ENGINEERING APPENDIX A APPENDIX 6

QUANTITIES – ALTERNATIVE ANALYSIS

IS I	Brazos River Floodgates Feasibility Study	Designed By	JK
US Army Corps	Alternative 2a - Major Rehab Existing Structure	Checked By	GK
New Orleans District	Quantities Estimate	14-Sep-2017	
Number	Nurshan Departmetian		
Number	Number Description	Quantity	Uni
1	Mob & Demob	LUMPSUM	LS
2	Major Rehabilitation (Quantities are for Existing West and East Gates)		
	Existing Sector Gates (2 sector gates, 4 leafs)		
	1. Remove and Rehab Sector Gate (2 gates, 4 leafs, east & west channel)	365	TON
	- Assume Gate Major Rehabilitation Work Costs 50% of New Cost		
3	Raise/Relocate Gate Operator Buildings		
	Raise Exist. West and East Gate Operator Buildings 4 feet higher		
	1. Raise Operator Building with New Foundation	2	LS
4	Madifu (Daira) Cata Mashinam Dita		┣—
4	Modify (Raise) Gate Machinery Pits		—
	Raise Exist. West and East Gate Machinery Pits 4 feet higher		
	1. Raise Machinery Pit with New Foundation	4	LS
5	Channel Maintenance Structure		
	Add Channel Maintenance Structure to belo with navigation		
	1. Install a Dolphin Alignment Structure at the River Side for Each Gate	2	IS
6	Modify Guide Walls		
	Replace Existing Timber Rub Facing with UHMW Panels		<u> </u>
			<u> </u>
	Remove Exist. Timber Facing on Guidewalls (incl. hardware)		<u> </u>
	1. West Gate 12"x12" Timbers	13,680	SF
	2. East Gate 12"x12" Timbers	10,260	SF
	Total =	23,940	SF
	Dub Fase LILIMM Danala Mounted to Steel Dista Attached to Evict. Sheet Dila Fac		
			05
	1. West Gate Rub Face UHIWW Panel (2.3/4" thick)	13,680	SF CE
	Z. Last Gate Rub Face Of INVIV Faller (2.5/4 tiller)	10,200	
	10(a) =	23,940	JOF
	1 West Gate Steel Plate (5/8" thick)	12 600	SE
	2 East Gate Steel Plate (5/8" thick)	10,260	SF
	Total =	23 940	SE
		23,940	51
7	Mechanical		
	1. Replace All Operating Machinery for Each Gate	2	LS
			Ē
8	Electrical		
	1. Replace All Electrical Equipment for Each Gate	2	LS
		1	

	,		U			•			
	RO - Raise/Reloc	ate Gate O	perator Build	ings					
MP - Modify (Raise) Gate Machinery Pit Location									
MG - Modify Guidewalls									
	CS - Channel Mai	intenance S	Structures						
Note: The	most recent BRFG	rehabilita	tion contrac	t (W912HY1 [,]	1C0009) was for \$	9.6M, lasted 6 y			
	Existing Gate:								
Ea	ach gate (lb) = 364,	500	(2 leafs)						
Ead	ch gate (ton) = 182.	3	(2 leafs)						
Two gates re	moved (ton) = 365		(4 leafs)						
0			`						
Guide wall r pile face. T attached to only differen	ub face: Use UHM he total height of Ul steel plate with 1" d ice is the specific lo	W sheets a HMW pane iameter bol cation to th	Ittached to study and steel p ts with 1' x 1' e gate is broken	eel plate mou blate estimate bolt spacing ken down.	nted to sheet pile f d at 9 feet tall. 2 3, grid. The length of	ace. WT steel v '4" thick UHMW rub face below i			
West Gate	Northwest	400		East Gate	Northwest	210			
in our outo	Northeast	360	\backslash	Luci Outo	Northeast	360			
	Southwest	430			Southwest	220			
	Southeast	330			Southeast	350			
Tot	al length (ft) =	1,520	\backslash	Тс	otal length (ft) =	1,140			
	0 ()		,		0 ()				
	Guide Wall Rub	Face Area	(ft2)	All Walls To	otal length (ft) =	2,660			
	West Gate	13,680			• • • •				
	East Gate	10,260							
Tot	al Area (ft2) =	23,940							
	ich Malaaular	Woight	Delvethy						

Ultra High Molecular Weight Polyethylene (UHMW-PE) WEAR ALLOWANCES

APPLICATION	t (mm)	W* (mm)	BOLT
Light duty	30	3 – 5	M16
Mandiana data	40	7 – 10	M40 M00
Mealum auty	50	10 – 15	M10 - M20
Heavy duty	60	15 – 19	
	70	18 - 25	M24 – M30
	80	22 - 32	
Extreme duty	90	25 - 36	N20 N26
Extreme duty	100	28 - 40	M30 - M30
Where allowances are t ue to fixing detail. Small ervice life for minimal ex	ypical values, actual we increases in facing thic tra cost.	ar allowance may vary kness can greatly extend	[Units: mm]

TYPICAL DIMENSIONS



250 - 350 45 - 80 300 - 450 5-10 Steel n and the second s



45 - 80



Dimensions will depend on pad thickness and application.

LARGE PADS VS SMALL PADS



Larger pads are usually more robust but smaller pads are easier and cheaper to replace.

The standard color is black, but UHMW-PE is available in many other colours if required.

Major Rehabilitation of the exiting floodgates is expected to include the following management measures:

MR - Major Rehab of the Floodgates (includes repair/replacement of damaged components, repainting, and replacement of cathodic protection)

years and was completed in mid-2017.

vertical guide for steel plate attachment to sheet / sheet attached to 5/8" thick steel plate. UHMW is the same as the lengths of guide wall above,

-	Brazos River Floodgates Feasibility Study	Designed By	JK
US Anny Carps of Englands, Net Disco Relat	Alternative 3a - Move Gates Farther Back in Exist. Channel	Checked By	GK
	Quantities Estimate	14-3ep-2017	
Number	Number Description	Quantity	Uni
1	Mob & Demob	LUMPSUM	LS
2	Demolition (Quantities are for existing West and East Gates)		
	Existing Sector Gates (2 sector gates, 4 leafs)		
	Remove and Salvage Sector Gate (2 gates, 4 leafs, east & west channel) Remove and Disperse Gate Foundation (2 gates)	365	TON
	3. Remove and Dispose Timber Piles (2 gates)	1.970	EA
	Guide Walls	4.004	TON
	1. Remove and Salvage Guide Walls (8 walls, east & west channel)	4,324	TOP
3	Excavation and Fill		
	Move Gates Farther Back In Existing Channel		
	1. Excavate Existing West Gate Channel	268,700	ĊΥ
	2. Excavate Existing East Gate Channel 3. Excavate West Bypass Channel	181,800	CY
	4. Excavate East Bypass Channel	888,800	CY
	Excavation Total =	2,202,500	CY
	1. Fill Existing Channel to Create Vessel Channel, West Gate	188,300	CY
	2. Fill Existing Channel to Create Vessel Channel, East Gate	201,000	CY
	Fill Total =	389 300	CY
	Riprap (3' Thick Layer)	8,000	TON
4	Cofferdam (Cofferdam placed around sector gates, 2 gates, 2 dams)		
	1. Excavation	35,600	CY
	2. Sand and Fill 3. Waler System - WE Members	12,600	CY
	4. Sheet Piles - AZ 38-700N	105,280	SF
	5. Internal Bracing (Struts) - 24" Dia. X 0.625" Thk.	4,600	LF
	6. King Post Piling (Piles 30" Dia. X 0.625" Thk.) 7. Support Piling 24" Dia. X 0.625" Thk.	3,400	LF
	8. Misc. Steel	4,200	TN
	9. Temporary Dewatering System	2	LS
	10. Removal of Cofferdam	2	LS
5	Sector Gate Monolith		
	1. Sand and Gravel Bedding	3,400	CY
	2. Tremie Concrete - Seal Slab	9,000	CY
	4. Reinforced Concrete Monolith	8,000	CY
	5. Pilings: a. Pilings - Vertical Spiral Piles - 30" Dia: X 0.625" Thk	40.200	LE
	 b. Pilings - Batter Spiral Piles - 30" Dia. X 0.625" Thk. 	44,838	LF
	6. Tension Connection	550	EA
	7. Bulkhead Slots - Stainless Steel w/Seals (Embedded in Monolith)	200	LF
	0. Ladder Sids - Stanless Steer w/Ladders (Linbedded in Mononiar)	100	LI
-	Sector Gate		-
	1. Sector Gates	1,136	ΤN
	2. Pintles and Hinges (King post)	2	LS
	4. Gate Seals, Seal Bearing Surfaces and Gate Track	2,300	LS
	5. Cathodic Protection	2	LS
			L
1			
			-
6	Maintenance Dewatering System		L
	Sector Gate Dewatering System (Maintenance Bulkhead)		Thi
	Maintenance Bulkhead Maintenance Bulkhead Storage Platform	633	IN
	a. Steel Framing	294	ΤN
	b. Piling Supports		
	1. Pilings - 36" Dia. X 0.625" Thk.	2,816	LF
			-
7	Guide Walls		
	Sheet Pile Guide Wall Tied Back to Sheet Pile Anchors		<u> </u>
	All Sheet File F 2-55 UTIESS NOTED UTIETWISE		L
-	1. West Gate North Guide Wall	63,840	SF
	2. West Gate South Guide Wall 3. East Gate North Guide Wall	63,840	SF
	4. East Gate South Guide Wall	47,880	SF
-	Total =	223,440	SF
	Guide Wall Hardware		
-	I otal Guide Wall Hardware (All walls)	499	ſN
	Rub Face UHMW Sheets Mounted to Steel Plate Attached to Sheet Pile Face		-

DEMOLITIO	N	
Existing Gate	r.	
Each gate (lb) =	364,500	(2 leafs
Each gate (ton) =	182.3	(2 leafs
ates removed (ton) =	365	(4 leafs

Conc. Foundation, one gate (cy) = 7,655 Foundation, wing walls, approach aprons priract Bid Documents used 25 feet timber pile length for bidding purposes.

