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Puget Sound Estuarine Study

INTERIM REPORT: SOCIO-ECONOMIC INSTITUTIONAL AND LEGAL CONSIDERATIONS IN THE MANAGEMENT OF PUGET SOUND ESTUARINE RESOURCES

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The following narrative report constitutes the interim report required under Contract No. 14-12-420 between the University of Washington and the Federal Water Pollution Control Administration.

I. Basic Physical and Biological Characteristics of Puget Sound.

The major effort to date in this field has been the compilation of selective bibliographies of published and unpublished material dealing with the physical and biological characteristics of Puget Sound that bear on the potential impact of water quality degradation. A compilation of material bearing on the physical characteristics of the Puget Sound estuarine system has been developed by Dr. George Anderson. This has been a tedious process since the aggregate quantity of material relevant to the study in unpublished form is very substantial, and had to be assembled largely by personnel interview. This aspect of the study is now complete and analysis of the material as indicated in the project proposal and in the work plan is now underway.

II. The Fisheries

Special attention has centered on the state of knowledge about the fisheries since it is apparent that damages to the valuable fish and shellfish stocks of Puget Sound constitute the greatest present and potential threat from pollution. A twenty-three page summary of the literature on water quality problems relating to fish and fisheries in Puget Sound has been prepared by Dr. Katz. The following material is now available in completed form. An annotated bibliography of the ecology of the salmonids in Puget Sound estuaries is now available. This is probably the most complete bibliography yet compiled on the migration and abundance of young salmon, migration and spawning density of adult salmon, types and sources of pollutants and the effects of toxic substances on salmonids and associated

fauna in estuaries. It is an outgrowth of a major study that has been underway since June, 1965 under the auspices of the Fisheries Research Institute, University of Washington. Tables showing landings of all commercial fish landings taken from Puget Sound waters have been compiled. These data are derived from annual statistical summaries of the State Department of Fisheries, but have been refined to delineate catches actually originating in Puget Sound. State data are organized by area of landing rather than by area in which fish were actually taken. Fortunately, for the overwhelmingly important salmon fishery additional information is available which permits us to segregate the landings by subarea in which the fish were taken.

A summary of gaps in existing knowledge of the salmon stocks and of the fisheries that exploit them has been prepared. This includes critical information requirements in both the biology of the salmonids, and in statistics relating to fishing effort and area distribution of fishing effort. Forecasts of the magnitude of the salmon stocks and of the yield from the salmon fisheries for the years 1975 and 1980 have been prepared. These relate to physical magnitudes only. Subsequent work will also project trends in real prices of Puget Sound fish through the same dates.

A survey of the literature on thermal effects from power generation on the marine environment has been completed. This is the first step in a detailed analysis of the potential impact of nuclear power plants on specific areas of Puget Sound. The impending shift of Northwest power to basic thermal generation, with the Columbia River system used as a peaking mechanism, accentuates the urgency of this work. Obviously, it cannot be completed within the term of this study but is being carried on as part of a larger project at the University of Washington.

The impact of heated discharges on marine life in Puget Sound is complicated tremendously by the diversity of local situations to be faced. It is distinctly possible that such discharges may be of considerable economic and environmental benefit in some areas of Puget Sound, particularly where water temperatures are marginal (on the low side) for the production of valuable shellfish. They may also have beneficial effects for some types of recreational use. There are, however, other areas where disturbances of a distinctly negative character may occur. Thus, though the overall heat sink capacity of Puget Sound is obviously sufficient to absorb vastly greater amounts of surplus heat than any likely number of nuclear power plants could provide, specific locations must be analyzed in detail and a wide range of benefits and costs must be evaluated.

A separate University of Washington team, including biologists, engineers, and economists, is initiating a study of this broader type, and while conclusions will not be forthcoming by the terminal date of this project, the general outlines of the problem should be well established.

