UC DAVIS
TAHOE ENVIRONMENTAL RESEARCH CENTER

# WIN $4,000


## Request for Proposals

Tahoe Environmental Research Center: "Lake Tahoe Research App Developer"
Proposals due April 10, 2015 by 5 p.m.

The UC Davis Tahoe Environmental Research Center (TERC) requests proposals from undergraduate or graduate students enrolled at UC Davis to develop a smartphone app focused on "citizen science" for Lake Tahoe. Proposals may be submitted by teams or by individuals. Future versions of this app may be expanded to a larger region surrounding the Lake, and possibly to other lakes around the United States and the world.

Project Background

TERC wishes to create a smartphone app to raise environmental awareness and encourage stewardship actions by Lake Tahoe residents and visitors. This app creation is part of a research project funded by the Institute for Museum and Library Studies (IMLS). One of the goals of the project is to quantify the experience of Lake Tahoe beach-goers and in particular their sense of environmental quality. The data collected (through this app) will be used by lake researchers at TERC, and as part of one or more exhibits at TERC's Tahoe Science Center (a public science museum in Incline Village, NV) that compares these perceptual data with instrument data collected at Lake Tahoe.

The app will enable users to record their experiences (or perceptions) related to water quality and lake conditions while at the lakeshore. Experiences include water clarity, presence of algae, beach conditions, etc. Users will be able to photograph conditions and record text observations. Social media functions such as

"following" people, awareness of who is on the app now, self-organizing of teams, and competition for most / types of observations ("leaderboard") are highly desirable.

The app will need to be usable on iPhone, Android, Galaxy, and future touchscreen-based smartphone systems. Although we use the word "app," it need not be a native app and could be a web-based solution. We have drafted basic specifications and a tentative navigational structure (see Appendices A and B) that will need fleshing out in certain areas (such as social and competitive functionalities) and may be altered if better ideas arise.

App Integration

Data from the app will be incorporated into an SQL database with webpage output. This perceptual or "soft" data will be used by TERC researchers as they study lake conditions. It will also feed into one or more electronic exhibits currently in development at the Tahoe Science Center.

Specifications

The basic specifications for the app are included as Appendix A. A tentative navigational structure has been created for most parts of the app (Appendix B), and early prototype mock-ups (Appendix C) have undergone a first level of user testing. The mock-ups were constructed for the sole purpose of thinking through the functionality and navigational construction of the app, and should not be thought of as design prototypes.

Proposal Submission

Interested candidates are asked to submit a proposal for developing the app. Your proposal should include the following:

A. Name(s), expected graduation date and degree, individual or team qualifications.
B. Provide a brief statement of why you/your team's architectural approach is the best choice for reliability and success for this app.
C. How will you meet basic requirements as presented in the wireframe shown in "Basic Specifications" Appendix A?
D. Which add-ons would be included (geo-mapping of user location, geo-mapping of all user reports within a specified time-range on a map, basic weather data sourced online based on user location, leaderboard, social media linkages, image upload to Facebook/Instagram/Flickr, hash-tag report out to Facebook/Instagram/Twitter, or others)?
E. How would TERC later modify the app (e.g. change wording of questions or add parameters)? If coding is necessary to make changes, what provisions and documentation will be made available to facilitate the changes without hands-on assistance from the original developer?
F. User Management: How will you identify and manage users? Please specify any tools or technologies you will implement.
G. Testing and Quality Assurance: How will you insure reliability and data integrity?
H. Operation: How will the application be operated conveniently and with optimal uptime and where will it be hosted (e.g. Google Cloud, MyAppBuilder.com, etc.)?
I. What are your plans for failure recovery and data back-ups?

J. Architecture: Which technologies will be incorporated into the App (programming language used, software development toolkits used, commercially licensed software or open-source software used)? TERC welcomes any architectural approach and any toolsets and services that can most readily meet current and future objectives. Examples include hosted platform services for creating simple business apps such as those detailed at: http://www.businessnewsdaily.com/4901-best-app-makers-creators.html and the open-source iNaturalist rails framework https://github.com/inaturalist/inaturalist.
K. Costs: Detail your expected expenses during the development and production phases and any forecasted expenses for future maintenance and upgrades. Note: Expenses for development that are approved in advance will be reimbursed.
L. The entire proposal should be submitted as a single PDF file to Alison Toy (antoy@ucdavis.edu) by 5 p.m. on April 10, 2015.

Selection of Winning Proposals
Candidates will be selected on the basis of the viability of their proposal, including the ability to deliver on-time and on-budget, the app's ease of use, robustness, upgradability and the selection committee's confidence in the candidate and the proposed architecture.

The top three proposals may be eligible for academic credit (199 or 299 units). Additionally, these top candidates will receive the TERC Application Development Award including a certificate award and press associated with selection, and upon delivery of a working beta-version of the app will be awarded $2,000 for individuals and $3,000 for teams.

Based on the beta-version of the app, one candidate or team will be selected for final development. The selected individual or team members will be named TERC 2015 Application Development Fellows and will receive an additional award of $2000 and the opportunity to work with Fielders, LLC, an exciting start-up focused on supporting institutions like TERC to complete the project.

An informational session for this project will be held on Wednesday, March 18, 2015, from 1:30–4:30 pm., in the Watershed Sciences Building conference room (Room 1105-F) on the UC Davis campus (directions at https://watershed.ucdavis.edu/about/directions). Prof. Geoffrey Schladow, Project PI, and John Keagy, App Project Manager and CEO of Fielders LLC, will be available to answer questions during that time.

Project Timeline:

1. Proposal
    1. Request for Proposal (RFP) out March 10, 2015
    2. Informational session on March 18, 2015 (on UC Davis campus, location to be determined)
    3. Proposals due April 10, 2015
    4. Notification of three finalists by April 17, 2015

2. Beta Phase

1. Three finalists announced by April 17, 2015 awarded $2,000 each and teams awarded $3,000 for delivery of working beta-version of app by June 18, 2015

3. Production Phase
    1. 1 *TERC Application Development Fellow* winner announced in June
    2. Additional award $2,000 for delivery of working app by August 10, 2015
    3. Optional research vessel trip on Lake Tahoe for scientific sampling with TERC director, Geoff Schladow
    4. Monthly stipend to operate working app available through September 2016

APPENDIX A: Basic Specifications

User Management

Users have the option of creating a unique user id. User id must be unique. No requirements for password strength.

- Option to log in as guest, app sequentially assigns guest user unique identifier
- Option to create user name and password
    - Usual tools to recover a lost password
- Option to use Facebook as identification credentials
- Use of username and password for users using multiple devices
- Lightweight effort to identify return visitors via device ID, cookie, or IP address
- What happens (select user ID and password) on first time visit, first time visit from each device, and future visits?

Automated Data Collection

Collect all data useful that would not normally be considered an invasion of privacy, but would enable TERC to identify user, including:

- Device ID
- Date and time
- GPS coordinates
- IP address
- User name
- If cookies are enabled, place a cookie and retrieve only cookies placed

User Submitted Data Collection

See wireframe document in Appendix B.

Data Output

- Data reporting of formatted raw data in a web browser in real-time
- Raw data export to CSV file. (Note: Raw data only. Future specifications will be developed for reports and to include data in an exhibit but this is not part of the scope of this project.)

APPENDIX B: Navigational Chart PDF

The navigational chart has been developed to outline the basic structure for the app. The navigational chart also shows two optional paths for users who have been certified by our community partner, The League to Save Lake Tahoe, in identifying invasive species ("Eyes on the Lake") and in monitoring inflow pipes at the lake ("Pipe Keepers"). For users who are trained and certified, these pathways would become available to the user as shown.

APPENDIX C: Wireframe (Sample) PDF

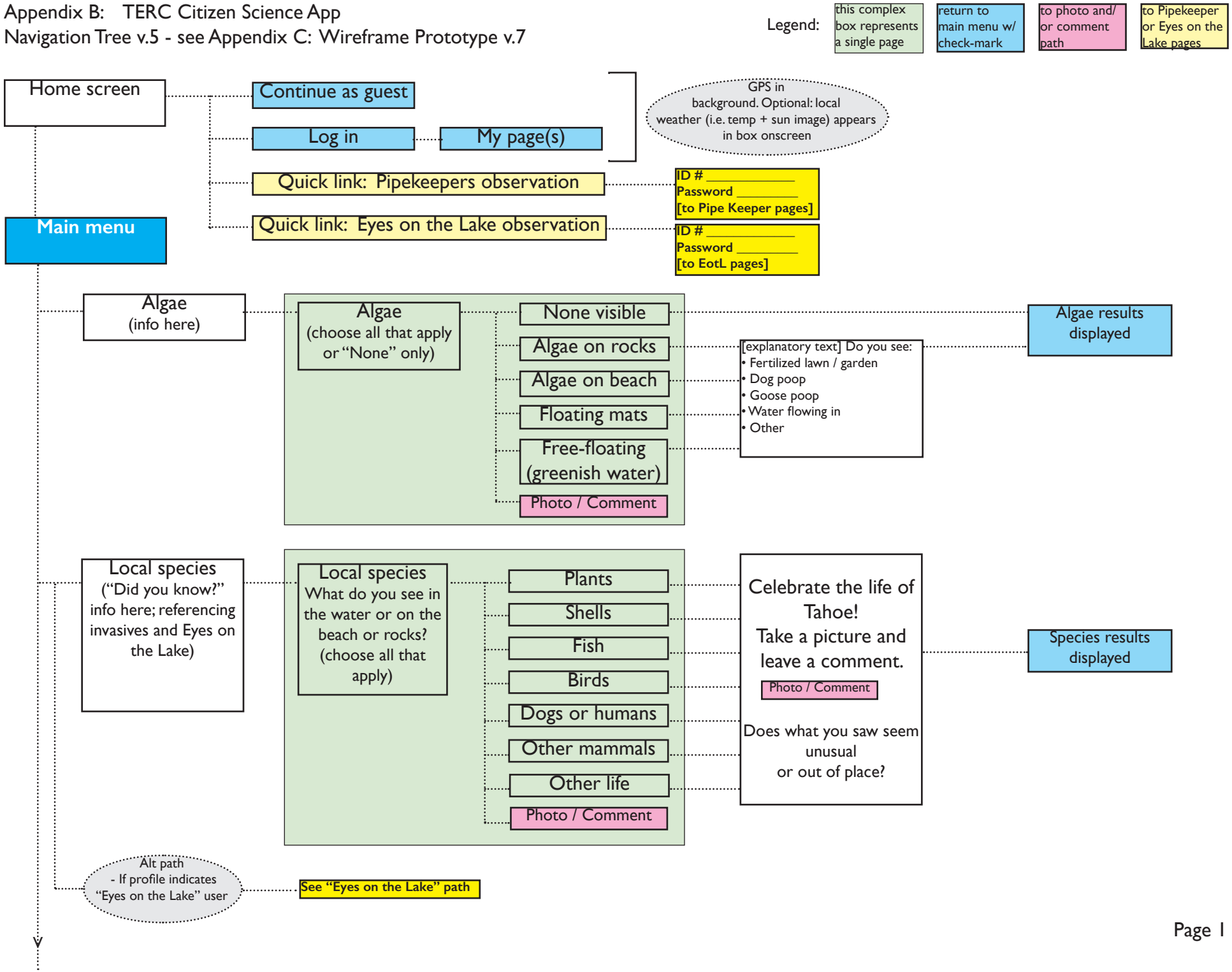
The wireframe PDF is internally linked and can be navigated onscreen as a prototype. This is not intended to be a final design solution (i.e. the final app does not need to look exactly like this sample).

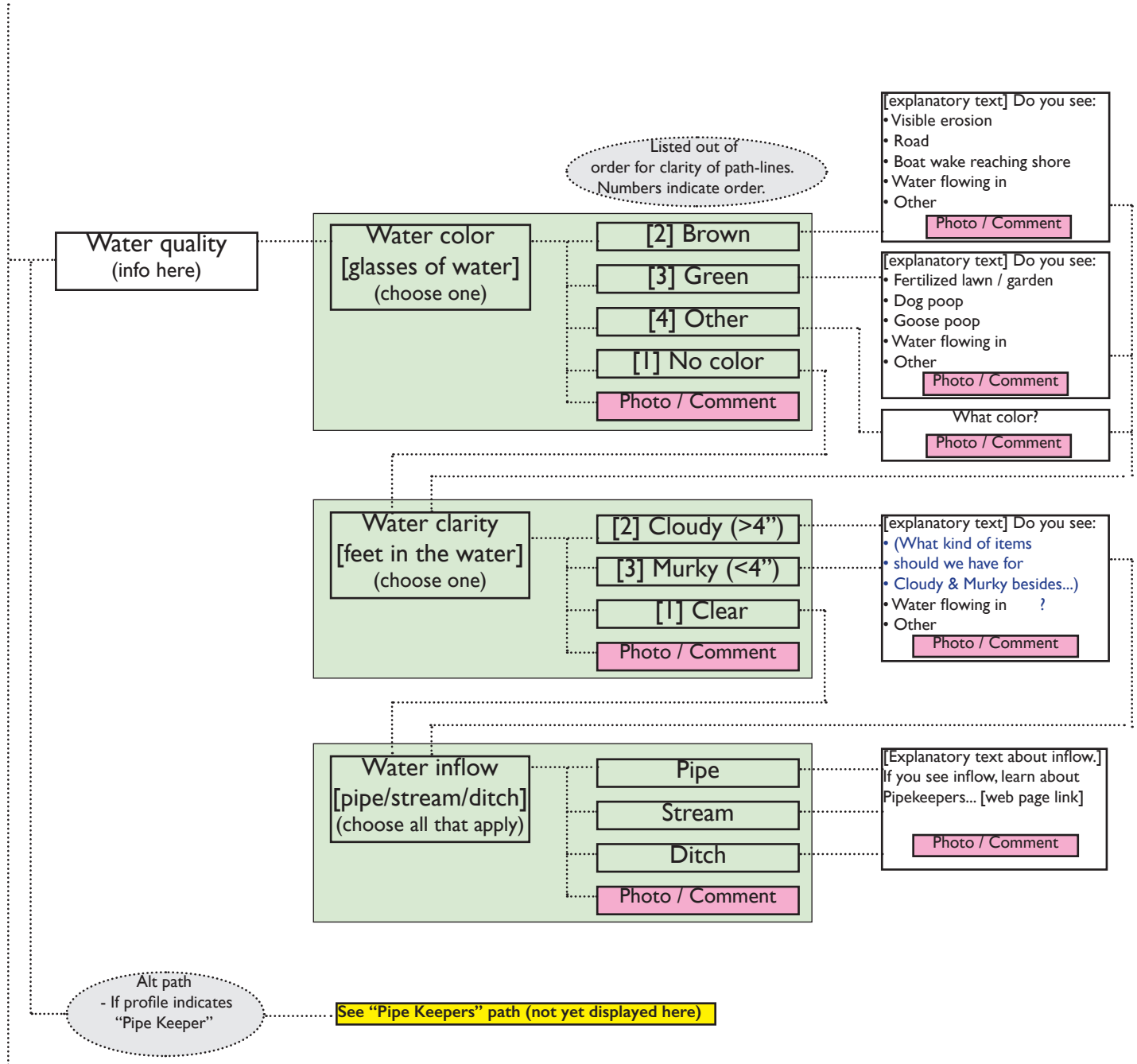
APPENDIX D: Brief Bios for Dr. Geoffrey Schladow, director TERC, and John Keagy, CEO Fielders LLC

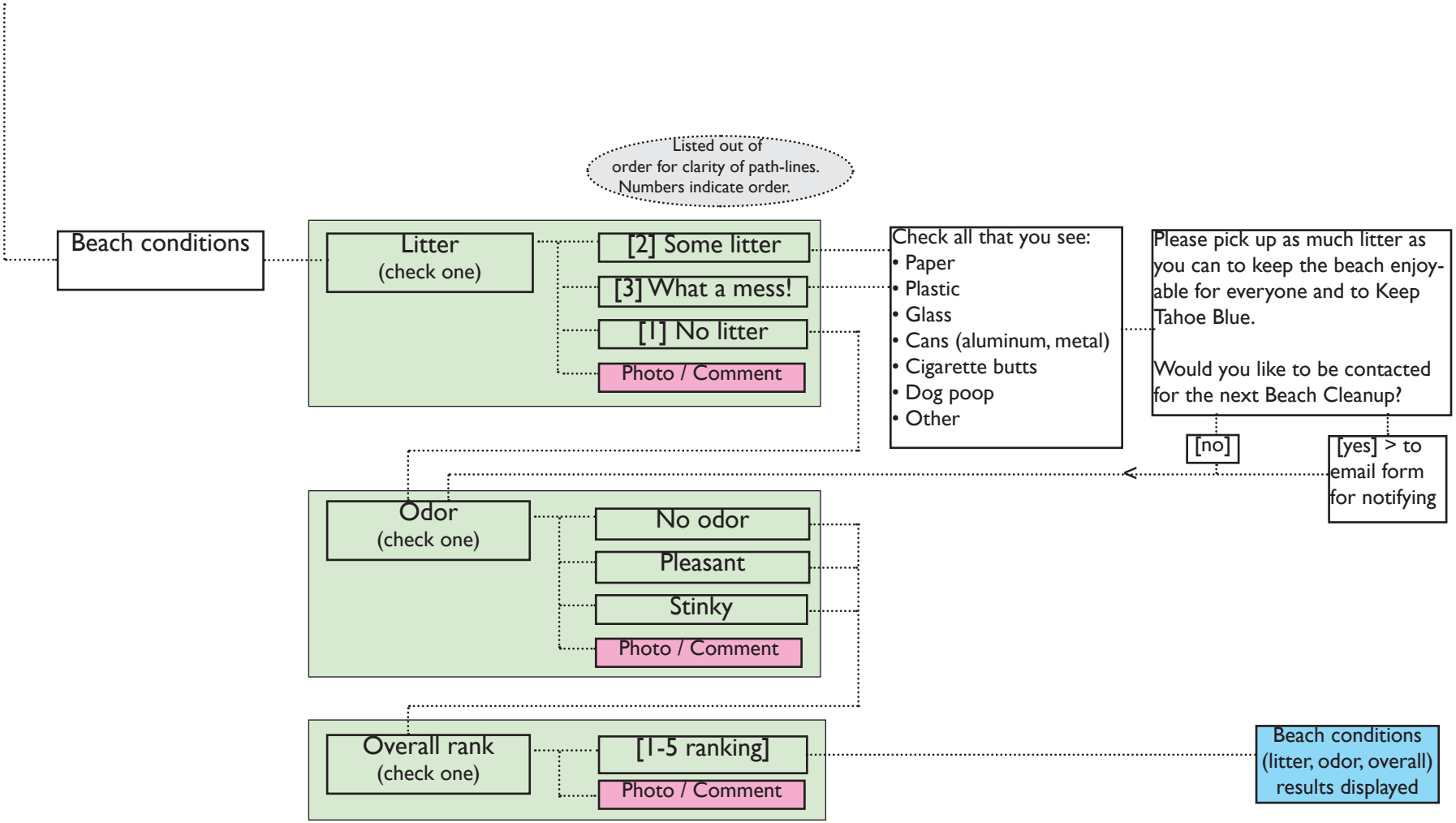
Geoffrey Schladow, Ph.D. holds a B. Eng. and Ph.D. degrees in civil engineering from the University of Western Australia, and an M. Eng. in hydraulic engineering from the University of California at Berkeley. For over thirty years his research has focused on the interactions between the complex fluid motions found in nature and their impacts on water quality, ecosystem health and watershed processes. He holds the position of Professor of water resources and environmental engineering at UC Davis, and is the founding director of the UC Davis Tahoe Environmental Research Center.