Total weight walls, one gate (b) = 4,323,700 Quantities based on East Gate Guide Wall take off, Guide Walls B5, B6, B7, B8, West Gate guide wall similar. Total weight walls, one gate (bn) = 2,162 Weight is steel material: sheet pile, anchor bar, waler, wall contact, pile cap, tangent plate, fender plate

985 Piles per rate

	Guide Wall	Anchor Wall	
Vall No	Sht Pile (sf)	Sht Pile (sf)	Total (sf)
B5	25,243	12,067	37,310
B6	21,736	10,076	31,812
B7	13,184	6,486	19,670
B8	13,184	6,486	19,670
			400 460

Note: The bypass channels would likely be turned into barge mooring/storage channels after construction, similar to the existing Texas Barge and Boat facility on Alignment C. Alignment C was the bypass channel during the construction of the existing BRFG facility, and now a portion of it has been turned into the existing Texas Barge and Boat facility.

SEE BOTTOM OF SPREADSHEET FOR EXCAVATION AND FILL QUANTITIES

Excavation Disposal Note: The current plan for the disposal of excavation material is to use the existing placement areas (PA) located along the GIWW.

Placament Areas No. 88 and 89 are the closest to the Brazos Floodqates and they were reported to have combined remaining capacity of approximately 3.8 million cubic yards. Based on SGCP' Gulf Side Sector Gate, 46.5' x 110' Sector Gate

Foundation = 116' x 260' *Similar Gulf Coast Project Brazos Sector Gate 31' x 125'

Perimeter of cofferdam (ft) = 752

Two ga

Cofferdam Note: Prior to cofferdam construction, install guide walls and fill in the wet to create vessel chamber and land adjacent to gates. Cofferdam placed around each sector gate, 2 gates, 2 cofferdams. The intent is to build the guide walls first, so that the temporary cofferdam wilb eretoucid in length and will be less expensive. The temporary cofferdam wilb ensulate between the permanent guide walls, and then dewatered in order to perform the monolith and sector gate construction work in the dry.

Extension Contendaming in a hard of weight is embedded and half he height is above mutiline, extenses these pilo length of 70 feet. Extenses the length of King poet piling to be embedded 20 feet and 25 feet above mutiline. For length of 85 feet. Extenses the langth of 10 feet. Extenses the langth of 10 feet. The length of 85 feet. Extenses the langth of 10 feet and 25 feet above mutiline, for length of 85 feet. Extenses the langth of 10 feet. The length of 10 feet. Extenses the langth of 10 feet. The lengths and quantity estimated above is a rough estimate and may change based on gestechnical conditions. Gestechnical conditions have not been evaluated, propose used owell points for devatering system.

The construction cofferdam would be designed and detailed by the construction contractor. However, it is anticipated that the cofferdam would include some larger diameter piles (king posts) help support the lateral loads on the cofferdam. Typically the internal bracing (struts) would well to the targer diameter piles (king support line) are as anticipated to the set and target diameter support. Some smaller diameter support piles are as anticipated to the equival to the target diameter piles (king target diameter support piles are as anticipated to the required to help vertically support and reduce the unbraced length of the internal bracing members.

This estimated sand and fill quantity is a minor item to help provide a stable work surface floor within the cofferdam and to fill in any holes where the geotechnical conditions may require overexcavation to reach a stable subgrade.

Based on SGCP Gulf S Foundation = 116' x 26	ide Sector i0'	Gate, 46.5' x 110' Sector Gate	-	Pile Lengths (ft) Vertical = 169 Batter = 178	Sector Gate Weight (ton) = 537 No of vertical piles = 134 No of batter piles = 141
Brazos Sector Gate 31	' x 125' (2 g	ates, 4 leafs)			
No of vertical piles =	268	Vertical pile length (ft) =	150	<= Enter vertical value	, batter will be calculated

 No of vertical piles =
 268
 Vertical piles =

 No of batter piles =
 282
 Batter piles =

Batter pile length (ft) = 159 3v:1h

The weight per enclosed volume of a sector gate leaf was calculated for several existing projects including the existing Brazos sector gate. The data results are as follows. Brazos 62 b/bt3 (pd), HNC 67 pd, and SGOP 48 pd. The average weight per enclosed volume for these projects is 5.9 pd. The estimated weight of the new Brazos sector gate leaf based on this similar project average of 5.9 pd for the projects is 5.9 pd. the stimated weight of the new Brazos sector gate leafs) is 588 tons. HNC refers to the inner Harbon Navigation Canal project. The top of the gates will match the top of the wall existion of 16.00 NAVDB8 with matches the Colorado River Locks, which were resently surveyed.

Based on SCGP Gulf Side Sector Gate, 46.5" x 110' Sector Gate. Maintenance bulkheads provide 29 feet of water protection. The bulkheads are 110' feet long and to be placed across the channel opening. 5 bulkheads stacked on top of each other used areach end of montilihi, total of 10 units to perform maintenance on a sector gate. Each bulkhead weights 63 tons. Provide one complete set (10 units) for one gate, maintenance performed on one gate at a time.

The maintenance bulkhead storage platform is estimated to require a balal deak was of approximately 16.060 square feet in order to bate 10.bulkhead storage balaform is estimated at the storage balance of the storage platform would be to bulkhead. The exclusion of the storage platform would be to bulkhead the storage balance of the storage platform would be platform balance bulkhead at the storage balance of the storage platform is estimated at the storage balance of the storage platform would be platform balance bulkhead the storage balance. The platform balance bulkhead the storage balance bulkhead the storage balance bulkhead the storage balance.

Since the guide walls must retain fill soil, use sheet pile guide walls similar to the type currently in use, sheet pile face tied back to sheet pile used as anchor. Quantities based on quantity take off of existing East gate guide walls BS, B6, B7, and B8, raised 6 feet to match top of wall elevation +16.00 NAVD88 at the Colorado River Locks, which were recently surveyed.



121	Brazos River Floodgates Feasibility Study	Designed By	JK
US, Array Carps	Alternative 3a - Move Gates Farther Back in Exist. Channel	Checked By	GK
Nue Witness Ballant	Quantities Estimate	14-Sep-2017	
Number	Number Description		
Number	Ramber Bedelpilon	Quantity	Unit
	1. West Gate Rub Face UHMW Panel (2 3/4" thick)	13,680	SF
	2. East Gate Rub Face UHMW Panel (2 3/4" thick)	10,260	SF
	Total =	23,940	SF
	1 Wast Gate Steel Plate (E/9" thick)	12 690	er
	2 East Gate Steel Plate (5/8" thick)	10,000	SF
	Total =	23,940	SF
8	Mechanical		
	1. Rack and Pinion System	2	LS
9	Electrical	2	LS
——			

Existing Weight per Linear Foot of Sheet Pile Guide Wall (lb/ft) = 3,069

Use sheet pile 56 feet total face sheet length (56 sf per linear foot) plus 50% wall face area for anchor sheet.

For Alternative	3a at New Location Farther Back in Existing Channel				
New Guide Wall Lengths (ft)		New Guide V	Vall Area (sf)	New Guide Wall Hardware (ton)	
North	760	North	63,840	North	143
South	760	South	63,840	South	143
North	570	North	47,880	North	107
South	570	South	47,880	South	107
al length (ft) =	2,660	Total Area (sf) =	223,440	Total Weight (ton) =	499

Guide wall rub face: Use UHMW sheets attached to steel plate mounted to sheet pile face. WT steel vertical guide for steel plate attachment to sheet pile face. The total height of UHMW panels and steel plate estimated at 9 feet tall. 2 34° thick UHMW sheet attached to 5/8° thick steel plate. UHMW attached to steel plate with 1° dismeter bolts with 1° 1° too spacing grid. The length of rub face below is the same as the lengths of guide wall above, only difference is the specific location to the gate is torken down.

Guide Wall Rub Face Lengths (ft) West Gate Northwest Northeast Southwest 400 360 430 East Gate Northwest Northeast 210 360 220 Southwest Southeast Total length (ft) = 330 Southeast 350 1,140 1,520 Total length (ft) = Guide Wall Rub Face Area (ft2) West Gate 13,680 East Gate 10,260 Total Area (ft2) = 23,940 All Walls Total length (ft) = 2,660

NUMBER			W* (ment)	8042	
Light duty	3	10	3-5	MS6	10 X
		10	7-20	1100000	1 1 1 1
Appendix on the	5	0	20 35	838-920	Contract T
	. 6	10	35-10		
Hoply duty	7	0	38-25	8524 - 8530	100
		10	22-32		
Particular States	9	10	25.34	tents were	
LOOPIN GLOV	3	20	28-80	- MAG - MAG	
When almoster or to here near	brial increases in mail increases in mail settle cost,	n actual wave alle - Saving Dackhese	cas fasaili cores minor cas nai)	Same and	
TPICAL DI	MENSIONS			45-80	Dimensions will depend on pad
T	111			210-300	thickness and application.
-	1			45-80	
+ +	+ ++			300 - 450	
	A . A 1			8 - 80	
		5 V.		Date and	
+ +	+ ++				
+ +	+ +		Steely	anel Open st	ructure Timber Sking
+ +	+ +		14	8 11	
+ +	+ +	-4	- 4		t = 30-150
		1	1	_ 73	
1.8.5	1.000			/ 44	- E
+ +	+ +		Aways	FRE DALATE REGISTER	6425 H (2012
ARGE PAI	DS VS SMA	LL PADS			Larger pads are usually more robust but smaller pads are easier and charger to rectace.

