ALA WAI CANAL PROJECT
O'AHU, HAWAI'I

FEASIBILITY STUDY REPORT WITH
INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D
COST ENGINEERING

ALA WAI CANAL PROJECT
O'AHU, HAWAI'I

FEASIBILITY STUDY REPORT WITH INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

SECTION 209 OF FLOOD CONTROL ACT OF 1962 (PUBLIC LAW 87-874)

APPENDIX D1

COSTS

(PN#102703)

(Rev 22 February 2017)

THIS DOCUMENT IS BASED ON THE INFORMATION AVAILABLE AT THE TIME OF PUBLICATION (Feb 22, 2017). The Corps of Engineers planning process is dynamic and responsive to public and stakeholder input; it is possible that the content herein may change as a result of review comments received. This document does not necessarily represent the perspective of higher review levels within the agencies involved or the Executive Branch of the federal government.

ALA WAI CANAL PROJECT
O'AHU, HAWAI'I

FEASIBILITY STUDY REPORT WITH
INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D

COSTS

TABLES

ATTACHMENTS

ALA WAI CANAL PROJECT
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FEASIBILITY STUDY REPORT WITH INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D

COSTS

1. PROJECT DESCRIPTION

The project consists of various measures to manage flood risk in Makiki, Manoa, Palolo and Ala Wai subwatersheds. The measures included in the recommended plan are indicated in Table D-1. Measures such as detention/debris basin or debris catchment are located in the upper watershed for Makiki, Manoa and Palolo. Measures in the Ala Wai Canal area include levees, floodwalls, pump stations, flood gates, and sediment basin. The project also includes cultural monitoring during construction, adaptive management during the environmental monitoring stage after construction is complete. Table D-1 describes the measures included in the recommended plan.

Table D-1. Measures

Summary of the Recommended Plan

Flood Risk Management Measure	Description
Waihi Debris and Detention Basin	Earthen dam, approximately 42 feet high and 477 feet across; reinforced concrete box to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. New access road to be constructed for construction and O&M.
Waiakeakua Debris and Detention Basin	Earthen dam, approximately 37 feet high and 401 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert.
Woodlawn Ditch Detention Basin	Three-sided berm, approximately 15 feet high and 840 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side.
Mānoa In-stream Debris Catchment	Concrete pad, approximately 8 feet wide and 60 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad.
Kanewai Field Multi-Purpose Detention Basin	Earthen berm, approximately 7 feet high, around 3 sides of the field; grouted rip rap inflow spillway along bank of Mānoa Stream to allow high flows to enter the basin; existing drainage pipe at south end of basin to allow water to re-enter stream.
Waiʻōmaʻo Debris and Detention Basin	Earthen dam, approximately 34 feet high and 275 feet across; Reinforced Box Culvert to allow small storm flows to pass; concrete spillway above culvert, with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. Excavation of approx. 3,060 yd^3 to provide required detention volume upstream of berm; low-flow channel with existing substrate to be restored following excavation. New access road to be constructed for construction and O&M.

Summary of the Recommended Plan

Flood Risk Management Measure	Description
Pūkele Debris and Detention Basin	Earthen dam, approximately 35 feet high and 82 feet across; Reinforced Concrete Box to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. New access road to be constructed for construction and O&M.
Makiki Debris and Detention Basin	Earthen dam, approximately 36 feet high and 100 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. New access road to be constructed for construction and O&M.
Ala Wai Canal Floodwalls	Concrete floodwalls ranging up to approximately 4 feet high, offset from existing Canal walls. Existing stairs to be extended and new ramps to be installed to maintain access to Canal; floodgate to be installed near McCully Street. Two pump stations to accommodate storm flows and gates installed at existing drainage pipes to prevent backflow from the Ala Wai Canal during a flood event.
Hausten Ditch Detention Basin	Concrete floodwalls and an earthen berm (approximately 4.3 feet high) to provide detention for local drainage; install concrete wall with four slide gates adjacent to the upstream edge of the existing bridge to prevent a backflow from the Ala Wai Canal during a flood event.
Ala Wai Golf Course Multi-Purpose Detention Basin	Earthen berm, up to averaging approximately 2.7 feet high, around the north and east perimeter of the golf course; grouted rip rap inflow spillway along bank of Mānoa-Pālolo Drainage Canal to allow high flows to enter the basin; sediment basin within western portion of golf course; floodgate across the main entrance road; passive drainage back into Ala Wai Canal.
Floodwarning System	Installation of 3 real-time rain gages (Mānoa, Makiki, and Pālolo streams) and 1 real-time streamflow or stage gage (Ala Wai Canal) as part of flood warning system for Ala Wai Watershed.

2. BASIS OF ESTIMATE AND QUANTITY

This feasibility cost estimate is based on the *Ala Wai Canal Project, Oahu, Hawaii, Feasibility Study Report with Integrated Environmental Impact Statement* (Feasibility Report/EIS)). Input for the estimate was obtained from the Project Delivery Team (PDT). Following Engineering Regulation (ER) 1110-2-1302, *Engineering and Design Civil Works Cost Estimating*, cost estimates were prepared at three levels:

- **Class 5** for screening of the initial viable array of alternatives which based the costs on historical cost data from the November 2008 Natural Resources Conservation Service, US Department of Agriculture and US Army Corps of Engineers (USACE), Honolulu District report titled *Technical Summary Report Manoa Watershed Project Honolulu, Hawaii*. Where costs were unavailable, Random Order of Magnitude cost were used by scaling available costs from the report.

- **Class 4** for the refinement of the final viable array of alternatives, which was based on a concept design. Cost was developed from rough quantity take-offs and supplemented with best professional judgment based on similar projects.

- **Class 3** for inclusion in the Feasibility Report/EIS which was based on a 35 percent level of design. Quantities for this level of design were calculated from 10 to 60 percent quality of project definition. Quantity calculations were aided by the use of Microstation, Google Earth, and Excel software. Quotes for major cost items were obtained from material suppliers.

3. ESTIMATED DESIGN AND CONSTRUCTION SCHEDULE

The estimate is based on the entire contract awarded to a single prime contractor subcontracting all of the work. The estimated schedule is shown in Table D-2.

Table D-2. Estimated Project Schedule

Phase	Estimated Start	Estimated End	Estimated Midpoint
Sign Design Agreement	Oct 2017	Sep 2018	N/A
Sign PPA	Oct 2020	Mar 2021	N/A
Real Estate Acquisition	Oct 2020	Sep 2021	Apr 2021
Preconstruction, Engrg & Design	Oct 2018	Sep 2020	Oct 2019
Solicit/Award	Oct 2020	Sep 2021	N/A

The Recommended Plan construction schedule is presented in this Appendix. The estimated construction time is based on:

- **Typical Construction Crew:** (1 shift) working 8 hr/day and x 5 day weeks.
- **Overall Production Efficiency Rate:** 80-90 percent which is based on anticipated project difficulty, method of construction, labor availability, supervision, job conditions, weather and expected delays. Anticipated weather delays are included in the construction schedule.

Table D-3. Estimated Construction Duration

	Recommended Plan
Construction Start	Oct 2021
Construction End	Sep 2024
Midpoint	Apr 2023
Adaptive Mgt Midpoint (3 yrs after Construction Complete=Yr 0)	Dec 2025

- **Construction Windows:** None
- **Overtime:** This estimate contains no overtime to complete the project.

4. ACQUISITION PLAN

4.1. Estimate: The estimate is based on a multiple single contracts being awarded to the Prime Contractor with multiple sub-contractors. The acquisition strategy is assumed as Full and Open Invitation for Bid. The prime contractor will be responsible for oversight of the contract overseeing the work performed by subcontractors.

4.2. Sub-Contracting: For the Recommended Plan estimate, the subcontractors are broken out as:

- Sitework Subcontractor
- Hauling Subcontractor
- Material Suppliers (concrete, soil, rocks, pipes)
- Disposal Costs
- Concrete Subcontractor
- Paving Subcontractor
- Electrical Subcontractor
- Landscaping Subcontractor
- Surveying Subcontractor
- Professional Services

It is assumed that the prime contractor will subcontract all of the work.

5. PROJECT CONSTRUCTION

5.1. Mobilization, Demobilization and Preparatory Work

Mobilization/Demobilization: The estimate for this study assumes the Contractors will be from Oahu. This does not exclude any work effort to contractors from other locations during the bidding process.
Temporary Facilities: The estimate includes the assumption office trailers and temporary utilities for the Prime Contractor and Government. The electricity will be supplemented by diesel generator. This assumption is covered by the Job Office Overhead percentage.

5.2. Surveys: Assume site pre-construction survey and layout, survey during construction and installation of three benchmarks per site.

5.3. Disposal: Approved on-island landfill with green waste and excavated rock to a recycler.

5.4. Features and Discussion

- **Site Access:** The sites are located in urban Honolulu, Island of Oahu. Where access to the construction site is not available, new access roads will be constructed. Where the haul road is steep, the final access road is assumed constructed of grooved 8" thick concrete. This assumption will be refined in the PED phase.

- **Borrow Areas:** The borrow sources is assumed from an on-island commercial source. Borrow areas for topsoil and fill is assumed to be from on-island.

- **Construction Methodology:** The construction methodology will be industry standard.

- **Unusual Conditions (Soil, Water, and Weather):** Locations in perpetual streams are assumed dewatered using cofferdams. Actual dewatering plan will be

determined by the Contractor performing the work after award of the construction project. The project schedule includes anticipated weather delays.

