NWQEP NOTES

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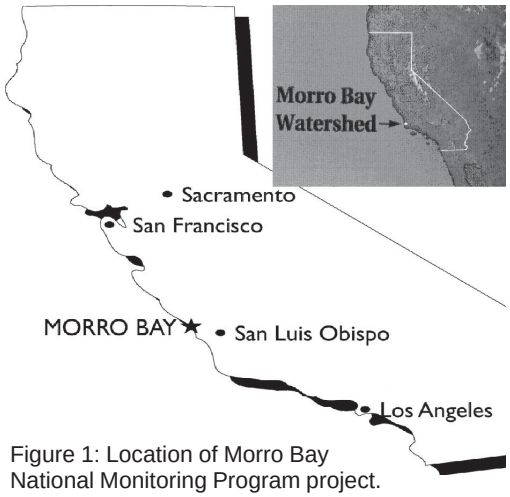

Figure 1: Location of Morro Bay National Monitoring Program project.

IN THIS ISSUE

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PROJECT SPOTLIGHT

The Morro Bay National Monitoring Program A Ten-Year Study of Rangeland BMPs

Katie McNeill[1], Dr. Lynn Moody[2], Dr. Brian Dietterick[2], Dr. Brent Hallock[2], Dr. Jon Beckett[2], Karen Worcester[1], David Paradies[1], and John H. Davis IV[1]

Introduction

For ten years, the California Regional Water Quality Control Board, Central Coast Region (RWQCB) and California Polytechnic State University (CPSU) monitored the effects of rangeland Best Management Practices (BMPs) in the Morro Bay watershed as a part of the U.S. EPA Section 319 National Nonpoint Source Monitoring Program (NMP). A paired watershed study at Chumash Creek and Walters Creek and two cattle exclusion projects at Dairy Creek and Chorro Creek were the focus of the Morro Bay National Monitoring Program project. The project has recently concluded and a summary of the results is presented in this article.

Morro Bay is located on the central coast of California (see Figures 1 and 2) and supports a variety of marine habitats, commercial and sport fishing, shellfish harvesting, and recreational activities. It is one of California's least disturbed estuaries. The watershed draining into the estuary includes two urban areas, cropland, rangeland, and a variety of natural habitats including marsh, oak woodland, riparian, and dunes. Chorro and Los Osos Creeks are the major streams flowing into Morro Bay (see Figure 3). In 1993, the U.S. Environmental Protection Agency (EPA) selected the Morro Bay watershed into the NMP program for ten years of water quality monitoring and evaluation of Best Management Practices (BMPs). The Morro Bay estuary was designated a National Estuary in 1995. The

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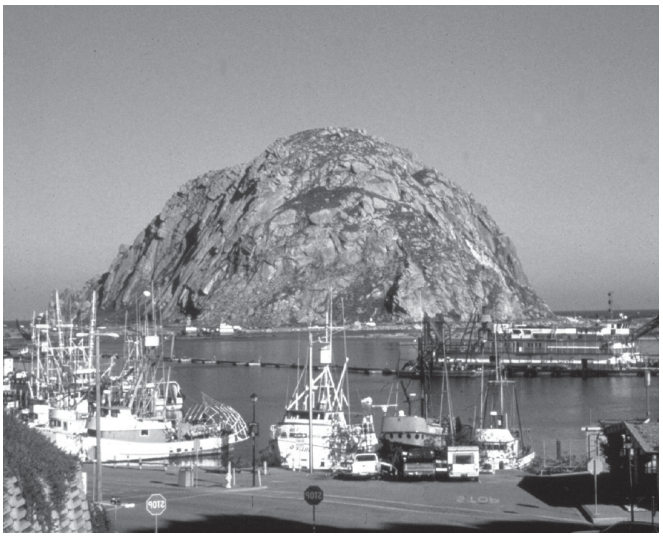

Figure 2: Morro Bay estuary and Morro Rock.

EDITOR'S NOTE

In this issue of *NWQEP NOTES*, we continue our series on National Nonpoint Source Monitoring Program (NMP) projects that have been completed and have documented improvements in water quality due to best management practice (BMP) implementation.

Unlike the other projects currently in the NMP, the Morro Bay project, located on the Central Coast of California, focused primarily on rangeland nonpoint source water quality issues. Over a 10-year period, the effects of rangeland BMPs were monitored in four subwatersheds.

Results from the paired watershed study indicated significant reductions in suspended sediment and turbidity from BMP implementation. Improvements in water temperature, dissolved oxygen, riparian vegetation and fecal coliform levels were also found in the studied subwatersheds. Results of this project, and other successful NMP projects, validate the importance and effectiveness of nonpoint source control practices in protecting and restoring water quality.

As always, please feel free to contact me regarding your ideas, suggestions, and possible contributions to this newsletter.

