

# Joint Water Research/Tools and Resources Webinar

July 24, 2019 from 2:00-3:30 pm ET

## CyAN App: Cyanobacteria Assessment Network Mobile Application

*New Tool for the Early Detection of Algal Blooms in U.S. Freshwater Systems*



A certificate for up to  
1.5 training hours will  
be provided for  
attending this webinar

**Webinar Slides:** Located under “Handouts” in the right navigation bar of your screen.

**To Ask a Question:** Type in the “Questions” box located in right navigation bar of your screen.

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## Requirements:

1. You must be registered for the **live webinar** or be in a room with someone who is.
2. You must **attend** the live webinar **for at least 60 minutes**.
3. If in a room with others, the **names of people not logged in must be provided by the person who is logged in**. Send names and email addresses to [webcastinfo@cadmusgroup.com](mailto:webcastinfo@cadmusgroup.com).
4. If you are logged in and did not request the certificate at registration, type your request in the “Questions” box.



### Note

*At this time, certificates cannot be provided for viewing webinar recordings.*

## 1. Tools and Resources Monthly Webinar Series

**August 6** (3:00-4:00 pm ET): *Tire Crumb Study Part 1 Report*

[epa.gov/research/epa-tools-and-resources-webinar-series](https://epa.gov/research/epa-tools-and-resources-webinar-series)

## 2. Small Drinking Water Systems Monthly Webinar Series

**August 27** (2:00-3:30 pm ET): *Increasing Analytical Laboratory Preparedness*

[epa.gov/water-research/small-systems-monthly-webinar-series](https://epa.gov/water-research/small-systems-monthly-webinar-series)

## 3. Water Research Bimonthly Webinar Series

**August 28** (2:00-3:00 pm ET): *Antimicrobial Resistance of Pathogens*

[epa.gov/water-research/water-research-webinar-series](https://epa.gov/water-research/water-research-webinar-series)

## 4. 16th Annual Drinking Water Workshop (in Cincinnati, Ohio)

**September 24-26:** *Will include a live demo of the CyAN App*

[epa.gov/water-research/16th-annual-epa-drinking-water-workshop](https://epa.gov/water-research/16th-annual-epa-drinking-water-workshop)

Cyanobacterial harmful algal blooms (HABs), which can appear in water bodies across the country, are an indicator of poor water quality and can potentially cause serious environmental and human and aquatic health effects. Historically, monitoring these HABs has been labor intensive and limited due to cost, time, and logistical constraints.

EPA developed the Cyanobacteria Assessment Network Mobile Application (CyAN app) to help local and state water quality managers make faster and better-informed management decisions related to cyanobacterial blooms. It provides an easy to use, customizable interface for accessing algal bloom satellite data for over 2,000 of the largest lakes and reservoirs in the United States.

The CyAN logo, with "CYAN" in white capital letters on a teal background. A small satellite icon is integrated into the letter "Y".

*The **CyAN app** is free and available for download on Google Play™. It is designed for use on Android™ devices and is compatible with versions 4.2-9.0 (API levels 18-26). It is currently being developed as a web-based app, which will be compatible with most devices.*

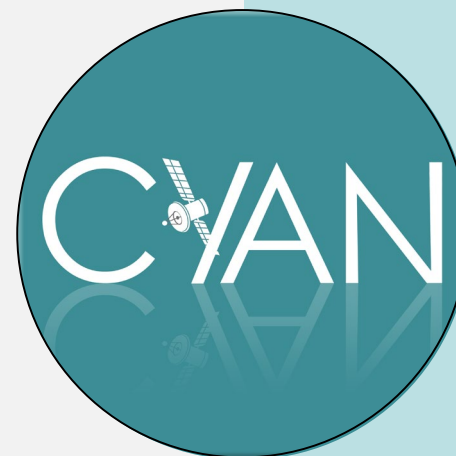
Download the CyAN app today: [epa.gov/water-research/CyANapp](https://epa.gov/water-research/CyANapp)



- 1. Overview Presentation and Q&A Session.** This portion of the webinar will provide a general overview of the app including what it is used for, why and how it was developed, and who it was designed for, as well as state case studies from their beta testing of the CyAN app. The research that led to the development of the app was conducted in collaboration with the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), and U.S. Geological Survey (USGS) through the [CyAN Project](#).
- 2. Step-by-Step Training and Q&A Session.** The second half of the webinar will be a step-by-step tutorial on how to use the CyAN app. We will walk through example scenarios and show you how to make fast and efficient initial assessments across water bodies that are roughly one square kilometer or greater. You will learn how to view cyanobacteria concentrations on a national-scale or zoom in to see data for a specific lake or reservoir, how to set queries to determine if blooms exceed your set limits, how to compare multiple water bodies at once, and how to use other functions in the app.

## **General Overview: 2:00 – 2:30 pm ET**

- Cyanobacteria Assessment Network
- Sentinel-3A satellite
- Known limitations
- Initial validation
- Resolvable lakes
- Mobile app overview
- App and health advisory validation
- Q&A session



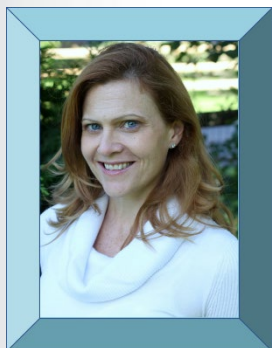
## **Training: 2:30 – 3:30 pm ET**

- App functions
  - Single location
  - Beach monitoring
  - State/US scale
- Q&A session



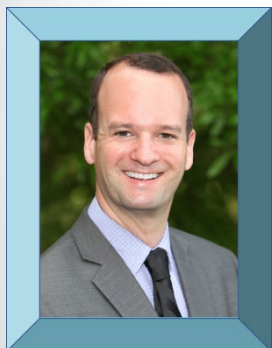
**John M. Johnston, Ph.D.** | Contact: [johnston.johnM@epa.gov](mailto:johnston.johnM@epa.gov)

John is a supervisory research ecologist with EPA's Office of Research and Development, National Exposure Research Laboratory in Athens, Georgia. His research focus is on water quality monitoring and modeling to forecast ecosystem services and their influence on human health. John's interests include life cycle impact assessment, remote sensing, spatial modeling, and sustainability analysis.



**Robyn Conmy, Ph.D.** | Contact: [conmy.robyn@epa.gov](mailto:conmy.robyn@epa.gov)

Robyn is a research ecologist with EPA's Office of Research and Development, National Risk Management Research Laboratory in Cincinnati, Ohio. Her research is dedicated to characterizing optical properties of organic matter in water bodies and discerning their impact to water quality conditions. Robyn's research interests include carbon biogeochemical cycling, optical tracking tools (in-situ and satellite remote sensing), landscape-watershed interactions, crude oil fate and transport, light attenuation in water, and surface-groundwater interactions.



**Blake A. Schaeffer, Ph.D.** | Contact: [schaeffer.blake@epa.gov](mailto:schaeffer.blake@epa.gov)

Blake is a physical scientist with EPA's Office of Research and Development, National Exposure Research Laboratory in Durham, North Carolina. His research focus is on the use of satellite remote sensing technology to monitor water quality in coasts, estuaries, and lakes. Blake's interests generally include integrating remote sensing technologies into water quality management frameworks.

# HABs: Overall Issues

**Harmful algal blooms (HABs) have the potential to cause adverse health, ecosystem and economic impacts.**

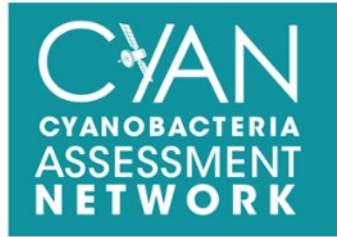
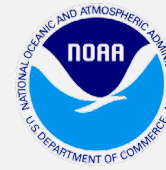
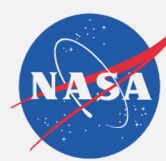


- Many different types of toxins.
  - Exposure through ingestion.
  - Exposure through recreational activity body contact—associated with gastrointestinal effects, breathing difficulty, skin irritation, and animal deaths.
  - Pure toxins in laboratory studies exert toxic effects on liver and nervous system.
- 
- Water treatment facilities alter operational practices and/or invest in new equipment → economic burden
  - Health effects → beach closures → loss of recreational/aesthetic value → economic burden
  - Large blooms upset water chemistry (pH, dissolved oxygen) and limit the penetration of sunlight → declines in fish populations → loss of recreational/aesthetic value → economic burden, long term ecosystem damage
  - Large blooms are odorous and unsightly → reluctance to swim → economic burden

# HABs: Overall Issues



# Partnership



[epa.gov/cyanoproject](http://epa.gov/cyanoproject)

CyAN is a multi-agency (NASA, NOAA, USGS and EPA) effort that supports environmental management and public use of US lakes and reservoirs by providing a capability of ***detecting and quantifying algal blooms*** using satellite data records and disseminating this information through a mobile application developed and hosted by EPA.

- CyAN Mobile App provides water quality managers with a user-friendly tool that reduces the complexities associated with accessing satellite data to allow fast, efficient, initial assessments across lakes and drinking water reservoirs.
- Data from the Ocean and Land Colour Instruments (OLCI) sensor onboard the European Space Agency Copernicus Sentinel-3 satellite are used in ***near real-time*** to make initial water quality assessments and quickly alert managers to potential problems and emerging threats related to cyanobacteria.



# Impact of CyAN

Supporting the environmental management and use of U.S. waters, protecting human health, conserving money and resources using satellite data records.



Schaeffer et al. Eos.  
[Article URL](#)



# Sentinel-3A Satellite Remote Sensing

Video Source: [European Space Agency](#)

## Ocean and Land Colour Instrument (OLCI)

- Revisit: 2-3 day
- Spatial resolution: 300m
- Surface water measures



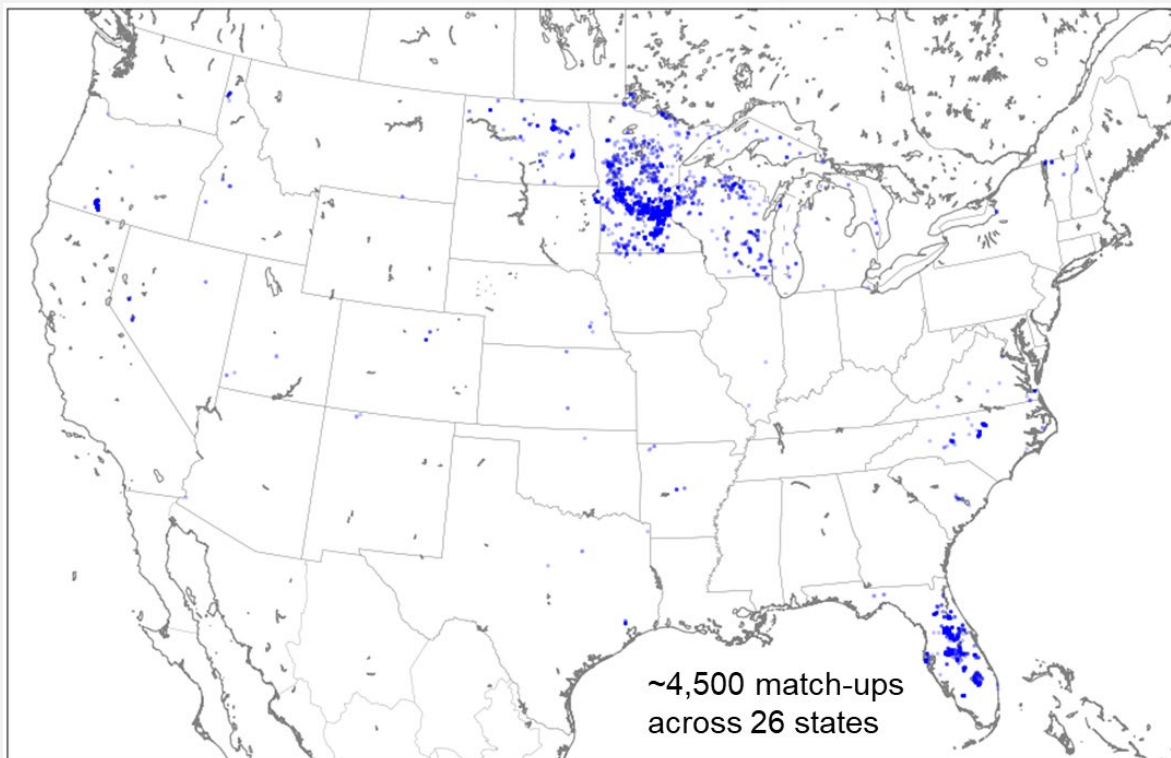


# Known Issues with Satellite Remote Sensing

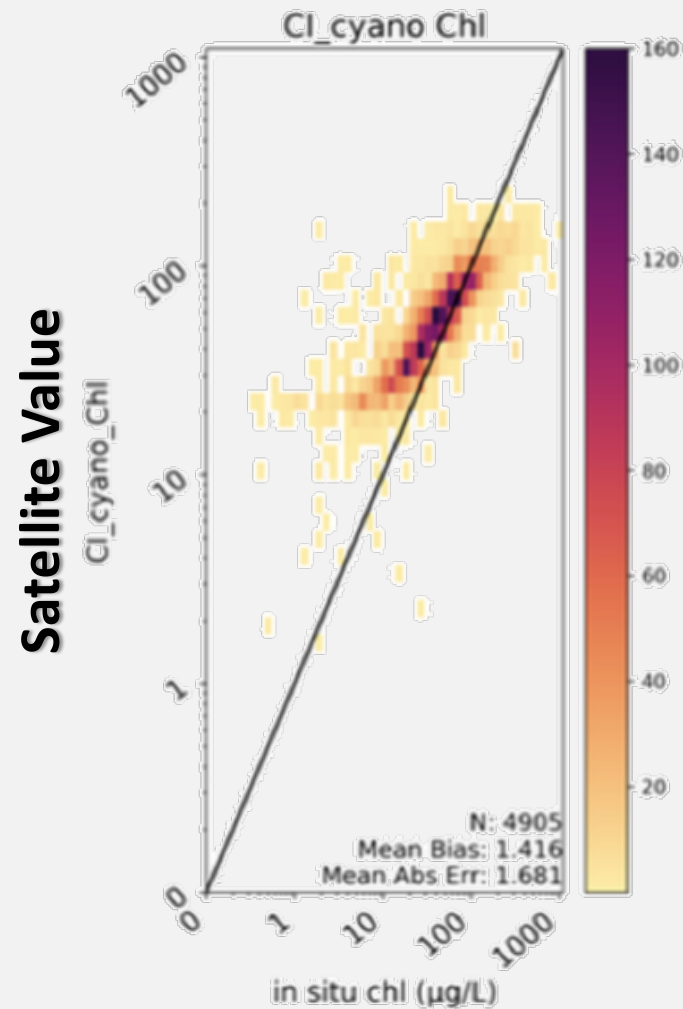
- Mixed pixels, drought/flood dynamics
- Ice and snow
- Provisional data may have errors
- Test QA flags now applied for mixed pixels and snow/ice



# Initial Chlorophyll Validation



Seegers et al. In Prep.



