Lutak Dock Replacement

A Life Cycle Cost Analysis

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Goal

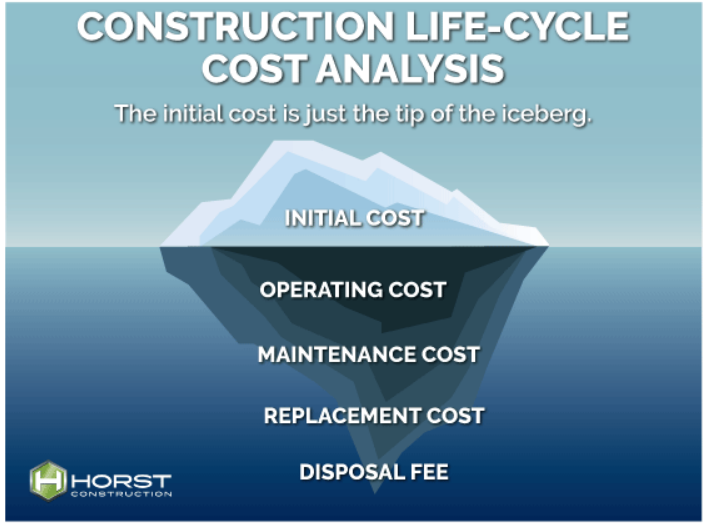
- The purpose of this document is to provide a framework for a Life Cycle Cost Analysis of two designs that have been approved by MARAD for the Lutak Dock Replacement project:
  1. The Turnagain Marine “Encapsulation” concept currently at 95% design stage
  2. The 2021 design by R&M that was the basis of the original RAISE grant award funding this project.
     - Due to a the use of a partial sheetpile bulkhead, this design is significantly more costly to maintain and replace than the simplest Rip-Rap based solution recently promoted by Lynn Canal Conservation, but this design was explicitly funded in the original award.

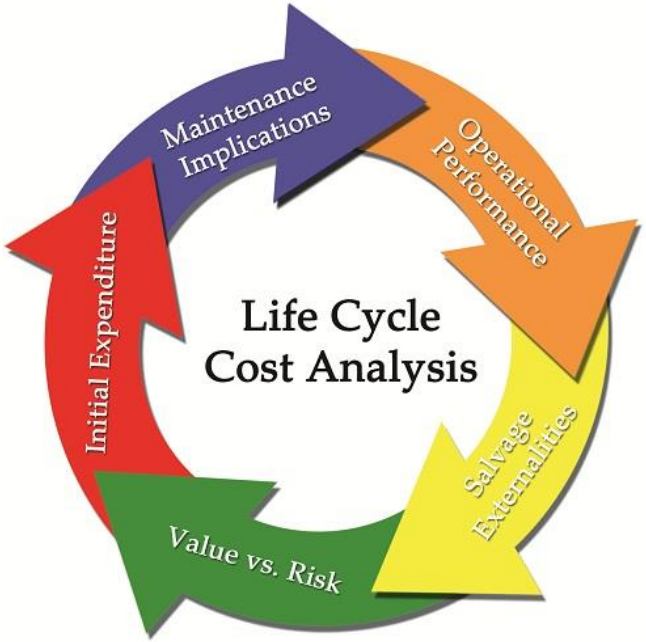
What is a LCCA?

- LCCA is widely used in infrastructure planning to evaluate design alternatives entire cost to the owner, beyond commonly considered construction and operation costs

- In some areas, LCCA is a requirement for all government funded projects, for example, Washington State statute RCW 39.35B.010:

  ...the legislature finds that: (1) Operating costs of a facility over its lifetime may greatly exceed the initial cost of the facility; (2) In the planning, design, and funding for new construction or major renovation of state-owned facilities it is desirable to consider not only the initial costs relating to design and construction or acquisition, but the anticipated operating costs relating to the building throughout its life...It is the policy of the state to consider life-cycle costs in the selection of facility design alternatives, to the full extent practical, reasonable, and cost-effective...





Why should Haines care about life cycle costs?