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watershed is about 48,450 acres in area, and ranges from sea level to 730 meters in elevation. Varied geology and rugged topography contribute to a variety of soils and plant communities. The watershed and estuary are in a Mediterranean type climate, with warm dry summers and cool wet winters.

The watershed and estuary have been impacted by pollutants, including sediment, bacteria, and nutrients, originating from cropland, urban areas, rangeland, eroding streambanks, poorly maintained roads, and other sources. These pollution sources are nonpoint, meaning diffuse in origin. Sediment has been of particular concern. A comprehensive study in the late 1980's estimated that 25 percent of the estuary's volume has been lost to accelerated sedimentation during the past century, and at that sedimentation rate, the bay could be lost as an open-water estuary within 300 years.

The goals of the Morro Bay project were to monitor the impacts of selected rangeland BMPs on water and habitat quality in the Morro Bay watershed. The project focused on:

- Characterization of sedimentation and water quality conditions in a portion of the Chorro Creek watershed, through sediment and water sample analysis in a paired watershed study.
- Evaluation of the effectiveness of a set of BMPs in improving water and habitat quality in one of the paired watersheds.
- Evaluation of the effectiveness of systems of BMPs in improving water and habitat quality in several locations in the Chorro Creek watershed.
- Evaluation of overall water quality at selected sites in the Morro Bay watershed to establish a database, prioritize problem areas, and aid in future monitoring efforts.
- Evaluation of hydrologic and water quality indicators to document the health and stability of selected streams in the Morro Bay watershed through annual monitoring practices.

This nonpoint source monitoring project is one of very few long-term watershed evaluation projects on the west coast of North America. The diversity of studies addressing the Morro Bay watershed, the Mediterranean climate with its strong seasonal rainfall distribution, and the predominance of agricultural rangeland use, all combine to make this study unique among Section 319 nonpoint source projects in the United States.

Chumash and Walters Paired Watershed Study

Introduction

Walters and Chumash Creek subwatersheds (see Figure 3) were chosen for the paired watershed study because of their similarities in size, aspect, slope, elevation, soils, climate, and vegetation. The Walters Creek watershed is 480 acres; the adjacent Chumash Creek watershed is 400 acres. Aspects are

southwest, elevations range from 300 to 700 feet. Vegetation is mainly introduced annual grasses with scattered stands of native perennial grasses. After a two-year pre-BMP monitoring period (calibration period), land treatment measures (BMPs) were installed in Chumash watershed, while Walters remained the control. Both watersheds are rangeland used for cattle grazing, and both are owned by CPSU and managed as the Escuela Ranch. Continuity of ownership and management was critical to the goal and objectives of the paired watershed project.

The Escuela Ranch contains Walters, Chumash, and one other subwatershed (Pennington Creek watershed, not included in the paired watershed study, see Figure 3). The grazing method utilized on the ranch is classified as rest/rotational grazing, with the treatment watershed consisting of smaller pasture sizes and more numerous pastures.

Pre-BMP monitoring occurred 1993 to 1995 in the Walters and Chumash watersheds. Rangeland BMPs were implemented in Chumash watershed from 1995-1997. Post-BMP monitoring occurred 1997 to 2001.

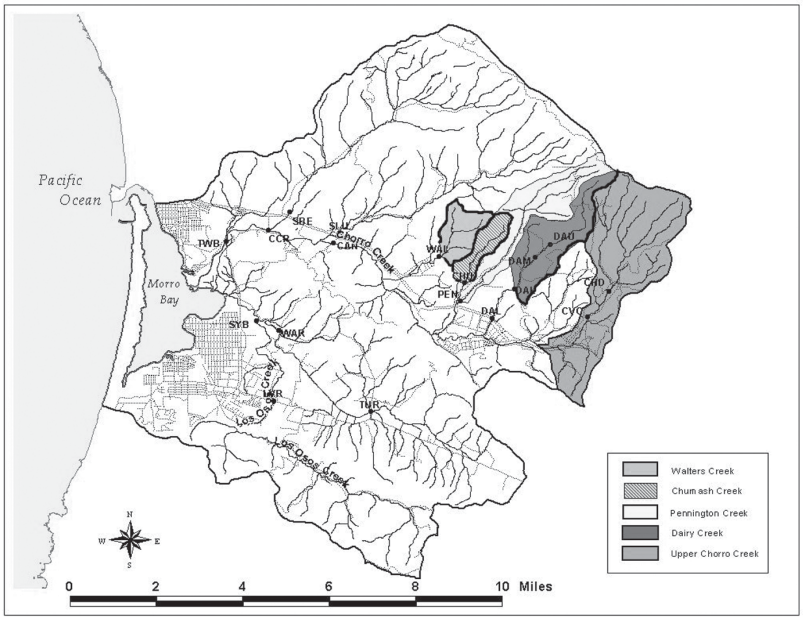


Figure 3: Morro Bay watershed and study subwatersheds. Walters and Chumash Creek subwatersheds are paired.

