SAN FRANCISCO BAY AREA WATER EMERGENCY TRANSPORTATION AUTHORITY

NORTH BAY OPERATIONS AND MAINTENANCE FACILITY – PILE RECONFIGURATION PROJECT

IFB #17-020

ADDENDUM NO. 6

August 18, 2017

SCOPE

Addendum No. 6 consists of one (1) page and one (1) attachment. Addendum No. 6 includes the following:

1. Questions and Answers

This addendum has been posted on the WETA website for review by all potential bidders.

1. Questions and Answers

Q10: We understand that a Hydroacoustic Minimization/Mitigation Plan (Plan) shall be submitted to DFG for approval prior to construction and that the plan shall include mitigation and minimization measures. If our plan shows acceptable compliance without a bubble curtain, is that acceptable?

A10: Submittal of a Hydroacoustic Minimization/Mitigation Plan to the California Department of Fish and Wildlife is not required. A bubble curtain is only required for impact pile driving. A bubble curtain is not needed for vibratory pile driving.

Q11: Is it possible to have access to the referenced National Marine Fisheries Service approved Hydroacoustic Monitoring Plan by Illingworth& Rodkin, Inc.

A11: See Attachment No. 1 for the Hydroacoustic Monitoring Plan.

Q12: It appears that only one reference is needed. Is it possible for you to confirm that?

A12: Per IFB Section 00420, Item 4, please name at least three projects with relevant contact information as requested. For each reference identified by the Bidder in Form 00420 the Reference Form on IFB Pages 00410-5 and 00410-6 shall be submitted. Reference forms can be submitted electronically to Chad Mason at mason@watertransit.org.

ACKNOWLEDGMENT BY BIDDER

Each bidder is required to acknowledge receipt of all Addenda, including this Addendum No. 6 as specified in the IFB Instructions to Bidders.

ISSUED BY

Chad Mason
Project Manager

8/18/17
Date

SAN FRANCISCO BAY AREA

WATER EMERGENCY TRANSPORTATION AUTHORITY

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Attachment No. 1

Hydroacoustic Monitoring Plan

VALLEJO FERRY TERMINAL

HYDROACOUSTIC MONITORING PLAN

Prepared for:
City of Vallejo

Prepared by:
Illingworth & Rodkin, Inc.
505 Petaluma Boulevard South
Petaluma, California 94952

August 2012

INTRODUCTION

The purpose of this Hydroacoustic Monitoring Plan is to describe the methodology proposed for measuring underwater sound levels during installation of steel pipe piles for the development of a new ferry maintenance facility (Facility) for the Vallejo Ferry system, owned by the City of Vallejo and operated by the Blue and Gold Fleet. The project consists of constructing a new facility of four new full service berths and two mooring-only berths for the ferry vessels. A third mooring berth, adjacent to the quay wall, would only be used in the event that a large land-based crane was necessary for a repair, such as removing the engine. The facility will be designed for six vessels. The berths will be constructed with floating docks and guide piles. An existing 4,080 square-foot maintenance float will be used to permit direct access for work at three of the berths. The maintenance float is currently tied to the sea wall at the existing facility and would be relocated to the new Facility and secured with piles, as part of the project. A maximum of 31~~54~~ piles will be placed into the water.

PILE INSTALLATION

Hydroacoustic monitoring will be conducted during all pile driving activities for the construction in 201~~1~~3. The pile driving will consist of the piles being installed using a vibratory hammer where feasible. This plan is being prepared because there is a possibility that impact driving may be required to install the piles to a sufficient depth.

