

# South Bar Small Craft Harbour Design

## Introduction & Project Scope

**Project Location:** South Bar, Cape Breton, Nova Scotia

**Project Overview:** Lobster fishing harbour facility redesign and consolidation.

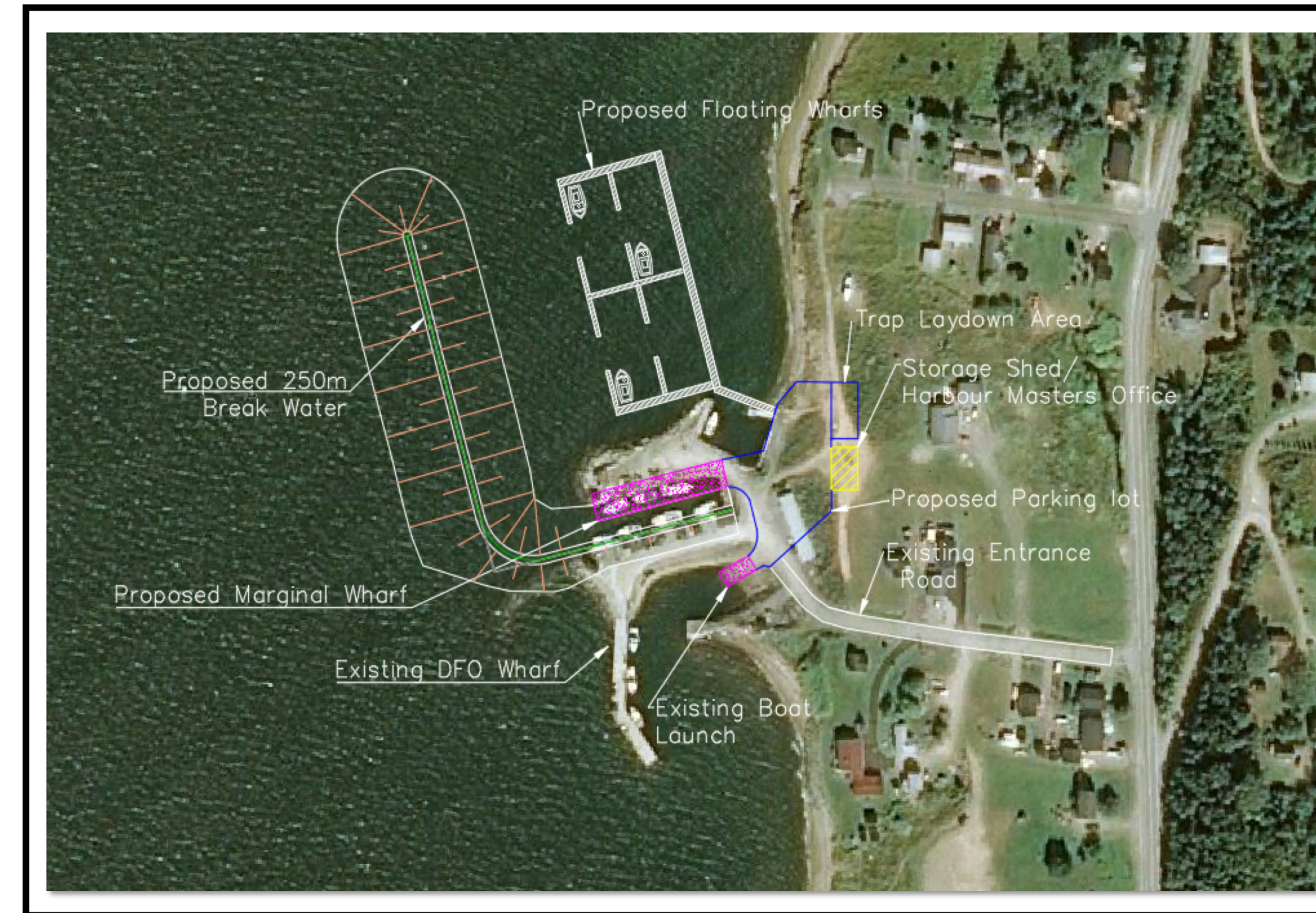
**Reason for Redesign:** Replacement of aging structures. Future maintenance deemed more costly than new construction.



