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Diane Cooper and Gordon King
Taylor Resources, Inc.
SE 130 Lynch Road
Shelton, WA 98584

Re: **Scope of Services to Address Aquatic Environment Issues, North Totten Inlet Site Proposed Mussel Culture**

Dear Diane,

The purpose of this letter is to describe a proposed scope of work for additional studies to address concerns raised by Thurston County with regard to the Taylor Resources proposal for a mussel culture operation in Totten Inlet, Washington. These concerns are to be addressed in an Environmental Impact Statement to be prepared in accordance with the Washington State Environmental Policy Act (SEPA).

Taylor Resources submitted an application for a Shoreline Substantial Development Permit (SSDP 961372) to expand mussel culture operations in Totten Inlet on November 13, 1996. Thurston County issued a SEPA Determination of Significance (SEPA File No. 961372) on September 9, 1998. Mr. James Driscoll, Thurston County Hearing Examiner, affirmed Thurston County's Determination of Significance (DS) on June 18, 1999 following an appeal by Taylor Resources. The DS listed the following possible significant adverse effects from expanded mussel culture operations in Totten Inlet:

A. Impacts to the bottom dwelling organisms (benthic community).
B. Impacts to the surrounding water column.
C. Impacts to the phytoplankton resource and the effects that could have on other aquaculture and aquatic life.
D. Impacts caused by escapement and propagation of mussels.
E. Impacts caused by navigational lighting.

The conclusions of the Hearing Examiner and Taylor Resources' communications with Thurston County staff indicate that the County's concerns are based largely on a lack of information specific to Totten Inlet in the materials provided with the permit application, and a desire to better understand the scientific issues associated with mussel aquaculture in order to make informed decisions about the project.

Aquatic Environmental Sciences proposes to provide services to Taylor Resources to address Items A and D. Item E, navigational lighting, will be addressed by others. Information relating to items B and C will become available with the results of the Pacific Shellfish Institute (PSI)

work. Providing *unequivocal answers* to some of the County's concerns would be exorbitantly expensive, if not impossible. The following proposal is based on well-focused questions that address the specific issues raised by Thurston County.

The following proposal will define the physicochemical and biological response in sediments adjacent to the existing North Totten site. This information, coupled with results from the PSI study and the already completed literature review, will allow us to predict the potential impacts of a mussel culture at the proposed North Totten site.

The following **Tasks** are designed to provide project-specific information requested by Thurston County and affirmed by the Thurston County Hearing Examiner. As stated in the Hearing Examiner's report**,** "The gap of information on Gallo mussels in Puget Sound creates scientific uncertainty concerning the impacts of the mussel farm. What is not provided is adequate information on the impact of the Gallo mussel to other shellfish in Totten Inlet; the water terpetity [turbidity] within the inlet; the flushing of the water in the inlet; and the impact of the Gallo mussel on the tube worms and the feeding chain involved therein. Without such information the County cannot exercise its discretion in protecting the environment to the fullest extent possible."

The results of studies identified in this scope of work, combined with information generated by the PSI *Carrying Capacity Study*, will also be used by a fisheries biologist (a member of the EIS team) to address potential impacts to salmonids. Work to be performed by the fisheries biologist will address potential impacts to fin fish (particularly threatened and endangered species) in the context of the SEPA EIS, and in preparation for a Biological Assessment to be prepared at the time of reapplication for the U.S. Army Corps of Engineers (federal) permit for the project.

While I have attempted to align this scope of work with Thurston County's DS elements listed on page 1 of this document, it is important to note that the list of potential impacts is interrelated and it is therefore difficult to assign studies to one task without having some overlap to other tasks. **The primary purpose of this scope of work is to answer questions relative to the potential environmental benthic impacts from the proposed mussel culture operation and therefore prioritizes substance over format.**

Task A. Effects on benthic resources. The deep water and currents at the North Totten site will disperse feces and pseudofeces from mussels and their fouling biomass. The rate of biodeposition from mussel cultures can be measured in a straightforward manner using sediment canisters. Determining the assimilative capacity of the sediments is more difficult. Assimilative capacity depends on the resident invertebrate community, bottom current speeds and dissolved oxygen content, water temperature, salinity fluctuations, allochthonous input, etc. All of these inputs can vary significantly with season. Mussels produce pseudofeces when the concentration of particulate organic and/or inorganic material in the water exceeds their digestive capacity. The threshold for pseudofeces generation depends on both the availability of food and on water physiochemistry.

