TRC Worldwide Engineering

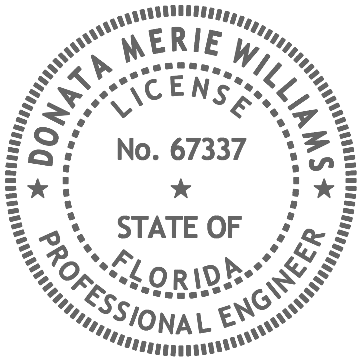
1230 N. University Drive
Plantation, FL 33322
Phone: (954) 484-7777
www.trcww.com

City of Fort Lauderdale Project No. P12212, Seawall Master Plan Summary Report

TRC Project #: 23FTL017

Prepared by:

Jenkins and Charland, Inc. Dba TRC Worldwide Engineering



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Donata Merie Williams, P.E.
FL. P.E. No. 67337

TO THE BEST OF MY KNOWLEDGE AND BELIEF, THE ATTACHED REPORT REPRESENTS AN ACCURATE APPRAISAL OF THE PRESENT CONDITION OF THE EXISTING STRUCTURE BASED ON EVALUATION OF THE OBSERVED CONDITIONS, TO THE EXTENT REASONABLY POSSIBLE

Summary Report

Summary Report Table of Contents

1.0 Introduction

1.1 Executive Summary

The majority of the City's seawalls are stable but exhibiting deficiencies typical of concrete structures in a corrosive environment and nearing the end of their design life. Several seawalls were seen to be deteriorated and require prioritization for repair/replacement. The majority of the City's natural banks and shorelines are in good condition. All seawalls except 3 require raising to address average top of wall elevations that do not meet the minimum top of Wall Elevation that was determined per the City of Fort Lauderdale Ordinance No. C23-05 on March 23,2023.

This Summary Report categorizes the walls into five-year program windows (0-5 years, 6-10 years, 11-15 years, 16-20 years, and 20+ years) based on the condition of the wall at the time of inspection. It is important to note that the decay of these walls is exponential, and it is difficult to quantify the amount of remaining life left in a wall. However, Jenkins and Charland, Inc. Dba TRC Worldwide Engineering (TRC) has used their experience to provide recommendations and a time frame to each wall. The highest priority for repair or replacement is categorized as 0-5yr program window, and the lowest priority is categorized as 20+ years. Table 1.1 below summarizes the costs anticipated over the next 20 years. Note that there were three walls that could not be inspected due to access issues ranging from private fences, to vegetations. No category has been provided to these 3 walls in the individual reports, however, they have still been included in the cost estimate under the work program window "UNKNOWN."

	Table 1.1 - Anticipated Costs By Work Program Window						
	0-5 YRS	6-10 YRS	11-15 YRS	16-20 YRS	20+ YRS	UNKNOWN	Total (Per TRC Recommendation)
*Material & Labor	$ 15,049,464.00	$ 24,790,440.00	$ 21,628,825.00	$ 3,836,766.00	$ 18,522,264.00	$ 524,250.00	$ 84,352,009.00
**Estimated Total	$ 25,283,099.52	$ 41,647,939.20	$ 36,336,426.00	$ 6,445,766.88	$ 31,117,403.52	$ 880,740.00	$ 141,711,375.12
*Total cost is based on historic data labor and material cost provided by the City of Fort Lauderdale. This cost does not include construction overhead, permitting fees, or engineering cost. Note that the cost shown in this table are cost associated with TRC's recommendation. Other options have been provided and presented in later tables. **A multiplier of 1.68 can be applied to the total material and labor cost to obtain total estimated price of construction.							

1.2 Scope of Work

TRC Worldwide Engineering was subcontracted by Craven Thompson & Associates, Inc. to assist the City of Fort Lauderdale with evaluating the condition of 74 City-owned walls and 7 natural shorelines that are found throughout Fort Lauderdale, FL. The current scope of 74 walls and 7 natural shorelines has grown since the 2016 Seawall Master plan report was released. In 2016 the report was inclusive of 35 walls that were within the city inventory (4.41 miles) and 7 natural shorelines (2.01 miles). This increase is the result of the inventory now being inclusive of parks and recreation, field investigation, and Broward County Property Appraiser research that has better identified property lines. In total, there are 74 City-owned seawalls (5.87 miles) and 7 natural shorelines (1.3 miles) in the City's inventory that have been inspected during this structural assessment. However, this value is based on current information and will continue to increase as additional findings are made. Appendix B provides additional details on the seawalls that were not inspected as part of this project.

An above water field inspection was to be performed, and confirmation of the limits and transition points into private walls was to be documented. Structural elements above the water line were examined for any deficiencies such as impact damage, deterioration caused by the elements, deterioration caused by lack of proper maintenance, or joint leakage. Impact damage, cracks, spalls, settlement, water staining, erosion, and section loss were located, measured, and documented. In addition to the seawall, the scope of work was inclusive of a visual inspection of the area and conditions in the immediate vicinity of the seawall for constructability concerns such as lack of staging area or trees that would need to be removed. In addition, wall elevations were to be measured to ensure the minimum top of wall elevation of 5.00FT NAVD were met per Ordinance No. C23-05 that was adopted on March 23,2023.

This limited visual inspection of the City's Seawalls was conducted to serve as the basis for a seawall management system. TRC has developed an inspection and reporting system, developed a deficiency and priority classification system, evaluated areas for improvement, and quantified repair replacement and raising costs. Seawall locations were also prioritized according to the City's 5-Year Increment Work Program Windows. Areas of improvement were identified and itemized, and then options were presented to reduce the number of seawalls in disrepair. TRC's findings and recommendations are included in this Summary Report.

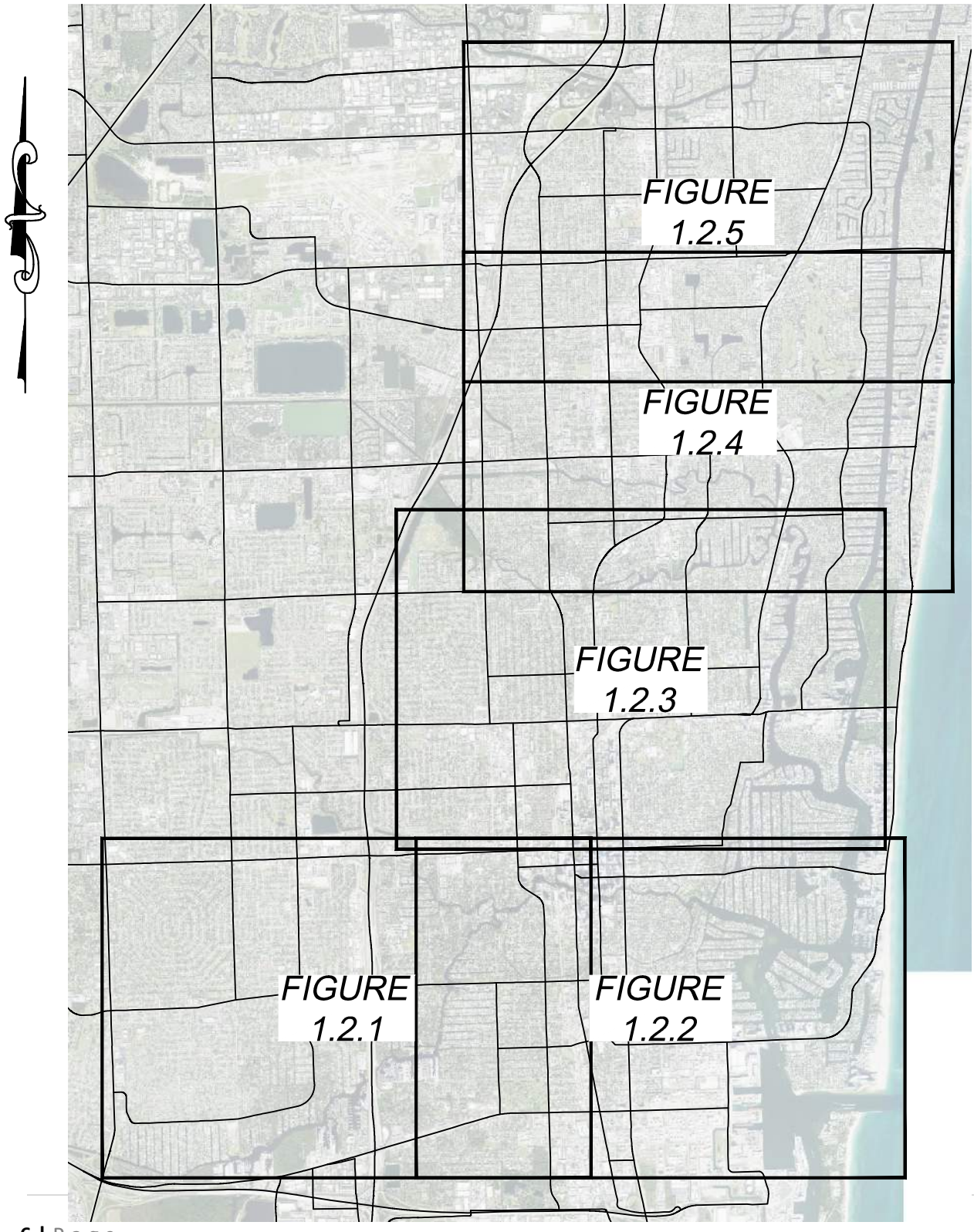
Seawall types vary throughout the City and include but are not limited to: coral rock, concrete panel/T-pile, king pile/panel, and steel sheet pile. They can be found across the City of Fort Lauderdale and can be seen on the maps that follow.

