GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

MARK WILLIAMS
COMMISSIONER

A.G. 'SPUD' WOODWARD
DIRECTOR

AUG 04 2017

CDR J.M. Santiago
Department of the Navy
Naval Submarine Base Kings Bay
1063 USS Tennessee Avenue
Kings Bay, GA 31547-2606

Re: Letter of Permission (LOP) and Revocable License (RL) for Fiber Optic Cable Installation, Site 6 Pier, Naval Submarine Base Kings Bay, Camden County, Georgia

Dear CDR Santiago,

This Letter of Permission (LOP) is in response to your request, received June 28, 2017, to install fiber optic cables at the Site 6 pier in Naval Submarine Base Kings Bay in Camden County. The project was previously authorized by the Department on August 22, 2016 to occur in the fall of 2016 but was not completed. No changes have been made to the proposed action to install approximately 4,000 linear feet of fiber optic cable at two (2) locations perpendicular to the existing Site 6 pier paralleling the shoreline. A vibratory plow towed behind an amphibious vehicle (LARC) will be used during low tide to bury the cable to a depth of approximately 2ft. in a trench that will be approximately 1ft. wide. The LARC is able to work on dry land and in water. The vibratory plow will simultaneously trench and bury the cable. The cables will be buried in unvegetated sediment in the "intertidal area" and at a depth of approximately 2ft. to 3ft. in the "water area" at low tide. These cable segments will connect to newly installed cables along the existing pier on existing brackets. The cable segments will be plowed as close to the pier as possible, then hand buried up to the pier. Work is expected to begin in September 2017, take approximately 11 days to complete, and must be completed within six (6) months.

The Department authorizes the fiber optic cable installation as depicted in the attached description provided all Best Management Practices (BMPs) are used to protect Coastal Marshlands. No unauthorized equipment, materials, or debris may be placed in, disposed of, or stored in marsh jurisdictional areas.

Please find enclosed a fully executed revocable license, dated August 22, 2016, for the above-described project. This license serves as authorization to utilize state owned tidal water bottoms for your project as per the dimensions and configuration described. Any change in the use, location, dimensions, or configuration of the approved project, without prior notification and approval from this office could result on the revocation of this authorization and required

AUG 04 2017

removal of the materials and related structures. This authorization does not relieve you from obtaining any other required federal or local permits. Tidal water bottoms and marshlands of coastal Georgia are public trust lands managed by the State, except for such lands where a validated Crown Grant or State Grant exists.

Please feel free to contact Skye Stockel at (912) 262-3127 if you have technical questions regarding the proposed action or Kelie Moore at (912) 262-2334 if you have questions about the federal consistency process.

Sincerely,

Jill Andrews
Chief, Coastal Management Section

Enclosures: Project Drawings and Description

File: LOP20170161

DEPARTMENT OF THE NAVY
NAVAL SUBMARINE BASE
1063 USS TENNESSEE AVENUE
KINGS BAY, GEORGIA 31547-2606

IN REPLY REFER TO:

5090
Ser PRB4/0685
June 22 2017

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Karl Burgess
Manager, Marsh & Shore Management Program
Coastal Resources Division
Georgia Department of Natural Resources
One Conservation Way, Suite 300
Brunswick, GA 31520

SUBJECT: PERMIT EXTENSION TO INSTALL A FIBER OPTIC CABLE AT KINGS BAY, GEORGIA

This letter is to request an extension of permit FDC20160066 (Enclosure 1). Work was to be completed in October/November 2016, but was delayed due to internal coordination issues. Therefore, the project was not completed within six months as stated in your letter received August 22, 2016. The new project start date is September 2017. All aspects of the project scope remain unchanged from the initial application (Enclosure 2).

We have corresponded with the U.S. Army Engineer District, Savannah (Code CESAS-OP-F), and they advised that we are still covered under NWP 12 until March 17, 2018.

If you have any questions concerning this application, my point of contact is Mr. Kurt Moseley at (912) 573-4678 or kurt.moseley@navy.mil.

Sincerely,

J. M. SANTIAGO, P.E., LEED AP
CDR, CEC, USN
Public Works Office
By direction of the
Commanding Officer

Enclosures:
1. Permit FDC20160066
2. Detailed Project Description for Proposed Fiber Optic Cable Installation at SUBASE Kings Bay

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

MARK WILLIAMS
COMMISSIONER

A.G. 'SPUD' WOODWARD
DIRECTOR

AUG 22 2016

CDR J.M. Santiago
Department of the Navy
Naval Submarine Base Kings Bay
1063 USS Tennessee Avenue
Kings Bay, GA 31547-2606

Re: Letter of Permission (LOP), Revocable License (RL) and Coastal Consistency Determination (CCD) for Fiber Optic Cable Installation, Site 6 Pier, Naval Submarine Base Kings Bay, Camden County, Georgia

Dear CRD Santiago,

Staff of the Georgia Coastal Management Program has reviewed your July 12, 2016 letter and supporting documents, received July 22, 2016, to install fiber optic cables at the Site 6 pier in Naval Submarine Base Kings Bay in Camden County. The proposed action is to install approximately 4,000 linear feet of fiber optic cable at two (2) locations perpendicular to the existing Site 6 pier paralleling the shoreline. A vibratory plow towed behind an amphibious vehicle (LARC) will be used during low tide to bury the cable to a depth of approximately 2ft. in a trench that will be approximately 1ft. wide. The LARC is able to work on dry land and in water. The vibratory plow will simultaneously trench and bury the cable. The cables will be buried in unvegetated sediment in the "intertidal area" and at a depth of approximately 2ft. to 3ft. in the "water area" at low tide. These cable segments will connect to newly installed cables along the existing pier on existing brackets. The cable segments will be plowed as close to the pier as possible, then hand buried up to the pier. Work is expected to begin October 2016, take approximately 11 days to complete, and must be completed within six (6) months.

The Department authorizes the fiber optic cable installation as depicted in the attached description provided all Best Management Practices (BMPs) are used to protect Coastal Marshlands. No unauthorized equipment, materials, or debris may be placed in, disposed of, or stored in marsh jurisdictional areas.

Please find enclosed a fully executed revocable license for the above-described project. This license serves as authorization to utilize state owned tidal water bottoms for your project as per the dimensions and configuration described.