- **Unique Techniques of Construction:** None
- **Equipment and Labor Availability:** The cost assumes equipment and labor is readily available on Oahu or from the other locations.
- **Environmental Concerns:** The estimate includes cost for Adaptive management for stream mitigation and is expected to include fish monitoring for 5 years after completion of constructed feature. A separate contract is assumed for physical changes based on the 5 year monitoring. This separate contract is assumed to be covered under O&M by others.
- Standard Best Management Practices such as silt fences, gravel entrances to the contractor's storage area are included in the estimate.

6. COST ESTIMATE ASSUMPTIONS

6.1. Effective Price Level: Project costs are presented in October 2016 (1Q2017) dollars.

6.2. Construction Cost Estimate. The construction cost estimate was developed using MCACES 2nd Generation estimating software in accordance with ER 1110-2-1302, *Civil Works Cost Engineering*, 15 Sep 2008; UFC 3-740-05, Handbook: *Construction Cost Estimating*, 8 November 2010, Change 1, June 2011. The construction cost estimate was prepared using MII Version 4.3, and the latest 2015 English Cost Book, quotes on major material items, and 2014 Equipment Library (Region 10).

6.3. Labor Rates. The labor rates used are Davis Bacon wage rates for the State of Hawaii General Decision Number HI160001 03/18/2016 Modification #54 for building, heavy (heavy and dredging), highway, and residential construction types for all counties in Hawaii statewide.

6.4. Labor and Equipment Productivity: No overtime hours have been included in the MCACES estimate. The estimate includes an overall Productivity factor of 80-90 percent which is based on anticipated project difficulty, method of construction, labor availability, supervision, job conditions, weather and expected delays.

6.5. Equipment Rates - Equipment rates were derived from EP1110-1-8 Equipment Ownership and Expenses Schedule for Region 10 published April 2014. The price level date for this manual is assumed to be Jan 2014. A 4% adjustment factor was included in the MCACES estimate to normalize the costs to 3rd Quarter 2016.

6.6. Material Rates – Minor Material costs were derived from CB15EngA – MII English Cost Book 2015 Rev A. The price level date for this Cost Book is assumed to be Jan 2015. A 4% adjustment factor was included in the MCACES estimate to normalize the costs to 3rd

Quarter 2016. Quotes were received for major material cost items and were overridden within the MCACES estimate.

6.7. Escalation: Escalation has been calculated within the estimate. Once labor, equipment, and material prices were normalized an escalation factor was included at the owner level to escalate the overall estimate to a price level date of Oct 2016. The price level of the MCACES estimate is Oct 2016. Price levels within the Total Project Cost Summary have been escalated from price levels of the construction cost estimate to the midpoint of construction indicated in Table D-3.

6.8. Functional Costs: Functional costs using the Civil Works Breakdown Structure (CWBS) associated with this work were developed from quantity take-offs using CAD drawings, historical costs and input from PDT members as follows:

01 – Lands and Damages: This account covers Real Estate costs for Construction. The initial estimate for real estate costs were derived from the tax map key for full replacement. Market cost will be determined at TSP level by an appraiser. Based on real estate's judgment, TMK costs are typically much lower than market costs.

04 – Dams: This account covers detention & debris basins. The detention and debris basis consists of a trapezoidal shaped structure crossing the stream. The interior of the debris & detention basin consists of impermeable fill. The spillway consists of a concrete top with 2' thick riprap on the upstream side and downstream side of the sloped part of the structure. A single reinforced concrete box or radius arch culvert allows the stream to pass thru the structure. Debris will be caught on the upstream side of the structure with debris catching posts. An access road will be constructed for O&M maintenance. This account also includes adaptive management monitoring for habitat impacted areas.

11 - Levees and Floodwalls: This account covers cost for levees and floodwalls. The Floodwalls is constructed of concrete with a sheet pile cutoff. The levee/berm consists of compacted impermeable fill and grass.

13 – Pumping Plants: This covers the pump stations near the Ala Wai Canal. Initial costs for the pump plants developed based on the plans. Historical pricing was obtained. Cost differences are included in the Cost and Schedule Risk Analysis. Pump station design will be further refined in the PED phase.

15 – Floodway Control and Diversion Structures: This account covers slide gates along the Ala Wai Canal for interior drainage and a debris catchment system consisting of concrete footing and metal posts crossing an existing stream.

18 – Cultural Resource Preservations: This account covers cultural monitoring during construction. The cost for this account was developed by the PDT Archeologist. Further investigations will be conducted during the PED phase.

19 – Buildings, Grounds and Utilities: This account covers the cost for a flood warning system. The initial flood warning system cost was based on historical costs obtained from the USGS. The location & type of stream gauge system will be determined after a study during PED determines the flood warning thresholds required. The initial estimate assumes 4 gauges, one each for Makiki, Palolo, Manoa Watershed, and the Ala Wai Canal.

30 – Planning, Engineering and Design (PED): This account covers all costs associated with Planning, Engineering, and Design. The costs are based on 26 percent of the construction cost.

The following data needs justify the need for increased PED costs:
- Topographic surveys
- Geotechnical investigation and design
- Structural analysis
- Electrical and mechanical design development for the pump stations
- Aesthetic improvements (especially along the Ala Wai Canal floodwalls)
- Unsteady flow HEC-RAS modeling
- Evaluation and relocation plans for existing utilities
- Ongoing stakeholder engagement/input

In addition, the geographical dispersion of the project features across the landscape of the watershed is not conducive to economies of scale for either construction or the acquisition of additional data. Essentially, nine separate project sites will require site specific investigations throughout the PED phase.

31 Construction Management (CM): This account covers supervision and administration costs during construction. The costs are based on 12.5 percent of the construction cost.

6.9. Estimate Assumptions: Key assumptions used for estimating the construction cost of the proposed alternative are as follows:

1) Analysis performed on major cost items based on level of design. The recommended plan is at approximately a 35 percent level of design.

2) Excavated material associated with the feature will be calculated for the structure. Where it is assumed the excavation consists of soil and rocks, the rocks will be screened out. Areas of clear and grubbed material will be mulched. Soil, rocks, and green waste will be hauled off site for either disposal or recycling.

3) The debris and detention basin structure is assumed constructed within a cofferdam with a bypass pipe to allow the streams to flow. It is assumed the construction of cofferdams will assist in keeping the structure construction area dry while the stream is normally flowing.

4) Access to structures will be constructed and used as permanent access roads for operations and maintenance (O&M). Entrances to access roads will be restricted by use of a chain link fence.

5) Actual site of the Ala Wai Floodwalls is approximate. The footprint of the floodwalls will be refined during PED.

6) The pump stations are assumed to have 8" thick concrete walls, approximately 67' x 81' x 38' tall with three pumps (each 200,000 gpm), wet wells, discharge pipes, and an electrical house. The design will be refined in the PED phase. 2 pump plants are included in the MCACES estimate.

7) General percentage markups have been used in the recommended plan estimate for both the prime contractor and subcontractors.

6.10. Contingencies by Feature: Current Headquarters USACE guidance requires a formal analysis on all projects where the projected cost exceeds $40 million. In accordance with ER 1110-2-1302 and ECB 2007-17, 10 Sep 2007, Cost Risk Analysis was used to identify and measure the cost impact of project uncertainties within the estimated total project cost.

Oracle Crystal Ball analysis was used to develop contingencies for the Recommended Plan.

Contingencies are added to the cost estimate based on results of risk analysis. Table D-4 summarizes the contingency amounts.

Unknowns that could affect the project costs and design assumptions prior to the detailed PED phase include:

- Site relocation of measures
- Under-designed floodwall footings
- Variation in estimated quantities
- Increased compliance with viewing planes, historical features or recreational access
- Additional appurtenances for features
- Unanticipated cultural deposits or artifacts
- Changes in Acquisition strategy
- Changes in bid schedule
- Unexpected contaminated soils
- Dewatering and control of water uncertainties
- Unexpected geotechnical or ground water issues
- Unanticipated underground utilities
- Increased landfill disposal rates
- Further refinement of designs based on refinement of hydraulic models
- Delays in real estate acquisition or funding
- Increased permitting regulations affecting designs

- Community opposition
- Responsibility of O&M between City and State Government
- Changes in interior drainage leading to the canal
- Changes in material to construct the hydraulic structures
- Changes in structural foundation designs
- Changes to adaptive management and duration
- Restrictions of public access during construction to recreational areas
- Traffic delays during construction of the features
- Unseasonal weather delays (hurricanes, tsunamis, flooding) during construction
- Unanticipated phasing requirements
- Single or multiple contracts over multiple years

Real Estate Contingency was based on judgment by the Real Estate Project Delivery Team for the recommended plan. TMK costs are typically much lower than market costs. The Real Estate Contingency typically covers fluctuation of the appraised value for land. Additional contingency has been added based on the Cost and Schedule Risk Analysis to cover other risks such as footprint increase of the detention basins once a full design is achieved.

6.11. Total Project Cost Summary: The Total Project Cost Summary (TPCS) Sheet includes the construction costs from the MCACES estimate, project markups, as well as costs for Lands and Damages, Planning, Engineering & Design, and Construction Management.

Table D-4. Recommended Plan Total Project Cost [1, 2, 3]
Total Project Cost (Fully Funded) Budget Year 2016 based on 35% Level of Design

CWBS Acct	Project First Cost 1 Oct 16 ($K) without Contingency	% Contingency	Project First Cost Oct 2016 ($K) with Contingency
01 Lands & Damages	$5,735	27.5%	$7,309
Construction			
02 Relocations	$7,663	29%	9,885
04 Dams	$55,262	29%	$71,288
06 Fish & Wildlife Facilities	$178	29%	$229
11 Levees/Floodwalls	$45,668	29%	$58,912
13 Pumping Station	$51,945	29%	$67,009
15 Floodway Control/ Diversion Structure	$5,016	29%	$6,470
18 Cultural Resource Preservation	$609	29%	$786
19 Buildings, Grounds & Utilities	$276	29%	$356
TOTAL CONSTRUCTION COST	**$166,616**		**$214,934**
30 Planning, Engineering, and Design	$43,897	29%	$56,627
31 Construction Management	$21,104	29%	$27,224
PROJECT COST TOTAL	**$233,836**		**$306,095**

[1] Total Project Cost (TPC) – includes contingency & escalation of a fully funded project.

