Subject:	**South Delta Conveyance Facilities Hydraulic Analysis Criteria and Analyses (Final Draft)**
Project feature:	South Delta Conveyance Facilities
Prepared for:	California Department of Water Resources (DWR) / Delta Conveyance Office (DCO)
Prepared by:	Delta Conveyance Design and Construction Authority (DCA)
Copies to:	File
Date/Version:	December 23, 2021
Reference no.:	EDM_SC_CE_TMO_SDCF-Hyd-Analysis-Criteria-Analyses_000964_V02_FD_20211223

1. Purpose

The purpose of the technical memorandum (TM) is to summarize the hydraulic analysis criteria and subsequent analyses for features included in the South Delta Conveyance Facilities (SDCF) of the Delta Conveyance Project (Project). The SDCF would convey flow from the Southern Forebay (SF) to the California (CA) Aqueduct upstream of the State Water Project (SWP) Harvey O. Banks Pumping Plant (Banks). Provisions have also been made for a possible extension of this system that would also convey flow to Central Valley Project's (CVP's) Delta-Mendota Canal (DMC), upstream of the C.W. "Bill" Jones Pumping Plant (Jones). Detailed operations and equipment information would be developed during final design.

1.1 Background

The overall project would receive water at intakes on the Sacramento River in the north Delta and deliver it downstream to Banks, with provisions to potentially supply Jones. The Project would include the following components:

- Up to three Sacramento River intakes
- A main tunnel connecting the river intakes to a new pumping plant located at a new SF
- The SDCF, which would deliver water from the SF to Banks and potentially Jones

Figure 1 in the attachment shows the overall plan of the SDCF that would deliver water to Banks. Figure 2 in the attachment shows the same plan with additional facilities that would be needed to deliver water to Jones. Figure 3 provides a flow schematic of the full SDCF showing both deliveries.

The Project's maximum design diversion capacity from the Sacramento River to the SF has not been selected. However, the DCO has established a range of conveyance capacities from 3,000 to 7,500 cubic feet per second (cfs). The DCA has performed a systemwide hydraulic and capacity analysis of the portions of the Project upstream of the SDCF to establish the design flow capacities of this capacity range. That analysis is described in the Capacity Analysis for Preliminary Tunnel Diameter Selection TM (DCA, 2021a).

As described in the Southern Forebay Siting Analysis TM, (DCA, 2021b), the SF was sized to store the daily pumping volume of Banks. Although sized for a maximum flow capacity of 10,670 cfs, Banks typically operates at, or less than, 9,000 cfs, resulting in a maximum daily export pumping volume of 9,000 acre-feet (AF), which is equal to the size of the proposed SF. The SF was sized to contain the 9,000-AF volume using a low water level (between elevations 5.0 and 5.5 feet) and a high-water level below the spillway (at elevation 21.0 feet and accounting for wave runup, which resulted in a high water elevation of 17.5 feet).

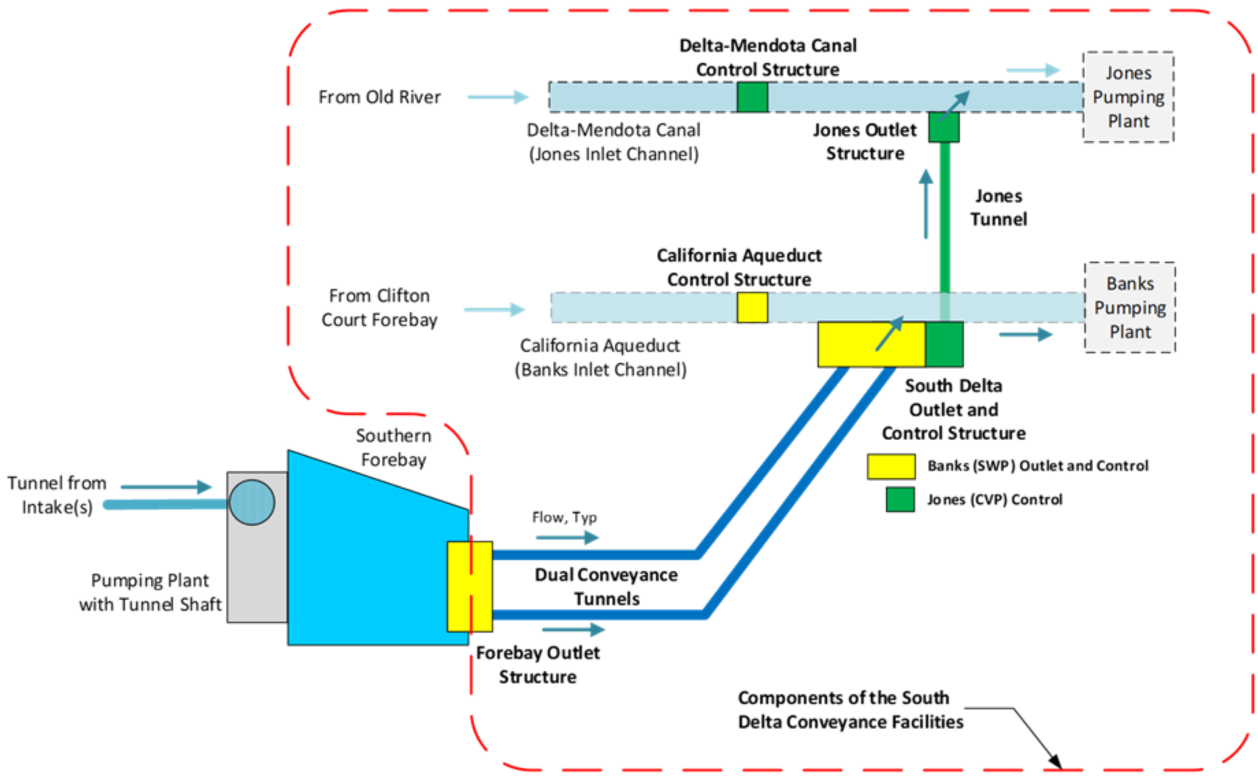

Figure 3. South Delta Conveyance Facilities Schematic

The design conveyance capacity of the SDCFs would be somewhat independent of the overall Project capacity. The SDCF conveyance capacity would be equal to Bank's capacity of 10,670 cfs for overall Project capacities up to 6,000 cfs. If the CVP extension is included, the capacity of the SDCF would increase by 1,500 cfs to 12,170 cfs for service to both the SWP and CVP facilities. SWP and CVP flows would be split at the South Delta Outlet and Control Structure, with a capacity of 1,500 cfs used for facilities extending to the CVP and 10,670 cfs used for facilities that control flows into the CA Aqueduct for the SWP. The CA Aqueduct Control Structure would control flows from Clifton Court Forebay (CCF) through the CA Aqueduct to Banks. Its conveyance capacity would match the maximum Banks capacity of 10,670 cfs. The DMC Control Structure would control flows from Old River through the DMC to Jones. Its conveyance capacity would match the maximum Jones capacity of 4,600 cfs.

