



**UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration**


*National Marine Fisheries Service*

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July 2, 2003

MEMORANDUM FOR: F/HC2 Tom Bigford

FROM: F/AKR4 Jon Kurland 

SUBJECT: Draft Policies on Gravel Extraction and Hardrock Mining

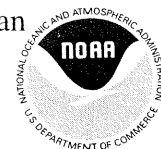
The Alaska Region (AKR) has reviewed the two draft NOAA Fisheries guidance documents on gravel extraction and hardrock mining. Both documents provide useful information and guidance for the subjects covered. We commend Dave Packer, Tony Paulson, and your office for this effort to assist project reviewers in the field. Field personnel often do not have the time to do extensive research on a subject but are nonetheless routinely asked to provide meaningful review of projects covering a wide range of impacts. The guidance documents will be helpful for reviewers new to a subject, and also to experienced reviewers as a checklist to ensure that comments cover all the issues of concern. If it would be possible to supply a complete set of the literature cited/references with the final guidance documents to each Region, these could be added to the Regions' libraries.

The two documents are similar in outline, but slightly different. For example, the hard rock mining document has a glossary, but the gravel extraction does not. The gravel extraction document has an appendix on summaries of major statutes, but the hard rock mining document does not. Statutes are discussed in the Introduction of the gravel extraction document, and in the Regulatory Framework section of the hard mining document. The gravel extraction document has a Literature Cited section, and the hard rock mining document has a References section. To the extent possible, it may be helpful to use similar outlines and section titles for guidance documents so that reviewers become familiar with those outlines for quick reference and comparison.

## **NATIONAL GRAVEL EXTRACTION GUIDANCE**

### General Comments

Mining of sand and gravel in the Alaska Region's watersheds is extensive, and represents a multi-million dollar business. It is not unusual for Regional staff to review a proposed action which may involve removing a million cubic yards of gravel from a river. Therefore, we recommend that the Introduction section of the Guidance remind the reader that the guidance is not meant to be "static or inflexible" as is done under the Recommendations. This said, AKR recognizes the guidance will serve to provide greater consistency throughout NOAA Fisheries concerning this issue. Gravel mining impacts are similar to other environmental impacts on streams and salmon habitat caused by logging, urban



development and road construction, and with the exception of dams, are some of the primary reasons for habitat loss and reduced anadromous fish populations. There is an extensive base of scientific knowledge on the effects of these impacts on habitat, and the subsequent detrimental effects on salmon.

Potential impacts from gravel mining should also include a section on impaired water quality and discuss increased turbidity, pollutants such as heavy metals, possible changes in dissolved oxygen, pH, total dissolved solids, and possibly nutrients. As a point of concern, urban development in Alaska has created serious problems with iron floc in streams and wetlands where gravel has been mined, ditches have been dug for stormwater drainage, or gravel containing iron has been used for fill.

We agree with the statement in Section II Scope Of Gravel Guidance, which references Kondalf 1993 and 1994a, suggesting that floodplain pits can become integrated into the active channel and should therefore be regarded as “dry pits” existing instream. Therefore, we recommend the document be organized to address four types of mining, and suggests that under Section III Environmental Effects Of Gravel Extraction the “effects” be organized by types of mining identified under Section II.

#### Specific Comments - (editing appears as redline and strikeout)

##### I. Introduction

- Third paragraph of section:

This paragraph discusses pertinent laws, and refers the reader to Appendix I: Summaries of Major Statues. This paragraph could stand alone as a section of pertinent laws, including how they are connected to the NMFS review process of gravel extraction. Addition information, specifically describing the Essential Fish Habitat consultation process, should be included with mention of the Magnuson-Stevens Fishery Conservation and Management Act, in both the third paragraph of the Introduction, and Appendix I. A description of the Anadromous Fish Act is given in Appendix I, but this law and its relationship to NMFS reviews is not mentioned in the third paragraph of the Introduction and its relevance is unclear.

##### II. Scope of Gravel Guidance

- First paragraph.

This Guidance document applies to tidal sloughs, intertidal and subtidal reaches of a stream, freshwater rivers and streams, and their associated wetlands and riparian zones where anadromous fish are currently or historically present. Gravel extraction is a major and longstanding activity in rivers and streams in most parts of the United States.

- Second paragraph, last sentence.

When the rate of gravel extraction exceeds the rate of natural deposition over an extended time

- Second paragraph, last sentence.  
When the rate of gravel extraction exceeds the rate of natural deposition over an extended time period, a net loss occurs due to the cumulative loss of gravel (Oregon Water Resources Research Institute (OWRRI) 1995).