- Based on a history of free money from the feds, Alaska historically evaluates projects based on short term construction job potential vs long term value proposition. Our generation is painfully learning the financial expectations of our parent's Alaska are not the reality for our Alaska.
- The removal complications of the existing Lutak dock have massively limited the options and inflated the costs of the replacement project
- Securing funding for this dock replacement cycle consumed a large portion of the borough's fundraising and project management capacity over the last decade to the detriment of other needs. As we look towards the next replacement cycle we should not consider outside grants as "free money"

Assumptions in this LCCA

- With advocacy, the Haines Borough can use the MARAD funding to construct either of the two designs approved by this agency in the past.
- Therefore, this analysis looks at costs starting after the dock is constructed, until it has reached end of life *and has been removed and replaced*
- For consistency, Turnagain Marine's maintenance cost estimates used for both designs, and scaled based on differences in design.
- TMC estimates at 65% design (last explicit costing provided) used for encapsulate design line item construction costs.
- R&M estimates in 2021 RAISE grant application used for Rip Rap design line item construction costs.

Option 1 – TMC Encapsulate Design

- Surround old dock in place with new sheet pile wall
- 890 Dock-Feet of pile wall with 47 feet exposed to seawater, 14 fenders, No mooring dolphins or catwalk

Lifecycle costs – TMC Encapsulate

Step 1: Maintain the dock over functional lifespan

Conservative estimate of required maintenance, does not include operating expenses such as electricity, snowplowing, administration, dockwork staff that would be applied against gross revenue in a Business Case Analysis

Item	Item Cost		Notes/Source/Assumptions
Periodic Inspection	$	835,000.00	Turnagain mininmum maintenance estimate over 50 yrs in 65% design submittal
Anode Replacement	$	2,850,000.00	Turnagain mininmum maintenance estimate over 50 yrs in 65% design submittal
Coating Repair		$0.00	The coating repair that is required by 95% plan set is not included in Turnagain min maintenance estimate, and was described as innefective by R&M. Turnagains adds $2m cost for this in high maintenance schedule. Failure of owner to perform this required maintenance schedule in per plans would absolve contractor of responsiblity in the event of unexpected premature corrosion
Site Grading, Civil maintenance	$	75,000.00	Turnagain mininmum maintenance estimate over 50 yrs in 65% design submittal
Lighting and electrical maintenance	$	385,000.00	Turnagain mininmum maintenance estimate over 50 yrs in 65% design submittal
Fender Maintenance and Repairs	$	3,250,000.00	Average of Turnagain mininmum maintenance estimateof 2.5M and high estimate of 4M
Concrete Pile Caprepairs due to degradation/ impact	$	100,000.00	Not mentioned in Turnagain maintenance estimate
RORO Maintenance	$	100,000.00	Estimate, RORO maintenance not listed in TMC maintenance schedule
Borough staff time to administer maintenance	$	112,425.000	1.5% of maintenance subtotal
Total Life Cycle Maintenance	$	7,707,425.00	Turnagain low estimate was $6.8M, high estimate was $10.6M