Recommended Study Approach:

1) A literature review and synthesis have been completed, summarizing the published information relative to benthic impacts associated with intensive fish and shellfish culture.

2) Aquatic Environmental Sciences has also completed a preliminary inventory of benthic invertebrates at the North Totten Inlet site. This inventory will be expanded to include 12 samples collected along two orthogonal transects (6 on each transect) crossing in the center of the proposed farm site. This will better characterize the benthos prior to the start of production. Each of these sediment samples will also be evaluated for sediment grain size, total sulfides, total volatile solids, and oxidation-reduction potential. This inventory will be valuable in defining the resources that would be put at risk should biodeposits exceed the assimilative capacity of local sediments. The inventory will also provide baseline data against which to assess benthic changes associated with the mussel culture operation.

3) In terms of hydrodynamics and production levels, Taylor Resources' mussel culture operation at Deepwater Point resembles the proposed mussel culture operation at the North Totten Inlet site. Sediment samples will be collected from under and adjacent to the Deepwater Point mussel culture operation for infaunal analysis and sediment physicochemistry (total volatile solids [TVS], total sulfides [$S^{=}$] and oxidation-reduction-potential [ORP]) bi-monthly for one year. These parameters will provide a basis for correlating changes in sediment physicochemistry with benthic infaunal response. These samples, and those described in Task A.2 above, will be collected with the same protocols being used in a series of studies in British Columbia to evaluate salmon aquaculture operations. A copy of those protocols is provided as Appendix 1 to this scope of work.

Task B. Escapement and propagation of mussels. The Thurston County Hearing Examiner concluded that, "The proposed mussel farms will have a probable significant adverse environmental impact to the Totten Inlet and to the waters of Puget Sound. The probable significant adverse impact relates to the establishment of the Gallo mussel as a common form of mussel within the Puget Sound waters and the impacts related to said introduction. *Findings of Fact Nos. 8 – 26*." In Conclusion (3), Mr. Driscoll notes that, "While there appears to be much scientific data on the study of Gallo mussels (*Finding of Facts No. 9*), and the qualities of Puget Sound (*Findings of Facts Nos. 13 & 14*), there is little, if any, information on the scientific data of the impact of the Gallo mussel in Totten Inlet."

Recommended Study Approach for Task B: The attached literature review includes a discussion of the genetics of *Mytilus edulis galloprovincialis* and its interaction with other members of the mytilid sibling complex. The following tasks are recommended to more closely examine this issue in Totten Inlet.

1) Visually search existing mussel populations in Totten Inlet to include intertidal areas and man-built structures such as buoys, piers and floats for mussels morphologically resembling *Mytilus edulis galloprovincialis.* The genetic identity of these mussels will be determined electrophoretically. In addition, randomly selected mussels observed in three areas adjacent to existing mussel culture operations and at two additional areas within Totten Inlet should be inventoried electrophoretically to determine the proportion of *M. e. galloprovincialis* genes at the *PGM-2* locus. Thurston County, in consultation with the independent technical reviewers, should approve the selected study sites. The time it has taken to initiate and complete reviews suggests that we should consider going forward without seeking their concurrence.

2) Conduct an inventory of existing *M.e. galloprovincialis* stocks in Totten Inlet. This will allow us to estimate previous recruitment of feral stocks and provide a basis for additional monitoring to evaluate future changes in the status of *galloprovincialis* and *trossulus* in Totten Inlet.

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Summary. The data collection recommended in this proposal, coupled with information generated in PSI's *Carrying Capacity Study*, should meet the requirements identified by Thurston County and affirmed by the Thurston County Hearing Examiner. Prior to undertaking the studies recommended herein, it would be desirable for Taylor Resources to obtain (if possible) confirmation from each of the regulatory agencies (Thurston County, DOE, WDFW, COE, USFWS, NMFS) that the studies identified herein will provide information needed to make decisions on their various permitting actions, and to confirm whether there are additional information needs related to the aquatic habitat concerns (Tasks A through D) to be addressed in the EIS.

All of the elements described in this scope of work are do-able. The questions can be answered with a reasonable degree of certainty using the proposed methodology. Many of the tasks can be accomplished efficiently, in parallel. If you have questions, please call.

Sincerely,

Dr. Kenneth M. Brooks
Aquatic Environmental Sciences