

**SCOPE OF WORK  
OCEAN ENGINEERING SERVICES  
IN SUPPORT OF  
UNDERWATER (U/W) FACILITY ASSESSMENTS AT VARIOUS  
LOCATIONS**

**A. PROJECT DEFINITION**

1. This is a task oriented engineering services contract in support of underwater assessments of waterfront and other structures at various locations. Underwater assessment includes, but is not limited to, underwater inspection; engineering analysis of existing conditions in comparison with design requirements, previous inspection reports and/or drawings of the facilities; engineering calculations for structural analysis with or without previous design calculations; documentation of findings; and recommendations with cost estimates for follow-on actions. All underwater assessments will be performed under the direct control and supervision of registered professional engineer-divers. For each underwater assessment, one registered professional engineer-diver shall be appointed as the engineer-in-charge (EIC). That EIC shall supervise the diving, dive at least 50% of the time, supervise the writing of the detailed inspection report, and write at least 50% of the detailed inspection reports. The other engineers that were on-site may write the balance of the report. The EIC shall ensure that all diving is done in accordance with OSHA standards. US citizenship is required for all individuals to gain access to inspection sites.

Additional products and services may include construction contract drawings and SPECSINTACT specifications; bid analyses; post construction award services (PCAS); TITLE II Inspection Services; engineering report review; database design, construction, and population; procedures reports; engineering calculations; static and dynamic mooring analysis using computer modeling; watertank inspections in accordance with applicable standards of the American Waterworks Association and NAVFAC MO-210.9; and FHWA certified inspections using NBIS standards of overland and overwater bridges.

A waterfront facility is defined as any structure which is located on the waterfront, in connection with, or potentially in contact with, water or the marine environment. This would include inland structures that require underwater investigations. Waterfront facilities include, but are not limited to, piers, wharves, bulkheads, quaywalls, offshore towers, potable water storage tanks, instrument support structures, dry docks, moorings, bridges, underwater cables, or any similar structures.

2. The work will require expertise in underwater inspection, damage and deterioration assessment, repair analysis, repair design, and cost estimating. The work may also include the preparation of underwater/topside repair contract drawings and specifications for competitive bidding.

3. The contractor shall provide the personnel and equipment necessary to perform an underwater inspection of the waterfront facility. The quality of inspection shall be such as to

allow the contractor to assess the general physical condition of the facility structure which is submerged and/or subject to frequent wetting by wave or tidal action. After first studying the Government Furnished Information (GFI) , the contractor shall perform a Level I, modified Level I, Level II, or Level III inspection as delineated below. Quantities of all levels are as set forth in a table provided with the specific scope of work for each task.

## **B. ADMINISTRATIVE PROCEDURES AND INSTRUCTIONS**

All correspondence shall be addressed to the Contracting Officer, Naval Facilities Contracting Office, 901 M Street SE, Building 218, Washington, DC 20374-5063 with Attention: Code 2727. The contract number assigned to the contract for this work will be shown in the specific requirements table for each deliver order. This number shall be used on all billings, reports and correspondences relative to this contract, together with any applicable contract modification number.

## **C. QUALITY CONTROL**

1. The contractor is responsible for the professional quality of his/her submittals including editing, checking, and reproducibility.

2. The contractor is responsible for conducting the underwater inspection to an approved safe diving practice which meets local, state, and federal regulations as applicable to the area of operation.

## **D. INSPECTION, STUDIES, ANALYSIS, & MISCELLANEOUS REQUIREMENTS**

### **1. UNDERWATER INSPECTION**

Field investigation shall be conducted by the contractor, which will normally involve diving operations and will include a thorough check of underwater conditions as well as other conditions pertinent to the required work. U.S. Citizenship is required for all individuals requiring access to inspection sites. All diving operations will be conducted in accordance with local, state, and federal regulations and safety standards as applicable to the required areas of operation. All underwater assessments will be performed under the direct control and supervision of registered professional engineer-divers. For each underwater assessment, one registered professional engineer-diver shall be appointed as the engineer-in-charge (EIC). That EIC shall supervise the diving, dive at least 50% of the time, supervise the writing of the detailed inspection report, and write at least 50% of the detailed inspection reports. The other engineers that were on-site may write the balance of the report. Government Furnished Information (GFI) relative to existing conditions at the site will be made available whenever possible to the contractor who shall evaluate

and verify such information to the extent that it is necessary to perform the work stated herein. The general pattern of the inspection to be followed, and the specifics of a particular inspection such as location of individual piles to be examined will be determined by mutual agreement between the contractor and the on-site Government representative.

a. Levels of Examination

The following levels of examination may be employed in the inspection and are to be construed only as general guidelines and not specific delivery order procedures. Within the description of any specific delivery order, the level and complexity required in an inspection will probably be a blend or combination of these levels of examination. Specific delivery order descriptions will use these definitions as a reference.

