

AWARENESS ASSESSMENT

regarding the

UPPER LAS POSITAS CREEK RESTORATION

and

STORM WATER MANAGEMENT PROJECT

for the

CITY OF SANTA BARBARA, CREEKS DIVISION

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Prepared by UCSB students as a course project for:

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Critical Thinking About Human-Environment Problems and Solutions

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Environmental Studies

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Acknowledgements

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Executive Summary

The Upper Las Positas Creek Restoration and Storm Water Management Project at the Santa Barbara Municipal Golf Course has two main goals: 1) treating water that flows through the golf course and 2) educating the golf course community about their involvement in hydrological processes.

In conjunction with the City of Santa Barbara, Creeks Division, a group of University of California, Santa Barbara students surveyed and analyzed the knowledge and attitudes of golf course users regarding the creek restoration and management project in order to create a set of recommendations. Data were gathered through orally administered surveys. Over 140 surveys were collected and from these, the students observed a number of trends that influenced the recommendations. There was an overwhelmingly positive attitude towards pro-environmental development at the golf course; however, specific knowledge regarding golf course impacts and watershed health was sparse.

The key findings include:

- The majority of the respondents were incorrect in their evaluation of watershed location, sources of anthropogenic water pollution, and golf course water supply and outlet.
- 66% of the respondents said that they liked the changes to the golf course and 50% believed they would benefit from such changes.
- 80-82% of the respondents who spoke directly to someone or took a tour of the project felt it would improve beach and water quality, while less than 60% of those who saw the construction felt the project would have a positive impact.
- The majority of respondents who took a tour or read about the project felt that minimizing the environmental impacts of the golf course was “very important.” Only 28-29% of those who saw the construction and/or spoke with other golfers felt it was “very important.”
- Many of those who indicated that they only had one source of information about the project felt that the golf course was not a significant source of water pollution.

Based on the findings a series of recommendations regarding education interventions for golf course users were formulated:

- Post signs and visual materials near the project sites.
- Print educational information on the back of golf scorecards.
- Sponsor a golf tournament to educate participants.
- Educate staff members and golf course marshals to encourage discussion or inform golf course visitors about the project and water quality.
- Create an advertisement targeting golf course visitors.
- Expanding educational outreach to Adams Elementary School and the Earl Warren Show Grounds.

Increasing outreach in all of these areas is essential to successfully educating the golf club community about the project, its potential environmental benefits, and creek and beach water quality.

Table of Contents

Acknowledgements

Executive Summary

Introduction.....	1
Background Information.....	2
<i>Golf Courses and Their Environmental Impact</i>	3
<i>NPDES – National Pollutant Discharge Elimination System</i>	4
<i>Habitat Restoration and Its Benefits</i>	5
<i>Other Golf Course Restoration Projects</i>	6
Survey: Data Collection Methodology.....	8
Survey: Data Analysis.....	11
<i>Respondents’ Familiarity with and Perceptions of Project</i>	11
<i>Respondents’ Knowledge of Hydrology and Water Pollution</i>	13
<i>Information Channels and Respondents’ Perspectives</i>	19
Recommendations.....	25
References Cited.....	31
Appendix A: Creeks Data Collection Schedule.....	33
Appendix B: Santa Barbara Golf Club Survey	34
Appendix C: Additional Data Analysis.....	36
Appendix D: Sample Poster.....	45

Introduction

The Santa Barbara Municipal Golf Club lies between the Santa Ynez Mountains and the Gaviota Coast in Southern California, specifically at 3500 McCaw Avenue in Santa Barbara, off of Las Positas Road. This 18-hole golf course also includes an award-winning Pro Shop and a full bar and restaurant, Mulligan's Café. Since the golf course lies between the mountains and the coast, rain flows from the mountaintops, through the golf course, and eventually makes its way to the Pacific Ocean. The City of Santa Barbara, Creeks Division is in the midst of a creek restoration and storm water management project at the Santa Barbara Municipal Golf Club. The main goals of the Upper Las Positas Creek Restoration and Storm Water Management Project are: treat polluted urban runoff, decrease flooding potential, restore wildlife habitat, maximize educational outreach, and maintain golf course playability. The purpose of this report, completed by UC Santa Barbara students as a course project for ENVS 106, is to provide information on the attitudes and opinions of Santa Barbara Municipal Golf Course users on the project and on their general knowledge of hydrological systems.

To formulate an effective survey, students researched various background topics including the following: environmental impacts of golf courses, habitat restoration, National Pollutant Discharge Elimination System regulations, and other golf courses participating in similar programs. With this broad background knowledge of golf courses, students developed a survey to assess golf club users' knowledge of the Upper Las Positas Creek Restoration and Storm Water Management Project. The results of this student research project provide the basis for a set of recommendations for the City of Santa Barbara, Creeks Division aimed at improving understanding of the creek restoration and storm water management project and watershed management throughout Santa Barbara.

Background Information

Golf Courses and Their Environmental Impact

Golf courses maintain a lush green appearance often at the expense of the local environment. First, golf clubs tend to use large amounts of fertilizers and pesticides, which can adversely affect downstream water quality and the health of local fauna. Second, significant quantities of water are needed for the upkeep of turf grass. Unnecessary irrigation, which is common on golf courses, vastly contributes to pollutants reaching waterways and the ocean. Finally, golf course construction may result in the destruction of local habitat.

Precipitation, combined with water used for landscaping on golf courses, contributes to urban runoff, which can contain a number of pollutants including trash, oil, sediments, landscape waste, pesticides, and fertilizers. These potentially harmful pollutants, particularly pesticides and fertilizers, enter ground water systems and are carried down waterways entering local ecosystems. Fertilizers have a major effect on water quality due to high nitrogen and phosphorous levels. The excessive amounts of nitrogen are not absorbed quickly because they move with high velocity through the channelized water system towards the ocean. High nitrate levels cause excessive aquatic plant growth, including algal blooms, which use up vital oxygen levels and disrupt the basis of the estuarine food chain (EPA 2010). The three main pesticide groups include herbicides, fungicides, and insecticides (Kohler 2004). In addition to contributing to water pollution, pesticides are a direct threat to local animals that consume grass and nearby plants on golf courses (Barnes 1999). Pesticides can also affect humans through skin exposure and breathing.

Because Santa Barbara is located on an alluvial fan (or floodplain), storm water management is one of the city's top priorities. Additionally, this area is unique in its biodiversity

and high concentration of coastal ecologically sensitive habitat areas (ESHA's), including marshes, estuaries, beaches, dunes, and bluffs. Because the water so vital to these ESHAs first runs through the city of Santa Barbara, inputs into the water table that could decrease water quality are a major concern. Moreover, the detection of fecal coliform bacteria in the study area surrounding Las Positas Creek is a water quality concern currently faced by the Creeks Division (City of Santa Barbara 2010). Left uncontrolled, such pollutants have major downstream consequences including the devastation of spawning areas and other wildlife habitat, fish kills, and the contamination of drinking water and recreational waterways resulting in threats to public health (USEPA 2005).

NPDES – National Pollutant Discharge Elimination System

The Federal Clean Water Act sets up a framework for a permitting process to control the discharge of pollutants to the nation's water bodies ("Water Permitting 101" 2009). Through the development of the Clean Water Act, the National Pollution Discharge Elimination System (NPDES) was created to induce the nation's states, regions, and cities to develop effective programs to reduce storm water pollution and in turn enhance freshwater and marine environments.

According to the NPDES guidelines, "all facilities which discharge pollutants from any point source into the waters of the United States are required to obtain an NPDES permit" ("Water Permitting 101" 2009). The EPA's Water Permits Division within the office of Wastewater Management oversees this program in partnership with EPA regional offices. To strengthen the potential effectiveness of this program, states, tribes, and territories may apply for authorization to implement NPDES permits, since they may have greater knowledge of what

specific permitting strategies would be best for their area (“State and Tribal” 2001). In order to obtain a permit, the developing agency must create a Best Management Practices (BMP) regime that is approved and followed to minimize the release of pollutants. BMPs can be technological advances that increase filtration, evaporation, and transpiration of polluted water, or can be planning techniques like building during the dry seasons to reduce storm water runoff. The permitting process itself involves submitting proposals and obtaining permit approval from the state or regional water boards (Environmental Protection Agency 2009). Implementation of the requirements of each NPDES permit is expected to decrease storm water run-off pollution.

Habitat Restoration and Its Benefits

The City of Santa Barbara, Creeks Division’s project on the Upper Las Positas Creek addresses both water quality and habitat concerns. To minimize the transmission of pollutants to areas lower in the watershed, a series of retention basins and bioswales have been constructed as part of the project and numerous native species planted on the golf course are expected to promote beneficial water filtration of the storm water before it reaches the creek that is eventually discharged at Arroyo Burro Beach.

Whether or not it takes place in a golf course, habitat restoration has a number of ecological and community-wide benefits. The goals of restoration often include increased biodiversity, improved water quality, decreased erosion, and flood control (TVA 2010). These projects also have additional, indirect effects: wildlife enhancement, public recreation, improved aesthetics, and noise dissipation (TVA 2010).

Water can be naturally filtered within riparian habitat systems. Native plants have adapted over millions of years to perform well in this specific region and remove harmful

particulates, resulting in natural filtration of the water. Using native plants helps preserve biodiversity, a general goal of biologists and ecologists worldwide. Native plant species also help improve habitat by decreasing erosion, increasing flood control and slowing degradation. As the plants begin to establish their roots, they add structure to the soil, making the habitat less susceptible to erosion (Densmore, R. V., & Karle, K. F. 2009).

The benefits of aesthetics cannot be underestimated when considering any ecosystem restoration effort. They become “assets that enhance development” says Phillip Amicone (Revkin 2009). “By building green corridors around exposed waters, cities hope to attract affluent and educated workers and residents who appreciate the feel of a natural environment in an urban setting” (Revkin 2009). Habitat restoration also has the ability to decrease noise pollution by reconstructing natural barriers. Noise dissipation from roads, traffic, and even nearby properties is a direct benefit to neighborhoods surrounding the restoration (TVA 2010).

Other Golf Course Restoration Projects

The Santa Barbara Municipal Golf Course is not alone in its innovative storm water management and habitat restoration efforts. Other golf courses are also beginning to implement habitat restoration projects as a result of becoming more aware of the importance of environmental sustainability. These courses are now aiming for protection of wildlife habitats, improvement of water and other resource efficiency, and reduction of harmful inputs into the environment (“Audubon cooperative sanctuary” 2010).

One golf course that exemplifies the goals of this new ideology is Mirimichi golf course, in Memphis, Tennessee. Mirimichi course has taken quite a few interesting and innovative steps to reduce their impact on the environment. Because water usage is a primary cause of concern

for golf courses that inevitably occur in arid regions, Mirimichi designated the largest portion of their efforts to reduction of water usage. They reduced the amount of lawn by almost 50%, replacing the green turf grass with 80% native grasses, and 20% exotics (d'Estries 2009). These grasses are all drought-resistant, requiring minimal watering and maintenance. They also installed a state-of-the-art irrigation system that helped them drastically reduce water usage, using recycled and recaptured rainwater ("Mirimichi golf course" 2009). This water is filtered through an increased lake and stream system and waste bunkers that function additionally as a habitat for wildlife and a bird sanctuary ("Mirimichi golf course" 2009). This combination of reduced water usage and increased water filtration drastically reduces runoff while increasing its quality, ideally leading to improved watershed health.

Another leading golf course dedicated to reducing toxic runoff is the PGA Golf Course at San Francisco's Harding Park. The city of San Francisco is trendsetting and has enacted very strict laws regarding pesticide usage near the Pacific Ocean and San Francisco Bay. They hired entomological experts to use integrated pest management to reduce weeds, and "groundskeepers use microbes to knock out fungus, [even using] soap to get rid of weeds; they hand pluck wild daisies, flush out moles with hoses, and use traps to catch cockroaches" ("Green and clean" 2005). They make efforts to plant grasses that need less watering and are therefore appropriate for the California climate, test soils to make sure they have proper nutrient balances, and re-use grass clippings as natural fertilizers ("Green and clean" 2005). In this way, they minimize inputs into the watershed.

While the San Francisco course is focused on reducing pesticide use, Colliers Reserve Country Club in Southwestern Florida is focused on creating habitat that can balance with nature. They added 500 native plants, requiring very little watering or maintenance, creating a

functional ecosystem that interacts with the “39 acres of created lakes and wetlands, more than 130 acres of habitat preserve and deer and bird feeders made of 100 percent post-consumer recycled materials” (Leonetti 1995).

