

SEATTLE HARBOR NAVIGATION IMPROVEMENT PROJECT

APPENDIX E

Cost Engineering

Final Integrated Feasibility Report and Environmental Assessment



**US Army Corps
of Engineers®**
Seattle District



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Contract Package - Estimate & Scope Information

District:	Seattle District
Project Title & Location:	Seattle Harbor Navigation Improvement Project (SHNIP)
Contract Scope Package:	Channel Deepening
Estimate Type:	TSP, Class 3
Date:	Aug 2017
FY:	FY18
Cost Engineer & Phone:	Kim Callan (509) 527-7511
Cost Team Lead & Phone:	Kim Callan (509) 527-7511
Cost QC Reviewer & Phone:	Rodriguez, Antonio NWS
Technical Lead & Phone:	Michalsen, David R NWS
Project Manager & Phone:	Nelson, Brian, NWS
Project File Location:	G:\My Documents\My Projects\SHNIP\TSP MS 4
Product Date:	30-Aug-2017



30-Aug-2017

NED 56' Total Project Cost Summary

Total Project Cost Summary

Project: **Seattle Harbor Navigation Improvement Project 56'**
 Location: Seattle Harbor
 District: NWS -Seattle District
 POC: Callan

P2: **452752**
 Report Type: **NED**
 Contingency Development: Crystal Ball
 CWCCIS Issue: **3/31/2017**

Authority: **CG**
 TPCS Preparation Date: 05-Jul-17
 FY: 2018

Scope Synopsis:

WBS			ESTIMATED COST				PROJECT FIRST COST CONSTANT DOLLAR BASIS				TOTAL PROJECT COST (FULLY FUNDED)			
Civil Works			Risk Based				Program Price Level Date: 2018-1Q							
WBS	Feature	Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	INFLATED (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)
02	RELOCATIONS		2.000	460	23%	2,460	2%	2,037	469	2,506	13%	2,295	528	2,823
12	NAVIGATION PORTS & HARBORS		29.587	7,034	24%	36,621	2%	30,136	7,165	37,301	13%	33,954	8,073	42,027
		S/T	31,587	7,494	24%	39,081	2%	32,174	7,633	39,807	13%	36,249	8,600	44,850
30	PLANNING ENGINEERING AND DESIGN		7.100	1,633	23%	8,733	3%	7,320	1,684	9,004	15%	8,414	1,935	10,349
		S/T	7,100	1,633	23%	8,733	3%	7,320	1,684	9,004	15%	8,414	1,935	10,349
31	CONSTRUCTION MANAGEMENT		3.300	759	23%	4,059	3%	3,402	783	4,185	27%	4,327	995	5,322
		S/T	3,300	759	23%	4,059	3%	3,402	783	4,185	27%	4,327	995	5,322
Totals			41,987	9,886	24%	51,873	2%	42,896	10,100	52,996	14%	48,990	11,531	60,521

CHIEF, COST ENGINEERING

PROJECT MANAGER

CHIEF, REAL ESTATE

CHIEF, PLANNING

CHIEF, ENGINEERING

CHIEF, OPERATIONS

CHIEF, CONSTRUCTION

CHIEF, CONTRACTING

CHIEF, PM-PB

CHIEF, DPM

Project First Cost for Report:

Cost (\$k) Contingency (\$k) Totals (\$k)

\$42,896	\$10,100	\$52,996
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Total Project Cost used to provide
Sponsor information:

\$48,990	\$11,531	\$60,521
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Contract Summary

WBS	ESTIMATED COST Estimate Class Level: Class 3				PROJECT FIRST COST <i>CONSTANT DOLLAR BASIS</i>				TOTAL PROJECT COST (FULLY FUNDED)				
Contract: Relocations	Est Preparation Date: <u>05-Sep-17</u> Est Price Level: <u>2017-1Q</u> Risk Based				Program Yr: <u>2018</u> Prog Level Date: <u>2018-1Q</u>								
Location: Seattle Harbor District: NWS -Seattle District	COST	CNTG	CNTG	TOTAL	ESC	COST	CNTG	TOTAL	MID-PT	INFLATED	COST	CNTG	TOTAL
	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	(DATE)	(%)	(\$K)	(\$K)	(\$K)
02 RELOCATIONS (EWW Telecommunication line)	2,000	460	23.0%	2,460	1.9%	2,037	469	2,506	2024-1Q	14.8%	2,295	528	2,823
Construction Activities <i>Total</i>	2,000	460		2,460		2,037	469	2,506			2,295	528	2,823
Relocations <i>Total</i>	2,000	460		2,460		2,037	469	2,506			2,295	528	2,823

Contract Summary

WBS	ESTIMATED COST Estimate Class Level: Class 3				PROJECT FIRST COST <i>CONSTANT DOLLAR BASIS</i>				TOTAL PROJECT COST (FULLY FUNDED)				
Contract: PED Phase	Est Preparation Date: <u>05-Jul-17</u> Est Price Level: <u>2017-1Q</u>				Program Yr: <u>2018</u> Prog Level Date: <u>2018-1Q</u>								
Location: Seattle Harbor	Risk Based												
District: NWS -Seattle District	COST	CNTG	CNTG	TOTAL	ESC	COST	CNTG	TOTAL	MID-PT	INFLATED	COST	CNTG	TOTAL
	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	(DATE)	(%)	(\$K)	(\$K)	(\$K)
<i>Project Management Mobilization & Demob</i>	500	115	23.0%	615	3.1%	516	119	634	2021-3Q	18.5%	593	136	729
<i>Planning & Environmental Compliance</i>	200	46	23.0%	246	3.1%	206	47	254	2021-3Q	18.5%	237	55	292
<i>Engineering & Design</i>	5,400	1,242	23.0%	6,642	3.1%	5,567	1,281	6,848	2021-3Q	18.5%	6,399	1,472	7,871
<i>Engineering Tech Review ATR & VE</i>	200	46	23.0%	246	3.1%	206	47	254	2021-3Q	18.5%	237	55	292
<i>Life Cycle Cost Updates</i>	100	23	23.0%	123	3.1%	103	24	127	2021-3Q	18.5%	119	27	146
<i>Contracting</i>	100	23	23.0%	123	3.1%	103	24	127	2021-3Q	18.5%	119	27	146
<i>Engineering During Construction</i>	500	115	23.0%	615	3.1%	516	119	634	2021-3Q	18.5%	593	136	729
<i>Planning During Construction</i>			23.0%		3.1%				2021-3Q	18.5%			
<i>Project Operations</i>	100	23	23.0%	123	3.1%	103	24	127	2021-3Q	18.5%	119	27	146
Planning Engineering and Design	<i>Total</i>	7,100	1,633	8,733		7,320	1,684	9,004			8,414	1,935	10,349
PED Phase	<i>Total</i>	7,100	1,633	8,733		7,320	1,684	9,004			8,414	1,935	10,349

Contract Summary

WBS	ESTIMATED COST Estimate Class Level: Class 3				PROJECT FIRST COST <i>CONSTANT DOLLAR BASIS</i>				TOTAL PROJECT COST (FULLY FUNDED)				
Contract: Construction (56' depth)	Est Preparation Date: <u>05-Jul-17</u> Est Price Level: <u>2017-1Q</u> Risk Based				Program Yr: <u>2018</u> Prog Level Date: <u>2018-1Q</u>								
Location: Seattle Harbor District: NWS -Seattle District	COST	CNTG	CNTG	TOTAL	ESC	COST	CNTG	TOTAL	MID-PT	INFLATED	COST	CNTG	TOTAL
	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	(DATE)	(%)	(\$K)	(\$K)	(\$K)
12 NAVIGATION PORTS & HARBORS Mob & Demob	1,336	307	23.0%	1,643	1.9%	1,361	313	1,674	2024-1Q	14.8%	1,533	353	1,886
12 NAVIGATION PORTS & HARBORS East Waterway	4,586	1,284	28.0%	5,870	1.9%	4,671	1,308	5,979	2024-1Q	14.8%	5,263	1,474	6,736
12 NAVIGATION PORTS & HARBORS West Waterway	23,665	5,443	23.0%	29,108	1.9%	24,104	5,544	29,648	2024-1Q	14.8%	27,158	6,246	33,404
Construction Activities <i>Total</i>	29,587	7,034		36,621		30,136	7,165	37,301			33,954	8,073	42,027
31 Construction Management (S&A) 11.2%	3,300	759	23.0%	4,059	3.1%	3,402	783	4,185	2024-1Q	31.1%	4,327	995	5,322
Construction Management <i>Total</i>	3,300	759		4,059		3,402	783	4,185			4,327	995	5,322
Construction (56' depth) <i>Total</i>	32,887	7,793		40,680		33,539	7,947	41,486			38,281	9,068	47,349

Print Date Wed 30 August 2017
Eff. Date 10/1/2017

U.S. Army Corps of Engineers
Project : Seattle Harbor Navigation Improvement Project (NED)
Cost Estimate Report

Time 13:32:44

Title Page

Estimated by Callan

Designed by USACE-NWS Seattle District

Prepared by Kim Callan

Preparation Date 7/18/2017

Effective Date of Pricing 10/1/2017

Estimated Construction Time Days

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Date Author Note

7/18/2017 Callan, Kim
10:08:51
AM

Seattle Harbor Navigation Improvement Project (SHNIP) Channel Deepening

COST ANALYSIS SUMMARY

The Corps and Port of Seattle initiated a feasibility study evaluating navigation improvements to Seattle Harbor's East and West Waterways. Navigational challenges were identified and current authorized depths, of 34 to 51 feet below mean lower low water, or MLLW, do not meet today's larger container ship draft requirements.

The project area includes the East and West waterways of Seattle Harbor, as they have been identified by the Corps and non-Federal sponsor, the Port of Seattle, as the areas of critical importance for navigation improvements.

Elliott Bay: naturally deep; ships access waterways one way in and out; use Elliott Bay as a turning basin.

Class 3 level estimates were developed using CEDEP. Detailed risk register was developed with the PDT team. Key dredging inputs were adjusted within the CSRA development. Spreadsheet format used for alternative level estimates. Once TSP has been selected class level 3 will be developed and utilize MII.

Labor and equipment was brought to current price levels.

Equipment comprised of smaller dredge (10 CY Clamshell plus support plant) will be used.

For non-suitable material for open water place upland placement was used. Dump Scow were utilized for open water placement, material barges were used for upland place at transload facility.

Typical Equipment List: Dredge, Work Tugs, Crew/Survey Boat, Derrick, Work Barge Towing Vessel, Scow(s)

For Additional details see "Cost Assumptions" document.

Local Davis Bacon rates Used, July 2017.

CEDEP 2017 used for estimate.

All Markups applied within CEDEP
25% OH, 8% profit, .8% Bond

Print Date Wed 30 August 2017
Eff. Date 10/1/2017

U.S. Army Corps of Engineers
Project : Seattle Harbor Navigation Improvement Project (NED)

Time 13:32:44

Cost Estimate Report

Feature Level Page 1

Description	UOM	Quantity	ContractCost	Escalation	Contingency	MiscOwner	SIOH	ProjectCost
Feature Level			29,587,433	0	0	0	0	29,587,433
A Seattle Harbor Navigation Improvement Project (56')	LS	1.0	29,587,433	0	0	0	0	29,587,433

Print Date Wed 30 August 2017
Eff. Date 10/1/2017

U.S. Army Corps of Engineers
Project : Seattle Harbor Navigation Improvement Project (NED)

Time 13:32:44

Cost Estimate Report

Feature & Subfeature Level Page 2

Description	UOM	Quantity	ContractCost	Escalation	Contingency	MiscOwner	SIOH	ProjectCost
Feature & Subfeature Level								
A Seattle Harbor Navigation Improvement Project (56')	LS	1.0	29,587,433	0	0	0	0	29,587,433
12 Navigation Ports & Harbors	LS	1.0	29,587,433	0	0	0	0	29,587,433
1 Mob, Demob & Preparatory Work	LS	1.0	1,335,848	0	0	0	0	1,335,848
1202 Harbors East Waterway	LS	1.0	4,586,261	0	0	0	0	4,586,261
1202 Harbors West Waterway	LS	1.0	23,665,324	0	0	0	0	23,665,324

Cost Estimate Report

Description	UOM	Quantity	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectCost	ContractCost	ProjectCost
Direct Cost			0.00	0.00	0.00	0.00	29,587,433.00	29,587,433.00	29,587,433.00
A Seattle Harbor Navigation Improvement Project (56')	LS	1.0000	0.00	0.00	0.00	0.00	29,587,433.00	29,587,433.00	29,587,433.00
12 Navigation Ports & Harbors	LS	1.0000	0.00	0.00	0.00	0.00	29,587,433.00	29,587,433.00	29,587,433.00
1 Mob, Demob & Preparatory Work	LS	1.0000	0.00	0.00	0.00	0.00	1,335,848.00	1,335,848.00	1,335,848.00
1202 Harbors East Waterway	LS	1.0000	0.00	0.00	0.00	0.00	4,586,261.00	4,586,261.00	4,586,261.00
1202 Harbors West Waterway	LS	1.0000	0.00	0.00	0.00	0.00	23,665,324.00	23,665,324.00	23,665,324.00

Cost Estimate Report

Description	UOM	Quantity	DirectCost	JOOH_PRM	HOOH_PRM	Profit_PRM	Bond_PRM	ContractCost	ProjectCost
InDirect Cost			29,587,433.00	0.00	0.00	0.00	0.00	29,587,433.00	29,587,433.00
A Seattle Harbor Navigation Improvement Project (56')	LS	1.0	29,587,433.00	0.00	0.00	0.00	0.00	29,587,433.00	29,587,433.00
12 Navigation Ports & Harbors	LS	1.0	29,587,433.00	0.00	0.00	0.00	0.00	29,587,433.00	29,587,433.00
1 Mob, Demob & Preparatory Work	LS	1.0	1,335,848.00	0.00	0.00	0.00	0.00	1,335,848.00	1,335,848.00
1202 Harbors East Waterway	LS	1.0	4,586,261.00	0.00	0.00	0.00	0.00	4,586,261.00	4,586,261.00
1202 Harbors West Waterway	LS	1.0	23,665,324.00	0.00	0.00	0.00	0.00	23,665,324.00	23,665,324.00

M	MOB & DEMOB	BID ITEM #	1
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DREDGE SIZE: 21 CY CLAMSHELL

	MOBILIZATION			DEMOBILIZATION		
	# DAYS	\$/DAY	TOTAL	# DAYS	\$/DAY	TOTAL
1. PREPARE DREDGE FOR TRANSFER	5	\$9,551	\$47,757	2	\$11,090	\$22,181
2. TRANSFER ALL PLANT	362 MILES			362 MILES		
@ 100 miles/day =	3.6	\$39,996	\$143,984	3.6	\$39,996	\$143,984
3. PERMANENT PERSONNEL & MISC.	L.S.		\$29,640	L.S.		\$29,640
4. PREPARE DREDGE AFTER TRANSFER	1	\$8,021	\$8,021	6	\$5,104	\$30,625
5. OTHER	Buoy Placement		\$25,000	L.S. (CLEANUP)		\$10,000
	SUBTOTAL MOBILIZATION		\$254,402	SUBTOTAL DEMOBILIZATION		\$236,430

			REMARKS
6. SUBTOTAL MOBILIZATION & DEMOBILIZATION	=	\$490,832	
7. OVERHEAD	25.0%	\$122,708	
	SUBTOTAL.....=	\$613,540	
8. PROFIT	8.0%	\$49,083	
	SUBTOTAL.....=	\$662,623	
9. BOND	0.8%	\$5,301	
10. TOTAL MOBILIZATION & DEMOBILIZATION	=	\$667,924	

M \ 1

MOB & DEMOB

BID ITEM # 1

DREDGE SIZE: 21 CY CLAMSHELL

1. PREPARE DREDGE FOR TRANSFER				MOBILIZATION	DEMOBILIZATION
Labor:	10 men @	8 hrs/day @	\$89.67 per hour =	\$7,174	\$7,174
Equipment:	Dredge	\$65.74 /hr (Standby) x 24 hrs per day =		\$1,578	\$1,578
	Towing Vessel	\$43.29 /hr (Standby) x 24 hrs per day =			\$1,039
	Support equipment with operators			\$500	\$500
	Supplies & small tools			\$150	\$150
	Additional Fuel (plant idle)			\$150	\$150
Subsistence:	10 men @	\$50.00 per day =		----	\$500
COST PER DAY				\$9,551	\$11,090
2. TRANSFER PLANT				MOBILIZATION	DEMOBILIZATION
Labor:	5 men/shift (2-12 hr shifts) @		\$89.67 per manhour =	\$10,760	\$10,760
Equipment:	Work Tug(s)	\$56.33 /hr			
	Dredge	\$65.74 /hr (Standby)			
	Crew Tug	\$0.76 /hr (Standby)			
	Derrick(s)	\$2.72 /hr (Standby)			
	Fuel Barge	\$0.85 /hr (Standby)			
	Work Barge(s)	\$1.12 /hr (Standby)			
	Unused	\$0.00 /hr (Standby)			
	Unused	\$0.00 /hr (Standby)			
	Scow(s)	\$26.24 /hr (Standby)			

		\$153.76 /hr x 24 hrs per day =		\$3,690	\$3,690
Subsistence	10 men @	\$50.00 per day =		\$500	\$500
Towing Vessel(s):					
Labor:	3 men/shift (2-12 hr shifts) @		\$89.67 per manhour =	\$6,456	\$6,456
Equipment:		\$774.54 per hr x 24 hrs per day =		\$18,589	\$18,589
COST PER DAY				\$39,996	\$39,996

M \ 2

MOB & DEMOB

BID ITEM # 1

DREDGE SIZE: 21 CY CLAMSHELL

3. PERMANENT PERSONNEL & MISC.				MOBILIZATION	DEMOBILIZATION
34 men @	8 hrs/day @	\$89.67 per hour @ 1 DAY		\$24,390	\$24,390
Travel Expenses	\$150 per man			\$5,100	\$5,100
Local hire				<u>\$150</u>	<u>\$150</u>
TOTAL				\$29,640	\$29,640
4. PREPARE DREDGE AFTER TRANSFER				MOBILIZATION	DEMOBILIZATION
Labor:	6 men @	8 hrs/day @	\$89.67 per hour =	\$4,304	\$4,304
Equipment:	Dredge	\$65.74 /hr (Standby) x 24 hrs per day =		\$1,578	
	Towing Vessel	\$43.29 /hr (Standby) x 24 hrs per day =		\$1,039	
Support equipment with operators				\$500	\$500
Supplies & small tools				\$150	\$150
Additional Fuel (plant idle)				\$150	\$150
Subsistence	6 men @	\$50.00 per day =		<u>\$300</u>	<u>----</u>
COST PER DAY				\$8,021	\$5,104

M \ 3

MOB & DEMOB

BID ITEM # 1

DREDGE SIZE: 21 CY CLAMSHELL

REMARKS

1 EQUIPMENT COSTS - WORKING RATES

RATES TAKEN FROM SHEET D \ 2 & SHEET D \ 3

A. WORK TUG(S) \$56.33 /HR

\$24,671 /MO DIVIDED BY 438 HRS/MO

B. TOWING VESSEL(S) \$774.54 /HR

\$565,413 /MO X 1 EACH DIVIDED BY 730 HRS/MO

2 LABOR COSTS

\$89.67 /MHR

FROM SHEET D \ 1

3 EQUIPMENT COSTS - STANDBY RATES

RATES TAKEN FROM SHEET D \ 2 & SHEET D \ 3

A. DREDGE \$65.74 /HR

1 EA @ \$ 65.74 /HR

B. CREW/SURVEY TUG \$0.76 /HR

1 EA @ \$ 0.76 /HR

C. DERRICK(S) \$2.72 /HR

2 EA @ \$ 1.36 /HR

D. FUEL/WATER BARGE \$0.85 /HR

1 EA @ \$ 0.85 /HR

E. WORK BARGE(S) \$1.12 /HR

2 EA @ \$ 0.56 /HR

F. ****Unused**** \$0.00 /HR

0 EA @ \$ 0.00 /HR

G. ****Unused**** \$0.00 /HR

0 EA @ \$ 0.00 /HR

H. SCOW(S) \$26.24 /HR

2.25 EA @ \$ 11.66 /HR

I. TOWING VESSEL(S) \$43.29 /HR

1 EA @ \$ 43.29 /HR

MOBIL & DEMOB COST:		Seattle Harbor Dredging	BID QUANTITY	21,400 C.Y.		
EXCAV. COST.	\$902,652		UNIT COST...	\$42.18 PER C.Y.	TIME.....	0.406 MONTHS

PG 1 OF 12: PROJECT TITLES

PROJECT -	Seattle Harbor Dredging
LOCATION -	Astoria OR
INVIT # -	Transload East Waterway - 56'
DATE OF EST. -	21 June 2017
EST. BY -	Callan
MOB. BID ITEM # -	1
EXCAV. BID ITEM # -	3

PG 5 OF 12: PROJECT TITLES

PG 5.....BUCKET CYCLE -	170 Seconds
OTHER FACTOR -	0.80 >Adjust for partial virgin material digging.
CLEANUP -	0% More Time
TIME EFFICIENCY -	60.0% of EWT

PG 9 OF 12: PROJECT TITLES

PG 9...SP COST/MO (1ST) -	\$20,000	Bucket Repair
SP COST/MO (2ND-14TH) -	\$50,000	From Sheet D4
Total	\$70,000	
SPECIAL COST LS (1ST) -	\$52,000	Hydrographic Survey
SP COST LS (2ND-14TH) -	\$0	From Sheet E
Total	\$52,000	

PG 6 OF 12: PROJECT TITLES

TUG DESCRIPT. -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	2 mi

PG 10 OF 12: PROJECT TITLES

PG 10....PRESENT YEAR -	2017
ECONOMIC INDEX -	8789
LAF -	1.080
INTEREST RATE -	2.500% /yr
TIME PERIOD -	Jan thru Jun 2017
BUCKET AVAILABILITY -	9 mos/yr
FUEL PRICE -	\$3.25 /gal

PG 2 OF 12: TYPE OF EST & IND COSTS

TYPE OF EST. -	1 - Planning Estimate (Includes Profit)
CONTRACTOR'S O.H. -	25.0%
CONTRACTOR'S PROFIT -	8.0%
CONTRACTOR'S BOND -	0.8%

SPEED TO D/A -	5 mph (24 min)
SPEED FROM D/A -	5 mph (24 min)
DUMP OR PUMPOUT -	370 min
DISENGAGE TOW -	10 min
AVE. CYCLE TIME -	443 min per trip
TOW EFFICIENCY -	50 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	80 %
% SOLIDS -	90 % (2,160 cy/load)

PG 3 OF 12: TYPE OF EST & IND COSTS

DREDGING AREA -	4,000,000 SQ. FT.
BANK HEIGHT -	5 ft
REQ'D EXCAVATION -	9,200 cyds
PAY OVERDEPTH -	12,200 cyds
CONTRACT AMOUNT -	21,400 cyds
NOT DREDGED -	6,100 cyds
NET PAY -	15,300 cyds
NONPAY YARDAGE -	0 cyds
GROSS YARDAGE -	15,300 cyds
Non-Pay Calc -	0.0 % of Pay O.D. for NonPay
TOTAL BANK HEIGHT -	5.0 ft

PG 7 OF 12: PROJECT TITLES

DREDGES -	1
SCOWS @ DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1

Production Summary

EXCAVATION PRODUCTION -	86 cy/hr (gross)
EXCAVATION EWT -	60.0% (438 hrs/mo)
EXCAVATION TIME -	0.406 months
HAULING PRODUCTION -	293 cy/hr (gross)
HAULING EWT -	50.0% (365 hrs/mo)
HAULING TIME -	0.143 months
DREDGING TIME -	0.406 months
EXCAVAT EWT (ADJUSTED) -	438 hrs/mo (60.0% EWT)
HAULING EWT (ADJUSTED) -	129 hrs/mo (17.7% EWT)
PRODUCTION (GROSS) -	37,668 cy per month
PRODUCTION (CONTRACT) -	37,668 pay cy per month

PG 4 OF 12: TYPE OF EST & IND COSTS

DREDGE SEL. -	10 CY CLAMSHELL
TYPE OF MATERIAL -	Clays and Less-Dense Sand
BUCKET SIZE -	8
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	5.5
BANK FACTOR -	0.91

PG 8 OF 12: PROJECT TITLES

ADDITIONAL SCOWS -	0
TOT SCOWS ON JOB -	2
QTRS ON DREDGE? -	Yes
SURVEY BOAT? -	1
CREW BOAT? -	0

A DESCRIPTION AND QUANTITY SUMMARY

1 PROJECT	<u>Seattle Harbor Dredging</u>	DATE OF ESTIMATE	<u>21 June 2017</u>
2 LOCATION	<u>Astoria OR</u>	INVIT. OR CONTR. NO.	<u>Transload East Waterway - 56'</u>
3 ESTIMATED BY	<u>Callan</u>	CHECKED BY	<u>Checker's Name</u>
4 TYPE OF DREDGE	<u>10 CY CLAMSHELL</u>	TYPE OF ESTIMATE	<u>1 - Planning Estimate (Includes Profit)</u>

3 56' Mechanical Dredge - Transload Facility

5 DESCRIPTION OF WORK

6 EXCAVATION		REMARKS
A. REQUIRED	<u>9,200</u> CY	
B. PAY OVERDEPTH	+ <u>12,200</u> CY	
C. MAX. PAY YARDAGE	= <u>21,400</u> CY	<u>(YARDAGE USED ON BID FORM)</u>
D. O.D. NOT DREDGED	- <u>6,100</u> CY	
E. NET PAY YARDAGE	= <u>15,300</u> CY	<u>(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)</u>
F. NON-PAY YARDAGE	+ <u> </u> CY	<u>% of Pay O.D. for NonPay</u>
G. GROSS YARDAGE	= 15,300 CY	<u>(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)</u>

B	DREDGING COST	BID ITEM # 3	REMARKS
1	GROSS YARDAGE	<u>15,300</u> CY	FROM SHEET A, ITEM 6 G.
2	PRODUCTION RATE	<u>/ 37,668</u> CY/MO	FROM SHEET C, ITEM 4.
3	DREDGING TIME	= <u>0.41</u> MONTHS	15,300 Net Pay CY / 0.406 MO = 37,668 Pay CY/MO
4	TOTAL MONTHLY COST	<u>x \$1,040,124</u>	FROM SHEET D, ITEM 5.
	SUBTOTAL.....=	<u>\$422,290</u>	
5	FIXED COSTS	<u>+ \$52,000</u>	FROM SHEET E, ITEM 15.
	SUBTOTAL.....=	<u>\$474,290</u>	
6	OVERHEAD	<u>25.0% + \$118,573</u>	
	SUBTOTAL.....=	<u>\$592,863</u>	
7	PROFIT	<u>8.0% + \$47,429</u>	
	SUBTOTAL.....=	<u>\$640,292</u>	
8	BOND	<u>0.8% + \$5,122</u>	
9	GROSS PRODUCTION COST	= <u>\$645,414</u>	
10	NET PAY YARDAGE	<u>/ 15,300</u> CY	FROM SHEET A, ITEM 6 E.
11	UNIT COST	= <u>\$42.18 /CY</u>	
12	MAX PAY YARDAGE	<u>x 21,400</u> CY	FROM SHEET A, ITEM 6 C.FROM SHEET A, ITEM 6 C.
13	DREDGING COST	= <u>\$902,652</u>	

C	MONTHLY PRODUCTION SUMMARY & ADJUSTED OPERATING HOURS	BID ITEM # 3
		REMARKS
1 EXCAVATION TIME	<u>0.406</u> MONTHS	37,668 CY/MO FROM SHEET C \ 1A
2 HAULING TIME	<u>0.143</u> MONTHS	106,945 CY/MO FROM SHEET C \ 2A
3 DREDGING TIME.....>	<u>0.406</u> MONTHS	<u>[Greater of Excavation Time or Hauling Time]</u>
4 PRODUCTION RATE.....>	<u>37,668</u> CY/MO	
5 PRODUCTION RATE.....>	<u>37,668</u> CY/MO	FROM ITEM 4.
6 GROSS PRODUCTION (DREDGE)	<u>/</u> <u>86</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 8.</u>
7 ADJUSTED OPERATING HOURS (DREDGE) =	<u>438</u> HR/MO	<u>DIVIDED BY 730 HRS = 60.0% OF EWT</u>
8 PRODUCTION RATE.....>	<u>37,668</u> CY/MO	FROM ITEM 4.
9 GROSS PRODUCTION (HAULING)	<u>/</u> <u>293</u> CY/HR	<u>FROM SHEET C \ 2B, ITEM 8.</u>
10 ADJUSTED OPERATING HRS (HAULING) =	<u>129</u> HR/MO	<u>DIVIDED BY 730 HRS = 17.7% OF EWT</u>

C \ 1A

EXCAVATION RATE & EXCAVATION TIME

BID ITEM # 3

REMARKS

1 MONTHLY EXCAVATION RATE:

A. DREDGE PRODUCTION	<u>86</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 6.</u>
B. EXCAVATION OPERATING TIME	<u>x</u> <u>438</u> HRS/MO	<u>FROM SHEET C \ 1B, ITEM 7B.</u>
C. EXCAVATION RATE	= <u>37,668</u> CY/MO	

REMARKS

2 EXCAVATION TIME:

A. GROSS CUBIC YARDS	<u>15,300</u> CY (GROSS)	<u>FROM SHEET A, ITEM 6G.</u>
B. EXCAVATION RATE	<u>/</u> <u>37,668</u> CY/MO	<u>FROM ITEM 1C.</u>
C. EXCAVATION TIME	= <u>0.406</u> MONTHS	

C \ 1B

**DREDGE PRODUCTION & EXCAVATION
OPERATING TIME**

BID ITEM # 3

1 SIZE OF DREDGE	<u>10 CY CLAMSHELL</u>	REMARKS
2 CYCLE RATE	<u>0.35</u> Buckets/Min <u>(60 SECONDS PER MIN / 170 SECONDS PER CYCLE)</u>	
	x <u>60</u> MIN/HR	
3 BUCKET SIZE	x <u>8</u> CY	
A. BUCKET FILL FACTOR	x <u>0.70</u>	<u>(WORKING CAPACITY = 5.60 CY/BUCKET)</u>
B. BANK FACTOR	x <u>0.91</u>	<u>(based on 5.0 Ft of Bank Height)</u>
C. OTHER FACTOR	x <u>0.80</u>	<u>>Adjust for partial virgin material digging.</u>
D. CLEANUP FACTOR	x <u>1</u>	<u>ADDITIONAL TIME</u>
4 PRODUCTION PER DREDGE	= <u>86</u> CY/HR	
5 NUMBER OF DREDGES	x <u>1</u>	
6 GROSS PRODUCTION	= <u>86</u> CY/HR	

		REMARKS
7 EXCAVATION OPERATING TIME:		
A. TIME EFFICIENCY	<u>60.0%</u>	<u>% OF EWT WITHOUT MAJOR WAITS FOR SCOWS</u>
	x <u>730</u> HRS/MO	
B. EXCAVATION OPERATING TIME	= <u>438</u> HRS/MO	

C \ 2A

HAULING RATE & HAULING TIME

BID ITEM # 3

REMARKS

1 MONTHLY HAULING RATE:

A. HAULING PRODUCTION 293 CY/HR FROM SHEET C \ 2B, ITEM 8.

B. HAULING OPERATING TIME x 365 HRS/MO FROM SHEET C \ 2B, ITEM 9B.

C. HAULING RATE = 106,945 CY/MO

REMARKS

2 HAULING TIME:

A. GROSS CUBIC YARDS 15,300 CY (Gross) FROM SHEET A, ITEM 6G.

B. HAULING RATE / 106,945 CY/MO FROM ITEM 1C.

C. HAULING TIME = 0.143 MONTHS

C \ 2B	HAULING PRODUCTION & HAULING OPERATING TIME	BID ITEM # 3
--------	--	--------------

		REMARKS
1 SIZE OF SCOW	_____ 3,000 CY	_____
A. CAPACITY	x _____ 0.8	_____
B. USEABLE VOLUME	= _____ 2,400 CY	_____
C. SLURRY DENSITY	x _____ 0.9	_____
2 AVERAGE VOLUME HAULED	= _____ 2,160 CY/SCOW	_____
3 SCOWS PER TOWING VESSEL	x _____ 1	_____
4 AVERAGE VOLUME HAULED	= _____ 2,160 CY/TRIP	_____
5 AVERAGE CYCLE TIME	/ _____ 443 MIN/TRIP	FROM SHEET C \ 2C, ITEM 3.
	x _____ 60 MIN/HR	_____
6 PRODUCTION PER TOWING VESSEL	= _____ 293 CY/HR	_____
7 NUMBER OF TOWING VESSELS	x _____ 1	_____
8 HAULING PRODUCTION	= _____ 293 CY/HR	_____

		REMARKS
9 HAULING OPERATING TIME:		_____
A. TIME EFFICIENCY	_____ 50.0%	% OF EWT WITHOUT WAITING FOR DREDGE(S)
	x _____ 730 HRS/MO	_____
B. HAULING OPERATING TIME	= _____ 365 HRS/MO	_____

C \ 2C	HAULING CYCLE TIME	BID ITEM # 3
1 SIZE OF TUG	3000 HP Diesel--Twin Screw	
2 CYCLE TIME PER TRIP:		REMARKS
A. PREPARE FOR SCOW TOW	15 MIN	
B. TO DISPOSAL AREA	+ 24 MIN	2 miles / 5.0 miles per hr x 60 min
C. DUMPING OR PUMPOUT	+ 370 MIN	Offload
D. FROM DISPOSAL AREA	+ 24 MIN	2 miles / 5.0 miles per hr x 60 min
E. DISENGAGE TOW RIGGING AND TIE UP SCOW	+ 10 MIN	
3 AVERAGE CYCLE TIME	= 443 MIN/TRIP	

