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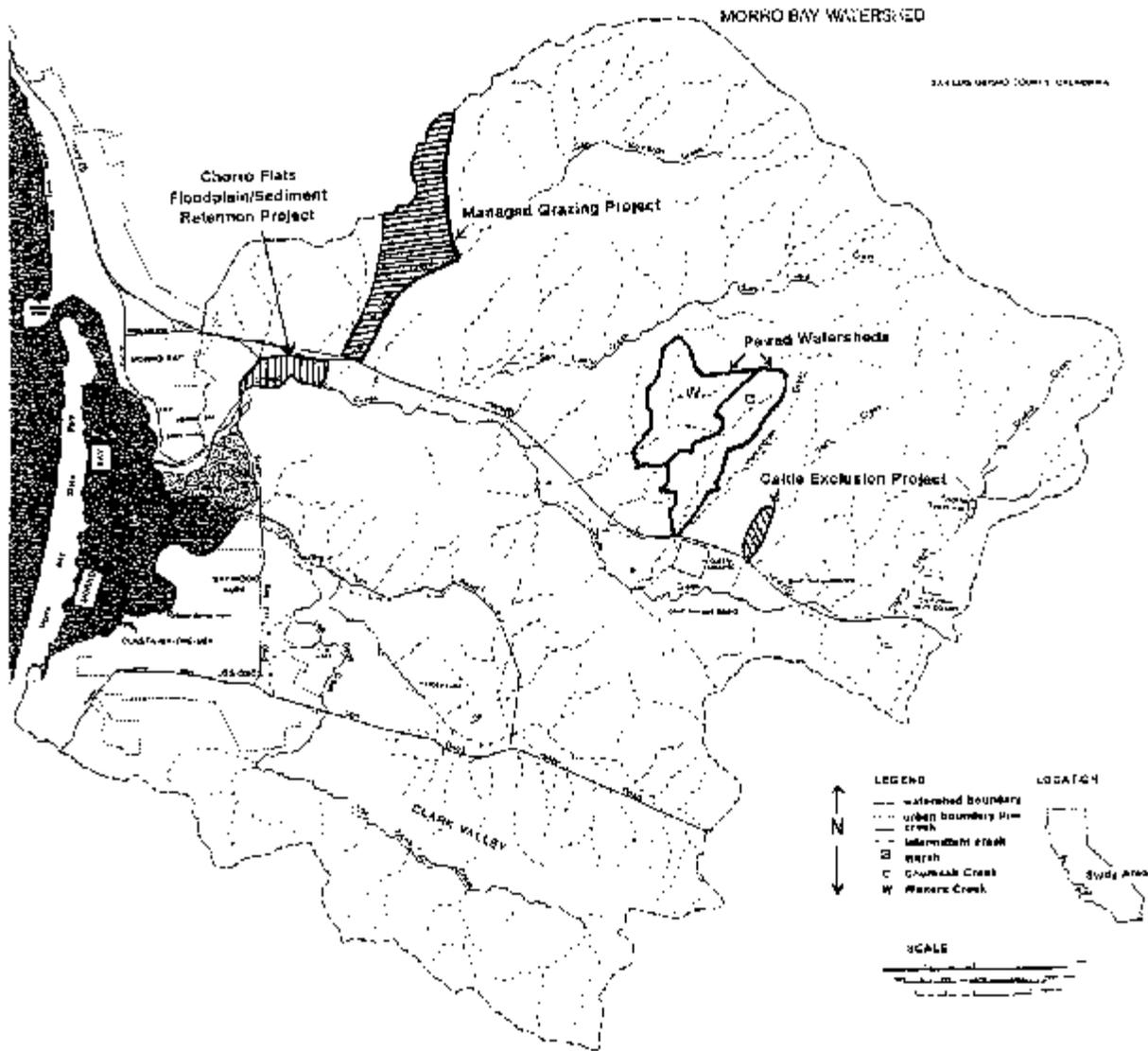
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PROJECT SPOTLIGHT

Monitoring of both land treatment and water quality is necessary to document the effectiveness of nonpoint source pollution controls in restoring water quality. The [Section 319 National Monitoring Program](#), administered by the U.S. Environmental Protection Agency, is designed to support watershed projects throughout the country that meet a minimum set of project planning, implementation, monitoring, and evaluation requirements. The requirements are designed to lead to successful documentation of project effectiveness with respect to water quality protection or improvement. The National Monitoring Program projects comprise a small subset of nonpoint source control projects funded under Section 319 of the Clean Water Act Amendments of 1987. The following article continues a series describing these projects.

