POSEIDON WATER

Appendix X
Construction Cost Estimates for Intake/Discharge Alternatives

Renewal of NPDES CA0109223
Carlsbad Desalination Project

Carlsbad Desalination Plant Intake/Discharge Construction Cost Estimates

5780 Fleet Street, Suite 140

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1. Introduction

The economic analysis presented below provides a relative comparison of the construction cost of the intake/discharge alternatives. These cost are included in the (per the Desalination Amendment), the life-cycle costs analyzed in Appendix N considered include permitting, design, land acquisition, financing, construction, operations, maintenance, mitigation, equipment replacement, insurance, taxes, management, and energy consumption over the lifetime of the facility. Savings considered include construction and operating allowances provided for in the Water Purchase Agreement between Poseidon and the San Diego County Water Authority (WPA) that are applicable to each of the of the intake/discharge alternatives and operational savings due reduced chemical consumption, extended membrane life, and reduced membrane cleaning frequency that is applicable to the subsurface intake alternatives.

A. SIG Intake with Discharge Flow Augmentation

The Desalination Amendment provides the following guidance for assessing the feasibility of subsurface intakes:

> *Subsurface intakes shall not be determined to be economically infeasible solely because subsurface intakes may be more expensive than surface intakes. Subsurface intakes may be determined to be economically infeasible if the additional costs or lost profitability associated with subsurface intakes, as compared to surface intakes, would render the desalination facility not economically viable.*

In August of 2014, Poseidon evaluated the cost of implementing a SIG intake with discharge flow augmentation and presented the evaluation to the SWRCB as part of comments to the proposed Ocean Plan Amendment. Since August of 2014, Poseidon has been engaged with the California Coastal Commission in the evaluation of alternative intakes for the proposed Huntington Beach Desalination Facility (HBDF). As a result of the HBDF intake evaluation (Report of Waste Discharge Appendix U), updates have been made to the design and layout of the SIG. Specifically, the updated design now provides stand-alone piping for each cell and the provision for an intermediate pump station, both resulting in additional costs compared to the design from August 2014. Since the cost evaluation from August 2014 already appeared cost prohibitive, and the new design would only increase project costs, the cost evaluation has not been re-preformed. Rather, the cost evaluation from August 2014 is presented below and considered to be aggressive for the purposes of this intake evaluation.

The estimated construction cost for the SIG Intake with the Discharge Flow Augmentation (304 MGD) alternative is $792,540,433.

304 MGD Seafloor Infiltration Gallery (SIG)							
Description	QTY	Unit	Labor $	Equipment $	Material $	Sub $	Total $
Dredging Operations							
SIG Dredging	1,749,290	CY	$9,183,773	$2,604,868	$0	$0	$11,788,641
Export Dredged Material	1,749,290	CY	$3,935,903	$2,736,064	$0	$61,225,150	$67,897,117
						Dredging Total	$79,685,758
Mechanical Operations							
Junction Structures - 46 Each at 12' x 12' x 20'	46	EA	$828,000	$26,422	$14,194,557	$1,000,408	$16,049,387
Fuse 12" & 24" HDPE Pipe for 76 Cells	157,168	LF	$3,420,054	$2,737,411	$36,934,480	$1,943,731	$45,035,677
Set 12" & 24" HDPE Pipe for 76 Cells	76	EA	$1,710,000	$54,568	$0	$2,047,060	$3,811,628
Fuse and Set 24" - 32" HDPE Conveyance Pipe	5,317	LF	$102,126	$81,742	$1,249,495	$58,042	$1,491,405
Fuse and Set 42" - 63" HDPE Conveyance Pipe	5,388	LF	$206,980	$117,820	$3,125,040	$167,654	$3,617,494
Wrap and Set 60" - 120" FRP Conveyance Pipe	6,572	LF	$7,399,125	$236,114	$7,399,125	$8,857,575	$23,891,939
						Mechanical Operations Total	$93,897,530
Engineered Fill							
Make Grade - 1 Foot Thick	209,915	TN	$1,102,054	$30,144	$5,479,411	$1,130,812	$7,742,421
Place Cell 1" Gravel Bedding - 1 Foot Thick	209,915	TN	$1,102,054	$30,144	$5,479,411	$1,130,812	$7,742,421
Place Cell 1" Gravel Zone- 5.5 Feet Thick	1,118,115	TN	$5,870,104	$160,561	$29,186,156	$6,023,286	$41,240,107
Place Cell 3/8" Gravel Backfill- 1 Foot Thick	209,915	TN	$1,102,054	$30,144	$5,168,632	$1,130,812	$7,431,642
Place Cell Sand Backfill- 5 Feet Thick	1,049,574	TN	$5,510,264	$150,719	$24,399,447	$5,654,055	$35,714,485
						Engineered Fill Total	$99,871,076
Tie-In to Plant							
120" Plant Tie-In	1	EA	$45,000	$10,406	$0	$25,500	$80,906
						Tie-In to Plant	$80,906
Schedule Related Equipment							
Liebherr 895 Crawler Crane	4	EA	$0	$28,356,384	$0	$0	$28,356,384
CAT 980 Loader	4	EA	$0	$12,797,236	$0	$0	$12,797,236
Marine Vessel	2	EA	$0	$1,772,274	$0	$0	$1,772,274
Lube Truck	1	EA	$0	$1,859,655	$0	$0	$1,859,655
						Schedule Related Equipment	$44,785,548
						Sub Total Cost	$318,320,818
Dilution Water Pump Station						Taken at 8% of Prior Sub Total	$26,000,000
						Sub Total Cost	$344,320,818
Indirects						Taken at 25% of Prior Sub Total	$86,080,205
Insurance and Environmental						Taken at 5% of Prior Sub Total	$17,216,041
Contractor Overhead and Profit						Taken at 25% of Prior Sub Total	$86,080,205
						Sub Total Cost	$533,697,268
Engineering						Taken at 5% of Prior Sub Total	$26,684,863
Legal						Taken at 5% of Prior Sub Total	$26,684,863
						Sub Total Cost	$587,066,995
Contingency						Taken at 35% of Prior Sub Total	$205,473,448
						Sub Total Cost	$792,540,443

