Acoustical Monitoring Plan
for the

Railroad Dock Dolphin Installation

White Pass & Yukon Route

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1. Description of the Project

1.1 Introduction

In response to demand from the cruise ship lines that call in Skagway, White Pass & Yukon Route (WP&YR), proposes to install two new 200-ton pile supported mooring dolphins at the south end of the company's Railroad Dock (RR Dock) to accommodate an increased number of large cruise ships. The aft berth of the dock is located at the southwest end of town near the terminus of Congress Way (Figures 1). The proposed project will occur in marine waters that support several marine mammal species. The Marine Mammal Protection Act of 1972 (MMPA) prohibits the taking of all marine mammals, which is defined as to "harass, hunt, capture or kill, or attempt to harass, hunt, capture or kill," except under certain situations. Section 101(a)(5)(D) of the MMPA allows for the issuance of an Incidental Harassment Authorization (IHA), provided an activity results in negligible impacts to marine mammals and would not adversely affect subsistence use of these animals. The project may result in marine mammals protected under the MMPA being exposed to sound levels above allowable noise harassment or non-serious injury thresholds during piling installation (pile driving and drilling).

Figure 1. Skagway Alaska

1.2 Pile Driving/Drilling Project Description

The proposed project would install two new 200-ton mooring dolphins along the Railroad Dock south floating dock extension during February 1 to April 30, 2019. Each dolphin will consist of six 42-inch diameter steel pipe piles up to 300-feet in length. Construction activities generally include mobilization, pile driving and drilling, pile splicing, pile-to-dolphin cap welding, erecting temporary weather structures and templates, and setting catwalks.

Temporary support piles (i.e. template piles) for pile driving will be installed to aid with construction and will be removed after the permanent dolphin piles have been installed. Temporary support piles will likely include fourteen (14) piles, 36-inch in diameter or smaller. Installation methods for the temporary support piles will be similar to the dolphin pile installation in that a combination of three pile driving methods will be used: vibratory, impact, and drilling. Temporary pile extraction will only be performed with a vibratory hammer. Specific detail on installation can be found in the Incidental Harassment Authorization (IHA) request this plan is supporting.

1.2.1 Pile Installation Equipment

Due to the challenging sub-bottom conditions, tight schedule, and the remote nature of Skagway, Alaska, the contractor will come prepared with an array of tools to utilize for the installation of the dolphin piles. Table 1 below provides a summary of the equipment which is estimated to be utilized on this project. The contractor may need to employ one or all of the pile driving or drilling methods as described during the installation process.

Table 1. Pile Installation Equipment

Pile Installation Equipment	Model/Size	Description/Purpose
Crane	200-250-ton barge with a 200-250-ft boom (up to 2 cranes)	Install piles, set dolphin caps, set catwalks, move material, etc.
Vibratory Hammer	APE 200 or equivalent	Advance pile through overburden to vibratory refusal
Impact Hammer	Delmag D100 Diesel hammer or equivalent	Advance pile through overburden once vibratory refusal has been reached.
Drill	Rock Anchor (8-inch hole): ICE - HS-27 Top drive down-hole hammer PDQL-80 or equivalent. Socket (42-inch hole): PPV ring bit MF34 down hole hammer or equivalent	A drill is inserted through the pile all the way down to bedrock. The drill breaks up rock into small flakes (tailings) which are removed from the drilled hole as the pile or casing advances.

To determine the extent (radii) of harassment and injury thresholds by the various pile driving and drilling activities, such that monitoring and shutdown safety zones can be established, Illingworth & Rodkin will be contracted to conduct a sound source verification (SSV) of the various installation types. The plan for conducting this monitoring follows.

2. Acoustical Monitoring Plan

2.1 Planning

Some planning effort would be required to arrange for staff and equipment to travel and conduct these measurements. It is assumed that our services would be requested at the time that measurements need to be made. These measurements would need to be conducted during a period of fairly calm whether where winds are light and seas are calm. Wind and waves would induce sound into the measurements. In addition, we assume the inlet would be ice free.