Step 2: Remove failed elements after functional lifespan

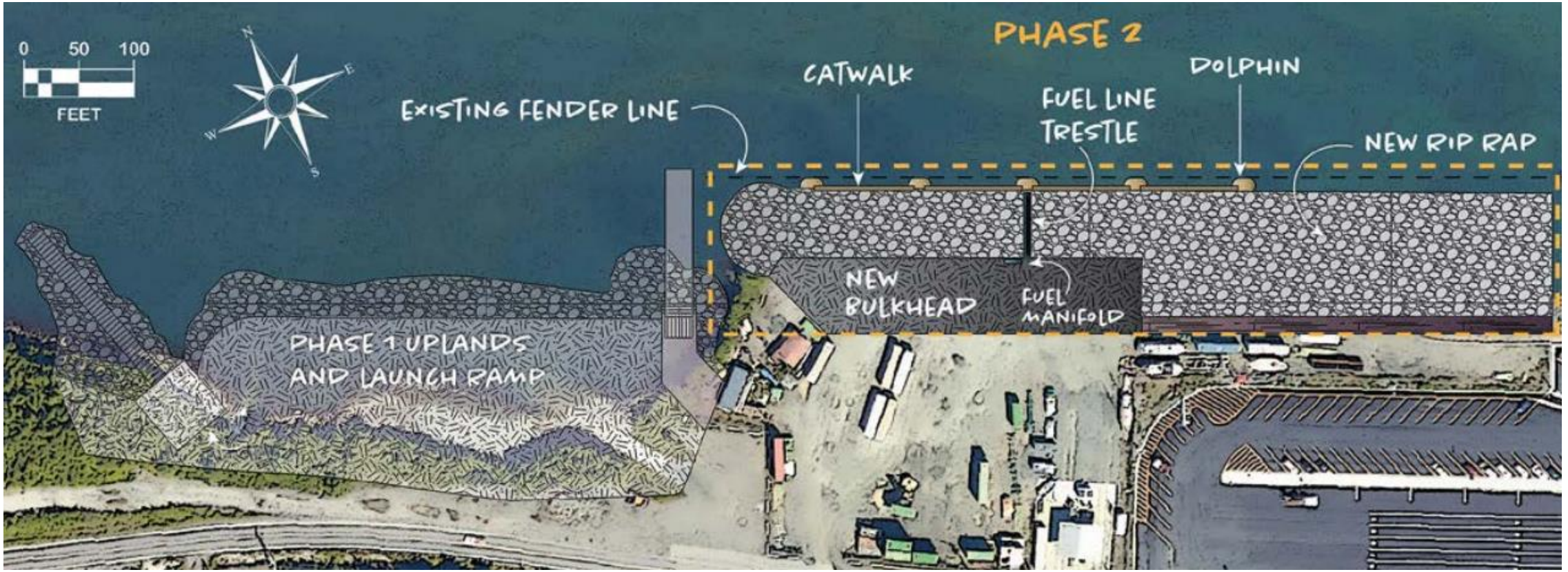
Item	Item Cost		Notes/Source/Assumptions
Demolish both encapsulated Lutak dock and added encapsulations materials	$	4,500,000.00	RAISE grant application from R&M estimates $3M cost to demolish current Lutak dock. Scaled by 1.5X to cover additional surface area of encapsulated dock,more than 2X pile quantity plus concrete embedded diagonal tieback pile. Conservative scale factor considering added complexity of excavating slanted tieback piles linking 2 degraded dock wall faces together
Remove existing RORO Ramp	$	165,000.00	Estimate based on 3X dolphin removal cost
Borough staff time to administer removal	$	67,500.00	1.5% of subtotal
Total Removal Cost	$	4,732,500.00	

Step 3: Replace Dock with one meeting RAISE Grant Design

Item	Item Cost		Notes/Source/Assumptions
Build Raise Grant Dock or similar	$	22,611,284.00	Cost of RAISE Grant dock less $3M demolition costs from Raise Grant that are applied above
Build Approach Dock (RORO)	$	3,250,000.00	AML Actual Cost to construct RORO 2020 + 25% contingency to be consistent with opt 2 calcs
Borough staff time to administer replacement	$	387,919.26	1.5% of subtotal, very likley the current dock replacement far exceeds this number over the 10+ year effort
Total Replacement Cost	$	26,249,203.26	
Total Lifecycle Cost	$	38,689,128.26	This is the true cost of the physical infrastructure of the Lutak Dock from 2025 thru the end of design life in this scenario

Option 2 – Rip Rap design from original Raise Grant Award

- Demolish old dock
- Replace with ~360 Dock-Feet of pile wall with 23' feet height exposed to seawater, 5 mooring Dolphins, 5 fenders, new backfilled uplands



Lifecycle costs – R&M "Rip Rap" Initial RAISE Grant

Step 1: Maintain the dock over functional lifespan

Conservative estimate of required maintenance, does not include operating expenses such as electricity, snowplowing, administration, dockwork staff that would be applied against gross revenue in a Business Case Analysis

Item	Item Cost		Notes/Source/Assumptions
Periodic Inspection	$	409,150.00	Option 1 inspection costs of $835k multiplied by scale factor of .49 to reflect ratio of saltwater exposed steel components between the two designs (58k sf in opt 1 vs 28k opt 2)
Anode Replacement	$	826,500.00	Option 1 anode replacement costs of $2.85M multiplied by Scale factor of .29, to reflect anode quantity ratio. Opt 1 uses 430 each 216lb anodes, Opt 2 uses 125 each 200lb anodes
Coating Repair		$0.00	Coating repair not required or specified by R&M in RAISE grant award design
Site Grading, Civil maintenance	$	75,000.00	Same as Opt 1
Lighting and electrical maintenance	$	385,000.00	Same as Opt 1
Fender Maintenance and Repairs	$	1,170,000.00	Option 1 Fender replacement cost of 3.25M multiplied by scale factor of .36 to reflect fender quantity ratio. Opt 1 uses 14 fenders, Opt 2 uses 5 Fenders
Catwalk and RORO maintenance	$	120,000.00	Estimate
Borough staff time to administer maintenance	$	44,784.750	1.5% of maintenance subtotal
Total Life Cycle Maintenance	$	3,030,434.75	

