

# NOAA California B-WET Program

---

## Watershed Action Program 2006-07 Evaluation Report

Project Title: Watershed Action Program  
Report Period: August 1, 2006 – July 31, 2007

### **Executive Summary**

#### **Introduction**

This evaluation of the Watershed Action Program (WAP) was conducted to assist the “X” staff and program partners with determining the impact and effectiveness of their in-depth watershed program on teacher and student participants, and to a lesser degree students’ families. The evaluation also serves as an invaluable tool in informing future programming and future program evaluation. Forty elementary school teachers and over 1,200 students participated in the WAP Program during the 2006-07 school year. Twelve of these programs (12 teachers and 360 students) were funded by the NOAA B-WET Program. This executive summary focuses on highlights and conclusions of the results from the evaluation process. A full report follows the summary.

The objectives of the Watershed Action Program for students are:

- Teach young students about their local watershed, how it is connected to the San Francisco Bay, the Pacific Ocean and two National Marine Sanctuaries.
- Teach students how their own actions affect these water bodies and the organisms that live in them.
- Provide opportunities for students to connect with a natural watershed habitat by taking them into the field to conduct investigations and explore a creek, bay, or ocean environment.
- Engage students in hands-on science learning experiences both in their classrooms and in the field—experience they will not otherwise receive.
- Engage students in service-learning “action projects” designed to teach students how they can become watershed stewards and environmental leaders/teachers in their communities.
- Improve the health of Alameda County watersheds, San Francisco Bay, and coastal marine habitats by inspiring students and their families to adopt responsible stewardship behaviors.

The objectives of the Watershed Action Program for teachers are:

- Provide in-class modeling, training, curriculum resources and support so that they are capable of and confident in including quality environmental science lessons in their classrooms.

- Provide opportunities for teachers to become comfortable teaching environmental science lessons in the field.
- Provide an opportunity to earn four to eight units of academic credit through our partnership with California State University East Bay.

To gather the data needed to assess whether these objectives were met, “X” administered a pre- and post-program survey and a written evaluation form to all teacher participants. Twenty-five of the forty teachers completed both surveys, and the results are included in this report. Eleven of the twelve teachers in programs funded by NOAA B-WET completed written evaluation forms; only the data from these eleven teachers are included in this evaluation report. Two-hundred students completed pre- and post-program surveys; these students were in classes that were at the fourth grade level and had relatively low numbers of English Language Learners. Results from these surveys are included in this report.

### **Results: Highlights and Conclusions**

Overall, results indicate that the goals of the Watershed Action Program and those of the B-WET program (the funder) were achieved. The WAP Program provided meaningful watershed experiences for elementary school students, and also provided professional development to classroom teachers in environmental education.

Students showed an overall increase in knowledge of the program content through results from the pre- and post-program surveys. The individual question results reveal that students did learn about their local watershed and its connection to the larger bay and ocean watersheds. Although students were able to identify the three local National Marine Sanctuaries due to participation in the program, the survey itself did not effectively measure if students understood specifically how the sanctuaries are connected to their local watersheds. It is however implied that students understand this concept because they showed knowledge about the connections between their local watershed and creek, the bay, and the ocean.

Both the student surveys and the teacher written evaluation forms show student comprehension of how their actions affect the local watershed environment and the animals and plants that share this environment. Many teachers commented that their students are more aware of how their actions can impact the environment. Teachers went on to report that their students have demonstrated a noticeable increase in environmentally-friendly attitudes and behaviors.

Although teachers were forthcoming about how the program has inspired responsible stewardship behaviors in their students, they felt less able to comment on whether the program has influenced students’ families. Some teachers felt that, because they do not regularly interact with their students’ families, they could not properly assess the impact the program has had on students’ home environments.

Many teachers also said that the field trip and the classroom workshops provided their students with new experiences and opportunities to engage in positive hands-on science

learning experiences. Teachers went on to say that the program provided experiences their students would otherwise not have been able to participate in. A contributing factor seemed to be that the program content and delivery was appropriate for the age and grade-level of the students.

Teacher survey and written evaluation form results indicate that the program provided professional development opportunities and the resources needed for teachers to feel comfortable teaching environmental science concepts and continuing the WAP Program on their own the following school year. Our direct in-class training model and the program equipment kit proved to be most effective in preparing teachers to teach the program themselves.

Although the majority of teachers felt more comfortable leading an outdoor environmental field trip after participating in the program, the percentage of teachers that felt the same or felt less comfortable after program participation is noteworthy. "X" will investigate further into *why* teachers may feel less comfortable leading an outdoor field trip after participating in one, so we can improve this component of the program and increase teachers' confidence levels in this area. Many teachers did express that the outdoor field trip was a valuable and important learning experience, which verifies teachers' interest and desire in offering these outdoor learning experiences for their students.

Every teacher felt prepared to teach the program to future classes of students after participating in the first year of the program, with most teachers feeling prepared to a considerable or great extent.

Given the results from the gathered evaluation data, "X" concludes that program objectives were largely met and that we should continue to provide the program to elementary school teachers and students. The evaluation process also enlightened us on ways to improve the evaluation tools themselves in order to acquire relevant and useful evaluation data.

# Watershed Action Program 2006-07

## Evaluation Report

### Project Overview

#### **Project Summary**

The Watershed Action Program provides 1) meaningful watershed experiences for elementary school students and 2) professional development in the area of environmental education for elementary school teachers. Our specific objectives are as follows:

Student Objectives: Provide meaningful watershed education for 360 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> grade students from low-income urban schools in Alameda County. The program will:

- Teach young students about their local watershed, how it is connected to the San Francisco Bay, the Pacific Ocean and two National Marine Sanctuaries.
- Teach students how their own actions affect these water bodies and the organisms that live in them.
- Provide opportunities for students to connect with a natural watershed habitat by taking them into the field to conduct investigations and explore a creek, bay, or ocean environment.
- Engage students in hands-on science learning experiences both in their classrooms and in the field—experience they will not otherwise receive.
- Engage students in service-learning “action projects” designed to teach students how they can become watershed stewards and environmental leaders/teachers in their communities.
- Improve the health of Alameda County watersheds, San Francisco Bay, and coastal marine habitats by inspiring students and their families to adopt responsible stewardship behaviors.

Teacher Objectives: Provide professional development opportunities in the area of environmental education for 12 Alameda County elementary school teachers. The program will:

- Provide in-class modeling, training, curriculum resources and support so that they are capable of and confident in including quality environmental science lessons in their classrooms.
- Provide opportunities for teachers to become comfortable teaching environmental science lessons in the field.
- Provide an opportunity to earn four to eight units of academic credit through our partnership with California State University East Bay.

#### **Program Description**

The Watershed Action Program includes five two-hour workshops at the school site and a full day field trip to a local creek, bay or delta habitat. In addition each class selects a watershed action project, which the students plan, develop and implement with guidance from their teacher and support and resources from “X”.

Teachers learn the programs alongside their students, attend planning and evaluation meetings with “X” instructors and teach preparation and follow up activities from the Curriculum Guide. Each team of teachers receives an equipment kit to continue teaching the program. “X” follows up with teachers in the year after their training to provide additional support and to evaluate success as the teacher teaches the program to her students.

A detailed description of the Watershed Action Program content and activities is located in Appendix A.

### **Evaluation Goals**

“X’s” program evaluation process is both summative and formative. The evaluation data collected from both teacher and student participants during the 2006-07 school year enables us to assess 1) the impact of the program on students and teachers, and 2) the effectiveness of the program content and delivery and how we can improve our teaching methods and curricula for future programming. An added benefit to the evaluation process is being able to assess the effectiveness of the evaluation tools themselves in gathering the desired data from program participants. Information on the types of responses we received, the quality of the responses, and the amount of data we collected from each evaluation tool we administered in 2006-07 will allow us to improve the tools themselves as well as the overall evaluation plan.

Specifically, the Watershed Action Program (WAP) evaluation process seeks to inform us of the following:

#### **Program Effectiveness and Improvement**

- Are we reaching our stated program goals and objectives for teacher and student participants?
- How can we improve the Watershed Action Program based on the feedback collected from teachers and the results of the evaluation process?

#### **Student Participants**

- What was the students’ overall experience of the program?
- Was there any increase in student knowledge due to participation in the program?
- Were there any changes in students’ attitudes, abilities, or behaviors due to participation in the program?
- What was the impact of the program on students’ families? In particular, have students’ families become more aware of local environmental issues and/or engaged in environmentally responsible behaviors as a result of the program?

#### **Teacher Participants**

- What was the teachers’ overall experience of the program?
- What suggestions do they have to improve the program content and delivery?

- Were there any increases in teachers' comfort level and perceived ability in:
  - teaching environmental science concepts
  - using the local environment as a learning resource
  - facilitating an environmental action project with their students
  - leading an outdoor environmental fieldtrip with their students?
- Do teachers feel prepared to teach the program next year?
- How useful were the various program components (in-class training, curriculum guide, equipment kit) in providing teachers with what they need to teach the program?

