PERMITTING AND CONSTRUCTING THE INTRACOASTAL WATERWAY DEEPENING PROJECT IN BROWARD COUNTY, FLORIDA

Lori S. Brownell, P.E.[1] and Yehya Siddiqui, E.I. [2]

ABSTRACT

Existing depths in the Intracoastal Waterway (ICWW) — part of the federally-authorized navigation channel along Florida's east coast — were -3 meters (m) Mean Low Water (MLW). The Florida Inland Navigation District (FIND) funded a project to deepen the ICWW channel to -4.5 m MLW in a ±3.4 km section from the 17th Street Causeway to just north of the Las Olas Bridge in Fort Lauderdale, Broward County, Florida. Material from the ICWW channel was mechanically dredged by Cashman Dredging and Marine Contracting Company, LLC and placed into a self-contained hopper barge. The material was dewatered and temporarily placed at a ±24,300 m^2 dredged material management area (DMMA) located at Port Everglades.

Broward County residents and the area's vital marine industry will benefit from deeper water and easier navigation following the completion of the ICWW deepening project. The FIND is committed to ensuring safe navigational waterways that allow for the passage of commercial and private vessels. Situated in the "Yachting Capital of the World", the project will result in significant increased economic benefits while providing for continued operation of the area as a boating destination and international marine hub. To remain competitive with other emerging popular marine destinations, Fort Lauderdale's waterways must remain open and accessible to boats of all sizes. The marine industry's estimated 110,000 marine-related jobs in Broward County comprise one of the largest portions of the industry's estimated $8.8 billion economic revenue to the County. According to a recent economic study, a similar, recently completed, $7 million dredging project at the Dania Cut-Off Canal resulted in a $23 million economic benefit to Broward County in the first year after completion. This financial input included $11 million in additional revenues for boatyards, hotel room nights, restaurants and other local businesses.

Taylor Engineering, on behalf of FIND, initiated permitting of the project in 2007 and acquired the Broward County License and the Florida Department of Environmental Protection and U.S. Army Corps of Engineers permits for the project between August 2011 and May 2014. Project construction initiated in May 2016 with completion expected by June 2017. Final submerged natural resources survey and dredging template identified ± 7,400 m^2 of submerged environmental resources (seagrass) within the project footprint. Due to the FIND's commitment to minimize (and in this case, completely avoid) environmental resource impacts, the FIND reduced the average bottom width of the channel from 38 m to 33.5 m. The dredging template required a minimum buffer from seagrass beds, and reflects a compromise between navigational requirements and minimization of environmental impacts.

Keywords: Dredging, economic benefit, deepening, navigation, seagrass.

INTRODUCTION

The Florida Inland Navigation District (FIND) — local sponsor for the 650 km federally authorized Florida Atlantic Intracoastal Waterway (ICWW) and the eastern 158 km of the Okeechobee Waterway (OWW) — recently deepened the Intracoastal Waterway (ICWW) in Broward County, Florida (Figure 1). The FIND formulated the project to provide larger marine vessels (including mega-yachts and commercial traffic) safer and deeper access to the boatyards and shipping facilities. Partnerships between project stakeholders and environmental regulatory agencies — including the FIND administration and Board of Commissioners, Port Everglades, Broward County, state and federal permitting agencies, local boating and commercial industry groups, as well as the FIND Engineer (Taylor Engineering, Inc.) and the dredging contractor (Cashman Dredging and Marine Contracting, LLC) — ultimately led to a successful project outcome.