**Bottle Samples**



Clark et al. 2015.  
*Ecological Indicators*.

[doi.org/10.1016/j.ecolind.2017.04.046](https://doi.org/10.1016/j.ecolind.2017.04.046)

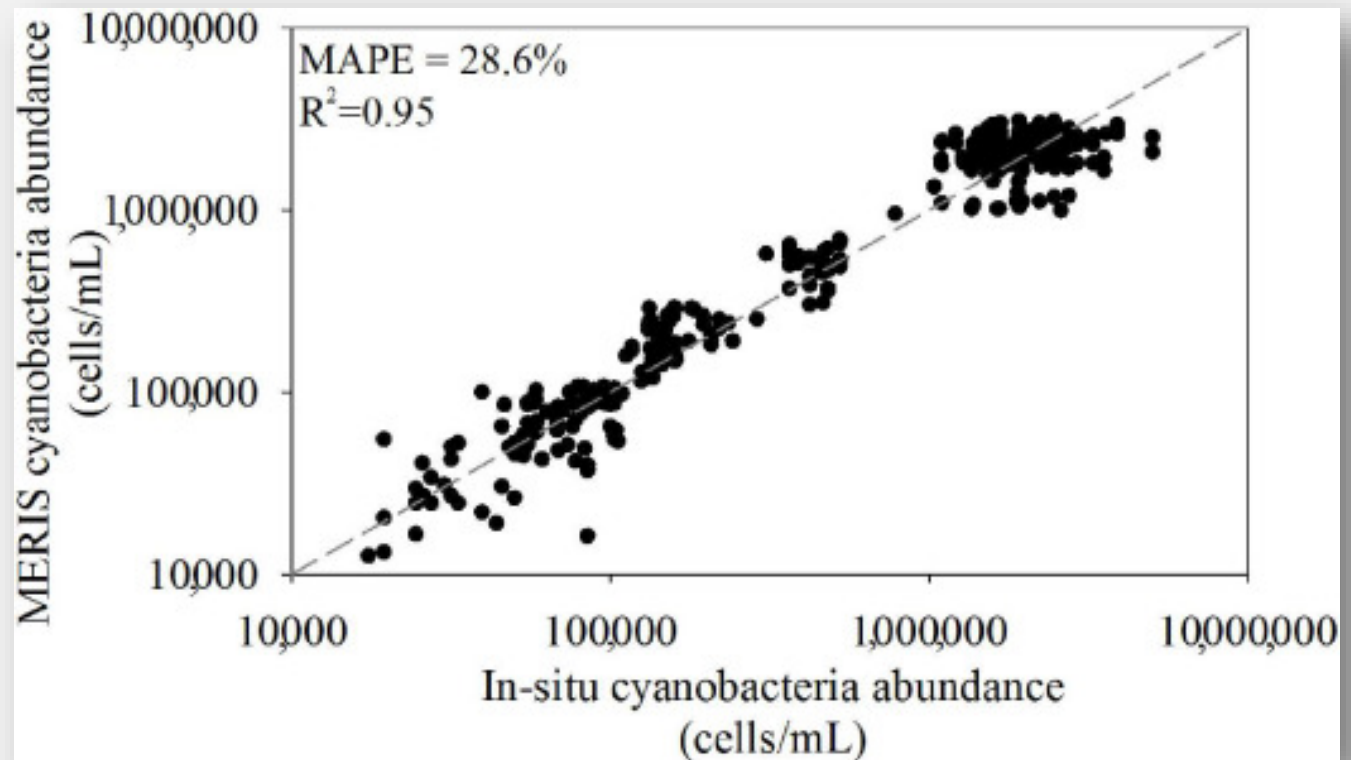


Lunetta et al. 2015.  
*Remote Sensing of Environment*.

[doi.org/10.1016/j.rse.2014.06.008](https://doi.org/10.1016/j.rse.2014.06.008)

# Initial Cyanobacteria Validation

Satellite Value



Bottle Samples

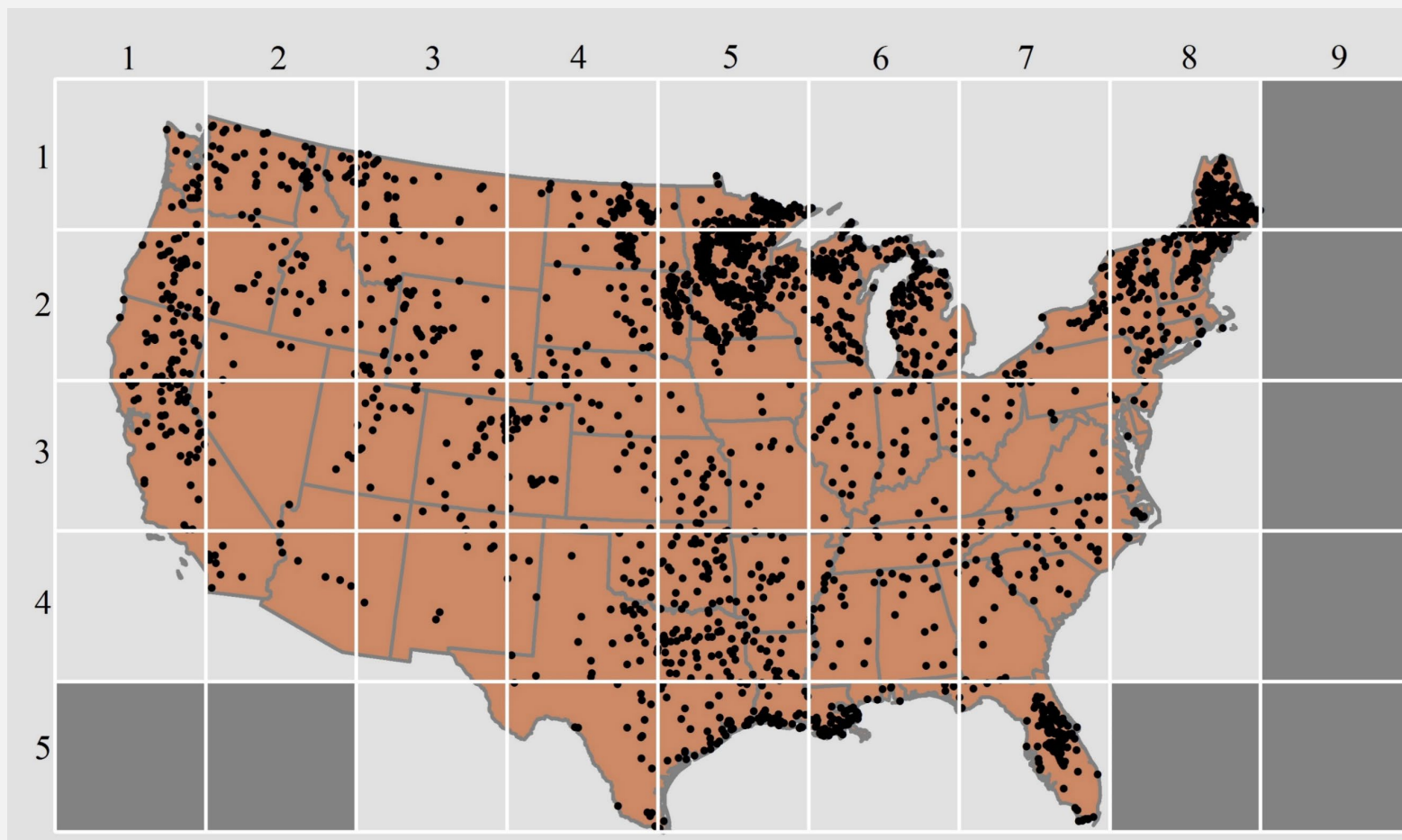
*Satellite results represent what is seen in the field.*





# Can I use the CyAN App for My Lake?

The CyAN app provides access to cyanobacterial bloom satellite data for over 2,000 of the largest lakes and reservoirs across the United States.



Schaeffer et al 2018.  
Environmental  
Modelling & Software.  
[doi.org/10.1016/j.envsoft.2018.08.015](https://doi.org/10.1016/j.envsoft.2018.08.015)

# Weekly Data *Behind the Scenes*

50,000  
cell/mL

200,000  
cell/mL



Sunday

Monday

Tuesday

Wednesday

Thursday

Friday

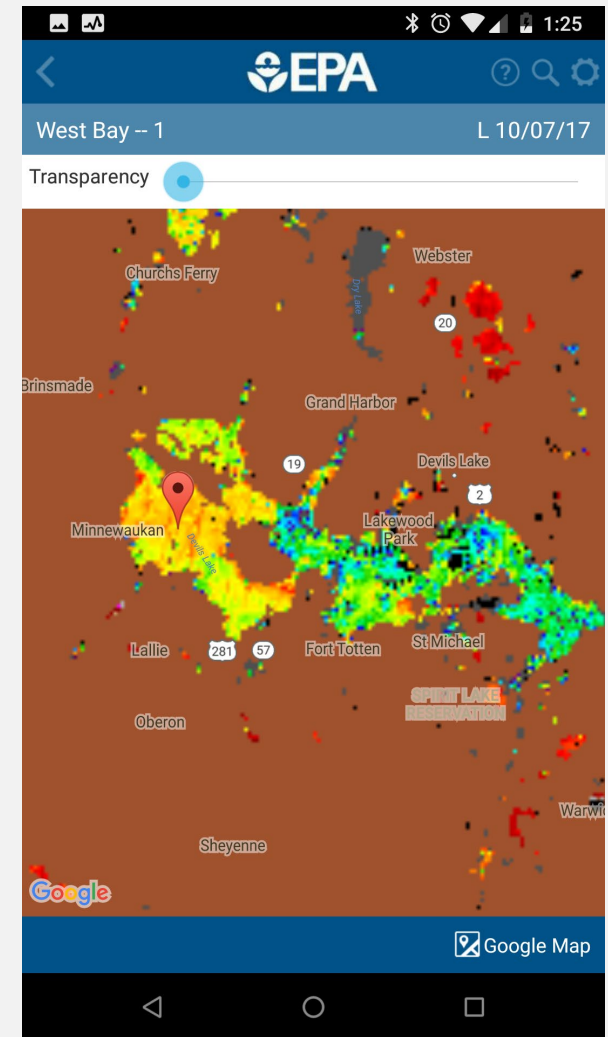
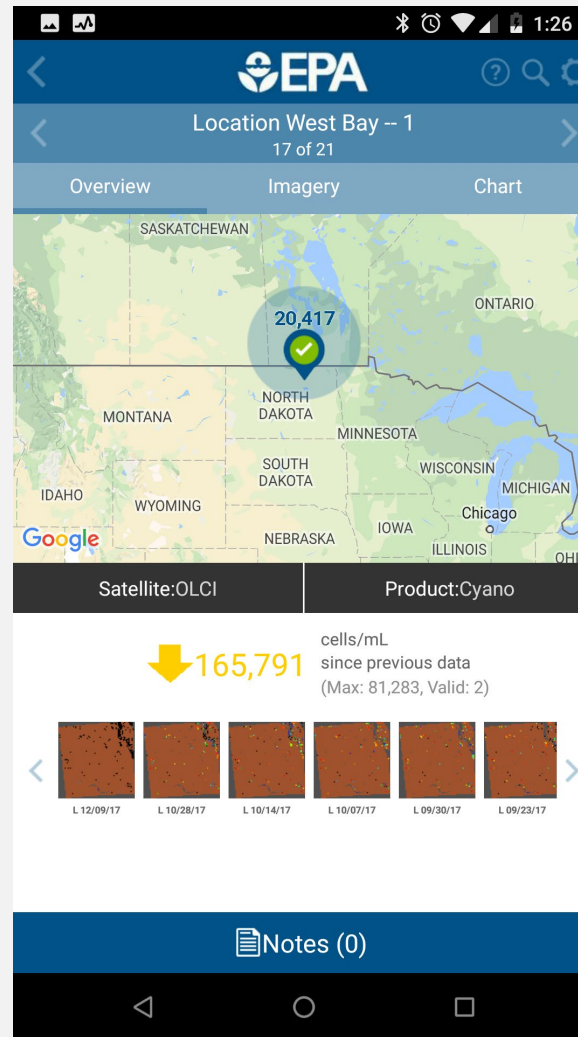
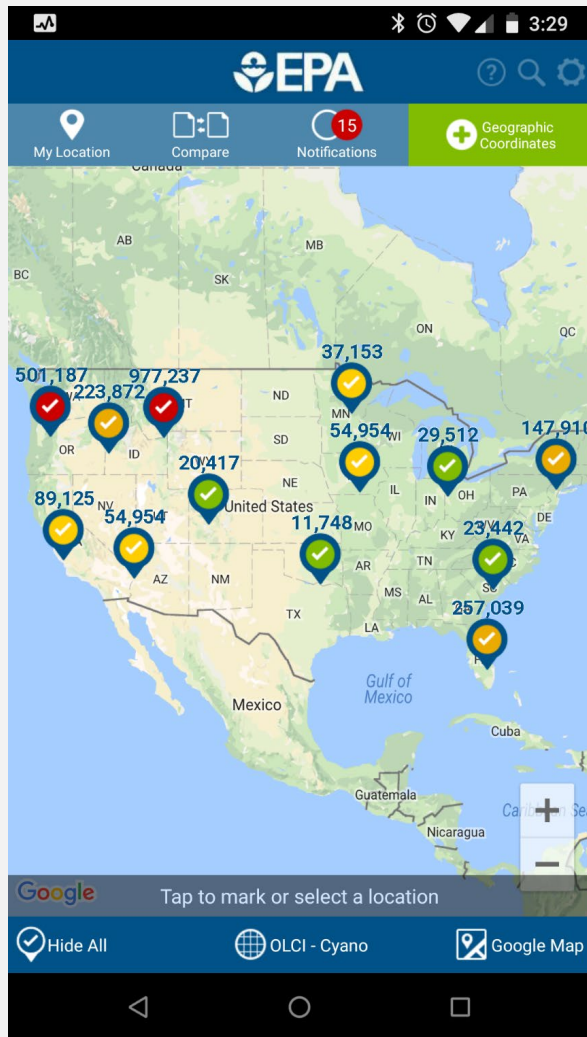
Saturday

