**Homer City Hall**
491 E. Pioneer Avenue
Homer, Alaska 99603
www.cityofhomer-ak.gov

# City of Homer
# Agenda

**City Council Worksession**
**Monday, May 18, 2020 at 5:00 PM**
**City Hall Cowles Council Chambers via Zoom Meeting**
**www.zoom.us; Meeting ID: 944 2828 1575 Password: 158760**
**Dial 1-669-900- 6833 or 1-253-215 8782; (Toll Free) 888-788-0099 or 877- 853-5247**

**CALL TO ORDER, 5:00 P.M.**

Councilmember Evensen requests excusal.

**AGENDA APPROVAL** (Only those matters on the noticed agenda may be considered, pursuant to City Council's Operating Manual, pg. 6)

**DISCUSSION TOPIC(S)**

a. Seawall Considerations

**COMMENTS OF THE AUDIENCE** (3 minutes)

**ADJOURNMENT NO LATER THAN 6:15 P.M.**
Next Regular Meeting is Tuesday, May 26, 2020 at 6:00 p.m., Committee of the Whole at 5:00 p.m. All meetings scheduled to be held in the City Hall Cowles Council Chambers located at 491 E. Pioneer Avenue, Homer, Alaska.

City of Homer
www.cityofhomer-ak.gov

Public Works
3575 Heath Street
Homer, AK 99603
publicworks@cityofhomer-ak.gov
(p) 907- 235-3170
(f) 907-235-3145

# Memorandum

**TO:** Marvin Yoder, City Manager

**FROM:** Carey S. Meyer, City Engineer

**DATE:** May 14, 2020

**SUBJECT:** Seawall Considerations

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The City of Homer has assisted homeowners residing in the Ocean Drive Loop Service Area (ODLSA) by facilitating the initial construction of and overseeing the reoccurring annual maintenance to the Seawall for many years. Seawall maintenance costs have been increasing while the winter storms persist in their strength. The wall was battered this past winter and damage incurred threatens the wall's integrity. Twenty of the eighty-five wood panels need significant rebuild (cost estimate approaching $100,000). In addition, sinkholes behind the wall are more frequent, indicating failure or weakening of the fiberglass sheet piling along the toe.

Damage to the wall is a direct result of erosion at the toe of the wall as confirmed by the engineering firm HDR Inc. Erosion of the toe exposes the fiberglass sheet pile (below the protective timber face). This makes it easier for wave forces to get behind the timber panels, breaking them while damaging the sheet pile. Holes in the sheet pile at the bottom of the wall then allow material from behind the wall to escape. The wall is structurally supported by tie-rodded concrete blocks buried behind the wall; these become exposed with the loss of material, damage to sheet pile, and breaking of timber panels (please see attached 'Figure 1' diagram). Protecting the toe of the wall from erosion therefore will extend wall life and significantly reduce maintenance costs.

This year's maintenance budget has already been spent (approximately $45,000). The work conducted will cover the wall through the summer, but another winter like the last one may cause damage significant enough to lead to the wall becoming ineffective at protecting the bluff from coastal erosion while depleting the remaining balance of the Seawall maintenance account. This may cause Council to have to consider passing an emergency ordinance to cover the deficit if/when immediate work is needed in the winter if no funds generated by the homeowners' mil rate contribution and the City's annual contribution remain. Administration will work with the Finance Department to provide Council with the most up to date balance of the Seawall maintenance accounts by the May 18th worksession.

The City has been looking at workable solutions to reinforce the toe of the wall. After hiring a coastal engineer from the firm HDR Inc. to produce a technical report regarding the Seawall and discussing its results with property owners who attended the multiple neighborhood meetings held last year, there was general consensus among attendees to protect the toe of the wall with armor stone. Armor Stone Scour Protection was the first concept proposed by Coastal Engineer McPherson and has a price estimate of $1.5M to $2.1M. McPherson recommended that if armor stone was the chosen method to pursue, the ODLSA residents and City need to: first, consider a more detailed alternatives analysis that would advance the design to a preliminary level and obtain more informed costs; and second, advance the project through a traditional design/bid/build or construction general contractor (CM/GC) delivery project.

Public Works has prepared a map demonstrating the current ODLSA neighborhood (shaded in beige) with an overlay depicting the historical and anticipated coastal erosion of the area by 2054 as determined by the Kachemak Research Reserve as part of a coastal erosion study of the Homer area. The complete study is available here: https://www.cityofhomer-ak.gov/planning/coastal-erosion. Also included is a spreadsheet demonstrating the characteristics of the lots included in the ODLSA and potential assessment costs (under several assessment methodologies) for a $1M improvement.

In 2012 as Homer City Council was considering raising the mil rate for the ODLSA, Councilmember Burgess addressed expanding the ODLSA to incorporate more parcels that indirectly benefit from the Seawall's placement and the mechanism used to raise funds:

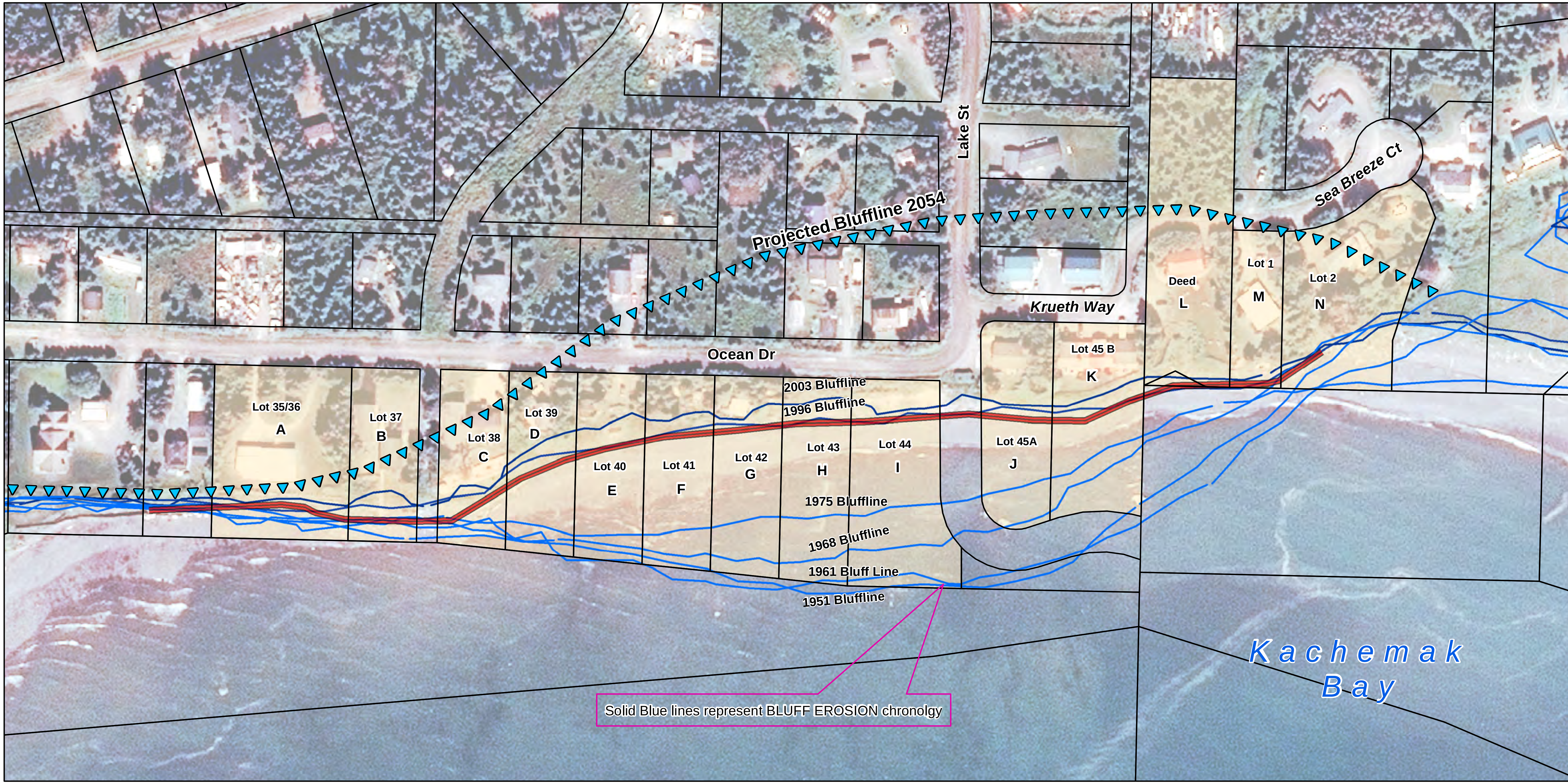
*"Councilmember Burgess commented we need a more long term solution to the Seawall. The City needs to bring in a larger group of people and identify the Seawall protects a larger group of people or say it is not our problem. The special service district is not the most appropriate tool. It does not equitably distribute the costs, which should be by linear footage of seawall."*
Source: https://www.cityofhomer-ak.gov/sites/default/files/fileattachments/city_council/meeting/2425/june_14_2012_special.pdf

