Seawall Improvement Concepts

Several concepts for improving the longevity of the existing seawall were reviewed.

1) Armor Stone Scour Protection
2) Geotextile Container Scour Protection
3) Groin Field
4) New Steel Sheet Pile Wall
5) New Soldier Pile and Concrete Lag Wall

Concept 1: Armor Stone Scour Protection

Armor stone scour protection involves constructing a revetment type structure at the base of the existing seawall. The structure would utilize at least two stone material classes: a filter stone and a primary armor stone. A non-woven geotextile fabric would be placed as a barrier between the filter stone and the seawall as well as the beach. Filter stone would then be placed as a wedge between the primary armor stone and the seawall. This rock material and geotextile fabric will act as filter layers to reduce sediment migration through the structure. Sediment loss behind the seawall should thereby be minimized, which would reduce localized failure from "sink holes." The filter stone will also provide protection to the existing seawall from the larger primary armor stone which could damage the seawall during construction or if stones moved during a storm event. This revetment concept would reduce scour (lowering of the beach) at the base of the seawall, which if were to continue, could result in the collapse of the seawall. This concept should also prevent continued damage at the base of the seawall such as the "kicking out" of the seawall at the base as observed during the site visit. However, it should be noted that repairing a localize failure of the seawall would become significantly more challenging with a rock structure in place at the toe. Figure 8 provides a schematic of this concept.

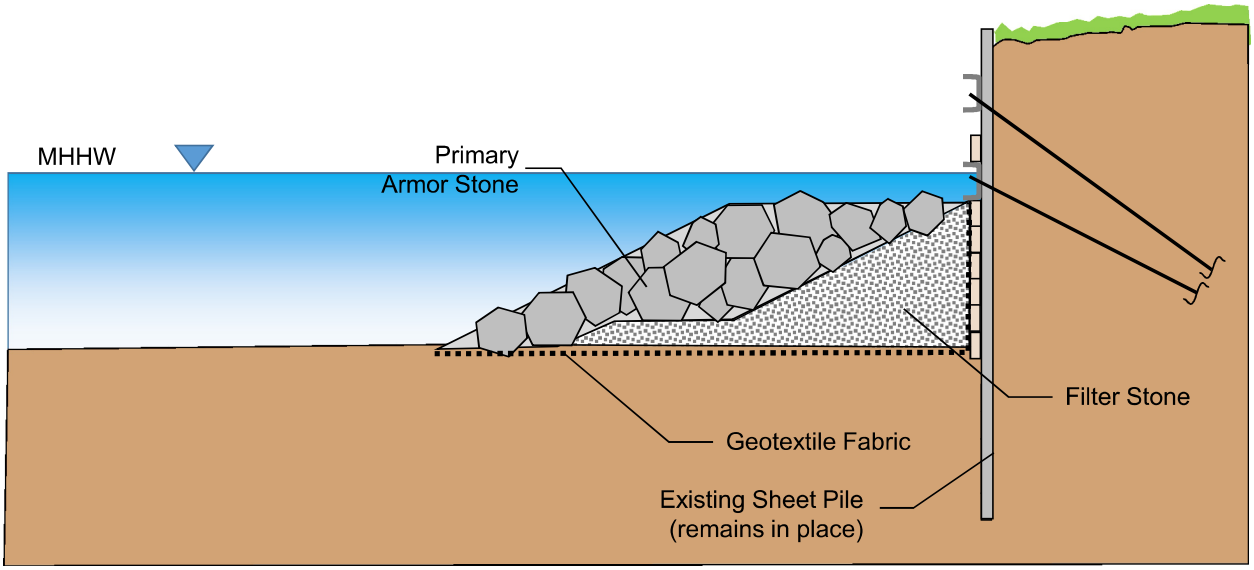

Figure 8. Concept 1 - Armor stone scour protection schematic.