Weekly composite



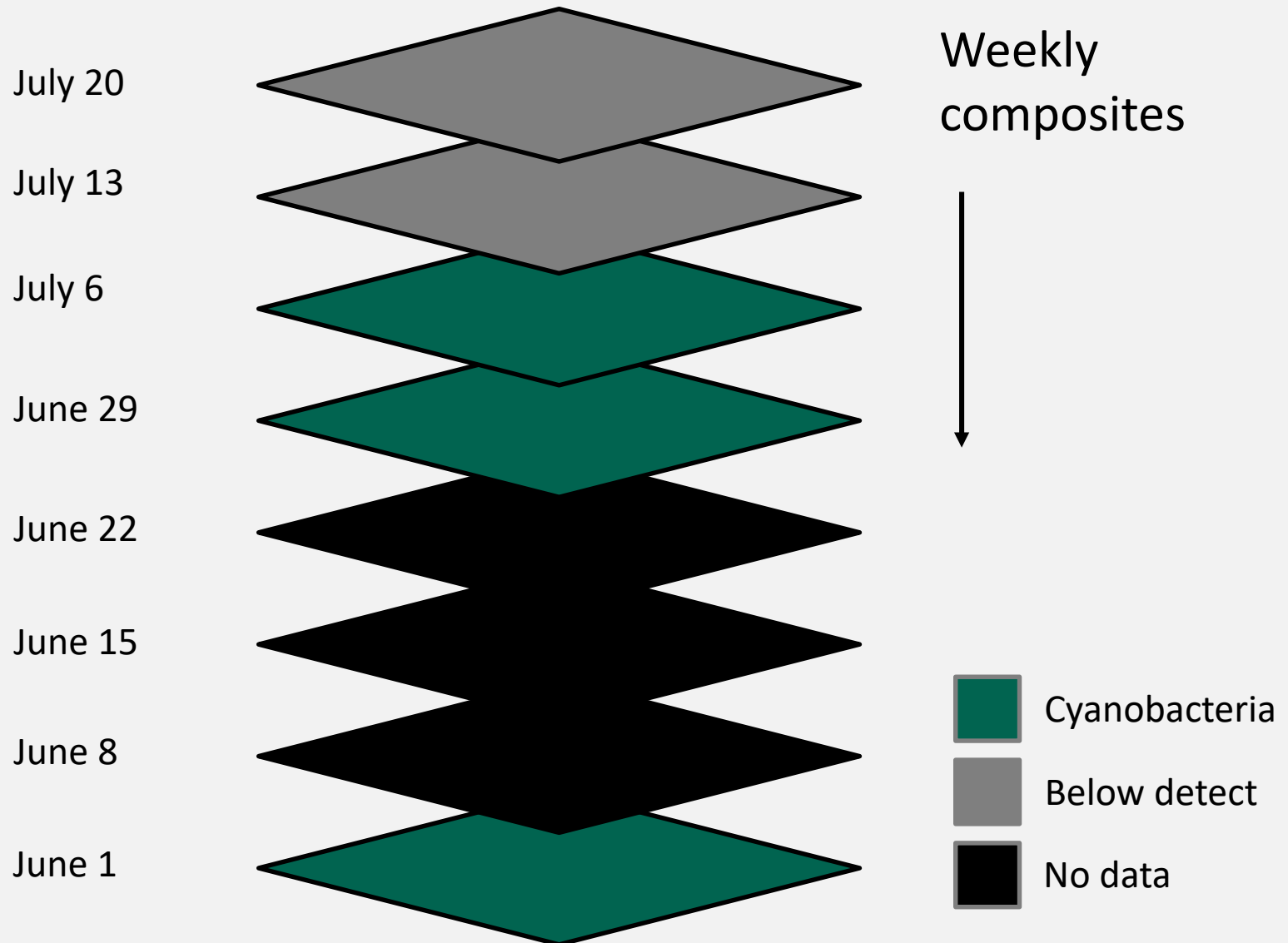
200,000  
cell/mL

# Mobile App Overview



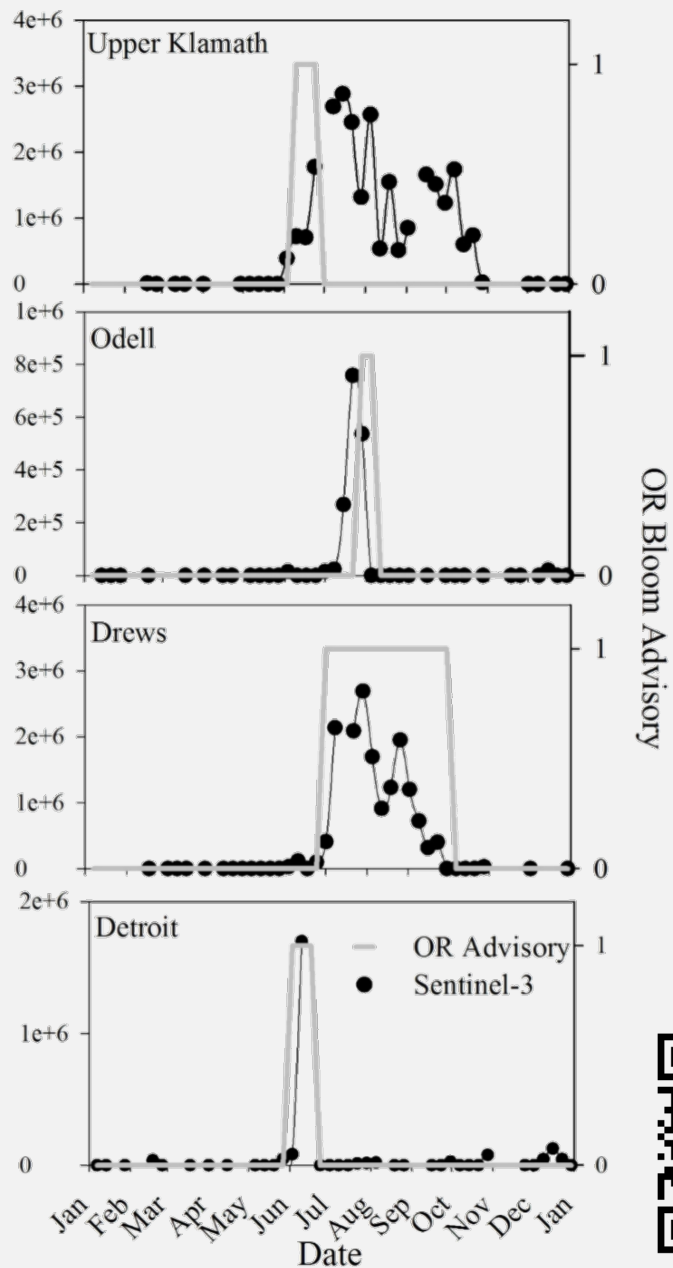
# Is the App Up-to-Date?

*Only reports when cyanobacteria is detected.*





Sentinel-3 cyanoHAB  
(cells mL<sup>-1</sup>)



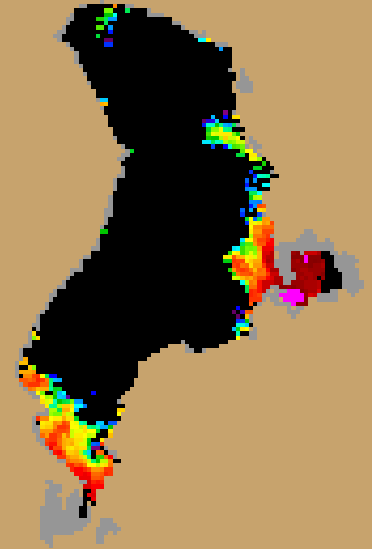


# Utah DEQ Case Study

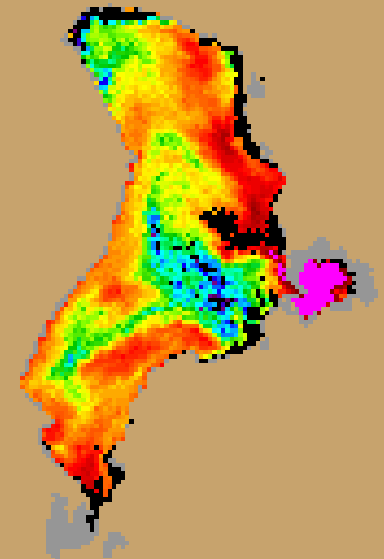
- Utah Department of Environmental Quality (DEQ)/Division of Water Quality (DWQ) conducted routine monthly sampling June 12, 2017.
- Satellite imagery provided the following week indicated a bloom was developing in a Utah lake used for recreation.
- Utah DEQ/DWQ scientists returned to the area June 22, 2017.
- On June 29, Utah DEQ issued an advisory warning that the public and pets should stay out of Utah Lake and Provo Bay.

