North Totten Inlet Mussel Culture Proposal

Response of the
Independent Technical Review Committee (ITRC)
to Thurston County and Taylor Resources

Regarding Letters of Comment Received in March 2002
During the Process to "Refresh" the Scope of EIS

August 20, 2002

On February 28, 2002, Thurston County issued a second Scoping notice for the Taylor Resources North Totten Inlet Mussel Culture EIS. Agencies, Tribes, and members of the public were invited to participate in "refreshing" the Scoping process for this EIS by commenting on the revised proposal and alternatives to be addressed in the EIS, and on the proposed scope of work for elements of the aquatic environment to be studied. Thurston County invited additional comments on the EIS scope of work at this time due to the:

- Amount of time that has passed since the Scoping process was originally conducted (September 14–October 5, 1998)
- Change in the description of the proposal (i.e., elimination of the proposal to expand mussel rafts at the Gallagher Cove site)
- Identification of an alternative to the North Totten Inlet proposal to be analyzed in the EIS
- Availability of additional detailed information describing the proposed scope of work and protocols for field studies to be performed to evaluate potential impacts to elements of the aquatic environment.

Thurston County received 28 letters of comment in response to this second EIS Scoping process conducted in March 2002. All of these letters were received from individuals, none from Tribes or regulatory agencies. The majority of the letters expressed opposition to the project, but did not address the EIS scope of work or the scope of the aquatic environment technical studies. Eight letters raised questions or made suggestions regarding the Aquatic Environmental Sciences (AES) or Pacific Shellfish Institute (PSI) proposed methods or protocols. A few other letters raised some of the same issues identified in these eight letters that were selected as representative of the comments on the technical scope:

A.P.H.E.T.I. (March 31, 2002)	Walker (March 25, 2002)
Acheson (March 22, 2002)	Wimberger (April 1, 2002)
Gentle (March 25, 2002)	Woodnutt (March 14, 2002)
Stein (March 27, 2002) + Attachment XIII	Ziemke (March 27, 2002)

Thurston County requested the opinion of the Independent Technical Review Committee: Should any changes be made to the work proposed for aquatic environment technical studies – beyond those identified in prior ITRC recommendations dated November 1, 2001 and February 13, 2002 – as a result of the Scoping comments received? This memo constitutes the consolidated response of the four ITRC members.

Members of the Independent Technical Review Committee and their respective areas of expertise are as follows:

Independent Technical Reviewer	*Area of Expertise*
J.E. Jack Rensel, Ph.D. Rensel Associates Aquatic Science Consultants	Phytoplankton, algal blooms, effects on benthic organisms, benthic conditions, beaches and finfish.
Mitsuhiro Kawase, Ph.D. University of Washington School of Oceanography	Physical oceanography: Flushing characteristics (circulation) and water quality (eutrophication).
Jan Newton, Ph.D. University of Washington, School of Oceanography	Biological oceanography: Water quality (nutrients, oxygen) and phytoplankton productivity.
Ralph Elston, Ph.D. AquaTechnics, Inc.	Mussel genetics: methods for species identification, and potential escapement and competition issues.

Re: Harmful algal blooms, effects on benthic organisms and conditions, effects on beaches and finfish.

1. The EIS should address potential impacts on nearby (and remote) beaches, including the fate of psuedofeces in terms of its density, sinking rate, transport and assimilation into the sediments and food web. If the Taylor Resources' consultant uses existing literature on this subject, coupled with known transport vector and site-specific circulation information, no special studies are needed. There is no evidence to suggest a significant impact of rotting mussels accumulating on the beaches that originate from mussel rafts.

2. If there has been any credible study or professional documentation of conditions in Penn Cove before and after mussel rafting was established, the EIS should examine it.

3. The EIS will undoubtedly discuss the nutrient and eutrophication status of Totten Inlet and its sensitivity to nutrient inputs or removal (or change from dissolved to solid form).

4. The water quality section of the EIS will undoubtedly deal with the fact that ammonium is produced by mussels, as well as its probable and rapid transformation to nitrate.

5. If dredging the bottom is proposed or commonly practiced beneath the mussel rafts, this should be discussed in the EIS. (*Note: Personal communication between Vicki Morris, ITRC Coordinator, and Diane Cooper, Taylor Resources 5/23/02: no dredging is proposed.*)

6. Taylor Resources' consultant is capable of analyzing and interpreting the acquired data, and utilizing best professional judgment for presenting this information in the EIS in the manner requested in the APHETI letter of comment. There have been a number of changes to the protocols based on the ITRC recommendations. The ITRC also expects that the technical report will deal with the issues outlined by the ITRC as possible problems.