Enclosure (1)

The Georgia Coastal Management Program concurs with your consistency determination by the issuance of this Letter of Permission and the Revocable License enclosed with this authorization letter. This determination ensures that the proposed project has been designed to comply to the maximum extent practicable with the applicable enforceable policies of the Georgia Coastal Management Program.

Any change in the use, location, dimensions, or configuration of the approved project, without prior notification and approval from this office could result on the revocation of this authorization and required removal of the materials and related structures. This authorization does not relieve you from obtaining any other required federal or local permits. Tidal water bottoms and marshlands of coastal Georgia are public trust lands managed by the State, except for such lands where a validated Crown Grant or State Grant exists.

Please feel free to contact Skye Stockel at (912) 262-3127 if you have technical questions regarding the proposed action or Kelie Moore at (912) 262-2334 if you have questions about the federal consistency process.

Sincerely,

Jill Andrews
Chief, Coastal Management Section

Enclosures: Project Drawings and Description

File: FDC20160066

STATE OF GEORGIA
5-YEAR REVOCABLE LICENSE REQUEST

APPLICANTS NAME(S): CDR J.M. Santiago, Naval Submarine Base Kings Bay

MAILING ADDRESS: 910 USS Hunley Road, Bldg 2015, 1st Floor, Kings Bay, GA 31547
(Street) (City) (State) (Zip)

PROJECT ADDRESS/LOCATION: Naval Submarine Base Kings Bay, Georgia

COUNTY: Camden **WATERWAY:** Kings Bay **DATE:** July 12, 2016

LOT, BLOCK & SUBDIVISION NAME FROM DEED: not applicable

Georgia Department of Natural Resources
Coastal Resources Division
One Conservation Way
Brunswick, Georgia 31520-8687

I am making application for a permit with the U.S. Department of the Army, Corps of Engineers, Savannah District. I understand that the issuance of such a permit will not relieve me of the obligation to obtain authorization from the State of Georgia since the proposed project would constitute an encroachment on the beds of tidewaters which are State-owned property. Accordingly, I hereby request that I be granted a revocable license from the State of Georgia. Attached hereto and made a part of this request is a copy of the plans and description of the project that will be the subject of such a license. I certify that all information submitted is true and correct to the best of my knowledge and understand that willful misrepresentation or falsification is punishable by law.

I understand that if permission from the State is granted, it will be a revocable license and will not constitute a license coupled with an interest. I acknowledge that this revocable license does not resolve any actual or potential disputes regarding the ownership of, or rights in, or over the property upon which the subject project is proposed, and shall not be construed as recognizing or denying any such rights or interests. I acknowledge that such a license would relate only to the property interests of the State and would not obviate the necessity of obtaining any other State license, permit or authorization required by State law. I further acknowledge that I will have no liveaboards, nor allow them to occur, at this structure. I recognize that I waive my right of expectation of privacy and I do not have the permission of the State of Georgia to proceed with such project until the Commissioner of DNR has signed a copy of this request.

Sincerely,

By: _____
(Applicant), title if applicable

By: CDR J. M. Santiago
(Applicant), title if applicable

Attachment

****

The State of Georgia hereby grants you a revocable license not coupled with an interest as provided in your request. This area may now or in the future be utilized by boats employing power drawn nets under the provisions for commercial or sport bait shrimping. In its occupancy and use of the premises, licensee shall not discriminate against any person on the basis of race, gender, color, national origin, religion, age, or disability. This covenant by licensee may be enforced by termination of this license, by injunction, and by any other remedy available at law to the Department. The project proposed for this license must be completed within 5 years of the date of issuance of the license and must be maintained in serviceable condition. Otherwise, action will be initiated to revoke this license and all structure must be removed immediately at the licensee's expense.

STATE OF GEORGIA
Office of the Governor

By: _____
For: Mark Williams, Commissioner-DNR

DATE: AUG 22 2016

Revised 3/2012

GA DNR

JUL 21 2016

Marsh & Shore Mgt. Program

DEPARTMENT OF THE NAVY
NAVAL SUBMARINE BASE
1063 USS TENNESSEE AVENUE
KINGS BAY, GEORGIA 31547-2606

IN REPLY REFER TO:

5090
Ser PRB4/ 1028
July 12 2016

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Ecological Services
Coastal Resources Division
Georgia Department of Natural Resources
1 Conservation Way
Brunswick, GA 31523

SUBJECT: PERMIT APPLICATION TO INSTALL A FIBER OPTIC CABLE WITHIN KINGS BAY, GEORGIA

Enclosed (1) is a Joint Application to install a fiber optic cable adjacent to the Site 6 pier at the Naval Submarine Base, Kings Bay.

The fiber optic cable will be buried in the sediment using a vibratory plow with the intertidal zone to a depth of approximately two feet. Enclosure 2 includes additional details about the proposed action. All activities will be performed in a manner to minimize turbidity in the bay. All work performed during construction will be done in a manner to prevent interference with any legitimate water uses.

A Copy of the permit application has been sent to U.S. Army Engineer District, Savannah (Code CESAS-OP-F); Georgia Department of Natural Resources, Environmental Protection Division; and Georgia Department of Natural Resources, Coastal Resources Division, Habitat Management Branch.

If you have any questions concerning this application, my point of contact is Mr. Kurt Moseley at (912) 573-4678 or kurt.moseley@navy.mil.

Sincerely,

J. M. SANTIAGO, P.E., LEED AP
CDR, CEC, USN
Public Works Office
By direction of the
Commanding Officer

Enclosures:
1. Joint Application
2. Detailed Project Description for Proposed Fiber Optic Cable Installation at SUBASE Kings Bay

JOINT APPLICATION
FOR
A DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS PERMIT,
STATE OF GEORGIA MARSHLAND PROTECTION PERMIT,
REVOCABLE LICENSE AGREEMENT
AND REQUEST FOR
WATER QUALITY CERTIFICATION
AS APPLICABLE

INSTRUCTIONS FOR SUBMITTING APPLICATION:

Every Applicant is Responsible to Complete The Permit Application and Submit as Follows: One copy each of application, location map, drawings, copy of deed and any other supporting information to addresses 1, 2, and 3 below. If water quality certification is required, send only application, location map and drawing to address No. 4.