[1] Director, Taylor Engineering, Inc. 10151 Deerwood Park Blvd., Bldg. 300, Ste. 300, Jacksonville, FL 32256 Phone: (904) 731-7040 Fax: (904) 731-9847 E-Mail: lbrownell@taylorengineering.com

[2] Staff Engineer, Taylor Engineering, Inc., 1655 Palm Beach Lakes Blvd., Suite 1012 West Palm Beach, FL 33401 Phone: (561) 445-9254 Fax: (904) 731-9847 E-Mail: ysiddiqui@taylorengineering.com

This challenging project, constructed between May 2016 and June 2017, involved removal of approximately 137,620 cubic meters (m^3) of weathered limestone, via a conventional bucket and limited hand-held hydraulic dredge, along a ±3.4 km section of the ICWW that extends section from the 17th Street Causeway to just north of the Las Olas Bridge in Fort Lauderdale, Broward County, Florida. Temporary material placement and dewatering occurred in a 24,300 km^2 dredged material management area (DMMA) on Port Everglades property located approximately 4.8 km south of the southerly project limit. Solely brokered by the contractor, final disposal of material occurred at local commercial-zoned construction projects.

Figure 1. Project Area Limits

PERMITTING AND DESIGN

Permitting for the project began in 2007 and the FIND received environmental permits from county, state, and federal regulatory agencies between 2011 and 2014. Major permitting challenges, which resulted in a nearly seven-year permitting timeframe, stemmed from (1) adjusting for significant navigational restrictions due to natural channels and existing infrastructure; (2) securing a temporary placement area for dewatering; (3) handling sediments with elevated contaminants — dibenzo(a,h)anthracene, total polychlorinated biphenyl (PCB), copper, and mercury — above the residential threshold criteria; and (4) avoiding submerged aquatic vegetation impacts, specifically *Halophila johnsonii* (Johnson's seagrass), a Federally listed Threatened species under the Endangered Species Act. Technical resolution and ultimate permit securement focused on clearly addressing regulatory agency concerns, garnering public support from the local marina industry, and developing a channel engineering design that minimized initial and maintenance dredging, environmental impacts, and required mitigation. The conceptual alternatives analysis for channel design considered

- channel footprint and dredge volume
- benefit of the proposed design to local marine industries and recreational boaters
- dredge spoil disposal alternatives
- dredge equipment and dewatering practices
- seagrass and hard coral impacts — direct and indirect
- other impacts to smalltooth sawfish, manatees, and state and county parks
- off-site material transport from the DMMA

Ultimately — with pre-construction depths ranging between -4.3 m Mean Low Water (MLW) to -3.0 m MLW — the negotiated permitted design template allowed for channel deepening to -4.6 m MLW with 0.6 m of allowable overdredge. Other permit and associated license requirements included

- environmental clamshell bucket, later modified to conventional bucket due to material hardness
- self-contained barge with containment rails to hold the dredged material and prevent any return water from entering the surface waters
- setback of 7.6 m from all structures and 3.0 m from all mangroves and root systems
- no impacts to identified submerged natural resources (i.e., seagrasses)
- 150-meter mixing zone downcurrent of the dredge location
- turbidity levels at or below 29 NTU above ambient background levels
- final material deposition at commercial (non-residential) zoned areas
- one-way access road from the DMMA with a limited maintenance of traffic plan

As part of the project design, FIND completed two types of geotechnical explorations for the project. The first, conducted in 2006, included the collection of forty standard penetration test (SPT) borings within the project area. The borings generally encountered weathered limestone below the mudline with relatively low penetration resistance (N-values < 10). An SPT N-value of 10 is approximately equivalent to a relative density of 35 percent and represents the approximate boundary between loose to medium dense for course-grained (cohesionless) deposits (Fugro, 2014). However, layers of hard, more competent rock (N values > 10) were encountered at a few borings (Ellis and Associates, 2006). For this reason, FIND conducted a second geotechnical exploration in 2014 — involving seismic reflection — to better characterize subsurface material during planned dredging activities, particularly the location of the limestone materials and other potentially dense/strong materials within the dredging template (Fugro, 2014). The results of the seismic reflection survey correlated well with the results of the previously collected SPT borings and indicated a high likelihood of encountering material with N-values greater than 10 in a large portion of the dredging template.

CONSTRUCTION

The FIND completed the construction phase of the project between May 2016 and June 2017, approximately 7 months before the required completion date. Despite the difficult and long permitting process, the construction phase of the project went relatively smoothly due largely to the contractor's attention to detail and support from the project stakeholders. A brief description of the equipment, procedures, and challenges follow.

