APPENDIX A

LAKE WORTH INLET

Palm Beach Harbor

NAVIGATION STUDY FOR
LAKE WORTH INLET, FLORIDA

DRAFT INTEGRATED FEASIBILITY REPORT
AND ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

ENGINEERING

USACE JACKSONVILLE DISTRICT

Attachment C
Geotechnical

NAVIGATION STUDY FOR
LAKE WORTH INLET, FLORIDA

DRAFT INTEGRATED FEASIBILITY REPORT
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ENGINEERING

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TABLE OF CONTENTS

1 Background 4
2 Regional and Local Geology 4
3 Materials Encountered 4
3.1 Entrance Channel, Area A-1 and Area B-2 4
3.1.1 Entrance Channel and B-2 up to Station 45 and Area A-1 5
3.1.2 Entrance Channel and B-2 from Station 45 to Cut 1 5
3.2 Settling Basins 6
3.3 Cut-1, Cut-2 and Area C 6
3.3.1 Cut-1 and Cut-2 6
3.3.2 Area C 7
3.4 Turning Basin, Area-D and Area-G 7
3.4.1 Turning Basin 7
3.4.2 Area D 7
3.4.3 Area G 8
4 Beneficial Use of Dredge Material 8
4.1 Beach and Nearshore Placement 8
4.2 Beneficial Use for Sea Grass Mitigation 8
5 Jetty Stability 9

INDEX OF FIGURES

Figure 1. The jetty templates, the existing surface, and the design surface. 11
Figure 2. Unsatisfactory FS of existing Southern Jetty 11
Figure 3. Adequate FS of existing Northern Jetty 12
Figure 4. Depiction of the north jetty with stabilization feature 12
Figure 5. Adequate FS of north and eastern borders of existing Northern Jetty bordering the SB 13

INDEX OF TABLES

Table 1: Lake Worth Inlet: List of Borings and Wash Probes 14

INDEX OF PLATES

Plate 1: Layout Overview 16
Plate 2: Boring Locations: Entrance Channel to STA 55, Area A-1, Area B-2 17
Plate 3: Boring Locations: Entrance Channel from STA 55 to Cut-1, Area B-2, Cut-1, Cut-2 18
Plate 4: Boring Locations: Turning Basin, Area G, Area D 19
Plate 5: Settling Basin 20
Plate 6: Summary of Geotechnical Information 21

APPENDIX:

Boring Logs and Laboratory Results: Entrance Channel, Area A-1, Area B-2 23
Boring Logs and Laboratory Results: Settling Basins 119
Sponsor Supplied Boring Logs and Laboratory Results: North Jetty and Area B-2 173
Boring Logs and Laboratory Results: Cut-1, Cut-2, Area C 200
Boring Logs and Laboratory Results: Turning Basin, Area G, Area D 223
Boring Logs and Laboratory Results: Beach 283

1 BACKGROUND

This section covers the historic and recent geotechnical information relevant to this project. Geotechnical investigations were conducted throughout the years for deepening projects as well as for maintenance dredging. Therefore a variety of historic data, such as boring logs and wash probe data are available and date as far back as 1962. Most historic borings reach below the recent maximum dredging depth, and are therefore viable data of the subsurface conditions of the proposed project. . In addition vibracore borings were advanced in June 2012. However, for the construction phase additional investigations will be required to characterize unknown areas and to define the material to greater depths in case blasting is needed.

This report includes a description of the regional and local geology, a description of the subsurface condition of the proposed widening and deepening design, and a jetty stability analysis. All borings included in this study are listed in **Table 1** and depicted in **Plates 1 through Plate 4**. Boring logs and laboratory results are attached in the **Appendix**.

The results of this geotechnical study are summarized and graphically depicted in **Plate 5.**

2 REGIONAL AND LOCAL GEOLOGY

Palm Beach County is made up of three physiographic areas: The Atlantic Coastal Ridge, the sandy flatlands and the Everglades. The formations exposed at the surface include sand, coquina and limestone deposited during the glacial epochs starting 1 to 2 million years ago.

Gray or white surface Pamlico sands mantle all of Palm Beach County east of the Everglades, except in the Loxahatchee marsh area where organic soils cover the surface. The surface sand is about 10 feet thick along the coastal ridge and the barrier beaches that are separated from the mainland by the Intracoastal Waterway. In the dune areas this sand attains a maximum thickness of about 50 feet.

Below the surface sands follows the Anastasia formation composed of sand, sandstone, limestone, coquina, and shell beds. The Anastasia Formation underlies all of eastern Palm Beach County from the beaches, where it can be up to 200 feet thick, to the edge of the Everglades, where it ranges from 40 to 50 feet.

Subsequent formations include the Tamiami, Hawthorne, Tampa, Suwannee limestone, Ocala Group and the Avon Park limestone.

3 MATERIALS ENCOUNTERED

3.1 Entrance Channel, Area A-1 and Area B-2

The Entrance Channel Area A-1 and Area B-2 analysis includes historic core borings from the 1960's and 1995, and nine (9) recent vibracore borings (VB-LWI12-01 through VB-LWI12-08, and VB-LWI12-20E). Due to the age of the historic borings, much of the material has been removed. However, they give indications of material in nearby areas that have not been dredged and have no core borings. In addition, the core borings extend below the current channel depth of -35 and -37(+2 ft allowable) MLW,

usually to -42 or -43 MLW making them viable borings. Along with the borings taken in 1995, twenty-two (22) wash probes (WB-PBH95-1 through WB-PBH95-22) were taken to define the top of rock. Borings obtained by the Town of Palm Beach (sponsor supplied borings) were also used to characterize the materials encountered.

The Entrance Channel, Area A-1 and Area B-2 can be divided in two portions based on the materials encountered:

1. The Entrance Channel and Area B-2 up to Station 45 and Area A-1 consisting of unconsolidated sediments.
2. The Entrance Channel and B-2 from Station 45 to Cut 1 consisting of rock.

Both areas are described in the following chapters. Boring locations are depicted in **Plate 2 and Plate 3.**

3.1.1 Entrance Channel and B-2 up to Station 45 and Area A-1

Unconsolidated material is present in the Entrance Channel and Area B-2 from Station 00 to Station 45. The material is composed of clean, gray, fine to medium grained, poorly graded quartz sand with trace to some small shell fragments. The sand does pack tightly with depth making it dense. The sand is primarily material that has shoaled in from the adjacent beaches and has less than 5% silt and is beach quality. Wash probes which were advanced to a maximum depth of -52 ft, and the recent vibracore borings show that this type of material extends to a minimum depth of -51 ft MLW in this portion of the channel.

Area A-1 can be characterized through field results of the recent vibracore borings (VB-LWI12-01 and VB-LWI12-02) and the borings in the channel nearby but also by the jetty extension core borings CB-LWI-SJ01-3 and CB-LWI-SJ01-6 which were advanced to –61.9 feet MLW and –52.2 feet MLW respectively. Unconsolidated sediments were encountered to 58.9 ft. MLW followed by rock in boring CB-LWI-SJ01-3 and to the end of the boring at 52.2 ft. MLW in boring CB-LWI-SJ01-6. The unconsolidated sediments consist of fine to medium grained sand with shells and a silt content of less than 5%.

Rock appears to drop off from the barrier island rapidly as shown by CB-LWI-SJ01-3 where rock was encountered at -58.9 feet.

3.1.2 Entrance Channel and B-2 from Station 45 to Cut 1

Rock is encountered at approximately -41 MLW from Station 45 throughout the rest of the Entrance Channel to Cut 1. Near Station 45 the rock is initially present in thin layers as seen in CB-38, but increases in thickness rapidly to be massive throughout the rest of the Entrance Channel to Cut-1. Rock is shown in borings CB-2, CB-3, CB-4, CB-5, CB-14, CB-22, CB-23, CB-43 and CB-44 and also in the recent vibracore borings VB-LWI12-06, VB-LWI12-07, and VB-LWI12-08, and in various rock probes. The borings extend to approximately -43 MLW and it is not known what the lithology is below this depth. The rock is described as a limestone or sandstone being moderately hard to hard, fossiliferous, porous, permeable, very friable, shelly and sandy with 10% to 50% calcareous matrix. It is often referred to as “coquina” and is part of the Anastasia Formation. Although most of the rock shown on the boring logs has already been dredged from the channel without blasting to -36 to -40 ft. MLW, without additional deeper borings it can’t be determined if this type of material continues..