1. For Department of the Army Permit, mail to: Commander, Savannah District, US Army Corps of Engineers, ATTN: CESAS-RD, 100 W. Oglethorpe Avenue, .Savannah, Georgia 31401-3640. Phone (912) 652-5347 and/or toll free, Nationwide 1-800-448-2402.

2. For State Permit - State of Georgia (six coastal counties only) mail to: Habitat Management Program, Coastal Resources Division, Georgia Department of Natural Resources, 1 Conservation Way, Brunswick, Georgia 31523. Phone (912) 264-7218.

3. For Revocable License - State of Georgia (six coastal counties plus Effingham, Long, Wayne, Brantley and Charlton counties only) - Request must have State of Georgia's assent or a waiver authorizing the use of State owned lands. All applications for dock permits in the coastal counties or for docks located in tidally influenced waters in the counties listed above need to be submitted to Real Estate Unit. In addition to instructions above, you must send two signed form letters regarding revocable license agreement to: Ecological Services Coastal Resources Division, Georgia Department of Natural Resources, 1 Conservation Way, Brunswick, Georgia 31523. Phone (912) 264-7218.

4. For Water Quality Certification State of Georgia, mail to: Water Protection Branch, Environmental Protection Division, Georgia Department of Natural Resources, 4220 International Parkway, Suite 101, Atlanta, Georgia 30354 (404) 675-1631.

The application must be signed by the person authorized to undertake the proposed activity. The applicant must be the owner of the property or be the lessee or have the authority to perform the activity requested. Evidence of the above may be furnished by copy of the deed or other instrument as may be appropriate. The application may be signed by a duly authorized agent if accompanied by a statement from the applicant designating the agent. See item 6, page 2.

1. Application No. _____

2. Date 7/12/2016

3. For Official Use Only_____

4. Name and address of applicant.

5. Location where the proposed activity exists or will occur.

Lat._____ Long._____ 30° 47' 28.59" N 81° 30' 11.15" W

Camden	Naval Submarine Base Kings Bay	Kings Bay
County	Military District	In City or Town
St Marys	n/a	n/a
Near City or Town	Subdivision	Lot No.
n/a	0 - 8 ft	Georgia
Lot Size	Approximate Elevation of Lo	State
Kings Bay	Crooked River, Cumberland Sound	
Name of Waterway	Name of Nearest Creek, River, Sound,	Bay or Hammock

CESAS Form 19

GA DNR

JUL 2 1 2016

Marsh & Shore Mgt. Program

Enclosure (1)

6. Name, address and title of applicant's authorized agent for permit application coordination.

Kurt Moseley, Natural Resource Manager
910 USS Hunley Ave
Building 2015, Room 212
NSB Kings Bay, GA 31547

Statement of Authorization: I hereby designate and authorize the above named person to act in my behalf as my agent in the processing of this permit application and to furnish, upon request, supplemental information in support of this application.

Signature of Applicant — Date: 7/15/16

7. Describe the proposed activity, its purpose and intended use, including a description of the type of structures, if any to be erected on fills, piles, of float-supported platforms, and the type, composition and quantity of materials to be discharged or dumped and means of conveyance. If more space is needed, use remarks section on page 4 or add a supplemental sheet. (See Part III of the Guide for additional information required for certain activities.)

The Department of the Navy proposes to install a fiber optic cable to a depth of 2 feet in the intertidal zone on the northwest side of the Land Water Interface. No structures will be erected on fills, piles, or float-supported platforms, and no materials are to be discharged or dumped. Attachment 1 provides additional details on the proposed cable installation.

8. Proposed use: Private ☐ Public ☐ Commercial ☐ Other ☒ (Explain) military

9. Names and addresses of adjoining property owners whose property also adjoins the waterway.

Not applicable. All property adjoining the project is Navy-owned.

10. Date activity is proposed to commence. October 2016

Date activity is expected to be completed. November 2016

11. Is any portion of the activity for which authorization is sought now complete ☐Y ☒N

a. If answer is "Yes", give reasons in the remarks in the remarks section.
Indicate the existing work on the drawings.

b. If the fill or work is existing, indicate date of commencement and completion.

c. If not completed, indicate percentage completed.

12. List of approvals or certifications required by other Federal, State or local agencies for any structures, construction discharges, deposits or other activities described in this application. Please show zoning approval or status of zoning for this project.

Issuing Agency	Type Approval	Identification No.	Date/Application	Date/Approval
none				

13. Has any agency denied approval for the activity described herein or for any activity directly related to the activity described herein?
☐ Yes ☒ NO (If "yes", explain).

Note: Items 14 and 15 are to be completed if you want to bulkhead, dredge or fill.

14. Description of operation: (If feasible, this information should be shown on the drawing).

a. Purpose of excavation or fill Temporary disturbance of linear area along shore for installation of fiber optic cable

1. Access channel length_____ depth_____ width_____

2. Boat basin length_____ depth_____ width_____

3. Fill area length_____ depth_____ width_____

4. Other narrow trench length 4,000 ft depth 2 ft width 1 ft
(Note: If channel, give reasons for need of dimensions listed above.)

b. If bulkhead, give dimensions _____

– Type of bulkhead construction (material)_____

1. Backfill required: Yes _____ No _____ Cubic yards _____

2. Where obtained _____

c. Excavated material

1. Cubic yards _____

2. Type of material _____

15. Type of construction equipment to be used LARC and vibratory plow

a. Does the area to be excavated include any wetland? Yes ☒ No ☐

b Does the disposal area contain any wetland? Yes ☐ No ☐

c. Location of disposal area_____

d. Maintenance dredging, estimated amounts, frequency, and disposal sites to be utilized: no maintenance dredging is required

e. Will dredged material be entrapped or encased? _____

f. Will wetlands be crossed in transporting equipment to project site? yes

g. Present rate of shoreline erosion (if known) negligble

16. Description of Avoidance, Minimization and Compensation: Provide a brief explanation describing how impacts to waters of the United States are being avoided and minimized on the project site. Also, provide a brief description of how impacts to waters of the United States will be compensated for, or a brief statement explaining why compensatory mitigation should not be required for those impacts.

Project design incorporates use of the pier structure to partially avoid the intertidal area. The least impactful methodology for installation of the cable is proposed for use, with minimial disturbance to soil and substrates through use of the narrow width vibratory plow. Installation will occur during low tide to minimize sediment transport, and will be performed by US Army Corps of Engineers personnel. Substrate will be replaced promptly over the top of the installed cable.

