

## Final Progress Report

1. **Organization Title:** Science Approach
2. **Project Title:** Channel Mappers: Geographic Information Systems (GIS) Materials, Professional Development, and Follow-Up Support for Implementing Meaningful Watershed Experiences in the Channel Islands Region
3. **Award Number:** NA06NOS4290202
4. **Report Period:** 1 September 2006 – 31 August 2007

### 5. Introduction:

The Center for Image Processing in Education (CIPE), in partnership with the Ventura County Superintendent of Schools Office (VCSSO), Channel Islands National Marine Sanctuary (CINMS), and the Marine Science Institute of the University of California, Santa Barbara (MSI-UCSB), proposed to promote geospatial analysis of CINMS and the Santa Barbara Channel watershed as a way of engaging students in grades 9-12 in meaningful watershed experiences. The project was to address the “Professional Development in the Area of Environmental Education Teachers” area of interest for the B-WET initiative by providing instructional materials, professional development, software, and follow-up support to a cohort of 20 teachers in the Oxnard, California region. The goal of the project was to simplify use of GIS as an instructional tool for teachers and build on existing materials and instructional approaches that have been developed during successful collaborations between CIPE and CINMS. The project planned to equip teachers with ready-to-use classroom lessons that make a direct connection to the greater marine environment of the Channel Islands region, integrate with conventional teaching practice, and provide templates for engaging students in meaningful watershed experiences.

### 6. Purpose:

The *Channel Mappers* project proposed to accomplish the following objectives:

1. Augment two lessons from the *Mapping an Ocean Sanctuary* materials co-developed by CIPE and CINMS so that they model the characteristics of meaningful watershed experiences.
  - A. Update the “Exploring a Sanctuary” lesson from *Mapping an Ocean Sanctuary* so that it makes direct connections to current ecological conditions at CINMS and involves students in problem-based learning about recent issues of concern to sanctuary managers.
  - B. Provide a template for teachers and students to engage in sustained research about the Channel Island region by integrating support for the Long Term Monitoring and Experiential Training for Students (LiMPETS) protocols of the National Marine Sanctuaries program into the “Environmental Monitoring” lesson from *Mapping an Ocean Sanctuary*.
  - C. Help teachers integrate project activities into their curriculum by aligning the adapted *Mapping an Ocean Sanctuary* lessons with the Ocean Literacy Essential Principles and Fundamental Concepts and specific California content standards for English, mathematics, history, social science, and science education.
  - D. Promote implementation of the adapted *Mapping an Ocean Sanctuary* materials by converting them for use with the My World GIS software of the GEODE Initiative at Northwestern University.
2. Implement the adapted materials at a workshop for teachers in grades 9-12 in the Oxnard, California, region and structure the workshop so that participating teachers:
  - A. are provided with an understanding of what a meaningful watershed experience is and why this type of pedagogy is important;

- B. learn a combination of computer-based and field activities that can be used to bring the Channel Islands region alive in the minds of students;
  - C. understand how to integrate pedagogical strategies and classroom activities introduced at the workshop into their instructional program;
  - D. have a template for implementing project strategies as sustained activities in their classrooms; and
  - E. develop skills to promote students' understanding of the environment and encourage them to work to improve environmental conditions in the Channel Islands region.
3. Provide follow-up support for participating teachers and an opportunity for the participants to share their implementation experiences with one another, project staff, project advisors, CINMS staff, and local communities.
  4. Evaluate the impact of the project on the workshop participants and the usefulness of the materials for their teaching practice.
  5. Revise and publish the materials for dissemination locally and sustained distribution to a national audience.

## **7. Approach:**

The project was directed by Steven Moore, Ph.D., CIPE's Executive Director. Dr. Moore also served as an editor for the lessons in development and developed the survey instruments to be used in the project evaluation. Catharine Reznicek, Technology Specialist with the Ventura County of Education office, and Laura Francis, Education Coordinator with CINMS, advised the project and helped with project coordination and teacher recruitment. Allison Whitmer, Ph.D., former Education Coordinator for MSI-UCSB and now an assistant dean at Georgetown University, also advised the project. Kris Rees, CIPE's Director of Business Operations, and Sandy Stoll, Business Operations Associate, provided logistics and publications support. David Smith, Educational Designer & Watershed Dynamics Project Lead, *The GLOBE Program*, adapted lessons for use with the My World GIS software and integrated support for PASCO monitoring probes into a lesson entitled "Environmental Monitoring." Natalie Senyk, Scientific Advisor with CINMS, edited instructional materials produced by the project and helped teach a workshop. Sam Jenkins, an instructional developer and workshop instructor with CIPE, helped edit lessons and teach a workshop. Wynne Brown, CIPE's Director of Publications, completed editing of the lessons in development and prepared them for publication and distribution.