D		MONTHLY COST SUMMARY		BID ITEM # 3	
DREDGE SIZE 10 CY CLAMSHELL		REMARKS			
1	LABOR COSTS (D1)	<u>\$676,297</u> /MO			
2	EXCAVATION (D2)		Ownership	Fuel	WLS Maintenance Repair
A.	DREDGE(S)	+ <u>\$70,467</u> /MO (1 ea)	<u>\$3,466</u>	+ <u>\$44,562</u>	+ <u>\$22,439</u>
B.	WORK TUG(S)	+ <u>\$14,331</u> /MO (1 ea)	<u>\$928</u>	+ <u>\$7,796</u>	+ <u>\$5,607</u>
C.	CREW/SURVEY TUG	+ <u>\$13,870</u> /MO (1 ea)	<u>\$555</u>	+ <u>\$8,629</u>	+ <u>\$4,686</u>
D.	DERRICK(S)	+ <u>\$4,113</u> /MO (1 ea)	<u>\$797</u>	+ <u>\$1,958</u>	+ <u>\$1,358</u>
E.	FUEL/WATER BARGE	+ <u>\$1,424</u> /MO (1 ea)	<u>\$618</u>	+ <u>\$158</u>	+ <u>\$648</u>
F.	WORK BARGE(S)	+ <u>\$817</u> /MO (1 ea)	<u>\$410</u>	+ <u></u>	+ <u>\$407</u>
H.	**Unused**	+ <u></u>	+ <u></u>	+ <u></u>	+ <u></u>
I.	**Unused**	+ <u></u>	+ <u></u>	+ <u></u>	+ <u></u>
3	HAULING				
A.	TOWING VESSEL(S)	+ <u>\$125,931</u> /MO (1 ea)	<u>\$31,600</u>	+ <u>\$61,505</u>	+ <u>\$32,826</u>
B.	SCOW(S)	+ <u>\$62,874</u> /MO (2 ea)	<u>\$17,030</u>	+ <u>\$13,052</u>	+ <u>\$32,792</u>
	Equip TOTALS----->	<u>\$293,827</u> /MO	<u>\$55,404</u>	+ <u>\$137,660</u>	+ <u>\$100,763</u>
4	OTHER MONTHLY COSTS (D3)	+ <u>\$70,000</u> /MO	FROM SHEET D \ 3		
5	TOTAL MONTHLY COST	= <u>\$1,040,124</u>			

Equipment Price Breakdown

	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8. Hourly Fuel	\$101.74	\$17.80	\$19.70	\$4.47	\$0.36			
x 1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
- 8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
Operating/Materials/Maintenance/Wear	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

Each	1	1	1	1	1	1		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
Operating/Materials/Maintenance/Wear/Repair	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

	Towing Vessel	Dump Scow
7b. Monthly Ownership:	\$31,600.00	\$8,515.00
8a. (1) Hrly Pr Eng Fuel:	\$438.75	
8a. (2) Hrly 2nd Eng Fuel:	\$38.03	\$8.94
8. Hourly Fuel	\$476.78	\$8.94
x 1j. Hrs Worked/Mo.....	129	730
Monthly Fuel:	\$61,504.62	\$6,526.20
- 8e. Monthly Operating:	\$94,331	\$22,922
Operating/Materials/Maintenance/Wear	\$32,826.38	\$16,395.80

Each	1	2
7b. Monthly Ownership:	\$31,600.00	\$17,030.00
Monthly Fuel:	\$61,504.62	\$13,052.40
Operating/Materials/Maintenance/Wear	\$32,826.38	\$32,791.60

D/2 EQUIPMENT COST

	Excavation							
	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work	**Unused**	**Unused**
1a. Plant Description.....								
1c. Prime Eng HP.....	625	100	100	100				
1d. (1) Dredge El Gen HP....	50	--	--	--	--	--	--	--
1d. Total 2nd Eng HP.....	210	25	40	25	10			
1e. Plant Value.....	\$370,000	\$67,000	\$42,000	\$127,000	\$95,000	\$63,000		
1f. Acquis Year.....	1995	1992	1997	1990	1990	1990		
1g. Pres Year.....	2017	2017	2017	2017	2017	2017	2017	2017
1h. Cost of Money Rate.....	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%
1i. Disc Money Rate:	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%
1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
2a. LAF.....	1.080	1.08	1.08	1.08	1.08	1.08	1.08	1.08
2b. Fuel Cost per Gal.....	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25
3a. Ec Index <for Acq Yr>..	5036	4679	5429	4271	4271	4271		
3b. Ec Index <for 2017>....	8789	8789	8789	8789	8789	8789	8789	8789
4a. Mos Available/Year.....	9	9	9	9	9	9	9	9
5a. Useful Life (in Yrs)...	13	8	8	20	20	20		
5b. Physical Life (in Hrs).	26,000	18,000	16,000	90,000	90,000	90,000		
5c. SLV Factor.....	0.05	0.10	0.15	0.10	0.05	0.05		
5d. Pr Eng Fuel Factor.....	0.039	0.045	0.045	0.011	0.011	0.011		
5e. 2nd Eng Fuel Factor....	0.033	0.039	0.039	0.011	0.011	0.011		
5f. WLS Factor.....	0.24	0.38	0.38	0.20	0.20	0.20		
5g. RPR Factor.....	1.00	0.80	0.70	0.70	0.60	0.60		
6a. Depreciation:	7.31%	11.25%	10.63%	4.50%	4.75%	4.75%		
6b. FCCM:	1.12%	1.21%	1.26%	1.15%	1.10%	1.10%		
6c. Total Ownership/Year:	8.43%	12.46%	11.89%	5.65%	5.85%	5.85%		
7a. Yearly Ownership:	\$31,191	\$8,348	\$4,994	\$7,176	\$5,558	\$3,686		
7b. Monthly Ownership:	\$3,466	\$928	\$555	\$797	\$618	\$410		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8b. (1) Hrly Pr Eng WLS:	\$19.01	\$5.56	\$5.56	\$0.72				
8b. (2) Hrly 2nd Eng WLS:	\$5.40	\$1.20	\$1.93	\$0.18	\$0.07			
8c. (1) EAF:	1.745	1.878	1.619	2.058	2.058	2.058		
8c. (2) Hrly Repair:	\$26.82	\$6.04	\$3.21	\$2.20	\$1.41	\$0.93		
8d. Total Hrly Operating:	\$152.97	\$30.60	\$30.40	\$7.57	\$1.84	\$0.93		
8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
11. MONTHLY RATE:	\$70,467	\$14,331	\$13,870	\$4,113	\$1,424	\$817		
12a. HRLY STANDBY ALLOW:	\$4.75	\$1.27	\$0.76	\$1.09	\$0.85	\$0.56		
12b. Gener Fuel Allowance:	\$5.36	--	--	--	--	--	--	--
12c. DREDGE HRLY STANDBY:	\$10.11	--	--	--	--	--	--	--

Hauling		
Towing	Dump Scow	Disposal Transport
Twin Screw	3,000 CY Capacity	Twin Screw
	Split Hull Scow	
3000		3000
300	250	300
\$6,000,000	\$1,310,000	\$6,000,000
2009	1992	2009
2017	2017	2017
2.5	2.500%	2.500%
0.02	2.000%	2.000%
129	730	730
1.08	1.08	1.08
3.25	\$3.25	\$3.25
8789	0.011	20
7773	4679	7773
9	9	9
25	20	25
120,000	90,000	120,000
0.10	0.05	0.10
0.045	0.011	0.045
0.039	0.011	0.039
0.38	0.20	0.38
1.20	0.70	1.20
3.60%	4.75%	3.60%
1.14%	1.10%	1.14%
4.74%	5.85%	4.74%
\$284,400	\$76,635	\$284,400
\$31,600	\$8,515	\$31,600
\$438.75		\$438.75
\$38.03	\$8.94	\$38.03
\$166.73		\$166.73
\$14.45	\$1.79	\$14.45
1.131	1.878	1.131
\$73.29	\$20.67	\$73.29
\$731.25	\$31.40	\$731.25
\$94,331	\$22,922	\$533,813
\$125,931	\$31,437	\$565,413
\$43.29	\$11.66	\$43.29

D \ 3 OTHER MONTHLY COSTS

BID ITEM # 3

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Bucket Repair Water Quality		\$20,000 /MO	
2	Monitoring	+	\$50,000 /MO	
3	>	+	\$0 /MO	
4	>	+	\$0 /MO	
5	>	+	\$0 /MO	
6	>	+	\$0 /MO	
7	>	+	\$0 /MO	
8	>	+	\$0 /MO	
9	>	+	\$0 /MO	
10	>	+	\$0 /MO	
11	>	+	\$0 /MO	
12	>	+	\$0 /MO	
13	>	+	\$0 /MO	
14	>	+	\$0 /MO	
15 TOTAL OTHER MONTHLY COSTS =				\$70,000 /MO

E FIXED COSTS

BID ITEM # 3

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Hydrographic Survey		\$52,000	
2	>	+	\$0	
3	>	+	\$0	
4	>	+	\$0	
5	>	+	\$0	
6	>	+	\$0	
7	>	+	\$0	
8	>	+	\$0	
9	>	+	\$0	
10	>	+	\$0	
11	>	+	\$0	
12	>	+	\$0	
13	>	+	\$0	
14	>	+	\$0	

15 FIXED COSTS = \$52,000

MOBIL & DEMOB COST:		Seattle Harbor Dredging	BID QUANTITY	192,600 C.Y.		
EXCAV. COST.	\$2,969,892		UNIT COST...	\$15.42 PER C.Y.	TIME.....	1.494 MONTHS

PG 1 OF 12: PROJECT TITLES

PROJECT -	Seattle Harbor Dredging
LOCATION -	Astoria OR
INVIT # -	Open East Waterway - 56'
DATE OF EST. -	21 June 2017
EST. BY -	Callan
MOB. BID ITEM # -	1

PG 5 OF 12: PROJECT TITLES

PG 5.....BUCKET CYCLE -	70 Seconds
OTHER FACTOR -	0.80 >Adjust for partial virgin material digging.
CLEANUP -	0% More Time
TIME EFFICIENCY -	60.0% of EWT

PG 9 OF 12: PROJECT TITLES

PG 9...SP COST/MO (1ST) -	\$20,000	Bucket Repair
SP COST/MO (2ND-14TH) -	\$50,000	From Sheet D4
Total	\$70,000	

PG 2 OF 12: TYPE OF EST & IND COSTS

TYPE OF EST. -	1 - Planning Estimate (Includes Profit)
CONTRACTOR'S O.H. -	25.0%
CONTRACTOR'S PROFIT -	8.0%
CONTRACTOR'S BOND -	0.8%

PG 6 OF 12: PROJECT TITLES

TUG DESCRIPT. -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	4 mi

SPECIAL COST LS (1ST) -	\$52,000	Hydrographic Survey
SP COST LS (2ND-14TH) -	\$0	From Sheet E
Total	\$52,000	

PG 3 OF 12: TYPE OF EST & IND COSTS

DREDGING AREA -	4,000,000 SQ. FT.
BANK HEIGHT -	5 ft
REQ'D EXCAVATION -	82,200 cyds
PAY OVERDEPTH -	110,400 cyds
CONTRACT AMOUNT -	192,600 cyds
NOT DREDGED -	55,200 cyds
NET PAY -	137,400 cyds
NONPAY YARDAGE -	0 cyds
GROSS YARDAGE -	137,400 cyds
Non-Pay Calc -	0.0 % of Pay O.D. for NonPay
TOTAL BANK HEIGHT -	5.0 ft

PG 7 OF 12: PROJECT TITLES

SPEED TO D/A -	7 mph (34 min)
SPEED FROM D/A -	7 mph (34 min)
DUMP OR PUMPOUT -	10 min
DISENGAGE TOW -	10 min
AVE. CYCLE TIME -	103 min per trip
TOW EFFICIENCY -	70 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	80 %
% SOLIDS -	90 % (2,160 cy/load)

PG 10 OF 12: PROJECT TITLES

PG 10....PRESENT YEAR -	2017
ECONOMIC INDEX -	8789
LAF -	1.080
INTEREST RATE -	2.500% /yr
TIME PERIOD -	Jan thru Jun 2017
BUCKET AVAILABILITY -	9 mos/yr
FUEL PRICE -	\$3.25 /gal

PG 4 OF 12: TYPE OF EST & IND COSTS

DREDGE SEL. -	10 CY CLAMSHELL
TYPE OF MATERIAL -	Clays and Less-Dense Sand
BUCKET SIZE -	8
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	5.5
BANK FACTOR -	0.91

SCOW DESCRIPTION -	3000 CY Split Hull Scow
ADDITIONAL SCOWS -	0.25
TOT SCOWS ON JOB -	2.25
DREDGES -	1
SCOWS @ DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1

PG 8 OF 12: PROJECT TITLES

QTRS ON DREDGE? -	Yes
SURVEY BOAT? -	1
CREW BOAT? -	0

Production Summary

EXCAVATION PRODUCTION -	210 cy/hr (gross)
EXCAVATION EWT -	60.0% (438 hrs/mo)
EXCAVATION TIME -	1.494 months
HAULING PRODUCTION -	1258 cy/hr (gross)
HAULING EWT -	70.0% (511 hrs/mo)
HAULING TIME -	0.214 months
DREDGING TIME -	1.494 months
EXCAVAT EWT (ADJUSTED) -	438 hrs/mo (60.0% EWT)
HAULING EWT (ADJUSTED) -	73 hrs/mo (10.0% EWT)
PRODUCTION (GROSS) -	91,980 cy per month
PRODUCTION (CONTRACT) -	91,968 pay cy per month

A DESCRIPTION AND QUANTITY SUMMARY

1 PROJECT	<u>Seattle Harbor Dredging</u>	DATE OF ESTIMATE	<u>21 June 2017</u>
2 LOCATION	<u>Astoria OR</u>	INVIT. OR CONTR. NO.	<u>Open East Waterway - 56'</u>
3 ESTIMATED BY	<u>Callan</u>	CHECKED BY	<u>Checker's Name</u>
4 TYPE OF DREDGE	<u>10 CY CLAMSHELL</u>	TYPE OF ESTIMATE	<u>1 - Planning Estimate (Includes Profit)</u>

2 56' Mechanical Dredge - Open Water

5 DESCRIPTION OF WORK

6 EXCAVATION		REMARKS
A. REQUIRED	<u>82,200</u> CY	
B. PAY OVERDEPTH	+ <u>110,400</u> CY	
C. MAX. PAY YARDAGE	= <u>192,600</u> CY	<u>(YARDAGE USED ON BID FORM)</u>
D. O.D. NOT DREDGED	- <u>55,200</u> CY	
E. NET PAY YARDAGE	= <u>137,400</u> CY	<u>(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)</u>
F. NON-PAY YARDAGE	+ _____ CY	<u>% of Pay O.D. for NonPay</u>
G. GROSS YARDAGE	= 137,400 CY	<u>(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)</u>

B	DREDGING COST	BID ITEM # 2	REMARKS
1	GROSS YARDAGE	<u>137,400</u> CY	<u>FROM SHEET A, ITEM 6 G.</u>
2	PRODUCTION RATE	<u>/ 91,980</u> CY/MO	<u>FROM SHEET C, ITEM 4.</u>
3	DREDGING TIME	= <u>1.49</u> MONTHS	<u>137,400 Net Pay CY / 1.494 MO = 91,968 Pay CY/MO</u>
4	TOTAL MONTHLY COST	<u>x \$1,007,033</u>	<u>FROM SHEET D, ITEM 5.</u>
	SUBTOTAL.....=	<u>\$1,504,507</u>	
5	FIXED COSTS	<u>+ \$52,000</u>	<u>FROM SHEET E, ITEM 15.</u>
	SUBTOTAL.....=	<u>\$1,556,507</u>	
6	OVERHEAD	<u>25.0% + \$389,127</u>	
	SUBTOTAL.....=	<u>\$1,945,634</u>	
7	PROFIT	<u>8.0% + \$155,651</u>	
	SUBTOTAL.....=	<u>\$2,101,285</u>	
8	BOND	<u>0.8% + \$16,810</u>	
9	GROSS PRODUCTION COST	= <u>\$2,118,095</u>	
10	NET PAY YARDAGE	<u>/ 137,400</u> CY	<u>FROM SHEET A, ITEM 6 E.</u>
11	UNIT COST	= <u>\$15.42 /CY</u>	
12	MAX PAY YARDAGE	<u>x 192,600</u> CY	<u>FROM SHEET A, ITEM 6 C.FROM SHEET A, ITEM 6 C.</u>
13	DREDGING COST	= <u>\$2,969,892</u>	

C	MONTHLY PRODUCTION SUMMARY & ADJUSTED OPERATING HOURS	BID ITEM # 2
		REMARKS
1 EXCAVATION TIME	<u>1.494</u> MONTHS	91,980 CY/MO FROM SHEET C \ 1A
2 HAULING TIME	<u>0.214</u> MONTHS	642,838 CY/MO FROM SHEET C \ 2A
3 DREDGING TIME.....>	<u>1.494</u> MONTHS	<u>[Greater of Excavation Time or Hauling Time]</u>
4 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	
5 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	FROM ITEM 4.
6 GROSS PRODUCTION (DREDGE)	<u>/</u> <u>210</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 8.</u>
7 ADJUSTED OPERATING HOURS (DREDGE) =	<u>438</u> HR/MO	<u>DIVIDED BY 730 HRS = 60.0% OF EWT</u>
8 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	FROM ITEM 4.
9 GROSS PRODUCTION (HAULING)	<u>/</u> <u>1258</u> CY/HR	<u>FROM SHEET C \ 2B, ITEM 8.</u>
10 ADJUSTED OPERATING HRS (HAULING) =	<u>73</u> HR/MO	<u>DIVIDED BY 730 HRS = 10.0% OF EWT</u>

C \ 1A

EXCAVATION RATE & EXCAVATION TIME

BID ITEM # 2

REMARKS

1 MONTHLY EXCAVATION RATE:

A. DREDGE PRODUCTION	<u>210</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 6.</u>
B. EXCAVATION OPERATING TIME	<u>x</u> <u>438</u> HRS/MO	<u>FROM SHEET C \ 1B, ITEM 7B.</u>
C. EXCAVATION RATE	= <u>91,980</u> CY/MO	

REMARKS

2 EXCAVATION TIME:

A. GROSS CUBIC YARDS	<u>137,400</u> CY (GROSS)	<u>FROM SHEET A, ITEM 6G.</u>
B. EXCAVATION RATE	<u>/</u> <u>91,980</u> CY/MO	<u>FROM ITEM 1C.</u>
C. EXCAVATION TIME	= <u>1.494</u> MONTHS	

C \ 1B

**DREDGE PRODUCTION & EXCAVATION
OPERATING TIME**

BID ITEM # 2

1 SIZE OF DREDGE	<u>10 CY CLAMSHELL</u>	REMARKS
2 CYCLE RATE	<u>0.86</u> Buckets/Min	<u>(60 SECONDS PER MIN / 70 SECONDS PER CYCLE)</u>
	x <u>60</u> MIN/HR	_____
3 BUCKET SIZE	x <u>8</u> CY	_____
A. BUCKET FILL FACTOR	x <u>0.70</u>	<u>(WORKING CAPACITY = 5.60 CY/BUCKET)</u>
B. BANK FACTOR	x <u>0.91</u>	<u>(based on 5.0 Ft of Bank Height)</u>
C. OTHER FACTOR	x <u>0.80</u>	<u>>Adjust for partial virgin material digging.</u>
D. CLEANUP FACTOR	<u>x 1</u>	<u>ADDITIONAL TIME</u>
4 PRODUCTION PER DREDGE	= <u>210</u> CY/HR	_____
5 NUMBER OF DREDGES	<u>x 1</u>	_____
6 GROSS PRODUCTION	= <u>210</u> CY/HR	_____
		REMARKS
7 EXCAVATION OPERATING TIME:		_____
A. TIME EFFICIENCY	<u>60.0%</u>	<u>% OF EWT WITHOUT MAJOR WAITS FOR SCOWS</u>
	x <u>730</u> HRS/MO	_____
B. EXCAVATION OPERATING TIME	= <u>438</u> HRS/MO	_____

C \ 2A

HAULING RATE & HAULING TIME

BID ITEM # 2

REMARKS

1 MONTHLY HAULING RATE:

A. HAULING PRODUCTION 1,258 CY/HR FROM SHEET C \ 2B, ITEM 8.

B. HAULING OPERATING TIME x 511 HRS/MO FROM SHEET C \ 2B, ITEM 9B.

C. HAULING RATE = 642,838 CY/MO

REMARKS

2 HAULING TIME:

A. GROSS CUBIC YARDS 137,400 CY (Gross) FROM SHEET A, ITEM 6G.

B. HAULING RATE / 642,838 CY/MO FROM ITEM 1C.

C. HAULING TIME = 0.214 MONTHS

C \ 2B	HAULING PRODUCTION & HAULING OPERATING TIME	BID ITEM # 2
--------	--	--------------

		REMARKS
1 SIZE OF SCOW	_____ 3,000 CY	_____
A. CAPACITY	x _____ 0.8	_____
B. USEABLE VOLUME	= _____ 2,400 CY	_____
C. SLURRY DENSITY	x _____ 0.9	_____
2 AVERAGE VOLUME HAULED	= _____ 2,160 CY/SCOW	_____
3 SCOWS PER TOWING VESSEL	x _____ 1	_____
4 AVERAGE VOLUME HAULED	= _____ 2,160 CY/TRIP	_____
5 AVERAGE CYCLE TIME	/ _____ 103 MIN/TRIP	FROM SHEET C \ 2C, ITEM 3.
	x _____ 60 MIN/HR	_____
6 PRODUCTION PER TOWING VESSEL	= _____ 1,258 CY/HR	_____
7 NUMBER OF TOWING VESSELS	x _____ 1	_____
8 HAULING PRODUCTION	= _____ 1,258 CY/HR	_____

		REMARKS
9 HAULING OPERATING TIME:		_____
A. TIME EFFICIENCY	_____ 70.0%	% OF EWT WITHOUT WAITING FOR DREDGE(S)
	x _____ 730 HRS/MO	_____
B. HAULING OPERATING TIME	= _____ 511 HRS/MO	_____

C \ 2C	HAULING CYCLE TIME	BID ITEM # 2
1 SIZE OF TUG	<u>3000 HP Diesel--Twin Screw</u>	
2 CYCLE TIME PER TRIP:		REMARKS
A. PREPARE FOR SCOW TOW	<u>15 MIN</u>	
B. TO DISPOSAL AREA	+ <u>34 MIN</u>	<u>4 miles / 7.0 miles per hr x 60 min</u>
C. DUMPING OR PUMPOUT	+ <u>10 MIN</u>	<u>Dump</u>
D. FROM DISPOSAL AREA	+ <u>34 MIN</u>	<u>4 miles / 7.0 miles per hr x 60 min</u>
E. DISENGAGE TOW RIGGING AND TIE UP SCOW	+ <u>10 MIN</u>	
3 AVERAGE CYCLE TIME	= <u>103 MIN/TRIP</u>	

D		MONTHLY COST SUMMARY		BID ITEM # 2	
DREDGE SIZE 10 CY CLAMSHELL		REMARKS			
1	LABOR COSTS (D1)	<u>\$676,297</u> /MO			
2	EXCAVATION (D2)		Ownership	Fuel	WLS Maintenance Repair
A.	DREDGE(S)	+ <u>\$70,467</u> /MO (1 ea)	<u>\$3,466</u>	+ <u>\$44,562</u>	+ <u>\$22,439</u>
B.	WORK TUG(S)	+ <u>\$14,331</u> /MO (1 ea)	<u>\$928</u>	+ <u>\$7,796</u>	+ <u>\$5,607</u>
C.	CREW/SURVEY TUG	+ <u>\$13,870</u> /MO (1 ea)	<u>\$555</u>	+ <u>\$8,629</u>	+ <u>\$4,686</u>
D.	DERRICK(S)	+ <u>\$4,113</u> /MO (1 ea)	<u>\$797</u>	+ <u>\$1,958</u>	+ <u>\$1,358</u>
E.	FUEL/WATER BARGE	+ <u>\$1,424</u> /MO (1 ea)	<u>\$618</u>	+ <u>\$158</u>	+ <u>\$648</u>
F.	WORK BARGE(S)	+ <u>\$817</u> /MO (1 ea)	<u>\$410</u>	+ <u></u>	+ <u>\$407</u>
H.	**Unused**	+ <u></u>	+ <u></u>	+ <u></u>	+ <u></u>
I.	**Unused**	+ <u></u>	+ <u></u>	+ <u></u>	+ <u></u>
3	HAULING				
A.	TOWING VESSEL(S)	+ <u>\$84,981</u> /MO (1 ea)	<u>\$31,600</u>	+ <u>\$34,805</u>	+ <u>\$18,576</u>
B.	SCOW(S)	+ <u>\$70,733</u> /MO (2 ea)	<u>\$19,159</u>	+ <u>\$14,684</u>	+ <u>\$36,891</u>
	Equip TOTALS----->	<u>\$260,736</u> /MO	<u>\$57,533</u>	+ <u>\$112,592</u>	+ <u>\$90,612</u>
4	OTHER MONTHLY COSTS (D3)	+ <u>\$70,000</u> /MO	FROM SHEET D \ 3		
5	TOTAL MONTHLY COST	= <u>\$1,007,033</u>			

Equipment Price Breakdown

	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8. Hourly Fuel	\$101.74	\$17.80	\$19.70	\$4.47	\$0.36			
x 1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
- 8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
Operating/Materials/Maintenance/Wear	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

Each	1	1	1	1	1	1		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
Operating/Materials/Maintenance/Wear/Repair	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

	Towing Vessel	Dump Scow
7b. Monthly Ownership:	\$31,600.00	\$8,515.00
8a. (1) Hrly Pr Eng Fuel:	\$438.75	
8a. (2) Hrly 2nd Eng Fuel:	\$38.03	\$8.94
8. Hourly Fuel	\$476.78	\$8.94
x 1j. Hrs Worked/Mo.....	73	730
Monthly Fuel:	\$34,804.94	\$6,526.20
- 8e. Monthly Operating:	\$53,381	\$22,922
Operating/Materials/Maintenance/Wear	\$18,576.06	\$16,395.80

Each	1	2.25
7b. Monthly Ownership:	\$31,600.00	\$19,158.75
Monthly Fuel:	\$34,804.94	\$14,683.95
Operating/Materials/Maintenance/Wear	\$18,576.06	\$36,890.55

D \ 1	LABOR COSTS	BID ITEM #	2
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DREDGE SIZE: 10 CY CLAMSHELL

Adjustments, Taxes and Insurance		Monthly Management Cost	
Overtime	14.29%	1	CAPTAIN \$6,147
Holiday 7 Days/Yr	1.92%	1	CHIEF ENG \$6,290
Vacation	8.00%	1	CIVIL ENG \$7,012
COMPOSITE.....	24.21%	1	OFFICE HELP \$2,439
			<u>\$21,888</u>
Social Security Tax	7.65%		
Workman's Compensation	45.00%		
State Unemployment Comp.	3.50%		
Federal Unemployment Comp.	1.00%		
COMPOSITE.....	57.15%		

Each Crew Position is Manned:	8 Hrs per Day
	x 7 Days per Week
=	56 Hrs per Week
	x 4.345 Wks per Month
=	243 Hrs per Month

Last Update...Mar 15

EA	CREW POSITION	O.T.		SUB-TOTAL	TAXES INSUR 57.15%	SUB-TOTAL	FRINGE BENEFITS \$17.40	HRLY COST	HOURS PER MONTH	MONTHLY COST
		BASIC HOURLY WAGE	VACATION & HOLIDAY 24.21%							
3	Operators (Dredge)	\$38.39	+ \$9.29	= \$47.68	+ \$27.25	= \$74.93	+ \$17.40	= \$92.33	x 730	= \$67,401
3	Engineers (Dredge)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 730	= 67,401
3	Mates (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 730	= 65,919
4	Launchmen (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 973	= 87,862
4	Deckhands (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 973	= 85,176
1	Cook (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943
1	Messman (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272
1	Launchmen (Survey)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943
1	Deckhands (Survey)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272
	Launchmen (Crew BT)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x	=
	Deckhands (Crew BT)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x	=
1	Tug Master (Tow Tug)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 243	= 22,436
2	Mates (Tow Tug)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 487	= 43,976
3	Deckhands (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904
3	Scowmen (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904
30	Total Crew									

	Labor Adjustment factor (risk analysis)	1
	MONTHLY CREW LABOR COST =	\$654,409
	(Average Gross Wage =	\$89.67 per manhour)

TOTAL MONTHLY LABOR COST = \$676,297

D/2 EQUIPMENT COST

	Excavation							
	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work	**Unused**	**Unused**
1a. Plant Description.....								
1c. Prime Eng HP.....	625	100	100	100				
1d. (1) Dredge El Gen HP....	50	--	--	--	--	--	--	--
1d. Total 2nd Eng HP.....	210	25	40	25	10			
1e. Plant Value.....	\$370,000	\$67,000	\$42,000	\$127,000	\$95,000	\$63,000		
1f. Acquis Year.....	1995	1992	1997	1990	1990	1990		
1g. Pres Year.....	2017	2017	2017	2017	2017	2017	2017	2017
1h. Cost of Money Rate.....	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%
1i. Disc Money Rate:	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%
1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
2a. LAF.....	1.080	1.08	1.08	1.08	1.08	1.08	1.08	1.08
2b. Fuel Cost per Gal.....	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25
3a. Ec Index <for Acq Yr>..	5036	4679	5429	4271	4271	4271		
3b. Ec Index <for 2017>....	8789	8789	8789	8789	8789	8789	8789	8789
4a. Mos Available/Year.....	9	9	9	9	9	9	9	9
5a. Useful Life (in Yrs)...	13	8	8	20	20	20		
5b. Physical Life (in Hrs).	26,000	18,000	16,000	90,000	90,000	90,000		
5c. SLV Factor.....	0.05	0.10	0.15	0.10	0.05	0.05		
5d. Pr Eng Fuel Factor.....	0.039	0.045	0.045	0.011	0.011	0.011		
5e. 2nd Eng Fuel Factor....	0.033	0.039	0.039	0.011	0.011	0.011		
5f. WLS Factor.....	0.24	0.38	0.38	0.20	0.20	0.20		
5g. RPR Factor.....	1.00	0.80	0.70	0.70	0.60	0.60		
6a. Depreciation:	7.31%	11.25%	10.63%	4.50%	4.75%	4.75%		
6b. FCCM:	1.12%	1.21%	1.26%	1.15%	1.10%	1.10%		
6c. Total Ownership/Year:	8.43%	12.46%	11.89%	5.65%	5.85%	5.85%		
7a. Yearly Ownership:	\$31,191	\$8,348	\$4,994	\$7,176	\$5,558	\$3,686		
7b. Monthly Ownership:	\$3,466	\$928	\$555	\$797	\$618	\$410		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8b. (1) Hrly Pr Eng WLS:	\$19.01	\$5.56	\$5.56	\$0.72				
8b. (2) Hrly 2nd Eng WLS:	\$5.40	\$1.20	\$1.93	\$0.18	\$0.07			
8c. (1) EAF:	1.745	1.878	1.619	2.058	2.058	2.058		
8c. (2) Hrly Repair:	\$26.82	\$6.04	\$3.21	\$2.20	\$1.41	\$0.93		
8d. Total Hrly Operating:	\$152.97	\$30.60	\$30.40	\$7.57	\$1.84	\$0.93		
8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
11. MONTHLY RATE:	\$70,467	\$14,331	\$13,870	\$4,113	\$1,424	\$817		
12a. HRLY STANDBY ALLOW:	\$4.75	\$1.27	\$0.76	\$1.09	\$0.85	\$0.56		
12b. Gener Fuel Allowance:	\$5.36	--	--	--	--	--	--	--
12c. DREDGE HRLY STANDBY:	\$10.11	--	--	--	--	--	--	--

Hauling		
Towing	Dump Scow	Disposal Transport
Twin Screw	3,000 CY Capacity	Twin Screw
	Split Hull Scow	
3000		3000
300	250	300
\$6,000,000	\$1,310,000	\$6,000,000
2009	1992	2009
2017	2017	2017
2.5	2.500%	2.500%
0.02	2.000%	2.000%
73	730	730
1.08	1.08	1.08
3.25	\$3.25	\$3.25
8789	0.011	20
7773	4679	7773
9	9	9
25	20	25
120,000	90,000	120,000
0.10	0.05	0.10
0.045	0.011	0.045
0.039	0.011	0.039
0.38	0.20	0.38
1.20	0.70	1.20
3.60%	4.75%	3.60%
1.14%	1.10%	1.14%
4.74%	5.85%	4.74%
\$284,400	\$76,635	\$284,400
\$31,600	\$8,515	\$31,600
\$438.75		\$438.75
\$38.03	\$8.94	\$38.03
\$166.73		\$166.73
\$14.45	\$1.79	\$14.45
1.131	1.878	1.131
\$73.29	\$20.67	\$73.29
\$731.25	\$31.40	\$731.25
\$53,381	\$22,922	\$533,813
\$84,981	\$31,437	\$565,413
\$43.29	\$11.66	\$43.29

D \ 3 OTHER MONTHLY COSTS

BID ITEM # 2

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Bucket Repair Water Quality		\$20,000 /MO	
2	Monitoring	+	\$50,000 /MO	
3	>	+	\$0 /MO	
4	>	+	\$0 /MO	
5	>	+	\$0 /MO	
6	>	+	\$0 /MO	
7	>	+	\$0 /MO	
8	>	+	\$0 /MO	
9	>	+	\$0 /MO	
10	>	+	\$0 /MO	
11	>	+	\$0 /MO	
12	>	+	\$0 /MO	
13	>	+	\$0 /MO	
14	>	+	\$0 /MO	
15 TOTAL OTHER MONTHLY COSTS =				\$70,000 /MO

E FIXED COSTS

BID ITEM # 2

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Hydrographic Survey		\$52,000	
2	>	+	\$0	
3	>	+	\$0	
4	>	+	\$0	
5	>	+	\$0	
6	>	+	\$0	
7	>	+	\$0	
8	>	+	\$0	
9	>	+	\$0	
10	>	+	\$0	
11	>	+	\$0	
12	>	+	\$0	
13	>	+	\$0	
14	>	+	\$0	

15 FIXED COSTS = \$52,000

MOBIL & DEMOB COST:		Seattle Harbor Dredging	BID QUANTITY	147,400 C.Y.		
EXCAV. COST.	\$5,621,836		UNIT COST...	\$38.14 PER C.Y.	TIME.....	3.45 MONTHS