Ultra High Molecular Weight Polyethylene (UHMW-PE)

CHANNEL EX	CAVATION					
	Location	Area (ft2)		Volume (yd3)		
	West channel north	169,830		113,300 }	- 268,700	
Exist.channel excavated	West channel south	232,990		155,400 J		
to open channel	East channel north	85,120		56,800 }	181,800	
	East channel south	187,500		125,000		
	West bypass	1,294,800		863,200		
	East bypass	1,333,100		888,800		
	Sum =	3,303,340	ft2	2,202,500 y	/d3	Average depth of excavation used = 18 ft

FILL EXISTING CHANNEL

West Gate North South East Gate North South Total length (ft) =

	Location	Area (ft2)		Volume (yd3)		
For new gate locations	West channel	282,370		188,300		
	East channel	301,370	_	201,000		
	Sum =	583,740	ft2	389,300	yd3	Average depth of fill used = 18 ft

(TwT)	Brazos River Floodgates Feasibility Study	Designed By	JK
	Alternative 3a.1: 3a Fast + Open Exist, Channel West	Checked By	GK
of Engineers		11 Oct 2017	OR
New Orleans District		11-Oct-2017	
Number	Number Description	Quantita	
- 1	Mak 9 Damak	Quantity	
1		LUMPSUM	LS
2	Demolition (Quantities are for existing West and East Gates)		
	Existing Sector Gates (2 sector gates, 4 leafs)		
	1 Pomovo and Salvago Soctor Cato (2 gatos, 4 loafe, cast 8 west channel)	365	TON
	2. Remove and Dispose Gate Foundation (2 gates)	15 310	cv
	2. Remove and Dispose Gate Foundation (2 gates)	10,510	
	5. Remove and Dispose Timber Files (2 gales)	1,970	
	1. Remove and Salvage Guide Walls (8 walls, east & west channel)	4,324	TON
3	Excavation and Fill		
	Move Gates Farther Back in Existing Channel		
	Excavation		
	1. Excavate Existing West Gate Channel	268,700	CY
	2. Excavate Existing East Gate Channel	181,800	CY
-	3. Excavate West Bypass Channel	431,600	CV
	4. Excavate Last Dypass Charmer	1 770 900	CY
	Fill	1,770,300	
	1. Fill Existing Channel to Create Vessel Channel, West	0	CY
	2. Fill Existing Channel to Create Vessel Channel, East Gate	201,000	CY
	Fill Total =	201,000	CY
4	Cofferdam (Cofferdam placed around sector gates, 1 gate, 1 dam)		
	1. Excavation	17,800	CY
	2. Sand and Fill	6,300	CY
	3. Waler System - WF Members	220	ΤN
	4. Sheet Piles - AZ 38-700N	52,640	SF
	5. Internal Bracing (Struts) - 24" Dia. X 0.625" Thk.	2,300	LF
	6. King Post Piling (Piles 30" Dia. X 0.625" Thk.)	1,700	LF
	7. Support Piling 24" Dia. X 0.625" Thk.	2,100	LF
	8. Misc. Steel	5	ΤN
	9. Temporary Dewatering System	1	LS
	10. Removal of Cofferdam	1	LS
5	Concrete Structure and Gate (Quantities are for 1 sector gate, 2 leafs)		
	Sector Gate Monolith	·	
L	1. Sand and Gravel Bedding	1,700	CY
ļ	2. I remie Concrete - Seal Slab	4,500	CY
	3. Reinforced Concrete Base Slab	8,900	CY
	4. Keiniorcea Concrete Monolith	4,000	CY
	jo. Fillings. a Pilings - Vertical Spiral Piles - 30" Dia X 0.625" Thk	20 100	IF
	b. Pilings - Batter Spiral Piles - 30" Dia. X 0.625" Thk	20,100	
	6. Tension Connection	275	EA
	7. Bulkhead Slots - Stainless Steel w/Seals (Embedded in Monolith)	100	LF
	8. Ladder Slots - Stainless Steel w/Ladders (Embedded in Monolith)	50	 F
		JU 30	1

DEMOLITION	
Existing Gate:	
Each gate (lb) = 364,500	(2 leafs)
Each gate (ton) = 182.3	(2 leafs)
Two gates removed (ton) = 365	(4 leafs)

Conc. Foundation, one gate (cv) = 7.655Foundation, wing walls, approach aprons Contract Bid Documents used 25 feet timber pile length for bidding purposes.

985 Piles per gate

Total weight walls, one gate (ton) = 2,162

Total weight guide walls, one gate (lb) = 4,323,700 Quantities based on East Gate Guide Wall take off, Guide Walls B5, B6, B7, B8, West Gate guide wall similar. Weight is steel material: sheet pile, anchor bar, waler, wall contact, pile cap, tangent plate, fender plate

B8	13,184	6,486	19,670
B7	13,184	6.486	19.670
B6	21.736	10.076	31.812
B5	25,243	12,067	37,310
Wall No	Sht Pile (sf)	Sht Pile (sf)	Total (sf)
	Guide Wall	Anchor Wall	

Note: The bypass channels would likely be turned into barge mooring/storage channels after construction, similar to the existing Texas Barge and Boat facility on Alignment C. Alignment C was the bypass channel during the construction of the existing BRFG facility, and now a portion of it has been turned into the existing Texas Barge and Boat facility. SEE BOTTOM OF SPREADSHEET FOR EXCAVATION AND FILL QUANTITIES

Excavation Disposal Note: The current plan for the disposal of excavation material is to use the existing placement areas (PA) located along the GIWW. Placement Areas No. 88 and 89 are the closest to the Brazos Floodgates and they were reported to have combined remaining capacity of approximately 3.8 million cubic yards. Based on SGCP* Gulf Side Sector Gate, 46.5' x 110' Sector Gate

Foundation = $116' \times 260'$ *Similar Gulf Coast Project Brazos Sector Gate 31' x 125'

Cofferdam Note: Prior to cofferdam construction, install guide walls and fill in the wet to create vessel chamber and land adjacent to gates. Cofferdam placed around each sector gate, 1 gate, 1 cofferdam. The intent is to build the guide walls first, so that the temporary cofferdam will be reduced in length and will be less expensive. The temporary cofferdam will be installed between the permanent guide walls, and then dewatered in order to perform the monolith and sector gate construction work in the dry.

Perimeter of cofferdam (ft) = 752

Estimate for sheet pile that half of height is embedded and half the height is above mudline, estimate sheet pile length of 70 feet. Estimate the length of King post piling to be embedded 50 feet and 35 feet above mudline, for length of 85 feet. Estimate that 20 King posts are required. Estimate the length of support piling to be 70 feet, half the length is embedded. Estimate that 30 support piling are required. The lengths and quantity estimated above is a rough estimate and may change based on geotechnical conditions. Geotechnical conditions have not been evaluated, propose use of well points for dewatering system.

The construction cofferdam would be designed and detailed by the construction contractor. However, it is anticipated that the cofferdam would include some larger diameter piles (king posts) to help support the lateral loads on the cofferdam. Typically the internal bracing (struts) would weld to the larger diameter piles (king posts) for lateral support. Some smaller diameter support piles are also anticipated to be required to help vertically support and reduce the unbraced length of the internal bracing members.

This estimated sand and fill quantity is a minor item to help provide a stable work surface floor within the cofferdam and to fill in any holes where the geotechnical conditions may require overexcavation to reach a stable subgrade.