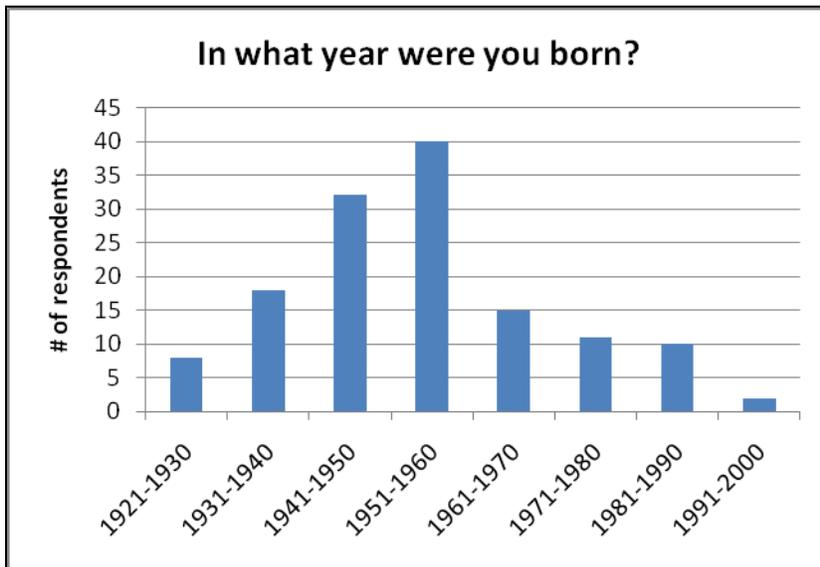
It is much easier and more cost-effective for a new golf course to be built with sustainability in mind than it is for an old course to renovate its infrastructure. In the United States, three golf courses open per week, adding to the nearly 14,500 courses that exist today (Leonetti 1995). With measures like these being taken all over the country, Santa Barbara Municipal Golf Course is becoming one of many courses dedicated to environmental responsibility.

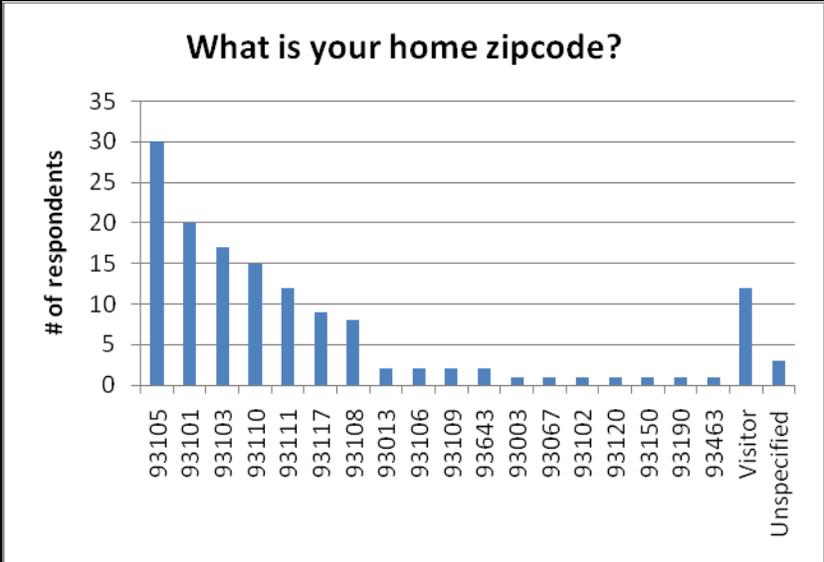
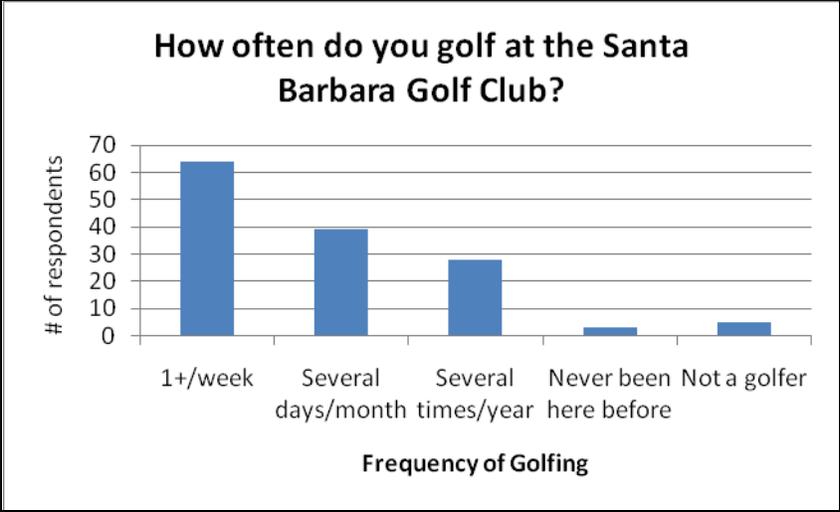
Survey: Data Collection Methodology

To gather information for the City of Santa Barbara, Creeks Division, twenty-seven UC Santa Barbara undergraduate students collected 141 completed surveys at the golf club over a ten day period from May 8-17, 2010. To achieve a varied sample of survey respondents, students aimed to collect data on various days and times of the week. Teams of 3-5 students visited the course at any given time. On average, each student spent three hours at the golf course and was able to get approximately eight survey forms filled out (see Appendix A: Data Collection Schedule). Surveys were administered by the students using face-to-face interviews. Students were stationed at the front walkway in between the parking lot and the course entrance to maximize the number of golf course users asked to participate in the survey, while also ensuring golfers were not disturbed while practicing or playing a round on the course. Most of the completed surveys were done on the participants' way out, since many potential respondents were on their way to make a tee-time for a tournament. Raffle tickets were offered as an incentive to attract participants and increase the overall response rate. The raffle tickets offered participants the chance of winning one of the \$25 certificates to Mulligan's Café, or one \$20 certificate to the Pro Shop.

The surveys administered entailed fifteen questions and took approximately ten minutes to complete. Questions included the following various styles: closed ended (yes or no), open ended (briefly discuss), ranking questions on a scale from 1 to 6 (1=not serious, 5=very serious, and 6=don't know), and a few "check all that apply" questions. The last three questions of the survey asked various demographic questions that allowed for more in-depth analysis of other trends in the data (see Appendix B: Survey Questions).

Survey respondents were primarily male. Only 9% of the respondents were female. This may reflect the gender balance of golf course users or may be an artifact of the survey. During some of the students' designated surveying time, a men's golf tournament took place. Therefore, data collected on these dates were predominately men. The age of respondents ranged from younger than 20 years to older than 80 years. The majority of respondents were born between 1941 and 1960 and golfed one or more times per week. Respondents generally lived in the greater Santa Barbara area.



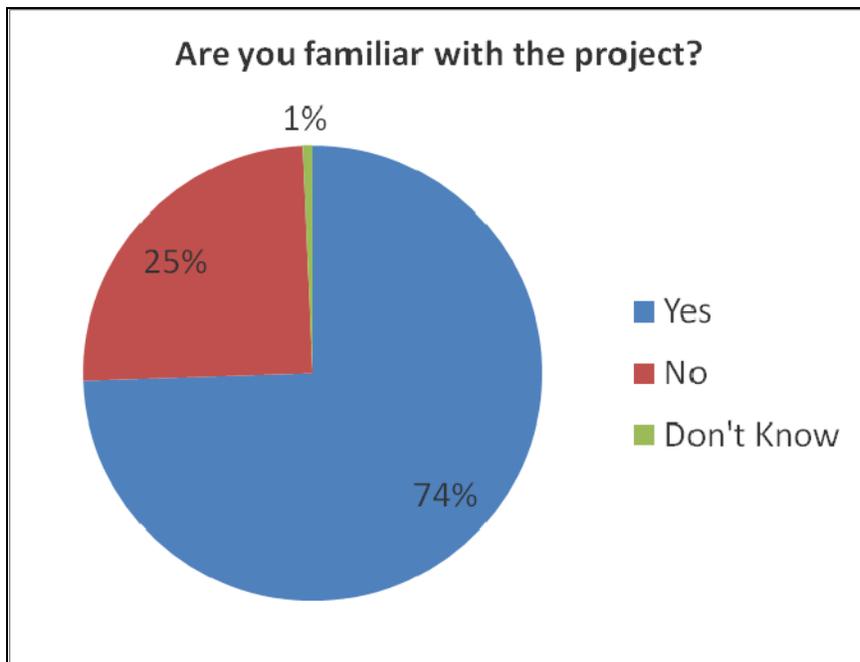


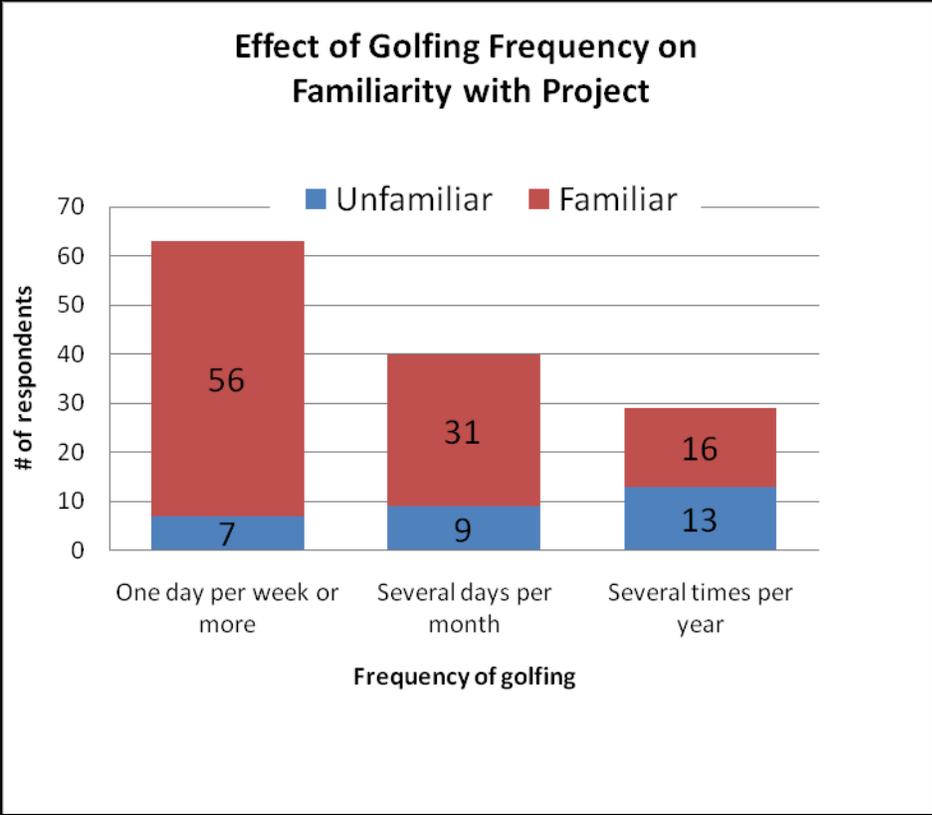
Survey: Data Analysis

The survey was intended to achieve two main goals: to assess golf club users' familiarity with and perceptions of the storm water management and ecological restoration project and to assess their understanding of the local hydrological system. Data are presented addressing each goal as well as the interaction between respondents' perceptions of the project and knowledge of local hydrology.