Equipment and Procedures

The contractor removed material from the bottom of the ICWW with a conventional open bucket (7.6 m^3) excavator (Figure 2) and placed it into hopper barges. The 50 m x 15 m x 3 m mechanical dredge — a Liebherr 994 excavator — provided a shallow draft (1.5 m) and was powerful enough to break through the weathered limestone material identified in the pre-construction geotechnical borings. When filled to capacity, the ±2,200 metric ton capacity hopper barges (70 m x 13 m x 3.6 m) would transport the material from the dredge site to the temporary DMMA located on Port Everglades property approximately 4.8 km south of the southerly project limit.

Figure 2. Conventional Open Bucket Excavator

Once at the DMMA, the contractor tied the loaded barges to fender dolphins and used a long-reach excavator (Sennebogen 880) and hydraulic clamshell bucket to unload the barges from land. Due to permit requirement of zero-water discharge directly into the adjacent canal, the contractor used a pump to remove and transfer any freestanding water from the barge into the DMMA. With the excess water removed, the excavator offloaded the dredged material directly into the DMMA. To prevent material from spilling onto the shoreline and protected mangroves, the contractor installed a steel spill plate directly over the shoreline and mangroves to collect and transfer any spilled material to an upland area (Figure 3). As the material began to build up at the discharge point, the contractor used a front-end loader to move the material within the DMMA to facilitate dewatering. Once the material was mostly dewatered, the contractor transferred the material into the "stockpile area" located on the north end of the DMMA for final draining and loading into sealed 13.8 m^3 dump trucks.

Water that collected in the material-settling pond was gravity fed to two corrugated metal pipe flashboard weir risers connected to two 0.8-m corrugated metal pipes that discharged into a decanter area. As visible in the Figure 4, the DMMA design allowed suspended sediments to settle out of the water column by slowing the flow rate through the decanter via interior baffle berms. Water traveled from the decanter area through an elevated drain consisting of a single 0.8-m corrugated metal pipe and across two trip dams for final discharge into the adjacent canal via an elevated drain/riser structure and a single 0.8-m corrugated metal pipe. This process gave sediments time to settle and thus prevented excessive turbidity in the discharge from the DMMA. Before allowing initial discharge of water from the DMMA, the permits required that the contractor collect and test water samples adjacent to the DMMA and background canal locations for contaminants. The contractor also collected and tested turbidity samples for compliance with the permit turbidity criterion. Once the contractor had obtained passing test results, discharge began.

Figure 3. Shoreline Steel Spill Plate at the DMMA Offloading Area

Figure 4. DMMA Overview

Challenges and Resolutions

Primary construction-related challenges — subaqueous utilities, marine traffic control, and maintenance of upland traffic — required detailed coordination with all stakeholders and the dredging contractor to develop appropriate solutions.

Subaqueous Utilities

FIND and its engineer identified six utility crossings — independently verified by the contractor — within the dredging template prior to construction. Of the six utility crossings, four were required to be relocated by the utility companies. The dredging template was altered to avoid the remaining two crossings. Identification and verification of the utility lines was a difficult and time-consuming process because most of the utility companies had inaccurate or missing as-built records of the actual utility line locations. Highly-specialized divers located utility crossings within the dredging template. The project plans required 15-m buffers between energized lines and dredging operations. Despite two years of advance coordination with each utility owner, only one entity (City of Ft. Lauderdale) completed its subaqueous line relocation prior to the completion of dredging. Table 1 summarizes the status of the utility crossings within the project template. Figures 5 and 6 show the remaining dredged material left within the template because of the utilities relocation delay. With a four-man dive team operating a 0.15-m x 0.2-m hydraulic powered suction dredge pump, the contractor safely achieved project depth above the Florida Department of Transportation bridge cables. For the remaining two utility crossings (Florida Power & Light and AT&T), approximately 4,129 m^3 of material at depths ranging between 3 and 4 m MLW remain in the template post-construction. Ultimately, FIND will to return to the area to clear the remaining volume in the dredged template.

