

CARLSBAD DESALINATION PROJECT THROUGH-  
SCREEN VELOCITY CALCULATION  
NOVEMBER 29, 2016

# Background and Objective

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## Background

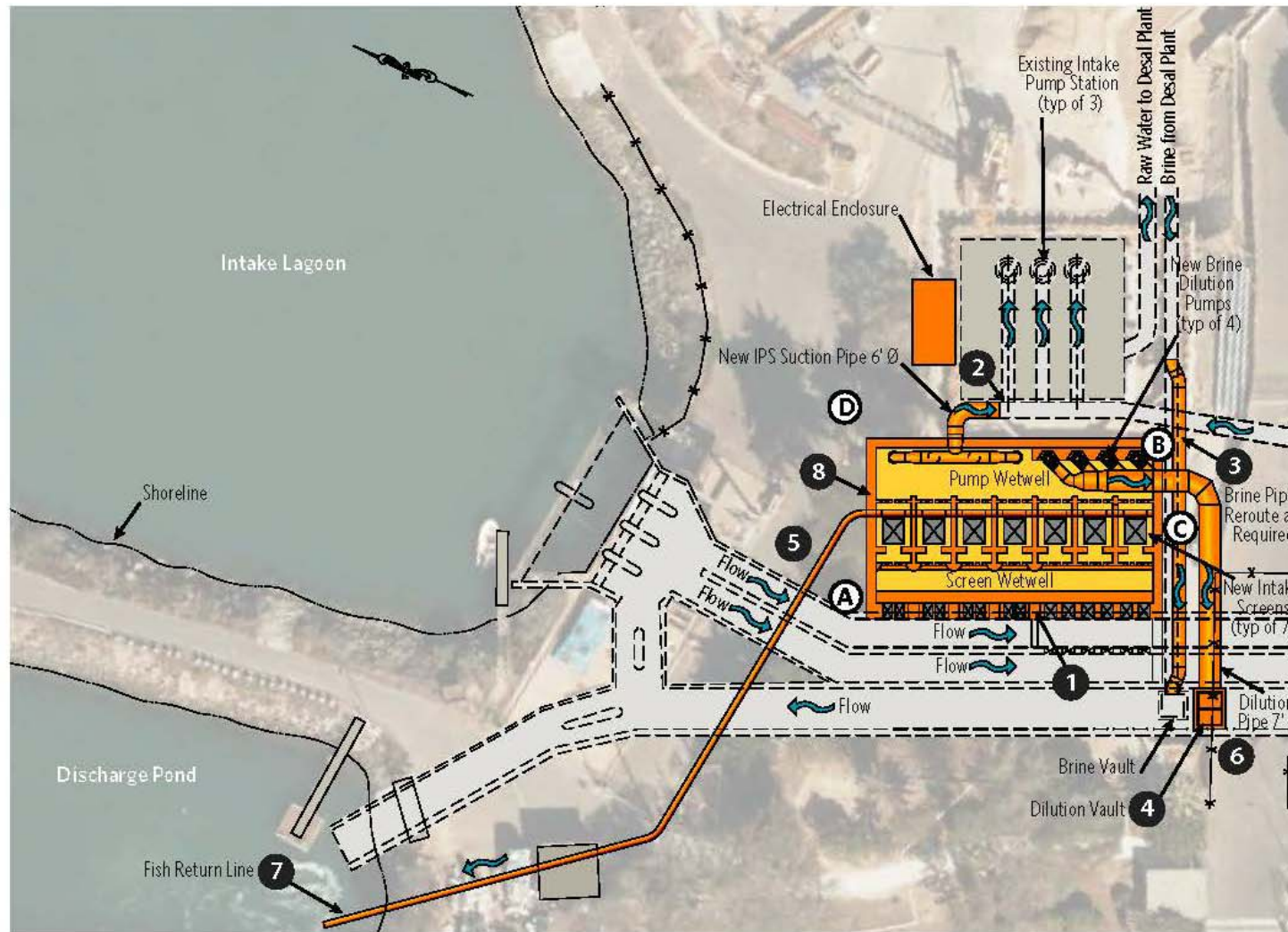
- Conceptual design of CDP is based on OPA requirements:
  - 1-mm mesh
  - 0.5 ft/sec through-screen velocity
- During Nov 2 meeting, RWQCB asked for more info on how the velocity calculations were made