Advantages:

- The seawall toe would be shored up with the armor stone mitigating localized failures of the seawall increasing the longevity of the structure. Continued lowering of the beach elevation in front of the seawall would not be a major concern.
- Armor stone structures can be design to have a long service life.

Disadvantages:

- If a localized failure were to occur due to a seepage of sediment through the seawall, repair of the failure would be more challenging (costly) than the current repair method.
- Armor stone can have a high construction cost.

Variations of Concept 1 – There are several other materials that can be used in lieu of armor rock for revetment type structures. These include gabion mattresses or baskets, geotextile marine mattresses, articulating concrete blocks, and concrete armor units. The following provides a few thoughts on these types of technologies for this application.

- Gabions – Gabions are wire baskets or mattresses that contain stone. Their advantage is that through the containment of smaller stones, their ability to withstand waves and currents is much greater than if the same size stones were uncontained. However, gabions will become ineffective and may fail if the wave environment is too great – which may be the case along the seawall. Since gabions are made of steel, they have a tendency to degrade quickly in a saltwater environment. To combat corrosion, gabions are manufactured with galvanized steel, stainless steel, and PVC coatings.
- Marine Mattress – Marine mattresses are similar to gabions in that they contain smaller stone, however, marine mattress use a flexible geosynthetic material. These structures are generally able to withstand the saltwater environment better. Similar to the gabion concept, marine mattresses are not effective and subject to failure if the wave environment becomes too extreme which may be the case along the seawall.
- Articulating Block Mats (ABMs) – ABMs come in a variety of shapes, sizes, and configurations. Often, ABMs interlock/connect with a puzzle type shape and/or rope or cable. ABMs offer good mitigation against erosion but are often damaged due to undermining of the structure and do not have the ability to self-adjust like an armor stone revetment. In addition, ABMs are typically used in lower energy wave environments.
- Concrete Armor Units (CAUs) – CAUs come in a variety forms but often resemble large concrete “jacks.” These type of structures can be very advantageous in high wave energy environments because they can be constructed larger than easily quarried armor stone. CAUs would breakdown wave energy approach the seawall but are not preferred over traditional armor stone in this situation because they would not easily mitigate localized scour and local failure of the existing seawall (i.e. they would not prevent sediment migration through the existing seawall).

Rough Order Magnitude Costs

A rough order of magnitude (ROM) cost for each concept was developed. Quantities were determined through conceptual design and assumed rough unit rates were applied to develop the ROM costs. Note, no design has been performed to determine quantities, and comparable project costs were not reviewed. ROM costs should be used as a general "order of magnitude" and not used for financial planning purposes. Costs associated with design and permitting of the concepts is include in the ROM cost values.

Table 2. Rough Order Magnitude Costs for Reviewed Concepts

	Rough Order Magnitude Cost
Concept 1 – Armor Stone Scour Protection	$1.5M to $2.1M
Concept 2 – Geotextile Container Scour Protection	$0.6M to $0.9M
Concept 3 – Groin Field (assumes 4 groins)	$3.0M to $4.3M
Concept 4 – New Steel Sheet Pile Wall	$2.9M to $4.0M
Concept 5 – New Soldier Pile and Concrete Lag Wall	$3.2M to $4.4M

Recommendations

The following provides some recommendations for advancing improvements to the Homer Seawall.

- Consider performing a more detailed alternatives analysis that focuses on 2 or 3 preferred concepts from this effort to advance the designs to a preliminary level and obtain more informed potential costs.
- Only consider the geotextile container option if funds are limited and the opportunity to receive additional funds is not likely in the foreseeable future.
- If the City of Homer procurement rules allow, consider advancing the seawall options as a design/build delivery project. These designs are not complicated and the cost can be highly influenced by the contractor's availability, equipment spread and location, and on-hand materials.
- For concepts using armor stone, recommend advancing the project through a traditional design/bid/build or construction manager/general contractor (CM/GC) delivery project.
- For the groin field concept, recommend performing an extensive modeling and performance analyses to inform potential for down-drift erosion impacts.