Water Quality Made Simple

Designing a dashboard for use with Platypus' autonomous water quality data monitoring system. A research and design report prepared by Aneesh Bhoopathy, Karina Chow, Dev Doshi, Soyeon Hwang, and Alex Rothera.

PLATYPUS

dreamtime

HCI!

Overview

Dreamtime learned how agricultural and environmental efforts can be empowered by water quality data, and designed a system based on the needs of Platypus' users.

Platypus engineers low-cost autonomous airboats which gather water quality data information such as pH, depth, and temperature from lakes, ponds, and streams. The boats can cover territory more quickly and reliably than stationary sensors, the current industry standard. Data from the boats can help generate real-time, spatiotemporal maps of these metrics, which provide immense value to several user groups, including farmers, environmentalists, and educators. Platypus wants to develop a platform for this data that is maximally useful for its diverse user segments.

The methods summary on the next page is a visual guide of our design process. More information is detailed in the pages ahead, which are organized into three sections: research, design, and implementation.

See platypus-dreamtime.herokuapp.com for a live demo.

Research

Our research included a case study, on-site contextual interviews, visits to farmers' markets and conventions. This research informed a survey of existing UI patterns.

Design

With research findings and UI inspiration in hand, we generated personas, and began sketching in parallel. After paper prototyping, testing and iterating, we felt we had validated our major design direction.

Implement

We sought to iron out the details with a working prototype, which would eventually be iterated into the final deliverable.

Project Timeline

January | February | March | April | May

Contextual Interviews

Interviewed farmers at the farm, on the phone, and at farmers market. Collected data about their daily routines, technology use, and water quality knowledge.

Final Prototype

Implemented features from user, faculty, and client, feedback

Competitive Analysis

Looked into other environmental monitoring to build a library of UI patterns.

Sketching

Began ideation process by sketching out a broad range of ideas and features.

Expert Review

Received feedback from faculty and other HCII students through speed-review sessions.

Case Study

Gained background knowledge about a community afflicted by water quality issues.

Personas & Scenarios

Developed fictional characters and use cases representative of our user base.

Lo-Fi Prototype

Built paper prototype, to test and iterate on data visualization techniques.

Hi-Fi Prototype

Designed and implemented an interactive, high-fidelity prototype with live code.

Lo-Fi User Testing

Tested our sketches and lo-fi designs at farmers markets and Farm To Table Conference.

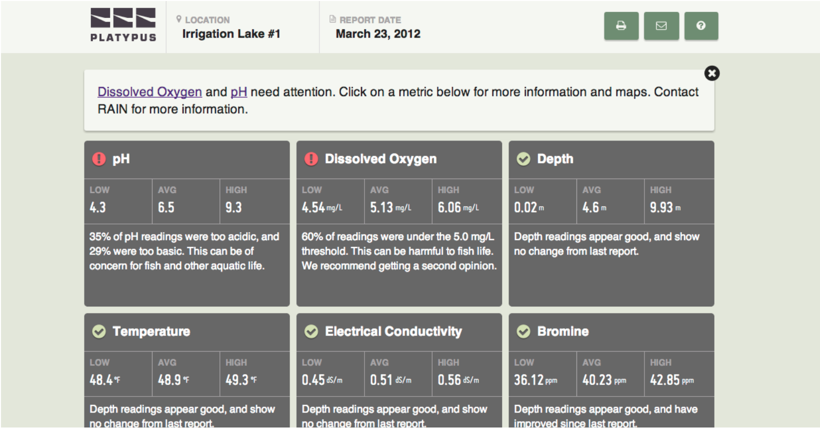
Hi-Fi User Testing

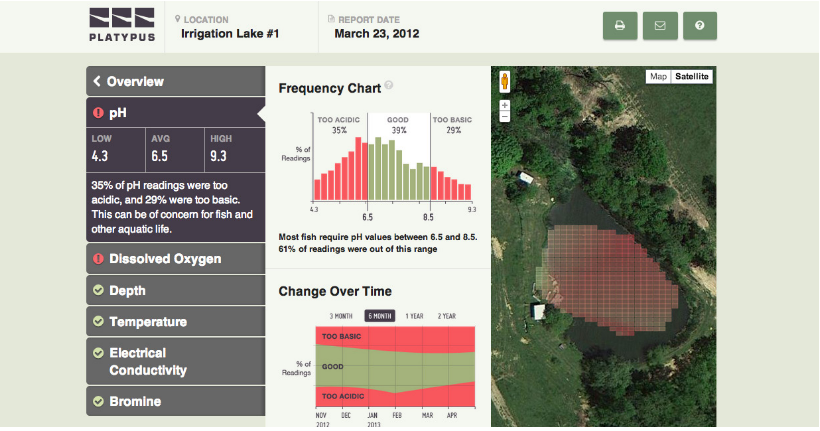
Tested interactive prototype at farmers' market and Carnegie Science Center.

Prototype Overview

This is summary of the prototype, explained through an viewpoint of an example Platypus customer, Troy. In this scenario, he receives an email from Platypus, notices some problems, clicks through to an interactive report, and then takes action (emailing the report to another organization).

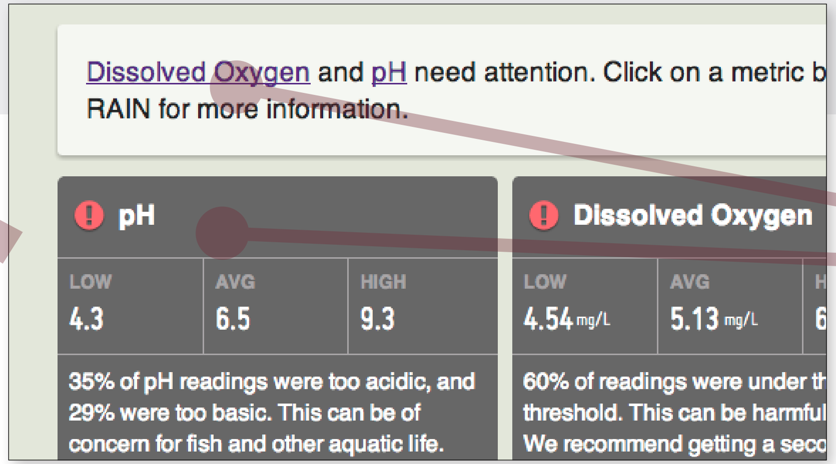
The two main screens of the app. These are explained more in detail in the implementation section. ›



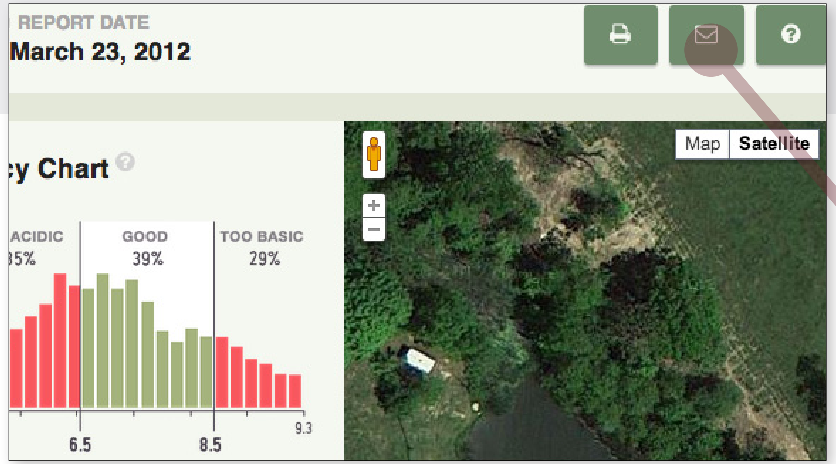


A couple days after scheduling a scan, Troy receives an email from Platypus summarizing the scan's results. The email suggests two metrics need his attention, so he continues to click through to the full report.

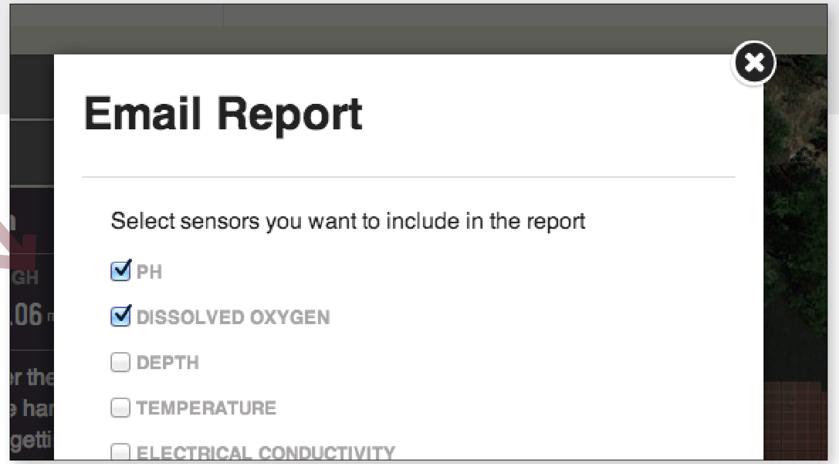
Troy views a summary of overall water quality, along with short explanations of each metric's status. This screen contains low, high, and average values for each metric. Troy clicks the pH tile to learn more.



On the pH screen, Troy views graphics explaining what percent of readings were under a threshold value. A map displays the water with an overlay showing under-threshold areas.



Using the top right toolbar buttons, Troy can generate a custom report to email someone for a second opinion. A modal pops up with options to complete the action.

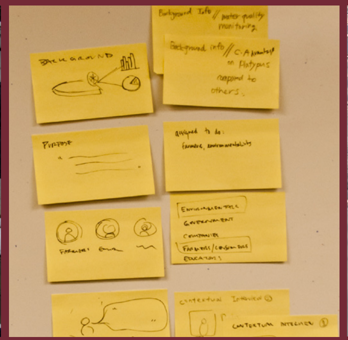


Research

We began with a case study on issues related to water contamination, especially in Greene County, PA. We reviewed water pollution cases and analyzed the relationship among energy companies, water monitoring groups, and users of the water "users". This grounded our interviewing process. We visited a Greene County farm and talked with two landowners in the area.

After getting a sense of how Platypus might address its user's needs, we began looking at existing environmental monitoring tools, and investigating patterns and interaction techniques that might motivate a prototype.