2. Conceptual Hydraulic Analysis Criteria

As Figure 2 shows, the SDCF comprise the following components, listed in direction of flow.

State Water Project Facilities (downstream of the SF)

- SF Outlet Structure
- Dual Conveyance Tunnels
- South Delta Outlet and Control Structure
- CA Aqueduct Control Structure

Extension to CVP Facilities (downstream of the South Delta Outlet and Control Structure)

- Jones Control Structure
- Jones Tunnel
- Jones Outlet Structure
- DMC Control Structure

Additional details regarding these components are presented in the South Delta Conveyance Facilities System Configuration TM (DCA, 2021c). The conceptual hydraulic analysis criteria for these facilites are described here.

2.1 Conceptual Hydraulic Analysis Criteria

The following items provide the boundary conditions and basic hydraulic analysis criteria for the overall SDCF.

Conveyance Capacities

- Established for the Project by DWR
- Maximum flow for SWP facilities = 10,670 cfs
- Maximum flow for SDCF CVP supply facilities = 1,500 cfs
- Maximum flow for DMC and DMC Control Structure = 4,600 cfs
- Maximum SDCF total flow from the SF without CVP supply = 10,670 cfs
- Maximum SDCF total flow from the SF with CVP supply = 12,170 cfs

Water Surface Elevations

- Minimum normal operating water surface elevation at Banks = +1.1 ft (WaterFix, 2018)
- Minimum allowable operating water surface elevation at Banks = -0.9 ft (WaterFix, 2018)
- Minimum allowable operating water surface elevation in the CA Aqueduct for Byron Bethany Irrigation District (BBID) Pumps = -0.4 ft. (WaterFix, 2018)
- Minimum design operating water surface elevation at Jones = -1.43 ft (WaterFix, 2018)
- Minimum allowable operating water surface elevation at Jones = -2.43 ft (WaterFix, 2018)
- Available driving water surface elevation in SF to convey design flows = between +5.0 and +5.5 ft to preserve operating water level band in SF (DCA, 2020b)

Each facility was sized, considering these boundary conditions. Calculations were performed by holding water levels at the downstream boundary conditions at Banks and Jones and determining upstream water levels through the various facility components until reaching the upstream driving water surface in the SF.

Since the design water surface at the inlet to Banks is elevation +1.1, and the BBID Pumps are on the CA Aqueduct upstream of Banks, the minimum allowable water surface at the BBID pumps would be above elevation +1.1. This water surface elevation meets the requirement for BBID pump operations, and no further analysis is needed.

2.2 State Water Project Delivery Facilities

2.2.1 California Aqueduct

Description

The CA Aqueduct feeds flow from the SDCF to Banks. The minimum allowable water surface elevation in the aqueduct at the pumping plant location corresponds to the minimum elevation required for correct submergence and normal operation of the individual pumps. Figure 4, excerpted from the original as-built construction drawings (DWR, 1965), shows the geometry of the canal that feeds Banks. DWR provided additional geometry used for the analysis (DWR, 1965). The headloss through the canal was estimated using Mannings equation, using the following criteria.

Criteria

- **Flow:** 10,670 cfs (maximum design flow for all scenarios)
- **Normal Low Water Elevation – Banks**: The minimum normal operating water level in the CA Aqueduct just upstream of Banks is 1.1 feet (ft)
- **Channel Bottom Width**: 80 ft
- **Channel Side slopes**: 3:1
- **Channel length**: 8,800 ft (to SDCF confluence point)
- **Manning's n**: 0.025
- **Minor Losses**: 2 times the velocity head for transitions

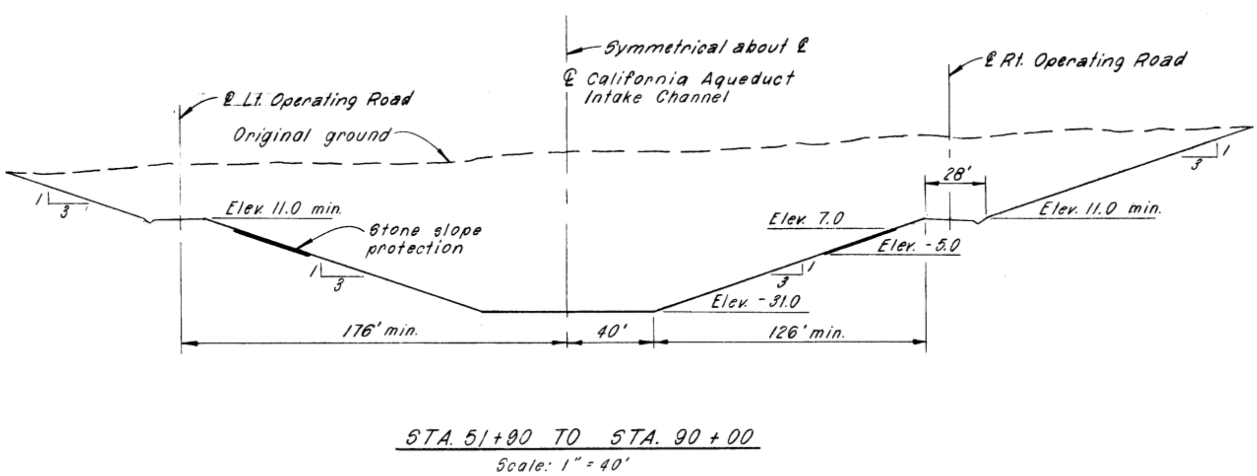

Figure 4. CA Aqueduct Cross Section (DWR, 1965)

2.2.2 South Delta Outlet and Control Structure

Description

As Figure 3 shows, the South Delta Outlet and Control Structure is the next hydraulic facility upstream of the CA Aqeuduct. This facility contains radial gates that control flow from the SF into the CA Aqeuduct. Figures 5 and 6 in the attachment show the structure details. The hydraulic criteria are provided here.