17. Water Quality Certification: In some cases, Federal law requires that a Water Quality Certification from the State of Georgia be obtained prior to issuance of a Federal license or permit. Applicability of this requirement to any specific project is determined by the permitting Federal agency. The information requested below is generally sufficient for the Georgia Environmental Protection Division to issue such a certification if required. Any item, which is not applicable to a specific project, should be so marked. Additional information will be requested if needed. .

a. Please submit the following:

1. A plan showing the location and size of any facility, existing or proposed, for handling any sanitary or industrial waste waters generally on your property.

2. A plan of the existing or proposed project and your adjacent property for which permits are being requested.

3. A plan showing the location of all points where petro-chemical products (gasoline, oils, cleaners) used and stored. Any aboveground storage areas must be diked, and there should be no storm drain catch basins within the dike areas. All valving arrangements on any petro-chemical transfer lines should be shown.

4. A contingency plan delineating action to be taken by you in the event of spillage of petro-chemical products or other materials from your operation.

5. Plan and profile drawings showing limits of areas to be dredged, areas to be used for placement of spoil, locations of any dikes to be constructed showing locations of any weir(s), and typical cross sections of the dikes.

b. Please provide the following statements:

1. A statement that all activities will be performed in a manner to minimize turbidity in the stream.

2. A statement that there will be no oils or other pollutants released from the proposed activities which will reach the stream.

3. A statement that all work performed during construction will be done in a manner to prevent interference with any legitimate water uses.

18. Application is hereby made for a permit or permits to authorize the activities described herein; Water Quality Certification from the Georgia Environmental Protection Division is also requested if needed. I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete and accurate. I further certify that I posses the authority to under take the proposed activities.

Signature of Applicant

19. U.S.C. Section 1001 provides that: Whoever, in any matter within the jurisdiction of any department or agency of the United States, knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious, or fraudulent statements or representations, or makes or uses false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined no more than $10,000 or imprisoned not more than 5 years or both.

PRIVACY ACT NOTICE

The Department of the Army permit program is authorized by Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act and Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972. These laws require permits authorizing structures and work in or affecting navigable waters of the United States, the discharge of dredged or fills material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Information provided will be used in evaluating the application for a permit. Information in the application is made a matter of public record through issuance of a public notice. Disclosure of the information requested is voluntary; however, the data requested are necessary in order to communicate with the applicant and to evaluate the permit application. If necessary information is not provided, the permit application cannot be processed nor can a permit be issued.

SUPPORTING REMARKS:

U.S. Army Corps of Engineers
Regulatory Branch, Coastal Area Section
100 West Oglethorpe Avenue
Savannah, Georgia 31401-3640

To Whom It May Concern:

This is to certify the work subject to the jurisdiction of the U.S. Army Corps of Engineers as described in my application dated July 12, 2016, is to the best of my knowledge, consistent with the Georgia Management Plan.

Since my project is located in the Coastal Area of Georgia, I understand the U.S. Army Corps of Engineers must provide this statement to the Georgia Department of Natural Resources, Coastal Resources Division, Ecological Services Section (GADNR-CRD) for its review, and a Department of Army permit will not be issued until the GADNR-CRD concurs with my findings. I also understand additional information may be required by the GADNR-CRD to facilitate its review of my project and the additional information certifications may be required for other Federal or State authorizations.

Signature of Application: by direction

Date: 7/15/16

Printed Name of Applicant: CDR J M SANTIAGO

Street Address: Naval Submarine Base Kings Bay

910 USS Hunley Road, Bldg 2015, 1st Floor

City, State, Zip Code: Kings Bay, GA 31547

Phone Number: 912-573-4600

Fax Number: 912-573-2661

E-Mail Address: jesus.m.santiago@navy.mil

For questions regarding consistency with the Georgia Coastal Management Program, Please contact Kelie Moore, GADNR-CRD, (912) 264-7218.

Enclosure 2

Detailed Project Description
for Proposed Fiber Optic Cable Installation at SUBASE Kings Bay

Kings Bay Distributed Fiber Seismic Sensor Installation

Clay Kirkendall, NRL
clay.kirkendall@nrl.navy.mil
202-767-1316

Introduction:

The Naval Research Lab (NRL) has been awarded a three year program to develop a Multi-Sensor Detection and Discrimination (MSDD) data fusion system for situational awareness in difficult terrain, including the land-water interface (LWI). The MSDD demonstration system consists of multiple sensing modalities including distributed seismic, radar, and imaging systems. The fiber-optic based distributed seismic sensor operates in the land, intertidal, and water zones at the LWI. The program includes an operational assessment phase at a realistic LWI location. The LWI on the North/West side of the pier at Site 6 of Naval Submarine Base Kings Bay has been selected for the operational assessment. The installation requirements of each sensor are described separately and this white paper addresses the installation requirements for the distributed seismic sensor. The desired sensor installation timeframe to meet the program goals is the late fall of 2016 (October – November).

This MSDD test requires installation of a buried fiber optic sensor cable at a nominal depth 2 feet in each of the land, intertidal, and water zones at the LWI. In 2013 a land based demonstration of a distributed seismic fiber optic sensor system was installed on this site as shown in red in Figure 1. The demonstration cable was buried at a depth of 2' and extends ~ 0.5 miles along the LWI. One end of the buried cable is terminated in the guard shack at the land end of the pier which is where the processing equipment was located.

Figure 1. Existing in-ground distributed fiber optic sensor system.

The MSDD program plans to reuse this fiber segment and add additional parallel segments in the intertidal and water zones as shown in Figure 2. Access to the new cable segments will be achieved via a fiber optic cable running along the pier. The guard shack at the land end of the pier will continue to house the processing equipment for all the MSDD sensor systems.

This white paper describes the planned installation of the fiber cable segments along the pier and in the intertidal and water zones.