A discription of the existing shellfish beds on public lands on Puget Sound has been completed and analysis of all shellfish stocks of Puget Sound is nearing completion. This includes the location and extent of both recreational and commercial shellfish areas.

Current and historical data on sport fishing activity in Puget Sound by subarea have been completed and summarized in tabular form. Preliminary projections of the demand for recreational fishing within the Sound to 1980 have also been completed, although these will be further defined as the results of a study now being conducted jointly by the State Department of Fisheries and the University of Washington become available.

In the past, the attention of saltwater sport fishermen has been concentrated almost entirely on salmon; there are also minor fisheries for sea-run cutthroat trout and for steelhead in a few areas where they can be taken by trolling or casting from the shore. Steelhead are also taken in all of the rivers tributary to Puget Sound from tide water on up. A detailed analysis of the present composition of the sport fishery has been completed, and this - coupled with our forecast for the availability of the major species - suggests that a growing population will put impossible pressure on these preferred species unless rationing by higher fees or some other technique is imposed. Otherwise the rationing is likely to be achieved by a continued reduction in the pleasure derived from sport fishing because of congestion and declining catches per angler day. For these reasons, it is anticipated that the abundant bottomfish resources of Puget Sound, now barely touched by sport fishermen except on a casual or intermittent basis, may become a highly valuable recreational asset. This pattern has been clearly evident in the intensive salt water sport fisheries of Southern California and Oregon, and it suggests the need for careful attention to the impact of water quality on these species as well as on the presently valuable sport fish.

The most obvious gap facing the study team with respect to fisheries is the inability to quantify functional relations between receiving water quality and the yield of useful commercial and recreational species. In part this reflects the tremendous complexity of the principal species involved. It is quite impossible, with present knowledge, to separate the effects of incremental changes in water quality from those arising from the dozens of other environmental factors influencing the productivity of the salmon stocks. Even less is known about the potential indirect impact of water quality degredation on the output of useful species through effects on one or more elements in the food web upon which the productivity of the stocks rest.

It is not expected that answers to these problems will be forthcoming by completion of this study. We do expect, however, to indicate with considerable greater precision the nature of the information required to reach appropriate public policy decisions and to formulate priorities for further research.

III. Other Outdoor Recreation

Work is proceeding on estimates of physical use rates for outdoor recreation on Puget Sound other than sport fishing. Of these the most important is boating. Current data and projections to 1980 are available for vessels subject to Coast Guard licensing requirements; i.e., vessels sixteen feet or more in length or carrying motors of ten horsepower or more. Data from another survey including boats of all sizes are being analyzed to prepare supplementary estimates and forecasts for boats under legal registration size.

Two other types of outdoor recreation directly dependent on use of Puget Sound waters and affected by water quality are scuba diving and water skiing, both of which are growing rapidly. Since these sports involve direct water contact, usually in inshore areas, they raise the possibility of a threat to health in some areas. Both sports have been actively pursued for some time in the warmer bays and inlets of Puget Sound. In recent years both have grown spectacularly with the adoption of wet suits that permit enjoyment of the activities even along the more open shores of Puget Sound where water temperatures are much colder throughout the summer. It is vitally impossible to determine the number of user days involved, but efforts are being continued to derive some quantitative measures of the importance of these water usages.

Much the same difficulty is encountered in deriving quantitative estimates of the importance of Puget Sound as a source of general recreation. Information has been assembled summarizing user days in the salt water parks of the State of Washington, but since the amount of waterfront property, including beach locations, in private hands, is much greater than that under public ownership, no meaningful estimate of total user days involved in hiking, beach picnics, and other generalized beach activities can be determined. It is an obvious adjunct of the recreational home boom around Puget Sound, and much of the value associated with this water usage is incorporated in the very high prices of beach lots and of property with access to the beach.

Analysis of the extent of Puget Sound's contribution to wildfowl (including adjacent fresh and brackish wetland areas) will be started this month. Most of the relevant data was assembled by the Principal Investigator for an earlier study and merely requires updating. We will also draw on an on-going study of the economic value of ducks in the Pacific flyway under the direction of Dr. Gardner Brown of the University of Washington.