The material encountered in the proposed widening area B-2 north of the entrance channel is represented in 2 sponsor supplied core borings (DM-3 and DM-4) which were performed in 1996 for the sand transfer plant by the Town of Palm Beach. The report includes a total of six borings (named B-1, B-2, DM-3 DM-4, DM-5, and DM-6) and is included in the **Appendix**. Only descriptive locations were given

for those borings therefore the plotted locations on **Plate 2** are approximate. These borings together with boring CB-4 and CB-43 located at the northern edge of the Entrance Channel verify the extension of the rock having a top elevation of approximately -25 ft. MLW. Unconfined compressive strength tests (UCS) performed on the rock from boring DM-3 ranging from 4545 pounds per square inch (psi) to 303 psi. The average strength for the boring was 1400 psi. The test with 4545 psi seems to be an anomaly from the rest of the area indicating an isolated dense layer at 30 feet and boring descriptions indicate it is only one foot thick. This layer may also occur in other areas, further supporting the allowance of blasting. All test results are included with the sponsor supplied boring logs in the **Appendix**.

3.2 Settling Basins

The current footprint of the Settling Basins is depicted in **Plate 5** and consisting of Settling Basin, Extended Settling Basin, and Expanded Settling Basin has currently an elevation of -10 to -30 ft. MLW. It is planned to dredge all Settling Basins to an elevation of -33 +2 ft MLW during the next dredging event in winter 2012.

Borings CB-LWI-PSB01-1 thru CB-LWI-PSB01-9, CB-LWI-SB01-1 thru CB-LWI-SB01-4, CB-PBH95-4 and CB-PBH95-5 are located in the footprint of the current Settling Basin Design. The borings were drilled to a depth of -35 ft. MLW. The material consists of sand and silty sand with a trace to some small shell fragments. In borings CB-LWI-PSB01-4, and CB-LWI-PSB01-7 through CB-LWI-PSB01-9, silty sand is encountered with silt contents as high as 22%. Wash probes were advanced in the Settling Basins showing no rock to -44.4 ft. MLW. The only rock encountered was in boring CB-LWI-PSB01-1, located in the upper northwest corner, where hard, vuggy, fossiliferous limestone was found at -30.9 MLW. The boring terminated in the rock at -35 MLW.

The material in the South-Eastern Portion of the Proposed Settling Basin (see Plate 5) consists of beach and nearshore compatible sands and silty sands to a depth of -35 ft. MLW.

No borings have been drilled in the North Western Portion of the Proposed Settling Basin (see Plate 5), and the character of materials is not known.

3.3 Cut-1, Cut-2 and Area C

All of the core borings in Cut 1 and Cut 2 are from 1962 and 1964. Due to the age of the borings, much of the material has been removed. However, they give indications of material in nearby areas such as Area C that have not been dredged and have no core borings. In addition, the core borings extend below the current channel depth of -35 (+2 ft allowable) MLW, usually ranging from -41 to -43 MLW making them viable borings for characterizing the material. Results from the recent vibracore borings in Cut-1, Cut-2 and Area C (VB-LWI12-09 through VB-LWI12-12) give additional information. All boring locations for Cut-1, Cut-2 and Area C are depicted in **Plate 3**.

3.3.1 Cut-1 and Cut-2

The unconsolidated material within Cut-1, Cut-2, and Area C consists of, gray, fine to medium grained, poorly sorted quartz sand with less than 5% silt passing the #200 sieve. The shell content varies from a trace to some small shell fragments. The sand is primarily material that has shoaled in from the adjacent beaches and is beach or nearshore quality.

With lower depths of Cut 1 and Cut-2 rock is present as a continuance of the Entrance Channel. The rock contains less shell and is primarily sandstone that is hard but very porous, permeable and friable with a low degree of cementation. The rock becomes less massive and is often layered with clean quartz sand as Cut-2 approaches the Turning Basin. Borings CB-18 and CB-20 show thick sand layers (> 5feet) underneath the rock at -35 and -38 ft MLW respectively and borings CB-19, CB-21, and VB-LWI2012-11 terminate in rock at the deeper depths but contained sand deposits above. This leads to the conclusion that the geology toward the turning basin changes from massive rock to interfingering layers of rock and unconsolidated sediments. Therefore excavation of the rock should become easier in Cut-2 due to a lower percentage of rock and influx of sand.

3.3.2 Area C

Area C is situated immediately north to Cuts 1 and 2. Three recent vibracores (VB-LWI12-09, VB-LWI12-10, and VB-LWI12-12) have been advanced to -24, -16, and -57 ft. MLW respectively. Borings VB-LWI12-09 and VB-LWI12-10 with shallow top elevations of -22 and -13 ft. MLW respectively, refused in rock after 2 to 3 feet. The rock is composed of hard to moderately hard sandstone and limestone. Vibracore boring VB-LWI2012-12 located closer to the turning basin with a top elevation of 38.5 feet MLW revealed the presence of sand, and silty sand underlain by rock at a depth of 51.9 feet. This supports the conclusion that the geology toward the turning basin changes from massive rock to interfingering layers of rock. Overall rock is predominant throughout Area C, resembling the conditions of Cut-1 and Cut-2 described above and may need blasting for removal pending equipment used.

3.4 Turning Basin, Area-D and Area-G

Seven (7) vibracore borings (VB-LWI12-13 through VB-LWI12-19) have been collected in 2012 in the Southern Turning Basin, Area-D and Area-G. In addition core borings from 1965 give viable information about the dredged materials, even though most of the surficial material has been removed the core borings extend below the current depth of the turning basin, usually ranging to -41 to -43 MLW. In addition, those borings give indications of the material still in place in Area D and Area G which never have been dredged. The 2011 hydro survey shows elevations between -33 to -39 ft. MLW in the Turning Basin, between -7 to -33 ft. MLW in Area D, and -5 to -30 ft. MLW in Area G. Boring locations for the Turning Basin, Area-D and Area G are depicted in **Plate 4.**

3.4.1 Turning Basin

The majority of the material in the Turning Basin is interfingering layers of sand and silty sand with limestone and calcareous sandstone layers throughout. The rock can be present in thin beds or in 1 to 2 foot thick layers and is usually moderately hard, highly fractured and filled with sand seams. Unconsolidated, beach compatible material composed of gray, fine to medium grained, poorly sorted quartz sand with trace to little silt and trace to some small shell fragments is present to -42 ft MLW in the north western portion of the Turning Basin (VB-LWI12-16, CB-29).

White milky turbidity plumes were observed in the water during vibracoring especially in the western portion of the Turning Basin.

3.4.2 Area D

Area D is located just south of Peanut Island and has never been dredged. One vibracore boring (VB_LWI12-14) was advanced to -42 ft. MLW in this area. Historical core borings CB-28, CB-31, and CB-

34 are located immediately adjacent of Area-D in the Turning Basin and extend vertical from approximately -17 ft. MLW to -41 ft. MLW. The material encountered consists of gray sand and silty sand to approximately -33 ft. MLW followed by interfingering layers of sand with rock similar to what was encountered in the rest of the Turning Basin.

3.4.3 Area G

Area G is located immediately south of the Turning Basin. Two vibracore borings VB_LWI12-18 and VB_LWI12-19 were advanced in Area G to -37.1 and 39.7. ft. MLW respectively. Nearby borings CB-30, CB-33 and CB-37 extending from -7 ft. MLW to -46 ft. MLW give additional information. The material encountered in vibracore boring VB-LWI12-19 consists of gray sand and silty sand to an approximate elevation of -38.5 ft. MLW, followed by soft limestone to the end of the boring at -39.7 ft. MLW. Vibracore boring VB-LWI12-18 located in the eastern portion of Area G encountered gray sand and silty sand to -27.1 ft. MLW followed by soft sandstone to the end of the boring at 37.1 ft. MLW. The rock layers are very soft and were easily penetrated by the vibracore unit.