*Satellite remote sensing data augmented state monitoring and ensured public health and safety.*

June 18, 2017



July 3, 2017



# CyAN App Feedback

Aaron Borisenko, Oregon Department of Environmental Quality:	<i>"Moving ahead we want to spread the word about the application and get more eyes on the situation. It is important to identify where blooms are typically occurring <b>using CyAN app as an early warning system.</b>"</i>
Benjamin Holcomb, Utah Department of Water Quality:	<i>"The images we've been receiving through the CyAN project have been tremendously helpful to the Utah Division of Water Quality (UDWQ), providing the foundation for a wide range of useful outputs. It <b>allows UDWQ to better target field sampling and more efficiently use our limited resources to protect public health.</b> Finally, images are easily shared with response agencies as a useful visual communication aid."</i>
Angela Shambaugh, Vermont Department of Environmental Conservation:	<i>"Large lakes like Lake Champlain have an extremely patchy distribution of cyanobacteria due to varying environmental conditions and lake shape. The CyAN app helps viewers <b>visualize that patchiness and provides additional context</b> for our [cyanobacterial] Tracker Map which shares data gathered by our cyanobacteria monitoring program."</i>
Daniela Gurlin, Wisconsin Department of Natural Resources:	<i>"The CyAN app provides our water resources specialists a tool to access <b>near real-time satellite data products for detecting and quantifying algal blooms in hundreds of lakes across Wisconsin.</b> Simple map navigation and minimal steps required to mark locations and view the latest images make this app a useful tool for responding to questions related to the potential presence of harmful algal blooms in specific lakes. Time series images and blooming charts provide additional insights into the temporal dynamics and intensities of algal blooms at a particular location."</i>
Bart Johnsen-Harris, Environment America:	<i>"From Florida to the Great Lakes to California, we are seeing widespread outbreaks of toxic algae in our waterways. As I work on these issues and advocate for clean water policy, <b>CyAN has proved to be a uniquely helpful tool.</b> I expect that scientists, lawmakers, and concerned citizens alike will benefit from these maps."</i>
Lenard Long, Lake Cascade Citizen Scientist Monitoring Group:	<i>"Our goal is to <b>enhance the community's ability to rapidly respond to and manage the growing threat posed by toxic algae</b> by reducing human controlled nutrient pollution; the CyAN app helps us do that.... the CyAN app has been extremely useful...."</i>



# Q&A Session 1

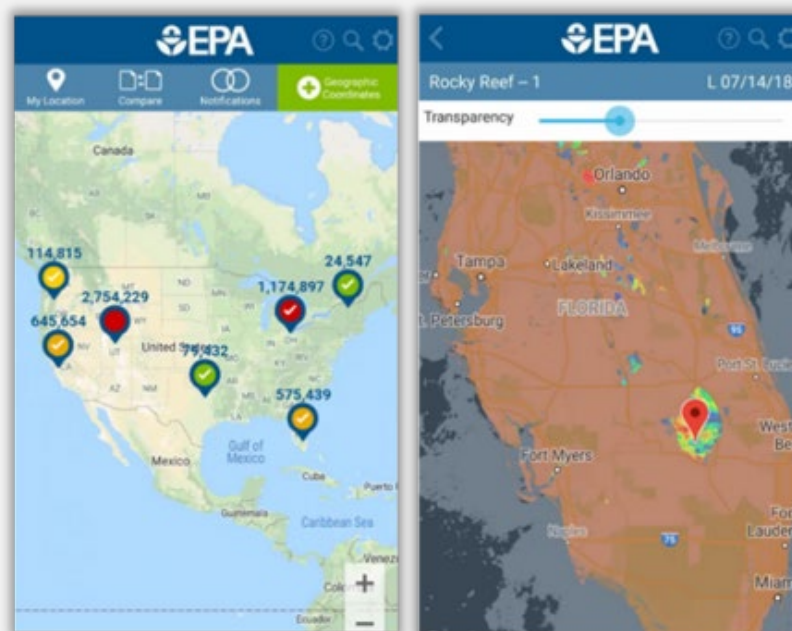
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**Download the CyAN app today:**  
[epa.gov/water-research/CyANapp](https://epa.gov/water-research/CyANapp)

