

High Performance Turf Reinforcement Mat (HPTRM) for improving the erosion resistance of clay levees within the Hurricane and Storm Damage Risk Reduction System with the ability to add mower wheel load capacity to wet soil
Sources Sought Notice: W912P8-12-SS-0007

237 -- Heavy and Civil Engineering Construction/237990 -- Other Heavy and Civil Engineering Construction

SYNOPSIS:

This Sources Sought (SS) is for supplying synthetic high performance turf reinforcement mat (HPTRM) that will provide improved erosion resistance to the crown and to the levee side slopes for the proposed Armoring Pilot - Demonstration Project, to be conducted on two Hurricane Storm Damage Risk Reduction System (HSDRRS) levee alignments. The Government will evaluate the manufacturer/supplier's responses to this Sources Sought synopsis and determine each manufacturer/supplier that qualifies for purchase and subsequent installation for testing under the levee Armoring Pilot – Demonstration Project. The quantity of HPTRM to be supplied for each demonstration area shall depend on the number of suppliers replying to Sources Sought. The Sources Sought shall be used to establish a two phase testing program as outlined below.

Within 15-days of Sources Sought closing date, the manufacturer/supplier shall be notified by the Contracting Officer of the square yard quantity using the manufacturer/supplier standard roll width and length of HPTRM to be provided for each levee test area. At the time of solicitation, only HPTRM manufacturer/supplier's having a minimum of 50,000 square yards of documented field installations shall be approved for consideration. The HPTRM manufacturer/supplier shall demonstrate that he can manufacture a minimum of 100,000 sy per month within 3-months of award of any future orders to supply HPTRM.

1.0 High Performance Turf Reinforcement Mat (HPTRM)

The HPTRM material shall be a High Performance Turf Reinforcement Mat (HPTRM) as defined by the Erosion Control Technology Council (ECTC), EPA, Storm Water Technology Fact Sheet, Turf Reinforcement Mats, and FHWA, FP-03, Materials shall consist of non-degradable synthetic fibers, monofilaments, mesh and/or other elements, processed into a three dimensional matrix capable of supporting the dense growth of grass roots through the material; shall be a woven polypropylene or polyester geogrid, both of which are specially designed for erosion resistance on levees with slopes as steep as 1V on 3H. HPTRMs shall conform to the following material specifications.

Average Roll Values for HPTRM:

<u>Property</u>	<u>Test Method</u>	<u>Avg. Roll Value</u>
Mass/Unit Area	ASTM D-6566	min. of 8.5 oz/sy
Thickness	ASTM D-6525	min. of 0.3 in
Light Penetration (% passing)	ASTM D-6567	max. of 45%
Tensile Strength	ASTM D-6818	min. of 3000 lb/ft in MD
Elongation	ASTM D-6818	max. of 50% 65%
Resiliency	ASTM D-6524	min. of 70%
UV Resistance @ 2500 hrs.	ASTM D-4355	min. of 80%

Manufacturer/supplier shall submit product data sheets demonstrating proposed product meets or exceeds minimum requirements specified above. All material properties shall be in accordance with the required ASTM test methods referenced above.

2.0 Field Testing Program (Govt. Expense)

Field testing for the Armoring Pilot – Demonstration Project to be conducted on two levee alignments shall evaluate the ability of the HPTRM system (HPTRM material, anchoring system including spacing layout) and grass combination to withstand normal O&M operations, e.g.

mowing the grass, and the ability of the grass to adhere and grow through the fabric. Also, the wheel load resistance performance shall be evaluated for each of the selected HPTRM systems installed, under the same environmental and levee field conditions. Anchor system / method for securing or anchoring fabric to existing levee slopes shall be evaluated for ease of installation and subsequent removal. The (HPTRM) armored levee test results shall be compared to both the performance of unarmored levee test results and the minimum standard of performance as outlined in the Field Testing Program in Attachment 1 in order for each HPTRM system to be considered acceptable for this phase of the 2-phase testing program.