Further research was conducted through several trips to the farmers market and one trip to the Farm to Table Pittsburgh Conference. These visits involved both user testing prototypes and collecting contextual user data.

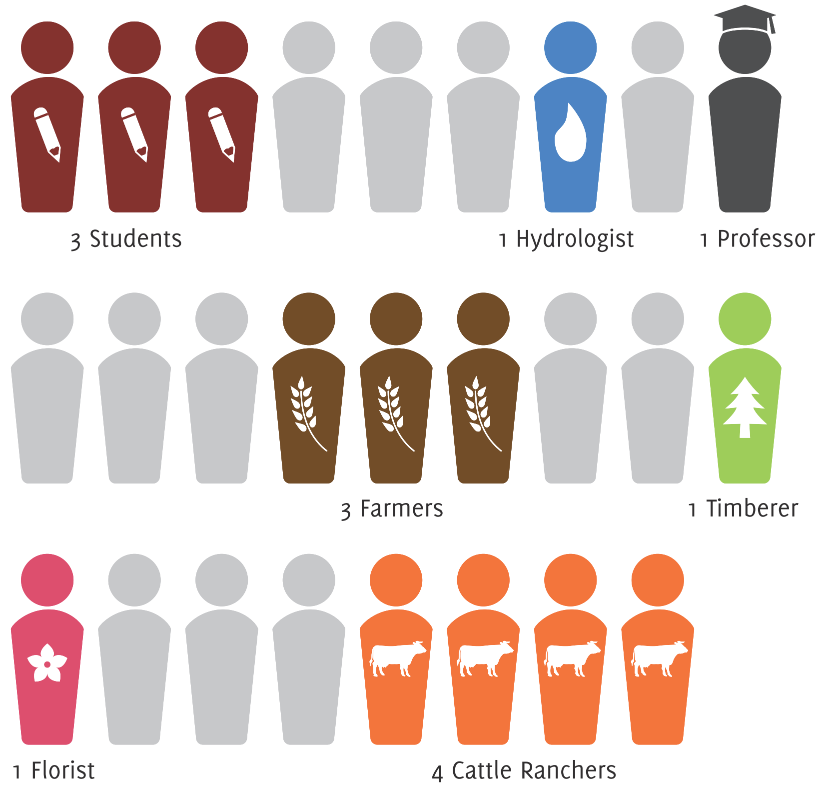


Interviewees Summary

The Dreamtime team spoke with 38 people, 14 of which we identified as ideal potential Platypus users. The original 38 people represented many user groups, such as farmers, environmentalists, and educational groups. However, early on we narrowed our target user group to farmers and focused on those contacts.

Of those we targeted, 4 raised livestock and 4 grew vegetables and grain (1 was also a hydrologist) making a total of 8 farmers. These farmers were found through personal contacts, trips to the Strip District Farmer's Market, and attendance at the Farm-to-Table Food Conference. In addition to these 8 farmers, we also had a variety of other users such as a handful of students, a Civil and Environmental Engineering professor, and a florist. We also had a few hybrid users, such as a farmer-hydrologist and a timberer-student, who contributed unique perspectives in terms of knowledge and tech familiarity on our project.

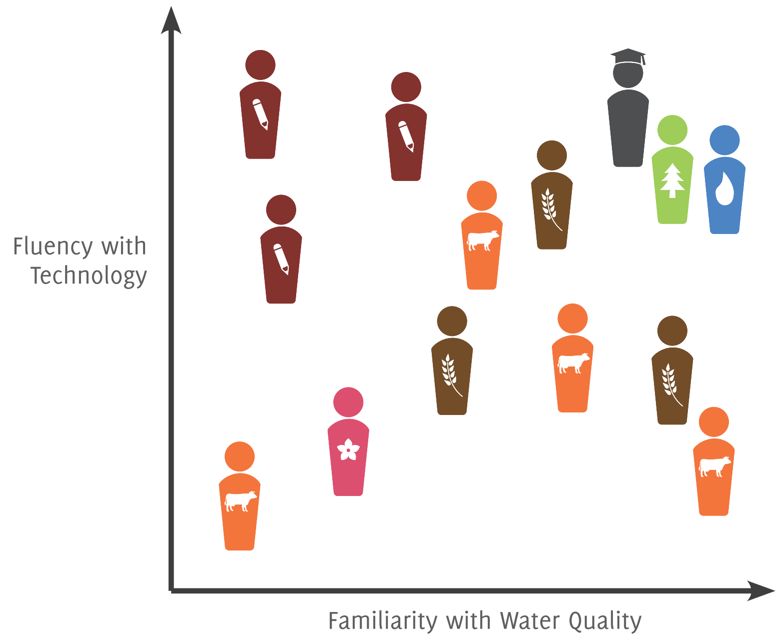
Interviewing Farmers at the Pittsburgh Public Market. The farmers varied greatly in their age, farm size, tech savviness, familiarity with water metrics, their level of concern about water, and their trust of organizations.



Developing Personas

Our trips to the farmers' market provided the opportunity to interview many farmers in one place, which made clear to us the sheer diversity of our user base. They varied greatly in their familiarity with technology, and their knowledge of environmental data, and their level of concern with ecological threats.

We sought a way to keep these varied users at the forefront of our design process, by generating personas on a 2 x 2 matrix of fluency with technology, and familiarity with water quality. We kept the needs of each of these users in mind as we prototyped.



‹ Where each of our real users fell on our persona matrix.

Personas

Design teams "personalize" user categories into single, fictional, personas. It is easier to empathise with a person with a picture and real background than with a set of data points. The personas also give the team a common language for referring to users. "Yes, that might work for Frank...but what about Troy?"

Fluency with Technology

Jason

42 year old rancher from Greene County. Jason knows very little about water data. He would like to know more but he does not have the time to because he is too busy tending to his ranch and five children. **He wants to get an understanding of the water data without expert knowledge.**

Troy

Aged 35, Troy is an organic farmer from California. Troy studied journalism in college and has a deep passion for organic farming. He also is very concerned with the environment and as such has extensive knowledge of water data. **He wants quick access to detailed water analytics.**

Frank

62 year old rancher from Iowa. Frank fully trusts energy companies and the government to dutifully protect his land. Unless there is an imminent problem, Frank does not think he has the expertise to do much. **Frank wants to understand data through timely alerts and reports when they are needed.**

Rita

56 year old potato and ginger farmer from Pittsburgh. She supplies Wholefoods and needs to meet their standards. She user public water and receives water reports from energy companies, but is skeptical about them. **Rita wants to find data about public water supply without depending on organizations**

Familiarity with Water Quality

Research Findings

Dreamtime's research into user needs produced some key ideas, which we've consolidated into into four main themes:

Enabling Customized Reporting
Visualizing Spatial and Temporal Dimensions
Contextualizing Metrics
Providing Actionable Information

In the following pages, we explain these main user needs, and provide an index of techniques to address these needs. These techniques are drawn from our survey of existing tools, both in the environmental monitoring space and in other sectors.

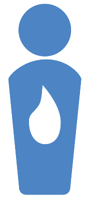
Research domains included government supported systems (i.e National Centers for Coastal Ocean Science), a mobile-web platform for farmers (The Climate Corporation), a web platform particularly designed for crisis (Google's Crisis Response) and NASA's Earth Now, among other tools. In all, we surveyed 12 environmental monitoring platforms.

Enable customized reporting

What metrics do users want to see and report on, and in what detail?

Platypus' water data is used differently by various user types. For example, environmental groups and governments might track large scale trends in environmental change whereas a farmer might wish to track the pH of his lake - or even be notified when bromine levels reach a threshold. Our solution must strike a balance between providing useful warnings and not triggering false alarms.

We anticipate that users will require varied alert methods, in accordance with their familiarity with technology, knowledge of environmental data, and level of concern. This was admittedly difficult to study without a working prototype, and will require future iteration.



"Dissolved oxygen is an irrelevant metric unless you're a fish farmer"

Hydrologist

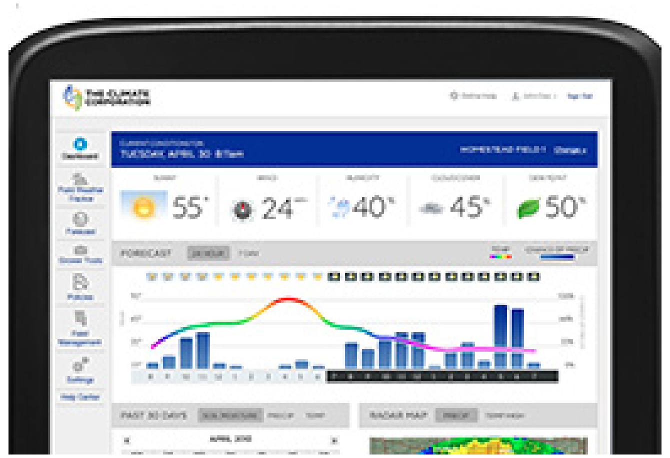
"If the information is emailed to those farmers every day or every week, that would be enough."

Timberer

Customizable Dashboards

Tailor information displays to user needs for specific metrics.

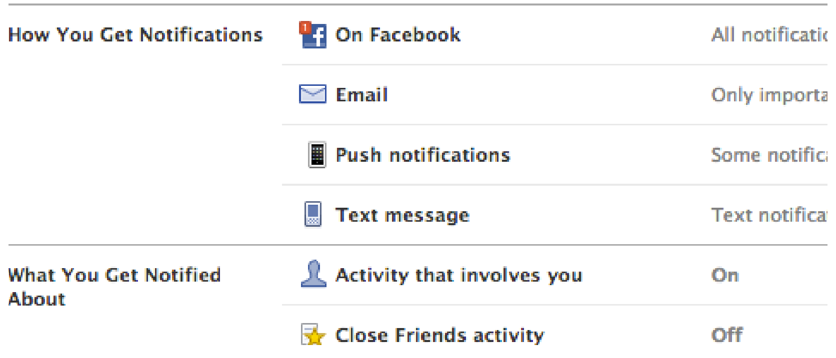
The high degree of customizability can be good for handling complex data sets, but also overwhelming to users.



The Climate Corporation's modular dashboard allows users to add and remove data "widgets" as needed

Alert Customization

Enable customization of type, medium (sms/email), and frequency of alerts.