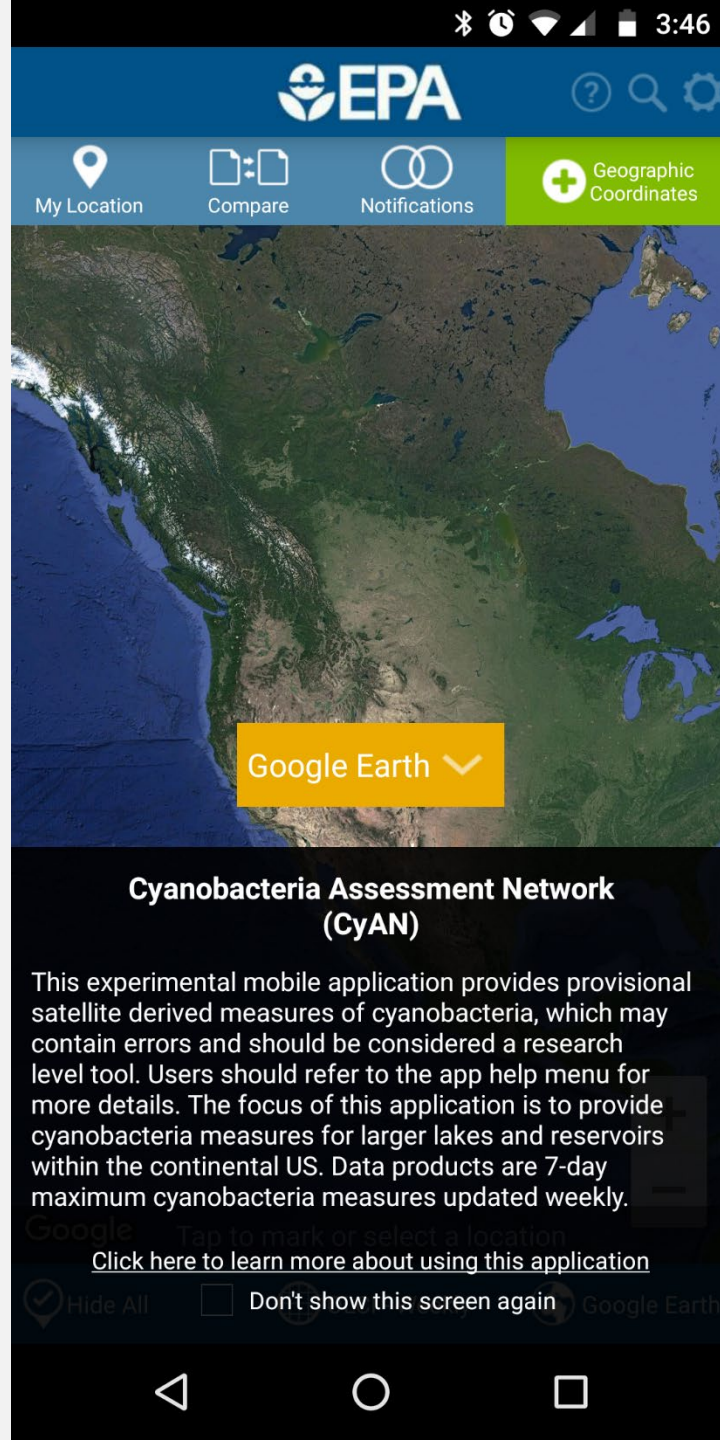


**Contact us about the CyAN app:**  
[CyAN@epa.gov](mailto:CyAN@epa.gov)

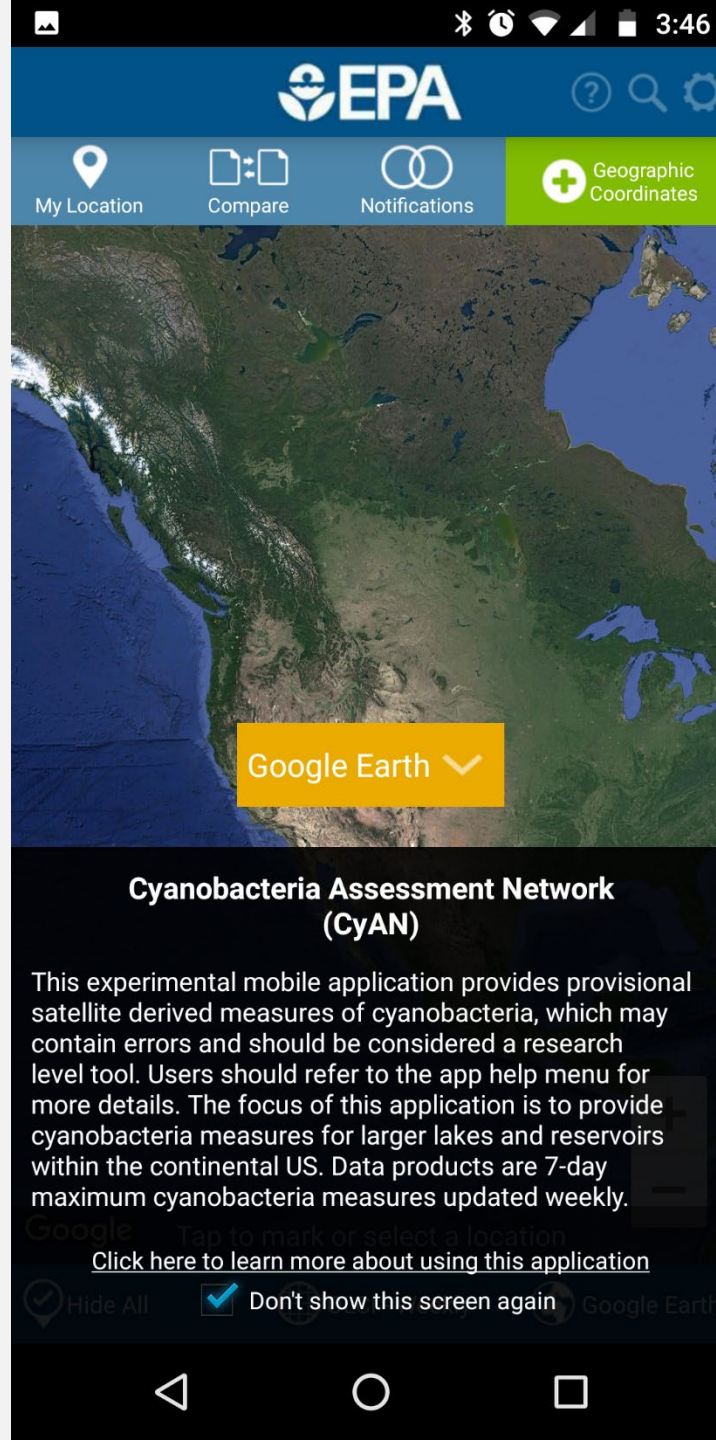
# Step-by-Step Training



# Single point location example



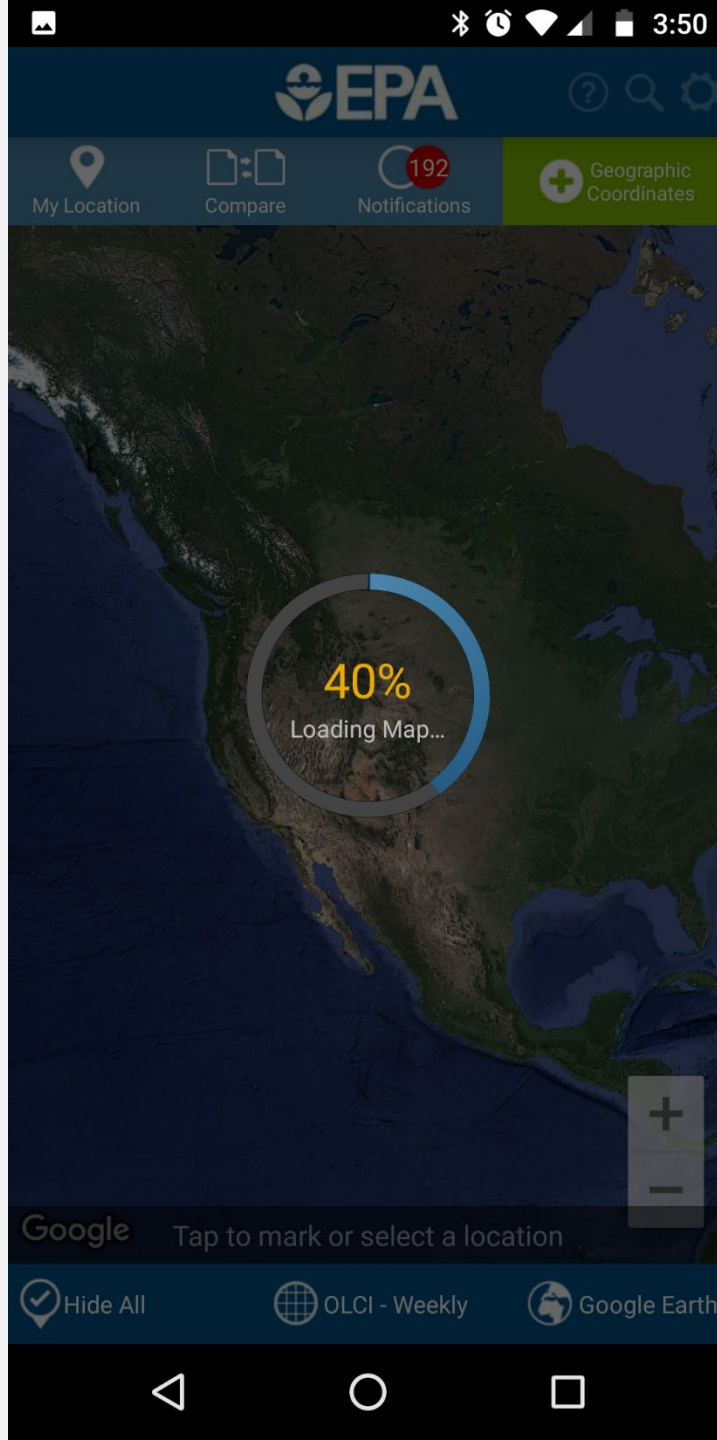


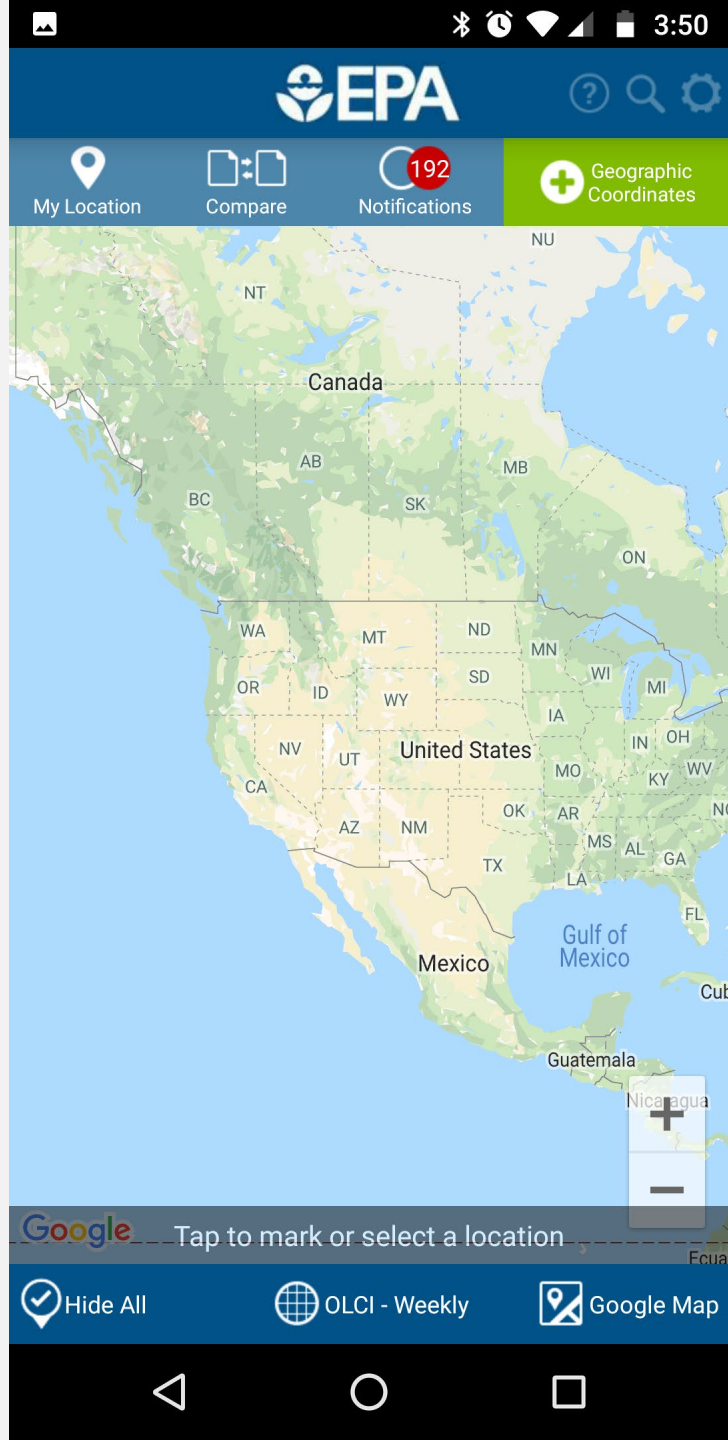


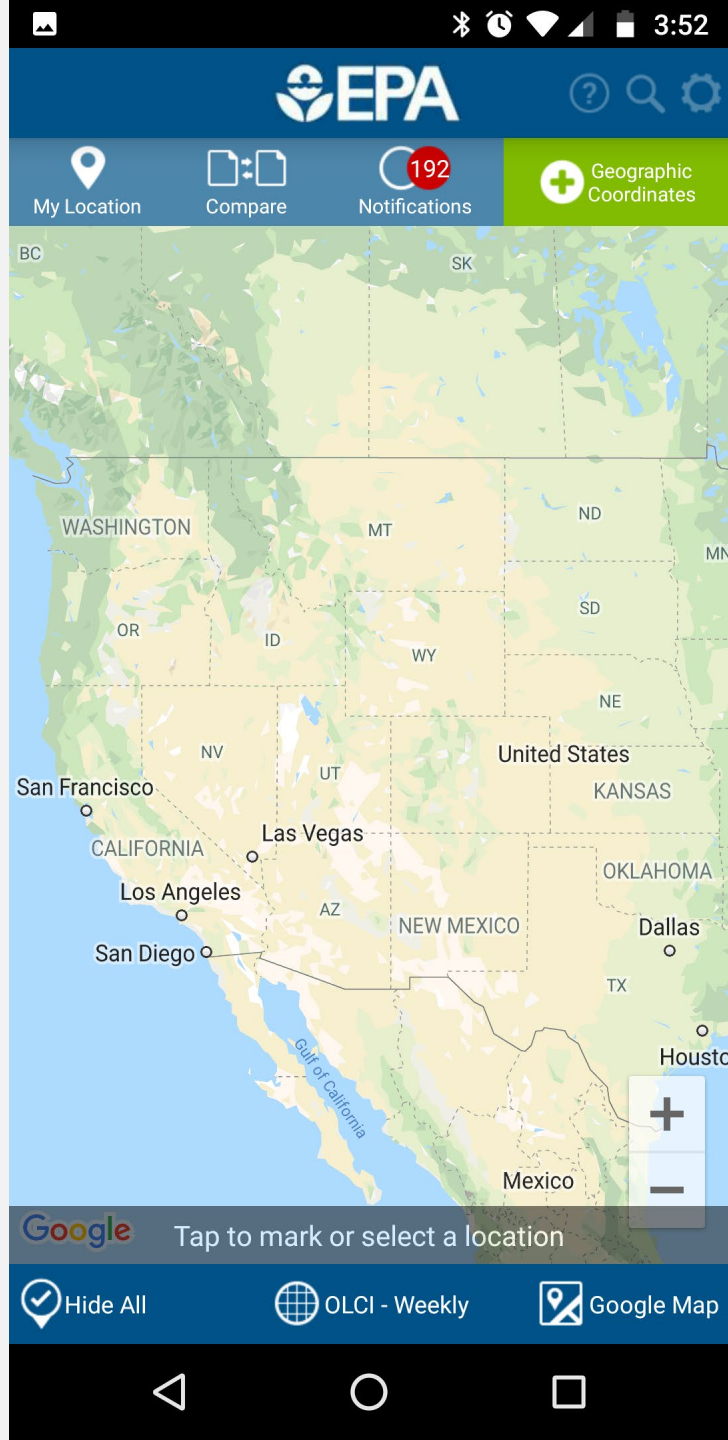












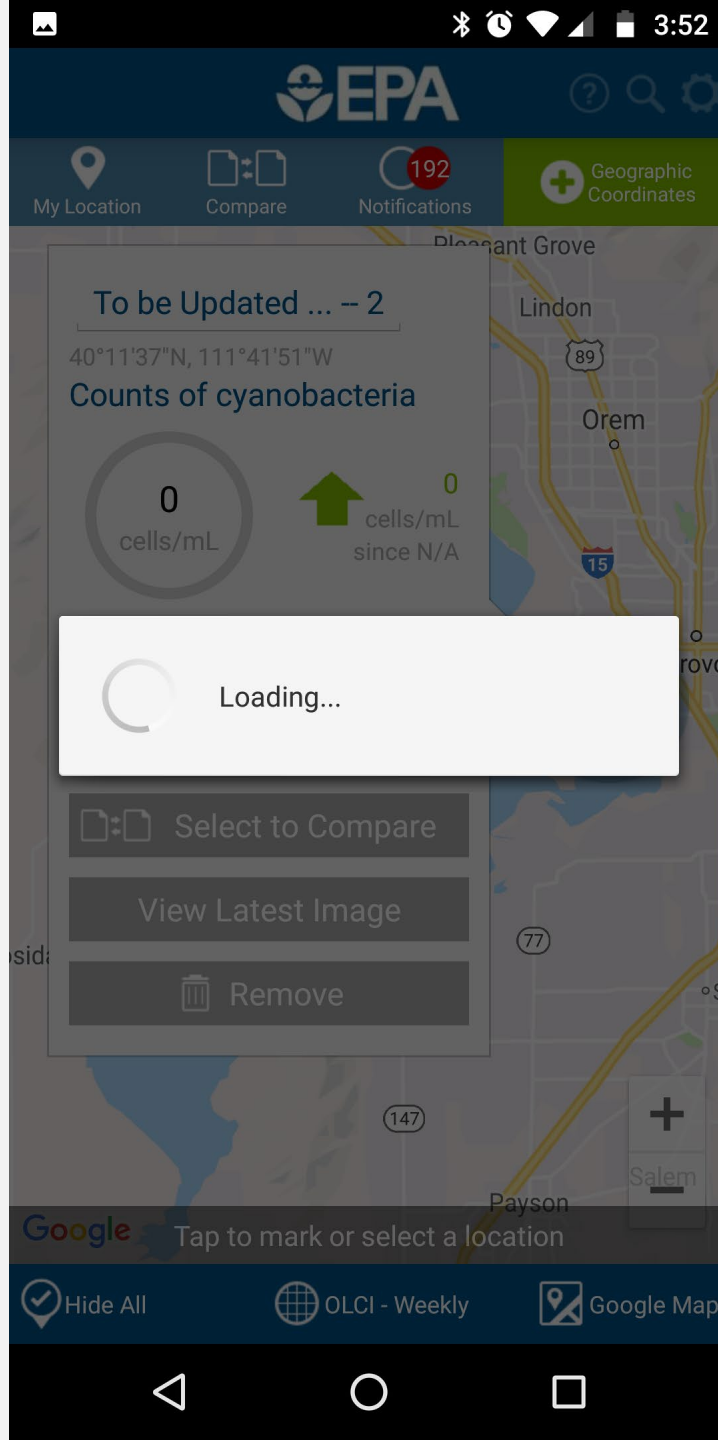




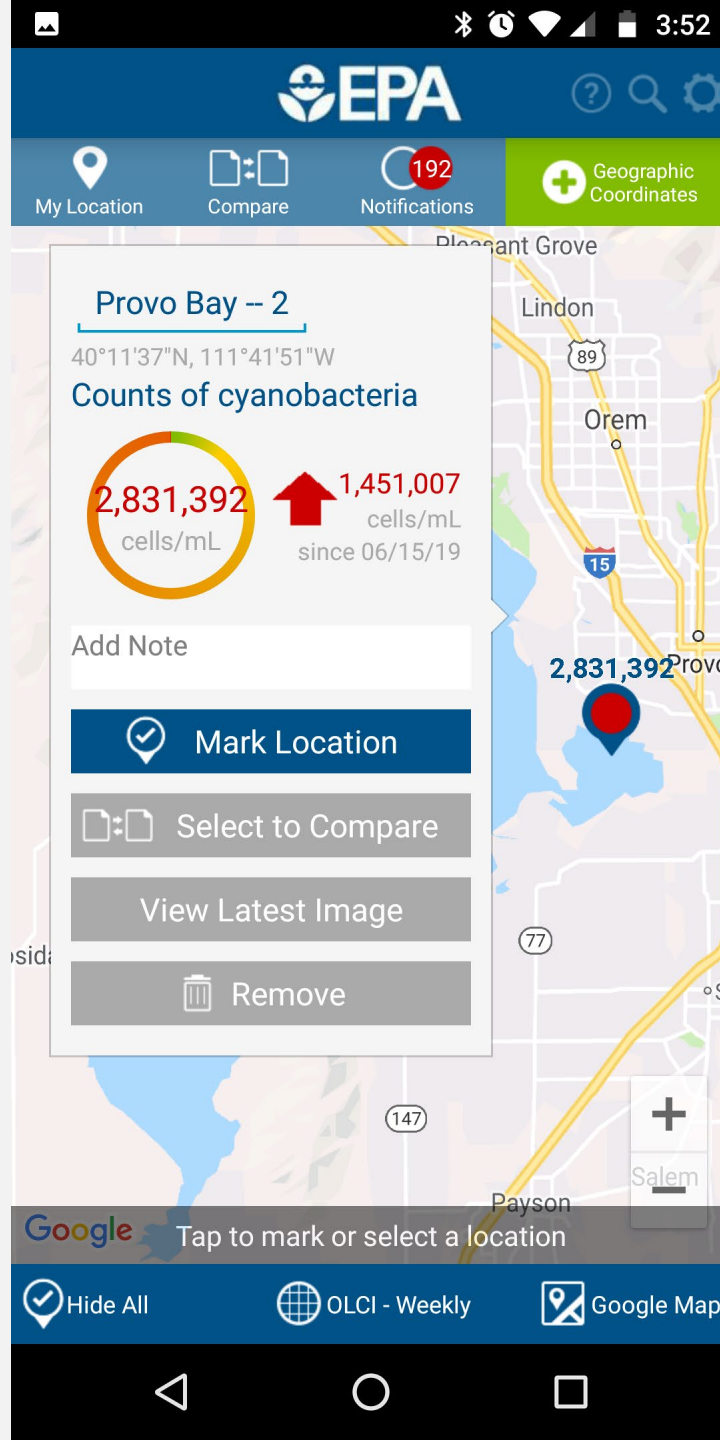


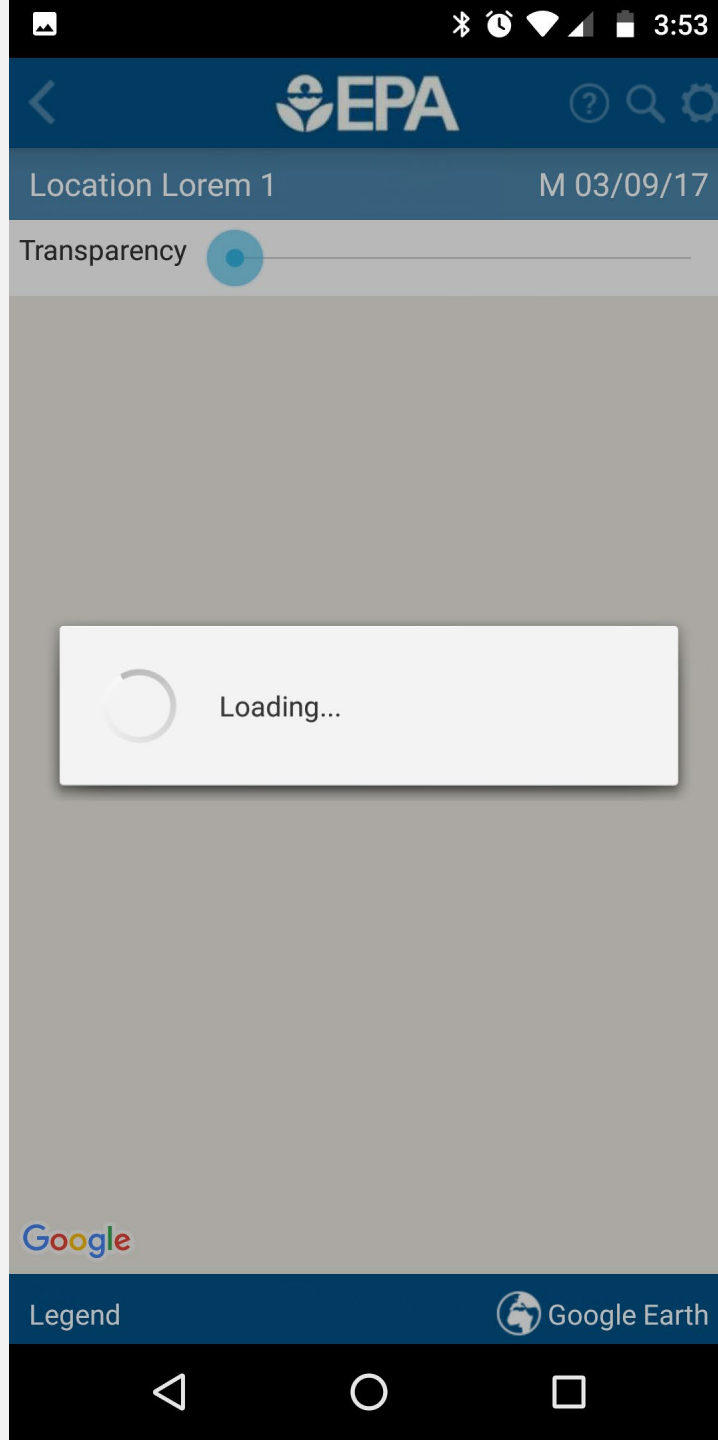


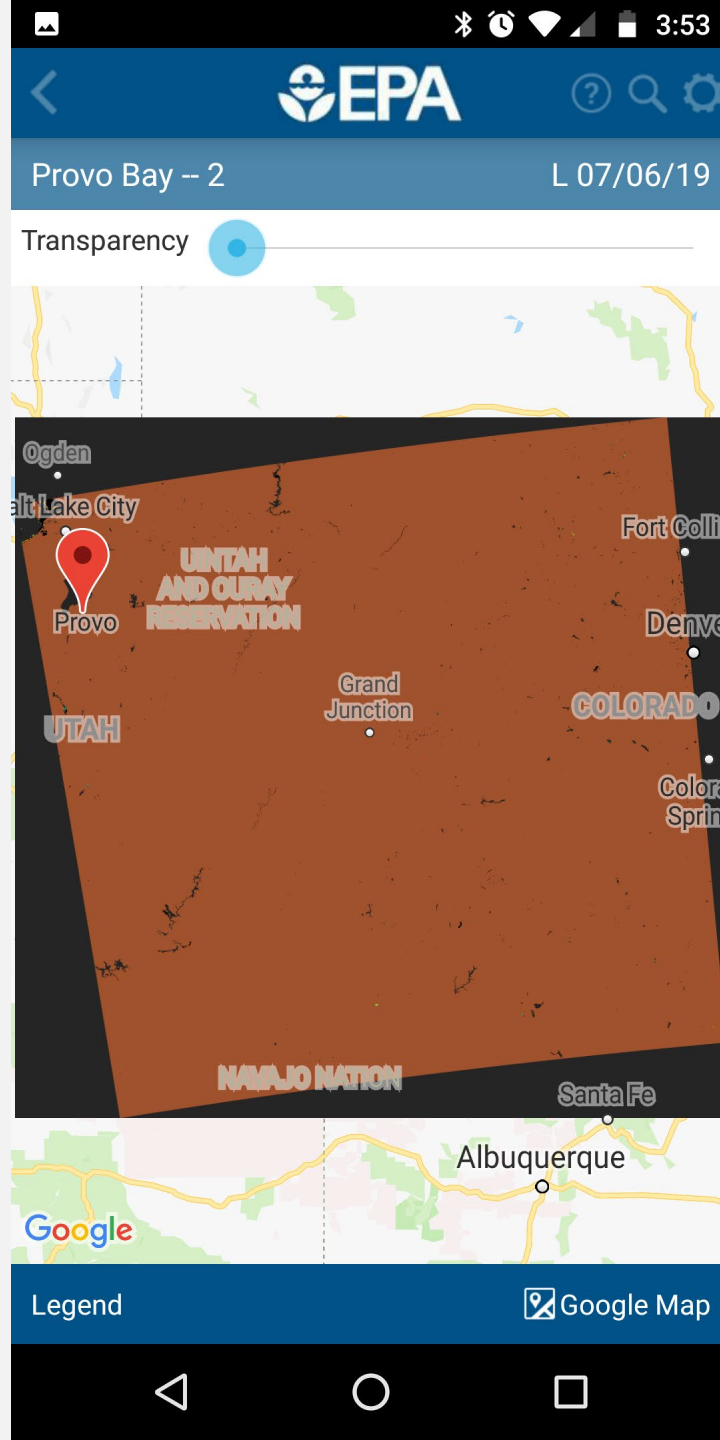


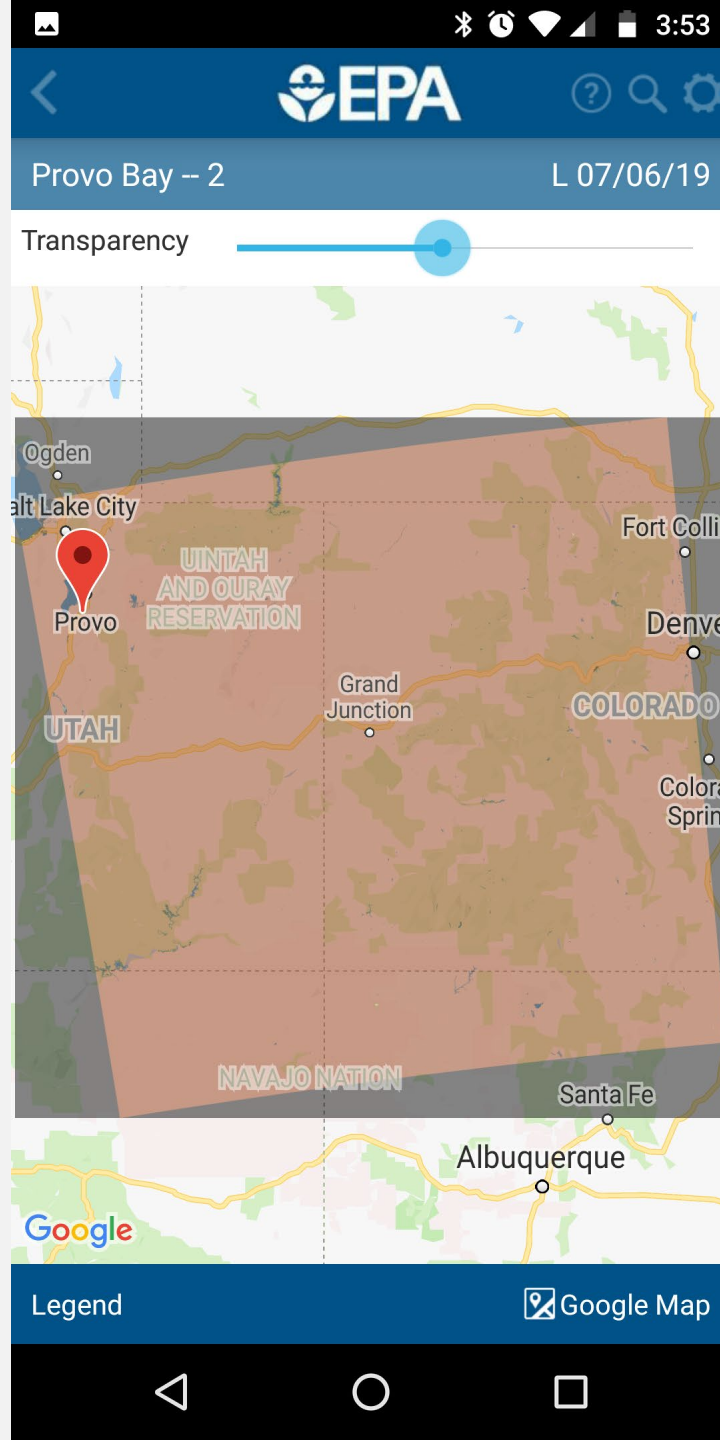


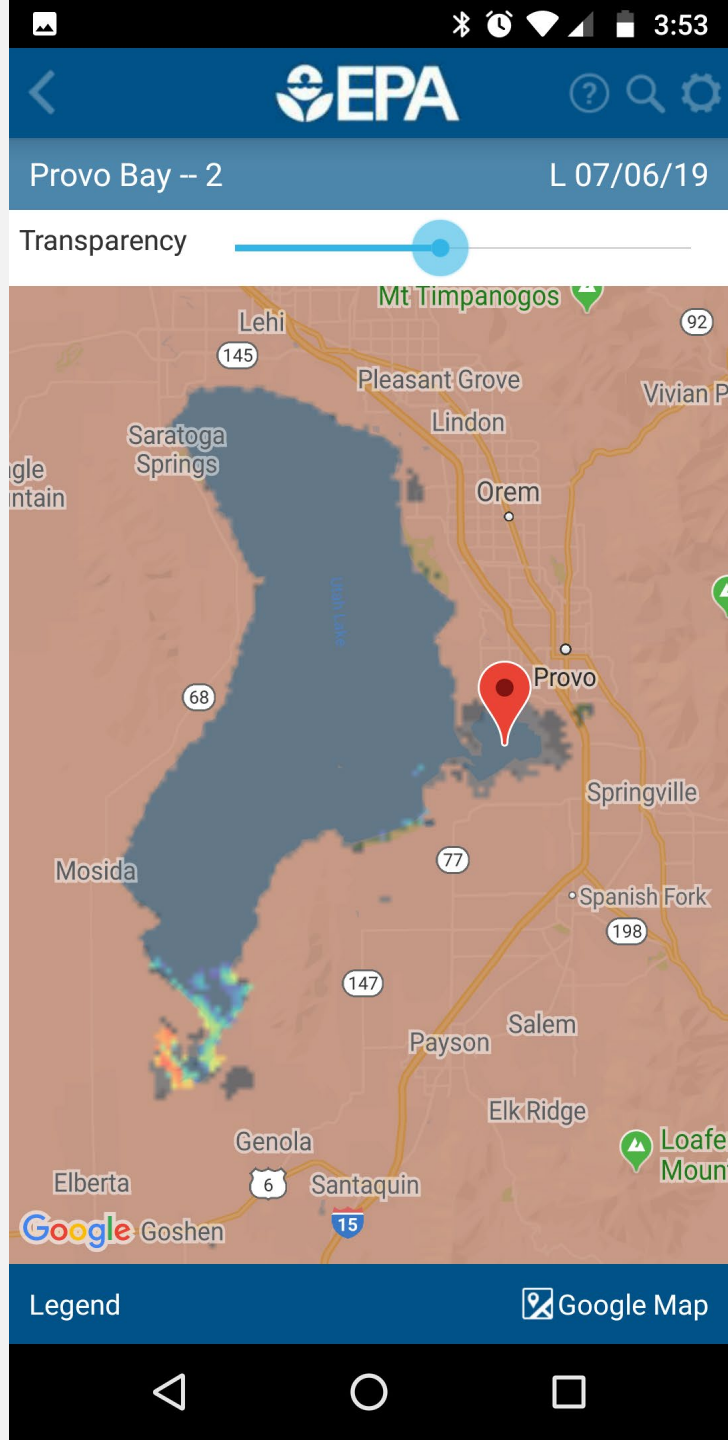




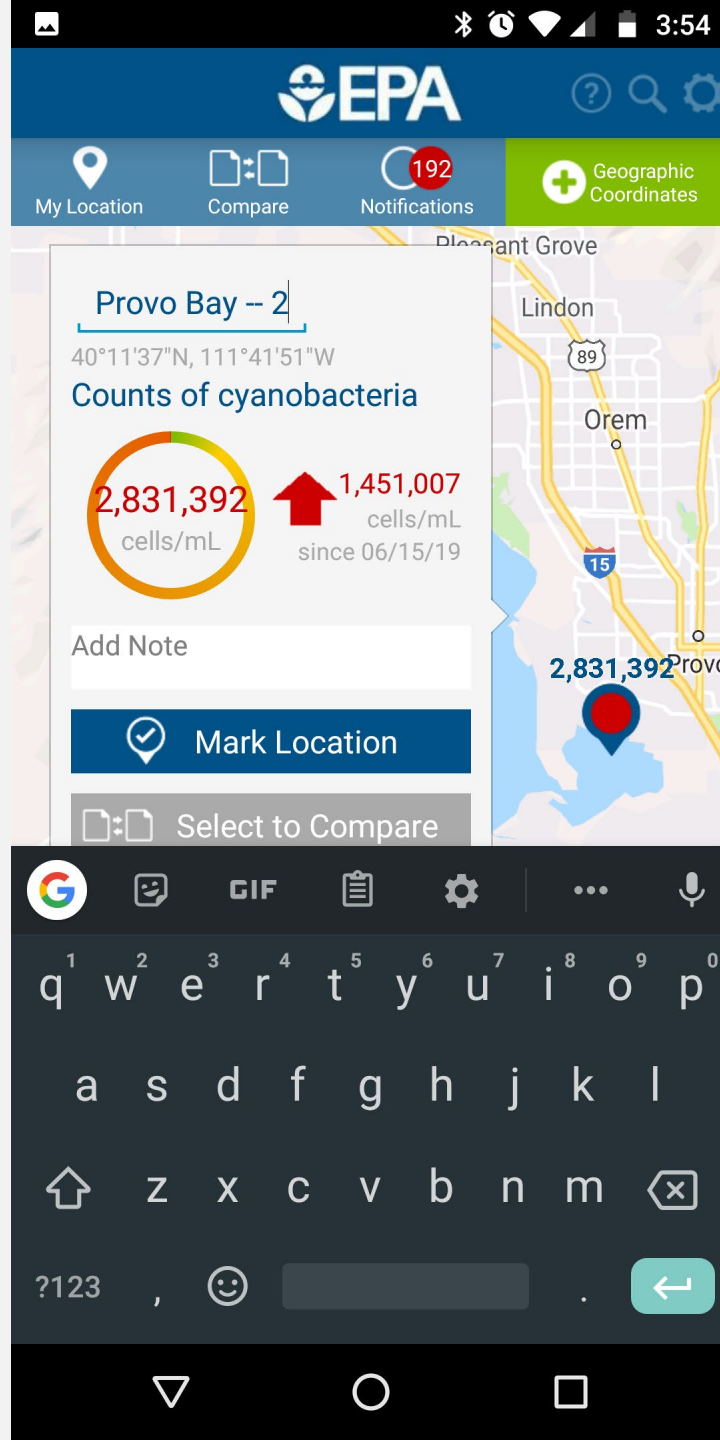