Each HPTRM manufacturer/supplier, by responding to this Sources Sought, agrees to provide a representative at the Armoring Pilot – Demonstration Project test site to witness the field wheel load performance on material and also prior to this to conduct five or more “pull-out” tests of the anchors, at locations to be determined by the Contracting Officer on the levee side slope for each demonstration levee. The test shall document the average pull-out strength over a minimum of five tests. The manufacturer/supplier shall demonstrate sufficient anchor pull-out strength to resist HPTRM movement from operation of maintenance/mowing equipment on the levee.

The testing shall be conducted prior to fabric installation and shall be reviewed and approved by Contracting Officer. All HPTRMs that meet the minimum performance standards outlined in the attached HPTRM Wheel Load Field Testing Plan shall be considered to have passed the phase 1 field wheel load performance testing.

Additional details of the field testing are included in Attachment 1

3.0 Wave Overtopping Testing (at HPTRM manufacturer/supplier expense in accordance with Wave Overtopping Testing minimum requirements. See Attachment 2 for details.)

In addition to the above levee Armoring Pilot – Demonstration Project field testing, each HPTRM manufacturer/supplier, by submitting his/her armoring material in response to this Sources Sought, also agrees to have full scale wave overtopping testing performed at Colorado State University (CSU), at manufacturer/supplier’s expense, and submit draft test results to the USACE by the end of 2012. **The manufacturer/supplier should contact CSU directly for a cost estimate of testing.** Each HPTRM tested at CSU must sustain wave overtopping flows of 4.0 cfs/ft for 3 equivalent test hours on dormant Bermuda grass with 0.2-ft or less of soil/grass erosion over a 4ft sq area.

All HPTRM test trays will be developed and tested in the same manner in order to ensure consistency so that the only significant variable is the type of HPTRM. Therefore all HPTRM test trays must be developed in the same manner including the same soil, compaction, moisture content, grass sod condition, watering, fertilizer, climate (temperature, sunshine), dormancy process and period. Each HPTRM shall be subjected to the same hydraulic testing process/protocols (wave number, volumes, distribution, etc.) as the previous Corps’ 2010 testing of two classes of TRM at CSU, at its maximum capable wave overtopping simulated flow of 4.0 cfs/ft. Additional details of the CSU testing protocols, geotechnical and grass growth requirements can be provided to HPTRM manufacturers/suppliers upon written request.

The manufacturer/supplier shall submit a schedule within 30 days of notification by the Contracting Officer of meeting the Sources Sought Inquiry indicating how he intends to complete all of the required testing and the draft report submittal by December 31, 2012. **This schedule is based on the requirement of the Government to deliver the completed project. This time does not include Government review of the Sources Sought posting period or review of submittals.** As a requirement of meeting this Sources Sought, a final report shall be due to USACE within one month of the manufacturer/supplier submitting the draft report.

Details of the wave overtopping testing are included in Attachment 2,

- 3.1 High Performance Turf Reinforcement Mat (HPTRM)
HPTRM material shall conform to specifications presented in Section 1.0, High Performance Turf Reinforcement Mat (HPTRM) above.
- 3.2 Soil
See Attachment 2 for further details on soil material and placement requirements.
- 3.3 Bermuda Grass
See Attachment 2 for further details on grass species, growth, and quality requirements.

The U.S. Army Corps of Engineers, New Orleans District, solicits a Statement of Compliance from all qualified companies.

Statement of Compliance:

The manufacturer/supplier shall provide the Government a statement with the name of the HPTRM manufacturer/supplier, the Trademark product name, chemical compositions of filaments or yarns and other pertinent information to fully describe the HPTRM, and a statement attesting that their high performance turf reinforcement mat meets these requirements. The statement shall be signed by an official authorized to attest on behalf of the manufacturer/supplier and shall be accompanied by a mill certificate that verifies physical properties shall be tested during manufacturing and lists the manufacturer/supplier's quality control testing. The documents shall include a statement confirming that all purchased resin to be used to produce reinforcement shall be virgin resin. The mill certificate shall include the tensile strength tested in accordance with ASTM D 6818. The statement of compliance shall also include the following:

- 1) Firm name, address, telephone/fax numbers, CAGE code, DUNS number, and proof of an active CCR registry.
- 2) Identification of the company's size status (large business or small business). If small business, submit proper certification (socioeconomic status, such as 8a, HubZone, Woman Owned, Service Disabled Veteran Owned). NAICS Code 237999 business size standard is not to exceed 500 each.
- 3) Past experience with HPTRM installation on a levee system.