How You Get Notifications	On Facebook	All notificatio
	Email	Only importa
	Push notifications	Some notifica
	Text message	Text notifica
What You Get Notified About	Activity that involves you	On
	Close Friends activity	Off

Facebook provides extensive notification customization

Visualize Spatial & Temporal Dimensions

How can visualizing spatial and temporal dimensions empower users?

Platypus boats offer high fidelity temporal and spatial data, a major competitive advantage over existing static sensors and lab samples. Spatial data helps determine the source of an irregularity. Taking multiple samples across space and time can increase validity.

Recognizing that this is one of Platypus' main competitive advantages, we seek to emphasize this value in our design in a way that empowers users.

"I would really want to know exactly where the problem is...the particular point of discharge if something is leaking in"

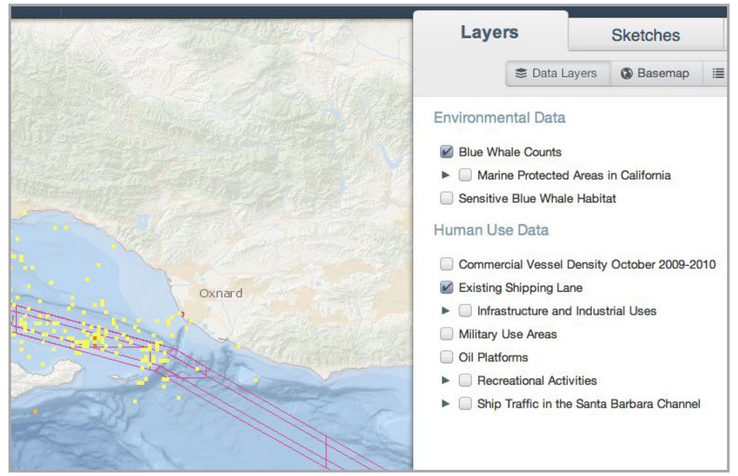
Farmer

"[I'd like to know] what the pH is over here versus someplace else in the pond"

Farmer

Data Layers

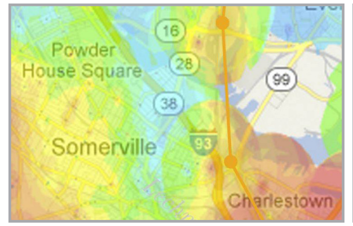
Allow toggling of multiple data layers on a single map interface. This allows users to customize their map display, and discern how one metric might affect another.

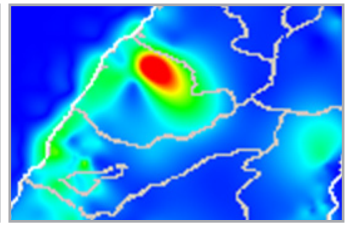


SeaSketch's data layers show interaction between "whale strikes" and "shipping lanes".

Heatmaps

Provide a graphical representation of the distribution and magnitude of a metric using color. We found this to be a very popular visualization technique in environmental dashboards. Can be used in conjunction with the "data layer" pattern.





Timelines

Allow users to select a period of time with a slider. They were a popular way of visualizing change over time in the interfaces we reviewed. Some included a play button, which automatically scrolls through a time series.

Contextualize Metrics

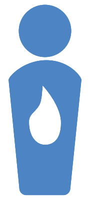
How can we provide numerical, historical and causal context to metrics?

Water quality data is neither easy nor simple. Simply reporting a metric is not as helpful as properly contextualizing it. It needs background information to understand what each component of the data means and how those data is related to one's interest. A data visualization interface should help answer questions like: How likely is this value to occur? Is it within an acceptable range of values? Is it trending upward or downward? What other metrics can help explain this data?

"What does it mean for the pH to be too low? For instance, the pH has to be kept around 3 for chickens and other livestock, but traditionally the standard is 7."

Cattle Rancher

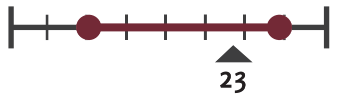
"I think you could...show fracking, pollution, climate, whether it's in a suburban or rural community..."

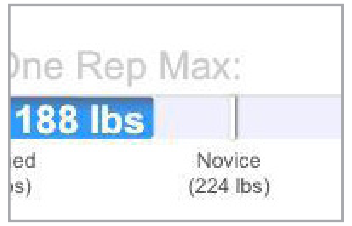


Hydrologist

Ranges

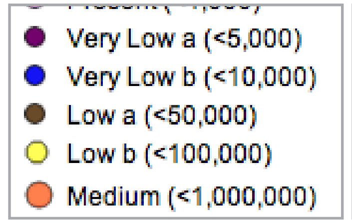
Place a point statistic in a range of values, perhaps based on historical data or EPA standards

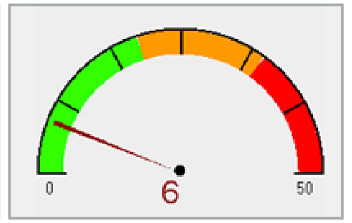




Color codes

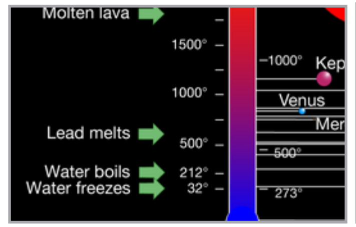
Provide a quick visual cue for displaying when something is at an acceptable or dangerous level. These generally use a common color spectrum from cold to warm colors.

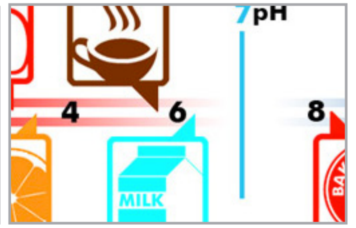




Analogies

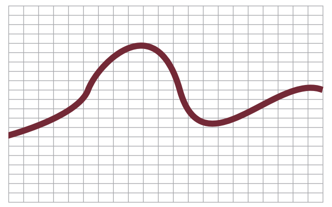
Relate numbers to familiar concepts, using analagous labels.

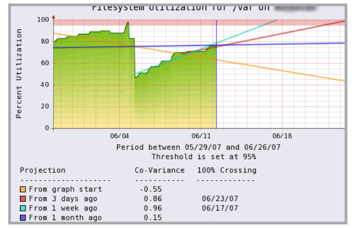




Trend Lines

show historical context for a metric, to easily determine if it is increasing or decreasing. This can be used in conjunction with the patterns above, such as ranges and color codes.





Provide actionable information

How do we bridge the gap between understanding and acting on data?

Data is often a means to an end. Users use data to stay informed, be alerted about problems, gain peace of mind, or help make a case to other people. We learned, both from interviews and background research, that the applications of water monitoring are diverse: ensuring irrigation and drinking water safety, detecting invasive species, and predicting floods. Current water quality reports and dashboards fall particularly short at providing actionable data. Our tool can go beyond providing understandable data to enable these next steps.

Cattle Rancher

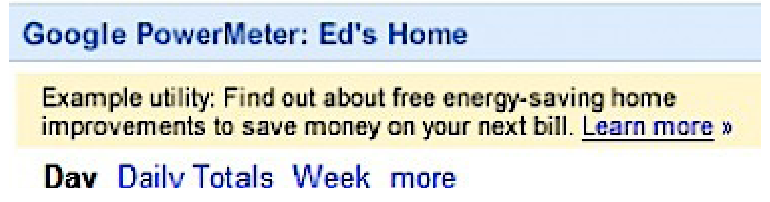
"I would think whoa...what does it mean for my dissolved oxygen to be low? What am I supposed to do?"

"[It'd be nice to have] a hint for what I should do next... or tell me what will happen if I don't do anything"

Farmer

Recommendations

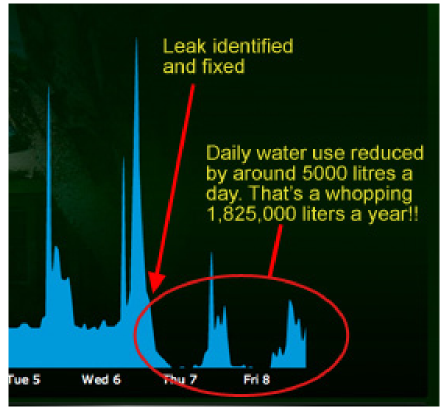
When something goes wrong, provide meaningful recommendations on how to fix a problem, who to contact for support, or what to read to learn more. However, designers must be careful to not provide misleading information here.



Google provides inline tips with its power saving tool.

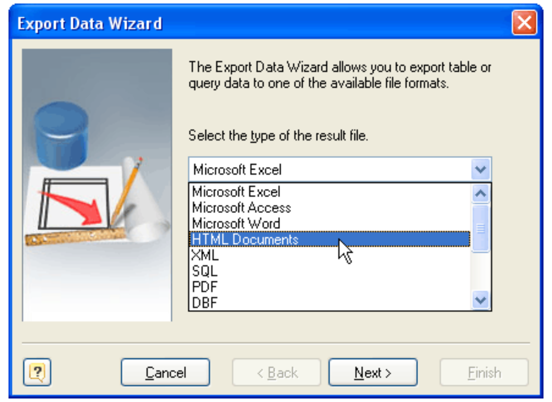
Annotation / sketching

Add human intelligence to data, where automated solutions come up short. This is specially useful in the context of map based visualizations and report generation functions. We must take care to differentiate these annotations from the original data.



Report generation

Data tools should strive for openness, allowing users to own their data. Allow users to generate reports for others (perhaps PDF, emails, or generated pages)



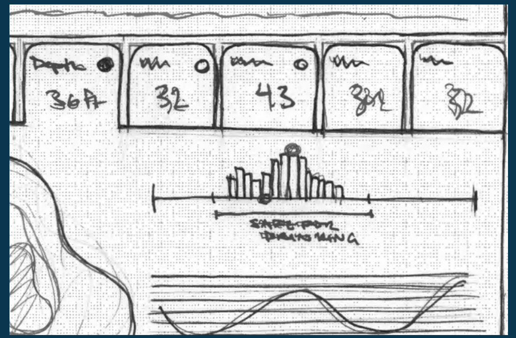
This "wizard" tries to tame the complexity of exporting big data sets to multiple formats.

