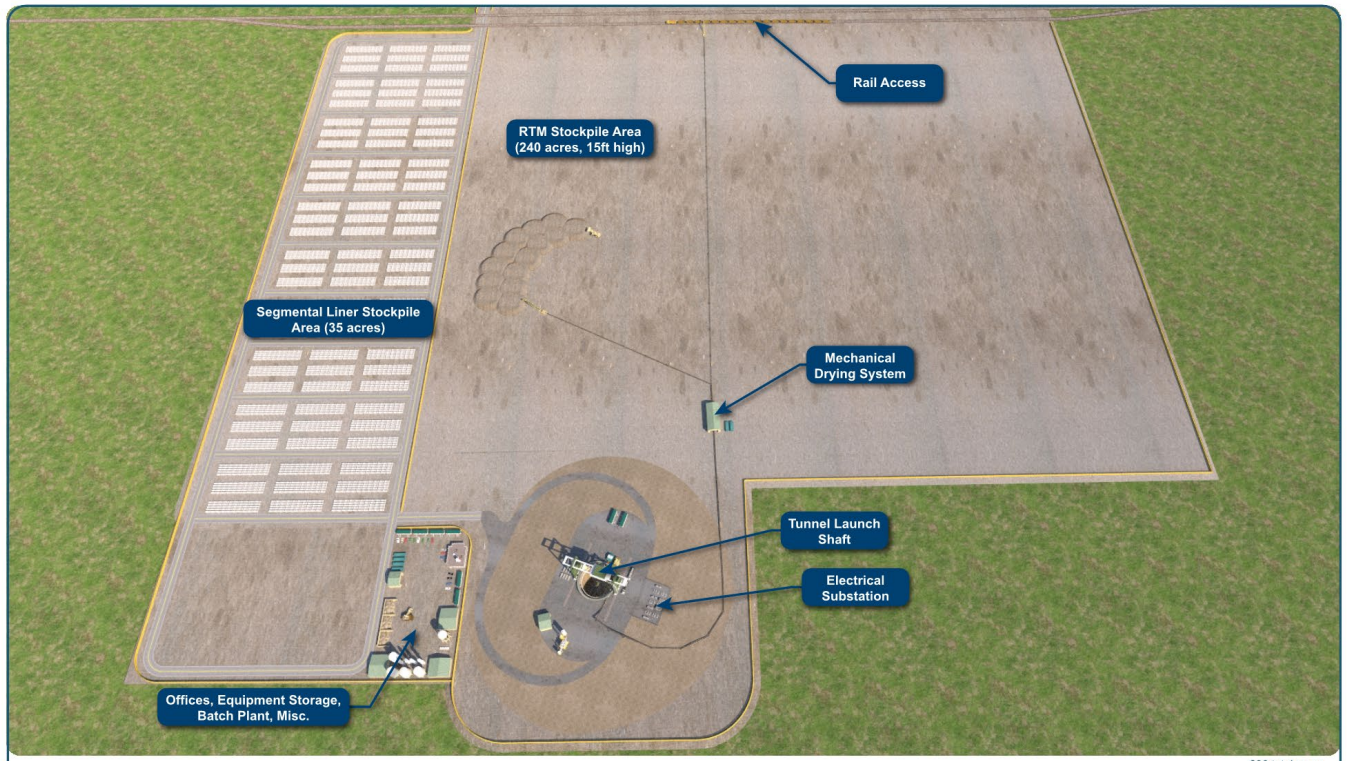
DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

STAKEHOLDER ENGAGEMENT COMMITTEE (SEC)

Stakeholder Engagement Committee (SEC)
Abridged Presentation: Launch Shaft Logistics
Presented at the February 12, 2020 Meeting

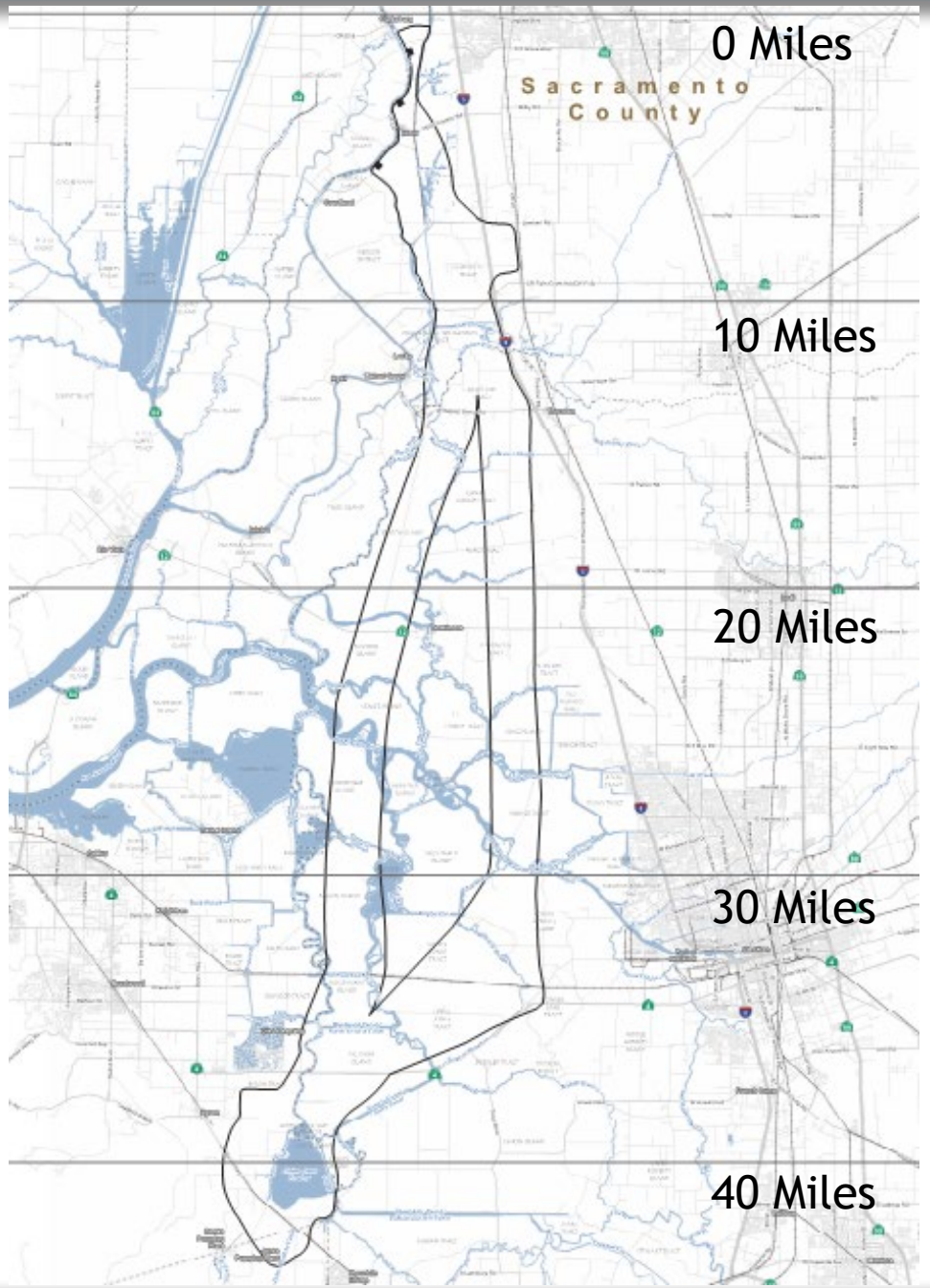
Launch Shafts

1. Substantial construction area required
2. Substantial production and stockpiling of RTM
3. Potential loading and hauling to move RTM off-site
4. Frequent tunnel liner segment deliveries and site stockpiling
5. Transportation logistics is one of the key factors in siting sites
   - Access to rail or barge landing would divert substantial traffic off local roads