The California Department of Fish and Game (CDFG), in the Streambed Alteration Agreement[1] have required that a Hydroacoustic Monitoring Plan be prepared and that underwater sound generated from pile driving activities be monitored. The Condition requires that, at a minimum the plan will:

- Be based on the dual metric criteria (Popper et al. 2006) and the accumulated SEL;
- Establish field locations that will be used to document the extent of the area experiencing 187 dB $_{\text{SEL accumulated}}$;
- Describe the methods necessary to continuously assess underwater noise on a real-time basis, including details on the number, location, distance and depth of hydrophones and associated monitoring equipment;
- Provide a means of recording the time and number of pile strikes, the peak sound energy per strike and interval between strikes;
- Provide provisions to provide all monitoring data to the CDFG;
- All temporary and permanent pile driving within 10 meters of the wetted channel shall be monitored
- Hydroacoustic data shall be submitted to the CDFG every other Monday. This data shall be submitted via email to mgrube@dfg.ca.gov.
- If underwater SPLs for each pile type and size do not vary to a large degree, the Permittee may request approval from CDFG to discontinue hydroacoustic monitoring.

Two hydrophone systems are proposed to record the sound levels at two locations and determine the extent that sound levels decrease spatially. One hydrophone will be located 10 meters from

[1] Final Lake or Streambed Alteration Agreement Notification No. 1600-2011-0028-R3, Dated August 2011

the pile being driven and the second hydrophone will be located between 20 meters and 30 meters from the pile being driven with a clear line-of-sight between the pile and the hydrophones. The second hydrophone will be placed at a location determined in the field that is accessible and provides a good secondary reading for comparing noise levels. The second hydrophone will be located in manner that emphasizes recording sound levels at least 20 meters from the pile.

CHARACTERISTICS OF UNDERWATER SOUND

Several descriptors are used to evaluate underwater noise impacts. Two common descriptors are the instantaneous peak sound pressure level (SPL) and the Root Mean Square (RMS) pressure level during the impulse, which are sometimes referred to as the SPL and RMS level respectively. The peak pressure is the instantaneous maximum or minimum overpressure observed during each pulse and can be presented in Pascals (Pa) or decibels (dB) referenced to a pressure of 1 micropascal (µPa). Since water and air are two distinctly different media, a different sound pressure level reference pressure is used for each. In water, the most commonly used reference pressure is 1 µPa whereas the reference pressure for air is 20 µPa. For comparison, an underwater sound level of equal perceived loudness would be 62 dB higher to a comparable sound level in air.

The RMS level is the square root of the sum of the squared pressures multiplied by the time increment and divided by the impulse duration. This level, presented in dB referenced 1 µPa, is the mean square pressure level of the pulse. It has been used by National Marine Fisheries Service (NMFS) in criteria for judging impacts to marine mammals from underwater impulse-type sounds. The majority of literature uses peak sound pressures to evaluate barotrauma injuries to fish.

Sound Exposure Level (SEL), frequently used for human noise exposures, is now used as a metric to quantify impacts to fish (Hastings and Popper 2005). SEL is calculated by summing the cumulative pressure squared (p^2) over the measurement duration, integrating over time, and normalizing to one second. This metric accounts for both negative and positive pressures because p^2 is positive for both negative and positive pressure and thus both are treated equally in the cumulative sum of p^2 (Hastings and Popper 2005)[2]. The units for SEL are dB re: 1 micropascal^2-sec. (1 µPa^2-sec).

METHODOLOGY

One hydrophone will be placed at mid water depth at the nearest distance, at approximately 10 meters depending on site conditions, from each pile being monitored. An additional hydrophone will be placed at mid water depth at a distance of 20 to 30 meters from the pile, to provide two sound level readings during ambient and pile driving recording. The 10-meter location will be monitored live to determine compliance with permit conditions. A weighted tape measure will be used to determine the depth of the water. The hydrophones will be attached to a nylon cord or

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[2] Hastings, M. C. and Popper, A. N. (2005). "Effects of sound on fish." Report to California Department of Transportation Contract No. 43A0139, Task order1, http://www.dot.ca.gov/hq/env/bio/files/Effects_of_Sound_on_Fish23Aug05.pdf

a steel chain if the current is swift enough to cause strumming of the line. One end of the nylon cord or chain will be attached to an anchor that will keep the hydrophone at the specified distance from the pile. The opposite end of the nylon cord or chain will be attached to a float or tied to a static line at the surface at the specified recording distance from the pile. The distance will be measured by a tape measure, where possible, or a range finder. To the extent practicable, there will be an unobstructed path between the pile and the hydrophones.