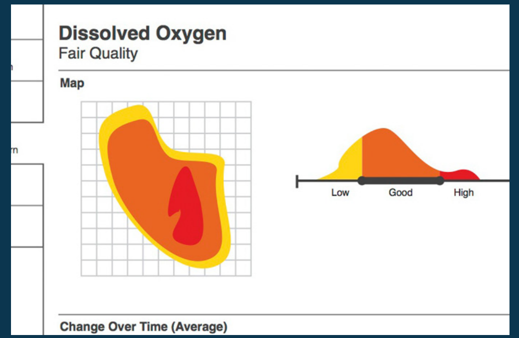
Design

With our personas, key ideas, and UI inspirations in hand, we began sketching in parallel to come up with a breadth of ideas.

We synthesized the best ideas from these into a lo-fi paper prototype. After two rounds of testing and iterating on this, we felt we had validated our major design direction.

We sought to iron out the details with a working prototype, which would eventually be iterated into the final deliverable.

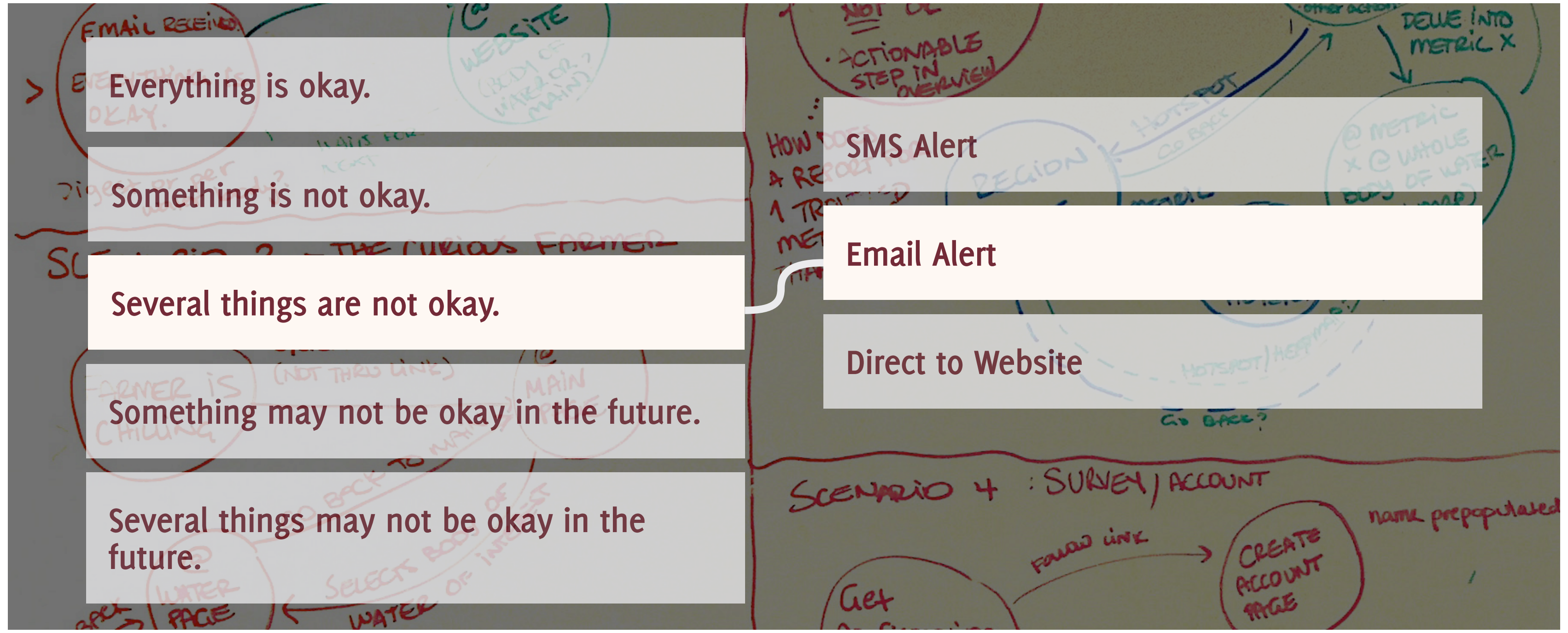




Preparing to Prototype

Scenarios

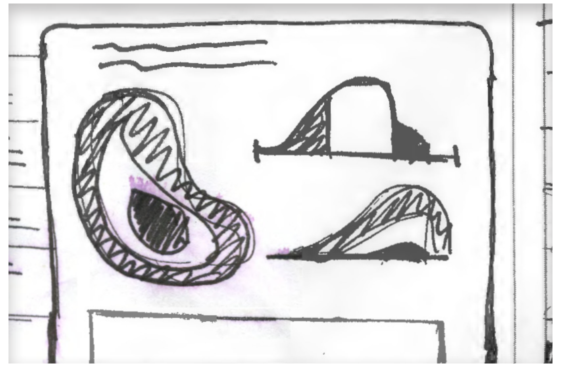
User needs and system specifications informed the creation of scenarios. Different system states (based on water quality) are combined with methods of reporting (SMS, email, website) to yield a number of different scenarios. We first directed our focus at the most complicated scenario: when a user is informed via email that multiple metrics are not okay. The other scenarios may end up being simplified versions of this one.

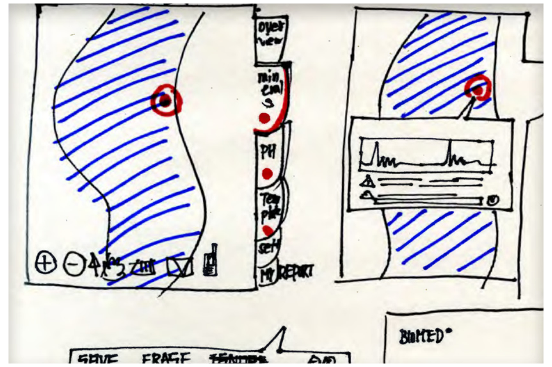


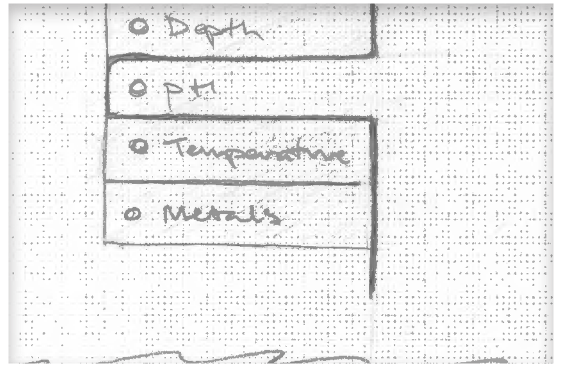
Sketching

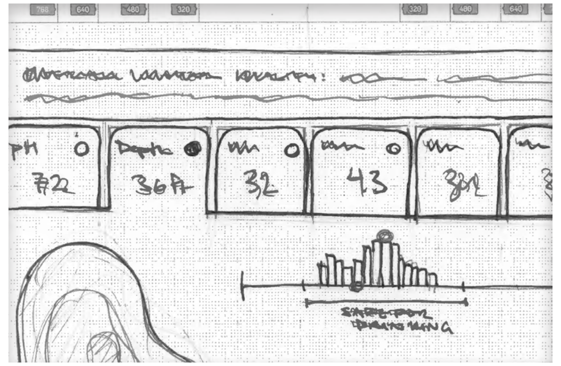
With a scenario to design for, we reviewed the main points of our first round of user research, best summarized by our 4 main research themes: enabling customized reporting, providing actionable information, contextualizing metrics, and visualizing spatial & temporal dimensions

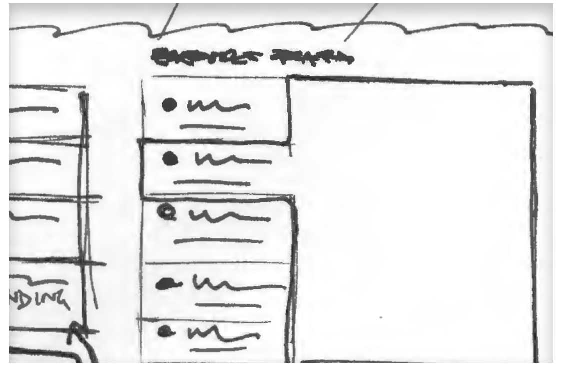
To explore a full breadth of ideas, we both sketched as individuals, and came together for group ideation sessions and discussion. This process enabled the entire team to get their ideas out before prototyping.