IV. Shipping

Professor Francis Bartlett is conducting a field investigation of interested industry personnel regarding future paths of development for port and shipping activities in Puget Sound. Although adequate data are available on present patterns of use, the fact that Puget Sound offers the sites on the Pacific Coast capable of handling supertankers and other large bulk cargo carriers raises the possibility of a radically different set of requirements. The choice of locations for new facilities capable of handling these vessels must be integrated with competing uses of the Sound in the area, particularly those involving outdoor recreation and esthetic considerations. The recent tumult over proposals to locate a petroleum refinery at Kayak Point and an aluminum plant on Guemes Island illustrate the kinds of conflicts that will arise if major receiving facilities for bulk

carriers are imposed on recreational and residential areas where access to the water and unobstructed views are a prime value factor. Consideration is also being given the applicability to Puget Sound of preliminary work on offshore facilities for large vessels that might obviate some of these difficulties.

The likelihood of increasing traffic involving huge liquid cargo carriers obviously increases the potential danger from accidental spills. The real danger in Puget Sound is obvious, although it should be noted that existing techniques for containing petroleum spills are likely to be more effective in a confined area in which the effects of rough seas and wind are much less evident. Nevertheless, even localized damage can be so severe in an area heavily utilized for recreation and fishery habitat that it may dictate new location patterns for port facilities.

V. Projections of Industrial and Population Growth.

Dr. Robert Bish has completed a review of recent forecasts of the level, composition, and location of principal industry groups on Puget Sound. The most current and reliable of these has been adjusted to indicate, with reasonable reliability, the structure of industry by four subareas of the major study area. Projections to 1975 and 1980 have been prepared. Similarly, existing studies of population in the study area have been analyzed, and projections prepared for the same period.

Since the region has been subject to several competent analyses of this type in recent years, it did not seem worthwhile to contemplate a new independent study even if time and funding permitted. The attached data are believed to be as reliable than any that can be produced at present.

As Dr. Bish has noted, however, the dangers of forecasting multiply greatly when the area under consideration is broken down into units as small as single counties or four county subareas. Changes in the economic structure and population of the Puget Sound region have been both rapid and relatively erratic in recent years, and both industrial and population forecasts must be interpreted with this in mind.

Copies of the initial drafts of these sections are appended.

VI. Identification of Pollution Sources

Identification of waste dischargers into Puget Sound is virtually complete, and a research assistant is presently compiling detailed information on volumes discharged by individual units. The task is made more difficult by the fact that there are more than one thousand individual dischargers, although a preliminary study suggests that not more than one hundred of them contribute significant amounts.

In order of relative importance, the pulp and paper industry and fruit and vegetable processors are the principal industrial sources. Identification of the individual units and the subareas of Puget Sound in which these types of operations present current or potential problems is in process and is already complete for the pulp and paper industry.

Three less obvious sources of potential danger are also under investigation. Probably the most serious of these is the astonishing proliferation of summer homes and other recreation oriented buildings on the shores of Puget Sound. These developments have been taking place at an accelerating rate over the past fifteen years, and extend from the extreme Northern end of the study area out to the westernmost limits of the Strait of Juan de Fuca. Few if any of these developments employ anything more than septic tank facilities for discharge of waste. A point has already been reached in some areas, and will eventually be reached in many others,

where the volume of waste discharged will present moderate to serious threats to human health as well as to fish life. The situation is made more acute by the apparent logic, from the standpoint of the individual builder or developer, of using septic tanks rather than installing expensive sewerage facilities in the initial stages of development, particularly in what are, at the moment, isolated areas. Unfortunately, the pace of development has been such that there are very few isolated areas left, and many recreational home owners are now faced far sooner than had been anticipated with the necessity of adding expensive additional facilities. It is obviously too late to do anything about past omissions, except to require proper installations, but it is clear that new developments should be subject to considerably more stringent regulations than are now evident in any of local requirements throughout the study area.