## **8. Results:**

During the relevant project period, *Channel Mappers* completed conversion of two *Mapping an Ocean Sanctuary (MOS)* lessons to the My World GIS platform, developed an evaluation approach and survey instruments for the project, advertised a weekend workshop for teachers, recruited participants, supported use and testing of the *MOS* lessons at two additional workshops, and prepared the lessons for publication and dissemination. Detailed descriptions of the results of these activities are provided next, organized according to the project objectives:

1. Augment two lessons from the *MOS* materials co-developed by CIPE and CINMS so that they model the characteristics of meaningful watershed experiences.

A. Update the "Storm Water Pollution" lesson from *MOS* to work with My World.

CIPE completed conversion of "Storm Water Pollution" to My World in January, 2007. Adaptation of the lesson included changing the lesson instructions to work with My World, creating new screen shots (photographs of the software windows) for the instructional materials, deleting materials irrelevant to the new software platform, converting the ArcView projects and GIS data to work with My World, and creating new lesson materials to take advantage of My

World's data processing and graphing functionality. New sections were added that include a quantitative comparison of turbidity and chlorophyll levels in the channel and instructions for creating a map to communicate the results of a students' work. During February – August, 2007, final editing and page layout was conducted to prepare the lesson for publication.

- B. Provide a template for teachers and students to engage in sustained research about the Channel Island region by integrating support for the Long Term Monitoring and Experiential Training for Students (LiMPETS) protocols of the National Marine Sanctuaries program into the “Environmental Monitoring” lesson from *MOS*.

Because continued funding for *Channel Mappers* was cancelled, the project abandoned its emphasis on integrating LiMPETS protocols into “Environmental Monitoring.” Integrating LiMPETS into “Environmental Monitoring” as described in the previous progress report required ongoing collaboration with the LiMPETS program during the summer and fall of 2007.

To provide a template that can be used in the region by B-WET programs and participating schools and teachers, CIPE teamed up with Cathy Reznicek, principal investigator of the Channel Islands Live project, to modify “Environmental Monitoring.” The modification supports collection of watershed data near teachers' schools and analysis of the data with My World. The conversion included: (1) updating the “surfer study” engagement portion of the lesson and converting it to work with My World; (2) updating the field data collection procedures to feature use of Xplorer GLX probes provided by PASCO Scientific Company; (3) conversion of the ArcView GIS project creation and analysis instructions to work with My World; and (4) alignment of the lesson with the Ocean Literacy Essential Principles and Fundamental Concepts and California content standards for English, mathematics, history, social science, and science education.

The updated and improved “Environmental Monitoring” lesson was tested at a Channel Mappers workshop conducted in June, 2007, and was used at two November 2007 workshops (see “2. Implement the adapted materials...” below).

- C. Help teachers integrate project activities into their curriculum by aligning the adapted *MOS* lessons with the Ocean Literacy Essential Principles and Fundamental Concepts and specific California content standards for English, mathematics, history, social science, and science education.

The “Storm Water Pollution” and “Environmental Monitoring” lessons were aligned with ocean literacy and California content standards. Because the purpose of “Environmental Monitoring” is to provide a template for teachers and students to conduct field investigations and analyze data on their own, science process standards were emphasized in its alignment. Standards alignments are provided in the teaching notes section of each lesson.

- D. Promote implementation of the adapted *MOS* materials by converting them for use with the My World GIS software of the GEODE Initiative at Northwestern University.

Conversion of two *MOS* lessons has been accomplished by CIPE. A third lesson—“Invisible Boundaries”—will be converted and published by CIPE's derivative organization, Science Approach, in early 2008. An installer format has been created that will simplify use of the *Channel Mappers* lesson data by teachers and students. A template CD-ROM has been designed that has PDF-formatted versions of the lessons, all data and projects needed for the lessons, and the My World GIS software for Mac and Windows.

2. Implement the adapted materials at a workshop for teachers in grades 9-12 in the Oxnard, California, region.

A *Channel Mappers* workshop was conducted on the weekend of June 2 – 3, 2007. The workshop was taught by Sam Jenkins (CIPE), Natalie Senyk (NOAA), Laura Francis (NOAA),

and Michelle Kissinger (University of California, Santa Barbara). Recruitment for the workshop focused on the Oxnard–Ventura region. Recruitment emails were sent to relevant Listservs and to all of the high school science departments in the region. Cathy Reznicek created and distributed a paper flyer for distribution to teachers and personally discussed the workshop with science department heads and faculty. She also set up an online registration site for the event. Eight educators registered for the event and five attended. Three of the participating educators were from the region; the other two were from the Los Angeles area.

During the workshop, teachers:

- worked through the “Environmental Monitoring” and “Storm Water Pollution lessons,
- learned about what GIS and global positioning systems (GPSs) are,
- were provided with an overview of the Channel Islands National Marine Sanctuary and the educational programs it offers,
- were led through a GIS activity on mapping shipwrecks in the Channel Islands region,
- received instruction about NOAA’s LiMPETS research protocols,
- implemented the LiMPETS protocols at Silver Strand beach in Oxnard, California,
- entered data collected from the site into My World GIS, and
- conducted a basic analysis of the data.

