construction adjacent to the Stone Lakes National Wildlife Refuge and Snodgrass Slough, and also would reduce truck traffic on existing roads.

### 6.1 Central Corridor – Recommended Reception Shaft Sites

The Central Corridor reception shafts include a single purpose shaft on Bacon Island and a dual purpose shaft on Bouldin Island. The Bouldin Island launch shaft, described above, would also serve as the reception shaft from the tunnel launch shaft on Twin Cities Complex.

#### 6.1.1 Bacon Island – Reception Shaft

The drive length between the Southern Forebay Launch Shaft and the Bouldin Island Shaft is approximately 16.4 miles, therefore, one reception shaft is recommended between these two points based on the maximum drive distance. Bacon Island is located at the approximate midpoint between these two sites and therefore was selected as the location of the reception shaft as shown on Attachment 5.1. A new access road will be required to provide access to this site. The drive distance from the Bouldin Island Launch Shaft to this site is approximately 9.9 miles. The drive distance from the Southern Forebay Launch Shaft to this site is approximately 6.5 miles but reduces to 5.5 miles from the Working Shaft which will serve as the tunnel drive site once the TBM has launched and traveled approximately one mile to the north.

## **6.2 Central Corridor – Recommended Maintenance Shaft Sites**

### **6.2.1 New Hope Tract – Maintenance Shaft**

The drive length between the Twin Cities Launch Shaft and the Bouldin Island Reception Shaft is approximately 14.4 miles, therefore, two maintenance shafts are recommended between these two points. The northern maintenance shaft location selected for this tunnel reach is on New Hope Tract on W Lauffer Road as shown in Attachment 5.1. The drive distance from the Twin Cities Launch Shaft to this shaft is approximately 4.1 miles. Positioning this site further south to reach the ideal 5-mile drive distance was not possible as the next two miles along the alignment were within either conservation land or existing house exclusion zones. Positioning the site on the north edge of Staten Island would result in a drive length of greater than 6 miles.

### **6.2.2 Staten Island – Maintenance Shaft**

The southern maintenance shaft location between the Twin Cities Launch Shaft and the Bouldin Island Reception Shaft is on Staten Island on North Staten Island Road as shown in Attachment 5.1. The drive distance from the New Hope Tract maintenance shaft is approximately 4.3 miles. The drive distance from this shaft to the Bouldin Island Shaft is approximately 6.0 miles. This site was shifted north to wider section of Staten Island to minimize effects to Greater Sandhill Crane on Tyler Island.

### **6.2.3 Mandeville Island – Maintenance Shaft**

The drive length between the Bouldin Island Launch Shaft and the Bacon Island Reception Shaft is approximately 9.9 miles, therefore, one maintenance shaft is recommended between these two points. The maintenance shaft for this tunnel reach is on Mandeville Island as shown in Attachment 5.1. A new access road will be required to provide access to this site. The drive distance from the Bouldin Island Shaft to this shaft is approximately 4.6 miles. The drive distance from this shaft to the Bacon Island Reception Shaft is approximately 5.3 miles.

### **6.2.4 Byron Tract – Working Shaft**

The drive length between the Southern Forebay Launch Shaft and the Bacon Island Reception Shaft is approximately 6.6 miles, therefore, one shaft is required between these two points. The shaft location selected along this tunnel reach is on Byron Tract, approximately 1 mile to the northeast of the Southern Forebay Launch Shaft as shown in Attachment 5.1. This shaft will serve as the launch shaft once the TBM passes through it from the Southern Forebay to help eliminate conflicts between work sites at the Southern Forebay outlet shaft and the South Delta Pumping Plant. This arrangement saves at least a year of construction. A new access road will be required to provide access to this site. The Byron Tract Working Shaft location was also selected to eliminate the need for a maintenance shaft further north on Byron Tract, immediately east of the Discovery Bay community. The selected site location would reduce construction traffic on State Route 4 between the bridges over Old River and Middle River. Additionally, the selected site would be located close enough to the Southern Forebay to effectively construct and operate conveyors from the working shaft to the Southern Forebay for transporting RTM. The drive distance from the Southern Forebay Launch Shaft to this shaft is approximately 1.0 mile. The drive distance from this shaft to the Bacon Island Reception Shaft is approximately 5.6 miles.

### **6.3 Eastern Corridor – Recommended Reception Shafts**

The Eastern Corridor reception shafts include a single purpose shaft on Terminous Tract and reception shafts on Byron Tract.

#### **6.3.1 Terminous Tract – Reception Shaft**

The drive length between the Twin Cities Launch Shaft and the Lower Roberts Island Shaft is approximately 22 miles, therefore, one reception shaft is recommended between these two points. Terminous Tract is located at the approximate midpoint between these two sites and therefore was selected as the location of the reception shaft at the location shown on Attachment 5.2, adjacent to Highway 12. The drive distance from the Twin Cities Launch Shaft to this site is approximately 12.7 miles. The drive distance from the Lower Roberts Launch Shaft to this site is approximately 9.3 miles.

### **6.4 Eastern Corridor – Recommended Maintenance Shafts**

#### **6.4.1 New Hope Tract – Maintenance Shaft**

The drive length between the Twin Cities Launch Shaft and the Terminous Tract Reception Shaft is approximately 12.7 miles, therefore, two maintenance shafts are recommended between these two points. The northern maintenance shaft location selected along this tunnel reach was on New Hope Tract, west of North Blossom Road and north of West Walnut Grove Road as shown in Attachment 5.2. A new access road will be required to access this site from Blossom Road to the east. The drive distance from the Twin Cities Launch Shaft to this shaft is approximately 4.5 miles. Positioning this shaft closer to North Blossom Road to the east or West Walnut Grove Road to the south was not feasible due to the many houses and conservation land in these areas.

#### **6.4.2 Canal Ranch Tract – Maintenance Shaft**

The southern maintenance shaft location between the Twin Cities Launch Shaft and the Terminous Reception Shaft is on Canal Ranch Tract, north of West Peltier Road as shown in Attachment 5.2. This location was selected instead of locations further south to provide additional distance between the site and the north and south units of the Woodbridge Ecological Reserve. The drive distance from the New Hope Tract Maintenance Shaft to this shaft is approximately 3.0 miles. The drive distance from this shaft to the Terminous Tract reception shaft is approximately 5.1 miles. Positioning this shaft further west was not feasible due to the houses in this area.

#### **6.4.3 King Island – Maintenance Shaft**

The drive length between the Lower Roberts Launch Shaft and the Terminous Tract Reception Shaft is approximately 9.3 miles, therefore, one maintenance shaft is recommended between these two points. The selected maintenance shaft location is on King Island on West Eight Mile Road as shown in Attachment 5.2. The tunnel drive distances along this tunnel reach are 5.3 miles from the Lower Roberts Launch Shaft to this maintenance shaft and 4.0 miles from the maintenance shaft to the Terminous Reception Shaft.

#### **6.4.4 Byron Tract – Working Shaft**

The tunnel length between the Southern Forebay Launch Shaft and the Lower Roberts Reception Shaft is approximately 12 miles, therefore, two maintenance shafts are recommended between these two

points. Similar to the Central Corridor, a working shaft on Byron Tract is recommended approximately 1 mile to the northeast of the Southern Forebay Launch Shaft as shown in Attachment 5.2 that will function as the launch shaft once the TBM passes through it from the Southern Forebay to help eliminate conflicts between work sites at the Southern Forebay outlet shaft and the South Delta Pumping Plant. This arrangement saves at least a year of construction. The Byron Tract working shaft location also has the added benefit of eliminating the need for a maintenance shaft on Victoria Island. This site location would reduce construction traffic on State Route 4 between the bridges over Old River and Middle River, and eliminate the need for a new bridge along State Route 4 to accommodate construction vehicle access to Victoria Island. The tunnel drive distance from the Southern Forebay Launch Shaft to this working shaft is approximately 1.0 mile. The drive distance from this shaft to the Upper Jones Maintenance Shaft is approximately 5.6 miles.

#### **6.4.5 Upper Jones Tract – Maintenance Shaft**

The maintenance shaft between the Byron Tract Working Shaft and the Lower Roberts Reception Shaft is recommended to be on Upper Jones Tract, north of West Bacon Island Road as shown in Attachment 5.2. The location is centrally located between the launch and reception shafts. The drive distance from this shaft to the Lower Roberts Island Shaft is approximately 5.2 miles.