Another persistent source of local difficulty, almost impossible to pinpoint with accuracy, is the discharge of oily waste materials from a wide variety of non-point sources. Waste oil from gasoline stations and garages and similar small quantities of oily materials from small manufacturing and service establishments are being dumped in quantities that probably increase proportionately with population. The aggregate quantities involved are not small, and since discharge points tend to be localized, some areas of Puget Sound adjacent to the larger cities will experience increasing difficulty from this source.

Although total waste discharges from pleasure boats could not be regarded as a serious threat from the standpoint of Puget Sound as a whole, there are many local areas in which concentrations of pleasure craft, particularly during the summer months, are large enough to raise serious problems

if discharges of untreated sewage continue. The problem is made more acute by the parallel growth of direct contact water sports such as skin diving and water skiing in the areas where the boats congregate. Pending legislation requiring proper sanitation equipment aboard pleasure craft may well become effective before the situation reaches serious proportions on Puget Sound.

Puget Sound is subject to an unusual type of "pollution" from floating logs and deadheads. Much of the shoreline, from low bank to high bluff, is forested to the land edge, and steady deposits of trees and stumps are inevitable. Large logs regularly drift loose from stationary boom areas and from the rafts that are towed to waterfront mills. Persistent damage to both pleasure craft and commercial vessels results, and occasional serious accidents are bound to occur.

The problems of municipal waste disposal remain large and are growing despite the major success achieved by Seattle Metro. There are still substantial discharges of municipal waste not subject even to primary treatment in various communities along Puget Sound. Moreover, the rate of population growth in other urban areas adjacent to Puget Sound (for example, Tacoma and the Bremerton area) suggests the need for collection and treatment systems that transcend the jurisdiction of single municipalities, perhaps along the order of Metro. The study will deal with the more pressing problems raised by these areas, and indicate the effectiveness, present and prospective of state efforts to deal with the problems.

At present there appear to be adequate controls over the activities of merchant ships to prevent significant changes in water quality effects of port activity in Puget Sound. This would remain true, however, only if the pattern of shipping activity remains the same. As indicated above,

however, the likelihood of major changes in the technology of marine shipping of petroleum and other bulk cargoes and in the handling of sea to surface transfer problems suggests the likelihood of a major reorientation of Puget Sound port facilities in the future - and with it, a new set of pollution hazards.

Finally, it does not appear that upstream activities that increase siltation in the rivers tributory to Puget Sound constitute a serious problem. The physical characteristics of the Sound are such that these effects are limited to a very small area, and in incremental terms, little more in the way of damage is to be expected from this source.

VII. Projection of Waste Loads

Unfortunately, projection of these waste load sources into the future is not a matter of simple linear extrapolation. The technology of pulp and paper now (on economic grounds) dictates the construction of new plants of sufficient size and with proper recovery equipment to reduce waste discharge problems to a fraction of former levels. The industry can conform much more closely to the rigorous standards now proposed without significant financial sacrifice as far as new plants are concerned. Similarly, there is no reason to assume that population growth along the perimeter of Puget Sound should be accompanied by a parallel growth in the discharge of untreated sewage. It is within the power of the state to require at least primary treatment of all municipalities discharging into Puget Sound, and a forecast of further growth in this type of waste loading would be, in effect, a denial of the objectives contemplated in the establishment of state water quality standards under federal legislation. The discharges of fruit and vegetable processors constitute a significant problem in some areas only because both water and the right to discharge waste are significantly

underpriced at the present time. Again, state policy can and should be directed at measures which would increase the incentive to reduce the volume of waste discharged by such plants - an objective which is well within our present technical capabilities.

