

DATE: 11 February 2022

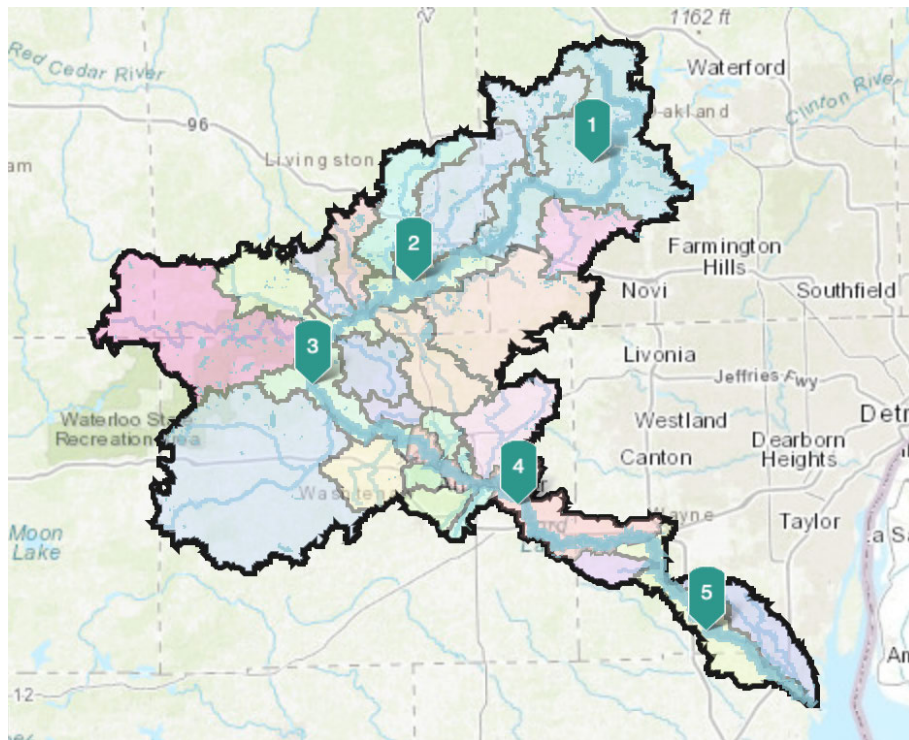
TO: [REDACTED] and [REDACTED]

SUBJECT: Digital Water Lab FEAST Platform Research

We are writing to inform you of possible technologies we have identified for our FEAST project with the Digital Water Lab. We discussed these findings as a team on 10 February 2022 and documented our conclusions below.

## 1) Inventory of Sites in the Huron River Watersheds to Use

All of the sensors on the current website measure mean depth in feet. This is the measurement that is the most useful to site workers. The nodes that will be our main focus are the ten sensors on the HRWC dashboard including the sites: North Territorial, Kensington Road, Chalmer's Drain, Woodruff Creek, Huron River at Maiden Lane, South Commerce Lake, Honey/Huron at Wagner, Huron River at Forest Ave, Oxbow Lake, and Huron at Shotwell. All sensors will be available on our prototype, however, when we meet with the HRWC representatives we will ask if it would be more convenient to have the nodes sectioned off by inside and outside the Huron River Watershed boundaries. A visual example of the sectioned-off watershed on a map can be seen below in Figure 1.



*Figure 1: Visual representation of sectioned Huron River Watershed*

## 2) The Most Promising Technologies for Visualizing Data and Creating User Interfaces

### Plotly Dash

Plotly seems to have the most diverse capabilities for data visualization. It mostly uses Python, which most of our team is somewhat familiar with, and uses Plotly Express (a built-in API) to develop complex visualizations.

Plotly provides a framework or packages for building web analytics applications, so it is ideal for building dashboards. Importantly, it can combine both line/bar graphs and interactive maps. It supports a variety of charts, including multidimensional plots such as equilibrium coordinates and parallel category plots, faceted generation animations, faceted plots, and multidimensional plots, and it allows them to be shown together on one page. This feature would allow us to maintain the map interface we currently have in Grafana, while also allowing for data on an individual sensor to be displayed on the same page. Plotly is also good at real-time data syncing, which is key for this specific project.

Plotly allows for advanced filtering of data points (sensors) based on activity status and other measures. It also has the capability to handle multi-page sites (so we could separate the map and dashboard, but easily navigate back and forth between the two. It also displays the data in a clear manner and allows for easy modifications to the display (users can edit the site theme). It's dynamic relative to the screen size (will make plots side-by-side or stacked vertically depending on the browser width), which makes it easy on various devices. Also, because it's based on Python and HTML, we could alter the style manually as well.

Another note about Plotly is that it makes it easy to convert the code to HTML, so the data is easy to export and share for use outside the site. It's also good with interaction—it provides various callbacks such as hovering over data points.

A few examples:

- <https://dash.gallery/ternary-map-explorer/>
  - This one combines a map with various other quantitative charts (bar chart, line chart, etc)
- <https://dash.gallery/ddk-oil-and-gas-demo/>
  - This example also combines a map with quantitative visualizations and has a complex filtering menu for easier searches
- <https://dash.gallery/dash-port-analytics/>
  - This is the multi-page example and includes a page that allows users to compare data from two points, which could be a useful feature

## Grafana

We have an upcoming Grafana dashboard tutorial meeting with Jack on Tuesday, February 15. Thus our preliminary research on Grafana consists of the general pros and cons of the program.