#### **6.5 Bethany Reservoir Alignment– Recommended Reception Shafts**

The Bethany Reservoir Alignment reception shafts include single purpose shafts on Terminous Tract and the Surge Basin at the BRPP. The Terminous Tract reception shaft is described in Section 5.3.3. The location of the BRPP is addressed in the CER Appendix D3 *Bethany Reservoir Pumping Plant Facilities and Site Configuration*.

#### **6.6 Bethany Reservoir Alignment – Recommended Maintenance Shafts**

The northern maintenance shafts for the Bethany Reservoir Alignment would be located on New Hope Tract, Canal Ranch Tract, and King Island as described in Section 5.3.4.1, 5.3.4.2, and 5.3.4.3, respectively.

##### **6.6.1 Upper Jones Tract – Maintenance Shaft**

The drive length between the Lower Roberts Island and the Surge Basin at BRPP is approximately 14.5 miles, therefore, two maintenance shafts are recommended between these two points. The northern maintenance shaft location selected along this tunnel reach would be on Upper Jones Tract along Bacon Island Road, as shown in Attachment 6.

##### **6.6.2 Union Island – Maintenance Shaft**

The southern maintenance shaft location between Lower Roberts Island tunnel launch shaft site and the BRPP Surge Basin would be on Union Island along Bonetti Road, as shown in Attachment 6.

## 7. References

Atwater, B.F. 1982. Geologic maps of the Sacramento - San Joaquin Delta, California. U.S. Geological Survey.

California Department of Water Resources (DWR). 2023. *Delta Conveyance Project Final Environmental Impact Report*. SCH# 2020010227. December

Delta Conveyance Design and Construction Authority (DCA). 2022a. Delta Conveyance Final Draft Engineering Project Report, Central and Eastern Options. May 2022.

Delta Conveyance Design and Construction Authority (DCA). 2022b. Delta Conveyance Final Draft Engineering Project Report. Bethany Reservoir Alternative. May 2022.

URS. 2008. Technical Memorandum: Delta Risk Management Strategy, Phase 1, Topical Area: Levee Vulnerability Final. May 15.

**Attachment 1**  
**Launch Shaft Siting Criteria**

Criterion	Importance Factor (I)	Sub-Criterion	Explanation of Ranking
Construction Considerations	NA	Access Suitability for Driveshaft Construction	Y: Site accessible by multiple modes of transportation including high quality road access. N: Site Not accessible by multiple modes of transportation.
	5	Proximity to Existing or New/Improved Roads	5: Adjacent to road with high ranking. 4: Adjacent to road with moderate ranking. 3: New road required to access high ranking road. New road does not require crossing major obstacles. 2: Adjacent to low ranking road OR new road to access moderately ranked road that does not require crossing major obstacles. 1: Site located on island with no or limited existing bridges.
	5	Proximity to Existing Railroad	5: Adjacent to railroad with high ranking. 4: Adjacent to railroad with moderate ranking or access to high ranking railroad with existing crossing or crossing that would otherwise be constructed as part of the project. 3: Access to high ranking railroad requires crossing major highway (i.e. I-5) that does not currently exist or would otherwise not be constructed as part of the project or access to railroad with moderate ranking does not require crossing major highway. 2: Access to moderate ranking railroad requires crossing major highway that does not already exist or access to high ranking railroad requires greater than 5 miles new rail length. 1: Adjacent to railroad with low ranking or no access to moderate or high ranking railroad within 5 miles; would require crossing major obstacles (i.e. waterways, conservation land).
	5	Proximity to Barge Routes	5: Adjacent to high ranking barge route with no obstructions and does not require potential levee enhancements for barge landing. 4: Adjacent to moderate ranking barge route OR access to high ranking barge route but with potential levee enhancements for barge landing without interference with major highways or obstacles 3: Adjacent to high ranking barge route but with potential levee enhancements for barge landing with interference with existing roads or structures. 2: Access to high ranking barge route but with barge landing requiring crossing major highway/obstacles OR access to moderate barge route with no major obstacles. 1: No barge access within vicinity of site or barge landing in vicinity of site has major interference/shallow areas OR access to moderate barge route will require crossing major highway/obstacles.
	4	Proximity to Existing High Voltage Substation and/or Existing High Voltage Transmission Line	5: Existing high voltage transmission line adjacent to site 4: Access to high voltage transmission line less than 3 miles away does not require crossing highways or significant obstacles (waterbodies, conservation land, etc.). 3: Unobstructed access to high voltage transmission line greater than 3 miles away OR access to existing high voltage transmission line with sufficient capacity less than 3 miles away requires crossing significant highway (i.e. I-5). 2: Access to existing high voltage transmission line greater than 3 miles away and requires crossing major highway. 1: Access to existing high voltage transmission line requires crossing major obstacles and would require construction in otherwise unaffected areas.
	4	Condition of Existing Levees	5: 100% of analyzed island levee sections meet PL84-99 geometry or island/tract not protected by levees. 4: 90% - <100% of analyzed island levee sections meet PL84-99 geometry. 3: 75% - <90% of analyzed island levee sections meet PL84-99 geometry. 2: 50% - <75% of analyzed island levee sections meet PL84-99 geometry. 1: less than 50% of analyzed island levee sections meet PL84-99 geometry.
Geotechnical/ Geological	5	Geologic Unit	5: Area contains predominately favorable deposits identified by existing geologic mapping (older, consolidated deposits). 3: Area contains both favorable and unfavorable deposits identified by existing geologic mapping (mixture of recent, soft deposits and older, consolidated deposits). 1: Area contains soft, normally consolidated soils (Atwater). Qb, Qpm considered unfavorable soil.
	5	Peat Thickness	5: Area contains <5 feet of peat. 4: Area contains 5-10 feet of peat. 3: Area contains 10-15 feet of peat. 2: Area contains 15-20 feet of peat. 1: Area contains >20 feet of peat.
Property and Land Use	2	Number of Landowners	5: Area contains single parcel or owned entirely by project participants. 4: Area contains 2 parcels. 3: Area contains 3 parcels. 2: Area contains 4 parcels. 1: Area contains >4 parcels.
	3	Future Development	5: Area not within current or 10 year spheres of influence for cities in Sacramento, San Joaquin and Contra Costa counties. 3: Area within 1 mile of existing or 10 year sphere of influence for cities within the counties noted above. 1: Significant portion of area within current or 10 year sphere of influence for cities within the counties noted above.
	4	Farmland Designation	5: No Farmland Designations 3: Prime Farmland, Unique Farmland, Farmland of Statewide Importance, Farmland of Local Importance 1: Williamson Act Farmland Security Zone
	5	Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat	5: Area not protected as conservation land, refuge, preserve, or vernal pool critical habitat. 3: Small area of conservation land, refuge or preserve within area (on boundary), or only limited construction activities allowed in a set aside area. 1: Area is protected as conservation land, refuge, preserve, or vernal pool critical habitat.
Existing Infrastructure	3	Existing Linear Infrastructure (Aqueducts, Electrical Transmission Gas Pipelines, Aqueducts)	5: Area does not cross any existing linear infrastructure. 3: Area is slightly impacted by linear infrastructure (lines near boundaries or not affected majority of area). 1: Area bisected by existing linear infrastructure.
	2	Existing Water Supply Wells	5: No record of water supply wells within the area, or only monitoring wells within area. 4: Presence of water supply wells along the border of the area adjacent to roadway. 3: Presence of 0-3, privately-owned water supply wells within the area. 2: Presence of 1 municipal well or 3-5 private wells within area. 1: More than 1 municipal water supply wells or greater than 5 private wells within area.
	3	Existing Structures/Properties (Houses, Barns, Cemetery, Airports, Landfills, Solar, Communication Towers, etc)	5: No existing structures or stockpiled materials/equipment within area. 4: Presence of stockpiled materials or equipment located on border of area. 3: Structures are located on border of area. 2: Presence of occupied houses, barns, solar, schools, stockpiled materials or equipment present within the interior of the area. 1: Presence of cemetery, landfill, airport flight path, communication towers.
	3	Gas Wells or Gas Oil Production Fields	5: No active or abandoned oil production field or gas wells within area. 4: Presence of dry, plugged, and cancelled wells within the area. 3: Less than 1/4 of area within active gas oil field or minor amount of active wells (<5). 1: Greater than 1/4 of area within active gas oil field or > 5 active wells. Idle wells were considered active.

