UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

December 18, 2003

Colonel Timothy J. Gallagher
U.S. Army Corps of Engineers
P.O. Box 898
Anchorage, Alaska 99506-0898

Attn: Dr. Jan Stuart

Dear Colonel Gallagher;

The National Marine Fisheries Service (NMFS) has reviewed the Public Notice of Application for Permit by the City of Valdez for work in Valdez Harbor (O-1969-0031 Valdez Harbor 30). The applicant proposes to dredge approximately 11,800 cubic yards of material from a 45,000 square foot area. The dredge spoils would be discharged within open water to the south of the dredge area. Approximately 1,300 cubic yards of filter rock and 4,000 cubic yards of armor rock would be discharged into 19,500 square feet below the high tide line for shoreline stabilization. The applicant also proposes to construct a 20 foot by 125 foot dock supported by 41 piles. Total impacted tidelands through dredging and filling would be approximately 2 acres.

The U.S. Army Corps of Engineers (Corps) has determined that the proposed work may adversely affect Essential Fish Habitat (EFH) for juvenile/adult salmon, groundfish, crab and forage fish. NMFS agrees with this determination. The Magnuson-Stevens Fishery Conservation and Management Act requires NMFS to make conservation recommendations regarding any federal action that would adversely affect EFH. The adverse effects of the proposed project can be reduced by incorporating the proposed conservation measures into the project permit. NMFS offers the following recommendations pursuant to section 305(b)(4)(A) of the Magnuson-Stevens Act to minimize project impacts.

EFH Conservation Recommendations

<u>Dredging</u>

1. Dredging should be conducted in a fashion to minimize turbidity.

2. All dredging activity should occur between October 1 and April 1 to minimize impacts to juvenile salmon in the area.

Filling

1. Riprap should be placed during lower tide stages when fewer fish will be in the construction zone. The applicant should use clean riprap that is relatively free of sediment to reduce turbidity.

Pile Driving

Pile driving can have adverse effects on fish. NMFS staff have summarized these impacts in the enclosed document titled "Summary of Potential Impacts to Fish From Pile Driving."

1. Fish are sensitive to underwater pressure waves. Larger waves are created by impact drivers than by vibratory drivers, which work well in a soft substrate. The project area contains mostly soft substrate. Pressure wave impact resulting from this project should be minimized by using a vibratory driver.

2. Pile driving should be conducted between October 1 and April 1. More fish are present in the area during the spring, summer and early fall. Marine juvenile fish often use shallow waters during the summer months, moving to deeper waters in the winter. Juvenile salmon (including the large number of salmon released from Solomon Gulch Hatchery) will also be in these near shore waters in the spring and early summer. The in-water work window will help minimize impact to fish in the project area.

3. Wooden materials associated with the pilings and dock should not be treated with pentachlorophenol or creosote. Specified wood treatments should be applied through pressure treatment rather than surface application. All treated wood used in conjunction with this project should be produced and installed in compliance with the most recent version of the Best Management Practices for the Use of Treated Wood in Aquatic Environments published by the Western Wood Preservers Institute (http://www.wwpinstitute.org/).

Please note that under section 305(b)(4) of the Magnuson-Stevens Act, the Corps is required to respond in writing within 30 days to NMFS recommendations. If the Corps does not make a decision within 30 days of receiving NMFS Conservation Recommendations, the Corps should provide NMFS with a letter to that effect, and indicate when a full response will be provided. Larry Peltz is the NMFS contact for this project, and can be reached by telephone at (907) 271-1332.