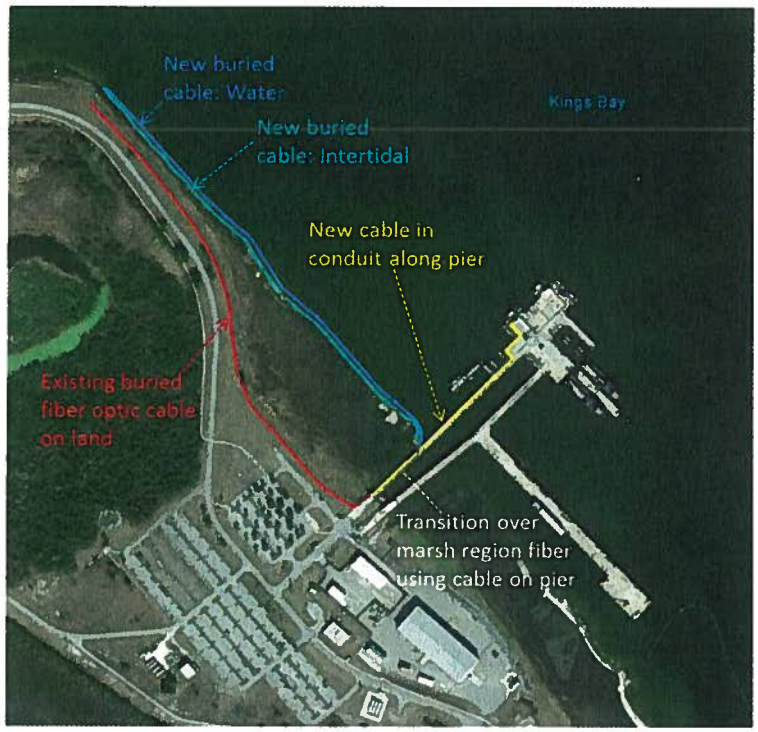

Figure 2. Proposed cable path for new buried intertidal and water zone cable segments. The pier is used to transition over the marsh region.

Cable installation along the pier

The south side of the pier has existing support brackets that will be used to carry the cable, in conduit, down the pier as shown in Figure 3. The support brackets already carry a large water pipe and an unknown cable down the pier. The new conduit will be standard 1" pvc pipe and will be attached to the support brackets with tie wraps and/or metal brackets as needed. The new conduit/cable will not interfere with the existing cable or infrastructure. A more detailed installation plan that includes the cable passing below the pier at the land end and the cable breakout box used to interconnect the newly installed cables is shown in Figure 4.

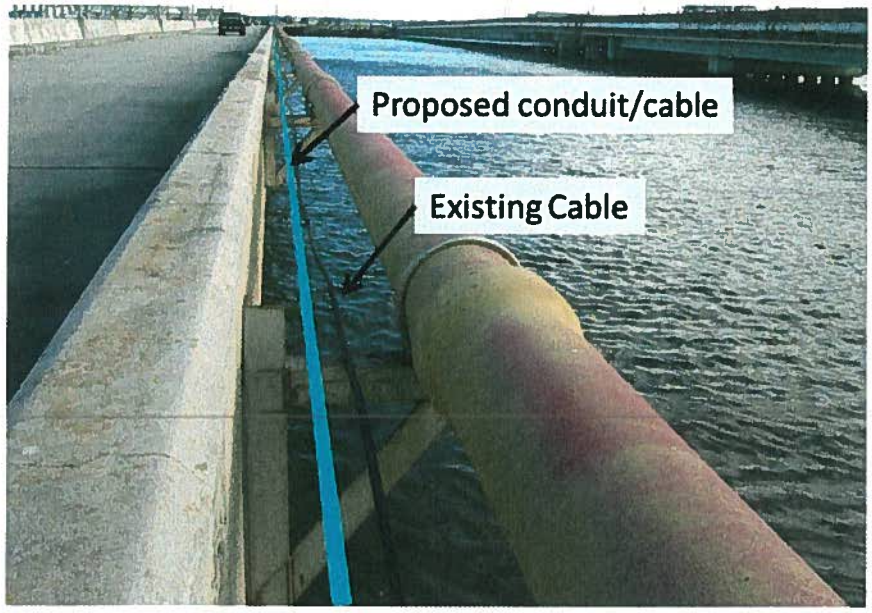

Figure 3. Proposed cable conduit path along pier.

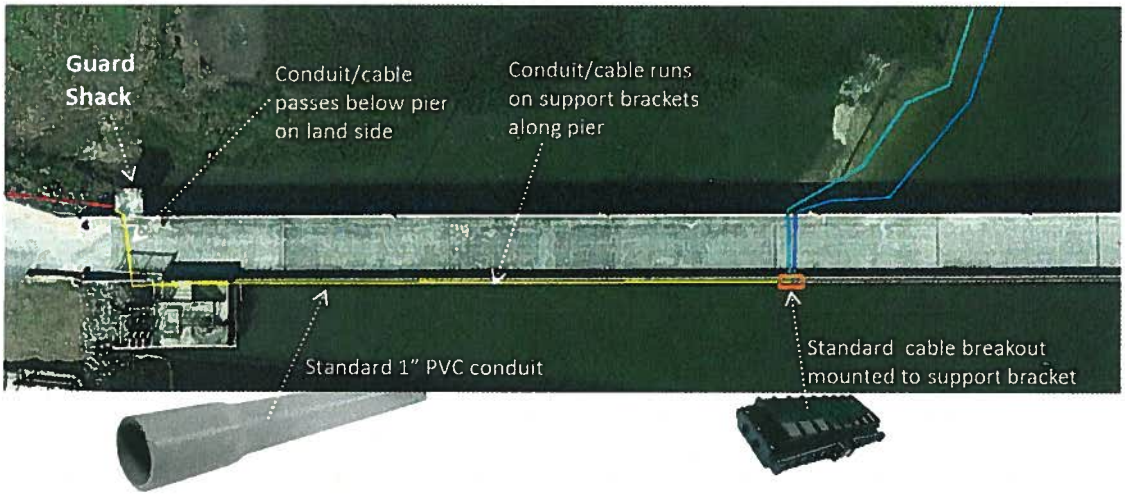

Figure 4. Conduit/cable installation detail from guard shack to cable breakout.

Cable Installation in the Intertidal and Water Zones

The two new cable segments will follow the shore/marsh from the pier to just short of the security buoy as shown in Figure 5. The cables will be buried in sand/sediment at a depth of approximately 2 feet and will not enter the sea grass along the shore. The intertidal segment will loosely follow the line of the

marsh without entering the marsh or burying through sea grass. The distance between the two cable segments will be from 6 to 30 feet with a nominal distance of 10 feet depending on terrain.