Dr. Brian Mar of the Department of Civil Engineering has just completed a study of waste loading (including thermal pollution) in the rivers flowing into Puget Sound. This work, together with a translation of the estimates of population and industry adjacent to the Sound, will provide a forecast of future waste loads given today's institutional and legal environment.

VIII. Legal Aspects

With respect to the legal study of the Puget Sound estuarine system, extensive research has been accomplished in the following areas: state pollution on control laws, policies and regulations of the state pollution control administration, pollution control activities of the major Puget Sound metropolitan areas and county governments; and the relationship of state and local to federal programs.

A major effort has been made to assemble materials from state and local agencies, published reports, legal journals, and statutory sources. It is estimated that the legal study is approximately fifty percent complete in terms of research. Further research and interviews are planned, and the target date for the first draft is April 30.

IX. Preliminary Conclusions.

1. Although the management of an estuarine system like Puget Sound must be ultimately directed toward maximizing socioeconomic values, the basic alternatives to be evaluated involve data to be generated by physical and biological oceanographers, fishery scientists, and engineers. The data required for intelligent formulation of alternatives is not adequate at present, in total or in incremental form. Thus, though our objectives in management are geared to human welfare, the bulk of the research effort required to permit rational management of Puget Sound falls on the shoulders of the several scientific and engineering disciplines concerned with estuarine analysis.

2. The state of the legal and institutional instrumentalities for management of a complex estuary like Puget Sound can best be described as chaotic. One of the major purposes to be served further development of this project is to formulate new governmental, organizations and procedures that permit coverage of the necessary range of alternatives and provide the competence to implement the choices that emerge. In this connection, the project group will examine carefully the report of the Commission on Marine Science, Engineering and Resources and the Panel report dealing with management of estuaries and the inshore coastal zone, which present in summary form a thorough examination of the problems involved in defining appropriate management units and techniques. It is believed that many of the recommendations set forth in the Commission's report will be directly applicable to the situation in Puget Sound.

3. The general level of water quality in Puget Sound at the present time is not a matter of deep concern. There are, however, already local problems that must be dealt with more effectively, and the rate of growth in population and industry projected for the counties included in the study

area provides no abasis for complacency. It is therefore essential that future work be directed toward the provision of economic incentives to utilize this technology or to alter production processes and/or location where necessary to achieve desired water quality standards.

4. The most serious data gaps are those relating to the damage functions that link incremental changes in water quality and recreational and esthetic "outputs" from the Puget Sound system. The biological links not yet quantified, and there are as yet no satisfactory ways of providing economic values for many types of saltwater based recreation. Future research may therefore be centered on optimal adjustments to relatively arbitratory standards of water quality, established as best we can at safe levels, but not capable of full scientific or economic justification. In effect, where the scientific problem is too complex to permit precise quantification, water standards should be established on the safe wide; and developments in pollution abatement technology and in the systematic analysis of alternatives suggest that this can be done without excessive cost to the industries or municipalities involved.

5. This study has centered, as required, on water quality as the link around which potential conflicts in use are to be organized. The study has already made it clear, however, that there are a variety of other actual and potential conflicts in use not related directly or indirectly to water quality but equally serious in terms of management. It should also be noted that conflict in use is, in some respects, a measure of the efficiency with which the resource is developed. It is impossible to conceive of multiple usage of the waters of Puget Sound that would be optimal from an overall social point of view without continuous (and continuously adjusted) conflict at the margins between alternative users.

Accordingly, it is essential to single out for detailed analysis specific local areas where water quality is of direct concern to multiple users of Puget Sound and adjacent land areas. The ultimate objective is to anticipate and to provide both data and technique that would provide a sound basis for long term planning and for rapid and accurate evaluation of the effects of major proposals such as the refinery of Port Susan or the aluminium plant on Guemes Island.

6. The principal polluters identified in the study oto date have one characteristic in common: technology now exists to abate or eliminate entirely the threat of water quality degradation posed by their operations, and at costs that do not threaten the economic viability of the units involved.