Council may want to continue discussion concerning expansion of the ODLSA since the coastal erosion study predictions demonstrate other properties would eventually be impacted if the Seawall was not in place.

**Initial questions for Council:**

1) Does Council wish to consider and have staff evaluate expanding the ODLSA to incorporate properties receiving indirect benefit from the Seawall as demonstrated by the Coastal Erosion Study?
2) What is the will of City Council to install the proposed Seawall Armor Rock improvements (estimated at $1.5M - 2.1M) with City financing that would create a new special assessment district (also known as a local improvement district)?
3) There is a June 15 deadline to adopt a resolution establishing the mill rate for both the City (Tax Authority Group 20) and ODLSA (Tax Authority Group 21) residents. This would have to occur by Council's June 8th meeting at the latest. The current mill rate set in place for the Seawall District is not raising enough funds to cover the increasing maintenance costs for the existing wall. There is currently an estimated $100,000 expense to fix twenty broken wood panels that are essential for protecting the tie-rodded concrete blocks that structurally support the wall. Does Council wish to consider increasing the mill rate to cover the increasing maintenance costs of the Seawall? Currently residents contribute 9.9625 mils out of the 21.4625 mils they pay overall. This would generate more funds while Council, staff, and ODLSA residents work together to determine the mechanism needed in order to raise funds for the installation of the armor stone capital improvement.

Enclosures:
Seawall Map Showing Historical/Projected Erosion
Seawall Special Assessment District Analysis Spreadsheet
Figure 1 – Erosion Control Project Diagram
June 27, 2019 HDR Inc. Homer Seawall Alternatives Analysis Report
KPB 2019 Mill Rates




# SEAWALL MAP SHOWING HISTORICAL/PROJECTED EROSION

**Legend**

- Projected Bluffline 2054
- Seawall - Sheet Pile
- Original Construction LID

500 250 0 500 Feet

N

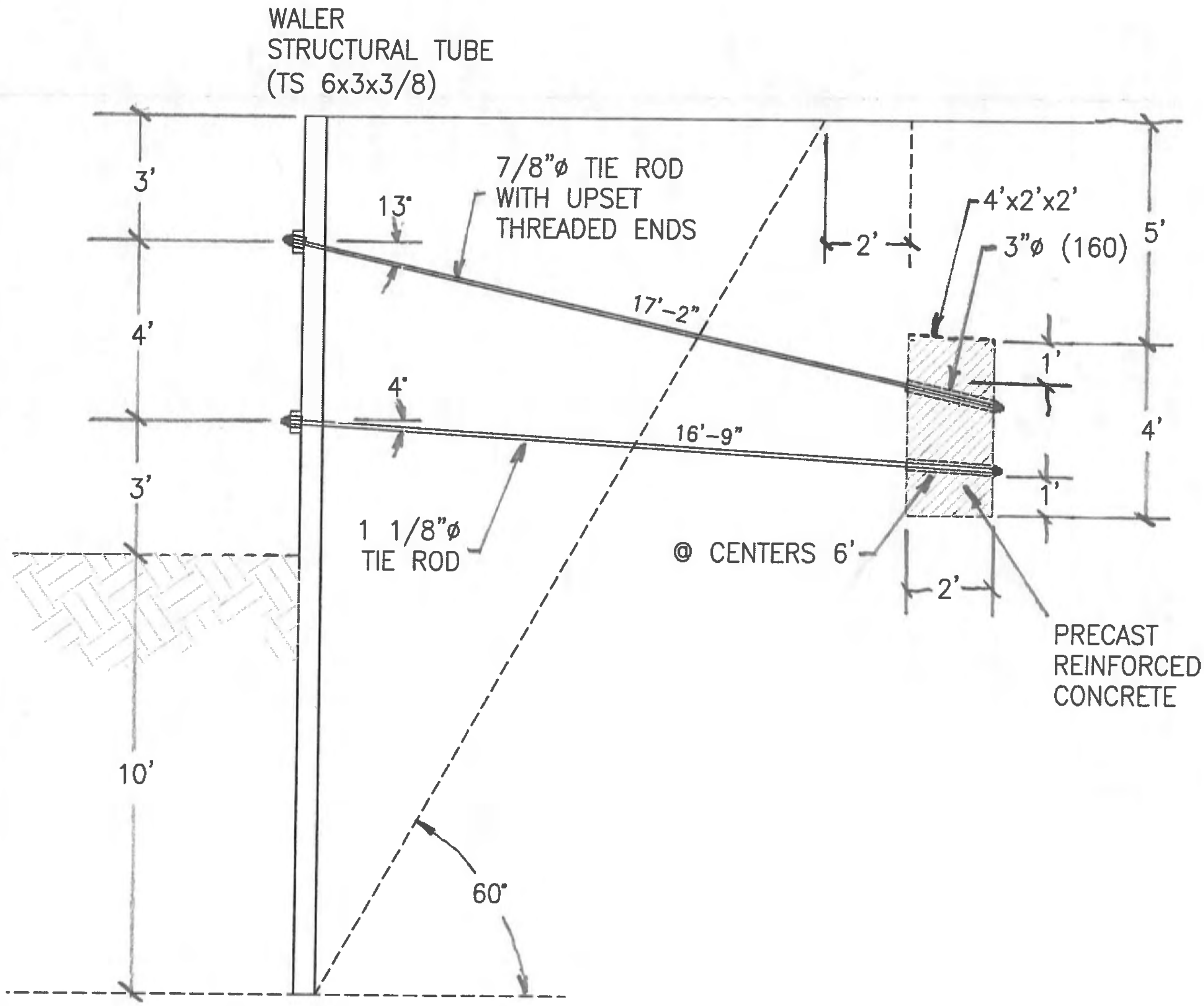
DEPT OF PUBLIC WORKS
March 11, 2020

Disclaimer:
It is expressly understood the City of Homer, its council, board, departments, employees and agents are not responsible for any errors or omissions contained herein, or deductions, interpretation or conclusions drawn therefrom.