IMPORTANT:

Responses shall be limited to no more than twenty (20) pages and received by the response time indicated below. This synopsis is for evaluation and planning purposes only and is neither to be construed as a commitment by the Government nor will the Government pay for information solicited. Respondents SHALL be notified of the field test results and evaluation of only its product. Statements that do not meet all requirements or submitted within the allotted time shall not be considered. Electronic submissions will be accepted.

The responses to this SOURCES SOUGHT synopsis may be e-mailed to Brooke.P.Woods@usace.army.mil and Michelle.Y.Lappen@usace.army.mil or faxed to 504-862-2889, Attn: Brooke Woods or Michelle Lappen.

Responses must be received no later than **11:00 A.M. Central Time Zone, Tuesday, June 12, 2012.**

Contracting Office Address:

USACE District, New Orleans, ATTN: CEMVN-CT, P.O. Box 60267, New Orleans, LA 70160-0267

Place of Performance:

USACE District, New Orleans ATTN: CEMVN-CT, P.O. Box 60267 New Orleans LA 70160-0267 US

Point of Contact(s):

Brooke Woods, 504-862-2416 Michelle Lappen, 504-862-1612

Attachment 1

Field Testing Program

1. All of the HPTRMs that meet the Sources Sought and Manufacturer/Suppliers agreeing to perform wave overtopping testing at CSU, shall be installed on the levee crown and landside slope in discrete distinguishable areas down the levee centerline for inclusion in the field performance testing program.
2. Grass shall be established with a combination of Bermuda grass sod and Bermuda grass seed to a quality defined as follows:
 - Min. ground cover of 90%
 - Total root length exceeding 37.72 cm
 - Total root volume exceeding 3.63 cm³
 - Weight exceeding 13.9 gm
3. Grass Growth Requirements

Grass shall be grown for the field testing using 1-1/2 in. thick common Bermuda sod conforming to an ABC Gradation (Louisiana Dept. of Agriculture and Forestry – LDAF) and Bermuda seed certified (blue-tag) seed in accordance with regulations from the U.S. Department of Agriculture (under the Federal Seed Act) and the Louisiana Department of Agriculture. Seed must be in sealed or unopened containers prior to initiation of application. Bermuda seed shall be hulled common Bermuda grass seed applied a 75 lbs/acre (min.). Sod and seed shall be installed with the manufacturer's HPTRM incorporated. Grass must be adequately watered and fertilized per the following.

- Depending on weather conditions, sod shall be irrigated immediately upon placement, which shall occur within one day of arrival on site and then watered twice to three times daily at 0.75 – 1.0 in. of water/ft²/day during the first 30 days and reduced to twice daily for the next 30 days at a total rate of 1/2 in. per day if average day-time temperatures are greater than 80 deg F, and 3/8 in. per day if the average day-time temperatures are less than 80 deg F.
- Seed watering operations shall be conducted one to two days after seed application. Water shall be applied at least 2 times per week for a period of 28 days unless otherwise directed. The application of water shall sufficiently moisten at least the top 2 in. of soil with each irrigation event
- The Contractor shall avoid excessive application of water to sod and seed, with the watering application rate not greater than the infiltration rate to prevent surface runoff. The application rate of irrigation shall not exceed the infiltration rate of the soil.

Following the installation of the sod, it shall be fertilized at 14 days post sod installation at 25 lb of nitrogen per acre and again 45 to 60 days post sod installation at 25 lb of nitrogen per acre, using water-soluble or slow-release nitrogen sources.