Table 1. Utility Crossings

Utility Owner	Description	Location	Depth (MLW)	Status
Florida Power & Light	Concrete encased cable duct bank	Swimming Hall of Fame	-4.4 m to -5.2 m	Pending relocation. Expected completion June 2017.
Florida Department of Transportation	Bridge switch cables	Las Olas Boulevard	-3.3 m to -5.3 m	No need to relocate
City of Ft. Lauderdale	Water Main		-5.4 m	Complete December 2016
AT&T	Conduit bundle		-4.9 m	Pending relocation. Expected completion June 2017.

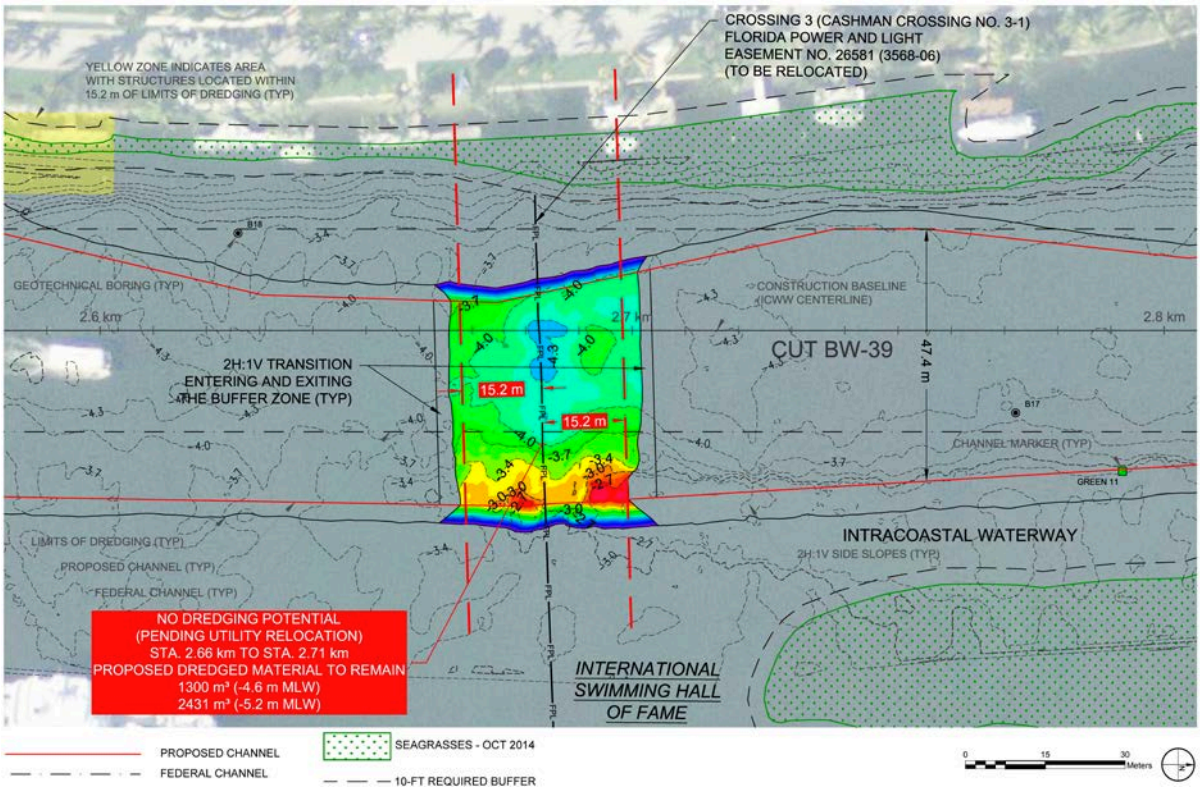

Figure 5. Florida Power & Light at Swimming Hall of Fame

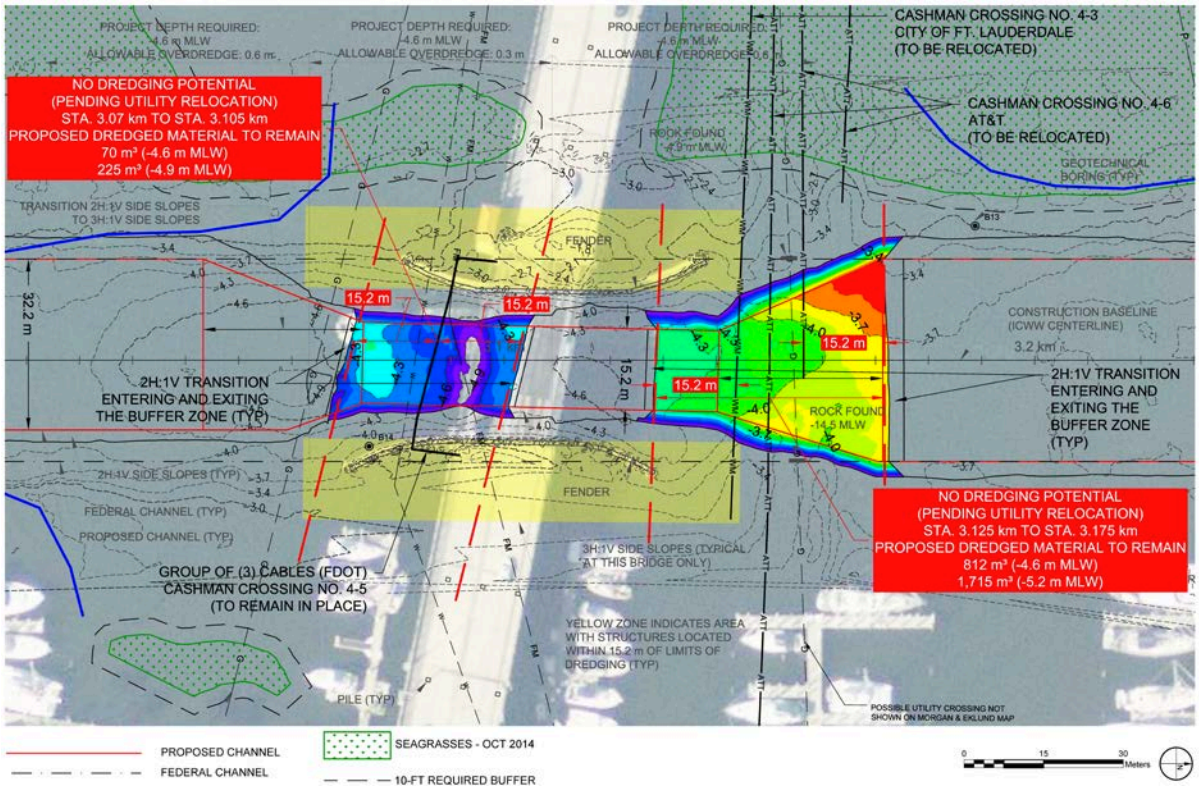

Figure 6. AT&T at Las Olas Boulevard

Marine Traffic Control.

The project area includes numerous marine-based industries that require continued access to the ICWW. With its ±30-m wide equipment (dredge and adjacent hopper barge), the contractor expected to significantly reduce the 38-m navigable channel width for vessel passage. Prior to project commencement, FIND conducted an outreach meeting with the local industries, U.S. Coast Guard (USCG), Port Everglades, and the dredging contractor. The dredging contractor explained the project logistics, including the operation schedule and dredging and offloading operations. To facilitate communication with marine operators, strict vessel movement protocols were put in place and coordinated with Port Everglades. In addition, the contractor provided daily equipment position reports (Figure 7) that helped to notify local mariners of dredging location and duration. Within the first two months of dredging eight vessel groundings were reported near the dredge. With alterations of the contractor's proactive communication (e.g., public outreach to local marinas and mariner groups, on-board signage, and daily equipment positions reports), no additional groundings were reported for the duration of the job.