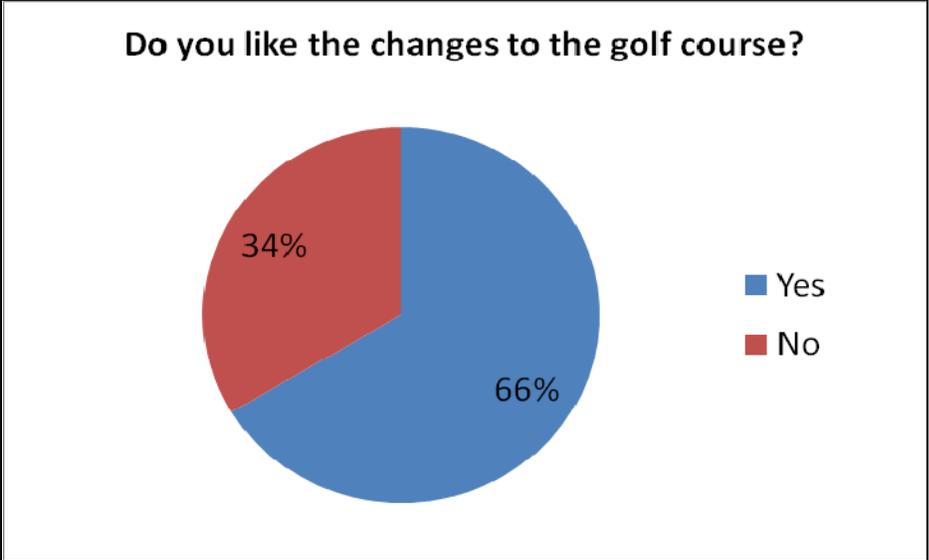
Respondents' Familiarity with and Perceptions of the Project

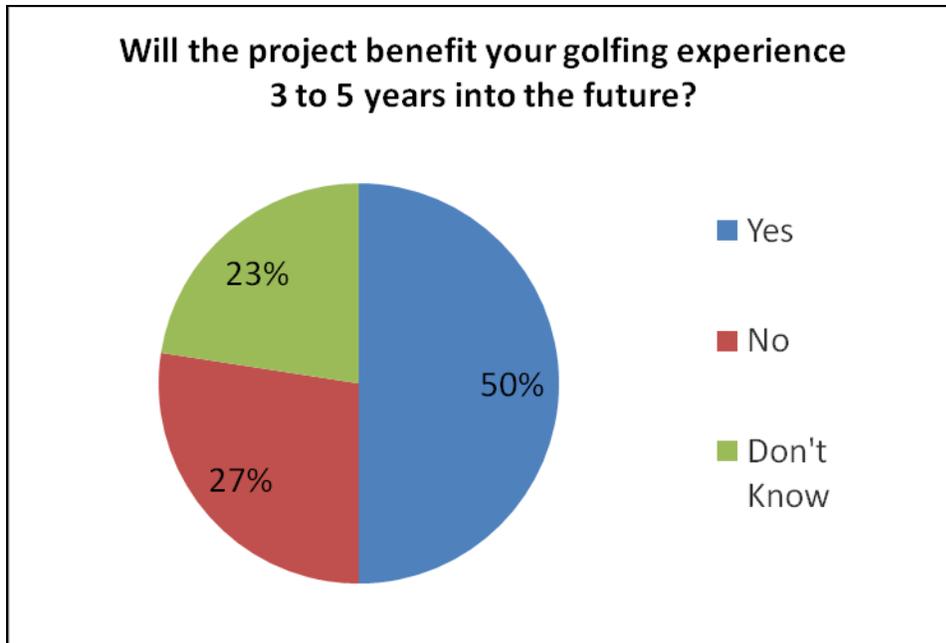
The survey shows that of the 141 respondents, 105 respondents, or 74% of the surveyed public, were familiar with the project. More frequent golfers tended to be more familiar with the project. Those who attended the golf course on a more regular basis were more likely to be familiar with the project. Of those who attended the golf course one day or more per week, 88.9% stated that they were familiar with the project; however, only 55.2% of those who visited only several times per year stated that they were familiar with the project.





Moreover, respondents generally held a favorable opinion of the project and perceived it as benefiting their golfing experience.

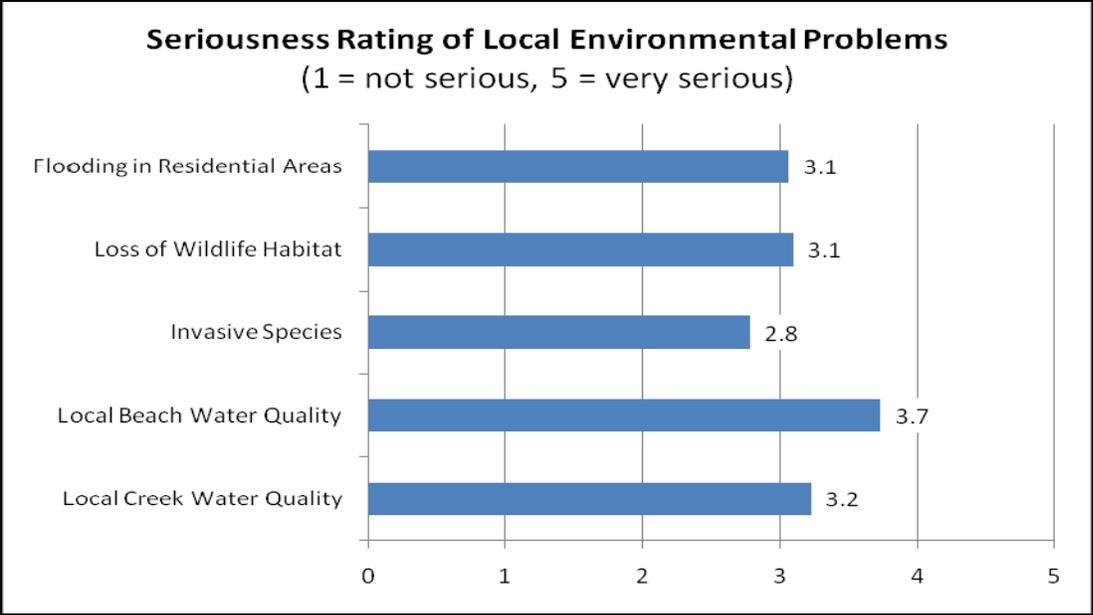




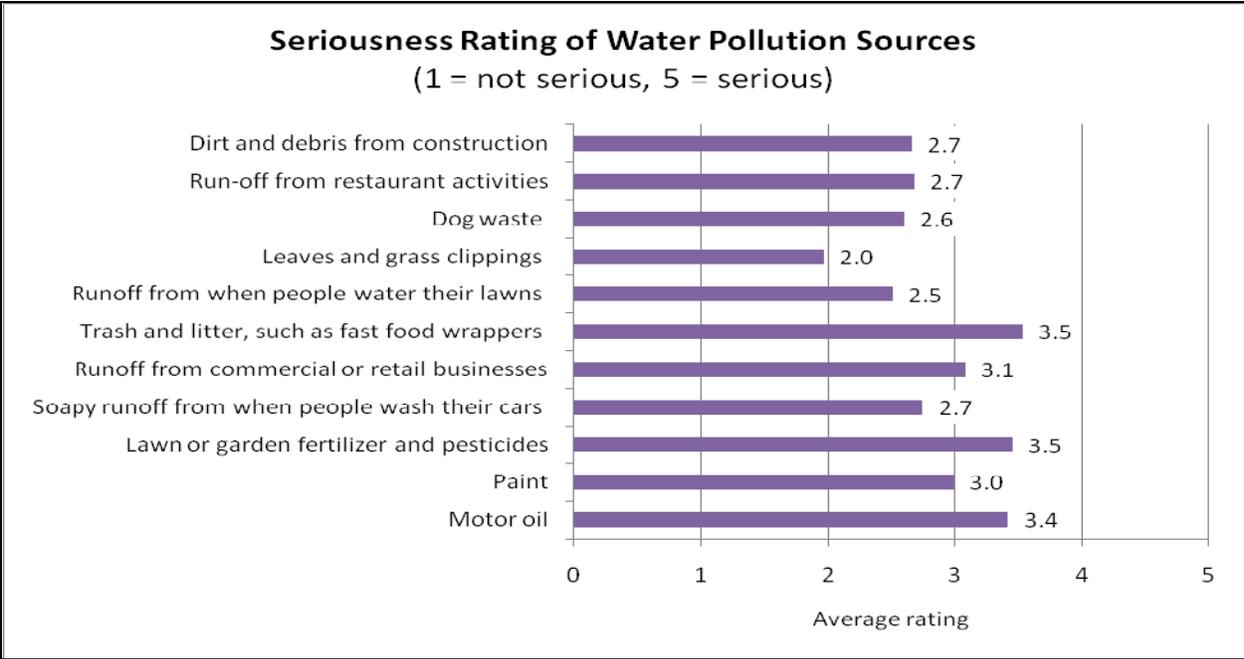
Both of these questions (“Do you like the changes?” and “Will the project benefit your golfing experience?”) asked the respondents why they felt the way they did. Of the 141 people surveyed, 22 offered additional comments: 11 people said the course will be more challenging and improved overall; 6 people thought that the course will be more environmentally friendly; 5 people stated that they enjoy the increased greenery. In contrast, 8 people were concerned with an increase in mosquitoes, 4 people were unsure of the final outcome of the project and 2 people said that the course was “made worse.”

Respondents’ Knowledge of Hydrology and Water Pollution

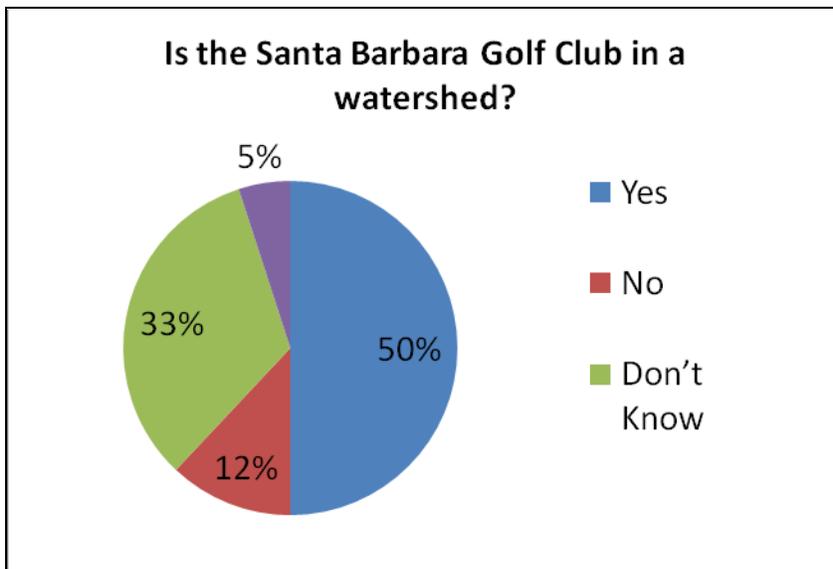
To address the second goal, a series of questions were asked pertaining to the respondents’ knowledge of water issues. Respondents were asked to rate the seriousness of water quality issues in Santa Barbara along with other local environmental issues, on a scaler from 1 to 5, with 1 = not serious and 5 = very serious. Beach water quality was of greatest concern, while invasive species were rated at least serious.



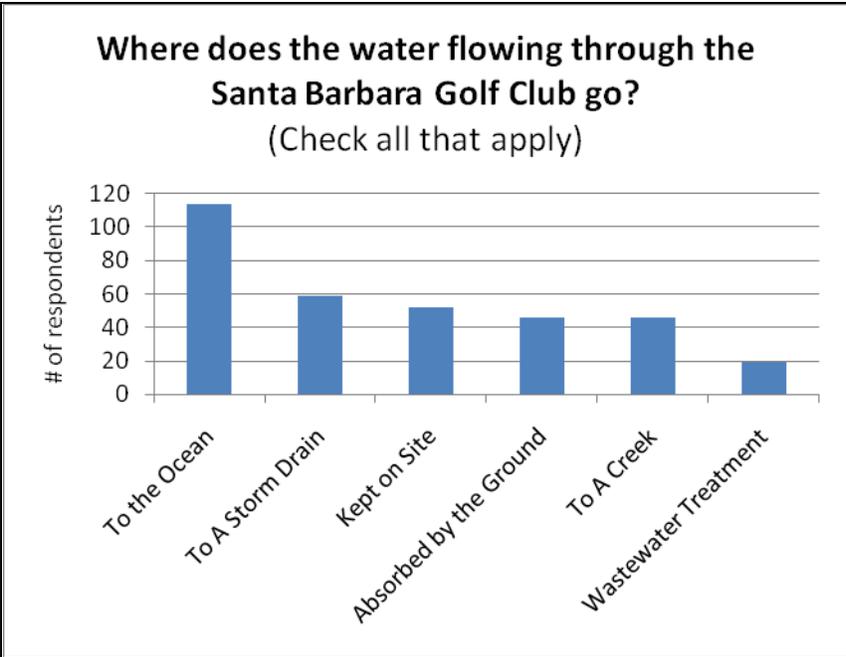
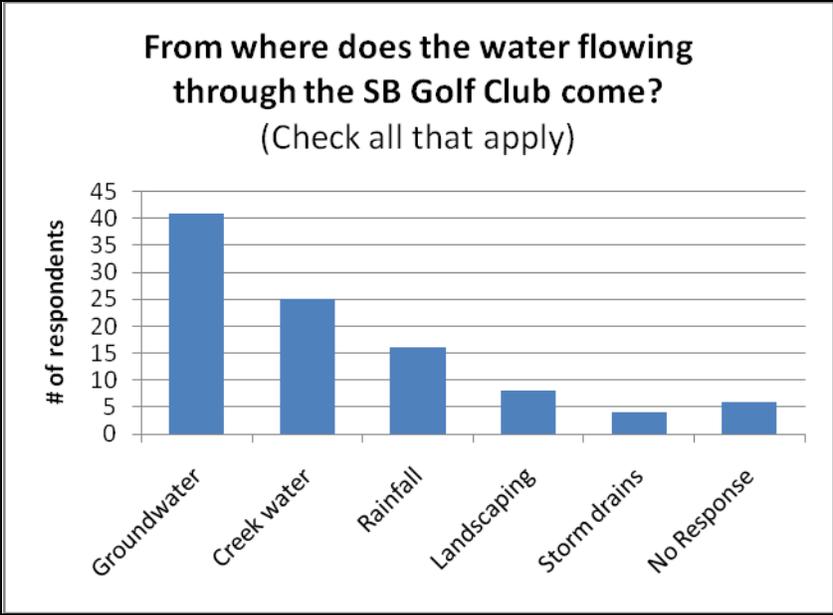
Participants were also asked to “Rate the level of seriousness of the following items as sources of water pollution on a scale from 1-5” (with 1= not serious and 5=very serious). The average level of seriousness for all the possible sources of water pollution hovered around 3, which was the middle ranking. The lowest ranking was 2 for leaf and grass clippings, while the highest was 3.5 for both trash and litter and fertilizer and pesticide.