Ambient underwater sound levels will be measured for at least 1 minute prior to initiation of pile driving, as well as in the absence of construction activities. The inspector/contractor will inform the hydroacoustics specialist when pile driving is about to start.

Underwater sound levels will be continuously monitored during the entire duration of each pile being driven. Peak levels of each strike will be monitored in real time. Sound levels will be measured in decibels.

Prior to and during the pile driving activity environmental data will be gathered including but not limited to wind speed and direction, air temperature, water depth, wave height, weather conditions, and other factors (e.g. aircraft, boats, etc.) that could contribute to influencing the underwater sound levels. Start and stop time of each pile driving event will be recorded.

As per the Streambed Alteration Agreement, CDFG has required the permittee to establish the 187dB $SEL_{accumulated}$ contour for each day of impact pile driving. During the impact pile driving the sound pressure levels will be measured at a distance of 10 meters and at 20 to 30 meters depending on site conditions. The use of two hydrophones will allow for the recording of underwater sound levels at two separate locations to determine the extent to which sound levels decrease spatially (transmission loss). One hydrophone will be located within a clear line of sight of approximately 10 meters from the pile being monitored and the second hydrophone will be located approximately 20 to 30 meters from the pile being monitored with a clear line-of-sight between the pile and the hydrophones. The second hydrophone will be placed at a location determined in the field that is accessible.

Ambient underwater sound levels will be measured for a minimum of one minute in the absence of construction activities to determine background levels. Ambient levels will be reported as SEL and include a representative spectral analysis.

All impact pile driving shall be monitored until such time that it can be shown the underwater SPLs for each pile type and size do not vary to a large degree. If during the pile driving sound pressure levels do not exceed either criterion of the dual metric exposure criteria the Permittee may request approval from CDFG to discontinue hydroacoustic monitoring of the pile driving operations, providing all subsequent pile driving is performed using the same equipment and materials and the number of pile strikes on each subsequent day does not exceed the total number of pile strikes that have been monitored during the previous days of pile driving[3]. Table 1 details the equipment that will be used to monitor underwater sound pressure levels.

[3] Final Lake or Streambed Alteration Agreement Notification No. 1600-2009-0356-R3, Dated October 21, 2009

The chief construction inspector will supply the hydroacoustics specialist with the substrate composition, hammer model and size; depth the pile is driven and blows per foot for the piles monitored. Hammer energy settings will also be recorded by the chief construction inspector, as well as any changes made to those settings during the pile monitoring period.

EQUIPMENT

Measurements will be made using hydrophones that have a flat frequency response and are omni-directional over a frequency range of 10 to 10,000 Hz. For example, a G.R.A.S. CT-10 hydrophone with PCB in-line charge amplifiers (Model 422E13) and PCB Multi-Gain Signal Conditioners (Model 480M122) or equivalent systems could be used to measure sound pressures that pile driving could generate. The signals will be fed into Integrating Sound Level Meters (SLM). Quality recordings using a digital audio recorder (either solid state or tape) would be made during attended measurements.

The peak pressure and SEL will be measured using a SLM. The SLM will have the ability to measure the C-weighted or unweighted peak sound pressure levels over the relative short periods (e.g., less than 50 milliseconds). The SLM can closely approximate the unweighted SEL of each pile strike, by measuring the one-second equivalent sound energy level (Leq $_{(1\text{-sec})}$) using the linear integration setting.

All measurement equipment used would be required to have a frequency response of $\pm$1dB from 10 Hz to 10,000 Hz over the anticipated measurement range of 170 to 220 dB linear peak re: 1 µPa. Hydrophones of different sensitivities may be required depending on the acoustic environment.

Table 1.
Equipment for underwater sound monitoring.