# SEAWALL SPECIAL ASSESSMENT DISTRICT (SAD) ANALYSIS - Current District Members Only

**EST. ARMOR ROCK IMPROVEMENT COST = $1,000,000**

| | | LOT CHARACTERISTICS | | | | | | | ALTERNATIVE ASSESSMENTS METHODS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PARCEL ID | KPB PARCEL_ID | DIRECT WALL FRONTAGE (LF) | KPB LAND VALUE | KPB STRUCTURE VALUE | TOTAL ASSESSED VALUE | TAXABLE VALUE | LOT AREA (SF) | BENEFITTED LOT AREA (SF) | DIRECT WALL FRONTAGE | KPB PROPRTY VALUE | LOT AREA | BENIFITTED LOT AREA | EQUAL SHARE |
| A | 17718019 | 200 | $ 127,200 | $ 325,500 | $ 452,700 | $ 102,700 | 50,682 | 3,950 | $129,450 | $125,590 | $106,492 | $18,499 | $71,429 |
| B | 17718016 | 100 | $ 120,900 | $ 366,800 | $ 487,700 | $ 137,700 | 25,329 | 18,719 | $64,725 | $135,299 | $53,221 | $87,668 | $71,429 |
| C | 17717701 | 110 | $ 117,000 | $ 461,500 | $ 578,500 | $ 528,500 | 25,679 | 17,122 | $71,197 | $160,489 | $53,956 | $80,189 | $71,429 |
| D | 17717702 | 115 | $ 64,600 | $ 118,900 | $ 183,500 | $ 183,500 | 26,568 | 10,582 | $74,434 | $50,907 | $55,824 | $49,560 | $71,429 |
| E | 17717703 | 100 | $ 53,700 | $ 71,900 | $ 125,600 | $ 75,600 | 27,411 | 7,209 | $64,725 | $34,844 | $57,595 | $33,762 | $71,429 |
| F | 17717704 | 100 | $ 44,900 | $ 1,500 | $ 46,400 | $ 46,400 | 28,247 | 6,128 | $64,725 | $12,872 | $59,352 | $28,700 | $71,429 |
| G | 17717705 | 100 | $ 31,900 | $ 1,500 | $ 33,400 | $ - | 29,075 | 5,310 | $64,725 | $9,266 | $61,092 | $24,869 | $71,429 |
| H | 17717706 | 100 | $ 2,100 | $ - | $ 2,100 | $ - | 29,977 | 3,414 | $64,725 | $583 | $62,987 | $15,989 | $71,429 |
| I | 17717707 | 100 | $ 2,600 | $ - | $ 2,600 | $ - | 42,759 | 5,500 | $64,725 | $721 | $89,844 | $25,759 | $71,429 |
| J | 17717904 | 100 | $ 106,000 | $ 148,300 | $ 254,300 | $ - | 30,555 | 12,735 | $64,725 | $70,549 | $64,201 | $59,643 | $71,429 |
| K | 17717903 | 140 | $ 111,500 | $ 405,100 | $ 516,600 | $ 516,600 | 37,135 | 13,948 | $90,615 | $143,317 | $78,027 | $65,324 | $71,429 |
| L | 17923036 | 130 | $ 96,700 | $ 320,700 | $ 417,400 | $ 417,400 | 56,319 | 56,319 | $84,142 | $115,796 | $118,336 | $263,763 | $71,429 |
| M | 17923026 | 75 | $ 73,200 | $ 181,400 | $ 254,600 | $ 254,600 | 17,180 | 15,890 | $48,544 | $70,632 | $36,098 | $74,419 | $71,429 |
| N | 17923028 | 75 | $ 94,000 | $ 155,200 | $ 249,200 | $ 249,200 | 49,008 | 36,695 | $48,544 | $69,134 | $102,974 | $171,857 | $71,429 |
| | | 1,545 | $ 1,046,300 | $ 2,558,300 | $ 3,604,600 | $ 2,512,200 | 475,924 | 213,521 | $ 1,000,000 | $ 1,000,000 | $ 1,000,000 | $ 1,000,000 | $ 1,000,000 |




| | | | | |
|---|---|---|---|---|
| C:\PhukanLogo.jpg | Civil Geotechnical Surveying Environmental Construction Materials Testing<br>2702 Gambell Street, Suite 201 Anchorage, Alaska., 99503<br>Tele: (907) 272-7111 Fax: (907) 277-3177<br>Email: pcaris@alaska.net | DATE | 12/11/01 | FIGURE 1 |
| | | SCALE | 1/4" = 1'-0" | - |
| | | FILE NAME | FIG-DRAFT | |
| | | JOB NO. | 01965.1 | EROSION CONTROL PROJECT<br>HOMER, AK |

# Memo


| | |
|---|---|
| Date: | Thursday, June 27, 2019 |
| Project: | Homer Seawall Study |
| To: | Carey Meyer, PE Homer City Engineer |
| From: | Ronny McPherson, PE HDR |
| Subject: | Homer Seawall Alternatives Analysis |

The purpose of this technical memorandum is to review the condition of the Homer seawall (herein referred to as the “seawall”) and provide concepts for improving the structure that would reduce maintenance cost and extend the functional life of the structure.

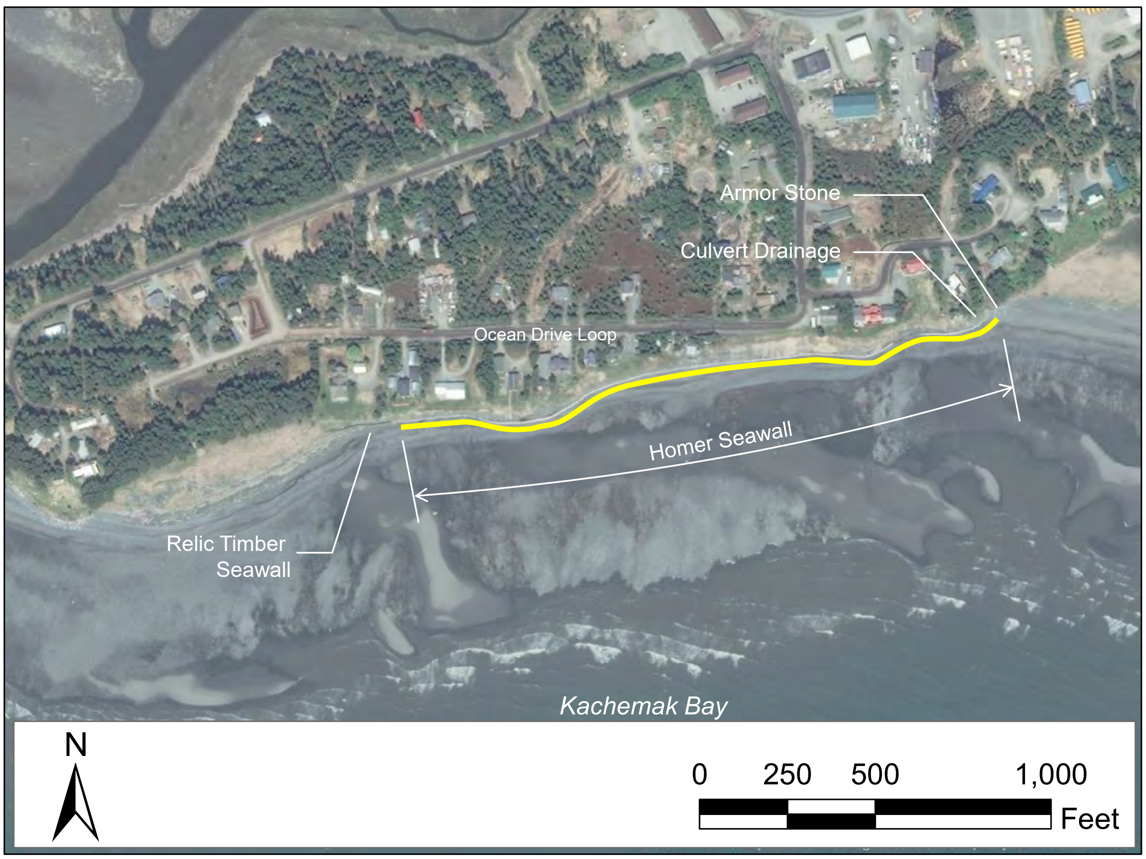



**Figure 1. Homer seawall location map.**

The seawall was constructed in 2002 using fiberglass sheet pile. Based on information provided by the City of Homer, the structure experienced immediate challenges primarily due to several major storm events occurring during construction and has since required continued maintenance to maintain functionality. One issue that was observed early in the project, was the degradation of the sheet pile material due to abrasion from the beach sediments. Timber paneling was subsequently installed to mitigate the abrasion. A steel whaler (horizontal structural member) was also installed to provide additional structural support for the wall (Figure 2 and Figure 3). Over time, it has been observed that the elevation of the seafloor at the toe of the wall is lowering, noting that the elevation of the toe varies greatly throughout the year (i.e. seasonal variations). Continued lowering of the toe elevation will eventually undermine the seawall and allow retained uplands to slough.