For discussion purpose only and subject to change

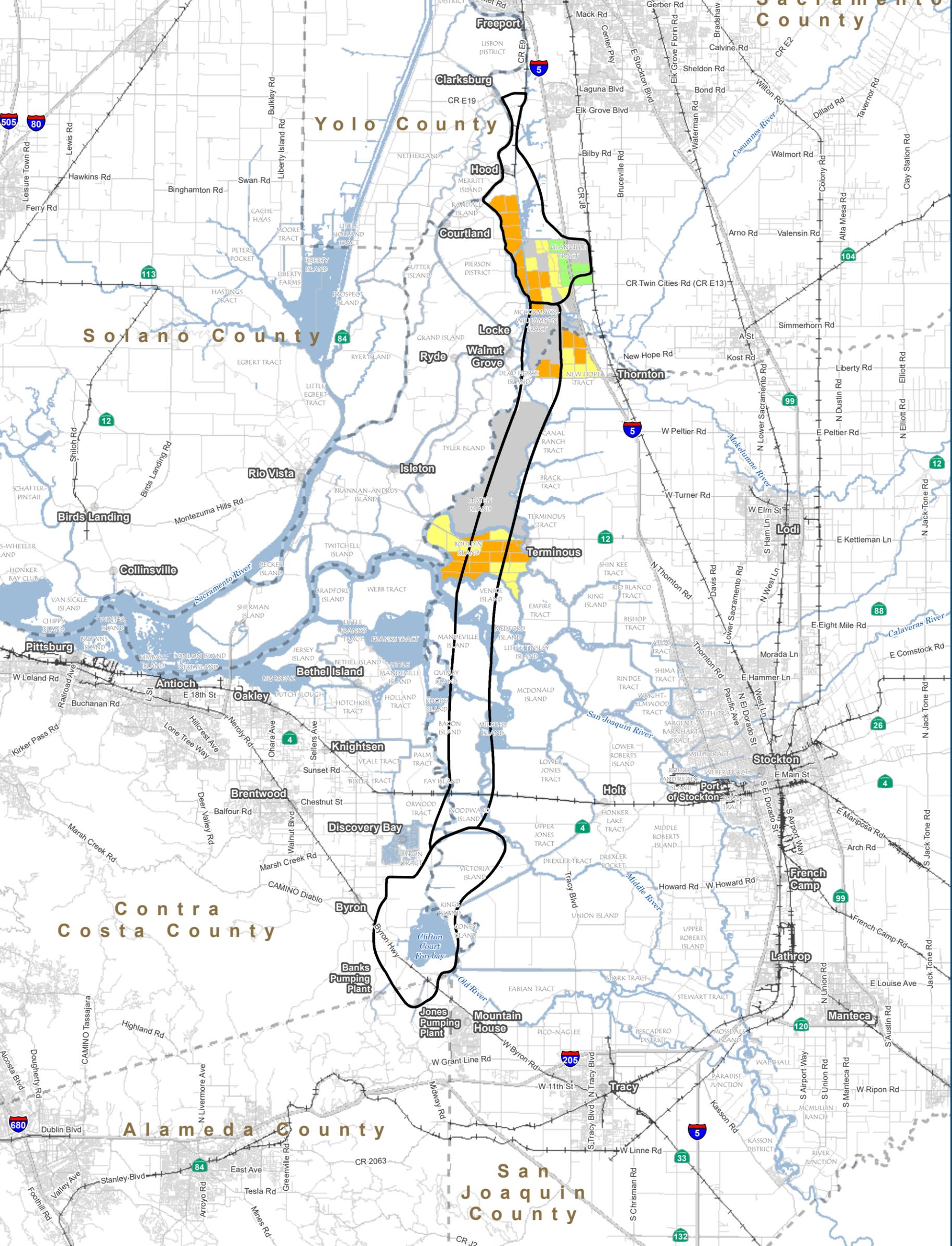
**Attachment 2**  
**Launch Shaft Siting Results**

**Legend**

Boundary of Potential Facility Corridors - Central

**Ranking**

- More Favorable
- Acceptable
- Less Favorable
- Poor for Launch Shaft Site



For Illustration Purposes Only



**Attachment 2.1**  
**Central Corridor**  
**Launch Shaft Siting Study Site Rankings**

Data Source: DCA, DWR

**Legend**

Boundary of Potential Facility Corridors - Central

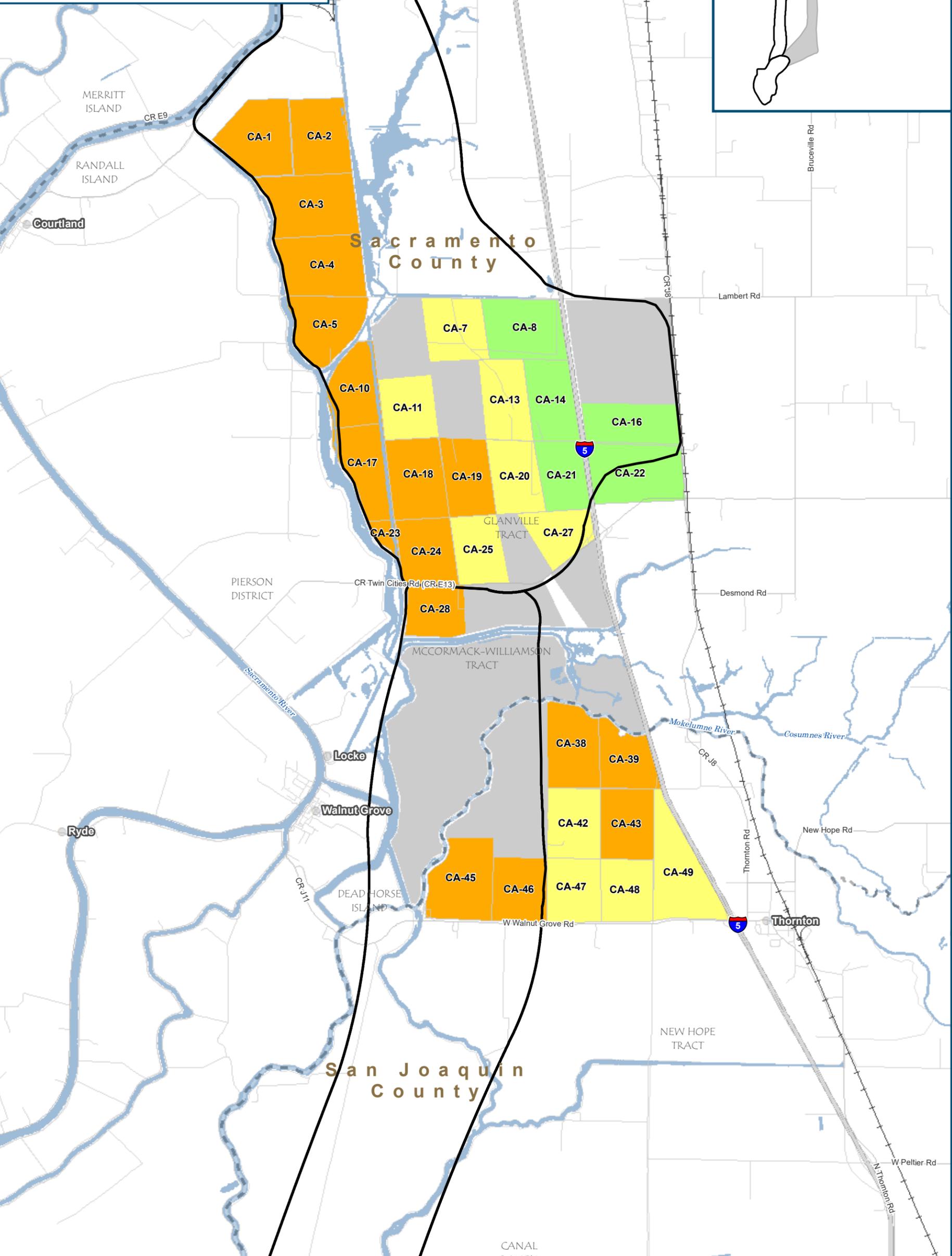
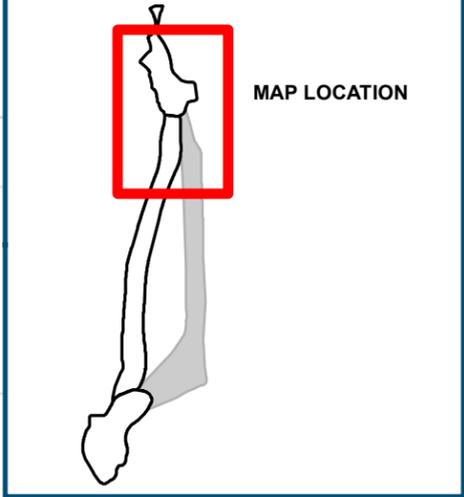
**Ranking**