**LEVEL I:** This level of effort is essentially a "swim-by" overview, which does not involve cleaning of any structural elements, and can therefore be conducted much more rapidly than the other levels of inspection. The Level I Examination should confirm as-built structural plans and detect obvious major damage or deterioration due to overstress (collisions, ice), severe corrosion, or extensive biological growth and attack.

The underwater inspector shall generally rely primarily on visual and/or tactile observations (depending on water clarity) to make condition assessments. These observations are normally made over 100% of the exterior surface area of the underwater structure whether it is a quaywall, bulkhead, seawall, pile, or mooring.

Visual documentation (utilizing underwater television and/or photography), may be included with the quantity and quality adequate for documentation of the findings which will be representative of the facility condition.

**MOD LEVEL I:** This level of effort consists of a swim by of every pile at an elevation of two to four feet below mean low water (MLW) to detect any obvious gross or major damage.

**LEVEL II:** This type of inspection is directed toward detecting and describing damaged/deteriorated areas which may be hidden by surface biofouling or deterioration and toward obtaining a limited amount of deterioration measurements. These data should be sufficient to enable rough estimates to be made of facility load capacity. Level II inspections will often require cleaning of structural elements. Since cleaning is time consuming, it is generally restricted to areas that are critical or which may be representative of the entire structure itself. The amount and thoroughness of cleaning to be performed is governed by what is necessary to discern the general condition of the overall facility. Simple instruments such as calipers, measuring scales, sounding devices, and ice picks are commonly used to take measurements. However, a small percentage of more accurate measurements may also be taken with more sophisticated instruments for several reasons. These measurements will validate large numbers of simple measurements and in some hard-to-measure areas will actually be easier and faster to obtain. Where the visual scrutiny,

cleaning, and/or simple measurements reveal extensive deterioration, a small sampling of detailed measurements will enable gross estimates to be made of the structure's integrity. For example, on extensively corroded steel H-piles, a small percentage should receive ultrasonic thickness measurements to determine typical cross section profiles. The cross sections determined by these spot checks would be used to determine individual H-pile load capability which would then be extrapolated to obtain a "ballpark" estimate of overall facility load capability. On steel structures which have an active or sacrificial cathodic protection system, measurements of anodes, voltage, or current may be required.

Visual documentation (utilizing underwater video and/or photography) should be included with the quantity and quality adequate to be representative of the range of facility damage/deterioration.

**LEVEL III:** This type of inspection will often require the use of Non Destructive Testing (NDT) Techniques, but may also require the use of partially destructive techniques such as sample coring through concrete and wood structures, physical material sampling, or in-situ surface hardness testing. The purpose of this type of inspection is to detect hidden or interior damage, loss in cross-sectional area, and material inhomogeneity. A Level III examination will usually require prior cleaning. The use of NDT techniques are generally limited to key structural areas, areas that may be suspect, or to structural members which are representative of the underwater structure.

Visual documentation (utilizing underwater video and/or photography) and a sampling of physical measurements should be included with quantity and quality adequate for documentation of the findings which will be representative of the facility condition.

#### b. Inspection Reporting

Each delivery order for an underwater inspection will require an engineering report to be written in accordance with the detailed guidelines of the Naval Facilities Engineering Service Center, East Coast Detachment, 901 M Street SE, Bldg 218 WNY, Washington, DC 20374-5063. The underwater inspection report will provide a detailed description, photographs and engineering assessment of the underwater and underdeck structural conditions encountered as well as recommendations for types of repairs and cost estimates for those repairs.