## Objective

- Walk through the through-screen velocity calculations for the Carlsbad Desalination Plant



# Proposed Intake Configuration



## LEGEND

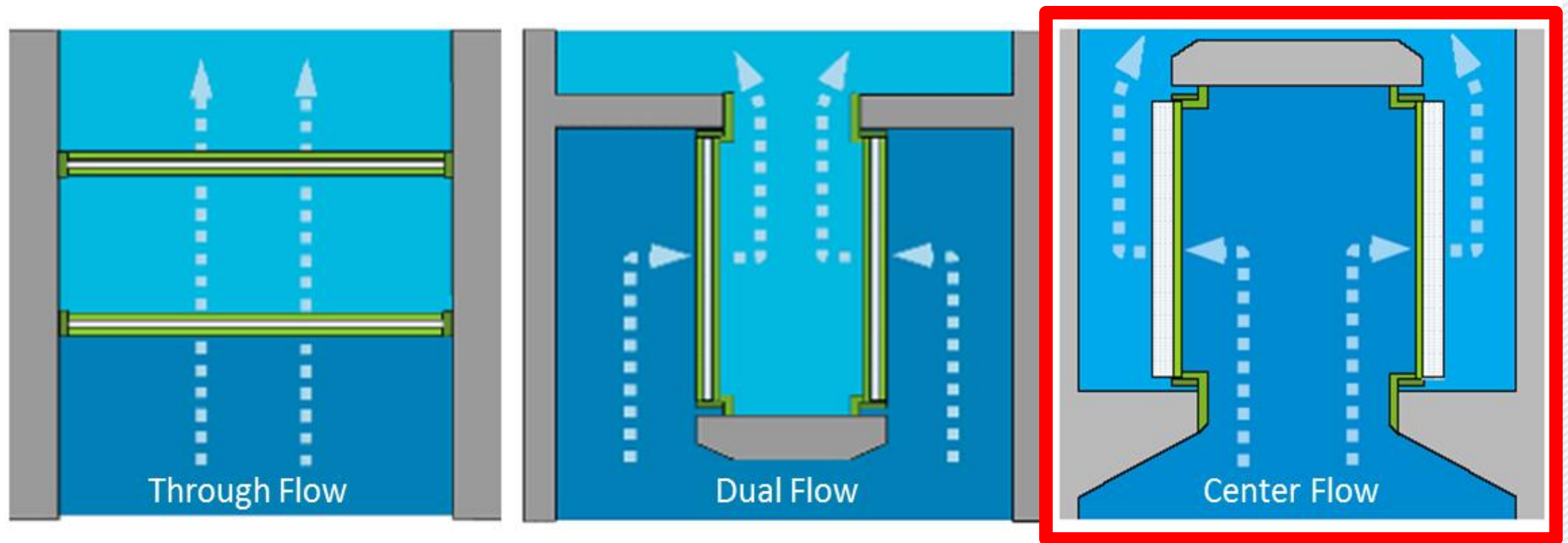
### Footprint Restrictions

- (A)** Inflow Tunnel
- (B)** IPS Suction Pipe
- (C)** Brine Discharge
- (D)** High Groundwater Table