FORT LAUDERDALE SEAWALLS

FIGURE 1.2 - KEY MAP

0 6000' 12000'

GRAPHIC SCALE IN FEET



Map Provided by Craven Thompson & Associates, Inc.

FORT LAUDERDALE SEAWALLS

FIGURE 1.2.1 - SECTOR 1

Map Provided by Craven Thompson & Associates, Inc.

FORT LAUDERDALE SEAWALLS

FIGURE 1.2.2 - SECTOR 2

Map Provided by Craven Thompson & Associates, Inc.

FORT LAUDERDALE SEAWALLS

FIGURE 1.2.3 - SECTOR 3

Map Provided by Craven Thompson & Associates, Inc.

FORT LAUDERDALE SEAWALLS

FIGURE 1.2.4 - SECTOR 4

Map Provided by Craven Thompson & Associates, Inc.

FORT LAUDERDALE SEAWALLS

FIGURE 1.2.5 - SECTOR 5

Map Provided by Craven Thompson & Associates, Inc.

2.0 Assessment Supporting the Recommendations

2.1 Inspection and Classification System

The intent of the inspection and classification system is to closely follow the National Bridge Inspection Standards (NBIS). The purpose of the inspection is to be thorough and identify conditions and defects of each seawall component, document deficiencies, and provide alerts to issues that may impact safety or the integrity of the structure. The inspection reports are formatted to address seawall conditions, components, and features, using language common across the industry to account for different inspectors completing the report over the lifespan of the seawall.

The “Condition State” classification system provides consistency in reporting conditions. In the individual reports, overall conditions are provided to highlight the condition of each seawall component on a scale of 1 to 4. A condition rating of 1 was given if the wall element was seen to be in "Good Condition", 2 for "Fair", 3 for "Poor", and 4 for “Severe”. For clarity, a written description of each Condition State, customized for each seawall component, is provided next to the Condition State number so there is an immediate understanding of the condition. This process is repeated throughout the report in greater detail for each seawall component.

2.2 Existing Data

The below table summarizes the existing data and source used in developing this report.

Table 2.2 - EXISITING DATA SOURCES

Data	Source
Wall and Shoreline Locations	City Provided Map
Inspection Reports	Inspection reports dated for 2016 (Walls 1-35)
Dimensions	Field Review and Property Appraiser Website
Top of Wall elevation	Survey conducted 1/2024 - 11/2024
Base Flood Elevations	FEMA Flood Maps (ASCE7 Hazard Tools)
Conceptual Repair and Wall Details	City Provided Repair Standards

2.3 Above Water Inspection

The above water inspection included an inspection of all visible seawall components. These inspections consisted of landside inspections, as well as water inspections, as needed. Variations in seawall type were documented as well as conditions behind the seawall such as facilities, properties, and outfalls. The water inspections were performed from on a boat with a team that consisted of three individuals: two inspectors and a boat captain. Note that not all walls required boat inspections. TRC, with the assistance of the City, performed boat inspections where wall visual inspections were found to be limited by land. Where inspections were performed by boat, one inspector remained in the boat to inspect from the water, and the second inspector walked landside to track the stationing and inspect top of wall caps and surrounding conditions behind the wall. At walls where only a land inspection was required, the inspection team consisted of 1-4 inspectors depending on the wall length.

Deficiency locations were measured from the end of seawall. Conditions were confirmed by hand measurements, wheel measurements, and sounding using a hammer or club. Conditions were documented by digital photograph. Crack widths were measured using a crack width comparator card (Figure 2.3.1). Relatively widespread deficiencies were documented as "General Conditions" and quantities based on regular measurements and overall percentage of seawall. Cause of deterioration (i.e. impact spall vs. delamination) were identified where appropriate and any loss of section documented. In all cases, deficiencies were noted in certain terms, such as *shallow spall with no exposed rebar, spall with exposed rebar, crack with staining, crack with efflorescence, crack (solid when sounded), crack (hollow when sounded).* Top of seawall elevations were confirmed in NAVD '88 and Base Flood Elevations confirmed using FEMA Base Flood Maps.

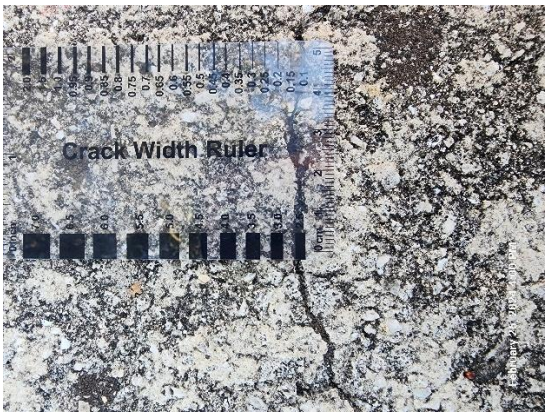


Figure 2.3.1 – Crack Comparator Card

Figure 2.3.2 – Inspectors Stationing

2.4 Wall and Shoreline Inspection Reports

An inspection report was prepared for each individual seawall. In some locations there were no walls present, and just the shoreline was inspected. Each report includes the deficiencies noted for that particular wall during the inspection. Photographs were used to supplement and support noted conditions, as well as clarify conditions and locations. Photographs were numbered and can be found at the end of each individual report. Photos are referred to in the inspection report text.

In addition to documentation of deficiencies, each report includes discussion of necessary short-term and long-term recommendations. Short-term recommendations reflect the need for work to be performed relatively sooner and focus on serious conditions that may require action before the long-term recommendations should take place. Recommendations are grouped into five-year program windows (i.e. 0-5 years, 6-10 years, 11-15 years and 16-20 years, and 20+ years) from the time of inspection. Long-term recommendations focus on anticipated remaining life of the seawalls and the need for rehabilitation or replacement. In the individual wall reports a long-term recommendation of "Routine inspection and maintenance until funding is available for replacement," was given. This long-term recommendation is intended for routine visits that would allow for monitoring for crack growth, identifying new cracks, and filling soil voids if necessary. It is difficult to predict the exponential growth of deficiencies such as cracks, spalls, and rebar deterioration, thus the long-term inspection is intended to assist with confirming the walls maintain current levels of integrity so that the wall can last its specified work program window/ wall priority.

The remaining life of the seawalls considered factors such as the year that the seawall was constructed (If known), the current condition, and average top of wall elevation. Most walls have not met the top of wall elevation minimum mandated by the City (5.0 FT). If a wall was inspected and seen to be of the coral rock wall type, and below the minimum elevation, TRC recommended repair to keep the wall in service until funding was made available, but full replacement is to be completed in order to meet elevation minimums.

For consistency, each report followed the same general format:

- Project Summary
- Element Condition State Classification Summary
- Importance of Repair and Cost Estimates of Repair by Wall Elements
- Summary of Cost and Repair
- Short and Long-term Recommendations
- Condition in Immediate Vicinity and Wall Impacts on other Elements
- Photo Exhibit
- Broward County Property Appraiser Documentation

2.5 Primary Considerations

The City's seawall inventory is located across the City of Fort Lauderdale and varies in seawall type, location, abutting conditions/facilities/structures, and exposure. Adjacent facilities vary from parks to streets, from commercial areas to residential. Waterways range from heavily travelled, deep-water access waterways such as the New River to relatively isolated canals with access restricted by low-level fixed bridges. Therefore, the considerations evaluated when investigating the seawalls cover a wide range of deficiencies. The following is a list of some typical deficiencies seen across more than 50% of the walls:

1) Displacement: Lateral movement/ rotation was noted in many instances across varying wall types:

Figure 2.5.1 Lateral Movement/Rotation (WALL 27)

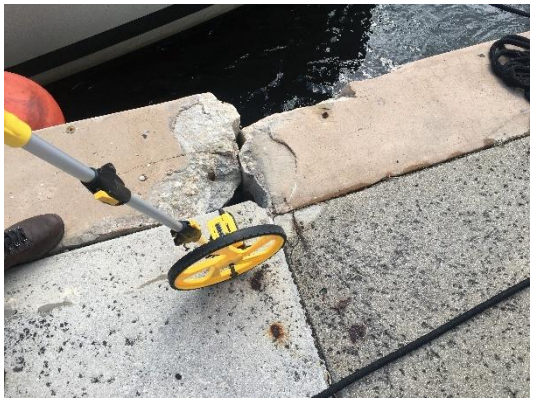


Figure 2.5.2 Lateral Movement, Separation (WALL 24)

2) Element Condition: Piles and Caps were seen to be spalled in various locations with reinforcement corrosion. It was stypical to see hairline cracks along caps and panels.