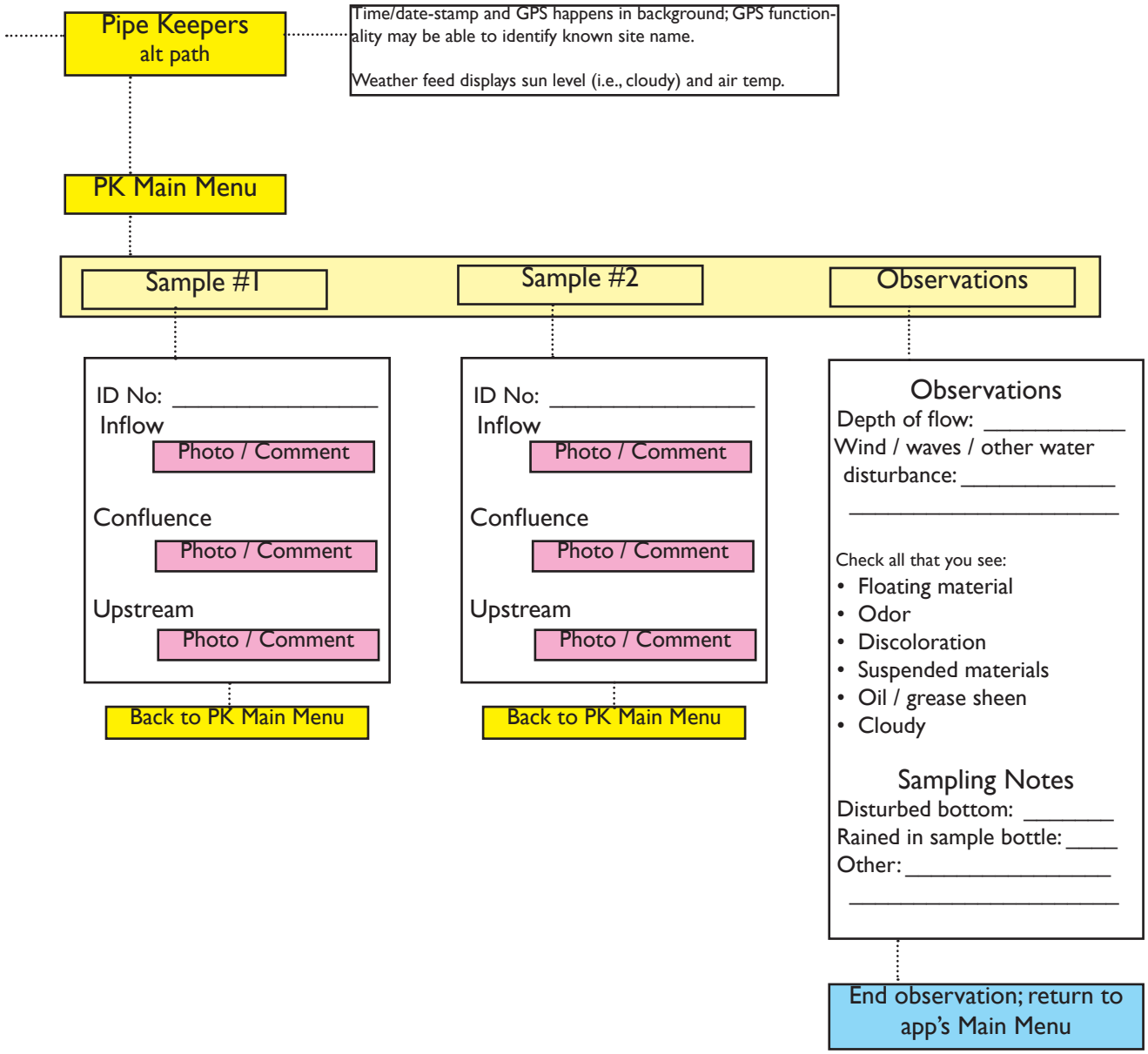
John Keagy is the Founder and CEO of Fielders, LLC, a pioneering startup with a mission to crowd-source perceptual data from the field. Keagy founded GoGrid, LLC in 2001 and served as Chairman of the Board and Chief Executive Officer. GoGrid, a global pioneering Cloud computing, was recently purchased by DataPipe. Keagy is an Internet infrastructure pioneer, having built and sold several successful Internet service providers since 1991. Keagy has over 20 years of CEO experience, founded 13 companies, and is named on more than 20 valuable software and infrastructure patents. John received a Bachelor of Science degree in Civil Engineering from UC Berkeley where he earned the Kennedy Award in Business Administration. He is also an alumnus of the Stanford Business School Executive Program.

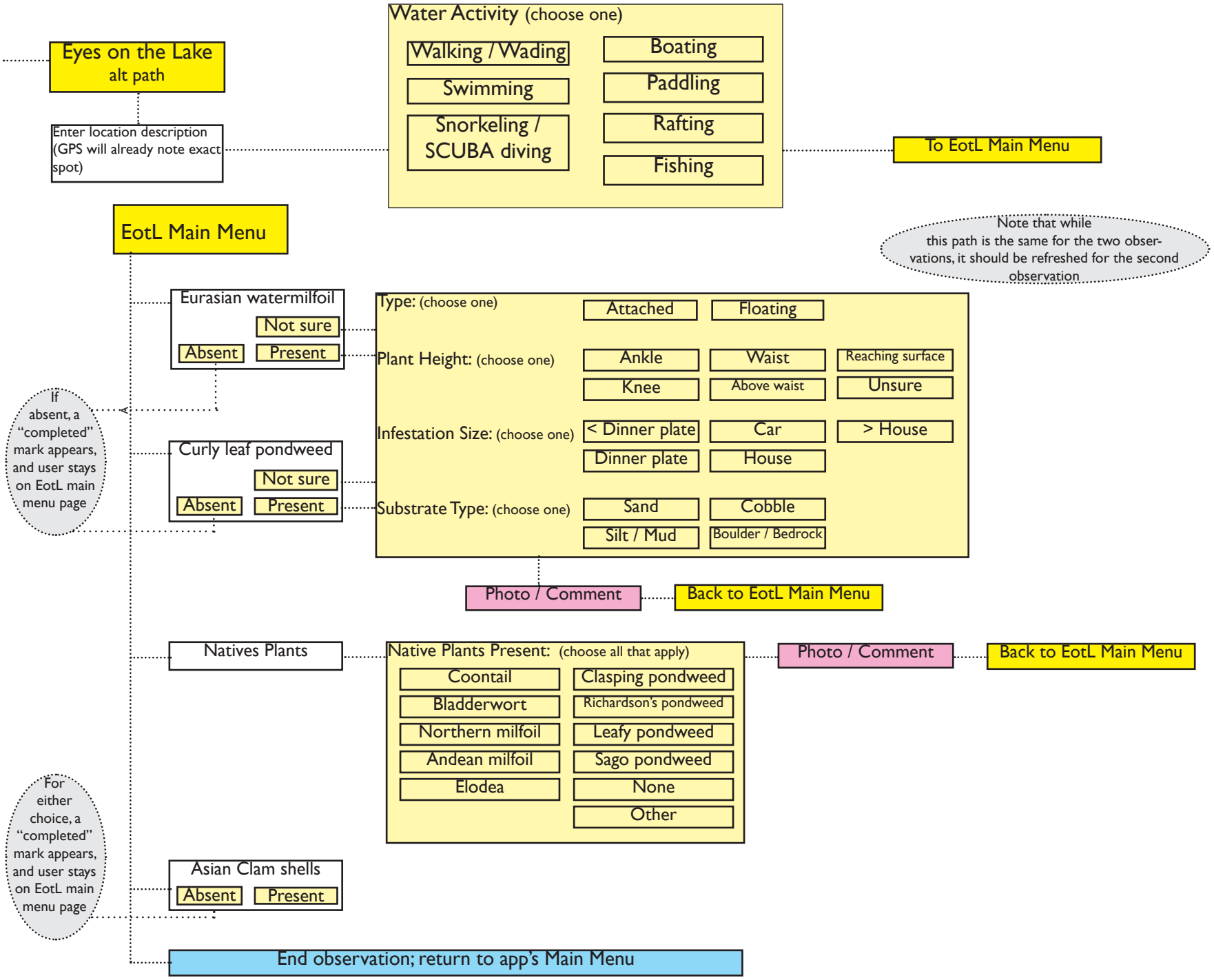
Appendix B: TERC Citizen Science App
Navigation Tree v.5 - see Appendix C: Wireframe Prototype v.7



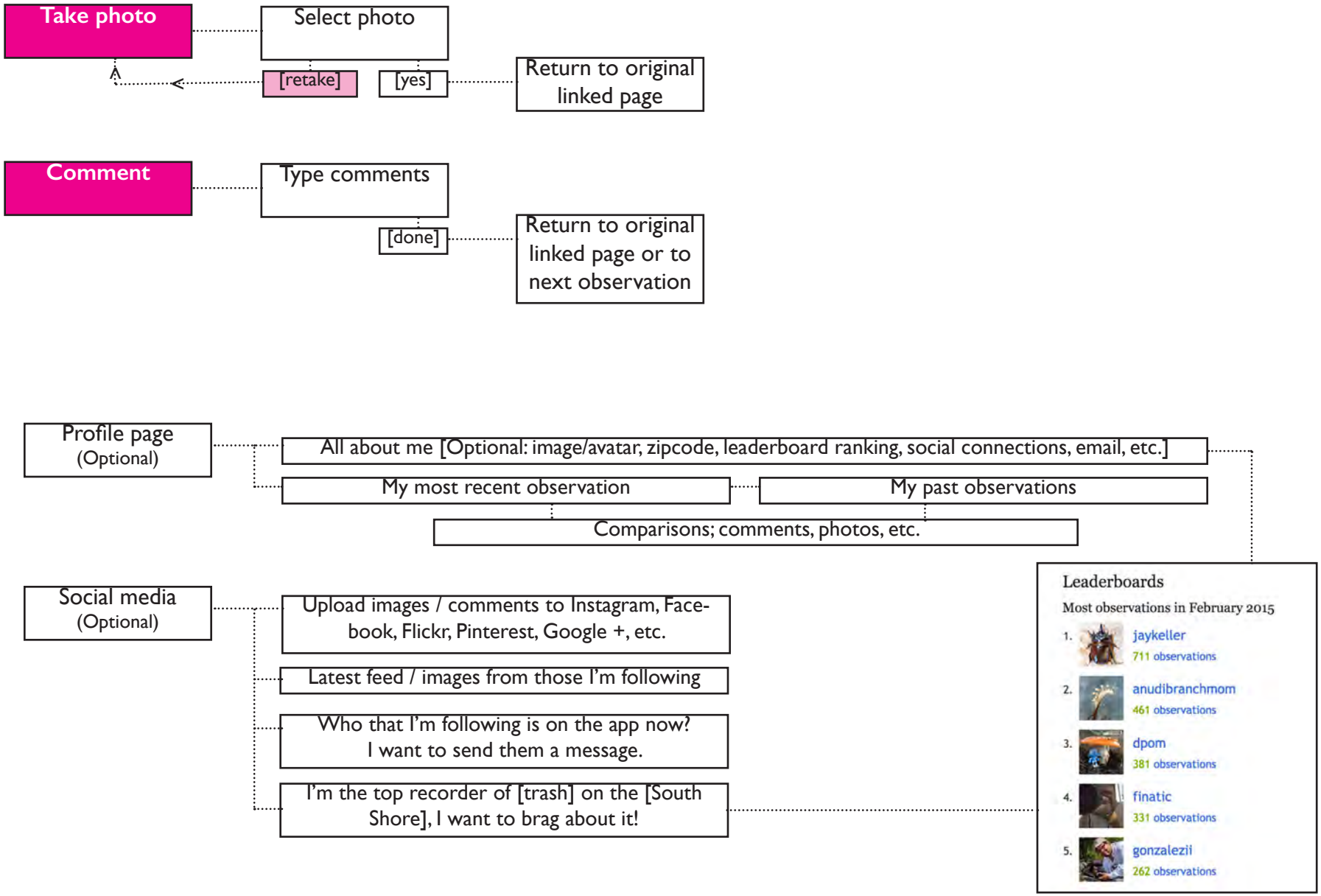

Water quality
(info here)
Listed out of order for clarity of path-lines. Numbers indicate order.
Water color
[glasses of water]
(choose one)
[2] Brown
[3] Green
[4] Other
[1] No color
Photo / Comment
[explanatory text] Do you see:
• Visible erosion
• Road
• Boat wake reaching shore
• Water flowing in
• Other
Photo / Comment
[explanatory text] Do you see:
• Fertilized lawn / garden
• Dog poop
• Goose poop
• Water flowing in
• Other
Photo / Comment
What color?
Photo / Comment
Water clarity
[feet in the water]
(choose one)
[2] Cloudy (>4")
[3] Murky (<4")
[1] Clear
Photo / Comment
[explanatory text] Do you see:
• (What kind of items
• should we have for
• Cloudy & Murky besides...)
• Water flowing in ?
• Other
Photo / Comment
Water inflow
[pipe/stream/ditch]
(choose all that apply)
Pipe
Stream
Ditch
Photo / Comment
[Explanatory text about inflow.]
If you see inflow, learn about
Pipekeepers... [web page link]
Photo / Comment
Alt path
- If profile indicates
"Pipe Keeper"
See "Pipe Keepers" path (not yet displayed here)


Listed out of order for clarity of path-lines. Numbers indicate order.
Beach conditions
Litter (check one)
[2] Some litter
[3] What a mess!
[1] No litter
Photo / Comment
Check all that you see:
• Paper
• Plastic
• Glass
• Cans (aluminum, metal)
• Cigarette butts
• Dog poop
• Other
Please pick up as much litter as you can to keep the beach enjoyable for everyone and to Keep Tahoe Blue.
Would you like to be contacted for the next Beach Cleanup?
[no]
[yes] > to email form for notifying
Odor (check one)
No odor
Pleasant
Stinky
Photo / Comment
Overall rank (check one)
[1-5 ranking]
Photo / Comment
Beach conditions (litter, odor, overall) results displayed

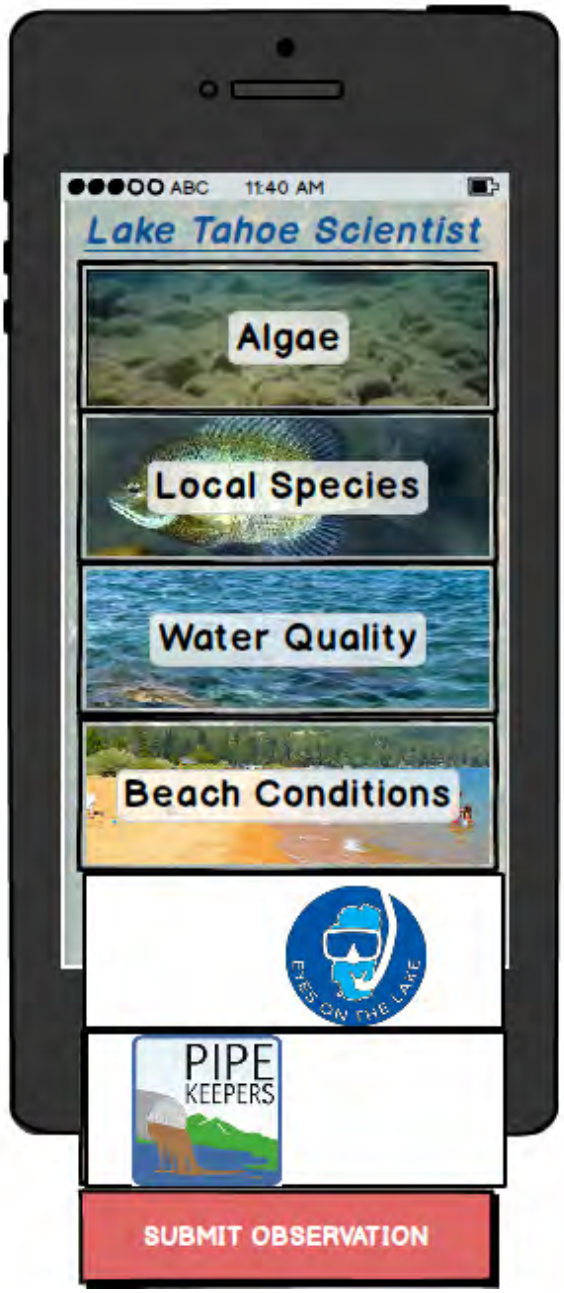

Pipe Keepers
alt path
Time/date-stamp and GPS happens in background; GPS functionality may be able to identify known site name.
Weather feed displays sun level (i.e., cloudy) and air temp.
PK Main Menu
Sample #1
Sample #2
Observations
ID No: _____
Inflow
Photo / Comment
Confluence
Photo / Comment
Upstream
Photo / Comment
Back to PK Main Menu
ID No: _____
Inflow
Photo / Comment
Confluence
Photo / Comment
Upstream
Photo / Comment
Back to PK Main Menu
Observations
Depth of flow: _____
Wind / waves / other water disturbance: _____
_____
Check all that you see:
• Floating material
• Odor
• Discoloration
• Suspended materials
• Oil / grease sheen
• Cloudy
Sampling Notes
Disturbed bottom: _____
Rained in sample bottle: _____
Other: _____
_____
End observation; return to app's Main Menu