Teachers attending the workshop received the workshop materials and a full license for the recently released 4.1 version of My World.

Two additional workshops using the “Storm Water Pollution” and “Environmental Monitoring” lessons were conducted by Catharine Reznicek and David Smith during the fall of 2007: (1) The “Investigating California Coastal Watersheds Teacher Professional Development Workshop” was sponsored by the Ventura County Office of Education as part of its *Channel Islands Live B-WET* project. Conducted during 2-3 November 2007, the workshop was designed to (a) provide resources that participating teachers can use to make the connection between watershed conditions on the mainland and ecosystem quality in the Santa Barbara Channel, (b) help schools use GIS and PASCO Scientific’s Xplorer GLX probes to document and monitor watershed conditions in their home communities, and (c) develop action plans to improve watershed conditions. (2) The “Investigating Vietnam Marine Protected Areas Using My World GIS” workshop was sponsored by NOAA as part of its Marine Protected Area Management (MPA) Capacity Building Training Program. Held during November 12-16, 2007, at the Conference Hall of Nui Chua National Park, Phan Rang, Ninh Thuan, Vietnam, the workshop taught MPA practitioners, managers and educational specialists how to use My World GIS software to facilitate ecosystem management decision-making and communication within an MPA managing organization and with the public.

3. Provide follow-up support for participating teachers and an opportunity for the participants to share their implementation experiences with one another, project staff, project advisors, CINMS staff, and local communities.

The *Channel Mappers* project has offered continued technical and implementation support to teachers who participated in the June workshop. This support will be continued by Science Approach as part of its normal teacher support services.

4. Evaluate the impact of the project on the workshop participants and the usefulness of the materials for their teaching practice.

Evaluation of the *Channel Mappers* project is discussed under “9. Evaluation,” below.

5. Revise and publish the materials for dissemination locally and sustained distribution to a national audience.

The *Channel Mappers* lessons have been prepared according to the standards used by CIPE for its published products. The lessons are currently being finalized for publication and will be disseminated from the Science Approach Web site free of charge beginning in February, 2008.

## **9. Evaluation**

Eight formative and summative questions guided the project evaluation. These questions addressed usability issues; relevance to teachers; usefulness in supporting authentic watershed experiences for students; teachers' understanding of ocean literacy concepts; teachers' understanding of relevant science, mathematics, geography content; comfort with the software used by the project; knowledge about meaningful watershed experiences and confidence about conducting such experiences with students; and confidence about promoting students' understanding of the environment and encouraging them to take action.

*Channel Mappers* conducted evaluation activities at a project workshop, implemented an online follow-up survey, and sought expert feedback about the activities it had generated. The project found that it had succeeded in preparing lessons that were valuable to teachers and supportive of authentic watershed experiences in the Channel Islands region. The project was also successful in helping small groups of teachers get started using geographic information systems (GIS) and global positioning systems (GPS) as tools for learning about the Santa Barbara Channel, developing ocean literacy, and conducting field research. Unfortunately, small numbers of respondents in the project evaluation led to an inability to address statistical significance in the analysis.

## **10. Changes/Problems Encountered**

The largest problem faced by *Channel Mappers* was that it did not recruit 20 teachers to participate in the project. The originally scheduled February 2007 workshop—which had twelve registrants—was cancelled because many local teachers withdrew at the last moment. The June 2007 workshop received eight registrations and five participants. Dr. Moore considered scheduling an additional project workshop in the summer, but decided not to do so because of limited travel funds. Instead, he redirected the project staff's efforts toward (1) converting an additional *MOS* lesson ("Invisible Boundaries") and (2) providing customized instructional materials for the November *Channel Islands Live* and NOAA workshops (the customized materials included support for Pasco Xplorer GLX probes in "Environmental Monitoring").

Two additional problems facing the *Channel Mappers* project were (1) the distance from Tucson to the performance site in the Oxnard region and (2) the project's emphasis on lesson conversion, which limited the time and resources available for professional development activities. The project attempted to overcome the first problem by hiring a staff member in the region (Natalie Senyk) and enlisting the aide of Ms. Reznicek. Although these collaborators greatly bolstered the local presence of the project, it would have been beneficial if CIPE staff could have interacted frequently with local teachers in their schools.

## **11. How to improve the project**

The most effective way to improve the project would have been to target a smaller number of teachers, provide stipends for participation in project events, and provide face-to-face training and support throughout an entire school year. These strategies were not possible with the available funding. Fortunately, CIPE's derivative organization—Science Approach—will implement this approach in the Channel Islands region during the 2009-2010 school year. The company was recently awarded a National Science Foundation (NSF) grant to involve grade 6-12 teachers and students in GIS-based explorations of coastal research conducted by NSF's long-term ecological research (LTER) network. The Santa Barbara Coastal LTER site is one of the collaborating organizations.