Lawrence Livermore National Laboratory Stakeholder and Economic Models for TMDL Development

Background:

The Department of Energy requested that Lawrence Livermore National Laboratory (LLNL) develop tools to assist in improving the TMDL process. We have begun the development of a stakeholder and an economic model to quantify the level of concern of possible allocation decisions and the potential economic consequences of the major stakeholder groups.

Stakeholder and Economic Models Components and Outputs:

We have conducted interviews with stakeholders from 2002 to the present with representatives of the major stakeholder groups. The groups interviewed are (1) non-profit organizations, (2) industry, (3) local government agencies, and (4) city governments. The data gathered in the interviews is being used to quantify the concerns and economic consequences of possible TMDL allocation decisions by the Los Angeles Regional Water Quality Control Board and the U.S. Environmental Protection Agency. Once the models are developed, stakeholders and decision makers can make adjustments to the inputs as new information is discovered with instant results to the output measures. We are also creating GIS maps to help visualize the stakeholder concerns in spatially and temporally. This will allow a visual representation of the potential TMDL allocation into recognizable units such as large and small cities, counties, local communities and industries. As the Los Angeles Regional Water Board and EPA prepare allocation and implementation plans, LLNL will feed that information into the models to evaluate each possible decision based on the data received from the interviews with stakeholders.

The stakeholder value model is implemented in the commercially available Logical Decisions For Windows, a software package designed to assess multi-attribute decision-making problems. As part of the model construction, we identify stakeholders with similar concerns and create representative groups stakeholders reflecting those similarities. The model contains a hierarchy of goals and attributes that contribute to evaluating TMDL plans. Each of the major stakeholder groups is represented and their concerns are broken out into appropriate categories such as time, cost, transparency etc. We have built into the model an assessment of the preference levels for possible outcomes for each attribute. The model accommodates non-linear changes in preferences between levels so one can accurately capture the value of adding or subtract from each attribute. Using implementation schedule as an example, the model assesses a stakeholder's preference for increasingly longer time periods for implementation. The assessment may identify a larger increase in preference from 1 to 3 years and a smaller incremental increase from 3 to 5 years even though the time period between each option is the same. The model assesses the relative preference between different goals and attributes. This helps identify the willingness to make tradeoffs between various attributes.

The economic model will be developed in an Excel spreadsheet. It will include the stakeholders' estimated cost to comply with various TMDL allocations. It will include the ability to analyze other scenarios such as trading among stakeholder groups and prioritizing certain segments of

the watershed. The cost estimates from the economic model will be used as inputs to the stakeholder model, and the results will be included in GIS visualizations.

The output of the stakeholder model provides a way to rank the relative preference of different TMDL plans. The decision maker can draft one or more potential TMDL plans. For each plan, we identify the resulting level of satisfaction for each of the attributes. The model then calculates an overall utility value for the plans based on the stakeholder preferences for each attribute and the relative importance between the attributes and goals. The model can report an overall ranking of the draft plans and a ranking for each stakeholder group. Used interactively, less acceptable potential plans can be modified and reassessed to determine if the changes improve acceptability.

Benefits to Stakeholders:

The stakeholder and economic models are based on voluntary input from the different stakeholder groups. The effort of contributing to the models should lead to several benefits during the TMDL process. First, the process improves stakeholder involvement and creates a more constructive dialogue. Second, the model transparently and quantifiably documents stakeholder values. Stakeholders can review the model and update their input if they feel it misrepresents their current values. Once agreed upon, the documentation of values in the model allow stakeholder interest to be assessed and incorporated. Third, new approaches to TMDL allocation can be evaluated, such as the value and preference for trading. Fourth, the model provides a way to communicate value tradeoffs in a consistent and tractable manner. Even though different stakeholder groups may not agree on an issue, the model can help the parties understand each other's positions and identify areas that maximize overall stakeholder utility, given the constraints of the regulatory agencies.

Use of Stakeholder and Economic Models During TMDL Development:

The stakeholder and economic models can provide benefits throughout the TMDL process. First the model provides a formal method for assessing and reporting stakeholder input. Ideally this provides a better understanding of stakeholder interests than ad hoc stakeholder involvement. It should also improve the transparency of the stakeholder input process and allow for early consideration of stakeholders concerns. Second the assessment of preference levels can be used by the decision maker when drafting potential TMDL plans. If the stakeholder input identifies critical areas that greatly improve the acceptance of plans, the draft plans can incorporate those levels. Third, given several possible draft TMDL plans, the model can compare the relative ranking of the plans overall and for each individual group. This can help identify which plans are more likely to be accepted by the stakeholders. Fourth, the model can help identify and test tradeoffs that can be made to draft TMDL plans that can help improve the acceptability of the plans. Finally, the model can help document why a certain TMDL plan was ultimately selected providing a transparent way to communicate the stakeholder values and tradeoffs used.

Conclusions:

The Stakeholder and Economic models give the decision maker the ability to see how different TMDL plan options rank in order of preference from the perspective of each represented stakeholder group and to evaluate how modifications can improve the perceived outcome. The model's advantages are (1) increased transparency to stakeholders (2) improved and measurable representation of stakeholder concerns, (3) improved perception of process for making decision. By formally incorporating the stakeholder value and economic models, the decision maker can select an implementation plan that systematically and explicitly addresses the values of the stakeholder groups. By improving the use of stakeholder information, decision makers and stakeholders can better understand each others positions and represent their own with a consistent and sound process.

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