## Methods

Quantitative and qualitative evaluation tools were administered to teacher and student participants between September 2006 and June 2007. The Watershed Action Program (intervention) consisted of five in-class workshops, an environmental action project, and a field trip to a creek, bay, or ocean site. Forty 3-5<sup>th</sup> grade classroom teachers and over 1,200 students participated in the WAP during the 06-07 school year. Twelve of these programs were funded by NOAA and had a special focus on the Marine Sanctuaries. Some evaluation data was collected from a sample of the entire participant group, while other data was collected specifically from those participants in the Marine Sanctuaries WAP. The methodology behind each evaluation tool varies and is described separately for each tool below.

### Student Pre- and Post- Program Surveys:

A sample of students completed a pre-survey (Appendix E) before the first classroom workshop, and completed an identical survey within one month of the completion of the classroom workshops. Out of the forty Watershed Action Programs, we selected classes that were at the fourth grade level and that had the lowest number of English Language Learners in order to create a more uniform pool of students. Then we randomly selected classes of students from this pool to complete the surveys.

The educational objectives for each classroom workshop were used as the basis for developing each question on the survey. The surveys were designed to show whether the lesson objectives were met and whether there were any changes in students' knowledge as a result of participating in the WAP. The surveys contained a variety of different question-and-answer styles and techniques (i.e. multiple choice, fill-in-the-blank, pictograms) that are appropriate and suitable for the age of the student participants (9-11 year olds). A variety of questioning strategies were used. Some questions simply checked for knowledge while others required critical thinking strategies and/or more depth of knowledge.

Two-hundred students completed the pre- and post-program surveys. Each classroom teacher administered the surveys using a script (Appendix G and H) to introduce and facilitate the survey process. Students used identification numbers instead of their names

to identify themselves on their surveys. The anonymity of the surveys helped students to understand that this was not a “test” that would be included in their school grades.

Within our smaller pool of student participants (fourth grade level and low number of E.S.L. students), we also selected classes who were participating in the Marine Sanctuaries WAP to complete one additional survey question (Appendix F) that focused on the marine sanctuaries. Seventy students completed the additional marine sanctuaries question.

#### Teacher Pre- and Post-Program Surveys:

Each teacher participant (40 total, including 12 in the Marine Sanctuaries WAP) completed a short pre-program survey (Appendix B) in September-October 2006, before the program started. They then completed a longer post-program survey (Appendix D) that contained the same questions as the pre-program survey, plus additional questions. This survey was administered at the completion of all program activities (including the field trip and action project). The pre-post survey questions contained standard likert-scale response options and asked teachers their comfort level in various areas such as leading an environmental field trip with their students and teaching environmental science concepts. The additional questions included in the post-survey asked how the resources we provided and the program structure enabled them to teach the program themselves. Results for the pre- and post-program surveys reflect the data collected from any of the 40 teacher participants who completed and turned in both surveys. Twenty-five teachers completed both surveys, and two additional teachers completed just the post-survey with additional questions.

#### Teacher Written Evaluation Forms:

Each teacher participant completed written evaluation forms (Appendix C and D) that asked open-ended questions about their overall impressions of the program, program highlights, suggestions for program improvement, and how the program has impacted them, their students, and the school community. Teachers completed one written evaluation form at the completion of the classroom workshops, and completed another at the close of all program activities. The open-ended questions allowed teachers to be insightful in their responses and also allowed them to be detailed in their answers. Only the results from the twelve Marine Sanctuaries WAP teacher participants are included in this report.

## **Data Analysis**

#### Student Pre- and Post Program Surveys:

Each question on the survey was given a specific point score (weight) and the total point score for the survey equaled 100. Some questions were given a higher weight than others based on what we felt was important for the students to know and understand. In other words, we prioritized the concepts and information we wanted students to know and assigned weight to each survey question accordingly. If we felt it was important for the

students to know a certain concept, the correlating question was given a higher weight than other questions on the survey.

Each class who completed the surveys was given a class code to identify them. We then compiled the pre-program and post-program surveys for each student using their identification numbers and discarded any surveys that did not have both a pre- and a post. Each pair of surveys was then given a new identification code. This code was recorded on both the surveys and the excel spreadsheet. The pre-surveys were graded and the results for each question were recorded in an excel spreadsheet. We also calculated the total point score for each survey and put this in a separate column. The post-surveys were graded and the results were entered into a separate excel spreadsheet.

Using the software program XLSTAT, we compared the pre-survey results to the post-survey results using a paired t-test. The survey results were compared to see if there was a significant increase in students' knowledge due to participation in the Watershed Action Program.

#### Teacher Pre- and Post-Program Surveys:

The pre-survey and post-survey responses from each teacher were put into a table and compared to see what, if any, changes occurred as a result of the intervention. The changes in responses were put into a separate table and then compiled into three percentage statements (i.e. increase, no change, or decrease) for each survey question. These are shown in the Results section. Results are shown for all WAP teacher participants that completed and turned in both pre- and post-program surveys. Twenty-five teachers completed both surveys, and two additional teachers completed just the post-survey with additional questions. The responses to the questions that were asked only in the post-program survey were compiled and displayed in a separate table.

#### Teacher Written Evaluation Forms:

The qualitative data we received from teachers' written evaluation forms was coded and quantified. We reviewed the fifteen questions posed on the evaluation forms and selected a few key questions to formally analyze. We then read and re-read all of the responses to each of the selected questions, eventually drawing out common themes and categories that emerged from the responses. As the responses were repeatedly reviewed, we merged some categories and created sub-categories where needed. Once we completed the list of categories, we assigned code words to identify each category. The responses to each question were then coded and put into a table. As responses were put into the table, we took note of how often each type of response was made. The results for the written evaluation forms are displayed using this information.

## Results

### Student Pre- and Post-Program Survey Results

#### **Whole Test Results**

*Results Summary: Paired t-test results from 200 fourth grade students determined that there was a statistically significant increase in knowledge after experiencing the Watershed Action Program intervention ( $t_{199} = 19.51, p < 0.0001$ ). The total possible score for the entire test was 100 and the mean score increase between pre- and post-tests was 23.52 points.*

<b>Pre-Test Mean Score</b>	<b>Post-Test Mean Score</b>	<b>Mean Score Increase</b>
53.48	77.00	23.52

*Results Summary: Paired t-test results from 70 fourth grade students who completed the additional marine sanctuaries question determined that there was a statistically significant increase in knowledge after participating in the Marine Sanctuaries Watershed Action Program intervention ( $t_{69} = 11.17, p < 0.0001$ ). The total possible score was 100 and the mean score increase between the pre- and post-tests was 46.96 points.*

<b>Pre-Test Mean Score</b>	<b>Post-Test Mean Score</b>	<b>Mean Score Increase</b>
28.67	75.63	46.96

#### **Individual Question Results**

Questions 1 and 2 asked students to name their local creek watershed and identify things that are a part of their watershed.

*Results Summary: Results show a significant increase in knowledge about watersheds.*

<b>Question</b>	<b>Total Possible Score</b>	<b>Paired t-test Results</b>	<b>Mean Score Increase</b>
1	4	$t(199) = 16.77, p < 0.0001$	2.42
2	3.5	$t(199) = 11.86, p < 0.0001$	0.83

Questions 5 and 11 checked students' knowledge about the storm drain system. Question 5 checked to see if students knew that storm drains connect to a local body of water. Question 11 asked students to identify, from a list of general actions, which actions could cause storm drain pollution.

*Results Summary: Results show a significant increase in knowledge about the storm drain system and potential pollutants.*

<b>Question</b>	<b>Total Possible Score</b>	<b>Paired t-test Results</b>	<b>Mean Score Increase</b>
5	12	$t(199) = 8.58, p < 0.0001$	3.74
11	9	$t(199) = 7.26, p < 0.0001$	1.44

Question 10 checked to see if students knew how pollution in the San Francisco Bay can harm human health through catching and eating fish from the bay.

*Results Summary: Results show a significant increase in knowledge about how Bay pollution can harm humans through the food chain.*

Question	Total Possible Score	Paired t-test Results	Mean Score Increase
10	2.5	t(199) = 6.63, p<0.0001	0.72

Questions 14 through 17 asked students to identify and label various locations on a map of the San Francisco Bay Watershed.

*Results Summary: Results show a significant increase in knowledge of San Francisco Bay geography.*

Question	Total Possible Score	Paired t-test Results	Mean Score Increase
14	2	t(199) = 8.21, p<0.0001	0.63
15	12	t(199) = 5.37, p<0.0001	2.46
16	11.5	t(199) = 2.66, p<0.004	1.04
17	2	t(199) = 4.92, p<0.0001	0.45

### **Teacher Pre- and Post-Program Survey Results**

**Question 1: To what extent do you feel comfortable using the local watershed environment as a learning resource? N = 25**

*Results Summary: The majority of teachers felt more comfortable using the local watershed environment as a learning resource after participating in the WAP Program. A considerable amount of teachers did not change their level of comfort in using the local watershed environment as a learning resource.*

8% of teachers felt less comfortable after participating in the WAP Program.

36% felt the same, no change, after participating in the WAP Program.

**56%** teachers felt more comfortable after participating in the WAP Program.

**Question 2: To what extent do you feel comfortable teaching environmental science concepts? N = 25**

*Results Summary: The majority of teachers felt more comfortable teaching environmental science concepts after participating in the WAP Program. A considerable amount of teachers did not change their level of comfort teaching environmental science concepts.*

16% of teachers felt less comfortable after participating in the WAP Program.

32% felt the same, no change, after participating in the WAP Program.