Note: Proposal Based on Rates Effective May of 2014

B. SIG Intake with Discharge Diffuser

Similar to the implementation of a SIG with discharge flow augmentation, Poseidon evaluated the cost of implementing a SIG with discharge diffuser in August of 2014. Since the cost evaluation from August 2014 already appeared cost prohibitive, and the new design would only increase project costs, the cost evaluation has not been re-preformed. Rather, the cost evaluation from August 2014 is presented below and considered to be aggressive for the purposes of this intake evaluation.

The estimated construction cost for the SIG Intake (104 MGD) with the Discharge Diffuser alternative is $545,126,147, the addition of the SIG (104 MGD) construction costs of $231,494,147, plus the Diffuser construction cost estimate of $313,632,000.

104 MGD Seafloor Infiltration Gallery (SIG)

Description	QTY	Unit	Labor $	Equipment $	Material $	Sub $	Total $
Dredging Operations							
SIG Dredging	592,018	CY	$3,108,095	$881,574	$0	$0	$3,989,669
Export Dredged Material	592,018	CY	$1,332,041	$925,975	$0	$20,720,630	$22,978,646
						Dredging Total	$26,968,315
Mechanical Operations							
Junction Structures - 15 Each at 12' x 12' x 20'	15	EA	$270,000	$8,616	$4,628,660	$326,220	$5,233,496
Fuse 12" & 24" HDPE Pipe for 76 Cells	53,768	LF	$1,170,019	$936,483	$12,635,480	$664,961	$15,406,943
Set 12" & 24" HDPE Pipe for 76 Cells	26	EA	$585,000	$18,668	$0	$700,310	$1,303,978
Fuse and Set 24" - 32" HDPE Conveyance Pipe	2,300	LF	$44,177	$35,359	$540,500	$25,107	$645,143
Fuse and Set 42" - 63" HDPE Conveyance Pipe	2,785	LF	$106,986	$60,900	$1,615,300	$86,658	$1,869,844
Wrap and Set 60" - 120" FRP Conveyance Pipe	500	LF	$562,500	$17,950	$562,500	$673,375	$1,816,325
						Mechanical Operations Total	$26,275,729
Engineered Fill							
Make Grade - 1 Foot Thick	71,042	TN	$372,971	$10,202	$1,854,409	$382,703	$2,620,285
Place Cell 1" Gravel Bedding - 1 Foot Thick	71,042	TN	$372,971	$10,202	$1,854,409	$382,703	$2,620,285
Place Cell 1" Gravel Zone- 5.5 Feet Thick	383,560	TN	$2,013,690	$55,079	$10,012,067	$2,066,238	$14,147,074
Place Cell 3/8" Gravel Backfill- 1 Foot Thick	71,042	TN	$372,971	$10,202	$1,749,232	$382,703	$2,515,108
Place Cell Sand Backfill- 5 Feet Thick	355,211	TN	$1,864,858	$51,008	$8,257,590	$1,913,522	$12,086,978
						Engineered Fill Total	$33,989,730
Tie-In to Plant							
120" Plant Tie-In	1	EA	$45,000	$10,406	$0	$25,500	$80,906
						Tie-In to Plant	$80,906
Schedule Related Equipment							
Liebherr 895 Crawler Crane	2	EA	$0	$8,092,054	$0	$0	$8,092,054
CAT 980 Loader	2	EA	$0	$3,651,944	$0	$0	$3,651,944
Marine Vessel	1	EA	$0	$505,753	$0	$0	$505,753
Lube Truck	1	EA	$0	$1,008,675	$0	$0	$1,008,675
						Schedule Related Equipment	$13,258,426
						Sub Total Cost	$100,573,106
Indirects					Taken at 25% of Prior Sub Total		$25,143,277
Insurance and Environmental					Taken at 5% of Prior Sub Total		$5,028,655
Contractor Overhead and Profit					Taken at 25% of Prior Sub Total		$25,143,277
						Sub Total Cost	$155,888,314
Engineering					Taken at 5% of Prior Sub Total		$7,794,416
Legal					Taken at 5% of Prior Sub Total		$7,794,416
						Sub Total Cost	$171,477,146
Contingency					Taken at 35% of Prior Sub Total		$60,017,001
						Sub Total Cost	$231,494,147

