

Community-Based Approach to Environmental Education

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Abstract

The Bayview-Hunters Point neighborhood in San Francisco, California, is a diverse community that experiences an inordinate amount of pollution. Within this five square mile area, heavy industry, the city's sewage treatment plant, and the former Hunters Point Naval Shipyard (HPNSY) all act as concentrated and diffuse pollution sources. This research project focuses on Yosemite Slough, which lies on the southeast shore of San Francisco and is plagued by the aforementioned hazards as well as several outfalls from the city's combined sewer. During heavy precipitation events, these combined sewer overflows (CSOs) discharge storm water runoff as well as untreated municipal sewage.

Undergraduate researchers from the University of San Francisco lead groups of community youth in a water sampling program. These local high school students are taught about the environmental factors that impact the slough, receive training on proper sampling procedures, and are ultimately certified as "research assistants" prior to participation in data collection during bimonthly sampling events. A year of baseline data has been collected and is currently under review by the community. Furthermore, geographical information systems (GIS) are utilized as a tool to analyze results and present the data to the community in a clear, dynamic, user-friendly format. These GIS displays are comprised of pertinent data layers, including water quality parameters, elevations, topography, and tidal activity.

The principal goal of the project, formally known as the Yosemite Slough and South Basin Watershed Restoration Project, is to educate local youth and the Bayview-Hunters Point community. This is accomplished through the scientific data collection process and regular community meetings and presentations. The data is ultimately targeted for community use in future redevelopment decisions. The aim is to empower the Bayview-Hunters Point community through environmental education so they can envisage a future in which they live in a safer and cleaner environment.

Background

Located in the southeast corner of the City and County of San Francisco, the Bayview-Hunters Point (BVHP) Community lies roughly within the boundaries of the watershed that historically drained into Yosemite Creek. This creek has since been overcome by urban development and today is restricted to flow through the city's combined sewer system or through soil medium.

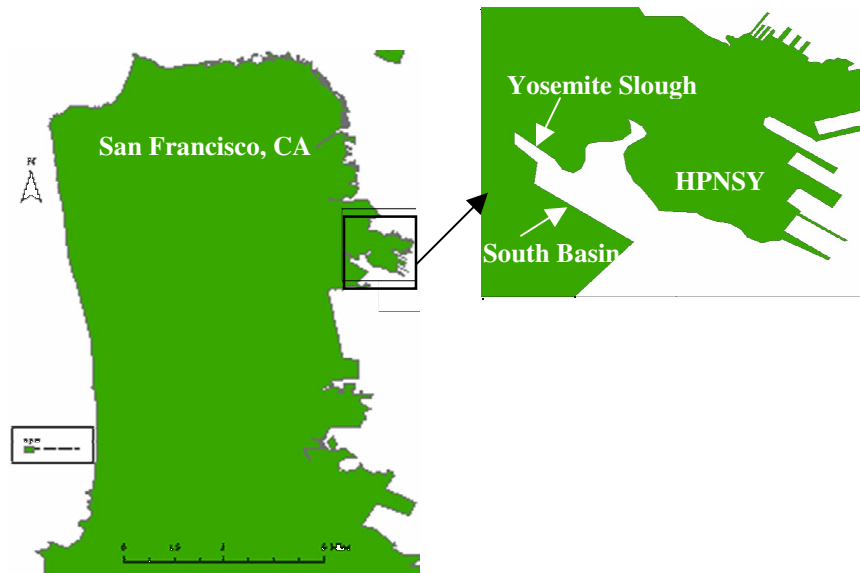


Figure 1: Location of Yosemite Slough, South Basin, and the former Hunters Point Naval Shipyard (HPNSY) in San Francisco, CA.

The visible remnant of the creek is the Yosemite Slough which serves as the interface between the watershed and the South Basin of San Francisco Bay, Figure 1.

The Yosemite Watershed faces severe environmental threats. Among them are 700 hazardous waste material facilities, 325 underground petroleum-storage tanks, and two Superfund cleanup sites¹. A study by the San Francisco Public Health Department in 1998 showed that the neighborhood of Bayview-Hunters Point had four times the amount of toxins than that found in any other neighborhood in the city². Yosemite Slough is a focal point of local environmental problems. It is plagued by surrounding industrial activity, illegal dumping, contamination from landfills at the adjacent former Hunters Point Naval Shipyard, and discharges of untreated sewage from three combined sewer overflow pipes during high precipitation events.