More Favorable

Acceptable

Less Favorable

Poor for Launch Shaft Site



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For Illustration Purposes Only



**Attachment 2.2**  
Central Site A  
Launch Shaft Siting Study Site Rankings

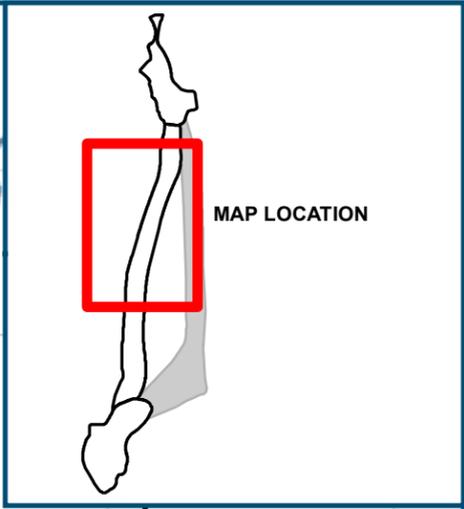
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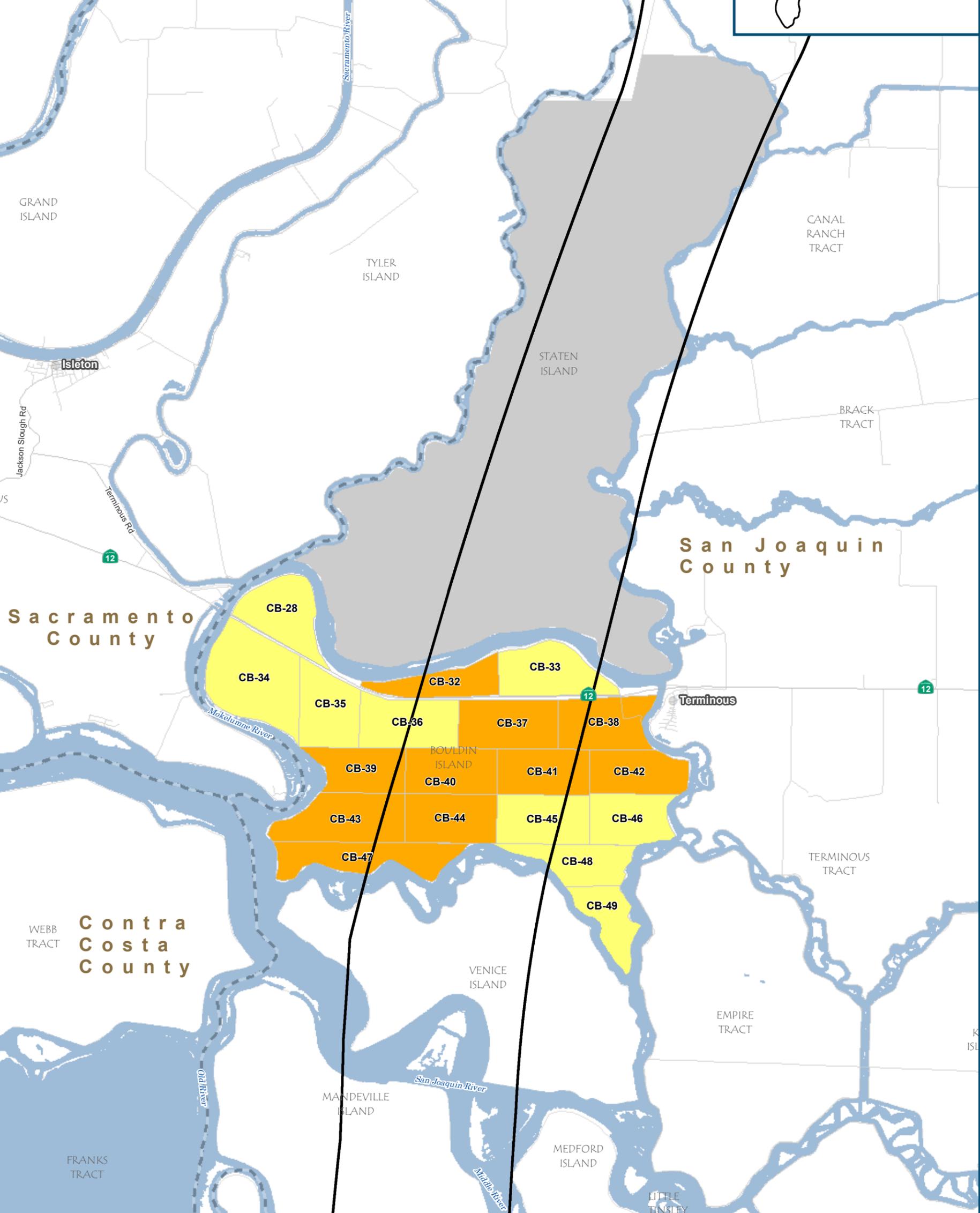
Boundary of Potential Facility Corridors - Central

**Ranking**

- More Favorable
- Acceptable
- Less Favorable
- Poor for Launch Shaft Site



Solano County



**For Illustration Purposes Only**

N

0 0.5 1 Miles

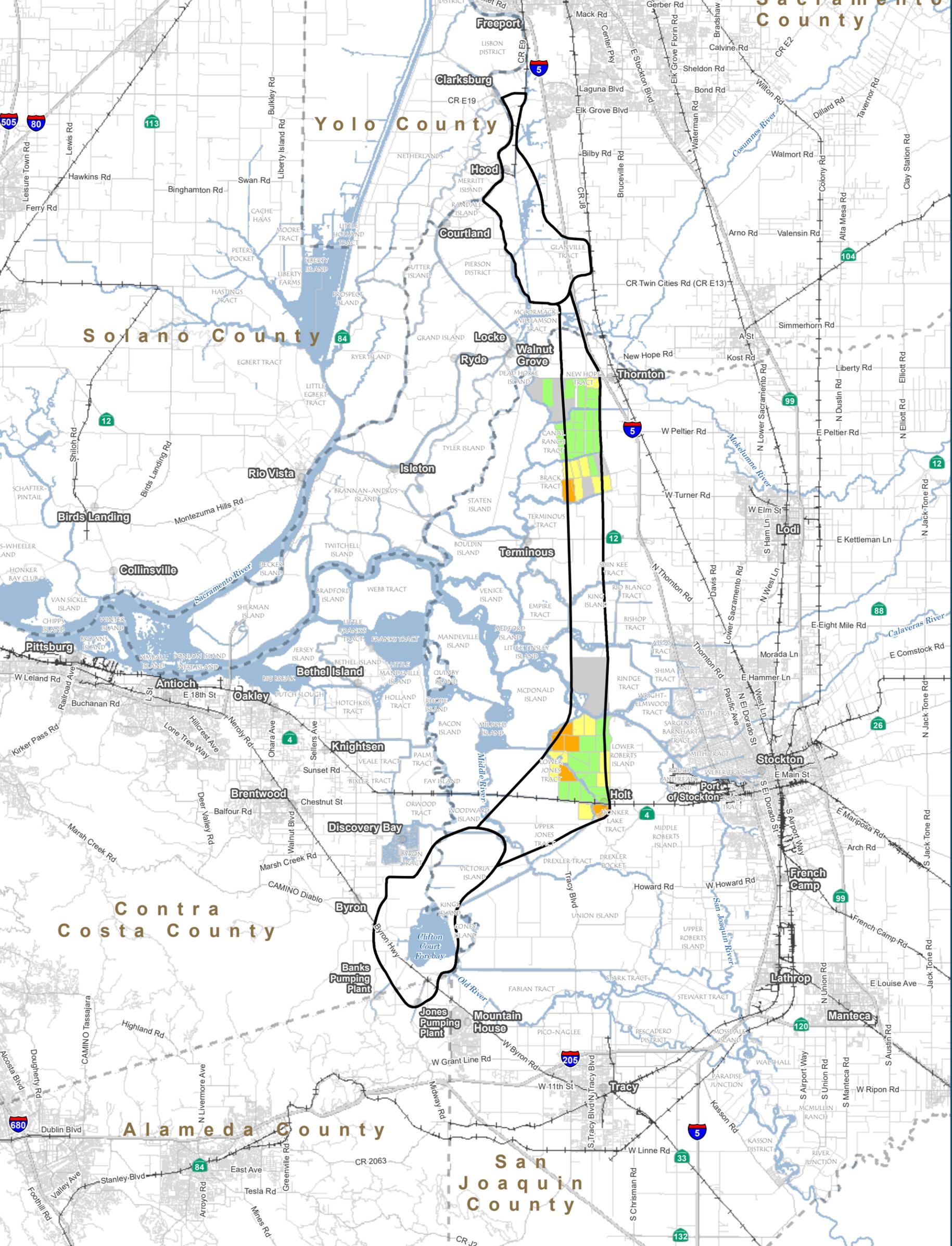
**Attachment 2.3**  
**Central Site B**  
**Launch Shaft Siting Study Site Rankings**