Land Treatment Measures

Control Watershed – Walters: When water quality, range, and stream data collection first began in 1993, the Walters watershed had four pastures ranging in size from 131 acres to 311 acres. This pasture design has not changed throughout the 10-year study and acts as a control with a few large pastures. Therefore, when cattle graze in this watershed, not only is grazing time relatively longer in four pastures, but the rest periods between rotations is less.

Treatment Watershed – Chumash: The BMPs implemented in Chumash watershed fell within four categories of rangeland management practices: livestock exclusion fencing from streams and alternate water supply development (subdividing existing pastures, installing spring boxes and water troughs), streambank stabilization (revegetation and gully repair), road improvement (water bar and culvert installation, and road abandonment), and grazing management (riparian pasture development and rest-rotation). Grazing management is discussed further below. Each BMP category contains individual BMPs that were intended to address the sources of nonpoint source pollution.

In 1993, the Chumash watershed was originally subdivided into only two pastures of 287 and 290 acres. During BMP implementation in 1995, most of the division of the two original pastures into 14 was completed, primarily with electric fencing but some with traditional barbed wire fencing. In 1996 and subsequent years, cattle have been rotated through the 14 pastures in the Chumash watershed ranging in size from 15 to 130 acres, with most of the pastures between 25 and 68 acres. Two of the 14 pastures were established as riparian pastures that were only grazed one to three days per year and only during the dry season. In the Chumash watershed, cattle spent less time in any single pasture, providing more rest for each pasture.

Event-Based Climate, Streamflow, and Water Quality Data

Water quality and streamflow were monitored from 1993 to 2001 with instrumented gauging stations installed at the outlet of each paired watershed. Gauging stations were installed at a location in each stream channel to allow collection of comparable and representative continuous streamflow and water quality samples. Climate data were measured at a centrally-located weather station representative of average conditions for the paired watersheds.

Event-based water samples were collected every 30 minutes by Sigma automated samplers during storm events that generated sufficient runoff to submerge the instream sampling intakes. Paired event-based water quality samples from Chumash Creek and Walters Creek watersheds were analyzed for turbidity, electrical conductivity, and suspended sediment concentration following USEPA procedures.

As stated previously, BMPs were implemented 1995-1997, with pre-BMP monitoring 1993-1995, and post-BMP monitoring 1997-2001. Examination of paired hydrographs during and after BMP implementation revealed interesting trends (see Figure 4). In the period of 1995 through 1998, the timing of peak flow in Walters and Chumash was approximately equal. Beginning early in 1999, peak flow of Chumash lagged behind that of Walters, by 30 minutes to 1 hour. This was most noticeable early in each post-BMP wet-weather season (November-April). This may have been attributed to increased infiltration and possibly to a lesser extent, plant interception.

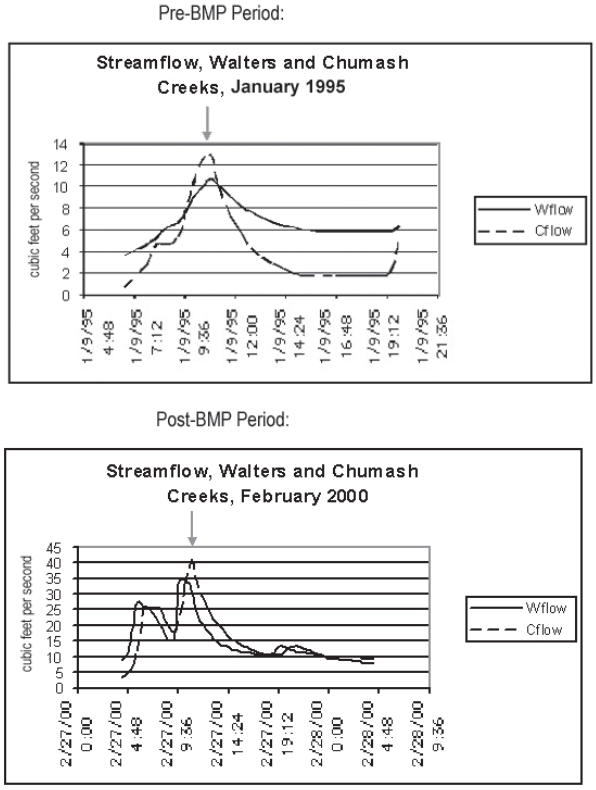


Figure 4: Streamflow at Walters (Wflow) and Chumash (Cflow) for two selected storms pre-BMP and post-BMP. Note lag in timing of peak flow for Chumash after BMPs were implemented.

As of the 2000-01 wet-weather season, the complete data set contained 82 events that included paired data on turbidity, and 80 events that included paired data on sediment. Significant declines in turbidity (Figure 5) and sediment (Figure 6) in Chumash Creek were found, as a result of implementing BMPs. Improvements have leveled off, or plateaued, beginning with the 1999-2000 sampling season. One hypothesis is that the plateau occurred because of the rapid colonization of vegetation in the channel and this has maximized the benefit in reducing channel scour and suspended sediment export, and slow-growing vegetation (such as sycamores and oaks) has not yet reached a stage of maturity where it is having a quantifiable affect on water quality.