Step 2: Remove failed elements after functional lifespan

Item	Item Cost		Notes/Source/Assumptions
Demolish and dispose Bulkead dock	$	750,000.00	RAISE grant application from R&M estimates $3M cost to demolish current Lutak dock. Fuel Bulkhead is 1/4 the surface area and approximately 1/6 the volume (due to being closer to shore so less overall depth)
Demolish and dispose of 5X Mooring Dolphins	$	275,000.00	Demolish 5 dolphins at raise RAISE Grant demolition cost of $55k per dolphin
Demolish and dispose Approach Dock (RORO Ramp)	$	165,000.00	Estimate based on 3X Dolphin Removal cost
Total	$	1,190,000.00	

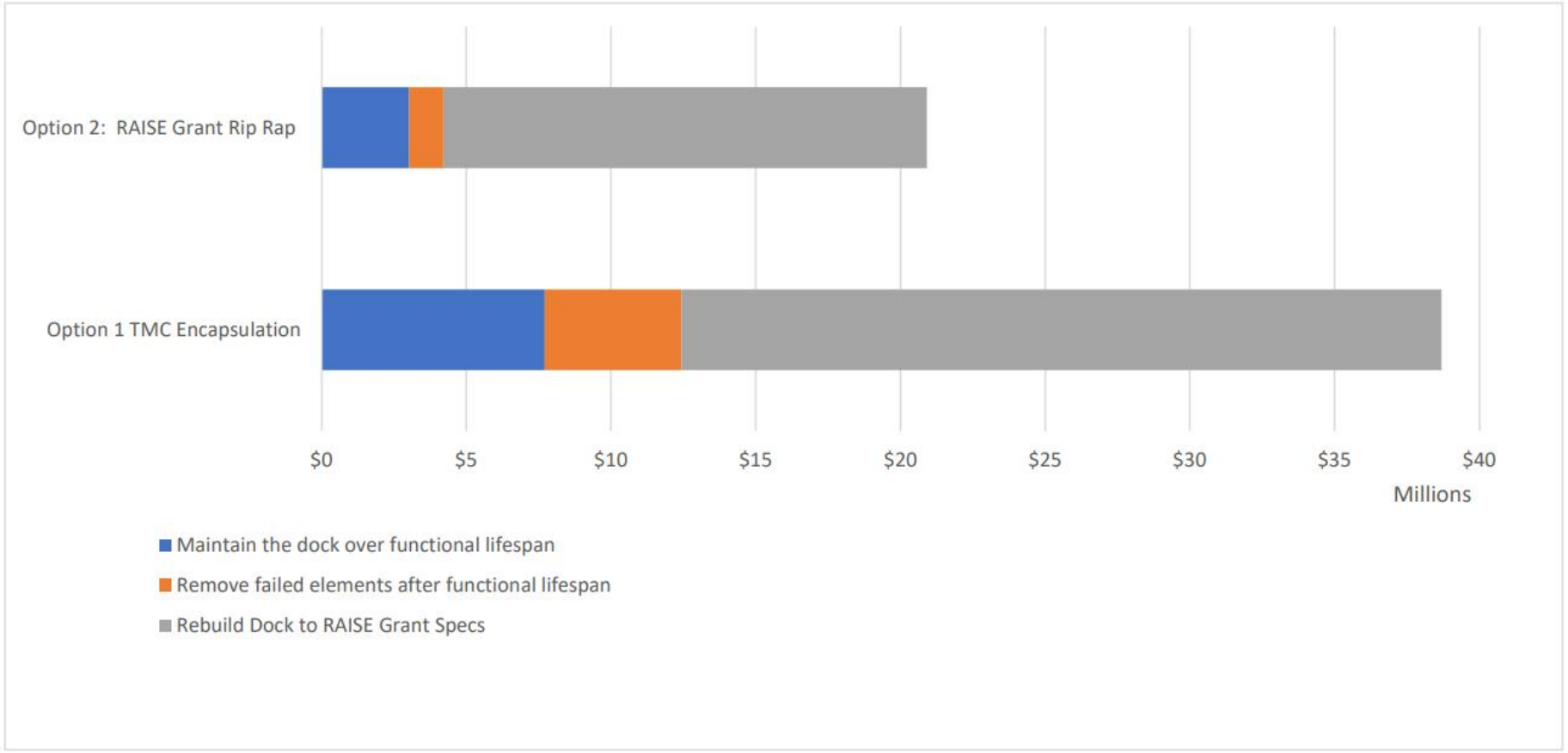
Step 3: Replace Dock with one meeting RAISE Grant Design