Sincerely,

James W. Balsiger
Administrator, Alaska Region

Attachment

cc: Francis Mann - USFWS Anchorage
Stewart Seaberg - ADNR Anchorage
Robin Willis - ADF&G Anchorage

NATIONAL MARINE FISHERIES SERVICE
SUMMARY OF POTENTIAL IMPACTS TO FISH FROM PILE DRIVING

Pile Installation and Removal

Pilings are an integral component of many overwater and in-water structures. They provide support for the decking of piers and docks, function as fenders and dolphins to protect structures, support navigation markers, and are used to construct breakwaters and bulkheads. Materials used in pilings include steel, concrete, wood (both treated and untreated), plastic or a combination thereof. Piles are usually driven into the substrate using one of two types of hammers - impact hammers and vibratory hammers. Impact hammers consist of a heavy weight that is repeatedly dropped onto the top of the pile, driving it into the substrate. Vibratory hammers utilize a combination of a stationary, heavy weight and vibration, in the plane perpendicular to the long axis of the pile, to force the pile into the substrate. The type of hammer used depends on a variety of factors, including pile material and substrate type. Impact hammers can be used to drive all types of piles, while vibratory hammers are generally most efficient at driving piles with a cutting edge (e.g., hollow steel pipe) and are less efficient at driving "displacement" piles (those without a cutting edge that must displace the substrate). Displacement piles include solid concrete, wood, and closed-end steel pipe. While impact hammers are able to drive piles into most substrates (including hardpan, glacial till, etc.), vibratory hammers are limited to softer, unconsolidated substrates (e.g., sand, mud, gravel). Since vibratory hammers do not use force to drive the piles, the bearing capacity is not known and the piles must often be "proofed" with an impact hammer. This involves striking the pile a number of times with the impact hammer to ensure that it meets the designed bearing capacity. Under certain circumstances, piles may be driven using a combination of vibratory and impact hammers. The vibratory hammer makes positioning of the pile, and making it plumb, easier, and is therefore often used to drive the pile through the soft, overlying material. Once the pile stops penetrating the sediment, the impact hammer is used to finish driving the pile to final depth. An additional advantage of this method is that the vibratory hammer can be used to extract and reposition the pile, while the impact hammer cannot.

Overwater structures must often meet seismic stability criteria, requiring that the supporting piles are attached to, or driven into, the underlying hard material. This requirement often means that at least some impact driving is necessary. Piles that do not need to be seismically stable, including temporary piles, fender piles and some dolphin piles, may be driven with a vibratory hammer, providing the type of pile and sediments are appropriate.

Piles can be removed using a variety of methods, including vibratory hammer, direct pull, clam shell grab, or cutting/breaking the pile below the mudline. Vibratory hammers can be used to remove all types of pile, including wood, concrete and steel. However, old, brittle piles may break under the vibrations and necessitate another method. The direct pull method involves placing a choker around the pile and pulling upward with a crane or other equipment. Broken stubs are often removed with a clam shell and crane. In this method, the clam shell grips the pile near the mudline and pulls it out. In other instances, piles may be cut or broken below the mudline, and the buried section left in place.

Pile Driving

Potential Adverse Impacts:

Pile driving can generate intense underwater sound pressure waves that may adversely affect the ecological functioning of EFH. These pressure waves have been shown to injure, and kill fish (e.g., CalTrans 2001, Longmuir and Lively 2001, Stotz and Colby 2001; Stadler, pers. OBS. 2002). Injuries associated directly with pile driving are poorly studied, but include rupture of the swimbladder and internal hemorrhaging (CalTrans 2001; Abbott and Bing-Sawyer 2002; Stadler, pers. OBS. 2002). Sound pressure levels 100 decibels (dB) above the threshold for hearing is thought to be sufficient to damage the auditory system in many fishes (Hastings 2002).

The type and intensity of the sounds produced during pile driving depend on a variety of factors, including, but not limited to, the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water and the type and size of the pile-driving hammer. Sound pressure levels are positively correlated with the size of the pile, as more energy is required to drive larger piles. Wood and concrete piles appear to produce lower sound pressures than hollow steel piles of a similar size, although it is not yet clear if the sounds produced by wood or concrete piles are harmful to fishes. Hollow steel piles as small as 14-inch diameter have been shown to produce sound pressure levels that can injure fish (Reyff 2003). Firmer substrates require more energy to drive piles, and produce more intense sound pressures. Sound attenuates more rapidly with distance from the source in shallow than in deep water (Rogers and Cox 1988).