### Construction Sequence Factors

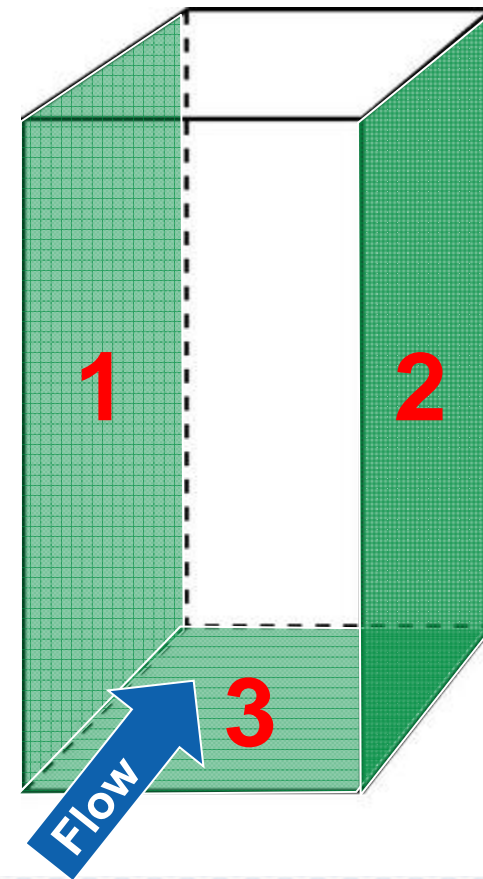
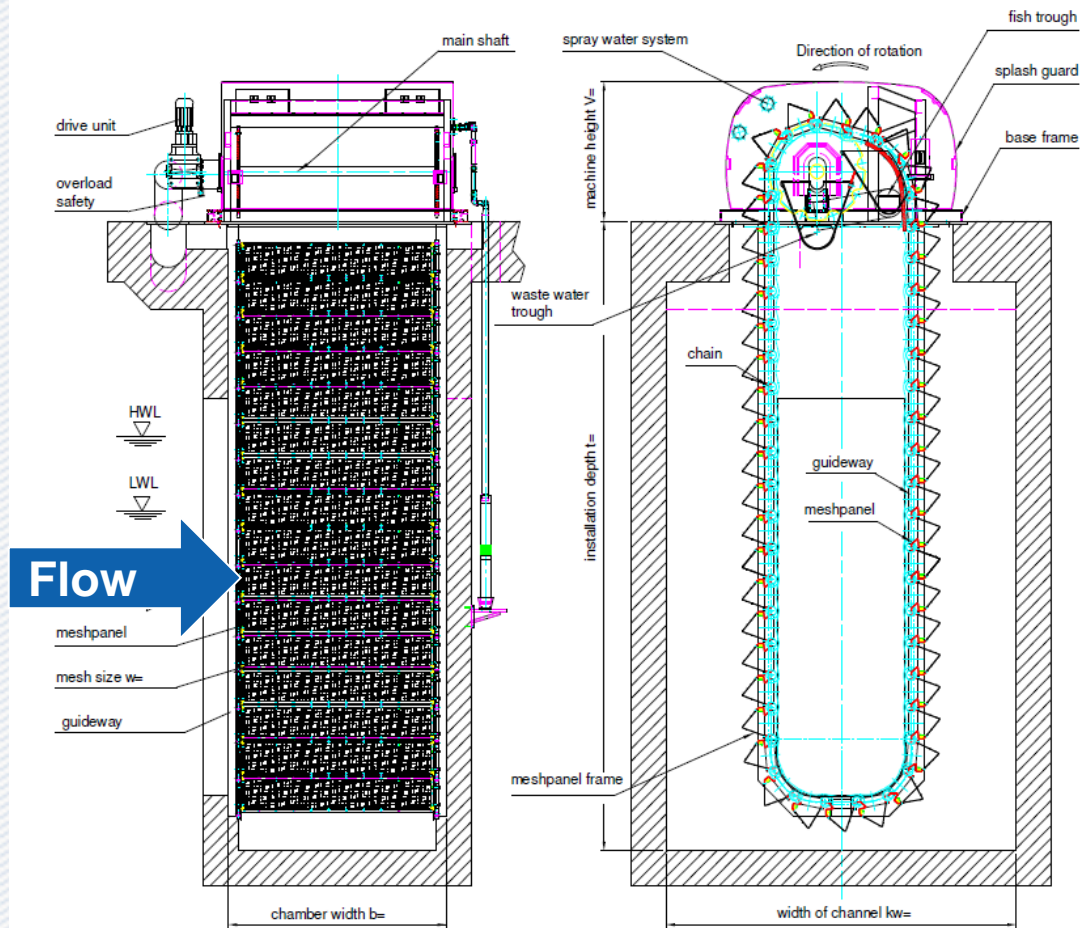
- (1)** Screen Structure Connection to Inflow Tunnels
- (2)** Connection to IPS Suction
- (3)** Brine Discharge Pipe Relocation
- (4)** Dilution Vault
- (5)** Existing Utility Relocations
- (6)** Guard Shack and Driveway Entrance Encroachment
- (7)** Fish Return Pipe
- (8)** Screen Structure Construction

