

Analysis of Potential Use of the Existing Facility During Reconstruction

Reconstruction of the Cargo Ferry Terminal
Sardinas Bay
Culebra, Puerto Rico

Prepared For:



Prepared By:

ATKINS

Culebra Ferry Ramp Rehabilitation Analysis of Potential Use of the Existing Facility During Reconstruction

Executive Summary

The Puerto Rico Ports Authority (PRPA) has entered the processes of obtaining financing and regulatory compliance in order to undertake the necessary works to reconstruct the Culebra Ferry Ramp at Sardinas Bay. The subject facility has deteriorated to the point that it needs to be rehabilitated promptly, at the risk of a collapse. The Puerto Rico Maritime Transportation Authority (PRMTA), the operator of the facility, has expressed that—operationally—it is impossible to simultaneously conduct:

- a) Passenger ferry service,
- b) Ro-Ro Cargo/passenger ferry service
- c) Rehabilitations of the existing passenger/cargo ferry ramp.

Since there are no other terminals in the Island capable of safely handling the cargo traffic, the PRPA has proposed the construction of an Auxiliary Terminal to divert cargo traffic prior to the improvement works at the Sardinas Terminal. A temporary facility was initially proposed, but with a multi-million dollar price tag, decision-makers decided that an Auxiliary Terminal would be a valuable, permanent asset to the security and safety of the Culebra residents and visitors.

This document presents the current conditions at the Sardinas Terminal, the elements that limit its ability to absorb additional activity there, and conclude that it is not feasible to keep all construction and operation within the Sardinas Bay due to safety and security concerns.

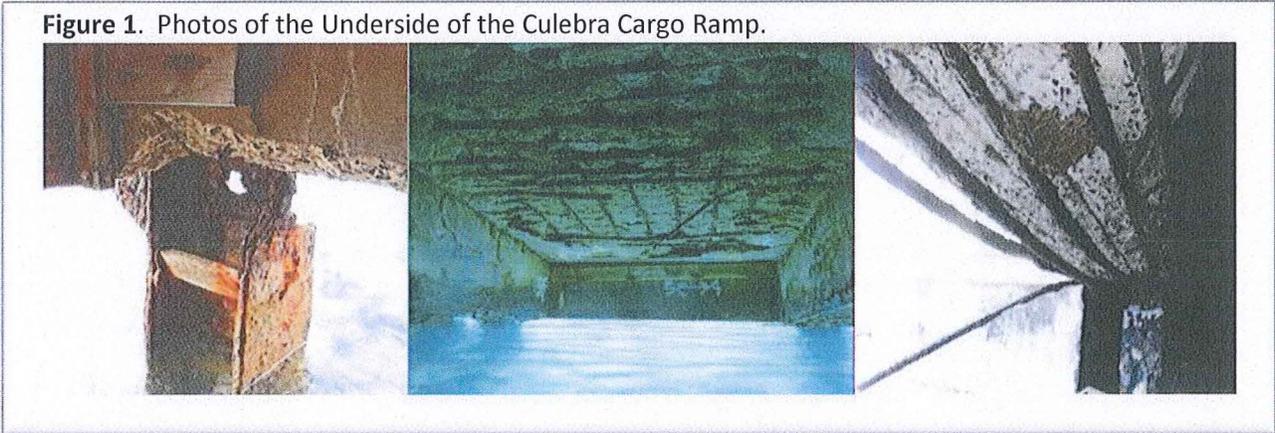
Introduction

The Culebra Ferry Ramp in Sardinas Bay has deteriorated to the point that it needs to be rehabilitated^{i,ii} (see **Figure 1**). Furthermore, if the rehabilitation of the cargo terminal is not conducted promptly, a collapse of the ramp may occur. Since 2010, the PRPA, the owner of the facility, has entered the processes of obtaining financing and regulatory compliance in order to undertake the necessary works. The PRMTA, the operator of the facility, has expressed that— operationally—it is impossible to simultaneously conduct these activities with an acceptable margin of safety:

- a) Passenger ferry service,
- b) Cargo/passenger ferry service
- c) Rehabilitations of the existing passenger/cargo ferry ramp.

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Figure 1. Photos of the Underside of the Culebra Cargo Ramp.



Therefore, an alternative site has been sought in order to maintain cargo operations in Culebra while the necessary repairs and improvements are undertaken at the Sardinas Bay terminal.

Existing Conditions

The Culebra Ferry Terminal in Sardinas Bay is the only passenger and heavy commercial cargo transportation port in Culebra. As such, it provides an essential service to the residents and visitors of this island-municipality with a resident population of approximately 2,000 and approximately 10,000 visitors annually. The island's economy mainly relies on tourism and construction activities with all of these activities tied to the main island of Puerto Rico through PRMTA ferry services, which constitutes this island life-line ⁱⁱⁱ.

A description of the existing facilities follows.

Culebra Ferry Terminal

The Culebra Ferry Terminal was originally completed June 25, 1984, and was last dredged in 1990^{iv}. In January, 2010 the MTA commissioned the design of a Master Plan for the Culebra Ferry Terminal to include additional uses to help develop the tourism potential in Culebra^v (see **Figure 2**). Please notice that the Master Plan did not utilize the passenger building to berth ferries at all. Then in August, 2010, the passenger building was devastated by Tropical Hurricane Earl. As a result, PRHTA tasked and contracted Del Valle Group with the emergency reconstruction of the passenger ferry platform, and later the construction of a building terminal facility. The blueprint utilized for said reconstruction was the one prepared as part of the Master Plan.