**52%** teachers felt more comfortable after participating in the WAP Program.

**Question 3: To what extent do you feel comfortable leading an outdoor environmental field trip with your class? N = 25**

*Results Summary: The majority of teachers felt more comfortable leading an outdoor environmental field trip with their class after participating in the WAP Program. A*

*considerable amount of teachers did not change their level of comfort in leading an outdoor environmental field trip, and a notable amount of teachers felt less comfortable leading an outdoor environmental field trip after participating in the WAP Program .*

24% of teachers felt less comfortable after participating in the WAP Program.  
 36% felt the same, no change, after participating in the WAP Program.  
**40%** teachers felt more comfortable after participating in the WAP Program.

**Question 4: To what extent do you feel comfortable facilitating an environmental action project with your class? N = 25**

*Results Summary: The majority of teachers felt more comfortable facilitating an environmental action project with their class after participating in the WAP Program. A considerable amount of teachers felt less comfortable facilitating an environmental action project.*

40% of teachers felt less comfortable after participating in the WAP Program.  
 16% felt the same, no change, after participating in the WAP Program.  
**44%** teachers felt more comfortable after participating in the WAP Program.

**Questions 5 – 8: Post-Program Questions**

*Results Summary: All classroom teachers feel prepared to teach the WAP Program themselves after participating in the program, with the majority of teachers feeling prepared ‘to a considerable extent’. All teachers felt that the resources we provided them enabled them to teach the program themselves, with the ‘in-class modeling’ and the ‘equipment kit’ having the highest ratings. A few teachers did not respond to question 8 because they had not received the equipment kit at that time and therefore did not know how to respond.*

N = 27	To No Extent	To a Slight Extent	To a Moderate Extent	To a Considerable Extent	To a Great Extent	No Answer
5) To what extent do you feel prepared to teach the Watershed Action Program to your class next year?			8 29.5%	<b>11</b> <b>41%</b>	8 29.5%	
6) To what extent do you feel the curriculum guide we provide enables you to teach the program?			3 11%	<b>14</b> <b>52%</b>	10 37%	
7) To what extent do you feel the in-class modeling we provide enables you to teach the program?			2 7%	10 37%	<b>15</b> <b>56%</b>	
8) To what extent do you feel the equipment kit, provided next fall, enables you to teach the program?			2 7%	7 26%	<b>14</b> <b>52%</b>	4 15%

## Teacher Written Evaluation Form Results

### **Question 1: Please give your overall impressions of the classroom workshops.**

**N = 11**

*Results Summary: The majority of teachers expressed overall satisfaction, enjoyment, and appreciation of the WAP Program. Many teachers commented on how the program had a beneficial impact on their students. Many teachers also wrote positive comments about the classroom workshop content. There were no negative comments in this section.*

#### Categories (Code Words)

1. Good Workshop Content (Content)
  - A. Direct correlation to standards, grade-level appropriate (Standards)
  - B. Fun, educational, relevant (Enjoyment)
  - C. Good balance of hands-on, writing, reading, doing, and learning (Balance)
2. Satisfaction with “X” Instructors (Instructors)
3. Good Curriculum (Curriculum)
  - D. Teacher/student supplemental materials were beneficial, continued flow to lessons (SuppMaterials)
  - E. Workshops were well-planned, well-organized (Well-planned)
4. Overall Appreciation (Overall)
  - F. Thankful to have participated, thankful for opportunity (Opportunity)
5. Impact on Students (StudImpact)
  - G. Raised awareness, interest in students about local geography, effects of pollution on environment (Awareness)
  - H. Increase in knowledge for students, will help community for years (Knowledge)
  - I. Solid beginning to science learning (Science Learning)
  - J. W-shops supported student learning (StudLearning)
    - i. Review of material covered (Review)
5. Hands-on activities kept students focused, interested (Hands-on)

#### **Good Workshop Content (Content)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
Standards	2	“I liked the content and how it correlated directly to 4 <sup>th</sup> grade standards.”
Standards	6	“The workshop contents were appropriate to third grade.”
Standards	9	“The (activities) are also directly connected to Grade 3 Standards.”
Enjoyment	5	“I thought the workshops were informative and interesting.”
Enjoyment	9	“The activities were fun, educational, and very relevant.”
Balance	7	“It...has a great balance of hands-on, writing, reading, doing, and learning.”

**Satisfaction with “X” Instructors (Instructors)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
Instructors	6	“Adrian was well-organized and presented the workshops effectively.”
Instructors	8	“The “X” Instructors are good with the kids, organized, and very well informed.”

**Overall Appreciation (Overall)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
Overall	6	“I thought the lessons were excellent.”
Overall	2	“The program, in all aspects, was very satisfying.”
Overall	3	“Very good!”
Overall	9	“The program was great!”
Opportunity	9	“I am definitely glad that my students and I participated.”
Opportunity	10	“I have enjoyed being a part of the “X” program very much. My class has been fortunate to take part in the learning provided by Ms. Cervantes and the program.”
Opportunity	11	“Overall, an excellent opportunity for me and my students.”
Well-Planned	1	“The classroom workshops were well-planned.”
Well-planned	4	“Well-organized and planned.”
Well-planned	7	“It is well organized, well-thought out...”
Well-planned	11	“Well planned out, all materials prepared ahead of time.”

**Impact on Students (StudImpact)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
StudLearning, Review, & Hands-on	1	“Each day began with a review of the previous material covered and included at least one hands-on activity. This model really supports students and helps them learn and remember the material.”
Hands-on	1	“The active hands-on portions help keep the students focused and interested.”
Hands-on	5	“I really appreciated the hands-on components.”
Science Learning	7	“The program has been a solid beginning to science learning in my class.”
Awareness	7	“The program has raised awareness and interest in my students about the Bay Area and the effects of pollution on the environment.”
Knowledge	10	“(My students) have gained knowledge that will aid them, and their community, for many years to come.”

**Good Curriculum (Curriculum)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
------------------	-------------------	--

Curriculum & SuppMaterials	4	“Great lessons and follow-up activities.”
SuppMaterials	2	“The homework and pre-teaching was beneficial for me to continue the flow of the lessons taught by Sayo.”
SuppMaterials	8	“The pre-organized materials are excellent. The in-class materials and the Handbook for the teachers are very informative and easy to use.”

**Question 2: Please describe one or two highlights from the classroom workshops.**

**N = 11**

*Results Summary: By far the majority of teachers mentioned the hands-on activities as the highlight of the classroom workshops. A few hands-on activities were cited specifically, with the San Francisco Bay-Delta Watershed Model receiving the highest number of comments. Many teachers also mentioned that the Neighborhood Pollution Survey and Clean-up was a highlight.*

Categories (Code Words)

1. Hands-on Activities (Hands-on)
  - A. SF Bay-Delta Watershed Models (Models)
  - B. Fish and Crab Investigations (Fish-Crab)
  - C. Neighborhood Pollution Survey and Clean-Up (Clean-Up)
    - i. Clean-Up May Inspire Attitude/Behavior Change (Change)
  - D. Food Chain Game (Game)
  - E. Bay Geography Map Study (Map)
  - F. Hands-on Activities Supported Learning, Reinforced Concepts (HandsSupport)
2. Visual Aids and Hand-Outs Are Good Teaching Tools (Materials)
3. Continual Reference to Concepts to Reinforce Learning (Reference)
4. Connection Between Pollution and Effects on Wildlife (Connection)
5. Strong Vocabulary Building (Vocab)
6. Overall Enjoyment (Enjoy)
7. “X” Supplied Everything Needed for Each Lesson (Supplies)
8. Relevance to Students’ Communities/Experiences (Relevance)
9. Provided New Opportunities for Students (Opportunities)

**Hands-on Activities (Hands-on)**

Code Word	Teacher ID	Responses from teacher participants
HandsSupport	1	“Not only did the class thoroughly enjoy the (bay model) project, but in building their models their ideas about the geography of the area improved and actually watching the salt and fresh water mix cemented the concept in a way just talking about it could not.”
HandsSupport & Game	1	“After the food chain activity, Greta was able to tell us that the red beans were the polluted ones...so obviously the lesson was very successful!”

Hands-on	1	"I think the best part of this program is how the hands-on activities support the concepts involved."
Hands-on	10	"(My students) really enjoyed the hands-on learning opportunities that Ms. Cervantes provided for them."
Hands-on	9	"I also really liked how hands-on most of the activities were."
Hands-on & Clean-Up	7	"My students definitely responded well to the hands-on investigations and the walking field trip."
Hands-on, Models, & Fish-Crab	4	"The hands-on activities were great- especially the observations of the sea creatures and the model of the bay area with clay."
Models	1	"The bay models on the first day."
Models	2	"Also the bucket with the estuary/ocean."
Models	6	"Highlights: building the bay with clay."
Models	11	"The creating the Bay Area in a plastic tub and mixing fresh water with salt water, the first lesson."
Model & Clean-Up	8	"The 'Bay Model' and the Trash/Recycle pick-up were fun and successful."
Change & Clean-Up	1	"Picking up the trash at school sparked conversations about over-packaging, laziness, and concern for the environment in a way that makes me think they will act on the issues."
Clean-Up	3	"Kids clean up and creek restoration."
Clean-Up	5	"I liked going outside to clean up and look for pollution in different forms, such as spilled oil."
Map	3	"Finding local places on map."
Fish-Crab	2	"Of course the striped bass and Dungeness crab activity."
Fish-Crab	6	"Highlights: viewing and handling of the crabs and fish."