[2] Effective Price Level

[3] Contingency determined by Cost Risk Analysis[4]. $K = $1,000

7. NATIONAL ECONOMIC DEVELOPMENT AND RECOMMENDED PLAN COST

After optimizing the costs, the design and economics determined the recommended and NED plan. The NED/Recommended Plan is a 4' floodwall along the Ala Wai Canal with a 90 percent assurance according to the FDA model. Refer to Appendix B, *Economics*, for further information.

The TPCS Sheet includes the construction costs from the MCACES estimate, project markups, as well as costs for Lands and Damages, Planning, Engineering & Design, and Construction Management. Table D-5 summarizes the TPCS.

Table D-5. Total Project Cost Summary

Project First Cost (1 Oct 16)	Total Project Cost (Fully Funded)
$306,095,000	$352,204,000

Based on 1 Oct 2016 (Budget Year 2017) price levels, the estimated project first cost is $306,095,000.

Cost Appendix Attachments

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 102703

POH – Ala Wai Canal Project
Feasibility Study

The Ala Wai Canal Project, as presented by Honolulu District, has undergone a successful Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of February 24, 2017, the Cost MCX certifies the estimated total project cost:

FY 17 Price Level:	$306,095,000
Fully Funded Amount:	$352,204,000

It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management throughout the life of the project.

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Date: 2017.02.24 13:30:23 -08'00'

Kim C. Callan, PE, CCE, PM
Chief, Cost Engineering MCX
Walla Walla District

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: Ala Wai Canal
PROJECT NO:#102703
LOCATION: Honolulu, Island of Oahu, Hawaii

DISTRICT: Honolulu District
POC: CHIEF, ENGINEERING & CONSTRUCTION, Todd C. Barnes

PREPARED: 2/22/2017

This Estimate reflects the scope and schedule in report: Ala Wai Canal Feasibility Study dated Aug 2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16									
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 10/1/2015 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
02	RELOCATIONS	$7,561	$2,193	29.0%	$9,753	1.4%	$7,663	$2,222	$9,885	$0	$9,885	13.6%	$8,707	$2,525	$11,232
04	DAMS	$54,524	$15,812	29.0%	$70,336	1.4%	$55,262	$16,026	$71,288	$0	$71,288	13.6%	$62,790	$18,209	$80,999
06	FISH & WILDLIFE FACILITIES	$175	$51	29.0%	$226	1.4%	$178	$51	$229	$0	$229	13.6%	$202	$59	$260
11	LEVEES & FLOODWALLS	$45,058	$13,067	29.0%	$58,125	1.4%	$45,668	$13,244	$58,912	$0	$58,912	13.6%	$51,889	$15,048	$66,937
13	PUMPING PLANT	$51,251	$14,863	29.0%	$66,114	1.4%	$51,945	$15,064	$67,009	$0	$67,009	13.6%	$59,021	$17,116	$76,137
15	FLOODWAY CONTROL & DIVERSION STRU	$4,949	$1,435	29.0%	$6,384	1.4%	$5,016	$1,455	$6,470	$0	$6,470	13.6%	$5,699	$1,653	$7,352
18	CULTURAL RESOURCE PRESERVATION	$601	$174	29.0%	$775	1.4%	$609	$177	$786	$0	$786	13.6%	$692	$201	$893
19	BUILDINGS, GROUNDS & UTILITIES	$272	$79	29.0%	$351	1.4%	$276	$80	$356	$0	$356	13.6%	$313	$91	$404
	CONSTRUCTION ESTIMATE TOTALS:	$164,390	$47,673		$212,064	1.4%	$166,616	$48,319	$214,934	$0	$214,934	13.6%	$189,313	$54,901	$244,213
01	LANDS AND DAMAGES	$5,658	$1,553	27.5%	$7,212	1.4%	$5,735	$1,575	$7,309	$0	$7,309	9.2%	$6,263	$1,720	$7,983
30	PLANNING, ENGINEERING & DESIGN	$42,743	$12,395	29.0%	$55,138	2.7%	$43,897	$12,730	$56,627	$0	$56,627	15.0%	$50,475	$14,638	$65,113
31	CONSTRUCTION MANAGEMENT	$20,549	$5,959	29.0%	$26,508	2.7%	$21,104	$6,120	$27,224	$0	$27,224	28.2%	$27,050	$7,845	$34,895
	PROJECT COST TOTALS:	$233,341	$67,581	29.0%	$300,922		$237,352	$68,743	$306,095	$0	$306,095	15.1%	$273,102	$79,103	$352,204

Todd C. Barnes — CHIEF, ENGINEERING & CONSTRUCTION, Todd C. Barnes

PROJECT MANAGER, Michael D. Wyatt

CHIEF, REAL ESTATE, Ashley N. Klimaszewski

ESTIMATED TOTAL PROJECT COST: **$352,204**

Filename: Ala Wai TPCS 22 Feb 2017 r1 - MCX CHECK.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Ala Wai Canal
LOCATION: Honolulu, Island of Oahu, Hawaii
This Estimate reflects the scope and schedule in report; Ala Wai Canal Feasibility Study dated Aug 2016

DISTRICT: Honolulu District
POC: CHIEF, ENGINEERING & CONSTRUCTION, Todd C. Barnes
PREPARED: 2/22/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-May-16 Effective Price Level: 1-Oct-15				Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%) RISK BASED	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Makiki Watershed													
02	RELOCATIONS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
04	DAMS	$10,896	$3,160	29.0%	$14,056	1.4%	$11,044	$3,203	$14,247	2023Q3	13.6%	$12,548	$3,639	$16,188
06	FISH & WILDLIFE FACILITIES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
11	LEVEES & FLOODWALLS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
13	PUMPING PLANT	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
15	FLOODWAY CONTROL & DIVERSION STRU	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
18	CULTURAL RESOURCE PRESERVATION	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
19	BUILDINGS, GROUNDS & UTILITIES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$10,896	$3,160	29.0%	**$14,056**		$11,044	$3,203	$14,247			$12,548	$3,639	$16,188
01	LANDS AND DAMAGES	$26	$7	27.5%	$33	1.4%	$26	$7	$34	2021Q3	9.2%	$29	$8	$37
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$272	$79	29.0%	$351	2.7%	$279	$81	$360	2020Q1	11.8%	$312	$91	$403
5.0%	Planning & Environmental Compliance	$545	$158	29.0%	$703	2.7%	$560	$162	$722	2020Q1	11.8%	$626	$182	$808
8.5%	Engineering & Design	$926	$269	29.0%	$1,195	2.7%	$951	$276	$1,227	2020Q1	11.8%	$1,064	$308	$1,372
0.5%	Reviews, ATRs, IEPRs, VE	$54	$16	29.0%	$70	2.7%	$55	$16	$72	2020Q1	11.8%	$62	$18	$80
0.5%	Life Cycle Updates (cost, schedule, risks)	$54	$16	29.0%	$70	2.7%	$55	$16	$72	2020Q1	11.8%	$62	$18	$80
2.0%	Contracting & Reprographics	$218	$63	29.0%	$281	2.7%	$224	$65	$289	2020Q1	11.8%	$250	$73	$323
3.0%	Engineering During Construction	$327	$95	29.0%	$422	2.7%	$336	$97	$433	2023Q3	28.2%	$430	$125	$555
2.0%	Planning During Construction	$218	$63	29.0%	$281	2.7%	$224	$65	$289	2023Q3	28.2%	$287	$83	$370
2.0%	Project Operations	$218	$63	29.0%	$281	2.7%	$224	$65	$289	2020Q1	11.8%	$250	$73	$323
31	CONSTRUCTION MANAGEMENT													
8.0%	Construction Management	$872	$253	29.0%	$1,125	2.7%	$896	$260	$1,155	2023Q3	28.2%	$1,148	$333	$1,481
2.0%	Project Operation:	$218	$63	29.0%	$281	2.7%	$224	$65	$289	2023Q3	28.2%	$287	$83	$370
2.5%	Project Management	$272	$79	29.0%	$351	2.7%	$279	$81	$360	2023Q3	28.2%	$358	$104	$462
	CONTRACT COST TOTALS:	$15,117	$4,383		$19,500		$15,378	$4,459	$19,837			$17,715	$5,137	$22,852

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Ala Wai Canal
LOCATION: Honolulu, Island of Oahu, Hawaii
This Estimate reflects the scope and schedule in report; Ala Wai Canal Feasibility Study dated Aug 2016

DISTRICT: Honolulu District PREPARED: 2/22/2017
POC: CHIEF, ENGINEERING & CONSTRUCTION, Todd C. Barnes