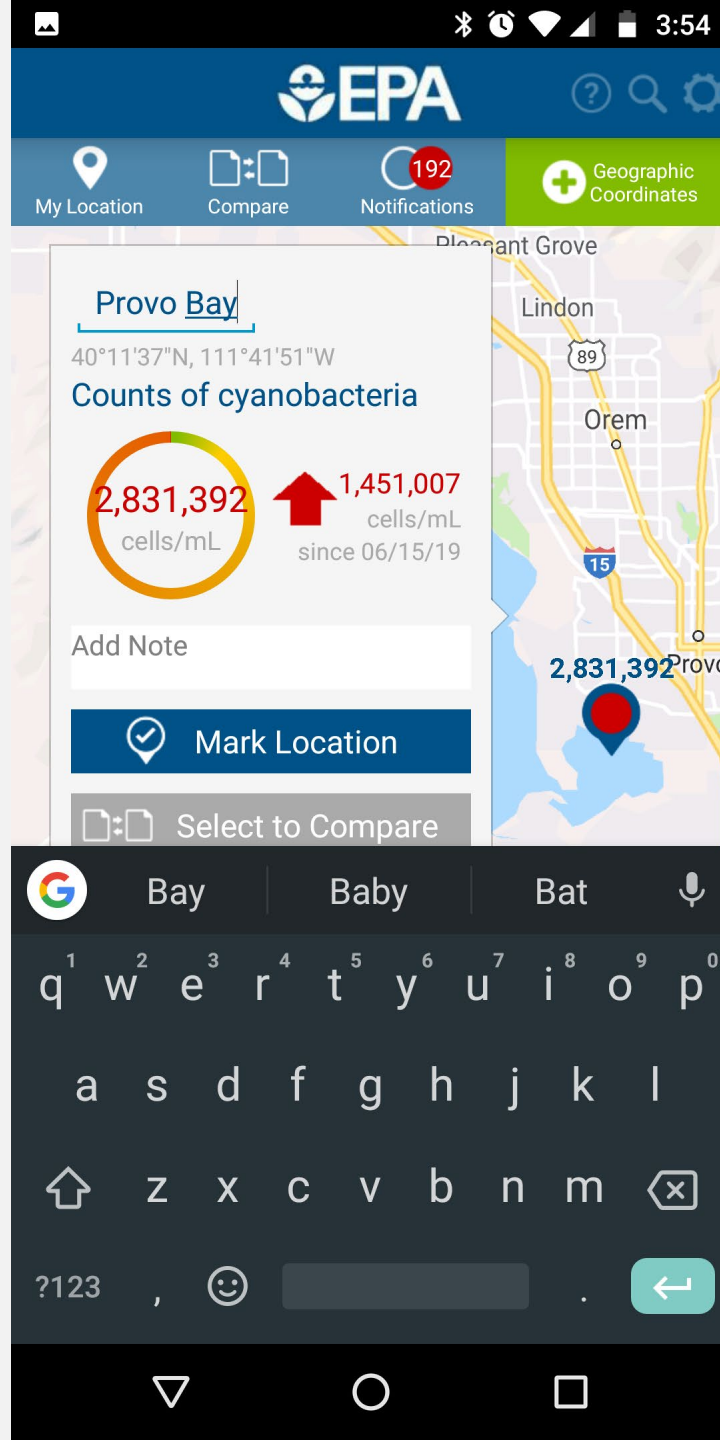
















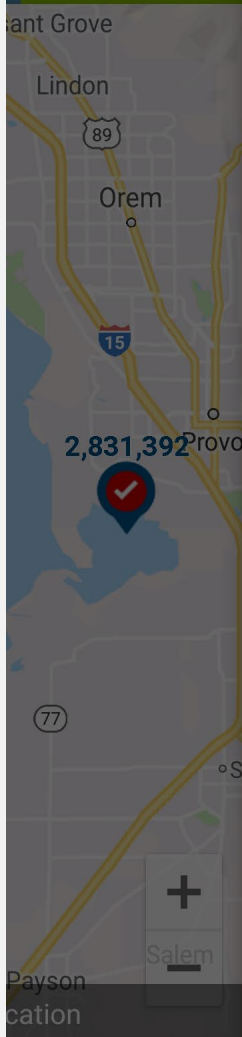





Version: R.1.0.1


Modify Graph Color Configuration

Geographic Coordinates





Salem

 Google Map

Low

From

10,000

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Very High

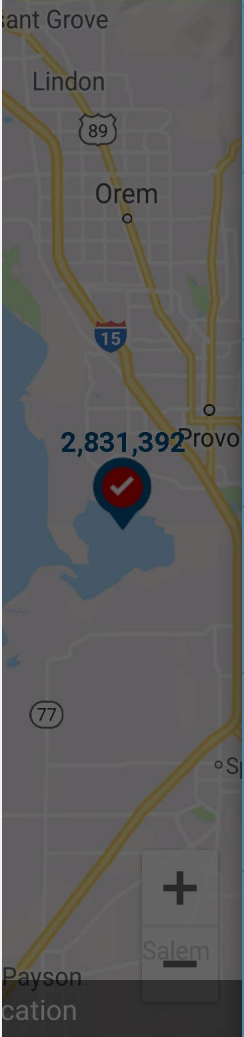
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☐ Alert when higher than

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Reload Data




 Geographic Coordinates

Version: R.1.0.1

Modify Graph Color Configuration

Low




From


10,000

To

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Medium