These items represent the costs described in the RAISE grant application less demolition costs and items recycled from 2020s dock (Rip Rap bank armor)

Item	Item Cost		Notes/Source/Assumptions
Mobilize/Demobilize equipment	$	2,494,858.00	Full Mob/Demob from Raise grant application, assumes all equipment is still needed
Replace Bulkhead	$	4,815,660.00	7.3M Bulkhead construction costs from RAISE Grant less the 2.5mil spent on rip rap that would be retained
Replace Dolphins and Catwalk	$	2,104,710.00	Full Dolphin/Catwalk construction costs from RAISE Grant
Replace Approach Dock (RORO)	$	2,600,000.00	AML Actual Cost to construct RORO 2020
Misc Construction Costs	$	542,360.00	Full Misc Const Costs from RAISE Grant application; electrical, lighting, fire, fuel systems.
Contractor's Construction Admin	$	603,763.80	6% of above construction items, same formula as used in RAISE Grant
Contingency	$	3,290,337.95	25% of above costs, same as RAISE Grant Application
Borough staff time to administer replacement	$	246,775.35	1.5% of subtotal
Total Replacement Cost	$	16,698,465.10	
Total Lifecycle Cost	$	20,918,899.85	This is the true cost of the physical infrastructure of the Lutak Dock from 2025 thru the end of design life in this scenario

Comparison

	Option 1 TMC Encapsulation	Option 2: RAISE Grant Rip Rap
Maintain the dock over functional lifespan	$ 7,707,425.00	$ 3,030,434.75
Remove failed elements after functional lifespan	$ 4,732,500.00	$ 1,190,000.00
Rebuild Dock to RAISE Grant Specs	$ 26,249,203.26	$ 16,698,465.10
Total Lifecycle cost	**$ 38,689,128.26**	**$ 20,918,899.85**