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			15-May-16 / 1-Oct-15	Program Year (Budget EC): / Effective Price Level Date:			2017 / 1 OCT 16					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Manoa Watershed													
02	RELOCATIONS	$175	$51	29.0%	$226	1.4%	$177	$51	$229	2023Q3	13.6%	$201	$58	$260
04	DAMS	$27,288	$7,914	29.0%	$35,202	1.4%	$27,658	$8,021	$35,679	2023Q3	13.6%	$31,426	$9,113	$40,539
06	FISH & WILDLIFE FACILITIES	$175	$51	29.0%	$226	1.4%	$178	$51	$229	2023Q3	13.6%	$202	$59	$260
11	LEVEES & FLOODWALLS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
13	PUMPING PLANT	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
15	FLOODWAY CONTROL & DIVERSION STRU	$336	$97	29.0%	$433	1.4%	$340	$99	$439	2023Q3	13.6%	$387	$112	$499
18	CULTURAL RESOURCE PRESERVATION	$136	$39	29.0%	$175	1.4%	$137	$40	$177	2023Q3	13.6%	$156	$45	$201
19	BUILDINGS, GROUNDS & UTILITIES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$28,110	$8,152	29.0%	**$36,262**		$28,490	$8,262	$36,752			$32,371	$9,388	$41,759
01	LANDS AND DAMAGES	$1,685	$463	27.5%	$2,148	1.4%	$1,708	$469	$2,177	2021Q3	9.2%	$1,866	$512	$2,378
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$703	$204	29.0%	$907	2.7%	$722	$209	$931	2020Q1	11.8%	$807	$234	$1,042
5.0%	Planning & Environmental Compliance	$1,405	$407	29.0%	$1,812	2.7%	$1,443	$418	$1,861	2020Q1	11.8%	$1,614	$468	$2,082
8.5%	Engineering & Design	$2,389	$693	29.0%	$3,082	2.7%	$2,454	$712	$3,165	2020Q1	11.8%	$2,744	$796	$3,540
0.5%	Reviews, ATRs, IEPRs, VE	$141	$41	29.0%	$182	2.7%	$145	$42	$187	2020Q1	11.8%	$162	$47	$209
0.5%	Life Cycle Updates (cost, schedule, risks)	$141	$41	29.0%	$182	2.7%	$145	$42	$187	2020Q1	11.8%	$162	$47	$209
2.0%	Contracting & Reprographics	$562	$163	29.0%	$725	2.7%	$577	$167	$745	2020Q1	11.8%	$646	$187	$833
3.0%	Engineering During Construction	$843	$244	29.0%	$1,087	2.7%	$866	$251	$1,117	2023Q3	28.2%	$1,110	$322	$1,432
2.0%	Planning During Construction	$562	$163	29.0%	$725	2.7%	$577	$167	$745	2023Q3	28.2%	$740	$215	$954
2.0%	Project Operations	$562	$163	29.0%	$725	2.7%	$577	$167	$745	2020Q1	11.8%	$646	$187	$833
31	CONSTRUCTION MANAGEMENT													
8.0%	Construction Management	$2,249	$652	29.0%	$2,901	2.7%	$2,310	$670	$2,980	2023Q3	28.2%	$2,961	$859	$3,819
2.0%	Project Operation:	$562	$163	29.0%	$725	2.7%	$577	$167	$745	2023Q3	28.2%	$740	$215	$954
2.5%	Project Management	$703	$204	29.0%	$907	2.7%	$722	$209	$931	2023Q3	28.2%	$925	$268	$1,194
	CONTRACT COST TOTALS:	$40,617	$11,753		$52,370		$41,313	$11,954	$53,267			$47,493	$13,744	$61,237

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Ala Wai Canal
LOCATION: Honolulu, Island of Oahu, Hawaii
This Estimate reflects the scope and schedule in report; Ala Wai Canal Feasibility Study dated Aug 2016

DISTRICT: Honolulu District
POC: CHIEF, ENGINEERING & CONSTRUCTION, Todd C. Barnes
PREPARED: 2/22/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-May-16 Effective Price Level: 1-Oct-15				Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16								
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Mid-Point Date P	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
	Palolo Watershed													
02	RELOCATIONS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
04	DAMS	$16,339	$4,738	29.0%	$21,077	1.4%	$16,560	$4,802	$21,363	2023Q3	13.6%	$18,816	$5,457	$24,273
06	FISH & WILDLIFE FACILITIES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
11	LEVEES & FLOODWALLS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
13	PUMPING PLANT	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
15	FLOODWAY CONTROL & DIVERSION STRU	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
18	CULTURAL RESOURCE PRESERVATION	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
19	BUILDINGS, GROUNDS & UTILITIES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$16,339	$4,738	29.0%	**$21,077**		$16,560	$4,802	$21,363			$18,816	$5,457	$24,273
01	LANDS AND DAMAGES	$2,539	$697	27.5%	$3,237	1.4%	$2,574	$707	$3,280	2021Q3	9.2%	$2,811	$772	$3,583
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$408	$118	29.0%	$526	2.7%	$419	$122	$541	2020Q1	11.8%	$469	$136	$605
5.0%	Planning & Environmental Compliance	$817	$237	29.0%	$1,054	2.7%	$839	$243	$1,082	2020Q1	11.8%	$938	$272	$1,211
8.5%	Engineering & Design	$1,389	$403	29.0%	$1,792	2.7%	$1,427	$414	$1,840	2020Q1	11.8%	$1,595	$463	$2,058
0.5%	Reviews, ATRs, IEPRs, VE	$82	$24	29.0%	$106	2.7%	$84	$24	$109	2020Q1	11.8%	$94	$27	$122
0.5%	Life Cycle Updates (cost, schedule, risks)	$82	$24	29.0%	$106	2.7%	$84	$24	$109	2020Q1	11.8%	$94	$27	$122
2.0%	Contracting & Reprographics	$327	$95	29.0%	$422	2.7%	$336	$97	$433	2020Q1	11.8%	$376	$109	$485
3.0%	Engineering During Construction	$490	$142	29.0%	$632	2.7%	$503	$146	$649	2023Q3	28.2%	$645	$187	$832
2.0%	Planning During Construction	$327	$95	29.0%	$422	2.7%	$336	$97	$433	2023Q3	28.2%	$430	$125	$555
2.0%	Project Operations	$327	$95	29.0%	$422	2.7%	$336	$97	$433	2020Q1	11.8%	$376	$109	$485
31	CONSTRUCTION MANAGEMENT													
8.0%	Construction Management	$1,307	$379	29.0%	$1,686	2.7%	$1,342	$389	$1,732	2023Q3	28.2%	$1,721	$499	$2,220
2.0%	Project Operation:	$327	$95	29.0%	$422	2.7%	$336	$97	$433	2023Q3	28.2%	$430	$125	$555
2.5%	Project Management	$408	$118	29.0%	$526	2.7%	$419	$122	$541	2023Q3	28.2%	$537	$156	$693
	CONTRACT COST TOTALS:	$25,169	$7,260		**$32,429**		$25,595	$7,383	$32,977			$29,333	$8,463	**$37,796**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Ala Wai Canal
LOCATION: Honolulu, Island of Oahu, Hawaii
This Estimate reflects the scope and schedule in report; Ala Wai Canal Feasibility Study dated Aug 2016

DISTRICT: Honolulu District PREPARED: 2/22/2017
POC: CHIEF, ENGINEERING & CONSTRUCTION, Todd C. Barnes

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			15-May-16 / 1-Oct-15	Program Year (Budget EC): / Effective Price Level Date:			2017 / 1 OCT 16	FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Ala Wai Canal													
02	RELOCATIONS	$7,386	$2,142	29.0%	$9,528	1.4%	$7,486	$2,171	$9,657	2023Q3	13.6%	$8,505	$2,467	$10,972
04	DAMS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
06	FISH & WILDLIFE FACILITIES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
11	LEVEES & FLOODWALLS	$45,058	$13,067	29.0%	$58,125	1.4%	$45,668	$13,244	$58,912	2023Q3	13.6%	$51,889	$15,048	$66,937
13	PUMPING PLANT	$51,251	$14,863	29.0%	$66,114	1.4%	$51,945	$15,064	$67,009	2023Q3	13.6%	$59,021	$17,116	$76,137
15	FLOODWAY CONTROL & DIVERSION STRU	$4,613	$1,338	29.0%	$5,951	1.4%	$4,675	$1,356	$6,031	2023Q3	13.6%	$5,312	$1,541	$6,853
18	CULTURAL RESOURCE PRESERVATION	$436	$126	29.0%	$562	1.4%	$442	$128	$570	2023Q3	13.6%	$502	$146	$647
19	BUILDINGS, GROUNDS & UTILITIES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$108,744	$31,536	29.0%	**$140,279**		$110,216	$31,963	$142,178			$125,229	$36,317	$161,546
01	LANDS AND DAMAGES	$1,407	$386	27.5%	$1,794	1.4%	$1,426	$392	$1,818	2021Q3	9.2%	$1,558	$428	$1,986
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$2,719	$789	29.0%	$3,508	2.7%	$2,792	$810	$3,602	2020Q1	11.8%	$3,123	$906	$4,029
5.0%	Planning & Environmental Compliance	$5,437	$1,577	29.0%	$7,014	2.7%	$5,584	$1,619	$7,203	2020Q1	11.8%	$6,245	$1,811	$8,056
8.5%	Engineering & Design	$9,243	$2,680	29.0%	$11,923	2.7%	$9,493	$2,753	$12,245	2020Q1	11.8%	$10,617	$3,079	$13,696
0.5%	Reviews, ATRs, IEPRs, VE	$544	$158	29.0%	$702	2.7%	$559	$162	$721	2020Q1	11.8%	$625	$181	$806
0.5%	Life Cycle Updates (cost, schedule, risks)	$544	$158	29.0%	$702	2.7%	$559	$162	$721	2020Q1	11.8%	$625	$181	$806
2.0%	Contracting & Reprographics	$2,175	$631	29.0%	$2,806	2.7%	$2,234	$648	$2,882	2020Q1	11.8%	$2,498	$725	$3,223
3.0%	Engineering During Construction	$3,262	$946	29.0%	$4,208	2.7%	$3,350	$972	$4,322	2023Q3	28.2%	$4,294	$1,245	$5,539
2.0%	Planning During Construction	$2,175	$631	29.0%	$2,806	2.7%	$2,234	$648	$2,882	2023Q3	28.2%	$2,863	$830	$3,694
2.0%	Project Operations	$2,175	$631	29.0%	$2,806	2.7%	$2,234	$648	$2,882	2020Q1	11.8%	$2,498	$725	$3,223
31	CONSTRUCTION MANAGEMENT													
8.0%	Construction Management	$8,699	$2,523	29.0%	$11,222	2.7%	$8,934	$2,591	$11,525	2023Q3	28.2%	$11,451	$3,321	$14,772
2.0%	Project Operation:	$2,175	$631	29.0%	$2,806	2.7%	$2,234	$648	$2,882	2023Q3	28.2%	$2,863	$830	$3,694
2.5%	Project Management	$2,719	$789	29.0%	$3,508	2.7%	$2,792	$810	$3,602	2023Q3	28.2%	$3,579	$1,038	$4,617
	CONTRACT COST TOTALS:	$152,018	$44,064		**$196,082**		$154,640	$44,823	$199,463			$178,070	$51,616	**$229,687**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Ala Wai Canal
LOCATION: Honolulu, Island of Oahu, Hawaii
This Estimate reflects the scope and schedule in report; Ala Wai Canal Feasibility Study dated Aug 2016