Criteria

- **Flow:** 10,670 cfs (SWP only); 12,170 (CVP option including 10,670 cfs to CA Aqueduct and 1,500 cfs to CVP facilities)
- **Normal Downstream Low Water Elevation**: Water surface elevation in the CA Aqueduct at confluence (computed per information in this TM)
- **Channel Side slopes**: 3 horizontal (H): 1 vertical (V) (trapezoidal section); vertical in the upstream gate and tunnel transition section
- **Structure Length**: 395 ft
- **Head Loss Through Gates**: 1 ft, design allowance at low water levels
- **Minor Losses**: 3 times the dual conveyance tunnel velocity head for exit losses, flow angle changes
- **Target Exit Velocity:** 3 feet per second (fps) or less to minimize erosion

2.2.3 Dual Conveyance Tunnels

Description

As Figure 3 shows, the dual conveyance tunnels are the next facility upstream of the South Delta Outlet and Control Facility. The tunnel hydraulic losses were calculated with Mannnings equation for pipe flow using the following criteria.

Criteria

- **Flow:** 10,670 cfs (SWP only); 12,170 (CVP option)
- **Tunnel Length**: 10,680 ft
- **Manning's n**: 0.016
- **Maximum Velocity**: 6 fps; tunnels sized to limit headloss to meet available driving head in SF
- **Minor Losses:** Included in structures

2.2.4 Southern Forebay Outlet Structure

Description

As Figure 3 shows, the SF Outlet Structure is the next facility upstream of the dual conveyance tunnels. The hydraulic criteria are provided here.

Criteria

- **Flow:** 10,670 cfs
- **Structure Length**: 430 ft
- **Minor Losses:** 1 times the dual conveyance tunnel velocity head for entrance and trash rack losses (assumed clean for minimum water level analysis)

2.2.5 Additional South Delta Outlet and Control and CA Aqueduct Control Structure Hydraulic Issues

During a review of the SDCF, the following two items described suggested further hydraulic studies would be needed to verify the concept design.

- **Raised Structure Invert - CA Aqueduct Control Structure:** The gates on the CA Aqueduct Control Structure need to be high enough to protect against the 200-year project flood event plus estimated sea level rise (elevation 20.8 per DWR), plus 3 ft of freeboard. This results in a top of gate elevation of about +24 ft. This criterion would require gates that were over 40 ft tall using the existing channel bottom elevation. More detailed hydraulic studies are needed to determine how high the invert of the structure could be raised without impacting the overall hydraulic gradeline of the CA Aqueduct. Raising the invert would allow shorter radial gates.
- **Gate Outlet Flow Velocity – South Delta Outlet and Control Structure:** When throttling with the radial gates, especially at high water levels in the SF, a high velocity jet of flow is set up underneath the control gates. More detailed hydraulic studies are needed to determine if this jet would cause damaging erosion at the confluence with the CA Aqueduct.

2.2.5.1 Raised Structure Invert

To assess raising the invert of the CA Aqueduct Control Structure, the open-channel model WinHydro (CH2M, 2020) was used to model the structure including the inlet transition, the outlet transition, and the radial gates. Different trials were performed at progressively higher invert elevations. For each trial, the model was used to calculate the difference in head across the structure, to examine the effects from raising the invert on the operational water surface elevations upstream of the structure. The analysis criteria are listed here:

Criteria

- **Success Criteria:** Raise bottom so overall headloss through the structure is no more than 2 ft (nominally 1 ft more than otherwise would have resulted through the new structure)
- **Flow:** 10,670 cfs
- **Structure Length**: 850 ft
- **Top of Gate Elevation:** +24.0 ft
- **Number of Main Gates:** 6 gates, 24 ft wide each
- **Structure Contraction Angle = 45 degrees, Minor loss K=0.125**
- **Structure Expansion Angle = 45 degrees, Minor loss K=0.23**

2.2.5.2 Gate Outlet Velocity

Flow from the South Delta Outlet and Control Structure would enter the CA Aqueduct at about a 40-degree angle. This angle helps lessen the flow directional change into the CA Aqueduct, reducing the turbulence, surface waves, and erosion potential. Because of the throttling nature of the radial gates, the potential exists for supercritical flow to emerge from beneath the gates that could scour the downstream transition area within the CA Aqueduct. Normal depth calculations on the CA Aqueduct indicate a hydraulic jump should occur somewhere downstream of the gates, and the flow velocity in the channel would eventually equilibrate to 3 fps or less, which is considered nonerosive. Therefore, confirmation that the hydraulic jump would occur within the structure would result in outflow at the sequent depth of this jump, which would essentially match the CA Aqueduct flow depth and reduce velocities in the confluence area to those that would not be considered erosive. Further analysis was performed to determine the hydraulic jump characteristics and confirm the jump would be contained within the structure. The invert of the South Delta Outlet and Control Structure was adjusted by trial and error to determine the elevation required to force the jump to remain within the structure. The analysis criteria are listed here.

Criteria

- **Success Criteria:** Hydraulic jump to be contained on concrete discharge apron within structure
- **Flow:** 10,670 cfs
- **Number of Main Gates:** 6 gates, 24 ft wide each
- **Gate Contraction Coefficient: 0.71**
- **Gate Opening: 2.2 ft**
- **Maximum Upstream Flow Depth = 36.5 ft** (worst case, assumes diversion during SF overflow event)

Equations

$$Y_2=(Y_1/2))\ [(1+8F_1^2)^{1/2}-1] \qquad \text{(Chow, 1959)}$$

Where:

$F_1 = V/(gY_1)^{1/2}$ Upstream Froude Number (Chow, 1959)

$V = Q/A$

And:

Y_1 = depth upstream of hydraulic jump

Y_2 = depth downstream of hydraulic jump (sequent depth)

g = acceleration of gravity (32.2 fps^2)

Q = flow (cfs)

A = area of flow (square feet)

V = upstream velocity (fps)

2.3 Central Valley Project Delivery Facilities

As Figures 2 and 3 show, possible water delivery to the CVP Jones would be accomplished by constructing a small separate control structure that connects to the dual conveyance tunnels outlet box of South Delta Outlet and Control Structure. From this smaller control structure, a single tunnel would extend to an outlet structure on the western bank of the DMC, upstream of Jones. Water would then flow down the DMC to Jones.

These facilities were analyzed starting from the downstream boundary condition (water surface elevation) just upstream of Jones. The analysis was extended upstream through the appropriate section of the DMC, through the outlet structure, up through the single tunnel, through the upstream control structure, and ending at the common point in collection box of the South Delta Outlet and Control Structure. The criteria are listed here.