Even-Interval Streamflow and Water Quality Data

In addition to event-based sampling, even-interval water quality sampling began on Chumash and Walters Creeks in 1993 and was conducted for twenty weeks during winter and spring each year through 2001. Water quality parameters including pH, conductivity, dissolved oxygen, and water temperature were measured year-round using a hand held multi-functioning water quality meter. Grab samples were also taken year-round for total and fecal coliform bacteria, nitrate and phosphate, and were sent to the Regional Board contract laboratory for analysis. Suspended sediment samples were taken during the winter months and analyzed at the CPSU laboratory.

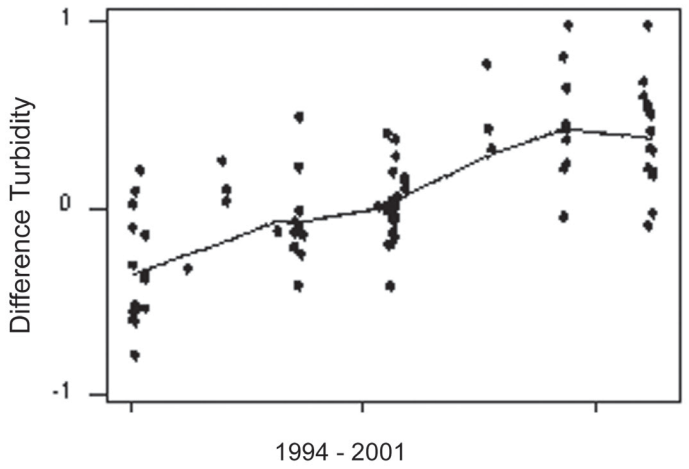


Figure 5: Annual mean difference between Chumash and Walters turbidity values. Increase in trend line indicates improvement of turbidity at Chumash over time. Each data point represents a storm. Each vertical group represents a water year (storm events Nov-May).

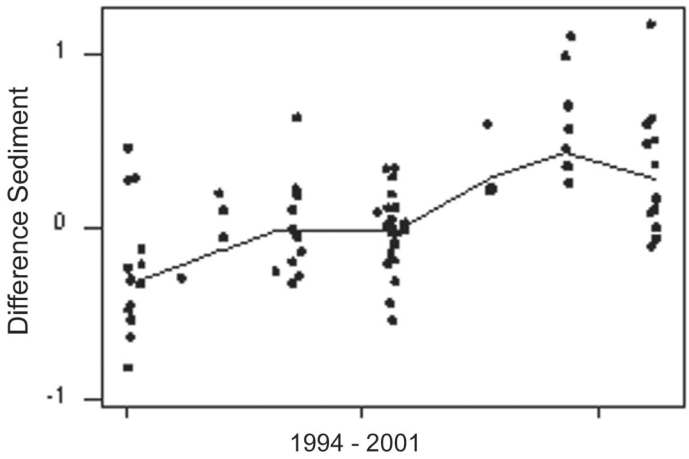


Figure 6: Annual mean difference between Chumash and Walters suspended sediment values. Increase in trend line indicates improvement of suspended sediment at Chumash over time. Each data point represents a storm. Each vertical group represents a water year (storm events Nov-May).

Results of even-interval water quality monitoring were mixed. The rangeland BMPs significantly lowered water temperatures at Chumash Creek, when compared to Walters Creek (see Figure 7). No significant change was detected in the number of fecal coliform bacteria exceeding the threshold over the study period. This is possibly due to grazing in the upper Chumash watershed or an increase in birds and wildlife. Nitrate exceeded the threshold value (0.7 mg/L) more often at Chumash Creek following BMP implementation when compared to Walters Creek. We hypothesized that this was due to riparian vegetative growth (and associated decomposition of organic material) at Chumash Creek. Dissolved oxygen concentrations significantly decreased at Chumash Creek. The reduction is seen as a definite improvement, as levels post-BMP implementation became closer to water quality objectives (<7.0 mg/l), and be-