DISTRICT: Honolulu District PREPARED: 2/22/2017
POC: CHIEF, ENGINEERING & CONSTRUCTION, Todd C. Barnes

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			15-May-16	Program Year (Budget EC):			2017	FULLY FUNDED PROJECT ESTIMATE				
		Effective Price Level:			1-Oct-15	Effective Price Level Date:			1 OCT 16					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Flood Warning System													
02	RELOCATIONS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
04	DAMS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
06	FISH & WILDLIFE FACILITIES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
11	LEVEES & FLOODWALLS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
13	PUMPING PLANT	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
15	FLOODWAY CONTROL & DIVERSION STRU	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
18	CULTURAL RESOURCE PRESERVATION	$30	$9	29.0%	$38	1.4%	$30	$9	$39	2023Q3	13.6%	$34	$10	$44
19	BUILDINGS, GROUNDS & UTILITIES	$272	$79	29.0%	$351	1.4%	$276	$80	$356	2023Q3	13.6%	$313	$91	$404
	CONSTRUCTION ESTIMATE TOTALS:	$302	$87	29.0%	**$389**		$306	$89	$394			$347	$101	$448
01	LANDS AND DAMAGES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$8	$2	29.0%	$10	2.7%	$8	$2	$11	2020Q1	11.8%	$9	$3	$12
5.0%	Planning & Environmental Compliance	$15	$4	29.0%	$19	2.7%	$15	$4	$20	2020Q1	11.8%	$17	$5	$22
8.5%	Engineering & Design	$26	$8	29.0%	$34	2.7%	$27	$8	$34	2020Q1	11.8%	$30	$9	$39
0.5%	Reviews, ATRs, IEPRs, VE	$2	$1	29.0%	$3	2.7%	$2	$1	$3	2020Q1	11.8%	$2	$1	$3
0.5%	Life Cycle Updates (cost, schedule, risks)	$2	$1	29.0%	$3	2.7%	$2	$1	$3	2020Q1	11.8%	$2	$1	$3
2.0%	Contracting & Reprographics	$6	$2	29.0%	$8	2.7%	$6	$2	$8	2020Q1	11.8%	$7	$2	$9
3.0%	Engineering During Construction	$9	$3	29.0%	$12	2.7%	$9	$3	$12	2023Q2	26.9%	$12	$3	$15
2.0%	Planning During Construction	$6	$2	29.0%	$8	2.7%	$6	$2	$8	2023Q2	26.9%	$8	$2	$10
2.0%	Project Operations	$6	$2	29.0%	$8	2.7%	$6	$2	$8	2020Q1	11.8%	$7	$2	$9
31	CONSTRUCTION MANAGEMENT													
8.0%	Construction Management	$24	$7	29.0%	$31	2.7%	$25	$7	$32	2023Q2	26.9%	$31	$9	$40
2.0%	Project Operation:	$6	$2	29.0%	$8	2.7%	$6	$2	$8	2023Q2	26.9%	$8	$2	$10
2.5%	Project Management	$8	$2	29.0%	$10	2.7%	$8	$2	$11	2023Q2	26.9%	$10	$3	$13
	CONTRACT COST TOTALS:	$420	$122		**$541**		$427	$124	$551			$491	$142	**$633**

Filename: Ala Wai TPCS 22 Feb 2017 r1 - MCX CHECK.xlsx
TPCS

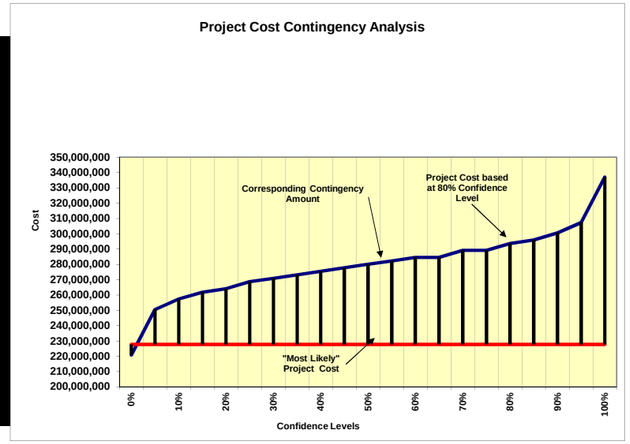
Contingency on Base Estimate	80% Confidence Project Cost
Baseline Estimate Cost ->	**$227,682,000**
Baseline Estimate Cost Contingency Amount ->	$66,027,780
Baseline Estimate Construction Cost (80% Confidence) ->	**$293,709,780**

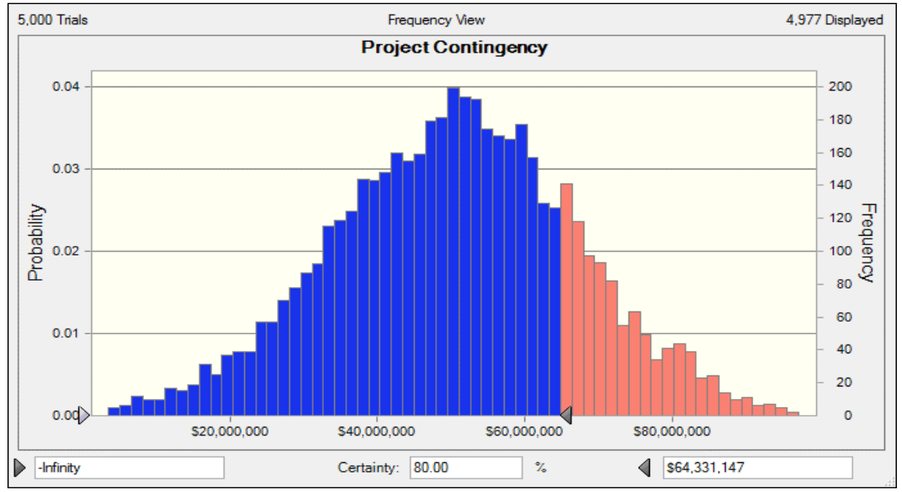
Contingency on Schedule	80% Confidence Project Schedule
Project Base Schedule Duration ->	**72.0 Months**
Schedule Contingency Duration ->	77.8 Months
Project Schedule Duration (80% Confidence) ->	**149.8 Months**

- PROJECT CONTINGENCY DEVELOPMENT -

Contingency Analysis

Most Likely Cost Estimate	$227,682,000	
Confidence Level	**Value**	**Contingency**
0%	**220,851,540**	**-3.00%**
5%	**250,450,200**	**10.00%**
10%	**257,280,660**	**13.00%**
15%	**261,834,300**	**15.00%**
20%	**264,111,120**	**16.00%**
25%	**268,664,760**	**18.00%**
30%	**270,941,580**	**19.00%**
35%	**273,218,400**	**20.00%**
40%	**275,495,220**	**21.00%**
45%	**277,772,040**	**22.00%**
50%	**280,048,860**	**23.00%**
55%	**282,325,680**	**24.00%**
60%	**284,602,500**	**25.00%**
65%	**284,602,500**	**25.00%**
70%	**289,156,140**	**27.00%**
75%	**289,156,140**	**27.00%**
80%	**293,709,780**	**29.00%**
85%	**295,986,600**	**30.00%**
90%	**300,540,240**	**32.00%**
95%	**307,370,700**	**35.00%**
100%	**336,969,360**	**48.00%**