7. Potential impacts to resident demersal and pelagic fishes should be addressed in the EIS in addition to potential impacts to Puget Sound chinook salmon. (*Note: The AES Scope of Services document dated August 29, 2001 at page 2 acknowledges that the results of the AES and PSI studies will also be used by a fisheries biologist – a member of the EIS team – to*

address potential impacts to salmonids. A fisheries biologist has been retained to review the scopes of work and protocols for the aquatic environment technical studies being performed by AES and PSI, and the recommendations of the ITRC that modify the original proposals for these studies. A subsequent memo will be prepared by the fisheries biologist, addressed to Thurston County, to comment on whether any additional information may be needed from the aquatic environment technical studies for use in preparing the EIS analysis of potential impacts to demersal and pelagic fishes, and potential affects on threatened and endangered species.)

8. The EIS should review available information on threatened or endangered species in the area that may be affected by the proposed mussel culture operation. It will need to address potential impacts to the prey organisms of Puget Sound chinook salmon, but no special studies are needed given the wealth of information about food habits, distribution and habitat preferences of salmon in southern Puget Sound. There are no naturally-occurring or hatchery populations of chinook salmon in the Totten Inlet drainage. However, colleagues of one ITRC member at NMFS have advised that because of the *possibility* of bona fide listed chinook salmon (e.g., White River spring or Northern Puget Sound stocks) rearing or residing as blackmouth (resident chinook salmon) in South Puget Sound marine areas, the NMFS Habitat Conservation Division is requiring sponsors of activities that may affect fish in those areas to consult with NMFS concerning potential ESA impacts. NMFS is also applying listed chinook species protection review/consultation requirements in some South Sound freshwater habitats (including Deschutes River stock) where chinook salmon have been observed spawning recently or in the past.

9. Analysis of the effects of mussel rafts on local currents, effects of waste accumulation on the benthic environment, and physical effects of raft operations on the benthic environment is proposed in the scope of work for aquatic environment technical studies.

Re: Water column impacts – flushing characteristics and eutrophication.

Clarification is offered here concerning the purpose of the water column impact study to address flushing and circulation in Totten Inlet. The first objective of the study is to establish the overall flushing time of Totten Inlet as a whole. The second objective is to establish the pattern of circulation within the Inlet itself, pathways of water that arrives at and departs from the proposed mussel raft site, and flushing rates of different parts of the Inlet.

The upper and lower bounds of the overall Inlet flushing time should be established by determining a) the net through-flow only, and b) for a complete tidal prism replacement on each tidal cycle, respectively. The upper bound is dependent on the amount of freshwater input to the Inlet. An exchange circulation will enhance flushing and would reduce the flushing time. A previous estimate of 10 days based on the net transport of 240 cubic meters per second (URS 1986) was reported in the *Visual Impact and Ecological Concerns Assessment for the Totten Inlet Mussel Rafts Project* (EDAW, Inc., January 1998). However, the net transport is likely to be highly variable, since the Inlet appears to lack a steady, significant source of freshwater. Especially during Summer months, when the freshwater input is at a minimum and the net through-flow and exchange circulation is weakest, Inlet flushing by these mechanisms could be highly inefficient. The correlation between seasonal flushing variability and the period of peak mussel growth needs to be examined.

Using the tidal volume estimates of McLellan (1954) – also cited in EDAW, Inc. (January 1998), and a simple tidal prism model, one can estimate a 10% dilution (90% replacement) time of 1.37

days for the lower bound of overall flushing time. It is highly unlikely that the Inlet would be flushed over such a short time frame due to refluxing (while unknown in percentage). During Summer months, tidal exchange could become the dominant mechanism for flushing. Available studies have not addressed this issue.

Tidal exchange and circulation will redistribute waterborne materials within the Inlet. The pattern of this redistribution could be complex, with some regions of the Inlet experiencing poor flushing relative to others. While the proposed mussel raft site is likely well-flushed by tidal currents, the materials that leave the site could end up in regions of poor flushing depending on the circulation pattern. Thus, circulation mapping within the Inlet is important to determine the potential impacts of the proposed raft site on the remainder of the Inlet.

10. The ITRC reiterates a previous recommendation that a reliable assessment of the flushing time of Totten Inlet be made principally through combined use of the existing data set and available numerical models. Additional measurements must be taken where data coverage is deficient. The analysis should endeavor to establish the upper and lower limits of residence time.