#### **Good Visual Aids and Hand-Outs (Materials)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
Materials	2	"The posters were terrific! The small ones which highlighted EJL and the large ones. It showed me what a great teaching tool it is."

#### **Continual Reference to Concepts to Reinforce Learning (Reference)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
Reference	5	"I liked that there was constant referring to the bay and its surroundings, so hopefully the kids internalized a working knowledge of this watershed."

#### **Connection Between Pollution and Effects on Wildlife (Connection)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
Connection	7	"They enjoy learning about ocean animals and made the connection between pollution and the harmful effects this has on wildlife."

### Strong Vocabulary Building (Vocab)

Code Word	Teacher ID	Responses from teacher participants
Vocab	7	“The vocabulary building is also very strong.”

### Overall Enjoyment (Enjoy)

Code Word	Teacher ID	Responses from teacher participants
Enjoy	8	“All of the in-class lessons were great!”
Enjoy	10	“My students lit up each time they saw “X” on our daily schedule.”

### “X” Supplied Everything Needed for Each Lesson (Supplies)

Code Word	Teacher ID	Responses from teacher participants
Supplies	9	“I really appreciated the fact that “X” pretty much supplied everything that was needed for every lesson.”

### Relevance to Students’ Communities/Experiences (Relevance)

Code Word	Teacher ID	Responses from teacher participants
Relevance	9	“I also really liked how (the hands-on activities) were directly connected to the children’s own communities and experiences.”

### Provided New Opportunities for Students (Opportunities)

Code Word	Teacher ID	Responses from teacher participants
Opportunities	10	“Some of the students would have never seen, let alone touched, a bass or crab if it hadn’t been for this program.”

### Question 3: Please suggest any improvements to the Watershed Action Program classroom workshop component. N = 11

*Results Summary: Five of the eleven teachers had no suggestions to improve the classroom workshops of the Watershed Action Program. The majority of the remaining comments focused on supplementing the program with additional classroom workshops, more hands-on activities, and language arts activities to reinforce the hands-on activities.*

#### Categories (Code Words)

1. No Improvements Needed (NoImprove)
2. Include Supplemental Activities (Supplemental)
  - A. Longer program with more lessons (Extend)
  - B. Include more reading and writing (LangArts)
  - C. More hands-on activities (MoreHands)
3. Too Much Repetition of Concepts (Repetition)
4. Break Up/Limit Lectures (Lectures)
5. EJ Piece Not Connected to Program Purpose (EJ)

**No Improvement Needed (NoImprove)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
NoImprove	1	“The classroom workshops are excellent as they are.”
NoImprove	6	“None”
NoImprove	8	“It’s really excellent as it stands.”
NoImprove	9	“I honestly can’t think of a way to improve this wonderful program.”
NoImprove	11	“There are no improvements that I can suggest...Overall it was great!”

**Include Supplemental Activities (Supplemental)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
LangArts	2	“I spoke with Sayo about the possibility of more reading related to the activities and then summary writing- more for synthesis of the information. Often with my hands-on activities the students miss the deeper meaning without embedded vocabulary in a text.”
MoreHands	7	“Because my students were SO engaged with the more active components of the program, I would recommend that even more ‘active/hands-on’ type activities were included/introduced.”
MoreHands	8	“Perhaps another ‘hands-on’. The Bay Model and animal investigations were very popular. Maybe a model of the creek and its path?”
Extend	10	“I can say it ended too quickly...(Ms. Cervantes) should have the opportunity to take the learning and the lessons even further...I think the program would benefit from further extensions of the lessons taught.”

**Too Much Repetition of Concepts (Repetition)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
Repetition	3	“A little too much repetition of concepts in classroom- kids knew some of material already.”

**Break Up/Limit Lectures (Lectures)**

<b>Code Word</b>	<b>Teacher ID</b>	<b>Responses from teacher participants</b>
Lectures	4	“Perhaps breaking up lectures with more ‘turn and talk’ time or pair-share.”
Lectures	10	“The time lecturing needs to be limited. The students mostly learn from hands-on project based experiences.”

**EJ Piece Not Connected to Program Purpose (EJ)**

Code Word	Teacher ID	Responses from teacher participants
EJ	5	"I felt the last lesson, in particular about poorer people living in more polluted areas went afield of the general purpose of saving the bay and marine sanctuaries. I agree with what was presented; I'm just not sure it was appropriate."

**Question 4: Please describe the overall experience of the field trip for you and your students. N = 7**

*Results Summary: All responses about the overall experience of the field trip were positive. Many teachers expressed that their students enjoyed the experience; a few teachers said that the field trip took their students to a place they had never been before. A few teachers also cited specific activities as highlights.*

Categories (Code Words)

1. Overall positive experience (Positive)
2. Field trip complemented classroom work (Compliment)
3. Clear expectations (Expectations)
4. Good mix of activities (Mix)
5. Well-paced (Well-paced)
6. Beautiful field trip site (Beauty)
7. New experience for students (StudExperience)
8. Student enjoyment, interest (StudEnjoy)
9. Opportunity for students (Opportunity)
10. New experience for teacher (TeachExperience)
11. Parent chaperones had a good experience (Parents)
12. Specific activities and/or use of equipment were highlights (Activities)
  - A. Creek investigations (Creek)
  - B. Use of microscopes (Micro)
  - C. Use of binoculars (Bino)
  - D. Ocean animal/plant investigations (Ocean)

Code Word	Teacher ID	Responses from 7 teacher participants
Positive	3	"It was excellent!"
Positive	5	"The field trip was great."
Positive & Mix	2	"The field trip was an excellent mix of fun and study."
Positive & Well-paced	4	"It was a really good field trip- well paced and monitored."
StudExperience	6	"For many of my students it was their first trip to see the ocean."
StudExperience	5	"For many of my students it was their first time going to the beach."
StudExperience	4	"And although most students had been to the area before- they had tools and different approaches to the environment."
StudEnjoy	6	"My students thoroughly enjoyed the field trip."
StudEnjoy	7	"Students enjoyed the overall observation of the creek habitat."

StudEnjoy & Beauty	5	“(Muir Beach) was beautiful. We were blessed with great weather and we all had a great time.”
Opportunity	6	“The chance to be outside and explore was wonderful and memorable.”
Opportunity & Compliment	5	“I was really glad that students had this opportunity to get out and do some hands-on learning that complimented what we’ve been studying in class.”
TeachExperience	5	“It was my first time going to Muir Beach.”
Parents	4	“The parents were also very impressed and enthusiastic.”
Creek & Micro	1	“We studied the creek using a field guide and journal. The students also used microscopes to study aquatic invertebrates.”
Creek	3	“The creek exploration portion especially held the students’ interest and excitement.”
Micro	3	“The microscopes were also a hit.”
Ocean	6	“(The students) were also thrilled to see the animals at the beach: sea stars, black turban snails, and crabs as well as seeing seaweed.”

**Question 5: Describe one or two highlights from the fieldtrip. N = 8**

*Results Summary: Many teachers described their students’ enthusiasm for the field trip and activities as a highlight. Most teachers cited specific activities as the highlights of the field trip, with investigating creek or ocean organisms and using science equipment having the highest number of comments.*

Categories (Code Words)

1. Specific activities were highlights (Activities)
  - A. Field guides (Guides)
  - B. Leaf rubbings (Leaf)
  - C. Microscopes (Micro)
  - D. Creek Investigations (Creek)
  - E. Observing live organisms (LiveOrg)
  - F. Student reflections (Reflect)
  - G. Scavenger hunt (Hunt)
  - H. Binocular Investigations (Bino)
  - I. Playing with the ocean tide (Tide)
2. Increase in student knowledge, awareness (StudAware)
3. Student enthusiasm, enjoyment (StudEnthus)
4. Opportunity for students to be outside, explore (Opportunity)
5. Free exploration time (Free)
6. Balance of free time and structured activities (Balance)
7. Conducting activities gave purpose, focus (Purpose)

Code Word	Teacher ID	Responses from 8 teacher participants
StudEnthus	2	“The students were very enthusiastic about what they were seeing.”
StudEnthus &	5	“Students were very excited about getting to see so many marine

LiveOrg		organisms in their natural habitat such as mussels, clams, starfish, and the different types of seaweed.”
StudEnthus & Tide	5	“Students also got a kick out of experiencing the tide coming in, even though a few of them got a little wet.”
StudEnthus & Bino	8	“Another highlight was using the binoculars to look for birds. Although there weren’t many birds the joy of seeing the ocean far out, the clouds, the far off rocks, filled the students with a closeness for their world.”
StudAware	8	“The impact was powerful! Seeing all of the tidepool life made the students aware of the adaptations each organism used to survive in their environment.”
Creek	3	“Creek exploration was really great. The students got very ‘hands-on’ and were really trying to ‘out-do’ each other in their findings.”
Creek	7	“Observations of creek life.”
Micro & Creek	1	“The microscope and studying aquatic invertebrates.”
Micro & Bino	4	“Definitely- the use of the microscopes and binoculars with the bird field guides.”
LiveOrg	2	“I think the students’ favorite parts of the field trip were seeing the hatching spiders and the banana slugs!”
LiveOrg & Purpose	6	“Another highlight was being able to see live sea stars, crabs, and black turban snails. Having a ‘job’ to do documenting the snails gave that activity purpose and focus.”
Leaf & Guide	1	“The leaf rubbing and using a field guide.”
Hunt	3	“The scavenger hunt was also interesting to (my students).”
Reflect	7	“The student reflections.”
Free	6	“I thought it was great to provide ‘free’ exploration time. Many of my students mentioned they like being able to look around the beach.”
Balance	5	“I thought there was a nice balance of free exploration and structured activities and documentation.”
Opportunity	2	“I often forget how many kids don’t get a chance to spend much time must outside, in a park, exploring and investigating what they find.”