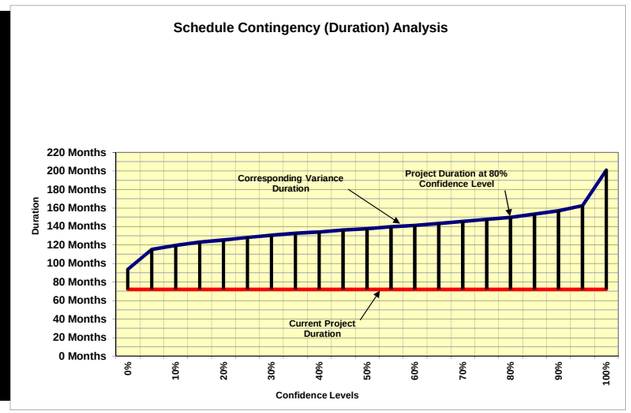


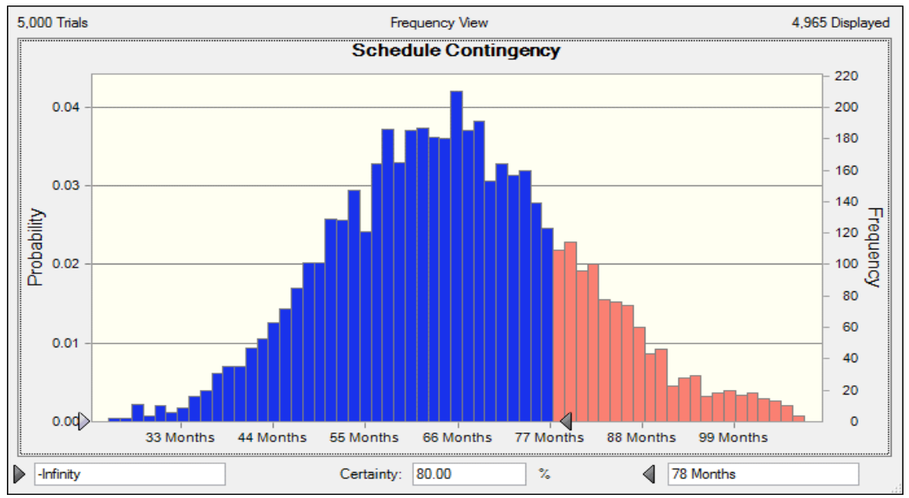


- SCHEDULE CONTINGENCY (DURATION) DEVELOPMENT -

Contingency Analysis

Base Case Schedule	72.0 Months	
Confidence Level	**Value**	**Contingency**
0%	**93.6 Months**	**30.00%**
5%	**115.2 Months**	**60.00%**
10%	**119.5 Months**	**66.00%**
15%	**123.1 Months**	**71.00%**
20%	**125.3 Months**	**74.00%**
25%	**128.2 Months**	**78.00%**
30%	**130.3 Months**	**81.00%**
35%	**132.5 Months**	**84.00%**
40%	**133.9 Months**	**86.00%**
45%	**136.1 Months**	**89.00%**
50%	**137.5 Months**	**91.00%**
55%	**139.7 Months**	**94.00%**
60%	**141.1 Months**	**96.00%**
65%	**143.3 Months**	**99.00%**
70%	**145.4 Months**	**102.00%**
75%	**147.6 Months**	**105.00%**
80%	**149.8 Months**	**108.00%**
85%	**153.4 Months**	**113.00%**
90%	**157.0 Months**	**118.00%**
95%	**162.7 Months**	**126.00%**
100%	**200.9 Months**	**179.00%**





Ala Wai Canal

Risk Matrix

Impact or Consequence of Occurrence

Likelihood of Occurrence	Negligible	Marginal	Significant	Critical	Crisis
Certain	Moderate	Moderate	High	High	High
Very Likely	Low	Moderate	High	High	High
Likely	Low	Moderate	High	High	High
Unlikely	Low	Low	Moderate	Moderate	High
Very Unlikely	Low	Low	Low	Low	Moderate

Overall Project Scope

The construction of detention basins at various locations, and flood protection along the Ala Wai Canal including Levees & Floodwalls; Contract 1 - Makiki Watershed; Contract 2 - Manoa Watershed; Contract 3 - Palolo Watershed; Contract 4 - Ala Wai Canal; Contract 5 - Adaptive Management; Contract 6 - Flood Warning System.

SEE ASSUMPTIONS TAB FOR COST VALUE RANGES DEVELOPMNENT

Negligible--- *Less than*		$1,138,410		2 Months	
Marginal ---*between*	$1,138,411	and	$4,553,640	2 Months	and 4 Months
Significant ---*between*	$4,553,641	and	$6,830,460	4 Months	and 7 Months
Critical--- *between*	$6,830,461	and	$11,384,100	7 Months	and 14 Months
Crisis ---*Over*	$11,384,101			14 Months	