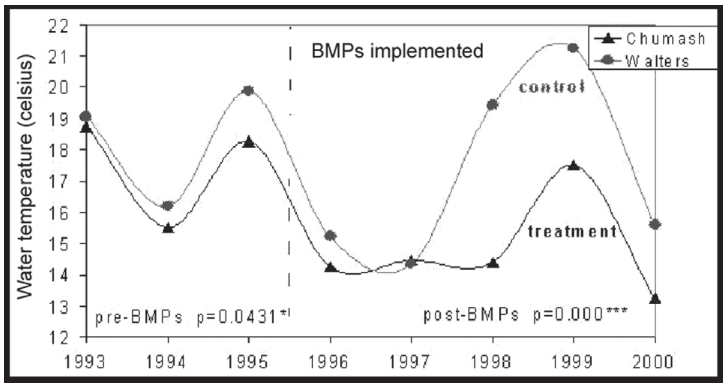
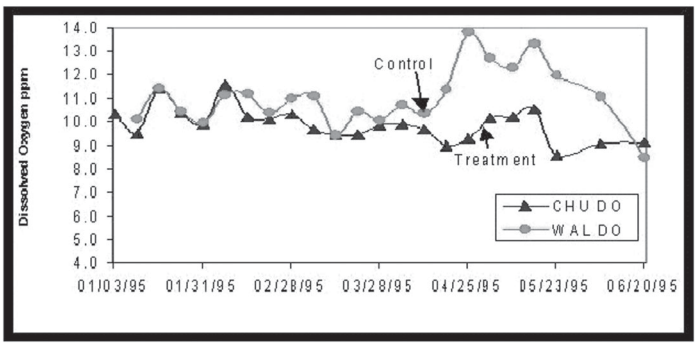
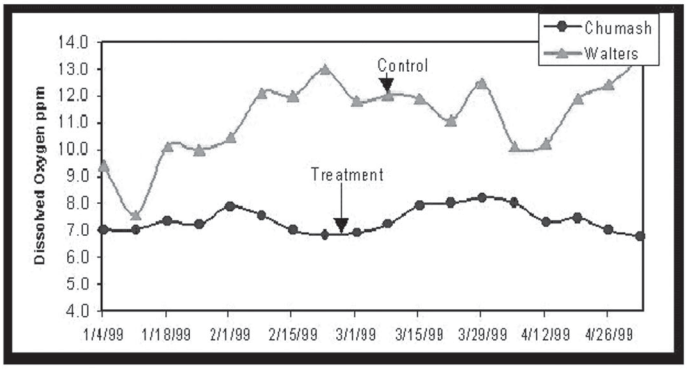


Figure 7: Water temperature improvements at Chumash (treatment) watershed after BMP implementation.

came less super-saturated (>10.0 mg/l) (see Figure 8). It should also be noted that dissolved oxygen levels at Chumash Creek as a result of BMP implementation are now more stable with less diurnal fluctuation, and are more typical of other healthy creeks in the Morro Bay watershed.



(a) pre-BMP



(b) post-BMP

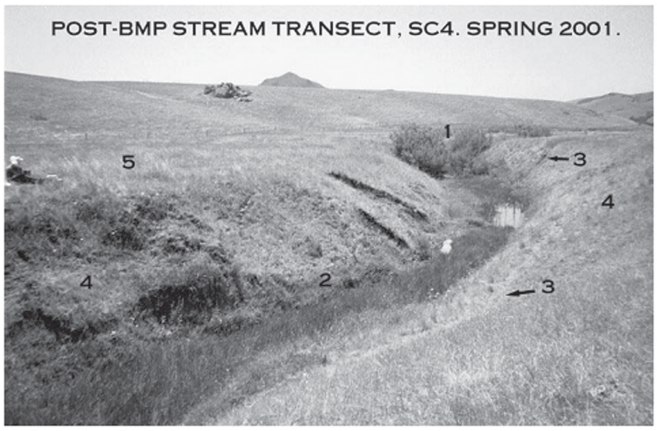
Figure 8: Selected Winter Dissolved Oxygen values pre- and post-BMP.

Even-interval turbidity samples also exceeded threshold values (7 NTUs) more often at Chumash Creek than at Walters Creek post-BMP. The increase in turbidity during low flow periods may possibly be related to an improvement in overall habitat quality and the increased plant growth and decay associated with the dynamically changing riparian plant community. Most suspended sediment is transported during storm events, and as discussed previously, turbidity levels in the event-based samples at Chumash during storm events decreased as a result of BMPs.

Rangeland Vegetation

Vegetative monitoring was conducted to document changes in plant composition and biomass. With covariables, very few differences were significant, primarily due to the low number of observations. In spite of the lack of statistical significance, the visual impact of Chumash post-BMP implementation, and especially when compared to Walters, is visually striking (see Figure 9). Stream channels in Chumash are revegetating with herbaceous plants and willows on the channel bottoms, and herbaceous and a variety of woody plants on banks. Cattle trails and slump scars along the streambanks are revegetating. On rangeland upland areas in the Chumash Creek watershed, decreases in bare ground have been documented and are visually evident, even though these improvements were not statistically significant.

Walters Creek



Chumash Creek

Figure 9: Chumash (treatment) watershed riparian vegetation compared to Walters (control) post-BMP.

Stream Channel Stability Evaluations

Stream channels showed only minor alterations during the monitoring period, including bank erosion, and channel bottom agradation and degradation. Average Pfankuch ratings (measure of channel stability) for Chumash Creek decreased somewhat post-BMP, suggesting that BMPs have been effective in improving stream stability. However, the improvements were not statistically significant.