Grafana is beneficial because our data is already implemented where the real-time is already graphically displayed. Grafana also has a USGS Plugin that allows comparable data. We believe that this may be beneficial to ensuring reliability to our clients. We've looked into featured reviews of past viewers. The positive comments highlighted the ease of access, alert settings, and customizable features.

*"What I like the most is the ease of creating dashboards that are very **useful for senior managers.**"*

*"I love the customizable dashboards with the ability to zero in on specific time frames. The **alert settings** can be adjusted, the **data sources can be customized**, and the notifications can be customized."*

*"Grafana also **provides sandboxes including alerts** (peak peaking, table, and gauge)"*

*"The updated colorful and meaningful graphs and charts are excellent, and with the great visualizations in the panels and the much-required metrics and other good features they provide."*

Some downsides to Grafana are that first-time users may have trouble navigating through the many folders and data, causing it to be user unfriendly in some cases. Below highlights some of the comments regarding the downsides of customizing the Grafana dashboard.

*"The downside of having something so customizable is that **you need to invest some time** to get it to produce what you're looking for."*

*"Getting the dashboards built out exactly how you want **can sometimes be difficult.**"*

Examples (from <https://rigorousthemes.com/blog/best-grafana-dashboard-examples/>):

A wind farm dashboard example can be seen [here](#).

Another dashboard example can be seen [here](#).

A monitor dashboard example can be seen [here](#).

A stats dashboard example can be seen [here](#).

## Tableau

Although we are pretty sure that Tableau is unable to visualize real-time data, it is still useful in our research and for the visualization of our prototypes. While researching Tableau, the usability and the clean visuals were both noted as pros of this program. We will not end using Tableau since it is more so used for business purposes and visualizing data from excel files. Even though we will not be pursuing this, Figure 2 can be seen as an example of how we would want to set up our future website.

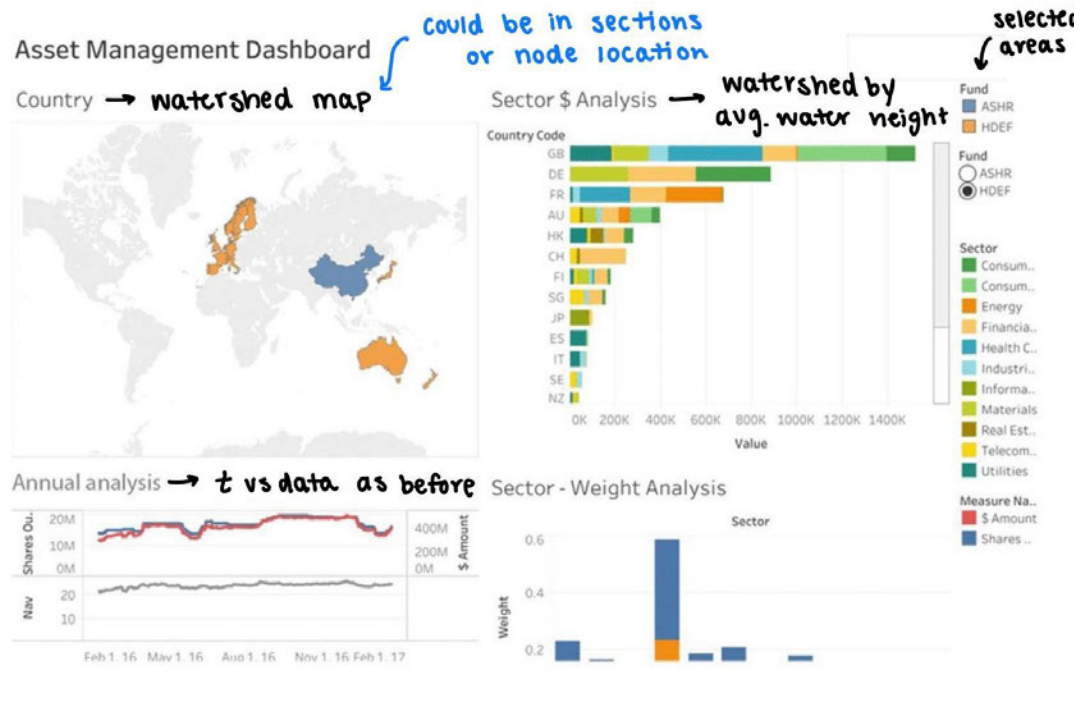


Figure 2: Tableau example, annotated

## 4) Questions for HWRC While Presenting Prototype v1

We will need to ask more specific questions to HWRC next time we meet in order to get a better understanding of 1) how they currently interact with our website and dashboards and 2) what their ideal tool looks like.

- How is the data accessed while on-site? (on a phone, computer, tablet?)
- How would better access to key data change day-to-day activities?
- Would you prefer the data to be organized based on the boundaries of inside and outside of the Huron River Watershed?
- Are alert settings useful? How have you been communicating for gate openings?

- Which alerts would you prioritize: water depth / flow (recreational users) or gate openings (municipal users)? How do they compare?
- Are there any other features you would like to see integrated?

Please let us know if you have any further questions.

Sincerely,  
DWL FEAST Team