**Legend**

- Boundary of Potential Facility Corridors - Eastern

**Ranking**

- More Favorable
- Acceptable
- Less Favorable
- Poor for Launch Shaft Site



For Illustration Purposes Only



**Attachment 2.4**  
**Eastern Corridor**  
**Launch Shaft Siting Study Site Rankings**

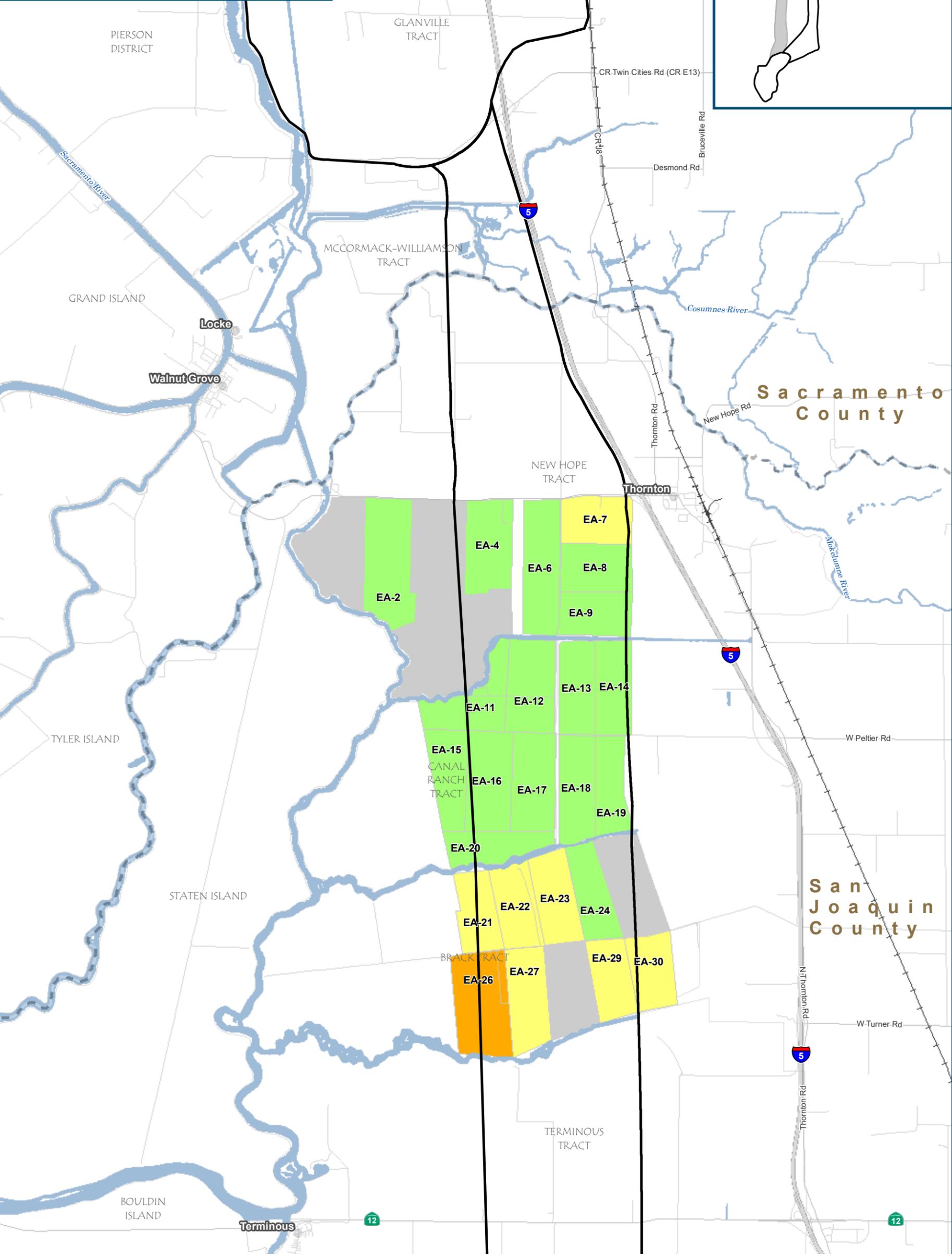
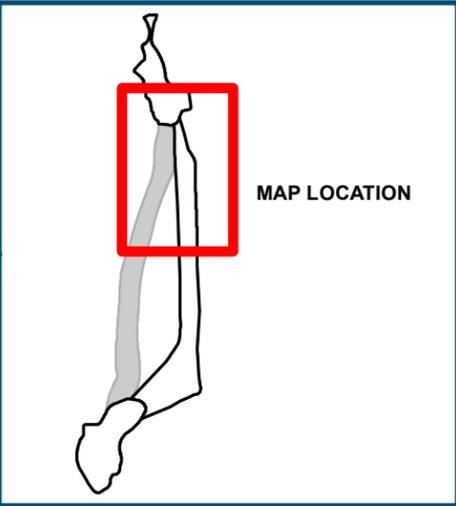
Data Source: DCA, DWR

**Legend**

Boundary of Potential Facility Corridors - Eastern

**Ranking**

- More Favorable
- Acceptable
- Less Favorable
- Poor for Launch Shaft Site



**DCA**  
DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

For Illustration Purposes Only

N

0 0.5 1 Miles

**Attachment 2.5**  
Eastern Site A  
Launch Shaft Siting Study Site Rankings

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Data Source: DCA, DWR







Criterion	Importance Factor (I)	Sub-Criterion	Eastern A																														
			EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11	EA-12	EA-13	EA-14	EA-15	EA-16	EA-17	EA-18	EA-19	EA-20	EA-21	EA-22	EA-23	EA-24	EA-25	EA-26	EA-27	EA-28	EA-29	EA-30	
			FINAL RANKING																														
			197		203		198	188	206	223		197	206	214	216	201	216	213	222	207	209	189	180	188	200		178	189		191	188		
Construction Considerations	NA	Access Suitability for driveshaft construction	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	5	Proximity to Existing or New/Improved Roads	5	5	5	5	3	5	5	4	4	3	4	4	5	5	4	4	4	5	5	2	2	2	2	2	2	2	2	2	2		
	5	Proximity to Existing Railroad	1	1	1	1	1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	3	3	
	5	Proximity to Barge Routes	4	4	4	4	4	4	2	2	2	4	4	4	1	1	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2		
	4	Proximity to Existing High Voltage Substation and/or Existing High Voltage Transmission Line.	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2	2	2	3	3	2	1	1	1	1	1	1	1	1	1		
	4	Condition of Existing Levees	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Geotechnical / Geological	5	Geologic Unit	3	3	3	3	3	3	3	3	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5			
	5	Peat Thickness	4	4	5	5	4	5	5	5	5	4	3	4	5	5	4	4	4	5	5	4	4	4	5	5	5	4	5	5	5		
Property and Land Use	2	Number of Landowners	5	5	4	3	3	1	1	5	5	4	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	4	4	3	
	3	Future Development	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		
	4	Farmland Designation	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
	5	Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat	1	3	1	5	1	5	5	5	5	1	5	5	5	5	5	5	5	5	3	5	5	5	5	5	1	5	5	1	3	5	
Existing Infrastructure	3	Existing Linear Infrastructure (aqueducts, electrical transmission gas pipelines, aqueducts)	5	3	1	3	1	1	3	3	5	1	1	1	5	5	1	5	3	3	3	5	3	3	5	5	3	5	5	5	1		
	2	Existing Water Supply Wells	5	5	5	4	3	3	3	3	5	5	5	4	5	3	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	3	5
	3	Existing Structures (houses, barns, schools, cemetery, airports, landfills, solar, communication towers, etc)	3	3	3	3	5	2	2	3	3	5	2	2	3	5	5	5	5	5	5	5	5	3	3	5	2	3	3	4	5	3	
	3	Gas Wells or Gas Oil Production Fields.	3	4	5	3	5	3	1	5	4	1	3	5	5	5	3	4	5	5	4	5	5	4	5	5	4	4	5	4	5		