Morro Bay Watershed (California) 319 National Monitoring Program Project

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Project Synopsis

The Morro Bay watershed (48,450 acres) is located on the central coast of California, 237 miles south of San Francisco in San Luis Obispo County. Two creeks, Los Osos and Chorro, drain the watershed into the Bay. Included within the watershed boundaries are two urban areas and prime agricultural and grazing lands. Heavy development activities, caused by an expanding population, have placed increased pressures on water resources in the watershed.

Morro Bay estuary is considered to be one of the least altered estuaries on the California coast. Its beneficial uses include recreation, industry, navigation, marine life habitat, shellfish harvesting, commercial and sport fishing, wildlife habitat, and rare and endangered species habitat. A number of fish species (including anadromous fish, which use the Bay and watershed streams during part of their life cycle) have been negatively affected by sedimentation in the streams and the Bay. Brushland and rangeland contribute the largest portion of sediment, with Chorro Creek contributing twice as much sediment as Los Osos Creek. At present rates of sedimentation, Morro Bay could be lost as an open water estuary within 300 years unless remedial action is undertaken. Approximately 100 acres of oyster beds have been lost due to excessive sedimentation. Fecal coliform bacteria, carried to the Bay by streams, have resulted in periodic closures of the

area to shellfish (oyster) harvesting (SCS, 1992).

The U.S. Environmental Protection Agency (USEPA) Section 319 National Monitoring Program project for the Morro Bay watershed has been developed to characterize the sedimentation rate and other water quality conditions in a portion of Chorro Creek, to evaluate the effectiveness of several best management practice (BMP) systems in improving water quality and habitat quality, and to evaluate the overall water quality at select sites in the watershed.

A paired watershed study on tributaries of Chorro Creek (Chumash and Walters creeks) will be used to evaluate the effectiveness of a BMP system in improving water quality. Monitoring sites outside the paired watershed have been established to evaluate specific BMP system effectiveness. Water quality samples throughout the watershed will be taken to document changes in water quality throughout the project.

In addition to the 319 project being led by the California Central Coast Regional Water Quality Control Board, many other agencies are involved in water quality activities in the watershed with the objective of reducing the quantity of sediment entering Morro Bay. The California Coastal Conservancy contracted with the Coastal San Luis Resource Conservation District in 1987 to inventory sediment sources to the estuary, quantify the rates of sedimentation, and develop a watershed enhancement plan. The Coastal Conservancy then provided cost share funds for BMP implementation by landowners. Funding is available through the U.S. Department of Agriculture Hydrologic Unit Area (HUA) project for technical assistance in the watershed, adult and youth watershed education programs, and cost share for farmers and ranchers for five years. An SCS range conservationist was hired to manage the range and farm land improvement program. Cooperative Extension received a grant to conduct detailed monitoring on a rangeland management project in the watershed. The California National Guard, a major landowner in the watershed, contracted with SCS to develop a management plan for grazing and road management. State funding from the Coastal Conservancy and Department of Transportation has been used to purchase a \$1.45 million parcel of agricultural land on Chorro Creek just upstream of the Morro Bay delta which will be restored as a functioning flood plain.

The Central Coast Regional Water Quality Control Board is studying abandoned mines in the watershed with USEPA 205(j) funds. The Board also obtained a USEPA Near Coastal Waters grant to develop a watershed work plan incorporating new USEPA nonpoint source (NPS) management measures and develop guidance packages for agencies whose activities may affect water quality in the watershed.

The Department of Fish and Game Wildlife Conservation Board has provided funding for steelhead habitat enhancement on portions of Chorro Creek. The state Department of Parks and Recreation funded studies of exotic plant invasions in the delta as a result of sedimentation. The California Coastal Commission used Morro Bay as a model watershed in a pilot study for a NPS management plan pursuant to Section 6217 of the Federal Coastal Zone Management Act Reauthorization Amendments of 1990.

Without the cooperation and financial support of many of these agencies, the 319 project would be unable to implement BMPs or educate landowners about NPS pollution.