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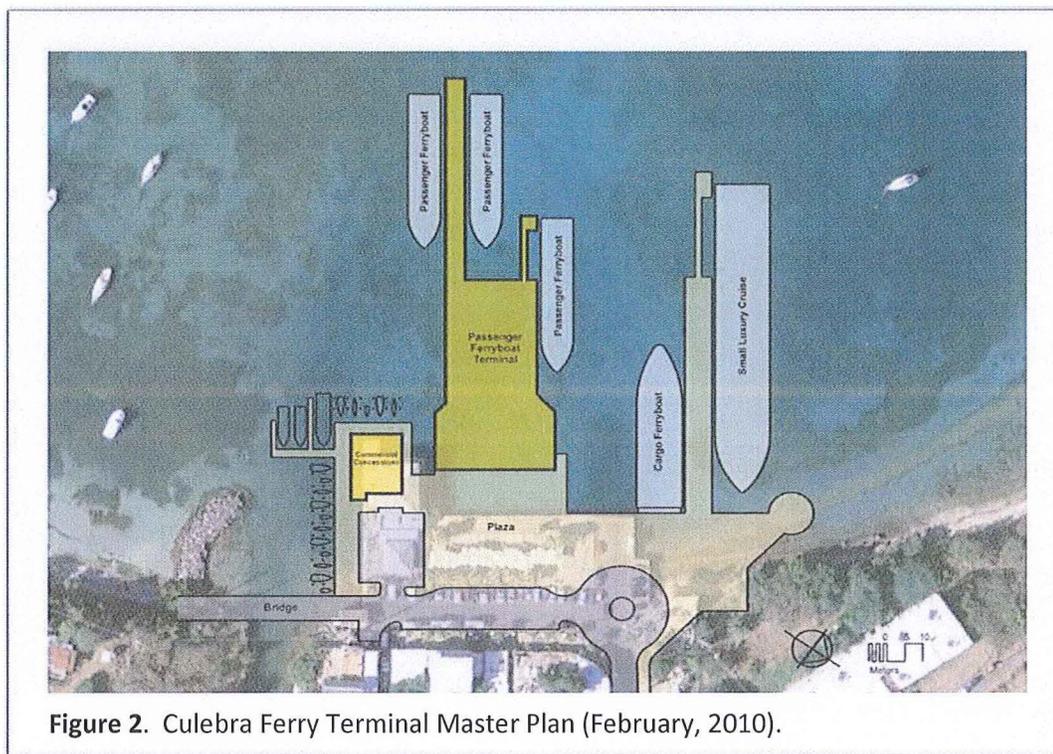


Figure 2. Culebra Ferry Terminal Master Plan (February, 2010).

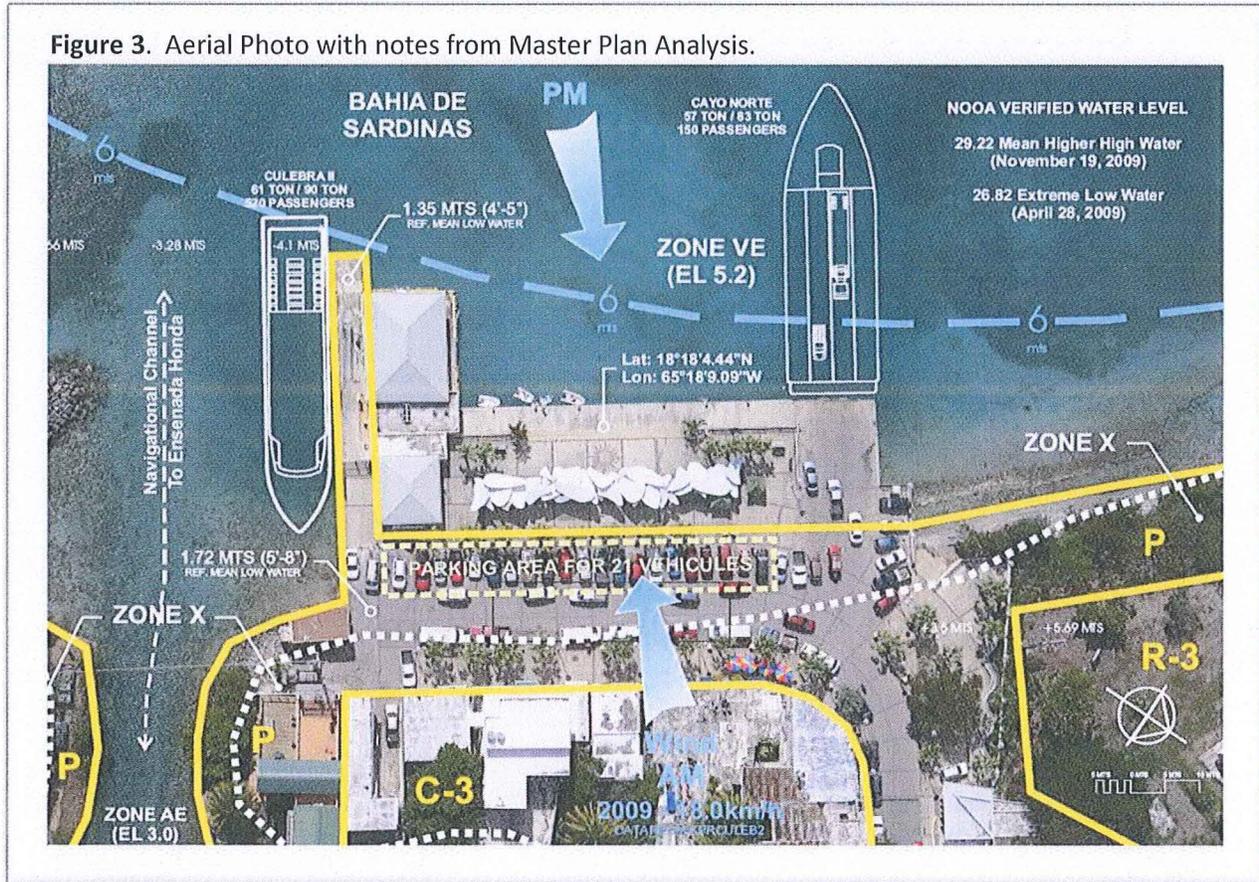
Landward Conditions

The Culebra Ferry Terminal is located in the Town of Dewey, the only town in Culebra, at the end of a dead end two lane street. Presently, the lack of flow-through vehicular traffic results in near chaotic conditions during almost every ferry loading/unloading operation. Vehicular traffic consist of taxis, shuttles, public busses, private vehicles, and all the vehicles loaded and unloaded to and from the ferries. Across the street is a row of businesses catering mainly to tourists. Both sides of the street are usually lined with parked vehicles. At the end of the street, southeast of the Terminal, is a canal that connects Sardinas Bay with Ensenada Honda. See **Figure 3**.

The landward facilities consist of a wharf with an elevation that ranges from +3.69 to +3.89 feet, and a concrete platform at the Passenger Terminal Building area with an approximate elevation of +7.08 feet. Beyond the concrete wharf, or at its northwestern end, there is a ramp (the Cargo Ramp) that rises to the street elevation of approximately +8.7 feet; however, for the rest of the terminal, there are pedestrian stairs or a wall in some areas between the wharf and the 7+ foot elevation at the waiting areas. See **Figures 4a** and **4b**.

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Figure 3. Aerial Photo with notes from Master Plan Analysis.



Seaward Conditions

The Culebra Ferry Terminal is located in Sardinias Bay, an open harbor that receives heavy winds and waves due to the prevailing weather patterns in the area (see **Figure 3**). In the past, hurricanes have extensively damaged the Culebra Ferry Terminal for weeks at a time, disrupting commerce, commuters and tourism—Culebra's main source of income^v. On numerous occasions, the cargo ferries have to return to Fajardo without delivering its payload, and delaying outgoing cargo, due to unsafe mooring conditions^{vi}.