Eyes on the Lake
alt path
Enter location description (GPS will already note exact spot)
Water Activity (choose one)
Walking / Wading
Boating
Swimming
Paddling
Snorkeling / SCUBA diving
Rafting
Fishing
To EotL Main Menu
EotL Main Menu
Note that while this path is the same for the two observations, it should be refreshed for the second observation
Eurasian watermilfoil
Not sure
Absent
Present
Type: (choose one)
Attached
Floating
Plant Height: (choose one)
Ankle
Waist
Reaching surface
Knee
Above waist
Unsure
Infestation Size: (choose one)
< Dinner plate
Car
> House
Dinner plate
House
Substrate Type: (choose one)
Sand
Cobble
Silt / Mud
Boulder / Bedrock
If absent, a "completed" mark appears, and user stays on EotL main menu page
Curly leaf pondweed
Not sure
Absent
Present
Photo / Comment
Back to EotL Main Menu
Natives Plants
Native Plants Present: (choose all that apply)
Coontail
Clasping pondweed
Bladderwort
Richardson's pondweed
Northern milfoil
Leafy pondweed
Andean milfoil
Sago pondweed
Elodea
None
Other
Photo / Comment
Back to EotL Main Menu
For either choice, a "completed" mark appears, and user stays on EotL main menu page
Asian Clam shells
Absent
Present
End observation; return to app's Main Menu

Other Paths / Sub-paths

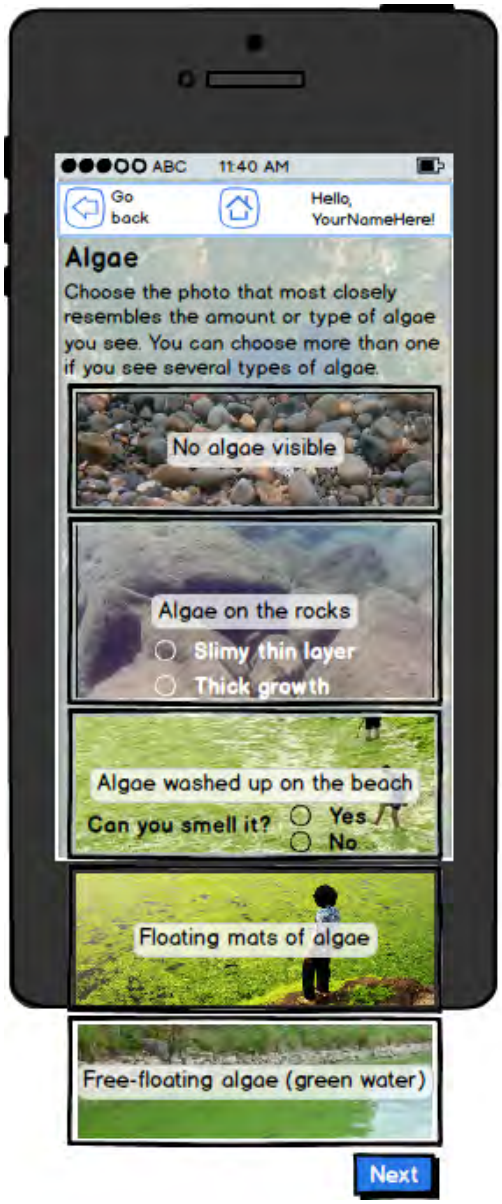



In this prototype, we do not show the login process.

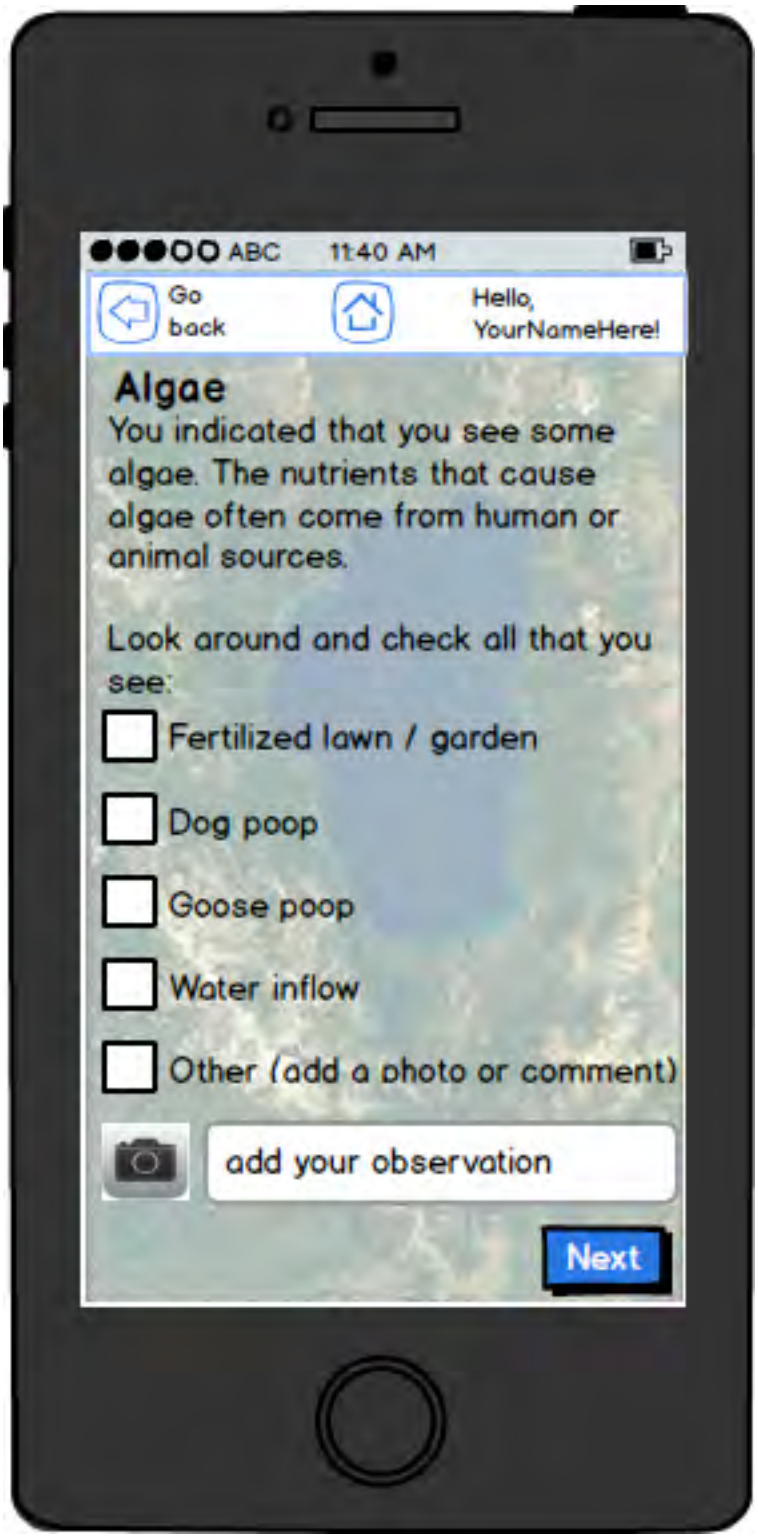

Alternative showing additional buttons for Eyes on the Lake and Pipe Keepers.

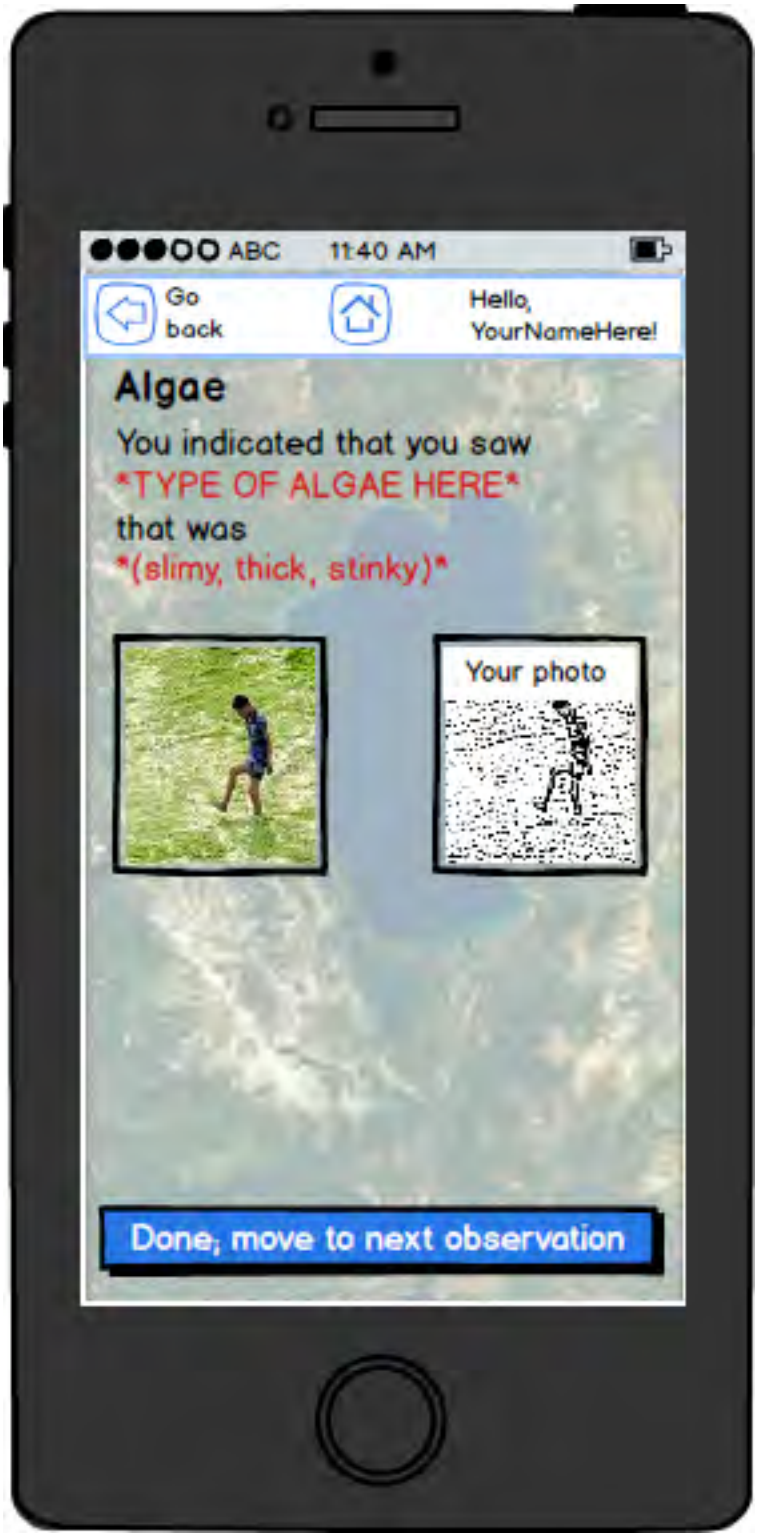

ABC
11:40 AM
Go back
Hello, YourNameHere!
Algae
Algae comes in many forms. It can be free-floating, attached to rocks, floating in mats, stringy, or rolling in clumps onto the beach. It can be green, red, brown, golden-brown, or blue-green.
Please report on the algae that you see.
Next

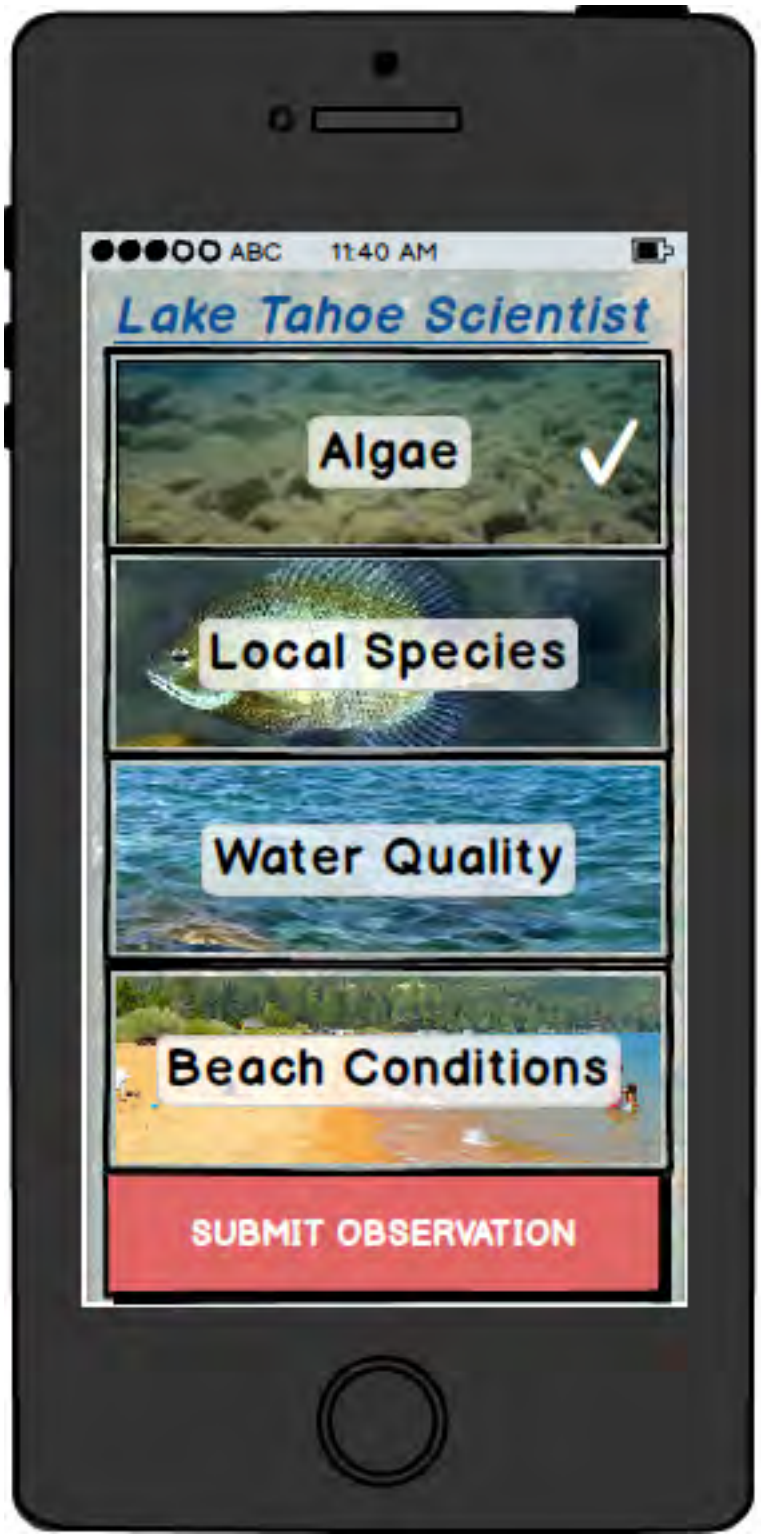



For the prototype, these images link to their individual destinations. Specifically, "no algae" links directly to the Results page and all other choices to the algae explanatory page, then to Results. In the actual app, each would show "selected" and the Next button will take user to the proper destination

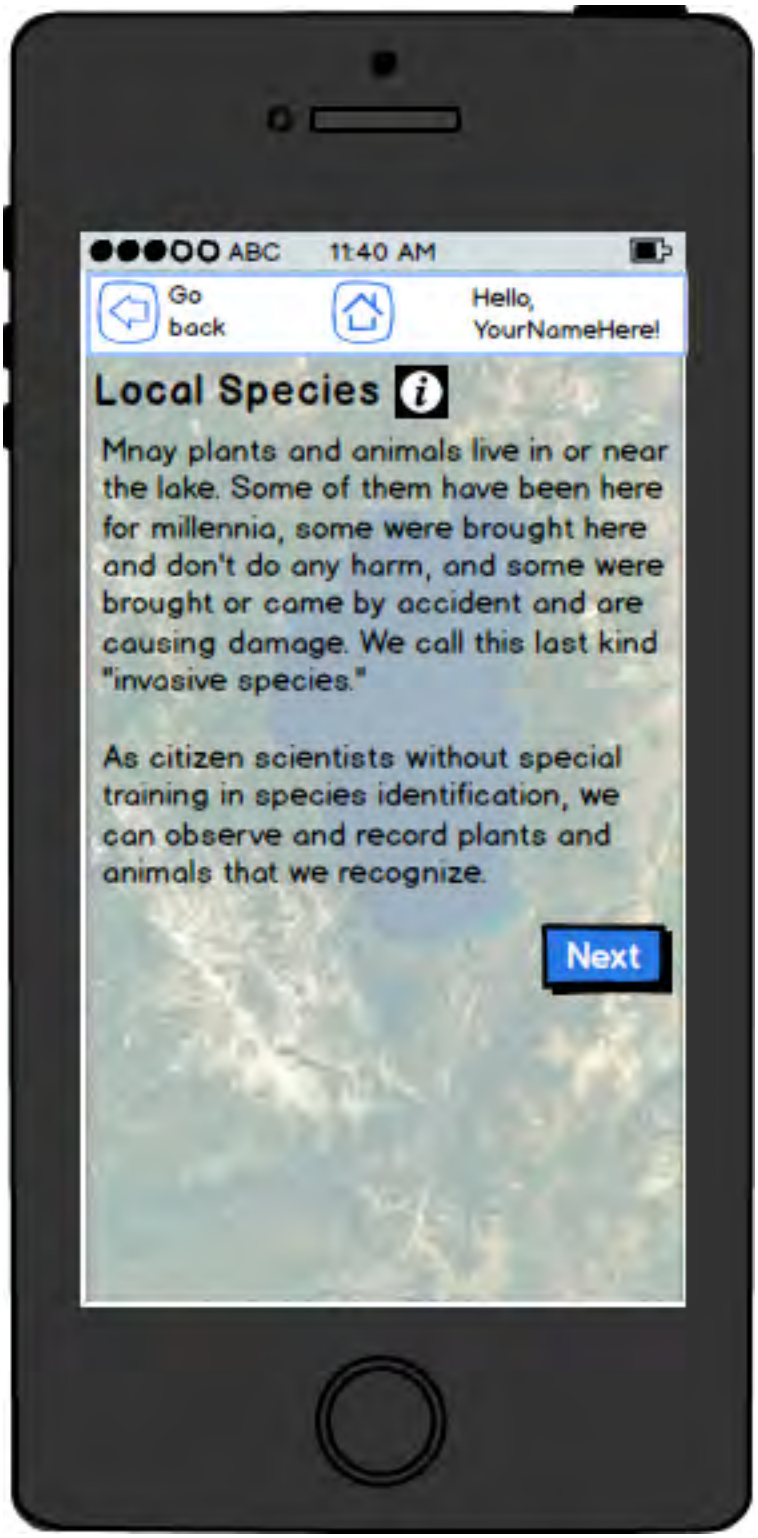

"No algae visible" selected, with photo / observation opportunity.