Forage Quality

During the sixth year of monitoring, it was noted that the BMPs implemented in the Chumash Creek watershed seem to have resulted in an increase in residual vegetation that is harvested by cattle during the dry season. Supplemental feed costs decreased over time, and we hypothesized that the grazing practices in the Chumash Creek watershed may have contributed to the increase in vegetation and decrease in supplemental feed costs. In 1999 during the post-BMP evaluation period, Cal Poly added a component to the study to evaluate the quality of the nutritional value that is contained within the forage in order to determine whether there is a net increase in total nutrients due to the implementation of the BMPs. Measures of forage quality differed by season, but significant differences were not found between the treatment and the control over-time. If nutrient contents were affected by implementation of BMPs (specifically grazing practices), they would have been detected by the end of the trial. Since differences were not detected in the last 3 years, the decision was made to not continue testing earlier samples. Further, it was felt that since a primary plant component (fiber) was not affected by implementation of BMPs, differences in crude protein were very unlikely.

Dairy Creek BMP Evaluation Project

Dairy Creek, a tributary to Chorro Creek, runs through El Chorro Regional Park and is the site of a cattle exclusion project. The land was grazed for many years without creek corridor protection, and in many areas the riparian vegetation was severely damaged (see Figure 10). Natural Resources Conservation Service partnered with San Luis Obispo County Parks Department and the Guidetti Family, the historical owners of the Dairy Creek Ranch. BMP implementation included fencing a mile-long riparian corridor through the park and revegetation of the floodplain. Improvements to the lower mile of creek were completed during the summer of 1994, with the remaining upper half-mile of creek fenced during the summer of 1995.

Even-interval monitoring occurred before and after BMPs were implemented at three sites. Two sites were located on Dairy Creek upstream and downstream of the BMPs, and one site was located at a paired station on an adjacent creek (Pennington Creek). Weekly monitoring was conducted for twenty weeks during each wet-weather season and biweekly monitoring was conducted year-round from 1993 to 2001. BMPs significantly

Figure 10: Dairy Creek cattle access to stream prior to cattle exclusion.

decreased water temperature and increased dissolved oxygen. Stabilized, less variable levels of dissolved oxygen were also reported. BMPs did not significantly change fecal coliform bacteria, nitrate, ortho-phosphate, and turbidity.

Chorro Creek BMP Evaluation Project

Chorro Creek Dam (CHD) and Chorro Valley Culvert (CVC) are the upper and lower sampling stations of a total cattle exclusion area on the Camp San Luis Military Reservation. Fencing was installed along the riparian corridor of upper Chorro Creek in 1994. This pair of sampling stations was established to examine changes in water quality as the stream moves through the cattle exclusion area.

Water temperature significantly decreased and dissolved oxygen significantly increased as a result of BMP implementation at CVC, the treatment site, when compared to CHD, the control site. Stabilized, less variable levels of dissolved oxygen were also reported. In addition, fecal coliform has significantly decreased at CVC, as a result of BMP implementation. The significant reduction in fecal coliform at this BMP evaluation project is most likely due to the fact that there is no cattle access to the creek via water gaps or riparian pasture, unlike the other Morro Bay watershed projects discussed here.

Overall Morro Bay NMP Conclusions

Significant changes have been detected due to BMP implementation at Chumash Creek, particularly reductions in suspended sediment and turbidity during storm events and improvements in water temperature and dissolved oxygen year-round. The cattle herd used in the project grazed both the paired watersheds included in the study as well as an additional watershed (Pennington Creek) not part of the study. The Cal Poly ranches have higher percentage rest than typical working

Continued on p. 9

ranches. If implementing BMPs improved water quality under these grazing conditions, then one would expect possibly even greater improvements in water quality from implementing BMPs in other, more traditional ranches.

Decreased water temperatures and increased levels of dissolved oxygen were found at Dairy and Chorro Creeks as a result of implementing rangeland BMPs. Stabilized, less variable levels of dissolved oxygen were also reported. Additionally, decreases in fecal coliform were found along Chorro Creek where cattle were totally excluded from the channel or riparian zone and given an alternate watering source. Riparian vegetative improvements are apparent at all sites where BMPs have been implemented.

Data from the Morro Bay NMP have assisted Total Maximum Daily Load (TMDL) development and nonpoint source pollution control implementation in the watershed. The project provided baseline values to establish the framework for a local volunteer monitoring program and a regionally-scaled ambient monitoring program. Efforts to evaluate long-term effects of BMP implementation on California rangelands and water quality continue in the Morro Bay watershed.

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The Final Report is available in hardcopy or on line at **http://www.swrcb.ca.gov/rwqcb3/WMI/MorroBay/index.htm**

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Conference Report

The 11th National Nonpoint Source Monitoring Workshop was held on September 8-11, 2003, in Dearborn, Michigan. Its focus was on monitoring and modeling the urban environment. Over 100 participants gathered to share information on best management practices in improving water quality, effective monitoring techniques, and statistical analysis of watershed data. Progress made and lessons learned from Section 319 National Nonpoint Source Monitoring Program projects, as well as other nonpoint source control watershed projects, were highlighted.