These environmental risks have led to suspicions regarding effects on public health. It has been shown that BVHP has hospitalization rates for asthma, congestive heart failure, hypertension, diabetes, and emphysema that were more than three times the California state average². Also, studies found that the community had the highest age-adjusted rates of breast, cervical, lung, and prostate cancer among all San Francisco neighborhoods¹. This study also commented on the “disproportionate burden of certain toxic substances” in the area and the need for further study to solidify a link between the environment and the health problems.

Socioeconomic data showing a plurality of the community (30%) earning less than \$10,000 annually sparks concerns of environmental justice. Additionally, BVHP has historically comprised the highest concentration of African American residents in the city. Recent demographics show a racial diversity with 55% African American, 17% Asian American, and 10% Latin American populations³. The ethnic makeup of the community has led many within the community to cite a case of environmental racism.

Plans for community redevelopment and habitat restoration motivate the efforts of the Yosemite Slough and South Basin Watershed Restoration Project. This partnership of six nongovernmental organizations and the University of San Francisco, works with the local community to establish a benchmark of the current state of water quality and ecosystem health at Yosemite Slough. Similar to other community-based projects, an emphasis on environmental stewardship is seen as a means by which significant progress can be achieved at a watershed scale⁴. The focus of this project is to empower the local community through an understanding of environmental impacts in their watershed and allow them to make informed decisions regarding the restoration of their neighborhood.

Project Description

This paper discusses the initial phase of the project centered on the assessment of the current conditions of Yosemite Slough. Primary concentration was on involving and educating the community and gathering a viable baseline dataset that could play a critical role in future phases of restoration efforts.

This paper focuses on *i*) the training program for community members; *ii*) the process of data collection; and *iii*) how data is shared with the broader community and utilized to influence community decision processes.

Training Requirements

Community research teams consist predominantly of local high school students, referred to within this text as research assistants (RAs). As previously described⁵, the University of San Francisco coordinates the training of these RAs in fundamental water quality concepts, site specific concerns, sampling technique and safety precautions. Training was designed to develop the RA's analytical capabilities and to develop their independence and self-assuredness by making them accountable for all data collected.⁶ All those that participate in the monitoring project are certified before sampling is under-taken. In addition to the basic training of RAs, there were two problems that occurred, requiring modification of our training regime. The first problem was that due to funding constraints, sampling did not occur for a 2-3 month period during summer months. Secondly, problems of attrition also required additional attention.

Because of the summer hiatus, the returning RAs had lost some of their familiarity with sampling procedures when sampling recommenced, requiring retraining. This refresher training was accomplished by an intensive program over a 4-hour period. First, the RAs were instructed by USF undergraduates of the sampling procedures and the reasons for sampling each of the selected parameters. Following this more traditional lecture and discussion session, the RAs were divided into small groups and worked their way through a circuit of hands-on training exercises. During these exercises, they worked as a group to sample various parameters using standard protocols. This was repeated at each station until every person had a chance to conduct the procedure, assist with conducting the procedure, and observe others conducting the procedure. This hand-on training occurred under the close supervision of a USF undergraduate student, who then evaluated each of the participants on a 5-point scale. Upon completion of the day's training, each RA was required to take a 10-point written examination on the sampling protocols and reasons for sampling. With a minimum combined score of 70% required for the

written and observational examinations, all 14 of the returning youth passed. While the minimum score to pass the recertification examination was 70%, 13 of the 14 RAs passed with scores of 80% or higher.