Risk No.	Risk/Opportunity Event	Concerns	PDT Risk Conclusions, Justification	Project Cost				Project Schedule				Variance Distribution	Correlation to Other(s)	Responsibility/POC	Affected Project Component
				Likelihood*	Impact*	Risk Level*	Rough Order Impact ($)	Likelihood*	Impact*	Risk Level*	Rough Order Impact (mo)				
	Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)														
	PROJECT & PROGRAM MGMT														
PM1	Staff Priorities	No control over staff priorities; Competing with other projects, funding, resources. The Project Manager currently does not have control over staff priorities.	There is a possibility that other priority projects will require staff to be pulled from this project and put on the priority project. Will most likely have national team or A/E perform design/plans/Spec. Therefore it is a very unlikely occurrence. No cost impact. If it does occur, assume 6 month delay.	Very Unlikely	Negligible	LOW	$0	Very Unlikely	Significant	LOW	6 Months	Custom		Project Manager	Project Schedule
PM2	Losing Critical Staff at Critical Point	Critical Staff members leave at crucial points in the project.	Turnover could happen during PED Phase. Will most likely have national team or A/E perform design/plans/Spec. Therefore it is a very unlikely occurrence. Very little cost impact. If it does occur, assume 3 month delay.	Very Unlikely	Negligible	LOW	$10,000	Very Unlikely	Marginal	LOW	3 Months	Custom		Project Manager	Project Cost & Schedule
PM3	Timely Decisions to changing policies	Policy implementation to clarify the decision that has been made on current ongoing projects	Waiting for decisions on how to implement decisions. Assume contractor in standby. Assume $10k/day x 60 days = $600k	Very Unlikely	Negligible	LOW	$600,000	Very Unlikely	Marginal	LOW	2 Months	Custom		Project Manager	Project Cost & Schedule
	CONTRACT ACQUISITION RISKS														
CA1	Undefined Acquisition Plan	The contract acquisition strategy has not been determined at this stage. Concern is that contract may go to small business setaside if broken into smaller contracts.	The contract acquisition strategy will be determined during the PED Phase. The estimate assumes a Prime contractor subcontracting out all of the work with a 90% productivity factor. However, if small business setasides occur, higher HOOH rates, slower production rates. Submittal process may take additional time. Assume an additional 15% in cost. Contract value $164M x 15% = $24.6M;	Likely	Crisis	HIGH	$24,600,000	Very Unlikely	Negligible	LOW	0 Months	Uniform		Contracting	Project Cost
CA2	Numerous Separate Contracts	Estimate assumes 6 contracts. Makiki watershed, Manoa Watershed, Palolo Watershed, Ala Wai Canal, Adaptive management, and the Flood Warning System.	There is a possibility that additional contracts would be added to the Manoa watershed and Ala Wai Canal. Assume up to 9 additional contracts @ $100k per contract.	Likely	Negligible	LOW	$900,000	Likely	Negligible	LOW	0 Months	Triangular		Contracting	Project Cost
CA3	Acquisition Strategy decreasing competition	Larger contracts will decrease competition.	Larger contracts will decrease competition because of bonding capacity. Baseline estimate assume larger contracts with one prime contractor subcontracting all of the work. If smaller contracts are used, the prime may perform more work. Assume one level of markups are removed for earthwork related work.	Likely	Crisis	HIGH	($22,944,000)	Likely	Negligible	LOW	0 Months	Triangular		Contracting	Project Cost
CA4	Acquisition Strategy - Design Build	Concern acquisition will be one contract for design and construction will be awarded. This will cause schedule delay and higher cost.	Will have to perform best value instead of LPTA. Potential 20% increase in cost due to contingencies, modifications. Chance <10%	Very Unlikely	Crisis	HIGH	$32,800,000	Very Unlikely	Crisis	HIGH	24 Months	Custom		Contracting	Project Cost & Schedule
CA5	Public/Private Partnership	Nonfederal sponsor completes design/construction and seek reimbursment.	Accelerates delivery of product therefore reducing schedule. Zero cost reduction. One year benefit in schedule. 30% chance of occurance.	Likely	Negligible	LOW	$0	Unlikely	Critical	MODERATE	-12 Months	Triangular		Contracting	Project Cost
CA6	Acquisition Strategy - IFB vs LPTA	LPTA has not resulted in best contract versus IFB	Cost savings is 8 people 20 days x $1000/day x 4 contracts = $640k	Likely	Negligible	LOW	$640,000	Likely	Critical	HIGH	8 Months	Uniform		Contracting	Project Cost & Schedule
	TECHNICAL RISKS														
TL1	Detention Basin Material	The availability of material to construct impervious detention basins may cause redesign.	Detailed site investigation or geotechnical investigations has not been performed along the entire alignments. Total amount of material may not be available from vendors. May have to pay a premium for clay material. Assume geomembrane is added for impermeability for each detention basin. Geotextile Fabric already included in Debris basins, none on levees. Assume Geomembrane would cost $0.10/sf more than geotextile fabric. 86210 sf for debris basins x $0.10/sf + 171512 sf for levees x $1.28/sf.	Unlikely	Negligible	LOW	$228,000	Very Unlikely	Negligible	LOW	0 Months	Custom		Geotechnical/Civil Design	Contract Cost
TL2	Detention Basin - Depth	Depth of basins may not be deep enough	Additional Excavation may be required to deepen basins. Assume additional 4 lf depth of excavation. Makiki - (30' x 470' x 4'/27') = 2089 cy; Waiamao - 30' x400' x 4'/27/cf/cy = 1778 cy; Pukele - 30' x 500' x 4'/27/cf/cy = 2222 cy; Total - 6089 cy x $73/cy = $445, 000	Very Unlikely	Negligible	LOW	$445,000	Very Unlikely	Negligible	LOW	0 Months	Triangular		Geotechnical/Civil Design	Project Cost
TL3	Detention Basin - Height	Height of Berms may not be tall enough	Additional fill may be required to increase height of berms. Assume additoinal 2 lf of height; Assume 16,000 cy x $175/cy = $2.8M	Very Unlikely	Marginal	LOW	$2,800,000	Very Unlikely	Negligible	LOW	0 Months	Custom		Geotechnical/Civil Design	Project Cost
TL4	Floodgate @ Community Center	The floodgate location and details are not well defined at the Communitity Center.	May need to add 1 additional Floodgate. Assume 1 additional gate @ $500k each;	Unlikely	Negligible	LOW	$500,000	Unlikely	Negligible	LOW	1 Months	Custom		Hydrology/Hydraulic Design	Project Cost & Schedule
TL5	Interior Drainage	The exit location of the interior drainage pipes into the Ala Wai Canal are not known.	Current estimate allows for flap gate connections to existing concrete walls. May different kind of connection. Assume 37 each x $5000 for different connection to pipe. NOT MODELED; SEE CO10.	Likely	Negligible	LOW	$185,000	Unlikely	Negligible	LOW	0 Months	Uniform		Geotechnical/Civil Design	Contract Cost
TL6	Sanitary Sewer Line Alignment	Runs parallel to flloodwall	Pipe is deep; 30 inverts; Can realign wall; negligilbe consequence	Very Unlikely	Negligible	LOW	$0	Very Unlikely	Negligible	LOW	0 Months	Custom		Geotechnical/Civil Design	Project Cost
TL7	Setback from Exist Canal Wall	Wall setback is based on 45 deg angle from base of exist wall.	May need to extend wall instead of realignment. DID NOT MODEL. SIMILAR TO TL8	Unlikely	Negligible	LOW	$0	Unlikely	Negligible	LOW	0 Months	Custom		Hydrology/Hydraulic Design	Project Cost
TL8	Water Surface Elev Changing	Water surface elevation is changing.	Wall & Footing sizes may be increased. Assume for estimating purposes 1 ft additional to both height and width; Wall - 14900 lf x 1.5 lf x 1 lf/27 cf/cy = 828 cy x $2400/cy ; Slab width = 1 lf x 1.5 lf x 14900 lf/27 cf/cy = 828 cy x $1200/cy; Total = $2M + $1M = $3M	Very Likely	Marginal	MODERATE	$3,000,000	Very Likely	Negligible	LOW	0 Months	Custom		Hydrology/Hydraulic Design	Project Cost
TL9	Bridge Transition	May need to relocate utilites	Assume 2 areas (McCully) x $100,000 per location as as an allowance to relocate utilities	Unlikely	Marginal	LOW	$200,000	Unlikely	Significant	MODERATE	6 Months	Triangular		Geotechnical/Civil Design	Contract Cost & Project Schedule
TL10	Gatewells	Ala Wai Golf Course Levee is crossing sewer lines. Positive Closure may be required.	Ala Wai Golf Course Levee is crossing sewer lines. May require gatewells structures . Assume $50k/gatewell x 2 each = $100k	Unlikely	Negligible	LOW	$100,000	Unlikely	Negligible	LOW	0 Months	Uniform		Geotechnical/Civil Design	Project Cost
TL11	Micropiles	Micropiles may be needed at McCully Bridge intersections for elevated platforms and narrowing foundations.	Assume 5" dia micropile 50 lf long each. 355 lf + 150 lf = 505 lf/ 5 lf on center = 101 piles x 1 row x 50 lf = 5050 vlf x $80/lf = say $400k	Very Likely	Negligible	LOW	$400,000	Unlikely	Negligible	LOW	0 Months	Custom		Geotechnical/Civil Design	Project Cost
TL12	Stable Slopes	Deep excavations with 1 on .5 slopes may not be stable for design.	Current estimate assumes a 1 on 2 slope as a minimum slope for Makiki and Pukele. Assume a 1 on 2 slope with a 10' wide bench at 15' height intervals for likely. Assume a 1 on 3 slope as maximum slope for Makiki and Pukele.	Likely	Marginal	MODERATE	$3,200,000	Unlikely	Negligible	LOW	0 Months	Triangular		Geotechnical/Civil Design	Project Cost
	LANDS AND DAMAGES RISKS														
LD1	RE Plan Defined - Staging Area	Staging area are defined.	These areas may increase in size. Assume 10% increase in size. 2500 sf x 5 sites x 10% = 1250 sf x $3500/acre/43560sf/acr = $287…say $1k	Likely	Negligible	LOW	$1,000	Likely	Marginal	MODERATE	3 Months	Uniform		Real Estate	Project Cost & Schedule
LD2	RE Plan Defined - Utility Easements	Utility Temporary easement changing footprint.	Incomplete data for Utilities. May find unmapped utilities. The entire footprint location may change.	Unlikely	Negligible	LOW	$5,000	Unlikely	Significant	MODERATE	7 Months	Uniform		Real Estate	Project Cost & Schedule
LD3	Land and Water Conservation Fund	Federal constraints on lands necessary for the project.	This may affect the flood wall near Ala Wai Community Park. Approval will be required from the National Park Service and May require land mitigation. Assume 1200 lf x 9.5 lf wide = 11400 sf/43560 sf/acre = .26 acres x $3500/acre = $915; say $1k	Very Unlikely	Negligible	LOW	$1,000	Very Unlikely	Negligible	LOW	0 Months	Uniform		Real Estate	Project Cost
LD4	Objections to right of way taking	May need to go into condemnation process at three locations. - Private Lands	Additional legal fees for 160 hours/condemnation x $200/hr x 3 locations = $96k	Very Likely	Negligible	LOW	$96,000	Very Likely	Critical	HIGH	15 Months	Uniform		Real Estate	Project Cost & Schedule
LD5	Improper Acquisition	Opponents of the project may delay acquisition by legal methods. Public lands.	Legal fees $200/hr x 200hr x 3 sites;	Unlikely	Negligible	LOW	$120,000	Unlikely	Critical	MODERATE	15 Months	Uniform		Real Estate	Project Cost & Schedule
LD6	Staff Assignments	Assigning Local Sponsor Contract to perform RE Acquisition	To date no personnel have been assigned to perform these functions.	Very Unlikely	Negligible	LOW	$0	Very Likely	Significant	HIGH	6 Months	Uniform		Real Estate	Project Schedule
LD7	State Setaside Lands	The golf course is a state setaside land.	Certain lands necessary for the project have been designated as State Set aside land by the govenor. The risk is the legistor could prevent the land from being used for the project. Golf course and Manoa District Park are considered State Setaside lands. 10% chance of occurring.	Very Unlikely	Marginal	LOW	$3,000,000	Very Unlikely	Critical	LOW	6 Months	Custom		Real Estate	Project Cost & Schedule
	REGULATORY AND ENVIRONMENTAL RISKS														
REG1	Archeological Monitoring	Inadvertant Discoveries at construction sites.	Upon discovery, the finding may require data recovery and site monitoring for the remainder of the construction. 9 sites x 80 hrs x $100/hr = $72k; Data Recovery - 2 people x 80 hrs x $100 x 9 sites = $144k; Report - 1 person 160 hrs x $100/hr x 9 sites - $144 k; Schedule delay 80 hrs x 9 site = 720 hr/160 hr/mo = 4.5 months + (2 months/site x 9 sites) consultation with Oahu Island Burial Council; $360k ; 5% chance of occurance.	Unlikely	Negligible	LOW	$360,000	Unlikely	Crisis	HIGH	23 Months	Uniform		Environmental	Project Cost & Schedule
REG2	Bats	Removal of Vegetation over 15' high will not be done from 1 June to 15 Sept. Protection of Juvenile bats during their infancy.	Mob and Demob will be incurred - $200k x 4 sites (Waihi, Waikiakua, Woodlawn, Makiki) ; Bat Survey - $10k	Unlikely	Negligible	LOW	$810,000	Unlikely	Significant	MODERATE	4 Months	Uniform		Environmental	Project Cost & Schedule
REG3	Cultural Monitoring	Inadvertant Discoveries at construction sites.	Upon discovery, the finding may require cultural monitoring and protocol for the remainder of the construction. 9 sites x 80 hrs x $100/hr = $72k; Data Recovery - 1 people x 80 hrs x $100 x 9 sites = $72k; Report - 1 person 80 hrs x $100/hr x 9 sites - $72 k; 216k ; 5% chance of occurance.	Unlikely	Negligible	LOW	$216,000	Unlikely	Negligible	LOW	0 Months	Uniform		Environmental	Project Cost
REG4	Elepaio	Removal of Suitable habitat/Vegetation will not be done from 1 Jan to 30 June. Protection of Elepaio during their infancy.	Mob and Demob will be incurred - $200k x 2 sites (Waihi, Waiakiakua; Elepaio Survey - $10k	Unlikely	Negligible	LOW	$410,000	Unlikely	Significant	MODERATE	6 Months	Uniform		Environmental	Project Cost & Schedule
	CONSTRUCTION RISKS														
CO1	Water Diversion - Detention	Water Care and Diversion plans has not been fully developed at this stage. The current estimate assumes sandbag dams with 24" dia bypass piping. The estimate also assumes 2 washouts per site location with no rework. Additional washouts could occur.	Assume an additional 2 washouts at each site plus rework. Assume 20% of the construction is assumed as rework. Assume 1 month delay per 5 sites. Total Backfilling costs incl structure = $11.5M x 20% + $400k addl washouts	Unlikely	Marginal	LOW	$2,700,000	Unlikely	Significant	MODERATE	5 Months	Triangular		Construction	Contract Cost & Project Schedule
CO2	Water Diversion - Hausten	Water Care and Diversion plans has not been fully developed at this stage	The current estimate assumes Riprap (with fines) dams with 24" dia bypass piping with no washouts. Cost includes an allowance for bypass pumps. Assume 1 additional pump may be required.	Unlikely	Negligible	LOW	$200,000	Very Unlikely	Negligible	LOW	0 Months	Triangular		Construction	Contract Cost
CO3	Water Diversion - Pump Plants	Water Care and Diversion plans has not been fully developed at this stage	The current estimate assumes Riprap (with fines) dams with 24" dia bypass piping. The estimate also assumes 0 washouts for three site location. Washouts likely to not occur. Assume 1% of pump station cost for rework per site location X $51M = $510k	Unlikely	Negligible	LOW	$510,000	Very Unlikely	Negligible	LOW	1 Months	Triangular		Construction	Contract Cost & Project Schedule