Note: Proposal Based on Rates Effective May of 2014

As noted in the Table below, the estimated cost of a 6,000 ft. outfall with a four multiport diffuser designed to discharge up to 54 MGD is $313,632,000. Since the cost evaluation from August 2014 already appeared cost prohibitive, and the new design would only increase project costs, the cost evaluation has not been re-preformed. Rather, the cost evaluation from August 2014 is presented below and considered to be aggressive for the purposes of this diffuser evaluation.

54 MGD Outfall with High Energy Diffuser				
Description	**QTY**	**Unit**	**Unit Cost $**	**Total $**
Direct Cost Work				
Tunnel Installation	**6,000**	**LF**	**$10,500**	**$63,000,000**
Pipe Installation	**1**	**LS**	**$50,000,000**	**$50,000,000**
Diffuser Installation	**1**	**LS**	**$15,000,000**	**$15,000,000**
			Direct Cost Total	**$128,000,000**
Project Management			Taken at 25% of Prior Sub Total	**$32,000,000**
Insurance and Environmental			Taken at 15% of Prior Sub Total	**$19,200,000**
Contractor Overhead and Profit			Taken at 25% of Prior Sub Total	**$32,000,000**
			Sub Total Cost	**$211,200,000**
Engineering			Taken at 5% of Prior Sub Total	**$10,560,000**
Legal			Taken at 5% of Prior Sub Total	**$10,560,000**
			Sub Total Cost	**$232,320,000**
Contingency			Taken at 35% of Prior Sub Total	**$81,312,000**
			Sub Total Cost	**$313,632,000**
Note: Proposal Based on Rates Effective August of 2014				

C. Screened Intake with Discharge Flow Augmentation

Poseidon evaluated the cost of implementing a Screened Intake with Flow Augmentation (New Screen/Fish Friendly Pumping Structure) in August of 2015.

The estimated construction cost for the Screened Intake with the Flow Augmentation (299 MGD) alternative is $31,699,730.

Carlsbad New Screening/Fish Friendly Pumping Structure & Fish Return System

Description	QTY	Unit	Labor $	Equip-ment $	Material $	Sub $	Total $
Civil Operations							
Civil Work							
Excavate & Set Grade	26,500	CY	$30			$1,550	$796,550
Backfill	16,800	CY	$20			$0	$336,000
L/R/F Base	601	TON	$50			$0	$30,050
Exc/BF 12" Fish Return Line	232	LF	$74			$0	$17,168
Set Up / Tear Down Access	1	LS	$112,320			$0	$112,320
Shoring Systems	15,797	SF	$0			$1,597,000	$1,597,000
Civil MHR ST&S		MHR	$83,045			$0	$83,045
Civil SUB							
Excess Soil Haul Off	14,326	CY	$0			$573,040	$573,040
Dewatering	12	EA	$0			$1,188,000	$1,188,000
Water Treatment	1	LS	$0			$675,000	$675,000
AC Paving	13,181	SF	$0			$39,543	$39,543
Underpinning	815	SF	$0			$211,900	$211,900
						Civil Operations Total	$5,659,616
Structures Operations							
Structures Work							
Concrete	3,974	CY	$1,307,446	$0	$1,138,630	$667,632	$3,113,708
2' Thick CIP Retaining Wall	210	CY	$69,531	$1	$60,169	$27,720	$157,421
Temporary Stop Logs	4	EA	$33,660	$0	$136,340	$0	$170,000
Permanent Stop Logs (Off-Load Only)	2	EA	$1,440	$0	$0	$0	$1,440
Flow Distributors	16	EA	$134,642	$0	$2,548,960	$0	$2,683,602
Structures MHR ST&S		MHR	$171,470			$0	$171,470
Structures SUB							
H20 Grating	262	SF	$0	$0	$0	$34,060	$34,060
Access Fence and Gate	68	LF	$0	$0	$0	$19,625	$19,625
Paintings / Coatings	1	LS	$0	$0	$0	$195,000	$195,000
						Structures Operations Total	$6,546,327