ABC
11:40 AM
Go back
Hello, YourNameHere!
Algae
You indicated that you see some algae. The nutrients that cause algae often come from human or animal sources.
Look around and check all that you see:
Fertilized lawn / garden
Dog poop
Goose poop
Water inflow
Other (add a photo or comment)
add your observation
Next

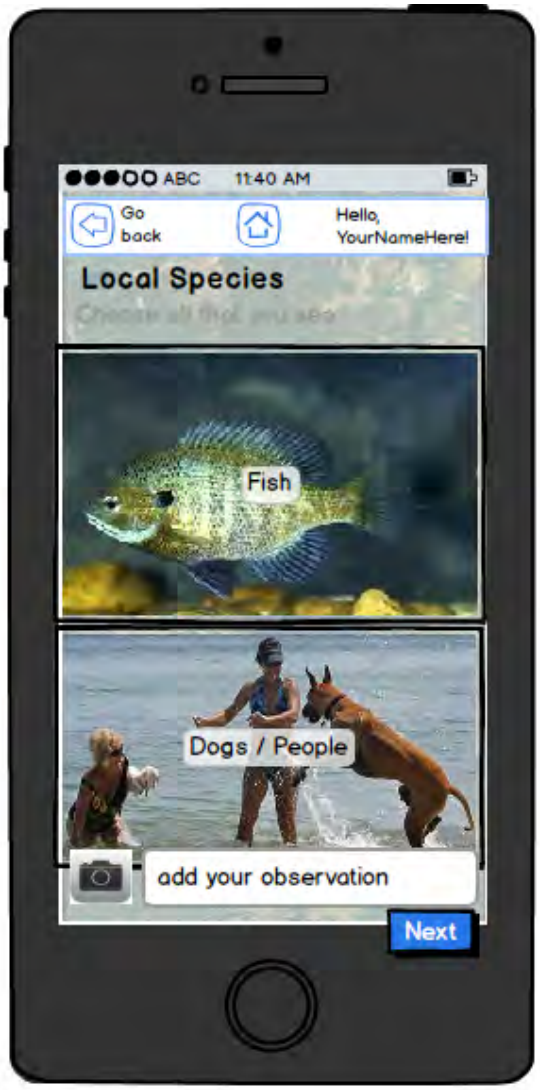

ABC
11:40 AM
Go back
Hello, YourNameHere!
Algae
You indicated that you saw
*TYPE OF ALGAE HERE*
that was
*(slimy, thick, stinky)*
Your photo
Done, move to next observation



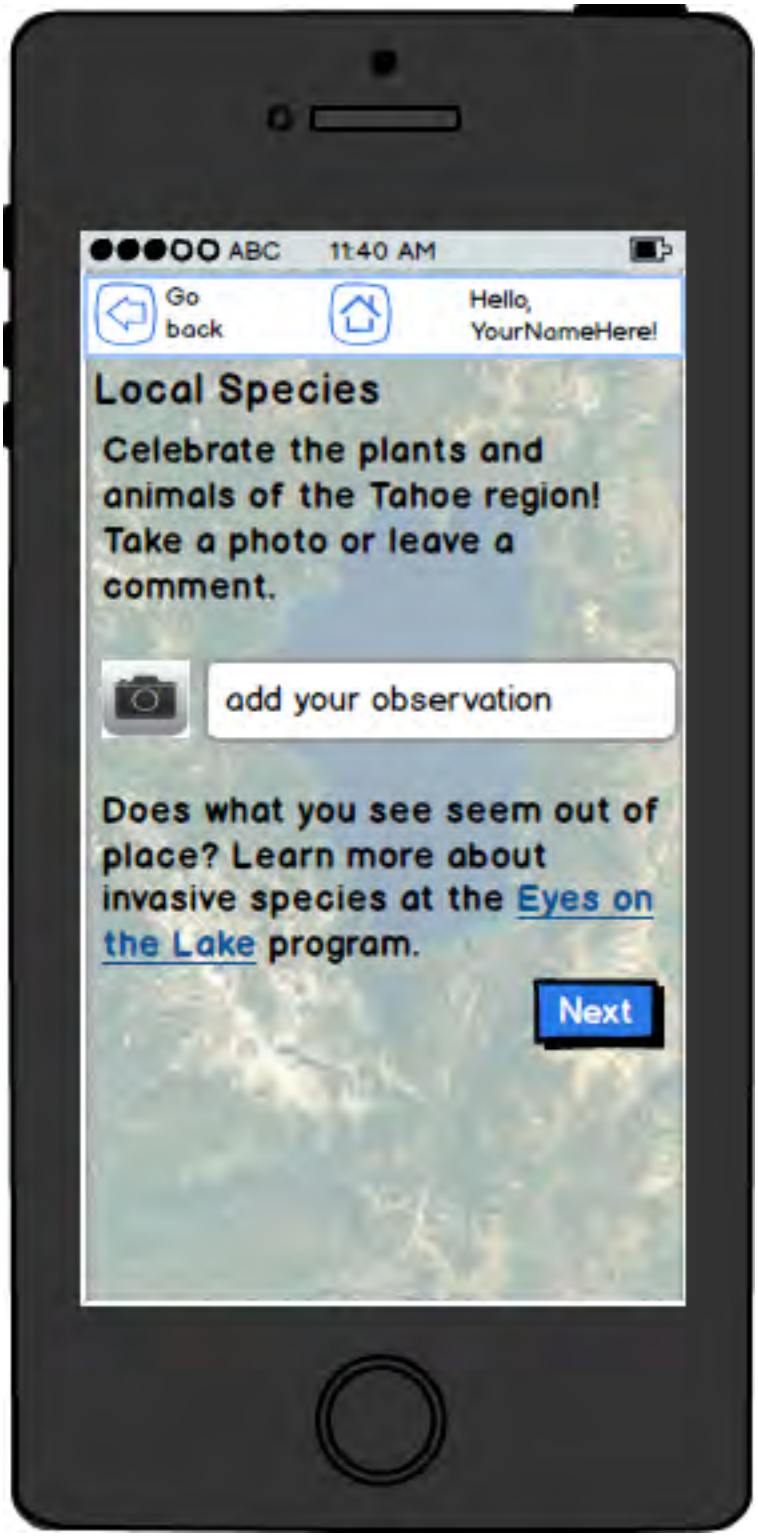

Here, a check-mark indicated "completed." Doesn't have to be a check-mark.

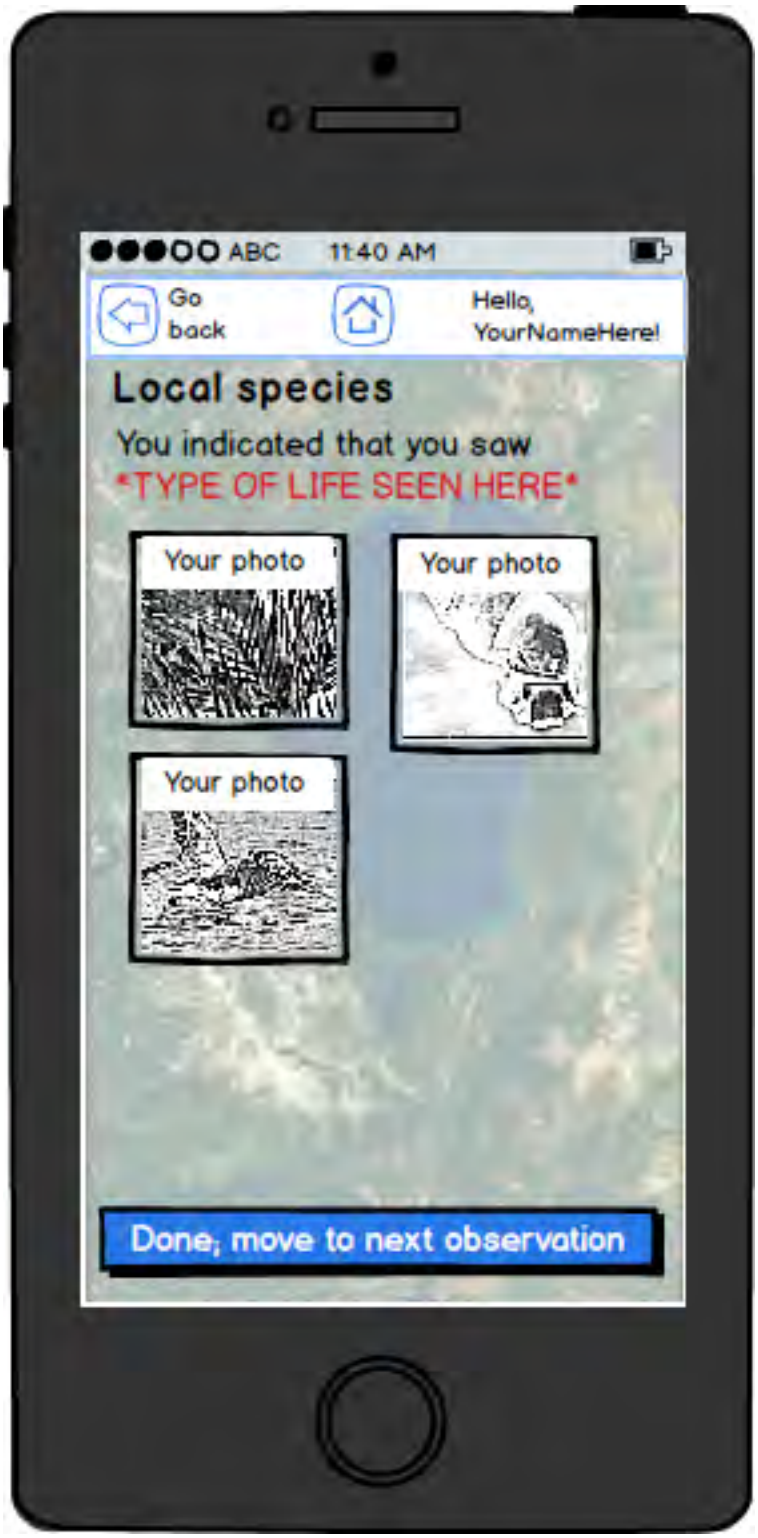

ABC
11:40 AM
Go back
Hello, YourNameHere!
Local Species
Mnay plants and animals live in or near the lake. Some of them have been here for millennia, some were brought here and don't do any harm, and some were brought or came by accident and are causing damage. We call this last kind "invasive species."
As citizen scientists without special training in species identification, we can observe and record plants and animals that we recognize.
Next

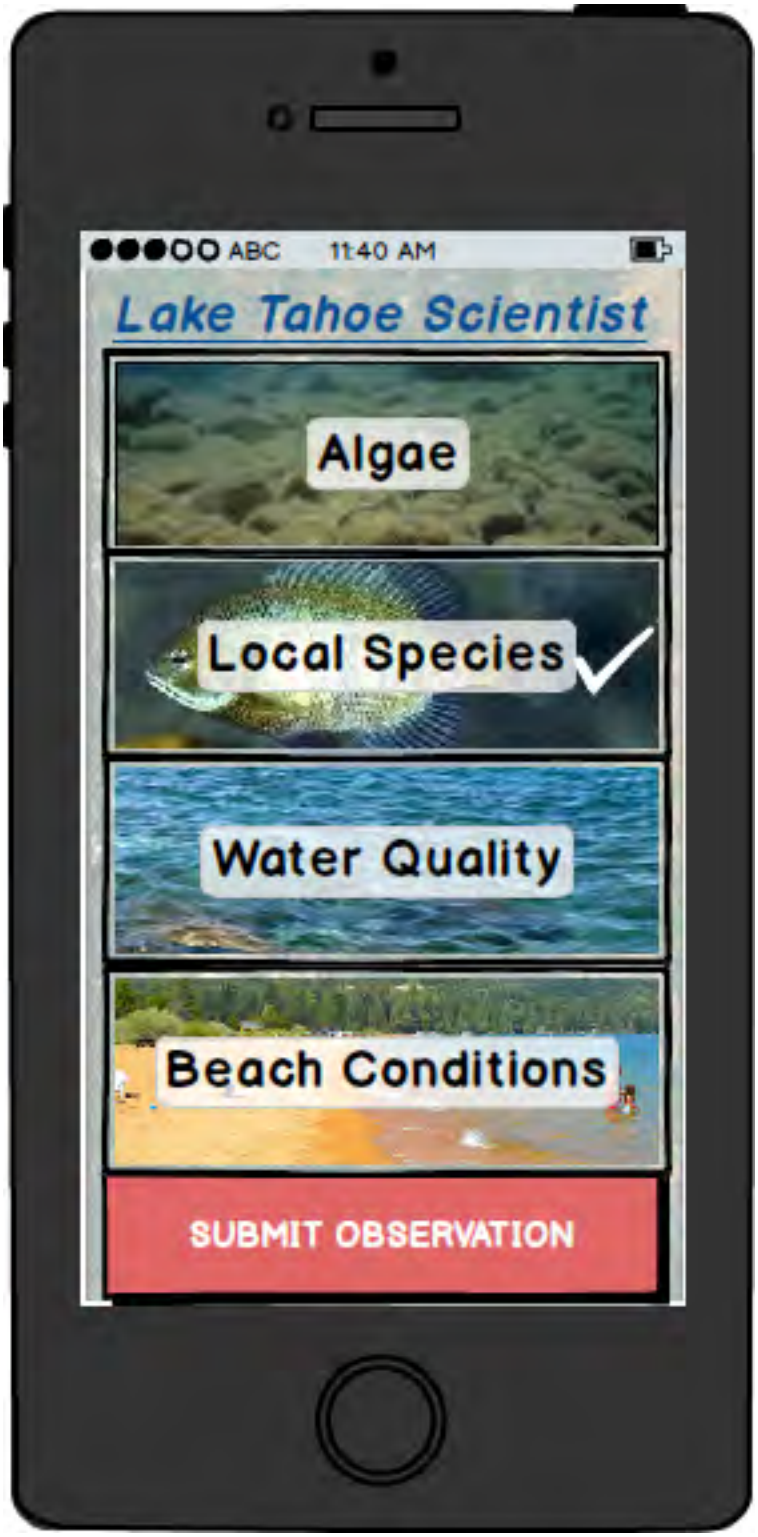

In this case, all selections lead to the same next page.

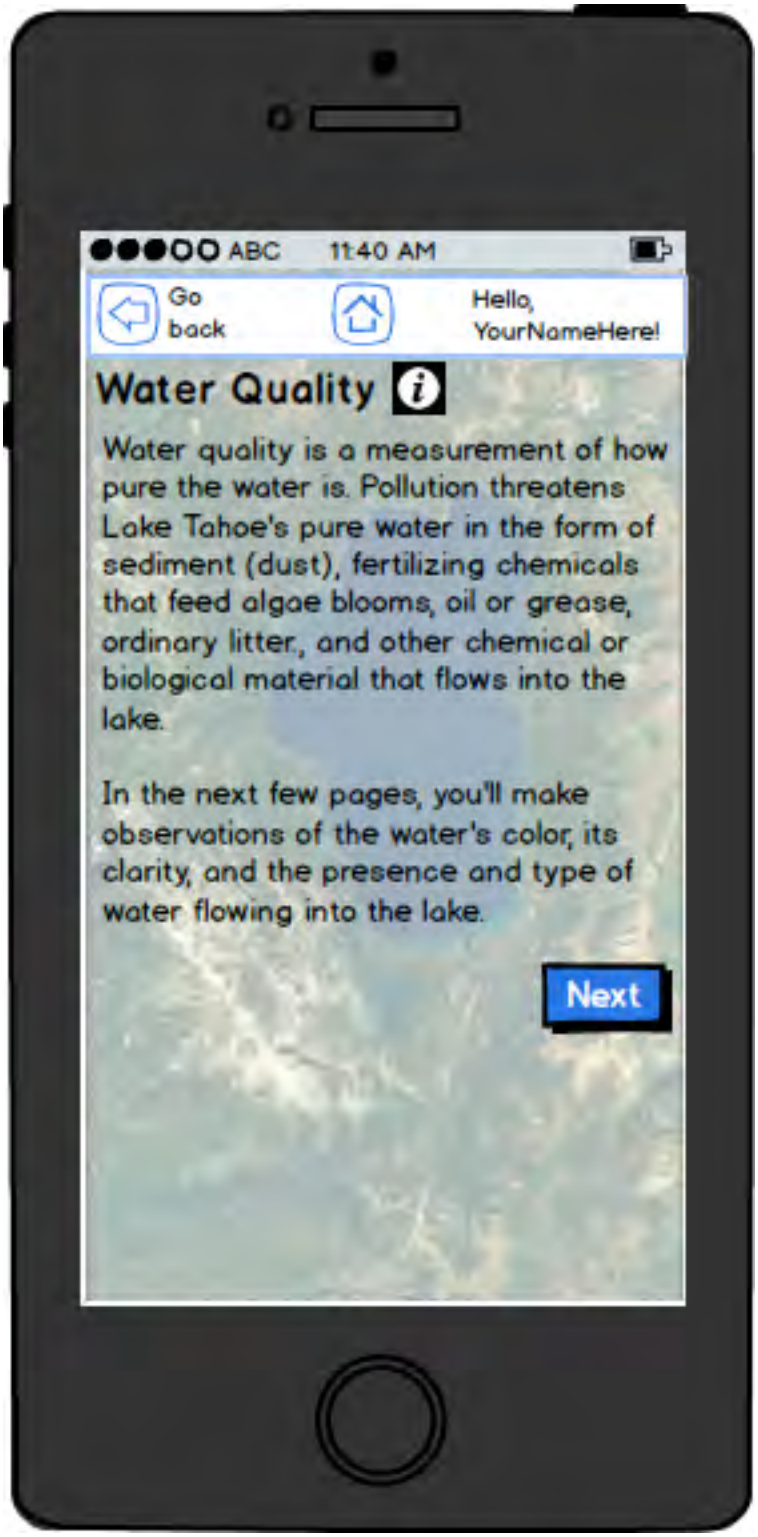



Two selections made, with photo / comment opportunity.