PG 1 OF 12: PROJECT TITLES

PROJECT -	Seattle Harbor Dredging
LOCATION -	Astoria OR
INVIT # -	Transload West Waterway - 56'
DATE OF EST. -	21 June 2017
EST. BY -	Callan
MOB. BID ITEM # -	1
EXCAV. BID ITEM # -	3

PG 5 OF 12: PROJECT TITLES

PG 5.....BUCKET CYCLE -	170 Seconds
OTHER FACTOR -	0.80 >Adjust for partial virgin material digging.
CLEANUP -	0% More Time
TIME EFFICIENCY -	60.0% of EWT

PG 9 OF 12: PROJECT TITLES

PG 9...SP COST/MO (1ST) -	\$20,000	Bucket Repair
SP COST/MO (2ND-14TH) -	\$50,000	From Sheet D4
Total	\$70,000	
SPECIAL COST LS (1ST) -	\$52,000	Hydrographic Survey
SP COST LS (2ND-14TH) -	\$0	From Sheet E
Total	\$52,000	

PG 2 OF 12: TYPE OF EST & IND COSTS

TYPE OF EST. -	1 - Planning Estimate (Includes Profit)
CONTRACTOR'S O.H. -	25.0%
CONTRACTOR'S PROFIT -	8.0%
CONTRACTOR'S BOND -	0.8%

PG 6 OF 12: PROJECT TITLES

TUG DESCRIPT. -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	2 mi
SPEED TO D/A -	5 mph (24 min)
SPEED FROM D/A -	5 mph (24 min)
DUMP OR PUMPOUT -	370 min
DISENGAGE TOW -	10 min
AVE. CYCLE TIME -	443 min per trip

PG 10 OF 12: PROJECT TITLES

PG 10....PRESENT YEAR -	2017
ECONOMIC INDEX -	8789
LAF -	1.080
INTEREST RATE -	2.500% /yr
TIME PERIOD -	Jan thru Jun 2017
BUCKET AVAILABILITY -	9 mos/yr
FUEL PRICE -	\$3.25 /gal

PG 3 OF 12: TYPE OF EST & IND COSTS

DREDGING AREA -	4,000,000 SQ. FT.
BANK HEIGHT -	5 ft
REQ'D EXCAVATION -	111,300 cyds
PAY OVERDEPTH -	36,100 cyds
CONTRACT AMOUNT -	147,400 cyds
NOT DREDGED -	17,500 cyds
NET PAY -	129,900 cyds
NONPAY YARDAGE -	0 cyds
GROSS YARDAGE -	129,900 cyds
Non-Pay Calc -	0.0 % of Pay O.D. for NonPay
TOTAL BANK HEIGHT -	5.0 ft

PG 7 OF 12: PROJECT TITLES

TOW EFFICIENCY -	50 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	80 %
% SOLIDS -	90 % (2,160 cy/load)
DREDGES -	1
SCOWS @ DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1

Production Summary

EXCAVATION PRODUCTION -	86 cy/hr (gross)
EXCAVATION EWT -	60.0% (438 hrs/mo)
EXCAVATION TIME -	3.45 months
HAULING PRODUCTION -	293 cy/hr (gross)
HAULING EWT -	50.0% (365 hrs/mo)
HAULING TIME -	1.21 months
DREDGING TIME -	3.45 months
EXCAVAT EWT (ADJUSTED) -	438 hrs/mo (60.0% EWT)
HAULING EWT (ADJUSTED) -	129 hrs/mo (17.7% EWT)
PRODUCTION (GROSS) -	37,668 cy per month
PRODUCTION (CONTRACT) -	37,652 pay cy per month

PG 4 OF 12: TYPE OF EST & IND COSTS

DREDGE SEL. -	10 CY CLAMSHELL
TYPE OF MATERIAL -	Clays and Less-Dense Sand
BUCKET SIZE -	8
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	5.5
BANK FACTOR -	0.91

PG 8 OF 12: PROJECT TITLES

ADDITIONAL SCOWS -	0
TOT SCOWS ON JOB -	2
QTRS ON DREDGE? -	Yes
SURVEY BOAT? -	1
CREW BOAT? -	0

A DESCRIPTION AND QUANTITY SUMMARY

1 PROJECT	<u>Seattle Harbor Dredging</u>	DATE OF ESTIMATE	<u>21 June 2017</u>
2 LOCATION	<u>Astoria OR</u>	INVIT. OR CONTR. NO.	<u>Transload West Waterway - 56'</u>
3 ESTIMATED BY	<u>Callan</u>	CHECKED BY	<u>Checker's Name</u>
4 TYPE OF DREDGE	<u>10 CY CLAMSHELL</u>	TYPE OF ESTIMATE	<u>1 - Planning Estimate (Includes Profit)</u>

3 56' Mechanical Dredge - Transload Facility

5 DESCRIPTION OF WORK

6 EXCAVATION		REMARKS
A. REQUIRED	<u>111,300</u> CY	
B. PAY OVERDEPTH	+ <u>36,100</u> CY	
C. MAX. PAY YARDAGE	= <u>147,400</u> CY	<u>(YARDAGE USED ON BID FORM)</u>
D. O.D. NOT DREDGED	- <u>17,500</u> CY	
E. NET PAY YARDAGE	= <u>129,900</u> CY	<u>(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)</u>
F. NON-PAY YARDAGE	+ <u> </u> CY	<u>% of Pay O.D. for NonPay</u>
G. GROSS YARDAGE	= 129,900 CY	<u>(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)</u>

B	DREDGING COST	BID ITEM # 3	REMARKS
1	GROSS YARDAGE <u>129,900</u> CY		FROM SHEET A, ITEM 6 G.
2	PRODUCTION RATE <u>/ 37,668</u> CY/MO		FROM SHEET C, ITEM 4.
3	DREDGING TIME = <u>3.45</u> MONTHS		129,900 Net Pay CY / 3.450 MO = 37,652 Pay CY/MO
4	TOTAL MONTHLY COST <u>x \$1,040,124</u>		FROM SHEET D, ITEM 5.
	SUBTOTAL.....= <u>\$3,588,428</u>		
5	FIXED COSTS <u>+ \$52,000</u>		FROM SHEET E, ITEM 15.
	SUBTOTAL.....= <u>\$3,640,428</u>		
6	OVERHEAD <u>25.0% + \$910,107</u>		
	SUBTOTAL.....= <u>\$4,550,535</u>		
7	PROFIT <u>8.0% + \$364,043</u>		
	SUBTOTAL.....= <u>\$4,914,578</u>		
8	BOND <u>0.8% + \$39,317</u>		
9	GROSS PRODUCTION COST = <u>\$4,953,895</u>		
10	NET PAY YARDAGE <u>/ 129,900</u> CY		FROM SHEET A, ITEM 6 E.
11	UNIT COST = <u>\$38.14 /CY</u>		
12	MAX PAY YARDAGE <u>x 147,400</u> CY		FROM SHEET A, ITEM 6 C.FROM SHEET A, ITEM 6 C.
13	DREDGING COST = <u>\$5,621,836</u>		

C	MONTHLY PRODUCTION SUMMARY & ADJUSTED OPERATING HOURS	BID ITEM # 3
		REMARKS
1 EXCAVATION TIME	<u>3.45</u> MONTHS	37,668 CY/MO FROM SHEET C \ 1A
2 HAULING TIME	<u>1.21</u> MONTHS	106,945 CY/MO FROM SHEET C \ 2A
3 DREDGING TIME.....>	<u>3.45</u> MONTHS	<u>[Greater of Excavation Time or Hauling Time]</u>
4 PRODUCTION RATE.....>	<u>37,668</u> CY/MO	
5 PRODUCTION RATE.....>	<u>37,668</u> CY/MO	FROM ITEM 4.
6 GROSS PRODUCTION (DREDGE)	<u>/</u> <u>86</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 8.</u>
7 ADJUSTED OPERATING HOURS (DREDGE) =	<u>438</u> HR/MO	<u>DIVIDED BY 730 HRS = 60.0% OF EWT</u>
8 PRODUCTION RATE.....>	<u>37,668</u> CY/MO	FROM ITEM 4.
9 GROSS PRODUCTION (HAULING)	<u>/</u> <u>293</u> CY/HR	<u>FROM SHEET C \ 2B, ITEM 8.</u>
10 ADJUSTED OPERATING HRS (HAULING) =	<u>129</u> HR/MO	<u>DIVIDED BY 730 HRS = 17.7% OF EWT</u>

C \ 1A

EXCAVATION RATE & EXCAVATION TIME

BID ITEM # 3

REMARKS

1 MONTHLY EXCAVATION RATE:

A. DREDGE PRODUCTION	<u>86</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 6.</u>
B. EXCAVATION OPERATING TIME	x <u>438</u> HRS/MO	<u>FROM SHEET C \ 1B, ITEM 7B.</u>
C. EXCAVATION RATE	= <u>37,668</u> CY/MO	

REMARKS

2 EXCAVATION TIME:

A. GROSS CUBIC YARDS	<u>129,900</u> CY (GROSS)	<u>FROM SHEET A, ITEM 6G.</u>
B. EXCAVATION RATE	/ <u>37,668</u> CY/MO	<u>FROM ITEM 1C.</u>
C. EXCAVATION TIME	= <u>3.45</u> MONTHS	

C \ 1B

**DREDGE PRODUCTION & EXCAVATION
OPERATING TIME**

BID ITEM # 3

1 SIZE OF DREDGE	<u>10 CY CLAMSHELL</u>	REMARKS
2 CYCLE RATE	<u>0.35</u> Buckets/Min <u>(60 SECONDS PER MIN / 170 SECONDS PER CYCLE)</u>	
	x <u>60</u> MIN/HR	
3 BUCKET SIZE	x <u>8</u> CY	
A. BUCKET FILL FACTOR	x <u>0.70</u>	<u>(WORKING CAPACITY = 5.60 CY/BUCKET)</u>
B. BANK FACTOR	x <u>0.91</u>	<u>(based on 5.0 Ft of Bank Height)</u>
C. OTHER FACTOR	x <u>0.80</u>	<u>>Adjust for partial virgin material digging.</u>
D. CLEANUP FACTOR	x <u>1</u>	<u>ADDITIONAL TIME</u>
4 PRODUCTION PER DREDGE	= <u>86</u> CY/HR	
5 NUMBER OF DREDGES	x <u>1</u>	
6 GROSS PRODUCTION	= <u>86</u> CY/HR	
REMARKS		
7 EXCAVATION OPERATING TIME:		
A. TIME EFFICIENCY	<u>60.0%</u>	<u>% OF EWT WITHOUT MAJOR WAITS FOR SCOWS</u>
	x <u>730</u> HRS/MO	
B. EXCAVATION OPERATING TIME	= <u>438</u> HRS/MO	

C \ 2A

HAULING RATE & HAULING TIME

BID ITEM # 3

REMARKS

1 MONTHLY HAULING RATE:

A. HAULING PRODUCTION 293 CY/HR FROM SHEET C \ 2B, ITEM 8.

B. HAULING OPERATING TIME x 365 HRS/MO FROM SHEET C \ 2B, ITEM 9B.

C. HAULING RATE = 106,945 CY/MO

REMARKS

2 HAULING TIME:

A. GROSS CUBIC YARDS 129,900 CY (Gross) FROM SHEET A, ITEM 6G.

B. HAULING RATE / 106,945 CY/MO FROM ITEM 1C.

C. HAULING TIME = 1.21 MONTHS

C \ 2B	HAULING PRODUCTION & HAULING OPERATING TIME	BID ITEM # 3
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		REMARKS
1 SIZE OF SCOW	_____ 3,000 CY	_____
A. CAPACITY	x _____ 0.8	_____
B. USEABLE VOLUME	= _____ 2,400 CY	_____
C. SLURRY DENSITY	x _____ 0.9	_____
2 AVERAGE VOLUME HAULED	= _____ 2,160 CY/SCOW	_____
3 SCOWS PER TOWING VESSEL	x _____ 1	_____
4 AVERAGE VOLUME HAULED	= _____ 2,160 CY/TRIP	_____
5 AVERAGE CYCLE TIME	/ _____ 443 MIN/TRIP	FROM SHEET C \ 2C, ITEM 3.
	x _____ 60 MIN/HR	_____
6 PRODUCTION PER TOWING VESSEL	= _____ 293 CY/HR	_____
7 NUMBER OF TOWING VESSELS	x _____ 1	_____
8 HAULING PRODUCTION	= _____ 293 CY/HR	_____

		REMARKS
9 HAULING OPERATING TIME:		_____
A. TIME EFFICIENCY	_____ 50.0%	% OF EWT WITHOUT WAITING FOR DREDGE(S)
	x _____ 730 HRS/MO	_____
B. HAULING OPERATING TIME	= _____ 365 HRS/MO	_____

C \ 2C	HAULING CYCLE TIME	BID ITEM # 3
1 SIZE OF TUG	<u>3000 HP Diesel--Twin Screw</u>	
2 CYCLE TIME PER TRIP:		REMARKS
A. PREPARE FOR SCOW TOW	<u>15 MIN</u>	
B. TO DISPOSAL AREA	+ <u>24 MIN</u>	<u>2 miles / 5.0 miles per hr x 60 min</u>
C. DUMPING OR PUMPOUT	+ <u>370 MIN</u>	<u>Offload</u>
D. FROM DISPOSAL AREA	+ <u>24 MIN</u>	<u>2 miles / 5.0 miles per hr x 60 min</u>
E. DISENGAGE TOW RIGGING AND TIE UP SCOW	+ <u>10 MIN</u>	
3 AVERAGE CYCLE TIME	= <u>443 MIN/TRIP</u>	

D		MONTHLY COST SUMMARY		BID ITEM # 3	
DREDGE SIZE 10 CY CLAMSHELL		REMARKS			
1	LABOR COSTS (D1)	\$676,297 /MO			
2	EXCAVATION (D2)		Ownership	Fuel	WLS Maintenance Repair
A.	DREDGE(S)	+ \$70,467 /MO (1 ea)	\$3,466	+ \$44,562	+ \$22,439
B.	WORK TUG(S)	+ \$14,331 /MO (1 ea)	\$928	+ \$7,796	+ \$5,607
C.	CREW/SURVEY TUG	+ \$13,870 /MO (1 ea)	\$555	+ \$8,629	+ \$4,686
D.	DERRICK(S)	+ \$4,113 /MO (1 ea)	\$797	+ \$1,958	+ \$1,358
E.	FUEL/WATER BARGE	+ \$1,424 /MO (1 ea)	\$618	+ \$158	+ \$648
F.	WORK BARGE(S)	+ \$817 /MO (1 ea)	\$410		+ \$407
H.	**Unused**				
I.	**Unused**				
3	HAULING				
A.	TOWING VESSEL(S)	+ \$125,931 /MO (1 ea)	\$31,600	+ \$61,505	+ \$32,826
B.	SCOW(S)	+ \$62,874 /MO (2 ea)	\$17,030	+ \$13,052	+ \$32,792
	Equip TOTALS----->	\$293,827 /MO	\$55,404	+ \$137,660	+ \$100,763
4	OTHER MONTHLY COSTS (D3)	+ \$70,000 /MO	FROM SHEET D \ 3		
5	TOTAL MONTHLY COST	= \$1,040,124			

Equipment Price Breakdown

	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8. Hourly Fuel	\$101.74	\$17.80	\$19.70	\$4.47	\$0.36			
x 1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
- 8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
Operating/Materials/Maintenance/Wear	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

Each	1	1	1	1	1	1		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
Operating/Materials/Maintenance/Wear/Repair	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

	Towing Vessel	Dump Scow
7b. Monthly Ownership:	\$31,600.00	\$8,515.00
8a. (1) Hrly Pr Eng Fuel:	\$438.75	
8a. (2) Hrly 2nd Eng Fuel:	\$38.03	\$8.94
8. Hourly Fuel	\$476.78	\$8.94
x 1j. Hrs Worked/Mo.....	129	730
Monthly Fuel:	\$61,504.62	\$6,526.20
- 8e. Monthly Operating:	\$94,331	\$22,922
Operating/Materials/Maintenance/Wear	\$32,826.38	\$16,395.80

Each	1	2
7b. Monthly Ownership:	\$31,600.00	\$17,030.00
Monthly Fuel:	\$61,504.62	\$13,052.40
Operating/Materials/Maintenance/Wear	\$32,826.38	\$32,791.60

D \ 1	LABOR COSTS	BID ITEM #	3
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DREDGE SIZE: 10 CY CLAMSHELL

Adjustments, Taxes and Insurance		Monthly Management Cost	
Overtime	14.29%	1	CAPTAIN \$6,147
Holiday 7 Days/Yr	1.92%	1	CHIEF ENG \$6,290
Vacation	8.00%	1	CIVIL ENG \$7,012
COMPOSITE.....	24.21%	1	OFFICE HELP \$2,439
			\$21,888
Social Security Tax	7.65%		
Workman's Compensation	45.00%		
State Unemployment Comp.	3.50%		
Federal Unemployment Comp.	1.00%		
COMPOSITE.....	57.15%		

Each Crew Position is Manned:	8 Hrs per Day
	x 7 Days per Week
	= 56 Hrs per Week
	x 4.345 Wks per Month
	= 243 Hrs per Month

Last Update...Mar 15

EA	CREW POSITION	O.T.		SUB-TOTAL	TAXES INSUR 57.15%	SUB-TOTAL	FRINGE BENEFITS \$17.40	HRLY COST	HOURS PER MONTH	MONTHLY COST
		BASIC HOURLY WAGE	VACATION & HOLIDAY 24.21%							
3	Operators (Dredge)	\$38.39	+ \$9.29	= \$47.68	+ \$27.25	= \$74.93	+ \$17.40	= \$92.33	x 730	= \$67,401
3	Engineers (Dredge)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 730	= 67,401
3	Mates (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 730	= 65,919
4	Launchmen (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 973	= 87,862
4	Deckhands (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 973	= 85,176
1	Cook (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943
1	Messman (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272
1	Launchmen (Survey)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943
1	Deckhands (Survey)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272
	Launchmen (Crew BT)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x	=
	Deckhands (Crew BT)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x	=
1	Tug Master (Tow Tug)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 243	= 22,436
2	Mates (Tow Tug)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 487	= 43,976
3	Deckhands (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904
3	Scowmen (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904
30	Total Crew									
										Labor Adjustment factor (risk analysis) 1
										MONTHLY CREW LABOR COST = \$654,409
										(Average Gross Wage = \$89.67 per manhour)
										TOTAL MONTHLY LABOR COST = \$676,297

D/2 EQUIPMENT COST

	Excavation							
	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work	**Unused**	**Unused**
1a. Plant Description.....								
1c. Prime Eng HP.....	625	100	100	100				
1d. (1) Dredge El Gen HP....	50	--	--	--	--	--	--	--
1d. Total 2nd Eng HP.....	210	25	40	25	10			
1e. Plant Value.....	\$370,000	\$67,000	\$42,000	\$127,000	\$95,000	\$63,000		
1f. Acquis Year.....	1995	1992	1997	1990	1990	1990		
1g. Pres Year.....	2017	2017	2017	2017	2017	2017	2017	2017
1h. Cost of Money Rate.....	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%
1i. Disc Money Rate:	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%
1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
2a. LAF.....	1.080	1.08	1.08	1.08	1.08	1.08	1.08	1.08
2b. Fuel Cost per Gal.....	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25
3a. Ec Index <for Acq Yr>..	5036	4679	5429	4271	4271	4271		
3b. Ec Index <for 2017>....	8789	8789	8789	8789	8789	8789	8789	8789
4a. Mos Available/Year.....	9	9	9	9	9	9	9	9
5a. Useful Life (in Yrs)...	13	8	8	20	20	20		
5b. Physical Life (in Hrs).	26,000	18,000	16,000	90,000	90,000	90,000		
5c. SLV Factor.....	0.05	0.10	0.15	0.10	0.05	0.05		
5d. Pr Eng Fuel Factor.....	0.039	0.045	0.045	0.011	0.011	0.011		
5e. 2nd Eng Fuel Factor....	0.033	0.039	0.039	0.011	0.011	0.011		
5f. WLS Factor.....	0.24	0.38	0.38	0.20	0.20	0.20		
5g. RPR Factor.....	1.00	0.80	0.70	0.70	0.60	0.60		
6a. Depreciation:	7.31%	11.25%	10.63%	4.50%	4.75%	4.75%		
6b. FCCM:	1.12%	1.21%	1.26%	1.15%	1.10%	1.10%		
6c. Total Ownership/Year:	8.43%	12.46%	11.89%	5.65%	5.85%	5.85%		
7a. Yearly Ownership:	\$31,191	\$8,348	\$4,994	\$7,176	\$5,558	\$3,686		
7b. Monthly Ownership:	\$3,466	\$928	\$555	\$797	\$618	\$410		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8b. (1) Hrly Pr Eng WLS:	\$19.01	\$5.56	\$5.56	\$0.72				
8b. (2) Hrly 2nd Eng WLS:	\$5.40	\$1.20	\$1.93	\$0.18	\$0.07			
8c. (1) EAF:	1.745	1.878	1.619	2.058	2.058	2.058		
8c. (2) Hrly Repair:	\$26.82	\$6.04	\$3.21	\$2.20	\$1.41	\$0.93		
8d. Total Hrly Operating:	\$152.97	\$30.60	\$30.40	\$7.57	\$1.84	\$0.93		
8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
11. MONTHLY RATE:	\$70,467	\$14,331	\$13,870	\$4,113	\$1,424	\$817		
12a. HRLY STANDBY ALLOW:	\$4.75	\$1.27	\$0.76	\$1.09	\$0.85	\$0.56		
12b. Gener Fuel Allowance:	\$5.36	--	--	--	--	--	--	--
12c. DREDGE HRLY STANDBY:	\$10.11	--	--	--	--	--	--	--

Hauling		
Towing	Dump Scow	Disposal Transport
Twin Screw	3,000 CY Capacity	Twin Screw
	Split Hull Scow	
3000		3000
300	250	300
\$6,000,000	\$1,310,000	\$6,000,000
2009	1992	2009
2017	2017	2017
2.5	2.500%	2.500%
0.02	2.000%	2.000%
129	730	730
1.08	1.08	1.08
3.25	\$3.25	\$3.25
8789	0.011	20
7773	4679	7773
9	9	9
25	20	25
120,000	90,000	120,000
0.10	0.05	0.10
0.045	0.011	0.045
0.039	0.011	0.039
0.38	0.20	0.38
1.20	0.70	1.20
3.60%	4.75%	3.60%
1.14%	1.10%	1.14%
4.74%	5.85%	4.74%
\$284,400	\$76,635	\$284,400
\$31,600	\$8,515	\$31,600
\$438.75		\$438.75
\$38.03	\$8.94	\$38.03
\$166.73		\$166.73
\$14.45	\$1.79	\$14.45
1.131	1.878	1.131
\$73.29	\$20.67	\$73.29
\$731.25	\$31.40	\$731.25
\$94,331	\$22,922	\$533,813
\$125,931	\$31,437	\$565,413
\$43.29	\$11.66	\$43.29

D \ 3 OTHER MONTHLY COSTS

BID ITEM # 3

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Bucket Repair Water Quality		\$20,000 /MO	
2	Monitoring	+	\$50,000 /MO	
3	>	+	\$0 /MO	
4	>	+	\$0 /MO	
5	>	+	\$0 /MO	
6	>	+	\$0 /MO	
7	>	+	\$0 /MO	
8	>	+	\$0 /MO	
9	>	+	\$0 /MO	
10	>	+	\$0 /MO	
11	>	+	\$0 /MO	
12	>	+	\$0 /MO	
13	>	+	\$0 /MO	
14	>	+	\$0 /MO	
15 TOTAL OTHER MONTHLY COSTS =				\$70,000 /MO

E FIXED COSTS

BID ITEM # 3

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Hydrographic Survey		\$52,000	
2	>	+	\$0	
3	>	+	\$0	
4	>	+	\$0	
5	>	+	\$0	
6	>	+	\$0	
7	>	+	\$0	
8	>	+	\$0	
9	>	+	\$0	
10	>	+	\$0	
11	>	+	\$0	
12	>	+	\$0	
13	>	+	\$0	
14	>	+	\$0	

15 FIXED COSTS = \$52,000

MOBIL & DEMOB COST:		Seattle Harbor Dredging	BID QUANTITY	546,200 C.Y.		
EXCAV. COST.	\$8,214,848		UNIT COST...	\$15.04 PER C.Y.	TIME.....	5.12 MONTHS

PG 1 OF 12: PROJECT TITLES

PROJECT -	Seattle Harbor Dredging
LOCATION -	Astoria OR
INVIT # -	Open West Waterway - 56'
DATE OF EST. -	21 June 2017
EST. BY -	Callan
MOB. BID ITEM # -	1
EXCAV. BID ITEM # -	2

PG 5 OF 12: PROJECT TITLES

PG 5.....BUCKET CYCLE -	70 Seconds
OTHER FACTOR -	0.80 >Adjust for partial virgin materia digging.
CLEANUP -	0% More Time
TIME EFFICIENCY -	60.0% of EWT

PG 9 OF 12: PROJECT TITLES

PG 9...SP COST/MO (1ST) -	\$20,000	Bucket Repair
SP COST/MO (2ND-14TH) -	\$50,000	From Sheet D4
Total	\$70,000	
SPECIAL COST LS (1ST) -	\$52,000	Hydrographic Survey
SP COST LS (2ND-14TH) -	\$0	From Sheet E
Total	\$52,000	

PG 2 OF 12: TYPE OF EST & IND COSTS

TYPE OF EST. -	1 - Planning Estimate (Includes Profit)
CONTRACTOR'S O.H. -	25.0%
CONTRACTOR'S PROFIT -	8.0%
CONTRACTOR'S BOND -	0.8%

PG 6 OF 12: PROJECT TITLES

TUG DESCRIPT. -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	4 mi
SPEED TO D/A -	7 mph (34 min)
SPEED FROM D/A -	7 mph (34 min)
DUMP OR PUMPOUT -	10 min
DISENGAGE TOW -	10 min
AVE. CYCLE TIME -	103 min per trip

PG 10 OF 12: PROJECT TITLES

PG 10....PRESENT YEAR -	2017
ECONOMIC INDEX -	8789
LAF -	1.080
INTEREST RATE -	2.500% /yr
TIME PERIOD -	Jan thru Jun 2017
BUCKET AVAILABILITY -	9 mos/yr
FUEL PRICE -	\$3.25 /gal

PG 3 OF 12: TYPE OF EST & IND COSTS

DREDGING AREA -	4,000,000 SQ. FT.
BANK HEIGHT -	5 ft
REQ'D EXCAVATION -	401,000 cyds
PAY OVERDEPTH -	145,200 cyds
CONTRACT AMOUNT -	546,200 cyds
NOT DREDGED -	75,000 cyds
NET PAY -	471,200 cyds
NONPAY YARDAGE -	0 cyds
GROSS YARDAGE -	471,200 cyds
Non-Pay Calc -	0.0 % of Pay O.D. for NonPay
TOTAL BANK HEIGHT -	5.0 ft

PG 7 OF 12: PROJECT TITLES

TOW EFFICIENCY -	70 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	80 %
% SOLIDS -	90 % (2,160 cy/load)
DREDGES -	1
SCOWS @ DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1

Production Summary

EXCAVATION PRODUCTION -	210 cy/hr (gross)
EXCAVATION EWT -	60.0% (438 hrs/mo)
EXCAVATION TIME -	5.12 months
HAULING PRODUCTION -	1258 cy/hr (gross)
HAULING EWT -	70.0% (511 hrs/mo)
HAULING TIME -	0.73 months
DREDGING TIME -	5.12 months
EXCAVAT EWT (ADJUSTED) -	438 hrs/mo (60.0% EWT)
HAULING EWT (ADJUSTED) -	73 hrs/mo (10.0% EWT)
PRODUCTION (GROSS) -	91,980 cy per month
PRODUCTION (CONTRACT) -	91,980 pay cy per month

PG 4 OF 12: TYPE OF EST & IND COSTS

DREDGE SEL. -	10 CY CLAMSHELL
TYPE OF MATERIAL -	Clays and Less-Dense Sand
BUCKET SIZE -	8
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	5.5
BANK FACTOR -	0.91

PG 8 OF 12: PROJECT TITLES

ADDITIONAL SCOWS -	0.25
TOT SCOWS ON JOB -	2.25
QTRS ON DREDGE? -	Yes
SURVEY BOAT? -	1
CREW BOAT? -	0

A DESCRIPTION AND QUANTITY SUMMARY

1 PROJECT	<u>Seattle Harbor Dredging</u>	DATE OF ESTIMATE	<u>21 June 2017</u>
2 LOCATION	<u>Astoria OR</u>	INVIT. OR CONTR. NO.	<u>Open West Waterway - 56'</u>
3 ESTIMATED BY	<u>Callan</u>	CHECKED BY	<u>Checker's Name</u>
4 TYPE OF DREDGE	<u>10 CY CLAMSHELL</u>	TYPE OF ESTIMATE	<u>1 - Planning Estimate (Includes Profit)</u>

2 56' Mechanical Dredge - Open Water

5 DESCRIPTION OF WORK

6 EXCAVATION		REMARKS
A. REQUIRED	<u>401,000</u> CY	
B. PAY OVERDEPTH	+ <u>145,200</u> CY	
C. MAX. PAY YARDAGE	= <u>546,200</u> CY	<u>(YARDAGE USED ON BID FORM)</u>
D. O.D. NOT DREDGED	- <u>75,000</u> CY	
E. NET PAY YARDAGE	= <u>471,200</u> CY	<u>(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)</u>
F. NON-PAY YARDAGE	+ _____ CY	<u>% of Pay O.D. for NonPay</u>
G. GROSS YARDAGE	= 471,200 CY	<u>(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)</u>

B		DREDGING COST	BID ITEM # 2
			REMARKS
1	GROSS YARDAGE	<u>471,200</u> CY	<u>FROM SHEET A, ITEM 6 G.</u>
2	PRODUCTION RATE	<u>/ 91,980</u> CY/MO	<u>FROM SHEET C, ITEM 4.</u>
3	DREDGING TIME	= <u>5.12</u> MONTHS	<u>471,200 Net Pay CY / 5.120 MO = 91,980 Pay CY/MO</u>
4	TOTAL MONTHLY COST	<u>x \$1,007,033</u>	<u>FROM SHEET D, ITEM 5.</u>
	SUBTOTAL.....=	<u>\$5,156,009</u>	
5	FIXED COSTS	<u>+ \$52,000</u>	<u>FROM SHEET E, ITEM 15.</u>
	SUBTOTAL.....=	<u>\$5,208,009</u>	
6	OVERHEAD	<u>25.0% + \$1,302,002</u>	
	SUBTOTAL.....=	<u>\$6,510,011</u>	
7	PROFIT	<u>8.0% + \$520,801</u>	
	SUBTOTAL.....=	<u>\$7,030,812</u>	
8	BOND	<u>0.8% + \$56,246</u>	
9	GROSS PRODUCTION COST	= <u>\$7,087,058</u>	
10	NET PAY YARDAGE	<u>/ 471,200</u> CY	<u>FROM SHEET A, ITEM 6 E.</u>
11	UNIT COST	= <u>\$15.04 /CY</u>	
12	MAX PAY YARDAGE	<u>x 546,200</u> CY	<u>FROM SHEET A, ITEM 6 C.FROM SHEET A, ITEM 6 C.</u>
13	DREDGING COST	= <u>\$8,214,848</u>	

C	MONTHLY PRODUCTION SUMMARY & ADJUSTED OPERATING HOURS	BID ITEM # 2
		REMARKS
1 EXCAVATION TIME	<u>5.12</u> MONTHS	91,980 CY/MO FROM SHEET C \ 1A
2 HAULING TIME	<u>0.73</u> MONTHS	642,838 CY/MO FROM SHEET C \ 2A
3 DREDGING TIME.....>	<u>5.12</u> MONTHS	<u>[Greater of Excavation Time or Hauling Time]</u>
4 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	
5 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	FROM ITEM 4.
6 GROSS PRODUCTION (DREDGE)	<u>/</u> <u>210</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 8.</u>
7 ADJUSTED OPERATING HOURS (DREDGE) =	<u>438</u> HR/MO	<u>DIVIDED BY 730 HRS = 60.0% OF EWT</u>
8 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	FROM ITEM 4.
9 GROSS PRODUCTION (HAULING)	<u>/</u> <u>1258</u> CY/HR	<u>FROM SHEET C \ 2B, ITEM 8.</u>
10 ADJUSTED OPERATING HRS (HAULING) =	<u>73</u> HR/MO	<u>DIVIDED BY 730 HRS = 10.0% OF EWT</u>

C \ 1A

EXCAVATION RATE & EXCAVATION TIME

BID ITEM # 2

REMARKS

1 MONTHLY EXCAVATION RATE:

A. DREDGE PRODUCTION	<u>210</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 6.</u>
B. EXCAVATION OPERATING TIME	x <u>438</u> HRS/MO	<u>FROM SHEET C \ 1B, ITEM 7B.</u>
C. EXCAVATION RATE	= <u>91,980</u> CY/MO	

REMARKS

2 EXCAVATION TIME:

A. GROSS CUBIC YARDS	<u>471,200</u> CY (GROSS)	<u>FROM SHEET A, ITEM 6G.</u>
B. EXCAVATION RATE	/ <u>91,980</u> CY/MO	<u>FROM ITEM 1C.</u>
C. EXCAVATION TIME	= <u>5.12</u> MONTHS	

C \ 1B

**DREDGE PRODUCTION & EXCAVATION
OPERATING TIME**

BID ITEM # 2

1 SIZE OF DREDGE	<u>10 CY CLAMSHELL</u>	REMARKS
2 CYCLE RATE	<u>0.86</u> Buckets/Min	<u>(60 SECONDS PER MIN / 70 SECONDS PER CYCLE)</u>
	x <u>60</u> MIN/HR	_____
3 BUCKET SIZE	x <u>8</u> CY	_____
A. BUCKET FILL FACTOR	x <u>0.70</u>	<u>(WORKING CAPACITY = 5.60 CY/BUCKET)</u>
B. BANK FACTOR	x <u>0.91</u>	<u>(based on 5.0 Ft of Bank Height)</u>
C. OTHER FACTOR	x <u>0.80</u>	<u>>Adjust for partial virgin materia digging.</u>
D. CLEANUP FACTOR	x <u>1</u>	<u>ADDITIONAL TIME</u>
4 PRODUCTION PER DREDGE	= <u>210</u> CY/HR	_____
5 NUMBER OF DREDGES	x <u>1</u>	_____
6 GROSS PRODUCTION	= <u>210</u> CY/HR	_____