4 BENEFICIAL USE OF DREDGE MATERIAL

4.1 Beach and Nearshore Placement

Dredged material from maintenance dredging of the entrance channel and the current settling basins has been continually place at the beach and in the nearshore. The unconsolidated material from the Entrance Channel, Area A-1, Area B-2 to STA 45 is composed of clean, gray, fine to medium grained, poorly graded quartz sand with trace to some small shell fragments and is also beach quality.

The material at the beach consists of sands composed of mostly fine to coarse grained sand-sized quartz and some medium sand sized sub angular shell fragments. Three core borings (CB-LWI99-1 thru CB-LWI99-3) advanced at the beach south of the Entrance channel provide additional information of the beach material. The material present in the Entrance Channel, Area A-1, Area B-2 to STA 45 as described above is compatible with that on the existing beach.

The logs and laboratory data of the beach borings are included in the **Appendix**.

4.2 Beneficial Use for Sea Grass Mitigation

A minimum of 45,000 cubic yards (cuyd) of sand and silty sand with less than <15% fines from Area G and the Turning Basin will be available for beneficial use as sea grass mitigation capping material.

5 JETTY STABILITY

Purpose

A slope stability analysis was performed for the Lake Worth Inlet project to determine if the proposed dredging design template would impact the stability of the existing jetties located to the north and south sides of the proposed dredging.

Slope Stability Analysis Software

The slope stability analysis was performed using SLOPE/W with models created using cross-sections taken along the channel stationing. The existing condition of both the north and south jetties were then analyzed for both the existing template and the proposed design template. SLOPE/W is a component of the software suite GeoStudio, created by Geo-Slope International. The version used in the analysis was, GeoStudio 2004 (Version 6.22).

Existing Jetty Conditions

Foundation Elevation: Per a letter titled "Town of Palm Beach 1986 CCMP Chapter 5 Lake Worth Inlet.pdf", the initial construction of the jetties is described as follows:

> Lake Worth Inlet was originally constructed in its present location between 1918 and 1925 by the Lake Worth Inlet District as part of the Port of Palm Beach development. Initially the inlet was 750 feet wide with a 300 foot wide dredged channel and a project depth of 15 to 18 feet MLW. Two rubble mound jetties 750 feet apart were constructed and extended to the 21-foot depth contour as it existed at that time. The North and South jetties were 1700 and 2150 feet long, respectively.
>
> In 1934 the Federal Government authorized funds to maintain a 16 foot inlet channel. The Corps of Engineers assumed responsibility for the maintenance of the inlet under the authorization of the River and Harbor Act of August 30, 1935.

Extending to the "21-foot depth contour" was interpreted to mean that the seaward extent of the jetty structure (i.e. the seaward toe of jetty) terminates at elevation -21.0 feet MLW (-23.5 NAVD88).

Archived USACE plans for proposed repairs to the north jetty dated 1934 depict raising the crest elevation, and consequently widening the cross-section of the existing jetties. Unfortunately, they do not note the jetty foundation elevation since the stone was placed on top of the existing jetty which was constructed between 1918 and 1925.

The models developed for slope stability analysis, assumed the foundation of the jetty to be at elevation -21.0 feet MLW (-23.5 feet NAVD88). All elevations for the purposes of the Geotechnical analysis herein are referenced to NAVD88. The final plans and specifications will be referenced in the project datum, MLLW.

Profile Geometry: The archived USACE plans for proposed repairs to the north jetty dated 1934 also show the north jetty side slopes at one foot vertical to two feet horizontal along alignment and one foot

vertical to three feet horizontal at head of the jetty as the crest tapers down seaward, terminating at 21-foot (MLW) depth contour as stated in the referenced document above. The geometry for the channel and existing side slopes were determined by hydrographic and topographic surveys which were merged to display a complete surface of the channel as well as the north and south jetties. The initial mapping was submitted to the USACE on March 29, 2002 by Charley Foster and Associates, Inc. The survey length was approximately 4000 feet, extending to the east 200 feet of the jetties and terminating in the west where the north jetty turns to the north.

Existing Jetty Stability

A. South Jetty: The 2002 survey showed an area extending from approximately STA 42+50 (the jetty toe) to STA 45+50. This area contained existing side slopes steeper than one foot vertical to two feet horizontal. Since the exact elevation of the bottom of the jetty foundation at these locations was not defined by the survey or any other know documentation, SPT borings in the vicinity were used to estimate this material to be high blow count sand. Due to the unknown jetty foundation location as described above, the most conservative analysis was performed, assuming that between elevation -23.5 and -30.0 the material was high blow count sand and not jetty stone. The results indicated that at this isolated area, the south jetty in its current state has an inadequate factor of safety.

B. North Jetty: The 2002 survey indicated no specific areas of concern where slopes were less than 1 foot vertical to 2 feet horizontal. Analysis found that the jetty is stable in its current state.

With Project Conditions

Modeling Approach

Slope stability analysis was completed for Lake Worth Inlet to determine if the dredging limits would impact jetty stability. Model geometry was based on the survey data and historical records mentioned above.

Models were created at critical stationing for the north and south jetties. Critical stationing was defined as areas where the channel footprint would come closest to the jetties. Once models were completed, it was determined that an additional 15’ horizontal bench should be added to the toe of the jetty as an additional safety measure. This was completed due to the somewhat uncertain nature of dredging accuracy. The jetty outline, with the additional 15’ horizontal bench, became the jetty template that was used throughout the analysis. The jetty template was then added to cross sections. Figure 1 shows the jetty templates, the existing surface, and the design surface.

Per guidelines in the USACE manual Geotechnical Engineering in the Coastal Zone dated 1987, coastal embankments (structures) shall have safety factors of or greater than 1.5.

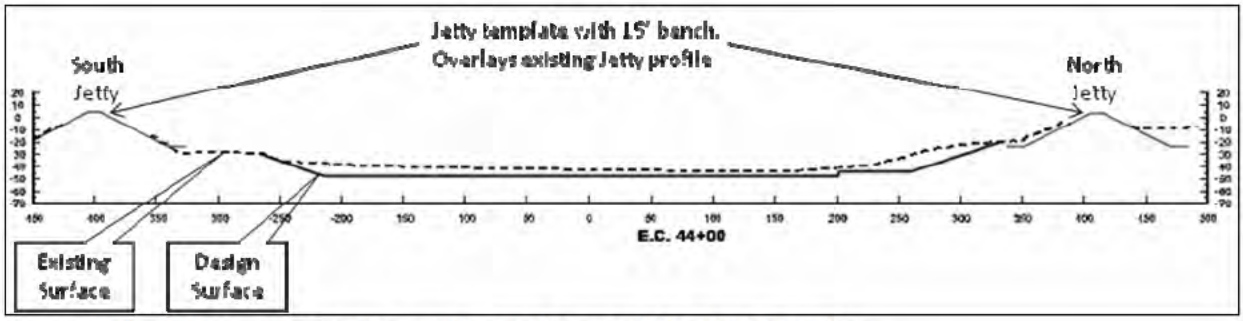


Figure 1. The jetty templates, the existing surface, and the design surface.

Model Parameters

Model parameters were based on estimates from existing core boring and vibracores obtained adjacent to the jetties. Detailed information regarding the data collected can be found above under Section 2 titled "Investigations". Soil parameter estimates were based on SPT blow counts, geologist's description of material, and past experience modeling similar materials. Values used in analysis are listed below.

	Unit Weight	Cohesion	Phi
Jetty (Rock)	150	0	40
Unconsolidated Sediments (Sand)	120	0	32
Interfingering Unconsolidated Sediments (Rock)	135	0	40

South Jetty

For the existing conditions, as mentioned above, model results showed an inadequate factor of safety from the jetty toe (STA 42+50) to approximately STA 45+50. This is due to existing steep side slopes from elevations approximately -23.5 to -30. The design channel did not impact jetty stability since the dredged template meets the existing surface approximately 50' north of the steepened areas. Figure 2 shows the factor of safety within this stationing and demonstrates that the dredged channel will not impact the existing southern jetty.