**Question 6: Please suggest any improvements to the fieldtrip component of the Watershed Action Program. N = 8**

*Results Summary: Many teachers had no suggestions to improve the field trip, and some teachers used this space to reiterate positive comments. Two teachers mentioned the timing of the day as a challenge, while others mentioned a variety of suggestions to improve the field trip.*

Categories (Code Words)

1. No improvements (NoImprove)
2. Weather was unfavorable (Weather)
3. Positive comments about the field trip (Positive)
4. Conduct field trip before the Action Project (BeforeAP)
5. Gather terrestrial insects (Insects)

6. Timing was an issue (Timing)
7. More play, free time for kids to explore, have fun (Free)
8. Missing field trip materials (Materials)

Code Word	Teacher ID	Responses from 8 teacher participants
Positive	2	"I think that the field trip was very well planned."
Positive	1	"It was a great field trip."
Positive	5	"But what we were able to do was great."
NoImprove	7	"None."
NoImprove	4	"None."
Timing	6	"Timing was tricky as we tried to fit in snacks, bathroom trips, activities, and lunch."
Timing	5	"Timing also proved to be tricky and it seemed that we were only able to actually do a small portion of what was planned. Part of this, of course, had to do with the bathroom breaks as well as snacks and time for lunch."
Materials	5	"I remember it being a bit of a bummer that we were missing some materials needed for the group activities (such as binoculars, I believe)."
Free	8	"Playtime. I'm not sure how to say this and it doesn't necessarily need to come from you but the kids wanted to get wet, throw stones, and goof around. How can this be done with a mindfulness to the context of environmental education?"
Insects	3	"Gather insects?"
Before AP	2	"I would, however, suggest that the field trip come before the Action Project, if possible. I think that experiencing the creek in Codornices Park before working on the rehabilitation would make the overall lesson even more powerful."
Weather	1	"Our day was incredibly cold with heavy fog, can you improve the weather?"

**Question 7: How has the Watershed Action Program helped you as a classroom teacher? N = 7**

*Results Summary: Two teachers commented that they learned new information through the program. Two teachers also mentioned that the program was well-planned and organized. The remaining feedback reflected a variety of ways that WAP Program has helped teachers.*

**Categories (Code Words)**

1. Teacher learning due to program (Learn)
  - A. Increase in classroom teachers' knowledge of program content (TeachKnow)
  - B. Learned teaching strategies through modeling of lessons (TeachStrategy)
  - C. In-class, hands-on training for teacher (Training)

2. Increase in teacher’s confidence to teach science (Confidence)
3. Program will have a long-term impact on students (Long-term)
4. Program is well-planned, organized (Well-planned)
5. Program has strong and varied science components (Science)
6. Teacher was able to extend program into other activities, subject areas (Extend)
7. “X” Instructors brought fresh, dedicated energy (Instructors)
8. Program brought resources otherwise not available to teachers (Resources)
  - D. Provided opportunity to provide environmental activities (Opportunity)
  - E. Environmental awareness content to continue in classroom (Awareness)
  - F. Support to continue program (Support)

Code Word	Teacher ID	Responses from 7 teacher participants
TeachKnow	4	“It has given me more information to share with my students.”
TeachKnow & TeachStrategy	5	“I learned a lot, not only in regards to content but also in terms of the most effective ways to teach the material and present the lessons.”
Well-planned	4	“The lessons that are provided are well constructed.”
Well-planned & Science	6	“The Watershed Action Program is thoroughly planned, well thought out, and contains many strong components for teaching science content.”
Opportunity	1	“It has provided me with the opportunity to provide environmental activities.”
Awareness	7	“Given me ideas of environmental awareness programs to initiate and maintain.”
Training, Long-Term, & Science	6	“Seeing it and experiencing it has helped me to see how important each of these parts are to creating a successful unit. The inclusion of science vocabulary lists, hands-on activities, a field trip, and an action component all make for a strong unit of study that will stick with my students.”
Resources	2	“The Watershed Action Program brought in resources that are not readily available to me.”
Instructors	2	“(The program) also brought in fresh and dedicated energy. Students respond well to guest teachers.”
Extend	3	“I have drawn from the information on the ecosystems of the watershed numerous vocabulary, art, and reflective-writing lessons.”
Confidence	5	“I feel more confident about teaching science next year.”
Support	1	“It gives me the knowledge and support to carry on the program.”

**Question 8: Please share the impact the Watershed Action Program has had on your students. Have you noticed a change in attitude or behavior in your students as a result of the program? N = 8**

*Results Summary: Most teachers commented that the WAP Program has directly impacted their students. Six teachers said that their students’ awareness of the*

*environment and environmental issues has increased. Many teachers also cited positive attitude and behavior changes in their students due to participation in the program.*

Categories (Code Words)

1. Increase in student awareness, knowledge (Aware)
2. Change in student behavior (Behavior)
3. Change in student attitude (Attitude)
4. Too early to know lasting impacts on students (Lasting?)
  - A. Students need reminders to continue helping environment (Reminders)

Code Word	Teacher ID	Responses from 8 teacher participants
Aware	5	“Their awareness about environmental issues, especially in regards to watersheds, has undoubtedly increased.”
Aware	6	“Certainly they are much more aware of the impact pollution has on the environment.”
Aware	6	“In general, my students have much more knowledge and awareness of their own impact on the ocean and bay.”
Aware	2	“They do, however, seem to be more aware of environmental issues. In addition, the general topic (keeping the environment healthy) seems to come up more in classroom discussions.”
Aware	1	“The noticeable impact on the students has been that they are more familiar with their surroundings.”
Aware & Behavior	8	“One impact I noticed was the awareness of trash in or near the stormdrains. They would pick up trash or be careful of their own on every field trip. They stopped one guy who was washing his car on the street and told him that water drains to the Bay!”
Aware & Behavior	8	“Their awareness of trash, where it goes, pollutants, and diversity of life in the Bay and how it could be affected has made them often come up to me and share stories of things they had done to help the Bay. We also went to the Oakland Museum and they saw the ‘Mermaid’ and said, ‘Our watershed!’”
Aware & Attitude	4	“They are more knowledgeable and they feel more empowered.”
Attitude & Reminders	7	“Yes, students want to help the environment- they need reminders to keep it up.”
Attitude	3	“I have had good journal responses in their reflective-writing on being ‘conservationalists’.”
Attitude	6	“They have a new interest in the ocean and feel connected to it and the animals that live there.”
Attitude & Behavior	5	“I observed a clear change in my students’ attitude and behavior.”
Behavior	3	“I have noticed them picking up after lunch and reminding each other to ‘use the recycle bin’.”
Behavior	6	“Surrounded by streets that are filled with litter, they know not to add to this trash and to remind others not to litter as well.”

Lasting?	2	“It’s too soon to tell how much lasting influence this program will have on my students.”
----------	---	---

**Question 9: How has the program impacted your students’ families and/or the school community? N = 7**

*Two teachers said the field trip was a way to engage students’ families in the program. Two teachers commented that it was difficult for them to know how the program has impacted students’ families. The remaining comments were varied, but reflected ways that the program has extended to include the students’ families.*

Categories (Code Words)

1. Field trip was a great way to share learning with families (FieldTrip)
2. Difficult for teacher to know this (Difficult)
3. Students have shared what they have learned with school community (School)
4. Action project involved families (ActionProject)
5. Take-home activities brought program content to families (TakeHome)
6. Program served to augment environmental activities at the school (Augment)

Code Word	Teacher ID	Responses from 7 teacher participants
FieldTrip	6	“The field trip was a great day to share our learning with families. This is definitely true for those families that joined us for the day as well as for families who may have heard about the experience at home.”
FieldTrip	7	“Some University Village families showed us their garden plot as an extension of the trip.”
Difficult	2	“I’m not sure how to assess this.”
Difficult	5	“This question is much harder to answer since I don’t necessarily interact with these people on daily basis.”
Augment	2	“Because (the school community) already has these ideas and values, this program served as a reminder and background for us.”
ActionProject	4	“Yes- because our action project was about personal actions for families.”
TakeHome	3	“The information brought home to families about the actual watershed and its ecosystem is valuable for everyone to know.”
School	5	“I can definitely say that my students have shared what they learned with various members of the school community and in various different ways.”

## **Discussion and Conclusions**

Overall, results indicate that the goals of the Watershed Action Program and those of the B-WET program (the funder) were achieved. The WAP Program provided meaningful watershed experiences for elementary school students, and also provided professional development to classroom teachers in environmental education.