2.2 Vessel and Operator Requirements

One vessel with a closed cabin (to project equipment from weather) and of enough size to operate in Taiya Inlet in the winter will be needed for this project. Only one acoustician would operate equipment in the field, so some assistance in deploying the equipment by the General Contractor or Owner may be necessary. A small davit would be useful.

2.3 Mobilization

Because of the contracted schedule needed to complete the dock construction project by May 1, installation of both temporary and permanent pilings will be conducted in conjunction (but not at the same time), using all three types of installation methods (impact hammer, vibratory hammer, and drilling). As a result, it is expected that all three installation methods can be measured during one mobilization to Skagway. In the event one method is delayed, a second mobilization will be planned.

2.4 Measurement Plan

Underwater sound from vibratory pile installation, impact pile driving, rock anchor drilling, and bedrock socket drilling events are planned to be measured using hydrophones. A series of measurements for each installation type (i.e. vibratory, impact, and drilling permanent pile) will be recorded. A minimum of one measurement event for each installation type is planned. A measurement event is defined as a series of measurements recorded over the period of time one installation type is performed. When practical, measurements of two or more events with differing installation types may be recorded during the same day. At no time will two installation types or events occur simultaneously at the same time. Due to the variable nature of the site conditions, measurements at specific stages (i.e. embedment depths and location) for each installation type cannot be predicted and is impractical to implement. All measured events will be conducted when practical, and will be based on the conditions encountered and logistical costs (number of acoustician site visits). For each event, underwater sound measurements will be conducted from a minimum of two positions: (1) one close in at about 10 meters from the source (a fixed position) for sound source verification (SSV) and (2) from a drifting vessel that will be in the acoustic far field to use for computing the sound fall-off rate. The measurements positions would have to be identified in the field and will depend on the field conditions (i.e., availability of access for fixed positions and boat positions). The intention of the drift measurements is to drift south-southwestward along the inlet away or toward the source (depending on tidal conditions).

Measurements at each station are planned with a two-channel system that could provide acoustic measurements at two specified depths up to 100 feet deep with the primary reported level being the deeper channel. To avoid noise contamination from current effects, acoustic far field measurements are planned from a drifting vessel that are concurrent with the fixed measurement at the close-in position (i.e., approximately 10 meters). This vessel will provide for sound measurements over a range of 100 meters to at least across the inlet (2,000 meters) and perhaps out to 5,000 meters or more down inlet. Hydrophones will be deployed from the vessel while it drifts

using buoys and weighted lines to minimize current and wave effects. The underwater sound levels will be measured using hydrophones, sound level meters, and recording devices. Measurements will be made with hydrophones that have a flat frequency response and are omni-directional over a frequency range of 20 to 20,000 Hz. Hydrophones will be deployed from a drifting or anchored vessel. The signals will be fed into an appropriate data-logging device, such as an integrating sound level meter. The systems will have the capability to make quality recordings using a digital audio recorder (either solid state or tape). The accuracy of the measurement system will be +/-1 dB from 10 to 20,000 Hz. Sound levels will be reported in decibels (dB), referenced to 1 micro Pascal (μPa). The measurement system will be able to measure the unweighted or Z-weighted root-mean-square (RMS) sound pressure levels in dB referenced to 1 μPa.

Digital audio recordings of these sounds will be conducted so that subsequent analysis could be provided, and certain sounds could be identified or at least described. The subsequent analysis will include providing representative frequency spectra for different sounds or distances from the source. The spectra data will be provided in ⅓ octave bands for sounds in the 10 to 20,000 Hz range.

2.5 Equipment

Table 2 is a list of the sound level monitoring equipment planned for underwater sound measurements. The equipment is planned to include a amplitude rang e of 120 to 220 dB referenced to one micropascal (re: 1 uPa) and a minimum frequency range of 10 Hz to 20 kHz with a minimum sampling rate of 44,000 Hz. Table 2 describes the minimum requirements of the equipment to be used. In addition to the equipment selection, quality control/quality assurance procedures should be described (e.g., how will system responses be verified and how will data be managed).