Mechanical Operations							
Misc. Small Bore	**1**	**LS**	**$14,416**	**$0**	**$1,077**	**$0**	**$15,493**
108" FRP Dilution Pipe	**367**	**LF**	**$66,520**	**$0**	**$191,974**	**$0**	**$258,494**
72" FRP Process Pipe	**130**	**LF**	**$62,474**	**$0**	**$52,277**	**$0**	**$114,751**
24" FRP Fish Return Line	**275**	**LF**	**$11,625**	**$0**	**$74,951**	**$0**	**$86,576**
16" FRP Pump Risers	**90**	**LF**	**$56,021**	**$0**	**$21,150**	**$0**	**$77,171**
Encasement/Pipe Supports	**515**	**CY**	**$23,566**	**$0**	**$147,558**	**$106,620**	**$277,744**
Intake Screens	**8**	**EA**	**$151,680**	**$0**	**$3,674,376**	**$0**	**$3,826,056**
Axial Flow Pumps	**4**	**EA**	**$35,932**	**$0**	**$1,051,315**	**$0**	**$1,087,247**
Mechanical MHR ST&S		**MHR**		**$56,628**		**$0**	**$56,628**
						Mechanical Operations Total	**$5,800,161**
Electrical Operations							
Electrical, I&C,HVAC Operations						**$2,500,000**	**$2,500,000**
						Electrical Operations Total	**$2,500,000**
Channel Tie-In							
Pump Down Channel	**2,006,400**	**GAL**	**$20,720**	**$0**	**$20,000**	**$0**	**$40,720**
Concrete Core Intake Tunnel	**12**	**EA**	**$0**	**$0**	**$0**	**$551,218**	**$551,218**
Dilution Pipe Channel Connection (DEMO)	**1**	**EA**	**$5,200**	**$0**	**$0**	**$75,581**	**$80,781**
Tie-In Hot Taps	**2**	**EA**	**$10,400**	**$0**	**$0**	**$151,163**	**$161,563**
Dispose Concrete	**97**	**CY**	**$1,920**	**$0**	**$0**	**$9,650**	**$11,570**
Channel Tie-In ST&S		**MHR**		**$2,680**		**$0**	**$2,680**
						Channel Tie-In Total	**$848,532**
Schedule Based Costs							
Direct Supervision	**400**	**WKS**	**$1,920,000**	**$0**	**$0**	**$0**	**$1,920,000**
300 Ton Crane	**64**	**WKS**	**$0**	**$773,164**	**$0**	**$0**	**$773,164**
185 CFM Compressor	**91**	**WKS**	**$0**	**$54,266**	**$0**	**$0**	**$54,266**
24 kW Generator	**64**	**WKS**	**$0**	**$38,168**	**$0**	**$0**	**$38,168**
RT Scissor Lift	**64**	**WKS**	**$0**	**$103,760**	**$0**	**$0**	**$103,760**
10,000# Extendable Forklift	**64**	**WKS**	**$0**	**$172,448**	**$0**	**$0**	**$172,448**
						Schedule Based Equipment Total	**$3,061,805**
						Sub Total Cost	**$24,416,441**
Engineering						Sub Total	**$2,000,000**
						Sub Total Cost	**$26,416,441**
Contingency						Taken at 15% of Prior Sub Total	**$5,283,288**
						Total Cost	**$31,699,730**

D. Screened Intake with Discharge Diffuser

As noted in the Tables above, the estimated construction cost for the Screened Intake with the Flow Augmentation (299 MGD) alternative is $31,699,730. A Screened Intake without Flow Augmentation (127.5MGD) is estimated to cost $12,680,000, approximately 40% of the Screened Intake with Flow Augmentation. In addition, also as noted above, the estimated construction cost of a 6,000 ft. outfall with a four multiport diffuser designed to discharge up to 67 MGD is $313,632,000. Therefore the estimated construction cost for the Screened Intake with Discharge Diffuser is $326,312,000.