Figure 2.5.3 Typical Spall at Cap (WALL 24)

Figure 2.5.4 T-Pile and Batter Pile Spall (WALL 41)

3) Section Loss: It was typical to see loss of rock and cracking of coral rock walls.

Figure 2.5.5 Missing Coral Rock in Wall (WALL 40)

4) Elevation Of Wall: Wall elevations were measured to ensure the minimum top of wall elevation of 5.00FT NAVD were met per Ordinance No. C23-05 that was adopted on March 23,2023. Most walls were found to not meet the required elevation.

Figure 2.5.6 Wall Elevations Below Required Ordinance (WALL 41)

5) Channel condition: The wall inspections performed by TRC were limited to above water inspections. Therefore, wall penetration, and the overall groundline in front of the wall could not be taken into consideration for the wall categorizing. The overall view of the channels were looked at and noted if any obstruction (debris) was blocking access to the channel. Additionally, when channels had one direction of entry this was noted in the report for wall access conditions.

Figure 2.5.7 Channel End (WALL 36)

6) Type of Seawall: The type of seawall factors into the repairs that could be performed, and whether the wall could or could not be raised. For example, TRC has omitted an option for raising seawalls of coral rock type because these walls are not typically formed with reinforcement and anchors in the way a batter piled/ T-pile wall would be, and therefore, would not typically support additional height and backfill soil pressure.

2.6 Constructability

Issues effecting constructability vary by location, orientation, disposition, and use. The following highlights the primary issues centered around constructability or repairs, raising, or replacing the City's seawalls.

1) Access: Seawalls accessible by land requiring access through private property will impact construction. Seawalls such as Seawall 66 are only accessible by crossing through private property, or via the waterway (Figure 2.6.1). Additionally, some walls are found within canals with lower water lines where equipment access may be limited.

Figure 2.6.1 Accessibility Issues (WALL 66)

2) Type of property behind seawall: Many seawalls support residential and commercial properties, see Figure 2.6.2. Minimizing impacts not only to the condition of the adjacent property but the operations and access to the property are key construction considerations.

Figure 2.6.2 Wall Supporting Parking and Structure Facilities (WALL 41)

3) Wall proximity to facilities: Many seawalls are in close proximity to existing roadways, driveways, sidewalks, bridges, parks, or other structures. Influences on construction include but are not limited to the size of the available work zone, overhead restrictions, and mitigating vibrations during seawall removal and/or installation.
4) Utilities: Seawalls are in close proximity to existing utilities, both buried and overhead, that would need to be considered during construction.
5) Presence of Tie Backs: Tie backs may extend below private property and critical structures or facilities.
6) Existing seawall capacity: Maintaining the integrity of the existing seawall during raising may involve considerations such as constructing the new cap using multiple pours in order to enable the new piling to support the additional dead load.

7) Environmental sensitivity: Presence of environmentally sensitive resources such as Mangroves may require mitigation.

Figure 2.6.3 Mangroves
(NORTH END OF WALL 21)

2.7 Summary of Conditions

The majority of the City's seawalls are stable but exhibiting deficiencies typical of concrete structures located in a corrosive environment that are nearing the end of their original design life. Some seawalls have significant structural deficiencies, but only for certain elements or limited lengths of the seawall. Several seawalls, primarily in the Las Olas Boulevard areas, were actively under construction during the time of this seawall investigation. Raising to address the minimum wall elevation ordinance is recommended at all seawall locations except walls: 3, 18A, and 52.

TRC recommends that the City move forward with a long-range inspection/monitoring program in conjunction with a repair/replacement/raising program that is based upon deliberately addressing the highest priority seawalls and shorelines first.

3.0 Tiered Rehabilitation System

3.1 Wall Priority

The volume of the City's inventory and the need to optimize budget and support long range planning have necessitated the categorizing of walls into 5 year work program windows that will allow the City to budget and repair or replace in order of most to least critical. After being placed in a work program window, TRC evaluated each individual wall within the individual work programs and determined which walls based on deficiencies were most critical.

In order to determine which walls were most critical, TRC developed an Importance of Repair Classification/ Priority System. This system was developed to prioritize work using a scale of 1(low priority) through 4 (emergency). Each individual inspection report contains a priority assigned to each seawall component. This along with the overall element ratings was used to rank the overall priority of the seawalls from 1 (most urgent) to 81 (least urgent). Elements were evaluated based on, but not limited to, severity of the following: cracks seen, spalling/ delaminating concrete, corrosive staining, exposed reinforcement, and overall conditions that could result in public safety issues. The tables on the following page summarizes which walls are included in the specific 5 year work program windows, as well as the order within the work program window they should be repaired.

Wall Priority 0-5 Year Work Program Window

TABLE 3.1.1: 0-5 YEAR WORK PROGRAM WINDOW

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Average Existing Top of Wall Elevation (FT)	Amount Below 5.0FT NAVD Minimum (FT)	Existing Wall Type	Proposed Wall Type	NOTES
1	0-5	**10**	Seven Isles Dr of Del Mar Pl	291	1.5	-3.50	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
2	0-5	**24**	Riverwalk North east of CSX	2,225	2.93	-2.07	Precast Concrete Panel, Concrete Panel, T-Pile with Concrete Panel	T-pile with Precast Concrete Panel & Battered Piles	
3	0-5	**57**	Directly south of 1 N Birch Road (Valencia Street Dead end)	48	3.2	-1.8	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
4	0-5	**92**	Alleyway terminus on SW 9th St at Tarpon River	17	2.89	-2.11	GRAVITY WALL- TYPE UNKNOWN	Steel Sheet Pile Wall	
5	0-5	**11**	City Pump Station / E Las Olas Blvd, east of Coconut Isle Dr	100	3.5	-1.50	T-pile with Precast Concrete Panel	T-pile with Precast Concrete Panel & Battered Piles	
6	0-5	**72**	Eastern terminus of alleyway between NE 30th Place and NE 30th Street	15	2.4	-2.6	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
7	0-5	**59**	SE 15th Street Park	40	3.05	-1.95	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
8	0-5	**7**	Bayview Dr north of NE 14th St	127	3.45	-1.55	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
9	0-5	**42**	Francis L. Abreu Place	74	2	-3.00	T-pile with Concrete Panels	Steel Sheet Pile Wall	
10	0-5	**34**	Barcelona Dr East of NE 26th Terr	104	1.92	-3.08	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
11	0-5	**5**	Bayview Dr north of NE 16th St	126	2.8	-2.20	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
12	0-5	**6**	Bayview Drive Canal Ends	124	2.76	-2.24	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
13	0-5	**27**	Richard Mancuso Greenway / N. and S. side of Himmarshee Canal	978	Segment 27A=1.68 Segment 27B=2.15 Segment 27C=1.59 Segment 27D=2.38	Segment 27A=-3.32 Segment 27B=-2.85 Segment 27C=-3.41 Segment 27D=-2.62	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
14	0-5	**37**	Ann Murray Greenway	39	2.25	-2.75	Precast Concrete Panel	T-pile with Precast Concrete Panel & Battered Piles	
15	0-5	**78**	Idlewyld Drive - Seawall at Intracoastal and Clematis Pl	50	2.65	-2.35	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
16	0-5	**28**	Colee Hammock Park	165	2.37	-2.63	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
17	0-5	**81**	Eastern terminus of SW 14 Ct on South Fork of New River (Shady Banks)	24	1.44	-3.56	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
18	0-5	**80**	Aurelia and Poinciana	50	1.91	-3.09	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
19	0-5	**63**	Northern terminus of SW 8th Ave at the Tarpon River	90	2.16	-2.84	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
20	0-5	**18B 18C 18D**	E. Las Olas West Side of ICWW	357	3.43	-2.2	Coral Rock Wall & T-Pile with Conrete Panel	T-pile with Precast Concrete Panel & Battered Piles	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

2) Wall 18 was broken into segments 18A, 18B, 18C, 18D, 18E and assigned work program windows per individual segment. This will result in multiple priorty numbers for this wall.