The objectives for students participating in the WAP Program included:

- √ Teach young students about their local watershed, how it is connected to the San Francisco Bay, the Pacific Ocean and two National Marine Sanctuaries.
- √ Teach students how their own actions affect these water bodies and the organisms that live in them.
- √ Improve the health of Alameda County watersheds, San Francisco Bay, and coastal marine habitats by inspiring students and their families to adopt responsible stewardship behaviors.
- √ Provide opportunities for students to connect with a natural watershed habitat by taking them into the field to conduct investigations and explore a creek, bay, or ocean environment.
- √ Engage students in hands-on science learning experiences both in their classrooms and in the field—experience they will not otherwise receive.
- √ Engage students in service-learning “action projects” designed to teach students how they can become watershed stewards and environmental leaders/teachers in their communities.

Students showed an overall increase in knowledge of the program content through results from the pre- and post-program surveys. The individual question results reveal that students did learn about their local watershed and its connection to the larger bay and ocean watersheds. Although students were able to identify the three local National Marine Sanctuaries due to participation in the program, the results do not show if students know how the sanctuaries are connected to their local watersheds. The student survey could be improved to test for knowledge around where the marine sanctuaries are located and how their local creek watershed is connected to these sanctuaries. This is not to say that students are not aware of these concepts, but the evaluation tool could be improved so students can show knowledge in this area.

Both the student surveys and the teacher written evaluation forms show student comprehension of how their actions affect the local watershed environment and the animals and plants that share this environment. Students increased their awareness about the storm drain system and potential pollutants that can enter the system and affect the local creek, the bay, and the ocean. Many teachers commented that their students are more aware of how their actions can impact the environment. Teachers went on to report that their students have demonstrated a noticeable increase in environmentally-friendly attitudes and behaviors. These observations of positive changes in students’ awareness, attitudes, and behaviors are coming from teachers who are in close and constant contact with their students. This type of information about students is more valid coming from

teachers than from students self-reporting about any changes they have made due to participation in the program.

Although teachers were forthcoming about how the program has inspired responsible stewardship behaviors in their students, they felt less able to comment on whether the program has influenced students' families. Some teachers felt that, because they do not regularly interact with their students' families, they could not properly assess the impact the program has had on students' home environments. "X" could work to improve the evaluation process to better assess the impact the program has on students' families as well as whether the program influences families' behaviors towards the environment.

The program provided opportunities for students to connect with a natural watershed habitat through field trips to a creek, bay, or ocean site. In their written feedback, teachers acknowledged that the field trip impacted their students in many positive ways. Teachers cited a variety of hands-on activities as highlights of the field trip, and also expressed gratitude that their students were able to use scientific equipment to explore and investigate the habitat. While a few teachers wrote that the field trip contained a good mix of science investigations and free exploration, some teachers felt there needed to be more time devoted to allowing students a chance to play and explore on their own. "X" acknowledges that free exploration time is essential for children to discover nature on their own and feel connected to their surroundings.

Many teachers also said that the field trip and the classroom workshops provided their students with new experiences and opportunities to engage in positive hands-on science learning experiences. Teachers went on to say that the program provided experiences their students would otherwise not have been able to participate in. A contributing factor seemed to be that the program content and delivery was appropriate for the age and grade-level of the students.

The objectives for teachers participating in the WAP Program included:

- √ Provide in-class modeling, training, curriculum resources and support so that they are capable of and confident in including quality environmental science lessons in their classrooms.
- √ Provide opportunities for teachers to become comfortable teaching environmental science lessons in the field.
- √ Provide an opportunity to earn four to eight units of academic credit through our partnership with California State University East Bay.

Teacher survey and written evaluation form results indicate that the program provided professional development opportunities and the resources needed for teachers to feel comfortable teaching environmental science concepts and continuing the WAP Program on their own the following school year. Our direct in-class training model and the program equipment kit proved to be most effective in preparing teachers to teach the program themselves. A few teachers did not respond to the question about the equipment kit; this is most likely due to the fact that the teachers had not yet received the kit and

therefore felt unable to respond. The curriculum guide was also seen as a valuable resource for increasing teachers' confidence in teaching the program themselves. The survey did not include a question as to whether the support from "X" staff the following year increases teacher confidence and perceived ability. Every teacher felt prepared to teach the program to future classes of students after participating in the first year of the program, with most teachers feeling prepared to a considerable or great extent.

Although the majority of teachers felt more comfortable leading an outdoor environmental field trip after participating in the program, the percentage of teachers that felt the same or felt less comfortable after participation are noteworthy. The unfavorable results could be because, after participating in the field trip, teachers gained a better sense of the planning and resources needed to complete a hands-on field trip in a natural environment. This is, of course, just one hypothesis as to the reasons behind the low increase in comfort level in leading an outdoor field trip. The real reasons can be revealed through questioning teachers further through the program evaluation process.

"X" also received valuable feedback from teachers through their answers to the question, "How has the Watershed Action Program helped you as a classroom teacher?" We learned that the program has provided teachers with knowledge, resources, and opportunities that they otherwise would not have received. The answers to this question reinforced the conclusions we have made as to the positive impact the program has had on teachers and their ability to teach hands-on environmental science.

### **Recommendations**

Although overall we received encouraging results as to the impact of the Watershed Action Program on teachers and students, we do have a few recommendations to improve the content and delivery so the program more effectively meets its goals and objectives. We also have some recommendations to improve the program evaluation process itself in order to strengthen the process and better assess whether we are achieving our objectives.

- Continue to provide hands-on, engaging environmental science lessons to elementary school students, both in the classroom and in the field. Continue to provide meaningful and relevant learning experiences, and opportunities for students to be engaged in learning about and caring for their local environment.
- Continue to provide classroom teachers with in-class training, resources such as a comprehensive curriculum guide and program equipment, and support so teachers feel comfortable and confident in teaching environmental science concepts and program activities/lessons.
- Work on ways to increase teachers' comfort level of leading an outdoor environmental field trip and facilitating an environmental action project with their students. This will involve getting feedback from teachers as to why some are *less* comfortable leading these activities after participating in the program. Therefore, we

recommend adding a piece to the program evaluation process that will allow us to gain insight into the reasons so we can effectively increase teachers' confidence and comfort levels.

- Work with teachers to improve the planning and timing of the field trips to the ocean at Muir Beach in Marin County. Use the written feedback from teachers for insight as to ways to improve the field trip component in these areas. Allow the teachers and students the opportunity to complete the planned activities and have a positive experience filled with a balance of hands-on learning and free exploration time.
- Evaluate and continue to improve the program evaluation process. Revise the stated program objectives to better fit the outcomes we seek to achieve. (Note: The student and teacher objectives have been revised recently to better reflect the impact we want the program to have on student and teacher participants.)

And, finally

- Evaluate and continue to improve the evaluation tools used to assess the impact of the program on teacher and student participants. The evaluation process is cyclical in nature, in that we are constantly moving along a cycle of assessment, program improvement, and evaluation improvement. Current recommendations to improve the evaluation tools include:
  - Student Pre-Post Program Surveys: Include a question that assesses whether students understand the connection of their local creek watersheds to the San Francisco Bay and the local National Marine Sanctuaries located in the Pacific Ocean.
  - Teacher Pre-Post Program Surveys: Ask teachers to list any potential barriers to conducting outdoor environmental field trips and facilitating action projects with their students.
  - Family Evaluation Tool: Include an evaluation tool and/or additional questions to existing tools to assess the impact of the program on students' families, and in particular any behavior changes due to their children's participation in the program.

## Appendices

### Program Content and Activities Description and Evaluation Instruments

## Appendix A. Watershed Action Program Content and Activities Description

The **Watershed Action Program** includes the following content and activities:

### **Classroom Workshop Descriptions**

#### Workshop One:

Students learn the concept of a watershed and how local bodies of water – local creeks, the San Francisco Bay and the Pacific Ocean - are interconnected and affect one another. Students learn the name of their local watershed and locate their school neighborhood within their watershed. They also learn about the three National Marine Sanctuaries (Cordell Bank, Gulf of the Farallones, and Monterey Bay) located near and connected to the San Francisco Bay. They study satellite maps and build clay models for a visual and hands-on experience in how an estuary is formed. Fresh and salt water are run through the model to see how these water bodies connect and mix in a real estuary. Students use scientific process skills to conduct an experiment to determine whether salt water is denser than fresh water.

#### Workshop Two:

Students learn that their neighborhood is connected to the creeks, the bay and ocean through the storm drain system. They learn various forms of stormwater pollution and how it affects organisms in the environment. Colorful posters demonstrate how debris and pollution from urban areas harms everything in the ecosystem, including marine life. The students perform a neighborhood survey to identify examples of stormwater pollution in their school neighborhood. They also perform a neighborhood clean up around the storm drains in the area. Finally, students take home a watershed pollution interview to engage and teach their family members about preventing pollution. Each student makes a pledge, together with a family member, to reduce stormwater pollution.

#### Workshop Three:

Students learn the difference between non-point and point source pollution. They also learn how pesticides can get into the groundwater and into the watershed ecosystem. They then take their knowledge of pollution and connect it with food chains. Through an outdoor game, the students learn that high amounts of pollution accumulates in top predators such as humans. This leads into discussion of safe bay food consumption and how to reduce intake of toxins in bay food. This is an important lesson on how human health is interconnected with a healthy watershed.