Approximately one month after the initial seeding, fertilizer shall be applied at the minimum rate of 45 lbs per acre using a slow-release nitrogen fertilizer formula. The fertilizer shall be applied with irrigation or rainfall occurring within 24 hours.

The first mowing of the sod areas should occur no earlier than 90 days after sod placement to allow for proper establishment and to limit rutting and injury to the grass and soil beneath the HPTRM. Grass shall be cut no lower than 6 in. above the ground. Fertilizing to establish a dense grass canopy is more important than mowing at intervals longer than 30 days to control weeds.

Seed areas shall be mowed to a height of 3 to 4-in. whenever the height of the vegetation is in excess of 8 in. Grass clippings created from mowing that will inhibit turf establishment shall be removed from the site.

To determine the adequate grass quality in the field, the grass stems shall be measured/counted in a 4-in.-diameter area as follows: Measure the density of grass using this stem count methodology at intervals of 90 to 120 days. If grass is properly watered and otherwise maintained during the establishment period (60 - 90 days) nearly complete coverage is anticipated. Successful installation shall be defined as +95% turf establishment, and no areas or browned / dead grass greater than 2 ft², and a shoot count of a minimum of 50 in a 4-in.-diameter area.

4. The wheel load that will be used for field testing shall be the mowing tractor that exerts the greatest wheel bearing pressure in psi from the Levee District where the test takes place. To be considered acceptable, the HPTRM must pass the wheel load test for both Levee Districts (East Bank of St. Charles Parish and West Bank of Jefferson Parish).
5. After the grass has reached the quality as stated in no. 2 above, the field performance tests can commence.
6. The maximum and average mower wheel load impressions on the unreinforced section shall be determined by measuring at 50 ft intervals (and extreme problem areas between) using a 5 ft long straight edge centered on the wheel track. The total deflection shall be the depth of the impression plus the pushup of the immediately adjacent surface to the wheel track.
7. The maximum and average mower wheel load deflections on each HPTRM reinforced section shall be determined by measuring at 50 ft intervals using a 5 ft long straight edge centered on the wheel track. The total deflection shall be the depth of the impression plus the pushup of the immediately adjacent surface to the wheel track.
8. The total deflection of each HPTRM reinforced section to be approved must be less than 50% of the unreinforced section or a total of 1.5 in., whichever is less, after a minimum of a 1 in. rainfall and a minimum of 35% m.c. of soil and a minimum wait time of four hours. Other combinations of rainfall amounts, moisture contents, and wait times will also be tested.
9. The Government reserves the option to revise the tests.

Attachment 2
Wave Overtopping Testing

CSU has constructed, calibrated, and made available a hydraulic wave overtopping device. CSU's device simulates overtopping waves that replicate both the flow volume and flow velocity of the equivalent overtopping wave. Each water release produces unsteady and turbulent flow conditions across the test levee crest and landside slope. The testing shall require observation and measurement of the effects of the simulated wave overtopping at a flow rate of 4.0 cfs/ft on various high performance turf reinforcement mats (HPTRM) and Bermuda grass. The materials shall be prepared in special steel trays (including grass growth) at the HPTRM manufacturer/supplier's expense, in accordance with Government requirements. **The manufacturer/supplier should contact CSU directly for a cost estimate of testing.**