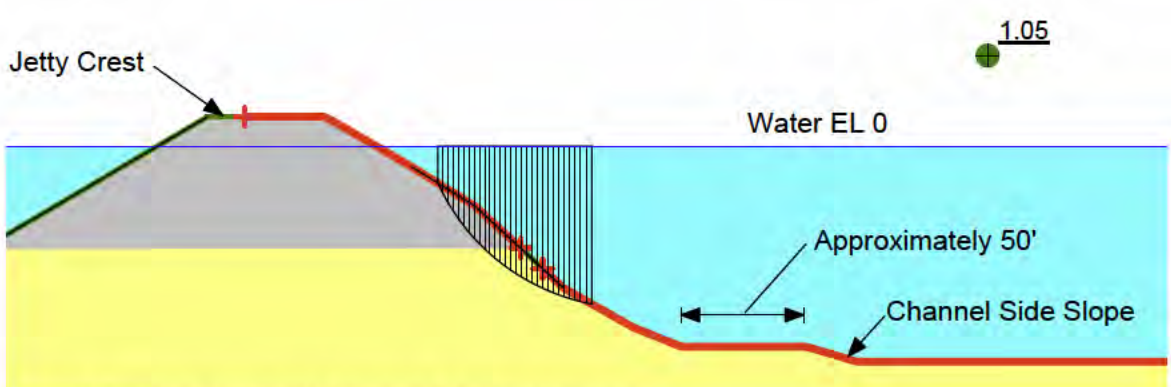


Figure 2. Unsatisfactory FS of existing Southern Jetty

North Jetty

Model results showed an adequate factor of safety greater than 1.5 for existing conditions (Figure 3). Once existing conditions showed satisfactory, the proposed design template was evaluated so that it didn't infringe on the jetty template. The settling basins that borders the jetty tip to the north, east, and south were also evaluated to determine their effect on jetty stability.

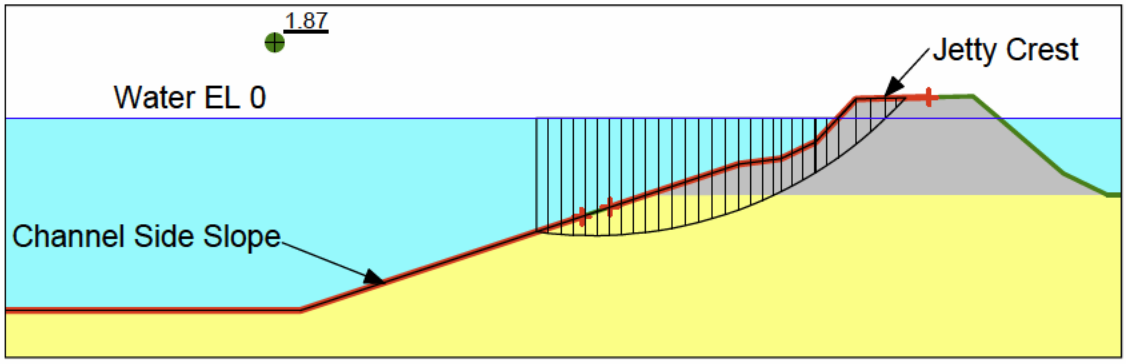


Figure 3. Adequate FS of existing Northern Jetty

Where the channel overlapped the jetty template (STA 39+00 to 44+00), the channel was either adjusted or jetty stabilization measures were implemented. Where channel adjustments were made, advanced maintenance was eliminated.

An abbreviated area, from approximately STA 38+75 to 40+75, required advance maintenance due to the vast amount of sand that shoals around the jetty tip. For this area a jetty stabilization feature will be implemented approximately 330 feet from the centerline of the channel. The jetty stabilization feature consists of a sheet pile wall placed near the jetty toe. This feature will prevent the jetty foundation from sliding into the dredged channel. Due to a lack of geotechnical data, the stabilization feature was preliminarily evaluated using CWALSHT, a sheetpile analysis and design program, with all the input parameters being estimated based on the best available data. Based on this analysis, a PZC-26 sheet extending to elevation -60.0 is recommended to stabilize the existing jetty. This preliminary evaluation was performed in order to provide sufficient detail to have the feature priced. Design details such as the exact location, width, depth, and sheet pile type will need to be refined at the PED phase using actual design values from the geotechnical exploration. Figure 4 depicts the profile of the jetty stabilization measure. Values used in analysis are listed below.

	Unit Weight	Cohesion	Phi
Jetty (Rock)	140	0	40
Unconsolidated Sediments (Sand)	125	0	32

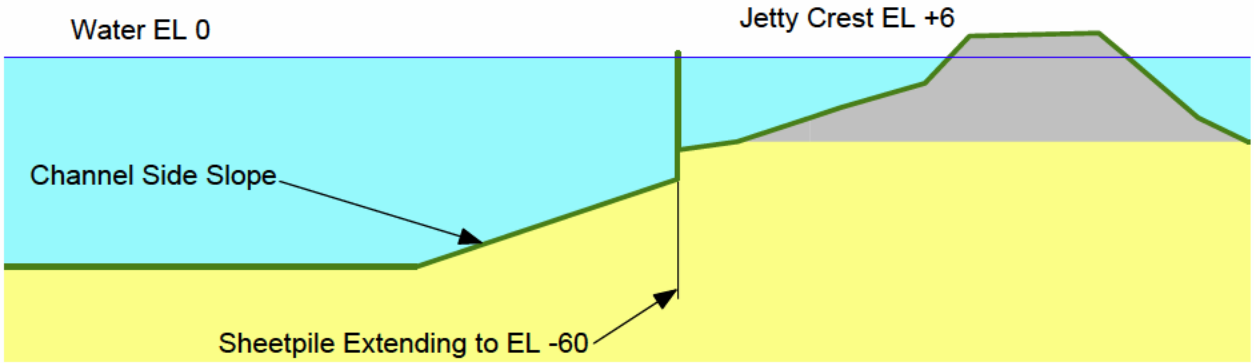


Figure 4. Depiction of the north jetty with stabilization feature.

Dredging Limits for Settling Basin

The configuration for the settling basin was optimized to capture the maximum amount of sand before it enters the entrance channel. Details of the analysis can be found in the Hydrodynamic and Sediment Transport Modeling within the Engineering Appendix. The sediment transport analysis determined that it would be highly beneficial if the basin could be moved as close as possible to the northern jetty. The north, east, and southern areas of the northern jetty were evaluated in SLOPE/W to ensure this dredging would not negatively impact the jetty. The northern and eastern borders of the jetty and settling basin intersect were acceptable as can be seen in Figure 5. This was due in large part by the shallow depths required within the settling basin. The southern border of the jetty required the stabilization feature (sheet pile) due to the deeper settling basin dredged depth and its closer proximity.

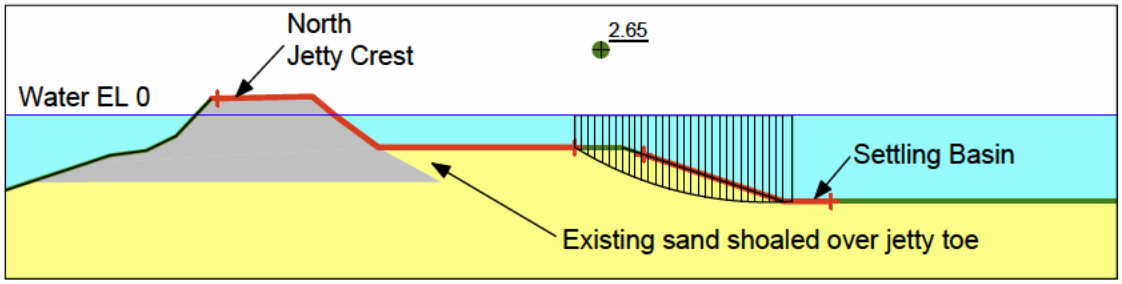


Figure 5. Adequate FS of north and eastern borders of existing Northern Jetty bordering the Settling Basin