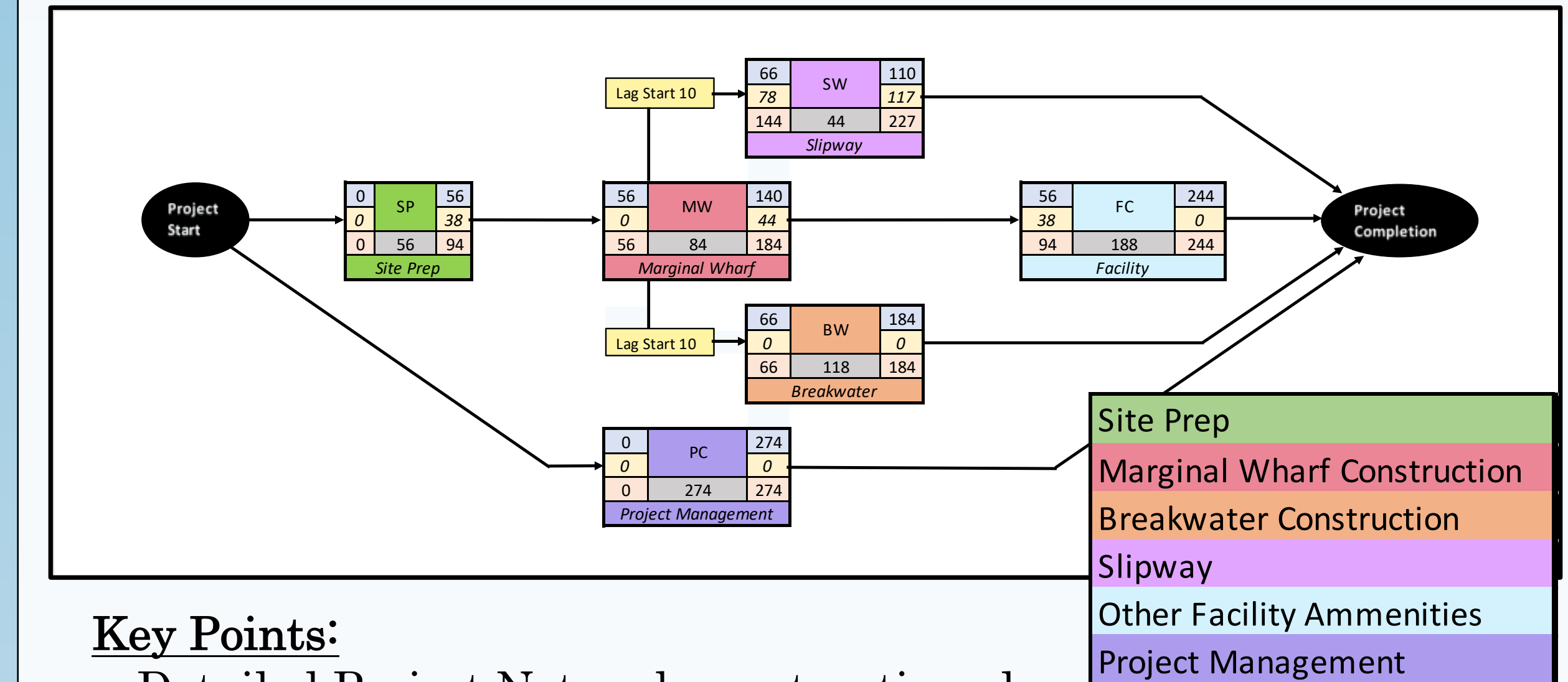
## Proposed Design

### Features:

- Rubble-Mound Breakwater
- Sheet-Pile Marginal Wharf
- Floating Wharf Berthing (16 Lobster boats + more)
- Slipway
- Harbour Master's Office
- Trap Laydown Area
- Parking lot