### III. Environmental Effects of Gravel Extraction

- third paragraph:  
The following reference after Brown et al. 1998, should be added Koski 1993.

Koski, K V. 1993. Riparian zone functions and interaction with sediment. *In Proceedings of a Technical Workshop on Sediments, February 3-7, 1992, Oregon State University, Corvallis, OR, Sponsored by Terrene Institute, U.S. EPA, and USFS. Terrene Institute, Wash, DC, pp 61-69.*

- Fourth paragraph (indented):  
Give additional information on nature of changes in-channel conditions and references.
- Fifth paragraph (indented):  
Second sentence “For example, aggregate mining involves the channel and boundary but requires...”, add descriptor for “boundary”, as in “upland boundary” or “floodplain boundary”.
- Items 1 and 2: The various terms used under the potential effects described in #1, and #2, such as sediment supply, transporting capacity, suspended sediment, sediment transport water turbidity and gravel siltation should be defined somewhere. The guidance should be designed to be used so that it is self explanatory.
- Item 1. last sentence. Qualify reference to gravel size by adding unit measurement as length or diameter, “Gravel mining itself often selectively removes gravels of approximately the same sizes as needed by salmonids for spawning (sizes of between 15-45 mm *diameter* (?).....”
- Item 2. second sentence. Add reference ....sediments as a result of channel deformation. As reviewed by Everest et al. (1987), fine sediments in particular are detrimental...

Everest, F.H., Robert L. Beschta, J. Charles Scrivener, K V. Koski, James R. Sedell, and C. Jeff Cederholm. 1987. Sediment and salmonid production: a paradox. Pages 98-142 *in* E.O.Salo and T.W.Cundy, eds. *Streamside Management: Forestry and Fishery Interactions*. Proc. Symp., University of Washington. Contrib. No. 57. Inst. Forest Resources, Univ. Washington, Seattle.

- Item 2. Third sentence. Add references ... sediment is deposited on the redd (Koski 1966,

1981; Chapman 1988; Reiser and White 1988; .....

Koski, K V. 1966. The survival of coho salmon (*Oncorhynchus kisutch*) from egg deposition to emergence in three Oregon coastal streams. M.S. thesis, Oregon State University, Corvallis, 84 pp.

Koski, K V. 1981. The survival and quality of two stocks of chum salmon (*Oncorhynchus keta*) from egg deposition to emergence. Rapp. P.-v. Reun. Cons. Int. Explor. Mer.,178: 330-333.

- Item 2. fourth sentence. “High silt loads may also inhibit larval, juvenile and adult behavior including migration, or spawning....”

Also add reference .....behavior, migration, or spawning (Koski 1975; Snyder 1959; Cordone and Kelly 1961....

Koski, K V. 1975. The survival and fitness of two stocks of chum salmon (*Oncorhynchus keta*) from egg deposition to emergence in a controlled stream environment at Big Beef Creek. Ph.D. Dissertation, University of Washington, Seattle, 212pp.

- Item 2. Fifth sentence. Add reference ....and impair feeding (Rivier and Siquier 1985; Sigler et al. 1984). Siltation, substrate....

Sigler, John W., T.C. Bjornn, and Fred H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Trans. Amer. Fish. Soc., 113:142-150.

- Item 3. Add reference .....OWRRI 1995; Brown et al. 1998; Sullivan et al. 1987). Gravel extraction can....

Sullivan, Kathleen, Thomas E. Lisle, C. Andrew Dolloff, Gordon E. Grant, and Leslie M. Reid. 1987. Stream channels: the link between forests and fishes. Pages 39-97 in E.O.Salo and T.W.Cundy, eds. Streamside Management: Forestry and Fishery Interactions. Proc. Symp., University of Washington. Contrib. No. 57. Inst. Forest Resources, Univ. Washington, Seattle.

- Item 5. Operation of heavy equipment in the channel bed can directly destroy spawning habitat, rearing habitat, macroinvertebrates, and produce increased turbidity and...
- Item 8. The importance of riparian habitat to anadromous fishes (Koski 1993) should not be underestimated....

Koski, K V. 1993. Riparian zone functions and interaction with sediment. In Proceedings of a

Technical Workshop on Sediments, February 3-7, 1972, Oregon State University, Corvallis, OR, Sponsored by Terrene Institute, U.S. EPA, and USFS. Terrene Institute, Wash, DC, pp 61-69.