Wall Priority 6-10 Year Work Program Window

TABLE 3.1.2: 6-10 YEAR WORK PROGRAM WINDOW									
Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Average Existing Top of Wall Elevation (FT)	Amount Below 5.0FT NAVD Minimum (FT)	Existing Wall Type	Proposed Wall Type	NOTES
21	6-10	47	Mitchell Family Park	372	Segment A=2.53 Segment B=3.20	Segment A=-2.47 Segment B=-1.80	Segment A= Coral Rock; Segment B=T-pile with Concrete Panels	T-pile with Precast Concrete Panel & Battered Piles	Overgrown vegetation resulted in a partial inspection.
22	6-10	4	Bayview Dr north of NE 17th St	126	2.38	-2.62	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
23	6-10	53	Waverly Property	360	2.2	-2.80	Sheet Pile Wall & Gravity Wall with Buttresses	T-pile with Precast Concrete Panel & Battered Piles	
24	6-10	73	Western terminus of NE 21st St and middle river Drive on the Middle River.	50	2.99	-2.01	Concrete Bag	T-pile with Precast Concrete Panel & Battered Piles	
25	6-10	8	Lake Melva north of Ford Dealer	297	4.5	-0.05	Vinyl Sheet Pile	T-pile with Precast Concrete Panel & Battered Piles	
26	6-10	9	Victoria Park	120	2.00	-3.00	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	TRC does not recommend raising Coral Rock Walls.
27	6-10	17	SE 5th St / Solar Plaza Dr	237	2.62	-2.38	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	TRC does not recommend raising Coral Rock Walls.
28	6-10	19	Swimming Hall of Fame	1,410	2.37	-2.63	Precast Concrete Panel	Steel Sheet Pile Wall	
29	6-10	21	Coontie Hatchee Park	136	2.70	-2.30	T-pile with Concrete Panels	T-pile with Precast Concrete Panel & Battered Piles	
30	6-10	31	Cox's Landing	736	2.50	-2.50	Coral Rock; T-pile with Concrete Panel;T-pile with Precast Concrete Panel and Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	240LF of this wall was not able to be inspected due to fencing around Police Facility
31	6-10	38	Bubier Park	296	3.30	-1.70	Sheet Pile Wall and Concrete Panel Wall	T-pile with Precast Concrete Panel & Battered Piles	
32	6-10	40	Riverside 2	756	2.54	-2.46	Sheet Pile and Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	TRC does not recommend raising Coral Rock Walls.
33	6-10	41	Esplande Park and adjacent Riverwalk	542	2.7	-2.3	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
34	6-10	50	Stranahan Landing	15	2.40	-2.60	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
35	6-10	61	Annie Beck Park	1,108	0.00	-5.00	No Wall Present	T-pile with Precast Concrete Panel & Battered Piles	No wall is present. Flood history should be reviewed to confirm if wall is needed.
36	6-10	70	Terminus of NE 21st Street near N. Victoria Park Road near South Fork of the Middle River	50	2.65	-2.35	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
37	6-10	77	Idlewyld Drive - Seawall at Intracoastal and Acacia Ct	50	2.73	-2.27	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
38	6-10	91	Alleyway terminus on SW 9th St at Tarpon River	43	2.47	-2.53	Concrete Bag Wall	T-pile with Precast Concrete Panel & Battered Piles	
39	6-10	1	Bayview Dr at Bay Colony	625	2.24	-2.76	T-pile with Concrete Panels	Repair and raise Segments 2 &4. Replace Segments 1, 3, and 5 with T-pile and battered pile system	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

2) Natural shorelines have been included in this work program window.

Wall Priority 11-15 Year Work Program Window

TABLE 3.1.3: 11-15 YEAR WORK PROGRAM WINDOW

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Average Existing Top of Wall Elevation (FT)	Amount Below 5.0FT NAVD Minimum (FT)	Existing Wall Type	Proposed Wall Type	NOTES
40	11-15	**26**	Riverwalk South	2,054	Segment 26A-26E= 3.35 Segment 26F & 26G=2.80	Segment 26A-26E= -1.65 Segment 26F & 26G=-2.20	Segment 26A= T-pile with Concrete Panel Segment 26B= Concrete Panel Wall Segment 26C= T-pile with Concrete Panel Segment 26D= Concrete Panel Wall Segment 26E= Sheet Pile Wall	IF REPLACED: T-pile with Precast Concrete Panel & Battered Piles	
41	11-15	**45**	Marshall Point	400	3.64	-1.36	T-pile with Concrete Panel & Battered Piles; Precast concrete Panel	IF REPLACED: T-pile with Precast Concrete Panel & Battered Piles	
42	11-15	**25**	SW 5th Ave	490	Segment 25A= 3.59 Segment 25B= 3.06	Segment 25A= -1.41 Segment 25B= -1.94	Segment 25A= T-Pile with Concrete Panels and Battered Piles Segment 25B = Coral Rock Wall	T-pile with Precast Concrete Panel & Battered Piles	
43	11-15	**20**	Bahia Mar	3,025	3.17	-1.83	Steel Sheet Piles with Battered Piles; Concrete Pile and Panel; Concrete Panel and Pile with Battered Piles; T-Pile with Concrete Panel and Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
44	11-15	**39**	Cooley's Landing	962	1.97	-3.03	T-Pile with Concrete Panel and Battered Piles; T-pile with Concrete Panels	IF REPLACED: T-pile with Precast Concrete Panel & Battered Piles	
45	11-15	**35**	SE 8th St	590	00+00.00 to 02+08.17= 1.54 02+08.17 to 03+07.58= 3.97 03+07.58 to 04+07.50= 2.74 04+07.50 to 05+08.25= 4.19 05+08.25 to 05+90.00 = 1.88	00+00.00 to 02+08.17= -3.46 02+08.17 to 03+07.58= -1.03 03+07.58 to 04+07.50= -2.26 04+07.50 to 05+08.25= -0.81 05+08.25 to 05+90.00 = -3.12	T-pile with Precast Concrete Panel and Battered Piles; Coral Rock Wall with Battered Piles; Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
46	11-15	**88**	2511 Barbara Drive	30	1.45	-3.55	T-Pile With Concrete Panels	IF REPLACED: T-pile with Precast Concrete Panel & Battered Piles	
47	11-15	**75**	Idlewyld Drive - Seawall at Intracoastal and Alamanda Ct	50	3.00	-2.00	Coral Rock	Steel Sheet Pile Wall	
48	11-15	**74**	Idlewyld Drive - Seawall at Intracoastal and Hibiscus Place	50	2.9	-2.1	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
49	11-15	**60**	Curve at Cypress Creek/NE 62nd Street into Bayview	240	2.37	-2.63	T-Pile with Concrete Panel	IF REPLACED: T-pile with Precast Concrete Panel & Battered Piles	
50	11-15	**79**	Idlewyld Drive - Seawall at Intracoastal and Datura Ct	50	2.48	-2.52	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
51	11-15	**85**	Directly east of 1775 W Las Olas Blvd	52	2.70	-2.30	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
52	11-15	**86**	Directly southeast of 1775 W Las Olas Blvd	52	2.71	-2.29	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

2) Wall 18 was broken into segments 18A, 18B, 18C, 18D, 18E and assigned work program windows per individual segment. This will result in multiple priorty numbers for this wall.

Wall Priority 11-15 Year Work Program Window Continued

TABLE 3.1.3: 11-15 YEAR WORK PROGRAM WINDOW									
Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Average Existing Top of Wall Elevation (FT)	Amount Below 5.0FT NAVD Minimum (FT)	Existing Wall Type	Proposed Wall Type	NOTES
53	11-15	**76**	Idlewyld Drive - Seawall at Intracoastal and Aurelia Place	50	2.93	-2.07	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
54	11-15	**22**	Lewis Landing Park	245	2.96	-2.04	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
55	11-15	**55**	SW 12 Ave	60	1.70	-3.30	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
56	11-15	**54**	Coconut Dr	35	2.3	-2.7	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
57	11-15	**65**	Terminus of Seminole Ave (SW 12th Ave) and alleyway on North Fork of New River	125	0.99	-4.01	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
58	11-15	**3**	Loggerhead Park	101	9.75	0.00	Precast Concrete Panel	IF REPLACED: T-pile with Precast Concrete Panel & Battered Piles	
59	11-15	**52**	Vista Park	113	10.4	0.00	Unknown- Asumed Precast Concrete Panel	IF REPLACED: T-pile with Precast Concrete Panel & Battered Piles	
60	11-15	**18E**	E. Las Olas West Side of ICWW	58	3.43	-2.20	Precast Concrete Panel	T-pile with Precast Concrete Panel & Battered Piles	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

2) Wall 18 was broken into segments 18A, 18B, 18C, 18D, 18E and assigned work program windows per individual segment. This will result in multiple priorty numbers for this wall.