		REMARKS
7 EXCAVATION OPERATING TIME:		_____
A. TIME EFFICIENCY	<u>60.0%</u>	<u>% OF EWT WITHOUT MAJOR WAITS FOR SCOWS</u>
	x <u>730</u> HRS/MO	_____
B. EXCAVATION OPERATING TIME	= <u>438</u> HRS/MO	_____

C \ 2A

HAULING RATE & HAULING TIME

BID ITEM # 2

REMARKS

1 MONTHLY HAULING RATE:

A. HAULING PRODUCTION 1,258 CY/HR FROM SHEET C \ 2B, ITEM 8.

B. HAULING OPERATING TIME x 511 HRS/MO FROM SHEET C \ 2B, ITEM 9B.

C. HAULING RATE = 642,838 CY/MO

REMARKS

2 HAULING TIME:

A. GROSS CUBIC YARDS 471,200 CY (Gross) FROM SHEET A, ITEM 6G.

B. HAULING RATE / 642,838 CY/MO FROM ITEM 1C.

C. HAULING TIME = 0.73 MONTHS

C \ 2B	HAULING PRODUCTION & HAULING OPERATING TIME	BID ITEM # 2
--------	--	--------------

		REMARKS
1 SIZE OF SCOW	_____ 3,000 CY	_____
A. CAPACITY	x _____ 0.8	_____
B. USEABLE VOLUME	= _____ 2,400 CY	_____
C. SLURRY DENSITY	x _____ 0.9	_____
2 AVERAGE VOLUME HAULED	= _____ 2,160 CY/SCOW	_____
3 SCOWS PER TOWING VESSEL	x _____ 1	_____
4 AVERAGE VOLUME HAULED	= _____ 2,160 CY/TRIP	_____
5 AVERAGE CYCLE TIME	/ _____ 103 MIN/TRIP	FROM SHEET C \ 2C, ITEM 3.
	x _____ 60 MIN/HR	_____
6 PRODUCTION PER TOWING VESSEL	= _____ 1,258 CY/HR	_____
7 NUMBER OF TOWING VESSELS	x _____ 1	_____
8 HAULING PRODUCTION	= _____ 1,258 CY/HR	_____

		REMARKS
9 HAULING OPERATING TIME:		_____
A. TIME EFFICIENCY	_____ 70.0%	% OF EWT WITHOUT WAITING FOR DREDGE(S)
	x _____ 730 HRS/MO	_____
B. HAULING OPERATING TIME	= _____ 511 HRS/MO	_____

C \ 2C	HAULING CYCLE TIME	BID ITEM # 2
1 SIZE OF TUG	3000 HP Diesel--Twin Screw	
2 CYCLE TIME PER TRIP:		REMARKS
A. PREPARE FOR SCOW TOW	15 MIN	
B. TO DISPOSAL AREA	+ 34 MIN	4 miles / 7.0 miles per hr x 60 min
C. DUMPING OR PUMPOUT	+ 10 MIN	Dump
D. FROM DISPOSAL AREA	+ 34 MIN	4 miles / 7.0 miles per hr x 60 min
E. DISENGAGE TOW RIGGING AND TIE UP SCOW	+ 10 MIN	
3 AVERAGE CYCLE TIME	= 103 MIN/TRIP	

D		MONTHLY COST SUMMARY		BID ITEM # 2	
DREDGE SIZE 10 CY CLAMSHELL		REMARKS			
1	LABOR COSTS (D1)	<u>\$676,297</u> /MO			
2	EXCAVATION (D2)		Ownership	Fuel	WLS Maintenance Repair
A.	DREDGE(S)	+ <u>\$70,467</u> /MO (1 ea)	<u>\$3,466</u>	+ <u>\$44,562</u>	+ <u>\$22,439</u>
B.	WORK TUG(S)	+ <u>\$14,331</u> /MO (1 ea)	<u>\$928</u>	+ <u>\$7,796</u>	+ <u>\$5,607</u>
C.	CREW/SURVEY TUG	+ <u>\$13,870</u> /MO (1 ea)	<u>\$555</u>	+ <u>\$8,629</u>	+ <u>\$4,686</u>
D.	DERRICK(S)	+ <u>\$4,113</u> /MO (1 ea)	<u>\$797</u>	+ <u>\$1,958</u>	+ <u>\$1,358</u>
E.	FUEL/WATER BARGE	+ <u>\$1,424</u> /MO (1 ea)	<u>\$618</u>	+ <u>\$158</u>	+ <u>\$648</u>
F.	WORK BARGE(S)	+ <u>\$817</u> /MO (1 ea)	<u>\$410</u>		+ <u>\$407</u>
H.	**Unused**	+ _____		+ _____	
I.	**Unused**	+ _____		+ _____	
3	HAULING				
A.	TOWING VESSEL(S)	+ <u>\$84,981</u> /MO (1 ea)	<u>\$31,600</u>	+ <u>\$34,805</u>	+ <u>\$18,576</u>
B.	SCOW(S)	+ <u>\$70,733</u> /MO (2 ea)	<u>\$19,159</u>	+ <u>\$14,684</u>	+ <u>\$36,891</u>
	Equip TOTALS----->	<u>\$260,736</u> /MO	<u>\$57,533</u>	+ <u>\$112,592</u>	+ <u>\$90,612</u>
4	OTHER MONTHLY COSTS (D3)	+ <u>\$70,000</u> /MO	FROM SHEET D \ 3		
5	TOTAL MONTHLY COST	= <u>\$1,007,033</u>			

Equipment Price Breakdown

	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8. Hourly Fuel	\$101.74	\$17.80	\$19.70	\$4.47	\$0.36			
x 1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
- 8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
Operating/Materials/Maintenance/Wear	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

Each	1	1	1	1	1	1		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
Operating/Materials/Maintenance/Wear/Repair	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

	Towing Vessel	Dump Scow
7b. Monthly Ownership:	\$31,600.00	\$8,515.00
8a. (1) Hrly Pr Eng Fuel:	\$438.75	
8a. (2) Hrly 2nd Eng Fuel:	\$38.03	\$8.94
8. Hourly Fuel	\$476.78	\$8.94
x 1j. Hrs Worked/Mo.....	73	730
Monthly Fuel:	\$34,804.94	\$6,526.20
- 8e. Monthly Operating:	\$53,381	\$22,922
Operating/Materials/Maintenance/Wear	\$18,576.06	\$16,395.80

Each	1	2.25
7b. Monthly Ownership:	\$31,600.00	\$19,158.75
Monthly Fuel:	\$34,804.94	\$14,683.95
Operating/Materials/Maintenance/Wear	\$18,576.06	\$36,890.55

D \ 1	LABOR COSTS	BID ITEM #	2
-------	-------------	------------	---

DREDGE SIZE: 10 CY CLAMSHELL

Adjustments, Taxes and Insurance		Monthly Management Cost	
Overtime	14.29%	1	CAPTAIN \$6,147
Holiday 7 Days/Yr	1.92%	1	CHIEF ENG \$6,290
Vacation	8.00%	1	CIVIL ENG \$7,012
COMPOSITE.....	24.21%	1	OFFICE HELP \$2,439
			<u>\$21,888</u>
Social Security Tax	7.65%		
Workman's Compensation	45.00%		
State Unemployment Comp.	3.50%		
Federal Unemployment Comp.	1.00%		
COMPOSITE.....	57.15%		

Each Crew Position is Manned:	8 Hrs per Day
	x 7 Days per Week
=	56 Hrs per Week
	x 4.345 Wks per Month
=	243 Hrs per Month

Last Update...Mar 15

EA	CREW POSITION	O.T.		SUB-TOTAL	TAXES INSUR 57.15%	SUB-TOTAL	FRINGE BENEFITS \$17.40	HRLY COST	HOURS PER MONTH	MONTHLY COST	
		BASIC HOURLY WAGE	VACATION & HOLIDAY 24.21%								
3	Operators (Dredge)	\$38.39	+ \$9.29	= \$47.68	+ \$27.25	= \$74.93	+ \$17.40	= \$92.33	x 730	= \$67,401	
3	Engineers (Dredge)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 730	= 67,401	
3	Mates (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 730	= 65,919	
4	Launchmen (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 973	= 87,862	
4	Deckhands (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 973	= 85,176	
1	Cook (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943	
1	Messman (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272	
1	Launchmen (Survey)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943	
1	Deckhands (Survey)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272	
	Launchmen (Crew BT)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x	=	
	Deckhands (Crew BT)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x	=	
1	Tug Master (Tow Tug)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 243	= 22,436	
2	Mates (Tow Tug)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 487	= 43,976	
3	Deckhands (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904	
3	Scowmen (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904	
30	Total Crew	Labor Adjustment factor (risk analysis) 1								MONTHLY CREW LABOR COST =	\$654,409
									(Average Gross Wage =	\$89.67 per manhour)	

TOTAL MONTHLY LABOR COST = \$676,297

D/2 EQUIPMENT COST

	Excavation							
	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work	**Unused**	**Unused**
1a. Plant Description.....								
1c. Prime Eng HP.....	625	100	100	100				
1d. (1) Dredge El Gen HP....	50	--	--	--	--	--	--	--
1d. Total 2nd Eng HP.....	210	25	40	25	10			
1e. Plant Value.....	\$370,000	\$67,000	\$42,000	\$127,000	\$95,000	\$63,000		
1f. Acquis Year.....	1995	1992	1997	1990	1990	1990		
1g. Pres Year.....	2017	2017	2017	2017	2017	2017	2017	2017
1h. Cost of Money Rate.....	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%
1i. Disc Money Rate:	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%
1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
2a. LAF.....	1.080	1.08	1.08	1.08	1.08	1.08	1.08	1.08
2b. Fuel Cost per Gal.....	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25
3a. Ec Index <for Acq Yr>..	5036	4679	5429	4271	4271	4271		
3b. Ec Index <for 2017>....	8789	8789	8789	8789	8789	8789	8789	8789
4a. Mos Available/Year.....	9	9	9	9	9	9	9	9
5a. Useful Life (in Yrs)...	13	8	8	20	20	20		
5b. Physical Life (in Hrs).	26,000	18,000	16,000	90,000	90,000	90,000		
5c. SLV Factor.....	0.05	0.10	0.15	0.10	0.05	0.05		
5d. Pr Eng Fuel Factor.....	0.039	0.045	0.045	0.011	0.011	0.011		
5e. 2nd Eng Fuel Factor....	0.033	0.039	0.039	0.011	0.011	0.011		
5f. WLS Factor.....	0.24	0.38	0.38	0.20	0.20	0.20		
5g. RPR Factor.....	1.00	0.80	0.70	0.70	0.60	0.60		
6a. Depreciation:	7.31%	11.25%	10.63%	4.50%	4.75%	4.75%		
6b. FCCM:	1.12%	1.21%	1.26%	1.15%	1.10%	1.10%		
6c. Total Ownership/Year:	8.43%	12.46%	11.89%	5.65%	5.85%	5.85%		
7a. Yearly Ownership:	\$31,191	\$8,348	\$4,994	\$7,176	\$5,558	\$3,686		
7b. Monthly Ownership:	\$3,466	\$928	\$555	\$797	\$618	\$410		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8b. (1) Hrly Pr Eng WLS:	\$19.01	\$5.56	\$5.56	\$0.72				
8b. (2) Hrly 2nd Eng WLS:	\$5.40	\$1.20	\$1.93	\$0.18	\$0.07			
8c. (1) EAF:	1.745	1.878	1.619	2.058	2.058	2.058		
8c. (2) Hrly Repair:	\$26.82	\$6.04	\$3.21	\$2.20	\$1.41	\$0.93		
8d. Total Hrly Operating:	\$152.97	\$30.60	\$30.40	\$7.57	\$1.84	\$0.93		
8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
11. MONTHLY RATE:	\$70,467	\$14,331	\$13,870	\$4,113	\$1,424	\$817		
12a. HRLY STANDBY ALLOW:	\$4.75	\$1.27	\$0.76	\$1.09	\$0.85	\$0.56		
12b. Gener Fuel Allowance:	\$5.36	--	--	--	--	--	--	--
12c. DREDGE HRLY STANDBY:	\$10.11	--	--	--	--	--	--	--

Hauling		
Towing	Dump Scow	Disposal Transport
Twin Screw	3,000 CY Capacity	Twin Screw
	Split Hull Scow	
3000		3000
300	250	300
\$6,000,000	\$1,310,000	\$6,000,000
2009	1992	2009
2017	2017	2017
2.5	2.500%	2.500%
0.02	2.000%	2.000%
73	730	730
1.08	1.08	1.08
3.25	\$3.25	\$3.25
8789	0.011	20
7773	4679	7773
9	9	9
25	20	25
120,000	90,000	120,000
0.10	0.05	0.10
0.045	0.011	0.045
0.039	0.011	0.039
0.38	0.20	0.38
1.20	0.70	1.20
3.60%	4.75%	3.60%
1.14%	1.10%	1.14%
4.74%	5.85%	4.74%
\$284,400	\$76,635	\$284,400
\$31,600	\$8,515	\$31,600
\$438.75		\$438.75
\$38.03	\$8.94	\$38.03
\$166.73		\$166.73
\$14.45	\$1.79	\$14.45
1.131	1.878	1.131
\$73.29	\$20.67	\$73.29
\$731.25	\$31.40	\$731.25
\$53,381	\$22,922	\$533,813
\$84,981	\$31,437	\$565,413
\$43.29	\$11.66	\$43.29

D \ 3 OTHER MONTHLY COSTS

BID ITEM # 2

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Bucket Repair Water Quality		\$20,000 /MO	
2	Monitoring	+	\$50,000 /MO	
3	>	+	\$0 /MO	
4	>	+	\$0 /MO	
5	>	+	\$0 /MO	
6	>	+	\$0 /MO	
7	>	+	\$0 /MO	
8	>	+	\$0 /MO	
9	>	+	\$0 /MO	
10	>	+	\$0 /MO	
11	>	+	\$0 /MO	
12	>	+	\$0 /MO	
13	>	+	\$0 /MO	
14	>	+	\$0 /MO	
15 TOTAL OTHER MONTHLY COSTS =				\$70,000 /MO

E FIXED COSTS

BID ITEM # 2

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Hydrographic Survey		\$52,000	
2	>	+	\$0	
3	>	+	\$0	
4	>	+	\$0	
5	>	+	\$0	
6	>	+	\$0	
7	>	+	\$0	
8	>	+	\$0	
9	>	+	\$0	
10	>	+	\$0	
11	>	+	\$0	
12	>	+	\$0	
13	>	+	\$0	
14	>	+	\$0	

15 FIXED COSTS = \$52,000

LPP 57' Total Project Cost Summary

Total Project Cost Summary

Project: **Seattle Harbor Navigation Improvement Project 57'**

P2: **452752**

Authority: **CG**

Location: **Seattle Harbor**

Report Type: **LPP**

TPCS Preparation Date: **05-Jul-17**

District: **NWS -Seattle District**

Contingency Development: **Crystal Ball**

FY: **2018**

POC: **Callan**

CWCCIS Issue: **3/31/2017**

Scope Synopsis:

WBS			ESTIMATED COST				PROJECT FIRST COST CONSTANT DOLLAR BASIS				TOTAL PROJECT COST (FULLY FUNDED)			
Civil Works			Risk Based				Program Price Level Date: 2018-1Q							
WBS	Feature	Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	INFLATED (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)
02	RELOCATIONS		2.000	460	23%	2,460	2%	2,037	469	2,506	13%	2,295	528	2,823
12	NAVIGATION PORTS & HARBORS		34.702	8,270	24%	42,972	2%	35,346	8,423	43,769	14%	40,426	9,633	50,059
		S/T	36,702	8,730	24%	45,432	2%	37,384	8,892	46,275	14%	42,721	10,161	52,882
30	PLANNING ENGINEERING AND DESIGN		7.100	1,633	23%	8,733	3%	7,320	1,684	9,004	15%	8,414	1,935	10,349
		S/T	7,100	1,633	23%	8,733	3%	7,320	1,684	9,004	15%	8,414	1,935	10,349
31	CONSTRUCTION MANAGEMENT		3.754	863	23%	4,617	3%	3,870	890	4,761	31%	5,079	1,168	6,248
		S/T	3,754	863	23%	4,617	3%	3,870	890	4,761	31%	5,079	1,168	6,248
Totals			47,556	11,226	24%	58,782	2%	48,574	11,465	60,039	16%	56,214	13,265	69,479

CHIEF, COST ENGINEERING

PROJECT MANAGER

CHIEF, REAL ESTATE

CHIEF, PLANNING

CHIEF, ENGINEERING

CHIEF, OPERATIONS

CHIEF, CONSTRUCTION

CHIEF, CONTRACTING

CHIEF, PM-PB

CHIEF, DPM

Project First Cost for Report:

Cost (\$k)

Contingency (\$k)

Totals (\$k)

\$48,574

\$11,465

\$60,039

Total Project Cost used to provide
Sponsor information:

\$56,214

\$13,265

\$69,479

Contract Summary

WBS	ESTIMATED COST Estimate Class Level: Class 3				PROJECT FIRST COST <i>CONSTANT DOLLAR BASIS</i>				TOTAL PROJECT COST (FULLY FUNDED)				
Contract: Relocations	Est Preparation Date: <u>05-Sep-17</u> Est Price Level: <u>2017-1Q</u> Risk Based				Program Yr: <u>2018</u> Prog Level Date: <u>2018-1Q</u>								
Location: Seattle Harbor District: NWS -Seattle District	COST	CNTG	CNTG	TOTAL	ESC	COST	CNTG	TOTAL	MID-PT	INFLATED	COST	CNTG	TOTAL
	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	(DATE)	(%)	(\$K)	(\$K)	(\$K)
02 RELOCATIONS (EWW Telecommunication line)	2,000	460	23.0%	2,460	1.9%	2,037	469	2,506	2024-1Q	14.8%	2,295	528	2,823
Construction Activities <i>Total</i>	2,000	460		2,460		2,037	469	2,506			2,295	528	2,823
Relocations <i>Total</i>	2,000	460		2,460		2,037	469	2,506			2,295	528	2,823

Contract Summary

WBS	ESTIMATED COST Estimate Class Level: Class 3				PROJECT FIRST COST <i>CONSTANT DOLLAR BASIS</i>				TOTAL PROJECT COST (FULLY FUNDED)				
Contract: PED Phase Location: Seattle Harbor District: NWS -Seattle District	Est Preparation Date: <u>05-Jul-17</u> Est Price Level: <u>2017-1Q</u>				Program Yr: <u>2018</u> Prog Level Date: <u>2018-1Q</u>								
	Risk Based												
	COST	CNTG	CNTG	TOTAL	ESC	COST	CNTG	TOTAL	MID-PT	INFLATED	COST	CNTG	TOTAL
	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	(DATE)	(%)	(\$K)	(\$K)	(\$K)
<i>Project Management</i>	500	115	23.0%	615	3.1%	516	119	634	2021-3Q	18.5%	593	136	729
<i>Planning & Environmental Compliance</i>	200	46	23.0%	246	3.1%	206	47	254	2021-3Q	18.5%	237	55	292
<i>Engineering & Design</i>	5,400	1,242	23.0%	6,642	3.1%	5,567	1,281	6,848	2021-3Q	18.5%	6,399	1,472	7,871
<i>Engineering Tech Review ATR & VE</i>	200	46	23.0%	246	3.1%	206	47	254	2021-3Q	18.5%	237	55	292
<i>Life Cycle Cost Updates</i>	100	23	23.0%	123	3.1%	103	24	127	2021-3Q	18.5%	119	27	146
<i>Contracting</i>	100	23	23.0%	123	3.1%	103	24	127	2021-3Q	18.5%	119	27	146
<i>Engineering During Construction</i>	500	115	23.0%	615	3.1%	516	119	634	2021-3Q	18.5%	593	136	729
<i>Planning During Construction</i>													
<i>Project Operations</i>	100	23	23.0%	123	3.1%	103	24	127	2021-3Q	18.5%	119	27	146
Planning Engineering and Design	<i>Total</i>			7,100		1,633		8,733			8,414	1,935	10,349
PED Phase	<i>Total</i>			7,100		1,633		8,733			8,414	1,935	10,349

Contract Summary

WBS	ESTIMATED COST Estimate Class Level: Class 3				PROJECT FIRST COST <i>CONSTANT DOLLAR BASIS</i>				TOTAL PROJECT COST (FULLY FUNDED)				
Contract: Construction (56' depth)	Est Preparation Date: <u>05-Jul-17</u> Est Price Level: <u>2017-1Q</u> Risk Based				Program Yr: <u>2018</u> Prog Level Date: <u>2018-1Q</u>								
Location: Seattle Harbor District: NWS -Seattle District	COST	CNTG	CNTG	TOTAL	ESC	COST	CNTG	TOTAL	MID-PT	INFLATED	COST	CNTG	TOTAL
	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	(DATE)	(%)	(\$K)	(\$K)	(\$K)
12 NAVIGATION PORTS & HARBORS Mob & Demob	1,336	307	23.0%	1,643	1.9%	1,361	313	1,674	2024-4Q	16.5%	1,556	358	1,914
12 NAVIGATION PORTS & HARBORS East Waterway	5,761	1,613	28.0%	7,374	1.9%	5,868	1,643	7,511	2024-4Q	16.5%	6,711	1,879	8,590
12 NAVIGATION PORTS & HARBORS West Waterway	27,605	6,349	23.0%	33,954	1.9%	28,118	6,467	34,585	2024-4Q	16.5%	32,158	7,396	39,554
Construction Activities <i>Total</i>	34,702	8,270		42,972		35,346	8,423	43,769			40,426	9,633	50,059
31 Construction Management (S&A) 10.8%	3,754	863	23.0%	4,617	3.1%	3,870	890	4,761	2024-4Q	35.3%	5,079	1,168	6,248
Construction Management <i>Total</i>	3,754	863		4,617		3,870	890	4,761			5,079	1,168	6,248
Construction (56' depth) <i>Total</i>	38,456	9,133		47,589		39,217	9,313	48,530			45,505	10,802	56,307

Print Date Wed 30 August 2017
Eff. Date 10/1/2017

U.S. Army Corps of Engineers
Project : Seattle Harbor Navigation Improvement Project (LPP)
Cost Estimate Report

Time 13:41:39

Title Page

Estimated by Callan

Designed by USACE-NWS Seattle District

Prepared by Kim Callan

Preparation Date 7/18/2017

Effective Date of Pricing 10/1/2017

Estimated Construction Time Days

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Date Author Note

7/18/2017 Callan, Kim
10:08:51
AM

Seattle Harbor Navigation Improvement Project (SHNIP) Channel Deepening

FEASIBILITY STUDY

COST ANALYSIS SUMMARY

The Corps and Port of Seattle initiated a feasibility study evaluating navigation improvements to Seattle Harbor's East and West Waterways. Navigational challenges were identified and current authorized depths, of 34 to 51 feet below mean lower low water, or MLLW, do not meet today's larger container ship draft requirements.

The project area includes the East and West waterways of Seattle Harbor, as they have been identified by the Corps and non-Federal sponsor, the Port of Seattle, as the areas of critical importance for navigation improvements.

Elliott Bay: naturally deep; ships access waterways one way in and out; use Elliott Bay as a turning basin.

Class 3 level estimates were developed using CEDEP. Detailed risk register was developed with the PDT team. Key dredging inputs were adjusted within the CSRA development. Spreadsheet format used for alternative level estimates. Once TSP has been selected class level 3 will be developed and utilize MII.

Labor and equipment was brought to current price levels.

Equipment comprised of smaller dredge (10 CY Clamshell plus support plant) will be used.

For non-suitable material for open water place upland placement was used. Dump Scow were utilized for open water placement, material barges were used for upland place at transload facility.

Typical Equipment List: Dredge, Work Tugs, Crew/Survey Boat, Derrick, Work Barge Towing Vessel, Scow(s)

For Additional details see "Cost Assumptions" document.

Local Davis Bacon rates Used, July 2017.

CEDEP 2017 used for estimate.

All Markups applied within CEDEP
25% OH, 8% profit, .8% Bond

Print Date Wed 30 August 2017
Eff. Date 10/1/2017

U.S. Army Corps of Engineers
Project : Seattle Harbor Navigation Improvement Project (LPP)

Time 13:41:39

Cost Estimate Report

Feature Level Page 1

Description	UOM	Quantity	ContractCost	Escalation	Contingency	MiscOwner	SIOH	ProjectCost
Feature Level			34,701,253	0	0	0	0	34,701,253
A Seattle Harbor Navigation Improvement Project (57')	LS	1.0	34,701,253	0	0	0	0	34,701,253

Print Date Wed 30 August 2017
Eff. Date 10/1/2017

U.S. Army Corps of Engineers
Project : Seattle Harbor Navigation Improvement Project (LPP)

Time 13:41:39

Cost Estimate Report

Feature & Subfeature Level Page 2

Description	UOM	Quantity	ContractCost	Escalation	Contingency	MiscOwner	SIOH	ProjectCost
Feature & Subfeature Level								
A Seattle Harbor Navigation Improvement Project (57')	LS	1.0	34,701,253	0	0	0	0	34,701,253
12 Navigation Ports & Harbors	LS	1.0	34,701,253	0	0	0	0	34,701,253
1 Mob, Demob & Preparatory Work	LS	1.0	1,335,848	0	0	0	0	1,335,848
1202 Harbors East Waterway	LS	1.0	5,760,536	0	0	0	0	5,760,536
1202 Harbors West Waterway	LS	1.0	27,604,869	0	0	0	0	27,604,869

Print Date Wed 30 August 2017
 Eff. Date 10/1/2017

U.S. Army Corps of Engineers
 Project : Seattle Harbor Navigation Improvement Project (LPP)

Time 13:41:39

Cost Estimate Report

Direct Cost Page 3

Description	UOM	Quantity	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectCost	ContractCost	ProjectCost
Direct Cost			0.00	0.00	0.00	0.00	34,701,253.00	34,701,253.00	34,701,253.00
A Seattle Harbor Navigation Improvement Project (57')	LS	1.0000	0.00	0.00	0.00	0.00	34,701,253.00	34,701,253.00	34,701,253.00
12 Navigation Ports & Harbors	LS	1.0000	0.00	0.00	0.00	0.00	34,701,253.00	34,701,253.00	34,701,253.00
1 Mob, Demob & Preparatory Work	LS	1.0000	0.00	0.00	0.00	0.00	1,335,848.00	1,335,848.00	1,335,848.00
1202 Harbors East Waterway	LS	1.0000	0.00	0.00	0.00	0.00	5,760,536.00	5,760,536.00	5,760,536.00
1202 Harbors West Waterway	LS	1.0000	0.00	0.00	0.00	0.00	27,604,869.00	27,604,869.00	27,604,869.00

Cost Estimate Report

Description	UOM	Quantity	DirectCost	JOOH_PRM	HOOH_PRM	Profit_PRM	Bond_PRM	ContractCost	ProjectCost
InDirect Cost			34,701,253.00	0.00	0.00	0.00	0.00	34,701,253.00	34,701,253.00
A Seattle Harbor Navigation Improvement Project (57')	LS	1.0	34,701,253.00	0.00	0.00	0.00	0.00	34,701,253.00	34,701,253.00
12 Navigation Ports & Harbors	LS	1.0	34,701,253.00	0.00	0.00	0.00	0.00	34,701,253.00	34,701,253.00
1 Mob, Demob & Preparatory Work	LS	1.0	1,335,848.00	0.00	0.00	0.00	0.00	1,335,848.00	1,335,848.00
1202 Harbors East Waterway	LS	1.0	5,760,536.00	0.00	0.00	0.00	0.00	5,760,536.00	5,760,536.00
1202 Harbors West Waterway	LS	1.0	27,604,869.00	0.00	0.00	0.00	0.00	27,604,869.00	27,604,869.00

M	MOB & DEMOB	BID ITEM #	1
---	-------------	------------	---

DREDGE SIZE: 21 CY CLAMSHELL

	MOBILIZATION			DEMOBILIZATION		
	# DAYS	\$/DAY	TOTAL	# DAYS	\$/DAY	TOTAL
1. PREPARE DREDGE FOR TRANSFER	5	\$9,551	\$47,757	2	\$11,090	\$22,181
2. TRANSFER ALL PLANT	362 MILES			362 MILES		
@ 100 miles/day =	3.6	\$39,996	\$143,984	3.6	\$39,996	\$143,984
3. PERMANENT PERSONNEL & MISC.	L.S.		\$29,640	L.S.		\$29,640
4. PREPARE DREDGE AFTER TRANSFER	1	\$8,021	\$8,021	6	\$5,104	\$30,625
5. OTHER	Buoy Placement		\$25,000	L.S. (CLEANUP)		\$10,000
	SUBTOTAL MOBILIZATION		\$254,402	SUBTOTAL DEMOBILIZATION		\$236,430

			REMARKS
6. SUBTOTAL MOBILIZATION & DEMOBILIZATION	=	\$490,832	
7. OVERHEAD	25.0%	\$122,708	
	SUBTOTAL.....=	\$613,540	
8. PROFIT	8.0%	\$49,083	
	SUBTOTAL.....=	\$662,623	
9. BOND	0.8%	\$5,301	
10. TOTAL MOBILIZATION & DEMOBILIZATION	=	\$667,924	

M \ 1

MOB & DEMOB

BID ITEM # 1

DREDGE SIZE: 21 CY CLAMSHELL

1. PREPARE DREDGE FOR TRANSFER				MOBILIZATION	DEMOBILIZATION
Labor:	10 men @	8 hrs/day @	\$89.67 per hour =	\$7,174	\$7,174
Equipment:	Dredge	\$65.74 /hr (Standby) x 24 hrs per day =		\$1,578	\$1,578
	Towing Vessel	\$43.29 /hr (Standby) x 24 hrs per day =			\$1,039
	Support equipment with operators			\$500	\$500
	Supplies & small tools			\$150	\$150
	Additional Fuel (plant idle)			\$150	\$150
Subsistence:	10 men @	\$50.00 per day =		----	\$500
COST PER DAY				\$9,551	\$11,090

2. TRANSFER PLANT				MOBILIZATION	DEMOBILIZATION
Labor:	5 men/shift (2-12 hr shifts) @		\$89.67 per manhour =	\$10,760	\$10,760
Equipment:	Work Tug(s)	\$56.33 /hr			
	Dredge	\$65.74 /hr (Standby)			
	Crew Tug	\$0.76 /hr (Standby)			
	Derrick(s)	\$2.72 /hr (Standby)			
	Fuel Barge	\$0.85 /hr (Standby)			
	Work Barge(s)	\$1.12 /hr (Standby)			
	Unused	\$0.00 /hr (Standby)			
	Unused	\$0.00 /hr (Standby)			
	Scow(s)	\$26.24 /hr (Standby)			

		\$153.76 /hr x 24 hrs per day =		\$3,690	\$3,690
Subsistence	10 men @	\$50.00 per day =		\$500	\$500
Towing Vessel(s):					
Labor:	3 men/shift (2-12 hr shifts) @		\$89.67 per manhour =	\$6,456	\$6,456
Equipment:		\$774.54 per hr x 24 hrs per day =		\$18,589	\$18,589
COST PER DAY				\$39,996	\$39,996

M \ 2

MOB & DEMOB

BID ITEM # 1

DREDGE SIZE: 21 CY CLAMSHELL

3. PERMANENT PERSONNEL & MISC.				MOBILIZATION	DEMOBILIZATION
34 men @	8 hrs/day @	\$89.67 per hour @ 1 DAY		\$24,390	\$24,390
Travel Expenses	\$150 per man			\$5,100	\$5,100
Local hire				<u>\$150</u>	<u>\$150</u>
TOTAL				\$29,640	\$29,640
4. PREPARE DREDGE AFTER TRANSFER				MOBILIZATION	DEMOBILIZATION
Labor:	6 men @	8 hrs/day @	\$89.67 per hour =	\$4,304	\$4,304
Equipment:	Dredge	\$65.74 /hr (Standby) x 24 hrs per day =		\$1,578	
	Towing Vessel	\$43.29 /hr (Standby) x 24 hrs per day =		\$1,039	
Support equipment with operators				\$500	\$500
Supplies & small tools				\$150	\$150
Additional Fuel (plant idle)				\$150	\$150
Subsistence	6 men @	\$50.00 per day =		<u>\$300</u>	<u>----</u>
COST PER DAY				\$8,021	\$5,104

M \ 3

MOB & DEMOB

BID ITEM # 1

DREDGE SIZE: 21 CY CLAMSHELL

REMARKS

1 EQUIPMENT COSTS - WORKING RATES

RATES TAKEN FROM SHEET D \ 2 & SHEET D \ 3

A. WORK TUG(S) \$56.33 /HR

\$24,671 /MO DIVIDED BY 438 HRS/MO

B. TOWING VESSEL(S) \$774.54 /HR

\$565,413 /MO X 1 EACH DIVIDED BY 730 HRS/MO

2 LABOR COSTS

\$89.67 /MHR

FROM SHEET D \ 1

3 EQUIPMENT COSTS - STANDBY RATES

RATES TAKEN FROM SHEET D \ 2 & SHEET D \ 3

A. DREDGE \$65.74 /HR

1 EA @ \$ 65.74 /HR

B. CREW/SURVEY TUG \$0.76 /HR

1 EA @ \$ 0.76 /HR

C. DERRICK(S) \$2.72 /HR

2 EA @ \$ 1.36 /HR

D. FUEL/WATER BARGE \$0.85 /HR

1 EA @ \$ 0.85 /HR

E. WORK BARGE(S) \$1.12 /HR

2 EA @ \$ 0.56 /HR

F. ****Unused**** \$0.00 /HR

0 EA @ \$ 0.00 /HR

G. ****Unused**** \$0.00 /HR

0 EA @ \$ 0.00 /HR

H. SCOW(S) \$26.24 /HR

2.25 EA @ \$ 11.66 /HR

I. TOWING VESSEL(S) \$43.29 /HR

1 EA @ \$ 43.29 /HR

MOBIL & DEMOB COST:		Seattle Harbor Dredging	BID QUANTITY	30,900 C.Y.		
EXCAV. COST.	\$1,048,437		UNIT COST...	\$33.93 PER C.Y.	TIME.....	0.493 MONTHS