The workshop included a pre-conference boat tour on the Detroit River to view local industry and learn about the region's stormwater and wastewater management programs; workshops on *Better Site Design* and *Strategies for Performing Watershed Assessments in Urban Environments;* and a half-day field trip. Conference session topics included low impact development (LID) approaches, urban stormwater and agricultural best management practices, stream buffers, urban stream restoration, and public information and education. The field tour visited the restoration-in-progress of an oxbow and adjacent floodplain reconnected to the Rouge River, restoration of the previously PCB-contaminated Newburgh Lake, and the tour highlight – the Ford Motor Company Rouge River Plant green roof. The roof, located on top of the Dearborn Truck Plant where the new F150 will be produced, is 10.4 acres in size, making it the largest green roof in the world. The company claims it lowers temperatures inside the truck plant by 10 degrees, absorbs up to 4 million gallons of rainwater per year, and improves air quality by converting CO_2 to 0_2. The green roof is a *Zerofloor* design, developed in Germany, and contains several layers — the perennial ground cover sedum, a soil layer, fleece, a drainage layer, and a waterproof layer. Native and migratory birds are frequent visitors to the roof. As Ford Motor Company has recently committed to environmentally sustainable operations, other recent water quality features at the Rouge River Plant include phytoremediation, wetland restoration, and green space for stormwater management and wildlife corridors. The Plant is also the future site of the largest pervious pavement in the world.

Thanks to Ralph Resnick with the Nonpoint Source Unit, Water Division, MI Dept. of Environmental Quality, for chairing the conference planning committee and for organizing such an informative and enjoyable workshop. Thanks also to Tammy Taylor with Conservation Technology Information Center (CTIC), workshop sponsors, hosts, and the rest of the planning committee. Next year's workshop will take place in Ocean City, Maryland, on September 26-30, 2004. Stay tuned for the Call for Papers announcement, which will be in the February issue of *NWQEP NOTES* and also on our website: **http://www.ncsu.edu/waterquality**

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Section 319 NMP project personnel at the Ford Motor Company Rouge River Plant restored wetland, Dearborn, Michigan.

Information

NCSU Water Quality Group Adds Staff

Kris Bass

The NCSU Water Quality Group welcomes Kris Bass! Kris joined the Group in June 2003 as an Extension Associate after working in consulting for the past three years. In his current position, Kris provides engineering and design support for stream and wetland restoration, stormwater, and other water quality projects. Kris received his B.S. and M.S. degrees in Biological & Agricultural Engineering (M.S. with minor in soil science) at North Carolina State University (NCSU) in 1997 and 2000, respectively.

Mike Burchell

Mike joined the NCSU Water Quality Group as an Extension Assistant Professor in May 2003. His research includes wetland restoration, constructed wetlands for water/stormwater treatment, stream restoration, and riparian buffers. Mike received his Ph.D. in 2003 from NCSU Biological and Agricultural Engineering department, where he studied subsurface drainage and constructed wetland design techniques to reduce nitrogen losses from agricultural fields. From 1993-1996, Mike worked with the U.S. Army Corps of Engineers – Engineering Research and Development Center (formally the Waterways Experiment Station) in the Environmental Engineering Laboratory. While there, he completed a M.S. degree in Civil/Environmental Engineering at the University of Mississippi. Mike received his B.S. in Biological Sciences in 1992 also from NCSU. Welcome Mike!

NWQEP NOTES On-Line

Subscribe to the new email list service for the NCSU Water Quality Group newsletter, *NQWEP NOTES.* This email list service is open to water quality professionals from government agencies, consulting firms, citizen groups, and academic institutions with interest in nonpoint source pollution control programs, projects, and technology development. If you currently receive a hardcopy of the newsletter and would like to switch to reading an electronic version, you may subscribe to the list service to receive an email announcing that the next issue of *NWQEP NOTES* is available to view on the web.

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Contact Cathy Smith at **cathy_scache@ncsu.edu** if more information is needed.

Office of Water Surveys State Nutrient Standards

EPA has announced the results of its survey of nutrient standards adopted by states, tribes and territories. Every state has narrative standards that protect the waters from conditions that might indicate nutrient problems, and some states have nutrient standards that specifically recognize eutrophication (a frequent result of nutrient overenrichment) as a problem. Numeric criteria for turbidity is the most common nutrient parameter, and the next most common is total phosphorus in lakes and rivers. You can download the complete document from the Internet at **www.epa.gov/waterscience/criteria/nutrient/statesummary.htm**.

New LID Materials Available

The LID Center, Inc. has recently completed two Assistance Agreements funded by USEPA Office of Wetlands, Oceans, and Watersheds Assessments and Watershed Protection Division.