Table 1

Lake Worth Inlet: List of Borings and Washprobes

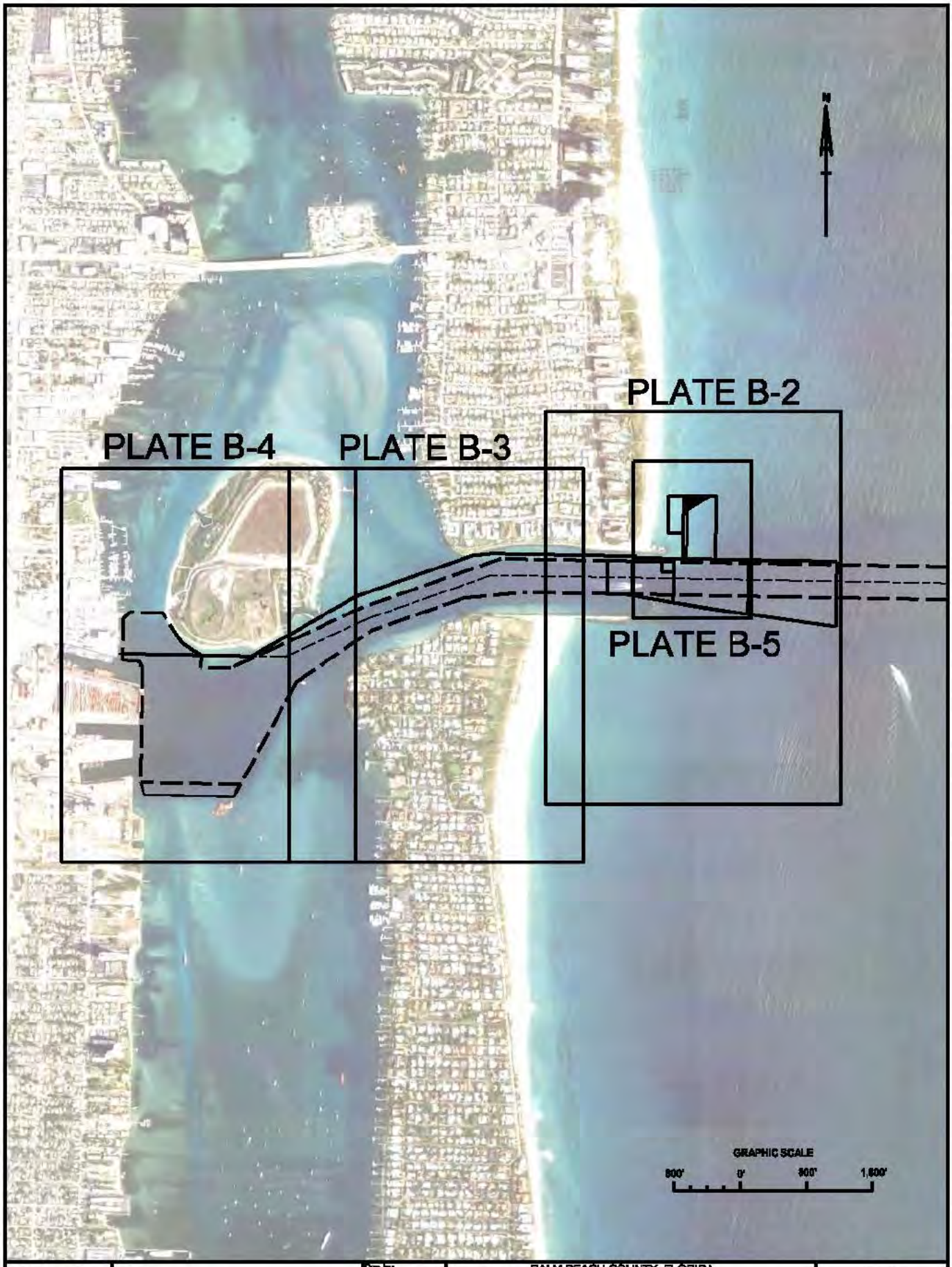
BORING	Type	NAD27		NAD83		Bottom of Boring	Area
		X	Y	X	Y		
CB-1	CB	815,920	887,550	972157	887713	42	Entrance Channel
CB-2	CB	815,120	887,590	971357	887753	43.3	Entrance Channel
CB-3	CB	815,125	887,285	971362	887448	41.7	Entrance Channel
CB-4	CB	814,410	887,700	970647	887863	42	Entrance Channel
CB-5	CB	814,270	887,405	970507	887568	42	Entrance Channel
CB-14	CB	814,440	887,590	970677	887753	42.5	Entrance Channel
CB-22	CB	814,915	887,575	971152	887738	42.4	Entrance Channel
CB-23	CB	814,370	887,360	970607	887523	43.4	Entrance Channel
CB-38	CB	815,380	887,560	971617	887723	42.8	Entrance Channel
CB-39	CB	815,730	887,485	971967	887648	43.2	Entrance Channel
CB-40	CB	815,880	887,620	972117	887783	43.1	Entrance Channel
CB-41	CB	816,780	887,600	973017	887763	42.8	Entrance Channel
CB-42	CB	817,320	887,600	973557	887763	42.5	Entrance Channel
CB-43	CB	814,700	887,690	970937	887853	42.5	Entrance Channel
CB-44	CB	814,680	887,320	970917	887483	41.6	Entrance Channel
CB-PBH95-1	CB	814,427	887,420	973840	887446	42.3	Entrance Channel
CB-PBH95-2	CB	817,221	887,325	973458	887488	41	Entrance Channel
CB-PBH95-3	CB	816,935	887,502	973172	887665	42.2	Entrance Channel
CB-PBH95-6	CB	815,526	887,492	971763	887655	40.1	Entrance Channel
CB-PBH95-7	CB	814,926	887,504	971163	887667	41.3	Entrance Channel
CB-PBH95-8	CB	814,524	887,582	970761	887745	40.3	Entrance Channel
VC-5[1]	VB	817,491	887,356	973728	887518	55	Entrance Channel
WB-PBH95-1	WP	814,427	887,420	970664	887583	42.3	Entrance channel
WB-PBH95-2	WP	814,520	887,577	970757	887740	40.5	Entrance channel
WB-PBH95-3	WP	814,722	887,585	970959	887748	41.7	Entrance channel
WB-PBH95-4	WP	814,927	887,313	971164	887476	42.2	Entrance channel
WB-PBH95-5	WP	815,032	887,665	971269	887828	41	Entrance channel
WB-PBH95-6	WP	815,220	887,385	971457	887548	47.5	Entrance channel
WB-PBH95-7	WP	815,422	887,549	971659	887712	41.4	Entrance channel
WB-PBH95-8	WP	815,675	887,370	971912	887533	41	Entrance channel
WB-PBH95-9	WP	815,813	887,596	972050	887759	52	Entrance channel
WB-PBH95-10	WP	816,118	887,317	972355	887480	52.4	Entrance channel
WB-PBH95-12	WP	816,328	887,597	972565	887760	45.9	Entrance channel
WB-PBH95-13	WP	816,422	887,322	972659	887485	49	Entrance channel
WB-PBH95-15	WP	816,624	887,432	972861	887595	47.1	Entrance channel
WB-PBH95-17	WP	816,721	887,590	972958	887753	45.7	Entrance channel
WB-PBH95-18	WP	816,925	887,375	973162	887538	45.5	Entrance channel
WB-PBH95-19	WP	817,127	887,554	973364	887717	47.3	Entrance channel
WB-PBH95-20	WP	817,331	887,372	973568	887535	46.6	Entrance channel
WB-PBH95-21	WP	817,514	887,450	973751	887613	47.1	Entrance channel
WB-PBH95-22	WP	817,603	887,300	973840	887463	46.7	Entrance channel
VB-LWI2012-03	VB			971933.5	887366.3	48.7	Entrance Channel
VB-LWI2012-04	VB			973544.6	887689.9	59.5	Entrance Channel
VB-LWI2012-05	VB			972557	887705.6	62.3	Entrance Channel
VB-LWI2012-06	VB			972192.8	887927.5	35.6	Entrance Channel
VB-LWI2012-07	VB			970831.9	887854.8	25.7	Entrance Channel
VB-LWI2012-08	VB			970279	887494.2	46	Entrance Channel
VB-LWI2012-20E	VB			972342	887956.8	29.6	Entrance Channel
VB-LWI2012-01	VB			973876.6	887227.6	51.6	Area A-1
VB-LWI2012-02	VB			973295.1	887326	53	Area A-1
CB-LWI-SJ01-3	CB	816,104	887,141	972341	887304	61.9	Area A-1
CB-LWI-SJ01-6	CB	816,469	887,125	972706	887288	52.2	Area A-1
B-2[1]	CB			970637	887201	97.01	South Jetty
B-1[1]	CB			972139	888070	92.71	North Jetty and Area B-2
DM-3[1]	CB			971495	888014	71.75	North Jetty and Area B-2
DM-4[1]	CB			971498	887973	43.8	North Jetty and Area B-2
DM-5[1]	CB			971623	887974	44.8	North Jetty and Area B-2
DM-6[1]	CB			971550	888013	28	North Jetty and Area B-2
CB-PBH95-4	CB	816,621	887,739	972858	887902	36.6	Settling Basins
CB-PBH95-5	CB	816,636	887,707	972873	887870	41	Settling Basins
CB-LWI-PSB01-1	CB	816,502	888,542	972739	888705	35	Settling Basins
CB-LWI-PSB01-2	CB	816,690	888,531	972927	888694	34.8	Settling Basins
CB-LWI-PSB01-3	CB	816,901	888,531	973138	888694	34.7	Settling Basins