Wall Priority 16-20 Year Work Program Window

TABLE 3.1.4: 16-20 YEAR WORK PROGRAM WINDOW									
Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Average Existing Top of Wall Elevation (FT)	Amount Below 5.0FT NAVD Minimum (FT)	Existing Wall Type	Proposed Wall Type	Notes
61	16-20	**44**	Laura Ward Plaza	116	00+00.00 to 00+74.00=3.04 00+74.00 to 01+04.25=5.38 01+04.25 to 01+16.00=3.83	00+00.00 to 00+74.00=-1.96 00+74.00 to 01+04.25=0.00 01+04.25 to 01+16.00= 1.17	T-Pile with Concrete Panel	T-pile with Precast Concrete Panel & Battered Piles	
62	16-20	**23**	Riverwalk North west of CSX	979	2.21MIN,3.35MAX	-2.79MIN,-1.65MAX	Sheet Pile with Battered Piles; Concrete Panel/ Concrete Panel with T-Pile and Battered Pile; Rip Rap	T-pile with Precast Concrete Panel & Battered Piles	
63	16-20	**58**	NW terminus of S. Ocean Lane at the Intracoastal on barrier Island	117	4.81	-0.19	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
64	16-20	**68**	Southern terminus of SE 9th Ave at New River (water taxi stop)	43	2.99	-2.01	Precast Concrete Panel	IF REPLACED: T-pile with Precast Concrete Panel & Battered Piles	
65	16-20	**62**	North end of S. Gordon Road on Navarro isle	50	2.93	-2.07	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
66	16-20	**69**	NE 18th Street and NE 8th Ave (City kayak Launch)	108	3.02	-1.98	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	
67	16-20	**33**	Sailboat Bend Preserve	300	3.28	-1.72	Coral Rock & Concrete Panel	T-pile with Precast Concrete Panel & Battered Piles	
68	16-20	**32**	Mola Ave	23	4.25	-0.75	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	
69	16-20	**84**	Southern terminus of SW 28th Ave (Chula Vista)	50	0	-5	No Wall	IF ADDED: T-pile with Precast Concrete Panel & Battered Piles	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.
2) Natural shorelines have been included in this work program window.

Wall Priority 20+ Year Work Program Window

TABLE 3.1.5: 20+ YEAR WORK PROGRAM WINDOW

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Average Existing Top of Wall Elevation (FT)	Amount Below 5.0FT NAVD Minimum (FT)	Existing Wall Type	Proposed Wall Type	Notes
70	20+	**18A**	E. Las Olas West Side of ICWW	122	5.1	0.00	Sheet Pile Wall	Sheet Pile Wall when Required	
71	20+	**48**	Riverlands Woods Park	100	0	-5.00	No Wall Present	T-pile with Precast Concrete Panel & Battered Piles	
72	20+	**36**	Ann Herman Park	131	2.01	-2.99	Sheet Pile Wall	Sheet Pile	
73	20+	**82**	Southern terminus of SW 28th Way (Chula Vista)	45	2.3	-2.7	Sheet Pile Wall	Sheet Pile Wall	
74	20+	**83**	Southern terminus of SW 28th Way (Chula Vista)	50	2.67	-2.33	Sheet Pile Wall	Sheet Pile	
75	20+	**71**	Western terminus of NE 19th Ave on the South Fork of the Middle River	90	2.62	-2.38	Sheet Pile Wall	Sheet Pile Wall	
76	20+	**56**	SW 10th Ave	41	3	-2	Coral Rock Wall	Sheet Pile	
77	20+	**87**	Sunrise Key Blvd	195	0	-5	No Wall Present	T-pile with Precast Concrete Panel & Battered Piles	
78	20+	**64**	Alleyway terminus of SW 9th St @ Tarpon River	43	0	-5.00	No Wall Present	T-pile with Precast Concrete Panel & Battered Piles	
79	20+	**43**	George English Park	2,500	0	-5	No Wall Present	T-pile with Precast Concrete Panel & Battered Piles	
80	20+	**46**	Mills Pond Park	3,000	0	-5.00	No Wall Present	T-pile with Precast Concrete Panel & Battered Piles	

Notes:
1) Wall numbers are listed in order of priority of repair/ replacement option.
2) Wall 18 was broken into segments 18A, 18B, 18C, 18D, and 18E and assigned work program windows per individual segment. This will result in multiple priorty numbers for this wall.

Wall Priority UNKNOWN Year Work Program Window

TABLE 4.5.6: "UNKNOWN" WORK PROGRAM WINDOW COST ESTIMATE									
Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Average Existing Top of Wall Elevation (FT)	Amount Below 5.0FT NAVD Minimum (FT)	Existing Wall Type	Proposed Wall Type	Notes
81	UNKNOWN	**66**	Western terminus of Brickell Drive near Tarpon Terrace	50	2.11	-2.89	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	Note that this wall was unable to be accessed for inspection.
82	UNKNOWN	**67**	Eastern terminus of Brickell Drive near SE 17th Ave	50	2.11	2.89	Coral Rock	T-pile with Precast Concrete Panel & Battered Piles	Note that this wall was unable to be accessed for inspection.
83	UNKNOWN	**90**	N. Birch between NE 9th Ct and NE 9th St	75	2.52	-2.48	T-pile with Precast Concrete Panel & Battered Piles	T-pile with Precast Concrete Panel & Battered Piles	Note that this wall was unable to be accessed for inspection.

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

4.0 Recommendations

4.1 Methods to Reduce the Number of Seawalls in Disrepair

The overall recommendation is to begin a scheduled maintenance and repair/replacement program that follows the timeframes of the work program windows. Walls are listed by order of importance in section 4.2 that follows (Tables 4.2.1 through 4.2.6). TRC has provided a cost summary for each program window with the walls within each work program ordered from most severe in the group, to least. The goal is to maximize the remaining service life of the structure by extending the life beyond its current state. The following summarizes several methods to reduce the number of seawalls in disrepair that may be evaluated further during the design at each location. These methods have been selected to be consistent and create an ease of comparison with the 2016 Seawall master plan report. These repair methods are what is the most typical and effective repair for industry standards, and are most effective based on the repetitive deficiencies that were noticed at the individual walls. Appendix C includes conceptual details for wall repairs and replacement.

4.1.1 Spall Repair

Spalls are defined as a loss of concrete via cracking/ delaminating. While spalls can occur due to various reasons, the most common spall seen at these walls was due to corrosive reinforcement. Water infiltrates the concrete and reaches the reinforcement within the specific element, expands, and the concrete spalls. Spall repairs are used to restore section loss or loss of concrete cover over top reinforcing in reinforced concrete components.

4.1.2 Crack Repair

The procedure of epoxy crack injection is effective in addressing cracking conditions in concrete components to prohibit the penetration of chlorides and stop deterioration from increasing to spalls or delamination. Cracks are cleaned, and holes drilled at regular intervals. Epoxy ports are inserted in the holes, and the ports injected with epoxy until the epoxy protrudes outside of the cracked surface. Once the epoxy cures, the ports are cut at the concrete surface and ground smooth. The epoxy creates and impenetrable barrier stronger than the surrounding concrete. Reference structural drawings in Appendix C for repair detail.

One challenge with crack repairs is when cracks exhibit efflorescence. Efflorescence is a white staining created by chemicals in hardened concrete being carried to the surface by water moving through the concrete. Efflorescence can create conditions where the crack opening cannot accept the epoxy. An effective solution to this condition is to route a groove for the length of the crack and seal the routed area with a high strength epoxy. This epoxy will not penetrate the crack but create a membrane to prohibit water intrusion into the exposed side of the crack from further accelerating the deterioration.

4.1.3 Joint Sealing

Proper sealing of the interface between piles and panels or interlocking sheets is key to avoiding long term settlement issues. This can be accomplished by routine maintenance sealing of joints and cracks.

4.2 Wall Replacement

Two options have been proposed for the replacement of a wall. The first option of replacement is a steel sheet pile seawall, and the second option is for the replacement of the wall with a new T-pile system with battered piles. In both options, the best method to replace the wall is to erect the new wall roughly 16 inches in front of the existing wall without compromising the properties behind the seawalls. This would mean that the existing wall is to be buried behind the new walls.

While two options for replacement have been provided, TRC's preferred replacement is the concrete T-pile system over the steel sheet pile method. The cost of installing a sheet pile system is more costly, and in TRC's opinion is more at risk for corrosion and section loss issues in the future. With the corrosion of the steel, there is the option to include cathodic protection systems, epoxy coatings and additional sacrificial thickness to increase the life span of steel sheet pile seawalls (not included in optional pricing). Note that, sheet piles of this material in the height range required for the City's seawalls would require corrugated shapes and would alter the visual appearance of the current seawalls and require consideration on a case-by-case basis. For these reasons it is TRC's opinion that the second option of a concrete t-pile/battered pile system is preferred. Tables 4.2.1 through 4.2.6 have been provided to in the following sections of this report in order to show a price comparison between the 2 replacement options, and the cost to repair. It is important to note that the cost of repair is not always an exact representation of a full wall repair. This largely is due to the limitation of wall visibility. Reference Appendix C for structural details for each of the two options.