The cargo ferry berthing depths range from -10.7 to -14.9 feet and the passenger ferry berthing areas vary from -8.5 to -12.8 feet. South of the Passenger Building, the area proposed for the mooring of the largest passenger ferry, the Cayo Blanco, depths vary from -8.5 to -16.1 up to approximately 90 feet from the distal end; beyond this, the seafloor climbs rapidly to -2.7 feet and shallower. See **Figure 4a**.

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Ro-Ro Ferries

Culebra vehicular cargo ferries transport a maximum of 24 vehicles per trip, or four trailers (52 foot maximum, with cabin) with twelve vehicles, or a combination thereof. The largest weight for a truck or trailer that can be loaded in the ferries is 80,000 pounds, where an average vehicle weighs 9,000 pounds. There are normally three cargo ferries per day (6:30 am, 1:00 pm and 5:00 pm), so the total maximum number of vehicles that move through the existing terminal is 72 vehicles incoming and 72 vehicles outgoing, for a total traffic of 144 vehicular movements in a 24 hour period. The cargo ferry schedule is presented in **Table 1**.

Table 1. Cargo Ferry Schedule (departure times)*

Fajardo to Culebra	
Monday, Tuesday & Thursday	Wednesday and Friday
4:00 am	4:00 am
5:00 pm	9:30 am
	5:00 pm
Culebra to Fajardo	
6:30 am	6:30 am
7:00 pm	1:00 pm
	7:00 pm

*Additional ferries may be scheduled.

Following is a description of the cargo ferries that make port in Culebra.

Cayo Norte: The Cayo Norte is a 156-foot, 11.75 foot maximum draft **vehicle** cargo and passenger ferry built in 1995 by The Blount Boats, Inc. It is able to transport 205 passengers and accommodate up to eight full-size trailers. Cayo Norte has two passenger exits located near the middle of the ship, one on the port side and one on the starboard side.

Cayo Largo: Cayo Largo is a passenger/cargo ferry built in 2008 by Blount Boats, Inc. with capacity for transporting 300 passengers and carrying 300 short tons (600,000 lbs.) of **vehicular** cargo. The ferry has a length overall (LOA) of 165 feet long, a 45 foot beam, and a loaded draft of 7 feet. Cayo Largo has two passenger exits located near the front of the ship, one on the port side and one on the starboard side.

Isleño: Built in 2004 by Blount Boats, Inc., Isleño is a 200 LT class passenger/cargo ferry that measures 155 feet in length, with a beam of 41.5 feet and a maximum draft of 11.75 feet. It has the capacity to transport 205 passengers and carry 200 long tons (448,000 lbs.) of

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Vehicular cargo. The ferry has 4 main exits near the front, two located on the port side and two on the starboard side.

Santa María: The Santa María was built in 1990 by Blount Boats, Inc. It has a LOA of 155 feet, and a 37.5 foot beam, a draft (loaded) of 11.75 feet, and the capacity to transport 149 passengers and 100 long tons (224,000 lbs.) of cargo. The ferry has two passenger exits located near the front of the ship, one on the port side and one on the starboard side.

Passenger Ferries

There are between 1,000 and 1,200 passengers transported daily between Fajardo and Culebra. The regular ferry schedule is shown below. During peak travel periods, such as Spring Break, Thanksgiving and Christmas, the ATM schedules additional ferry service to meet the demand. The passenger schedule is presented in **Table 2**.

Table 2. Passenger Ferry Schedule (departure times)*

Fajardo to Culebra	
Monday through Sunday	
9:00 am	
3:00 pm	
7:00 pm	
Culebra to Fajardo	
Monday through Friday	Saturday & Sunday
6:00 am	6:30 am
1:00 pm	1:00 pm
5:00 pm	5:00 pm

*Additional ferries may be scheduled.

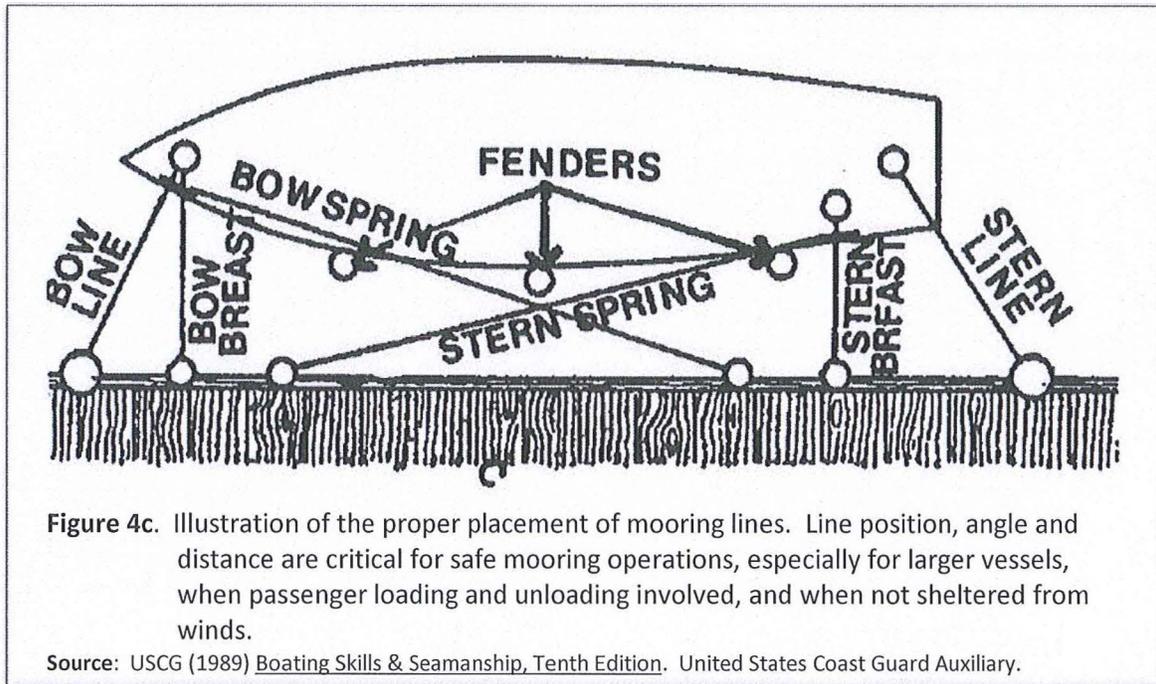
Following is a description of the passenger ferries that make port in Culebra.