When working with the local community youth, there tends to be flux in the participants over the course of the project, necessitating a continuing training program. In the case of this project, over 40% of the youth did not return for a second year of sampling or left the project during the first year. The reasons for turnover included some youth leaving the community to pursue college educations, some being fired for poor attendance, some quitting because they need to work longer hours, and in the case of one individual, being fired for cause. Because of this relatively high turnover rate, new participants were trained in an “on-the-job” manner in which they observe and assist veteran RA’s in sampling. This method was a direct result of recommendations on how to address this training issue made by youth working on the project. The result was that veteran RA’s acted as guides, and played significant roles in training newcomers. This form of training served a dual purpose. First, the new participants were effectively trained by their peers as well as university personnel. Second, the veteran RA’s were required to have a strong grasp of the information in order to successfully train the new colleagues, thereby further reinforcing the concepts of the project and encouraging teaching experience.

Sampling Logistics

Once certified as Research Assistants, the community youth conducted water samples on a bimonthly basis, using standardized testing protocols^{7,8} and strict quality assurance standards⁸ so as to ensure reliability of results. The RA’s were split into two groups each group responsible for three of the six sampling locations, Figure 2. Over a four hour time period, a series of tests

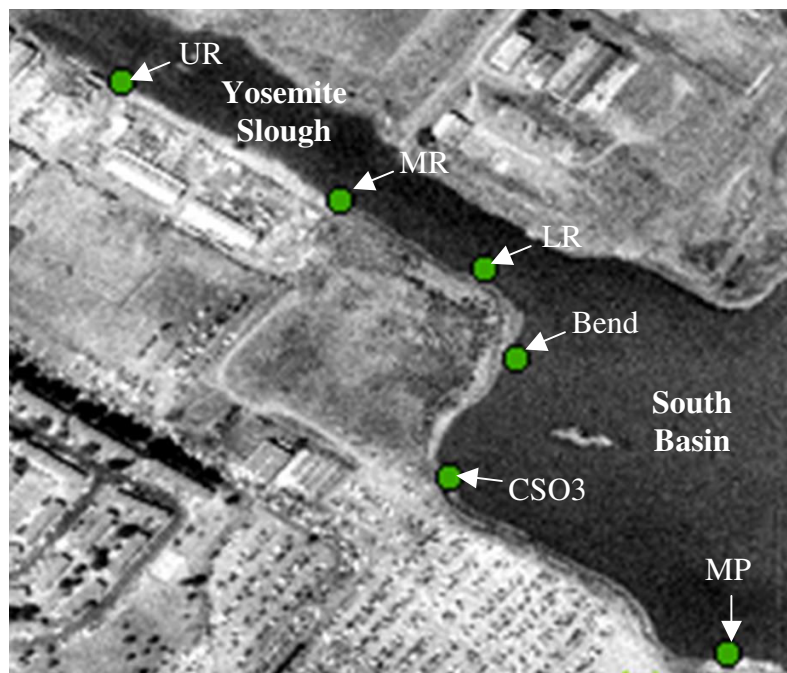


Figure 2: Sampling Locations at Yosemite Slough and South Basin.

were conducted at each site under the supervision of USF personnel. A Hydrolab Minisonde 4a with a Datasonde data logging system (Loveland, CO) facilitated field measurements of dissolved oxygen, pH, temperature, specific conductance, and oxidation-reduction potential. HACH CEL/890 advanced portable laboratory equipment (Loveland, CO) facilitated measurements of ortho-phosphates, nitrates, and turbidity. Research Assistants also obtained and stored water samples that were taken back to the USF lab for further analyses. Among these, total coliform was measured using the most probable number technique and Hach MEL/MPN Total Coliform and E. Coli Laboratory (Loveland, CO); total solids were measured by EPA standard procedure, biochemical oxygen demand was measured using either a Hach BODTrak apparatus (Loveland, CO) or standard methods specified by the American Public Health Association.⁷

Data Presentation

Data gathered during each sampling event was stored in a computer database at USF and organized for analysis and assessment. At the completion of sampling in January 2004, USF personnel will complete a water quality report based on the data, to be submitted in June 2004. The beginning stage of the data analysis has focused attention on statistical significance of the data set, an example of which is shown in Figure 3.