2.6 Reporting

Data summaries will be prepared to report the following information:

- Duration and number of pile strikes per pile and per day (for impact pile driving).
- For each recorded impact pile strike (or each strike from a subset), report the following:
    - The median value of the peak pressure, defined as the maximum absolute value of the instantaneous pressure (overpressure or under pressure).
    - The median value of the root mean squared sound pressure across 90% of the pile strike energy (pulse RMS),
    - The median value of the pulse duration used to compute the RMS pulse sound pressure level.
    - The median value of the sound exposure level (SEL), measured for each second or pile strike and the accumulation of SEL across the duration of the event.
- Maximum, mean, and minimum of the pile strike peak pressure (for peak pressures above 170 dB) (in final report).
- Maximum, mean, and minimum of the pile strike pulse RMS, (in final report)
- Maximum, mean, and minimum of the pile strike pulse SEL (in final report).
- Cumulative SEL for all measured events
- Time history trace of measured sound levels.
- Note that vibratory pile installation and drilling activities would include maximum peak, mean and median RMS and accumulated SEL for those entire events only. The corresponding time durations will also be reported.

- Mean 1/3rd-octave band spectra and the computed median power spectral density (PSD) for events (in final report)

Following the completion of all monitoring activities, an SSV report will be prepared. The report will describe the sources of the sound, the environment and the measurements. The methodology employed to make the measurements will be described. Results will be presented as overall sound pressure levels and displays of ⅓ octave band sound levels. Specific sounds will be identified. This task involves time to analyze the acoustical data for each source, which may require post analysis of recordings. The intent is to measure these sounds live and minimize any post-measurement analyses. A preliminary report will be provided to the National Marine Fisheries Service (NMFS) within one week of completing the field measurements, and a final full report within 60 days. If two mobilizations are required, a brief preliminary report will be provided after the first mobilization. This information will be needed to adjust, as appropriate, the monitoring and shutdown safety zones.

Table 2. Underwater Sound Monitoring Equipment

Item	Specifications	Minimum Quantity	Usage
Hydrophone (e.g., Reson Type 4013 and 4033)	Receiving Sensitivity 211 dB ± 3 dB re 1 V/μPa OR 203 dB + 2 dB re 1 V/μPa	2	Capture underwater sound pressures 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 103 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.
Digital Signal Analyzer	Sampling Rate- 48kHz or greater	1	Analyzes and transfers digital data to laptop hard drive.
Laptop computer or Digital Audio Recorder	Compatible with digital signal analyzer and can capture signals at a sampling rate of 10 to 44,000Hz*	1	Record digital data on hard drive or digital media (e.g., SC Card).
Real Time and Post-analysis software	-	1	Monitor real-time signal and post-analysis of sound signals.

2.7 Contingencies

Close coordination with the contractors and appropriate operations personnel will be required to make this effort successful and cost-effective. Please note that there are conditions that are beyond our control that could affect the level of effort. The primary issues are as follows:

- Access to Skagway: We are assuming that commercial ferry or seaplane travel service would be available to Skagway.
- Lodging. We are assuming that lodging and local transportation are available in Skagway at reasonable rates. Given that this work may occur during the winter season when many businesses may not operate.
- Weather and Sea Conditions: high winds and rough seas would either make boat operations unsafe and/or cause background noise due to waves that would not allow us to make the proper measurements to identify fairly low-level sound sources emanating from the driven pile;
- Sound Measurement Limitations: Strong tidal currents would introduce considerable noise that may not allow us to make the proper measurements to identify fairly low-level sound sources (we would try to target our measurements around slack tidal currents to minimize this effect and drift while making measurements);
- Boat Services and Construction Access: Boat access needs to be provided so we can be in the proper positions for conducting each of these measurements. In addition, access to the construction area and nearby dock facilities needs to be provided so that we can deploy two hydrophone systems that can be left unattended and be secure.