2.3.1 Delta-Mendota Canal

Description

The DMC feeds Jones from the Old River including the section downstream of the SDCF connection to the canal. Geometry used for the analysis was provided by the United States Bureau of Reclamation (USBR 1947). The following criteria will be used to analyze the hydraulics of the canal:

Criteria

- **Flow:** 4,600 cfs
- **Normal Low Water Elevation – Jones**: The minimum design operating water level in the DMC upstream of Jones is -1.43 ft
- **Channel Bottom Width**: 66 ft
- **Channel Side slopes**: 3:1
- **Channel length**: 4,050 ft (to confluence with SDCF)
- **Manning's n**: 0.025
- **Minor Losses**: 2 times the velocity head for transitions

2.3.2 Jones Tunnel, Jones Control Structure, Jones Outlet Structure

Description

As Figure 3 shows, the Jones Outlet, Tunnel, and Jones Control structures are the next facilities upstream of the DMC, respectively, leading to the South Delta Outlet and Control Facility. Figures 7 and 8 in the attachment show the small control structure on the side of the South Delta Outlet and Control Structure. The following are the general design criteria. The tunnel hydraulic losses will be calculated with Mannning's equation.

Criteria

- **Flow:** 1,500 cfs
- **Tunnel Length**: 7,900 ft
- **Manning's n**: 0.016
- **Maximum Velocity**: 6 fps
- **Minor Losses at Jones Outlet Structure:** 1 times the Jones Tunnel velocity head
- **Minor Losses at Jones Control Structure (including gates):** 3 times the dual conveyance tunnel velocity head

- **Downstream Head:** Water surface elevation in the DMC at confluence (computed per information in this TM)

3. Hydraulic Analyses and Results

3.1 Water Level Analyses

Hydraulic computations were conducted for components of the SDCF described in Section 2, for two hydraulic design scenarios:

1) SWP only deliveries
2) Combined SWP and CVP deliveries

The hydraulic analysis and results for these scenarios are presented here.

3.1.1 State Water Project Deliveries Only

Figure 9 shows the hydraulic analysis schematic and estimated design water levels for components that deliver water to Banks.

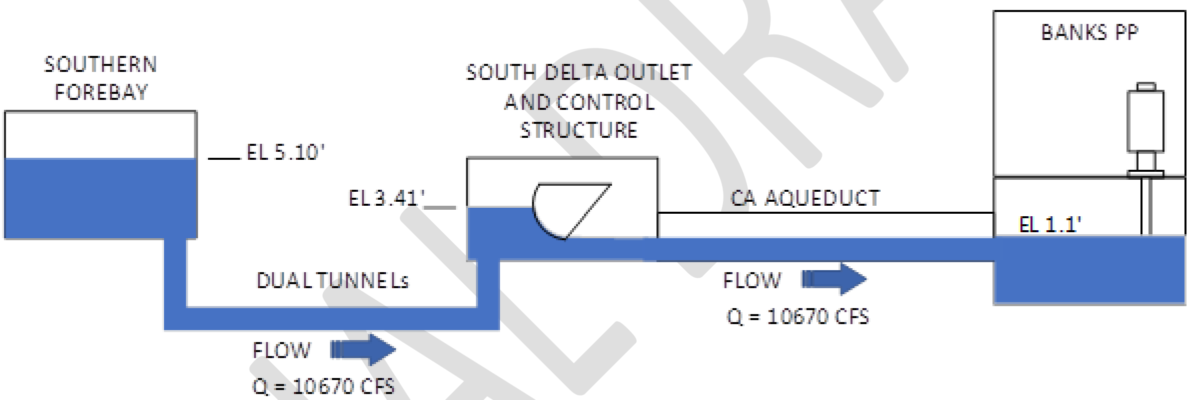

Figure 9. SWP Deliveries-only Hydraulic Analysis Schematic

The downstream boundary condition for delivery of water to Banks is the lowest recommended water surface elevation in the CA Aqueduct for proper pumping operations (El 1.1 ft). The estimated upstream water surface elevation at the SF (+5.10 ft) is within the operational elevation range required for the SF. This level represents the lowest design operational water level required in the SF. All higher levels in the SF would be able to meet required delivery conditions. The system would deliver 10,670 cfs under these minimal water level conditions. Calculations use the minimum normal operating water level in the CA Aqueducts at Banks, then headloss determine headloss in accordance with criteria listed here in the upstream direction until the value at the SF was determined. Tunnel sizes were varied by trial and error to provide an upstream water surface elevation at the SF that was within the range specified for the driving water surface (between + 5.0 and +5.5 ft). The resulting tunnel diameter was 38 ft for the dual conveyance tunnels.

3.1.2 Combined State Water Project and Central Valley Project Deliveries

Figure 10 shows the hydraulic analysis schematic and estimated design water levels for components that deliver water to both the SWP and CVP facilities.