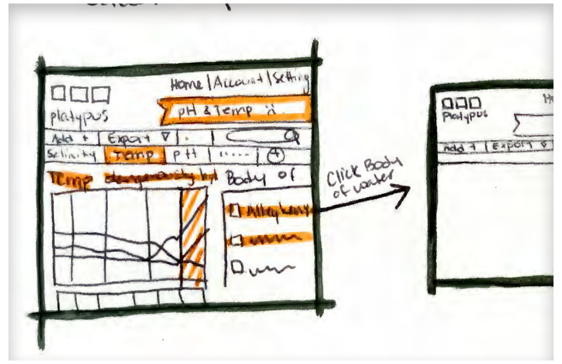






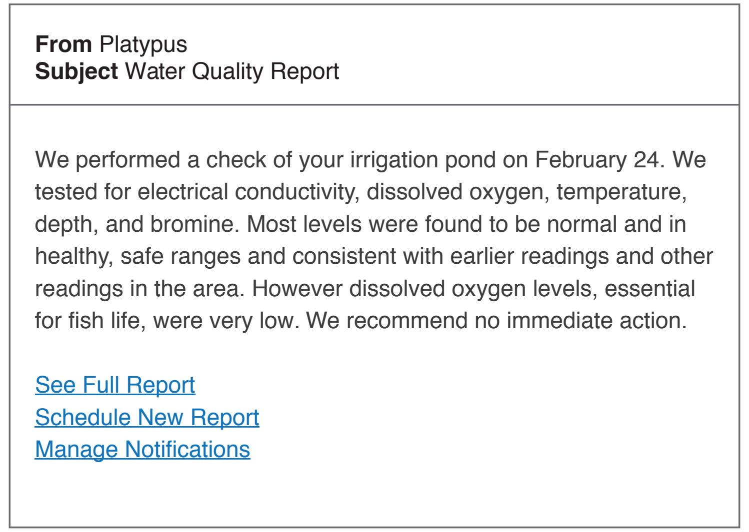






Lo-fi Prototyping

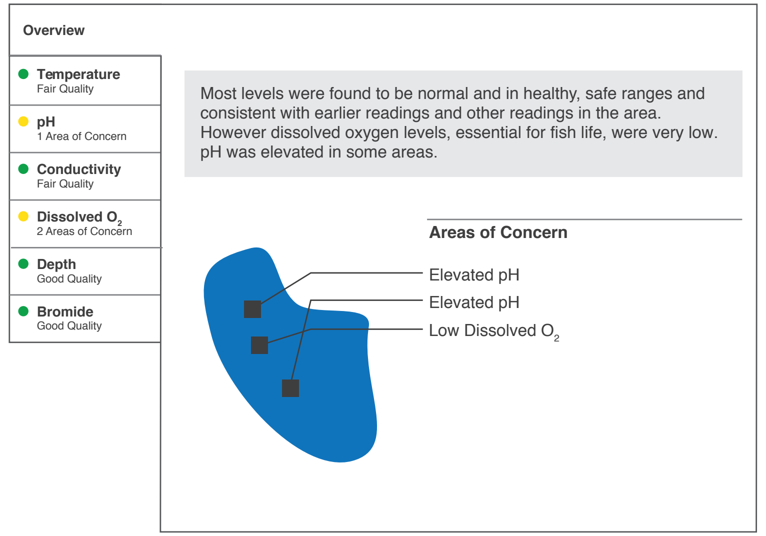
We consolidated our sketchy ideas into a lo-fi prototype for a selected scenario. A user receives an email, stating that dissolved oxygen levels are low. They then use a link to a web dashboard to receive more information about the metric, its history, and where the problem spots are.


From Platypus
Subject Water Quality Report

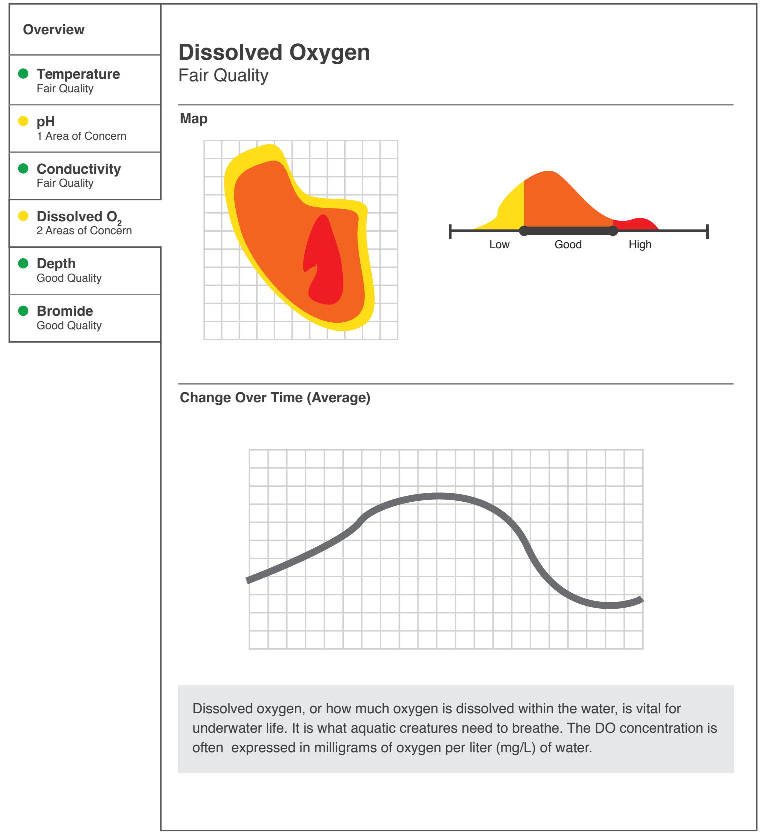
We performed a check of your irrigation pond on February 24. We tested for electrical conductivity, dissolved oxygen, temperature, depth, and bromine. Most levels were found to be normal and in healthy, safe ranges and consistent with earlier readings and other readings in the area. However dissolved oxygen levels, essential for fish life, were very low. We recommend no immediate action.

See Full Report
Schedule New Report
Manage Notifications

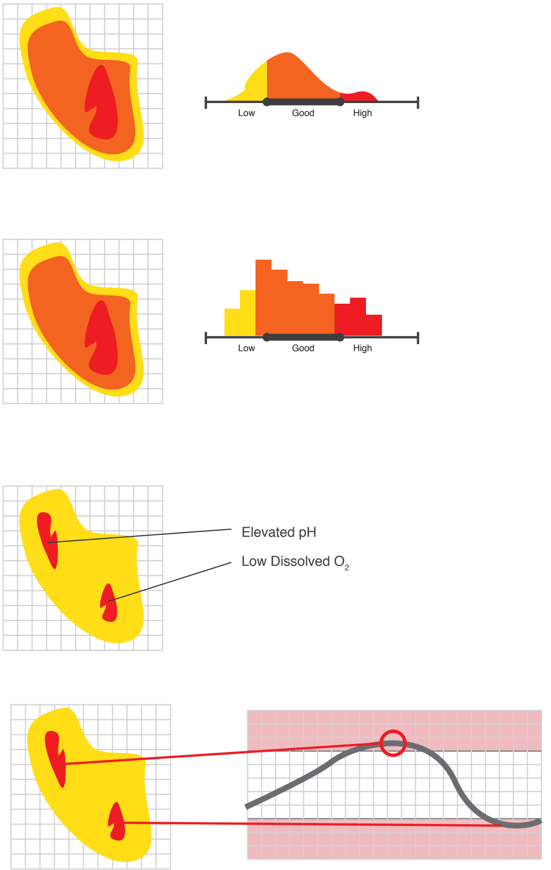
A sample email. This is largely taken from the static report Platypus already issues. It provides links for users to perform further action.



One proposed interface. We intentionally left charts and axes unlabeled for user testing. This let users respond to purely visual cues and context. We believe the gist of a graph should be apparent even before it is "read". However, user testing showed us that our visualizations were far from perfect.



We also iterated on the "problem area" visualization, to determine users' mental models for understanding each of them.



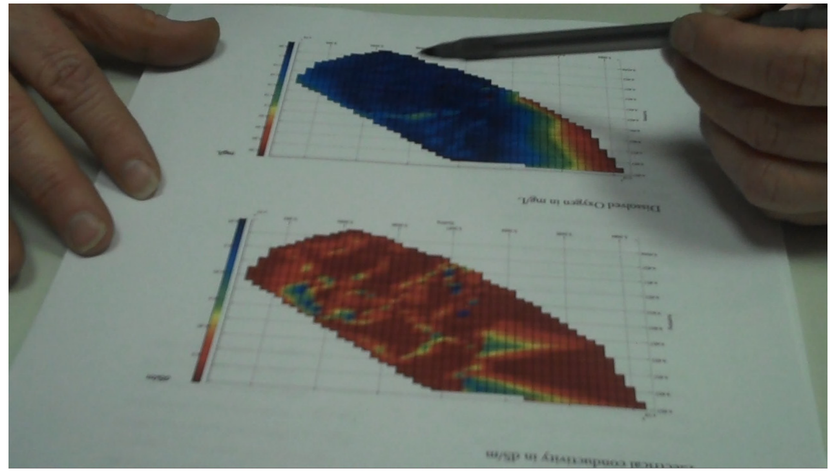
Lo-fi Testing

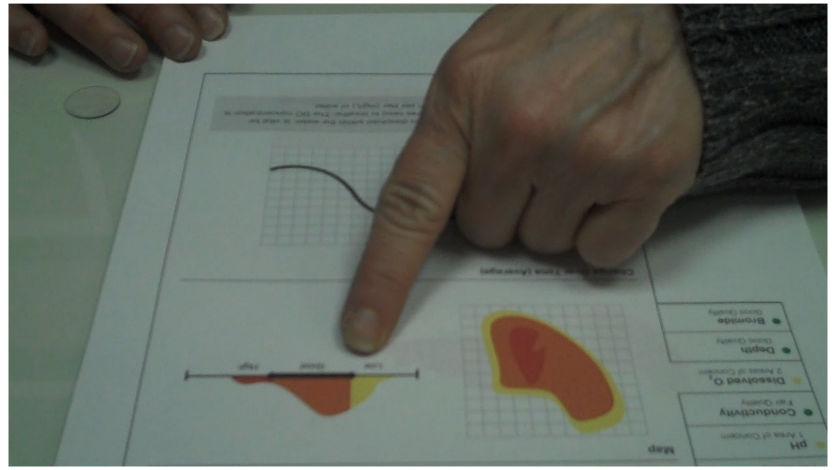
For faster iteration cycles, we looked to more accessible user groups to fit into our 2x2 matrix of technical fluency and environmental knowledge.

We tested with a CMU writing major for our "low technology, low environmental user group", a biology major and botanist for the "low technology, high environmental" user group, a CS major for the "high technology, low environmental" user group, and an environmental engineering professor (who does informatics research) for our "high technology, high environmental" case. Though we are aware of the shortcomings in this user selection, it did lend a wide cross section of ability to our user research.

We began testing each user by having them use Platypus' existing paper report to find the problem areas with dissolved oxygen. The task required users flipping between pages of the document: the metric reporting section, the heatmap section, and the metric description at the end to perform the task. Most users glanced through the document, found the heatmap, and pointed out the red areas on the heatmap as "danger" zones, even though the color scale is relative, and the entire lake is actually a danger zone. Only the "high tech, "high environmental" professor performed the task correctly.

We introduced our prototypes by providing users with a little backstory, asking them to pretend they received the email report, and having them "click" and interact with the prototypes and think aloud as they tried to identify the problem areas with dissolved oxygen levels.





Lo-fi Design Suggestions

Use color consistently

Color served as an important visual cue for users. However, conflicting color schemes can be confusing. We used both a "traffic light" scheme (red, yellow, and green) to indicate danger levels, and a "heatmap" scheme (yellow, red, and orange) in separate pieces of our interface. This added ambiguity to colors like red and yellow. Color cues must be used consistently.

Follow visual conventions

Users form instant notions about what visualizations mean. A horizontally oriented smooth line immediately connotes change over time - while the same graph with bars does not. We will continue to iterate, and gauge user response to these visualizations.