## Timeline Management



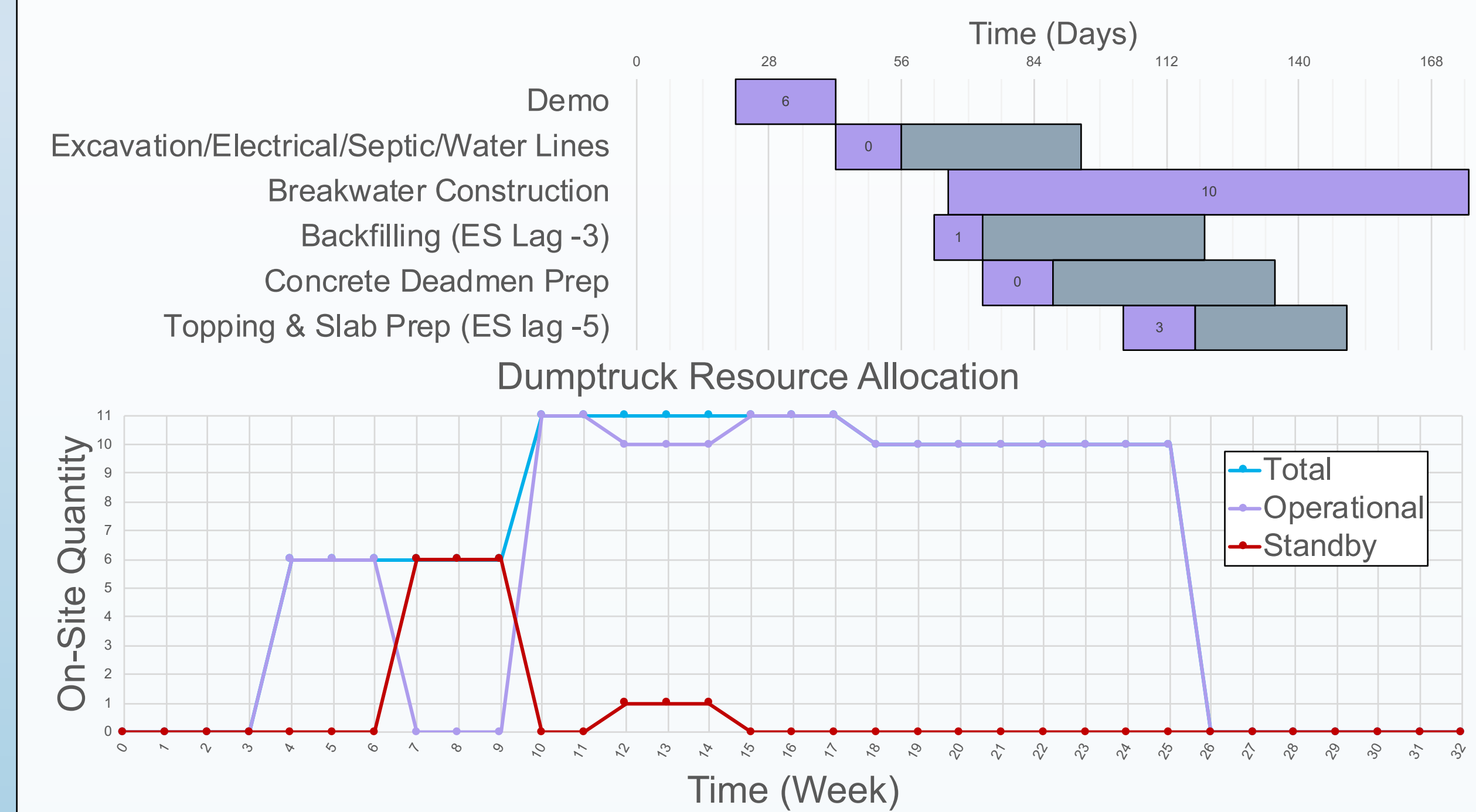
### Key Points:

- Detailed Project Network construction plan
- Total Project Timeline: **274 Days**
- Key Timeline Factors:
  - Total Time
  - Resource Allocation/Mgmt.
  - Fishing Season (August-Mid-October)
- Start:** Nov. 4, 2021; **End:** July 3, 2022

**Resource/Service Allocation** - Timeline management by consideration of services and associated costs and coordination therein.