ABC
11:40 AM
Go back
Hello, YourNameHere!
Local Species
Celebrate the plants and animals of the Tahoe region! Take a photo or leave a comment.
add your observation
Does what you see seem out of place? Learn more about invasive species at the Eyes on the Lake program.
Next

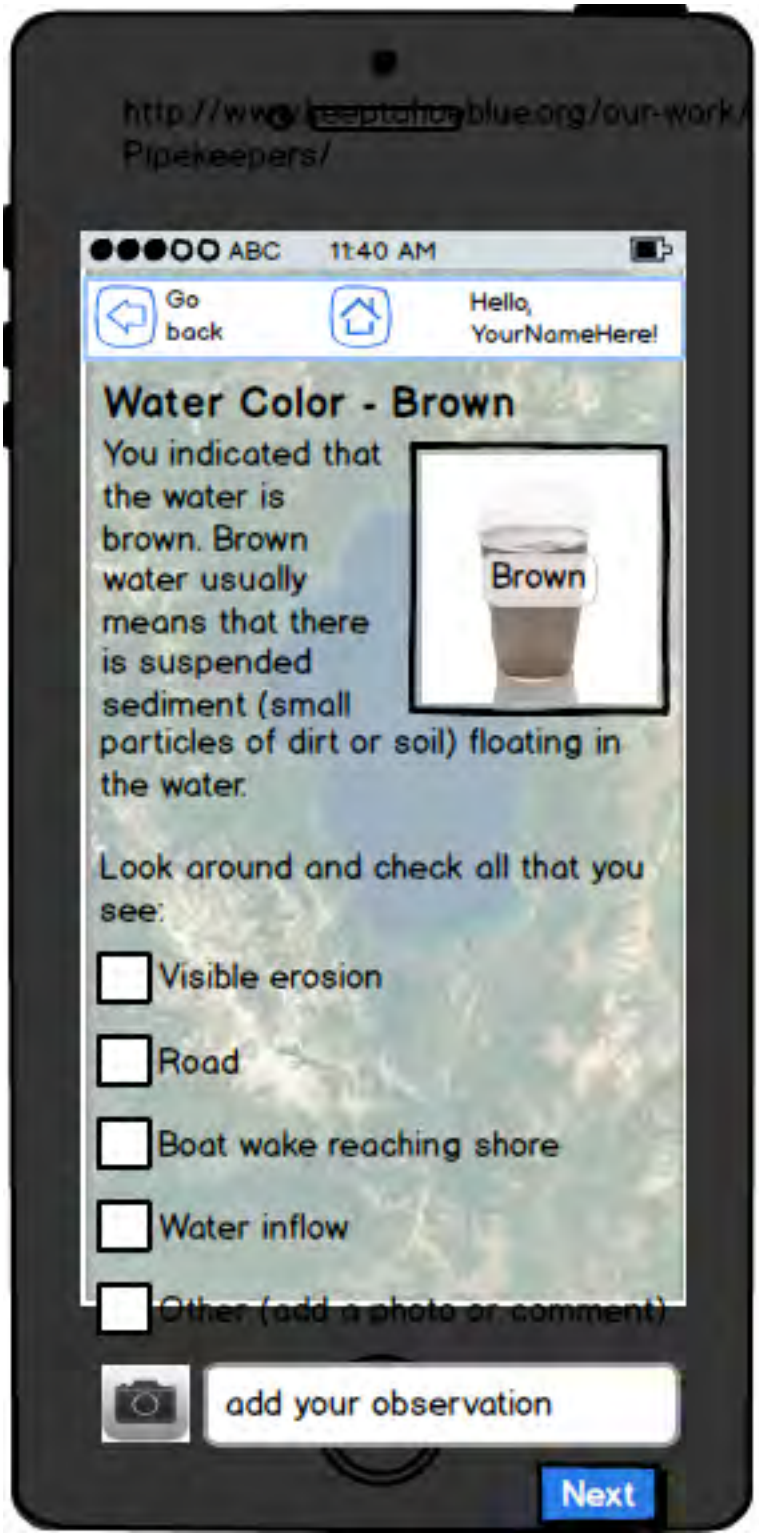

ABC
11:40 AM
Go back
Hello, YourNameHere!
Local species
You indicated that you saw
*TYPE OF LIFE SEEN HERE*
Your photo
Your photo
Your photo
Done, move to next observation


ABC
11:40 AM
Lake Tahoe Scientist
Algae
Local Species
Water Quality
Beach Conditions
SUBMIT OBSERVATION


ABC
11:40 AM
Go back
Hello, YourNameHere!
Water Quality
Water quality is a measurement of how pure the water is. Pollution threatens Lake Tahoe's pure water in the form of sediment (dust), fertilizing chemicals that feed algae blooms, oil or grease, ordinary litter, and other chemical or biological material that flows into the lake.
In the next few pages, you'll make observations of the water's color, its clarity, and the presence and type of water flowing into the lake.
Next


For the prototype, these images link to their individual destinations. In the actual app, each will display a "selected" state when touched, and the Next button will take user to the proper destination.

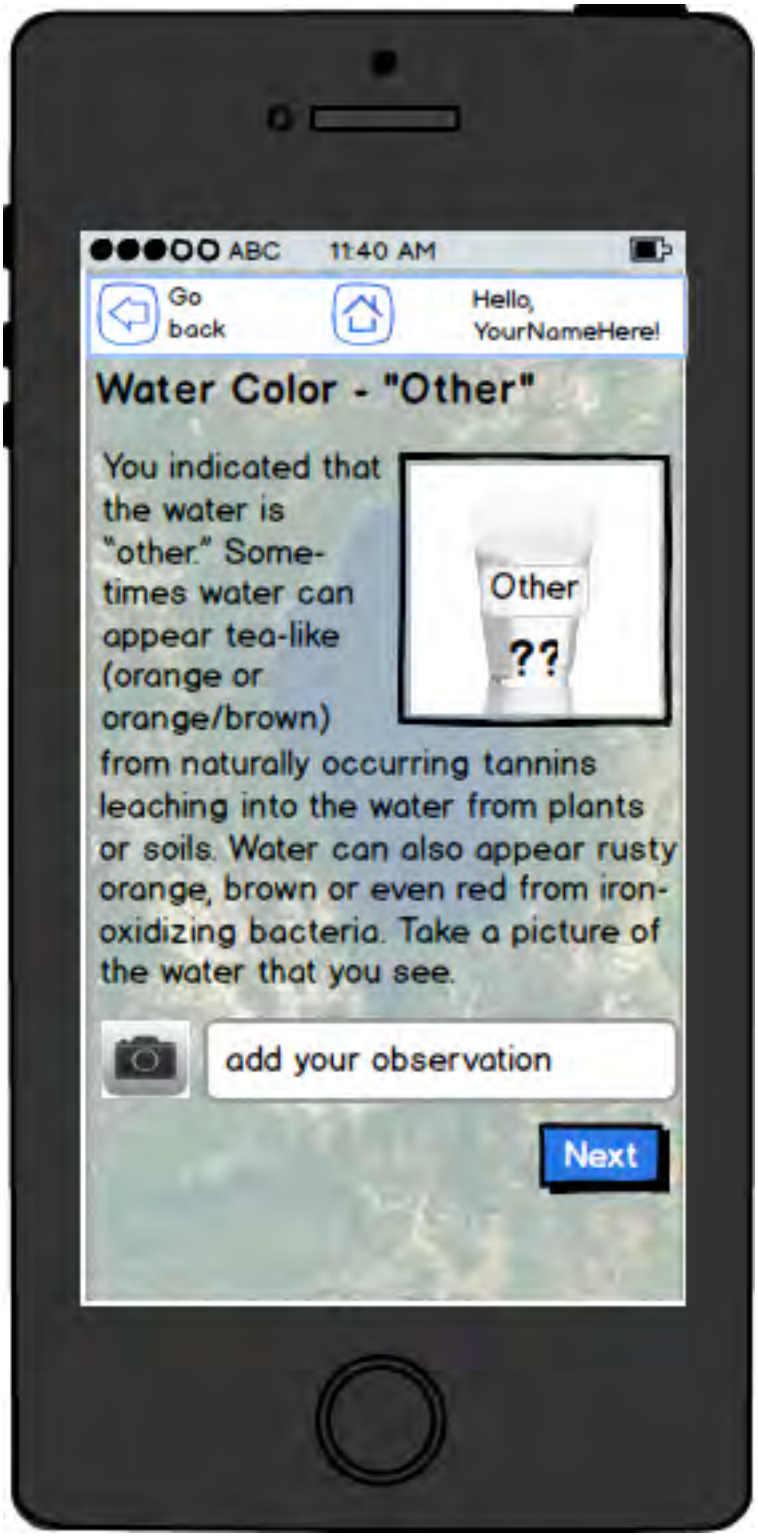

"No color" selected, with photo / observation opportunity.




Last check-box here reads:

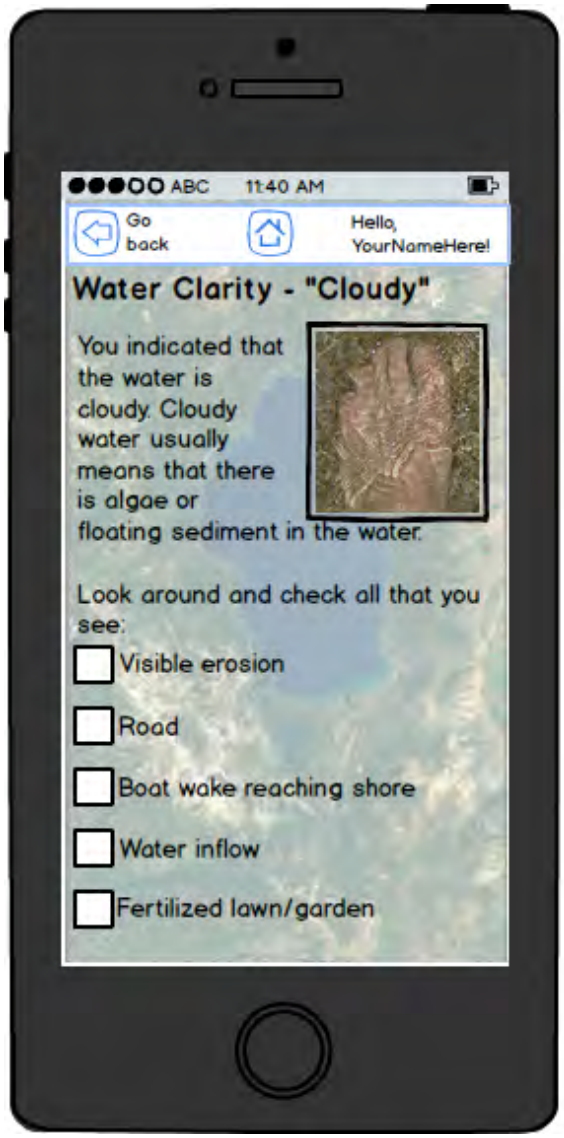
"Other (add a photo or comment)"


ABC
11:40 AM
Go back
Hello, YourNameHere!
Water Color - Green
You indicated that the water is brown. Green water usually means that there is algae floating in the water.
Green
Look around and check all that you see:
Fertilized lawn/garden
Dog poop
Goose poop
Water inflow
Other (add a photo or comment)
add your observation
Next


ABC
11:40 AM
Go back
Hello, YourNameHere!
Water Color - "Other"
You indicated that the water is "other." Sometimes water can appear tea-like (orange or orange/brown) from naturally occurring tannins leaching into the water from plants or soils. Water can also appear rusty orange, brown or even red from iron-oxidizing bacteria. Take a picture of the water that you see.
Other
??
add your observation
Next


For the prototype, these images link to their individual destinations. In the actual app, each will display a "selected" state when touched, and the Next button will take user to the proper destination.


"Clear water" selected, with photo / comment opportunity.

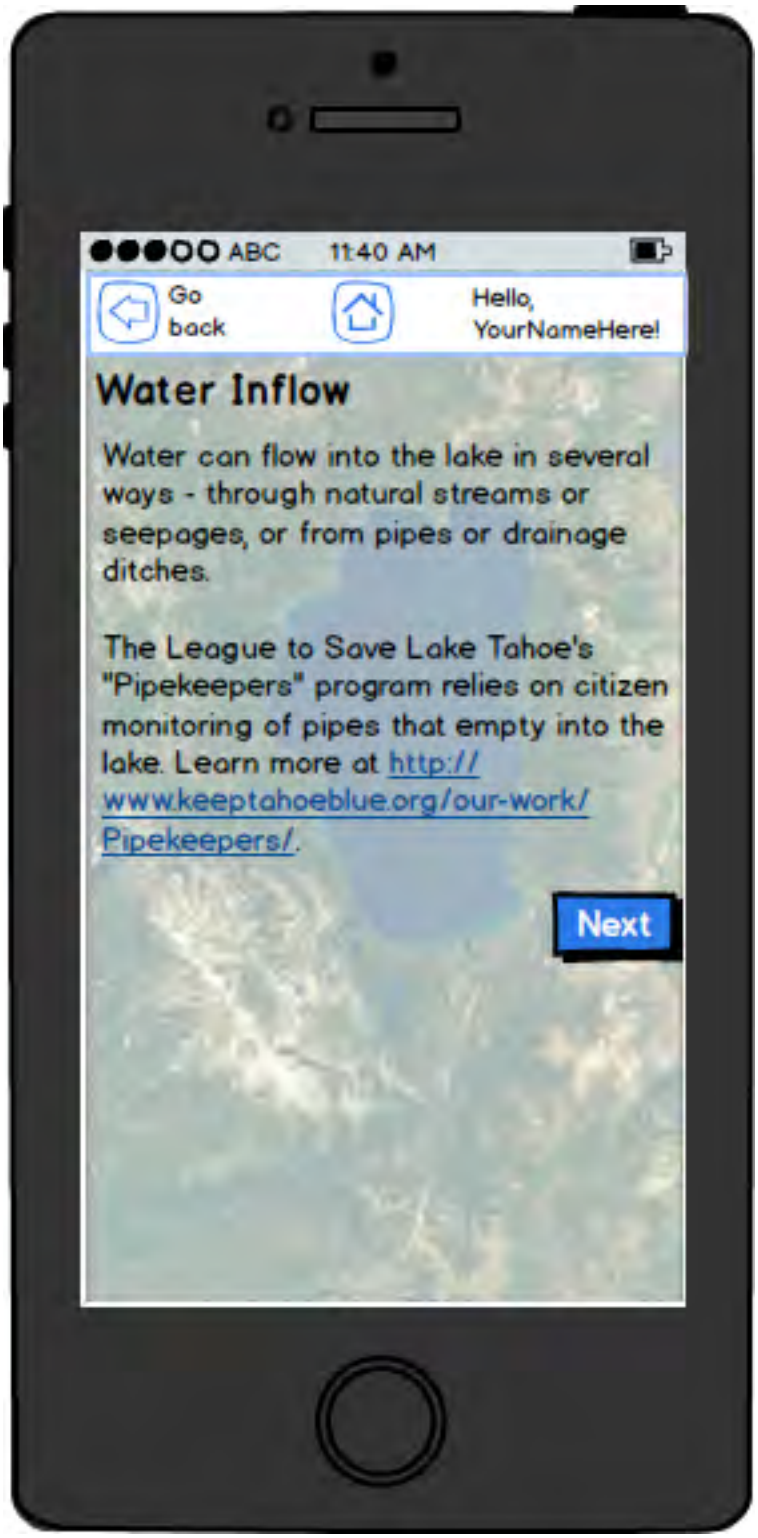


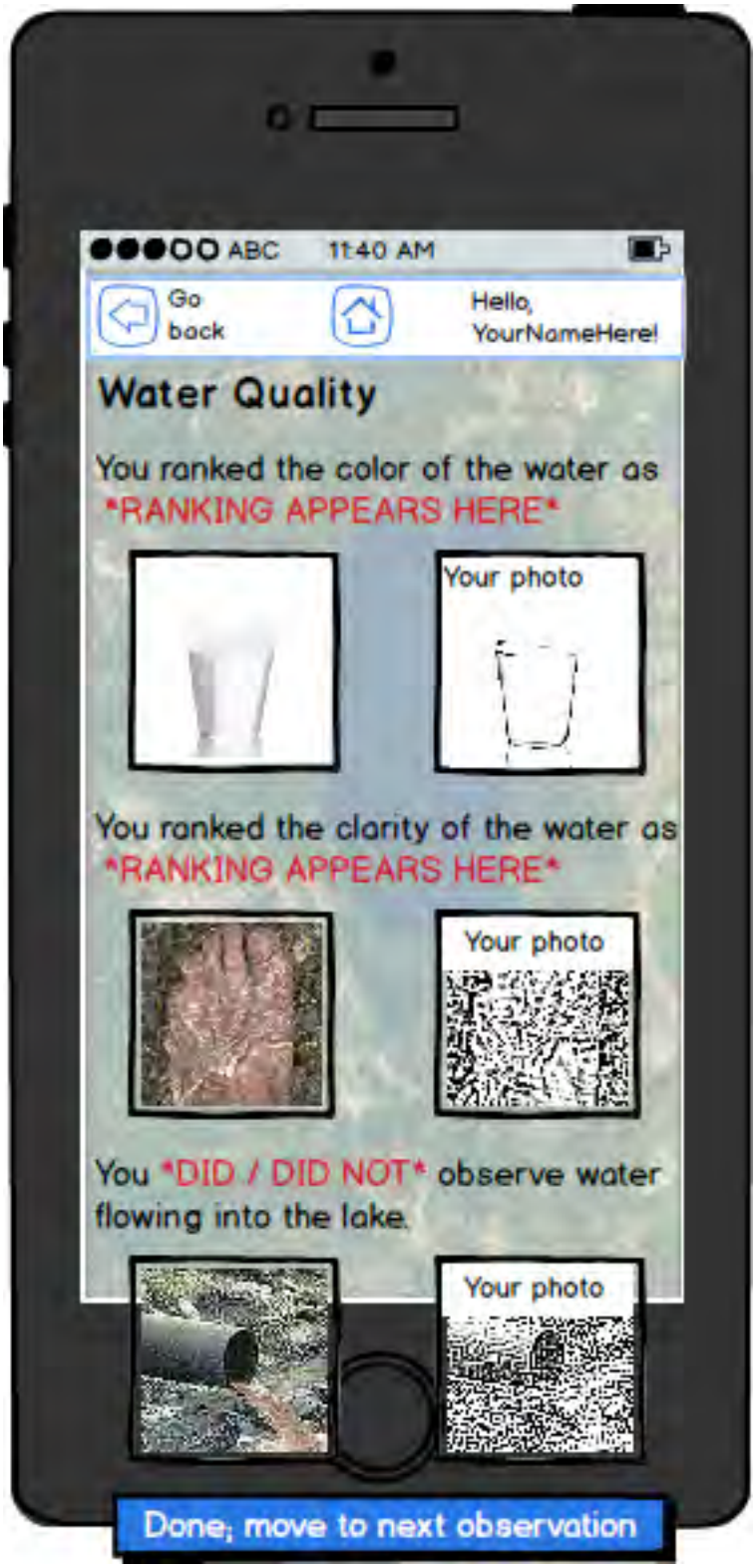

The "Water Clarity - Murky" selection result will be virtually identical to this page.