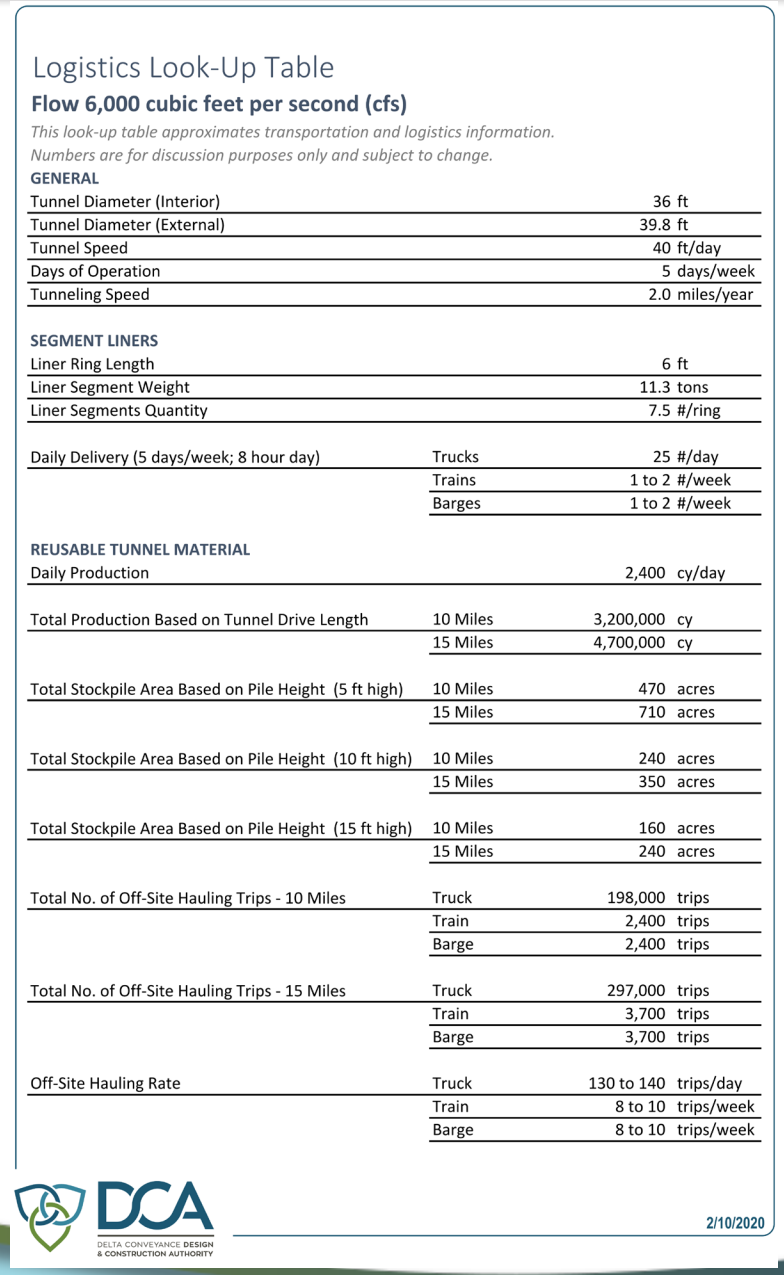
Tunnel Drive Length

1. The tunnel drive length dictates the number of liners needed and the amount of RTM produced
2. Engineering team recommends drive lengths between 10 to 15 miles based on Delta underground conditions (soft ground; consistent characteristics)
3. For the ~40 mile total tunnel length:
    - 3 to 4 tunnel drives
    - 2 to 3 launch shafts
    - 2 to 3 retrieval shafts



Look-Up Tables

1. Each table includes information on each capacity alternative in the NOP (3,000 cfs to 7,500 cfs)
2. Table includes the preliminary information:
   - Tunnel Diameter
   - Drive Speed
   - Liner Transport Trips
   - RTM Production and Total Stockpile Area
   - RTM Transport Trips
3. Transportation calculations based on trucking, rail, and barge options (count = roundtrips)
4. ***Data is based on a set of assumptions for the purposes of relative comparison and discussion – all are subject to refinement as engineering is progressed***



Logistics Look-Up Table

Flow 6,000 cubic feet per second (cfs)

This look-up table approximates transportation and logistics information.
Numbers are for discussion purposes only and subject to change.

GENERAL			
Tunnel Diameter (Interior)		36	ft
Tunnel Diameter (External)		39.8	ft
Tunnel Speed		40	ft/day
Days of Operation		5	days/week
Tunneling Speed		2.0	miles/year
SEGMENT LINERS			
Liner Ring Length		6	ft
Liner Segment Weight		11.3	tons
Liner Segments Quantity		7.5	#/ring
Daily Delivery (5 days/week; 8 hour day)	Trucks	25	#/day
	Trains	1 to 2	#/week
	Barges	1 to 2	#/week
REUSABLE TUNNEL MATERIAL			
Daily Production		2,400	cy/day
Total Production Based on Tunnel Drive Length	10 Miles	3,200,000	cy
	15 Miles	4,700,000	cy
Total Stockpile Area Based on Pile Height (5 ft high)	10 Miles	470	acres
	15 Miles	710	acres
Total Stockpile Area Based on Pile Height (10 ft high)	10 Miles	240	acres
	15 Miles	350	acres
Total Stockpile Area Based on Pile Height (15 ft high)	10 Miles	160	acres
	15 Miles	240	acres
Total No. of Off-Site Hauling Trips - 10 Miles	Truck	198,000	trips
	Train	2,400	trips
	Barge	2,400	trips
Total No. of Off-Site Hauling Trips - 15 Miles	Truck	297,000	trips
	Train	3,700	trips
	Barge	3,700	trips
Off-Site Hauling Rate	Truck	130 to 140	trips/day
	Train	8 to 10	trips/week
	Barge	8 to 10	trips/week

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2/10/2020

Tunnel – Basic Data

1. Internal tunnel diameter is a function of flow
2. External tunnel diameter accounts for liner thickness
3. Tunnel boring speed dependent on tunnel diameter and daily operating hours
   - Smaller = faster
   - Daily Operation = 20 hours
4. Distance per year based on annual days of operation

Tunnel Data

	Tunnel Diameter			
Capacity	**Interior**	**External**	**Tunneling Speed**	
cfs	*ft*	*ft*	*ft/day*	*miles/year*
3,000	25	28.5	45	2.2
4,500	31	34.5	40	2.0
6,000	36	39.8	40	2.0
7,500	40	44.8	35	1.7

Annual tunnel distance assumes 5 days/week of tunnel operations; 1 day of maintenance; 1 day of rest; 50 total work weeks in year.