- Labour Crews (Concrete or Other trades)
- Equipment schedules:
  - Dump trucks
  - Excavators
  - Roller-Compactor
- Services Provided (Concrete pumps/delivery)

Dump Truck Resource Allocation Timeline



## Locational Earth & Environment Study

### Research Sections:

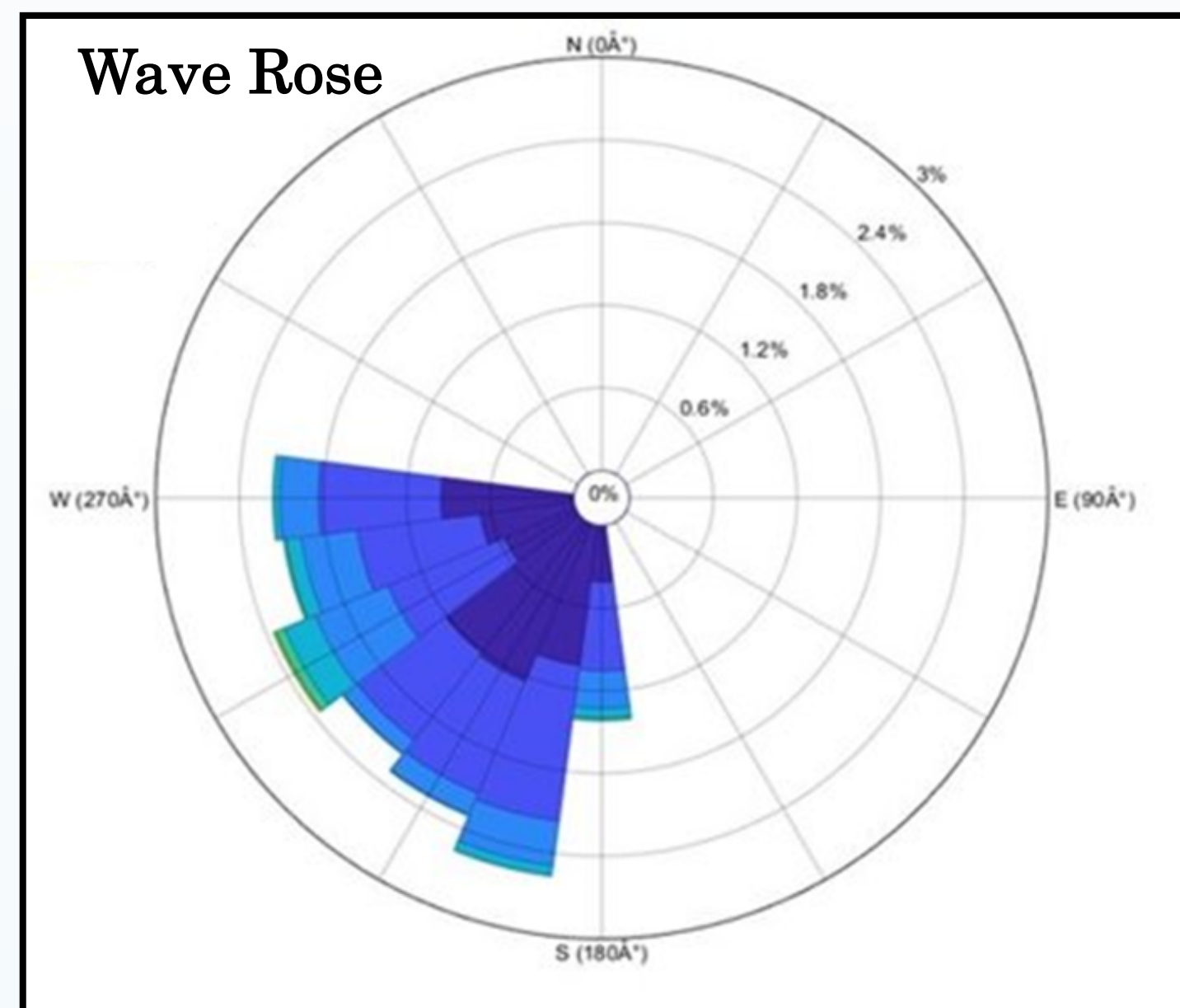
- Wind/Wave Study
- Tides/Ice
- Bathymetry
- Geology (Bedrock & Top-soil)
- Surrounding Topography
- Local Resources

### Wave Climate Design Process

Predominant Wind Speeds and Directions	<ul style="list-style-type: none"> <li>MSC50 Climactic Data</li> <li>Development of Wind Rose</li> </ul>
Site Specific Wave Influence Factors	<ul style="list-style-type: none"> <li>Fetch limited or fully developed waves</li> <li>Protection from northern sea swell</li> </ul>
Development of Design Wave Parameters	<ul style="list-style-type: none"> <li>Wave rose developed for onshore conditions</li> <li>Wave Transformations</li> </ul>