Facilitate at-a-glance browsing

A wall of text summary in the email and overview box was a bit too much text. That information should be expressed tabularly, or using bullets or lists. The same principle should be applied to all the "paragraph-ish" elements of our design, including metric descriptions.

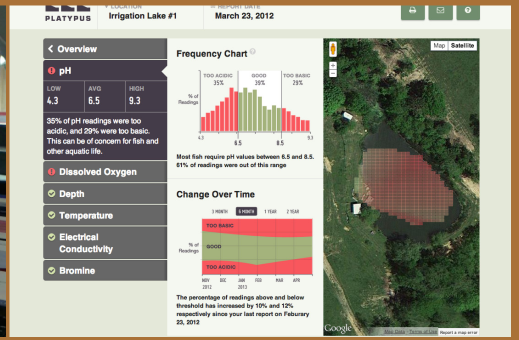
Provide better text

The summary was not descriptive enough for some more scientific users. It confused other users. Across the board, it could be sharper, more sequential, and have clear actionability.

Implement

With insights from low-fidelity prototype testing, we began to develop and iterate on our first interactive prototype as a browser application. We tested this prototype, obtained peer feedback, and generated a list of feature fixes for our final prototype.

Implementation details are provided in this section. We hope that this prototype serves as both proof-of-concept of our design and research process, as well as a starting point for Platypus to develop it's final product.

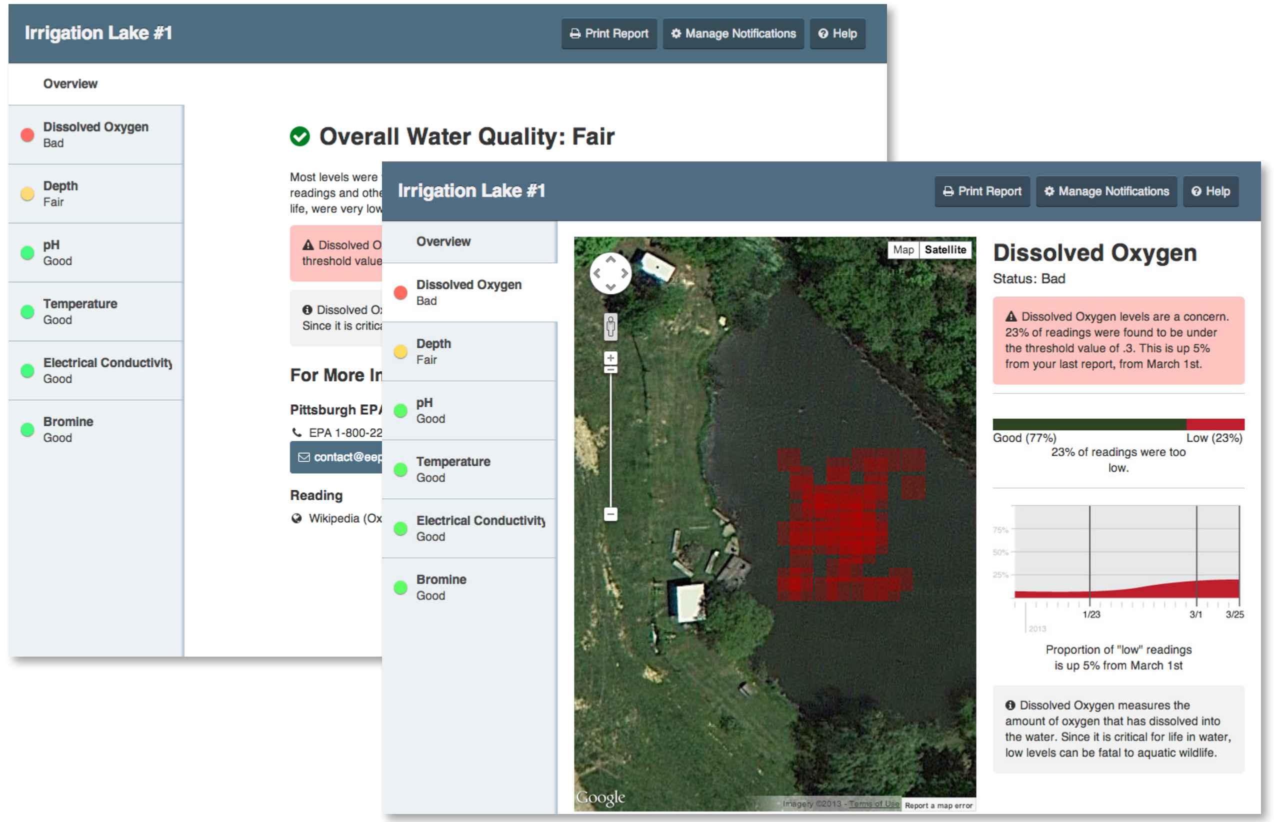


Hi-Fidelity Prototyping (v1)

Taking insights from low-fidelity testing, we developed our first interactive prototype using HTML and backbone.js.

We returned to the Pittsburgh Public Farmers' Market to test V1 of our hi-fi prototype with 3 users. We used a scenario, which involved users reading an email report from Platypus, and navigating to the dashboard for more information.

In addition to user testing, we received feedback from our faculty advisors, as well as a peer review session with classmates. We synthesized data from each of these sources into "design suggestions".



V1 Design Suggestions

Add informational tooltips to map.

It is important to know the specifics of a particular point to locate the source of the metric gone awry.

Use a map key or legend.

Ensure that map regions are interpreted correctly. A key can elucidate what colors mean. Adding hover and/or click functionality to the map may make this easier.

Suggest causes and remedies.

For those unfamiliar with water metrics, seeing whether a metric is low or high isn't enough. Add actionability suggestions inline with each metric.

Show the connections between metrics and external factors.

Water metrics are often strongly correlated with one another and external factors. It's important to point out these connections to help the novice water analyst take the right actions.

Change info icon and explain abbreviated items.

The gray info/description box was initially thought to be an alert due to its similar shape and icon as the alert box. When laid side by side, an 'i' is sometimes difficult to tell from an '!'. In addition, novice water analysts and farmers may not know abbreviations, so additional help (e.g. perhaps a tooltip?) may be needed.

Separate/Differentiate the alert box from the info box.

Many users thought the gray info/description box was an alert. Changing its shape, icon, and position on the screen would likely help. Perhaps it should be removed entirely from the overview screen.

Add a way to see previous reports.

Though our interface allows users to see evolution over time, a user may want to see a particular reading (e.g. a particular point on the map) from the past.

Tailor information to the user.

The user may not understand how metric readings pertain to his particular situation. It's important to make the information relevant to each specific users' water needs

Provide exact numerical data for those who want it.

Expert users want precise numbers and units to manually evaluate the status of their water. Be sure to provide for these users while still abstracting information for more novice users.

Make the scrollbar more apparent, or fit visualizations above fold.

Every user did not notice the scrollbar on the right. In the future when we add more visualizations and metrics, missing any part of the information is a critical problem.

Final Prototype

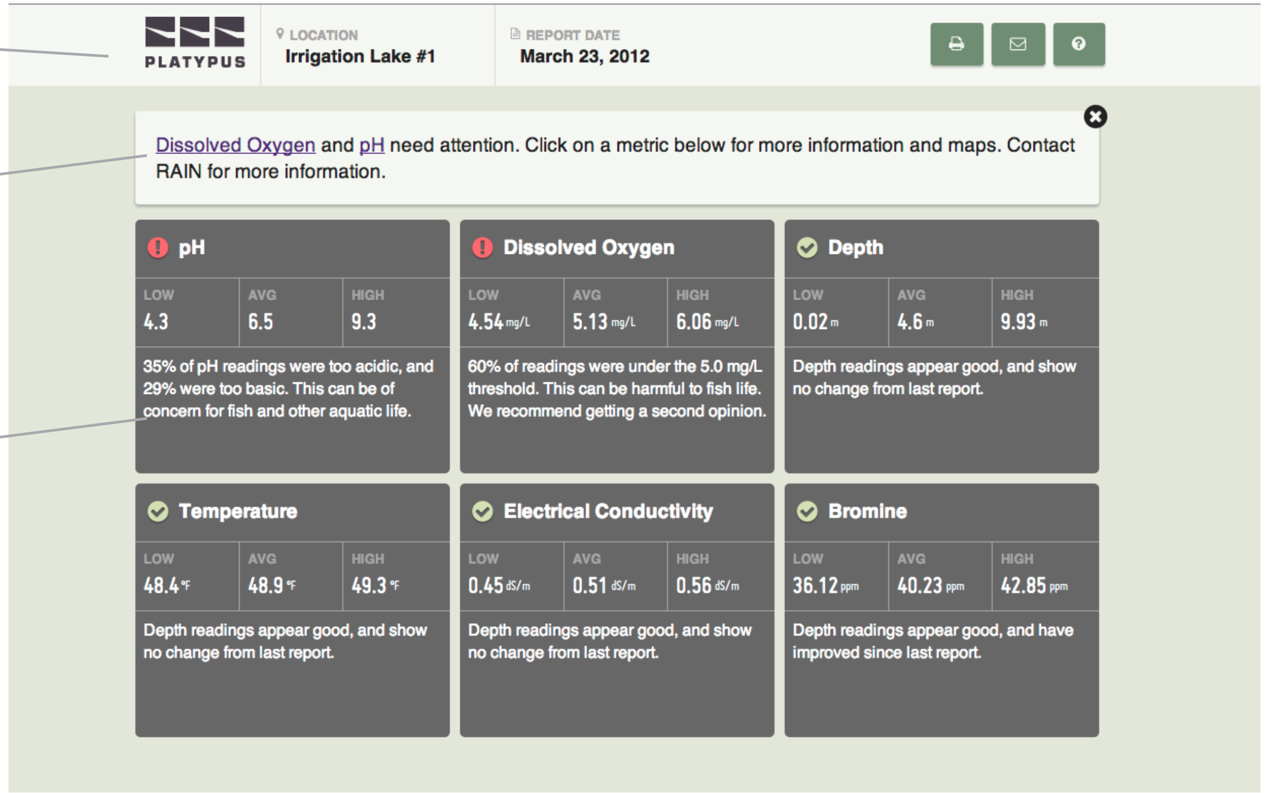
Overview Screen

The overview screen is meant to summarize the water quality situation. It includes an overall statement of water quality, along with “alert” text for metrics that require attention.