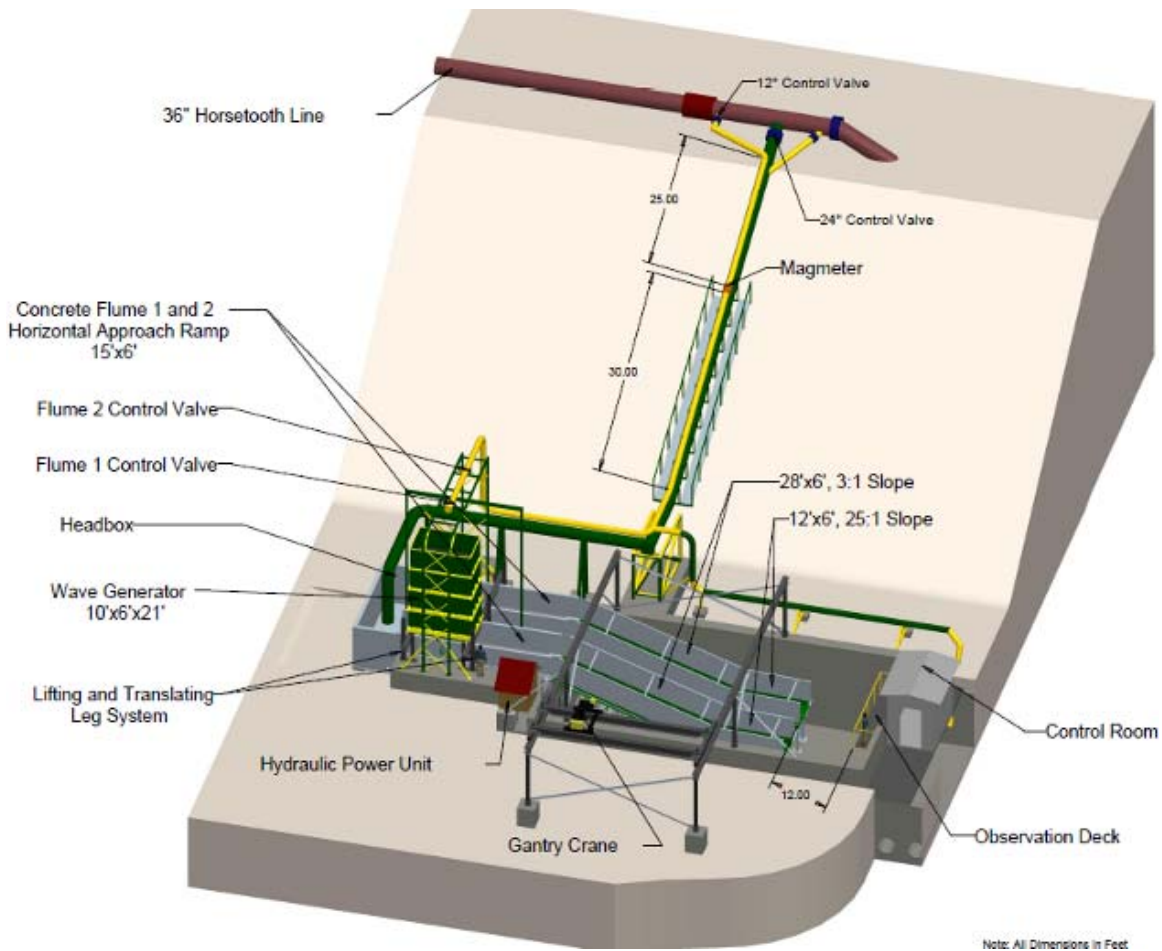


Figure 1.0 Wave overtopping facility schematic.

The levee landside slope in each test channel is comprised of two trays (tray set) as shown schematically in Figure 2. The upper tray is straight, and the lower tray is constructed with an angle at the inflection point. When the tray set is installed in the flume, the trays represent a levee with a 28-ft-long section having a 1-on-3 slope that transitions to a 12-ft-long berm section having a 1-on-25 slope.

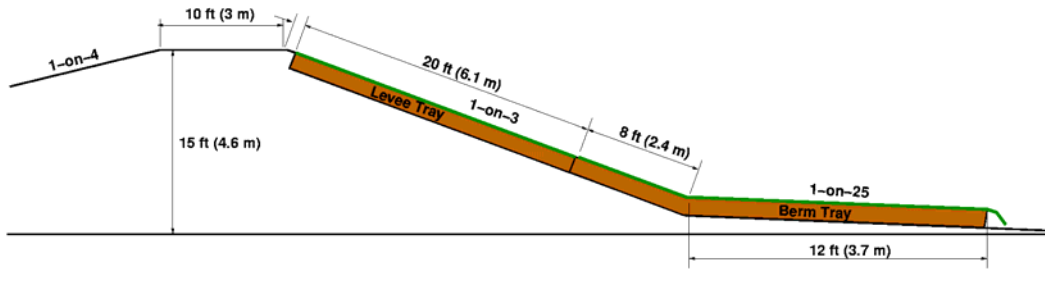


Figure 2.0 Dimensions and orientation of test trays.