## Existing Homer Seawall Observations

A site visit was conducted on April 25, 2019 with the City of Homer City Engineer to observe the condition of the seawall. During the visit, several sink holes at the top of the seawall were observed. These were generally correlated with local failures of the timber facing at the toe of seawall (Figure 4). Within these local failures, the degrading effects of the prior abrasion were observed. Seawall height, as measured from the beach to the top of the sheet pile, was measured near the culvert drainage located on the east side of the seawall (Figure 1) and was found to be approximately 15 feet. A schematic showing the approximate conditions of the existing seawall is shown in Figure 2. Armor stone was observed on the eastern terminal of the seawall and is shown in Figure 5. Many of the armor stone were observed to have rounded edges indicating recurring movement over time which is assumed to be due to wave action. Based on rough measurements and an assumed density of 160 pounds per cubic foot, stones were found to range from 1,500 lbs. to 7,500 lbs. in weight with most stones weighing less than 2,000 lbs.

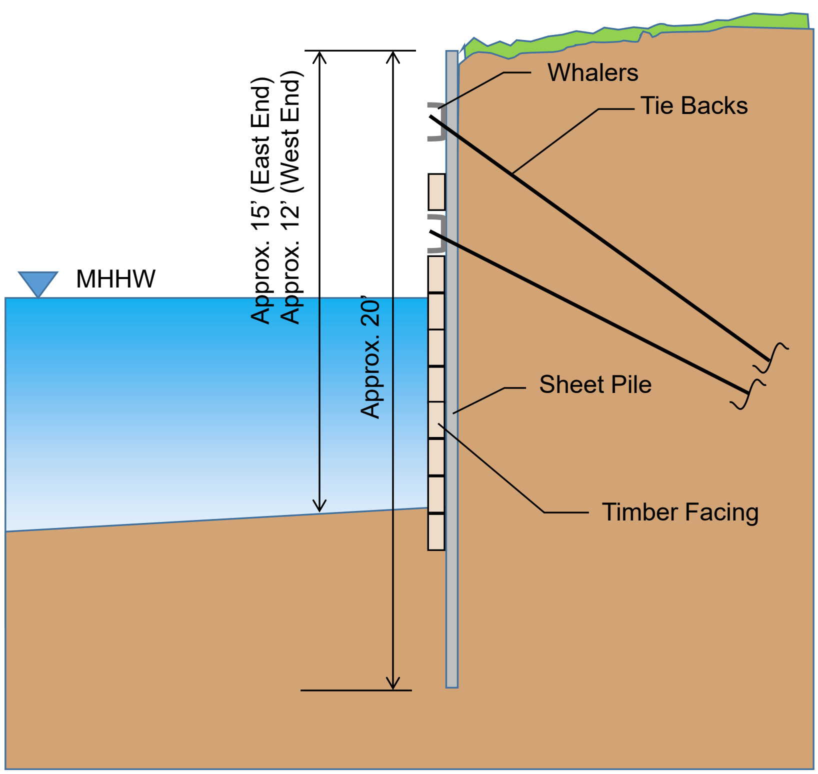



**Figure 2. Existing seawall schematic.**


**Figure 3. Seawall existing condition.**

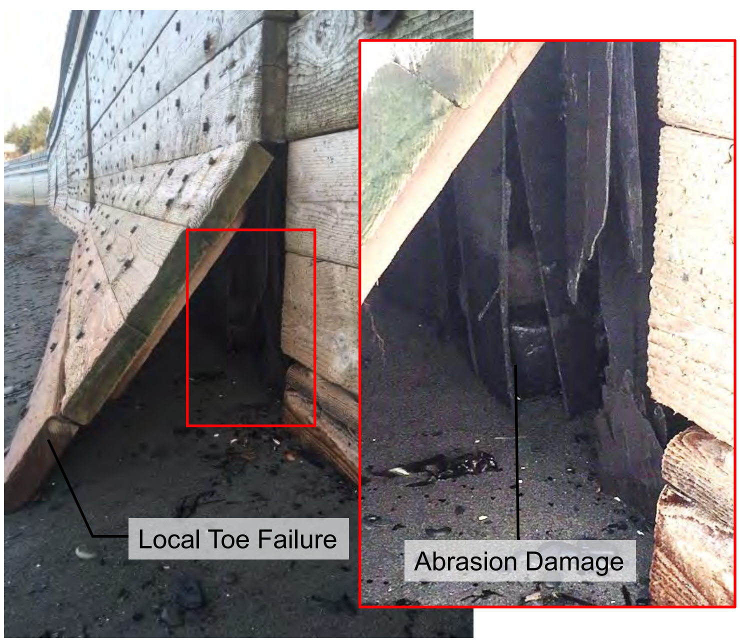



**Figure 4. Example of observed local failure – correlates to sink hole at top of the seawall. Inset shows previous assumed abrasion damage.**

**Figure 5. Observed armor stone at east terminal of the seawall.**

## Metocean Conditions and Sediment Transport

The following provides a brief description of the meteorological and oceanographic (metocean) conditions as well as sediment transport trends near the seawall.

### Tide

Tide datums for the area were gathered from the NOAA tide station located at Seldovia, AK and are provided in Table 1. Although this station is located across Kachemak Bay, the tide datums provide a good representation of conditions at the project site. The base of the seawall is estimated to be at an elevation of approximately +12' Mean Lower Low Water (MLLW) based on observed tide levels during the site visit.

**Table 1. Tidal Datums at Seldovia NOAA Tide Gauge (NOAA 2019)**

| | Elevation, FT (MLLW) | Elevation, FT (NAVD88) |
|---|---|---|
| **Mean Higher High Water** | 18.1 | 12.7 |
| **Mean High Water** | 17.2 | 11.9 |
| **Mean Sea Level** | 9.6 | 4.3 |
| **Mean Low Water** | 1.7 | -3.6 |
| **Mean Lower Low Water (MLLW)** | 0.0 | -5.3 |
| **North American Datum of 1988 (NAVD88)*** | 5.3 | 0.0 |
| **NAVD88 conversion calculated using Alaska Department of Natural Resources – Alaska Tidal Datum Portal (DGGS 2019).* | | |

### Wind

Figure 6 provides a wind rose from data gathered at the Homer airport. The wind rose graphically shows the wind direction, magnitude, and frequency of occurrence. A silhouette of the Homer spit with the seawall location shown as a “star” is also included in the figure in the background. This provides a graphical orientation of the shoreline at the seawall in relation to the wind trends. From the figure, it can be seen that annually wind predominantly blows in two directions: northeast and west southwest.

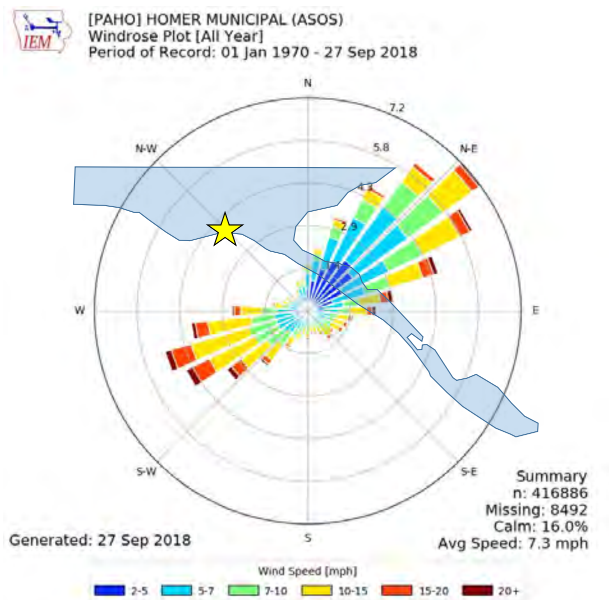



**Figure 6. Wind rose showing predominant wind direction, freqency, and magnitude at Homer, AK (ISU 2019).**

### Waves

Kachekmak Bay is relatively shielded from open ocean swell coming from the Gulf of Alaska. Waves generated at the site are primarily wind-generated waves that have developed within the Kachekmak Bay/Cook Inlet water bodies. Because of this, wave directional trends will closely align with wind directional trends shown in Figure 6. Due to the presencse of the Homer spit and orientation of the project shoreline, waves traveling form the northeast direction will not be able to develop to any significant size prior to impacting the seawall. However, waves traveling from west southwest can reach a significant size due to the large fetch (>80 miles) and deep water across Kachemak Bay and Cook Inlet. Considering these conditions, it is believed that depth limited storm waves impact the seawall on a regular basis. Figure 7 provides an example of storm conditions during a high tide at the seawall. In addition to the large wind-generated waves impacting the seawall, wave reflection off the seawall likely amplifies the waves just seaward of the structure.