11. A reasonable point was made in one letter received during the March 2002 Scoping process that Totten Inlet does not discharge into an open body of water, but rather into a network of channels and other inlets for which ventilation characteristics may be quite complex. The water column impacts assessment should include estimates of the dispersion and transit time of water originating in Totten Inlet and in the neighboring bodies of water. The important neighboring bodies of water are the waterways around Squaxin Island, Dana Passage, and Pickering Passage.

To help clarify an appropriate level of effort for the measurements recommended in the comments above, a suggested experimental setup is provided as an attachment to this memorandum.

Re: Water quality, phytoplankton, and nutrients.

12. Previous recommendations of the ITRC (November 1, 2001 and February 13, 2002) identified the need for a study plan to assess potential project-specific impacts on water quality, phytoplankton, and nutrients from the proposed mussel rafts. The PSI study, as some of the Scoping letters recap, approaches the water column work from a very different perspective. Taylor Resources has not yet provided the document requested to "bridge the gap" between the PSI work and the project-specific impact analysis. Therefore, the ITRC has not yet received a response to this recommendation to facilitate review of these elements of the proposed scope of work. Public comments received will be taken into consideration when the ITRC recommendations are formulated regarding the water column studies. Taylor Resources is encouraged to also consider these comments as the study plan is being prepared.

13. The study of water quality, phytoplankton and nutrients should be well-coordinated with (i.e., conducted to complement and take advantage of results from) the studies of flushing and circulation in order to evaluate dynamics of the system. The water quality, phytoplankton, nutrient study should be conducted to assess conditions throughout an annual cycle, due to seasonal variation in primary productivity. The study may be less intensive in Winter, but Spring, Summer and Fall conditions should be characterized.

14. Cumulative environmental effects should be addressed in the water column study plan requested.

15. Use of any computer models needs to be outlined in the study plan requested above, including model definition and intended application for the EIS impact analysis.

Re: Mussel species identification, escapement and propagation.

16. The genetic marker methodology to be used for mussel species identification is well-covered in the ITRC November 1, 2001 Recommendations, based on input solicited from a leading mussel genetics expert. Comments submitted by Peter Wimberger (Associate Professor of Biology, University of Puget Sound) can be conveyed to the independent geneticist who will run the assays if the County so desires.

17. Sampling aimed at detecting 10% increments in relative populations (as proposed in the AES scope of work) is adequate. The ITRC does not consider it necessary for any additional samples be collected, nor for additional sampling sites (beyond the 3 proposed), larger sampling sites, or longer sampling periods to be established.

Re: Gallagher Cove as a Study Site Instead of or In Addition To Deepwater Point

Strong sentiment was expressed among members of the Association for Protection or Hammersly, Eld & Totten Inlets (APHETI) that the Taylor Resources mussel farm location in Gallagher Cove be an aquatic environment study site instead of or in addition to the Deepwater Point mussel farm site. In a memorandum dated July 1, 2002, Taylor Resources described their rationale for selecting Deepwater Point as the "treatment site" for study of the effects of mussel faming in Totten Inlet. Reasons given describe more similarity in the physical characteristics of the Deepwater Point and North Totten Inlet sites, and in the size of the existing and proposed mussel farms.

The ITRC is in general agreement that the Deepwater Point site is suitable for the aquatic environment technical studies, and that it is not necessary to completely duplicate sampling at the Gallagher Cove site. The Committee does, however, recommend that the cumulative impact analysis address whether or not nutrient fluxes are likely to occur in Gallagher Cove as a result of the proposed mussel farm installation at the North Totten Inlet site. The flushing and circulation study should include drogue deployment to determine the relative transport of nutrients between the North Totten Inlet site and Gallagher Cove. The Committee also requests a description of sediment grain size in Gallagher Cove in comparison to the Deepwater Point site and the North Totten Inlet site. A relatively simple task, such characterization will tend to indicate if bottom water currents are similar and will help describe the relative depositional or erosional nature of the sea bottom at both locations.