Available bathymetry data for this location is also included in Figure 5. Based on the bathymetry data the majority of the cable path is relatively shallow from the pier to the last few hundred feet at the Northern end before the security buoy.

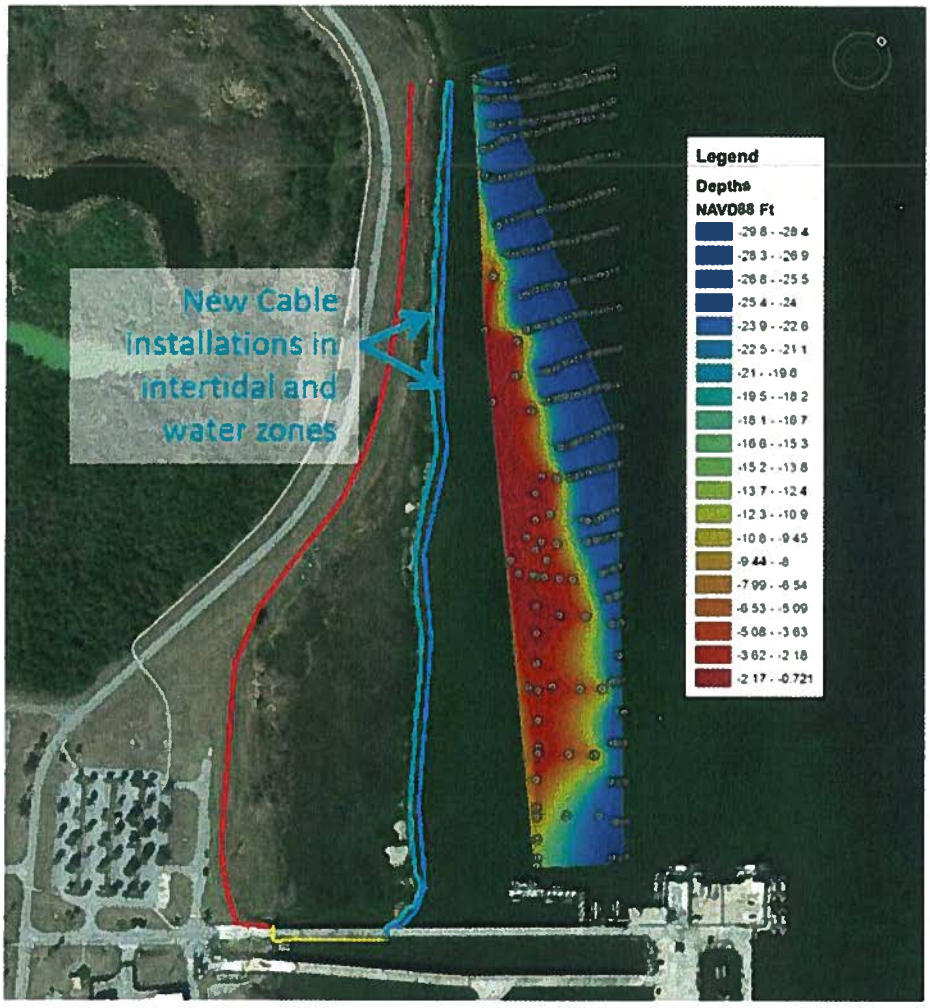

Figure 5. New cable installations between the pier and security buoy are shown in shades of blue. The cable will follow the shoreline and not interfere with sea grass. Available bathymetry data and associated color scale are included.

A more detailed view of the shallower Norther end of the cable path is shown in Figure 6 along with the distances from the marsh to the closest bathymetry measurements. Based on the depths where the bathymetry measurements were stopped and the distance from these measurements to the marsh it is expected that the depths at the cable burial locations will be sufficiently shallow for the proposed installation approach (described in the following paragraph). The installation will proceed as far north as possible up to ~ 50 feet short of the security buoy.