Cayo Blanco. The passenger ferry Cayo Blanco, built by Conrad Industries, Inc. in 2009, is able to transport 600 passengers in a two deck configuration. The ferry has a LOA of 160 feet, a 32 foot beam and 12.75 foot maximum draft. Cayo Blanco only has one passenger exit located on the starboard side. Given the bottom obstructions on the south side of the Passenger Building platform, and the location of the passenger access way of the Cayo Blanco, this ferry cannot safely moor at the Passenger Terminal Building platform; there is not enough room to secure spring lines and bow/stern lines to stabilize the vessel there. A mooring dolphin is proposed to solve this shortcoming.

Caribeña. Caribeña is an aluminum passenger ferry built in 2004 by Blount Boats, Inc. The smallest vessel on the MTA fleet, the ferry has an LOA of 80 feet and a 10 foot maximum

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draft, and is able to transport 287 passengers in a two level deck configuration. Caribeña has a total of four passenger exits, two on the port side (one bow, one stern) and two on the starboard side (one bow, one stern). Due to availability of fenders and deck fittings, the Caribeña can only embark/disembark passengers at the wharf platform, even though it can be moored to the Passenger Building platform.



Proposed Action

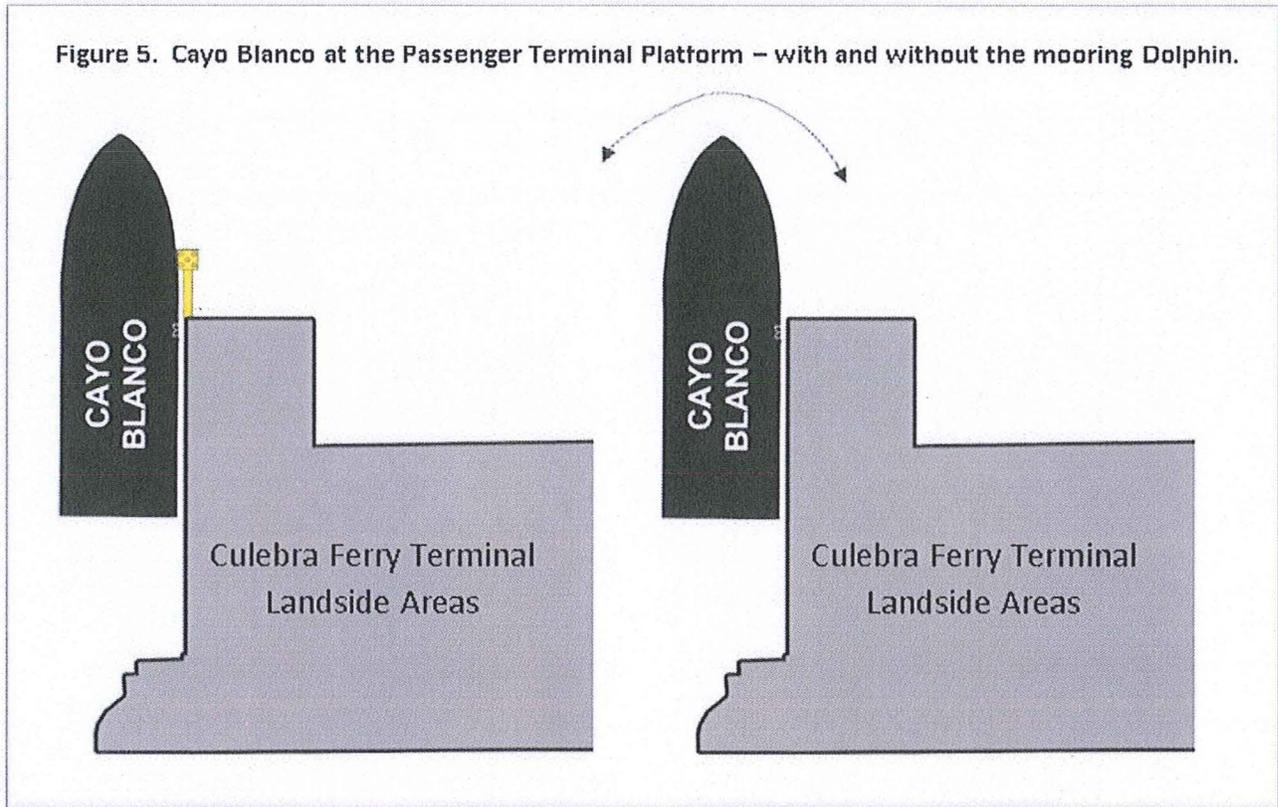
The proposed action consists of a three step construction plan:

- 1. Installation of mooring pilings at the existing terminal.**

The first step of the proposed action consists of installing a mooring dolphin, which will allow the use of the Passenger Terminal platform to board and un-board passengers from the Cayo Blanco ferry. Presently, the necessary mooring support is absent for the Cayo Blanco at this location. Given the depth limitations at this location, the Cayo Blanco can only enter about half of its 150 foot length. At this position, without a mooring dolphin, the Cayo Blanco would not have the necessary support for a safe mooring operation. The installation of a new mooring dolphin will provide the necessary support. This construction keeps away the Cayo Blanco and its maneuvers from the wharf, and thus, puts distance between part of the passenger ferry traffic and the construction activity.

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A catwalk, for use by ATM personnel, will be required between the mooring dolphin and the Passenger Terminal platform. See **Figure 5**.



2. Construction of the Auxiliary Terminal.

The PRPA proposes the construction of an Auxiliary Terminal to:

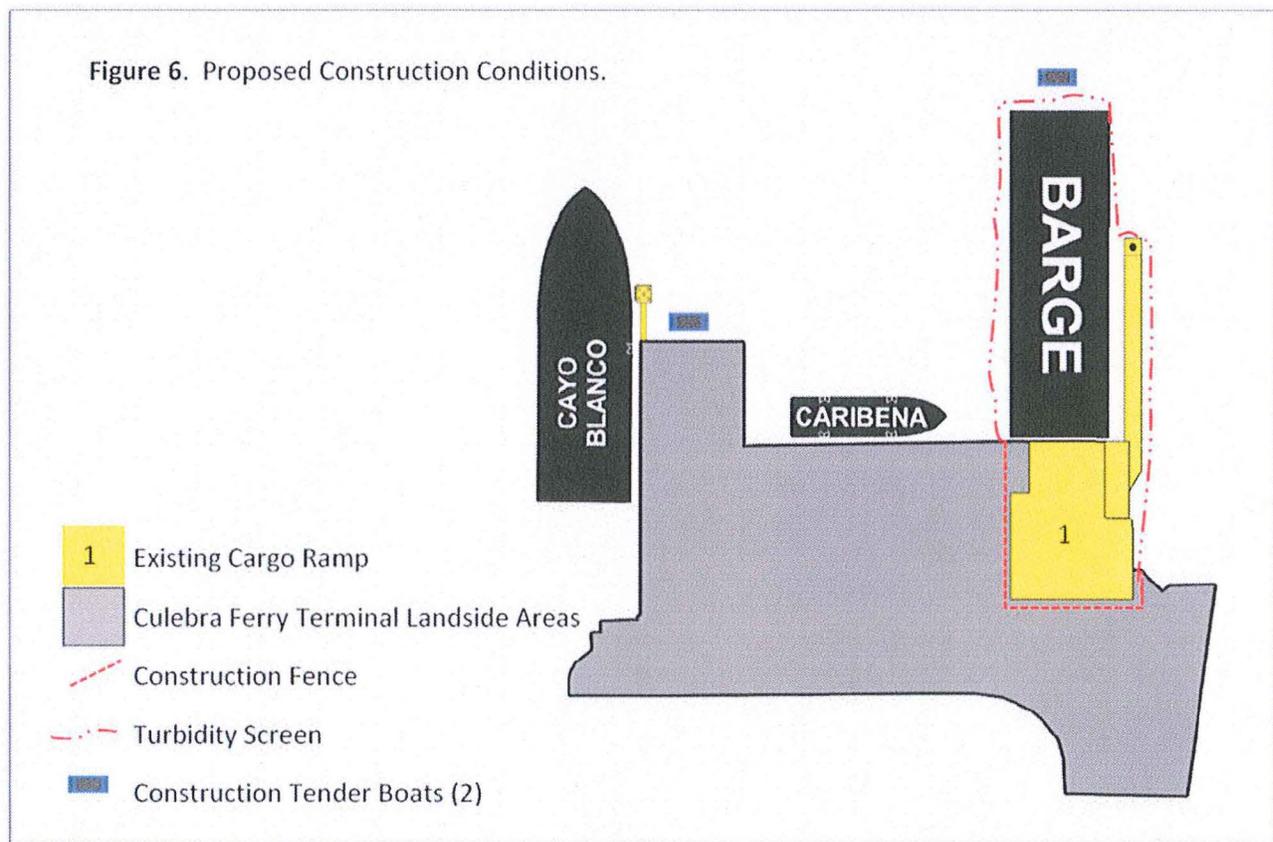
- a) provide cargo service to Culebra during the approximately six month reconstruction of the existing Cargo Platform,
- b) thereafter, to provide cargo service to Culebra when weather conditions make it impossible to make port in Sardina Bay, during emergency situations, and during excessive cargo/travel demands, and
- c) to reduce the risk of cargo/passenger service interruptions for Culebra residents and visitors by installing a ferry terminal in the safest harbor in the region^{vi,vii}. The absence of a suitable alternate cargo vessel dock to receive basic habitation services for this island is both a safety and a security concern^{vi}.

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Two existing sites were evaluated for the auxiliary terminal, San Ildefonso and Fulladosa. The former requires minimal landward and seaward improvements to safely accommodate the required facilities, while the latter would need large-scale earth movement on the landside and dredging of the seafloor in the Ensenada Honda side. The environmental impacts and the cost associated with these improvements make the Fulladosa Pier unacceptable. For a full alternatives assessment please see the proposed action's Environmental Assessment document.

3. Reconstruction of the existing Cargo Ramp.

Reconstruction of the existing Cargo Ramp is proposed under the reduced-activity scenario where the cargo ferry traffic is diverted to an Auxiliary Terminal. Construction activity includes a construction barge, demolition, one crane, pile driving and one or two tender boats maneuvering within the confines of the Culebra Ferry Terminal facilities.



With the Cayo Largo docking at the Passenger Building platform, only the smaller passenger ferries will dock at the wharf. Even so, the construction activity and the passenger ferry traffic will need to take precautions to avoid collisions. See **Figure 6**.

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Alternative Use of the Sardinias Bay Terminal during Reconstruction

The alternative to the Proposed Action requires that the following three activities occur simultaneously at the Culebra Ferry Terminal in Sardinias Bay for an approximate six month period:

- a) passenger ferry service,
- b) passenger/cargo ferry service, (a and b are the existing condition) and
- c) rehabilitation of the existing passenger/cargo ferry ramp.
- d) mooring dolphin construction.

Since a spare cargo ramp does not exist at the Culebra Ferry Terminal, this alternative also requires that a new cargo ramp be constructed, which requires that the following three activities occur simultaneously at the Culebra Terminal at Sardinias Bay for an approximate nine month period:

- a) passenger ferry service,
- b) passenger/cargo ferry service, (a and b are the existing condition) and
- c) demolition of part of the existing wharf and construction of a temporary cargo ramp.

Below we discuss the steps required for this alternative proposal.

1. Construction of mooring dolphin at the existing terminal.

As with the PRPA Proposed Action, this step consists of installing pilings to create a mooring dolphin, which will allow the use of the Passenger Building platform to board/un-board passengers to and from the Cayo Blanco ferry. This will keep the Cayo Blanco and its maneuvers away from the wharf. See **Figure 5**.