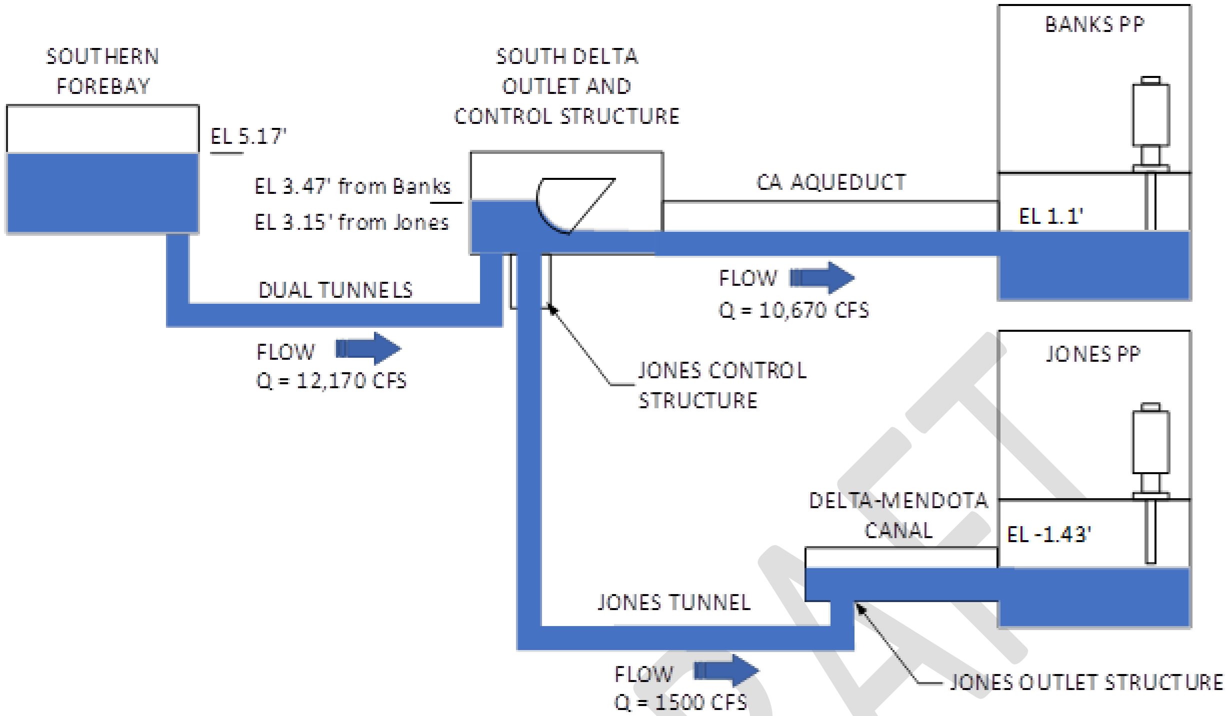

Figure 10. Combined SWP and CVP Deliveries Hydraulic Analysis Schematic

The downstream boundary condition for water delivery to Jones is the minimim recommended design water surface elevation in the DMC for proper pump operation (elevation -1.43 ft). The estimated upstream water surface elevation in the SF (elevation +5.17 ft) is within the operational elevation range required for the SF. This level represents the lowest design operation water level required in the SF. All higher levels in the forebay would be able to meet required delivery conditions. The system would deliver 12,170 cfs (10,670 cfs to the SWP and 1,500 cfs to the CVP) under these minimal conditions. Calculations use the normal water level in the DMC at Jones, then headloss was determined in accordance with the listed criteria in the upstream direction until the value at the SF was determined. Tunnel sizes were varied by trial and error to provide an upstream water surface elevation at the SF Outlet that is was within the range specified for the driving water surface (between + 5.0 and +5.5 ft). The resulting tunnel diameters were 20 ft for the Jones Tunnel and 40 ft for the dual conveyance tunnels.

3.1.3 Comparison of Hydraulic Design Scenarios

As Figures 9 and 10 show, the required driving head at the SF is slightly greater for combined SWP and CVP deliveries than for SWP-only deliveries. However, the differences are minimal and within the range of error for this planning-level analysis. Both scenarios result in the required driving head at the SF within the lower portion of the required range. Therefore, the required flow deliveries would be achievable at essentially the same driving head in accordance with either of the conceptual scenarios and associated configurations presented here.

3.2 Special Analyses

As mentioned, two items that suggested further study included raising the invert of the CA Aqueduct Control Structure to reduce the gate height and designing the South Delta Outlet and Control Structure to limit exit velocities to reduce the potential for erosion.

3.2.1 Raised Structure Invert – California Aqueduct Control Structure

The goal of the analysis was to limit the height of the control gates to 40 ft or less, which would convey the required flow and protect against the 200-year flood event plus estimated sea level rise (elevation 20.8 per DWR) plus 3 ft of freeboard. In addition, the goal was to limit the headloss through the structure to no more than 2.0 ft. The results of this special analysis showed that raising the invert of the structure up to elevation -16 ft would result in 40-ft-tall gates and a resulting headloss of 1.97 ft.

3.2.2 Gate Outlet Flow Velocity – South Delta Outlet and Control Structure

When throttling the radial gates within the South Delta Outlet and Control Structure, supercritical flow can occur through the gates and resulting velocities could potentially cause high turbulence and erosive scour as flow enters the CA Aqueduct. At some point downstream of the gates, a hydraulic jump would occur to match the subcritical flow water surface elevation in the CA Aqueduct. The potential for scour could be mitigated by causing the hydraulic jump to form within the downstream concrete-lined portion of the South Delta Outlet and Control Structure, before the confluence with the CA Aqueduct.

The results of the hydraulic jump analysis estimate the conjugate depth downstream of the gates is 14.0 ft. The actual calculated normal depth in the CA aqueduct is 15.5 ft. Based on these values, the hydraulic jump would be contained within the downstream concrete-lined portion of the South Delta Outlet and Control Structure.

4. Conclusions

The hydraulic design criteria outlined in this TM would be used for conceptual sizing and configuration establishment for the major components of the SDCF, which will deliver water from the SF to the SWP Banks and possibly to the CVP Jones. The configurations developed for each delivery scenario are suitable to establish the sizing and layout of the SDCF.

The criteria presented are for the development of planning-level documents. It is expected that these criteria would be expanded, and in some cases modified, during later stages of design to provide complete and operational facilities.

5. References

California Department of Water Resources (DWR). 1965. *Miscellaneous California Aqueduct Intake Channel Drawings, SPEC. No. 63-22, As-Built, Including Drawing Nos. L-IKI-2, L-IKI-3, L-IFI-2, L-IFI-3, L-IFI-4, L-IBI-1, L-IGI-1, and L-IGI-2*.

California WaterFix (WaterFix). 2018. *Conceptual Engineering Report. Byron Tract Forebay Option. Volume 1 of 3*.

CH2M HILL Engineers, Inc. (CH2M). 2020. *WinHydro Version 3.0.7* (proprietary hydraulic analysis software).

Chow, Ven Te. 1959. *Open Channel Hydraulics*. McGraw-Hill.

Delta Conveyance Design and Construction Authority (DCA). 2021a. Capacity Analysis for Preliminary Tunnel Diameter Selection. Final Draft.

Delta Conveyance Design and Construction Authority (DCA). 2021b. Southern Forebay Siting Analysis Technical Memorandum. Final Draft.

Delta Conveyance Design and Construction Authority (DCA). 2021c. South Delta Conveyance Facilities System Configuration Technical Memorandum. Final Draft.

United States Department of the Interior, Bureau of Reclamation (USBR). 1947. *Central Valley Project-California, Delta-Mendota Canal, STA. LR- 10+00 to STA. L -132+24 Profile and Sections, Drawing 214-D-13607*. February.

6. Document History and Quality Assurance

Reviewers listed have completed an internal quality review check and approval process for deliverable documents that is consistent with procedures and directives identified by the Engineering Design Manager (EDM) and the DCA.