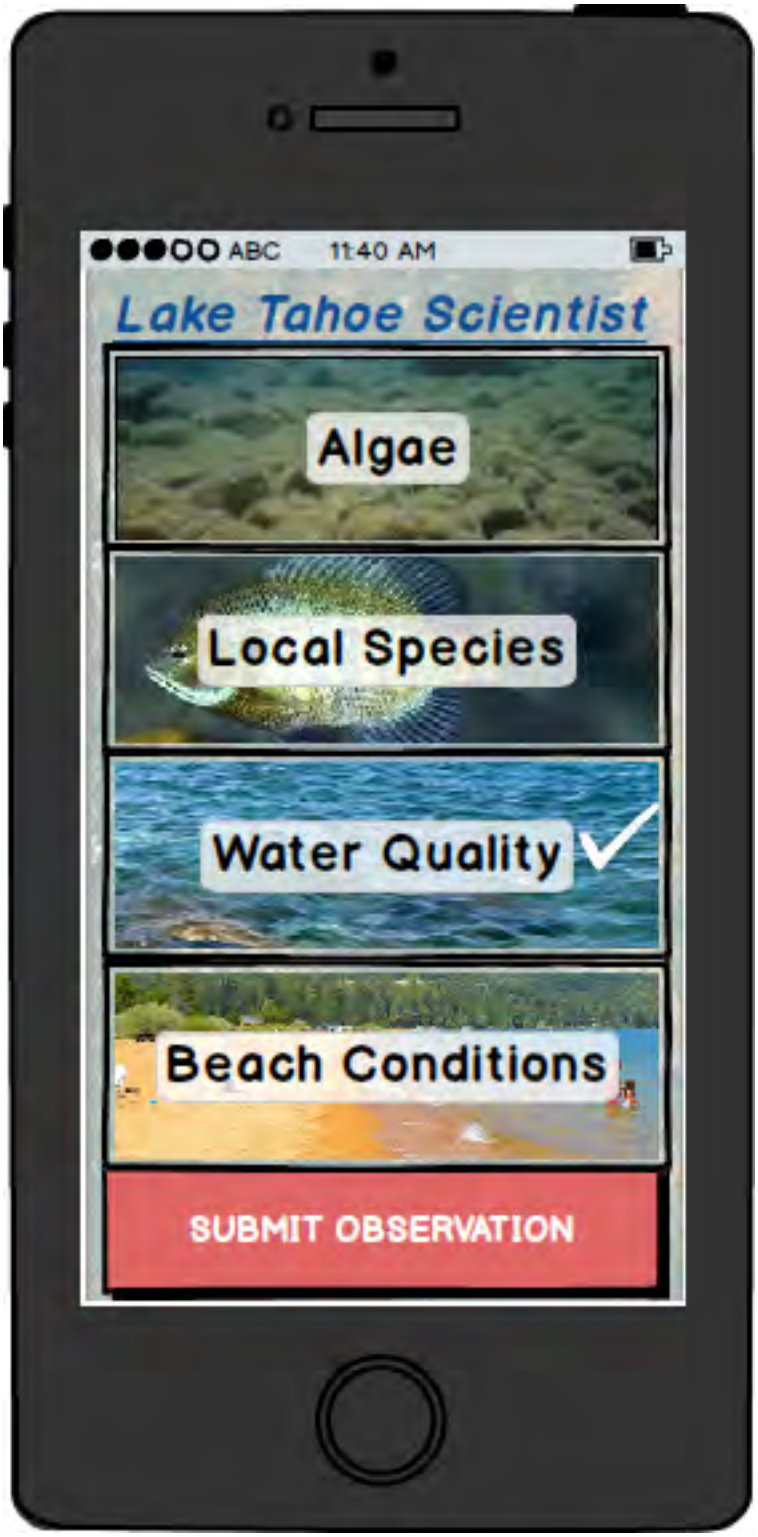

This shows the continuing page as it scrolls down...

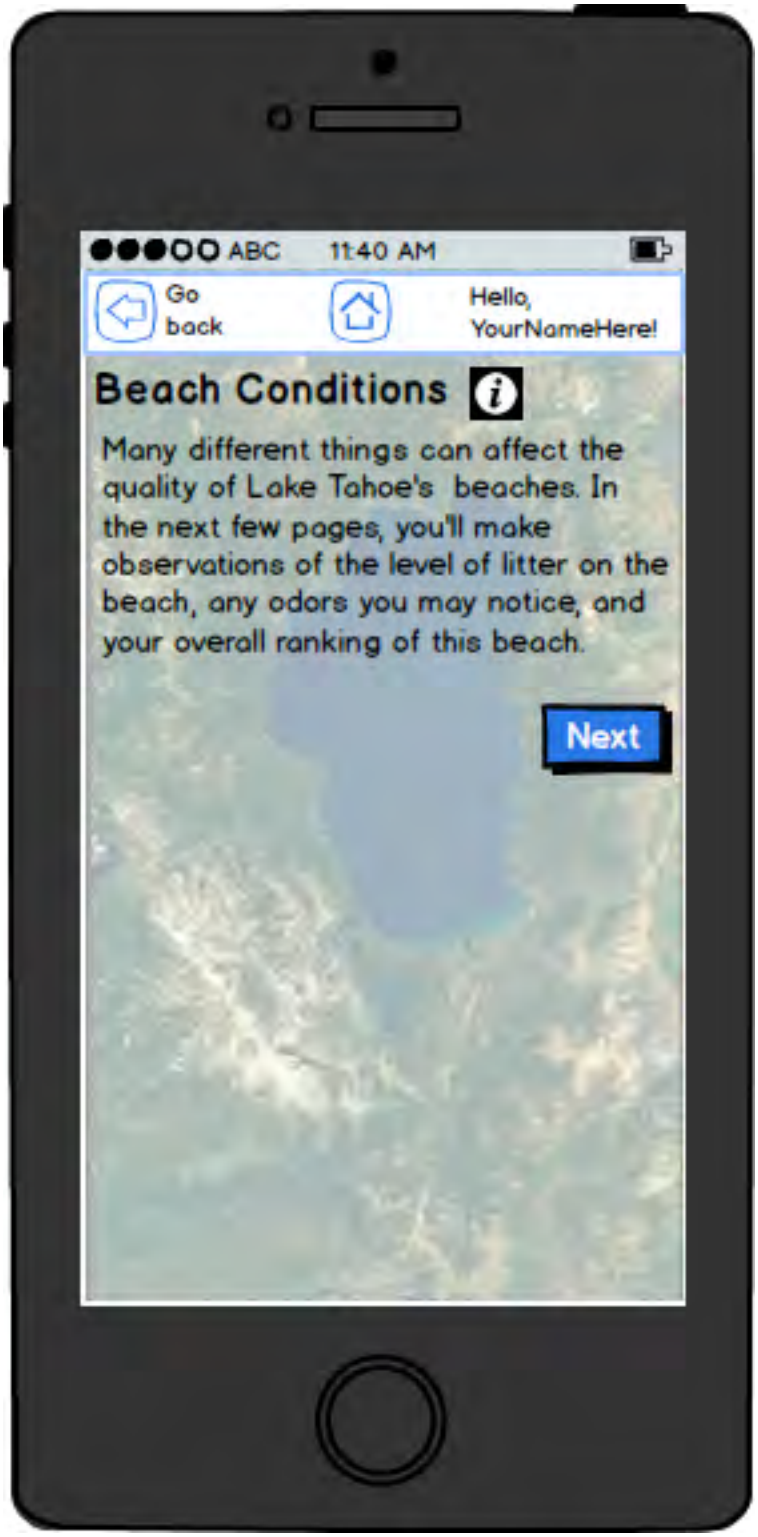

In this case, all selections lead to the same next page.


"Pipe" selected, with photo / observation opportunity.


ABC
11:40 AM
Go back
Hello, YourNameHere!
Water Inflow
Water can flow into the lake in several ways - through natural streams or seepages, or from pipes or drainage ditches.
The League to Save Lake Tahoe's "Pipekeepers" program relies on citizen monitoring of pipes that empty into the lake. Learn more at http://www.keeptahoeblue.org/our-work/Pipekeepers/.
Next


ABC 11:40 AM
Go back
Hello, YourNameHere!
Water Quality
You ranked the color of the water as
*RANKING APPEARS HERE*
Your photo
You ranked the clarity of the water as
*RANKING APPEARS HERE*
Your photo
You *DID / DID NOT* observe water flowing into the lake.
Your photo
Done; move to next observation

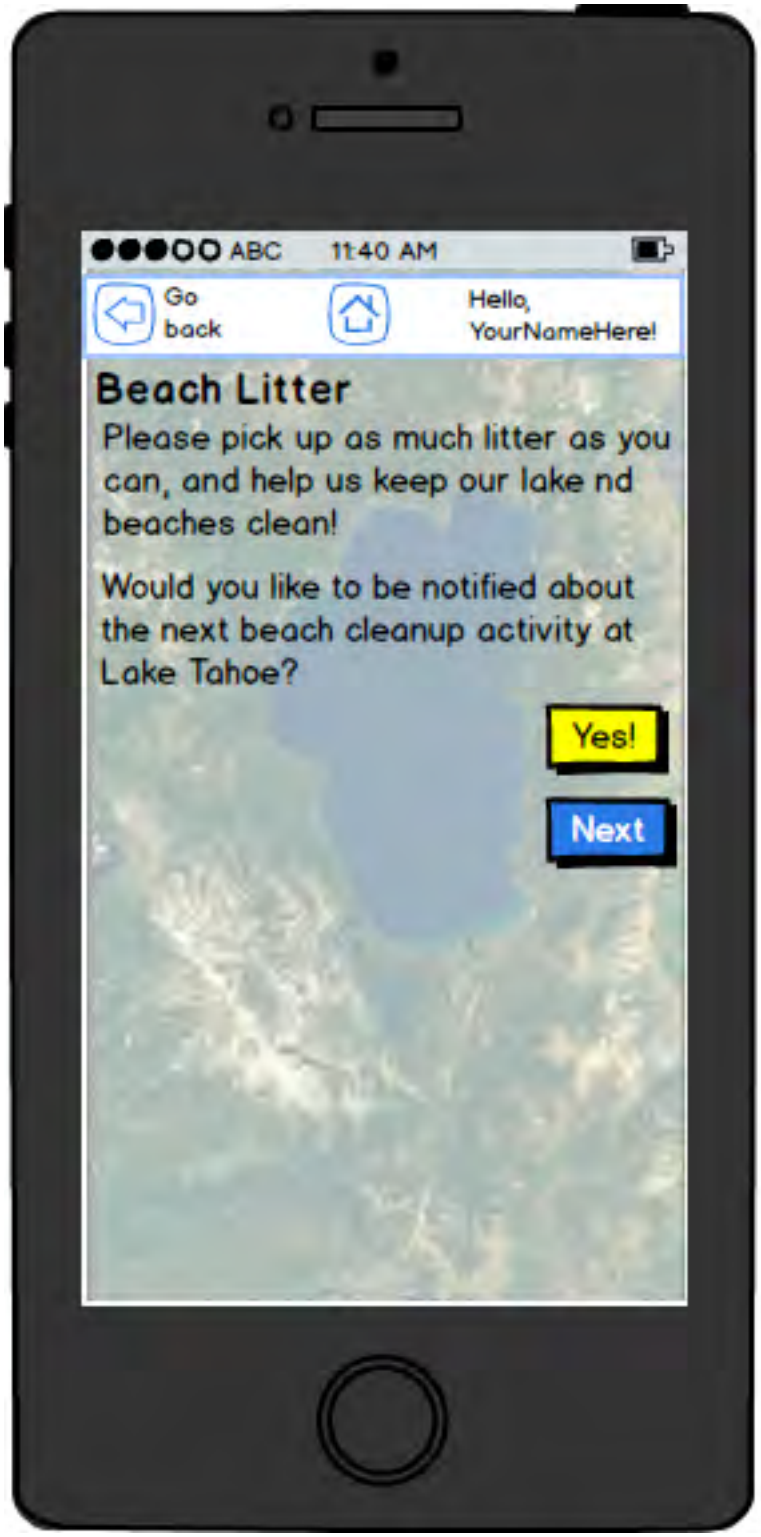

ABC
11:40 AM
Lake Tahoe Scientist
Algae
Local Species
Water Quality
Beach Conditions
SUBMIT OBSERVATION


ABC
11:40 AM
Go back
Hello, YourNameHere!
Beach Conditions
Many different things can affect the quality of Lake Tahoe's beaches. In the next few pages, you'll make observations of the level of litter on the beach, any odors you may notice, and your overall ranking of this beach.
Next


For the prototype, these images link to their individual destinations. In the actual app, each will display a "selected" state when touched, and the Next button will take user to the proper destination.


"Some litter" selected, with photo / observation opportunity.

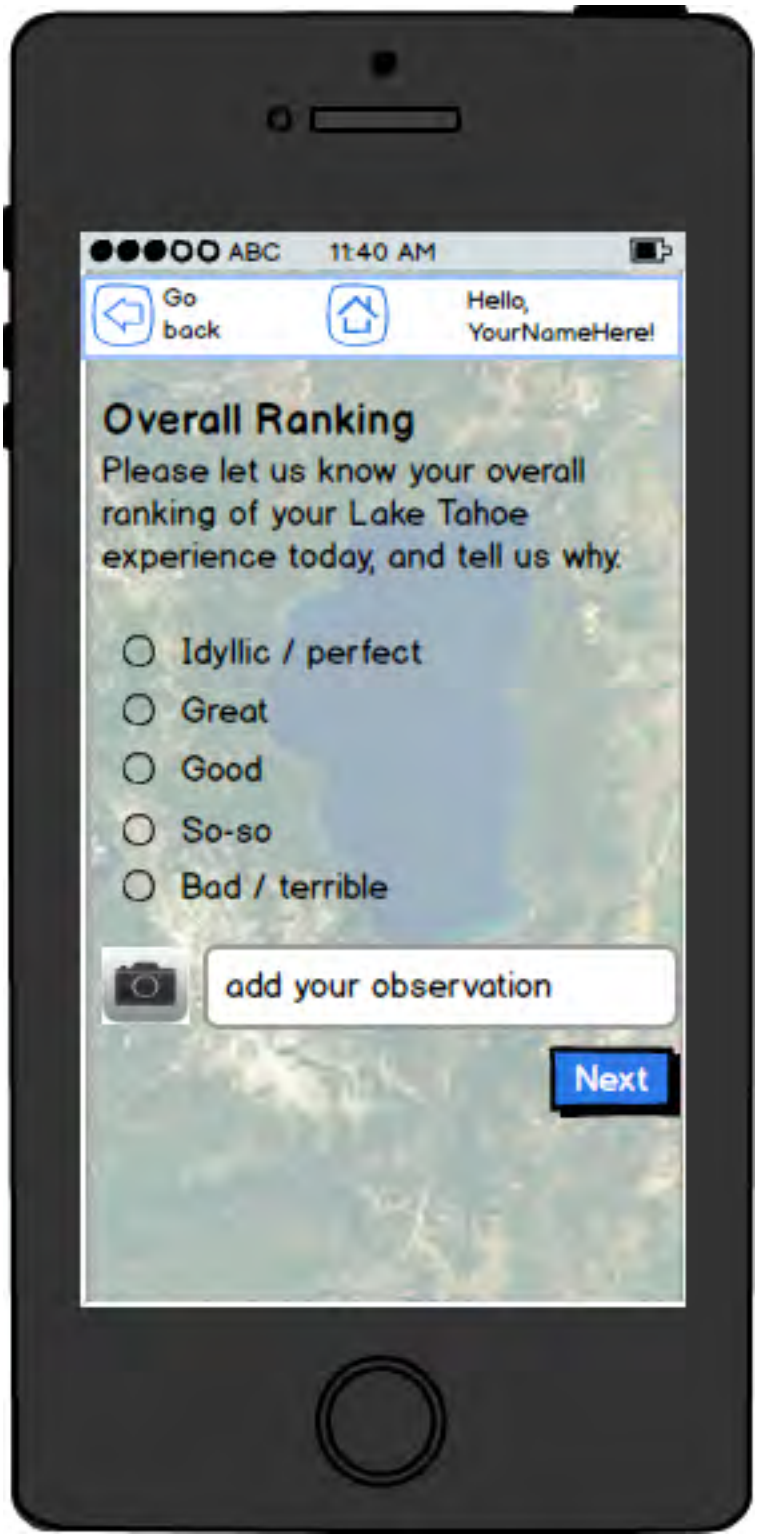

ABC
11:40 AM
Go back
Hello, YourNameHere!
Beach Litter
You indicated that you see litter on the beach. Check all the types of litter that you see here.
Paper
Plastic
Glass
Cans (aluminum, other metal)
Cigarette butts
Dog poop
Other (add a photo or comment)
add your observation
Next

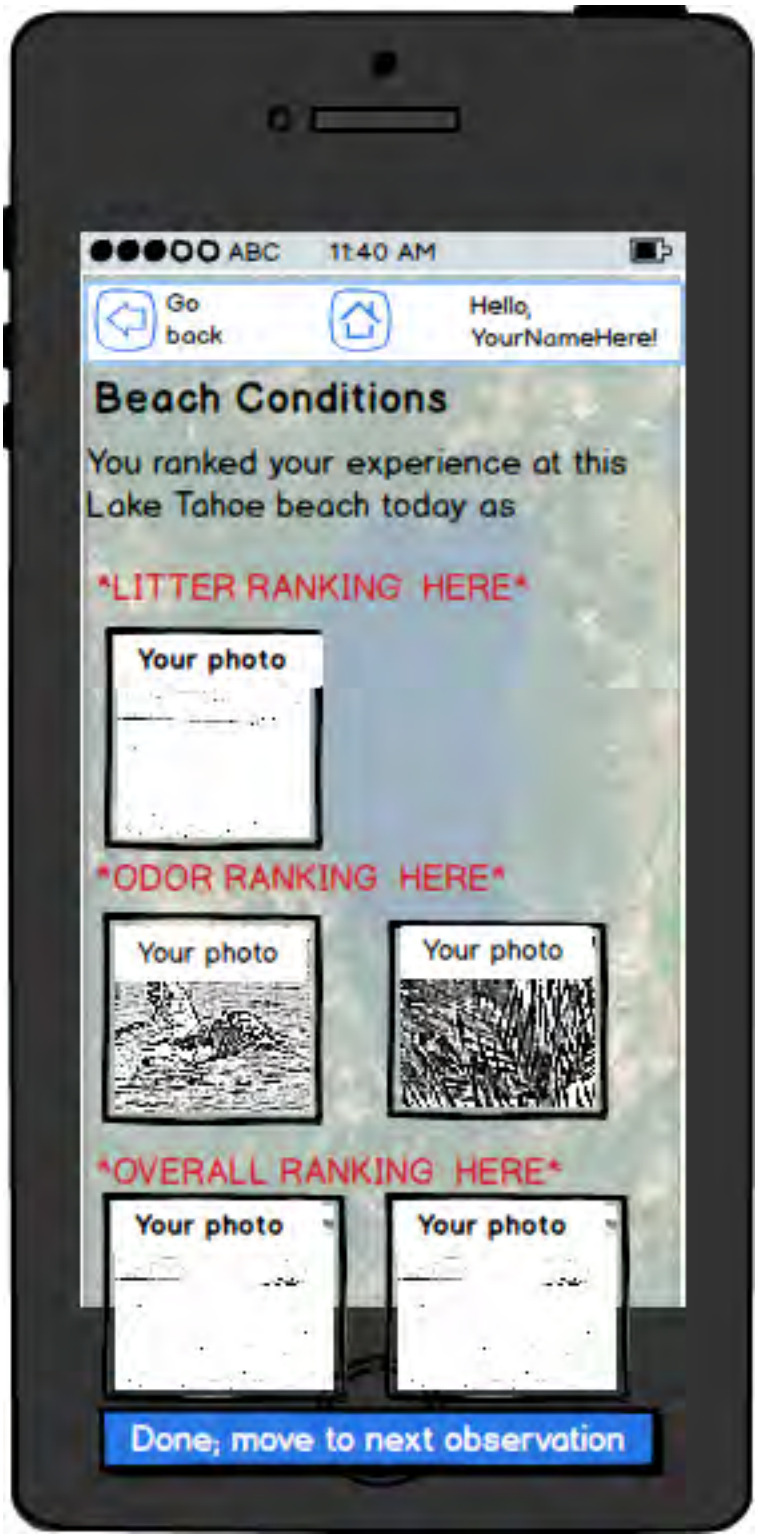



YES leads to email pop-up.