In order to evaluate the links between the stormwater management and ecological restoration project on the golf course and local water quality, several survey sought to elicit respondents' knowledge regarding the place of the golf club in the local hydrological system. When asked "Is the golf course located in a watershed?" 33% of the survey participants responded "don't know", and 12% responded "no." With the exclusion of the 5% who did not respond, these data suggest that only 50% of the respondents understood that the Santa Barbara Golf Club is located within a watershed.

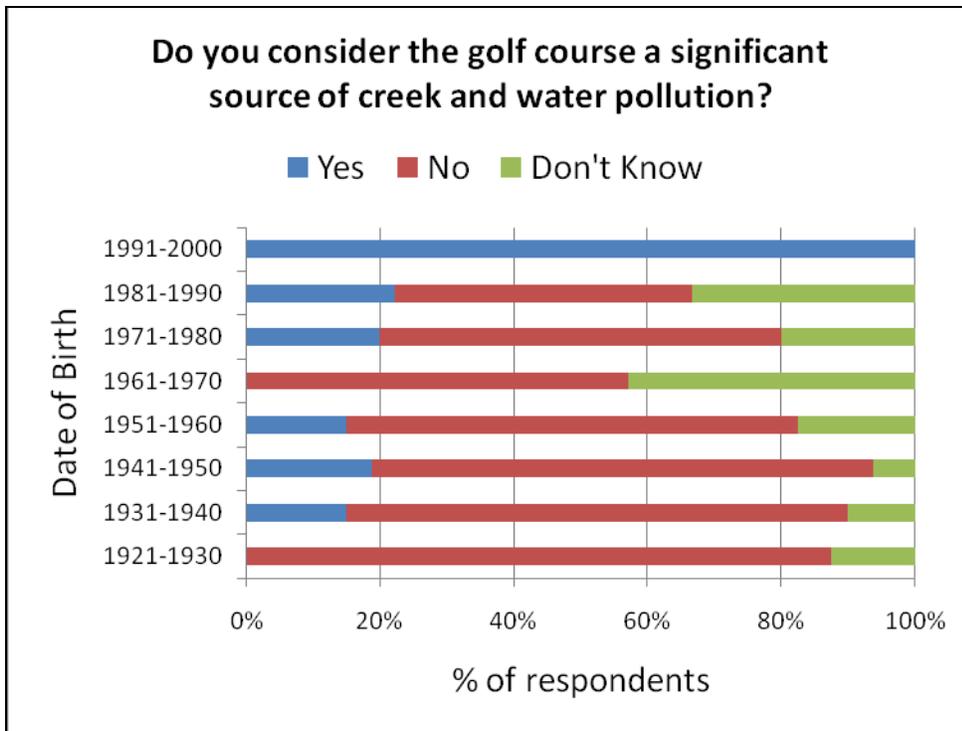
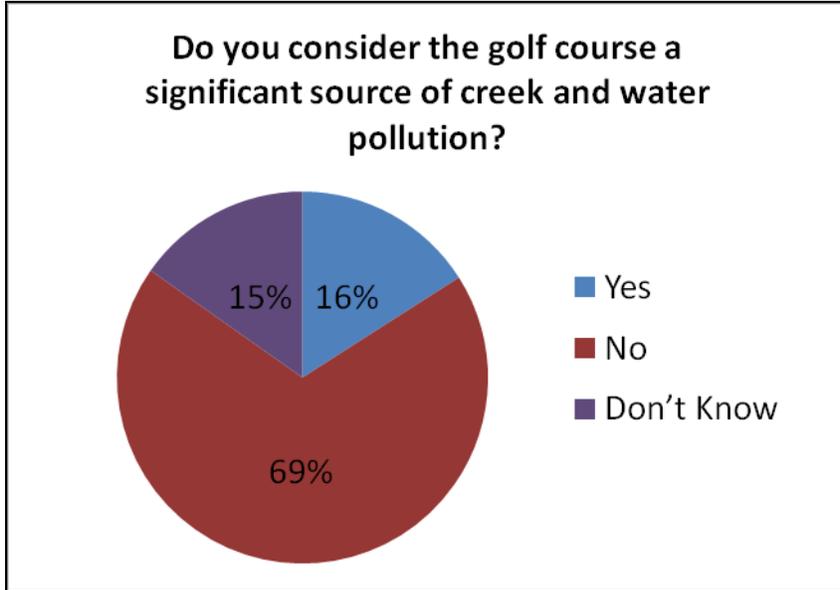


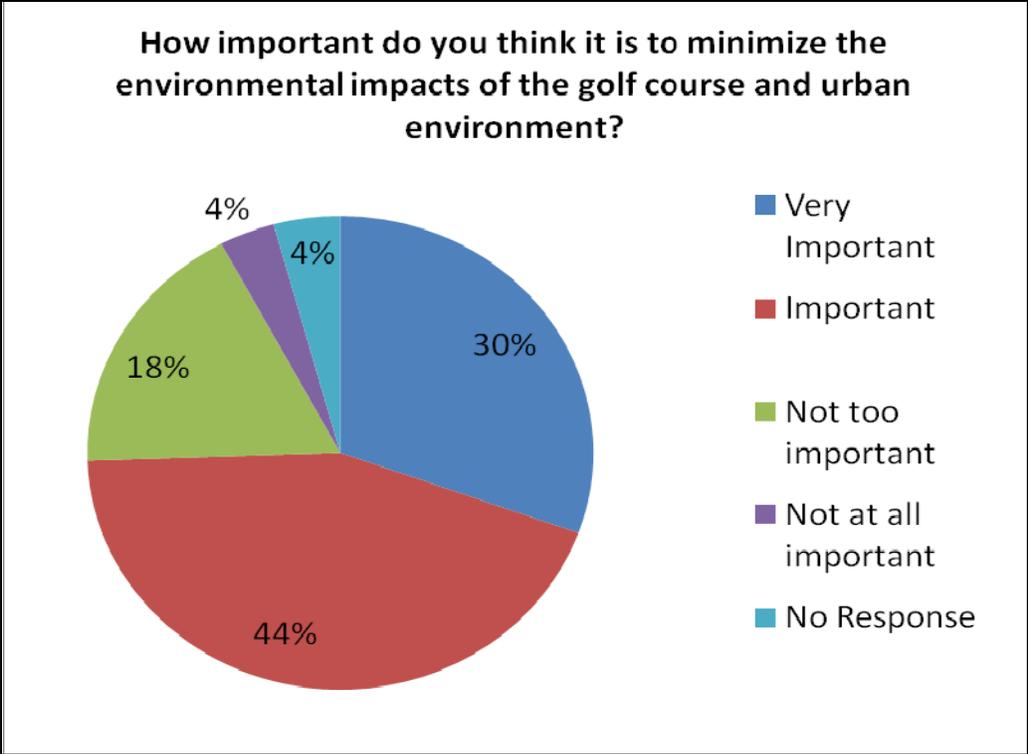
Many of the respondents were also unsure of where the water on the golf course came from and flowed to. When asked where the water came from, only 42 respondents indicated that groundwater was a source of the golf course's water. When asked where the water flows to, an overwhelming majority understood that water flows to the ocean, and less than half indicated that the water flows to a storm drain. Moreover, less than 50 respondents stated that the water flows to a creek.



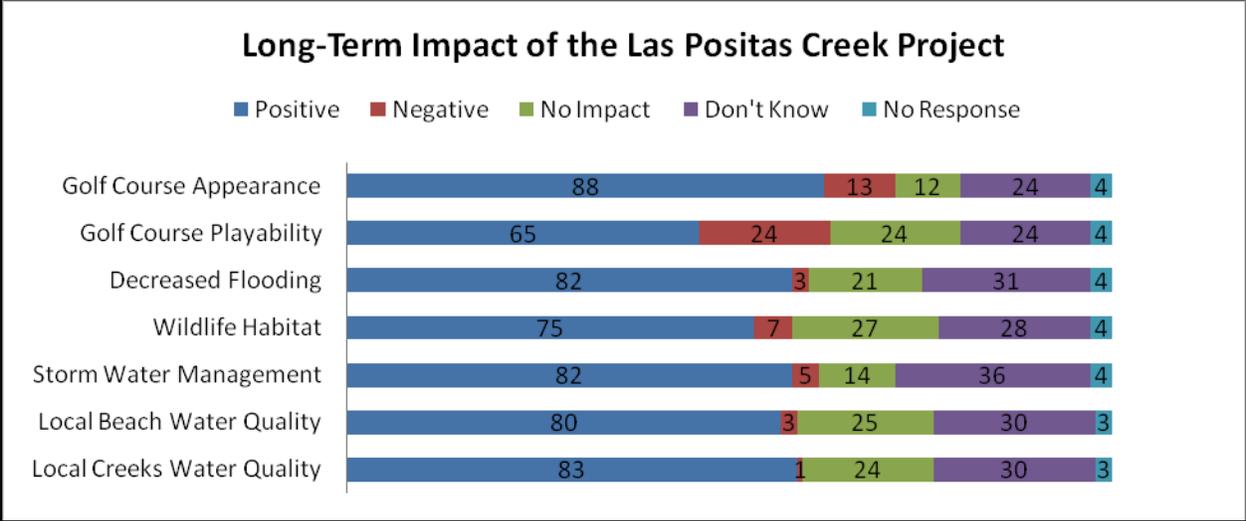
When asked whether or not respondents felt that the golf course is a significant source of water pollution 69% of respondents said no. These data suggest that respondents may benefit from education efforts focused on making the connection between golf courses as a potential

source of water pollution. Moreover, respondents expressed overwhelming support for minimizing the environmental impacts of the golf course and urban environment.