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Very High




Higher than

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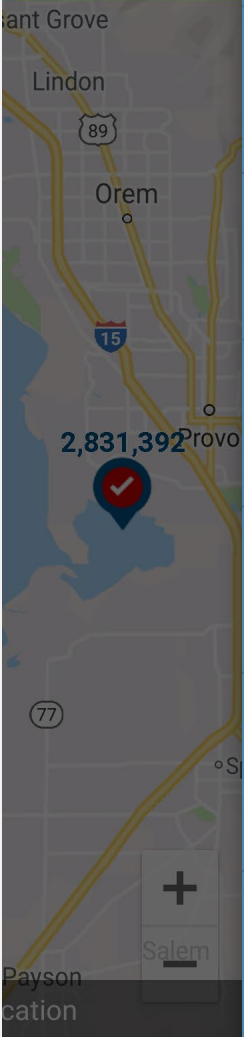
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Reload Data


 Google Map






Geographic Coordinates

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89  
Orem  
15  
2,831,392  
Provo  
77  
Payson  
cation  
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Google Map





Version: R.1.0.1

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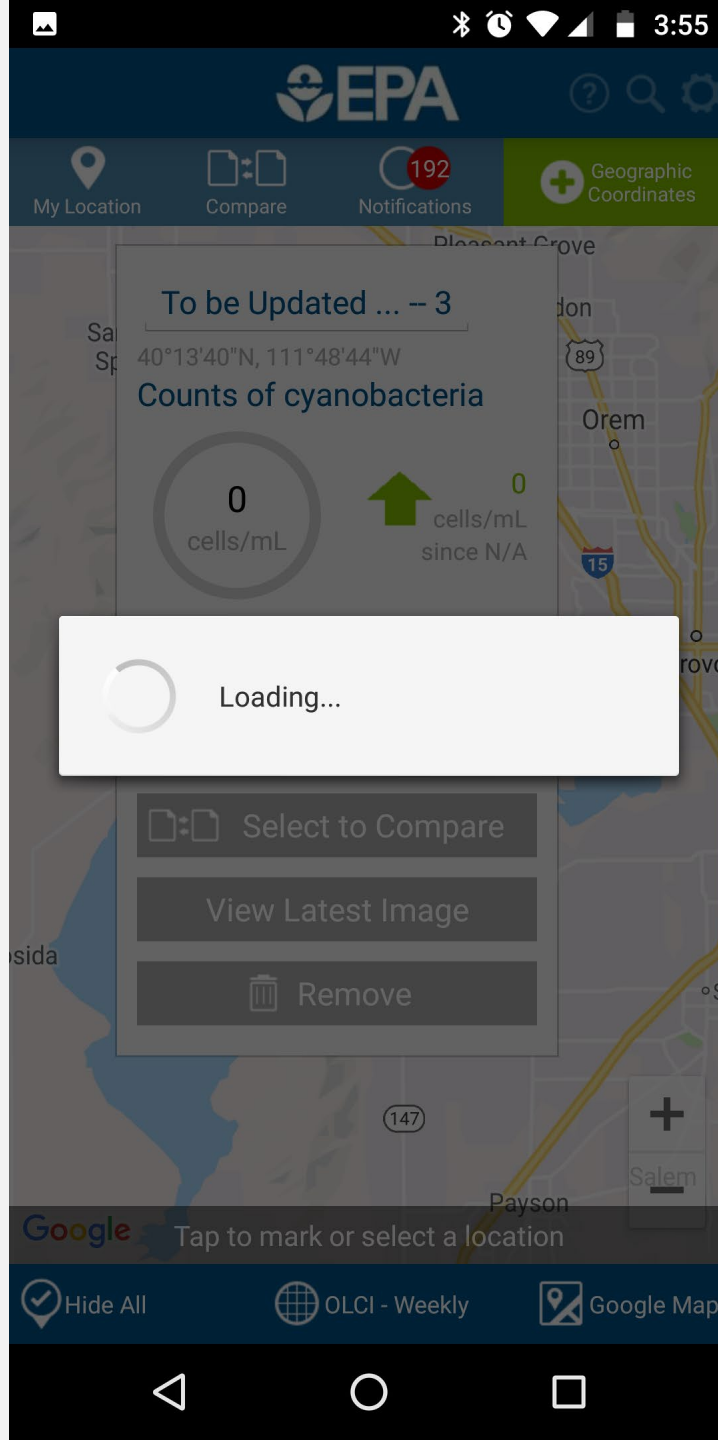
Low	From	To
	10,000	109,000
Medium	From	To
	110,000	299,000
High	From	To
	300,000	501,000
Very High	Higher than	
	502,000	