Approval Names and Roles			
Prepared by	**Internal Quality Control review by**	**Consistency review by**	**Approved for submission by**
Ted Davis / EDM SDCF Facility Lead	Phil Ryan / EDM Engineering Design Manager	Gwen Buchholz / DCA Environmental Consultant	Terry Krause / EDM Project Manager

This interim document is considered preliminary and was prepared under the responsible charge of Philip K. Ryan, California Professional Engineering License C41087.

Note to Reader

This is an early foundational technical document. Contents therefore reflect the timeframe associated with submission of the initial and final drafts. Only minor editorial and document date revisions have been made to the current Conformed Final Draft for Administrative Draft Engineering Project Report version.

FINAL DRAFT

Attachment

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

REV	DATE	DESCRIPTION	SUB.	APPD

DESIGNED: L. ALLIGER
DRAWN: T. PATTISON
CHECKED:
APPROVAL RECOMMENDED:
APPROVAL BY:

DCA
DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

ENGINEERING PROJECT REPORT
DELTA CONVEYANCE PROJECT
SINGLE TUNNEL - CENTRAL CORRIDOR

SOUTH DELTA CONVEYANCE FACILITIES
SWP-ONLY DELIVERIES

PROJECT NO.
W8X97000

FIGURE 1

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SOUTH DELTA CONVEYANCE

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					L. ALLIGER	
					DRAWN	APPROVAL BY
					T. PATTISON	
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DCA
DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

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SOUTH DELTA CONVEYANCE FACILITIES
SWP AND CVP DELIVERIES

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PROJECT NO.
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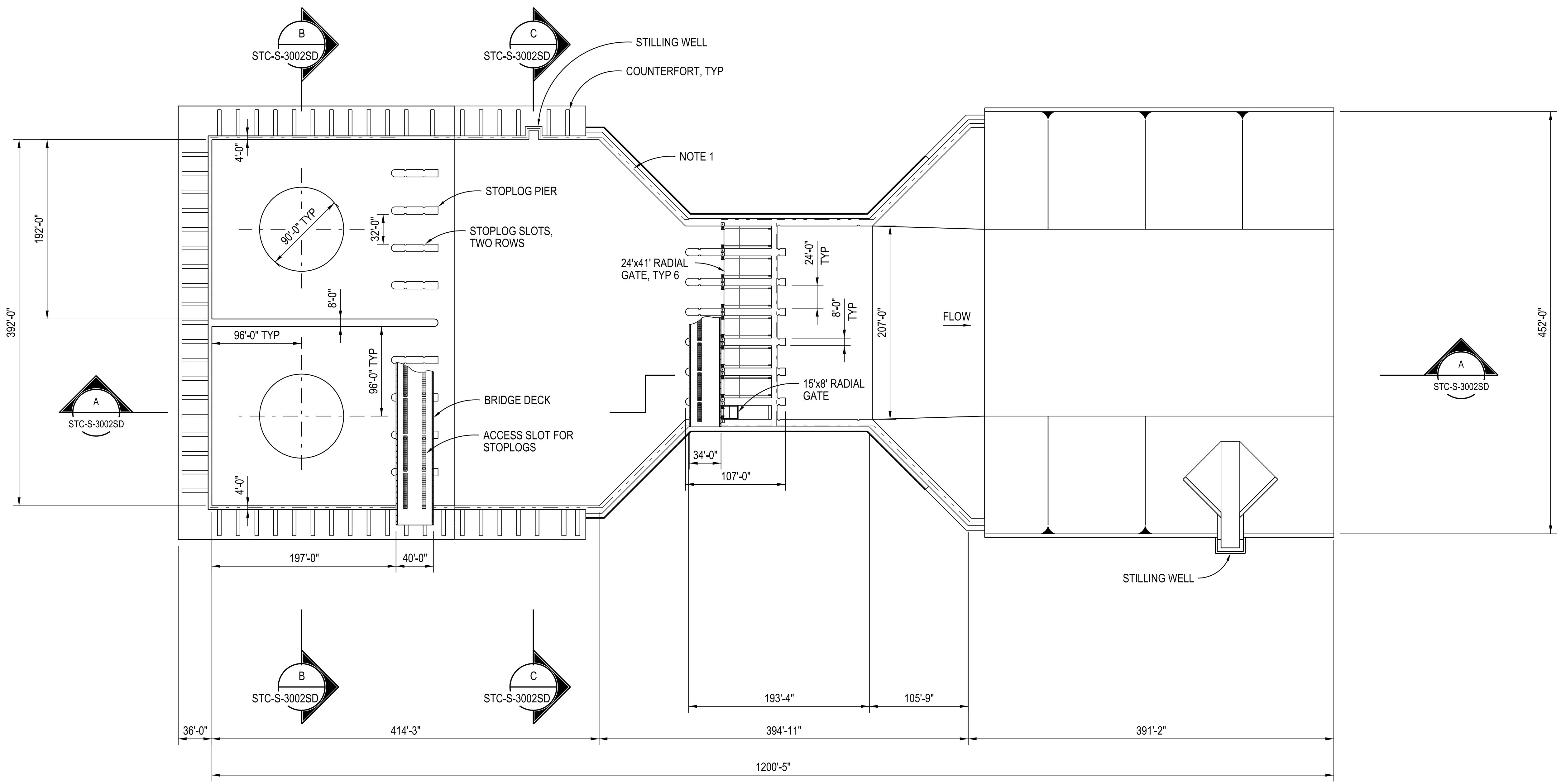
FIGURE 2

NOTE:

1. RAILING SHALL BE PROVIDED AROUND TOP OF STRUCTURE. SEE SECTIONS.



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SOUTH DELTA CONVEYANCE

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DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