Table 1

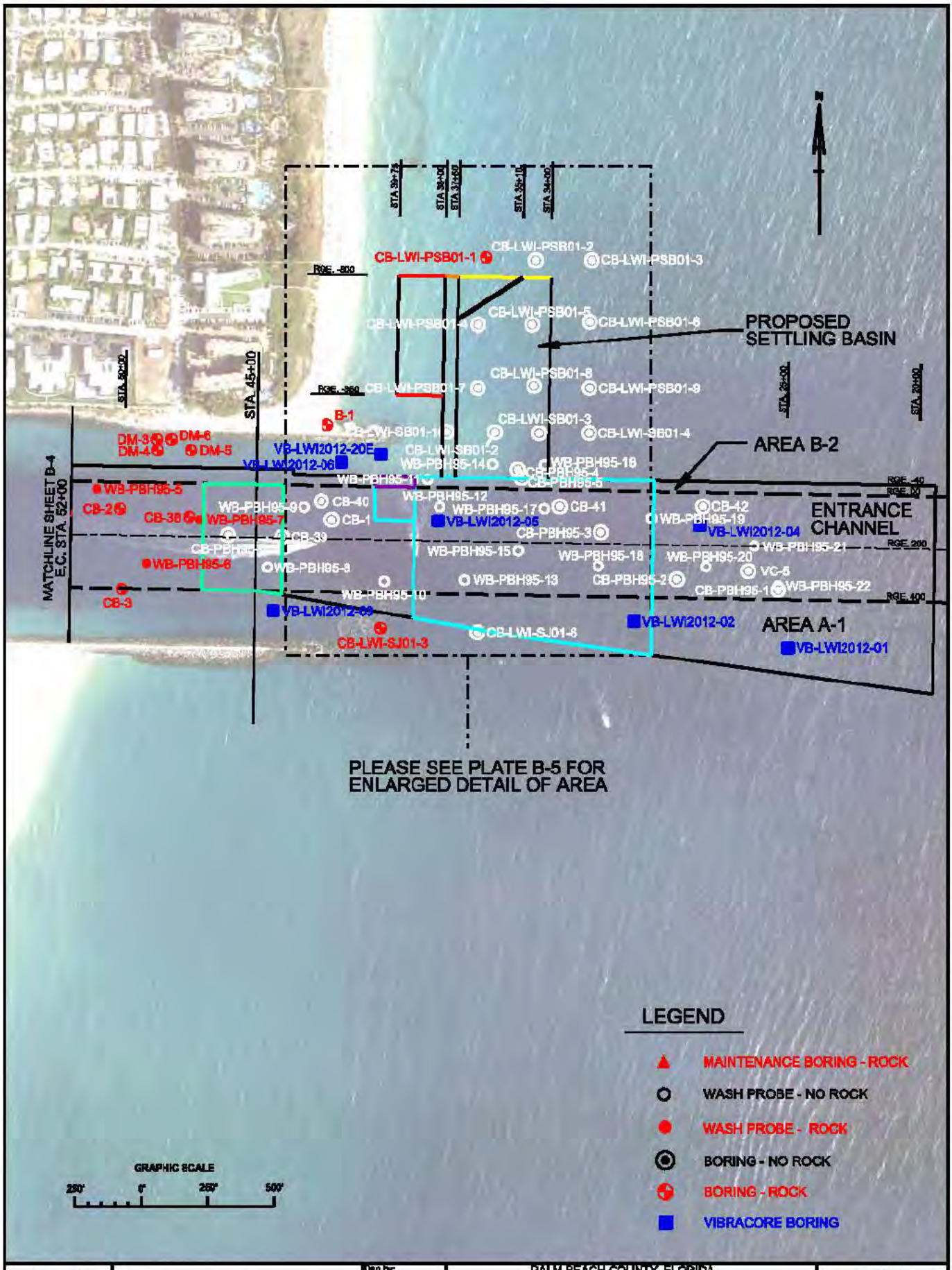
Lake Worth Inlet: List of Borings and Washprobes

BORING	Type	NAD27		NAD83		Bottom of Boring	Area
		X	Y	X	Y		
CB-LWI-PSB01-4	CB	816,473	888,289	972710	888452	35.2	Settling Basins
CB-LWI-PSB01-5	CB	816,676	888,289	972913	888452	35.3	Settling Basins
CB-LWI-PSB01-6	CB	816,893	888,299	973130	888462	35.3	Settling Basins
CB-LWI-PSB01-7	CB	816,471	888,050	972708	888213	35	Settling Basins
CB-LWI-PSB01-8	CB	816,683	888,058	972920	888221	35	Settling Basins
CB-LWI-PSB01-9	CB	816,892	888,050	973129	888213	35	Settling Basins
CB-LWI-SB01-1	CB	816,353	887,881	972590	888044	35.7	Settling Basins
CB-LWI-SB01-2	CB	816,535	887,880	972772	888043	35.9	Settling Basins
CB-LWI-SB01-3	CB	816,703	887,879	972940	888042	34.9	Settling Basins
CB-LWI-SB01-4	CB	816,891	887,877	973128	888040	35.2	Settling Basins
WB-PBH95-11	WP	816,282	887,701	972519	887864	42	Settling Basins
WB-PBH95-14	WP	816,527	887,758	972764	887921	43.9	Settling Basins
WB-PBH95-16	WP	816,723	887,755	972960	887918	44.4	Settling Basins
CB-6	CB	813,880	887,530	970117	887693	41.7	Cut-1
CB-7	CB	813,765	887,500	970002	887663	42.6	Cut-1
CB-8	CB	813,300	887,310	969537	887473	42	Cut-1
CB-9	CB	813,340	887,190	969577	887353	42	Cut-1
CB-10	CB	812,850	887,150	969087	887313	42.8	Cut-1
CB-15	CB	813,915	887,220	970152	887383	43	Cut-1
CB-16	CB	813,665	887,330	969902	887493	43.2	Cut-1
CB-17	CB	813,190	887,140	969427	887303	41.3	Cut-1
CB-18	CB	812,400	886,775	968637	886938	42.9	Cut-2
CB-19	CB	812,185	886,800	968422	886963	40.8	Cut-2
CB-20	CB	811,750	886,595	967987	886758	40.8	Cut-2
CB-21	CB	812,000	886,520	968237	886683	41.4	Cut-2
VB-LWI2012-11	VB			968516.7	886930.2	48.6	Cut-2
VB-LWI2012-09	VB			969656.9	887693	38.2	Area C
VB-LWI2012-10	VB			968825	887409.7	32.5	Area C
VB-LWI2012-12	VB			967955.8	886964.8	60.7	Area C
CB-WP97-2	CB	811,209	886,545	967446	886708	38	Turning Basin
CB-24	CB	810,135	885,480	966372	885643	41.1	Turning Basin
CB-26	CB	809,730	886,585	965967	886748	41	Turning Basin
CB-27	CB	809,860	885,880	966097	886043	41.2	Turning Basin
CB-28	CB	810,200	886,540	966437	886703	41.1	Turning Basin
CB-29	CB	810,180	886,050	966417	886213	41	Turning Basin
CB-30	CB	810,180	885,210	966417	885373	41.4	Turning Basin
CB-31	CB	810,700	886,280	966937	886443	41.2	Turning Basin
CB-32	CB	810,700	885,840	966937	886003	40.8	Turning Basin
CB-33	CB	810,700	885,285	966937	885448	46.1	Turning Basin
CB-34	CB	811,235	886,480	967472	886643	41.6	Turning Basin
CB-35	CB	811,180	886,130	967417	886293	41	Turning Basin
CB-36	CB	811,175	885,560	967412	885723	41.6	Turning Basin
CB-37	CB	811,180	885,180	967417	885343	41.5	Turning Basin
CB-PBH95-9	CB	810,665	886,735	966220	887195	27.6	Turning Basin
CB-PBH95-11	CB	809,924	886,867	966161	887030	28.3	Turning Basin
CB-PBH95-12	CB	810,046	886,932	966283	887094	36.7	Turning Basin
VB-LWI2012-13	VB			967726.9	886421.4	51.5	Turning Basin
VB-LWI2012-15	VB			967296.5	886039.7	56.8	Turning Basin
VB-LWI2012-16	VB			966405.2	886335.4	54.3	Turning Basin
VB-LWI2012-17	VB			966629.6	885712	53	Turning Basin
VB-LWI2012-14	VB			966952.6	886601.6	50.6	Area D
VB-LWI2012-18	VB			966973.3	885073.5	40.7	Area G
VB-LWI2012-19	VB			966230	885125.2	41.7	Area G
CB-LWI99-1	CB	814,524	886,552	970765	886715	21	Beach
CB-LWI99-3	CB	814,086	884,230	970323	884393	24.4	Beach
CB-LWI99-2	CB	814,266	885,750	970503	885913	7.5	Beach