PG 1 OF 12: PROJECT TITLES

PROJECT -	Seattle Harbor Dredging
LOCATION -	Astoria OR
INVIT # -	Transload East - 57'
DATE OF EST. -	21 June 2017
EST. BY -	Callan
MOB. BID ITEM # -	1
EXCAV. BID ITEM # -	3

PG 5 OF 12: PROJECT TITLES

PG 5.....BUCKET CYCLE -	170 Seconds
OTHER FACTOR -	0.00 >Material Separation
CLEANUP -	0% More Time
TIME EFFICIENCY -	60.0% of EWT

PG 9 OF 12: PROJECT TITLES

PG 9...SP COST/MO (1ST) -	\$20,000	Bucket Repair
SP COST/MO (2ND-14TH) -	\$50,000	From Sheet D4
Total	\$70,000	
SPECIAL COST LS (1ST) -	\$52,000	Hydrographic Survey
SP COST LS (2ND-14TH) -	\$0	From Sheet E
Total	\$52,000	

PG 2 OF 12: TYPE OF EST & IND COSTS

TYPE OF EST. -	1 - Planning Estimate (Includes Profit)
CONTRACTOR'S O.H. -	25.0%
CONTRACTOR'S PROFIT -	8.0%
CONTRACTOR'S BOND -	0.8%

PG 6 OF 12: PROJECT TITLES

TUG DESCRIPT. -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	2 mi
SPEED TO D/A -	5 mph (24 min)
SPEED FROM D/A -	5 mph (24 min)
DUMP OR PUMPOUT -	370 min
DISENGAGE TOW -	10 min
AVE. CYCLE TIME -	443 min per trip
TOW EFFICIENCY -	50 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	80 %
% SOLIDS -	90 % (2,160 cy/load)

PG 10 OF 12: PROJECT TITLES

PG 10....PRESENT YEAR -	2017
ECONOMIC INDEX -	8789
LAF -	1.080
INTEREST RATE -	2.500% /yr
TIME PERIOD -	Jan thru Jun 2017
BUCKET AVAILABILITY -	9 mos/yr
FUEL PRICE -	\$3.25 /gal

PG 3 OF 12: TYPE OF EST & IND COSTS

DREDGING AREA -	4,000,000 SQ. FT.
BANK HEIGHT -	5 ft
REQ'D EXCAVATION -	15,300 cyds
PAY OVERDEPTH -	15,600 cyds
CONTRACT AMOUNT -	30,900 cyds
NOT DREDGED -	7,800 cyds
NET PAY -	23,100 cyds
NONPAY YARDAGE -	0 cyds
GROSS YARDAGE -	23,100 cyds
Non-Pay Calc -	0.0 % of Pay O.D. for NonPay
TOTAL BANK HEIGHT -	5.0 ft

PG 7 OF 12: PROJECT TITLES

DREDGES -	1
SCOWS @ DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1
ADDITIONAL SCOWS -	0
TOT SCOWS ON JOB -	2

Production Summary

EXCAVATION PRODUCTION -	107 cy/hr (gross)
EXCAVATION EWT -	60.0% (438 hrs/mo)
EXCAVATION TIME -	0.493 months
HAULING PRODUCTION -	293 cy/hr (gross)
HAULING EWT -	50.0% (365 hrs/mo)
HAULING TIME -	0.216 months
DREDGING TIME -	0.493 months
EXCAVAT EWT (ADJUSTED) -	438 hrs/mo (60.0% EWT)
HAULING EWT (ADJUSTED) -	160 hrs/mo (21.9% EWT)
PRODUCTION (GROSS) -	46,866 cy per month
PRODUCTION (CONTRACT) -	46,856 pay cy per month

PG 4 OF 12: TYPE OF EST & IND COSTS

DREDGE SEL. -	10 CY CLAMSHELL
TYPE OF MATERIAL -	Clays and Less-Dense Sand
BUCKET SIZE -	8
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	5.5
BANK FACTOR -	0.91

PG 8 OF 12: PROJECT TITLES

QTRS ON DREDGE? -	Yes
SURVEY BOAT? -	1
CREW BOAT? -	0

A DESCRIPTION AND QUANTITY SUMMARY

1 PROJECT	<u>Seattle Harbor Dredging</u>	DATE OF ESTIMATE	<u>21 June 2017</u>
2 LOCATION	<u>Astoria OR</u>	INVIT. OR CONTR. NO.	<u>Transload East - 57'</u>
3 ESTIMATED BY	<u>Callan</u>	CHECKED BY	<u>Checker's Name</u>
4 TYPE OF DREDGE	<u>10 CY CLAMSHELL</u>	TYPE OF ESTIMATE	<u>1 - Planning Estimate (Includes Profit)</u>

3 56' Mechanical Dredge - Transload Facility

5 DESCRIPTION OF WORK

6 EXCAVATION		REMARKS
A. REQUIRED	<u>15,300</u> CY	
B. PAY OVERDEPTH	+ <u>15,600</u> CY	
C. MAX. PAY YARDAGE	= <u>30,900</u> CY	<u>(YARDAGE USED ON BID FORM)</u>
D. O.D. NOT DREDGED	- <u>7,800</u> CY	
E. NET PAY YARDAGE	= <u>23,100</u> CY	<u>(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)</u>
F. NON-PAY YARDAGE	+ <u> </u> CY	<u>% of Pay O.D. for NonPay</u>
G. GROSS YARDAGE	= 23,100 CY	<u>(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)</u>

B	DREDGING COST	BID ITEM # 3	REMARKS
1	GROSS YARDAGE	<u>23,100</u> CY	<u>FROM SHEET A, ITEM 6 G.</u>
2	PRODUCTION RATE	<u>/ 46,866</u> CY/MO	<u>FROM SHEET C, ITEM 4.</u>
3	DREDGING TIME	= <u>0.49</u> MONTHS	<u>23,100 Net Pay CY / 0.493 MO = 46,856 Pay CY/MO</u>
4	TOTAL MONTHLY COST	<u>x \$1,062,793</u>	<u>FROM SHEET D, ITEM 5.</u>
	SUBTOTAL.....=	<u>\$523,957</u>	
5	FIXED COSTS	<u>+ \$52,000</u>	<u>FROM SHEET E, ITEM 15.</u>
	SUBTOTAL.....=	<u>\$575,957</u>	
6	OVERHEAD	<u>25.0% + \$143,989</u>	
	SUBTOTAL.....=	<u>\$719,946</u>	
7	PROFIT	<u>8.0% + \$57,596</u>	
	SUBTOTAL.....=	<u>\$777,542</u>	
8	BOND	<u>0.8% + \$6,220</u>	
9	GROSS PRODUCTION COST	= <u>\$783,762</u>	
10	NET PAY YARDAGE	<u>/ 23,100</u> CY	<u>FROM SHEET A, ITEM 6 E.</u>
11	UNIT COST	= <u>\$33.93 /CY</u>	
12	MAX PAY YARDAGE	<u>x 30,900</u> CY	<u>FROM SHEET A, ITEM 6 C.FROM SHEET A, ITEM 6 C.</u>
13	DREDGING COST	= <u>\$1,048,437</u>	

C	MONTHLY PRODUCTION SUMMARY & ADJUSTED OPERATING HOURS	BID ITEM # 3
		REMARKS
1 EXCAVATION TIME	<u>0.493</u> MONTHS	46,866 CY/MO FROM SHEET C \ 1A
2 HAULING TIME	<u>0.216</u> MONTHS	106,945 CY/MO FROM SHEET C \ 2A
3 DREDGING TIME.....>	<u>0.493</u> MONTHS	<u>[Greater of Excavation Time or Hauling Time]</u>
4 PRODUCTION RATE.....>	<u>46,866</u> CY/MO	
5 PRODUCTION RATE.....>	<u>46,866</u> CY/MO	FROM ITEM 4.
6 GROSS PRODUCTION (DREDGE)	<u>/</u> <u>107</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 8.</u>
7 ADJUSTED OPERATING HOURS (DREDGE) =	<u>438</u> HR/MO	<u>DIVIDED BY 730 HRS = 60.0% OF EWT</u>
8 PRODUCTION RATE.....>	<u>46,866</u> CY/MO	FROM ITEM 4.
9 GROSS PRODUCTION (HAULING)	<u>/</u> <u>293</u> CY/HR	<u>FROM SHEET C \ 2B, ITEM 8.</u>
10 ADJUSTED OPERATING HRS (HAULING) =	<u>160</u> HR/MO	<u>DIVIDED BY 730 HRS = 21.9% OF EWT</u>

C \ 1A	EXCAVATION RATE & EXCAVATION TIME	BID ITEM # 3
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		REMARKS
1 MONTHLY EXCAVATION RATE:		
A. DREDGE PRODUCTION	<u>107</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 6.</u>
B. EXCAVATION OPERATING TIME	<u>x</u> <u>438</u> HRS/MO	<u>FROM SHEET C \ 1B, ITEM 7B.</u>
C. EXCAVATION RATE	= <u>46,866</u> CY/MO	

		REMARKS
2 EXCAVATION TIME:		
A. GROSS CUBIC YARDS	<u>23,100</u> CY (GROSS)	<u>FROM SHEET A, ITEM 6G.</u>
B. EXCAVATION RATE	<u>/</u> <u>46,866</u> CY/MO	<u>FROM ITEM 1C.</u>
C. EXCAVATION TIME	= <u>0.493</u> MONTHS	

C \ 1B

**DREDGE PRODUCTION & EXCAVATION
OPERATING TIME**

BID ITEM # 3

1 SIZE OF DREDGE	<u>10 CY CLAMSHELL</u>	REMARKS
2 CYCLE RATE	<u>0.35</u> Buckets/Min <u>(60 SECONDS PER MIN / 170 SECONDS PER CYCLE)</u>	
	x <u>60</u> MIN/HR	
3 BUCKET SIZE	x <u>8</u> CY	
A. BUCKET FILL FACTOR	x <u>0.70</u>	<u>(WORKING CAPACITY = 5.60 CY/BUCKET)</u>
B. BANK FACTOR	x <u>0.91</u>	<u>(based on 5.0 Ft of Bank Height)</u>
C. OTHER FACTOR	x <u>1.00</u>	<u>>Material Separation</u>
D. CLEANUP FACTOR	<u>x 1</u>	<u>ADDITIONAL TIME</u>
4 PRODUCTION PER DREDGE	= <u>107</u> CY/HR	
5 NUMBER OF DREDGES	<u>x 1</u>	
6 GROSS PRODUCTION	= <u>107</u> CY/HR	
REMARKS		
7 EXCAVATION OPERATING TIME:		
A. TIME EFFICIENCY	<u>60.0%</u>	<u>% OF EWT WITHOUT MAJOR WAITS FOR SCOWS</u>
	x <u>730</u> HRS/MO	
B. EXCAVATION OPERATING TIME	= <u>438</u> HRS/MO	

C \ 2A

HAULING RATE & HAULING TIME

BID ITEM # 3

REMARKS

1 MONTHLY HAULING RATE:

A. HAULING PRODUCTION 293 CY/HR FROM SHEET C \ 2B, ITEM 8.

B. HAULING OPERATING TIME x 365 HRS/MO FROM SHEET C \ 2B, ITEM 9B.

C. HAULING RATE = 106,945 CY/MO

REMARKS

2 HAULING TIME:

A. GROSS CUBIC YARDS 23,100 CY (Gross) FROM SHEET A, ITEM 6G.

B. HAULING RATE / 106,945 CY/MO FROM ITEM 1C.

C. HAULING TIME = 0.216 MONTHS

C \ 2B	HAULING PRODUCTION & HAULING OPERATING TIME	BID ITEM # 3
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		REMARKS
1 SIZE OF SCOW	_____ 3,000 CY	_____
A. CAPACITY	x _____ 0.8	_____
B. USEABLE VOLUME	= _____ 2,400 CY	_____
C. SLURRY DENSITY	x _____ 0.9	_____
2 AVERAGE VOLUME HAULED	= _____ 2,160 CY/SCOW	_____
3 SCOWS PER TOWING VESSEL	x _____ 1	_____
4 AVERAGE VOLUME HAULED	= _____ 2,160 CY/TRIP	_____
5 AVERAGE CYCLE TIME	/ _____ 443 MIN/TRIP	FROM SHEET C \ 2C, ITEM 3.
	x _____ 60 MIN/HR	_____
6 PRODUCTION PER TOWING VESSEL	= _____ 293 CY/HR	_____
7 NUMBER OF TOWING VESSELS	x _____ 1	_____
8 HAULING PRODUCTION	= _____ 293 CY/HR	_____

		REMARKS
9 HAULING OPERATING TIME:		_____
A. TIME EFFICIENCY	_____ 50.0%	% OF EWT WITHOUT WAITING FOR DREDGE(S)
	x _____ 730 HRS/MO	_____
B. HAULING OPERATING TIME	= _____ 365 HRS/MO	_____

C \ 2C	HAULING CYCLE TIME	BID ITEM # 3
1 SIZE OF TUG	<u>3000 HP Diesel--Twin Screw</u>	
2 CYCLE TIME PER TRIP:		REMARKS
A. PREPARE FOR SCOW TOW	<u>15 MIN</u>	
B. TO DISPOSAL AREA	+ <u>24 MIN</u>	<u>2 miles / 5.0 miles per hr x 60 min</u>
C. DUMPING OR PUMPOUT	+ <u>370 MIN</u>	<u>Offload</u>
D. FROM DISPOSAL AREA	+ <u>24 MIN</u>	<u>2 miles / 5.0 miles per hr x 60 min</u>
E. DISENGAGE TOW RIGGING AND TIE UP SCOW	+ <u>10 MIN</u>	
3 AVERAGE CYCLE TIME	= <u>443 MIN/TRIP</u>	

D		MONTHLY COST SUMMARY		BID ITEM # 3	
DREDGE SIZE 10 CY CLAMSHELL		REMARKS			
1	LABOR COSTS (D1)	\$676,297 /MO			
2	EXCAVATION (D2)		Ownership	Fuel	WLS Maintenance Repair
A.	DREDGE(S)	+ \$70,467 /MO (1 ea)	\$3,466	+ \$44,562	+ \$22,439
B.	WORK TUG(S)	+ \$14,331 /MO (1 ea)	\$928	+ \$7,796	+ \$5,607
C.	CREW/SURVEY TUG	+ \$13,870 /MO (1 ea)	\$555	+ \$8,629	+ \$4,686
D.	DERRICK(S)	+ \$4,113 /MO (1 ea)	\$797	+ \$1,958	+ \$1,358
E.	FUEL/WATER BARGE	+ \$1,424 /MO (1 ea)	\$618	+ \$158	+ \$648
F.	WORK BARGE(S)	+ \$817 /MO (1 ea)	\$410		+ \$407
H.	**Unused**				
I.	**Unused**				
3	HAULING				
A.	TOWING VESSEL(S)	+ \$148,600 /MO (1 ea)	\$31,600	+ \$76,285	+ \$40,715
B.	SCOW(S)	+ \$62,874 /MO (2 ea)	\$17,030	+ \$13,052	+ \$32,792
	Equip TOTALS----->	\$316,496 /MO	\$55,404	+ \$152,440	+ \$108,652
4	OTHER MONTHLY COSTS (D3)	+ \$70,000 /MO	FROM SHEET D \ 3		
5	TOTAL MONTHLY COST	= \$1,062,793			

Equipment Price Breakdown

	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8. Hourly Fuel	\$101.74	\$17.80	\$19.70	\$4.47	\$0.36			
x 1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
- 8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
Operating/Materials/Maintenance/Wear	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

Each	1	1	1	1	1	1		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
Operating/Materials/Maintenance/Wear/Repair	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

	Towing Vessel	Dump Scow
7b. Monthly Ownership:	\$31,600.00	\$8,515.00
8a. (1) Hrly Pr Eng Fuel:	\$438.75	
8a. (2) Hrly 2nd Eng Fuel:	\$38.03	\$8.94
8. Hourly Fuel	\$476.78	\$8.94
x 1j. Hrs Worked/Mo.....	160	730
Monthly Fuel:	\$76,284.80	\$6,526.20
- 8e. Monthly Operating:	\$117,000	\$22,922
Operating/Materials/Maintenance/Wear	\$40,715.20	\$16,395.80

Each	1	2
7b. Monthly Ownership:	\$31,600.00	\$17,030.00
Monthly Fuel:	\$76,284.80	\$13,052.40
Operating/Materials/Maintenance/Wear	\$40,715.20	\$32,791.60

D \ 1	LABOR COSTS	BID ITEM #	3
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DREDGE SIZE: 10 CY CLAMSHELL

Adjustments, Taxes and Insurance		Monthly Management Cost	
Overtime	14.29%	1	CAPTAIN \$6,147
Holiday 7 Days/Yr	1.92%	1	CHIEF ENG \$6,290
Vacation	8.00%	1	CIVIL ENG \$7,012
COMPOSITE.....	24.21%	1	OFFICE HELP \$2,439
			<u>\$21,888</u>
Social Security Tax	7.65%		
Workman's Compensation	45.00%		
State Unemployment Comp.	3.50%		
Federal Unemployment Comp.	1.00%		
COMPOSITE.....	57.15%		

Each Crew Position is Manned:	8 Hrs per Day
	x 7 Days per Week
=	56 Hrs per Week
	x 4.345 Wks per Month
=	243 Hrs per Month

Last Update...Mar 15

EA	CREW POSITION	O.T.		SUB-TOTAL	TAXES INSUR 57.15%	SUB-TOTAL	FRINGE BENEFITS \$17.40	HRLY COST	HOURS PER MONTH	MONTHLY COST	
		BASIC HOURLY WAGE	VACATION & HOLIDAY 24.21%								
3	Operators (Dredge)	\$38.39	+ \$9.29	= \$47.68	+ \$27.25	= \$74.93	+ \$17.40	= \$92.33	x 730	= \$67,401	
3	Engineers (Dredge)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 730	= 67,401	
3	Mates (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 730	= 65,919	
4	Launchmen (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 973	= 87,862	
4	Deckhands (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 973	= 85,176	
1	Cook (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943	
1	Messman (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272	
1	Launchmen (Survey)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943	
1	Deckhands (Survey)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272	
	Launchmen (Crew BT)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x	=	
	Deckhands (Crew BT)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x	=	
1	Tug Master (Tow Tug)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 243	= 22,436	
2	Mates (Tow Tug)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 487	= 43,976	
3	Deckhands (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904	
3	Scowmen (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904	
30	Total Crew								MONTHLY CREW LABOR COST =		\$654,409
								(Average Gross Wage =	\$89.67	per manhour)	

TOTAL MONTHLY LABOR COST = \$676,297

D/2 EQUIPMENT COST

	Excavation							
	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work	**Unused**	**Unused**
1a. Plant Description.....								
1c. Prime Eng HP.....	625	100	100	100				
1d. (1) Dredge El Gen HP....	50	--	--	--	--	--	--	--
1d. Total 2nd Eng HP.....	210	25	40	25	10			
1e. Plant Value.....	\$370,000	\$67,000	\$42,000	\$127,000	\$95,000	\$63,000		
1f. Acquis Year.....	1995	1992	1997	1990	1990	1990		
1g. Pres Year.....	2017	2017	2017	2017	2017	2017	2017	2017
1h. Cost of Money Rate.....	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%
1i. Disc Money Rate:	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%
1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
2a. LAF.....	1.080	1.08	1.08	1.08	1.08	1.08	1.08	1.08
2b. Fuel Cost per Gal.....	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25
3a. Ec Index <for Acq Yr>..	5036	4679	5429	4271	4271	4271		
3b. Ec Index <for 2017>....	8789	8789	8789	8789	8789	8789	8789	8789
4a. Mos Available/Year.....	9	9	9	9	9	9	9	9
5a. Useful Life (in Yrs)...	13	8	8	20	20	20		
5b. Physical Life (in Hrs).	26,000	18,000	16,000	90,000	90,000	90,000		
5c. SLV Factor.....	0.05	0.10	0.15	0.10	0.05	0.05		
5d. Pr Eng Fuel Factor.....	0.039	0.045	0.045	0.011	0.011	0.011		
5e. 2nd Eng Fuel Factor....	0.033	0.039	0.039	0.011	0.011	0.011		
5f. WLS Factor.....	0.24	0.38	0.38	0.20	0.20	0.20		
5g. RPR Factor.....	1.00	0.80	0.70	0.70	0.60	0.60		
6a. Depreciation:	7.31%	11.25%	10.63%	4.50%	4.75%	4.75%		
6b. FCCM:	1.12%	1.21%	1.26%	1.15%	1.10%	1.10%		
6c. Total Ownership/Year:	8.43%	12.46%	11.89%	5.65%	5.85%	5.85%		
7a. Yearly Ownership:	\$31,191	\$8,348	\$4,994	\$7,176	\$5,558	\$3,686		
7b. Monthly Ownership:	\$3,466	\$928	\$555	\$797	\$618	\$410		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8b. (1) Hrly Pr Eng WLS:	\$19.01	\$5.56	\$5.56	\$0.72				
8b. (2) Hrly 2nd Eng WLS:	\$5.40	\$1.20	\$1.93	\$0.18	\$0.07			
8c. (1) EAF:	1.745	1.878	1.619	2.058	2.058	2.058		
8c. (2) Hrly Repair:	\$26.82	\$6.04	\$3.21	\$2.20	\$1.41	\$0.93		
8d. Total Hrly Operating:	\$152.97	\$30.60	\$30.40	\$7.57	\$1.84	\$0.93		
8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
11. MONTHLY RATE:	\$70,467	\$14,331	\$13,870	\$4,113	\$1,424	\$817		
12a. HRLY STANDBY ALLOW:	\$4.75	\$1.27	\$0.76	\$1.09	\$0.85	\$0.56		
12b. Gener Fuel Allowance:	\$5.36	--	--	--	--	--	--	--
12c. DREDGE HRLY STANDBY:	\$10.11	--	--	--	--	--	--	--

Hauling		
Towing	Dump Scow	Disposal Transport
Twin Screw	3,000 CY Capacity	Twin Screw
	Split Hull Scow	
3000		3000
300	250	300
\$6,000,000	\$1,310,000	\$6,000,000
2009	1992	2009
2017	2017	2017
2.5	2.500%	2.500%
0.02	2.000%	2.000%
160	730	730
1.08	1.08	1.08
3.25	\$3.25	\$3.25
8789	0.011	20
7773	4679	7773
9	9	9
25	20	25
120,000	90,000	120,000
0.10	0.05	0.10
0.045	0.011	0.045
0.039	0.011	0.039
0.38	0.20	0.38
1.20	0.70	1.20
3.60%	4.75%	3.60%
1.14%	1.10%	1.14%
4.74%	5.85%	4.74%
\$284,400	\$76,635	\$284,400
\$31,600	\$8,515	\$31,600
\$438.75		\$438.75
\$38.03	\$8.94	\$38.03
\$166.73		\$166.73
\$14.45	\$1.79	\$14.45
1.131	1.878	1.131
\$73.29	\$20.67	\$73.29
\$731.25	\$31.40	\$731.25
\$117,000	\$22,922	\$533,813
\$148,600	\$31,437	\$565,413
\$43.29	\$11.66	\$43.29

D \ 3 OTHER MONTHLY COSTS

BID ITEM # 3

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Bucket Repair Water Quality		\$20,000 /MO	
2	Monitoring	+	\$50,000 /MO	
3	>	+	\$0 /MO	
4	>	+	\$0 /MO	
5	>	+	\$0 /MO	
6	>	+	\$0 /MO	
7	>	+	\$0 /MO	
8	>	+	\$0 /MO	
9	>	+	\$0 /MO	
10	>	+	\$0 /MO	
11	>	+	\$0 /MO	
12	>	+	\$0 /MO	
13	>	+	\$0 /MO	
14	>	+	\$0 /MO	
15 TOTAL OTHER MONTHLY COSTS =				\$70,000 /MO

E FIXED COSTS

BID ITEM # 3

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Hydrographic Survey		\$52,000	
2	>	+	\$0	
3	>	+	\$0	
4	>	+	\$0	
5	>	+	\$0	
6	>	+	\$0	
7	>	+	\$0	
8	>	+	\$0	
9	>	+	\$0	
10	>	+	\$0	
11	>	+	\$0	
12	>	+	\$0	
13	>	+	\$0	
14	>	+	\$0	

15 FIXED COSTS = \$52,000

MOBIL & DEMOB COST:		Seattle Harbor Dredging	BID QUANTITY	277,400 C.Y.		
EXCAV. COST.	\$4,219,254		UNIT COST...	\$15.21 PER C.Y.	TIME.....	2.25 MONTHS

PG 1 OF 12: PROJECT TITLES

PROJECT -	Seattle Harbor Dredging
LOCATION -	Astoria OR
INVIT # -	Open East Waterway - 57'
DATE OF EST. -	21 June 2017
EST. BY -	Callan
MOB. BID ITEM # -	1
EXCAV. BID ITEM # -	2

PG 5 OF 12: PROJECT TITLES

PG 5.....BUCKET CYCLE -	70 Seconds
OTHER FACTOR -	0.80 >Adjust for partial virgin materia digging.
CLEANUP -	0% More Time
TIME EFFICIENCY -	60.0% of EWT

PG 9 OF 12: PROJECT TITLES

PG 9...SP COST/MO (1ST) -	\$20,000	Bucket Repair
SP COST/MO (2ND-14TH) -	\$50,000	From Sheet D4
Total	\$70,000	
SPECIAL COST LS (1ST) -	\$52,000	Hydrographic Survey
SP COST LS (2ND-14TH) -	\$0	From Sheet E
Total	\$52,000	

PG 6 OF 12: PROJECT TITLES

TUG DESCRIPT. -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	4 mi
SPEED TO D/A -	7 mph (34 min)
SPEED FROM D/A -	7 mph (34 min)
DUMP OR PUMPOUT -	10 min
DISENGAGE TOW -	10 min
AVE. CYCLE TIME -	103 min per trip
TOW EFFICIENCY -	70 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	80 %
% SOLIDS -	90 % (2,160 cy/load)

PG 10 OF 12: PROJECT TITLES

PG 10....PRESENT YEAR -	2017
ECONOMIC INDEX -	8789
LAF -	1.080
INTEREST RATE -	2.500% /yr
TIME PERIOD -	Jan thru Jun 2017
BUCKET AVAILABILITY -	9 mos/yr
FUEL PRICE -	\$3.25 /gal

PG 2 OF 12: TYPE OF EST & IND COSTS

TYPE OF EST. -	1 - Planning Estimate (Includes Profit)
CONTRACTOR'S O.H. -	25.0%
CONTRACTOR'S PROFIT -	8.0%
CONTRACTOR'S BOND -	0.8%

PG 3 OF 12: TYPE OF EST & IND COSTS

DREDGING AREA -	4,000,000 SQ. FT.
BANK HEIGHT -	5 ft
REQ'D EXCAVATION -	137,400 cyds
PAY OVERDEPTH -	140,000 cyds
CONTRACT AMOUNT -	277,400 cyds
NOT DREDGED -	70,000 cyds
NET PAY -	207,400 cyds
NONPAY YARDAGE -	0 cyds
GROSS YARDAGE -	207,400 cyds
Non-Pay Calc -	0.0 % of Pay O.D. for NonPay
TOTAL BANK HEIGHT -	5.0 ft

PG 7 OF 12: PROJECT TITLES

DREDGES -	1
SCOWS @ DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1

PG 4 OF 12: TYPE OF EST & IND COSTS

DREDGE SEL. -	10 CY CLAMSHELL
TYPE OF MATERIAL -	Clays and Less-Dense Sand
BUCKET SIZE -	8
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	5.5
BANK FACTOR -	0.91

PG 8 OF 12: PROJECT TITLES

ADDITIONAL SCOWS -	0.25
TOT SCOWS ON JOB -	2.25
QTRS ON DREDGE? -	Yes
SURVEY BOAT? -	1
CREW BOAT? -	0

Production Summary

EXCAVATION PRODUCTION -	210 cy/hr (gross)
EXCAVATION EWT -	60.0% (438 hrs/mo)
EXCAVATION TIME -	2.25 months
HAULING PRODUCTION -	1258 cy/hr (gross)
HAULING EWT -	70.0% (511 hrs/mo)
HAULING TIME -	0.32 months
DREDGING TIME -	2.25 months
EXCAVAT EWT (ADJUSTED) -	438 hrs/mo (60.0% EWT)
HAULING EWT (ADJUSTED) -	73 hrs/mo (10.0% EWT)
PRODUCTION (GROSS) -	91,980 cy per month
PRODUCTION (CONTRACT) -	91,980 pay cy per month

A DESCRIPTION AND QUANTITY SUMMARY

1 PROJECT	<u>Seattle Harbor Dredging</u>	DATE OF ESTIMATE	<u>21 June 2017</u>
2 LOCATION	<u>Astoria OR</u>	INVIT. OR CONTR. NO.	<u>Open East Waterway - 57'</u>
3 ESTIMATED BY	<u>Callan</u>	CHECKED BY	<u>Checker's Name</u>
4 TYPE OF DREDGE	<u>10 CY CLAMSHELL</u>	TYPE OF ESTIMATE	<u>1 - Planning Estimate (Includes Profit)</u>

2 57' Mechanical Dredge - Open Water

5 DESCRIPTION OF WORK

6 EXCAVATION		REMARKS
A. REQUIRED	<u>137,400</u> CY	
B. PAY OVERDEPTH	+ <u>140,000</u> CY	
C. MAX. PAY YARDAGE	= <u>277,400</u> CY	<u>(YARDAGE USED ON BID FORM)</u>
D. O.D. NOT DREDGED	- <u>70,000</u> CY	
E. NET PAY YARDAGE	= <u>207,400</u> CY	<u>(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)</u>
F. NON-PAY YARDAGE	+ _____ CY	<u>% of Pay O.D. for NonPay</u>
G. GROSS YARDAGE	= 207,400 CY	<u>(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)</u>

B	DREDGING COST	BID ITEM # 2	REMARKS
1	GROSS YARDAGE	<u>207,400</u> CY	FROM SHEET A, ITEM 6 G.
2	PRODUCTION RATE	<u>/ 91,980</u> CY/MO	FROM SHEET C, ITEM 4.
3	DREDGING TIME	= <u>2.25</u> MONTHS	207,400 Net Pay CY / 2.250 MO = 91,980 Pay CY/MO
4	TOTAL MONTHLY COST	<u>x \$1,007,033</u>	FROM SHEET D, ITEM 5.
	SUBTOTAL.....=	<u>\$2,265,824</u>	
5	FIXED COSTS	<u>+ \$52,000</u>	FROM SHEET E, ITEM 15.
	SUBTOTAL.....=	<u>\$2,317,824</u>	
6	OVERHEAD	<u>25.0% + \$579,456</u>	
	SUBTOTAL.....=	<u>\$2,897,280</u>	
7	PROFIT	<u>8.0% + \$231,782</u>	
	SUBTOTAL.....=	<u>\$3,129,062</u>	
8	BOND	<u>0.8% + \$25,032</u>	
9	GROSS PRODUCTION COST	= <u>\$3,154,094</u>	
10	NET PAY YARDAGE	<u>/ 207,400</u> CY	FROM SHEET A, ITEM 6 E.
11	UNIT COST	= <u>\$15.21 /CY</u>	
12	MAX PAY YARDAGE	<u>x 277,400</u> CY	FROM SHEET A, ITEM 6 C.FROM SHEET A, ITEM 6 C.
13	DREDGING COST	= <u>\$4,219,254</u>	

C	MONTHLY PRODUCTION SUMMARY & ADJUSTED OPERATING HOURS	BID ITEM # 2
		REMARKS
1 EXCAVATION TIME	<u>2.25</u> MONTHS	91,980 CY/MO FROM SHEET C \ 1A
2 HAULING TIME	<u>0.32</u> MONTHS	642,838 CY/MO FROM SHEET C \ 2A
3 DREDGING TIME.....>	<u>2.25</u> MONTHS	<u>[Greater of Excavation Time or Hauling Time]</u>
4 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	
5 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	FROM ITEM 4.
6 GROSS PRODUCTION (DREDGE)	<u>/</u> <u>210</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 8.</u>
7 ADJUSTED OPERATING HOURS (DREDGE) =	<u>438</u> HR/MO	<u>DIVIDED BY 730 HRS = 60.0% OF EWT</u>
8 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	FROM ITEM 4.
9 GROSS PRODUCTION (HAULING)	<u>/</u> <u>1258</u> CY/HR	<u>FROM SHEET C \ 2B, ITEM 8.</u>
10 ADJUSTED OPERATING HRS (HAULING) =	<u>73</u> HR/MO	<u>DIVIDED BY 730 HRS = 10.0% OF EWT</u>

C \ 1A

EXCAVATION RATE & EXCAVATION TIME

BID ITEM # 2

REMARKS

1 MONTHLY EXCAVATION RATE:

A. DREDGE PRODUCTION	<u>210</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 6.</u>
B. EXCAVATION OPERATING TIME	x <u>438</u> HRS/MO	<u>FROM SHEET C \ 1B, ITEM 7B.</u>
C. EXCAVATION RATE	= <u>91,980</u> CY/MO	

REMARKS

2 EXCAVATION TIME:

A. GROSS CUBIC YARDS	<u>207,400</u> CY (GROSS)	<u>FROM SHEET A, ITEM 6G.</u>
B. EXCAVATION RATE	/ <u>91,980</u> CY/MO	<u>FROM ITEM 1C.</u>
C. EXCAVATION TIME	= <u>2.25</u> MONTHS	

C \ 1B

**DREDGE PRODUCTION & EXCAVATION
OPERATING TIME**

BID ITEM # 2

1 SIZE OF DREDGE	<u>10 CY CLAMSHELL</u>	REMARKS
2 CYCLE RATE	<u>0.86</u> Buckets/Min	<u>(60 SECONDS PER MIN / 70 SECONDS PER CYCLE)</u>
	x <u>60</u> MIN/HR	_____
3 BUCKET SIZE	x <u>8</u> CY	_____
A. BUCKET FILL FACTOR	x <u>0.70</u>	<u>(WORKING CAPACITY = 5.60 CY/BUCKET)</u>
B. BANK FACTOR	x <u>0.91</u>	<u>(based on 5.0 Ft of Bank Height)</u>
C. OTHER FACTOR	x <u>0.80</u>	<u>>Adjust for partial virgin materia digging.</u>
D. CLEANUP FACTOR	x <u>1</u>	<u>ADDITIONAL TIME</u>
4 PRODUCTION PER DREDGE	= <u>210</u> CY/HR	_____
5 NUMBER OF DREDGES	x <u>1</u>	_____
6 GROSS PRODUCTION	= <u>210</u> CY/HR	_____
REMARKS		
7 EXCAVATION OPERATING TIME:		_____
A. TIME EFFICIENCY	<u>60.0%</u>	<u>% OF EWT WITHOUT MAJOR WAITS FOR SCOWS</u>
	x <u>730</u> HRS/MO	_____
B. EXCAVATION OPERATING TIME	= <u>438</u> HRS/MO	_____