#### Workshop Four:

Students investigate organisms in bay watershed food chains and learn about some of the adaptations of algae, Dungeness crab and Striped Bass fish. Working in groups, students answer analytical questions about anatomy and physiology and make scientific diagrams of these organisms. In order to inspire environmentally friendly behavior changes that help protect the watershed, students learn about the very small percentage of freshwater in the world and discuss water conservation methods. Students also complete a take-home water conservation assignment.

## **Appendix A.**

### Workshop Five:

Students discuss the differences between a healthy and unhealthy watershed. They then discuss the health of their own watershed environment and what measures need to be taken to make it healthier. Students also read short biographies of environmental justice leaders in groups and each group shares their leader with the class. Learning about leaders in the environmental movement inspires students to think about their action project that they will complete as a class. As a mini action project students make informational posters to inspire others to make environmentally friendly behavior changes that help protect the watershed.

### Marine Sanctuaries Activities:

Classes participating in the Marine Sanctuaries WAP also complete special projects and activities focused around learning about the sanctuaries and their inhabitants. Emphasis is placed on protecting the marine sanctuaries through education and action.

### **Creek and Bay Field Trips**

The field trips give students and teachers a direct, hands-on experience in a natural watershed habitat. In addition to learning the science of the habitat, students make real connections with nature and develop further reasons to protect and care for their watershed. The Program Director meets the class at the field trip site and leads activities with students and models them for the teacher. Students use scientific equipment and field guides to investigate the many organisms that inhabit the creek, bay or delta habitat they are studying.

### **Local Watershed Action Projects**

Students have the opportunity to develop their leadership skills by completing an action project in their local watershed environment. Students select their own project, as a class, and take action to:

- teach schoolmates and family members about the local National Marine Sanctuaries through informational posters and presentations
- monitor water quality, assess creek health and share findings with local government officials
- interview local politicians about watershed environmental health and justice issues in their neighborhoods
- teach family members and peer students how to safely prepare and cook fish from the San Francisco Bay to reduce intake of toxins.

## Appendix B. Teacher Pre-Program Survey

### Watershed Action Pre-Program Survey

1. To what extent do you feel comfortable using the local watershed environment as a learning resource?

- \_\_\_\_\_ To no extent
- \_\_\_\_\_ To a slight extent
- \_\_\_\_\_ To a moderate extent
- \_\_\_\_\_ To a considerable extent
- \_\_\_\_\_ To a great extent

2. Last school year, how often did you use the local environment as a learning resource?

- \_\_\_\_\_ Not at all
- \_\_\_\_\_ Once or twice
- \_\_\_\_\_ Three to five times
- \_\_\_\_\_ More than five times
- \_\_\_\_\_ More than ten times

3. To what extent do you feel comfortable teaching environmental science concepts?

- \_\_\_\_\_ To no extent
- \_\_\_\_\_ To a slight extent
- \_\_\_\_\_ To a moderate extent
- \_\_\_\_\_ To a considerable extent
- \_\_\_\_\_ To a great extent

4. To what extent do you feel comfortable leading an outdoor environmental field trip with your class?

- \_\_\_\_\_ To no extent
- \_\_\_\_\_ To a slight extent
- \_\_\_\_\_ To a moderate extent
- \_\_\_\_\_ To a considerable extent
- \_\_\_\_\_ To a great extent

5. To what extent do you feel comfortable facilitating an environmental action project with your class?

- \_\_\_\_\_ To no extent
- \_\_\_\_\_ To a slight extent
- \_\_\_\_\_ To a moderate extent
- \_\_\_\_\_ To a considerable extent
- \_\_\_\_\_ To a great extent

**Appendix C. Teacher Classroom Workshop Evaluation Form**

**Watershed Action Program  
Classroom Workshop Evaluation**

**NAME:** \_\_\_\_\_ **SCHOOL:** \_\_\_\_\_

**DATE:** \_\_\_\_\_ **GRADE:** \_\_\_\_\_

**“X” PROGRAM COORDINATOR:** \_\_\_\_\_

**Classroom Workshop Evaluation**

**1. Please give your overall impressions of the classroom workshops.**

**2. Please describe one or two highlights from the classroom workshops.**

Continued on following page...

**Appendix C.**

**3. Please suggest any improvements to the Watershed Action Program classroom workshop component.**

**4. Please describe your overall experience working with your “X” Program Coordinator (communication, classroom management, student interactions, teaching style).**

**5. Any other comments?**

**Appendix D. Teacher AP, FT, Overall Evaluation Form and Post-Program Survey**

**Watershed Action Program  
Action Project, Fieldtrip, Overall Evaluation**

School: \_\_\_\_\_ Date: \_\_\_\_\_

Teacher's Name: \_\_\_\_\_ "X" Program Director: \_\_\_\_\_

Fieldtrip Site: \_\_\_\_\_

Action Project(s): \_\_\_\_\_

**Action Project Evaluation**

1. Please describe the overall experience of the action project for you and your students.
  
  
  
  
  
  
  
  
  
  
2. Do you feel that the class' action project was successful? Why or why not?
  
  
  
  
  
  
  
  
  
  
3. Please include any suggestions you might have to improve the action project component of the Watershed Action Program.

**Appendix D.**

**Fieldtrip Evaluation**

**1. Please describe the overall experience of the field trip for you and your students.**

**2. Describe one or two highlights from the fieldtrip.**

**3. Please suggest any improvements to the fieldtrip component of the Watershed Action Program.**

**Please recommend any teachers that might be interested in “X’s” programs.**

Name	School	Grade Level	Contact Info



\*\*\*Please complete the survey on the following page...

**Appendix D.**

**Watershed Action Program  
Post-Program Survey**

Teacher Name \_\_\_\_\_ School Name \_\_\_\_\_ Date \_\_\_\_\_

1. To what extent do you feel comfortable using the local watershed environment as a learning resource?

- \_\_\_\_\_ To no extent
- \_\_\_\_\_ To a slight extent
- \_\_\_\_\_ To a moderate extent
- \_\_\_\_\_ To a considerable extent
- \_\_\_\_\_ To a great extent

2. To what extent do you feel comfortable teaching environmental science concepts?

- \_\_\_\_\_ To no extent
- \_\_\_\_\_ To a slight extent
- \_\_\_\_\_ To a moderate extent
- \_\_\_\_\_ To a considerable extent
- \_\_\_\_\_ To a great extent

3. To what extent do you feel comfortable leading an outdoor environmental field trip with your class?

- \_\_\_\_\_ To no extent
- \_\_\_\_\_ To a slight extent
- \_\_\_\_\_ To a moderate extent
- \_\_\_\_\_ To a considerable extent
- \_\_\_\_\_ To a great extent

4. To what extent do you feel comfortable facilitating an environmental action project with your class?

- \_\_\_\_\_ To no extent
- \_\_\_\_\_ To a slight extent
- \_\_\_\_\_ To a moderate extent
- \_\_\_\_\_ To a considerable extent
- \_\_\_\_\_ To a great extent

5. To what extent do you feel prepared to teach the Watershed Action Program to your class next year?

- \_\_\_\_\_ To no extent
- \_\_\_\_\_ To a slight extent
- \_\_\_\_\_ To a moderate extent
- \_\_\_\_\_ To a considerable extent
- \_\_\_\_\_ To a great extent

## Appendix D.

6. To what extent do you feel the following resources we provide enable you to teach the program?

Curriculum Guide

\_\_\_\_\_ To no extent  
\_\_\_\_\_ To a slight extent  
\_\_\_\_\_ To a moderate extent  
\_\_\_\_\_ To a considerable extent  
\_\_\_\_\_ To a great extent

In-Class Modeling

\_\_\_\_\_ To no extent  
\_\_\_\_\_ To a slight extent  
\_\_\_\_\_ To a moderate extent  
\_\_\_\_\_ To a considerable extent  
\_\_\_\_\_ To a great extent

Equipment Kit (provided next fall)

\_\_\_\_\_ To no extent  
\_\_\_\_\_ To a slight extent  
\_\_\_\_\_ To a moderate extent  
\_\_\_\_\_ To a considerable extent  
\_\_\_\_\_ To a great extent

## Appendix E. Student Pre-Post Program Survey

### Watershed Action Program Pre-Program Survey

Student ID# \_\_\_\_\_ Date \_\_\_\_\_

Teacher's Name \_\_\_\_\_ School \_\_\_\_\_

1) What is the **name** of the **creek watershed** your school is in?

\_\_\_\_\_ Creek Watershed

2) **Circle** everything in this list that is part of your **creek watershed**:

airplanes	water	school playground
people	gardens	storm drains
trees	streets	kitchen sink

3) What **two types of water** are in the **San Francisco Bay** that make it an **estuary**?

\_\_\_\_\_ water \_\_\_\_\_ water

4) Where do these two types of **water** come from?

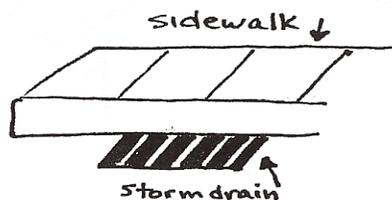
The \_\_\_\_\_ **water** comes from \_\_\_\_\_,

and the \_\_\_\_\_ **water** comes from \_\_\_\_\_.