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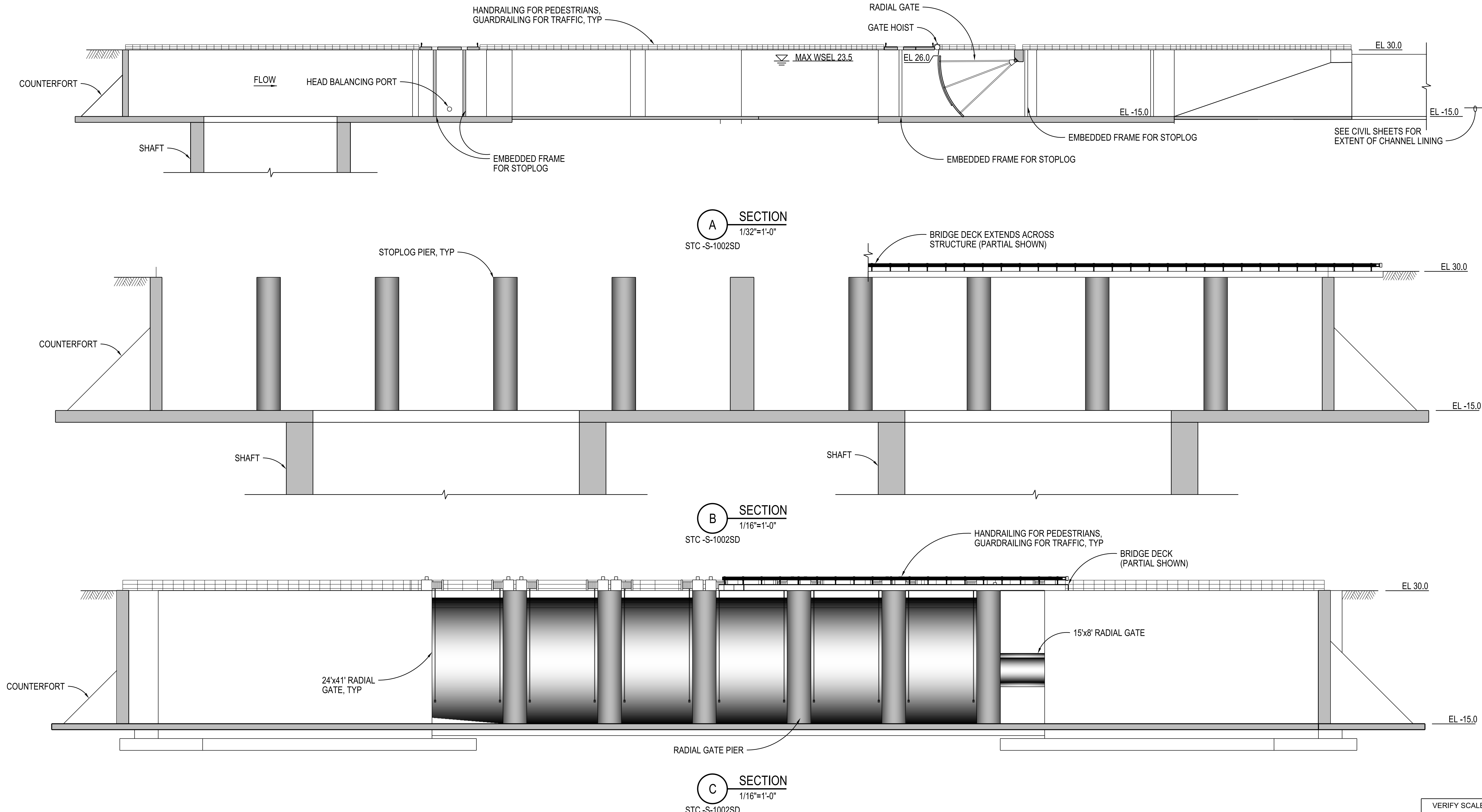
DELTA CONVEYANCE PROJECT
SINGLE TUNNEL - CENTRAL CORRIDOR

SOUTH DELTA OUTLET AND CONTROL STRUCTURE
PLAN

PROJECT NO.
W8X97000

FIGURE 5



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DELTA CONVEYANCE PROJECT
SINGLE TUNNEL - CENTRAL CORRIDOR

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SOUTH DELTA OUTLET AND CONTROL STRUCTURE
SECTIONS

FIGURE 6

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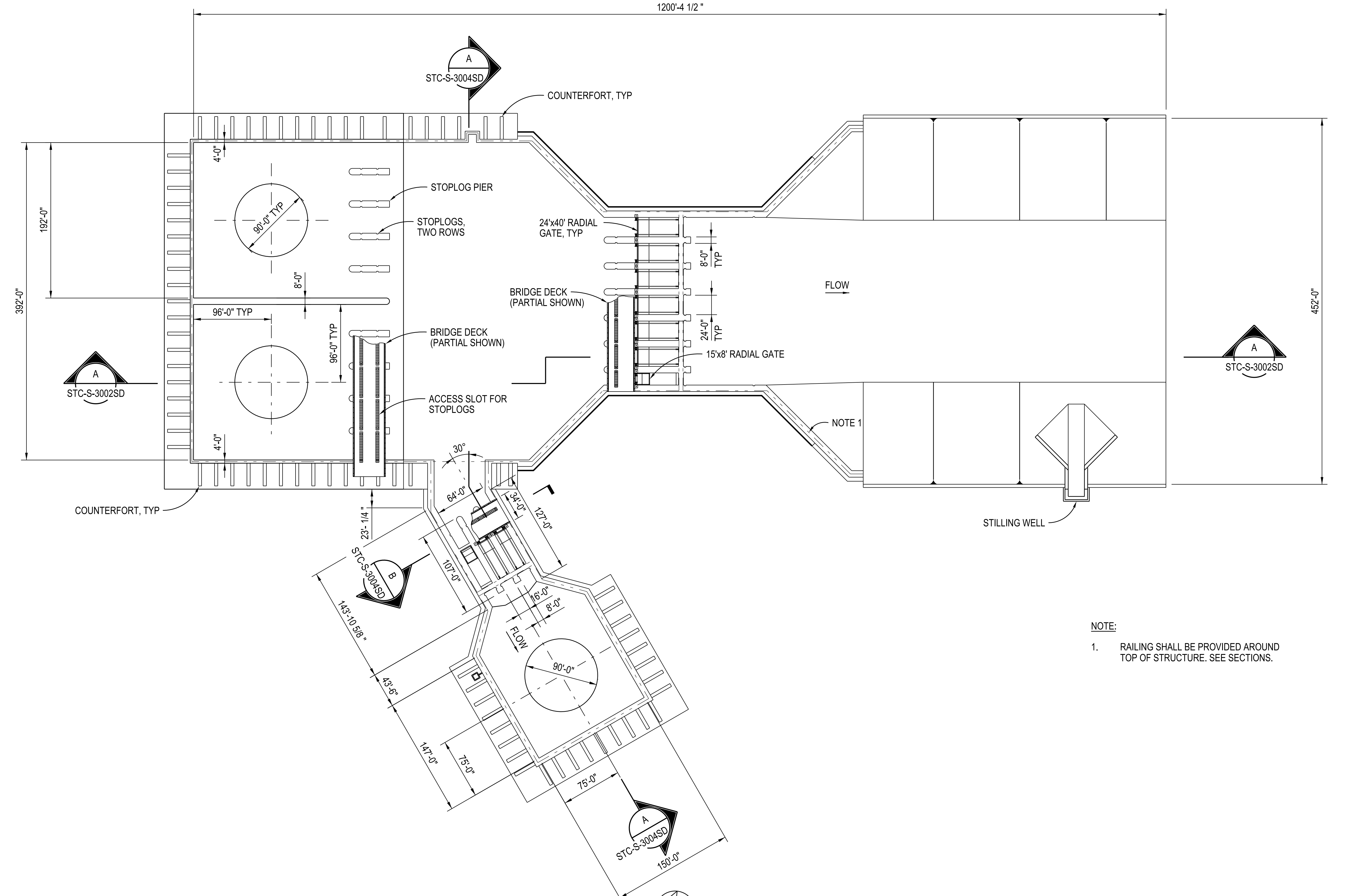