CB= Core Boring
VB= Vibracore Boring
WP= Washprobe
[1] Sponser Supplied Borings



US Army Corps of Engineers Jacksonville District	GEOTECHNICAL DRAWINGS NOT FOR CONSTRUCTION	Dwn by: BJS	PALM BEACH COUNTY, FLORIDA	PLATE
		Dwn by: CJB	LAKE WORTH FEASABILITY STUDY	B-1
	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	Chd by: BJS		
		Dated: AUG 2012	OVERVIEW MAP	



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Jacksonville District

GEOTECHNICAL DRAWINGS
NOT FOR CONSTRUCTION

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Dwn by: BJS
Dwn by: CJB
Chkd by: BJS
Dated: AUG 2012

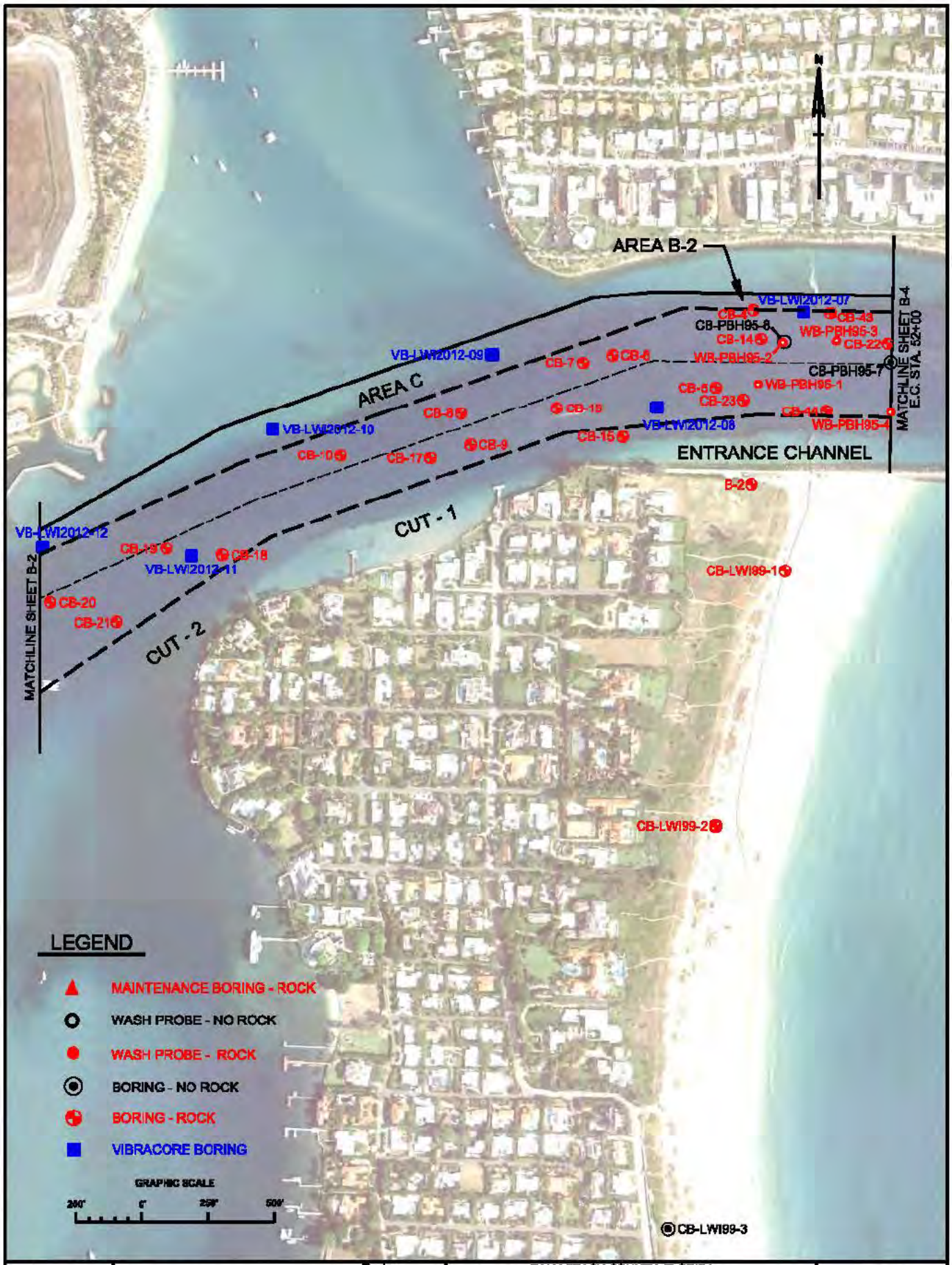
PALM BEACH COUNTY, FLORIDA

LAKE WORTH FEASABILITY STUDY

BORING LOCATION PLAN

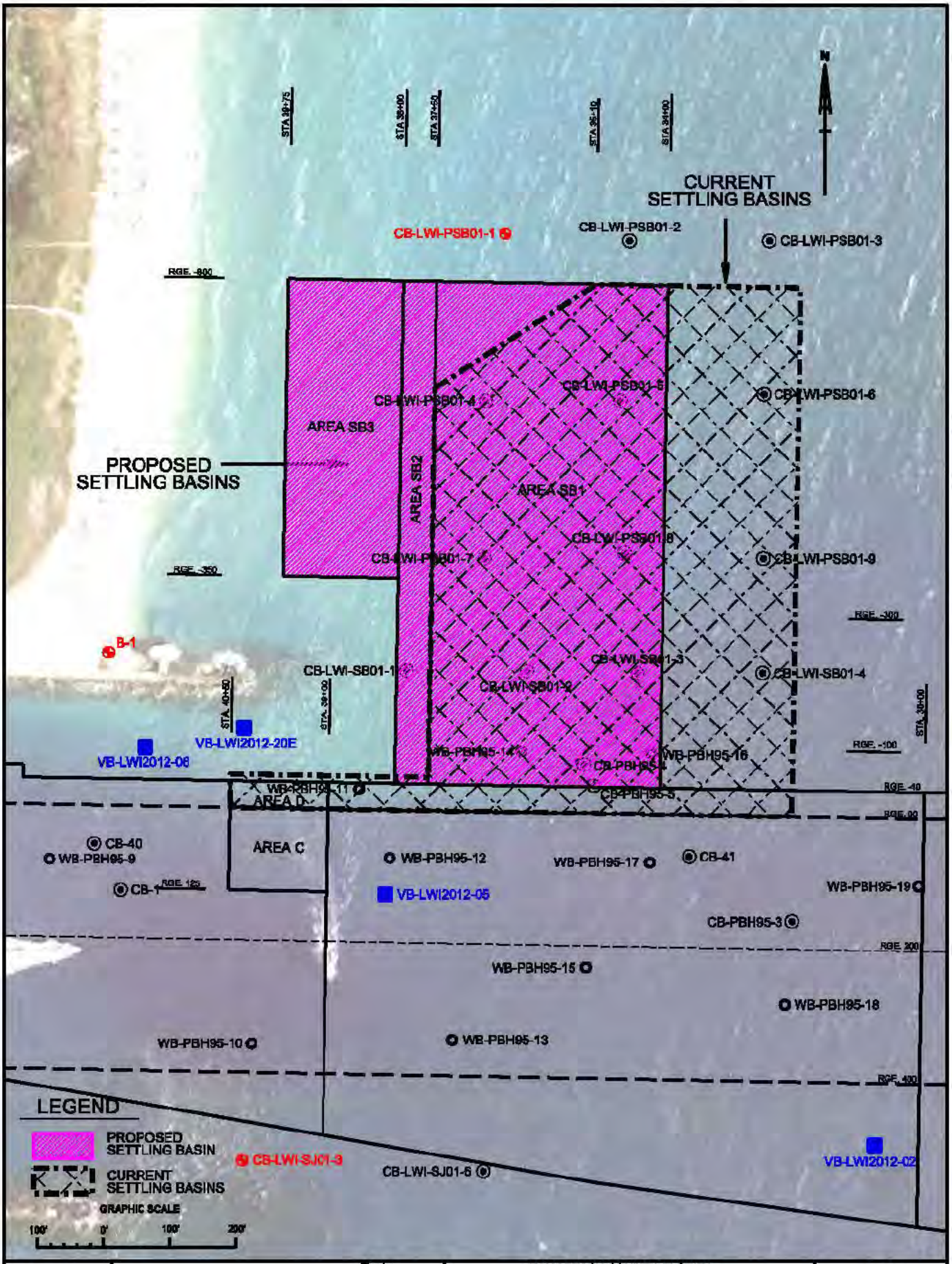
PLATE

B-2



US Army Corps of Engineers Jacksonville District	GEOTECHNICAL DRAWINGS NOT FOR CONSTRUCTION	Dsn by: BJS	PALM BEACH COUNTY, FLORIDA	PLATE
		Dwn by: CJB	LAKE WORTH FEASABILITY STUDY	B-3