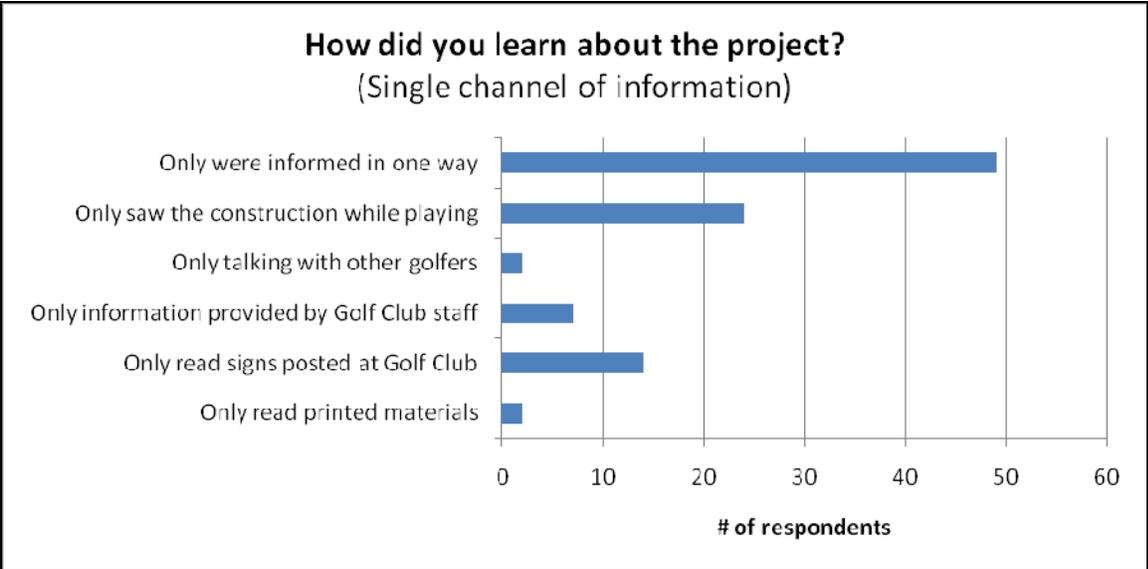
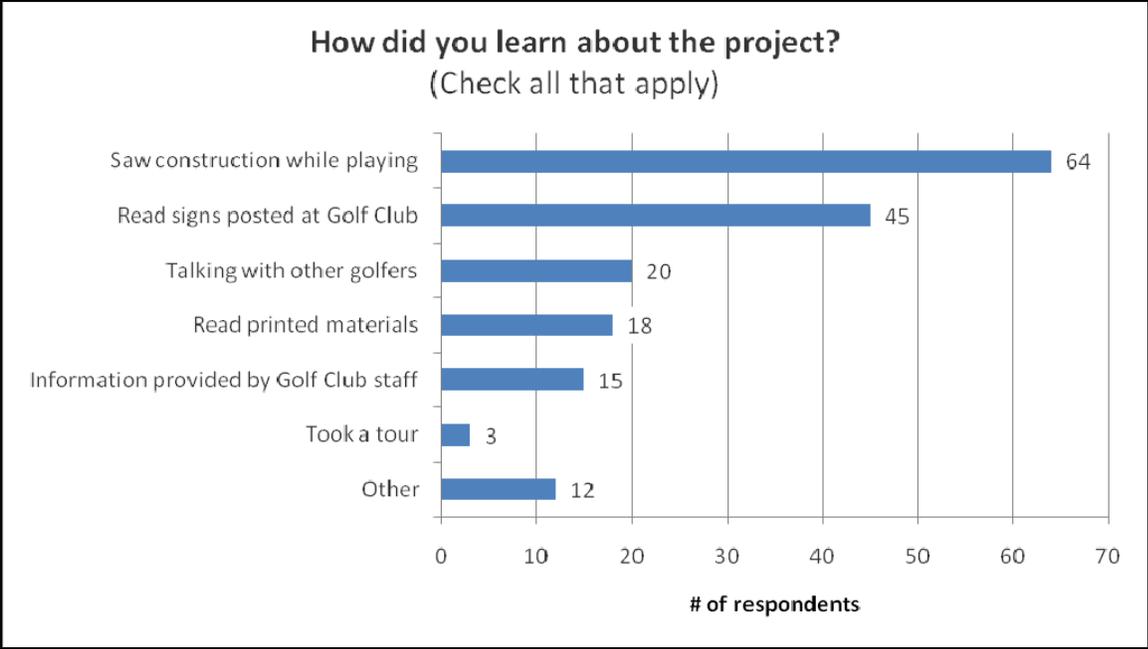
The general perception was that the Upper Las Positas Creek project would have an overall positive environmental impact on local creeks, local beaches, storm water management, wildlife habitat, and decreased flooding in the long-term. Respondents generally saw as benefit to golf course appearance. Fewer, although still a majority, projected a positive impact on golf course playability.



Information Channels and Respondent Perceptions

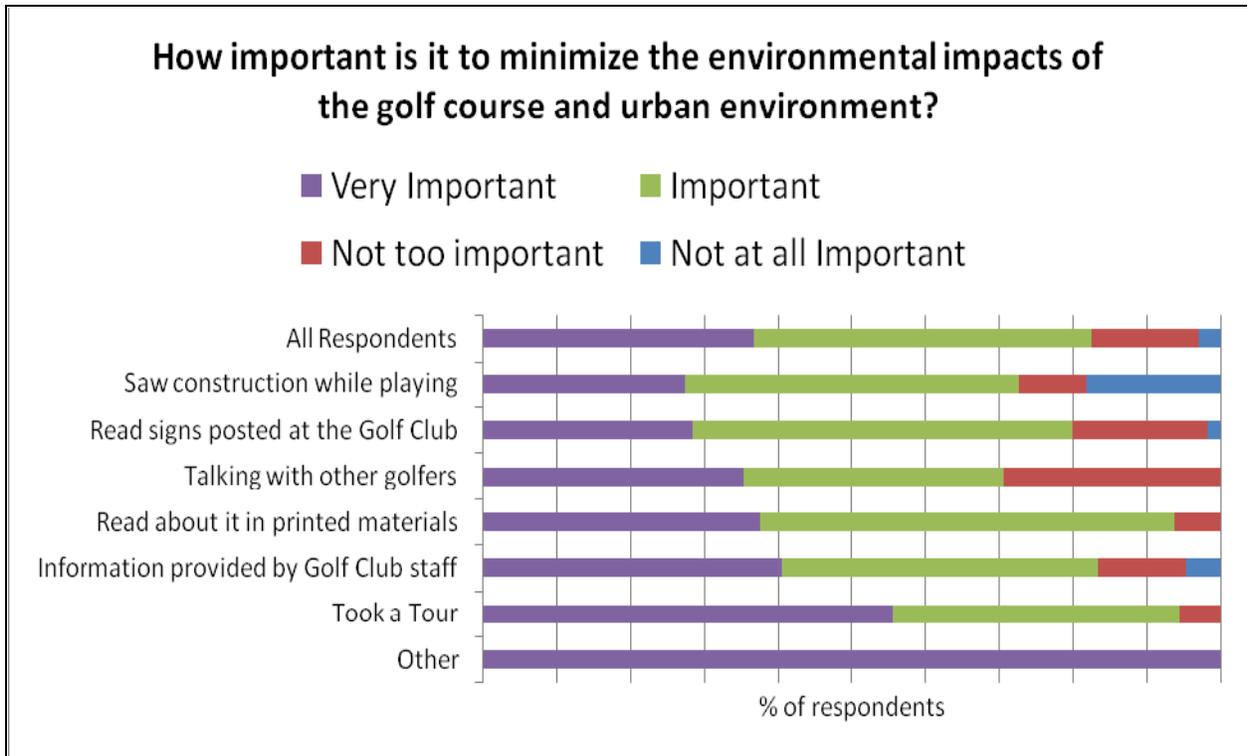
The data were analyzed further in order to relate how respondents' perceptions of the project were shaped by the information channels through which they learned about the Las Positas storm water management and ecological restoration project. When the respondents were asked how they learned about the project, they were allowed to check all that applied. Options included taking a tour, reading about the project in printed materials, reading signs posted at the Golf Club, information provided by Golf Club staff, talking to other golfers, seeing construction while playing, and other sources of information. The most likely source of information about the project was either seeing the construction or reading the signage posted throughout the golf course. Only three respondents participated in a tour of the project. Other channels of receiving project information included service on the advisory committee, the Santa Barbara News Press, and attending a meeting.

Data regarding information channels were analyzed in two ways. We tracked the opinions of all the respondents who accessed a particular information channel. In addition, we analyzed the perceptions of respondents who only had access to one particular source of information. Most individuals learned about the project via multiple sources of information. Of the 141 total respondents, 49 individuals identified only one primary source of information.



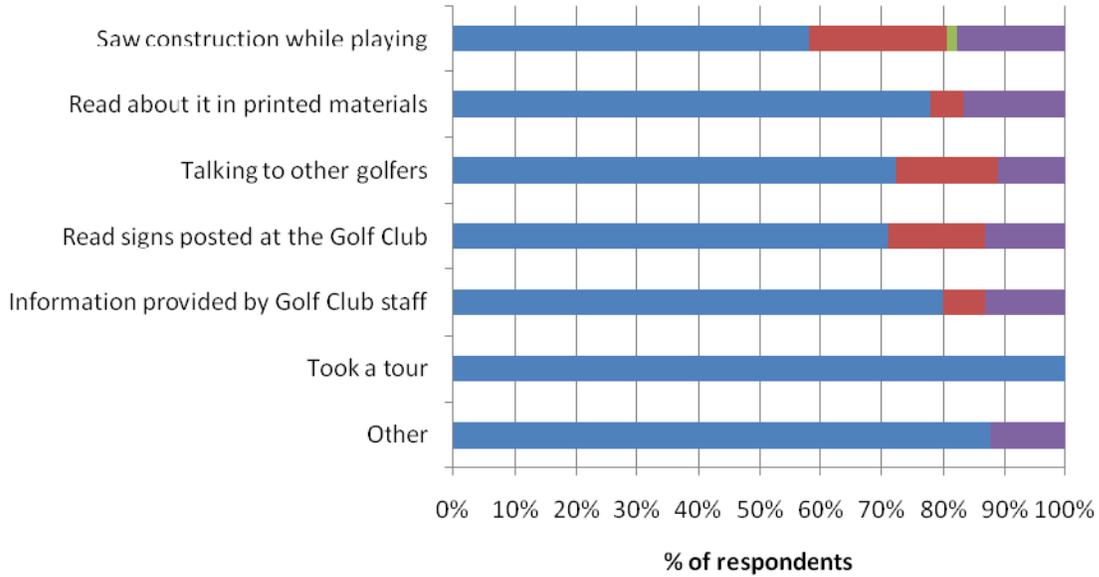
There are clear trends relating respondents’ understanding of the project and the information channels which they accessed. The implications of this correlation are more difficult to disentangle. Going on a tour might result in a more informed respondent. However, those respondents with a high degree of interest in the project and the environmental footprint of the golf course may have been more likely to go on a tour or speak with Golf Club staff about the project. Nevertheless, the data show that people who took a project tour and interacted with Golf

Club staff were more concerned about minimizing the environmental impact of the golf course and better understood the impacts of the project on beach and creek water quality. Everyone who took a tour (only three individuals) considered minimizing the environmental impact of the golf course as very important and stated that the golf course restoration would have a positive impact on local beach and water quality. Moreover, 82% of those who spoke with Golf Club staff felt that the restoration project would improve beach water quality and around 80% felt that the project would improve creek water quality. In contrast, of those who saw construction, less than 60% felt that the project would have a positive impact on creek water quality and about 60% thought that the project would improve beach water quality.