1.0 Test Trays

Completion of the test trays require:

- Fabricating 2 - 6 ft. w x 20 ft. lg x 12 in. deep steel trays both of which together constitute a set
- Installing HSDRRS clay in the trays according to HSDRRS specs;
- Placing the HPTRM according to each manufacturer/supplier's specifications and populated with 1-1/2 in. thick Bermuda grass sod on top of the clay; Cultivating the grass during the growing season; and then letting the Bermuda to go dormant by exposure to below freezing night temperatures until reaching the following grass quality before testing commences:
 - Min. ground cover of 90%
 - Total root length exceeding 37.72 cm.
 - Total root volume exceeding 3.63 cm Weight exceeding 13.9 gm

2.0 Infrastructure

The overtopping tests shall be conducted in such a way to represent a full-scale replica of a levee protected side slope (including a 10-ft wide horizontal crest). Once in place, the trays and supporting infrastructure shall resemble a levee having a slope of 1V:3H and a downslope length of approximately 28 ft. At the toe of the slope the levee shall transition into a protected side berm, which shall have slope of 1V:25H over a distance of a minimum of 12 ft. The supporting infrastructure accommodates two sets of trays side-by-side, with each tray having a width of approximately 6 ft. A dividing wall (or other such functional barrier) separates the two sets of trays. This configuration allows placement of two sets of test trays simultaneously but testing of only one set at a time.

The structural design of the tray sets shall be the responsibility of the manufacturer/supplier and shall assure the tray design matches CSU's existing infrastructure. The test trays shall be populated with HSDRRS soil and the manufacturer's HPTRM product, sodded, and cultivated on-site.

Overtopping flow is controlled using a fixed overtopping wave simulator device. This device is capable of storing sufficient quantities of water such that the full potential energy of the largest and smallest specified overtopping wave volume can be realized and all volumes in between. The release of water and the creation of the "slug" of unsteady, turbulent flow is achieved using a gravity discharge mechanism. Valve and discharge infrastructure is such that the typical tongue of an overtopping wave is simulated across the width of the levee section and the device is ready to fill and discharge flow as quickly as the desired wave conditions demand.

3.0 Clay Placement

HSDRRS clay (CH & CL) shall be used to fill the trays and establish the grass. The HPTRM manufacturer shall coordinate with the USACE to have Bonnet Carre Spillway clay (meeting HSDRRS clay specs) loaded into his trucks and transported to CSU at his expense. Filter fabric

shall first be placed on the bottom of the steel tray, then 2 in. of pea gravel, another layer of filter fabric and then after compaction, the remaining 10 in. depth of compacted clay shall fill the tray. The clay shall be placed in 6 to 8 in. uncompacted layers, at -3 to +5% of optimum moisture content and compacted using a non-vibrating device like a wacker packer to obtain a min. of 90% of max. dry density per ASTM 698, standard Proctor. Geotechnical testing shall be performed to verify that the aforementioned specs were met in two random locations in each tray of the tray set, at manufacturer's expense, and a report shall be submitted that verifies that the clay meets these geotechnical requirements.

4.0 Grass Growth Requirements

Grass shall be grown in trays using 1-1/2 in. thick common Louisiana grown Bermuda sod conforming to an ABC Gradation (Louisiana Dept. of Agriculture and Forestry – LDAF) with the manufacturer's HPTRM incorporated. Trays must be adequately watered and fertilized per the following:

- Depending on weather conditions, sod shall be irrigated immediately upon placement, which shall occur within one day of arrival on site and then watered twice to three times daily at 0.75 – 1.0 in. of water/sq ft/day during the first 30 days and reduced to twice daily for the next 30 days at a total rate of 1/2 in. per day if average day-time temperatures are greater than 80 deg F, and 3/8 in. per day if the average day-time temperatures are less than 80 deg F.
- The Contractor shall avoid excessive application of water, with the watering application rate not greater than the infiltration rate to prevent surface runoff. The application rate of irrigation shall not exceed the infiltration rate of the soil.