5) The **storm drains** around your school **connect directly** to:

(check off only one answer)

- the Pacific Ocean
- the sewer
- the local creek
- the Atlantic Ocean



**Appendix E.**

Student ID# \_\_\_\_\_

Date \_\_\_\_\_

Teacher's Name \_\_\_\_\_

School \_\_\_\_\_

6) Put the following **plant** and **animals** together into a **food chain**:

mouse

grass

snake

Write the food chain here:

→

→

7) Write or draw **two** examples of **food chains** in the **San Francisco Bay**.

---

---

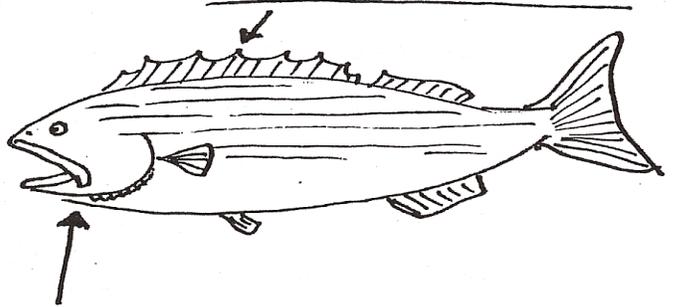
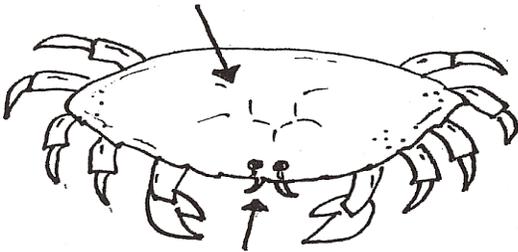
8) Use the **vocabulary words** to **label** the body parts of a **Striped Bass** and **Dungeness Crab**.

dorsal fin

carapace

gill

antennae



## Appendix E.

Student ID# \_\_\_\_\_

Date \_\_\_\_\_

Teacher's Name \_\_\_\_\_

School \_\_\_\_\_

9) What are **pesticides**?

(Check off only one answer)

- Chemicals that people use to kill "pests".
- Small animals that live in the Bay.
- Insects that eat people's gardens.
- A type of mineral.

10) How can **pollution** in the **San Francisco Bay** harm humans?

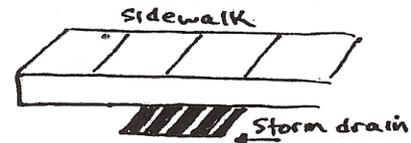
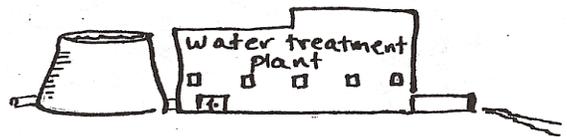
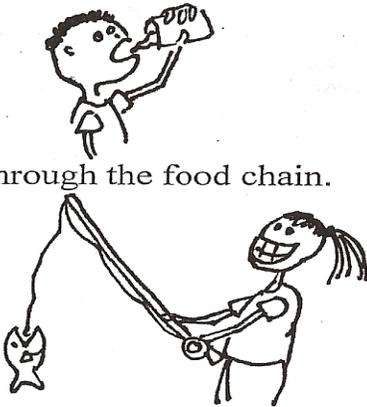
(Check off only one answer)

Through drinking water from the sink.

Through the sewer system.

Through the food chain.

Through the storm drain system.



11) Put a **check mark** next to **each** thing that can **cause storm drain pollution**.

- washing a car in the street with soap
- pouring motor oil in the street
- a car with smoke coming out of the tail pipe
- pouring paint in the kitchen sink
- throwing garbage on the street

## Appendix E.

Student ID# \_\_\_\_\_

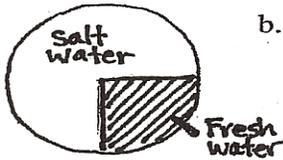
Date \_\_\_\_\_

Teacher's Name \_\_\_\_\_

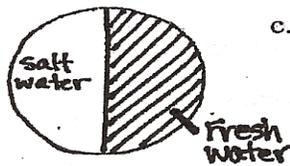
School \_\_\_\_\_

12) Put a **check mark** next to the pie chart that represents the **amount** of **fresh water** in the **world**. (Check off only one answer)

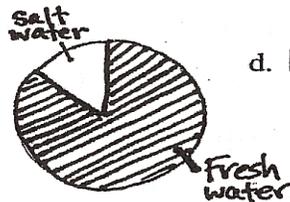
a.



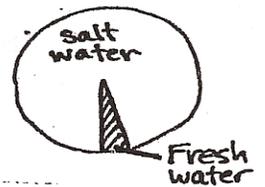
b.



c.



d.

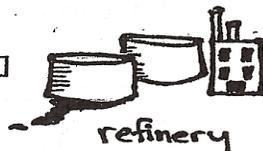


13) Put a **check mark** next to **each** picture below that is an example of **point source** pollution.

a.



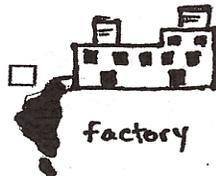
b.



c.



d.



**Appendix E.**

Student ID# \_\_\_\_\_

Date \_\_\_\_\_

Teacher's Name \_\_\_\_\_

School \_\_\_\_\_

Using the map below:

14) Put an X where your **school** is located

15) Label the **San Francisco Bay**

16) Label the **Pacific Ocean**

17) Label the **San Pablo Bay**



## Appendix F. Student Pre-Post Program Survey: Marine Sanctuaries Question

---

Student ID# \_\_\_\_\_ Date \_\_\_\_\_  
Teacher's Name \_\_\_\_\_ School \_\_\_\_\_

**1)** Put a **check mark** next to **each** of the names of our **local National Marine Sanctuaries.**

- Gulf of the Farallones
- Florida Keys
- Channel Islands
- Cordell Bank
- Monterey Bay
- Gray's Reef

## Appendix G. Teacher Directions for Student Pre-Program Survey

### Dear Teacher,

Thank you for helping us with our program evaluation by administering this survey to your class of students. Please read over the directions and carefully follow each direction when administering the survey to your class.

### Directions

#### Before the Survey:

Please assign your students an identification number. **Each student will need his/her own unique “Student ID #” and will need to use the same number for the pre- and post-program surveys.** If students already have a number in the class (i.e. from the class roster or from the school), then have students use this number for their Student ID # on the surveys.

#### When Administering the Survey:

- 1) **Say:** “Our class will be doing a science program with “X”. We will be learning about our local environment and what we can do to make it a cleaner and healthier place for everyone.”
- 2) **Say:** “Before the program starts, each of you will fill out some information on a survey.” (Show them the survey.) “This survey is like a test, but you won’t be graded on your answers. “X” is asking us to fill this out because they want to find out what students learn through their programs.”
- 3) **Say:** “I will pass out the survey, and we will complete part of it together. Do not start on the questions yet.”
- 4) **Pass out** the survey and with your students complete the following sections on the top of each page: student ID #, date, teacher’s name, and school.
- 5) **Say:** “I will read each question out loud, and give you time to complete your answer. I will repeat the question if you need me to.”
- 6) **Say:** “You might not know how to answer some of these questions. It is okay if you don’t know the answer to a question. Just do your best. If you don’t know an answer, make your best guess.”
- 7) **Read** each question out loud, and then give students time to write their answer. Repeat the question if they need it read out loud again. **Do not influence students’ answers at any point during the survey.**
- 8) When students are finished, make sure students have their names and other information filled out on each page, collect all of the surveys, and put them in the “X” envelope. Give the envelope to your “X” Program Director during the next lesson.

**Thank you again for helping us to improve our programs!**

If you have any more questions, please do not hesitate to contact your “X” Program Director.

## Appendix H. Teacher Directions for Student Post-Program Survey

### Dear Teacher,

Thank you for helping us with our program evaluation by administering this survey to your class of students. Please read over the directions and carefully follow each direction when administering the survey to your class.

### Directions

#### Before the Survey:

Your students will need to use the same unique identification numbers they used on their pre-program surveys. Please have these ID #'s ready so students can enter them onto their post-program surveys.

#### When Administering the Survey:

- 1) **Say:** "X wants to find out what you have learned through their program." (Show them the survey.) "This survey is the same one you completed before the program started. The survey is like a test, but you won't be graded on your answers. "X" is asking us to fill this out because they want to find out what you've learned."
- 2) **Say:** "I will pass out the survey, and we will complete part of it together. Do not start on the questions yet."
- 3) **Pass out** the survey and with your students complete the following sections on the top of each page: student ID #, date, teacher's name, and school.
- 4) **Say:** "I will read each question out loud, and give you time to complete your answer. I will repeat the question if you need me to."
- 5) **Say:** "You might not know how to answer some of these questions. It is okay if you don't know the answer to a question. Just do your best. If you don't know an answer, make your best guess."
- 6) **Read** each question out loud, and then give students time to write their answer. Repeat the question if they need it read out loud again. Try not to influence students' answers at any point during the survey.
- 7) When students are finished, make sure students have their names and other information filled out on each page, collect all of the surveys, and put them in the "X" envelope. Give the envelope to your "X" Program Director during the next lesson.

#### Thank you again for helping us to improve our programs!

If you have any more questions, please do not hesitate to contact your "X" Program Director.