**Figure 7. Storm waves impacting existing Homer seawall (photo courtesy of City of Homer).**

## Sediment Transport

For discussion purposes, sediment transport can be simplified as cross-shore transport and long shore transport.

Cross-shore transport is the movement of sediment up and down the beach profile (section view). In typical open-ocean beaches, wave action from winter storms will cause cross-shore sediment transport to the lower part of the beach profile creating a skinner beach or lower beach elevations. During calmer summer periods, cross-shore transport will move this sediment back up into the higher portions of the beach profile creating a seasonally wider beach. This trend or some variation is likely occurring as seasonal variations of the Homer beach elevations are typical.

Long shore sediment transport is the movement of sediment parallel to the shoreline. Sediment will move along the shoreline as waves approach a shoreline from an oblique angle. The more oblique the angle and more wave energy, the more sediment is transported. Based on the wave directional trends and orientation at the Homer seawall, the beach experiences waves impacting the shoreline from a consistent oblique angle, thus a net sediment transport from west to east can be assumed with minimal to no seasonal transport from east to west. In addition, the overall presence and orientation of the neighboring Homer spit also indicates that the net sediment transport is from west to east at the seawall.

## 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.

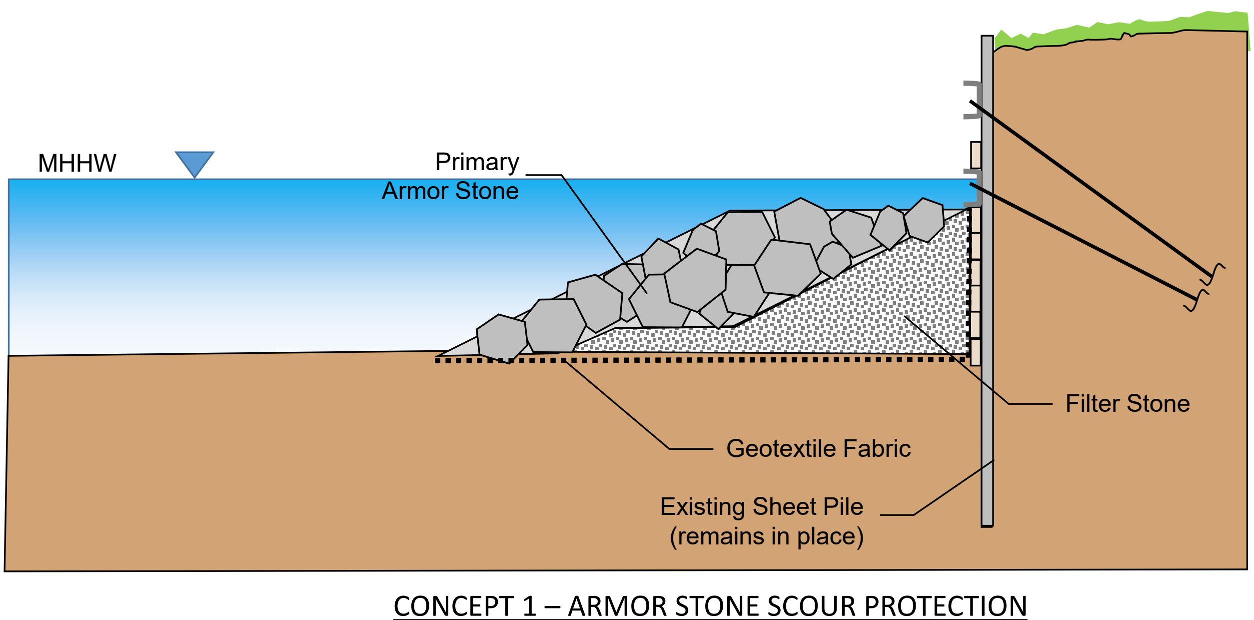



**Figure 8. Concept 1 - Armor stone scour protection schematic.**

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).

**Concept 2: Geotextile Container Scour Protection**

Geotextile container scour protection would be very similar to the shape and functionality of the armor stone scour protection (Concept 1), however, the primary building material would be a sand-filled geotextile fabric container. The container would be made using a two-layer geotextile fabric system. The inner-fabric of the container would be made of non-woven geotextile material to prevent sediment migration through the container. The outer-fabric would be made of a strong woven geotextile fabric to support the weight of the container which can be upwards of 2,000 lbs. Containers would be fabricated with three sides pre-fabricated (sewn) similar to a pillow case. The container would also have pre-fabricated straps sewn in to allow a spreader bar to place the container in the desirable location. The containers would then be filled with locally sourced sand using a hopper and the remaining side sewn in the field. Ideally containers would be sized to be the maximum weight the construction equipment could handle and maneuver. The containers would be placed along the toe of the seawall to prevent scour. Figure 9 provides a schematic showing the section and plan of this concept. Figure 10 provides an example of a geotextile container revetment, however, note the containers are placed differently (pyramid-layout) than shown in Figure 9 and are not placed directly against the seawall.

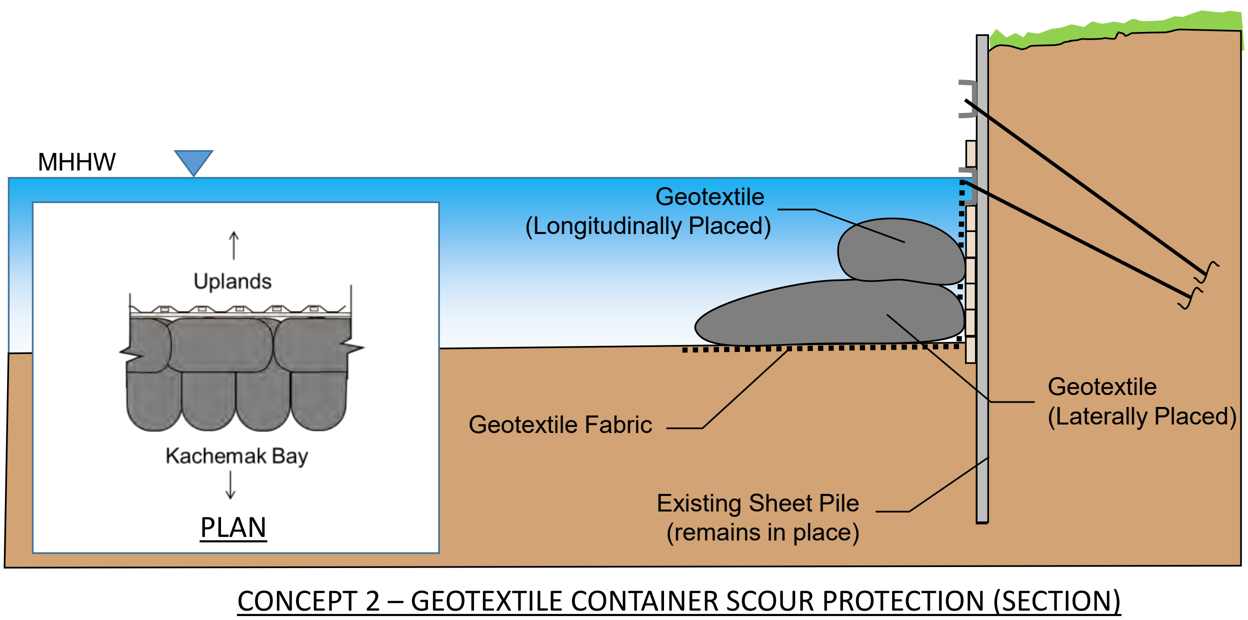



**Figure 9. Concept 2 - Geotextile container scour protection section schematic.**

**Figure 10. Example of geotextile container revetment (pyramid layout). In the Homer seawall case, the containers would be placed against the seawall.**

Advantages:

- The seawall toe would be shored up with the geotextile container mitigating localized failures of the seawall increasing the longevity of the structure. Continued lower of the beach elevation in front of the seawall would not be a major concern.
- Geotextile container fabrication is significantly less costly than armor stone. Sand used to fill the containers is assumed to be readily available in the Homer area.
- If a localized failure were to occur due to a seepage of sediment through the seawall, repair of the failure would be not be as challenging as an armor stone revetment since only a few containers would need to be removed and replaced.
- The structure would be fairly inexpensive to repair if some containers were damaged. At the time of initial construction, additional containers could be fabricated and stored until needed.