Based on SGCP Gulf Side Sector Gate, 46.5' x 110' Sector Gate Foundation = 116' x 260'

→ Pile Lengths (ft) Vertical = 169 Batter = 178

Brazos Sector Gate 31' x 125' (1 gate, 2 leafs)

No of vertical piles =	134	Vertical pile length (ft) =	150
No of batter piles =	141	Batter pile length (ft) =	159
		3v:1h	

<= Enter vertical value, batter will be calculated

Sector Gate Weight (ton) = 537 No of vertical piles = 134 No of batter piles = 141

	Sector Gate		
	1. Sector Gates	568	TN
	2. Pintles and Hinges (King post)	1	LS
	3. Sector Gate Protection Fenders	1,180	
	4. Gate Seals, Seal Bearing Surfaces and Gate Track	1	LS
			15
6	Maintenance Dewatering System		
	Sector Gate Dewatering System (Maintenance Bulkhead)		
	1 Maintenance Bulkhead	633	TN
	2 Maintenance Bulkhead Storage Diatform	000	
-		204	TN
		294	TIN
	b. Piling Supports		
	1. Pilings - 36" Dia. X 0.625" Thk.	2,816	LF
7	Guide Walls		
	Sheet Pile Guide Wall Tied Back to Sheet Pile Anchors		
	All Sheet Pile PZ-35 Unless Noted Otherwise		
	1 West Gate North Guide Wall	0	SF
	2 West Gate South Guide Wall	0	SF
	3 East Gate North Guide Wall	47 880	SF
	4. East Gate North Guide Wall	47,000	SE
		47,000	0
	I Otal =	95,760	51
	Guide Wall Hardware		
	Total Guide Wall Hardware (All walls)	214	TN
	Rub Face UHMW Sheets Mounted to Steel Plate Attached to Sheet Pile Face		
	1. West Gate Rub Face UHMW Panel (2 3/4" thick)	0	SF
	2. East Gate Rub Face UHMW Panel (2 3/4" thick)	10,260	SF
	Total =	10,260	SF
-			
	1 West Gate Steel Plate (5/8" thick)	0	SF
	2 East Gate Steel Plate (5/8" thick)	10.260	SF
		10,200	
		10,260	55
	Machania		
8			
	1. Rack and Pinion System	1	LS
	Electrical	1	15
3			
			-
-			
-			
L		<u> </u>	I

The weight per enclosed volume of a sector gate leaf was calculated for several existing projects including the existing Brazos sector gate. The data results are as follows, Brazos 6.2 lb/ft3 (pcf), IHNC 6.7 pcf, and SGCP 4.8 pcf. The average weight per enclosed volume for these projects is 5.9 pcf. The estimated weight of the new Brazos sector gate leaf is based on this similar project average of 5.9 pcf for the proposed 31' x 125' gate. The estimated weight of the proposed sector gate (2 leafs) is 568 tons. IHNC refers to the Inner Harbor Navigation Canal project. The top of the gates will match the top of the wall elevation +16.00 NAVD88 which matches the Colorado River Locks, which were recently surveyed.

Based on SCGP Gulf Side Sector Gate, 46.5' x 110' Sector Gate, Maintenance bulkheads provide 29 feet of water protection. The bulkheads are 110' feet long and to be placed across the channel opening. 5 bulkheads stacked on top of each other used at each end of monolith, total of 10 units to perform maintenance on a sector gate. Each bulkhead weighs 63 tons. Provide one complete set (10 units) for one gate, maintenance performed on one gate at a time.

The maintenance bulkhead storage platform is estimated to require a total deck area of approximately 18,060 square feet in order to store 10 bulkhead sections stacked 2 high. The required footprint on the platform would be for 5 bulkheads. The exact plan configuration of the storage platform would depend on the land available and how the USACE would like to store/arrange the bulkheads. One possible platform deck configuration would be 54 feet wide for 255 feet and 33 feet wide for 130 feet. Typical pile lengths are 88 feet for the maintenance bulkhead storage platform.

Since the guide walls must retain fill soil, use sheet pile guide walls similar to the type currently in use, sheet pile face tied back to sheet pile used as anchor. Quantities based on quantity take off of existing East gate guide walls B5, B6, B7, and B8, raised 6 feet to match top of wall elevation +16.00 NAVD88 at the Colorado River Locks, which were recently surveyed.

	Existing East Gui	de Wall Lengths (ft)	Exist.Guide Wal	I Take Off Weigh	See Demolition	on Above for g Wall section	Sheet Pile Area Breakou ons B5, B6, B7, B8	ıt
Wall section B5 487			PZ 35 sheet pile	3,796,100				
	B6	408	Anchor bar	170,470				
	B7	257	Waler	140,990	Hardware weig	ht per foot (lb	o/ft)	
	B8	257	Wall contact	29,196	375			
Tota	al length (ft) =	1,409	Pile cap	114,870				
			Tangent wall plate	42,385				
			Fender plate	29,661				
			Total Steel Weight (lb) =	4,323,700				
	Existing Wei	ght per Linear Foot of	Sheet Pile Guide Wall (lb/ft) =	3,069	Use sheet pile plus 50% wall	e 56 feet tota face area fo	l face sheet length (56 si r anchor sheet.	per linear foot)
	For Alternative	Ba at New Location F	Farther Back in Existing Channe	el				
	New Guide Wall	Lengths (ft)			New Guide W	all Area (sf)	New Guide Wa	III Hardware (ton)
West Gate	North	0			North	0	North	0
	South	0			South	0	South	0
East Gate	North	570			North	47,880	North	107
	South	570			South	47,880	South	107
Tota	al length (ft) =	1,140			Total Area (sf) =	95,760	Total Weight (ton) =	214

Guide wall rub face: Use UHMW sheets attached to steel plate mounted to sheet pile face. WT steel vertical guide for steel plate attachment to sheet pile face. The total height of UHMW panels and steel plate estimated at 9 feet tall. 2 3/4" thick UHMW sheet attached to 5/8" thick steel plate. UHMW attached to steel plate with 1" diameter bolts with 1' x 1' bolt spacing grid. The length of rub face below is the same as the lengths of guide wall above, only difference is the specific location to the gate is broken down.

		Guide Wall Ru	b Face Len	<u>gths (ft)</u>		
West Gate	Northwest	0	\backslash	East Gate	Northwest	210
	Northeast	0			Northeast	360
	Southwest	0			Southwest	220
	Southeast	0			Southeast	350
Tota	al length (ft) =	0	\	\ To	otal length (ft) =	1,140

Guide Wall Rub Face Area (ft2)

Ultra High Molecular Weight Polyethylene (UHMW-PE) West Gate 0 WEAR ALLOWANCES East Gate 10,260 APPLICAT Light duty BOLT Total Area (ft2) = 10,260 3-5 7-10 10-15 15-19 18-25 22-32 25-36 28-40 M16 Medium duty M16 – M20 60 Heavy duty 70 M24 – M30 IF 1 90 100 M30 – M36 Extreme duty * Where allowances are typica due to fixing detail. Small incr [Units: mm] ance may vary an greatly exten TYPICAL DIMENSIONS Dimensions will depend on pad thickness and application. 45 - 80 * * * * 45 - 80 45 - 80 300 - 450 -5 - 10 . . --(Units: . ---Timber fixing Open structure + --Stee -ap t ≈ 30–150 ۰ ۰ --+ ato . --CHANNEL EXCAVATION -٠ . άΦ Area (ft2) Volume (yd3) Location + --++ West channel north 169,830 113,300 268,700 Exist.channel excavated 232,990 155,400 LARGE PADS VS SMALL PADS West channel south 0 to open channel East channel north 85,120 56,800 181,800 0 0 0 000 Larger pads are usually more robust but smaller pads are easier and cheaper to replace. East channel south 187,500 125,000 000 West bypass 647,400 431,600 ~ 000 East bypass 1,333,100 888,800 The standard color is black, but UHMW-PE is available in many other colours if required. Sum = 2,655,940 ft2 1,770,900 yd3

FILL EXISTING CHANNEL

	Location	Area (ft2)		Volume (yd3)	
For new gate locations	West channel	0		0		
	East channel	301,370		201,000	_	
	Sum =	301,370	ft2	201,000	yd3	Average dep

Average depth of excavation used = 18 ft

pth of fill used = 18 ft

ini i	Brazos River Floodgates Feasibility Study	Designed By	JK						
US Array Corps. of Engineers.	Alternative 9a - Open Channel on Alignment C without Gates	Checked By	GK						
New Orleans District	Quantities Estimate	14-Sep-2017							
Maria	Number Description								
Number	Number Description	Quantity	Unit						
1	Mob & Demob	LUMPSUM	LS						
	Demolition (Quantities are for existing West and East Gates)			DEMOLITION	Remove o	nly Gates for Alternative 9a			
	Existing Sector Gates (2 sector gates, 4 leafs)			Existing Gate:					
	1. Remove and Salvage Sector Gate (2 gates, 4 leafs, east & west channel)	365	TON	Each gate (lb) = 364,500	(2 leafs)				
	2. Existing Gate Foundation and Piles to Remain (2 gates)	0	CY	Each gate $(ton) = 182.3$	(2 leafs)				
				Two gates removed (ton) = 365	(4 leafs)				
2	Excavation and Fill								
	Open Channel on Alignment C, Fill Existing Channels								
	1. Excavate New West Open Channel	908,200	CY						
	2. Excavate New East Open Channel	695,600	CY						
	Excavation Total =	1,603,800	CY						
			<u></u>						
	1. Fill Existing West Vessel Channel	108,200	CY						
	2. Fill Existing East Vessel Channel	63,400	CY						
	Fill Total =	171,600	UT						
3	Electrical								
0	Site Electrical	1	LS						
	Real Estate Acquisition and Relocation for Alignment C								
	· · ·								
				CHANNEL EXCAVATION		CADD channel excavati	on overlaid with aeria	al image of existin	g channel outline
				Alignment C through existing barge	facility.	West channel currently	not being used, East	channel is occupi	ed, West requires
				The area is partially excavated.		more excavation (subtra	ict less)	(1.0)	
				Location	Area (ft2)		Area 205	(ft2) 4.4.4 Cubben et thi	
				(Barge facility) East channel	el 353,525	Use 75% of area for depth of excava	tion 205,		s area from CADD value
				(Darge radiity) East chain	000,000	Ose 50% of alea for depth of excava	400,	ooo (Area area	
				Location	Area (ft2)		Location Area	(ft2)	Volume (yd3)
				Channel excavation West channel	el 1.627.310	Channel Excavation	Nest channel 1.362	.166	908.200
				required from CADD East chan	ne 1,538,370)	East channel 1,043	,370	695,600
							Sum = 2,405	,536 ft2	1,603,800 yd3
									Average depth of excavation used = 18 ft
				FILL EXISTING CHANNEL	Aroa (#0)	Volume (vd3)			
				At existing gates West chapt	al 162 260	108 200			
				East chan	el 95.090	63,400			
				Sum	= 257,350	ft2 171,600 yd3	Average depth of fi	ll used = 18 ft	