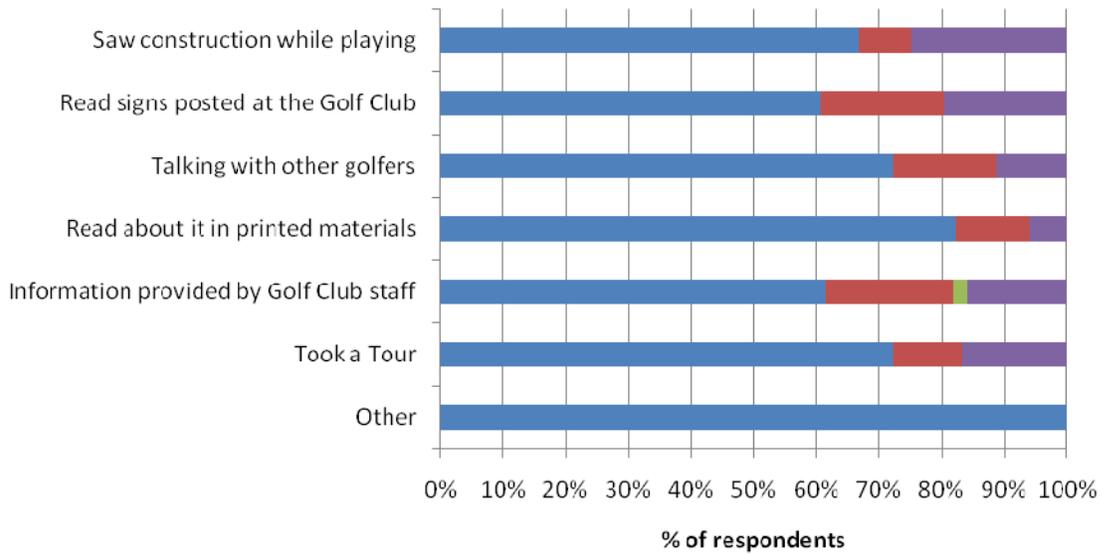
Impact on Local Creeks Water Quality

■ Positive ■ No impact ■ Negative ■ Don't know



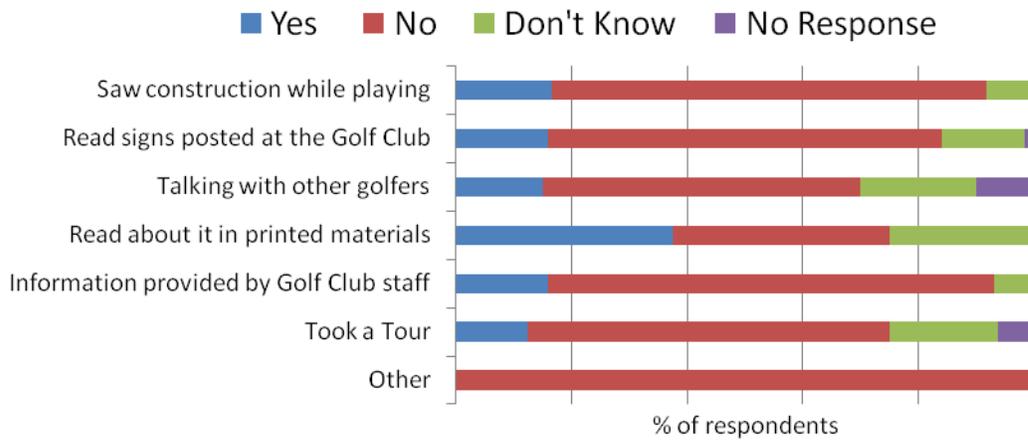
Impact on Local Beach Water Quality

■ Postive ■ No Impact ■ Negative ■ Don't Know

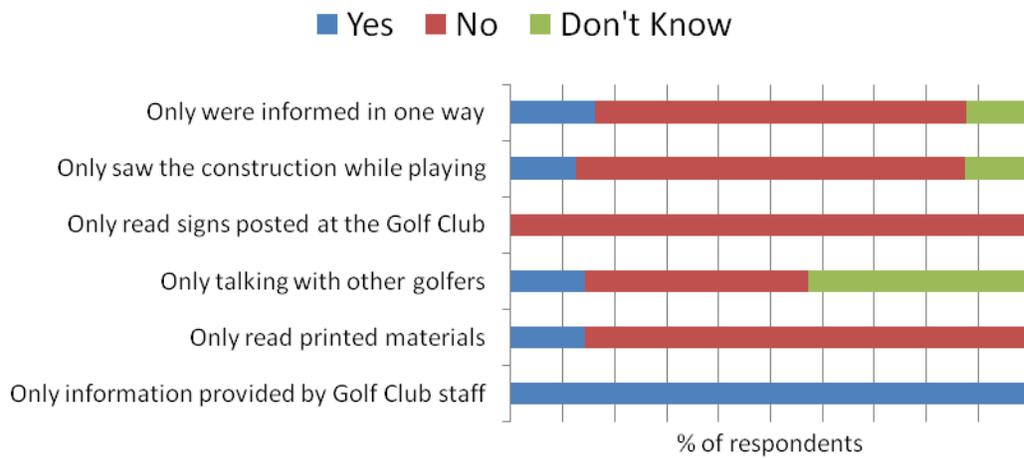


Similar patterns characterize the extent to which respondents identified the golf course as a source of pollution. Of those respondents who identified construction as their only source of information (24 respondents) about the project, 75% of them felt that golf course was not a significant source of creek and water pollution. Of those who only read the signs (12 respondents), 85% of them stated that they didn't consider the golf course as a significant source of creek and water pollution. In contrast, those who only read printed materials (only 2 respondents) felt that the golf course was a significant source of creek and water pollution. When asked the importance of minimizing the environmental impact of the golf course and the urban environment, all of those who took a tour said that this was "very important." Over 55% of those who read about the project in printed materials answered in kind. Approximately 28% of those who only saw the construction stated that minimizing the impacts of the golf course on the urban environment was "very important." Interestingly, 29% of those who spoke with other golfers felt that minimizing the impacts of golf courses on the environment was "not too important." This was the highest percentage of those surveyed who stated that it was "not too important."

Do you consider the golf course a significant source of creek and water pollution?



Do you consider the golf course a significant source of creek and water pollution?



Recommendations

Based on the data analysis, the student researchers composed a series of recommendations for the City of Santa Barbara, Creeks Division to implement in order to increase Golf Club user knowledge about the project and improve public attitudes regarding its effectiveness. Students feel the following will be beneficial: 1) improve and increase signage on the golf course in areas near the project, 2) print material on scorecards, 3) educate Santa Barbara Golf Club Pro Shop staff members, 4) sponsor a Santa Barbara Creeks Division golf tournament, 5) creating an additional Creeks Division advertisement targeting golf course visitors, and 6) expanding educational outreach to Adams Elementary School and Earl Warren Show Grounds.

Students see great potential for enhanced perception of the project's goals by improving signage and educational material. Signs and printed material should connect the creek restoration project on the golf course with improvements of the watershed quality. While 74% of people surveyed thought it was "important" to "very important" for minimizing the environmental impacts of the golf course, 67% did not consider the golf course a significant source of pollution. In addition, 33% of respondents did not know if the golf course was in a watershed. These data indicate a lack of information regarding respondents' active roles in their local watershed.

The student researchers believe it is important to identify major sources of pollution coming from the golf course as well as to create visual representations of how these pollutants are trapped, sequestered, and bio-remediated by the holding ponds. Illustrations should include a cross-sectional drawing of a water basin that shows the flow of water and pollutants. In order to bring forth the implications of untreated storm water runoff, students recommend a sign with a map of the Arroyo Burro Creek and Las Positas Watershed highlighting the Santa Barbara Golf

Club location. The signs would visually demonstrate water flow and the implications of untreated runoff to Arroyo Burro Beach by highlighting creeks and streams within and near the golf course. Students believe addressing local creeks and beaches within the Arroyo Burro watershed is effective since 59% of respondents said they visited local creeks and 92% of respondents said they visited local beaches within the last two years. Students recommend installing these signs on the tee boxes closest to the restoration project, especially on par three holes where golfers have the most waiting time.

Students asked survey participants to indicate if they believed the Upper Las Positas Creek project would affect the following items: golf course appearance, golf course playability, decreased flooding, wildlife habitat, storm water management, local creeks water quality, and local beach water quality. Respondents could answer: “positive impact”, “negative impact”, “no impact”, or “don’t know.” On average, 21% of the total respondents did not know what the long-term impacts of the Upper Las Positas Project would have on the golf course. Participants with prior knowledge of the project gained information predominately through viewing construction or signs on sight. Therefore, students recommend a visual demonstrating the completed project with fully matured plants and trees. This visual should address all aspects of the question asked in the survey including the following: a fully developed aesthetic of the golf course along with continued golf play, connection of how the bioswales and basins assist flood control, links of improved beach and creek water quality, increased local habitat diversity, and improvements to storm water management. However, students felt the visual did not need to be a permanent sign along the golf course showing the completed aesthetic with matured plants and trees since it would eventually develop to match the sign.

Similar to the suggested signage discussed above, students recommend printing educational material on the backs of scorecards. Information would include a connection to the creek restoration project on the golf course with improvements of the watershed quality. In addition, a printed link to the Creeks Division website would offer interested golf course users further sources of information regarding project successes and local water quality.

While expanding and improving educational material on the golf course is the primary recommendation, taking a multifaceted approach is vital to ensure maximized knowledge and acceptance of the project. Survey results showed that people who spoke with the golf club and creeks division staff had an overall better understanding of the impacts of golf courses on beach and creek water quality, in addition to feeling more positively about the project. Among those who spoke with staff members directly, 82% felt the project would improve beach water quality and 80% thought it would improve creek water quality. Staff members will be more willing and able to correct any misconceptions golf course users may have through an in-depth education of the Upper Las Positas project goals. This is especially important in the case of golf course marshals, since they are the ones on the course while play takes place. By facilitating discussion about the restoration project with groups who are waiting during times of slow play, marshals can help answer questions the golfers have about the new signage.

In addition to improving educational material on the golf course, students recommend a golf tournament sponsored by the Santa Barbara Creeks Division to celebrate the completion of the project. The tournament's ultimate goals would be to directly educate the golf course community on the purpose of the project, improve their attitudes toward the new changes, raise funds for future projects of this nature, and open up discussion for additional potential improvements of this kind on the golf course.

For people to relate environmental issues directly to their personal lives, we recommend the Santa Barbara Creeks Division make an iconic image similar to their advertisements educating the public on water quality (City of Santa Barbara, What We Can Do...And Why We Should 2010). The Creeks Division already has advertisements showing how individuals' actions directly affect water quality through the following images: a man with his dog that is defecating, a man fertilizing his lawn, a car leaking oil, and a man washing his car. All of these advertisements are positioned over the ocean showing viewers the correlation of humans' actions leading to the ocean. Students suggest the Creeks Division create an additional advertisement linking golf courses and golf course users to ocean water quality (see Appendix D).

Although the majority of this project focused on the Santa Barbara Municipal Golf Course, it is advised that the Santa Barbara Creeks division expand the above educational methods to surrounding areas within the Arroyo Burro watershed. Both the Adams Elementary School and the Earl Warren Show Grounds contribute to water pollution and affect the quality of local creeks and the ocean. By viewing construction, 61% of the golf course users were educated about the Upper Las Positas Project and 43% were educated by viewing posted project signs. Although in close proximity, individuals located at the school and show grounds lack access to the two highest ranked sources of becoming informed of the project. To expand educational outreach on creek and ocean water quality, it is urged that the Creeks Division increase their target audience from just the golf course users. Students suggest implementation of the following signs at both the Adams Elementary School and Earl Warren Show Grounds locations: map of the Arroyo Burro watershed, image of the completed project at the Santa Barbara Municipal Golf Course, and connections of school and show grounds' pollution to creek and ocean water quality. Although construction will not be apparent from the two new locations,

signs will educate individuals at the school and show grounds about the interconnectedness of their locations with the rest of the Arroyo Burro watershed.

Finally, it is felt that integrating multiple recommendations is pertinent to positively increasing educational outreach. As the data show, 86% of those that only read signs posted on the golf course still felt the golf course was not a significant source of pollution. However, those who read signs in addition to utilizing other outlets of information felt minimizing the environmental impacts of the golf course was very important. Therefore, by incorporating signs in addition to further recommendations (e.g. printed material, educating staff, golf tournament, advertisements, expanding local educational outreach) is vital to the Santa Barbara Creeks Division's project goals.

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Appendix A

Creeks Data Collection Schedule

Saturday 5/8, (9-12am)

1. Alex Curtis
2. Ariel Miller
3. Logan McCoy

Sunday 5/9 (9-12am)

1. Jared Kanashiro
2. Dominic Parducci

Monday 5/10 (3-6pm)

1. Patrick Mullens
2. Andrew Chang
3. Kelsey Wheeler
4. Margaret Castaneda
5. Aracely Montero

Tuesday 5/11 (1-4pm)

1. Matt Dimichele
2. Joey Burgess
3. Riley Kriebel
4. Christen Chaffin
5. Dietrich Graumann

Sunday 5/16 (1-4pm)

1. Shay Kahen
2. Katt Knecht

Monday 5/17 (1-4pm)

1. Ali Morrow
2. Emily Golding

Appendix B

Santa Barbara Golf Club Survey

This survey is being conducted by UCSB students in collaboration with the City of Santa Barbara. It investigates the opinions of visitors to the Santa Barbara Golf Club regarding the Upper Las Positas Creek Restoration and Storm Water Management Project. Coinciding with this project was the Golf Club Safety Improvement Project, which included the creation of new greens, as well as golf cart path replacement. This survey is specifically about the Restoration and Storm Water project.

The survey should take approximately 10 minutes to complete. Participation is voluntary and your consent to participate in the research project is required. In order to assure your privacy, all participants in the survey will remain completely anonymous. As a way to thank you for your participation, you can enter into a raffle for gift certificates to Mulligan's and the Pro Shop.

1. On average, how often do you golf at the Santa Barbara Golf Club? (Select ONE)

- One day per week or more
- Several days per month
- Several times per year
- Never been here before
- Not a golfer (i.e. Mulligan's customer)

2. Are you familiar with the Upper Las Positas Creek Restoration and Stormwater Management Project currently taking place at the golf course?