4.3 Wall Raising

All seawalls except Wall Nos. 3, 18A, and 52 require raising. Raising amounts vary from just over 1 foot to over 3 feet. For the purposes of this study, it was determined that raising by more than 1 foot will require a built-up reinforced concrete cap doweled into the existing seawall cap, and additional battered piling used to support the additional lateral load due to surcharge. Depending on the size of the built-up cap, areas where existing seawalls have undergone movement or rotation would require stabilization before the raising is performed and/or additional piling installed adjacent to the existing seawall. Given the different types of seawalls and different conditions of each seawall, this would need to be evaluated on a site-specific basis. Any of the wall types, apart from coral rock walls, were considered for cap raising. Coral rock walls were not included in wall raising because based on TRC's professional opinion, these walls are not typically formed with reinforcement and anchors in the way a battered pile/ T-pile wall would be. Thus coral rock walls would not typically support additional height and backfill soil pressure. Reference Appendix C for structural drawings for wall raising details.

4.4 Recommended Options and Associated Costs

More than 80 % of the inspected seawalls are recommended for full replacement within the next 10 years. The following tables summarize the recommended option for each wall included in each 5-Year Work Program Window. Costs have been totaled for each 5-year Work Program Window. Table 4.5.1 – Table 4.5.6 that follow will show two costs associated with each work program window. Cost 1 is the associated price for strictly labor and material for the recommended repair/replacement. Cost 2 is the price provided using a multiplier of 1.68. This multiplier provides an estimated cost of construction inclusive of construction overhead, permitting fees, and engineering cost.

Construction costs are based on wall type and cost per linear foot of seawall. TRC has used City provided historical data and contacted contractors to gage a representative pricing for labor and material at price per linear foot.

4.5 Recommended Future Scheduled Inspection

Upon completion of the individual wall inspections and reports, the City provided TRC with an additional wall/ natural shoreline schedule that has now been added to the master list. While these walls were not inspected by TRC, it is recommended that an inspection of these walls take place to determine if the walls meet the minimum elevation ordinance, and that the walls are structurally sound. It is recommended that these walls be inspected within a year of this 2024 Master seawall report. Most walls that were inspected were seen to be in poor conditions, therefore this leads TRC to believe that the remaining walls may be in poor conditions. A list of the additional walls can be found in Appendix B of this summary report.

TABLE 4.5.1: 0-5 YEAR WORK PROGRAM WINDOW COST ESTIMATE

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Recommendation	Cost To Repair	Cost to Replace Option 1: Sheet pile System	Cost to Replace Option 2: T-pile System	Average Existing Top of Wall Elevation (FT)	NOTES
1	0-5	**10**	Seven Isles Dr of Del Mar Pl	291	Replace with Option 2	CANNOT BE REPAIRED	$ 1,194,264.00	$ 873,000.00	1.5	
2	0-5	**24**	Riverwalk North east of CSX	2,225	Replace With Option 2	$ 6,508,500.00	$ 9,131,400.00	$ 6,675,000.00	2.93	
3	0-5	**57**	Directly south of 1 N Birch Road (Valencia Street Dead end)	48	Replace with Option 2	CANNOT BE REPAIRED	$ 196,992.00	$ 144,000.00	3.2	
4	0-5	**92**	Alleyway terminus on SW 9th St at Tarpon River	17	Replace with Option 1	CANNOT BE REPAIRED	$ 69,768.00	$ 51,000.00	2.89	
5	0-5	**11**	City Pump Station / E Las Olas Blvd, east of Coconut Isle Dr	100	Replace with Option 2	CANNOT BE REPAIRED	$ 410,400.00	$ 300,000.00	3.5	
6	0-5	**72**	Eastern terminus of alleyway between NE 30th Place and NE 30th Street	15	Replace with Option 2	CANNOT BE REPAIRED	$ 61,560.00	$ 45,000.00	2.4	
7	0-5	**59**	SE 15th Street Park	40	Replace with Option 2	CANNOT BE REPAIRED	$ 164,160.00	$ 120,000.00	3.05	
8	0-5	**7**	Bayview Dr north of NE 14th St	127	Replace with Option 2	$ 134,595.00	$ 521,208.00	$ 381,000.00	3.45	
9	0-5	**42**	Francis L. Abreu Place	74	Replace with Option 1	$ 52,200.00	$ 303,696.00	$ 222,000.00	2	
10	0-5	**34**	Barcelona Dr East of NE 26th Terr	104	Replace with Option 2	CANNOT BE REPAIRED	$ 426,816.00	$ 312,000.00	1.92	
11	0-5	**5**	Bayview Dr north of NE 16th St	126	Replace with Option 2	$ 244,239.00	$ 517,104.00	$ 378,000.00	2.8	
12	0-5	**6**	Bayview Drive Canal Ends	124	Replace with Option 2	$ 313,697.50	$ 508,896.00	$ 372,000.00	2.76	
13	0-5	**27**	Richard Mancuso Greenway / N. and S. side of Himmarshee Canal	978	Replace with Option 2	CANNOT BE REPAIRED	$ 4,013,712.00	$ 2,934,000.00	Segment 27A=1.68 Segment 27B=2.15 Segment 27C=1.59 Segment 27D=2.38	
14	0-5	**37**	Ann Murray Greenway	39	Replace with Option 2	CANNOT BE REPAIRED	$ 160,056.00	$ 117,000.00	2.25	
15	0-5	**78**	Idlewyld Drive - Seawall at Intracoastal and Clematis Pl	50	Replace with Option 2	CANNOT BE REPAIRED	$ 205,200.00	$ 150,000.00	2.65	
16	0-5	**28**	Colee Hammock Park	165	Replace with Option 2	CANNOT BE REPAIRED	$ 677,160.00	$ 312,000.00	2.37	
17	0-5	**81**	Eastern terminus of SW 14 Ct on South Fork of New River (Shady Banks)	24	Replace with Option 2	CANNOT BE REPAIRED	$ 98,496.00	$ 72,000.00	1.44	
18	0-5	**80**	Aurelia and Poinciana	50	Replace with Option 2	$ 1,125.00	$ 205,200.00	$ 150,000.00	1.91	
19	0-5	**63**	Northern terminus of SW 8th Ave at the Tarpon River	90	Replace with Option 2	CANNOT BE REPAIRED	$ 369,360.00	$ 270,000.00	2.16	
20	0-5	**18B 18C 18D**	E. Las Olas West Side of ICWW	357	Replace with Option 2	CANNOT BE REPAIRED	$ 1,465,128.00	$ 1,071,000.00	3.43	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

2) Wall 18 was broken into segments 18A, 18B, 18C, 18D, 18E and assigned work program windows per individual segment. This will result in multiple priorty numbers for this wall.

3) Repair Price is not exact reflection of total repair cost. See individual reports for explanation of what repair cost includes. Wall visibility and other conditions could factor in an increase of repair cost.

	OPTION 1	OPTION 2
0-5 YR Subtotal Cost per Replacement Option	$ 20,700,576.00	$ 14,949,000.00
Total No. of Walls 0-5 Yr Program	20 Walls	
COST PER TRC RECOMMENDATION	**$ 15,049,464.00**	
Estimated Price of Construction(1.68 Multiplier)	**$ 25,283,099.52**	

