Presentation to The Fish and Wildlife Commission

February 10, 2018

Washington Prospectors and Mining Association
Chuck Wilson, President
Sultan Federal Mining District
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Dear Commissioners:

Our organizations would like to present the following information to you for consideration as requested in support of small scale dredging.

Commission Question: What does not impact fish?

Topic 1: Sound Generated by Small Scale Dredging Gas Motors does not impact fish life.

There have been assertions by others that the sound generated from the gas motors on operating small-scale dredges travel through the air environment and into the water column (river or stream) at levels which could disturb or scare fish.

Commission Question: How are those affects addressed or not addressed in the Gold and Fish pamphlet regulations?

The Gold and Fish Pamphlet uses the 2006 Small Scale Mining White Paper as one of its main technical basis documents. In Section 7.7 Disturbances, it is stated that "Research related to the amount of noise generated during small-scale mining activities is not available, so the anticipated influence on potentially covered species is speculative.

However, Table 13, pages 9-8 thru 9-12 of the White Paper states that noise from motorized panning, use of sluice boxes and suction dredging (human disturbance/noise) presents low to moderate and moderate risk levels to fish life, even though the White Paper established that no data exists on this topic. Table 8 and Table ES-1 further speculates that noise from small scale dredging has "The potential for human disturbances (e.g., noise) along the channel during mineral prospecting activities to indirectly displace or disrupt the behavior of potentially covered fish species".

We desire to establish with the WDFW staff and the Commission that it is a fact that sounds generated in the air such as from a gas motor on a small-scale dredge do not migrate into the water column and the sections identified in the White Paper need to be revised as such as there is no risk of impact to fish from dredge motor or mining sounds generated in the air.

In the technical paper, "A Concise Survey of the Fundamental Properties of Sound Waves Composed by Dr. J. B. Calvert, Associate Professor Emeritus of Engineering, University of Denver Registered Professional Engineer, State of Colorado No.12317, Created 6 May 2000, Last revised 24 September 2003 - https://mysite.du.edu/~jcalvert/waves/soundwav.htm " it is established that sounds in air do not propagate into the water column. The key statement from this document is presented as follows:

> "A dense, rigid medium has a very large acoustic impedance. In this case, ξ' = -ξ, and ξ'' = 0, so the wave is completely reflected. If the second medium has a much smaller acoustic impedance, the reflected wave is in phase instead. Although actual materials cannot be perfect reflectors, the impedance match between air and a solid or liquid is generally so poor that very little energy goes into sound waves in the denser medium. The behavior at a solid is quite complicated, because three modes of waves exist in a solid, not just the longitudinal compression wave. *Waves from the air do not penetrate into water, and sound waves in water do not penetrate into the air. The two media are acoustically separate. This may be of interest to anglers, who can feel free to talk while they fish. They should beware of casting moving shadows on the water, however."*

Additional support for this fact can be found in any testimony from any small-scale dredge miner who is suction dredging fully underwater breathing compressed air. They will attest that the sound of the dredge motor cannot be heard by the miner when underwater. In many situations, the first indication that the miner encounters that tells them that the dredge motor has stopped is when their compressed air supply stops due to the motor shutting down.

The inability of air generated sounds to penetrate the water as proven by Dr. Calvert's document, is the reason behind the fish behavior as described in Section 7.7 of the White Paper which states: "Although the noises and movement of personnel associated with small-scale mining activities could offer negative effects on the feeding behavior of fish, NMFS, U.S. Forest Service (USFS), and mining industry personnel observed juvenile steelhead feeding within a few feet of the mining activity and often in the plume itself (NMFS 2006o).

In summary, the sounds emitted from small scale dredge gas motors do not impact fish life to any degree as proven by science and field experience. To further prove this once and for all, the WPMA has developed a field test plan to use sophisticated acoustic hydrophones, data recorders and analysis software to collect data and publish the results this year. The results are expected to show no increase in the ambient noise level in the water column at various distances from a small motor operating on the bank and from operating suction dredges.

Respectfully Submitted:

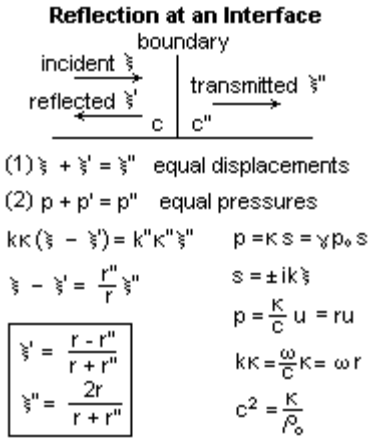
Chuck Wilson, President WPMA/Sultan Federal Mining District

attachment 1

https://mysite.du.edu/~jcalvert/waves/soundwav.htm

Reflection and Refraction

When a plane sound wave encounters a plane material interface, it is reflected and refracted according to the laws familiar from optics. The amounts reflected and transmitted depend on the relative acoustic impedance of the two media. We can easily solve the problem for normal incidence by using the results we have already found. In the figure, quantities in the incident wave are unprimed, those in the reflected wave singly primed, and those in the transmitted wave are doubly primed. The waves are described by their displacements ξ. The volume elasticity κ is used for generality, instead of γp for an ideal gas. At the boundary, the two media must remain in contact as the wave passes, and the pressures must be equal on the two sides of the interface. These two boundary conditions can be expressed as shown in terms of the displacements. The pressure condition is put in terms of the displacement by assuming a harmonic wave, a very convenient, but not essential, way to proceed here. Everything can be expressed in terms of the acoustic impedances r and r" of the two media. Finally, the simultaneous equations are easily solved for ξ' and ξ" in terms of ξ, and the results appear in the box.



A dense, rigid medium has a very large acoustic impedance. In this case, ξ' = -ξ, and ξ" = 0, so the wave is completely reflected. If the second medium has a much smaller acoustic impedance, the reflected wave is in phase instead. Although actual materials cannot be perfect reflectors, the impedance match between air and a solid or liquid is generally so poor that very little energy goes into sound waves in the denser medium. The behaviour at a solid is quite complicated, because three modes of waves exist in a solid, not just the longitudinal compression wave. Waves from the air do not penetrate into water, and sound waves in water do not penetrate into the air. The two media are acoustically separate. This may be of interest to anglers, who can feel free to talk while they fish. They should beware of casting moving shadows on the water, however.

Reflection and refraction in three dimensions is only a little more complicated. Many texts complicate the matter, but it is really easy to understand if you look at it in terms of fundamentals, and not just as a mathematical exercise. The nature of the interface between the media deserves some consideration first. We'll consider two fluid media with a plane interface of a thickness much less than a wavelength. Ideally, we should think of a massless, flexible film separating the two media. When the two media are gaseous, diffusion at least will blur the transition, so such a film would be necessary. The interface between a gas and a liquid, or between two immisicble liquids, would generally suit our condition quite naturally.