Yes/ No / Don't Know

IF YES, 2.A. How did you learn about this project? (check ALL that apply)

- Took a tour
- Read about it in printed materials
- Read signs posted at the Golf Club
- Information provided by Golf Club staff
- Talking with other golfers
- Saw construction while playing
- Other. Please specify _____

IF YES, 2.B. Do you like the changes to the golf course that have been made as a part of the Las Positas Creek project?

Yes / No

Briefly explain why or why not: _____

IF YES, 2.C. Do you think the Las Positas Creek project will benefit your golfing experience three to five years into the future?

Yes / No / Don't Know

Briefly explain why or why not: _____

3. In the last year or two, have you visited one of the local creeks in the Santa Barbara area?

Yes / No

4. In the last year or two, have you visited one of the beaches in the Santa Barbara area?

Yes / No

5. On a scale from 1 to 5, (with 1 = not serious and 5 = very serious) rate the following items as serious or not serious problems in Santa Barbara:

- Local Creek Water Quality
- Local Beach Water Quality
- Invasive Species
- Loss of Wildlife Habitat
- Flooding in Residential Areas

6. On a scale from 1 to 5, (with 1= not serious and 5=very serious), rate the level of seriousness of the following items as sources of water pollution. If you don't know, simply say "don't know":

- | | |
|--|---|
| <input type="checkbox"/> Motor oil | <input type="checkbox"/> Trash and litter, such as fast food wrappers |
| <input type="checkbox"/> Paint | <input type="checkbox"/> Runoff from when people water their lawns |
| <input type="checkbox"/> Lawn or garden fertilizer and pesticides | <input type="checkbox"/> Leaves and grass clippings |
| <input type="checkbox"/> Soapy runoff from when people wash their cars | <input type="checkbox"/> Dog waste |
| <input type="checkbox"/> Runoff from commercial or retail businesses | <input type="checkbox"/> Run-off from restaurant activities |
| | <input type="checkbox"/> Dirt and debris from construction |

7. As far as you know, is the Santa Barbara Golf Club located in a watershed?

Yes / No/ Don't Know

8. From where does the water flowing through the Santa Barbara Golf Club come?

(Check ALL that apply)

- Groundwater
- Creek water
- Landscaping
- Storm drains
- Rainfall

9. Where does the water flowing through the Santa Barbara Golf Club go?

(Check ALL that apply)

- Wastewater treatment plant
- Absorbed by the ground
- To the ocean
- To a creek
- To a storm drain
- Kept onsite in ponds

10. Do you consider the golf course a significant source of creek and water pollution?

Yes / No / Don't Know

11. Indicate if you believe the Las Positas Creek project will have an impact on the following issues in the long-term:

- | | |
|----------------------------|--|
| Local Creeks Water Quality | positive / negative / no impact / don't know |
| Local Beach Water Quality | positive / negative / no impact / don't know |
| Storm Water Management | positive / negative / no impact / don't know |
| Wildlife Habitat | positive / negative / no impact / don't know |
| Decreased Flooding | positive / negative / no impact / don't know |
| Golf Course Playability | positive / negative / no impact / don't know |
| Golf Course Appearance | positive / negative / no impact / don't know |

12. How important do you think it is to minimize the environmental impacts of the golf course and urban environment?

Not at all important No too important Important Very important

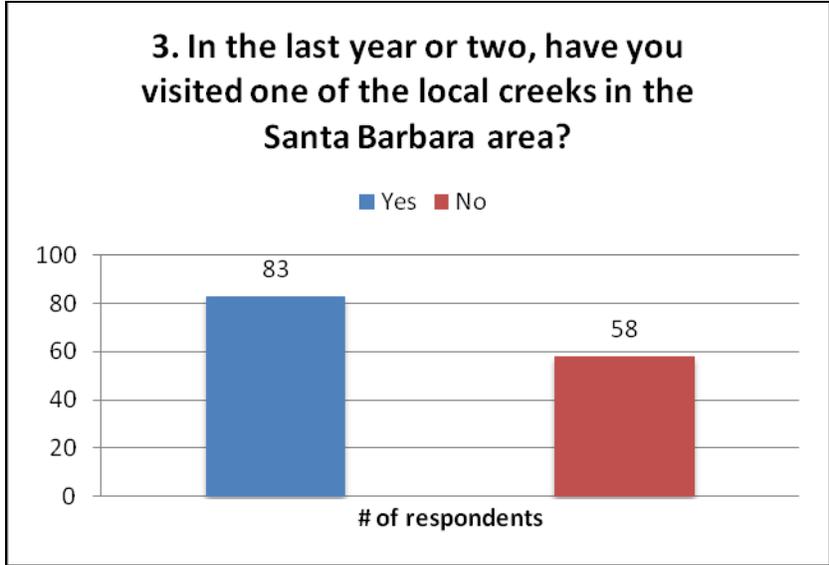
13. Are you a Santa Barbara resident or a visitor?

13.A. If you are a resident, what is your home zip code? _____

14. What is your gender? Male / Female

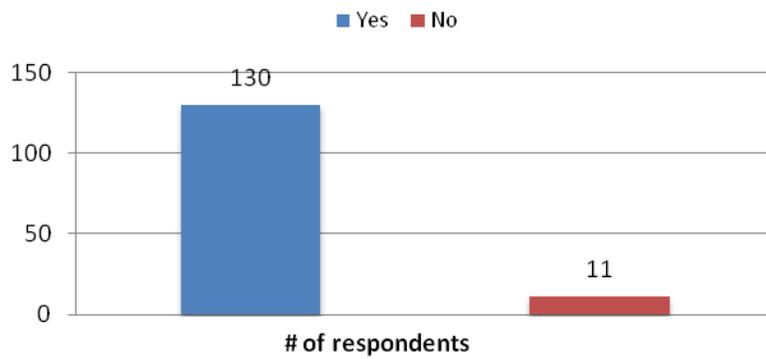
15. In what year were you born? _____

Appendix C: Additional Data Analysis



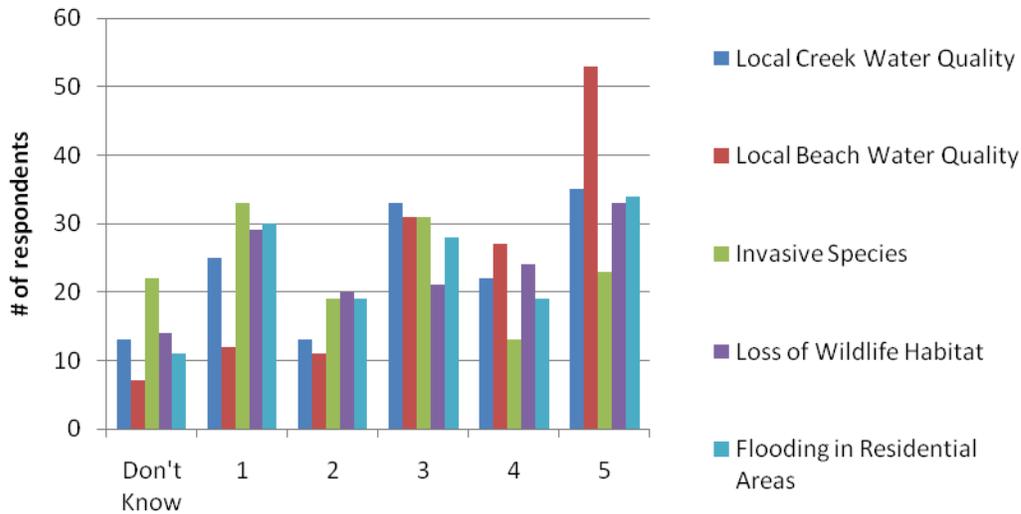
3. In the last year or two, have you visited one of the local creeks in the Santa Barbara area?	Sum of Respondents
Yes	83
No	58
Total	141

4. In the last year or two, have you visited one of the beaches in the Santa Barbara area?



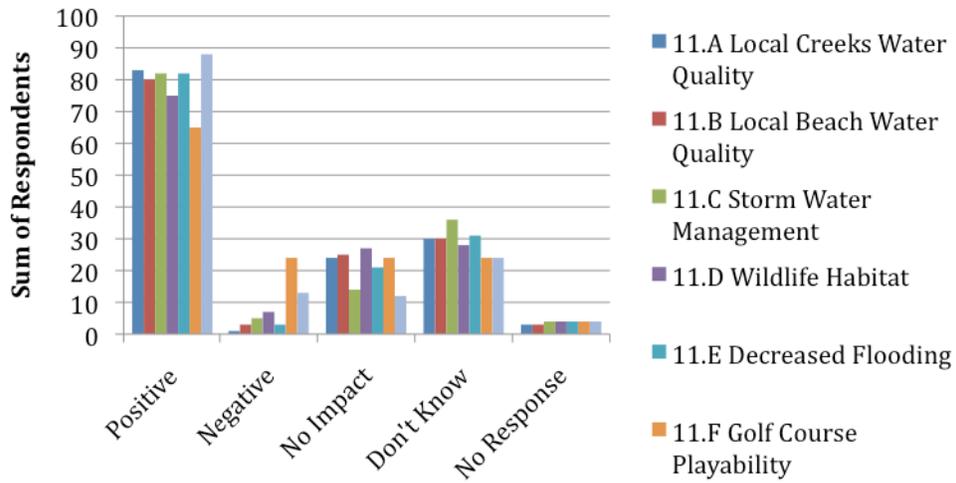
4. In the last year or two, have you visited one of the beaches in the Santa Barbara area?	Sum of Respondents
Yes	130
No	11
Total	141

5. Seriousness Rating of Local Environmental Issues (1 = not serious and 5 = very serious)

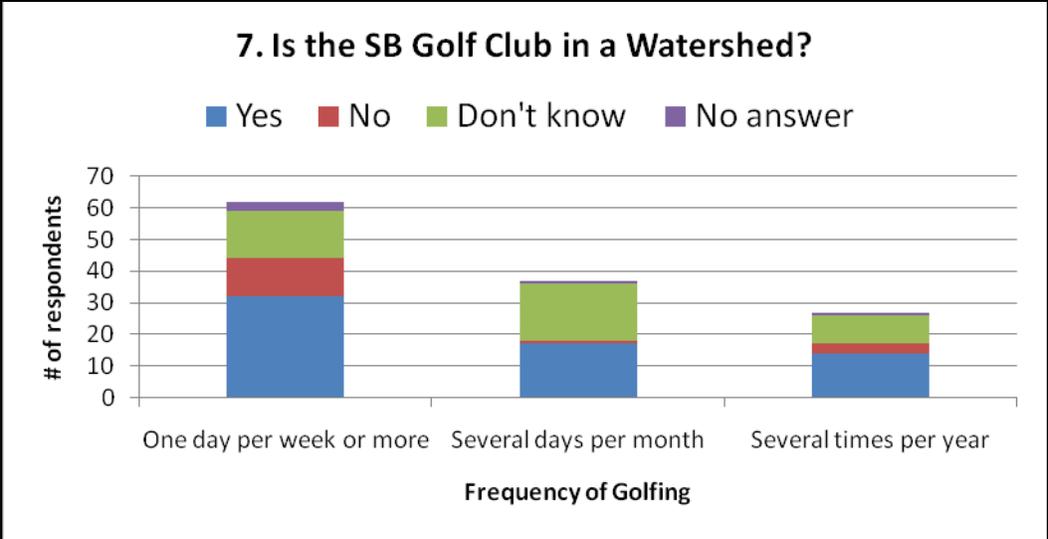


Score	5.A Local Creek Water Quality	5.B Local Beach Water Quality	5.C Invasive Species	5.D Loss of Wildlife Habitat	5.E Flooding in Residential Areas
Don't Know	13	7	22	14	11
1	25	12	33	29	30
2	13	11	19	20	19
3	33	31	31	21	28
4	22	27	13	24	19
5	35	53	23	33	34
Sum (excluding "No Response")	128	134	119	127	130
Average Score	3.23	3.73	2.78	3.09	3.06