Criterion	Importance Factor (I)	Sub-Criterion	Eastern B																																	
			EB-1	EB-2	EB-3	EB-4	EB-5	EB-6	EB-7	EB-8	EB-9	EB-10	EB-11	EB-12	EB-13	EB-14	EB-15	EB-16	EB-17	EB-18	EB-19	EB-20	EB-21	EB-22	EB-23	EB-24	EB-25	EB-26	EB-27	EB-28	EB-29	EB-30	EB-31	EB-32		
			FINAL RANKING								171	185	192	203	160	165	201	206	186	197	204	211	196	192	178	205	190	204	217	206	215	210	182	179		
Construction Considerations	NA	Access Suitability for driveshaft construction	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	5	Proximity to Existing or New/Improved Roads	1	1	1	1	1	1	1	1	2	2	2	4	2	2	2	4	2	2	2	2	4	2	2	2	4	4	4	4	4	4	4	4	5	
	5	Proximity to Existing Railroad	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	3	4	4	4	
	5	Proximity to Barge Routes	4	4	4	5	4	4	5	5	2	3	3	3	2	2	2	2	4	2	4	2	2	4	4	4	2	2	4	4	4	4	4	2	2	
	4	Proximity to Existing High Voltage Substation and/or Existing High Voltage Transmission Line.	1	1	1	1	1	1	1	1	3	3	4	4	3	3	4	4	3	3	3	3	4	4	1	1	4	4	1	1	1	4	4	1	4	
	4	Condition of Existing Levees	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	1	4	4	4	4	4	4	4	4	2	1
Geotechnical / Geological	5	Geologic Unit	1	1	5	1	1	5	1	3	1	3	3	3	1	1	3	3	1	3	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3	
	5	Peat Thickness	3	4	4	3	3	4	3	3	2	2	2	3	3	3	3	3	3	3	4	3	3	4	4	3	3	3	3	3	3	3	3	3	2	2
Property and Land Use	2	Number of Landowners	4	3	3	4	3	3	4	4	2	3	3	3	4	5	4	5	2	5	3	5	5	5	4	4	2	3	3	3	3	3	2	5	1	
	3	Future Development	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	4	Farmland Designation	1	1	1	1	3	1	1	1	3	3	3	3	1	1	1	3	3	1	3	3	3	3	3	1	3	3	3	3	3	3	3	3	1	3
	5	Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Existing Infrastructure	3	Existing Linear Infrastructure (aqueducts, electrical transmission gas pipelines, aqueducts)	5	5	5	3	5	5	3	3	5	1	1	1	3	1	5	3	1	5	3	5	1	5	3	5	1	5	3	3	1	1	3	1		
	2	Existing Water Supply Wells	5	5	5	5	5	5	5	5	5	5	5	3	2	5	5	5	5	4	4	5	3	5	5	5	3	5	5	4	5	4	4	2		
	3	Existing Structures (houses, barns, schools, cemetery, airports, landfills, solar, communication towers, etc)	5	2	5	5	3	5	3	3	3	2	3	3	3	2	5	2	3	5	3	5	2	5	3	3	2	3	5	3	5	2	3	2		
	3	Gas Wells or Gas Oil Production Fields.	5	5	4	4	4	5	4	4	1	5	5	5	1	3	4	4	5	4	4	4	4	4	4	4	4	4	4	5	4	4	5	5	4	

**Attachment 3**  
**Maintenance and Reception Shaft Siting Criteria**

Criterion	Importance Factor (I)	Sub-Criterion	Explanation of Ranking
Construction Considerations	NA	Access Suitability	Y: Site within 1/8 mile of existing road. N: Site >1/8 mile from existing road.
	5	Quality of Adjacent Road	5: Adjacent to road with high ranking. 4: Adjacent to road with moderate ranking. 3: Adjacent to road with low ranking OR adjacent to levee with existing paved road on crown. 1: No road adjacent to site.
	5	Access Constraints	5: Access for maintenance/reception shaft construction is achieved with modest improvements to existing roads and bridges. 1: Access for maintenance/reception shaft construction requires major improvement or modification to existing roads, bridges, or structures.
	5	Concrete Source	Evaluation considers haul distance from nearest Redimix facility. On-site batch plant may be required for travel times greater than 1.5 hours. 5 = 2 optional routes/30 minute drive time 4 = 1 route/30 minute drive time 3 = 2 routes/30-1 hour drive time 2 = 1-2 routes/1 hr - 1.5 hr drive time 1 = >1.5 hour drive time
	4	Condition of Existing Levees	5: 100% of analyzed island levee sections meet PL84-99 geometry or island/tract not protected by levees. 4: 90% - <100% of analyzed island levee sections meet PL84-99 geometry. 3: 75% - <90% of analyzed island levee sections meet PL84-99 geometry. 2: 50% - <75% of analyzed island levee sections meet PL84-99 geometry. 1: less than 50% of analyzed island levee sections meet PL84-99 geometry.
Geotechnical/ Geological	5	Geologic Unit	5: Area contains predominately favorable deposits identified by existing geologic mapping (older, consolidated deposits). 3: Area contains both favorable and unfavorable deposits identified by existing geologic mapping (mixture of recent, soft deposits and older, consolidated deposits). 1: Area contains soft, normally consolidated soils (Atwater). Qb, Qpm considered unfavorable soil.
	5	Peat Thickness	5: Area contains <5 feet of peat. 4: Area contains 5-10 feet of peat. 3: Area contains 10-15 feet of peat. 2: Area contains 15-20 feet of peat. 1: Area contains >20 feet of peat.
Property and Land Use	NA	Conservation Land, Refuges, Preserves, and Vernal Pool Critical Habitat	Y: Area is greater than 1/4 mile from land designated as conservation land, refuge, preserve, or vernal pool critical habitat. N: Area is within 1/4 mile of land noted above.
	3	Number of Land Owners	5: Area contains single land owner. 1: Area contains >1 land owner.
	3	Future Development	5: Area not within current spheres of influence for cities in Sacramento, San Joaquin and Contra Costa counties. 1: Significant portion of area within current sphere of influence for cities within the counties noted above.
	3	Farmland Designation	5: No Farmland Designations 3: Prime Farmland, Unique Farmland, Farmland of Statewide Importance, Farmland of Local Importance 1: Williamson Act Farmland Security Zone
Existing Infrastructure	NA	Existing Houses, Schools, Hospitals	Y: Site greater than 1/4 mile from existing residential structures and 1/2 mile from existing schools or hospitals. N: Site within 1/4 mile of existing residential structures or within 1/2 mile of existing schools or hospitals.
	3	Existing Linear Infrastructure (Aqueducts, Electrical Transmission, Gas Pipelines)	5: Area does not cross any existing linear infrastructure. 3: Area is slightly impacted by linear infrastructure (lines near boundaries or not affected majority of area). 1: Area bisected by existing linear infrastructure.
	2	Existing Water Supply Wells	5: No record of water supply wells within the area. 1: Presence of water supply wells within the area.
	3	Existing Structures (Barns, Sheds, Solar, etc.)	5: No existing structures or stockpiled materials/equipment within area. 1: Structures present within the area.
	3	Gas Wells or Gas Oil Production Fields	5: No active or abandoned oil production field or gas wells within area. 1: Presence of active or abandoned oil production field or gas wells within area.