	Brazos River Floodgates Feasibility Study	Designed By	JK
US Anny Corps. of Engineers	Alternative 9b - New Gates on Alignment C w/o Sediment Contro	Checked By	GK
Real Debans (Non-VE	Quantities Estimate	14-Sep-2017	
Number	Number Description		
Number	Number Description	Quantity	Unit
1	Mob & Demob	LUMPSUM	LS
2	Demolition (Quantities are for existing West and East Gates)		
	Existing Sector Gates (2 sector gates, 4 leafs)		TOUL
	 Remove and Salvage Sector Gate (2 gates, 4 leafs, east & west channel) 	365	TON
	2. Remove and Dispose Gate Foundation (2 gates)	15,310	CY
	3. Remove and Dispose Timber Piles (2 gates)	1,970	EA
	Guide Walls		
	1. Remove and Salvage Guide Walls (8 walls, east & west channel)	4,324	TON
3	Excavation and Fill		
0	New Gates on Alignment C		
	1 New West Channel Excavation	607 000	CV
	2 New East Channel Excavation	476 500	CY
	Excavation Total =	1,174,400	CY
	Excertain Fold =	.,,	<u> </u>
	1. Fill for New Gate Location, West Gate	98,700	CY
	2. Fill for New Gate Location, East Gate	88,200	CY
	3. Fill Existing West Vessel Channel	108,200	CY
	4. Fill Existing East Vessel Channel	63,400	CY
	Fill Total =	358,500	CY
	Riprap (3' Thick Layer)	8,000	TON
4	Coffordem (Coffordem placed around costor gates, 2 gates, 2 dams)		
4	1 Execution	35 600	CV
	2 Sand and Fill	12 600	CY
	2. Water System - WE Members	12,000	TN
	4. Shoet Dilog, AZ 29 700N	105 290	CE.
	4. Silect Files - AZ 36-700N	103,280	JE
	5. Internal Bracing (Struts) - 24 Dia. X 0.625 Thk.	4,600	
	6. King Post Piling (Piles 30° Dia. X 0.625° Thk.)	3,400	
	7. Support Piling 24" Dia. X 0.625" Thk.	4,200	
	8. Misc. Steel	10	IN
	9. Temporary Dewatering System	2	LS
	10. Removal of Cotterdam	2	LS
			1
			l –
5	Concrete Structure and Gate (Quantities are for 2 sector gates, 4 leafs)		
	Sector Gate Monolith		
	1. Sand and Gravel Bedding	3,400	CY
	2. Tremie Concrete - Seal Slab	9,000	CY
	3. Reinforced Concrete Base Slab	17,800	CY
	4. Reinforced Concrete Monolith	8,000	CY
	5. Pilings:		
	a. Pilings - Vertical Spiral Piles - 30" Dia. X 0.625" Thk.	40,200	LF
	D. Pliings - Batter Spiral Piles - 30" Dia. X 0.625" Thk.	44,838	
	o. rension connection 7. Bulkhaad Slots - Stainless Steel w/Seals /Embedded in Monolith)	550	
	8 Ladder Slots - Stainless Steel w/Ladders (Embedded in Monolith)	200	LE
		100	-
			<u> </u>
	Sector Gate		
	1. Sector Gates	1.136	ΤN
	2. Pintles and Hinges(King post)	2	LS
	3. Sector Gate Protection Fenders	2,360	LF
	4. Gate Seals, Seal Bearing Surfaces and Gate Track	2	LS
	5. Cathodic Protection	2	LS
			└──
			┝──
6	Maintenance Dewatering System		
U	maintenance Dewalering System		1

DEMOLITION

(2 leafs)
(2 leafs)
(4 leafs)

Conc. Foundation, one gate (cy) = 7,655 Foundation, wing walls, approach aprons Contract Bid Documents used 25 feet timber pile length for bidding purposes. 94

985 Piles per gate

Total weight guide walls, one gate (lb) = 4,323,700 Quantities based on East Gate Guide Wall take off, Guide Walls B5, B6, B7, B8, West Gate guide wall similar. Total weight guide walls, one gate (ton) = 2,162 Weight is steel material: sheet pile, anchor bar, waler, wall contact, pile cap, tangent plate, fender plate

	Guide Wall	Anchor Wall	
Wall No	Sht Pile (sf)	Sht Pile (sf)	Total (sf)
B5	25,243	12,067	37,310
B6	21,736	10,076	31,812
B7	13,184	6,486	19,670
B8	13,184	6,486	19,670
			109 462

SEE BOTTOM OF SPREADSHEET FOR EXCAVATION AND FILL QUANTITIES

Excavation Disposal Note: The current plan for the disposal of excavation material is to use the existing placement areas (PA) located along the GIWW. Placement Areas No. 88 and 89 are the closes to the Brazos Floodgates and they were reported to have combined remaining capacity of approximately 3.8 million cubic yards. Based on SGCP* Gut Side Sector Gate, 46.5'x 110' Sector Gate

Foundation = 116' x 260' *Similar Gulf Coast Project

Cofferdam Note: Prior to cofferdam construction, install guide walls and fill in the wet to create vessel chamber and land adjacent to gates. Cofferdam placed around each sector gate, 2 gates, 2 cofferdams. The intent is to build the guide walls first, so that the temporary cofferdam will be reduced in length and will be less expensive. The temporary cofferdam will be installed between the permanent guide walls, and then dewatered in order to perform the monolith and sector gate construction work in the dry.

Brazos Sector Gate 31' x 125' Perimeter of cofferdam (ft) = 752

Estimate for sheet pile that half of height is embedded and half the height is above mudline, estimate sheet pile length of 70 feet. Estimate the length of King post piling to be embedded 50 feet and 35 feet above mudline, for length of 85 feet. Estimate that 20 King post are required. Estimate the length of support piling to be 70 feet, half the length is embedded. Estimate that 30 support piling are required. The length sand quantity estimated above is a rough estimate and may change based on geotechnical conditions. Geotechnical conditions have not been evaluated, propose use of well points for dewatering system.

The construction cofferdam would be designed and detailed by the construction contractor. However, it is anticipated that the cofferdam would include some larger diameter piles (king posts) to help support the lateral loads on the cofferdam. Typically the internal bracing (struts) would weld to the larger diameter piles (king diameter support piles are also anticipated to be required to help vertically support and reduce the unbraced length of the internal bracing members.

This estimated sand and fill quantity is a minor item to help provide a stable work surface floor within the cofferdam and to fill in any holes where the geotechnical conditions may require overexcavation to reach a stable subgrade.

Based on SGCP Gulf Foundation = 116' x 20	Side Secto 60'	r Gate, 46.5' x 110' Sector Gate	→ Pile Lengths (ft) Vertical = 169 Batter = 178	Sector Gate Weight (ton) = 537 No of vertical piles = 134 No of batter piles = 141
Brazos Sector Cate 3	1' × 125' (2	nates 4 leafs)		
Diazos Sector Gale 5	I A 123 12	gates, + loais)		
No of vertical piles =	268	Vertical pile length (ft) = 150	<= Enter vertical val	ue, batter will be calculated

The weight per enclosed volume of a sector gate leaf was calculated for several existing projects including the existing Brazos sector gate. The data results are as follows, Brazos 6.2 lb/ft3 (pcl), IHNC 6.7 pcl, and SGCP 4.8 pcf. The average weight per enclosed volume for these projects is 5.9 pcf. The estimated weight of the new Brazos sector gate leaf is based on this similar project average of 5.9 pcf for the proposed 31'x 125' gate. The estimated weight of the proposed sector gate (2 leafs) is 568 tons. IHNC refers to the Inner Harbor Navigation Canal project. The top of the gates will match the top of the wall elevation +16.00 NAVD88 which matches the Colorado River Locks, which were recently surveyed.

-	Brazos River Floodgates Feasibility Study	Designed By	JK
US Anny Corps	Alternative 9b - New Gates on Alignment C w/o Sediment Contro	Checked By	GK
of Engineers , Nex Share Deput	Quantities Estimate	14-Sen-2017	
		11000 2011	
Number	Number Description	Quantity	Unit
	Sector Gate Dewatering System (Maintenance Bulkhead)	quantity	01110
	1. Maintenance Bulkhead	633	TN
	2. Maintenance Bulkhead Storage Platform		
	a. Steel Framing	294	TN
	b. Piling Supports		
	1. Pilings - 36" Dia, X 0.625" Thk.	2.816	LF
		_10.0	
7	Guide Walls		
	Sheet Pile Guide Wall Tied Back to Sheet Pile Anchors		
	All Sheet Pile PZ-35 Unless Noted Otherwise		
	1. West Gate North Guide Wall	63,840	SF
	2. West Gate South Guide Wall	63,840	SF
	3. East Gate North Guide Wall	47,880	SF
	4. East Gate South Guide Wall	47,880	SF
	Total =	223,440	SF
	Guide Wall Hardware		
	Total Guide Wall Hardware (All walls)	499	TN
	Rub Face UHMW Sheets Mounted to Steel Plate Attached to Sheet Pile Face		
	1. West Gate Rub Face UHMW Panel (2 3/4" thick)	13,680	SF
	2. East Gate Rub Face UHMW Panel (2 3/4" thick)	10.260	SF
	Total =	23,940	SF
	1. West Gate Steel Plate (5/8" thick)	13,680	SF
	2. East Gate Steel Plate (5/8" thick)	10.260	SF
	Total =	23 940	SF
		20,010	0.
8	Mechanical		
	1. Rack and Pinion System	2	LS
9	Electrical	2	LS

Ultra High Molecular Weight Polyethylene (UHMW-PE)

7-10

10 - 15 15 - 19

18-25

22 - 32

25 - 36

28-40

100

* Where allowances are typical values, actual wear allowance may very due to long detail. Small increases in facing thekeess can greatly exten-service life for minimal extra cost.