Driving hollow steel piles with impact hammers produce intense, sharp spikes of sound which can easily reach levels that injure fish. Vibratory hammers, on the other hand, produce sounds of lower intensity, with a rapid repetition rate. A key difference between the sounds produced by impact hammers and those produced by vibratory hammers is the responses they evoke in fish. When exposed to sounds which are similar to those of a vibratory hammer, fish consistently displayed an avoidance response (Enger et al. 1993; Dolat 1997; Knudsen et al. 1997; Sand et al. 2000), and did not habituate to the sound, even after repeated exposure (Dolat, 1997; Knudsen et al. 1997). Fishes may respond to the first few strikes of an impact hammer with a "startle" response. After these initial strikes, the startle response wanes and the fishes may remain within the field of a potentially-harmful sound (Dolat 1997; NOAA Fisheries 2001). The differential responses to these sounds are due to the differences in the duration and frequency of the sounds. When compared to impact hammers, the sounds produced by vibratory hammers are of longer duration (minutes vs. msec) and have more energy in the lower frequencies (15-26 Hz vs 100-800 Hz) (Würsig, et al. 2000; Carlson et al. 2001; Nedwell and Edwards 2002). Studies have shown that fish respond to particle acceleration of 0.01 m/s^2 at infrasound frequencies, that the response to infrasound is limited to the nearfield (< 1 wavelength), and the fish must be exposed to the sound for several seconds (Enger et al. 1993; Knudsen et al. 1994; Sand et al. 2000). Impact hammers, however, produce such short spikes of sound with little energy in the infrasound range, that fish fail to respond to the particle motion (Carlson et al. 2001). Thus, impact hammers may be more harmful than vibratory hammers for two reasons: first they produce more intense pressure waves, and second, the sounds produced do not elicit an avoidance response in fishes, which will expose them for longer periods to those harmful pressures.

The degree to which an individual fish exposed to sound will be affected is dependent on a number of variables, including: 1) species of fish; 2) fish size; 3) presence of a swimbladder; 4) physical condition of the fish; 5) peak sound pressure and frequency; 6) shape of the sound wave (rise time); 7) depth of the water around the pile; 8) depth of the fish in the water column; 9) amount of air in the water; 10) size and number of waves on the water surface; 11) bottom substrate composition and texture; 12) effectiveness of bubble curtain sound/pressure attenuation technology; 13) tidal currents; and 14) presence of predators.

Depending on these factors, effects on fish can range from changes in behavior to immediate mortality. There is little data on the sound pressure level required to injure fish. Short-term exposure to peak sound pressure levels above 190 dB (re:1 μPa) are thought to inflict physical harm on fish (Hastings 2002). However, 155 dB (re: 1 μPa) may be sufficient to temporarily stun small fish (J. Miner, pers. comm. 2002). Stunned fish, while perhaps not physically injured, are more susceptible to predation. Small fish are more prone to injury by intense sound than are larger fish of the same species (Yelverton *et al*. 1975). For example, a number of surfperches (*Cymatogaster aggregata* and *Embiotoca lateralis*) were killed during impact pile driving (Stadler, pers. OBS. 2002). Most of the dead fish were the smaller *C. aggregata* and similar sized specimens of *E. lateralis*, even though many larger *E. lateralis* were in the same area. Dissections revealed that the swimbladder of the smallest fish (80 mm forklength [FL]) were completely destroyed, while those of the largest individual (170 mm FL) was nearly intact, indicating a size-dependent effect. The sound pressure levels that killed these fish are not yet known. Of the reported fish kills associated with pile driving, all have occurred during use of an impact hammer on hollow steel piles (Longmuir and Lively, 2001; NOAA Fisheries, 2001; Stotz and Colby , 2001; NOAA Fisheries 2003).

Systems successfully designed to reduce the adverse effects of underwater sound pressure levels on fish have included the use of air bubbles. Both confined (i.e. metal or fabric sleeve) and unconfined air bubble systems have been shown to attenuate underwater sound pressures up to 28 dB (Wursig *et al*. 2000; Longmuir and Lively 2001; Christopherson and Wilson 2002; Reyff and Donovan 2003). When using an unconfined air bubble system in areas of strong currents, it is critical that the pile is fully contained within the bubble curtain. To accomplish this, adequate air flow and ring spacing both vertically and distance from the pile are factors that should be considered when designing the system.