Project Time Frame

August 1, 1993 - June 30, 2003

Pre-Project Water Quality

Chorro and Los Osos creeks are listed by the state as impaired for sedimentation, temperature, and agricultural NPS pollution (Central Coast Regional Water Quality Control Board, 1993).

Studies conducted within the watershed have identified sedimentation as a serious threat in the watershed and

estuary. The rate of sedimentation has increased ten-fold during the last 100 years (SCS, 1989a). The estuary has lost 25% of its tidal volume in the last century as a result of accelerated sedimentation and has become, on average, about two feet shallower since 1935 (Haltiner, 1988). Approximately 45,500 tons of sediment are delivered to Morro Bay each year (SCS, 1989b).

Nonpoint Source Control Strategy

In the paired watershed, a BMP system will be used to control NPS pollutants. California Polytechnic State University (Cal Poly) will implement the system on Chumash Creek (using 319(h) funds). BMPs to be implemented include: 1) fencing the entire riparian corridor; 2) creating smaller pastures for better management of cattle grazing; 3) providing appropriate water distribution to each of the smaller pastures; 4) stabilizing and revegetating portions of the stream bank; and 5) installing water bars and culverts on farm roads. During the project, riparian vegetation is expected to increase from 0 to at least 50% coverage. A goal of 50% reduction in sediment following BMP implementation has been set.

Three BMP systems established by SCS will be evaluated for their effects on water and habitat quality. A floodplain/sediment retention project will be established at Chorro Flats to retain sediment. A riparian area along a tributary of Chorro Creek will be fenced and revegetated (cattle exclusion project). Fences will be installed to allow rotational grazing of pastures on a 1,400-acre ranch (managed grazing project). The goals are to achieve the following reductions in sediment yield: 34% from the sediment retention project, 66% from the cattle exclusion project, and 30% as a result of the managed grazing project.

Water Quality Monitoring Design

Two watersheds have been selected for a paired watershed study. Chumash Creek (400 acres) and Walters Creek (480 acres) both drain into Chorro Creek. The creeks are similar in soils, vegetative cover, elevation, slope, and land use. Cal Poly ownership of the land surrounding the creeks will ensure continuity and control of land treatment.

The paired watershed plan entails monitoring: stream flow/climate, water quality, and biota/habitat. The calibration period, in which both watersheds will be monitored to establish statistical relationships between them, will be at least two rainy seasons in duration. A BMP system will then be installed in one watershed, the other serving as control.

Other systems of BMPs established in the watershed will be evaluated with upstream/downstream and single station monitoring. An upstream/downstream design will be used to monitor the water quality effect of the floodplain/sediment retention and cattle exclusion projects. A single station on a subdrainage will be used to evaluate changes in water quality from implementation of the managed grazing project.

Ongoing water quality sampling will take place at selected sites throughout the watershed to document long-term changes in water quality and identify problem areas. Grab samples will be taken least 20 times (at evenly-spaced intervals) during the rainy season. Variables to be measured at some or all of the sites include: fecal coliform bacteria, suspended and bedload sediment, turbidity, nitrate, total Kjeldahl nitrogen, total phosphorus, conductivity, and pH. Explanatory variables include: precipitation, stream flow, evaporation, and animal units.

Riparian vegetation will be assessed via aerial photography conducted bi-annually during the first, fifth, and tenth years of the project. Four permanent vegetation transects will be conducted three times each year to sample actual vegetation and document changes during the life of the project.

Project Water Quality Objectives

- Identify sources, types, and amounts of nonpoint source pollutants originating in paired watersheds in the Chorro Creek watershed.
- Determine stream flow/sediment load relationships in the paired watersheds.
- Evaluate the effectiveness of BMPs implemented as a BMP system in improving water quality in one of the paired watersheds.
- Evaluate the effectiveness of three additional BMP systems in improving water or habitat quality at selected locations.
- Monitor overall water quality to identify problem areas for future work, detect improvements or changes, and contribute to the database for watershed locations.
- Develop a geographic information system (GIS) database for this project and future monitoring efforts.

Information, Education, and Publicity

Informal educational programs will be conducted, including workshops about water quality problems within the watershed. Target groups are landowners, local agencies, and local groups such as Friends of the Estuary, Morro Bay Natural History Association, and Morro Bay Task Force.

Water Quality Data Management and Analysis

Water quality data and BMP implementation information will be handled by the project team. Data will be entered into STORET and reported using the Nonpoint Source Management System Software. GIS will be used to map nonpoint pollution sources, BMPs, and land uses, and to determine resulting water quality problem areas.