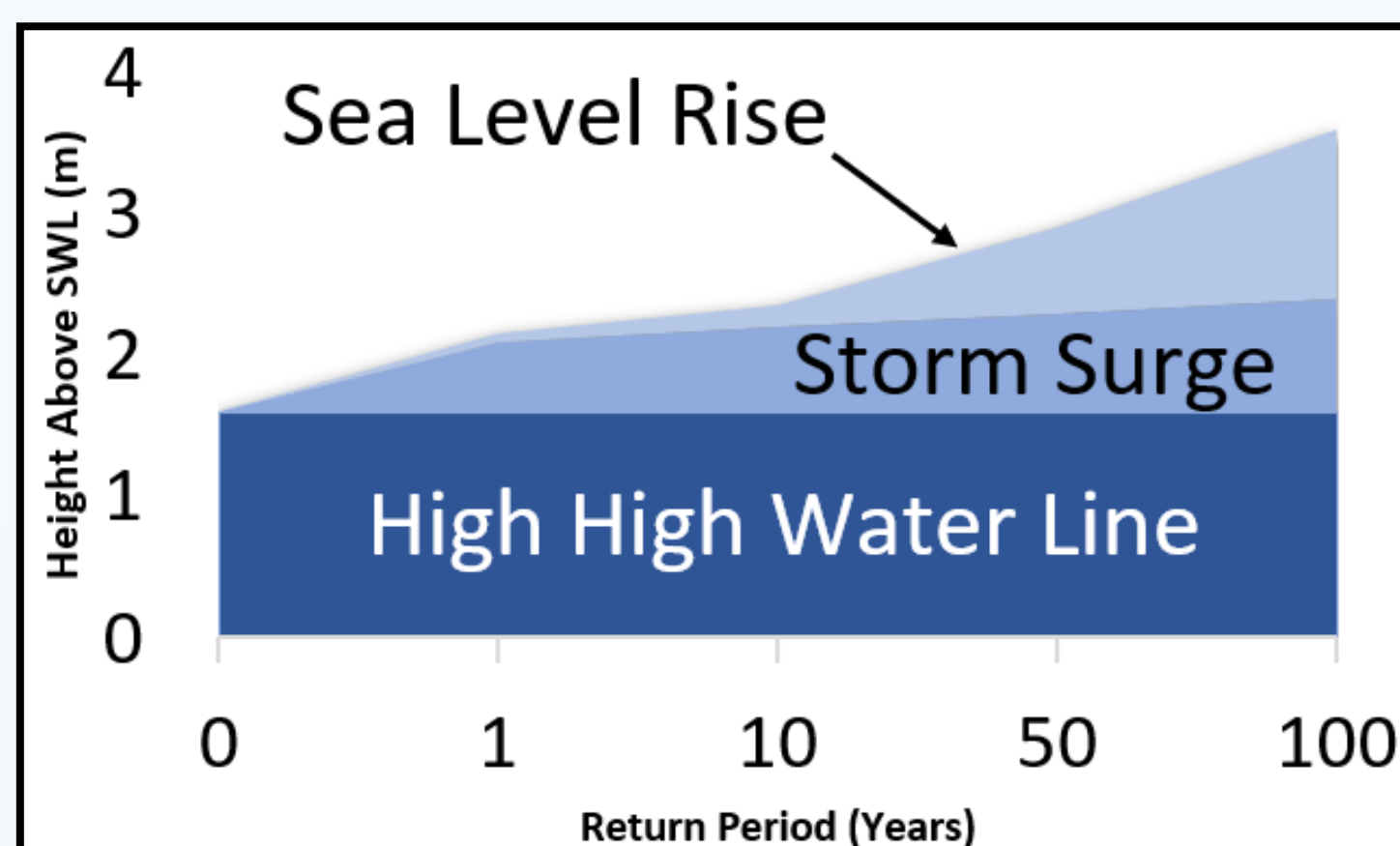
### On Shore Wave Conditions

- Wave Height: 1.4m
- Wave Period: 4s
- Wave Direction: 60° (NNW)