= TRC Recommended Repair/ Replacement Option

TABLE 4.5.2: 6-10 YEAR WORK PROGRAM WINDOW COST ESTIMATE

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Recommendation	Cost To Repair	Cost to Replace Option 1: Sheet pile System	Cost to Replace Option 2: T-pile System	Average Existing Top of Wall Elevation (FT)	NOTES
21	6-10	**47**	Mitchell Family Park	372	Replace with Option 2	$ 435,030.00	$ 1,526,688.00	$ 1,116,000.00	Segment A=2.53 Segment B=3.20	Overgrown vegetation resulted in a partial inspection.
22	6-10	**4**	Bayview Dr north of NE 17th St	126	Replace with Option 2	$ 458,750.00	$ 517,104.00	$ 378,000.00	2.38	
23	6-10	**53**	Waverly Property	360	Replace with Option 2	CANNOT BE REPAIRED	$ 1,477,440.00	$ 1,080,000.00	2.2	
24	6-10	**73**	Western terminus of NE 21st St and middle river Drive on the Middle River.	50	Replace with Option 2	CANNOT BE REPAIRED	$ 205,200.00	$ 150,000.00	2.99	
25	6-10	**8**	Lake Melva north of Ford Dealer	297	Replace with Option 2	CANNOT BE REPAIRED	$ 1,218,888.00	$ 891,000.00	4.5	
26	6-10	**9**	Victoria Park	120	Replace with Option 2	$ 61,767.50	$ 492,480.00	$ 360,000.00	2.00	TRC does not recommend raising Coral Rock Walls.
27	6-10	**17**	SE 5th St / Solar Plaza Dr	237	Replace with Option 2	CANNOT BE REPAIRED	$ 972,648.00	$ 711,000.00	2.62	TRC does not recommend raising Coral Rock Walls.
28	6-10	**19**	Swimming Hall of Fame	1,410	Replace with Option 1	CANNOT BE REPAIRED	$ 5,786,640.00	$ 4,230,000.00	2.37	
29	6-10	**21**	Coontie Hatchee Park	136	Replace with Option 2	CANNOT BE REPAIRED	$ 874,152.00	$ 639,000.00	2.70	
30	6-10	**31**	Cox's Landing	736	Replace with Option 2	CANNOT BE REPAIRED	$ 2,035,584.00	$ 1,488,000.00	2.50	240LF of this wall was not able to be inspected due to fencing around Police Facility
31	6-10	**38**	Bubier Park	296	Replace with Option 2	$ 738,000.00	$ 1,214,784.00	$ 888,000.00	3.30	
32	6-10	**40**	Riverside 2	756	Replace with Option 2	$ 4,193.00	$ 3,102,624.00	$ 2,268,000.00	2.54	TRC does not recommend raising Coral Rock Walls.
33	6-10	**41**	Esplande Park and adjacent Riverwalk	542	Replace with Option 2	N/A	$ 2,224,368.00	$ 1,626,000.00	2.7	
34	6-10	**50**	Stranahan Landing	15	Replace with Option 2	$ 1,569,115.00	$ 3,078,000.00	$ 2,250,000.00	2.40	
35	6-10	**61**	Annie Beck Park	1,108	Construct Option 2 Wall	No Wall Present	$ 4,547,232.00	$ 3,324,000.00	0.00	No wall is present. Flood history should be reviewed to confirm if wall is needed.
36	6-10	**70**	Terminus of NE 21st Street near N. Victoria Park Road near South Fork of the Middle River	50	Replace with Option 2	CANNOT BE REPAIRED	$ 205,200.00	$ 150,000.00	2.65	
37	6-10	**77**	Idlewyld Drive - Seawall at Intracoastal and Acacia Ct	50	Replace with Option 2	$ 33,500.00	$ 205,200.00	$ 150,000.00	2.73	
38	6-10	**91**	Alleyway terminus on SW 9th St at Tarpon River	43	Replace with Option 2	$ 250.00	$ 164,160.00	$ 120,000.00	2.47	
39	6-10	**1**	Bayview Dr at Bay Colony	625	Repair and raise segments 2 &4. Replace segments 1, 3, and 5 with option 2	$ 1,414,800.00	$ 2,565,000.00	$ 1,875,000.00	2.24	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.
2) The cost for installing a wall at the natural shoreline was included in this cost to give a conservative pricing.
3) Repair Price is not exact reflection of total repair cost. See individual reports for explanation of what repair cost includes. Wall visibility and other conditions could factor in an increase of repair cost.

= TRC Recommended Repair/ Replacement Option
= Natural Shoreline. Recommend wall if flooding or other factor deem it

	OPTION 1	OPTION 2
6-10 YR Subtotal Cost per Replacement Option	$ 30,886,704.00	$ 22,578,000.00
Total No. of Walls 6-10 Yr Program	19 Walls	
COST PER TRC RECOMMENDATION	**$ 18,724,440.00**	
Estimated Price of Construction(1.68 Multiplier)	**$ 31,457,059.20**	

TABLE 4.5.3: 11-15 YEAR WORK PROGRAM WINDOW COST ESTIMATE

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Recommendation	Cost To Repair	Cost to Replace Option 1: Sheet pile System	Cost to Replace Option 2: T-pile System	Average Existing Top of Wall Elevation (FT)	NOTES
40	11-15	**26**	Riverwalk South	2,054	Repair and Raise Wall	$ 3,347,930.00	$ 8,429,616.00	$ 6,162,000.00	Segment 26A-26E= 3.35 Segment 26F & 26G=2.80	
41	11-15	**45**	Marshall Point	400	Repair and Raise Wall	$ 667,590.00	$ 1,641,600.00	$ 1,200,000.00	3.64	
42	11-15	**25**	SW 5th Ave	490	Replace with Option 2	$ 913,830.00	$ 2,010,960.00	$ 1,470,000.00	Segment 25A= 3.59 Segment 25B= 3.06	
43	11-15	**20**	Bahia Mar	3,025	Replace with Option 2	$ 9,353,358.00	$ 12,414,600.00	$ 9,075,000.00	3.17	
44	11-15	**39**	Cooley's Landing	962	Repair and Raise Wall	$ 2,043,455.00	$ 3,948,048.00	$ 2,886,000.00	1.97	
45	11-15	**35**	SE 8th St	590	Replace with Option 2	$ 151,290.00	$ 2,421,360.00	$ 1,770,000.00	00+00.00 to 02+08.17= 1.54 02+08.17 to 03+07.58= 3.97 03+07.58 to 04+07.50= 2.74 04+07.50 to 05+08.25= 4.19 05+08.25 to 05+90.00 = 1.88	
46	11-15	**88**	2511 Barbara Drive	30	Repair and Raise Wall	$ 62,550.00	$ 123,120.00	$ 90,000.00	1.45	
47	11-15	**75**	Idlewyld Drive - Seawall at Intracoastal and Alamanda Ct	50	Replace with Option 1	$ 1,285.00	$ 205,200.00	$ 150,000.00	3.00	
48	11-15	**74**	Idlewyld Drive - Seawall at Intracoastal and Hibiscus Place	50	Replace with Option 2	$ 29,250.00	$ 205,200.00	$ 150,000.00	2.9	
49	11-15	**60**	Curve at Cypress Creek/NE 62nd Street into Bayview	240	Repair and Raise Wall	$ 493,600.00	$ 984,960.00	$ 720,000.00	2.37	
50	11-15	**79**	Idlewyld Drive - Seawall at Intracoastal and Datura Ct	50	Replace with Option 2	$ 1,607.00	$ 205,200.00	$ 150,000.00	2.48	
51	11-15	**85**	Directly east of 1775 W Las Olas Blvd	52	Replace with Option 2	$ 37,995.00	$ 213,408.00	$ 156,000.00	2.70	
52	11-15	**86**	Directly southeast of 1775 W Las Olas Blvd	52	Replace with Option 2	$ 37,995.00	$ 213,408.00	$ 156,000.00	2.71	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

2) Wall 18 was broken into segments 18A, 18B, 18C, 18D, 18E and assigned work program windows per individual segment. This will result in multiple priorty numbers for this wall.

3) Repair Price is not exact reflection of total repair cost. See individual reports for explanation of what repair cost includes. Wall visibility and other conditions could factor in an increase of repair cost.

= TRC Recommended Repair/ Replacement Option

	OPTION 1	OPTION 2
11-15 YR Subtotal Cost per Replacement Option	$ 36,262,528.00	$ 26,496,000.00
Total No. of Walls 11-15 Yr Program	21 Walls	
COST PER TRC RECOMMENDATION	**$ 21,628,825.00**	
Estimated Price of Construction(1.68 Multiplier)	**$ 36,336,426.00**	

TABLE 4.5.3: 11-15 YEAR WORK PROGRAM WINDOW COST ESTIMATE

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Recommendation	Cost To Repair	Cost to Replace Option 1: Sheet pile System	Cost to Replace Option 2: T-pile System	Average Existing Top of Wall Elevation (FT)	NOTES
53	11-15	**76**	Idlewyld Drive - Seawall at Intracoastal and Aurelia Place	50	Replace with Option 2	$ 250.00	$ 205,200.00	$ 150,000.00	2.93	
54	11-15	**22**	Lewis Landing Park	245	Replace with Option 2	$ 1,970.00	$ 1,005,480.00	$ 735,000.00	2.96	
55	11-15	**55**	SW 12 Ave	60	Replace with Option 2	$ 183,070.00	$ 262,240.00	$ 180,000.00	1.70	
56	11-15	**54**	Coconut Dr	35	Replace with Option 2	$ 650.00	$ 143,640.00	$ 105,000.00	2.3	
57	11-15	**65**	Terminus of Seminole Ave (SW 12th Ave) and alleyway on North Fork of New River	125	Replace with Option 2	CANNOT BE REPAIRED	$ 513,000.00	$ 375,000.00	0.99	
58	11-15	**3**	Loggerhead Park	101	Repair Cap	$ 49,500.00	$ 414,504.00	$ 303,000.00	9.75	
59	11-15	**52**	Vista Park	113	Monitor and Repair	$ 113,000.00	$ 463,752.00	$ 339,000.00	10.4	
60	11-15	**18E**	E. Las Olas West Side of ICWW	58	Replace with Option 2	CANNOT BE REPAIRED	$ 238,032.00	$ 174,000.00	3.43	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

2) Wall 18 was broken into segments 18A, 18B, 18C, 18D, 18E and assigned work program windows per individual segment. This will result in multiple priorty numbers for this wall.