C \ 2A

HAULING RATE & HAULING TIME

BID ITEM # 2

REMARKS

1 MONTHLY HAULING RATE:

A. HAULING PRODUCTION 1,258 CY/HR FROM SHEET C \ 2B, ITEM 8.

B. HAULING OPERATING TIME x 511 HRS/MO FROM SHEET C \ 2B, ITEM 9B.

C. HAULING RATE = 642,838 CY/MO

REMARKS

2 HAULING TIME:

A. GROSS CUBIC YARDS 207,400 CY (Gross) FROM SHEET A, ITEM 6G.

B. HAULING RATE / 642,838 CY/MO FROM ITEM 1C.

C. HAULING TIME = 0.32 MONTHS

C \ 2B	HAULING PRODUCTION & HAULING OPERATING TIME	BID ITEM # 2
--------	--	--------------

		REMARKS
1 SIZE OF SCOW	_____ 3,000 CY	_____
A. CAPACITY	x _____ 0.8	_____
B. USEABLE VOLUME	= _____ 2,400 CY	_____
C. SLURRY DENSITY	x _____ 0.9	_____
2 AVERAGE VOLUME HAULED	= _____ 2,160 CY/SCOW	_____
3 SCOWS PER TOWING VESSEL	x _____ 1	_____
4 AVERAGE VOLUME HAULED	= _____ 2,160 CY/TRIP	_____
5 AVERAGE CYCLE TIME	/ _____ 103 MIN/TRIP	FROM SHEET C \ 2C, ITEM 3.
	x _____ 60 MIN/HR	_____
6 PRODUCTION PER TOWING VESSEL	= _____ 1,258 CY/HR	_____
7 NUMBER OF TOWING VESSELS	x _____ 1	_____
8 HAULING PRODUCTION	= _____ 1,258 CY/HR	_____

		REMARKS
9 HAULING OPERATING TIME:		_____
A. TIME EFFICIENCY	_____ 70.0%	% OF EWT WITHOUT WAITING FOR DREDGE(S)
	x _____ 730 HRS/MO	_____
B. HAULING OPERATING TIME	= _____ 511 HRS/MO	_____

C \ 2C	HAULING CYCLE TIME	BID ITEM # 2
1 SIZE OF TUG	3000 HP Diesel--Twin Screw	
2 CYCLE TIME PER TRIP:		REMARKS
A. PREPARE FOR SCOW TOW	15 MIN	
B. TO DISPOSAL AREA	+ 34 MIN	4 miles / 7.0 miles per hr x 60 min
C. DUMPING OR PUMPOUT	+ 10 MIN	Dump
D. FROM DISPOSAL AREA	+ 34 MIN	4 miles / 7.0 miles per hr x 60 min
E. DISENGAGE TOW RIGGING AND TIE UP SCOW	+ 10 MIN	
3 AVERAGE CYCLE TIME	= 103 MIN/TRIP	

D		MONTHLY COST SUMMARY		BID ITEM # 2	
DREDGE SIZE 10 CY CLAMSHELL		REMARKS			
1	LABOR COSTS (D1)	\$676,297 /MO			
2	EXCAVATION (D2)		Ownership	Fuel	WLS Maintenance Repair
A.	DREDGE(S)	+ \$70,467 /MO (1 ea)	\$3,466	+ \$44,562	+ \$22,439
B.	WORK TUG(S)	+ \$14,331 /MO (1 ea)	\$928	+ \$7,796	+ \$5,607
C.	CREW/SURVEY TUG	+ \$13,870 /MO (1 ea)	\$555	+ \$8,629	+ \$4,686
D.	DERRICK(S)	+ \$4,113 /MO (1 ea)	\$797	+ \$1,958	+ \$1,358
E.	FUEL/WATER BARGE	+ \$1,424 /MO (1 ea)	\$618	+ \$158	+ \$648
F.	WORK BARGE(S)	+ \$817 /MO (1 ea)	\$410		+ \$407
H.	**Unused**				
I.	**Unused**				
3	HAULING				
A.	TOWING VESSEL(S)	+ \$84,981 /MO (1 ea)	\$31,600	+ \$34,805	+ \$18,576
B.	SCOW(S)	+ \$70,733 /MO (2 ea)	\$19,159	+ \$14,684	+ \$36,891
	Equip TOTALS----->	\$260,736 /MO	\$57,533	+ \$112,592	+ \$90,612
4	OTHER MONTHLY COSTS (D3)	+ \$70,000 /MO	FROM SHEET D \ 3		
5	TOTAL MONTHLY COST	= \$1,007,033			

Equipment Price Breakdown

	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8. Hourly Fuel	\$101.74	\$17.80	\$19.70	\$4.47	\$0.36			
x 1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
- 8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
Operating/Materials/Maintenance/Wear	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

Each	1	1	1	1	1	1		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
Operating/Materials/Maintenance/Wear/Repair	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

	Towing Vessel	Dump Scow
7b. Monthly Ownership:	\$31,600.00	\$8,515.00
8a. (1) Hrly Pr Eng Fuel:	\$438.75	
8a. (2) Hrly 2nd Eng Fuel:	\$38.03	\$8.94
8. Hourly Fuel	\$476.78	\$8.94
x 1j. Hrs Worked/Mo.....	73	730
Monthly Fuel:	\$34,804.94	\$6,526.20
- 8e. Monthly Operating:	\$53,381	\$22,922
Operating/Materials/Maintenance/Wear	\$18,576.06	\$16,395.80

Each	1	2.25
7b. Monthly Ownership:	\$31,600.00	\$19,158.75
Monthly Fuel:	\$34,804.94	\$14,683.95
Operating/Materials/Maintenance/Wear	\$18,576.06	\$36,890.55

D \ 1	LABOR COSTS	BID ITEM #	2
-------	-------------	------------	---

DREDGE SIZE: 10 CY CLAMSHELL

Adjustments, Taxes and Insurance		Monthly Management Cost	
Overtime	14.29%	1	CAPTAIN \$6,147
Holiday 7 Days/Yr	1.92%	1	CHIEF ENG \$6,290
Vacation	8.00%	1	CIVIL ENG \$7,012
COMPOSITE.....	24.21%	1	OFFICE HELP \$2,439
			<u>\$21,888</u>
Social Security Tax	7.65%		
Workman's Compensation	45.00%		
State Unemployment Comp.	3.50%		
Federal Unemployment Comp.	1.00%		
COMPOSITE.....	57.15%		

Each Crew Position is Manned:	8 Hrs per Day
	x 7 Days per Week
=	56 Hrs per Week
	x 4.345 Wks per Month
=	243 Hrs per Month

Last Update...Mar 15

EA	CREW POSITION	O.T.		SUB-TOTAL	TAXES INSUR 57.15%	SUB-TOTAL	FRINGE BENEFITS \$17.40	HRLY COST	HOURS PER MONTH	MONTHLY COST
		BASIC HOURLY WAGE	VACATION & HOLIDAY 24.21%							
3	Operators (Dredge)	\$38.39	+ \$9.29	= \$47.68	+ \$27.25	= \$74.93	+ \$17.40	= \$92.33	x 730	= \$67,401
3	Engineers (Dredge)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 730	= 67,401
3	Mates (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 730	= 65,919
4	Launchmen (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 973	= 87,862
4	Deckhands (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 973	= 85,176
1	Cook (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943
1	Messman (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272
1	Launchmen (Survey)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943
1	Deckhands (Survey)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272
	Launchmen (Crew BT)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x	=
	Deckhands (Crew BT)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x	=
1	Tug Master (Tow Tug)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 243	= 22,436
2	Mates (Tow Tug)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 487	= 43,976
3	Deckhands (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904
3	Scowmen (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904

30 Total Crew MONTHLY CREW LABOR COST = \$654,409

(Average Gross Wage = \$89.67 per manhour)

TOTAL MONTHLY LABOR COST = \$676,297

D/2 EQUIPMENT COST

	Excavation							
	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work	**Unused**	**Unused**
1a. Plant Description.....								
1c. Prime Eng HP.....	625	100	100	100				
1d. (1) Dredge El Gen HP....	50	--	--	--	--	--	--	--
1d. Total 2nd Eng HP.....	210	25	40	25	10			
1e. Plant Value.....	\$370,000	\$67,000	\$42,000	\$127,000	\$95,000	\$63,000		
1f. Acquis Year.....	1995	1992	1997	1990	1990	1990		
1g. Pres Year.....	2017	2017	2017	2017	2017	2017	2017	2017
1h. Cost of Money Rate.....	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%
1i. Disc Money Rate:	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%
1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
2a. LAF.....	1.080	1.08	1.08	1.08	1.08	1.08	1.08	1.08
2b. Fuel Cost per Gal.....	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25
3a. Ec Index <for Acq Yr>..	5036	4679	5429	4271	4271	4271		
3b. Ec Index <for 2017>....	8789	8789	8789	8789	8789	8789	8789	8789
4a. Mos Available/Year.....	9	9	9	9	9	9	9	9
5a. Useful Life (in Yrs)...	13	8	8	20	20	20		
5b. Physical Life (in Hrs).	26,000	18,000	16,000	90,000	90,000	90,000		
5c. SLV Factor.....	0.05	0.10	0.15	0.10	0.05	0.05		
5d. Pr Eng Fuel Factor.....	0.039	0.045	0.045	0.011	0.011	0.011		
5e. 2nd Eng Fuel Factor....	0.033	0.039	0.039	0.011	0.011	0.011		
5f. WLS Factor.....	0.24	0.38	0.38	0.20	0.20	0.20		
5g. RPR Factor.....	1.00	0.80	0.70	0.70	0.60	0.60		
6a. Depreciation:	7.31%	11.25%	10.63%	4.50%	4.75%	4.75%		
6b. FCCM:	1.12%	1.21%	1.26%	1.15%	1.10%	1.10%		
6c. Total Ownership/Year:	8.43%	12.46%	11.89%	5.65%	5.85%	5.85%		
7a. Yearly Ownership:	\$31,191	\$8,348	\$4,994	\$7,176	\$5,558	\$3,686		
7b. Monthly Ownership:	\$3,466	\$928	\$555	\$797	\$618	\$410		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8b. (1) Hrly Pr Eng WLS:	\$19.01	\$5.56	\$5.56	\$0.72				
8b. (2) Hrly 2nd Eng WLS:	\$5.40	\$1.20	\$1.93	\$0.18	\$0.07			
8c. (1) EAF:	1.745	1.878	1.619	2.058	2.058	2.058		
8c. (2) Hrly Repair:	\$26.82	\$6.04	\$3.21	\$2.20	\$1.41	\$0.93		
8d. Total Hrly Operating:	\$152.97	\$30.60	\$30.40	\$7.57	\$1.84	\$0.93		
8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
11. MONTHLY RATE:	\$70,467	\$14,331	\$13,870	\$4,113	\$1,424	\$817		
12a. HRLY STANDBY ALLOW:	\$4.75	\$1.27	\$0.76	\$1.09	\$0.85	\$0.56		
12b. Gener Fuel Allowance:	\$5.36	--	--	--	--	--	--	--
12c. DREDGE HRLY STANDBY:	\$10.11	--	--	--	--	--	--	--

Hauling		
Towing	Dump Scow	Disposal Transport
Twin Screw	3,000 CY Capacity	Twin Screw
	Split Hull Scow	
3000		3000
300	250	300
\$6,000,000	\$1,310,000	\$6,000,000
2009	1992	2009
2017	2017	2017
2.5	2.500%	2.500%
0.02	2.000%	2.000%
73	730	730
1.08	1.08	1.08
3.25	\$3.25	\$3.25
8789	0.011	20
7773	4679	7773
9	9	9
25	20	25
120,000	90,000	120,000
0.10	0.05	0.10
0.045	0.011	0.045
0.039	0.011	0.039
0.38	0.20	0.38
1.20	0.70	1.20
3.60%	4.75%	3.60%
1.14%	1.10%	1.14%
4.74%	5.85%	4.74%
\$284,400	\$76,635	\$284,400
\$31,600	\$8,515	\$31,600
\$438.75		\$438.75
\$38.03	\$8.94	\$38.03
\$166.73		\$166.73
\$14.45	\$1.79	\$14.45
1.131	1.878	1.131
\$73.29	\$20.67	\$73.29
\$731.25	\$31.40	\$731.25
\$53,381	\$22,922	\$533,813
\$84,981	\$31,437	\$565,413
\$43.29	\$11.66	\$43.29

D \ 3 OTHER MONTHLY COSTS

BID ITEM # 2

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Bucket Repair Water Quality		\$20,000 /MO	
2	Monitoring	+	\$50,000 /MO	
3	>	+	\$0 /MO	
4	>	+	\$0 /MO	
5	>	+	\$0 /MO	
6	>	+	\$0 /MO	
7	>	+	\$0 /MO	
8	>	+	\$0 /MO	
9	>	+	\$0 /MO	
10	>	+	\$0 /MO	
11	>	+	\$0 /MO	
12	>	+	\$0 /MO	
13	>	+	\$0 /MO	
14	>	+	\$0 /MO	
15 TOTAL OTHER MONTHLY COSTS =				\$70,000 /MO

E FIXED COSTS

BID ITEM # 2

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Hydrographic Survey		\$52,000	
2	>	+	\$0	
3	>	+	\$0	
4	>	+	\$0	
5	>	+	\$0	
6	>	+	\$0	
7	>	+	\$0	
8	>	+	\$0	
9	>	+	\$0	
10	>	+	\$0	
11	>	+	\$0	
12	>	+	\$0	
13	>	+	\$0	
14	>	+	\$0	

15 FIXED COSTS = \$52,000

MOBIL & DEMOB COST:	Seattle Harbor Dredging	BID QUANTITY	165,125 C.Y.		
EXCAV. COST. \$5,183,274		UNIT COST...	\$31.39 PER C.Y.	TIME.....	3.15 MONTHS

PG 1 OF 12: PROJECT TITLES

PROJECT -	Seattle Harbor Dredging
LOCATION -	Astoria OR
INVIT # -	Transload West Waterway- 57'
DATE OF EST. -	21 June 2017
EST. BY -	Callan
MOB. BID ITEM # -	1
EXCAV. BID ITEM # -	3

PG 5 OF 12: PROJECT TITLES

PG 5.....BUCKET CYCLE -	170 Seconds
OTHER FACTOR -	0.00 >Material Separation
CLEANUP -	0% More Time
TIME EFFICIENCY -	60.0% of EWT

PG 9 OF 12: PROJECT TITLES

PG 9...SP COST/MO (1ST) -	\$20,000	Bucket Repair
SP COST/MO (2ND-14TH) -	\$50,000	From Sheet D4
Total	\$70,000	
SPECIAL COST LS (1ST) -	\$52,000	Hydrographic Survey
SP COST LS (2ND-14TH) -	\$0	From Sheet E
Total	\$52,000	

PG 2 OF 12: TYPE OF EST & IND COSTS

TYPE OF EST. -	1 - Planning Estimate (Includes Profit)
CONTRACTOR'S O.H. -	25.0%
CONTRACTOR'S PROFIT -	8.0%
CONTRACTOR'S BOND -	0.8%

PG 6 OF 12: PROJECT TITLES

TUG DESCRIPT. -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	2 mi
SPEED TO D/A -	5 mph (24 min)
SPEED FROM D/A -	5 mph (24 min)
DUMP OR PUMPOUT -	370 min
DISENGAGE TOW -	10 min
AVE. CYCLE TIME -	443 min per trip
TOW EFFICIENCY -	50 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	80 %
% SOLIDS -	90 % (2,160 cy/load)

PG 10 OF 12: PROJECT TITLES

PG 10....PRESENT YEAR -	2017
ECONOMIC INDEX -	8789
LAF -	1.080
INTEREST RATE -	2.500% /yr
TIME PERIOD -	Jan thru Jun 2017
BUCKET AVAILABILITY -	9 mos/yr
FUEL PRICE -	\$3.25 /gal

PG 3 OF 12: TYPE OF EST & IND COSTS

DREDGING AREA -	4,000,000 SQ. FT.
BANK HEIGHT -	5 ft
REQ'D EXCAVATION -	129,900 cyds
PAY OVERDEPTH -	35,225 cyds
CONTRACT AMOUNT -	165,125 cyds
NOT DREDGED -	17,725 cyds
NET PAY -	147,400 cyds
NONPAY YARDAGE -	0 cyds
GROSS YARDAGE -	147,400 cyds
Non-Pay Calc -	0.0 % of Pay O.D. for NonPay
TOTAL BANK HEIGHT -	5.0 ft

PG 7 OF 12: PROJECT TITLES

DREDGES -	1
SCOWS @ DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1
ADDITIONAL SCOWS -	0
TOT SCOWS ON JOB -	2

Production Summary

EXCAVATION PRODUCTION -	107 cy/hr (gross)
EXCAVATION EWT -	60.0% (438 hrs/mo)
EXCAVATION TIME -	3.15 months
HAULING PRODUCTION -	293 cy/hr (gross)
HAULING EWT -	50.0% (365 hrs/mo)
HAULING TIME -	1.38 months
DREDGING TIME -	3.15 months
EXCAVAT EWT (ADJUSTED) -	438 hrs/mo (60.0% EWT)
HAULING EWT (ADJUSTED) -	160 hrs/mo (21.9% EWT)
PRODUCTION (GROSS) -	46,866 cy per month
PRODUCTION (CONTRACT) -	46,794 pay cy per month

PG 4 OF 12: TYPE OF EST & IND COSTS

DREDGE SEL. -	10 CY CLAMSHELL
TYPE OF MATERIAL -	Clays and Less-Dense Sand
BUCKET SIZE -	8
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	5.5
BANK FACTOR -	0.91

PG 8 OF 12: PROJECT TITLES

QTRS ON DREDGE? -	Yes
SURVEY BOAT? -	1
CREW BOAT? -	0

A DESCRIPTION AND QUANTITY SUMMARY

1 PROJECT	<u>Seattle Harbor Dredging</u>	DATE OF ESTIMATE	<u>21 June 2017</u>
2 LOCATION	<u>Astoria OR</u>	INVIT. OR CONTR. NO.	<u>Transload West Waterway- 57'</u>
3 ESTIMATED BY	<u>Callan</u>	CHECKED BY	<u>Checker's Name</u>
4 TYPE OF DREDGE	<u>10 CY CLAMSHELL</u>	TYPE OF ESTIMATE	<u>1 - Planning Estimate (Includes Profit)</u>

3 57' Mechanical Dredge - Transload Facility

5 DESCRIPTION OF WORK

6 EXCAVATION		REMARKS
A. REQUIRED	<u>129,900</u> CY	
B. PAY OVERDEPTH	+ <u>35,225</u> CY	
C. MAX. PAY YARDAGE	= <u>165,125</u> CY	<u>(YARDAGE USED ON BID FORM)</u>
D. O.D. NOT DREDGED	- <u>17,725</u> CY	
E. NET PAY YARDAGE	= <u>147,400</u> CY	<u>(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)</u>
F. NON-PAY YARDAGE	+ <u> </u> CY	<u>% of Pay O.D. for NonPay</u>
G. GROSS YARDAGE	= 147,400 CY	<u>(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)</u>

B	DREDGING COST	BID ITEM # 3	REMARKS
1	GROSS YARDAGE <u>147,400</u> CY		FROM SHEET A, ITEM 6 G.
2	PRODUCTION RATE <u>/ 46,866</u> CY/MO		FROM SHEET C, ITEM 4.
3	DREDGING TIME = <u>3.15</u> MONTHS		147,400 Net Pay CY / 3.150 MO = 46,794 Pay CY/MO
4	TOTAL MONTHLY COST <u>x \$1,062,793</u>		FROM SHEET D, ITEM 5.
	SUBTOTAL.....= <u>\$3,347,798</u>		
5	FIXED COSTS <u>+ \$52,000</u>		FROM SHEET E, ITEM 15.
	SUBTOTAL.....= <u>\$3,399,798</u>		
6	OVERHEAD <u>25.0% + \$849,950</u>		
	SUBTOTAL.....= <u>\$4,249,748</u>		
7	PROFIT <u>8.0% + \$339,980</u>		
	SUBTOTAL.....= <u>\$4,589,728</u>		
8	BOND <u>0.8% + \$36,718</u>		
9	GROSS PRODUCTION COST = <u>\$4,626,446</u>		
10	NET PAY YARDAGE <u>/ 147,400</u> CY		FROM SHEET A, ITEM 6 E.
11	UNIT COST = <u>\$31.39 /CY</u>		
12	MAX PAY YARDAGE <u>x 165,125</u> CY		FROM SHEET A, ITEM 6 C.FROM SHEET A, ITEM 6 C.
13	DREDGING COST = <u>\$5,183,274</u>		

C	MONTHLY PRODUCTION SUMMARY & ADJUSTED OPERATING HOURS	BID ITEM # 3
		REMARKS
1 EXCAVATION TIME	<u>3.15</u> MONTHS	46,866 CY/MO FROM SHEET C \ 1A
2 HAULING TIME	<u>1.38</u> MONTHS	106,945 CY/MO FROM SHEET C \ 2A
3 DREDGING TIME.....>	<u>3.15</u> MONTHS	<u>[Greater of Excavation Time or Hauling Time]</u>
4 PRODUCTION RATE.....>	<u>46,866</u> CY/MO	
5 PRODUCTION RATE.....>	<u>46,866</u> CY/MO	FROM ITEM 4.
6 GROSS PRODUCTION (DREDGE)	<u>/</u> <u>107</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 8.</u>
7 ADJUSTED OPERATING HOURS (DREDGE) =	<u>438</u> HR/MO	<u>DIVIDED BY 730 HRS = 60.0% OF EWT</u>
8 PRODUCTION RATE.....>	<u>46,866</u> CY/MO	FROM ITEM 4.
9 GROSS PRODUCTION (HAULING)	<u>/</u> <u>293</u> CY/HR	<u>FROM SHEET C \ 2B, ITEM 8.</u>
10 ADJUSTED OPERATING HRS (HAULING) =	<u>160</u> HR/MO	<u>DIVIDED BY 730 HRS = 21.9% OF EWT</u>

C \ 1A	EXCAVATION RATE & EXCAVATION TIME	BID ITEM # 3
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		REMARKS
1 MONTHLY EXCAVATION RATE:		
A. DREDGE PRODUCTION	<u>107</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 6.</u>
B. EXCAVATION OPERATING TIME	<u>x</u> <u>438</u> HRS/MO	<u>FROM SHEET C \ 1B, ITEM 7B.</u>
C. EXCAVATION RATE	= <u>46,866</u> CY/MO	

		REMARKS
2 EXCAVATION TIME:		
A. GROSS CUBIC YARDS	<u>147,400</u> CY (GROSS)	<u>FROM SHEET A, ITEM 6G.</u>
B. EXCAVATION RATE	<u>/</u> <u>46,866</u> CY/MO	<u>FROM ITEM 1C.</u>
C. EXCAVATION TIME	= <u>3.15</u> MONTHS	

C \ 1B

**DREDGE PRODUCTION & EXCAVATION
OPERATING TIME**

BID ITEM # 3

1 SIZE OF DREDGE	<u>10 CY CLAMSHELL</u>	REMARKS
2 CYCLE RATE	<u>0.35</u> Buckets/Min <u>(60 SECONDS PER MIN / 170 SECONDS PER CYCLE)</u>	
	x <u>60</u> MIN/HR	
3 BUCKET SIZE	x <u>8</u> CY	
A. BUCKET FILL FACTOR	x <u>0.70</u>	<u>(WORKING CAPACITY = 5.60 CY/BUCKET)</u>
B. BANK FACTOR	x <u>0.91</u>	<u>(based on 5.0 Ft of Bank Height)</u>
C. OTHER FACTOR	x <u>1.00</u>	<u>>Material Separation</u>
D. CLEANUP FACTOR	<u>x 1</u>	<u>ADDITIONAL TIME</u>
4 PRODUCTION PER DREDGE	= <u>107</u> CY/HR	
5 NUMBER OF DREDGES	<u>x 1</u>	
6 GROSS PRODUCTION	= <u>107</u> CY/HR	
REMARKS		
7 EXCAVATION OPERATING TIME:		
A. TIME EFFICIENCY	<u>60.0%</u>	<u>% OF EWT WITHOUT MAJOR WAITS FOR SCOWS</u>
	x <u>730</u> HRS/MO	
B. EXCAVATION OPERATING TIME	= <u>438</u> HRS/MO	

C \ 2A

HAULING RATE & HAULING TIME

BID ITEM # 3

REMARKS

1 MONTHLY HAULING RATE:

A. HAULING PRODUCTION 293 CY/HR

FROM SHEET C \ 2B, ITEM 8.

B. HAULING OPERATING TIME x 365 HRS/MO

FROM SHEET C \ 2B, ITEM 9B.

C. HAULING RATE = 106,945 CY/MO

REMARKS

2 HAULING TIME:

A. GROSS CUBIC YARDS 147,400 CY (Gross)

FROM SHEET A, ITEM 6G.

B. HAULING RATE / 106,945 CY/MO

FROM ITEM 1C.

C. HAULING TIME = 1.38 MONTHS

C \ 2B	HAULING PRODUCTION & HAULING OPERATING TIME	BID ITEM # 3
--------	--	--------------

		REMARKS
1 SIZE OF SCOW	_____ 3,000 CY	_____
A. CAPACITY	x _____ 0.8	_____
B. USEABLE VOLUME	= _____ 2,400 CY	_____
C. SLURRY DENSITY	x _____ 0.9	_____
2 AVERAGE VOLUME HAULED	= _____ 2,160 CY/SCOW	_____
3 SCOWS PER TOWING VESSEL	x _____ 1	_____
4 AVERAGE VOLUME HAULED	= _____ 2,160 CY/TRIP	_____
5 AVERAGE CYCLE TIME	/ _____ 443 MIN/TRIP	FROM SHEET C \ 2C, ITEM 3.
	x _____ 60 MIN/HR	_____
6 PRODUCTION PER TOWING VESSEL	= _____ 293 CY/HR	_____
7 NUMBER OF TOWING VESSELS	x _____ 1	_____
8 HAULING PRODUCTION	= _____ 293 CY/HR	_____

		REMARKS
9 HAULING OPERATING TIME:		_____
A. TIME EFFICIENCY	_____ 50.0%	% OF EWT WITHOUT WAITING FOR DREDGE(S)
	x _____ 730 HRS/MO	_____
B. HAULING OPERATING TIME	= _____ 365 HRS/MO	_____

C \ 2C	HAULING CYCLE TIME	BID ITEM # 3
1 SIZE OF TUG	3000 HP Diesel--Twin Screw	
2 CYCLE TIME PER TRIP:		REMARKS
A. PREPARE FOR SCOW TOW	15 MIN	
B. TO DISPOSAL AREA	+ 24 MIN	2 miles / 5.0 miles per hr x 60 min
C. DUMPING OR PUMPOUT	+ 370 MIN	Offload
D. FROM DISPOSAL AREA	+ 24 MIN	2 miles / 5.0 miles per hr x 60 min
E. DISENGAGE TOW RIGGING AND TIE UP SCOW	+ 10 MIN	
3 AVERAGE CYCLE TIME	= 443 MIN/TRIP	

D		MONTHLY COST SUMMARY		BID ITEM # 3	
DREDGE SIZE 10 CY CLAMSHELL		REMARKS			
1	LABOR COSTS (D1)	\$676,297 /MO			
2	EXCAVATION (D2)		Ownership	Fuel	WLS Maintenance Repair
A.	DREDGE(S)	+ \$70,467 /MO (1 ea)	\$3,466	+ \$44,562	+ \$22,439
B.	WORK TUG(S)	+ \$14,331 /MO (1 ea)	\$928	+ \$7,796	+ \$5,607
C.	CREW/SURVEY TUG	+ \$13,870 /MO (1 ea)	\$555	+ \$8,629	+ \$4,686
D.	DERRICK(S)	+ \$4,113 /MO (1 ea)	\$797	+ \$1,958	+ \$1,358
E.	FUEL/WATER BARGE	+ \$1,424 /MO (1 ea)	\$618	+ \$158	+ \$648
F.	WORK BARGE(S)	+ \$817 /MO (1 ea)	\$410		+ \$407
H.	**Unused**				
I.	**Unused**				
3	HAULING				
A.	TOWING VESSEL(S)	+ \$148,600 /MO (1 ea)	\$31,600	+ \$76,285	+ \$40,715
B.	SCOW(S)	+ \$62,874 /MO (2 ea)	\$17,030	+ \$13,052	+ \$32,792
	Equip TOTALS----->	\$316,496 /MO	\$55,404	+ \$152,440	+ \$108,652
4	OTHER MONTHLY COSTS (D3)	+ \$70,000 /MO	FROM SHEET D \ 3		
5	TOTAL MONTHLY COST	= \$1,062,793			

Equipment Price Breakdown

	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8. Hourly Fuel	\$101.74	\$17.80	\$19.70	\$4.47	\$0.36			
x 1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
- 8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
Operating/Materials/Maintenance/Wear	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

Each	1	1	1	1	1	1		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
Operating/Materials/Maintenance/Wear/Repair	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

	Towing Vessel	Dump Scow
7b. Monthly Ownership:	\$31,600.00	\$8,515.00
8a. (1) Hrly Pr Eng Fuel:	\$438.75	
8a. (2) Hrly 2nd Eng Fuel:	\$38.03	\$8.94
8. Hourly Fuel	\$476.78	\$8.94
x 1j. Hrs Worked/Mo.....	160	730
Monthly Fuel:	\$76,284.80	\$6,526.20
- 8e. Monthly Operating:	\$117,000	\$22,922
Operating/Materials/Maintenance/Wear	\$40,715.20	\$16,395.80

Each	1	2
7b. Monthly Ownership:	\$31,600.00	\$17,030.00
Monthly Fuel:	\$76,284.80	\$13,052.40
Operating/Materials/Maintenance/Wear	\$40,715.20	\$32,791.60

D \ 1 LABOR COSTS

BID ITEM # 3

DREDGE SIZE: 10 CY CLAMSHELL

Adjustments, Taxes and Insurance

Monthly Management Cost

Overtime	14.29%
Holiday 7 Days/Yr	1.92%
Vacation	8.00%
COMPOSITE.....	24.21%

1	CAPTAIN	\$6,147
1	CHIEF ENG	\$6,290
1	CIVIL ENG	\$7,012
1	OFFICE HELP	\$2,439
		<u>\$21,888</u>

Social Security Tax	7.65%
Workman's Compensation	45.00%
State Unemployment Comp.	3.50%
Federal Unemployment Comp.	1.00%
COMPOSITE.....	57.15%

Each Crew Position is Manned:	8 Hrs per Day
	x 7 Days per Week
=	56 Hrs per Week
	x 4.345 Wks per Month
=	243 Hrs per Month

Last Update...Mar 15

EA	CREW POSITION	O.T.		SUB-TOTAL	TAXES INSUR 57.15%	SUB-TOTAL	FRINGE BENEFITS \$17.40	HRLY COST	HOURS PER MONTH	MONTHLY COST
		BASIC HOURLY WAGE	VACATION & HOLIDAY 24.21%							
3	Operators (Dredge)	\$38.39	+ \$9.29	= \$47.68	+ \$27.25	= \$74.93	+ \$17.40	= \$92.33	x 730	= \$67,401
3	Engineers (Dredge)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 730	= 67,401
3	Mates (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 730	= 65,919
4	Launchmen (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 973	= 87,862
4	Deckhands (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 973	= 85,176
1	Cook (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943
1	Messman (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272
1	Launchmen (Survey)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943
1	Deckhands (Survey)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272
	Launchmen (Crew BT)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x	=
	Deckhands (Crew BT)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x	=
1	Tug Master (Tow Tug)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 243	= 22,436
2	Mates (Tow Tug)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 487	= 43,976
3	Deckhands (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904
3	Scowmen (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904

30 Total Crew MONTHLY CREW LABOR COST = \$654,409

(Average Gross Wage = \$89.67 per manhour)

TOTAL MONTHLY LABOR COST = \$676,297

D/2 EQUIPMENT COST

	Excavation							
	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work	**Unused**	**Unused**
1a. Plant Description.....								
1c. Prime Eng HP.....	625	100	100	100				
1d. (1) Dredge El Gen HP....	50	--	--	--	--	--	--	--
1d. Total 2nd Eng HP.....	210	25	40	25	10			
1e. Plant Value.....	\$370,000	\$67,000	\$42,000	\$127,000	\$95,000	\$63,000		
1f. Acquis Year.....	1995	1992	1997	1990	1990	1990		
1g. Pres Year.....	2017	2017	2017	2017	2017	2017	2017	2017
1h. Cost of Money Rate.....	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%
1i. Disc Money Rate:	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%
1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
2a. LAF.....	1.080	1.08	1.08	1.08	1.08	1.08	1.08	1.08
2b. Fuel Cost per Gal.....	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25
3a. Ec Index <for Acq Yr>..	5036	4679	5429	4271	4271	4271		
3b. Ec Index <for 2017>....	8789	8789	8789	8789	8789	8789	8789	8789
4a. Mos Available/Year.....	9	9	9	9	9	9	9	9
5a. Useful Life (in Yrs)...	13	8	8	20	20	20		
5b. Physical Life (in Hrs).	26,000	18,000	16,000	90,000	90,000	90,000		
5c. SLV Factor.....	0.05	0.10	0.15	0.10	0.05	0.05		
5d. Pr Eng Fuel Factor.....	0.039	0.045	0.045	0.011	0.011	0.011		
5e. 2nd Eng Fuel Factor....	0.033	0.039	0.039	0.011	0.011	0.011		
5f. WLS Factor.....	0.24	0.38	0.38	0.20	0.20	0.20		
5g. RPR Factor.....	1.00	0.80	0.70	0.70	0.60	0.60		
6a. Depreciation:	7.31%	11.25%	10.63%	4.50%	4.75%	4.75%		
6b. FCCM:	1.12%	1.21%	1.26%	1.15%	1.10%	1.10%		
6c. Total Ownership/Year:	8.43%	12.46%	11.89%	5.65%	5.85%	5.85%		
7a. Yearly Ownership:	\$31,191	\$8,348	\$4,994	\$7,176	\$5,558	\$3,686		
7b. Monthly Ownership:	\$3,466	\$928	\$555	\$797	\$618	\$410		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8b. (1) Hrly Pr Eng WLS:	\$19.01	\$5.56	\$5.56	\$0.72				
8b. (2) Hrly 2nd Eng WLS:	\$5.40	\$1.20	\$1.93	\$0.18	\$0.07			
8c. (1) EAF:	1.745	1.878	1.619	2.058	2.058	2.058		
8c. (2) Hrly Repair:	\$26.82	\$6.04	\$3.21	\$2.20	\$1.41	\$0.93		
8d. Total Hrly Operating:	\$152.97	\$30.60	\$30.40	\$7.57	\$1.84	\$0.93		
8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
11. MONTHLY RATE:	\$70,467	\$14,331	\$13,870	\$4,113	\$1,424	\$817		
12a. HRLY STANDBY ALLOW:	\$4.75	\$1.27	\$0.76	\$1.09	\$0.85	\$0.56		
12b. Gener Fuel Allowance:	\$5.36	--	--	--	--	--	--	--
12c. DREDGE HRLY STANDBY:	\$10.11	--	--	--	--	--	--	--