11. Opinions about the Long-term Impact of the Las Positas Creek Project

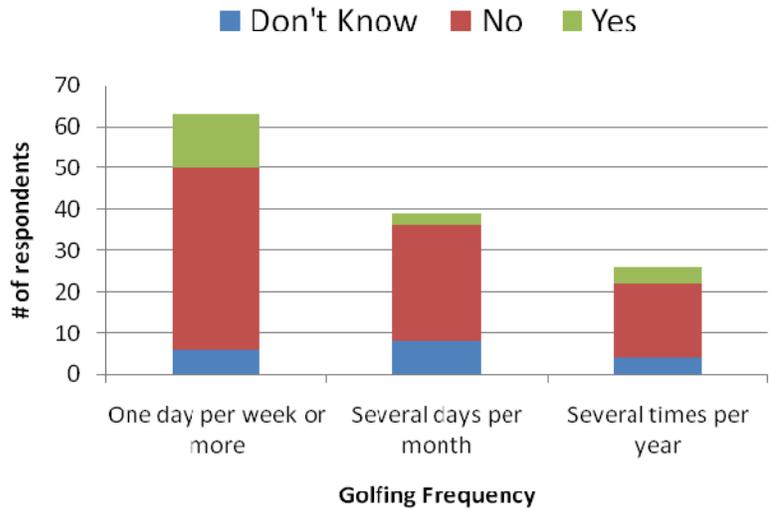


11. Long-term impact	Local Creeks Water Quality	Local Beach Water Quality	Storm Water Management	Wildlife Habitat	Decreased Flooding	Golf Course Playability	Golf Course Appearance	Total Sum of All Categories
Positive	83	80	82	75	82	65	88	555
Negative	1	3	5	7	3	24	13	56
No Impact	24	25	14	27	21	24	12	147
Don't Know	30	30	36	28	31	24	24	203
No Response	3	3	4	4	4	4	4	26
Total Participants	141	141	141	141	141	141	141	

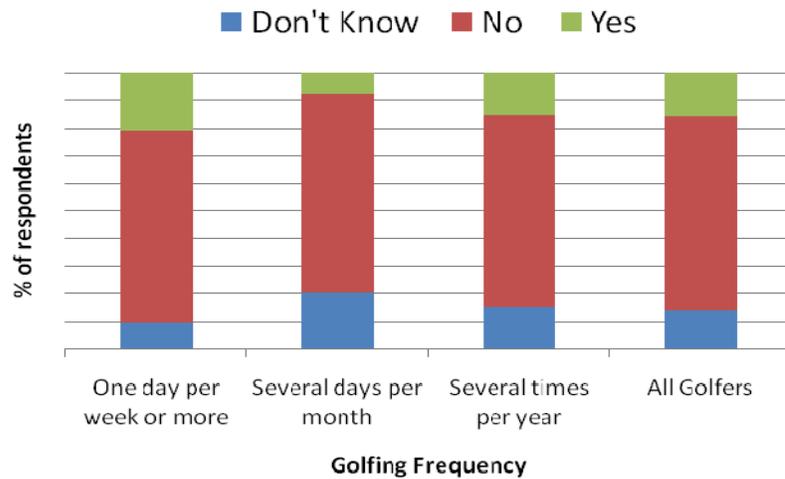


	Yes	No	Don't know	No answer
One day per week or more	32	12	15	3
Several days per month	17	1	18	1
Several times per year	14	3	9	1

10. Do you consider the golf course a significant source of creek and water pollution?



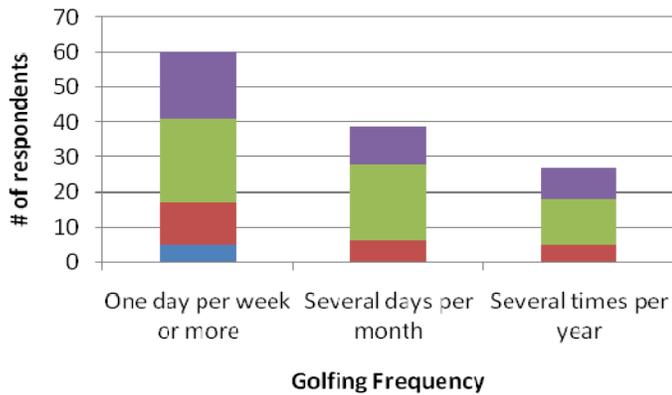
10. Do you consider the golf course a significant source of creek and water pollution?



Agregate	Don't Know	No	Yes	Sum	No Response
One day per week or more	6	44	13	63	1
Several days per month	8	28	3	39	0
Several times per year	4	18	4	26	2
All Golfers	18	90	20	128	

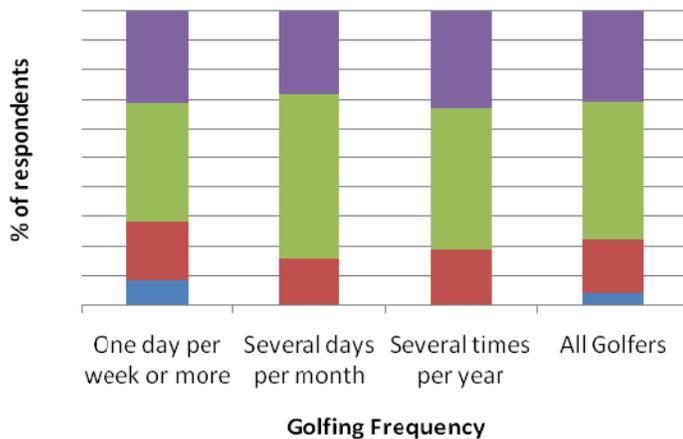
12. How Important it is to minimize environmental impact of golf course and urban environment?

■ Not Important ■ Not Too Important ■ Important ■ Very Important



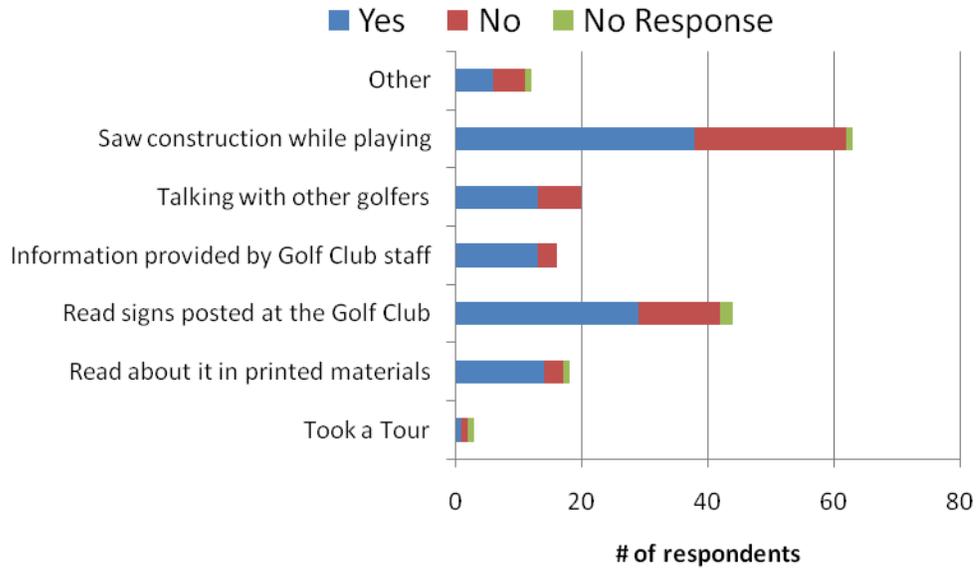
12. How Important it is to minimize environmental impact of golf course and urban environment?

■ Not Important ■ Not Too Important ■ Important ■ Very Important



Aggregate	Not Important	Not Too Important	Important	Very Important	Sum
One day per week or more	5	12	24	19	60
Several days per month	0	6	22	11	39
Several times per year	0	5	13	9	27
All Golfers	5	23	59	39	126

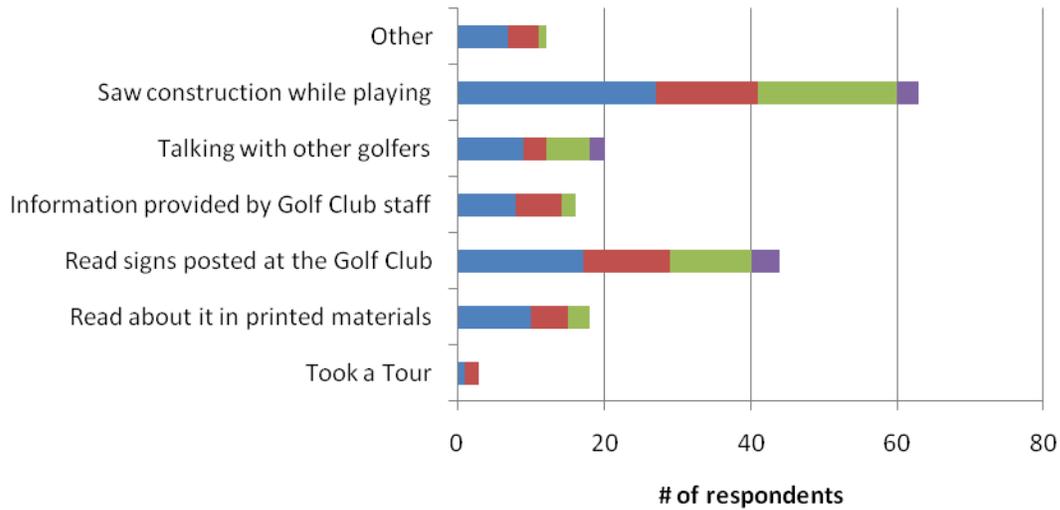
2.B. Do you like the changes to the golf course that have been made as a part of the Las Positas Creek Project?



2.B. Do You like the Changes?	Yes	No	No Response
Took a Tour	1	1	1
Read about it in printed materials	14	3	1
Read signs posted at the Golf Club	29	13	2
Information provided by Golf Club staff	13	3	0
Talking with other golfers	13	7	0
Saw construction while playing	38	24	1
Other	6	5	1

2.C. Do you think the Las Positas Creek Project will benefit your golfing experience three to five years into the future?

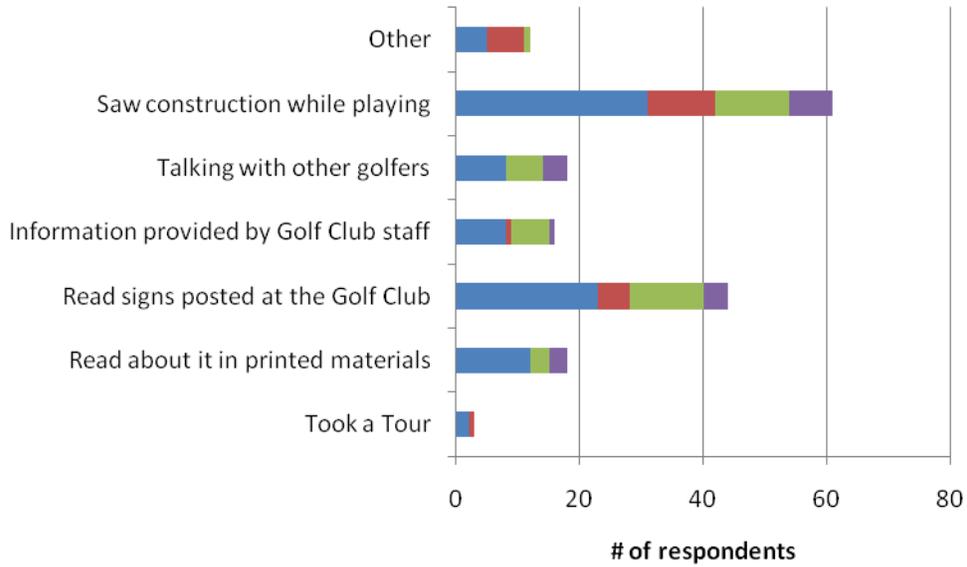
■ Yes ■ No ■ Don't Know ■ No Response



2.C. Will changes benefit future exp?	Yes	No	Don't Know	No Response
Took a Tour	1	2	0	0
Read about it in printed materials	10	5	3	0
Read signs posted at the Golf Club	17	12	11	4
Information provided by Golf Club staff	8	6	2	0
Talking with other golfers	9	3	6	2
Saw construction while playing	27	14	19	3
Other	7	4	1	0

11F. Impact on Golf Course Playability

■ Postive ■ Negative ■ No Impact ■ Don't Know



11.F Golf Course Playability	Postive	Negative	No Impact	Don't Know	Sum
Took a Tour	2	1	0	0	3
Read about it in printed materials	12	0	3	3	18
Read signs posted at the Golf Club	23	5	12	4	44
Information provided by Golf Club staff	8	1	6	1	16
Talking with other golfers	8	0	6	4	20
Saw construction while playing	31	11	12	7	63
Other	5	6	1	0	12

Appendix D: Sample Poster