### Local Geology:

- Sandstone (~200kPa bearing)
- Topsoil: Stony Sand Till



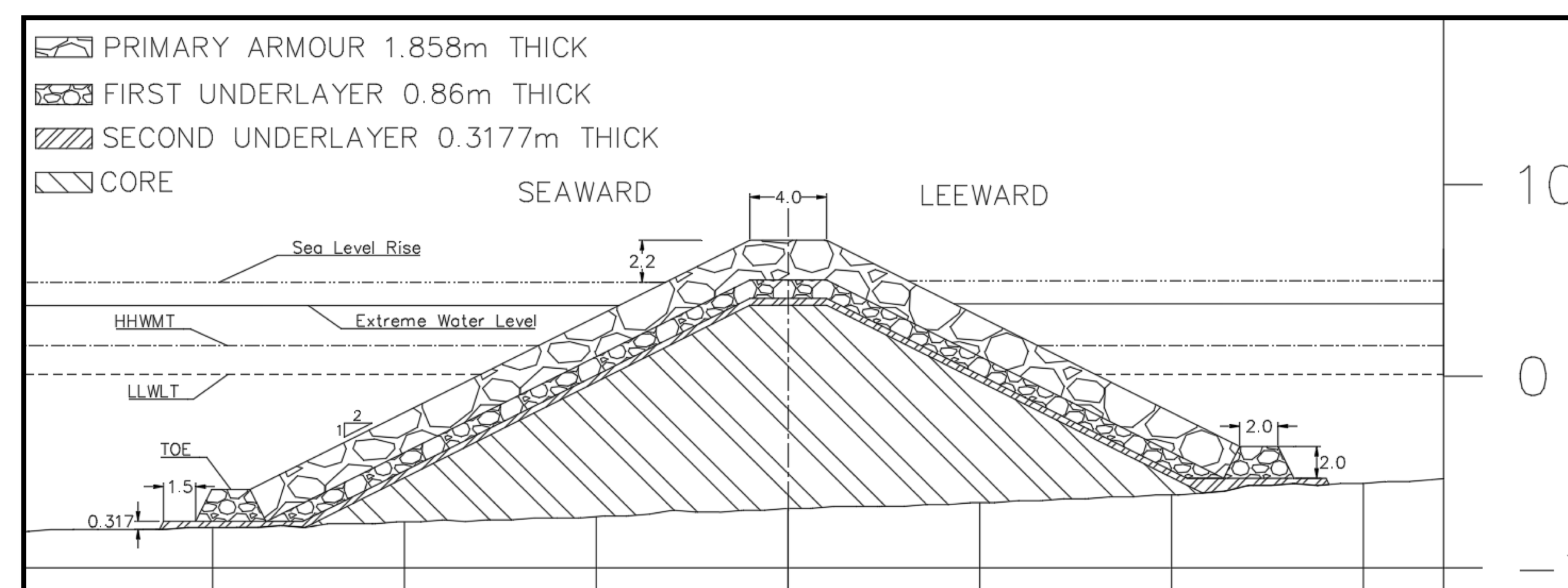
### Tidal Range, Sea Level Rise & Ice Conditions

- Highest Water Line: 3.6m
- Ice Thickness: 70cm To 120cm
- Tidal Range: 1.5m
- 100yr. Sea-Level Rise: 1.2m