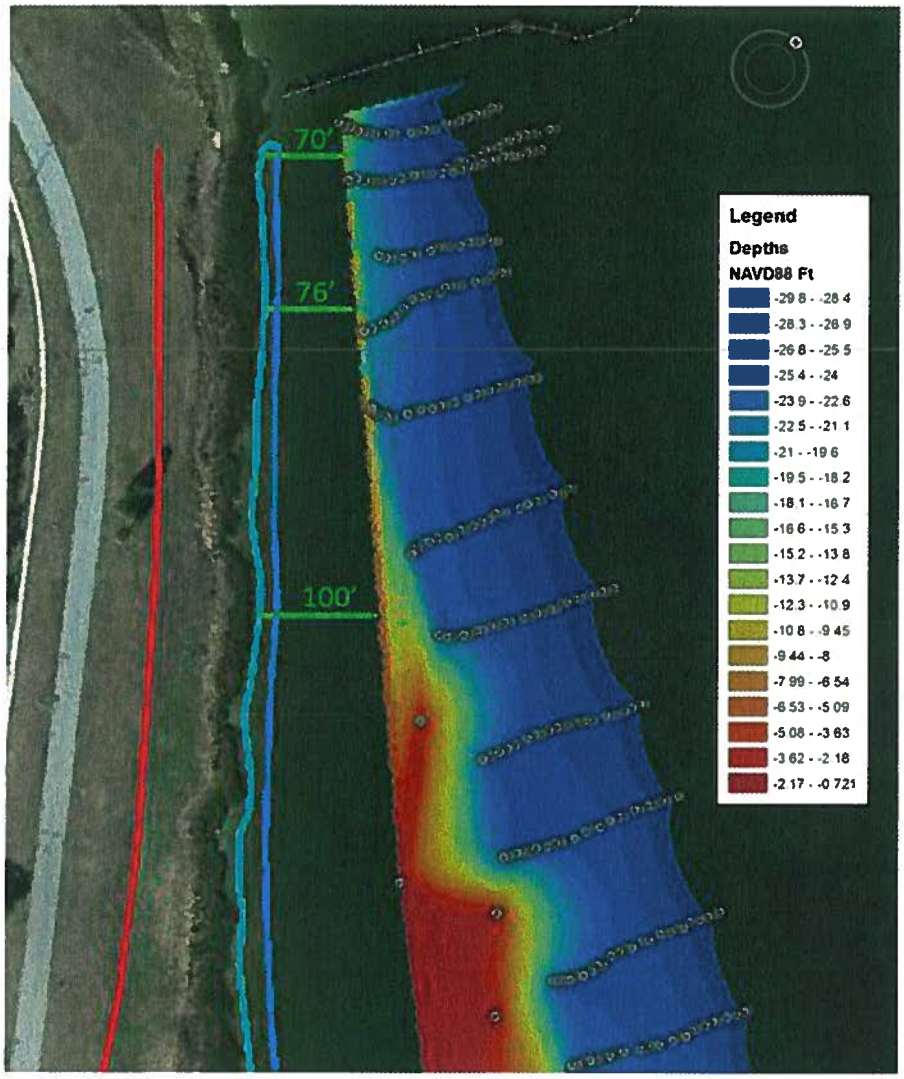

Figure 6. Detailed view of the shallow Northern end of the cable run.

The US Army Corps of Engineers Coastal & Hydraulics Laboratory (USACE -CHL) located in Kitty Hawk North Carolina will be installing the new segments of buried cable in the intertidal and water zones. They will be using burial techniques that they developed to bury cable in coastal regions and have used in Currituck Sound. The installation approach is based on using an amphibious vehicle (LARC), shown in Figure 7, to pull a vibratory plow which is used to bury the cable in a single continuous pass. The spool holding the cable to be installed will be on the deck of the LARC (as shown in Figure 7). Figure 8 shows a close-up view of the vibratory plow and a sample slit trench in sand. The vibratory plow simultaneously trenches and buries a cable with minimal disturbance to the ground. The cable burial depth can be controlled from 1 to 4 feet with a nominal depth for this installation of 2 feet. The vibratory plow will be connected to the rear of the lark and will bury the cable as the LARC drives along the coast. The LARC is able to work on dry land, in water, and in-between the two. The MSDD installation will occur at low tide

when the intertidal zone segment is dry and the water zone segment is at minimum depth (water depth of 2' to 3' at burial location). The cable will be installed by simply driving the lark along the desired installation cable path.

Figure 7. LARC amphibious vehicle to be used for the cable installation.

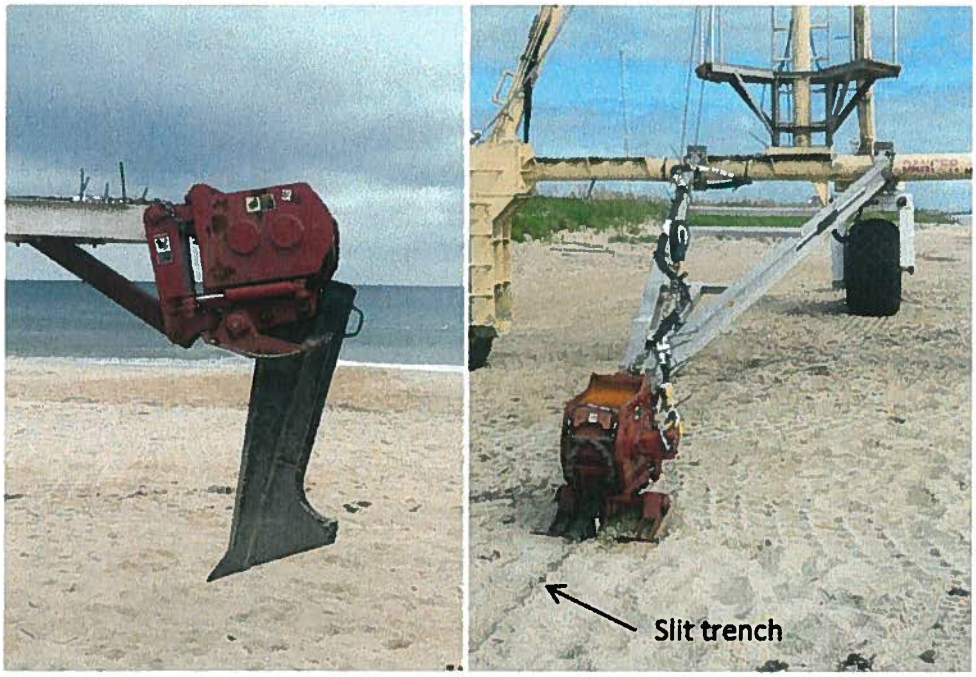

Figure 8. Vibratory plow showing plow blade (left) and during operation (without cable) in sand showing the resulting slit trench.

The LARC will launch from the boat launch area south of Site 6 and transit to the installation site as shown in Figure 9. Prior to launching on the water the Captain of the LARC will contact the appropriate base personnel for approval. The LARC will maintain constant radio contact with base security throughout the installation process and let them know when water operations for the day are complete.