Tunnel Liner Segment Deliveries

1. Daily number of segments needed dependent on tunnel diameter and boring speed
   - Larger diameter = heavier liner
   - Larger diameter = slower speed
2. Daily number of deliveries is driven by the weight of the liners

Deliveries					
Capacity	# Segments	Truck		20 Car Rail	Barge
		24 ton, 10 hour day		*100 ton/car*	*2,000 ton*
cfs	*per day*	*#/day*	*Interval*	*Interval*	*Interval*
3,000	49	25	20 to 25 min	5 to 7 days	5 to 7 days
4,500	50	25	20 to 25 min	4 to 6 days	4 to 6 days
6,000	50	25	20 to 25 min	3 to 5 days	3 to 5 days
7,500	50	50	10 to 15 min	2 to 4 days	2 to 4 days

Note: Assumes liner deliveries keep pace with daily production rates for the purposes of comparison and discussion. Actual deliveries may vary depending on ultimate manufacturing and delivery plan.

RTM Stockpile Area (Drive in One Direction)

1. RTM volume per drive is based on the tunnel diameter and the total drive length
2. Total area needed is dependent on how high the material is piled
3. Launch site consideration includes sufficient space to stockpile the entire volume of RTM produced to minimize risk of work stoppage
4. The total acreage needed could decrease if material could be hauled off-site for beneficial reuse as the tunnel is excavated

Stockpile Area						
Capacity	**10 Mile Bore**			**15 Mile Bore**		
	5 Ft High	10 Ft High	15 ft High	5 Ft High	10 Ft High	15 ft High
cfs	*Acres*			*Acres*		
3,000	240	120	80	360	180	120
4,500	350	180	120	530	270	180
6,000	470	240	160	710	350	240
7,500	600	300	200	900	450	300

Note: The date in the table is based on a single drive direction. If a two drives are launched from a single location, i.e. tunneling north and tunneling south, then these quantities would double.

RTM Off-Site Hauling (Where Required)

1. RTM can be used by:
   - Conveyance project at the launch shaft site *(highest priority)*
   - Offsite conveyance project facilities
   - Offsite to other identified beneficial reuse
   - Stockpiled on site for future unknown use
2. Two project features require RTM:
   - Southern Forebay (~5,000,000 cy @ 6,000 cfs)
   - Mitigation Areas (quantity and locations unknown)
3. Access to rail or barge desirable for off-site transport - high volume of material
4. Team prefers to identify beneficial reuse scheme as part of this project so that public has complete picture of potential transportation requirements

RTM Off-Site Hauling

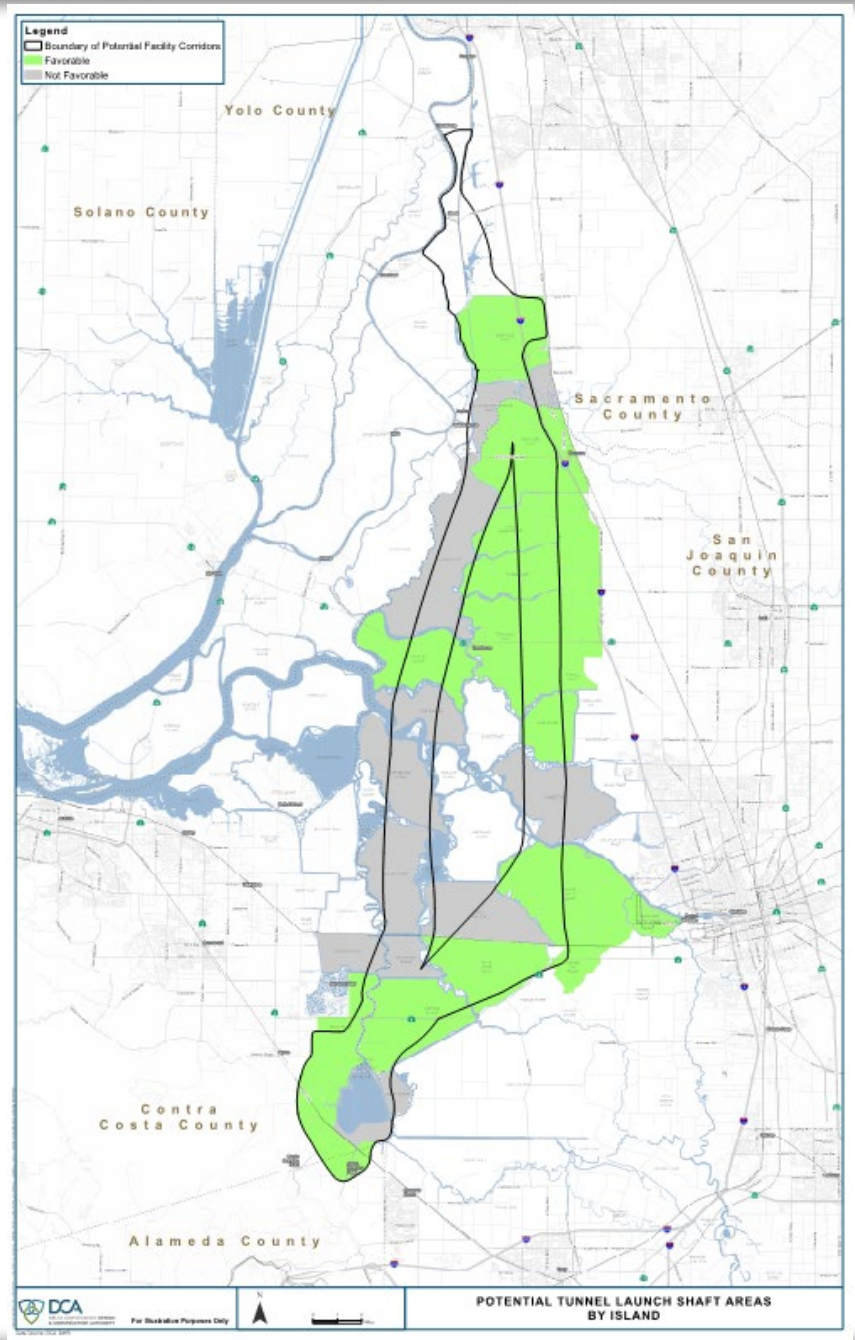
Capacity	RTM Generated	Transportation Trips			
		Truck		20 Car Rail	Barge
		16 cy, 10 hour day		*(65 cy/car)*	*(1,300 cy)*
cfs	*cy/day*	*#/day*	*Interval*	*#/day*	*#/day*
3,000	1,400	90	7 to 8 min	1 to 2	1 to 2
4,500	1,800	110	5 to 6 min	1 to 2	1 to 2
6,000	2,400	150	4 to 5 min	2	2
7,500	2,700	170	3 to 4 min	2	2

Note: For the basis of comparison, the RTM hauling counts are based on the daily volume of material generated at a launch shaft site and 5 days a week of operation and hauling.