## 2. REPAIR DESIGN, SPECIFICATIONS AND DRAWINGS

The Government reserves the right to include in the work, by option, all design and engineering services necessary for the preparation of construction contract drawings and specifications for competitive bidding, engineering calculations, and cost estimates, for necessary repairs identified by the inspection. Design and engineering services for repair contract documents may be exercised at any time within the effective date of the contract.

## 3. REPAIR AND COST ANALYSIS

If the underwater inspection has revealed significant damage, a gross assessment of the reparability should be performed. This analysis takes into consideration life cycle costs for various repair techniques as well as structural consideration in recommending particular repair techniques. An important component of a repair analysis that should be included is an order-of-magnitude cost estimate for the total repair effort including design.

#### 4. POST REPAIR SERVICE

The Government reserves the right to task the contractor, by option, to perform Post Construction Award Services (PCAS) and Title II inspection services on waterfront facilities.

### **E. PROGRESS SUBMITTAL PROCEDURES AND SUBMISSION SCHEDULE**

#### 1. INSPECTION COMMENCEMENT

The inspection commencement date and inspection time period shall be established by mutual agreement between the Government and the contractor.

#### 2. IN-BRIEF

At the commencement of the field investigation, the contractor will usually be required to participate in, or conduct, a briefing to interested parties at the site. This is for the purpose of reviewing the scope of work for the specific tasks and insuring that all cognizant parties, i.e. security and safety personnel, are aware of the contractor's presence on the site.

#### 3. ON-SITE REPORTING

A log shall be kept of all findings and shall be made available to the on-site Government representative for his/her perusal while on site. The log shall clearly reference the exact location of all major damage showing at the least relative elevation on the pile or bulkhead, water depth relative to mean low water, and position of the damage on the structure. One legible reproduction of the log shall be made available to the Government one week after completion of the on-site inspection.

#### 4. EXIT BRIEF

The contractor shall present a summary of the preliminary findings in an exit brief held on-site prior to leaving the activity inspected. The contractor shall also provide a written survey of preliminary findings to be submitted one week after completion of the on-site inspection.

#### 5. FINAL REPORT

The results of the inspection and analysis shall be submitted in the form of a formal engineering report. This report shall provide a detailed description, underwater photographs, and engineering assessments of the underwater structural conditions encountered as well as recommendations for the types of repairs and budget cost estimates for those repairs. The format and details of content required are specified in the detailed guidelines of the Naval Facilities Engineering Service Center.

## 6. GOVERNMENT FURNISHED INFORMATION (GFI)

Prior inspection reports, if any, and available design and construction drawings for the facility will be provided to the contractor as GFI. These documents are for contractor's information only. The contractor is responsible for his/her interpretation and subsequent use of this information. GFI shall be returned to the Government after completion of the project.

## 7. PHOTOGRAPHIC DOCUMENTATION

Still photographs will be taken both above and below the water by the contractor regardless of the water clarity or visibility for incorporation in the final report. It is the responsibility of the contractor to provide the equipment (clear water box, close-up lens, etc.) necessary to meet this requirement. Photographs will be taken of damage/deterioration to structural members as well as typical conditions such as representative samples of the piling at the mudline, splash or tidal zone and midway in between. It would also be appropriate to include photographs of typical or extraordinary marine biofouling deposits, pile splices or joints, cross-bracing, previous repairs, etc. Photos should also be taken of the facility from above the water which indicate the overall appearance of the structure.

### **F. Task Description**

#### 1. UNDERWATER (U/W) INSPECTION

##### a. Level I (see paragraph D.1.a. for definition)

A Level I general swim-by shall be performed on the quantity of piles set forth in the individual delivery order. Closed type structures such as bulkheads shall be examined along their faces at three levels: mudline (ML), just below mean low water (MLW), and in the splash zone or inter-tidal zone (ITZ).

##### b. Modified Level I (see paragraph D.1.a. for Definition)

A Modified Level I (modified swim-by) is performed at an elevation of two (2) to four (4) feet below MLW to detect any obvious major damage on the piles as set forth in the individual delivery order.

c. Level II (see paragraph D.I.a. for definition)

A Level II examination shall be performed on a percentage of piles within open and closed type structures as set forth in the individual delivery order. Piles will be cleaned at the number of elevations specified, which is normally at ML, MLW, and halfway in between ML and MLW. Where water depths preclude being able to spread these bands equidistant in the water column, band-cleaned areas may be continuous, not segmented. Shallow water depths do not negate

cleaning. The Level II examination will involve cleaning of piles in the following manner:

**Wood Bearing Piles:** Cleaned band around perimeter of the pile to a width of 10 inches to expose underlying pile at three elevations; ML, MLW, and halfway in between ML and MLW. Measure minimum diameter.