M16-M20

M24 - M30

MRG - MRG

45-80

250 - 350 45-80

300-450

5-10

Open structure

(Linix mm)

Dimensions will depend on pad

Timber fixing

1=30-150

1

thickness and application

WEAR ALLOWANCES

TYPICAL DIMENSIONS

+ + + +

+

+ + +

+ + + +

+ +

+ + + + + + + + LARGE PADS VS SMALL PADS

+ + +

APPLICAT

Modium duty

Heavy duty

Extreme duty

Based on SCGP Gulf Side Sector Gate, 46.5' x 110' Sector Gate. Maintenance bulkheads provide 29 feet of water protection. The bulkheads are 110' feet long and to be placed across the channel opening. 5 bulkheads stacked on top of each other used at each end of monolith, total of 10 units to perform maintenance on a sector gate. Each bulkhead weighs 63 tons. Provide one complete set (10 units) for one gate, maintenance performed on one gate at a time.

The maintenance bulkhead storage platform is estimated to require a total deck area of approximately 18,060 square feet in order to store 10 bulkhead sections stacked 2 high. The required footprint on the platform would be for 5 bulkheads. The exact plan configuration of the storage platform would depend on the land available and how the USACE would like to store/arrange the bulkheads. One possible platform deck configuration would be 54 feet wide for 255 feet and 33 feet wide for 130 feet. Typical pile lengths are 88 feet for the maintenance bulkhead storage platform.

Since the guide walls must retain fill soil, use sheet pile guide walls similar to the type currently in use, sheet pile face tied back to sheet pile used as anchor. Quantities based on quantity take off of existing East gate guide walls B5, B6, B7, and B8, raised 6 feet to match top of wall elevation +16.00 NAVD88 at the Colorado River Locks, which were recently surveyed.



de Wall Hardware (ton) 143 143

107

107

499

New Guide Wa	all Lengths (t) New Guide Wa	II Area (sf)	New Guid
North	760	North	63,840	North
South	760	South	63,840	South
North	570	North	47,880	North
South	570	South	47,880	South
Length (ft) =	2,660	Total Area (sf) =	223,440	Total Weight (ton)

Guide wall rub face: Use UHMW sheets attached to steel plate mounted to sheet pile face. WT steel vertical guide for steel plate attachment to sheet pile face. The total height of UHMW panels and steel plate estimated at 9 feet tall. 2 3/4" thick UHMW sheet attached to 5/8" thick steel plate. UHMW attached to steel plate with 1" diameter bolts with 1' x 1' bolt spacing grid. The length of rub face below is the same as the lengths of guide wall above, only difference is the specific location to the gate is broken down.

Guide Wall Rub Face Lengths (ft)

West Gate	Northwest	400	\	East Gate	Northwest	210
	Northeast	360	$\langle \rangle$		Northeast	360
	Southwest	430			Southwest	220
	Southeast	330	\backslash		Southeast	350
Tota	al length (ft) =	1,520	```	Tota	I length (ft) =	1,140
	Guide Wall Ru	ib Face Area (<u>ft2)</u> A	II Walls Tota	l length (ft) =	2,660
	West Gate	13,680				
	East Gate	10,260				
Tota	al Area (ft2) =	23,940				



CHANNEL EXCAVATION

West Gate

East Gate

Total Length (ft) =

1	Brazos River Floodgates Feasibility Study	Designed By	JK
of Engineers	Quantities Estimate	Checked By 14-Sep-2017	GK
Number	Number Description	Quantity	Unit
	UHMW-PE is available in many other colours if required.		

Alignment C through e The area is partially e	existing barge facil kcavated.	ity.	West channel currently not being used more excavation (subtract less)	l, East channe	el is occupied, West requires
Exist. channel areas: (Barge facility)	Location West channel East channel	<u>Area (ft2)</u> 353,600 550,000	Use 75% of area for depth of excavation Use 90% of area for depth of excavation	<u>Area (ft2)</u> 265,200 495,000	Subtract this area from channel excavation (Area already excavated)
(Alignment C) Channel excavation required from CADD Exist.channel excavated to open channel (Alignment A)	Location West channel East channel st channel north st channel north st channel south	Area (ft2) 1,312,000 1,209,700 169,830 232,990 85,120 187,500	Channel Excavation West channel East channel West channel owth East channel north East channel north	Area (ft2) 1,046,800 714,700 169,830 232,990 85,120 187,500 2,436,940	Volume (yd3) 697,900 476,500 113,300 268,700 155,400 56,800 125,000 1624,900 yd3

Average depth of excavation used = 18 ft

FILL FOR NEW GATE LOCATIONS

-	Sum =	560,370	ft2	186,900 yd3	Average depth of fill used = 9 ft	
_	East Gate	264,420	_	88,200		
For the new gate locations	West Gate	295,950		98,700		
	Location	Area (ft2)		Volume (yd3)		

US Arry Corps of Englissers,	Brazos River Floodgates Feasibility Study Alternative 9c - New Gates on Alignment C w/ Sediment Contro	Designed By Checked By	JK GK
	Quantities Estimate	14-Sep-2017	
Number	Number Description	0	11.2
1	Mob & Domob	Quantity	Unit
	MOD & Demod	LOWF SOM	L3
2	Demolition (Quantities are for existing West and East Gates)		
	Existing Sector Gates (2 sector gates, 4 leafs)		
	1. Remove and Salvage Sector Gate (2 gates, 4 leafs, east & west channel)	365	TON
	2. Remove and Dispose Gate Foundation (2 gates)	15,310	CY
	3. Remove and Dispose Timber Piles (2 gates)	1,970	EA
	Guide Walls	4.004	TON
-	1. Remove and Salvage Guide Walls (8 walls, east & west channel)	4,324	TUN
3	Excavation and Fill		
	New Gates on Alignment C		
	1. New West Channel Excavation	697,900	CY
	2. New East Channel Excavation	476,500	CY
	3. Excavate Existing West Gate Channel	268,700	CY
	Excavation Total =	1,443,100	CΥ
	1. Fill for New Gate Location, West Gate	98,700	CY
	2. Fill for New Gate Location, East Gate	88,200	CY
	3. Fill Existing East Vessel Channel	63,400	CY
	Fill Total =	250,300	CY
-	Ripran (3' Thick Laver)	8 000	TON
		0,000	1011
4	Cofferdam (Cofferdam placed around sector gates, 2 gates, 2 dams)	05.000	01/
	1. Excavation	35,600	CY
	2. Sand and Fill	12,600	C Y
	4. Sheet Piles - A7 38-700N	105 280	SE
-	5. Internal Bracing (Struts) - 24" Dia, X 0.625" Thk.	4,600	LF
	6. King Post Piling (Piles 30" Dia, X 0.625" Thk.)	3,400	LF
	7. Support Piling 24" Dia. X 0.625" Thk.	4,200	LF
	8. Misc. Steel	10	TN
	9. Temporary Dewatering System	2	LS
	10. Removal of Cofferdam	2	LS
5	Concrete Structure and Gate (Quantities are for 2 sector gates, 4 leafs)		
	Sector Gate Monolith		01/
	1. Sand and Gravel Bedding	3,400	CY
	2. Treffile Concrete Pase Stab	9,000	CV
<u> </u>	4. Reinforced Concrete Monolith	17,800	CY
	5. Pilings:	0,000	
	a. Pilings - Vertical Spiral Piles - 30" Dia. X 0.625" Thk.	40,200	LF
	b. Pilings - Batter Spiral Piles - 30" Dia. X 0.625" Thk.	44,838	LF
	7. Bulkhead Slots - Stainless Steel w/Seals (Embedded in Monolith)	200	LF
ŀ	8. Ladder Slots - Stainless Steel w/Ladders (Embedded in Monolith)	100	 LF
	(()))))))))))))))))))))))))))))))		
	Sector Gate		TN
	1. Sector Gates 2. Pintles and Hindes (King post)	1,136	IN
ŀ	3. Sector Gate Protection Fenders	2.360	LF
	4. Gate Seals, Seal Bearing Surfaces and Gate Track	2	LS
	5. Cathodic Protection	2	LS
6	Maintenance Dewatering System		

DEMOLITION

Two

Existing Gate:	
Each gate (lb) = 364,500	(2 leafs)
Each gate (ton) = 182.3	(2 leafs)
gates removed (ton) = 365	(4 leafs)

Conc. Foundation, one gate (cy) = 7,655 Foundation, wing walls, approach aprons Contract Bid Documents used 25 feet timber pile length for bidding purposes. 985