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NOTE:

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DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

ENGINEERING PROJECT REPORT
DELTA CONVEYANCE PROJECT
SINGLE TUNNEL - CENTRAL CORRIDOR

SOUTH DELTA OUTLET AND CONTROL STRUCTURE WITH JONES EXTENSION - PLAN

PROJECT NO.
W8X97000

FIGURE 7

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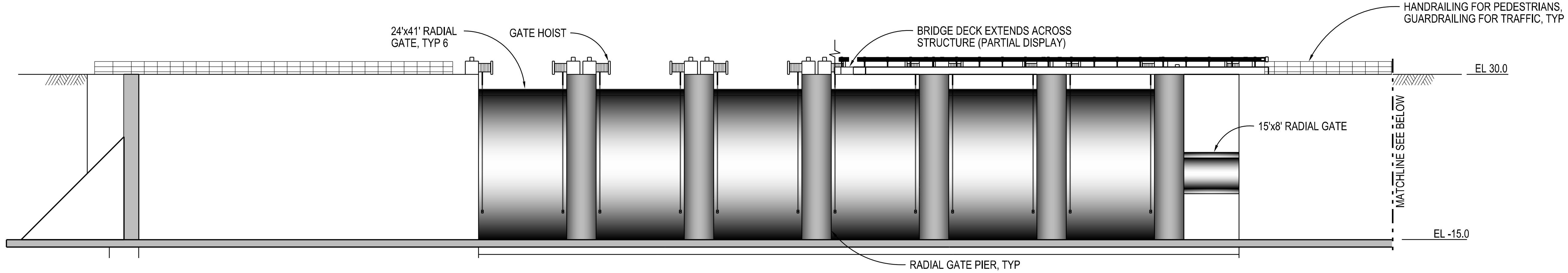

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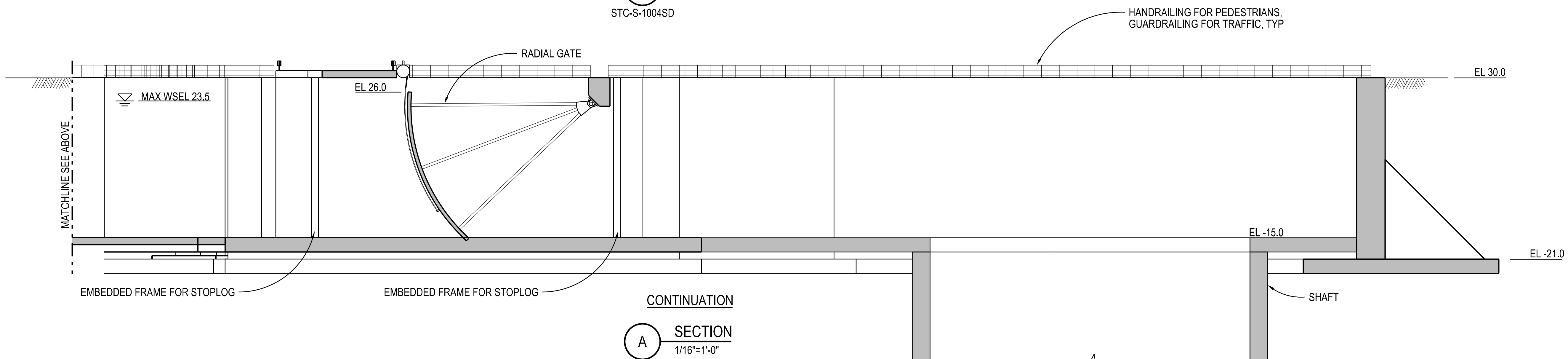

CONTINUATION

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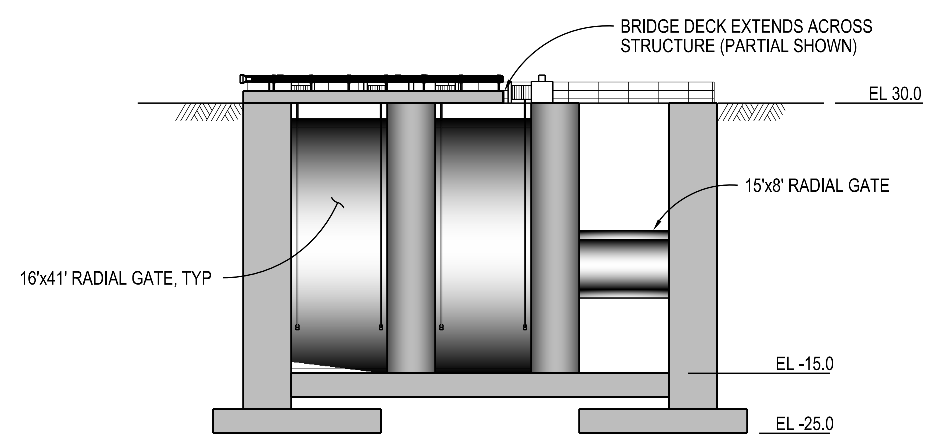

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DRAWN J SMITH
CHECKED
APPROVAL RECOMMENDED
APPROVAL BY

DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

SOUTH DELTA CONVEYANCE

ENGINEERING PROJECT REPORT
DELTA CONVEYANCE PROJECT
SINGLE TUNNEL - CENTRAL CORRIDOR

SOUTH DELTA OUTLET AND CONTROL STRUCTURE WITH JONES EXTENTION - SECTIONS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

PROJECT NO.
W8X97000

Figure 8

FIGURE 1