Existing data indicates RTM suitable for reuse (e.g. levee construction) subject to more extensive field testing and analysis.

Launch Shaft - Logistics Maps

- Maps identifying feasibility of existing routes for surface roads, rail and barging for the purposes of siting a Launch Shaft
- “Heat Maps” identifying islands that are accessible by road, rail or barge
- Favorable access represents areas that have good road access and either rail or barge access
- Rating System for Launch Shaft Siting:
  - Green – Favorable for Tunnel Launch Shaft
  - Grey – Not Favorable for Tunnel Launch Shaft



Clarifications?

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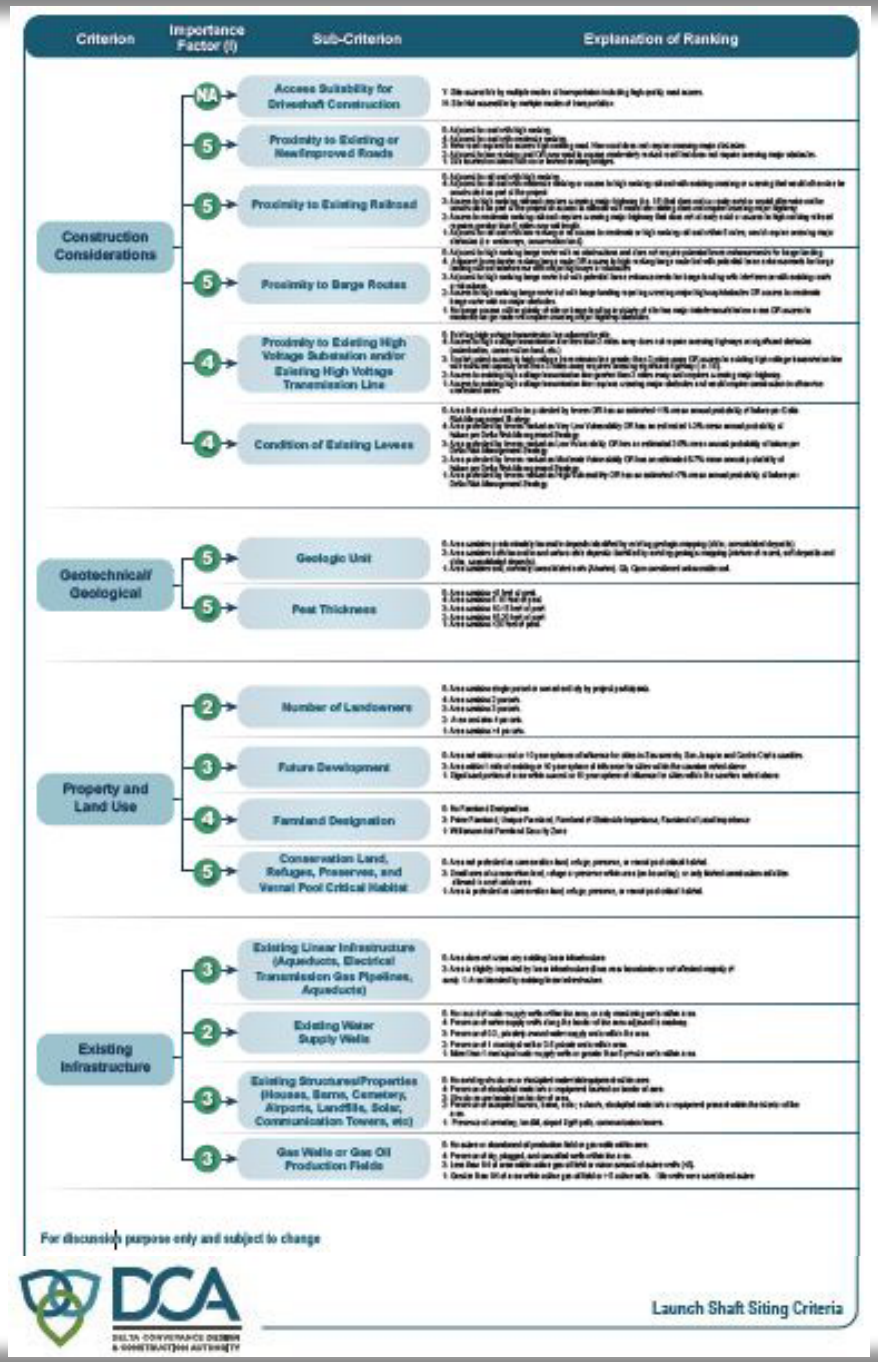
LAUNCH SHAFT SITING ANALYSIS