**Attachment 4**  
**Maintenance and Reception Shaft Siting Results**

**Legend**

 Boundary of Potential Facility Corridors - Central

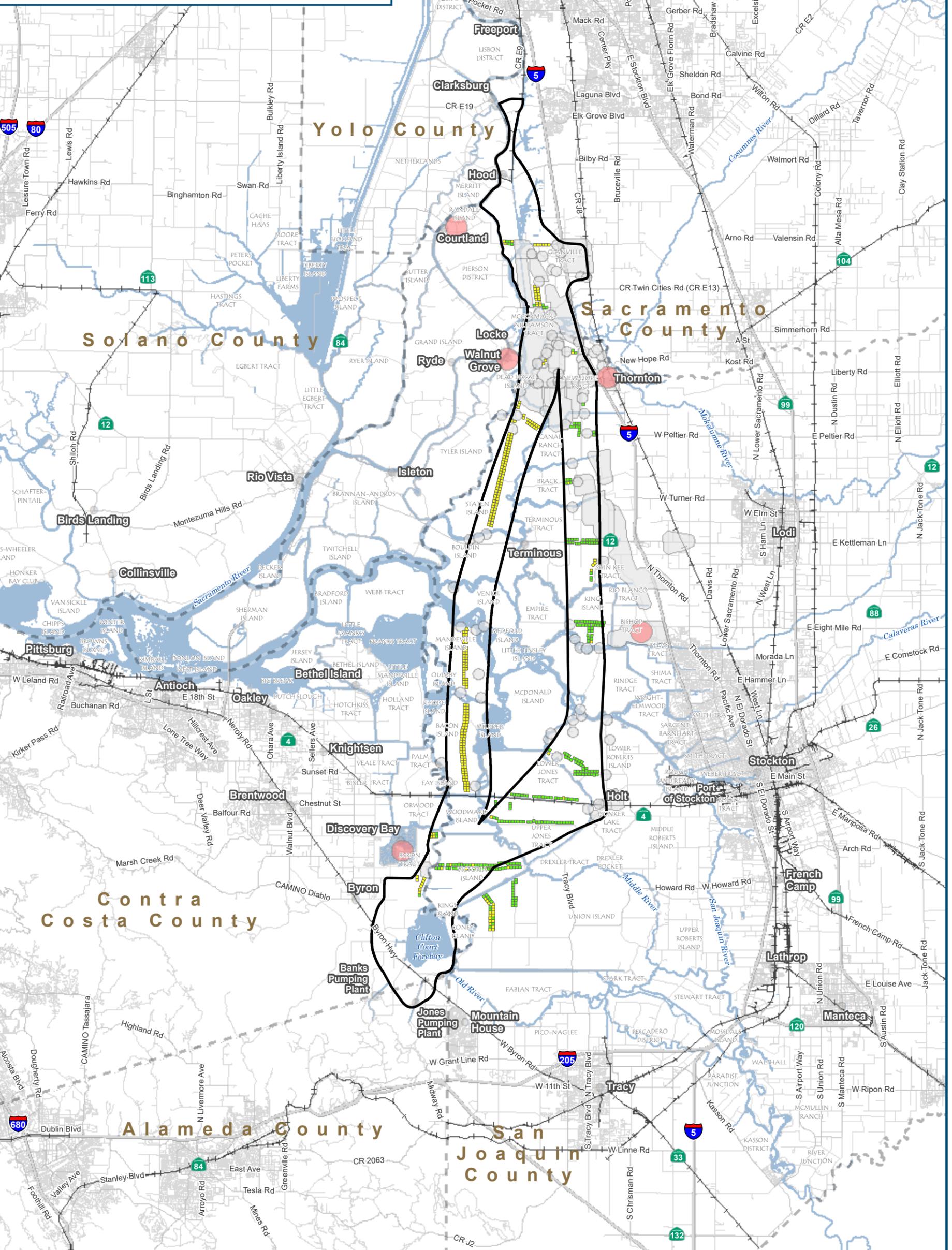
 1/2 - mile Buffer for Schools

 1/4 - mile Buffer for Houses and Conservation Land

**Ranking of Potential Maintenance/Reception Shaft Locations**

 More Favorable

 Less Favorable



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**Attachment 4.1**  
 Central and Eastern Corridors  
 Maintenance/Reception Shaft Siting Study

















**Attachment 5**  
**Recommended Maintenance and Reception**  
**Shaft Locations**

**Legend**

- Launch/Reception Shaft
- Maintenance Shaft
- Reception Shaft

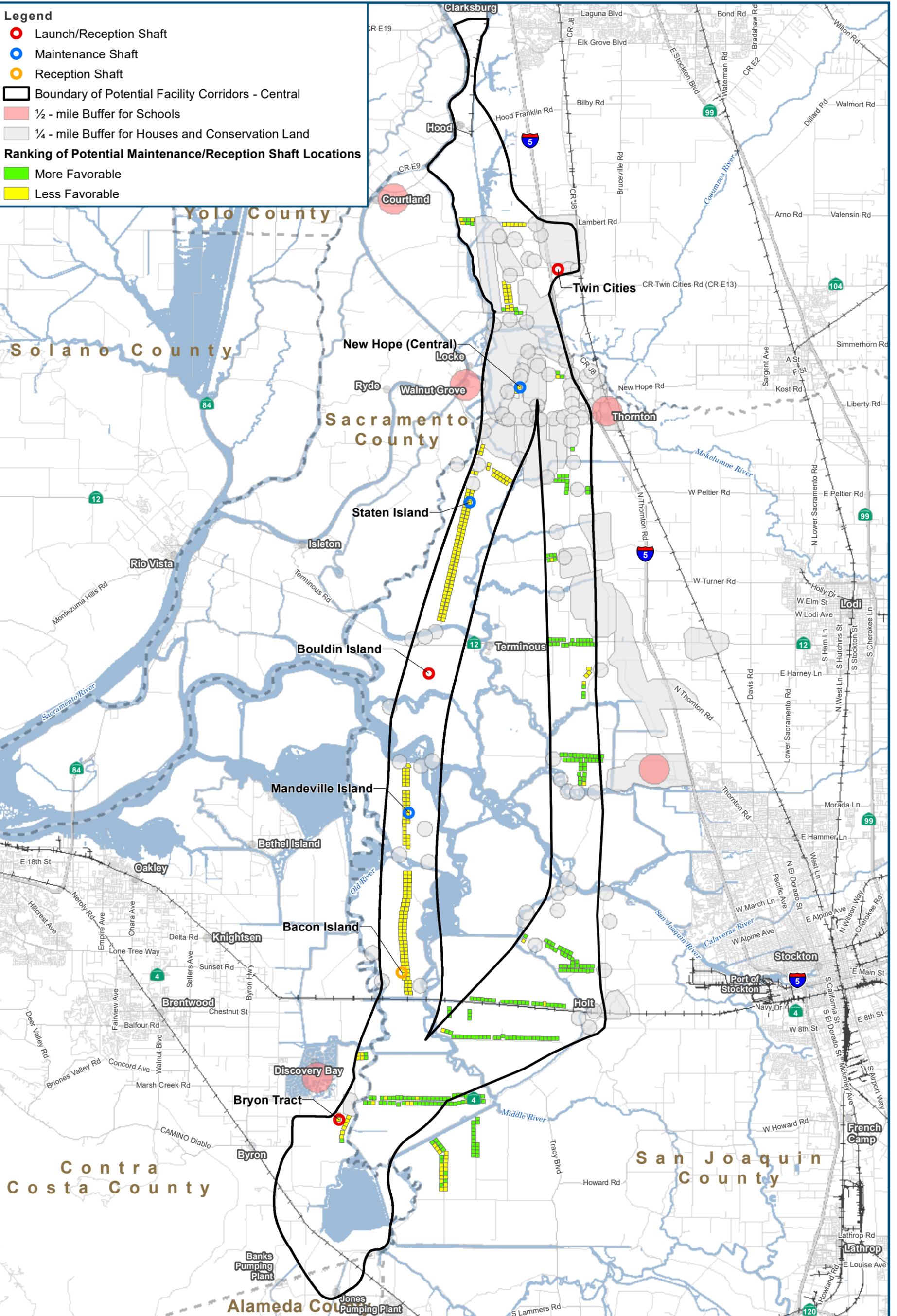
Boundary of Potential Facility Corridors - Central

1/2 - mile Buffer for Schools

1/4 - mile Buffer for Houses and Conservation Land

**Ranking of Potential Maintenance/Reception Shaft Locations**

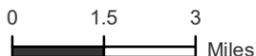
- More Favorable
- Less Favorable



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**Attachment 5.1**  
Central Corridor  
Maintenance/Reception Shaft Siting Study