A Quality Assurance Project Plan for water quality sampling and analysis will be developed by the Central Coast Regional Water Quality Control Board.

Parametric and non-parametric statistical tests will be used to analyze the data. Possible tests include linear regression F-tests, analysis of variance, covariance F-test, Wilcoxon-Rank Sum tests, and Kendall's Tau test. A two-way contingency table will be used for comparison of the levels of pollutant concentrations and levels of explanatory variables. Three variable contingency tables will be prepared, including time (season or year), pollutant concentration, and an explanatory variable (such as flow or land treatment).

For Further Information

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References

Central Coast Regional Water Quality Control Bd. 1993. *Nonpoint Source Pollution and Treatment Measure Evaluation for Morro Bay Watershed*.

Haltiner, J. 1988. *Sedimentation Processes in Morro Bay, California*. Prepared by Philip Williams and Associates for the Coastal San Luis Resource Conservation District with funding by the California Coastal Conservancy.

SCS. 1989a. *Morro Bay Watershed Enhancement Plan*. Soil Conservation Service, U.S. Department of Agriculture.

SCS. 1989b. *Erosion and Sediment Study Morro Bay Watershed*. Soil Conservation Service, U.S. Department of Agriculture.

SCS. 1992. *FY-92 Annual Progress Report Morro Bay Hydrologic Unit Area*. Soil Conservation Service, U.S. Department of Agriculture.

INFORMATION

1993 Summary Report: Section 319 National Monitoring Program Projects

Osmond, D.L., J. Spooner, J.B. Mullens, J.A. Gale, and D.E. Line. 1993. *1993 Summary Report: Section 319 National Monitoring Program Projects*. Nonpoint Source Watershed Project Studies, NCSU Water Quality Group, Biological and Agricultural Engineering Department North Carolina State University, Raleigh, NC, 121p.

The Section 319 National Monitoring Program is mandated by Section 319 of the Clean Water Act as amended in 1987. Program goals are to: 1) document the water quality benefits of nonpoint source (NPS) pollution control programs; 2) improve understanding of the effectiveness of NPS efforts; and 3) develop better NPS projects. Funding for the program comes from a 5% setaside of annual Section 319 funds allocated to U.S. EPA Regions. At present, the focus of the program is on stream systems. Although the projects funded to date involve agricultural NPS pollution, projects can address NPS problems from other sources such as urban or forested areas.

This annual report on the Section 319 National Monitoring Program projects provides profiles of the six projects approved for USEPA funding as of September, 1993. The projects are: Morro Bay Watershed (California); Eastern Snake River Plain (Idaho); Sny Magill Watershed (Iowa); Sycamore Creek Watershed (Michigan); Elm Creek Watershed (Nebraska); and Long Creek Watershed (North Carolina).

Also included in the report is a chapter on project design emphasizing land treatment and water quality monitoring designs that optimize the probability of documenting a link between land treatment implementation and water quality changes.

The report may be ordered from Publications Coordinator, NCSU Water Quality Group, 615 Oberlin Rd., Suite 100, Raleigh, NC 27605-1126. The cost per copy is \$10. (Please make check out to NCSU-BAE-NWQEP and refer to WQ-82 when ordering.)

Rural Clean Water Program Evaluation Reports

Gale, J.A., D.E. Line, D.L. Osmond, S.W. Coffey, J. Spooner, J.A. Arnold, T.J. Hoban, and R.C. Wimberley. 1993. *Evaluation of the Experimental Rural Clean Water Program*. National Water Quality Evaluation Project, NCSU Water Quality Group, Bio & Ag Eng Dept, North Carolina State University, Raleigh, NC (published by U.S. Environmental Protection Agency) EPA-841-R-93-005, 559p. (cost: \$6 to cover postage) (WQ-79)

Gale, J.A., D.E. Line, D.L. Osmond, S.W. Coffey, J. Spooner, J.A. Arnold, T.J. Hoban, and R.C. Wimberley. 1993. Executive Summary: Evaluation of the Experimental Rural Clean Water Program. National Water Quality Evaluation Project, NCSU Water Quality Group, Bio & Ag Eng Dept, NCSU, Raleigh, NC, 46p. (cost: \$5 to cover printing & postage) (WQ-84)