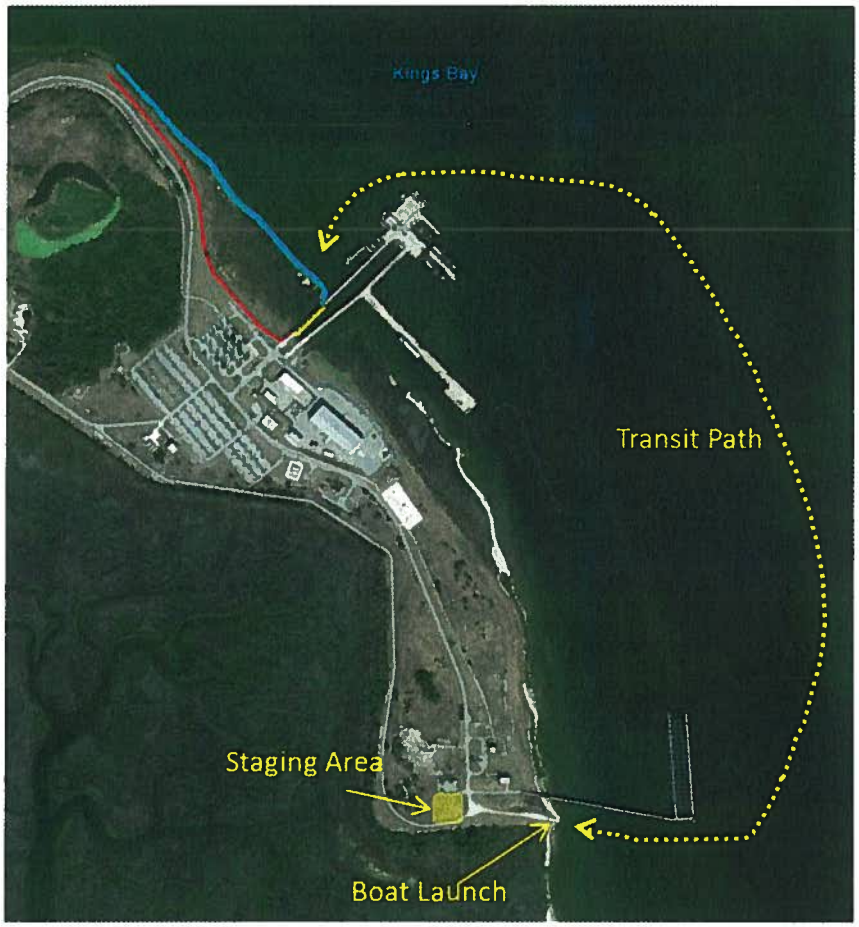

Figure 9. Boat launch, equipment staging, and water transit path.

The cable segments will be plowed in as close to the pier as possible and then hand buried up to the pier. PVC conduit will be used to transition the cables from below ground to above ground and to protect the cables through the tidal surge zone. The cables, in conduit, will travel under the pier along a support pylon and connect to the fiber breakout on the pier as shown in Figure 10.

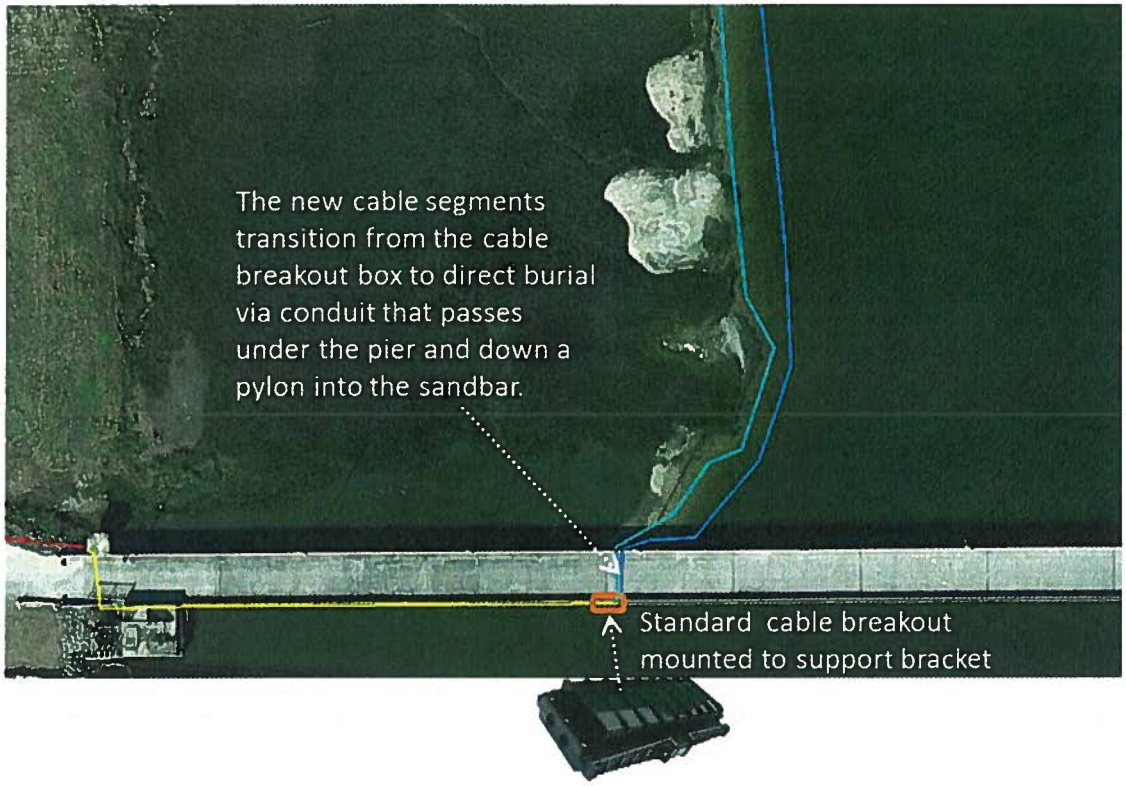

Figure 10. Transition from cable breakout to direct burial.

Notional Installation Schedule

The cable installation work will be performed in two phases. Phase 1 will install the cable from the guard shack at the end of the pier to the cable break out on the pier. This work is expected to last three days and the plan includes two contingency days for a maximum of five days.

Table 1. Notional installation schedule for phase 1.

Phase 1 - Pier Installation	
Day	**Activity**
1	Arrive on site. Add cable access hole in guard shack to. Prepair for conduit installation on the pier.
2	Install conduit and cable breakout along the pier
3	Pull fiber optic cable from guard shack to cable breakout. Terminate cable and check continuity. Ensure installation work site is clean of debris.
4	Contingency day.
5	Contingency day.

The sensor cable will be installed in the intertidal and water zones in phase 2 as shown in Table 2. The installation involves the amphibious LARC transiting from the boat launch to the installation site which will require communication with base security. Prior to the installation a dry run of the entire installation will be performed (day 2 of schedule). It is anticipated that the cable burial step will take less than one day but the plan includes multiple contingency days if needed. The tide schedule will be taken into account when scheduling the phase 2 effort as it is important that low tide occurs during normal daylight working hours.

Table 2. Notional phase 2 installation schedule.

Phase 2 - Sensor Installation	
Day	**Activity**
1	Stage LARC, plow, and sensor cable spool near boat launch. Meet with base securty personnel to review security and communications proceedures for water operations.
2	Dry run cable installation. Transit LARC from boat launch to installation location and drive installation path in mock deployment. Install PVC conduit under pier for cable transition from breakout box. Load sensor cable and vibratory plow on LARC.
3	Install cable: Transit from boat launch to pier, bury sensor cable, pull cable ends through conduit to cable breakout on pier.
4	Terminate cables and check continuity
5	Contingency day.
6	Contingency day.