Additionally, the water quality report will incorporate Geographical Information Systems in both the organization and analysis of the data. It is hoped that this format will enhance the presentation of the data and assist in clearly communicating the results of the study to the general

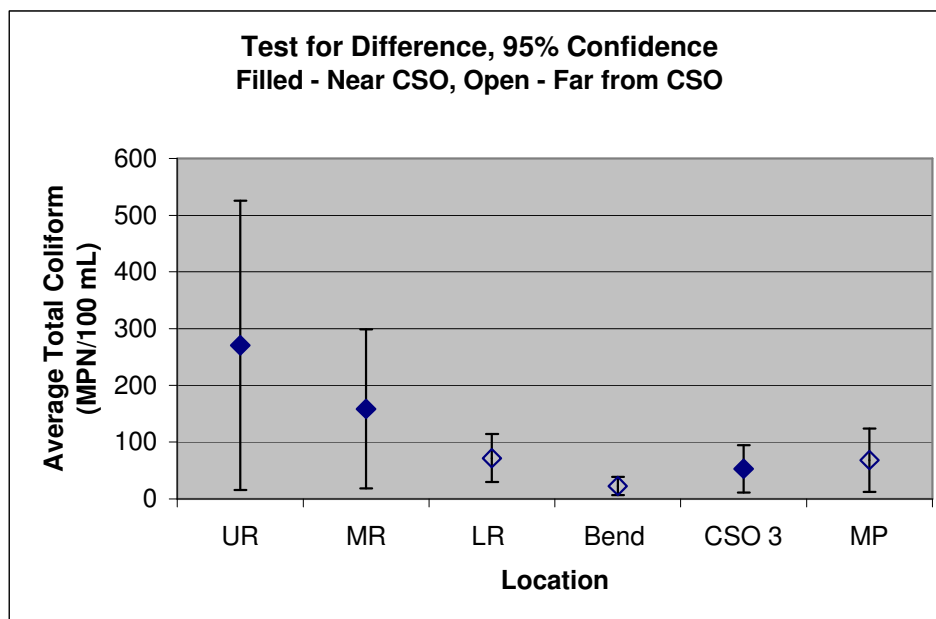


Figure 3: Average total coliform data for the various sample locations over the life of the project. Error bars represent plus or minus 95% confidence intervals. Filled diamonds denote sample locations in close proximity to CSO outfalls, while open diamonds denote sample locations not located near CSO outfalls.

BVHP community. The expectation is that this data will be used by the community to develop:

- A much-needed watershed management perspective and baseline data to inform on-going redevelopment plans and water infrastructure investments; and
- A community-based watershed planning process and design of a restoration and management plan for Yosemite Slough, informed by the results of the assessment.

Outcomes of Community Involvement

The outcomes of community involvement in this study may be grouped into three separate areas, youth enrichment, community awareness of our work, and area improvements resulting from our work.

Youth Enrichment

Because local youth are involved in sampling an area contaminated by many different sources, concern for their safety was paramount. Of particular note were the impacts on the project due to findings of significant PCB contamination of sediments at the sample site. While the RAs did not actively sample sediments, they would often come into contact with potentially contaminated sediment during their work. Thus, safety precautions and a detailed understanding of the hazards participants faced while on site as well as how to protect them from contamination were an area of significant focus. As training on how to avoid contact with PCBs and developing a better understanding of this contamination developed, the youth became much more active in educating their community on this issue. Specifically, they participated in and presented their research findings at a public meeting with the local community and regulatory agencies discussing the PCB problem.

To better understand how the project impacted the youth, surveys were performed. The surveys were based on a 4-point scale with 4 being the most favorable rating and 1 the least favorable.

Table 1: Perceptions of community youth involved in the project changed over the duration of the project.

Question	At Start of Project	After 7 months in Project	Statistical DifferenCE (95% CI)
How comfortable are you working as part of a group?	3.00	3.78	YES
How comfortable are you with public speaking and making presentations?	2.11	2.11	NO
How much knowledge did you have about issues relating to water quality of San Francisco Bay?	2.11	3.22	YES
How much knowledge did you have about issues relating to the wildlife of San Francisco Bay?	2.22	3.22	YES

Table 1 shows how the RAs involved in the project changed their perceptions of certain issues over time. Of particular note was their increased confidence in their knowledge of environmental issues. However, it was also clear that the project did not increase their comfort in public speaking.

In addition to changes in perception, survey questions evaluated the value of the project to both the community and the personal lives of RAs, Table 2.