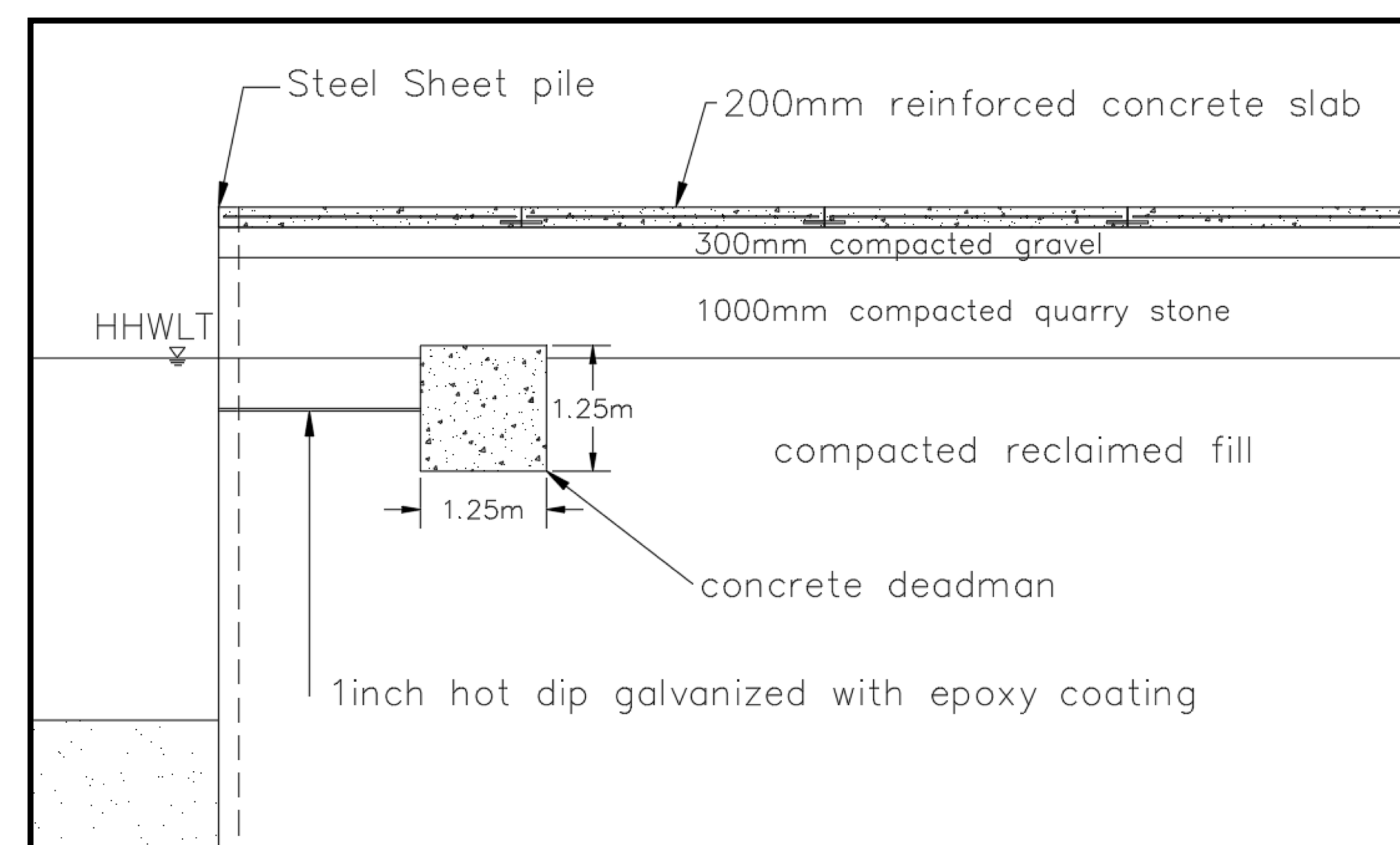
## Rubble-Mound Breakwater

### Design Layers:

- 1.02m diameter **armour stone** layer.
- 0.5m and 0.17m diameter **underlayers**.
- 0.045m diameter **core**.
- 2m x 2m **toes** using 0.5m diameter stones.
- 2.2m **freeboard**.
- 4m **crest**.



## Steel Sheet-pile Marginal Wharf



Steel sheet-pile retaining wall with cathodic protection, supported by concrete dead-man anchors @ 2m o.c., surfaced with a 200mm slab-on-grade designed for impact loading. Backed with compacted gravel, quarry stone, and reclaimed local stony sand till.