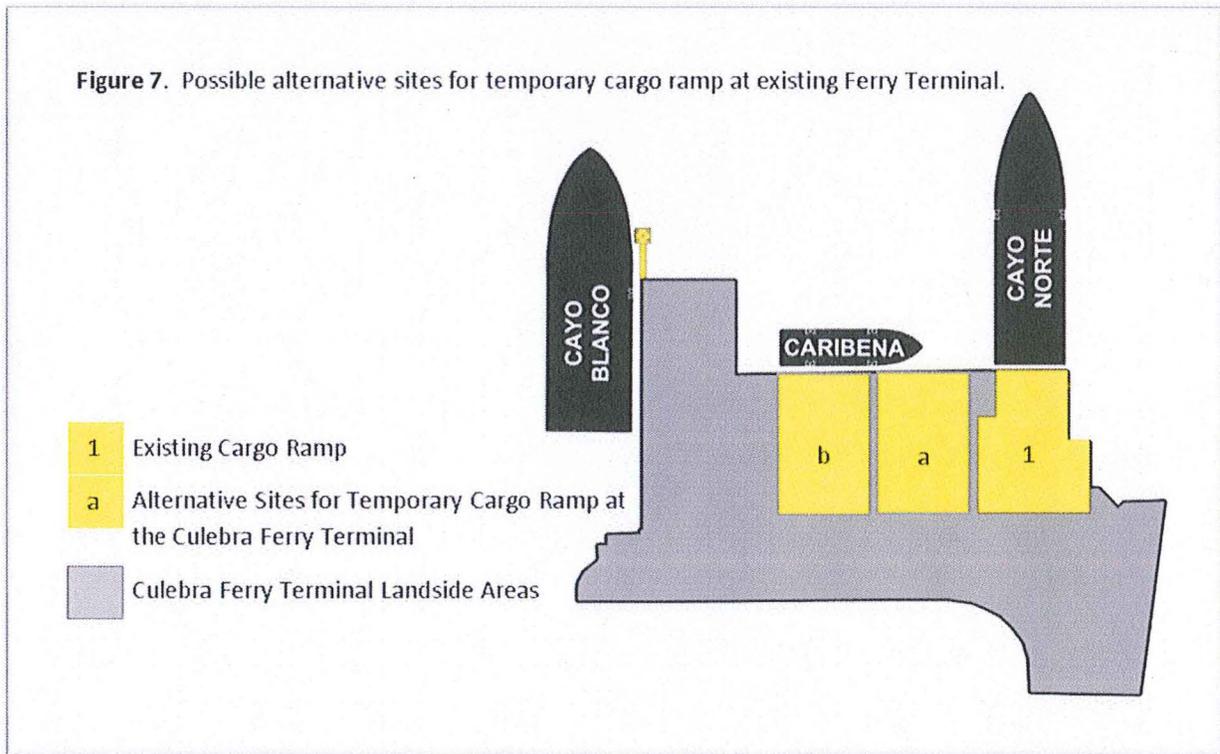
2. Construction of a temporary cargo ramp at existing Culebra Terminal in Sardinias Bay.

The existing facilities are designed to provide cargo loading/ unloading only through the Cargo Ramp. Other areas of the existing Terminal are not configured for this: there are concrete stairs to climb up the approximately +4.5 foot elevation difference between the platform and the street level, there is public art, concrete benches and a canopy for waiting passengers (see **Figure 4B**). Additionally, the area was designed for pedestrian traffic, not vehicle or heavy traffic. In order to build a temporary cargo ramp at the Culebra Ferry Terminal the following must be done:

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a. Selection of the temporary cargo platform site.

Selection of the site is relatively simple: it must be as close as possible to the existing ramp in order to be as far from the passenger traffic areas; otherwise, the waiting area for the passengers is impossibly curtailed, and the smaller passenger ferries will not have a docking space. See **Figure 7**. It is important to mention that the Cayo Blanco Ferry can accommodate 600 passengers which need a waiting area; when arrivals and departures are combined, it may total 1,200 passengers in transit through the landside areas of this facility.



b. Demolition of a portion of the wharf & construction of the temporary cargo ramp.

During demolition and reconstruction of the temporary cargo ramp, the cargo and passenger movements are supposed to continue uninterrupted, in accordance to the schedules in **Tables 1 & 2**. As illustrated in **Figure 8**, the smaller ferries will not have enough room for docking with the construction barge in working position. As a result, every time the small ferry comes to moor, there will have to be coordination between the MTA and the Contractor to move the construction barge. This process involves retrieving the barge's turbidity screen, raising the spuds from the seafloor, moving the construction barge further north to a temporary location, where it will re-deploy the

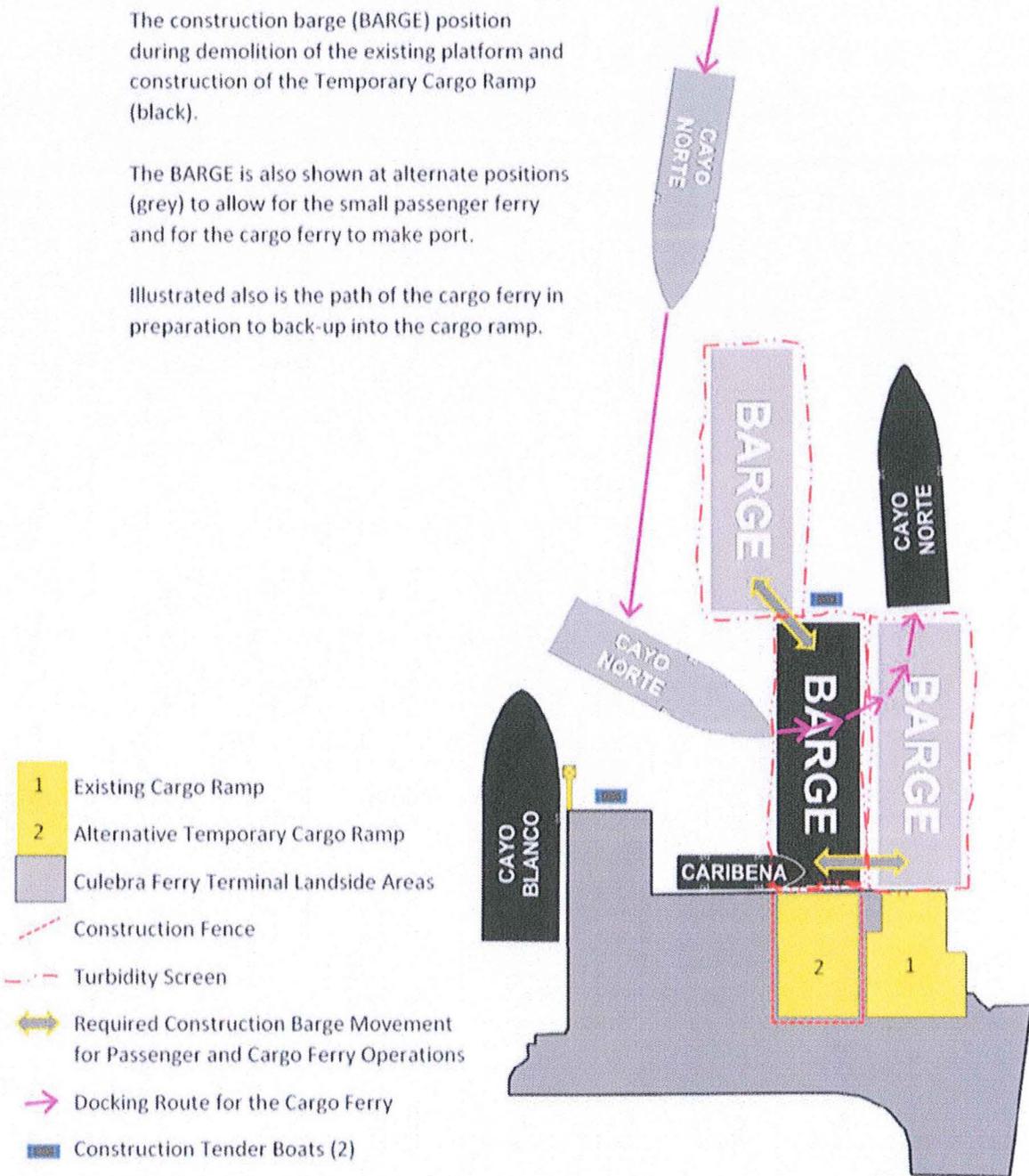
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Figure 8. Construction of the Alternative Temporary Cargo Ramp at Sardinas Bay.