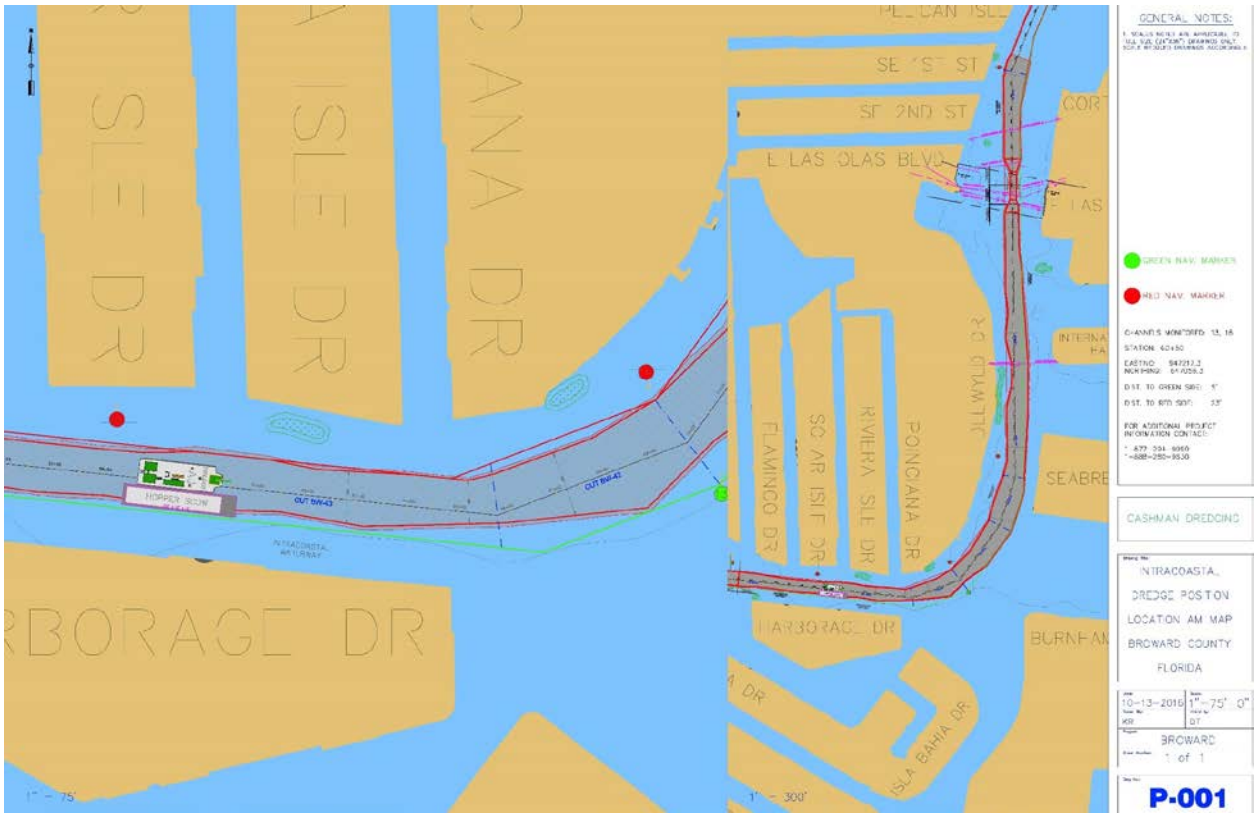

Figure 7. Example Daily Equipment Position Report

Maintenance of Upland Traffic

One year of the seven-year permitting process was strictly dedicated to securing an access point through a newly created temporary haul road outside of the Port Everglades property so as not to disturb ongoing port related operations. The 4.5 m wide x 550 m long one-way access road required authorization from landowners (Broward County Parks and Recreation and Florida Power & Light), permits from the U.S. Army Corps of Engineers and Broward County, and an individual license from the Florida Power & Light that included a fee for use along with design mandates, monthly usage fees, and environmental monitoring reports from a third independent party. The contractor was also required to have its upland Maintenance of Traffic Plan approved by Port Everglades, Broward County, and Florida Power & Light prior to engaging in any hauling traffic. Over the course of the 11-month long trucking portion of the project, only two complaints were filed by commercial users west of the access road due to a build-up of traffic. The contractor was able to adjust the truck haul schedule to accommodate the adjacent commercial land users and facilitate traffic during peak hour flow.