Gale, J.A., D.E. Line, D.L. Osmond, S.W. Coffey, J. Spooner, J.A. Arnold, T.J. Hoban, and R.C. Wimberley. 1993. Evaluation of the Experimental Rural Clean Water Program: Abbreviated Version for Congressional Review. National Water Quality Evaluation Project, NCSU Water Quality Group, Bio & Ag Eng Dept, NCSU, Raleigh, NC, 109p. (cost: \$12 to cover printing & postage) (WQ-85)

Gale, J.A., D.E. Line, D.L. Osmond, S.W. Coffey, J. Spooner, and J.A. Arnold. 1992. Summary Report: Evaluation of the Experimental Rural Clean Water Program. National Water Quality Evaluation Project, NCSU Water Quality Group, Bio & Ag Eng Dept, NCSU, Raleigh, NC, 38p. (free) (WQ-75)

Four reports on the comprehensive evaluation of the Rural Clean Water Program (RCWP) are now available. The RCWP was a federally-sponsored nonpoint source (NPS) pollution control program initiated in 1980 as an experimental effort to address agricultural NPS pollution. The evaluation was conducted by the National Water Quality Evaluation Project at NCSU in cooperation with the U.S. Department of Agriculture (USDA) and the U.S. Environmental Protection Agency (USEPA).

The RCWP is significant because it combined land treatment and water quality monitoring to document NPS pollution control effectiveness. Landowner participation was voluntary, with cost sharing and technical assistance offered as incentives for implementing best management practices. The RCWP was administered by the USDA - Agricultural Stabilization and Conservation Service in consultation with USEPA. The USDA - Soil Conservation Service and Extension Service and many other federal, state, and local agencies also participated. With a total appropriation of \$64 million, the RCWP funded 21 experimental watershed projects representing a wide range of impaired water uses.

The RCWP experience provides valuable information for NPS control programs. RCWP projects have contributed significantly to our knowledge about NPS pollution control technology, and effectiveness of BMPs and voluntary cost share programs in reducing agricultural NPS pollution.

The RCWP evaluation is based on on-site evaluations of the 21 RCWP projects, surveys of project personnel

and project-area farmers who did and did not participate in RCWP projects, and project reports. All four reports: 1) describe RCWP organization and objectives and 2) articulate lessons learned about the design, organization, funding, management, implementation, monitoring, and evaluation of agricultural NPS pollution control programs. The complete evaluation report (WQ-79) illustrates each lesson learned with examples from the RCWP projects, reports on the farmer survey, and provides a detailed description of each RCWP project. The Abbreviated Version (WQ-85) contains lessons learned (without project examples), results of the farmer survey, and brief synopses of the RCWP projects. The Executive Summary (WQ-84) and Summary Report (WQ-75) present lessons learned and brief project synopses.

The reports (prices listed at the end of each reference above) may be ordered from Ms. Janet Young, NCSU Water Quality Group, 615 Oberlin Road, Suite 100, Raleigh, NC 27605-1126. Please make check out to NCSU-BAE-NWQEP and refer to the WQ # listed at the end of each reference when ordering.

Sustainable Agriculture Directory of Expertise

1993 Directory Available

Released in June, 1993, by the Rodale Institute, the premier edition of the *Sustainable Agriculture Directory of Expertise* contains 717 listings of people and groups with expertise in sustainable agriculture. The directory may be ordered from (checks payable to): Sustainable Agriculture Publications, Hills Bldg., Room 12, University of Vermont, Burlington, VT 05405. The cost is \$14.95.

Nominations Sought for 1994 Directory

Nominations of people with special knowledge and skills in sustainable agriculture are being sought by the Appropriate Technology Transfer for Rural Areas (through March, 1994) for inclusion in the 1994 Sustainable Agriculture Directory of Expertise. Nomination forms may be obtained from: ATTRA, P.O. Box 3657, Fayetteville, AR 72702, Tel: (501) 442-9824, FAX: (501) 442-9842. An information form will be sent to nominees.

EDITOR'S NOTE

NWQEP NOTES is issued bimonthly. Subscriptions are free within the United States (contact: Publications Coordinator at the address below or via internet at wq_puborder@ncsu.edu). A list of publications on nonpoint source pollution distributed by the NCSU Water Quality Group is included in each hardcopy each issue of the newsletter.

I welcome your views, findings, information, and suggestions for articles. Please feel free to contact me.

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