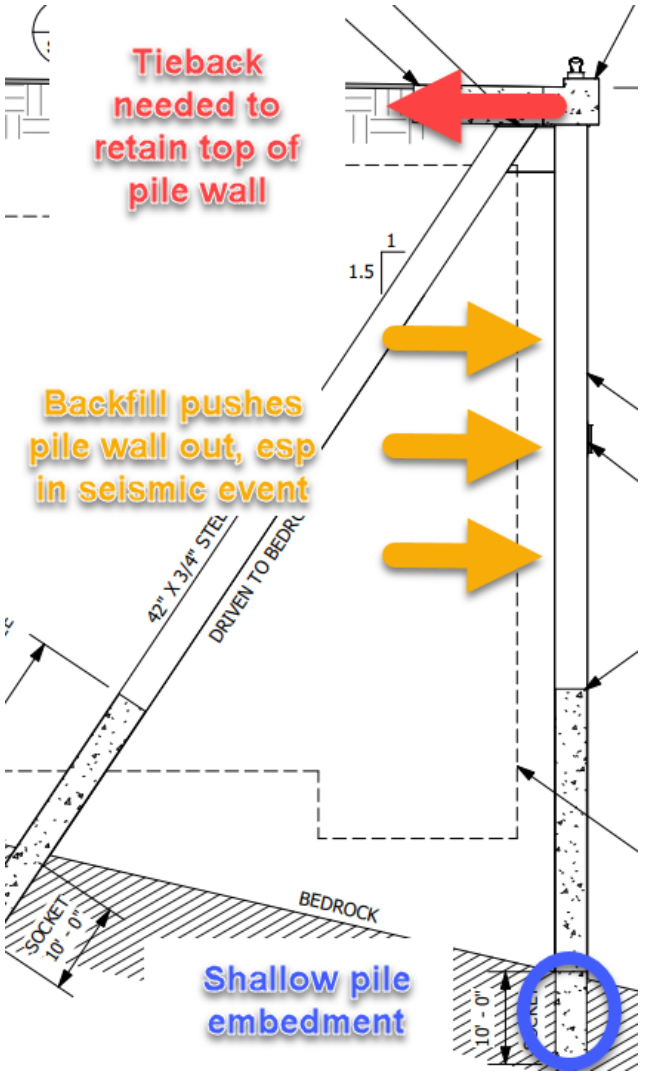


Risk and LCCA

- Many professional LCCAs also consider risk, the preceding one does not.
- Alaskan adventurers know that risks are best considered alongside consequences: Its fun and beneficial to take risks with small consequences but you will live longer if you don't roll the dice when the stakes are high.
- The dock replacement project is only possible due to outside funding barely adequate to cover construction costs in the best case scenario. Haines does not have the financial resources to power through construction problems or issues that crop up after completion
- Haines can't afford to take risks on this project and should prefer lower risk options

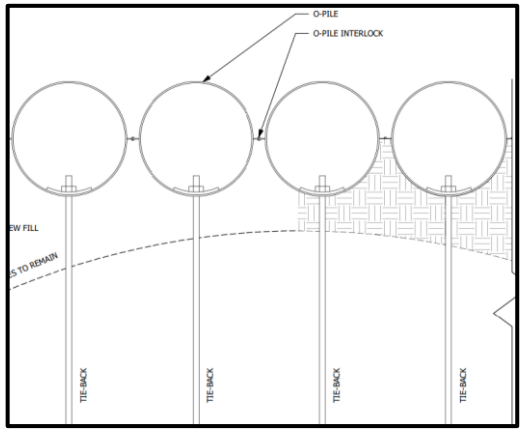
Project Risks: Piledriving

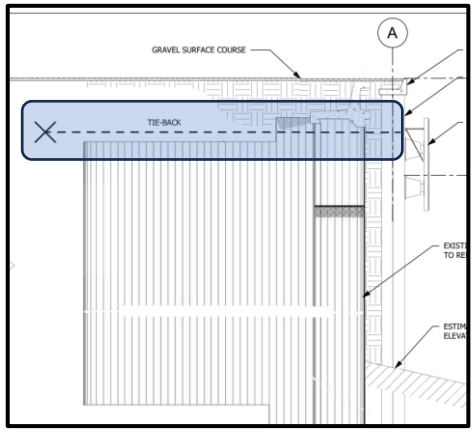
- RFP responses from all 3 firms cited geotechnical conditions as a prime project risk
- The Army solved this problem with self supporting circular cells that don’t require tieback. Encapsulating these failing cells with a new wall downslope requires taller piles retained against outward forces
- The Rip Rap design of RAISE Grant award uses a pile wall half the height, half the width, further inland, with virgin backfill to reduce pile driving risk, along with other low risk elements such as rock bank armor and freestanding dolphins similar to ferry dock and AML RORO