Disadvantages:

- More easily damaged by larger wave forces and has higher potential for rupturing due to debris.
- Geotextile containers do not have as long of a design life as other materials such as armor stone or steel sheet pile. The fabric breaks down overtime due to sunlight and weathering.
- Geotextile containers are easily vandalized (e.g. cut with a knife) and rendered ineffective.

**Concept 3: Groin Field**

A groin is a coastal structure that is orientated perpendicular to the shoreline with the intent of disrupting the long shore sediment transport. A groin field is a series of groins placed relatively uniformly along a shoreline that create pocket beaches between structures. Groins can be constructed with a variety of materials but are most often constructed with armor stone. As sediment travels along the shoreline due to wave action and currents, a groin will disrupt the flow of sediment and accrete sediment along the up-drift side of the groin (called a filet). Since wave action and/or currents will continue to move sediment, the down-drift side of the groin will lose sediment/erode. In the situation of a groin field, sediment between groins is relatively stable. The most down-drift groin, however, is still subject to this potential erosional effect. Since there is a significant net long shore sediment transport along the seawall, a groin field would be very effective at retaining sediment in front of the seawall. However, erosion effects at the down-drift side of the seawall could be very significant with minimal opportunities for wave action to replenish the down-drift side with sediment. A potential solution to offset the significance of the down-drift erosion is to create a groin structure that is quasi-porous allowing a portion of the sediment to transport through the groin structure. An example of this would be a series of timber piles driven close to each other or armor rock structure with a low crest elevation. Making the groin structure quasi-porous also limits the effectiveness of the groin. Figure 11 provides a plan-view schematic of this concept.

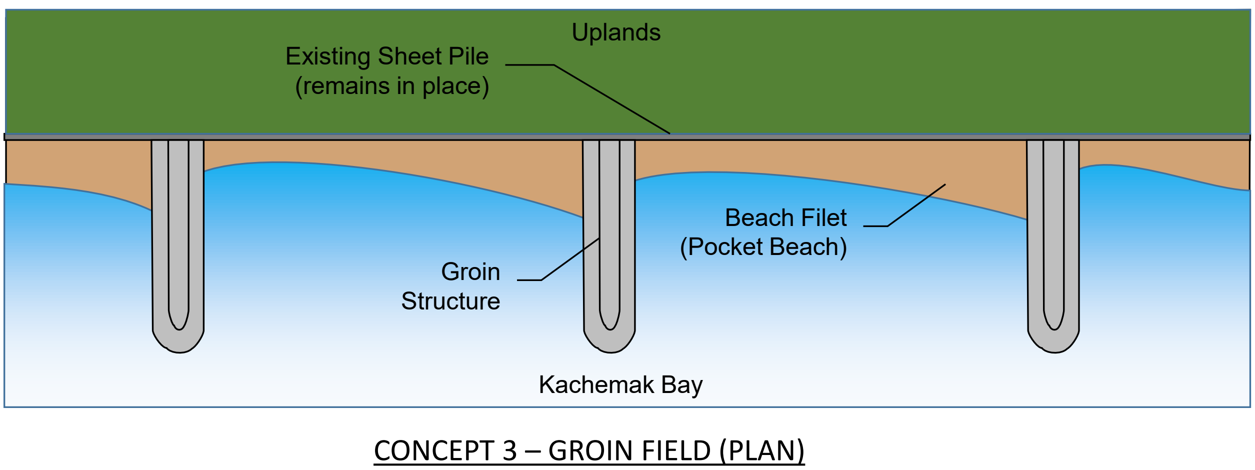



**Figure 11. Concept 3 - Groin field plan schematic.**

Advantages:

- The seawall toe would be shored up with additional natural sediment. Continued lower of the beach elevation would be halted or slowed greatly.
- Localized failures of the seawall would not be any more challenging than they are today.
- Depending on the amount of sediment accumulation in front of the seawall, localized failures would likely be reduced.

Disadvantages:

- Groins to do not limit cross-shore sediment transport. A large storm could erode sediment at the base of the seawall.
- Multiple groin structures, especially made of armor stone or sheet pile, would be very costly.
- Groin structures made of timber would have a limited life span compared to armor stone.
- Potential for down-drift erosional impacts are great.

**Concept 4: New Steel Sheet Pile Wall**

A new steel sheet pile wall, similar to the wall used to repair the seawall on the eastern side could be installed just seaward of the existing wall. The wall could be design to be cantilevered (i.e. requiring no tie backs). Fill would be placed between the new steel sheet pile wall and the existing sheet pile wall effectively encapsulating the structure. The design life of the existing structure would then be negated as the design life would solely rely on the new steel sheet pile wall. This concept would be similar to the current seawall, but with a more robust structure. Figure 12 provides a schematic of this concept.

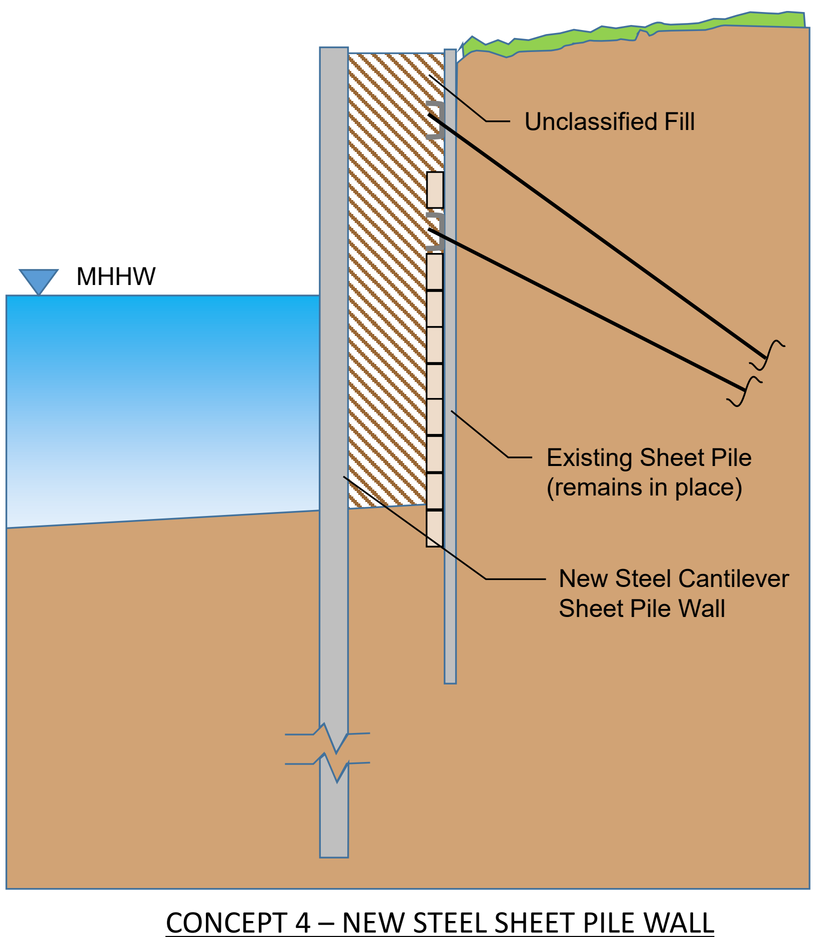



**Figure 12. Concept 4 - New steel sheet pile wall schematic.**

Advantages:

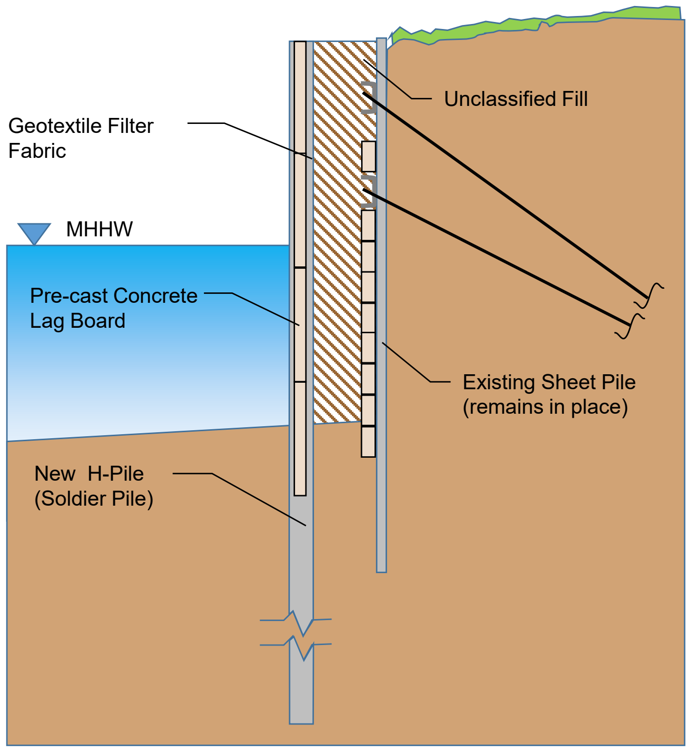
- Condition of the existing seawall (e.g. localized failures) would not be a factor in the longevity of the retaining structure.
- Lowering of the beach elevation could be factored into the design.
- Steel sheet pile walls can be design to have a long service life.

Disadvantages:

- Installation of steel sheet pile can very expensive and is often more expensive than armor stone structures.

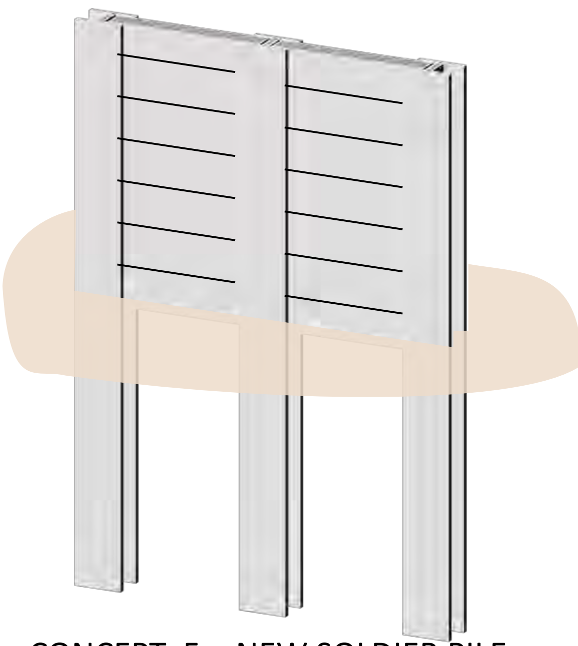
**Concept 5: New Soldier Pile and Concrete Lag Wall**

A solider pile and concrete lag wall would be an innovative approach to shoring up the existing seawall. A soldier pile is a single pile that is designed to be stout and handle significant loading. A concrete lag is a pre-cast concrete block. This concept would entail driving steel H-piles and then sliding concrete lags between H-piles to create a wall. The overall wall would be designed to be cantilevered (i.e. does not require tie-backs). This wall would be installed just seaward of the existing seawall and fill would be placed between the new seawall and the existing seawall. A unique feature of this concept is that as the beach elevation lowers over time, the concrete lags can be lowered to meet the new beach grade (and might lower due to their own weight). Then additional lags can be placed on top of the existing lags to continue expanding the height of the wall. Note, placing additional lags would require mobilizing construction equipment. A geotextile filter fabric would need to be installed on the landward side of the wall to prevent sediment from piping through the concrete lags. If existing lags are moved deeper and additional lags are placed, careful maintenance of the geotextile filter fabric will be required to mitigation sediment from migrating through the wall. Figure 13 and Figure 14 provide schematics of Concept 5. An example of this concept is shown in Figure 15

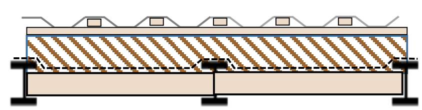



CONCEPT 5 – NEW SOLDIER PILE AND CONCRETE LAG WALL (SECTION)

**Figure 13. Concept 5 - New soldier pile and concrete lag wall section schematic.**



CONCEPT 5 – NEW SOLDIER PILE AND CONCRETE LAG WALL (OBLIQUE)



CONCEPT 5 – NEW SOLDIER PILE AND CONCRETE LAG WALL (PLAN)

**Figure 14. Concept 5 - New soldier pile wall and concrete lag wall section oblique and plan schematic.**

**Figure 15. Example of a concrete lag wall (source: easternvault.net).**

Advantages:

- Condition of the existing seawall (e.g. localized failures) would not be a factor in the longevity of the retaining structure.
- Lower of the beach elevation can be addressed by lowering concrete lags as necessary and adding additional lags on top of existing lags.
- Steel pile and concrete can be design for an extremely long design life.

Disadvantages:

- Installation of piles and lags can be very expensive and is likely more expansive than armor stone structures.
- Concrete lags require geotextile fabric to prevent sediment migration (piping) through the structure.

## 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.

## References

DGGS, 2019. Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys, Alaska Tidal Datum Port. Webpage, http://dggs.alaska.gov/sections/engineering/ak-tidal-datum-portal/calculator.php

ISU, 2019. Iowa State University, Iowa Environmental Mesonet. Webpage, http://mesonet.agron.iastate.edu/sites/locate.php

NOAA, 2019. Center for Operational Oceanographic Products and Services (CO-OPS), webpage, http://tidesandcurrents.noaa.gov/