Toolbar displays title of area, and has buttons for app-wide actions.

Overview displays a more detailed overview of water status in one place.

Tiles serve as navigation, and as at-a-glance status overview. Metrics are color coded and ordered according to severity.



Metric Screen

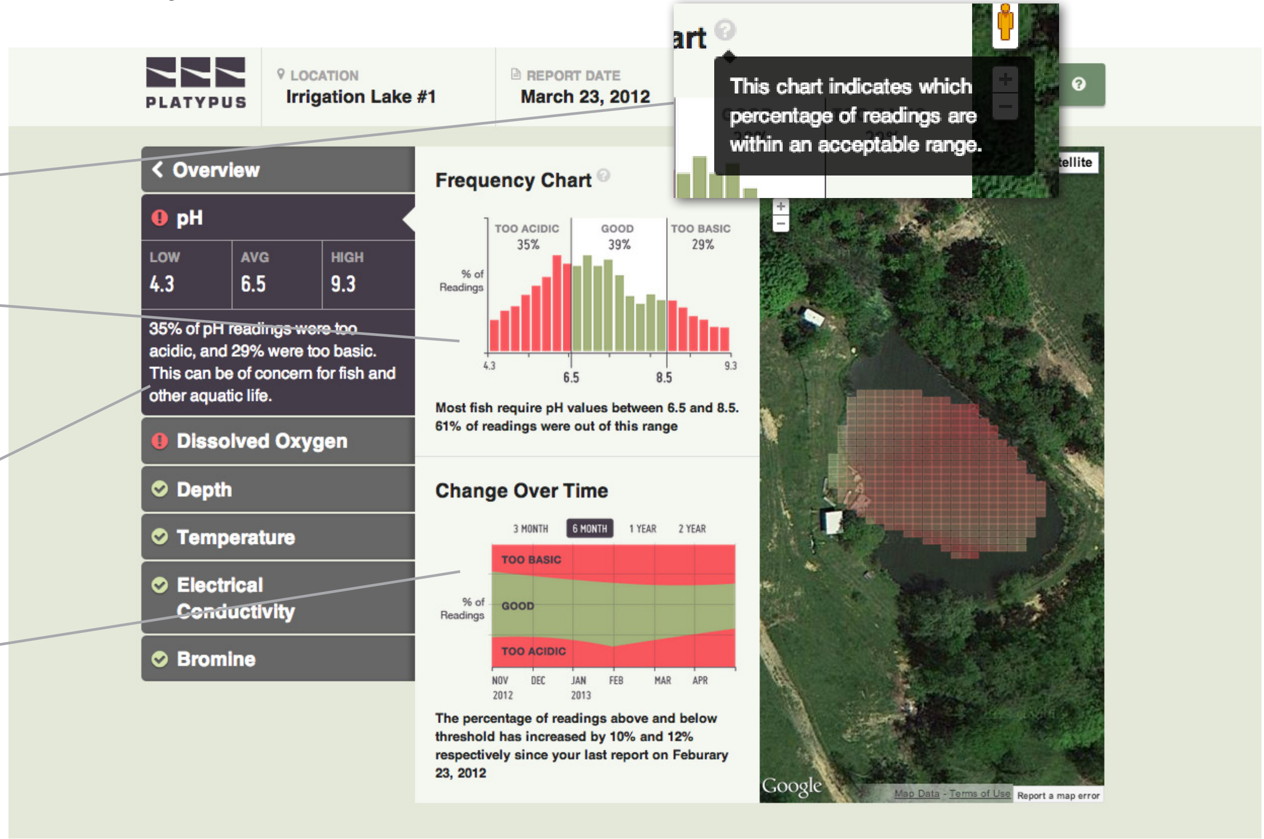
Metric displays a map of the body of water, with an overlaying showing under threshold areas. Graphics show what percent of readings were in an acceptable range for this report, as well as the trend over previous reports.

Tooltips provide definitions for metrics and explanations for graphics.

This graphic shows what percentage of the readings were under the threshold value.

This text summarizes the status of each metric. Eventually, it can perhaps be customized be a Platypus employee.

Time series graphic depicts the changing proportion of readings under threshold between this report and previous reports.



Implementation

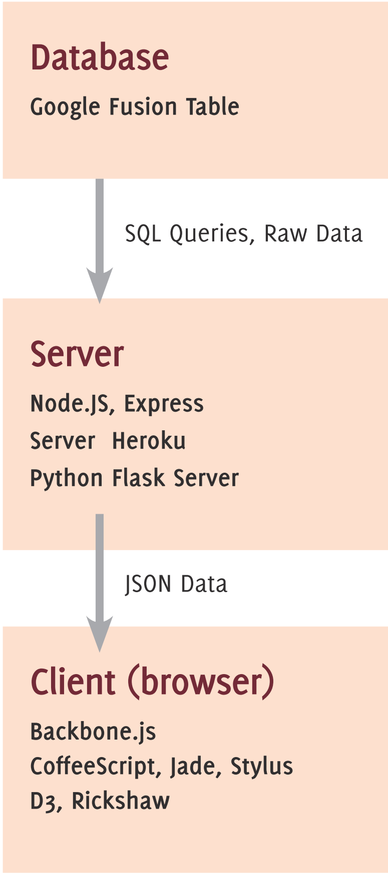
The hi-fi prototype is implemented as a browser-based HTML application. We selected tools and libraries to use that enabled swift implementation for this prototype, but also generated a helpful codebase for Platypus to use in future production.

For the purposes of the prototype, our raw data lives in a Google Fusion Table, a free, SQL-like database implementation.

Server side logic, templating, and routing is handled by a node.js based Express app, which serves data through a JSON API. This same backend app could eventually be used to handle heavy-lifting like data interpolation, user accounts, email/sms updates, and PDF generation.

The front-end is based on backbone.js, a minimal JavaScript application framework. Backbone enables client-side models, collections, views, and event handlers. To save development time, we used CoffeeScript, Jade, and Stylus to write JS, HTML, and CSS respectively. We are working to use Rickshaw, which is built on top of d3.js, to deliver charts.

We are working in a private GitHub repo, with nightly builds deployed to platypus-dreamtime.herokuapp.com.



Integration

Questions to consider before moving to production

What will the data infrastructure look like?

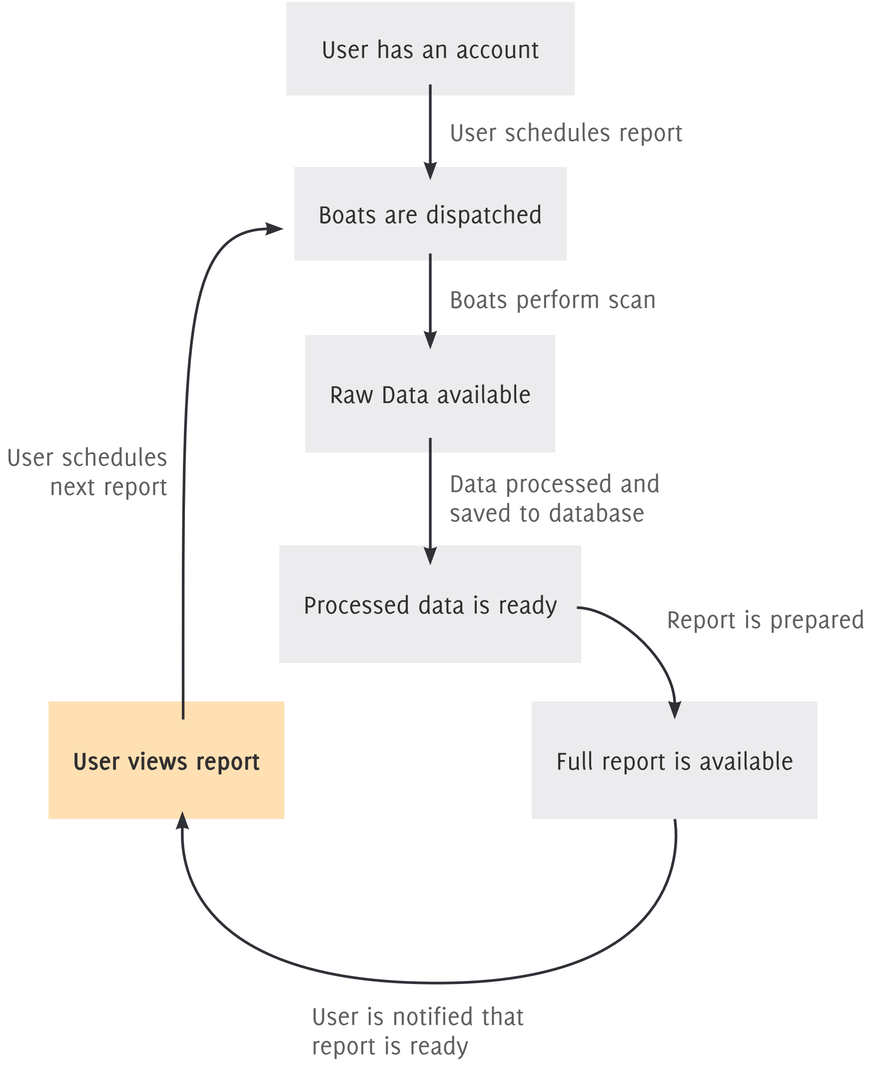
Since the data we had was not complete and sensors were not calibrated, we worked under the assumption data would be provided in a certain format. We developed the graphics and map visualization with only that data set to work with.

How does this fit into a complete system?

For this project, we focused on report visualization, and deferred judgement on the larger system it fits into. Thus, we didn't rigorously define the data schema or interfaces for managing users, accounts, locations, or multiple reports. A possible full system schematic is given here, with our piece highlighted. Many other pieces can be eventually be included in a unified system: an account manager, boat scheduler, data processor, and report annotation interface.

How will it look across platforms?

The prototype was only tested on Chrome on Mac and Windows. Before deployment, Platypus should ensure it degrades gracefully across devices, operating systems, and browsers.



Carnegie Mellon provides an undergraduate major in Human-Computer Interaction, which brings together students from diverse disciplines with a focus on group work. The curriculum teaches students an iterative cycle of design, evaluation, and implementation as it applies to building technology for people.