Suggested Experimental Setup
to Establish the Residence/Ventilation Time of Water in Totten Inlet

A focused study of Totten Inlet flushing and circulation during a few key months would address the scope of work questions identified for the North Totten Inlet Mussel Culture Proposal EIS. The purpose of the study should be to quantify the range of flushing time within the Inlet. In particular, the study should examine the upper bound ("worst-case") situation, when flushing is at a minimum and flushing time is longest. This is likely to occur in the Summer, when surface water runoff to the Inlet is at a minimum and prevailing northerly winds tend to oppose generation of the density-driven exchange circulation. Another study period would be during the maximum anticipated impact from the mussel culture operation. (It is possible that this would be the same as the Summer study period previously described. Taylor Resources should clarify the period of maximum mussel growth for use in designing the water column study.) Lastly, an "average" period of flushing and residence time should be examined. Suggested methods for conducting this study (which may be refined by the consultant retained to perform the work) include:

1. Place an array of 4 to 5 acoustic Doppler current profilers (ADCP) or similar instruments across the mouth of Totten Inlet to measure the influx/outflux and structure of tidal currents and exchange circulation at the mouth. The measurement should have sufficient horizontal (4–5) resolution and duration (over two fortnightly tidal cycles) to resolve horizontal and vertical structure of the tidal and time-mean (exchange circulation).

2. Monitor relative tidal elevation during one of the reflux surveys and relate this information to profiler information. Tidal level measurements will help refine the estimate of the tidal prism, and will also augment the ADCP measurements. Alternative methods for tidal elevation monitoring include: a) Deploy internally-recording pressure sensors on pilings, and calibrate with stadia rods at the beginning and end of drogue deployments. b) Attach a stadia rod to a piling and record the tidal elevations periodically during the survey. If possible, relate the stadia rod elevations to benchmarks or other objects of known elevation nearby. A further refinement would be to use a rotating laser beacon on shore to record the elevations in the survey boat using a stadia rod with laser detector. The beacon could be set up near a benchmark or other exact known elevation.

3. Deploy 10 or more drifters drogued at a near-surface level in Totten Inlet to ascertain the pattern of tidal currents within the Inlet, as well as to measure their escape from the inlet. Ten drogues would be sufficient if deployment occurs over multiple tidal periods. If short-duration deployments (like one tidal cycle) are performed, it is recommended that 20 drogues be deployed. Include Gallagher Cove as one study location. Two depths are recommended: one relatively shallow (e.g., 1 m) and another deeper, approximately half way to the average bottom depth in the area being surveyed.

4. To accomplish an empirical measurement of tidal excursion, deploy drogued drifters (mini-windowshades recommended) in upper Totten Inlet from high water through low water and back to high water on a true mean tidal exchange day. This usually happens once or twice per year, typically in September or October.

5. Deploy 10 or more drogued drifters in Dana Passage, Pickering Passage, and the waterways around Squaxin Island to measure the efficacy of the "conveyer belt" circulation around Hartstene Island to flush out outflow from Totten Inlet. Make serial releases from the mouth of the inlet at exact intervals throughout average tides (or minimal and extreme range tides,

too, if desired). Estimate reflux by counting the number of drogues (if any) that return, and calculating the concurrent water exchange during the corresponding tidal cycle phase (non-linear volumes of water passing out and back in). It is recommended that this task be performed during the Summer to record worst-case conditions (i.e., the nutrient-sensitive period with no south wind to help move surface water to the north as would occur in the Winter and Summer/early Fall).

Note: A drogue and current meter study performed in Pickering and Squaxin Passage for the Squaxin Tribe may be available upon request to augment the measurements recommended above.

6. Spot-monitor temperature and salinity (T&S) at different locations in Totten Inlet. Three or four continuous monitoring stations at different locations would be ideal. Relatively inexpensive instruments that continuously record temperature, salinity, and pressure (such as Hydrolab DataSondes) are available that could be used to record the data requested in both Tasks 1 and 5 of the Totten Inlet residence/ventilation time experiment. The T&S devices can be bolted to existing pilings just below the mean lower low water (MLLW) level. The instruments should be calibrated by direct measurement at the time of deployment and retrieval.

   In order to monitor the evolution of stratification, direct measurements of temperature and salinity at the surface, mid-depth and bottom should be made whenever there is operation out in the Inlet. In addition, it is strongly recommended that a continuous monitoring of temperature and salinity be made with a device mounted on the cage of the central ADCP deployed at the mouth of the Inlet, as recommended in Item 1 above. A high-precision instrument is strongly recommended for this deployment.

7. Compare data with numerical model of circulation.

The residence/ventilation time experiment should cover two full spring-neap tidal cycles (approximately one month). It should take place during the relevant season (i.e, during the period of maximum mussel growth or mussel fecal matter discharge).