*TAF= Tax Authority Fund

# 2019 MILL RATE

## TAX YEAR 2019 - FY 2020

*TAG = Tax Authority Group

| TAF | TAG | |
|---|---|---|
| | **10 SELDOVIA** | |
| **10** | Seldovia | 7.50 |
| **11** | Seldovia RSA | 0.75 |
| **50** | Borough | 4.70 |
| | | **12.95** |
| | **11 SELDOVIA RSA** | |
| **11** | Seldovia RSA | 0.75 |
| **50** | Borough | 4.70 |
| **56** | South Hospital | 1.18 |
| **67** | Road Maint. | 1.40 |
| | | **8.03** |
| | **20 HOMER** | |
| **20** | Homer | 4.50 |
| **50** | Borough | 4.70 |
| **52** | SH TY18&Prior Debt | 1.12 |
| **56** | South Hospital | 1.18 |
| | | **11.50** |
| | **21 HOMER ODLSA** | |
| **20** | Homer | 4.50 |
| **21** | Homer ODLSA | 9.9625 |
| **50** | Borough | 4.70 |
| **52** | SH TY18&Prior Debt | 1.12 |
| **56** | South Hospital | 1.18 |
| | | **21.4625** |
| | **30 KENAI** | |
| **30** | Kenai | 4.35 |
| **50** | Borough | 4.70 |
| **51** | CH TY18&Prior Debt | 0.00 |
| **59** | Central Hospital | 0.01 |
| | | **9.06** |
| | **40 SEWARD** | |
| **40** | Seward | 3.84 |
| **43** | Sew/Bear Cr. Flood | 0.75 |
| **50** | Borough | 4.70 |
| | | **9.29** |
| | **41 SEWARD SPECIAL** | |
| **41** | Seward Special | 3.84 |
| **43** | Sew/Bear Cr. Flood | 0.75 |
| **50** | Borough | 4.70 |
| | | **9.29** |
| | **43 SEWARD-BEAR CREEK FLOOD SA** | |
| **43** | Sew/Bear Cr Flood | 0.75 |
| **50** | Borough | 4.70 |
| **67** | Road Maint. | 1.40 |
| | | **6.85** |
| | **52 SOUTH HOSPITAL** | |
| **52** | SH TY18&Prior Debt | 1.12 |
| **50** | Borough | 4.70 |
| **56** | South Hospital | 1.18 |
| | | **7.00** |
| | **53 NIKISKI FIRE** | |
| **53** | Nikiski Fire | 2.70 |
| **50** | Borough | 4.70 |
| **51** | CH TY18&Prior Debt | 0.00 |
| **54** | No. Pen Rec. | 1.00 |
| **59** | Central Hospital | 0.01 |
| **67** | Road Maint. | 1.40 |
| | | **9.81** |
| | **54 N. PENINSULA RECREATION** | |
| **54** | No.Pen.Rec. | 1.00 |
| **50** | Borough | 4.70 |
| **51** | CH TY18&Prior Debt | 0.00 |
| **58** | Cen.Emer.Ser. | 2.85 |
| **59** | Central Hospital | 0.01 |
| **67** | Road Maint. | 1.40 |
| | | **9.96** |

| TAF | TAG | |
|---|---|---|
| | **55 NIKISKI SENIOR** | |
| **55** | Nikiski Sen. | 0.20 |
| **50** | Borough | 4.70 |
| **51** | CH TY18&Prior Debt | 0.00 |
| **53** | Nikiski Fire | 2.70 |
| **54** | No. Pen Rec. | 1.00 |
| **59** | Central Hospital | 0.01 |
| **67** | Road Maint. | 1.40 |
| | | **10.01** |
| | **57 BEAR CREEK FIRE** | |
| **57** | Bear Creek Fire | 3.25 |
| **43** | Sew/Bear Cr. Flood | 0.75 |
| **50** | Borough | 4.70 |
| **67** | Road Maint. | 1.40 |
| | | **10.10** |
| | **58 CENTRAL EMERGENCY SERVICES** | |
| **58** | Cen. Emer.Ser. | 2.85 |
| **50** | Borough | 4.70 |
| **51** | CH TY18&Prior Debt | 0.00 |
| **59** | Central Hospital | 0.01 |
| **67** | Road Maint. | 1.40 |
| | | **8.96** |
| | **59 CENTRAL HOSPITAL** | |
| **50** | Borough | 4.70 |
| **52** | SH TY18&Prior Debt | 1.12 |
| **59** | Central Hospital | 0.01 |
| **67** | Road Maint. | 1.40 |
| | | **7.23** |
| | **61 CENTRAL HOSPITAL WEST** | |
| **50** | Borough | 4.70 |
| **51** | CH TY18&Prior Debt | 0.00 |
| **59** | Central Hospital | 0.01 |
| **67** | Road Maint. | 1.40 |
| | | **6.11** |
| | **62 CENTRAL HOSPITAL SOUTH** | |
| **50** | Borough | 4.70 |
| **52** | SH TY18&Prior Debt | 1.12 |
| **59** | Central Hospital | 0.01 |
| **64** | Cent. Pen. EMS | 1.00 |
| **67** | Road Maint. | 1.40 |
| | | **8.23** |
| | **63 CENTRAL HOSPITAL EAST** | |
| **50** | Borough | 4.70 |
| **51** | CH TY18&Prior Debt | 0.00 |
| **59** | Central Hospital | 0.01 |
| **64** | Cent. Pen. EMS | 1.00 |
| **67** | Road Maint. | 1.40 |
| | | **7.11** |
| | **64 CENTRAL PEN. EMERGENCY MEDICAL** | |
| **64** | Cent Pen. EMS | 1.00 |
| **50** | Borough | 4.70 |
| **52** | SH TY18&Prior Debt | 1.12 |
| **56** | South Hospital | 1.18 |
| **67** | Road Maint. | 1.40 |
| | | **9.40** |
| | **65 SOUTH HOSPITAL/ROADS** | |
| **50** | Borough | 4.70 |
| **52** | SH TY18&Prior Debt | 1.12 |
| **56** | South Hospital | 1.18 |
| **67** | Road Maint. | 1.40 |
| | | **8.40** |
| | **67 KPB ROAD MAINTENANCE** | |
| **50** | Borough | 4.70 |
| **67** | Road Maint. | 1.40 |
| | | **6.10** |

06/05/2019

| TAF | TAG | |
|---|---|---|
| | **68 ANCHOR POINT FIRE/EMERGENCY** | |
| **68** | Fire/Emergency | 2.75 |
| **50** | Borough | 4.70 |
| **52** | SH TY18&Prior Debt | 1.12 |
| **56** | South Hospital | 1.18 |
| **67** | Road Maint. | 1.40 |
| | | **11.15** |
| | **69 SOUTH HOSPITAL KBAY** | |
| **50** | Borough | 4.70 |
| **56** | South Hospital | 1.18 |
| **67** | Road Maint. | 1.40 |
| | | **7.28** |
| | **70 SOLDOTNA** | |
| **70** | Soldotna | 0.50 |
| **50** | Borough | 4.70 |
| **51** | CH TY18&Prior Debt | 0.00 |
| **58** | Cent. Emer. Ser. | 2.85 |
| **59** | Central Hospital | 0.01 |
| | | **8.06** |
| | **80 KACHEMAK*** | |
| **80** | Kachemak | 1.00 |
| **50** | Borough | 4.70 |
| **52** | SH TY18&Prior Debt | 1.12 |
| **56** | South Hospital | 1.18 |
| | | **8.00** |
| | **81 KACHEMAK EMERGENCY SERV.** | |
| **81** | Kachemak EMS | 2.60 |
| **50** | Borough | 4.70 |
| **52** | SH TY18&Prior Debt | 1.12 |
| **56** | South Hospital | 1.18 |
| **67** | Road Maint. | 1.40 |
| | | **11.00** |

**EMS VOLUNTEER 10,000 EXEMPTION**
**ALL BOROUGH TAF's**
**HOMER (20) & SEWARD (40)**

**50K Borough TAF's and Homer 20K**
**All other City TAF mills do not apply**

***Kachemak City TAG 80-No tax on personal property/boats/aircraft**

**100,000 PERSONAL EXEMPTION**
**ALL BOROUGH TAF's**
**HOMER (20) & SOLDOTNA (70)**

**AIRCRAFT TAX:**
**FLAT TAX FOR ALL BOROUGH TAF'S, SELDOVIA (10) & SOLDOTNA (70)**
**Borough Flat Portion + City Flat Portion**
**TAG'S 20,40 &41**
**Full value X TAF Millrate**
**Plus (+) Borough Flat Portion**

**BOAT TAX:**
**FLAT TAX FOR ALL BOROUGH TAF'S**
**HOMER(20),SOLDOTNA(70),SELDOVIA(10)**
**Borough Flat Portion + City Flat Portion**
**TAG'S 40 & 41 (Seward )**
**Full value X TAF Millrate PLUS (+) Borough Flat Portion**
**TAG 30 Class 1 & 2 Exempt and Class 3-7 Full value X TAF Millrate PLUS (+) Borough Flat Portion**

**Senior Exemptions:**
**Borough 300,000 exempt unless Variable 10,20,30,40,41,70,80 upto 150,000 exempt over is Taxed at City TAF Rate**

**Disability Tax Credit:**
**TAF 30 Kenai $250.00**
**Borough TAF'S $500.00**