CO4	Utility Relocations	Utilities may be encountered during construction activities.	It is likely that utilities will be encountered during excavation. Any relocation to sewer lines could be significant when compared to relocating waterlines, cable and electircal lines. Exploration of utilities will be investigated during the PED phase. Assume $10k per occurance x 10 ea allowance = $100k; Schedule delay assume 1 month/occurance x 10 months = 10 months.	Likely	Negligible	LOW	$100,000	Likely	Critical	HIGH	10 Months	Triangular		Construction	Contract Cost & Project Schedule
CO5	Modifications - Pump Plants	Assume modifications will occur at 20% of construction costs.	Assume 20% x $51.3M construction costs = $10.26M	Likely	Critical	HIGH	$10,260,000	Likely	Significant	HIGH	6 Months	Uniform		Construction	Contract Cost & Project Schedule
CO6	Modifications - Remaining	Assume modificatons will occur at 10% of construction costs.	Assume 10% x $113M Ala Wai Canal except pump plants construction costs = $11.3M	Likely	Critical	HIGH	$11,300,000	Likely	Negligible	LOW	2 Months	Uniform		Construction	Contract Cost & Project Schedule
CO7	Ala Wai Canal Traffic Control	Traffic and parking along the Ala Wai Canal may cause logistic issues	The current estimate includes 2 flagman for 90 weeks. Additional signage and traffic control may be required. Assume $50k additional	Likely	Negligible	LOW	$50,000	Likely	Negligible	LOW	0 Months	Uniform		Construction	Contract Cost
CO8	Beach Walk Buffer Zone	Vibration around the forcemains and Pump station	No vibration will require a different construction technique instead of the use of micro piles. AZ14 sheetpile - Excavate and place instead of driving sheetpile. No cost change.	Likely	Negligible	LOW	$0	Likely	Negligible	LOW	0 Months	Triangular		Construction	Contract Cost
CO9	Lack of skilled trades	Economic boom causing lack of workers	Contractor may have to pay higher wages in order to attract workers. Assume 10% higher wages x $26.2 M = $2.62M	Unlikely	Marginal	LOW	$2,620,000	Unlikely	Negligible	LOW	0 Months	Triangular		Construction	Contract Cost
CO10	Flap Gate Mounting	May have to mount flap gates inside closest manholes instead of headwall	Assume new manhole to accommodate flap gate mounting. Assume 20 new manholes x $10k/manholes = $200k plus $5k traffic control x 20 ea = $100k = $300k + 17 ea x $5000 ea for different flapgate mounting from TL5 = $385k total	Likely	Negligible	LOW	$385,000	Likely	Negligible	LOW	0 Months	Triangular		Construction	Contract Cost
	ESTIMATE AND SCHEDULE RISKS														
ET1	Pump Plants	The design for the pump plants is at an early stage without many specifics.	Estimate has been detailed out in cost estimate. However, parametric estimates indicate the estimate may be too low. Parametric estimates indicate $22 to $30k/cfs. Current estimate is approximately $19k/cfs. Pump plant walls may be to thin. Generator may not be large enough. Low = M2 estimate; Most Likeley = Assume 446 cfs x 6 pumps x $3k difference = $8.03M; High = 446 cfs x 6 pumps x $11k difference = $29.44M	Likely	Crisis	HIGH	$29,440,000	Likely	Critical	HIGH	12 Months	Triangular		Cost Engineering	Project Cost & Schedule
ET2	Pump Plant #2 Flap Gate	Drawings do not indicate a flapgate is required for 48" da RCP	No cost has been included for this 48" dia RCP. May need to include.	Very Likely	Negligible	LOW	$40,000	Very Unlikely	Negligible	LOW	0 Months	Uniform		Cost Engineering	Project Cost
ET3	Impervious Material	The availability of impervious material is questionable.	The estimate assumes none of the material excavated at the sites is suitable for reuse as impervious material to be used in a dam detention structure. Commercial vendors may not have the required amount of impervious material. Assume $10/cy additional cost for impervious material. Assume 25% of material can be reused.	Likely	Marginal	MODERATE	-$2,000,000 to $3,220,000	Very Unlikely	Negligible	LOW	0 Months	Triangular		Cost Engineering	Project Cost
ET4	Haul Roads	There is no current design for the haul road to determine cut and fill quantities.	The current estimate assumes roads are placed on existing ground in shown configurations. A cost may need to be included for cut/fill to allow for appropriate grades. This has been included in the baseline estimate. DO NOT MODEL.	Very Unlikely	Negligible	LOW	$0	Very Unlikely	Negligible	LOW	0 Months	Custom		Cost Engineering	Project Cost
ET5	Floodgate Transitions	Wiper walls may need to be constructed to accommodate Floodgates	No design has been included to determine the extent of the wiper wall. Current estimate includes an allowance of $100k per wall. Assume an additional $50k per wall x 4 each = $200k	Unlikely	Negligible	LOW	$200,000	Very Unlikely	Negligible	LOW	0 Months	Uniform		Cost Engineering	Project Cost
ET6	Hausten Br Conc Wall	No transition details have been provided at this stage of design.	No design has been included to determine the transition details. Current estimate includes an allowance of $100k. Assume an additional $50k.	Unlikely	Negligible	LOW	$50,000	Very Unlikely	Negligible	LOW	0 Months	Uniform		Cost Engineering	Contract Cost
ET7	Prime/Subcontractor Structure	Baseline estimate assumed prime contractor will subcontract out all of the work. Layers of markups would be removed if more of the work is performed by prime contractor.	Layers of markups may be deleted if more of the work is performed by prime contractor. Same as CA-3. NOT MODELED.	Likely	Crisis	HIGH	($22,262,000)	Very Unlikely	Negligible	LOW	0 Months	Triangular		Cost Engineering	Contract Cost
ET8	Cost of Fuel	Fuel costs have extreme flucuations. Equipment Manual default prices used in the estimate.	Fuel may decrease up to 40% more per gallon and may increase 10% per gallon. ($1.583M) to $2.410M	Likely	Marginal	MODERATE	-$1,583,000 to $2,410,000	Very Unlikely	Negligible	LOW	0 Months	Triangular		Cost Engineering	Contract Cost
ET9	Site Access Restrictions	Tight corridor to work within. Current Baseline Estimate includes 90% productivity for the Manoa Watershed and Ala Wai Canal area, and 80% productivity for the Makiki and Palolo Watersheds.	Assume all areas at a 80% production rates. Increase of $7.7M & delay of up 12months based on 60 months x 0.2 = 12 months.	Unlikely	Critical	MODERATE	$7,700,000	Unlikely	Critical	MODERATE	12 Months	Triangular		Cost Engineering	Contract Cost & Project Schedule
ET10	Utility Relocations	Utility relocations may have to be relocated in a different configuration. Historically this item could double in cost.	Utility relocations may have to be relocated in a different configuration. Historically this item could double in cost. Current estimate includes a placeholder for relocations since no design has been provided. For estimating assume a 50% contingency. $7.4M x 50% contingency = $3.7M	Likely	Marginal	MODERATE	$3,700,000	Unlikely	Negligible	LOW	0 Months	Uniform		Cost Engineering	Contract Cost
ET11	Union Labor Rates	Union Labor May be used.	Add 5% to labor rates. $26.2M x 5% = $1.31M. Very likely to occur.	Very Likely	Negligible	LOW	$1,310,000	Very Unlikely	Negligible	LOW	0 Months	Uniform		Cost Engineering	Contract Cost
ET12	HOOH	10% Home Office Overhead used in baseline estimate at early stage. Used as a percentage markup.	This may vary from 5 to 15% depending on size of contractor.	Likely	Critical	HIGH	-$7,470,000 to $7,470,000	Very Unlikely	Negligible	LOW	0 Months	Triangular		Cost Engineering	Contract Cost
ET13	JOOH	15% Job Office Overhead used in baseline estimate at early stage. Used as a percentage markup.	This may vary from 10 to 15%; Assume 10% as a low.	Likely	Critical	HIGH	($7,143,000)	Very Unlikely	Negligible	LOW	0 Months	Triangular		Cost Engineering	Contract Cost
ET14	Clear & Grub	The quantity of material to be hauled off site is difficult to quantify.	Estimate is based on historical basal area. Research does not indicate more than 300sf/acre of basal area. Calculations are based on 10' spacing of trees at 1' dia with 1 cy rootball each. Overall quantity calc resulted in less than 2% of area cleared. M2 estimate includes 2% basal area. Assume risk up to 5% basal area.	Likely	Marginal	MODERATE	$1,750,000	Very Unlikely	Negligible	LOW	0 Months	Triangular		Cost Engineering	Contract Cost
	Programmatic Risks	(External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)													
PR1	Adequacy of Project Funding	Most likely will receive incremental funding combined with projected schedule delay.	Currently assume 6 contracts. Assume 0.5% above projected inflation for 12.5 years for schedule contingency = 6.2% compounded, Therefore = 6.2% x $233M = say $14.5M	Likely	Crisis	HIGH	$14,500,000	Likely	Crisis	HIGH	12 Months	Uniform		District Management	Project Schedule
PR2	Market Conditions	Assume number of bidders affect overall construction prices.	assume -10% plus 15% depending on the number of bidders. $164M x 15% = $24.6M; $164M x -10% = -$16.4M	Likely	Crisis	HIGH	-$16,400,000 to $24,600,000	Very Unlikely	Negligible	LOW	0 Months	Triangular		N/A	Contract Cost

*Likelihood, Impact, and Risk Level to be verified through market research and analysis (conducted by cost engineer).