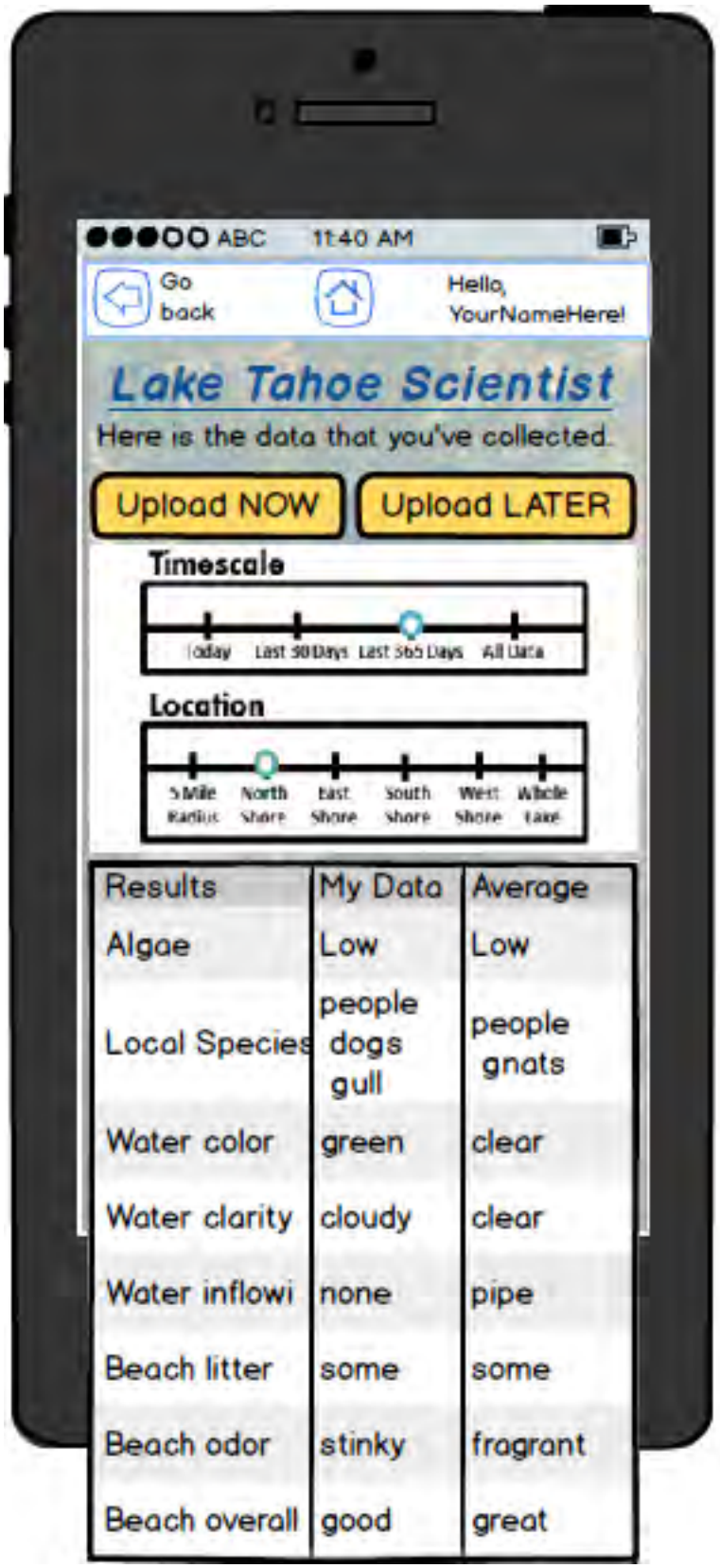

In this case, all selections lead to the same next page.


"Smells good" selected, with photo / observation opportunity.


ABC
11:40 AM
Go back
Hello, YourNameHere!
Overall Ranking
Please let us know your overall ranking of your Lake Tahoe experience today, and tell us why.
Idyllic / perfect
Great
Good
So-so
Bad / terrible
add your observation
Next

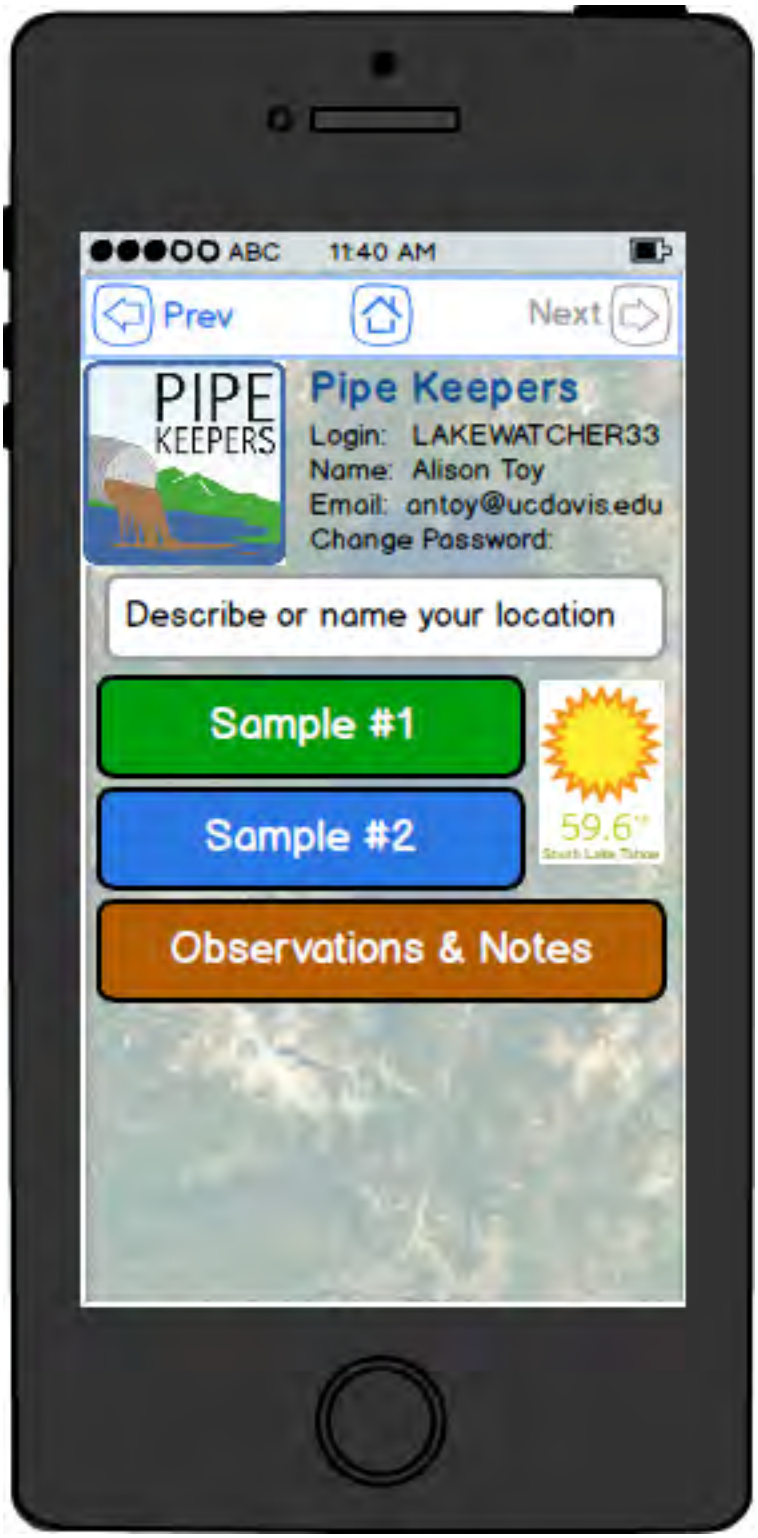

ABC
11:40 AM
Go back
Hello, YourNameHere!
Beach Conditions
You ranked your experience at this Lake Tahoe beach today as
*LITTER RANKING HERE*
Your photo
*ODOR RANKING HERE*
Your photo
Your photo
*OVERALL RANKING HERE*
Your photo
Your photo
Done, move to next observation


ABC
11:40 AM
Lake Tahoe Scientist
Algae
Local Species
Water Quality
Beach Conditions
SUBMIT OBSERVATION

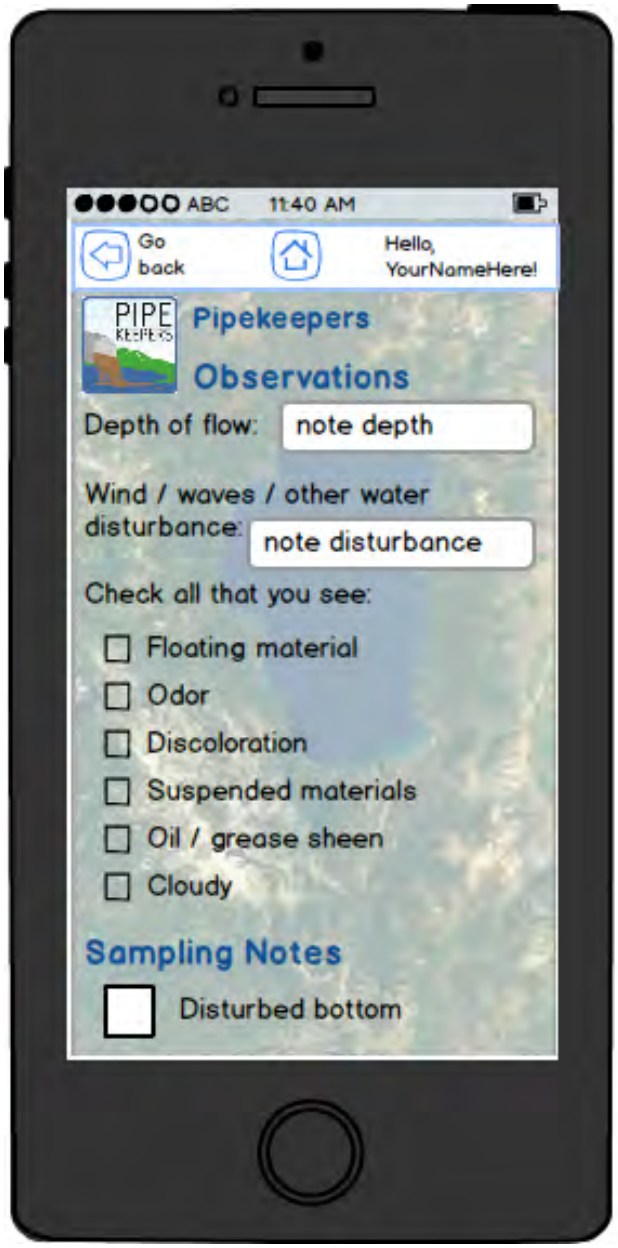


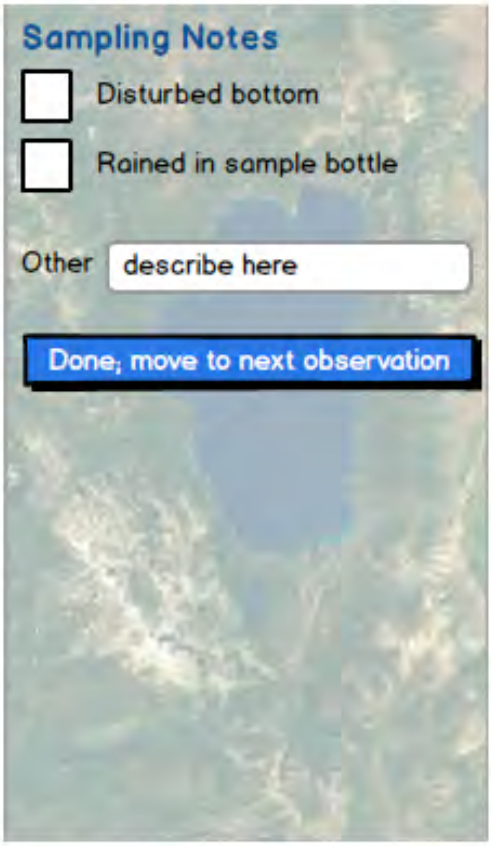

| Results | My Data | Average |
|---|---|---|
| Algae | Low | Low |
| Local Species | people dogs gull | people gnats |
| Water color | green | clear |
| Water clarity | cloudy | clear |
| Water inflowi | none | pipe |
| Beach litter | some | some |
| Beach odor | stinky | fragrant |
| Beach overall | good | great |

Users can select a period of time and a location as a basis for comparing their data with "average" responses.

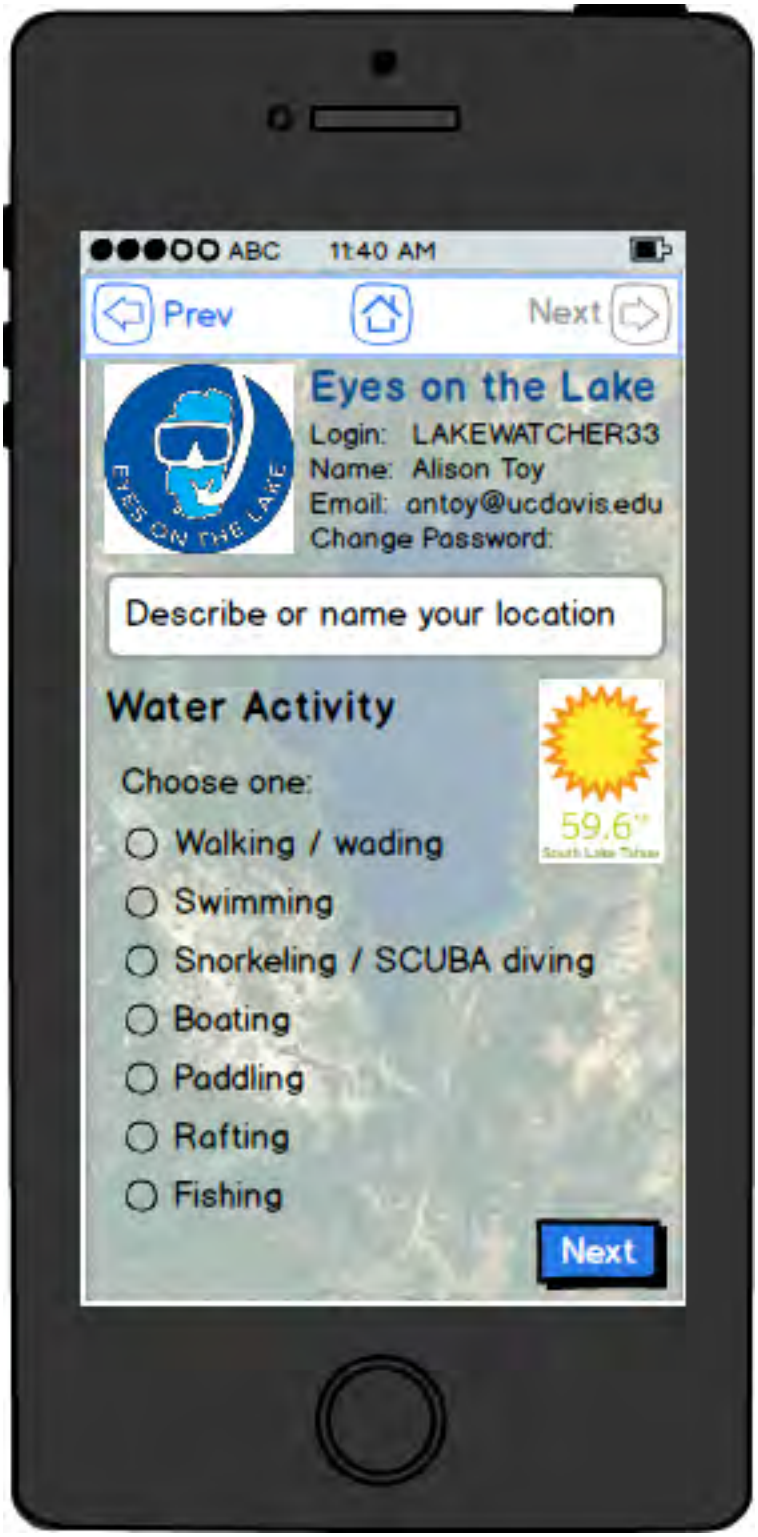

ABC
11:40 AM
Prev
Next
PIPE KEEPERS
Pipe Keepers
Login: LAKEWATCHER33
Name: Alison Toy
Email: antoy@ucdavis.edu
Change Password:
Describe or name your location
Sample #1
Sample #2
59.6°
Observations & Notes

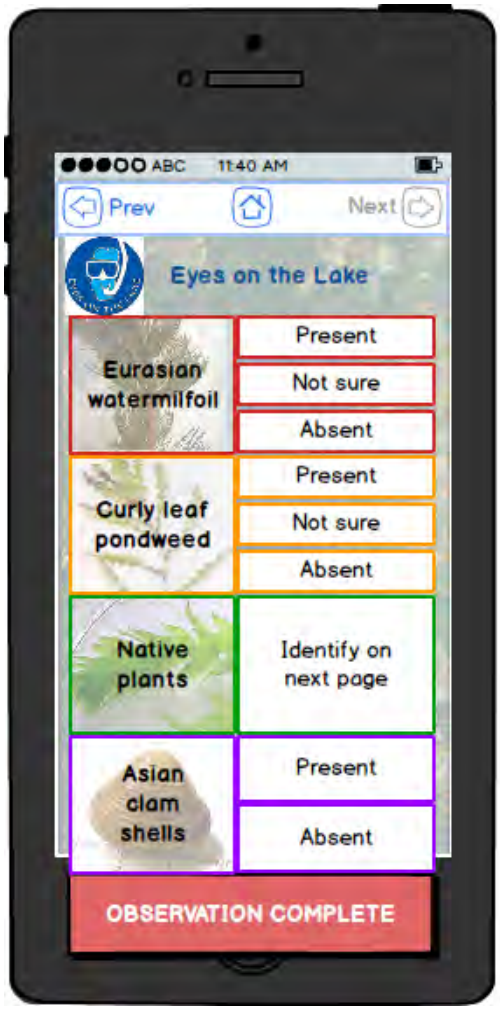

Note that this path will be taken twice, and needs to collect the data individually each time.