The construction barge (BARGE) position during demolition of the existing platform and construction of the Temporary Cargo Ramp (black).

The BARGE is also shown at alternate positions (grey) to allow for the small passenger ferry and for the cargo ferry to make port.

Illustrated also is the path of the cargo ferry in preparation to back-up into the cargo ramp.



turbidity screen before lowering its spuds to the seafloor and waiting while the small ferry makes port, passengers disembark, new passengers load, and the ferry gets underway. This operation could take a minimum of one hour, yet the schedule in

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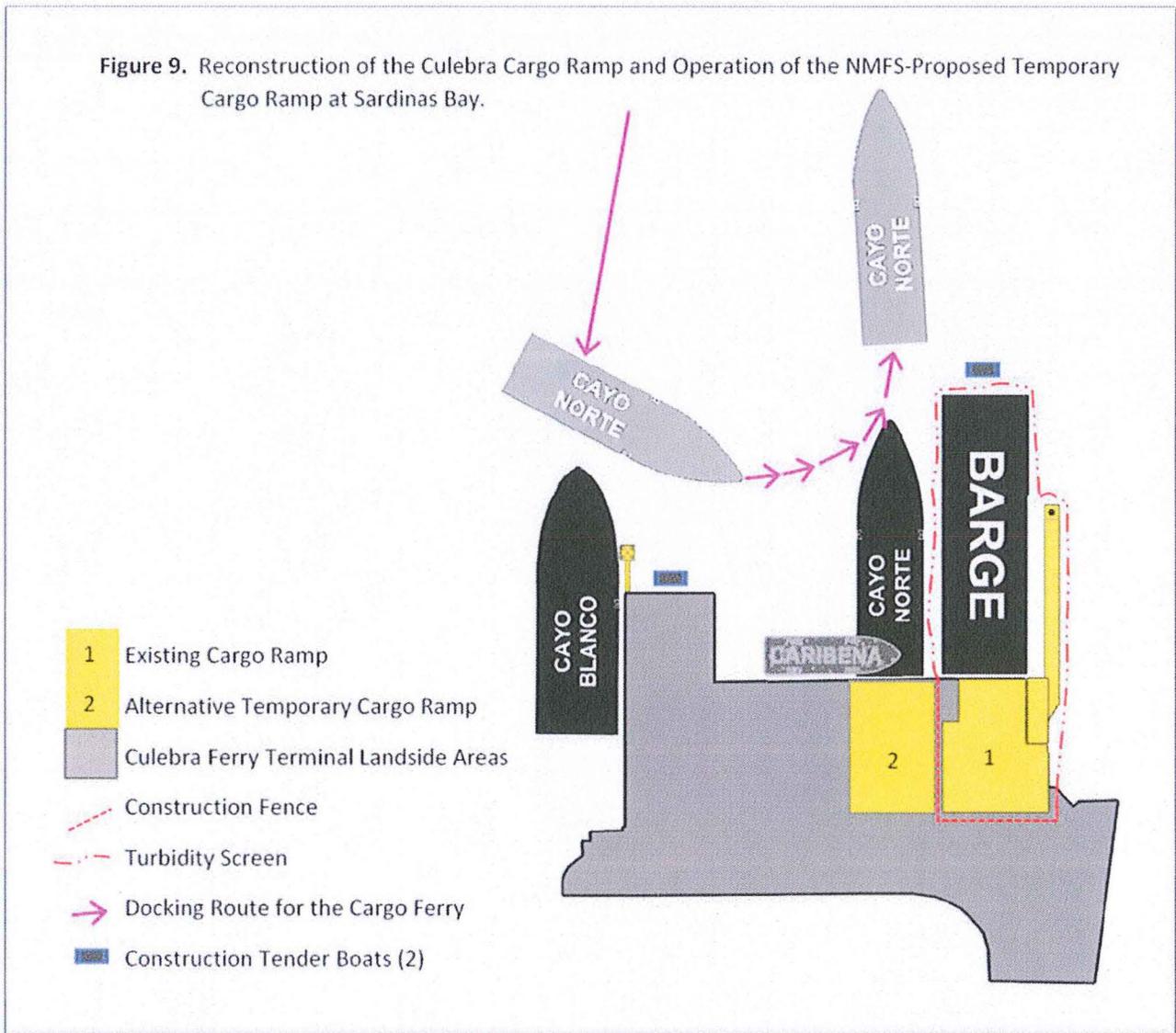
Table 2 indicates that the passenger ferry spends from 2 to 11.5 hours at the Culebra Terminal; therefore, when the smaller passenger ferry is utilized it must be moved from the wharf between unloading and loading its passengers for construction to proceed.

After the small ferry leaves for Fajardo (or is moved to its berthing location), the construction barge can then retrieve its turbidity screen, raise its spuds from the seafloor, move to the construction position, re-deploy the turbidity screen and lowers its spuds to the seafloor. The total time for this operation is a minimum of two hours, and the small ferry delivers passengers to Culebra up to twice daily, for a total time where construction is interrupted of four hours per day.

Logistical problems compound when the cargo ferry arrives. The cargo ferries must maneuver in reverse for their docking procedure. With the construction barge within ten feet of the docking position of the cargo ferry (i.e. the Cayo Norte), it must move elsewhere to make room for the cargo ferry. There are only two safe places to locate the BARGE for the cargo ferry to make port: One is the waters to the north (right in **Figure 8**) of the Cargo Ramp, where there are seagrass beds present, and the other is in the middle of the Sardinias Bay, where the cargo ferry will circle around it to back into position. Again, every time the cargo ferry comes to the Terminal, there will have to be coordination between the MTA and the Contractor to move the construction barge, a process identical to the one previously described for the small passenger ferry. After the cargo ferry leaves for Fajardo, the construction barge can repeat the procedure to return to the construction position. The total time for this operation is a minimum of two hours, and the cargo ferry travel to Culebra a minimum of twice daily, for a total construction-disruption time of approximately four additional hours per day.