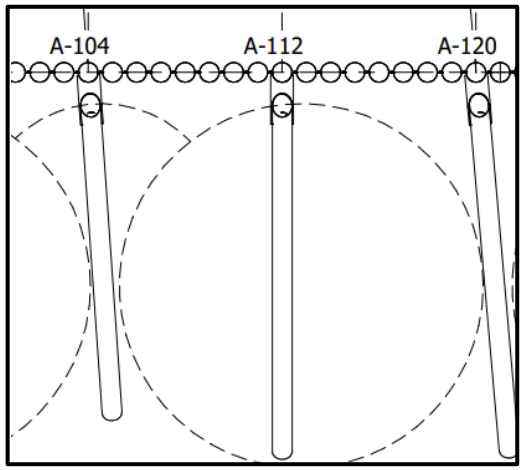
Project Risks: Piledriving

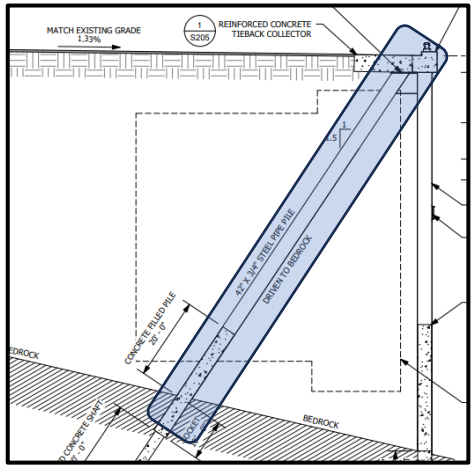
- The TMC encapsulate design is a prototype of a novel concept for rehabbing failing bulkhead docks that has not been widely implemented
- The Haines Borough cannot afford to develop new techniques. Typically the design phase is rosy and problems are found once dirt starts moving. This is magnified with new ideas. Ask yourself if contractor relations in this pre construction phase could be described as “rosy”
- The prototype nature of this design can be seen in the major change to critical tieback elements between 35% and 65% designs. Each of these designs have significant advantages and disadvantages that cannot be evaluated until dock has been constructed and in service for many years.





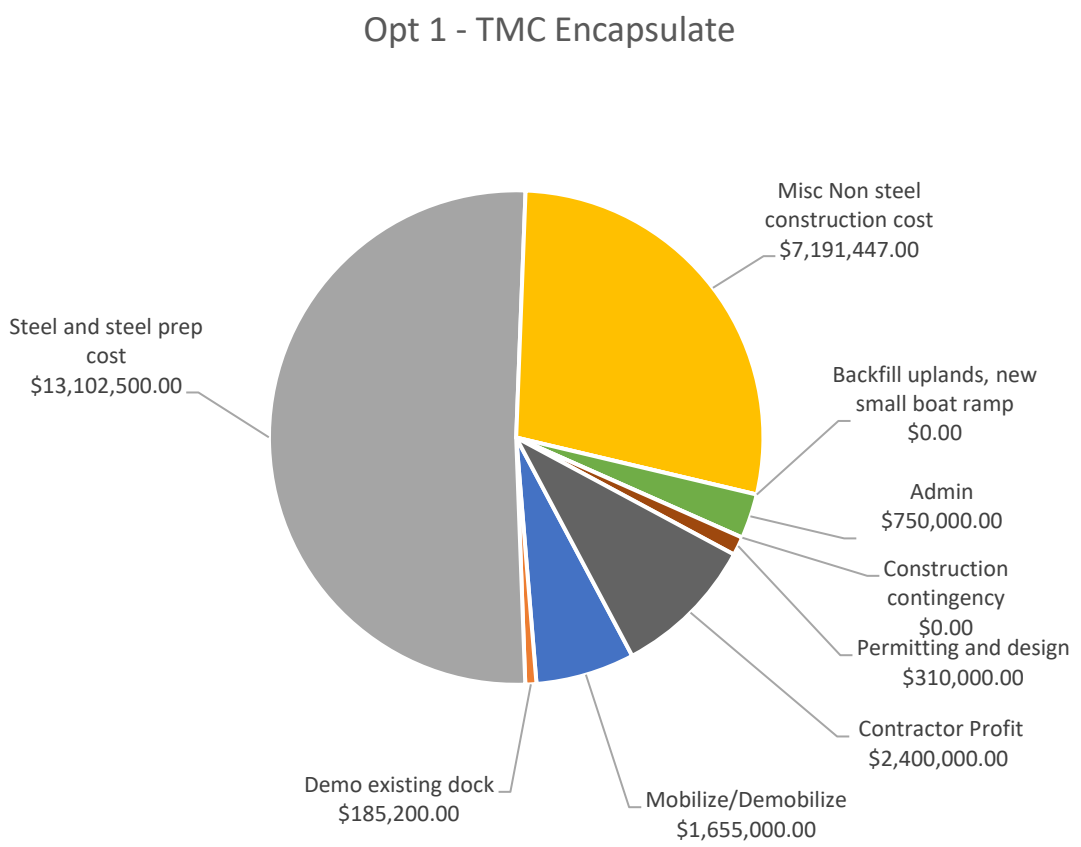
35% design: Small horizontal tiebacks in every pile, up high above old dock cells