- Also check formatting on this page. The items following “a” would appear to be a list under “a” Perhaps this section should more appropriately start as follows:

### Summary

Gravel extraction activities can damage the riparian zone in several ways:

- If the floodplain aquifer discharges into the stream, groundwater levels can be lowered because of channel degradation. Lowering the water table can destroy riparian vegetation (Collins and Dunne 1990).
- Long-term loss of riparian vegetation can occur when gravel is removed to depths that result in permanent flooding or ponded water....

And so forth...

### IV. Recommendations

- **Item 5. Gravel bar skimming should only be allowed under restricted conditions.** For the suggestion that “bar skimming operations need to be monitored”, it would be helpful to provide some information on how that should be done, and what action should be taken if an adverse effect is detected from monitoring. Preferably, a reference should be provided as well.
- **Item 6. Pit excavations located on adjacent floodplain or terraces should be separated from the active channel by a buffer designed to maintain this separation for two or more decades.** What is the basis/origin for the standard of two or more decades? Is it the Kodolf (1993, 1994a) reference? Also give reference for how to design levees that separate the pits from the active channel to withstand long-term flooding or inundation by the channel, as suggested.

As an additional note, in Alaska the connection between the pits and the active channel is encouraged. The side gravel excavation areas are used as mitigation to create spawning and rearing habitat for salmon.

- **Item 10. The cumulative impacts of gravel extraction operations to anadromous fishes and their habitats should be addressed by the Federal, state, and local resource management and permitting agencies and considered in the permitting process.** This section gives no guidance on assessing cumulative impacts, identifying it as a future need outside the scope of the Guidance, but directs that “individual gravel extraction operations must be

judged from a perspective that includes their potential adverse cumulative impacts...”. Until NMFS develops its own cumulative impact guidance, it would be helpful to provide a few references that address this issue. EPA and the Council on Environmental Quality have both produced documents to address cumulative impacts. Two possible references are:

U.S. Environmental Protection Agency, Office of Federal Activities. 1999. Consideration of Cumulative Impacts in EPA Review of NEPA Documents. EPA 315-R-99-002

Council on Environmental Quality. 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President, Washington DC. January.

- Item 11. Management is used to implement plans to prevent, minimize, and mitigate negative impacts.” Provide definitions of mitigation and restoration, both of which are used in this section. Also, the suggestion in this section for monitoring may be difficult to implement.

#### V. Optimum Management of Gravel Extraction Operations

- “This section outlines a management scenario for gravel extraction operations, ...” The framework described is far from simple.
- Phase I. This section directs that studies “Characterize and identify species distributions and abundances; identify habitats critical to fisheries management objectives and NOAA Fisheries responsibilities under a variety of legislative mandates;” and “determine the limiting environmental factors of the anadromous fish populations (Koski 1992).” The Koski (1992) reference outlines the need for understanding limiting environmental factors, but does not provide any methods. References that describes methodologies for determining limiting factors would be helpful here. Fry (1971), referenced in Koski (1992), provides some description of a method for determining habitat limiting factors based on anadromous fish life stage, but does not address other limiting factors, such as water quality parameters.
- Phase III. Paragraph 2. Reference is made to the California regulation of gravel extraction. A survey of state regulations regarding this topic would be helpful as an attached appendix. The discussion of the concept of “reclamation” would be a useful addition to the hard rock mining document, which also makes reference to the term.

#### Appendix I.

- Anadromous Fish Conservation Act. Reference is made to the authority given in this Act to the Secretary of Commerce for accepting donations to acquire or manage lands of “interest”. Does this mean that NMFS could accept in-lieu fee payments for Corps of Engineers projects that

damage habitat by gravel extraction for these purposes?

## NATIONAL HARDROCK MINING GUIDANCE

### General Comments:

Though this guidance is directed at hardrock mining, other activities affecting the stream channel such as gravel extraction, ditching, or filling can have similar impacts on salmon habitat in areas that are underlain with iron pyrites. Many lowland areas in southeast Alaska that were once under the sea have iron pyrites that produce iron floc as ground water reaches the surface. Though iron floc is a natural occurrence, any development activity that disturbs these gravels can result in heavy loads of iron floc that can impair aquatic habitat.

### Specific Comments

## II. Scope of Guidance

### III. Potential Environmental Impacts of Hardrock Mining on Anadromous Fish and Associated Habitat

- Item 2. third paragraph, reference to “Farag et al”, add period to “al.”
- Item 4. Fourth paragraph, add to sentence and add reference; ...harm fish eggs by reducing intragravel flow and reducing the concentration of dissolved oxygen (Koski 1975) reduce spawning success, decrease growth, ...

Koski, K V. 1975. The survival and fitness of two stocks of chum salmon (*Oncorhynchus keta*) from egg deposition to emergence in a controlled stream environment at Big Beef Creek. Ph.D. Dissertation, University of Washington, Seattle, 212pp.