Hauling		
Towing	Dump Scow	Disposal Transport
Twin Screw	3,000 CY Capacity	Twin Screw
	Split Hull Scow	
3000		3000
300	250	300
\$6,000,000	\$1,310,000	\$6,000,000
2009	1992	2009
2017	2017	2017
2.5	2.500%	2.500%
0.02	2.000%	2.000%
160	730	730
1.08	1.08	1.08
3.25	\$3.25	\$3.25
8789	0.011	20
7773	4679	7773
9	9	9
25	20	25
120,000	90,000	120,000
0.10	0.05	0.10
0.045	0.011	0.045
0.039	0.011	0.039
0.38	0.20	0.38
1.20	0.70	1.20
3.60%	4.75%	3.60%
1.14%	1.10%	1.14%
4.74%	5.85%	4.74%
\$284,400	\$76,635	\$284,400
\$31,600	\$8,515	\$31,600
\$438.75		\$438.75
\$38.03	\$8.94	\$38.03
\$166.73		\$166.73
\$14.45	\$1.79	\$14.45
1.131	1.878	1.131
\$73.29	\$20.67	\$73.29
\$731.25	\$31.40	\$731.25
\$117,000	\$22,922	\$533,813
\$148,600	\$31,437	\$565,413
\$43.29	\$11.66	\$43.29

D \ 3 OTHER MONTHLY COSTS

BID ITEM # 3

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Bucket Repair Water Quality		\$20,000 /MO	
2	Monitoring	+	\$50,000 /MO	
3	>	+	\$0 /MO	
4	>	+	\$0 /MO	
5	>	+	\$0 /MO	
6	>	+	\$0 /MO	
7	>	+	\$0 /MO	
8	>	+	\$0 /MO	
9	>	+	\$0 /MO	
10	>	+	\$0 /MO	
11	>	+	\$0 /MO	
12	>	+	\$0 /MO	
13	>	+	\$0 /MO	
14	>	+	\$0 /MO	
15 TOTAL OTHER MONTHLY COSTS =				\$70,000 /MO

E FIXED COSTS

BID ITEM # 3

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Hydrographic Survey		\$52,000	
2	>	+	\$0	
3	>	+	\$0	
4	>	+	\$0	
5	>	+	\$0	
6	>	+	\$0	
7	>	+	\$0	
8	>	+	\$0	
9	>	+	\$0	
10	>	+	\$0	
11	>	+	\$0	
12	>	+	\$0	
13	>	+	\$0	
14	>	+	\$0	

15 FIXED COSTS = \$52,000

MOBIL & DEMOB COST:		Seattle Harbor Dredging	BID QUANTITY	625,895 C.Y.		
EXCAV. COST.	\$9,031,665		UNIT COST...	\$14.43 PER C.Y.	TIME.....	5.94 MONTHS

PG 1 OF 12: PROJECT TITLES

PROJECT -	Seattle Harbor Dredging
LOCATION -	Astoria OR
INVIT # -	Open West Waterway - 57'
DATE OF EST. -	21 June 2017
EST. BY -	Callan
MOB. BID ITEM # -	1
EXCAV. BID ITEM # -	2

PG 5 OF 12: PROJECT TITLES

PG 5.....BUCKET CYCLE -	70 Seconds
OTHER FACTOR -	0.80 >Adjust for partial virgin materia digging.
CLEANUP -	0% More Time
TIME EFFICIENCY -	60.0% of EWT

PG 9 OF 12: PROJECT TITLES

PG 9...SP COST/MO (1ST) -	\$20,000	Bucket Repair
SP COST/MO (2ND-14TH) -	\$50,000	From Sheet D4
Total	\$70,000	
SPECIAL COST LS (1ST) -	\$52,000	Hydrographic Survey
SP COST LS (2ND-14TH) -	\$0	From Sheet E
Total	\$52,000	

PG 6 OF 12: PROJECT TITLES

TUG DESCRIPT. -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	4 mi
SPEED TO D/A -	7 mph (34 min)
SPEED FROM D/A -	7 mph (34 min)
DUMP OR PUMPOUT -	10 min
DISENGAGE TOW -	10 min
AVE. CYCLE TIME -	103 min per trip
TOW EFFICIENCY -	70 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	80 %
% SOLIDS -	90 % (2,160 cy/load)

PG 10 OF 12: PROJECT TITLES

PG 10....PRESENT YEAR -	2017
ECONOMIC INDEX -	8789
LAF -	1.080
INTEREST RATE -	2.500% /yr
TIME PERIOD -	Jan thru Jun 2017
BUCKET AVAILABILITY -	9 mos/yr
FUEL PRICE -	\$3.25 /gal

PG 2 OF 12: TYPE OF EST & IND COSTS

TYPE OF EST. -	1 - Planning Estimate (Includes Profit)
CONTRACTOR'S O.H. -	20.0%
CONTRACTOR'S PROFIT -	8.0%
CONTRACTOR'S BOND -	0.8%

PG 3 OF 12: TYPE OF EST & IND COSTS

DREDGING AREA -	4,000,000 SQ. FT.
BANK HEIGHT -	5 ft
REQ'D EXCAVATION -	471,200 cyds
PAY OVERDEPTH -	154,695 cyds
CONTRACT AMOUNT -	625,895 cyds
NOT DREDGED -	79,695 cyds
NET PAY -	546,200 cyds
NONPAY YARDAGE -	0 cyds
GROSS YARDAGE -	546,200 cyds
Non-Pay Calc -	0.0 % of Pay O.D. for NonPay
TOTAL BANK HEIGHT -	5.0 ft

PG 7 OF 12: PROJECT TITLES

DREDGES -	1
SCOWS @ DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1
ADDITIONAL SCOWS -	0.25
TOT SCOWS ON JOB -	2.25

PG 4 OF 12: TYPE OF EST & IND COSTS

DREDGE SEL. -	10 CY CLAMSHELL
TYPE OF MATERIAL -	Clays and Less-Dense Sand
BUCKET SIZE -	8
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	5.5
BANK FACTOR -	0.91

PG 8 OF 12: PROJECT TITLES

QTRS ON DREDGE? -	Yes
SURVEY BOAT? -	1
CREW BOAT? -	0

Production Summary

EXCAVATION PRODUCTION -	210 cy/hr (gross)
EXCAVATION EWT -	60.0% (438 hrs/mo)
EXCAVATION TIME -	5.94 months
HAULING PRODUCTION -	1258 cy/hr (gross)
HAULING EWT -	70.0% (511 hrs/mo)
HAULING TIME -	0.85 months
DREDGING TIME -	5.94 months
EXCAVAT EWT (ADJUSTED) -	438 hrs/mo (60.0% EWT)
HAULING EWT (ADJUSTED) -	73 hrs/mo (10.0% EWT)
PRODUCTION (GROSS) -	91,980 cy per month
PRODUCTION (CONTRACT) -	91,953 pay cy per month

A DESCRIPTION AND QUANTITY SUMMARY

1 PROJECT	<u>Seattle Harbor Dredging</u>	DATE OF ESTIMATE	<u>21 June 2017</u>
2 LOCATION	<u>Astoria OR</u>	INVIT. OR CONTR. NO.	<u>Open West Waterway - 57'</u>
3 ESTIMATED BY	<u>Callan</u>	CHECKED BY	<u>Checker's Name</u>
4 TYPE OF DREDGE	<u>10 CY CLAMSHELL</u>	TYPE OF ESTIMATE	<u>1 - Planning Estimate (Includes Profit)</u>

2 56' Mechanical Dredge - Open Water

5 DESCRIPTION OF WORK

6 EXCAVATION		REMARKS
A. REQUIRED	<u>471,200</u> CY	
B. PAY OVERDEPTH	+ <u>154,695</u> CY	
C. MAX. PAY YARDAGE	= <u>625,895</u> CY	<u>(YARDAGE USED ON BID FORM)</u>
D. O.D. NOT DREDGED	- <u>79,695</u> CY	
E. NET PAY YARDAGE	= <u>546,200</u> CY	<u>(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)</u>
F. NON-PAY YARDAGE	+ _____ CY	<u>% of Pay O.D. for NonPay</u>
G. GROSS YARDAGE	= 546,200 CY	<u>(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)</u>

B		DREDGING COST	BID ITEM # 2
			REMARKS
1	GROSS YARDAGE	<u>546,200</u> CY	<u>FROM SHEET A, ITEM 6 G.</u>
2	PRODUCTION RATE	<u>/ 91,980</u> CY/MO	<u>FROM SHEET C, ITEM 4.</u>
3	DREDGING TIME	= <u>5.94</u> MONTHS	<u>546,200 Net Pay CY / 5.940 MO = 91,953 Pay CY/MO</u>
4	TOTAL MONTHLY COST	<u>x \$1,007,033</u>	<u>FROM SHEET D, ITEM 5.</u>
	SUBTOTAL.....=	<u>\$5,981,776</u>	
5	FIXED COSTS	<u>+ \$52,000</u>	<u>FROM SHEET E, ITEM 15.</u>
	SUBTOTAL.....=	<u>\$6,033,776</u>	
6	OVERHEAD 20.0%	<u>+ \$1,206,755</u>	
	SUBTOTAL.....=	<u>\$7,240,531</u>	
7	PROFIT 8.0%	<u>+ \$579,242</u>	
	SUBTOTAL.....=	<u>\$7,819,773</u>	
8	BOND 0.8%	<u>+ \$62,558</u>	
9	GROSS PRODUCTION COST	= <u>\$7,882,331</u>	
10	NET PAY YARDAGE	<u>/ 546,200</u> CY	<u>FROM SHEET A, ITEM 6 E.</u>
11	UNIT COST	= <u>\$14.43</u> /CY	
12	MAX PAY YARDAGE	<u>x 625,895</u> CY	<u>FROM SHEET A, ITEM 6 C.FROM SHEET A, ITEM 6 C.</u>
13	DREDGING COST	= <u>\$9,031,665</u>	

C	MONTHLY PRODUCTION SUMMARY & ADJUSTED OPERATING HOURS	BID ITEM # 2
		REMARKS
1 EXCAVATION TIME	<u>5.94</u> MONTHS	91,980 CY/MO FROM SHEET C \ 1A
2 HAULING TIME	<u>0.85</u> MONTHS	642,838 CY/MO FROM SHEET C \ 2A
3 DREDGING TIME.....>	<u>5.94</u> MONTHS	<u>[Greater of Excavation Time or Hauling Time]</u>
4 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	
5 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	FROM ITEM 4.
6 GROSS PRODUCTION (DREDGE)	<u>/</u> <u>210</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 8.</u>
7 ADJUSTED OPERATING HOURS (DREDGE) =	<u>438</u> HR/MO	<u>DIVIDED BY 730 HRS = 60.0% OF EWT</u>
8 PRODUCTION RATE.....>	<u>91,980</u> CY/MO	FROM ITEM 4.
9 GROSS PRODUCTION (HAULING)	<u>/</u> <u>1258</u> CY/HR	<u>FROM SHEET C \ 2B, ITEM 8.</u>
10 ADJUSTED OPERATING HRS (HAULING) =	<u>73</u> HR/MO	<u>DIVIDED BY 730 HRS = 10.0% OF EWT</u>

C \ 1A

EXCAVATION RATE & EXCAVATION TIME

BID ITEM # 2

REMARKS

1 MONTHLY EXCAVATION RATE:

A. DREDGE PRODUCTION	<u>210</u> CY/HR	<u>FROM SHEET C \ 1B, ITEM 6.</u>
B. EXCAVATION OPERATING TIME	x <u>438</u> HRS/MO	<u>FROM SHEET C \ 1B, ITEM 7B.</u>
C. EXCAVATION RATE	= <u>91,980</u> CY/MO	

REMARKS

2 EXCAVATION TIME:

A. GROSS CUBIC YARDS	<u>546,200</u> CY (GROSS)	<u>FROM SHEET A, ITEM 6G.</u>
B. EXCAVATION RATE	/ <u>91,980</u> CY/MO	<u>FROM ITEM 1C.</u>
C. EXCAVATION TIME	= <u>5.94</u> MONTHS	

C \ 1B

**DREDGE PRODUCTION & EXCAVATION
OPERATING TIME**

BID ITEM # 2

1 SIZE OF DREDGE	<u>10 CY CLAMSHELL</u>	REMARKS
2 CYCLE RATE	<u>0.86</u> Buckets/Min	<u>(60 SECONDS PER MIN / 70 SECONDS PER CYCLE)</u>
	x <u>60</u> MIN/HR	_____
3 BUCKET SIZE	x <u>8</u> CY	_____
A. BUCKET FILL FACTOR	x <u>0.70</u>	<u>(WORKING CAPACITY = 5.60 CY/BUCKET)</u>
B. BANK FACTOR	x <u>0.91</u>	<u>(based on 5.0 Ft of Bank Height)</u>
C. OTHER FACTOR	x <u>0.80</u>	<u>>Adjust for partial virgin materia digging.</u>
D. CLEANUP FACTOR	x <u>1</u>	<u>ADDITIONAL TIME</u>
4 PRODUCTION PER DREDGE	= <u>210</u> CY/HR	_____
5 NUMBER OF DREDGES	x <u>1</u>	_____
6 GROSS PRODUCTION	= <u>210</u> CY/HR	_____
REMARKS		
7 EXCAVATION OPERATING TIME:		_____
A. TIME EFFICIENCY	<u>60.0%</u>	<u>% OF EWT WITHOUT MAJOR WAITS FOR SCOWS</u>
	x <u>730</u> HRS/MO	_____
B. EXCAVATION OPERATING TIME	= <u>438</u> HRS/MO	_____

C \ 2A

HAULING RATE & HAULING TIME

BID ITEM # 2

REMARKS

1 MONTHLY HAULING RATE:

A. HAULING PRODUCTION 1,258 CY/HR FROM SHEET C \ 2B, ITEM 8.

B. HAULING OPERATING TIME x 511 HRS/MO FROM SHEET C \ 2B, ITEM 9B.

C. HAULING RATE = 642,838 CY/MO

REMARKS

2 HAULING TIME:

A. GROSS CUBIC YARDS 546,200 CY (Gross) FROM SHEET A, ITEM 6G.

B. HAULING RATE / 642,838 CY/MO FROM ITEM 1C.

C. HAULING TIME = 0.85 MONTHS

C \ 2B	HAULING PRODUCTION & HAULING OPERATING TIME	BID ITEM # 2
--------	--	--------------

		REMARKS
1 SIZE OF SCOW	_____ 3,000 CY	_____
A. CAPACITY	x _____ 0.8	_____
B. USEABLE VOLUME	= _____ 2,400 CY	_____
C. SLURRY DENSITY	x _____ 0.9	_____
2 AVERAGE VOLUME HAULED	= _____ 2,160 CY/SCOW	_____
3 SCOWS PER TOWING VESSEL	x _____ 1	_____
4 AVERAGE VOLUME HAULED	= _____ 2,160 CY/TRIP	_____
5 AVERAGE CYCLE TIME	/ _____ 103 MIN/TRIP	FROM SHEET C \ 2C, ITEM 3.
	x _____ 60 MIN/HR	_____
6 PRODUCTION PER TOWING VESSEL	= _____ 1,258 CY/HR	_____
7 NUMBER OF TOWING VESSELS	x _____ 1	_____
8 HAULING PRODUCTION	= _____ 1,258 CY/HR	_____

		REMARKS
9 HAULING OPERATING TIME:		_____
A. TIME EFFICIENCY	_____ 70.0%	% OF EWT WITHOUT WAITING FOR DREDGE(S)
	x _____ 730 HRS/MO	_____
B. HAULING OPERATING TIME	= _____ 511 HRS/MO	_____

C \ 2C	HAULING CYCLE TIME	BID ITEM # 2
1 SIZE OF TUG	3000 HP Diesel--Twin Screw	
2 CYCLE TIME PER TRIP:		REMARKS
A. PREPARE FOR SCOW TOW	15 MIN	
B. TO DISPOSAL AREA	+ 34 MIN	4 miles / 7.0 miles per hr x 60 min
C. DUMPING OR PUMPOUT	+ 10 MIN	Dump
D. FROM DISPOSAL AREA	+ 34 MIN	4 miles / 7.0 miles per hr x 60 min
E. DISENGAGE TOW RIGGING AND TIE UP SCOW	+ 10 MIN	
3 AVERAGE CYCLE TIME	= 103 MIN/TRIP	

D		MONTHLY COST SUMMARY		BID ITEM # 2	
DREDGE SIZE 10 CY CLAMSHELL		REMARKS			
1	LABOR COSTS (D1)	\$676,297 /MO			
2	EXCAVATION (D2)		Ownership	Fuel	WLS Maintenance Repair
A.	DREDGE(S)	+ \$70,467 /MO (1 ea)	\$3,466	+ \$44,562	+ \$22,439
B.	WORK TUG(S)	+ \$14,331 /MO (1 ea)	\$928	+ \$7,796	+ \$5,607
C.	CREW/SURVEY TUG	+ \$13,870 /MO (1 ea)	\$555	+ \$8,629	+ \$4,686
D.	DERRICK(S)	+ \$4,113 /MO (1 ea)	\$797	+ \$1,958	+ \$1,358
E.	FUEL/WATER BARGE	+ \$1,424 /MO (1 ea)	\$618	+ \$158	+ \$648
F.	WORK BARGE(S)	+ \$817 /MO (1 ea)	\$410		+ \$407
H.	**Unused**				
I.	**Unused**				
3	HAULING				
A.	TOWING VESSEL(S)	+ \$84,981 /MO (1 ea)	\$31,600	+ \$34,805	+ \$18,576
B.	SCOW(S)	+ \$70,733 /MO (2 ea)	\$19,159	+ \$14,684	+ \$36,891
	Equip TOTALS----->	\$260,736 /MO	\$57,533	+ \$112,592	+ \$90,612
4	OTHER MONTHLY COSTS (D3)	+ \$70,000 /MO	FROM SHEET D \ 3		
5	TOTAL MONTHLY COST	= \$1,007,033			

Equipment Price Breakdown

	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8. Hourly Fuel	\$101.74	\$17.80	\$19.70	\$4.47	\$0.36			
x 1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
- 8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
Operating/Materials/Maintenance/Wear	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

Each	1	1	1	1	1	1		
7b. Monthly Ownership:	\$3,466.00	\$928.00	\$555.00	\$797.00	\$618.00	\$410.00		
Monthly Fuel:	\$44,562.12	\$7,796.40	\$8,628.60	\$1,957.86	\$157.68			
Operating/Materials/Maintenance/Wear/Repair	\$22,438.88	\$5,606.60	\$4,686.40	\$1,358.14	\$648.32	\$407.00		

	Towing Vessel	Dump Scow
7b. Monthly Ownership:	\$31,600.00	\$8,515.00
8a. (1) Hrly Pr Eng Fuel:	\$438.75	
8a. (2) Hrly 2nd Eng Fuel:	\$38.03	\$8.94
8. Hourly Fuel	\$476.78	\$8.94
x 1j. Hrs Worked/Mo.....	73	730
Monthly Fuel:	\$34,804.94	\$6,526.20
- 8e. Monthly Operating:	\$53,381	\$22,922
Operating/Materials/Maintenance/Wear	\$18,576.06	\$16,395.80

Each	1	2.25
7b. Monthly Ownership:	\$31,600.00	\$19,158.75
Monthly Fuel:	\$34,804.94	\$14,683.95
Operating/Materials/Maintenance/Wear	\$18,576.06	\$36,890.55

D \ 1	LABOR COSTS	BID ITEM #	2
-------	-------------	------------	---

DREDGE SIZE: 10 CY CLAMSHELL

Adjustments, Taxes and Insurance		Monthly Management Cost	
Overtime	14.29%	1	CAPTAIN \$6,147
Holiday 7 Days/Yr	1.92%	1	CHIEF ENG \$6,290
Vacation	8.00%	1	CIVIL ENG \$7,012
COMPOSITE.....	24.21%	1	OFFICE HELP \$2,439
			<u>\$21,888</u>
Social Security Tax	7.65%		
Workman's Compensation	45.00%		
State Unemployment Comp.	3.50%		
Federal Unemployment Comp.	1.00%		
COMPOSITE.....	57.15%		

Each Crew Position is Manned:	8 Hrs per Day
	x 7 Days per Week
=	56 Hrs per Week
	x 4.345 Wks per Month
=	243 Hrs per Month

Last Update...Mar 15

EA	CREW POSITION	O.T.		SUB-TOTAL	TAXES INSUR 57.15%	SUB-TOTAL	FRINGE BENEFITS \$17.40	HRLY COST	HOURS PER MONTH	MONTHLY COST	
		BASIC HOURLY WAGE	VACATION & HOLIDAY 24.21%								
3	Operators (Dredge)	\$38.39	+ \$9.29	= \$47.68	+ \$27.25	= \$74.93	+ \$17.40	= \$92.33	x 730	= \$67,401	
3	Engineers (Dredge)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 730	= 67,401	
3	Mates (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 730	= 65,919	
4	Launchmen (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 973	= 87,862	
4	Deckhands (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 973	= 85,176	
1	Cook (Dredge)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943	
1	Messman (Dredge)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272	
1	Launchmen (Survey)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 243	= 21,943	
1	Deckhands (Survey)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 243	= 21,272	
	Launchmen (Crew BT)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x	=	
	Deckhands (Crew BT)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x	=	
1	Tug Master (Tow Tug)	38.39	+ 9.29	= 47.68	+ 27.25	= 74.93	+ 17.40	= 92.33	x 243	= 22,436	
2	Mates (Tow Tug)	37.35	+ 9.04	= 46.39	+ 26.51	= 72.90	+ 17.40	= 90.30	x 487	= 43,976	
3	Deckhands (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904	
3	Scowmen (Tow Tug)	35.93	+ 8.70	= 44.63	+ 25.51	= 70.14	+ 17.40	= 87.54	x 730	= 63,904	
30	Total Crew								MONTHLY CREW LABOR COST =		\$654,409
								(Average Gross Wage =	\$89.67	per manhour)	

TOTAL MONTHLY LABOR COST = \$676,297

D/2 EQUIPMENT COST

	Excavation							
	Dredge	Tugs & Tenders		Barges			Other	
	10 CY CLAMSHELL	Work Tug	Crew/Surv	Derrick	Fuel/Water	Work	**Unused**	**Unused**
1a. Plant Description.....								
1c. Prime Eng HP.....	625	100	100	100				
1d. (1) Dredge El Gen HP....	50	--	--	--	--	--	--	--
1d. Total 2nd Eng HP.....	210	25	40	25	10			
1e. Plant Value.....	\$370,000	\$67,000	\$42,000	\$127,000	\$95,000	\$63,000		
1f. Acquis Year.....	1995	1992	1997	1990	1990	1990		
1g. Pres Year.....	2017	2017	2017	2017	2017	2017	2017	2017
1h. Cost of Money Rate.....	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%	2.500%
1i. Disc Money Rate:	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%	2.000%
1j. Hrs Worked/Mo.....	438	438	438	438	438	438	438	438
2a. LAF.....	1.080	1.08	1.08	1.08	1.08	1.08	1.08	1.08
2b. Fuel Cost per Gal.....	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25	\$3.25
3a. Ec Index <for Acq Yr>..	5036	4679	5429	4271	4271	4271		
3b. Ec Index <for 2017>....	8789	8789	8789	8789	8789	8789	8789	8789
4a. Mos Available/Year.....	9	9	9	9	9	9	9	9
5a. Useful Life (in Yrs)...	13	8	8	20	20	20		
5b. Physical Life (in Hrs).	26,000	18,000	16,000	90,000	90,000	90,000		
5c. SLV Factor.....	0.05	0.10	0.15	0.10	0.05	0.05		
5d. Pr Eng Fuel Factor.....	0.039	0.045	0.045	0.011	0.011	0.011		
5e. 2nd Eng Fuel Factor....	0.033	0.039	0.039	0.011	0.011	0.011		
5f. WLS Factor.....	0.24	0.38	0.38	0.20	0.20	0.20		
5g. RPR Factor.....	1.00	0.80	0.70	0.70	0.60	0.60		
6a. Depreciation:	7.31%	11.25%	10.63%	4.50%	4.75%	4.75%		
6b. FCCM:	1.12%	1.21%	1.26%	1.15%	1.10%	1.10%		
6c. Total Ownership/Year:	8.43%	12.46%	11.89%	5.65%	5.85%	5.85%		
7a. Yearly Ownership:	\$31,191	\$8,348	\$4,994	\$7,176	\$5,558	\$3,686		
7b. Monthly Ownership:	\$3,466	\$928	\$555	\$797	\$618	\$410		
8a. (1) Hrly Pr Eng Fuel:	\$79.22	\$14.63	\$14.63	\$3.58				
8a. (2) Hrly 2nd Eng Fuel:	\$22.52	\$3.17	\$5.07	\$0.89	\$0.36			
8b. (1) Hrly Pr Eng WLS:	\$19.01	\$5.56	\$5.56	\$0.72				
8b. (2) Hrly 2nd Eng WLS:	\$5.40	\$1.20	\$1.93	\$0.18	\$0.07			
8c. (1) EAF:	1.745	1.878	1.619	2.058	2.058	2.058		
8c. (2) Hrly Repair:	\$26.82	\$6.04	\$3.21	\$2.20	\$1.41	\$0.93		
8d. Total Hrly Operating:	\$152.97	\$30.60	\$30.40	\$7.57	\$1.84	\$0.93		
8e. Monthly Operating:	\$67,001	\$13,403	\$13,315	\$3,316	\$806	\$407		
11. MONTHLY RATE:	\$70,467	\$14,331	\$13,870	\$4,113	\$1,424	\$817		
12a. HRLY STANDBY ALLOW:	\$4.75	\$1.27	\$0.76	\$1.09	\$0.85	\$0.56		
12b. Gener Fuel Allowance:	\$5.36	--	--	--	--	--	--	--
12c. DREDGE HRLY STANDBY:	\$10.11	--	--	--	--	--	--	--

Hauling		
Towing	Dump Scow	Disposal Transport
Twin Screw	3,000 CY Capacity	Twin Screw
	Split Hull Scow	
3000		3000
300	250	300
\$6,000,000	\$1,310,000	\$6,000,000
2009	1992	2009
2017	2017	2017
2.5	2.500%	2.500%
0.02	2.000%	2.000%
73	730	730
1.08	1.08	1.08
3.25	\$3.25	\$3.25
8789	0.011	20
7773	4679	7773
9	9	9
25	20	25
120,000	90,000	120,000
0.10	0.05	0.10
0.045	0.011	0.045
0.039	0.011	0.039
0.38	0.20	0.38
1.20	0.70	1.20
3.60%	4.75%	3.60%
1.14%	1.10%	1.14%
4.74%	5.85%	4.74%
\$284,400	\$76,635	\$284,400
\$31,600	\$8,515	\$31,600
\$438.75		\$438.75
\$38.03	\$8.94	\$38.03
\$166.73		\$166.73
\$14.45	\$1.79	\$14.45
1.131	1.878	1.131
\$73.29	\$20.67	\$73.29
\$731.25	\$31.40	\$731.25
\$53,381	\$22,922	\$533,813
\$84,981	\$31,437	\$565,413
\$43.29	\$11.66	\$43.29

D \ 3 OTHER MONTHLY COSTS

BID ITEM # 2

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Bucket Repair Water Quality		\$20,000 /MO	
2	Monitoring	+	\$50,000 /MO	
3	>	+	\$0 /MO	
4	>	+	\$0 /MO	
5	>	+	\$0 /MO	
6	>	+	\$0 /MO	
7	>	+	\$0 /MO	
8	>	+	\$0 /MO	
9	>	+	\$0 /MO	
10	>	+	\$0 /MO	
11	>	+	\$0 /MO	
12	>	+	\$0 /MO	
13	>	+	\$0 /MO	
14	>	+	\$0 /MO	
15 TOTAL OTHER MONTHLY COSTS =				\$70,000 /MO

E FIXED COSTS

BID ITEM # 2

DREDGE SIZE: 10 CY CLAMSHELL

REMARKS

1	Hydrographic Survey		\$52,000	
2	>	+	\$0	
3	>	+	\$0	
4	>	+	\$0	
5	>	+	\$0	
6	>	+	\$0	
7	>	+	\$0	
8	>	+	\$0	
9	>	+	\$0	
10	>	+	\$0	
11	>	+	\$0	
12	>	+	\$0	
13	>	+	\$0	
14	>	+	\$0	

15 FIXED COSTS = \$52,000

Seattle Harbor Schedule

Chief's Report	May-18
PED Start	Oct-20
Contract Award (2 season's of dredging	Jun-23
Contract Complete	Sep-25

¹ Volumes have been computed relative to the June 2016 condition survey; includes 1-foot of overdepth tolerance; includes a 10% contingency
Federal channel: Approach Width = 700'; Inner Width = 500'

low, likely, and high quantities are to specify the probable range for the cost-risk analysis.

50'	Open water disposal (CY)		Upland Disposal (CY)	
East Waterway				
Required Yardage...	5,800	C.Y.	700	C.Y.
+ Pay Overdepth....	-	C.Y.	-	C.Y.
Total Allowed Quantity (CLN Qty)	5,800	C.Y.	700	C.Y.
- Cyds Assumed Not Dug..	-	C.Y.	-	C.Y.
Net Pay Yardage	5,800	C.Y.	700	C.Y.

West Waterway				
Required Yardage...	133,600	C.Y.	25,900	C.Y.
+ Pay Overdepth....	-	C.Y.	-	C.Y.
Total Allowed Quantity (CLN Qty)	133,600	C.Y.	25,900	C.Y.
- Cyds Assumed Not Dug..	-	C.Y.	-	C.Y.
Net Pay Yardage	133,600	C.Y.	25,900	C.Y.

NED '56	Open water disposal (CY)		Upland Disposal (CY)	
East Waterway				
Required Yardage...	82,200	C.Y.	9,200	C.Y.
+ Pay Overdepth....	110,400	C.Y.	12,200	C.Y.
Total Allowed Quantity (CLN Qty)	192,600	C.Y.	21,400	C.Y.
- Cyds Assumed Not Dug..	55,200	C.Y.	6,100	C.Y.
Net Pay Yardage	137,400	C.Y.	15,300	C.Y.

West Waterway				
Required Yardage...	401,000	C.Y.	111,300	C.Y.
+ Pay Overdepth....	145,200	C.Y.	36,100	C.Y.
Total Allowed Quantity (CLN Qty)	546,200	C.Y.	147,400	C.Y.
- Cyds Assumed Not Dug..	75,000	C.Y.	17,500	C.Y.
Net Pay Yardage	471,200	C.Y.	129,900	C.Y.

LPP '57	Open water disposal (CY)		Upland Disposal (CY)	
East Waterway				
Required Yardage...	137,400	C.Y.	15,300	C.Y.
+ Pay Overdepth....	140,000	C.Y.	15,600	C.Y.
Total Allowed Quantity (CLN Qty)	277,400	C.Y.	30,900	C.Y.
- Cyds Assumed Not Dug..	70,000	C.Y.	7,800	C.Y.
Net Pay Yardage	207,400	C.Y.	23,100	C.Y.

West Waterway				
Required Yardage...	471,200	C.Y.	129,900	C.Y.
+ Pay Overdepth....	154,695	C.Y.	35,225	C.Y.
Total Allowed Quantity (CLN Qty)	625,895	C.Y.	165,125	C.Y.
- Cyds Assumed Not Dug..	79,695	C.Y.	17,725	C.Y.
Net Pay Yardage	546,200	C.Y.	147,400	C.Y.



**US Army Corps
of Engineers®**

**Seattle Harbor Navigation Improvement Project,
Seattle WA
Project Cost and Schedule Risk Analysis Report**



Prepared for:

U.S. Army Corps of Engineers,
Seattle District

Prepared by:

U.S. Army Corps of Engineers
Cost Engineering Directory of Expertise, Walla Walla

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1.0 PURPOSE	4
2.0 PROJECT SCOPE AND BACKGROUND	4
3.0 REPORT SCOPE	4
3.1 USACE Risk Analysis Process.....	4
4.0 PDT INVOLVEMENT	6
4.2 Quantify Risk Factor Impacts	7
4.3 Analyze Cost Estimate and Schedule Contingency.....	7
5.0 Basis of Estimate -Cost Assumptions	8
6.0 RESULTS	11
6.1 Risk Register	11
6.2 Cost Contingency Results	11
6.2.1 Sensitivity Analysis.....	12
6.2.2 Sensitivity Analysis Results	12
6.3 Schedule and Contingency Risk Analysis	13
7.0 RISK IDENTIFICATION and RISK REDUCTION MEASURES	13
7.1 Project Cost and Schedule Risk.....	14

LIST OF FIGURES

Figure 1. Cost Sensitivity Analysis.....	13
--	----

LIST OF TABLES

Table ES-1. Construction Contingency Results	3
--	---

Table 1. Construction Cost Contingency Summary 12
Table 2. Construction Cost Comparison Summary (Uncertainty Analysis)..... 14

LIST OF APPENDICES

Risk Register APPENDIX A

EXECUTIVE SUMMARY

The US Army Corps of Engineers (USACE), Seattle District, presents this cost and schedule risk analysis (CSRA) report regarding the risk findings and recommended contingencies for the Seattle Harbor Navigation Improvement Project (SHNIP). In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis, *Monte-Carlo* based-study was conducted by the Project Development Team (PDT) on remaining costs. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommend 80% confidence level of successful execution to project completion.