**Concrete Bearing Pile:** Clean band of biofouling or debris on three (3) sides or face of each pile to an approximate width of 10 inches to expose underlying pile surface for inspection at three elevations; ML, MLW, and halfway in between ML and MLW.

**Concrete Sheet Pile:** Clean a 12-inch-square area of bulkhead at three elevations; ML, MLW, and halfway in between ML and MLW.

**Steel Bearing Pile:** Clean band cleaned of biofouling or debris on three (3) sides or faces of each pile to an approximate width of ten (10) inches to expose underlying pile surface for inspection at three elevations; ML, MLW, and halfway in between ML and MLW. On steel structures which have an active or sacrificial cathodic protection system, measurements of anodes, voltage, or current may be required.

**Steel Sheet Pile:** Clean a 6-inch-square area of bulkhead on the flange and web of the sheet pile at three areas which include ML, MLW, and halfway in between ML and MLW. On steel structures which have an active or sacrificial cathodic protection system, measurements of anodes, voltage, or current may be required.

d. Level III (see paragraph D.I.a. for definition)

A Level III examination shall be performed on every steel bulkhead and steel H-pile cleaned under Level II, and measurements taken at all locations cleaned. The Level III examination for wood piles shall include taking wood cores at the number of piles indicated in the delivery order. Three core samples will be taken at each pile location. All cores are to be taken to the center of the pile and plugged with a treated plug. The Level III examination may also include taking a pipe section (from a non-critical pile) for laboratory analysis.

2. INSPECTION PATTERN

The general pattern of inspection to be followed, and the specific location of piles to be inspected and cleaned, will be determined by mutual agreement between the contractor and the on-site Government representative. That decision should be based upon the Level I findings and other pertinent considerations.

## **G. ASSESSMENT OF APPARENT CONDITION OF STRUCTURE**

### **1. ASSESSMENT**

The contractor shall assess the structure's integrity as follows:

a. Based on the contractor's professional experience, training, and judgment, the contractor shall provide back-up computations of loss in section, strength, and other characteristics that will quantify the assessment. The Government furnished information and the data obtained in the underwater inspection portion of this work shall be used as additional basis for this assessment.

b. The results of this assessment shall be reported in terms of minimum cross sections, equivalent effective cross sections, and attendant geometric properties such as section modulus, moment of inertia, and radius of gyration. The assessment shall also result in the recommendation of any prudent temporary action that should be taken relative to any downgrading of the capacity of the facility prior to the corrective action such as repair of pilings.

### **2. RECOMMENDATION**

a. The final task of the contractor shall be to provide recommendations for actions to be taken to insure long-term cost effective maintenance and repair (M&R) and utilization of the inspected facility. These recommendations shall include the types of repairs required and budget level cost estimates for these repairs.

b. One recommendation would be based on the contractor finding the facility to be in apparent excellent condition. In this event, the contractor should propose only future periodic reinspections at specific intervals along with comparisons of a standard format of inspection data.

c. Another recommendation would be a downgrading of facility load capability from the design load. This would be justified after a Level II or III examination. Where a Level II examination is used as a basis, the approximations of load capability predictions and repair costs should be commensurate with the limited measurements taken. Structural analysis may be required of lateral and/or vertical load capabilities depending upon the specific scope of work..

d. A common recommendation would be the type of repairs for specific elements (piles, areas of bulkhead, etc.) of each facility found deficient and possibly the projection of those repairs to the total repairs required in the whole facility.

e. The general intent of the recommendations is to provide the responsible activity with a quantified assessment of the facilities' physical condition and order-of-magnitude estimates of repair costs which can be used to request M&R funding from the major claimant.

## **H. COMPLETION DATE**

The Specific Requirements for each delivery order will specify the number of weeks after completion of the field inspections when the first draft of the report is due and when the final draft report is due.