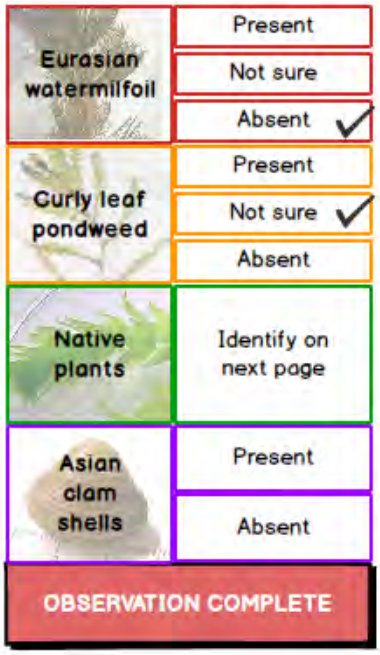



This shows the continuing page as it scrolls down...


ABC
11:40 AM
Prev
Next
Eyes on the Lake
Login: LAKEWATCHER33
Name: Alison Toy
Email: antoy@ucdavis.edu
Change Password:
Describe or name your location
Water Activity
Choose one:
Walking / wading
Swimming
Snorkeling / SCUBA diving
Boating
Paddling
Rafting
Fishing
59.6°
Next



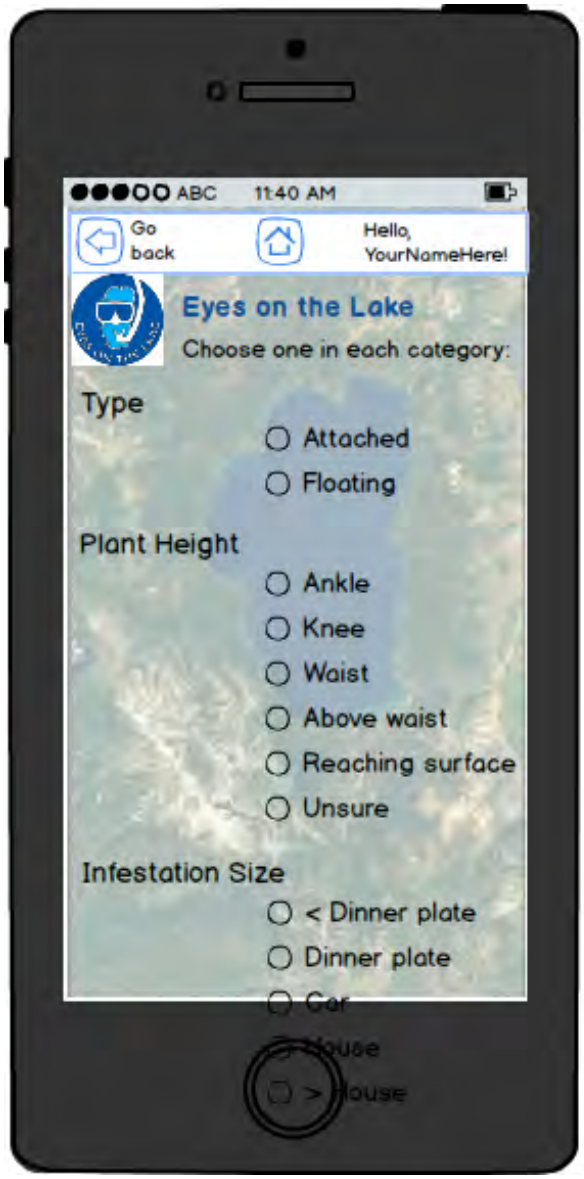




This image shows how the page might look when two observations are complete. Like the app's main menu, the check-marks here represent "complete."

Choosing "Absent" causes the "complete" marker to appear without any intervening pathway, because there was nothing to observe.

Choosing "Present" or "Not sure" leads to main observation path, returning the user to this menu when the observation is finished. The "complete" marker will appear on whichever (Present or Not sure) button was originally selected.

There is no observation path for Asian clams, so the "complete" marker will appear on either button when selected - they are either present or absent with no further observation.

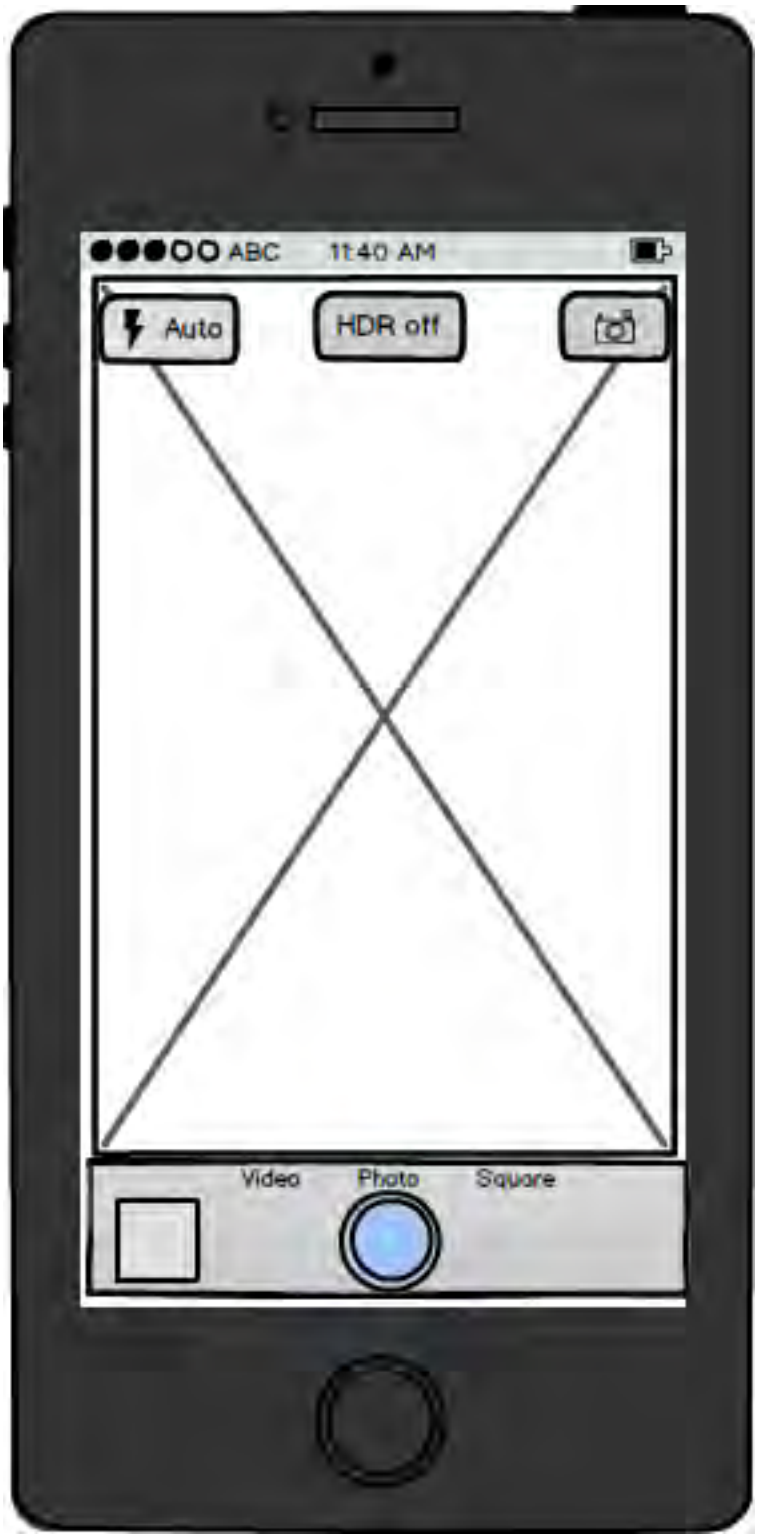


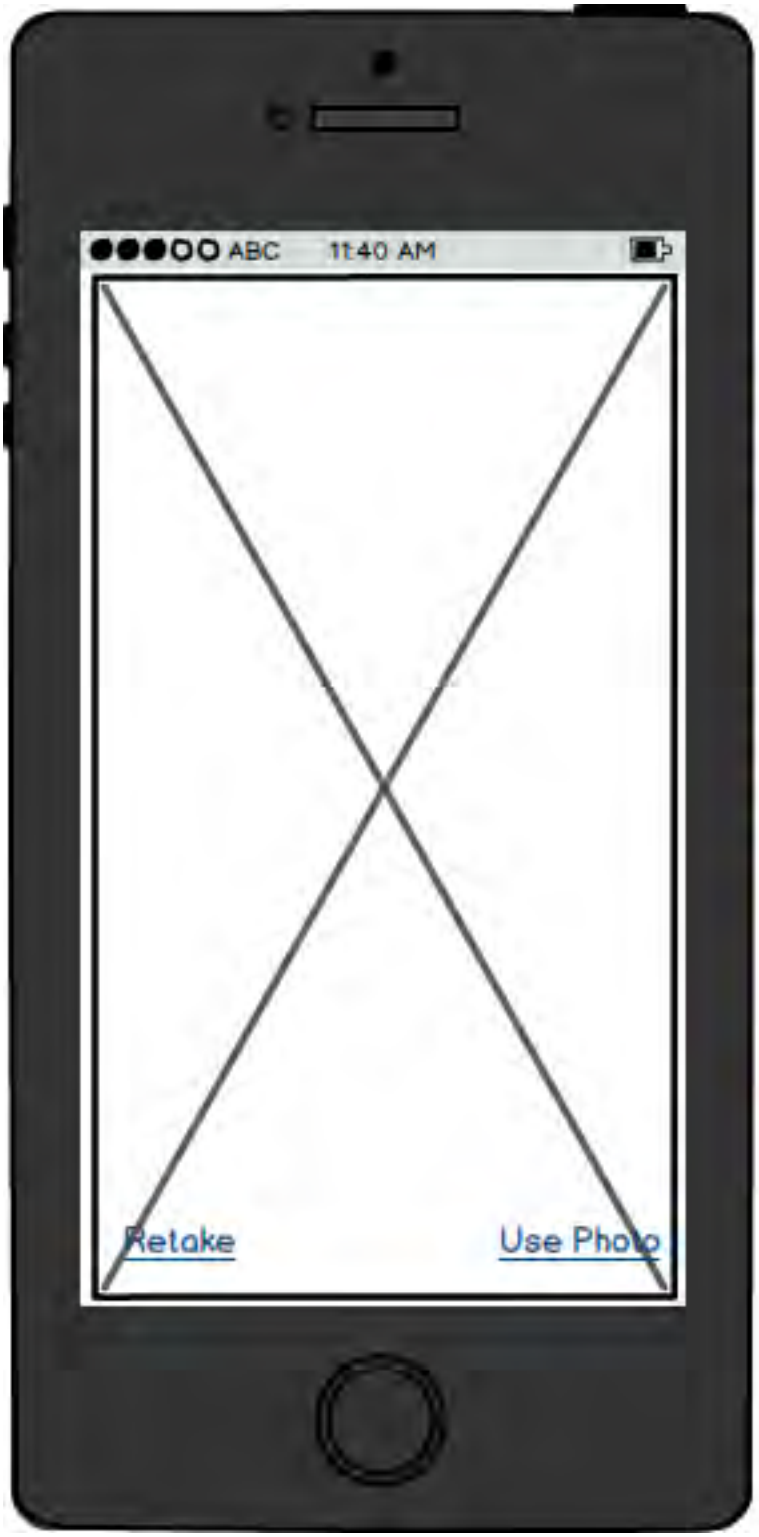


This shows the continuing page as it scrolls down...

Note that this path may be taken more than once, and needs to collect the data individually each time - e.g., for milfoil or pondweed.

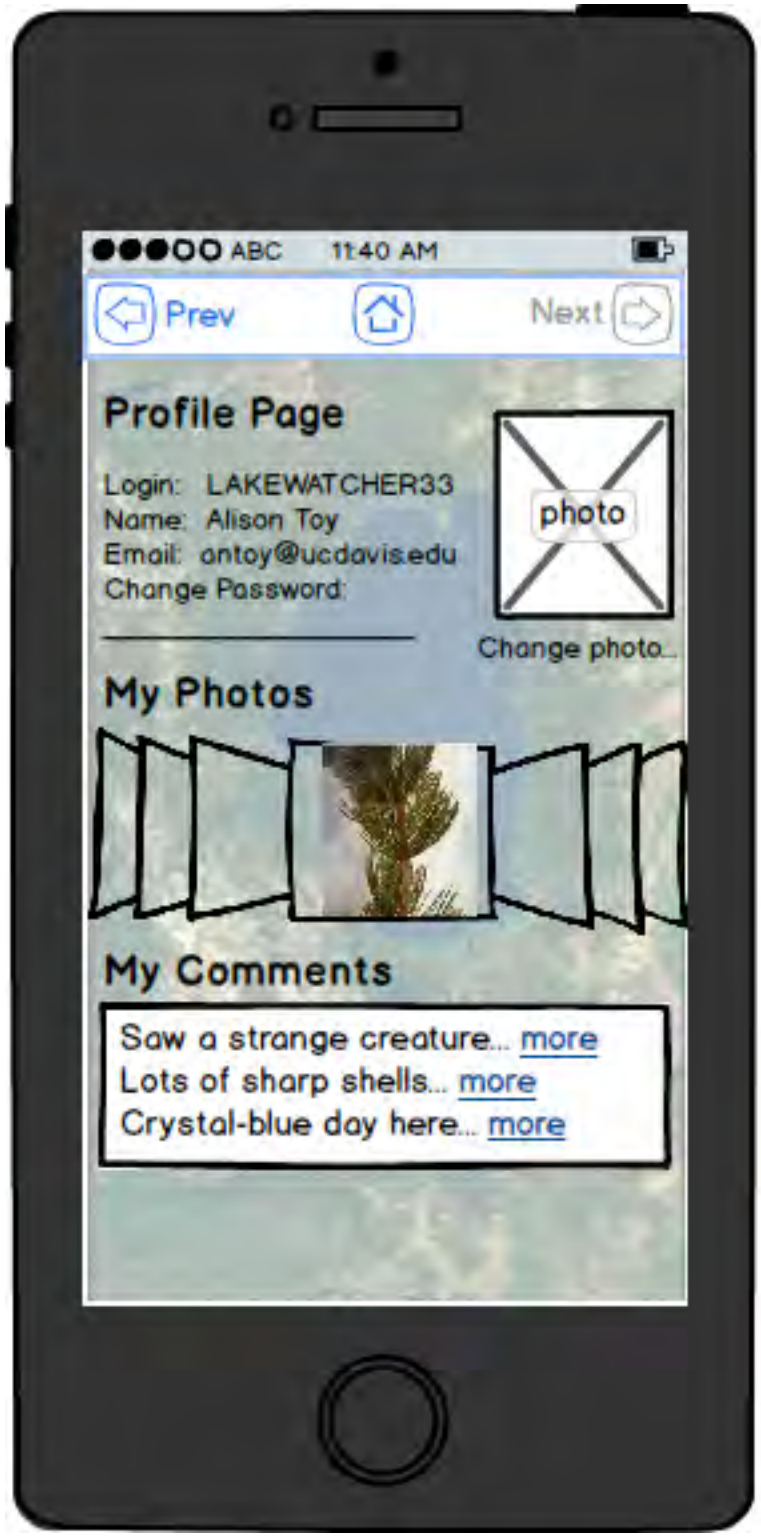

ABC
11:40 AM
Go back
Hello, YourNameHere!
Eyes on the Lake
Select all native plants that you can see:
Coontail
Bladderwort
Northern milfoil
Andean milfoil
Elodia
Clasping pondweed
Richardson's pondweed
Leafy pondweed
Sago pondweed
Other
None
add your observation
Done, move to next observation


ABC
11:40 AM
Auto
HDR off
Video
Photo
Square




"Use Photo" link will return to the page the user was on before clicking on the camera icon.

In this prototype, the "Use Photo" link will return the tester to the main menu, where s/he will need to re-navigate to the previous page.




If we include a social component or ranking, these or others may also appear:

## My Feed

| | |
|---|---|
| Algae Photo<br>Joe said: "Yech!" | 3 min ago |
| Algae Post<br>Jane liked your post | 5 min ago |
| Smell Post<br>Sue said: "OMG UR kidding | 2 days ago |

## My Rank:

| | |
|---|---|
| ★★★★★ | ≤ 0.03W |
| ★★★★ | > 0.03W to 0.15W |
| ★★★ | > 0.15W to 0.25W |
| ★★ | > 0.25W to 0.35W |
| ★ | > 0.35W to 0.5W |
| No Stars | > 0.5W |