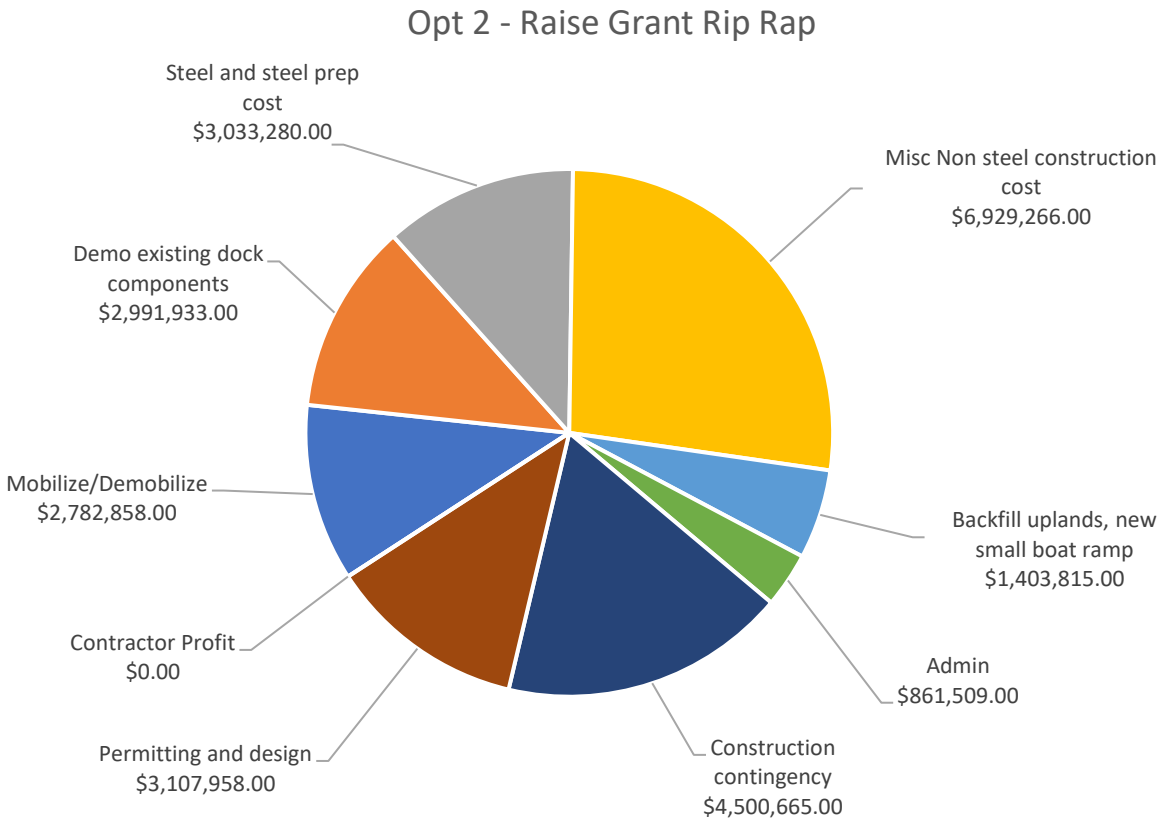




65% design: Large diagonal pile tiebacks, spaced 6-10 face piles apart, embedded in bedrock

Project Risks: Steel price fluctuation





- Option 1 costs highly linked to steel prices – steel order costs less than $13M million increase contractor profits, steel prices over 13M decrease contractor profits

Project Risks: Steel price fluctuation

- Linking contractor profits to steel prices creates an incentive to order when prices are good despite other project impacts
- A steel price dominated budget leads to cuts in other areas, notably the TMC design phase at $310,000 vs competitors design bids of $685,000 and $1,900,000 or the RAISE Grant estimate of $3,100,000 by R&M

Hot Rolled steel coil prices have varied by almost 2X over the past year…

Risk vs Value

- Sheetpile bulkheads appear to be the main drivers of project cost and risk.
- The stated value of these bulkhead structures is:
  1. Increased uplands for freight storage and handling
  2. Pass-Pass loading along entire vessel length
- Current freight operations are supported with minimal uplands and no pass-pass capacity.
- Given present dock users, adding these features costs taxpayers money by adding maintenance and replacement cost without bringing in new revenue.