Siting Methodology

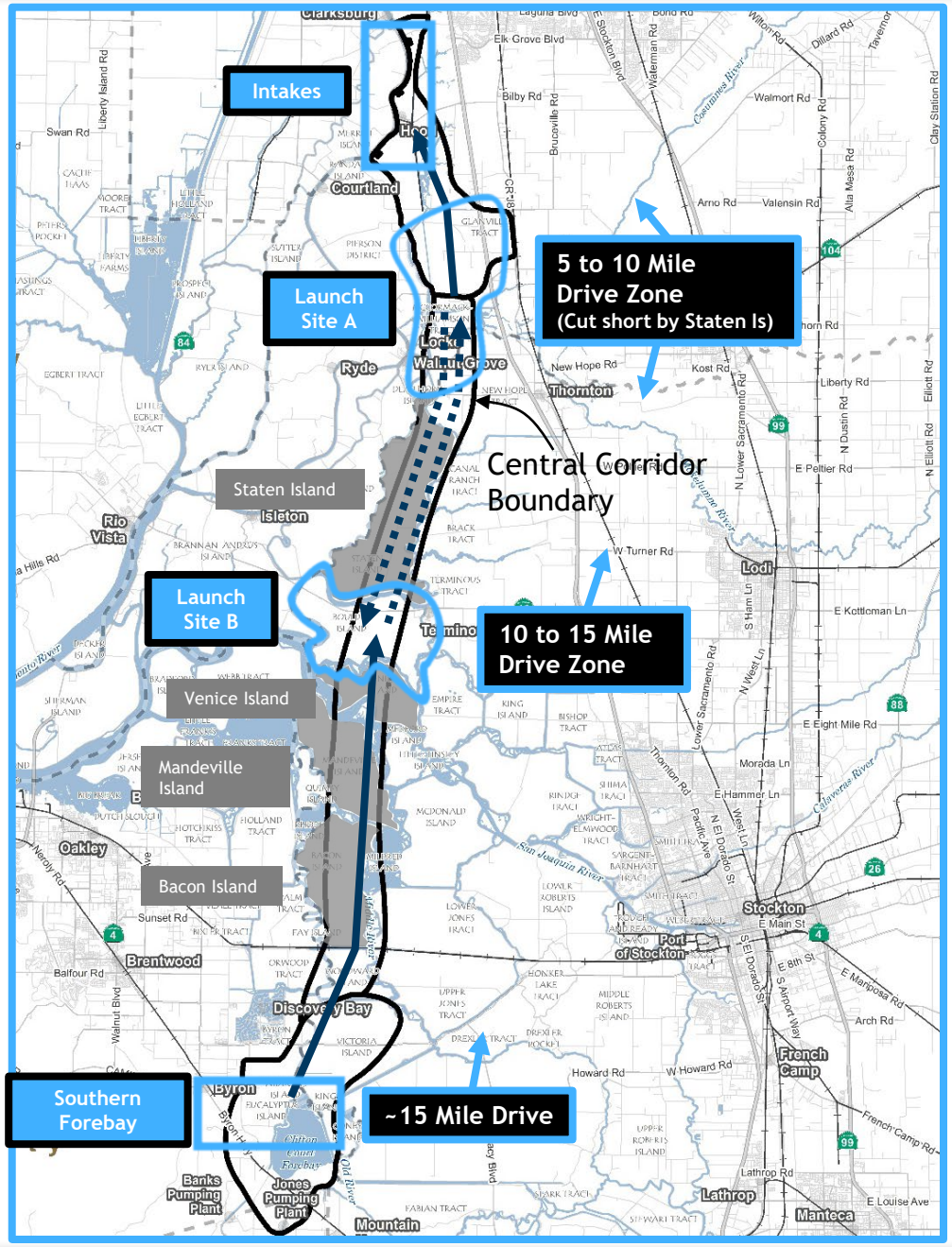
- Siting methodology breakdown is in handout packet
- Methodology is broken out into criteria and sub-criteria
- Sub-criteria are assigned an Importance Factor to reflect their weighting
- Criteria are based on design and construction considerations
  - The CEQA process will consider additional environmental considerations



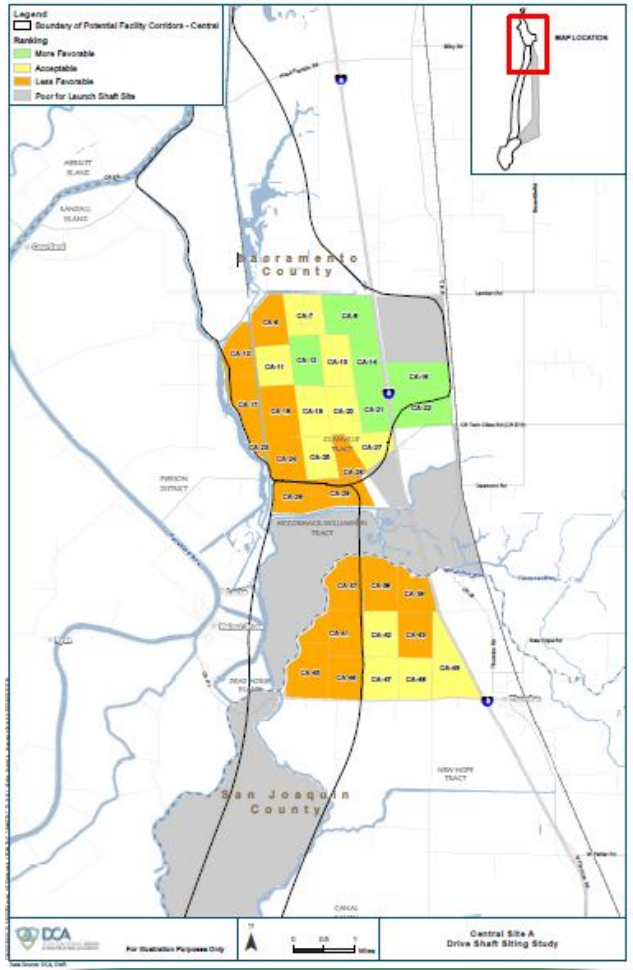
Central Alignment

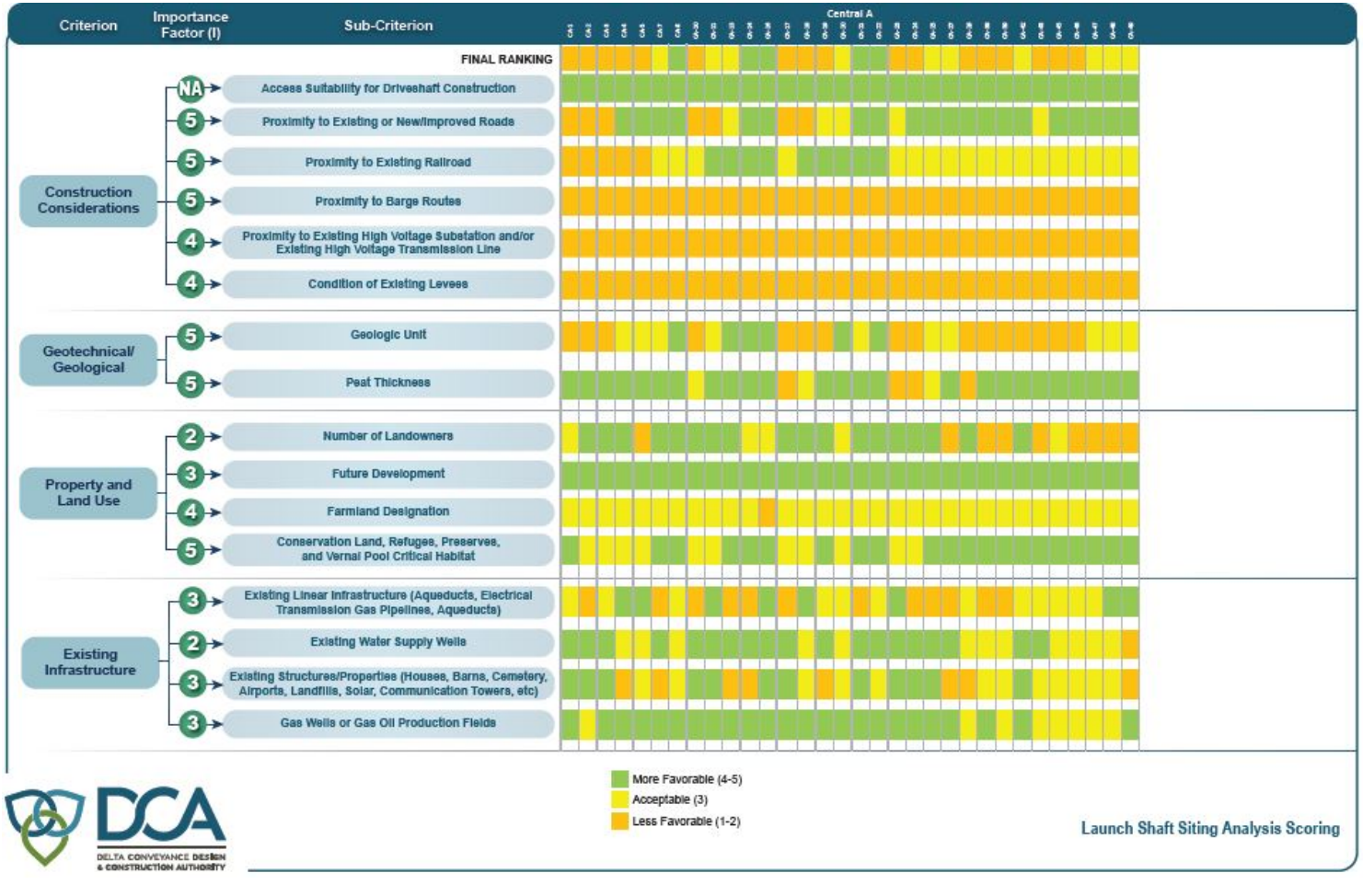
3 Drives:

1. **Intakes to Launch Site A**
   - Drive shorter than desirable to avoid Staten Island
   - Drive north to reduce potential effects at intakes
   - Sites closer to rail preferable for liner and RTM transport
2. **Launch Site A to Launch Site B (Bouldin Island)**
   - Good road (Hwy 12) and barge access (off San Joaquin River)
   - Good location to stockpile RTM for Delta beneficial reuse
   - Launch or receive at this site depending on where RTM desired
3. **Launch Site B to Southern Forebay**
   - Drive north from Southern Forebay to Bouldin – use RTM to build forebay levees
   - Potential for ~100% reuse of material on site

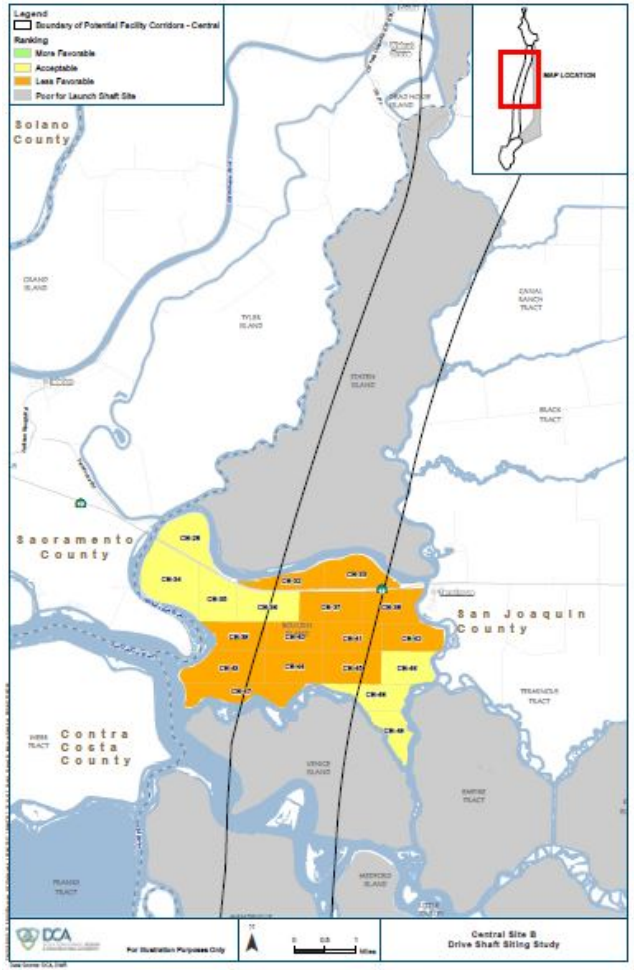


Central Alignment -Shaft Site A





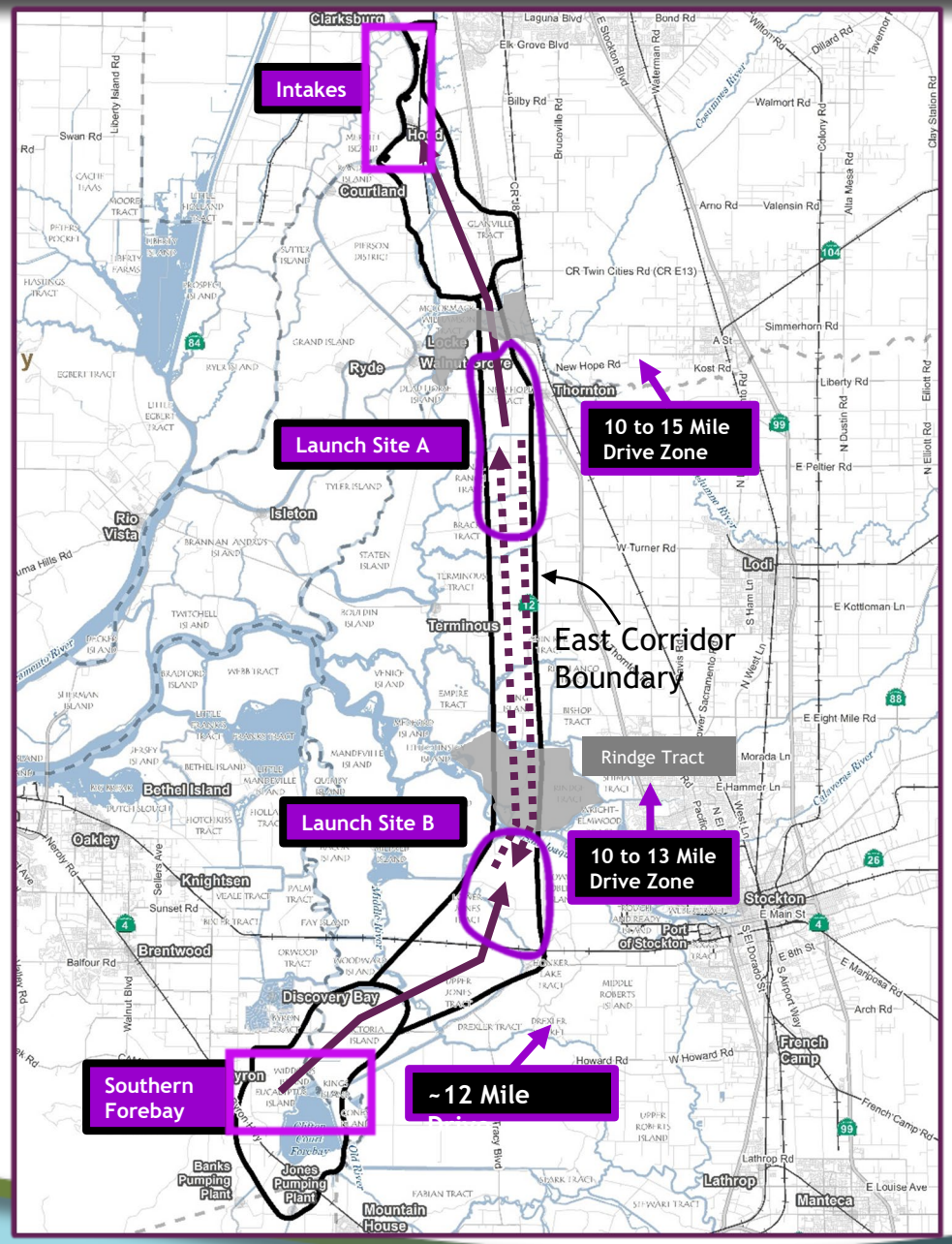
Central Alignment -Shaft Site B



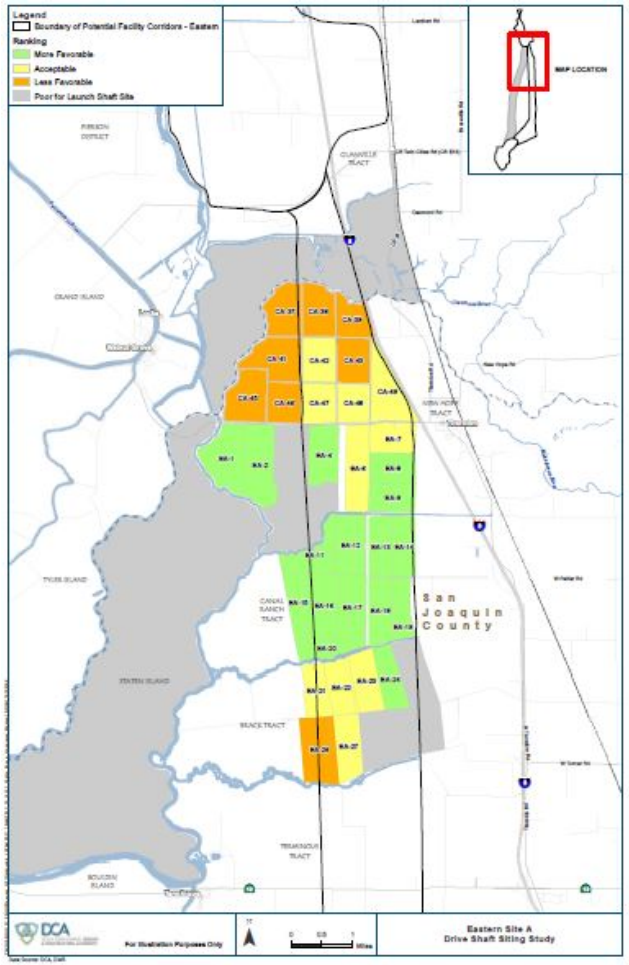
Configurations - East

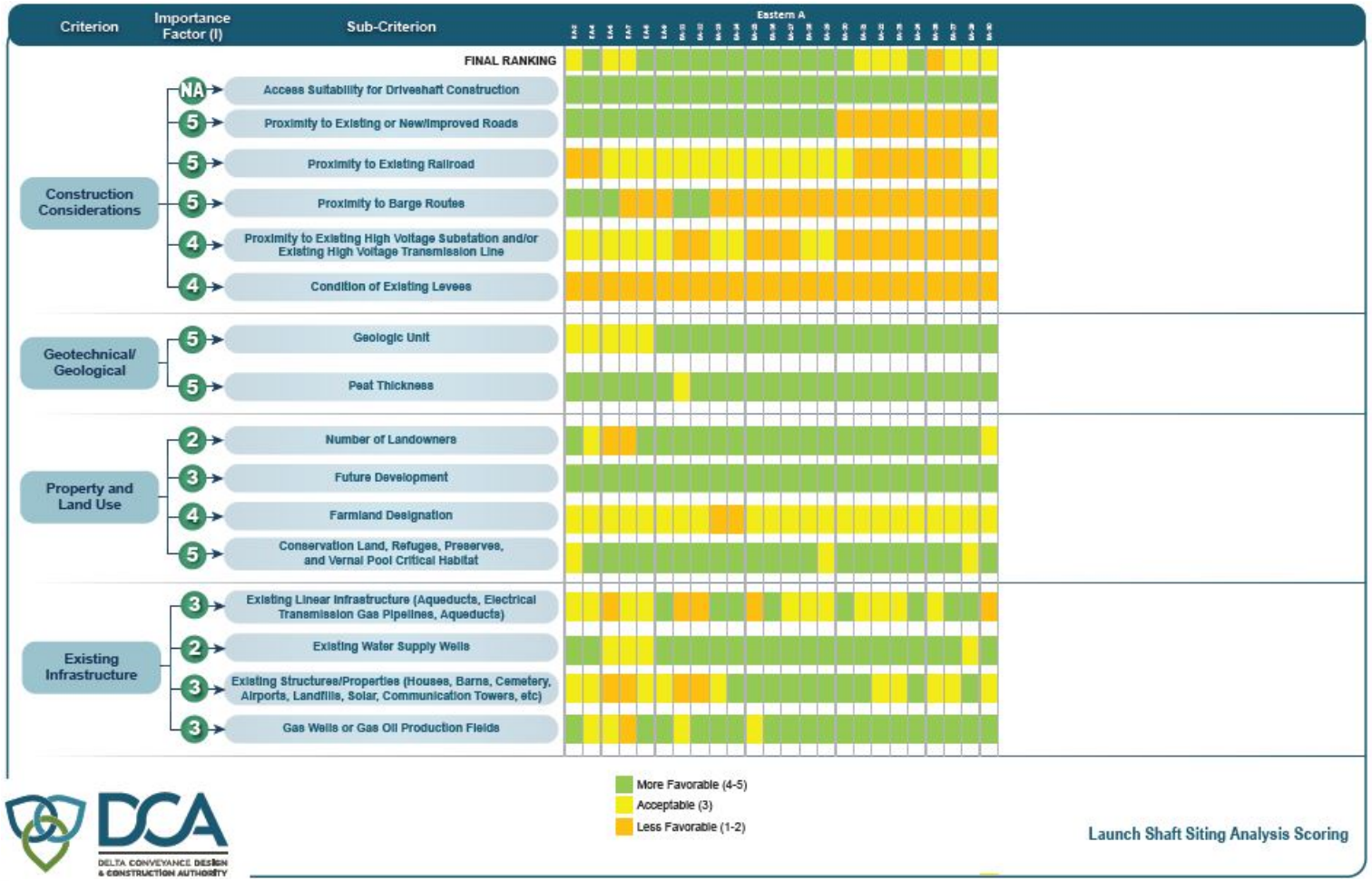
3 Drives:

1. **Intakes to Launch Site A**
   - Drive north to reduce potential effects at Intakes
   - Sites closer to rail preferable for liner and RTM transport
2. **Launch Site A to Launch Site B**
   - Acceptable road (Hwy 4) and barge access (San Joaquin River)
   - Good location to stockpile RTM for Delta beneficial reuse
   - Launch or receive at this site depending on where RTM desired
3. **Launch Site B to Southern Forebay**
   - Drive from Forebay north to Launch Site B – use RTM to build forebay levees
   - Potential for ~100% reuse of material on site

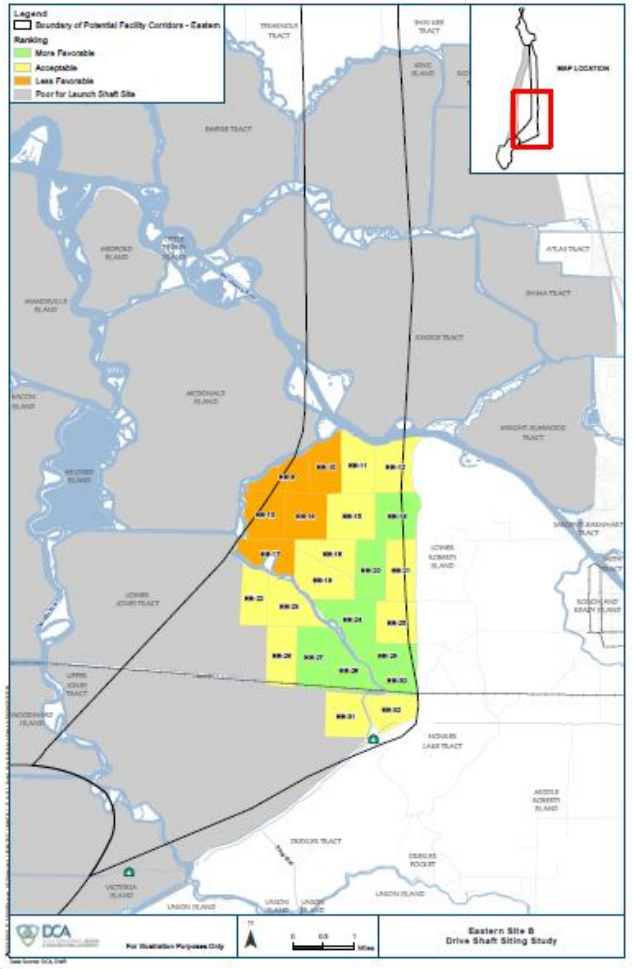


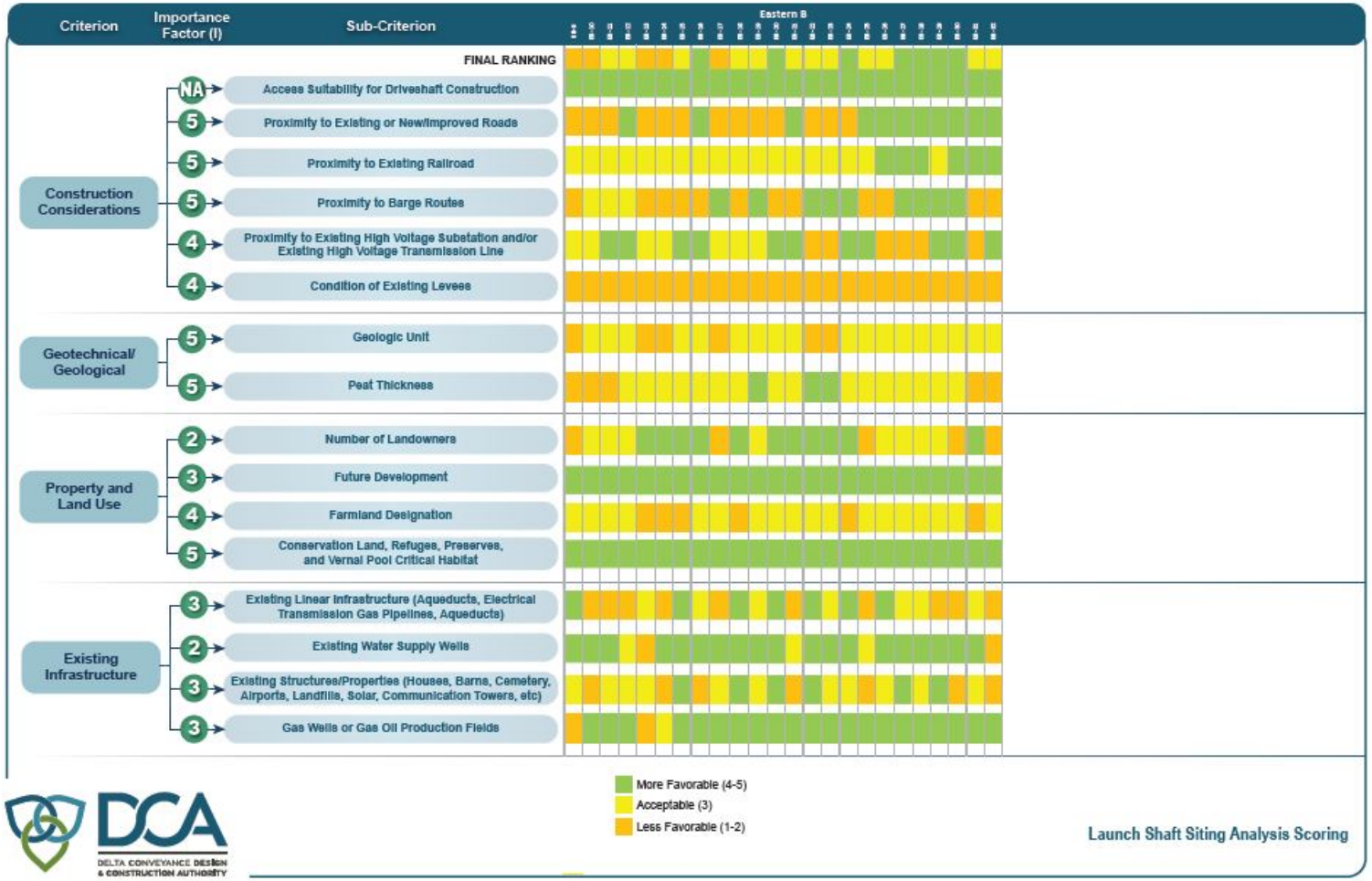
East Alignment – Shaft Site A





East Alignment – Shaft Site B





Clarifications?

For SEC Consideration

- DCA has identified zones where we believe launch shafts could be located based on acceptable drive lengths and has created an evaluation system to rank feasible sites within each of these zones. We have reviewed the results of this exercise with you today.
- Questions for SEC to consider:
  - Do you feel that the evaluation system captures the design and construction issues important to the Delta?
  - Do the results of the evaluation system applied to the areas within each zone make sense? What specifically seems appropriate or inappropriate?
  - Do you have any thoughts regarding areas that would be preferred for locating a launch shaft?
- Is there any additional information related to the **siting** of launch shafts that you would like presented at the next SEC meeting on February 26?