Cost estimates fluctuate over time. During this period of study, minor cost fluctuations can and have occurred. For this reason, contingency reporting is based in cost and per cent values. Should cost vary to a slight degree with similar scope and risks, contingency per cent values will be reported, cost values rounded

Table ES-1. Construction Contingency Results

Base Case Construction Cost Estimate	\$43,403,000	
Confidence Level	Construction Value (\$\$)	Contingency (%)
80%	\$53,690,000	23.7%

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The PDT worked through the risk register on two separate occasions: September 2015 and again in June 2017. That period of time included the alternative formulation process and the TSP selection. The TSP was based on improved project scope definition, investigations, design and cost information, and resulted in reduced risks in certain project areas. The key risk drivers identified through sensitivity analysis suggest a cost contingency of \$10.3M at an 80% confidence level.

The project is a typical port dredging project with normal risk assigned. Dredged material will be disposed at open water site within 3 miles of project. For unsuitable material, a transload facility is located within 3 miles of the project.

Cost Risks: From the CSRA, the key or greater Cost Risk items of include:



Cost and Schedule Risk Register Summary (High and Moderate)

Thursday, September 07, 2017
1:42:31 PM

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u> Risk Level	<u>Schedule</u> Risk Level
-------	------------------------	------------------------	-----------------	---------------------------	-------------------------------

02 Scope Variance

3 **Yardage split between upland disposal vs. open water**

Assumptions regarding quantities of dredged material requiring upland disposal are based on Dredged Material Management Program (DMMP) and CERCLA testing results. These testing results and associated assumptions regarding quantities for upland disposal may not provide sufficient data to confirm in-water or upland disposal assumptions during the feasibility phase. More upland disposal may be required, which is a more costly disposal method. East: Alternatives are based on CERCLA feasibility study.

Sediment sampling and partial DMMP testing (including dioxin) were conducted in the West Waterway to estimate the volume of dredged material that would be suitable for in-water disposal versus upland confined disposal. Due to time constraints on the acceptability of data for construction (3-year limit for data acceptability under the DMMP guidelines), a full DMMP suitability determination will be completed during the Pre-Construction, Engineering, and Design (PED) phase. Feasibility-level sampling will not occur in the East Waterway because existing sampling data in this area is adequate to support development of quantities and associated cost estimates during the feasibility phase. The Corps used data from the draft CERCLA RI/FS (Anchor QEA 2014) for that occur in the East Waterway because existing sampling data in this area is adequate to support development of quantities and associated cost estimates during the feasibility phase. The Corps used data from the draft CERCLA RI/FS (Anchor QEA 2014) for the East Waterway to estimate the volume of dredged material that would be suitable for in-water versus upland disposal.

High **Moderate**

Risk Method: Take Actions to Reduce (Mitigate)

Risk Reduction Measures: Additional DMMP sampling will be performed during PED.

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u> Risk Level	<u>Schedule</u> Risk Level
05 Contract Acquisition					
10	Contract Type	Final acquisition method has not been identified. Past methods have including various scenarios including use of small business and full and open competition.	The base case estimate is based on full and open competition. Risk would be for additional cost associated with small business. Small business may need to rent/lease additional plant resulting in higher cost.	High	Low
	Risk Method:	<u>Take Actions to Reduce (Mitigate)</u>			
	Risk Reduction Measures:	Schedule early contract solicitation and award to provide maximum flexibility in establishing schedule and agreements with Transload facilities.			
.....					
23	Contractor Competition and perceived Risk	Dredging competition is limited throughout the industry.	This project involves sufficient material quantities to attract regional competition. Current area has seen stable bid climate and competition. Project does include the potential for contaminated material with restrictive hauling requirements	Moderate	Low
	Risk Method:	<u>Take Actions to Reduce (Mitigate)</u>			
	Risk Reduction Measures:	Review of acquisition plan, communication to contractors and early solicitation of contract could a reduce risk maximizing competition.			
.....					

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
07 Construction Activity					
5	Dredging Effective Time (Time spent active dredging of material)	Work is being performed in an active harbor with large vessel traffic. Cost estimate is based on typical effective time used for mechanical dredging harbor work (60% effective time).	The project has received the maximum allowable work window from the Services. There is a risk we may need a third dredging year if this productivity is insufficient. Estimate is based on conservative effective time (60%) based on potential for heavy traffic. Maximum amount of time is 730 hrs/mo (24 hrs/day x 30.42 days/mo). Therefore, 60% equates to 438 hrs/mo of active dredging or digging of material.	Moderate	Low
	Risk Method:	<u>Accept the Risk.</u>			
	Risk Reduction Measures:	Attempt provide maximum flexibility of allowable dredging months.			
6	Material Hauling Time Effective Time (Time spent active hauling of material)	Work is being performed in an active harbor with large vessel traffic. Cost estimate is based on typical hauling effective time used for mechanical dredging harbor work (50% effective time for Upland and 60% for open water disposal).	Estimate is based on conservative effective time for upland disposal (50%) based on potential for heavy traffic. Open water is based on 60% effective time. Maximum amount of time is 730 hrs/mo (24 hrs/day x 30.42 days/mo). Therefore, 50% equates to 365 hrs/mo of active hauling and disposing of material of material for upland, and 511 hrs/mo for open water. Also adjust average speed. base estimate used 7 mph. Adjust for slower speeds during transload disposal cycle.	Moderate	Low
	Risk Method:	<u>Take Actions to Reduce (Mitigate)</u>			
	Risk Reduction Measures:	Evaluation of market survey to assure competitive solicitation.			
12	Transload Facility Capacity	The dredging cycle is dependent on the hauling cycle. If wait time occurs at the unloading facility, the overall cost of project will increase.	The existing transload facility located close to the work site, has indicated that the transload facility has the ability to increase offload production to reduce or eliminate wait times. However, there is a potential multiple projects may utilize the site concurrently to this contract. The transload also stated that it is important to lock in early the schedule and yardage amounts going to the transload site early. This would dictate production and potential wait times. Rate at transload may vary with future use. Adjust rate per ton.th future use. Adjust rate per ton.	Moderate	Low
	Risk Method:	<u>Accept the Risk.</u>			
	Risk Reduction Measures:	NA			

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
07 Construction Activity					
15	Open Water Disposal Capacity	There is a identified open water disposal within 3 miles of the project.	There is possibility that an alternate site may have to be used for open water. Currently there are limited options for disposal.	Moderate	Low
	Risk Method:	<u>Accept the Risk.</u>			
	Risk Reduction Measures:	NA			
21	Dredging area physical obstructions (East waterway Cable crossings, etc..)	A communication cable crosses the East Waterway. Based on available information, the cable is located between Station 27+00 and Station 30+00 (between Terminal 18 and the northern portion of Terminal 30). The cable was originally buried in 1972 at approximately - 64 feet MLLW in an armored trench. During PED, an underwater channel survey will confirm the size, depth, and extent of armoring of the communication cable. Based on the results of the channel survey, it is uncertain whether the armoring should be replaced or relocated. The Corps conservatively assumes the utility will be relocated at the expense of the non-Federal sponsor; therefore an estimated relocation cost was included in the baseline real estate cost estimate.	During PED, an underwater channel survey will confirm the size, depth, and extent of armoring of the communication cable. Based on the results of the channel survey, it may be determined that the armoring should be replaced or relocated.	Moderate	Low
	Risk Method:	<u>Accept the Risk.</u>			
	Risk Reduction Measures:	NA			
24	Modifications and Claims During Construction	Changes and or Claims possibility during the construction execution.	Due to the inherent unknowns related to physical conditions at all dredging locations there is risk of site changes. For this site, the risk is lower than other sites since the project location is well defined and surveyed.	Moderate	Low
	Risk Method:	<u>Take Actions to Reduce (Mitigate)</u>			
	Risk Reduction Measures:	utilize technical reviews to reduce risk within the contract			

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
08 Cost and Schedule					
8	Fuel Cost	Fuel is typically a key cost driver for dredging projects where large equipment usage is dependent on fuel.	Estimate is based on current dredging window fuel pricing. Cost risk will be based on a potential high value.	Moderate	Low
	Risk Method:	<u>Accept the Risk.</u>			
	Risk Reduction Measures:	N/A			
14	Prevailing Wages for Unsuitable Material (Unloading, Transportation & Disposal)	The cost associated with the disposal of unsuitable material is the responsibility of the port. The cost would fluctuate if the contract documents are developed so that prevailing wages are to be used during the offloading, transportation and final disposal of unsuitable material.	The PDT assumption is that once the title of the unsuitable material is turned over to the disposal company, which would be at the transloading facility, the disposal company takes ownership and responsibility of the material. Therefore, prevailing wages would not be required by USACE after offloading.	Moderate	Low
	Risk Method:	<u>Accept the Risk.</u>			
	Risk Reduction Measures:	NA			
16	Contract Plant Makeup	The dredge project assumes a typical dredging operation where dredging operations and hauling cycle represent a reasonable balance. Since the identified disposal sites are nearby (2 to 4 miles). The assumed plant is 1 each medium size mechanical dredge and 2 each material barges.	Required contract documents may require a specified dredged yardage amount per season. This could result in additional plant being utilized. This would add to mobilization, demobilization and operating cost. This may be offset by reduced wait times if any would reduce the requirement for additional or larger plant makeup.	Moderate	Low
	Risk Method:	<u>Take Actions to Reduce (Mitigate)</u>			
	Risk Reduction Measures:	Review final contract documents for unnecessary risk items passed on the contractor.			

MAIN REPORT

1.0 PURPOSE

Under the auspices of the US Army Corps of Engineers (USACE), Seattle District, this report presents a recommendation for the total project cost and schedule contingencies for the Seattle Harbor Navigation Improvement Project Feasibility Report.

2.0 PROJECT SCOPE AND BACKGROUND

The federally authorized Seattle Harbor navigation project, consisting of the East, West, and Duwamish Waterways, is located in Puget Sound's Elliott Bay at Seattle, Washington (Figure 1-1). The authorized project is located from Elliott Bay to the head of the Federal navigation channel upstream approximately five miles. The authorized project consists of the East Waterway, -34 to -51 feet below mean lower low water (MLLW) (hereafter expressed as -X MLLW; which indicates number of feet below MLLW); the West Waterway, -34 MLLW; the Duwamish Waterway, -30 MLLW for 2.6 miles, -20 MLLW for 0.8 miles, and -15 MLLW for 1.8 miles to the head of navigation. These three waterways provide over 7 miles of deep draft navigation accessible from Elliott Bay, Puget Sound, and the Pacific Ocean. As a part of this effort, Seattle District requested that the USACE Cost Engineering Directory of Expertise for Civil Works (Cost Engineering MCX) provide an agency technical review (ATR) of the cost estimate and schedule for Recommended Project Plan. That tasking also included providing a risk analysis study to establish the resulting contingencies.

3.0 REPORT SCOPE

The scope of the risk analysis report is to identify cost and schedule risks with a resulting recommendation for contingencies at the 80 percent confidence level using the risk analysis processes, as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for cost risks for construction features. The CSRA excludes Real Estate costs and does not include consideration for life cycle costs.

3.1 USACE Risk Analysis Process

The risk analysis process for this study follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering MCX. The risk analysis process reflected within this report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. Furthermore, the scope of the report includes the identification and

communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register. The analysis process evaluated the Micro Computer Aided Cost Estimating System (MCACES) cost estimate, project schedule, and funding profiles using Crystal Ball software to conduct a *Monte Carlo* simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

To fully recognize its benefits, cost and schedule risk analysis should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting and scheduling.

This risk analysis was performed to meet the requirements and recommendations of the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.
- Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008.
- Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

Contingency is an amount added to an estimate to allow for items, conditions or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The risk analysis process uses Monte Carlo techniques to determine probabilities and contingency. The Monte Carlo techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results are provided in Section 6.

4.0 PDT INVOLVEMENT

The Cost Engineering MCX performed the Cost and Schedule Risk Analysis, relying on local district staff to provide expertise and information gathering. The PDT conducted initial risk identification via webinar/teleconference with the Walla Walla Cost Engineering MCX facilitator. The initial risk identification meeting also included qualitative analysis to produce a risk register that served as the draft framework for the risk analysis.

Participants in the risk identification meeting(s) included:

Name	Organization
Nelson, Brian C NWS	Project Manager
Anderson, Kym	Port of Seattle/Operations
Barrow, Charyl L NWS	Econ
Chien, Elizabeth NWS	Operations
Fox, David F NWS	Operations
Gleason, Nancy C NWS	Project Management
Kanaby, Kara NWS	Project Management
Kerns, Kristen NWS	Engineering
Mesko, Rachel NWS	Planning
Michalsen, David R NWS	Engineering
Rodriguez, Antonio NWS	Cost Engineering
Wickstrom, Leah J NWS	Planning
Callan, Kim	Facilitator/Cost Engineering

4.1 Identifying and Assess Risk Factors

Identifying the risk factors via the PDT is considered a qualitative process that results in establishing a risk register that serves as the document for the quantitative study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

A formal PDT meeting was held with the Seattle District office for the purposes of identifying and assessing risk factors. The meeting included capable and qualified representatives from multiple project team disciplines and functions, including project management, cost engineering, design, environmental compliance, and real estate

The initial formal meetings focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope and geographic location. Additionally, numerous conference calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis

to further facilitate risk factor identification, market analysis, and risk assessment. A final meeting was held for finalization of the risk register, resulting CSRA model, findings and results.

4.2 Quantify Risk Factor Impacts

The quantitative impacts (putting it to numbers of cost and time) of risk factors on project plans were analyzed using a combination of professional judgment, empirical data and analytical techniques. Risk factor impacts were quantified using probability distributions (density functions) because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involved multiple project team disciplines and functions. However, the quantification process relied more extensively on collaboration between cost engineering and risk analysis team members with lesser inputs from other functions and disciplines. This process used an iterative approach to estimate the following elements of each risk factor:

- Maximum possible value for the risk factor
- Minimum possible value for the risk factor
- Most likely value (the statistical mode), if applicable
- Nature of the probability density function used to approximate risk factor uncertainty
- Mathematical correlations between risk factors
- Affected cost estimate and schedule elements

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the baseline cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

5.0 Basis of Estimate -Cost Assumptions

Assumptions may change as additional technical information is gained during design maturity.

Estimate Level – Class #3.

Depths

- NED 56' & LPP 57'
- 2' allowed overdepth (Assume avg 1' taken)

Equipment

- 10CY – 26CY Mechanical dredge(s) Use: 10CY
- Flatdeck/Material barges for upland Disposal & dump scows for open water disposal
- Material Barges (1200 CY (1500T) to 3000 CY (3900T) Use =2000 CYD Material Barge and 3000 CYD Dump Scow
- Assume Mechanical Dredge utilized for materials suitable for Open Water
- Assume Mechanical Dredge w/environmental bucket for materials un-suitable for Open Water

Labor

- General Decision Number: WA170105 03/31/2017 WA105
- Superseded General Decision Number: WA20140105
- State: Washington
- Construction Type: Heavy Dredging
- Counties: Washington Statewide.
- DREDGING CONSTRUCTION PROJECTS (Excludes D.O.E. Hanford Site in Benton and Franklin Counties)

Work Window

-
- Officially 16 July – 15 FEB;
 - NMFS may shorten season to 1 Oct to 15 Feb: Rockfish listing.
 - Chinook Salmon arriving in estuary earlier in JAN.
 - Multiple Seasons
 - 7 days/ week
 - For the purposes of the conceptual costs, need separate/individual costs for each waterway; assume separate mob/de-mob
 - Operating Before Nov/Dec may require tribal compensation

Production Rates

- Trans Load Distance - West – 2 miles, East 2-4 Miles
- Speed Zone – No Wake Zone Assume 7 mph (5 -7 Knots or 5.75mph to 8mph)
- Historical Port production rates from New York Harbor using Environmental Bucket
- News article on LA River Deepening using Environmental Bucket

Quantities (for estimate totals quantity section)

- When the unsuitable material is removed from West Waterway, a one-foot vertical buffer will need to be added to ensure that all unsuitable material has been removed prior to dredging the underlying suitable material. Since the unsuitable material is mostly in the top 4 feet, that means the top 5 feet would need to be dredged and taken to a landfill.
- In West Waterway, the surface 0-4 feet of material that is suitable for open-water disposal will likely need to be run through a 1-ft x 1-ft (2FT X 2FT ALLOWED AT TRANSLOAD) grizzly to remove debris. That will increase mobilization costs and reduce the dredging production rate. Disposal requirements for screened material. Additional Barge, taken to Transload

Disposal Sites

- Upland Site (Transload)
- Deep water Disposal
- Assume Elliott Bay Disposal for 100% deep water material.
- Distance to disposal: Assume 2.5 mile one way
- Placement requirements if any: Additional cost for large debris and the Separation of material,
- Paint filter test not usually required when go by rail out of Roosevelt
- Gravity de-watering

General

- Overflow not allowed at dredging site
- Active de-water as barge continues to fill
- Sometimes have to slow down to allow de-water to catch up
- Large Duwamish project utilized sump pump with filter bag
- Flat deck barge—carries the contaminated materials upland; more stringent de-water procedures
- Bottom Dump Barge (won't require as stringent de-watering procedures)
- 24 hrs/day—city ordinance does allow
- The cost of a hydrographic survey following removal of the contaminated material will need to be included.

6.0 RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The actual risk register is provided in Appendix A. The complete risk register includes low level risks, as well as additional information regarding the nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

6.2 Cost Contingency Results

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve the desired level of cost confidence. Per regulation and guidance, the P80 confidence level (80% confidence level) is the normal and accepted cost confidence level. District Management has the prerogative to select different confidence levels, pending approval from Headquarters, USACE.

Table 1 provides the construction cost contingencies calculated for the P80 confidence level and rounded to the nearest thousand. The construction cost contingencies for the P5, P50 and P90 confidence levels are also provided for illustrative purposes only.

Cost contingency for the Construction risks (including schedule impacts converted to dollars) was quantified as approximately \$8.4 Million at the P80 confidence level (22% of the baseline construction cost estimate).

Table 1. Construction Cost Contingency Summary

Base Case Construction Cost Estimate	\$38,434,000	
Confidence Level	Construction Value (\$\$)	Contingency (%)
80%	\$53,690,000	23.7%

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

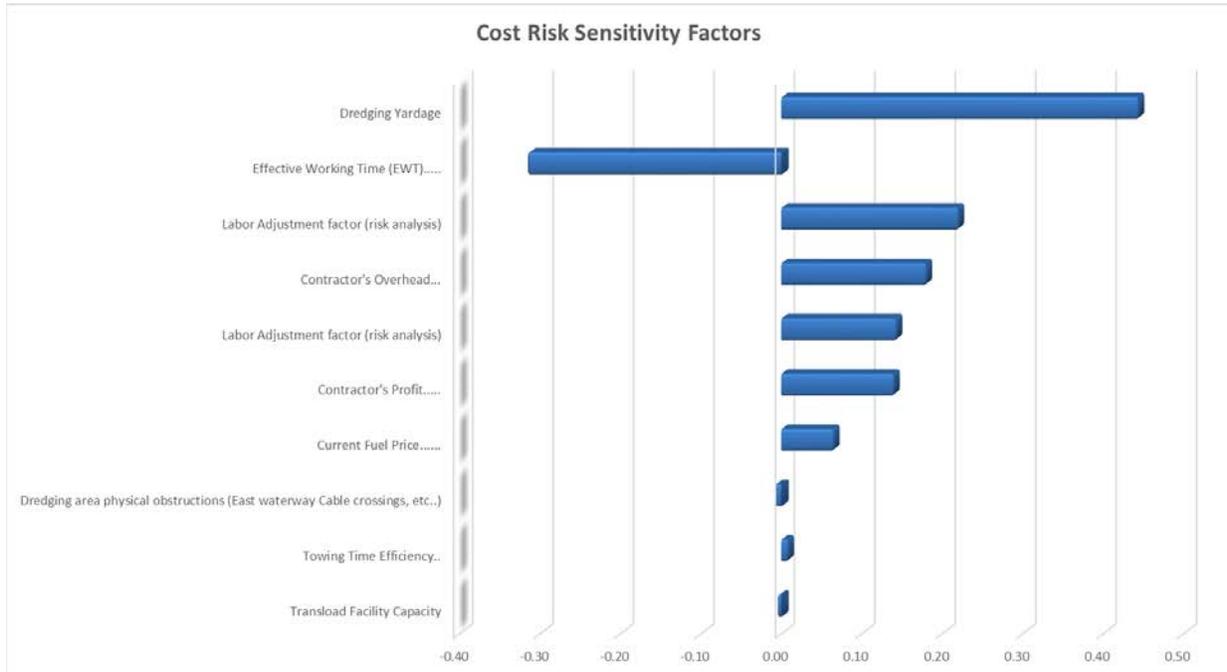
Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers and the respective value variance are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to project cost.

Figure 1 presents a sensitivity analysis for cost growth risk from the high level cost risks identified in the risk register. Likewise, Figure 2 presents a sensitivity analysis for schedule growth risk from the high level schedule risks identified in the risk register.

Figure 1. Cost Sensitivity Analysis



6.3 Schedule and Contingency Risk Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project duration at intervals of confidence (probability).

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P90 confidence levels are also provided for illustrative purposes.

Schedule duration contingency was not a factor. The PDT team identified all potential risk events as being low.

7.0 RISK IDENTIFICATION and RISK REDUCTION MEASURES

This section provides a summary of significant risk analysis results that are identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of

risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

7.1 Project Cost and Schedule Risk

Project cost and schedule comparison summaries

Table 2. Construction Cost Comparison Summary (Uncertainty Analysis)

Confidence Level	Value (\$)	Contingency
0%	17,708,502	0.0%
10%	19,650,959	11.0%
20%	20,101,538	13.5%
30%	20,440,523	15.4%
40%	20,722,665	17.0%
50%	20,987,426	18.5%
60%	21,255,195	20.0%
70%	21,566,650	21.8%
80%	21,906,003	23.7%
90%	22,415,823	26.6%
100%	25,462,772	43.8%



Cost and Schedule Risk Register Summary (High and Moderate)

Thursday, September 07, 2017
1:42:46 PM

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
02 Scope Variance					
1	Total Dredged Yardage	Dredge volumes are based on the June 2016 condition survey. The calculated volumes include a 10% contingency to account for any sloughing and shoaling that may occur between the authorization and the construction date. The quantities assume a 1' overdredge tolerance (or approximately 50% of the paid overdepth allowed in a contract)	Yardages are based on specific dredged depths. Area historically has very low shoaling and material depth changes. Assumptions: Quantities used within base estimate include a 10% increase in the volume between present date and the project start date (2020 estimated).	Low	Low
3	Yardage split between upland disposal vs. open water	Assumptions regarding quantities of dredged material requiring upland disposal are based on Dredged Material Management Program (DMMP) and CERCLA testing results. These testing results and associated assumptions regarding quantities for upland disposal may not provide sufficient data to confirm in-water or upland disposal assumptions during the feasibility phase. More upland disposal may be required, which is a more costly disposal method. East: Alternatives are based on CERCLA feasibility study.	Sediment sampling and partial DMMP testing (including dioxin) were conducted in the West Waterway to estimate the volume of dredged material that would be suitable for in-water disposal versus upland confined disposal. Due to time constraints on the acceptability of data for construction (3-year limit for data acceptability under the DMMP guidelines), a full DMMP suitability determination will be completed during the Pre-Construction, Engineering, and Design (PED) phase. Feasibility-level sampling will not occur in the East Waterway because existing sampling data in this area is adequate to support development of quantities and associated cost estimates during the feasibility phase. The Corps used data from the draft CERCLA RI/FS (Anchor QEA 2014) for the East Waterway because existing sampling data in this area is adequate to support development of quantities and associated cost estimates during the feasibility phase. The Corps used data from the draft CERCLA RI/FS (Anchor QEA 2014) for the East Waterway to estimate the volume of dredged material that would be suitable for in-water versus upland disposal.	High	Moderate

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
02 Scope Variance					
25	Confined Aquatic Disposal Site	There is a Confined Aquatic Disposal (CAD) site in the southern portion of West Waterway. Based on best available information, the site is located at Station 12+50 (i.e. 1,250 feet from the south end of West Waterway) and is approximately 75 feet to the east of the channel centerline. The quantities developed for the recommended plan include assumptions for disposal based on the partial suitability determination completed in the feasibility phase.	During the PED phase, a full suitability determination will be completed in accordance with Dredged Material Management Program standards. The scope of the suitability determination will include additional samples in/around the CAD footprint in order to confirm the boundaries of the footprint and verify whether the site and contaminated material is located within the deepening footprint of the Federal navigation channel. Based on the results of the suitability determination, there may be additional quantities (10,000 cy or less) at the CAD site that are required for upland disposal. ties (10,000 cy or less) at the CAD site that are required for upland disposal.	Low	Low
26	Geotechnical Investigation	Detailed geotechnical studies are required in PED to determine the exact channel footprint to avoid damaging Local Service Facilities (LSF) and Private structures located on the waterways.	The assumption is the sponsor will preform all necessary structural improvements to the LSF and any impacts to private infrastructure will be avoided. Thus the risk is that the channel footprint may decrease in size if geotechnical analysis confirms slope stability is an issue near private infrastructure.	Low	Low
27	Schedule for Implementation of CERCLA Actions on East Waterway	A CERCLA feasibility study is ongoing for the East Waterway Operable Unit (OU). It is assumed that a remedy for the East Waterway OU would be implemented prior to construction of the Corps recommended plan. If the Corps' recommended alternative overlaps with an area in the East Waterway proposed for remedy by EPA, and that remedy has not been finalized in a ROD, there may be schedule limitations to the completion of the feasibility phase.	The Corps will continue to actively coordinate with EPA and Ecology throughout the feasibility study to manage compatibility of the proposed remedy with the deepening project as well as manage schedule constraints as the project progresses.	Low	Low
03 Funding Issues					
22	Sufficient funding on a yearly basis	Project most likely will require multiple dredging seasons. Partial funding may result in limited dredging resulting in additional seasons.	Currently base case is assuming one season for smaller yardage and two seasons for larger quantities. Reduced funding could result in additional seasons and mob/demob cost.	Low	Low

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
05 Contract Acquisition					
10	Contract Type	Final acquisition method has not been identified. Past methods have including various scenarios including use of small business and full and open competition.	The base case estimate is based on full and open competition. Risk would be for additional cost associated with small business. Small business may need to rent/lease additional plant resulting in higher cost.	High	Low
11	Bid Schedule Structure and Contract Documents.	Structure of bid schedule may pass on unintentional risk to contractor. This could result in higher contractor cost. Examples of this is bid schedule structure with unclear yardage amounts for upland disposal or dredge operation restrictions.	Bid schedules should be established to best reduce contractor risk as best possible. Specific contract restrictions should be reviewed by pdt in order to best reduce unwarranted contract risk.	Low	Low
23	Contractor Competition and perceived Risk	Dredging competition is limited throughout the industry.	This project involves sufficient material quantities to attract regional competition. Current area has seen stable bid climate and competition. Project does include the potential for contaminated material with restrictive hauling requirements	Moderate	Low

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
07 Construction Activity					
5	Dredging Effective Time (Time spent active dredging of material)	Work is being performed in an active harbor with large vessel traffic. Cost estimate is based on typical effective time used for mechanical dredging harbor work (60% effective time).	The project has received the maximum allowable work window from the Services. There is a risk we may need a third dredging year if this productivity is insufficient. Estimate is based on conservative effective time (60%) based on potential for heavy traffic. Maximum amount of time is 730 hrs/mo (24 hrs/day x 30.42 days/mo). Therefore, 60% equates to 438 hrs/mo of active dredging or digging of material.	Moderate	Low
6	Material Hauling Time Effective Time (Time spent active hauling of material)	Work is being performed in an active harbor with large vessel traffic. Cost estimate is based on typical hauling effective time used for mechanical dredging harbor work (50% effective time for Upland and 60% for open water disposal).	Estimate is based on conservative effective time for upland disposal (50%) based on potential for heavy traffic. Open water is based on 60% effective time. Maximum amount of time is 730 hrs/mo (24 hrs/day x 30.42 days/mo). Therefore, 50% equates to 365 hrs/mo of active hauling and disposing of material of material for upland, and 511 hrs/mo for open water. Also adjust average speed. base estimate used 7 mph. Adjust for slower speeds during transload disposal cycle.	Moderate	Low
12	Transload Facility Capacity	The dredging cycle is dependent on the hauling cycle. If wait time occurs at the unloading facility, the overall cost of project will increase.	The existing transload facility located close to the work site, has indicated that the transload facility has the ability to increase offload production to reduce or eliminate wait times. However, there is a potential multiple projects may utilize the site concurrently to this contract. The transload also stated that it is important to lock in early the schedule and yardage amounts going to the transload site early. This would dictate production and potential wait times. Rate at transload may vary with future use. Adjust rate per ton.th future use. Adjust rate per ton.	Moderate	Low
13	Debris Separation	There is potential for debris within the dredging prism in West Waterway. It is assumed for open water disposal that at least some of the suitable material will be screened with grizzly for separation. For disposal at upland, no initial screening would be required. However, additional cost would incur for separation of large debris, cable, etc. at the transload site and disposal of debris at the upland site.	The most likely scenario is that the suitable material in the upper 4 feet will need to be screened (280,000 cy). The worst-case scenario is that 80% of all suitable material, regardless of depth, will need to be screened (440,000 cy).The base estimate includes a 20% reduction in production rate for the most likely scenario. Additional cost is also allowed for the disposal.	Low	Low

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
07 Construction Activity					
15	Open Water Disposal Capacity	There is a identified open water disposal within 3 miles of the project.	There is possibility that an alternate site may have to be used for open water. Currently there are limited options for disposal.	Moderate	Low
21	Dredging area physical obstructions (East waterway Cable crossings, etc..)	A communication cable crosses the East Waterway. Based on available information, the cable is located between Station 27+00 and Station 30+00 (between Terminal 18 and the northern portion of Terminal 30). The cable was originally buried in 1972 at approximately - 64 feet MLLW in an armored trench. During PED, an underwater channel survey will confirm the size, depth, and extent of armoring of the communication cable. Based on the results of the channel survey, it is uncertain whether the armoring should be replaced or relocated. The Corps conservatively assumes the utility will be relocated at the expense of the non-Federal sponsor; therefore an estimated relocation cost was included in the baseline real estate cost estimate.	During PED, an underwater channel survey will confirm the size, depth, and extent of armoring of the communication cable. Based on the results of the channel survey, it may be determined that the armoring should be replaced or relocated.	Moderate	Low
24	Modifications and Claims During Construction	Changes and or Claims possibility during the construction execution.	Due to the inherent unknowns related to physical conditions at all dredging locations there is risk of site changes. For this site, the risk is lower than other sites since the project location is well defined and surveyed.	Moderate	Low

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
08 Cost and Schedule					
7	Disposal Site (Upland)	Currently there is a transload site located within 2 miles of the project. The estimate is based on current pricing used by the transload facility. The charges reflect complete disposal cost. Offload, transport and final disposal.	Potential for 2nd upland disposal facility. There are other options which lower potential risk of higher upland disposal cost. Including potential for the Port taking ownership of materials not suitable for open water disposal.	Low	Low
8	Fuel Cost	Fuel is typically a key cost driver for dredging projects where large equipment usage is dependent on fuel.	Estimate is based on current dredging window fuel pricing. Cost risk will be based on a potential high value.	Moderate	Low
14	Prevailing Wages for Unsuitable Material (Unloading, Transportation & Disposal)	The cost associated with the disposal of unsuitable material is the responsibility of the port. The cost would fluctuate if the contract documents are developed so that prevailing wages are to be used during the offloading, transportation and final disposal of unsuitable material.	The PDT assumption is that once the title of the unsuitable material is turned over to the disposal company, which would be at the transloading facility, the disposal company takes ownership and responsibility of the material. Therefore, prevailing wages would not be required by USACE after offloading.	Moderate	Low
16	Contract Plant Makeup	The dredge project assumes a typical dredging operation where dredging operations and hauling cycle represent a reasonable balance. Since the identified disposal sites are nearby (2 to 4 miles). The assumed plant is 1 each medium size mechanical dredge and 2 each material barges.	Required contract documents may require a specified dredged yardage amount per season. This could result in additional plant being utilized. This would add to mobilization, demobilization and operating cost. This may be offset by reduced wait times if any would reduce the requirement for additional or larger plant makeup.	Moderate	Low
17	Dredge Window Restrictions	Potential for reduced dredging months due to environmental conditions.	The district has coordinated with the local agencies. The official dredge window will be 16 July – 15 FEB is dredging window per the natural resource agencies.	Low	Low
18	Water Quality Monitoring and achieving	It is assumed water quality management would be implemented on the project. If levels do exceed pre specified amounts then additional measure would be required.	Water quality personnel are included within cost estimate. It is assumed that all material will be the currently identified levels. This material will meet the subtitle D requirements. Additional measures could include a reduction in dredging rate.	Low	Low

Ref #	Risk/Opportunity Event	Risk Event Description	PDT Discussions	<u>Cost</u>	<u>Schedule</u>
				Risk Level	Risk Level
08 Cost and Schedule					
19	Treatment @ Dredge Site	Some dredging projects require treatment of material before the hauling operation. The assumed contract requirements would not allow for water overflow.	The assumed dredge operation for unsuitable material would utilize environmental type bucket. The reduces water content within the bucket and thus less water within the material barge. The assumed cost estimate does allow for hay bales and filter fabric with baffling within the receiving barge to allow for more sedimentation prior to discharge. to be utilized for filtration purpose.	Low	Low
20	Perm. Navigation Aids	Navigation Aids may be installed on the project. USACE may install the aids, but the Coast Guard pays 100% of the installation cost.	No risk to USACE	Low	Low