The first is an interactive web tool of LID projects for grades K-12. It contains information and projects for students, teachers, and community groups. The second is a LID primer for transportation planners and engineers. It contains information on planning, design, construction, and maintenance issues. This program has been developed using the National Highway Institute training format.

The projects can be found at **www.lowimpactdevelopment.org** under the section EPA Assistance Agreements.

USDA Releases First Annual National Resources Inventory

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) releases results from its new annual National Resources Inventory (NRI). The NRI provides comprehensive and statistically reliable information on various natural resource conditions and trends on nonfederal lands. Results from the 2001 Annual NRI on cropland soil erosion show:

- Conservation efforts have reduced soil erosion substantially, from 3.1 billion tons per year in 1982 to 1.8 billion tons per year in 2001.
- Between 1982 and 2001, sheet and rill erosion (the removal of layers of soil from the land surface by the action of rainfall and runoff) dropped from 4.0 tons per acre per year to 2.7 tons per acre per year. Wind erosion dropped from 3.3 tons per acre per year to 2.1 tons per acre per year during the same period.

Additional results and information on the 2001 Annual NRI are available on the Web at: **www.nrcs.usda.gov/news**. Information on previous NRIs is available at: **www.nrcs.usda.gov/technical/NRI**.

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Meetings

Call For Papers

STORMWATER: Emerging Issues for Local Communities, 2004 Southeast Regional Conference: April 19-21, 2004, Raleigh, North Carolina. The conference objective is to provide opportunities for local governments and watershed organizations to learn about new programs and technologies addressing stormwater quality. The focus will be on sharing ideas for implementing successful local programs to meet requirements of EPA's NPDES Phase II Stormwater Program. The event will include preconference workshops on Stormwater BMPs, Low Impact Development, Educational Programs, and Monitoring.

Categories of interest include:

- Stormwater Pollutants and Impacts
- Stormwater Regulations
- Financing Local Stormwater Programs
- Urban Stream Assessment
- Stormwater Management
- Structural Treatment Practices
- Illicit Discharge Detection and Removal
- Good Housekeeping
- Construction BMPs
- Educating Homeowners
- Educating Officials
- Involving the Public
- Other

Website: **www.soil.ncsu.edu/swetc/stormwaterconf/main.htm**. Contact Dr. Bill Hunt at bill_hunt@ncsu.edu. **Abstracts due January 8, 2004**.

Production of NWQEP NOTES is funded through U.S. Environmental Protection Agency (EPA) Grant No. X825012. Project Officer: Tom Davenport, Office of Wetlands, Oceans, and Watersheds, EPA. 77 W. Jackson St., Chicago, IL 60604. Website: http://www.epa.gov/OWOW/NPS

Soil and Water Conservation Society 2004 Annual Conference: July 24-28, 2004, St. Paul, MN. Abstracts due December 12, 2003. Contact Nancy Herselius, SWCS meetings coordinator. Tel: 515-289-2331, ext. 17; Email: nancy.herselius@swcs.org;Website:www.swcs.org/t_what_callforpapers04.htm.

7th International Conference on Precision Agriculture and Other Precision Resources Management: July 25-28, 2004, Minneapolis, MN. Abstracts due December 14, 2003. Website http://www.precision.agri.umn.edu/Conference/.

StormCon 2004, the North American Surface Water Quality Conference & Exposition: July 26-29, 2004, Palm Desert, CA. Abstracts due December 12, 2003. Website: www.StormCon.com.

Meeting Announcements — 2004

February

International Erosion Control Association 35th Annual Conference & Expo: February 16-20, 2004, Philadelphia, PA. Contact IECA at Tel: 970-879-3010; Email: ecinfo@ieca.org; Website: www.ieca.org

March

National Agricultural Environmental Management Systems Forum: March 3-4, 2004, Arlington, VA. Tel: 608-265-2772; Website: http://www.uwex.edu/AgEMS/

Erosion and Sediment Control Solutions for the Southeast: IECA Southeast Chapter Conference: March 17-19, 2004, Charlotte, NC. Contact Kathryn Murray at 919-515-7154. Web site: http://www.soil.ncsu.edu/swetc/ieca/main.htm

May

4th National Monitoring Conference: Building and Sustaining Successful Monitoring Programs: May 17-20, 2004, Chattanooga, TN. Contact the conference coordinator at nwqmc2004@tetratech-ffx.com or 410-356-8993. Web site: www.nwqmc.org

September

Second National Conference on Coastal and Estuarine Habitat Restoration: September 12-15, 2004, Seattle, WA. Contact Nicole Maylett at nmaylett@estuaries.org; Web site: http://www.estuaries.org/2ndnationalconference.php

12th National Nonpoint Source Monitoring Workshop: September 26-30, 2004, Ocean City, MD. Contact Tammy Taylor at 765-494-1814 or taylor@ctic.purdue.edu

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