Between the Caribeña (small) passenger ferry operation and the construction ferry operation, this option forces the construction barge to be out of demolition & construction position approximately eight hours per day. Each movement of the construction barge carries a collision risk, causes sediment resuspension and causes damage to the seafloor.

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c. Reconstruction of the Culebra Cargo Ramp.

Once the temporary cargo platform is built, reconstruction of the Culebra Cargo Ramp begins. See **Figure 9**. A construction barge will serve as the laydown area, given the lack of available landside area. The small passenger ferry operation is interrupted by the cargo ferry using the Temporary Cargo Ramp; therefore, the small passenger ferry cannot be utilized during this period, limiting the flexibility for the MTA. It is feasible that the construction barge will not have to be moved for the cargo ferry operations. At this stage, it is the waiting passengers who will see the most disruption. The use of the temporary cargo ramp at Sardinias Bay will occupy over a third of the area that

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passengers previously occupied, and their movement areas will be shared with loading and unloading vehicles, potentially causing unsafe conditions for pedestrians.

Cargo ramps are angled toward the water, which makes it unsuitable for pedestrians; therefore, it has to be demolished and reconstructed back to its existing condition. Also, the Culebra Ferry Terminal barely has the capacity for the existing pedestrian flow, so the area occupied by the temporary cargo ramp at Sardinias Bay cannot remain as a cargo ramp.

d. Return the temporary cargo ramp to its existing use.

This phase will cause conditions similar to that illustrated in **Figure 8**, where the construction barge must move out of the way to give way to the cargo ferry, causing approximately 4 hours per day of disruption in the construction process, causing seafloor damage (lowering spuds three times per day in new areas) and resuspending sediments (movement of the turbidity screen, lowering and raising spuds).

The above-described alternative, namely, the partial demolition of the existing wharf, the construction of a temporary cargo ramp at existing Culebra Terminal in Sardinias Bay has a price tag of between \$9 million and \$12 million. Returning the facilities to their original use will cost approximately \$2 million. This alternative will cause construction impacts for approximately fifteen months at the most densely populated portion of Culebra: Noise, traffic congestion, risks of collision to pedestrians, risk of collision to passengers and ferries, damage to the seafloor (barge spuds up and down on new seafloor four to six times per day), and sediment resuspension (spuds up and down, turbidity screen removal and redeployment).

Conclusion

Other than the physical areal limitations, which result in unreasonable delays and impossible coordination between the contractor and the MTA, and the excessive cost for a truly temporary facility that will only be used for six months to a year, there are the following concerns with the alternative to keep the cargo and passenger operations at the Sardinias Bay site during reconstruction of the cargo ramp:

- I. Structural Integrity.** An engineering evaluation from 2010 indicates that parts of the existing Cargo Platform are “structurally destroyed”, a condition easily observed by the physical separation of the supporting pilings from the Platform structural beams. According to the report, the existing Cargo Platform stands—partly—because it is structurally attached to the rest of the wharf’s concrete platform. Demolishing part

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of that concrete platform may further weaken the existing Cargo Platform, deteriorating already unsafe conditions.

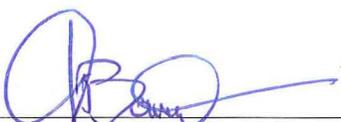
- II. **Pedestrian Safety.** The Culebra Ferry Terminal is presently very small. The required reconstruction of the cargo ramp will impact the area with heavy machinery and construction vehicles. Adding another construction phase at this terminal will add approximately fifteen months of additional construction impacts to an area with the highest population density in the Island Municipality. This plus the additional vehicular traffic will all result in additional risks to pedestrians in an area that already has pedestrians and vehicles in extremely close a proximity.

- III. **Passenger and Ferry Safety.** Compare **Figure 6** with **Figures 8**. **Figure 6** represents the conditions at the Culebra Ferry Terminal as proposed by PRPA, MTA and FEMA. **Figures 8** represents the conditions keeping the impacts within Sardinias Bay. **Figure 6** provides minimum, safe room for the passenger ferries to continue operating in Sardinias Bay while cargo ferries use the Auxiliary Terminal, proposed for the San Ildefonso area, during approximately six months. **Figure 6** requires no recurring daily movement of the cargo barge, and adequate operating room for both passenger ferries operations. The construction activities illustrated in **Figure 6** will impact the town of Dewey only approximately six months, while diverting chaotic traffic conditions away during this period. **Figure 8**, on the other hand, illustrates chaotic conditions on both the landward and the seaward side of the operation. These are the types of conditions that make uneasy anybody responsible for the safety and wellbeing of the passengers, personnel and ferries, including the undersigned.

In conclusion, the undersigned would under no circumstance endorse the alternative to keep the impacts at the Sardinias Bay Terminal given the safety, security and environmental concerns entailed. This document has been prepared jointly by the PRPA and the MTA, which certify that it's content accurately reflect the described conditions and limitations.



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- ⁱ UE&RC (2010) Structural Evaluation of Culebra Ferry Pier, Culebra Puerto Rico. Underwater Engineering & Research Corporation. Prepared for Ramos & Ramos Associates. September 21, 2010.
- ⁱⁱ Atkins (2013) Technical Note, Culebra Ferryboat Terminal Cargo Ramp Repair/Reconstruction. November 25, 2013. Concludes that the structure is unsuitable to perform the current operation. Observations include: severe spalling of the concrete cover and corroded reinforcement, all five concrete beams have severe spalling and heavily corroded horizontal and transverse reinforcement, there are 27 steel piles which show significant deterioration with some having lost most of the web and flange material.
- ⁱⁱⁱ USCB (2012) Puerto Rico: 2010 Summary Population and Housing Characteristics, 2010 Census of Population and Housing. U.S. Department of Commerce, Economics and Statistics Administration, U.S. Census Bureau. September, 2012.
- ^{iv} APPR (1992) Autoridad de los Puertos de Puerto Rico: 50 Años Acercando el Mundo a Puerto Rico.
- ^v Villamil, J.J (2011) Master Plan for the Sustainable Development of Vieques and Culebra. Land Use Update Presented to: Vieques Sustainability Task Force Meeting November 16, 2011 San Juan, Puerto Rico. José J. Villamil, Estudios Técnicos, Inc.
- ^{vi} USCG (2014) R.W. Warren, Captain of the Port, letter to Therese W. McMillan, Acting Administrator, Federal Transit Administration.
- ^{vii} Griffes, P.L. (2004) Atlantic Boating Almanac 2004: Volume 5 Gulf of Mexico, Puerto Rico and Virgin Islands. ProStar Publications, Annapolis, MD.