3) Repair Price is not exact reflection of total repair cost. See individual reports for explanation of what repair cost includes. Wall visibility and other conditions could factor in an increase of repair cost.

= TRC Recommended Repair/ Replacement Option

	OPTION 1	OPTION 2
11-15 YR Subtotal Cost per Replacement Option	$ 36,262,528.00	$ 26,496,000.00
Total No. of Walls 11-15 Yr Program	21 Walls	
COST PER TRC RECOMMENDATION	**$**	**21,628,825.00**
Estimated Price of Construction(1.68 Multiplier)	**$**	**36,336,426.00**

TABLE 4.5.4: 16-20 YEAR WORK PROGRAM WINDOW COST ESTIMATE

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Recommendation	Cost To Repair	Cost to Replace Option 1: Sheet pile System	Cost to Replace Option 2: T-pile System	Average Existing Top of Wall Elevation (FT)	Notes
61	16-20	**44**	Laura Ward Plaza	116	Replace with Option 2	$ 129,375.00	$ 476,064.00	$ 348,000.00	00+00.00 to 00+74.00=3.04 00+74.00 to 01+04.25=5.38 01+04.25 to 01+16.00=3.83	
62	16-20	**23**	Riverwalk North west of CSX	979	Repair and Raise Wall	$ 1,508,325.00	$ 4,017,816.00	$ 2,937,000.00	2.21MIN,3.35MAX	
63	16-20	**58**	NW terminus of S. Ocean Lane at the Intracoastal on barrier Island	117	Replace with Option 2	$ 193,337.00	$ 480,168.00	$ 351,000.00	4.81	
64	16-20	**68**	Southern terminus of SE 9th Ave at New River (water taxi stop)	43	Repair and Raise Wall	$ 98,541.00	$ 176,472.00	$ 129,000.00	2.99	
65	16-20	**62**	North end of S. Gordon Road on Navarro isle	50	Replace with Option 2	$ 1,377.00	$ 205,200.00	$ 150,000.00	2.93	
66	16-20	**69**	NE 18th Street and NE 8th Ave (City kayak Launch)	108	Replace with Option 2	$ 825.00	$ 443,232.00	$ 324,000.00	3.02	
67	16-20	**33**	Sailboat Bend Preserve	300	Replace with Option 2	CANNOT BE REPAIRED	$ 1,231,200.00	$ 900,000.00	3.28	
68	16-20	**32**	Mola Ave	23	Repair and Raise Wall	$ 6,900.00	$ 94,392.00	$ 69,000.00	4.25	
69	16-20	**84**	Southern terminus of SW 28th Ave (Chula Vista)	50	Replace with Option 2	NO WALL PRESENT	$ 205,200.00	$ 150,000.00	0	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

2) Repair Price is not exact reflection of total repair cost. See individual reports for explanation of what repair cost includes. Wall visibility and other conditions could factor in an increase of repair cost.

= TRC Recommended Repair/ Replacement Option

	OPTION 1	OPTION 2
16-20 YR Subtotal Cost per Replacement Option	$ 7,329,744.00	$ 5,358,000.00
Total No. of Walls 16-20 Yr Program	9 Walls	
COST PER TRC RECOMMENDATION	**$**	**3,836,766.00**
Estimated Price of Construction(1.68 Multiplier)	**$**	**6,445,766.88**

TABLE 4.5.5: 20+ YEAR WORK PROGRAM WINDOW COST ESTIMATE

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Recommendation	Cost To Repair	Cost to Replace Option 1: Sheet pile System	Cost to Replace Option 2: T-pile System	Average Existing Top of Wall Elevation (FT)	Notes
70	20+	18A	E. Las Olas West Side of ICWW	122	Routine Maintenance and Inspection	$ -	$ 500,688.00	$ 366,000.00	5.1	
71	20+	48	Riverlands Woods Park	100	Replace with Option 2	No Wall	$ 410,400.00	$ 300,000.00	0	
72	20+	36	Ann Herman Park	131	Replace with Option 1	$ 196,500.00	$ 537,624.00	$ 393,000.00	2.01	
73	20+	82	Southern terminus of SW 28th Way (Chula Vista)	45	Replace with Option 1	$ 67,500.00	$ 184,680.00	$ 135,000.00	2.3	
74	20+	83	Southern terminus of SW 28th Way (Chula Vista)	50	Replace with Option 1	$ 75,000.00	$ 205,200.00	$ 150,000.00	2.67	
75	20+	71	Western terminus of NE 19th Ave on the South Fork of the Middle River	90	Replace with Option 1	$ 135,000.00	$ 369,360.00	$ 270,000.00	2.62	
76	20+	56	SW 10th Ave	41	Replace with Option 1	$ 917.00	$ 168,264.00	$ 123,000.00	3	
77	20+	87	Sunrise Key Blvd	195	Construct Option 2 Wall	No Wall	$ 800,280.00	$ 585,000.00	0	
78	20+	64	Alleyway terminus of SW 9th St @ Tarpon River	43	Construct Option 2 Wall	No Wall	$ 176,472.00	$ 129,000.00	0	
79	20+	43	George English Park	2,500	Construct Option 2 Wall	No Wall	$ 10,260,000.00	$ 7,500,000.00	0	
80	20+	46	Mills Pond Park	3,000	Construct Option 2 Wall	No Wall	$ 12,312,000.00	$ 9,000,000.00	0	

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.

2) Wall 18 was broken into segments 18A, 18B, 18C, 18D, and 18E and assigned work program windows per individual segment. This will result in multiple priorty numbers for this wall.

3) The cost for installing a wall at the natural shoreline was included in this cost to give a conservative pricing.

3) Repair Price is not exact reflection of total repair cost. See individual reports for explanation of what repair cost includes. Wall visibility and other conditions could factor in an increase of repair cost.

= TRC Recommended Repair/ Replacement Option

= Natural Shoreline. Recommend wall if flooding or other factor deem it necessary.

	OPTION 1	OPTION 2
20+ YR Subtotal Cost per Replacement Option	$ 25,924,968.00	$ 18,951,000.00
Total No. of Walls 20+ Yr Program	11 Walls	
COST PER TRC RECOMMENDATION	**$ 1,008,264.00**	
Esitmated Price of Construction(1.68 Multiplier)	**$ 1,693,883.52**	

TABLE 4.5.6: "UNKNOWN" WORK PROGRAM WINDOW COST ESTIMATE

Priority Number	Work Program Window	Wall No.	Facility Name	Length (LF)	Recommendation	Cost To Repair	Cost to Replace Option 1: Sheet pile System	Cost to Replace Option 2: T-pile System	Average Existing Top of Wall Elevation (FT)	Notes
81	UNKNOWN	**66**	Western terminus of Brickell Drive near Tarpon Terrace	50	Replace with Option 2	Wall Not Accessible	$ 205,200.00	$ 150,000.00	2.11	Note that this wall was unable to be accessed for inspection.
82	UNKNOWN	**67**	Eastern terminus of Brickell Drive near SE 17th Ave	50	Replace with Option 2	Wall Not Visible	$ 205,200.00	$ 150,000.00	2.11	Note that this wall was unable to be accessed for inspection.
83	UNKNOWN	**90**	N. Birch between NE 9th Ct and NE 9th St	75	Replace with Option 2	Wall Not Accessible	$ 307,800.00	$ 224,250.00	2.52	Note that this wall was unable to be accessed for inspection.

Notes:

1) Wall numbers are listed in order of priority of repair/ replacement option.
2) Repair Price is not exact reflection of total repair cost. See individual reports for explanation of what repair cost includes. Wall visibility and other conditions could factor in an increase of repair cost.

= TRC Recommended Repair/ Replacement Option

	OPTION 1	OPTION 2
UNKNOWN Subtotal Cost per Replacement Option	$ 718,200.00	$ 524,250.00
Total No. of Walls Unknown Program	3 Walls	
COST PER TRC RECOMMENDATION	**$**	**524,250.00**
Esitmated Price of Construction(1.68 Multiplier)	**$**	**880,740.00**

4.6 Establish a Maintenance Plan

The main importance of the maintenance plan is establishing the City Standards required to conduct the routine inspections that should be regularly performed to ensure there is no progressive change in conditions that may alter seawall priorities, and result in advancing seawalls within the 5-Year Work Program Windows. It is recommended to have an inspection performed every 6 months for walls that fall within the 0-5 year work program window, once a year for the 6-10 year work program, once every 2 years for 11-15, once every 3 years for 16-20, and once every 4 to 5 years for the 20+ year wall categories. The unknown work window should follow the 0-5 year work window unless, access is gained for the site, and a wall category can be assigned that would warrant for a different inspection time frame.

4.7 GIS System

A key aspect of the City's Seawall Management System is maintaining a detailed, accurate GIS System. The City's GIS file includes the following seawall information:

-Location map with wall stationing

-Photograph

-Wall type

-Overall seawall condition

-Seawall priority number

-Date of most recent inspection