Item	Specifications	Quantity	Usage
Hydrophone	Minimum Sensitivity- 211dB ±3dB re 1V/µPa	2	Capture underwater sound pressures and convert to voltages that can be recorded/analyzed by other equipment.
Signal Conditioning Amplifier	Amplifier Gain- 0.1 mV/pC to 10 V/pC Transducer Sensitivity Range- 10^{-12} to 10^{3} C/MU	2	Adjust signals from hydrophone to levels compatible with recording equipment.
Calibrator (pistonphone-type)	Accuracy- IEC 942 (1988) Class 1	1	Calibration check of hydrophone in the field.
SLM and Solid State Recorder	Sampling Rate- 24K Hz or greater	2	Measures and Records data
Laptop computer	Compatible with digital analyzer	1	Store digital data on hard drive.
Post-analysis	Real time Analyzer-	1	Monitor real-time signal and post-

			analysis of sound signals.

Note: All have current National Institute of Standards and Technology (NIST) traceable calibration.

CALIBRATION

Calibration of measurement systems shall be established prior to use in the field each day. An acoustical piston phone and hydrophone coupler would be used along with manufacturer calibration certificates. Calibration of measurement systems would be established as follows:

- Use an acoustically certified piston phone and hydrophone coupler that fits the hydrophone and that directly calibrates the measurement system. The volume correction of the hydrophone coupler using the hydrophone is known so that the piston phone produces a known signal that can be compared against the measurement system response. The response of the measurement system is noted in the field book and applied to all measurements.

The SLMs are calibrated to the calibration tone prior to use in the field. The tone is then measured by the SLM and is recorded on to the beginning of the digital audio recordings that will be used. The system calibration status would be checked by measuring the calibration tone and recording the tones. The recorded calibration tones are used for subsequent detailed analyses of recorded pile strike sounds.

All field notes would be recorded in water-resistant field notebooks. Such notebook entries would include operator's name, date, time, calibration notes, measurement positions, pile-driving information, system gain setting, and equipment used to make each measurement.

The equipment will be calibrated and set to properly measure sounds in the proper range; that is, pile-driving sounds will not overload the instrumentation and the noise floor of the instrumentation is not set too high that pile-driving sounds above 170 dB $_{peak}$ cannot be properly measured.

REPORTING

In coordination with the Construction Liaison and project Biologist the hydroacoustic data consisting of Peak sound levels single strike SEL levels and accumulated SEL levels will be submitted to the CDFG, bi-weekly. These will be considered preliminary data and include:

- The observed typical and maximum peak pressures as recorded in field notebooks or depicted from instrument raw data output.
- The typical and maximum single strike SEL and the daily cumulative SEL as recorded from the SLM.

A Final Hydroacoustic Report will be prepared and submitted within 30 days following the completion of pile driving activities. This report will contain acoustical information (peak, RMS, and SEL) for all piles where measurements were made. The report shall include:

1. Size and type of piles.
2. A detailed description of the sound attenuation device including design specifications.

3. The impact hammer force used to drive the piles.
4. A description of the monitoring equipment.
5. The distance between hydrophones and pile.
6. The depth of the hydrophone.
7. The distance from the pile to the wetted perimeter.
8. The depth of water in which the pile was driven.
9. The depth into the substrate that the pile was driven.
10. The physical characteristics of the bottom substrate into which the piles were driven.
11. The ranges and means for peak, RMS, and SELs for each pile.
12. The results of the hydroacoustic monitoring, including the frequency spectrum, peak and RMS SPLs, and single-strike and cumulative SEL.

If at any time during the pile driving event more than 10 fish are observed dead, as seen floating on the surface, within 50 meters from the pile, pile driving will cease for 30 minutes. After this period of time the pile driving may continue and the biologist will again make observations. If additional mortality is observed, pile driving will cease and The City of Vallejo or their designee shall contact Mitsuko Grube, Environmental Scientist for the CDFG, within 24 hours to of the exceedences. All sensitive fish species shall be collected by the biologist to be retained and preserved for submittal to DFG, if requested.

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