<u>Recommended Conservation Measures:</u>

1. Conduct the installation of hollow steel piles with an impact hammer at a time of year when

larval and juvenile stages of fish species not present. If this is not possible, then the following measures should be incorporated to minimize adverse effects.
2. Drive piles during low tide periods when located in intertidal and shallow subtidal areas.
3. Use a vibratory hammer when driving hollow steel piles. Under those conditions where impact hammers are required for reasons of seismic stability or substrate type, it is recommended that the pile be driven as deep as possible with a vibratory hammer prior to the use of the impact hammer.
4. Monitor peak sound pressure levels during pile driving to ensure that they do not exceed the 190 dB re:1 μPa threshold for injury to fish.
5. Implement measures to attenuate the sound should sound pressure levels exceed the 180 dB re 1 μPa threshold. If sound pressure levels exceed acceptable limits, implement measures to reduce sound pressure levels. Methods to reduce the sound pressure levels include, but are not limited to:
   a) Surround the pile with an air bubble curtain system or air-filled coffer dam.
   b) Use a smaller hammer to reduce the sound pressure. The sound produced in pile driving has a direct relationship to the force used to drive the pile. A smaller hammer will have less force on the pile therefore, producing less sound.
   c) Use a hydraulic hammer if impact driving cannot be avoided. The force of the hammer blow can be controlled with hydraulic hammers, and reducing the impact force will reduce the intensity of the resulting sound.
6. Drive piles when the current is reduced (i.e., centered around slack current) in areas of strong current to minimize the number of fish exposed to adverse levels of underwater sound.

Pile Removal

Potential Adverse Impacts:

The primary adverse effect of removing piles is the suspension of sediments which may result in harmful levels of turbidity and release of contaminants contained in those sediments. Vibratory pile removal tends to cause the sediments to slough off at the mudline, resulting in relatively low levels of suspended sediments and contaminants. Vibratory removal of piles is gaining popularity because it can be used on all types of piles, providing that they are structurally sound. Breaking or cutting the pile below the mudline may suspend only small amounts of sediment, providing the stub is left in place and little digging is required to access the pile. Direct pull or use of a clamshell to remove broken piles, however, may suspend large amounts of sediment and contaminants. When the piling is pulled from the substrate using these two methods, sediments clinging to the piling will slough off as it is raised through the water column, producing a potentially harmful plume of turbidity and/or contaminants. The use of a clamshell may suspend additional sediment if it penetrates the substrate while grabbing the piling.

While there is a potential to adversely affect EFH during the removal of piles, many of those removed are old creosote-treated timber piles. In some cases, the long-term benefits to EFH obtained by removing a consistent source of contamination may outweigh the temporary adverse effects of turbidity.

Recommended Conservation Recommendations:

1. Remove piles completely rather than cutting or breaking off if the pile is structurally sound.
2. Minimize the suspension of sediments and disturbance of the substrate when removing piles. Measures to help accomplish this include, but are not limited to:
   a) When practicable, remove piles with a vibratory hammer, rather than the direct pull or clamshell method.
   b) Remove the pile slowly to allow sediment to slough off at, or near, the mudline.
   c) The operator should first hit or vibrate the pile to break the bond between the sediment and pile to minimize the potential for the pile to break, as well as reduce the amount of sediment sloughing off the pile during removal.
   d) Place a ring of clean sand around the base of the pile. This ring will contain some of the sediment that would normally be suspended.
   e) Encircle the pile, or piles, with a silt curtain that extends from the surface of the water to the substrate.
3. Complete each pass of the clamshell to minimize suspension of sediment if pile stubs are removed with a clamshell.
4. Fill all holes left by the piles with clean, native sediments if possible.
5. Place piles on a barge equipped with a basin to contain all attached sediment and runoff water after removal. Creosote-treated timber piles should be cut into short lengths to prevent reuse, and all debris, including attached, contaminated sediments, should be disposed of in an approved upland facility.
6. Drive broken/cut stubs using a pile driver, sufficiently below the mudline to prevent release of contaminants into the water column as an alternative to their removal.

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