# Centerflow Screen





# Screening Area



# Through-Screen Velocity Calculation

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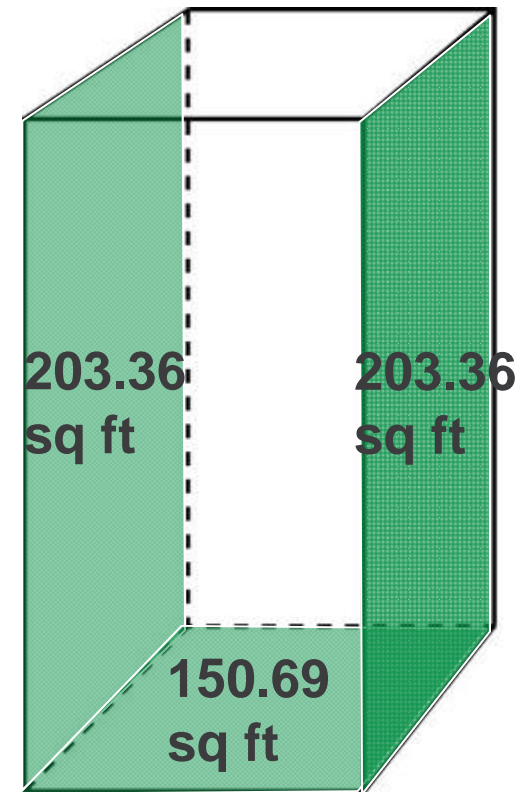
## **Calculation assumes worst-case scenario:**

- Only 6 screens in operation (normal operation is with 7)
- 15% fouling with debris
- Mean Lower Low Water level = -2.29 ft
- $Q = AV$  or  $V = Q/A$

# Through-Screen Velocity Calculation

(Depth LWL 17.71 ft) X  
 (length 11.48 ft) = 203.36 sq ft  
 (length 11.48 ft) X (channel  
 width 13.12 ft) = 150.69 sq ft

Description	Value	Unit
Total Flow Rate – (US gallons not UK gallons)	299	MGD
Total Flow Rate	463	CFS
HWL	3.04	ft
LWL (MLLW)	-2.29	ft
Finished Floor	-20	ft
Depth HWL	23.04	ft
Depth LWL = LWL – Finished Floor = -2.29 – (-20) =	17.71	ft
Channel Width	4.00	m
Channel Width	13.12	ft
Length	3.50	m
Length	11.48	ft
Surface Area Each Side Screen (Single Plane) HWL	264.57	ft <sup>2</sup>
Surface Area Each Side Screen (Single Plane) LWL	203.36	ft <sup>2</sup>
Surface Area Bottom Screen (Single Plane)	150.69	ft <sup>2</sup>
Total Screen Surface Area (Single Plane) HWL	679.83	ft <sup>2</sup>
Total Screen Surface Area (Single Plane) LWL	557.42	ft <sup>2</sup>
No. of Screens	6	-
Effective Open Area	0.37	-
Open Area Each Screen HWL	253.80	ft <sup>2</sup>
Open Area Each Screen LWL	208.10	ft <sup>2</sup>
Clean Velocity LWL = 463 CFS / 1248.6 sq ft =	0.37	ft/s
15% Fouling Velocity LWL	0.44	ft/s



Total Surface Area per Screen =  
 557.42 sq ft

Total Open Area per Screen = 557.42  
 sq ft x 0.37 = 208.10 sq ft

Total Open Area per 6 Screens =  
 208.10 x 6 = 1248.6 sq ft

# Through-Screen Velocity Calculation

6 Screens

Through-Screen Velocity  
for Clean Screens

$$V = Q/A$$

$$V = \frac{463 \text{ cu ft/sec}}{1248.6 \text{ sq ft}}$$

$$V = 0.37 \text{ ft/sec}$$

Through-Screen Velocity  
for 15% Fouled Screens

$$V = Q/A$$

$$V = \frac{463 \text{ cu ft/sec}}{(1248.6 \text{ sq ft})(0.85)}$$

$$V = 0.44 \text{ ft/sec}$$

7 Screens

Through-Screen Velocity  
for Clean Screens

$$V = Q/A$$

$$V = \frac{463 \text{ cu ft/sec}}{1456.7 \text{ sq ft}}$$

$$V = 0.32 \text{ ft/sec}$$

Through-Screen Velocity  
for 15% Fouled Screens

$$V = Q/A$$

$$V = \frac{463 \text{ cu ft/sec}}{(1456.7 \text{ sq ft})(0.85)}$$

$$V = 0.37 \text{ ft/sec}$$