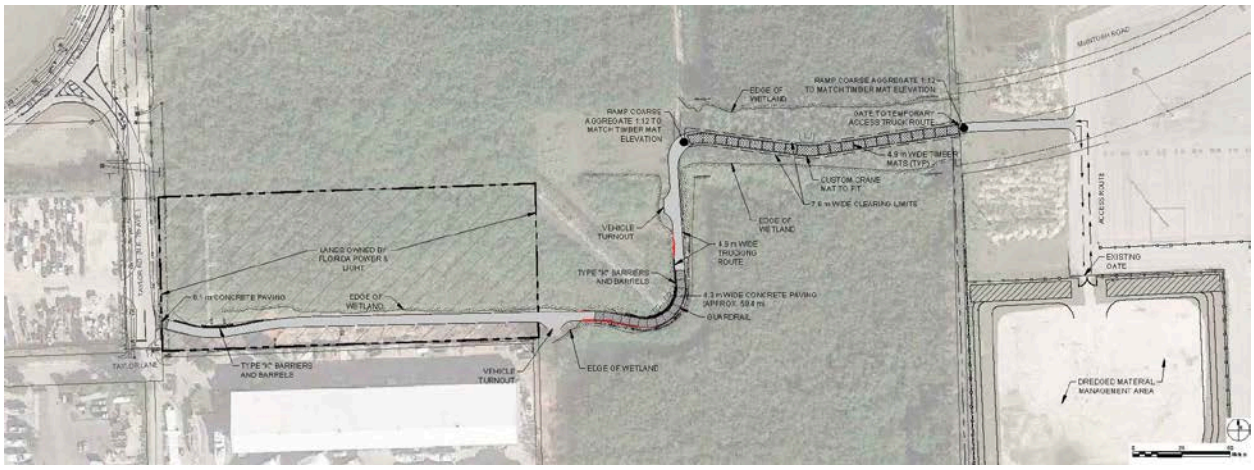

Figure 8. One-Way Truck Haul Road for Dewatered Dredged Material

CONCLUSIONS

On average, the dredging contractor achieved a production rate of approximately 965 m^3/day over the course of the 160-day working or 665 m^3/day over the 232-day total dredging period. With exception of one turbidity exceedance early in the construction period, the project resulted in no environmental permit violations. The contractor achieved the design project depth through most of the project area. Unfortunately, due to the delay in relocating Florida Power & Light and AT&T utility crossings, FIND will eventually need to return to the area to dredge the 4,129 m^3 of material remaining within the permitted dredging template. Within the next year, FIND will perform an updated economic study to determine the net increase in marine economic output; however, FIND strongly believes the expected economic benefits justify the construction cost of $19.5 million.

REFERENCES

Ellis & Associates, Inc. (2006). "Report of Geotechnical Exploration and Engineering Services Broward County ICWW/Dania Canal Deepening Project, Broward County, Florida." E&A Project No. 05JX-1341.

Fugro Consultants, Inc. (2014). "Seismic Reflection Investigation. Final Report. Intracoastal Waterway Deepening Broward County, Florida. Fugro Job No. 04.81140008.

CITATION

Brownell, L.S. and Siddiqui, Y. "Permitting and Constructing the Intracoastal Waterway Deepening Project in Broward County, Florida" *Proceedings of the Twenty-First World Dredging Congress, WODCON XXI, Miami, Florida*, USA, June 13-17, 2017.

ACKNOWLEDGEMENTS

The authors would like to thank the client, Florida Inland Navigation District (Mark Crosley, Executive Director; Tyler Chappell, Broward County Commissioner; David Roach, former Executive Director), the dredging contractor, Cashman Marine Dredging and Marine Contracting Company (Stephen Tobin, Project Manager and Danielle Taylor, QA/QC Officer), Port Everglades (Peg Buchan, Assistant Port Director), and previous Taylor Engineering employees (John Adams, Engineer of Record and Cathy Shell, CAD designer) that have worked on this project.