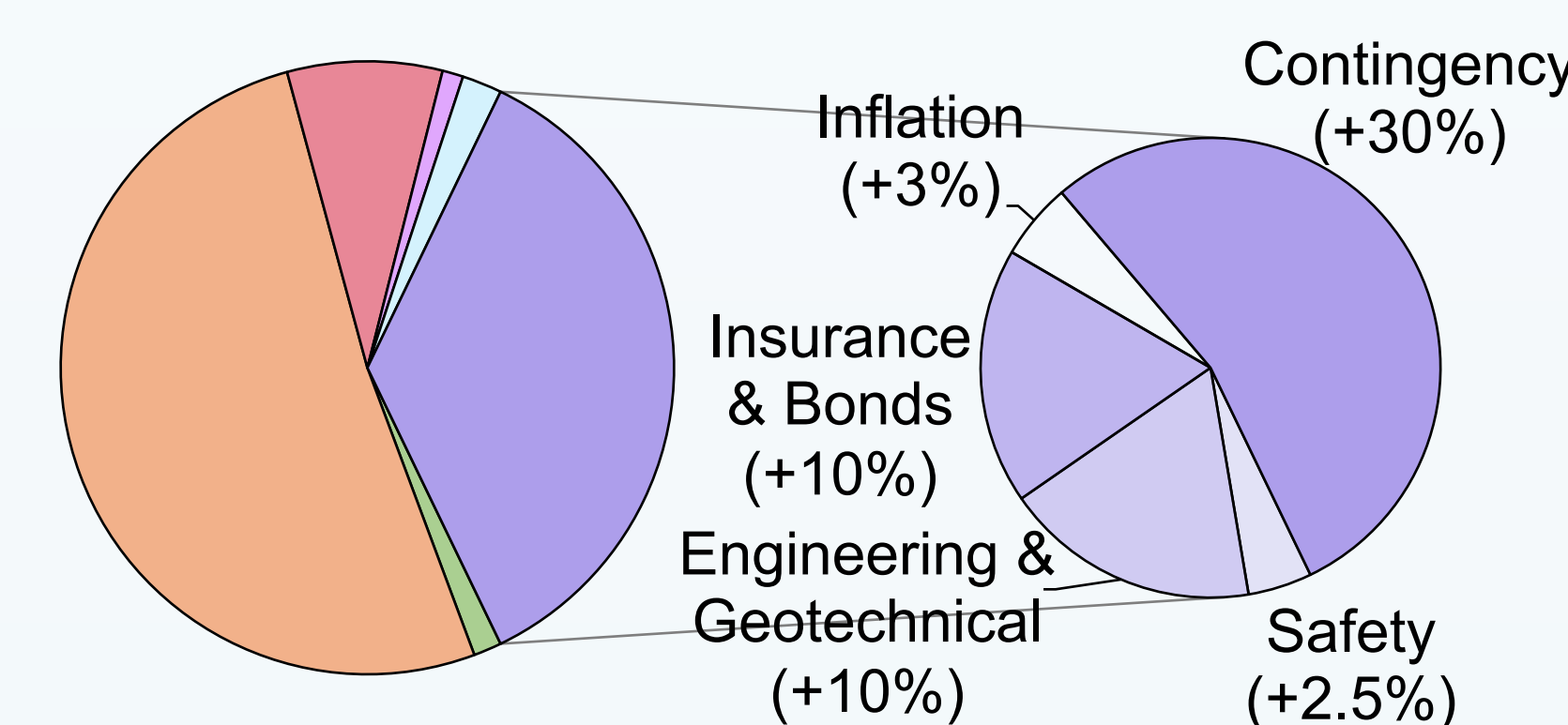
## Cost Analysis

Stage	Cost
Site Prep	\$183,000
Breakwater	\$6,360,000
Marginal Wharf	\$1,010,000
Floating Wharf	\$136,000
Other Amenities	\$260,000
<b>Total (\$)</b>	<b>\$7,949,000</b>

Extra	#	Unit	Cost
Safety	2.5	%	\$198,725
Engineering & Geotechnical	10	%	\$794,900
Insurance & Bonds	10	%	\$794,900
Inflation	3	%/yr.	\$238,470
Contingency	30	%	\$2,384,700
<b>Total</b>			<b>\$4,411,695</b>

### Project Cost Structure



**Grand Total: \$12.4M + \$1.85M (HST)**

## Key References

- Introduction to Coastal Engineering and Management – Kamphuis (2019) – 3<sup>rd</sup> ed.
- The Rock Manual – CIRIA (2007)
- Coastal Engineering Manual – US Army Corps of Engineers (2006)
- Harbour Accommodations Guidelines – Public Works Canada (2015)

## Acknowledgements

Group 6 would like to extend our thanks to our academic and industry advisors **Dr. Mysore Satish (Dal.)**, **Danker Kolijn (CBCL)**, as well as course coordinators **Dr. Yi Liu** and **Dr. Craig Lake** for providing guidance, support and the necessary tools to successfully complete our project.