**Legend**

- Launch/Reception Shaft
- Maintenance Shaft
- Reception Shaft

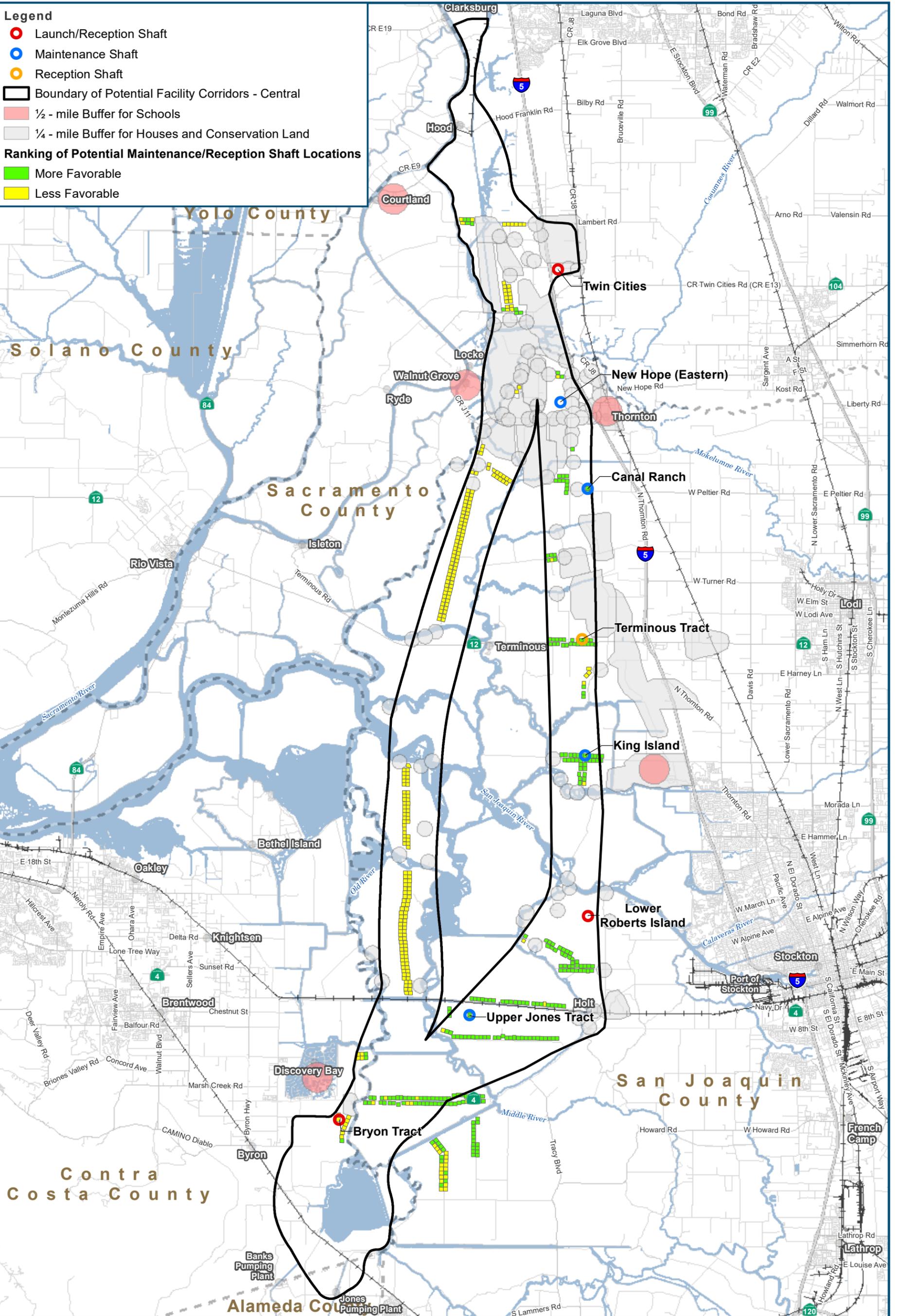
Boundary of Potential Facility Corridors - Central

1/2 - mile Buffer for Schools

1/4 - mile Buffer for Houses and Conservation Land

**Ranking of Potential Maintenance/Reception Shaft Locations**

- More Favorable
- Less Favorable



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**Attachment 5.2**  
 Eastern Corridor  
 Maintenance/Reception Shaft Siting Study

Data Source: DCA, DWR

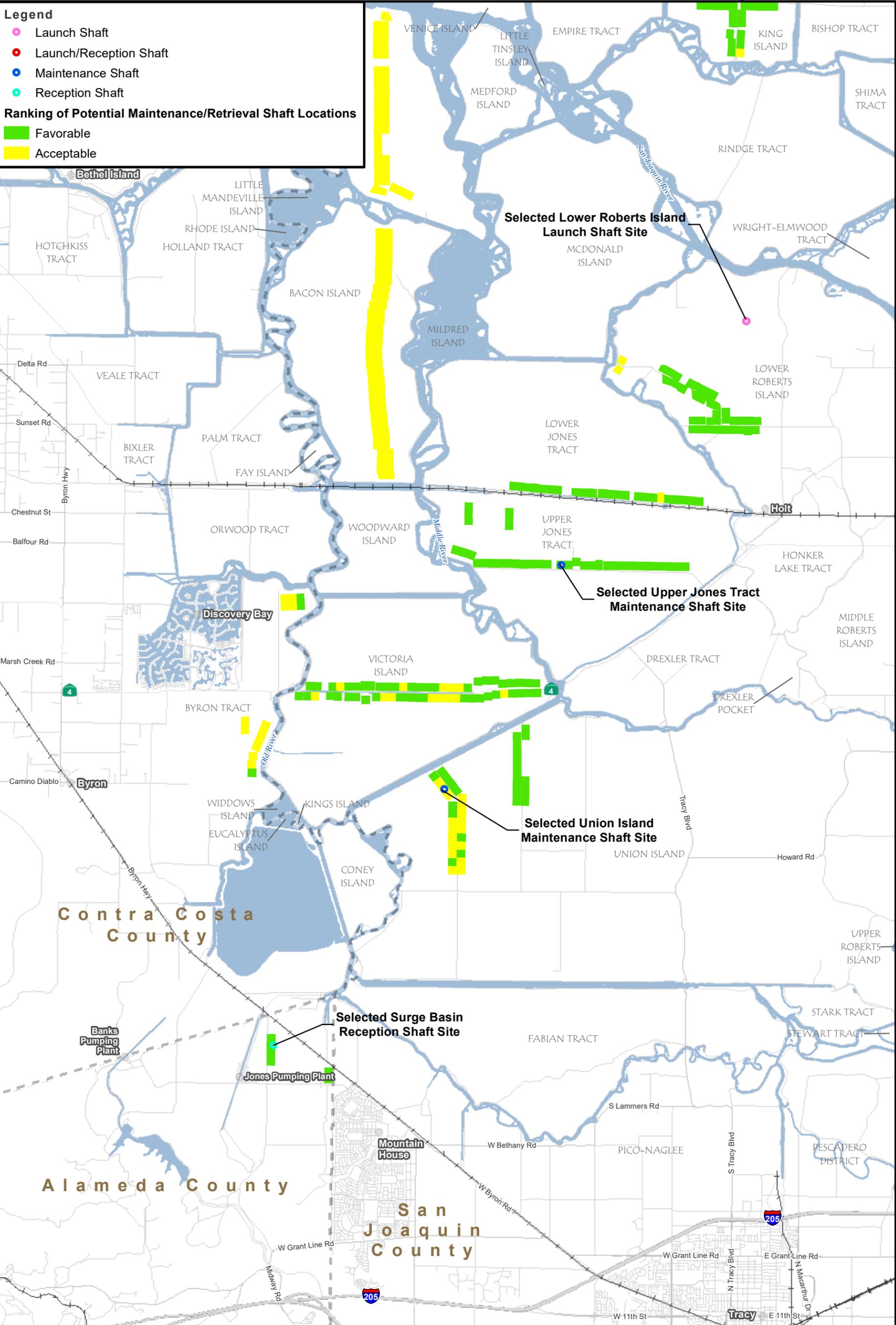
**Attachment 6**  
**Maintenance and Reception Shaft Siting for the Bethany**  
**Reservoir Alignment**

**Legend**

- Launch Shaft
- Launch/Reception Shaft
- Maintenance Shaft
- Reception Shaft

**Ranking of Potential Maintenance/Retrieval Shaft Locations**

- Favorable
- Acceptable



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**Attachment 6  
Bethany Reservoir Alignment  
Maintenance/Reception Shaft Siting Study**

Data Source: DCA, DWR