	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	Ckd by: BJS		
		Dated: AUG 2012	BORING LOCATION PLAN	

US Army Corps of Engineers Jacksonville District	GEOTECHNICAL DRAWINGS NOT FOR CONSTRUCTION	Dsn by: BJS	PALM BEACH COUNTY, FLORIDA	PLATE
		Dwn by: CJB	LAKE WORTH FEASABILITY STUDY	B-4
	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	Ckd by: BJS		
		Dated: AUG 2012	BORING LOCATION PLAN	



US Army Corps of Engineers Jacksonville District

GEOTECHNICAL DRAWINGS NOT FOR CONSTRUCTION

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Dsn by: BJS
Dwn by: CJB
Ckd by: BJS
Dated: AUG 2012

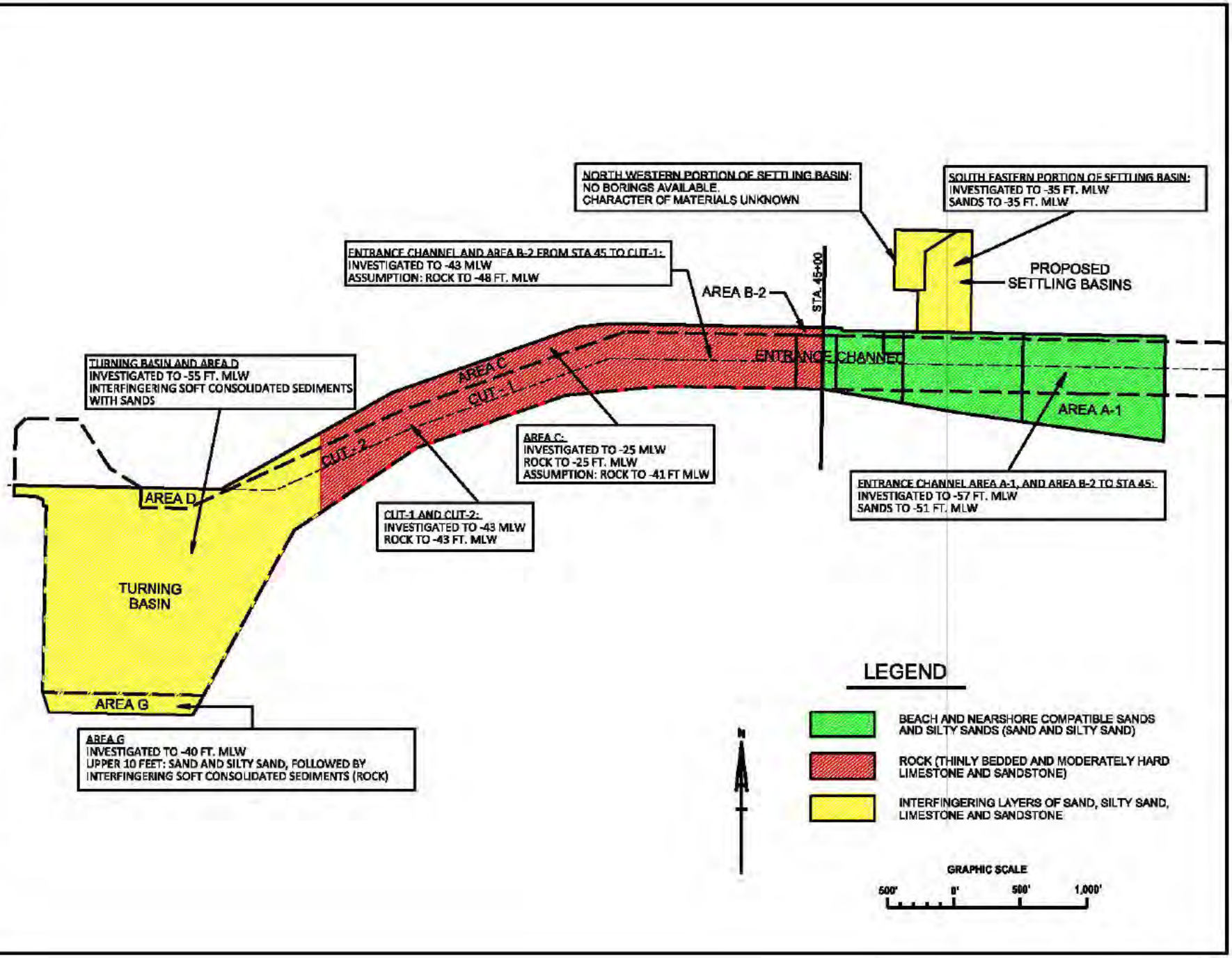
PALM BEACH COUNTY, FLORIDA

LAKE WORTH FEASABILITY STUDY

SETTLING BASIN DETAIL

PLATE

B-5



US Army Corps of Engineers
Jacksonville District

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PALM BEACH COUNTY, FLORIDA

LAKE WORTH FEASABILITY STUDY

SUMARIZED GEOTECHNICAL INFORMATION

PLATE
B-6