Following the installation of the sod, it should be fertilized at 14 days post sod installation at 25 lb of nitrogen per acre and again 45 to 60 days post sod installation at 25 lb of nitrogen per acre, using water-soluble or slow-release nitrogen sources.

The first mowing should occur no earlier than 90 days after sod placement to allow for proper establishment and to limit rutting and injury to the grass and soil beneath the HPTRM. Grass shall be cut no lower than 6 inches above the ground. Fertilizing to establish a dense grass canopy is more important than mowing at intervals longer than 30 days to control weeds.

Root establishment shall comply with the following after dormancy occurs:

- Min. ground cover of 90%
- Total root length exceeding 37.72 cm.
- Total root volume exceeding 3.63 cm³
- Weight exceeding 13.9 gm

5.0 Testing Schedule

The levee support structure accommodates adjacent trays but independent tests cannot be carried out simultaneously.

A single test shall be defined as one wave overtopping simulation down the flume on one set of trays (linear and angled sections) for a 3 equivalent test hours at 4.0 cfs/ft with dormant Bermuda grass. Passing this wave overtopping test is defined as surviving the 3 equivalent test hours without visible damage. Visible damage is defined as follows:

- a loss of grass in a single location greater than 2 sq. in.
- a total summation of visible loss of grass of greater than 6 sq. in. and/or
- 0.2-ft. or more of soil/grass erosion over a 4 ft² area.

Each type of HPTRM armoring product shall be subject to 1 wave overtopping test on each tray set at 4.0 cfs/ft for 3 equivalent test hours (~6 elapsed hours).

During testing for the HPTRM, testing shall be suspended after each equivalent test hour to conduct visual inspections for onset of damage using a total station surveying on 8 rows equally spaced over the 40 ft length at 1 ft distances across the tray. Areas of suspected on-set of damage shall be documented photographically (video movie and photographs) to provide visual comparisons at the next stopping point.

6.0 Materials Sourcing/soil/Manufacturer/Supplier

Each HPTRM manufacturer/supplier shall be responsible for procurement and supply of their HPTRM armoring materials.

The USACE supplied HSDRRS clay material shall be compacted, with requirements specified above in Section 3.0, Clay Placement. This shall be carried out on-site at CSU.

During testing, representatives of the USACE shall be given access to the testing site and also for the grass growing on test trays.

7.0 Hydrodynamics

The overtopping simulators shall be operated to assure they can reproduce the hydrodynamic conditions (4.0 cfs/ft) for wave-only overtopping determined for all critical reaches of the New Orleans Hurricane Storm Damage Risk Reduction System (HSDRRS) as established for the 500-year storm surge. This operational requirement includes meeting the maximum wave volume and wave distribution as determined in previous overtopping testing by the Corps in 2010 at CSU.

8.0 Reporting

A complete factual final report of all testing procedures followed; hydrodynamic loads simulated; flows and velocities, and visual and instrumental observations shall be required to be furnished by the HPTRM manufacturer/supplier to the USACE. The report shall include the results for all HPTRM armoring materials tested. These results shall include, but are not limited to, the following:

- Specific hydraulic conditions including, at minimum, the overtopping rate, measured/calculated velocities and locations, measured/calculated depths and locations, other measured/calculated parameters as applicable; and,
- Noted performance of each HPTRM armoring material during test(s).

The report shall include complete descriptions of the materials tested including:

- Types of HPTRM, including general descriptions and manufacturer/supplier; and,
- Physical properties such as, unit weight, tensile strength, etc., as applicable.

9.0 Safety

Compliance of the manufacturer's wave overtopping testing with all federal and state safety regulations is a requirement.