- Item 5. **Mining and supporting infrastructure can negatively impact fish and habitat resources.** Reference is made to non-point sources of pollution, including petroleum products. The document would benefit from a mechanistic discussion of the effects of hydrocarbons (i.e. petroleum products) to anadromous fish, as has been done for acids, heavy metals, and sedimentation. There has been work done by the Auke Bay Laboratory that emphasizes the extreme toxicity of hydrocarbons to early life history stages of salmonids on the order of parts per billion ranges. The following reference may be used:

Marty, G.D., J.W. Short, D.M. Dambach, N.H. Willits, R.A. Heintz, S.D. Rice, J.J. Steeman and D.E. Hinton. 1997. Ascites, premature emergence, increased gonadal apoptosis, and cytochrome P4501A induction in pink salmon larvae continuously exposed to oil-contaminated

gravel during development. Can. J. Zool. 75:989-1007.

## V. General Recommendations

- Item 3. paragraph five. Habitat monitoring should be conducted to assess impacts to riparian areas, instream physical and chemical attributes and other relevant parameters, including substrate composition, streamflow, pool frequency and size, woody debris, and presence or absence of iron floc.
- Item 3. paragraph six second sentence. For the sentence “This monitoring should include counts of spawning fish, juvenile presence and *escapement*, ....” *Escapement* is a term most associated with the numbers of spawning adult salmon allowed to “escape” commercial and sport fishery harvests. Juvenile movements are not usually referred to with this word, but instead “out-migration” is a term used to describe juvenile movement from fresh to salt water. Therefore we recommend the following wording:

This monitoring should include counts and distribution of spawning fish, number of redds, juvenile presence or absence, relative abundance of juveniles, timing of juvenile outmigration, macro invertebrate numbers and species diversity, and other appropriate parameters, including heavy metal concentrations in fish.

- **Item 5. Mitigation of environmental impacts and reclamation of the mine site should conform to existing Federal and state laws.** This discussion should define and distinguish the terms “mitigation”, “reclamation”, and “restoration.” A discussion in the gravel extraction document of reclamation may be appropriate for this document as well.
- **Item 6. Financial assurance should include the costs of reclaiming the site to prevent acid and heavy metal drainage.** This section states that “All western states that have mining on Federal lands now require financial assurance for reclamation.” An appendix of references for each state would be helpful so reviewers are able to find this information.
- Item 11. Adequate sampling to assess the level of acid drainage should be conducted. Refer reader to Appendix B for definitions of “static” and “kinetic” testing.

## VI. Technical Recommendations

- Check formatting in this section. It appears that it picks up where it left off from the last section.
- Item 8. (should be Item 2). Add the following sentence and reference to this section. A minimum riparian buffer width of 100' (30 m) should provide adequate filtering capability of the



riparian zone depending on amount and type of vegetation (Koski 1993; Murphy 1995)

Koski, K V. 1993. Riparian zone functions and interaction with sediment. *In* Proceedings of a Technical Workshop on Sediments, February 3-7, 1992, Oregon State University, Corvallis, OR, Sponsored by Terrene Institute, U.S. EPA, and USFS. Terrene Institute, Wash, DC, pp 61-69.

Murphy, Michael L. 1995. Already cited.

## VII. References

- Reference for Koski (1992) is incomplete. It should be as follows:

Koski, K.V. 1992. Restoring stream habitats affected by logging activities. *In*: Restoring the nation's marine environment (G.W. Thayer, ed.), pp. 343-404. Maryland Sea Grant College, College Park, MD. 716 pp.

- Change capitalization of "Brown Trout" to "Brown trout" in (Woodward et al., 1995).

## Appendix B: Acid-Base Accounting

- sentence seven, add italics to read "The acid production potential (AP) is based on the elemental S concentration in the solid according to the stoichiometry of equations 1-5 (*see Appendix A*).
- paragraph two and three: For the discussion of the equation  $NNP = NP - AP$ , the second paragraph states that "A solid with a negative NNP is likely to produce acid drainage. A positive NNP indicates that the solid has enough base to neutralize all the sulfur.." However, seemingly contradictory statements are made in the third paragraph as "Empirical observations suggest that a solid sample with a NNP greater than +20 kg/ton ( $AP > NP$ ) will generate acid drainage..", and "Solid material with an NNP of less than -20 kg/ton ( $NP > AP$ ) are not predicted to generate acid drainage." Are these backwards?

## Appendix C. Glossary

- Add the following terms to the glossary: gangue, liquefaction, soxhelet