985 Piles per gate

Total weight guide walls, one gate (lb) = 4,323,700 Quantities based on East Gate Guide Wall take off, Guide Walls B5, B6, B7, B8, West Gate guide wall similar. Total weight guide walls, one gate (ton) = 2,162 Weight is steel material: sheet pile, anchor bar, waler, wall contact, pile cap, tangent plate, fender plate

	Guide Wall	Anchor Wal	
Wall No	Sht Pile (sf)	Sht Pile (sf)	Total (sf)
B5	25,243	12,067	37,310
B6	21,736	10,076	31,812
B7	13,184	6,486	19,670
DO	12 104	6 496	10,670

SEE BOTTOM OF SPREADSHEET FOR EXCAVATION AND FILL QUANTITIES

108 462

Excavation Disposal Note: The current plan for the disposal of excavation material is to use the existing placement areas (PA) located along the GIWW. Placement Areas No. 88 and 89 are the closest to the Brazos Floodgates and they were reported to have combined remaining capacity of approximately 3.8 million cubic yards. Based on SCCP* GuIf Side Sector Gate. 46.5 x 110* Sector Gate

Foundation = 116' x 260'

*Similar Gulf Coast Project Brazos Sector Gate 31' x 125'

Cofferdam Note: Prior to cofferdam construction, install guide walls and fill in the wet to create vessel chamber and land adjacent to gates. Cofferdam placed around each sector gate, 2 gates, 2 cofferdams. The intent is to build the guide walls first, so that the temporary cofferdam will be reduced in length and will be less expensive. The temporary cofferdam will be installed between the permanent guide walls, and then dewatered in order to perform the monolith and sector gate construction work in the dry.

Perimeter of cofferdam (ft) = 752

Estimate for sheet pile that half of height is embedded and half the height is above mudline, estimate sheet pile length of 70 feet. Estimate the length of King post piling to be embedded 50 feet and 35 feet and 35 feet above mudline, for length of 85 feet. Estimate that 20 King post are required. Estimate the length of support piling to be 70 feet, half the length is embedded. Estimate that 30 support piling are required. The length and quantity estimated above is a rough estimate and may change based on geotechnical conditions. Geotechnical conditions have not been evaluated, propose use of well points for dewatering system.

The construction cofferdam would be designed and detailed by the construction contractor. However, it is anticipated that the cofferdam would include some larger diameter piles (king posts) to help support the lateral loads on the cofferdam. Typically the internal bracing (struts) would weld to the larger diameter piles (king diameter support piles are also anticipated to be required to help vertically support and reduce the unbraced length of the internal bracing (struts).

This estimated sand and fill quantity is a minor item to help provide a stable work surface floor within the cofferdam and to fill in any holes where the geotechnical conditions may require overexcavation to reach a stable subgrade.

Based on SGCP Gulf Side Sector Gate, 46.5' x 110' Sector Gate Foundation = 116' x 260'			→ Pile Lengths (ft) Vertical = 169 Batter = 178	Sector Gate Weight (ton) = 537 No of vertical piles = 134 No of batter piles = 141
Brazos Sector Gate 3	1' x 125' (2	gates, 4 leafs)		
Brazos Sector Gate 3 No of vertical piles =	1' x 125' (2 268	gates, 4 leafs) Vertical pile length (ft) = 150	<= Enter vertical val	ue, batter will be calculated

The weight per enclosed volume of a sector gate leaf was calculated for several existing projects including the existing Brazos sector gate. The data results are as follows, Brazos 6.2 lb/ft3 (pcl), IHNC 6.7 pcl, and SGCP 4.8 pcl. The average weight per enclosed volume for these projects is 5.9 pcl. The estimated weight of the new Brazos sector gate leaf is based on this similar project average of 5.9 pcf for the proposed 31* x 125 gate. The estimated weight of the proposed sector gate (2 leafs) is 588 tons. IHNC refers to the Inner Harbor Navigation Canal project. The top of the gates will match the top of the wall elevation +16.00 NAVD88 which matches the Colorado River Locks, which were recently surveyed.

US Acros Corps. of Engineers , Nex Schars Dated	Brazos River Floodgates Feasibility Study Alternative 9c - New Gates on Alignment C w/ Sediment Control Quantities Estimate	Designed By Checked By 14-Sep-2017	JK GK
Number	Number Description	Quantity	Unit
	Sector Gate Dewatering System (Maintenance Bulkhead)	633	TN
	2. Maintenance Bulkhead Storage Platform	000	118
	a. Steel Framing	294	TN
	 Piling Supports Pilings - 36" Dia. X 0.625" Thk. 	2,816	LF
-			
1	Sheet Pile Guide Wall Tied Back to Sheet Pile Anchors		
	All Sheet Pile PZ-35 Unless Noted Otherwise		
	1. West Gate North Guide Wall	63.840	SF
	2. West Gate South Guide Wall	63,840	SF
	3. East Gate North Guide Wall	47,880	SF
	4. East Gate South Guide Wall	47,880	SF
	10(a) -	223,440	51
	Guide Wall Hardware		
	Total Guide Wall Hardware (All walls)	499	ΤN
	Rub Face UHMW Sheets Mounted to Steel Plate Attached to Sheet Pile Face		
	1. West Gate Rub Face UHMW Panel (2 3/4" thick)	13,680	SF
	2. East Gate Rub Face UHMW Panel (2 3/4" thick)	10,260	SF
	Total =	23,940	SF
	1. West Gate Steel Plate (5/8" thick)	13.680	SF
	2. East Gate Steel Plate (5/8" thick)	10,260	SF
	Total =	23,940	SF
8	Mechanical		
	1. Rack and Pinion System	2	LS
9	Electrical	2	LS
10	Sediment Central or Sluice Gates		
10	1 Structure		
	Piling - 14 x 73 H-piles, 90' length	23,940	LF
	Concrete Base Slab	3,323	CY
	Concrete Walls and Slabs	965	CY
	Sluice Gates (Rodney Hunt with Stem and Gear Box)	3	EA
	Hand Rail, 2" Standard Aluminum Pipe	263	LBS
	Rip Rap	6.000	TON
	Tie-in Sheetpile - PZ-35, 60' length	3,600	SF
	I le-In Embankment	2,000	CY
	Earth Dewatering Dam		
	10' Crown, 1:3 Side Slopes		
	Sand Core	3,426	CY
	ε σιαγ σαρ	1,138	51

Based on SCGP Gulf Side Sector Gate, 46.5' x 110' Sector Gate. Maintenance bulkheads provide 29 feet of water protection. The bulkheads are 110' feet long and to be placed across the channel opening. 5 bulkheads stacked on top of each other used at each end of monolith, total of 10 units to perform maintenance on a sector gate. Each bulkhead weighs 63 tons. Provide one complete set (10 units) for one gate, maintenance performed on one gate at a time.

The maintenance bulkhead storage platform is estimated to require a total deck area of approximately 18,060 square feet in order to store 10 bulkhead sections stacked 2 high. The required footprint on the platform would be for 5 bulkheads. The exact plan configuration of the storage platform would depend on the land available and how the USACE would like to store/arrange the bulkheads. One possible platform deck configuration would be 54 feet wide for 255 feet and 33 feet wide for 130 feet. Typical pile lengths are 88 feet for the maintenance bulkhead storage platform.

Since the guide walls must retain fill soil, use sheet pile guide walls similar to the type currently in use, sheet pile face tied back to sheet pile used as anchor. Quantities based on quantity take off of existing East gate guide walls B5, B6, B7, and B8, raised 6 feet to match top of wall elevation +16.00 NAVD88 at the Colorado River Locks, which were recently surveyed.

Existing East Gui	de Wall Lengths (ft)	Exist.Guide \	Wall Take Of	f Weight (Ib)	See Demolition Above for Shee <=For Existing W	et Pile Area Breakout all sections B5, B6, B7, B8
Wall section B5	487	PZ 35 sheet pile	3,796,100			
B6	408	Anchor bar	170,470			
B7	257	Waler	140,990		Hardware weight per foot (lb/ft)	
B8	257	Wall contact	29,196	\geq	375	
Total length (ft) =	1,409	Pile cap	114,870			
		Tangent wall plate	42,385			
		Fender plate	29,661			
		Total Steel Weight (lb) =	4,323,700			

Existing Weight per Linear Foot of Sheet Pile Guide Wall (lb/ft) = 3,069

Use sheet pile 56 feet total face sheet length (56 sf per linear foot) plus 50% wall face area for anchor sheet.

	For Alternative	e 9c, New Gates on Alignment C with Sediment Control	×			
	New Guide Wa	all Lengths (ft)	New Guide Wa	III Area (sf)	New Guide Wa	II Hardware (ton)
Gate	North	760	North	63,840	North	143
	South	760	South	63,840	South	143
ate	North	570	North	47,880	North	107
	South	570	South	47,880	South	107
Tota	I Length (ft) =	2,660	Total Area (sf) =	223,440	Total Weight (ton) =	499

Guide wall rub face: Use UHMW sheets attached to steel plate mounted to sheet pile face. WT steel vertical guide for steel plate attachment to sheet pile face. The total height of UHIW panels and steel plate estimated at 9 feet tall. 2 3/4 thick UHIW sheet attached to 5/8 thick steel plate. UHMW attached to steel plate with 1* diameter bolts with 1' x 1' bolt spacing grid. The length of rub face below is the same as the lengths of guide wall above, only difference is the specific location to the gate is broken down.