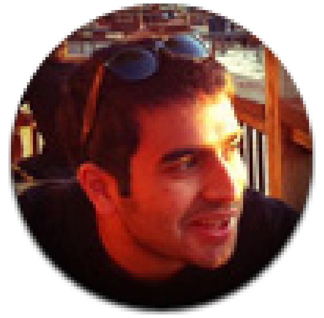
We, the students of team dreamtime, worked with Platypus as our semester long capstone project, meant to be an application of all we have learned so far.

Dreamtime worked under the guidance of Vincent Aleven (aleven@cs.cmu.edu) and Jenna Date (jdate@cs.cmu.edu), and we are grateful for their mentorship.

We would lastly like to thank our clients at Platypus, for being helpful, responsive, inquisitive, and for providing us with an amazing project for us to work on.

PLATYPUS dreamtime

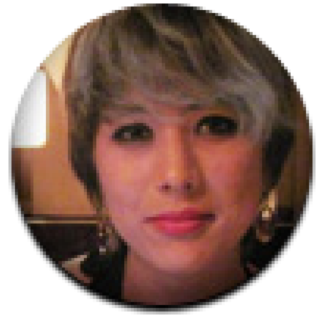
dreamtime



Aneesh Bhoopathy

Project Manager
Cognitive Science/HCI

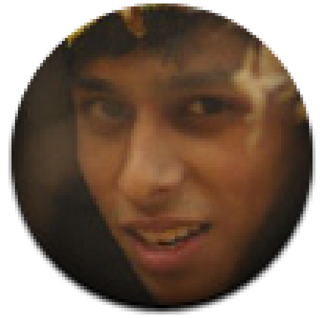
Aneesh started designing things by playing around in Photoshop. He has since moved on to bigger and better things. He enjoys sandwiches, hockey, and stand-up comedy. He especially enjoyed the group road trip to Greene County!



Karina Chow

Documentation Lead
Computer Science/HCI

Karina has three main interests: people, technology, and design. She loves data visualization projects like Platypus'. She really enjoyed the opportunity to learn from people whom she normally would not interact with.



Dev Doshi

Tech Lead & Client Liaison
Computer Science/HCI

Dev brings DreamTime 10 years of experience in technical support and web development. He is interested in the applications of technology to education. He enjoyed learning how Platypus' cool robotics platform could empower users.

Soyeon Hwang

User Testing Coordinator
Psychology/HCI

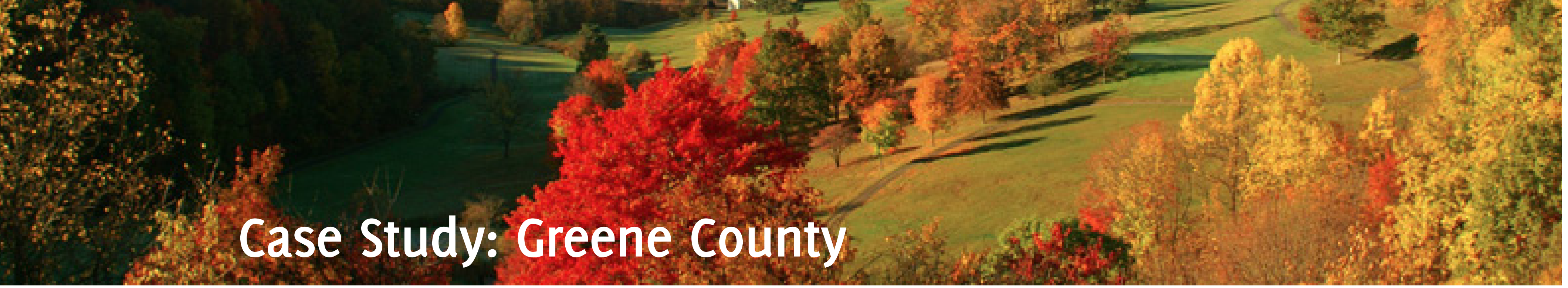
Soyeon likes to observe various people and understand their cognition, emotion and interaction with others. She enjoyed going to the farmer's market, talking with farmers and savoring fresh agricultural products.

Alex Rothera

Design Lead
Art/HCI

Alex strives to work on technology that is meaningful and will change the world for the better. In working with Platypus he was grateful to help on a project that has such a great potential to help save the environment in the future.

Appendix



Case Study: Greene County

Greene County is among the poorest counties in Pennsylvania, but is well endowed with an abundance of natural resources. It specializes in exporting water, timber, and livestock[1]. The region sits on the Marcellus Shale Formation, which expands from West Virginia to New York. Energy companies are drawn to the region's rich shale deposits - but that can cause unintended consequences for air and water quality.

In addition to water contamination, mining has lead to the draining of private ponds due to broken rock foundations. The weathering of coal mines leads to the release of sulfuric acid, which can propagate through the rock. This may also cause a secondary reaction that produces high concentrations of aluminum, magnesium, and zinc, all of which may find their way to streams.[3] Similarly, oil companies have contributed to the poor water quality in Greene County. The fracking industry in Pennsylvania uses a technique called hydrofracturing that uses high pressure water, sand, and chemicals to break up shale to ease the flow of gas to the surface. This technique can use as much as 300,000 gallons of water a day.[2] This left over water then requires deep treatment to become nontoxic. Though frack water has designated treatment plants, it sometimes reaches water supplies, causing devastating results.

Experts believe the drinking water in Greene County has become toxic. According to the National Academy of Sciences, a lifetime of drinking Greene county water causes 1 in 100 incidence of cancer deaths, which is well above the national average. Despite these health risks, state and federal officials monitoring of pollution still comes up short. In many cases, the reports they provide are either inaccessible, or unclear, too infrequent, or downright nonexistent.

By providing spatial and temporal data, real time alerts, and more accessible reports, Platypus is well positioned to make a real difference in Greene County, and the lives of its citizens.

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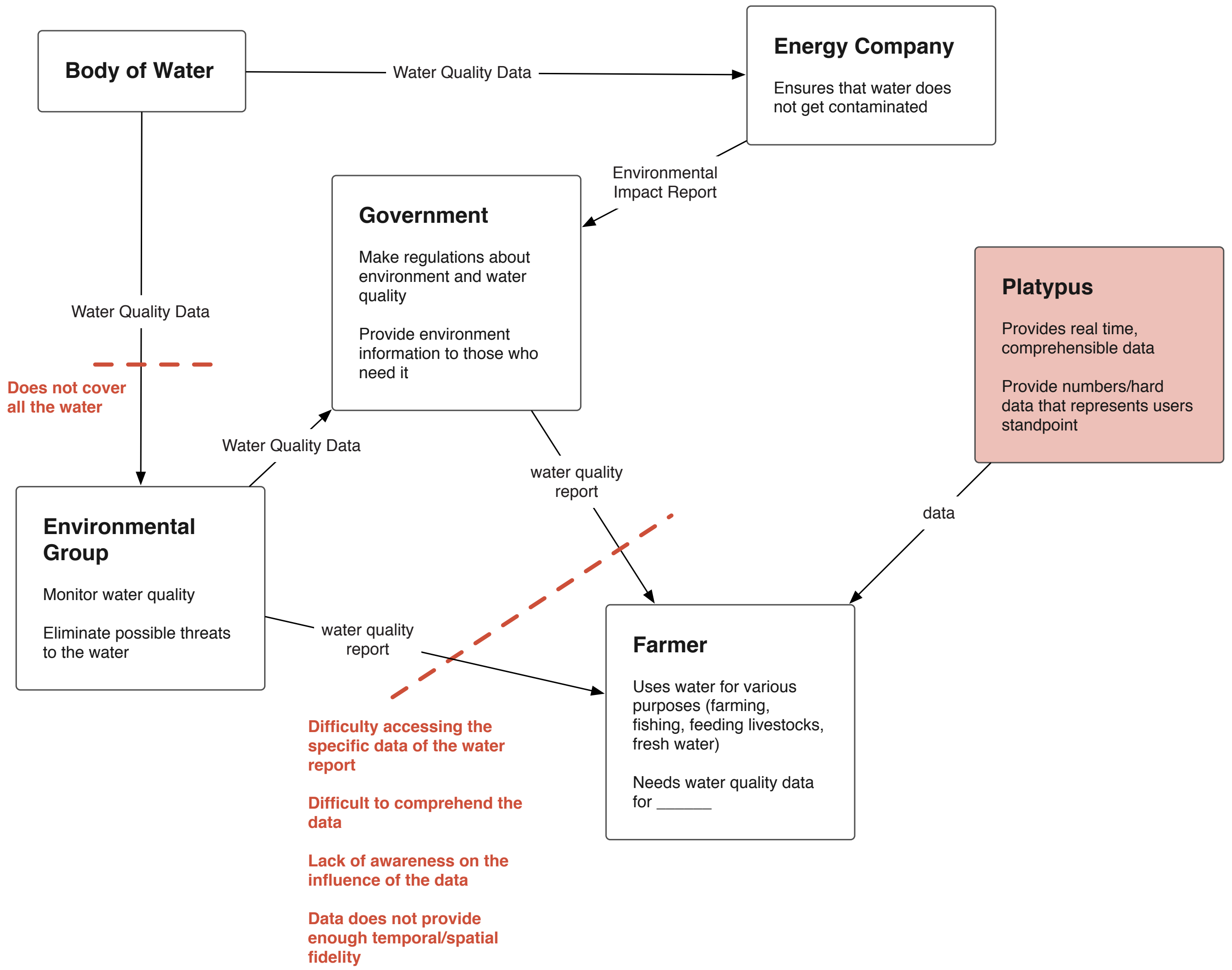
[1] Marcellus Education Fact Sheet. The Pennsylvania State University, College of Agricultural Sciences. 2010. ‹http://pubs.cas.psu.edu/freepubs/pdfs/ua460.pdf›.

[2] Pollution Unchecked: A Case Study of Greene County, Pennsylvania. Natural Resources Defense Council. 2004. ‹https://www.nrdc.org/water/pollution/greene/greene.pdf›.

[3] Effects of Coal-Mine Drainage on Stream Water Quality in the Allegheny and Monongahela River Basins—Sulfate Transport and Trends. U.S. Department of the Interior and U.S. Geological Survey. 2000. ‹http://pa.water.usgs.gov/reports/wrir_99-4208.pdf›.



Flow model summarizing the flow of information between involved parties