USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Oregon Coastal Lakes: Water Quality Status and Management Implications Based on Nutrient Loading

Duration: April 1, 1999 to March 31, 2000

Fiscal Year 1999 Federal Funds:

- Total: $8,215
- Direct: $8,215
- Indirect: $0

Non Federal Funds:

- Total: $16,645
- Direct:$10,318
- Indirect: $6,327

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Critical Need for Research

The project addresses the problem of water quality management of Oregon's coastal lakes, a unique ecological, recreational, and economic resource of the state and region. The focus of the study Is the control of nutrient enrichment of these lakes in the process known as eutrophication. Excessive enrichment as a result of human activities in lake watersheds is called "cultural eutrophication" and in many lakes can be controlled by coordinated lake watershed management practices. Oregon's coastal lakes are experiencing rapid development along their shores and in their watersheds (Larson, 1991).

Need for research on the problem

Regulatory agencies, specifically the Oregon Department of Environmental Quality (DEQ), and local planning agencies need a method for relating the cause-and-effect of land use changes and lake water quality (Schaedel, 1991). Blair and Nelson (1993) developed a methodology and framework for application of a phosphorus mass-balance model adapted to the geomorphological and hydrological conditions of Oregon coastal lakes. 'Me model can be used as a predictive toot for lake and watershed management applications. Giese (I 996) studied land use and phosphorus export- in a coastal lake watershed and estimated phosphorus loading to two Oregon coastal lakes. This has reduced the uncertainty that existed in use of the Blair and Nelson model. There is a need to update model projections of coastal lake water quality based on present and future watershed land uses. Water quality data summaries for Oregon coastal lakes (Blair and

Nelson, 1993; Adains, 1996) will be updated to include all published results for the last approximately 5 years. The integration of updated water quality data and model projections will complete this research.

Expected Results and Benefits

Results from this project will provide updated information on key areas related to Oregon's coastal lakes. Specifically, the updated phosphorus mass balance model will be used to predict phosphorus loadings from various nonpoint source land use types and from point sources in coastal take watersheds. Information on current water quality and trophic states of the lakes will be updated from a review of data from recent studies. The phosphorus loading model may be used as a land use planning tool to relate present and proposed future land uses to take water quality conditions. Changes or trends in water quality and nutrient loading will be estimated to the extent possible by comparison to historical data. Currently, quantitative projections of water quality effects that result from land use changes are not used in the management of Oregon coastal lakes.

The key end product of this research will be a report summarizing the analyses of the State of Oregon coastal lakes with regard to nutrient loading and water quality. This infon-nation, coupled with recent information from studies on lake trophic status and water quality trends, will be used to estimate permissible nutrient loading to maintain the existing or desired future lake water quality. This could form the basis for DEQ and local planning agencies establishing total maximum daily loads (TMDLS) for phosphorus for Oregon coastal lakes.

Goals and Objectives of Research

This proposed study addresses the subject area of managing water quality in lakes with watersheds subject to multiple uses. Oregon's coastal lakes and their watersheds are used extensively for residential development, recreational activities, forestry practices, and as water supply sources.

These uses conflict in ten-ns of effects on and requirements for water quality. The coastal lakes vary in water quality from that characteristic of oligotrophic lakes (low nutrient enrichment, pristine water quality) to that of eutrophic lakes (high nutrient enrichment, poor water quality). Complex interactions of both natural processes and anthropogenic influences deten-nine present lake water quality. The relative effects on water quality of these watershed processes and uses, and trends or changes that may have occurred, are not well known.

This study will complete an updated survey of the water quality and trophic state of Oregon coastal lakes. Areas under various types of land uses in the watersheds of these lakes will be quantified. Best estimates of areal loading rates from different types of land uses will be used to estimate loadings of nutrients to the lakes. The calibrated lake mass-balance model will be used to relate phosphorus loadings to average phosphorus concentration in each lake and to predict the resultant effect on lake trophic state and

water quality. Current water quality will be classified for these lakes in terms of nutrient loading and trophic state.

Specific tasks required to complete this proposed study are:

1. Watershed characterization: Update watershed land uses and vegetation types from recent surveys or studies for the Oregon coastal takes.

2. Hydrologic characterization: Update as required the hydrologic budget for the study . lakes.

3. Lake water quality characterization: Update the data base of chemical and biological parameters from recent reports for the study takes;

4. Water quality model calibration: Use watershed land use data to predict nutrient loading for the study takes. Validate by comparison with lake phosphorus data and biological trophic state indicators.

5. Water quality model predictions: Use the phosphorus mass-balance model to estimate nutrient loadings required to maintain the existing or desired future water quality of the study lakes

6. Summarize results in a comprehensive final report