	G	uide Wall Rub I	ace Lengths	(ft)		
West Gate	Northwest	400	East	Gate	Northwest	210
	Northeast	360	\backslash		Northeast	360
	Southwest	430			Southwest	220
	Southeast	330			Southeast	350
Tota	al length (ft) =	1,520		Tota	l length (ft) =	1,140
	Guide Wall Ru	b Face Area (ft	2) All Wall	s Tota	l length (ft) =	2,660
	West Gate	13,680				
	East Gate	10,260				
Tota	al Area (ft2) =	23,940				

Ultra High Molecular Weight Polyethylene (UHMW-PE) W

	/EAR	ALL	.OW	AN	C	ES
--	------	-----	-----	----	---	----

APPLICATION		Mar (man)	BOLT	
Light duty	30	3-5	M16	
	40	7-10	1000	
Modium duty	50	10 - 15	M16 - M20	
	60	16 - 19		i LLU
Heavy duty	70	18 - 25	M24 - M30	144
	80	22 - 32		
Extreme duty	90	25 - 36	M30 - M36	<u>N 88</u>

CHANNEL EXCAVATION Alignment C through existing barge facility. The area is partially excavated.

West Gate

East Gate

CADD channel excavation overlaid with aerial image of existing channel outline West channel currently not being used, East channel is occupied, West requires more excavation (subtract less)



	CIVIL CONSTRUCTION COST ESTIMATE - ROM		SHEET	SHEET 1 OF 1			
PROJECT:	CRL, OPEN CHANNEL		BY: Grev				
			EST BY:	EST BY: Petitbon			
		COMBO					
IIEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT		
	BLH -DRY Enhancement (99 AC)						
1.	MOB AND DEMOB	1	JOB	\$0.00	\$0.00		
2.	Clearing and Grubbing Clearing and grubbing is to be completed prior to dredging the bypass channel. Trees are to be removed to ground level and stumps and roots are to be removed. All cleared material will be placed within the disposal area and burned on site. East Lock 8.5 AC, West Lock 10.5 AC	19	AC	\$0.00	\$0.00		
3	Bypass Channel Stone Removal Prior to dredging, stone armoring needs to be removed. The stone will be disposed of within the disposal area. Armoring is assumed to be 2-ft thick 500lb stone. 599 tons of stone is within the East Lock.	3,850	TONS	\$0.00	\$0.00		
4.	Bypass Channel Dredging If the land within the bypass channel is cleared and grubbed and the stones remove. The bypass channel can dredged via hydraulic dredge. Dredge material will be disposed of within the existing disposal area. It is assumed that the disposal area retention dikes and available capacity is suitable.	586,700	СҮ	\$0.00	\$0.00		
5.	Lock Chamber Stone Armoring Removal To be completed prior to dredging the new channel. Assume a 50/50 split between East and West Lock for quantity.	9,550	TONS	\$0.00	\$0.00		
6.	New Channel Dredging The new channel dredging will remove the remaining material between the bypass channel cut and the existing 125' wide channel. This would be completed after the existing lock structures are removed. Structures will provide quantity estimates.	355,900	СҮ	\$0.00	\$0.00		
7	Existing Gate and Wall Demolition The limits of the new open channel will extend into the existing lock structure. Demolition will be required on the concrete approach walls sector gate walls sector gate removal interior guidewall and	20,184 50,000 50' Sheet pile	CY SF	\$0.00 \$0.00	\$0.00 \$0.00		
	existing sheet pile approach walls on the river side. This is to be done only on the side of the structure with the open channel. Existing	Remove 4 Sector Gates	JOB	\$0.00	\$0.00		
	CONSTRUCTION SUBTOTAL:				\$0.00		
	E&D S&A	6% 8%			\$0.00 \$0.00		
	SUBTOTAL (CONSTRUCTION + E&D + S&A):				\$0.00		
	CONTINGENCIES	25	%		\$0.00		
	TOTAL COST :				\$0.00		

(TwT)	Colorado Locks Rehab Estimate	Designed By	JMR
US Army Corps	Matagorda, Texas	Checked By	DPL
of Engineers _© New Orleans District	Gate Rehab and Guidewall Replacement		
Niccostrate	Number Deceminting		
Number	Number Description	Quantity	Unit
1	Mob & Demob	LUMPSUM	LS
2	Foundation		
	Guidewall		
	18" Pipe Pile, 1/2" Wall	46,735	LF
	Tension Connector	576	EA
	Paint top 15 feet of pile excluding slab embedded 1'-0", Coaltar Expoxy, System 6	8,640	LF
3	Sector Gate		
	Replacement Plates (ASTM A-572, Grade 50)	2,400	LBS
	Sand Blast and Paint 8 Gates	87,600	SF
	Paint Sector Gates, Coaltar Expoxy, System 6-A-Z		
4	Structural Concrete		
	Guidewall		
	Reinforced slabs	3,900	CY
	Reinforced walls	3,150	CY
	Machinery House		
	Concrete Soil Founded Slab, 6" thick (10'x10') - 8 total (#6@12" Middle, Each Way)	15	CY
5	Miscellaneous Metals		
	Guidewall (Chamber)		
	3/4" SST Anchor Rod, with 2 Nuts and Washers, 18"	6,480	EA
	1" SST Anchor Rod, with 2 Nuts and Washers, 18"	216	EA
	3/8" SST Corner Plate, 6" Radius, 1'-0" top to bottom, with 2 L #5 studs 2'-0" OC	1,800	LF
	Mooring Bollard	36	EA
	8"x12" Reinforced Marine Composite Timber	16,200	LF
6	Mechanical		
	Sector Gate		
	Rack & Pinion System - drive gear and rack sections	LUMPSUM	LS
	Hydraulic Rotary Motor (Hagglund Viking 63 series)		
	Hydraulic Power Unit with redundant motor/pump assembly		
	Hydraulic Hoses		
	Local Control Panels		
	Maakin and Haussa (0 (ata), 4 (an aash, mata) 40k40k40k Day (at. 1 ai'i i'u u		1.0
	Machinery House (& total, 1 for each gate) 10'x10'x10' Pre-fab building	LUMP SUM	LS
7	Electrical		
1	Lieuliudi		
	Lour Complex Dewer Distribution, Pack up newer Lighting, and Lightening Systems		
	Prover Distribution, Back-up power, Lighting, and Lightening Systems		
	Program Logic Control (PLC); Hardwire Back-up Controls	LUMPSUM	LS

(\$120,000 per gate) (\$1,000,000 total from Rachael for all items)

(\$1,000,000 from Jabeen) (\$600,000 from Jabeen)

8	Riverside Gate Channel Inlet Sheetpile Replacement		
	100 feet on 4 sides; original sheet 50 foot long; New Sheet PZ-35 - 75 foot long	30,000	SF
	Paint top 20 feet, Coaltar Epoxy, System 6	8,000	LF
	UHMW-PE Panels - Heavy Duty Grade - Type 1	396	EA
	UHMW-PE Panels - Heavy Duty Grade - Type 2	168	EA
	UHMW-PE 1" Bolts	7,744	EA
	5/8" Steel Backing Plate	8,172	SF

US Army Corps of Engineers	Colorado Locks Rehab Estimate Matagorda, Texas	Designed By Checked By	JMR DPL
New Orleans District	Riverside Gate Removal Alternative 4b.1		
Number	Number Description	Quantity	Unit
1	Mob & Demob	LUMPSUM	LS
2	Demolition		
	Remove Existing Interior Guidewall	LUMPSUM	LS
	Remove 4 Existing Sector Gates	LUMPSUM	LS
	Remove Existing Control House and Machinery Buildings (4 total)	LUMPSUM	LS
	Sheet Pile Approach Wall Removal (50 ft long)	103,250	SF
	Main Structure Demolition (Vertical Walls Only)	11,180	CY
	East Side Parking Lot Slab	45	CY
	Channel Work (125')		
	Land Excavation	50.930	CY
	Dredging	34,000	CY
	5 5	,	
	Riprap (3' Layer)	4,000	TON
4	Sector Gate (Existing Structure Rehab)		
	Replacement Plates (ASTM A-572, Grade 50)	2,400	LBS
	Sand Blast and Paint 4 Gates	87,600	SF
	Paint Sector Gates, Coaltar Expoxy, System 6-A-Z		
F	Structural Constate (Eviating Structure Babab)		
5	Machinery House		
	Concrete Soil Founded Slab. 6" thick (10'x10') 4 total (#6@12" Middle, Fach Way)	0	CV
	Concrete Soli Founded Slab, o tinck (10x10) -4 total (#0@12 Wilddle, Each Way)	0	CI
6	Mechanical (Existing Structure Rehab)		
	Sector Gate		
	Rack & Pinion System - drive gear and rack sections	LUMPSUM	LS
	Hydraulic Rotary Motor (Hagglund Viking 63 series)		
	Hydraulic Power Unit with redundant motor/pump assembly		
	Hydraulic Hoses		
	Local Control Panels		
	Maakinary Hauss / A total A far asak gata) 10/x10/x10/ Dro fak huilding		10
	Machinery House (4 total, 1 for each gate) 10 x10 x10 Pre-rab building	LUIVIP SUIVI	LS
7	Electrical (Existing Structure Rehab)		
	Gate Complex		
	Power Distribution, Back-up power, Lighting, and Lightening Systems	LUMPSUM	LS
	Program Logic Control (PLC); Hardwire Back-up Controls	LUMPSUM	LS