Table 2: Participants state that there is value of the project experience on community and personal life.

Question	Average Value	Standard Deviation
How well do you think this project will help the community?	3.60	0.42
Do you think your participation is or will make an impact on the community?	3.20	0.68
Do you think your experience in the field help or reinforce your academics?	3.40	0.60

Local youth involved in this project recognize the importance of the project beyond the initial baseline data gathering phase. This is shown in their desire to participate in data analysis, one aspect of the project that is beyond the scope of their involvement, necessitating voluntary participation without compensation.

Community Awareness

Through public meetings, where RAs associated with this project attended and in some cases participated, the local community is becoming aware of our data. Of particular note is the interest of the California State Parks, the agency that owns the land where the data is collected. Specifically, they have become interested in the total coliform data that indicate higher levels (with 95% confidence) of these bacteria at sample locations adjacent to CSOs compared with those sample locations not adjacent to the CSOs, Figure 3. Additionally, after repeated analyses, the data suggest that one CSO in particular (UR) has higher average levels of total coliform bacteria; however this difference is not statistically significant. This latter result is of particular interest because it could indicate that this CSO is leaking sewage into the slough even when there is not an overflow event, but further study is required to properly evaluate this hypothesis. Besides this interest in some specific data, California State Parks recognizes the value of the community aspect of this work and has expressed interest in working with this group during restoration of the park over the next several years. The final goal of the park restoration is to return the slough to a thriving and ecologically diverse salt water marsh.

Besides California State Parks, local community members also recognize the value of this project to the youth of the community and the community itself. Of particular note is the interest by the newly developing Community Watershed Council on having local youth participate in their proceedings and testify to the state of the environment in this watershed.

Area Improvements

As a direct result of our concerns with PCB contamination of sediments in the slough, a series of meetings have taken place to discuss the level of PCB contamination and possible actions that can be taken to mitigate the threat to the community. The meetings were attended by a diverse group of stakeholders with representatives from the Yosemite Slough and South Basin Watershed Restoration Project partners, the US Environmental Protection Agency, California State Parks, San Francisco Department of the Environment, the State Water Resources Control Board, and the San Francisco Redevelopment Agency. Further study of PCB contamination in this area, not necessarily a direct result of these meetings but occurring at the same time as this heightened awareness, revealed multiple potential sources on the former Hunters Point Naval Shipyard, which borders South Basin. As a result of this activity, the US Navy is considering removal actions to lesson the probability that these contaminated areas will continue to further contaminate the surrounding waters.

While the remediation activates for PCB contamination of the area cannot be shown to be a direct result of these meetings, posting of PCB contaminated fish signs were a direct result. Following training of the RAs on the PCB threat, they noticed that local community members fished Yosemite Slough and South Basin for sustenance. Realizing this was a true threat to the health of the local community, the youth pushed forward the idea that signs should be posted in the local area to warn anglers of the danger. They further suggested that, given the diversity of the community, the signs should be in multiple languages and also be pictorial. Following these suggestions, warning signs have been posted in the areas of greatest fishing, Figure 4. The



Figure 4: Warning sign posted in areas of PCB contamination.

posted signs, created by a group of organizations separately from this project, have graphic depictions of the problem as well as text in seven different languages.

Conclusions and Future Research

Conclusions drawn from this study are that:

- i) Training programs of community sampling projects must allow for refresher training as well as turnover of personnel;
- ii) Data collection must occur following strict adherence to standard procedures so that data may be trusted by the community and government agencies;
- iii) Data sharing with the community is a vital part of such a project and leads to educational advantages for those who participate, increased community awareness, and area improvements.

Considering the findings of the research, there remain three focal points for continued work and research. First, further development of a community watershed council would improve the communication between those community members conducting the environmental sampling, the broader community, and the governmental agencies that make decisions affecting the community. Second, community assessment of environmental data should continue during and after redevelopment or restoration of the area. This continued evaluation of environmental parameters would help to assure that the community understands the environmental impact of redevelopment or restoration plans. Finally, more research needs to be conducted on the educational and career enhancements that result from community and youth involvement in projects such as this.

Acknowledgements

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