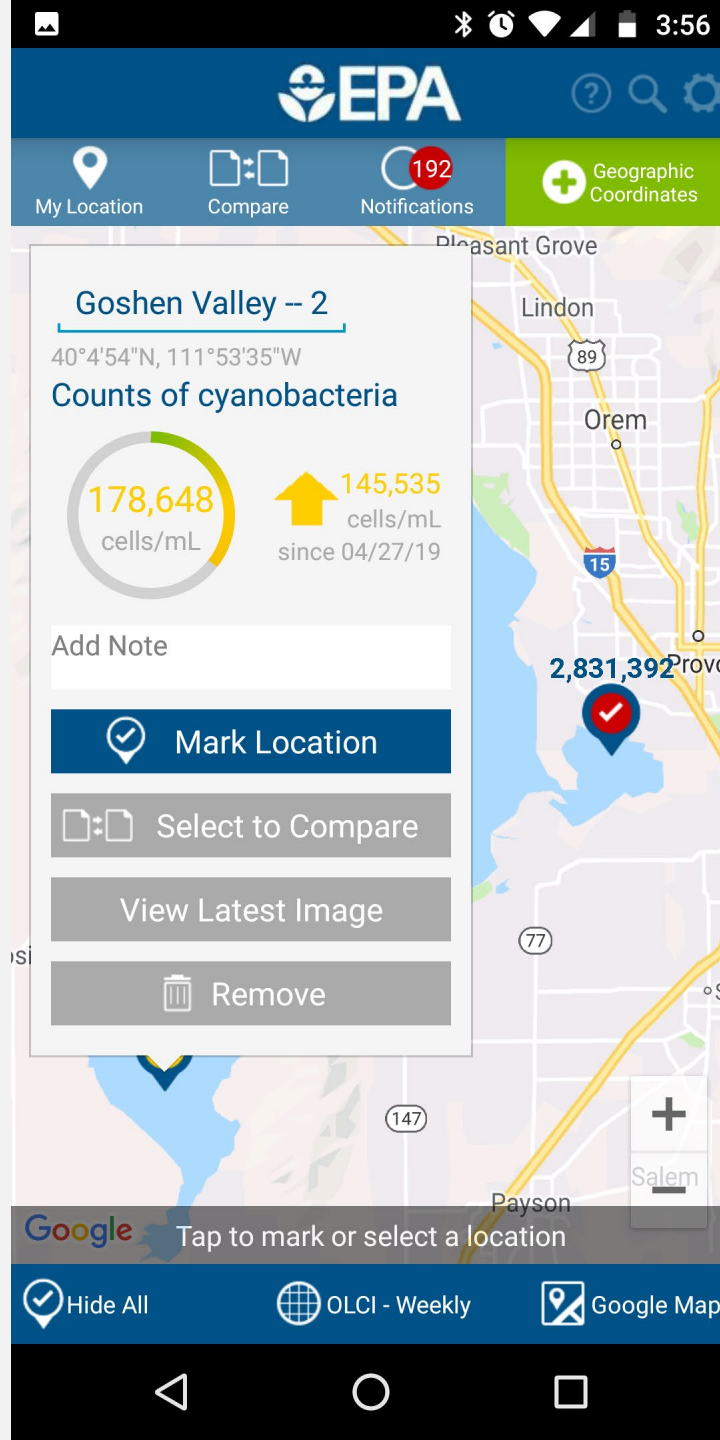
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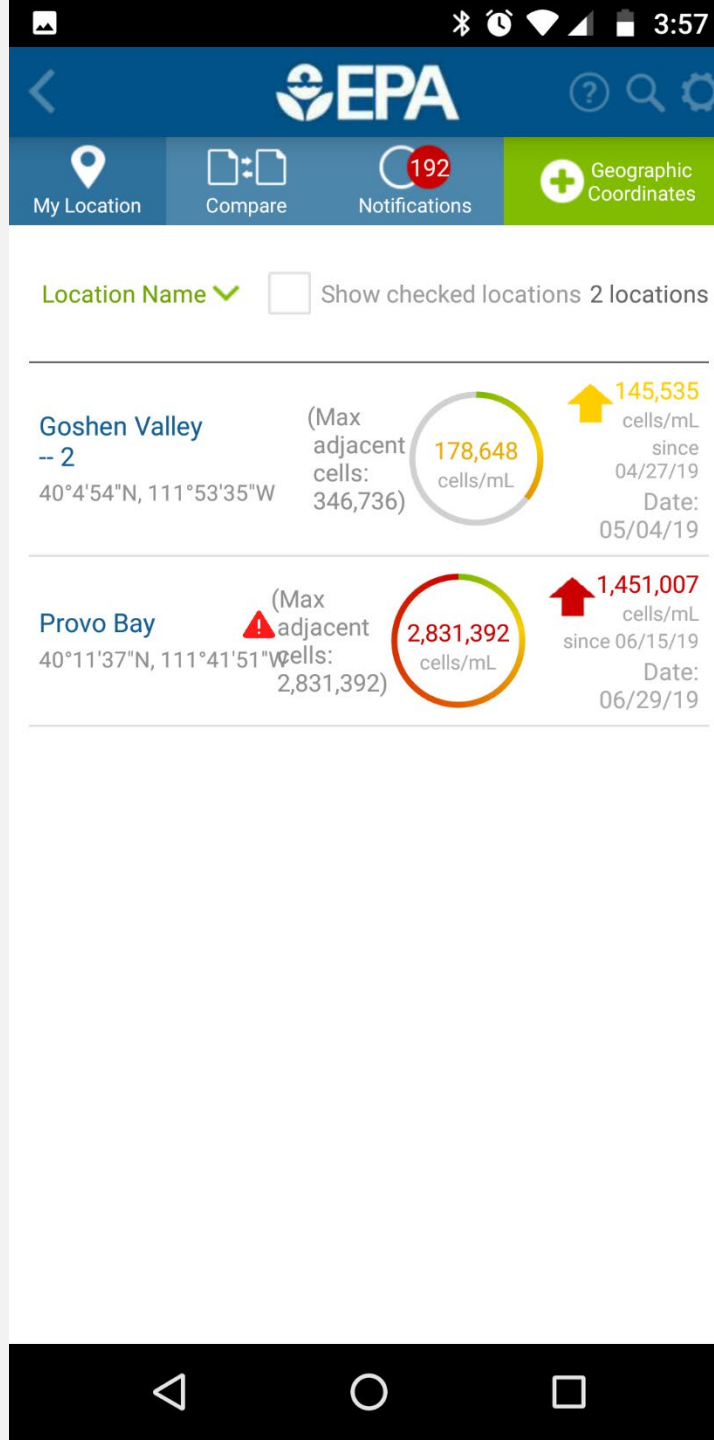
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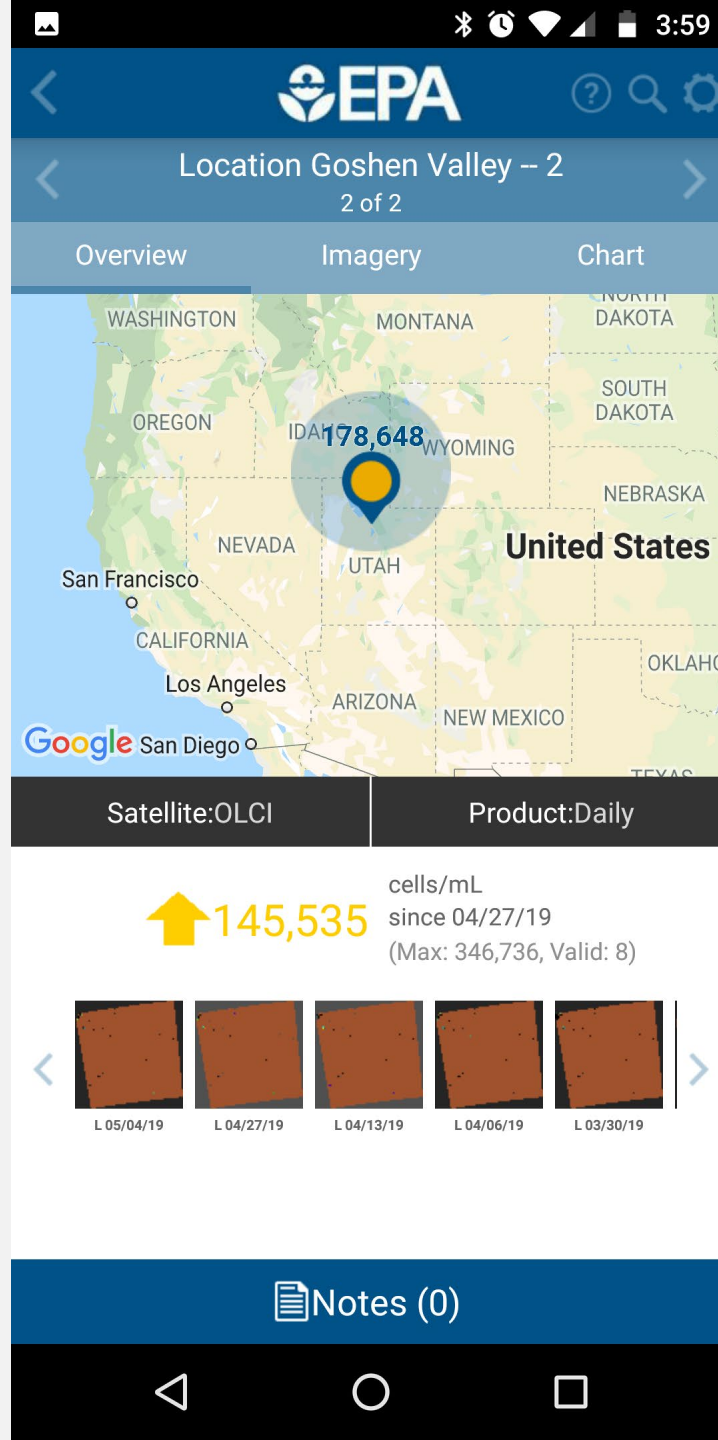




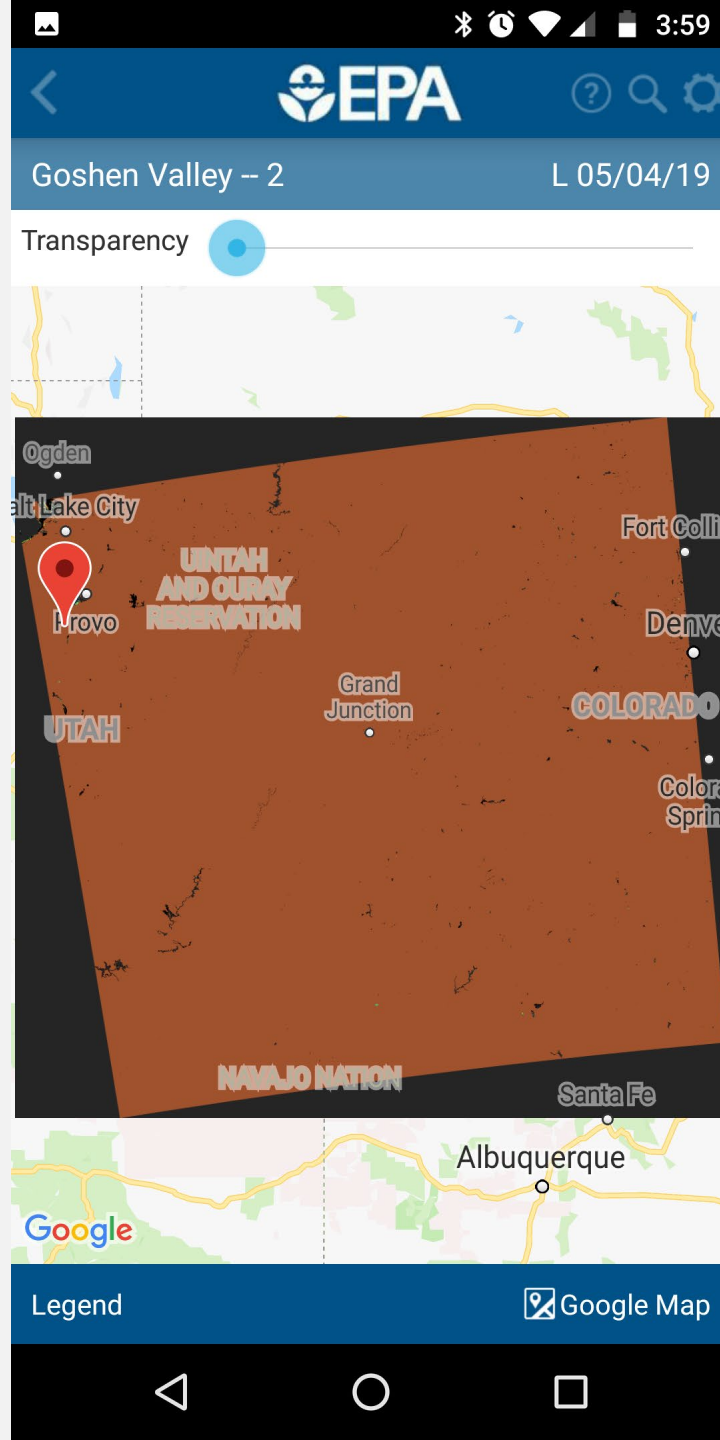


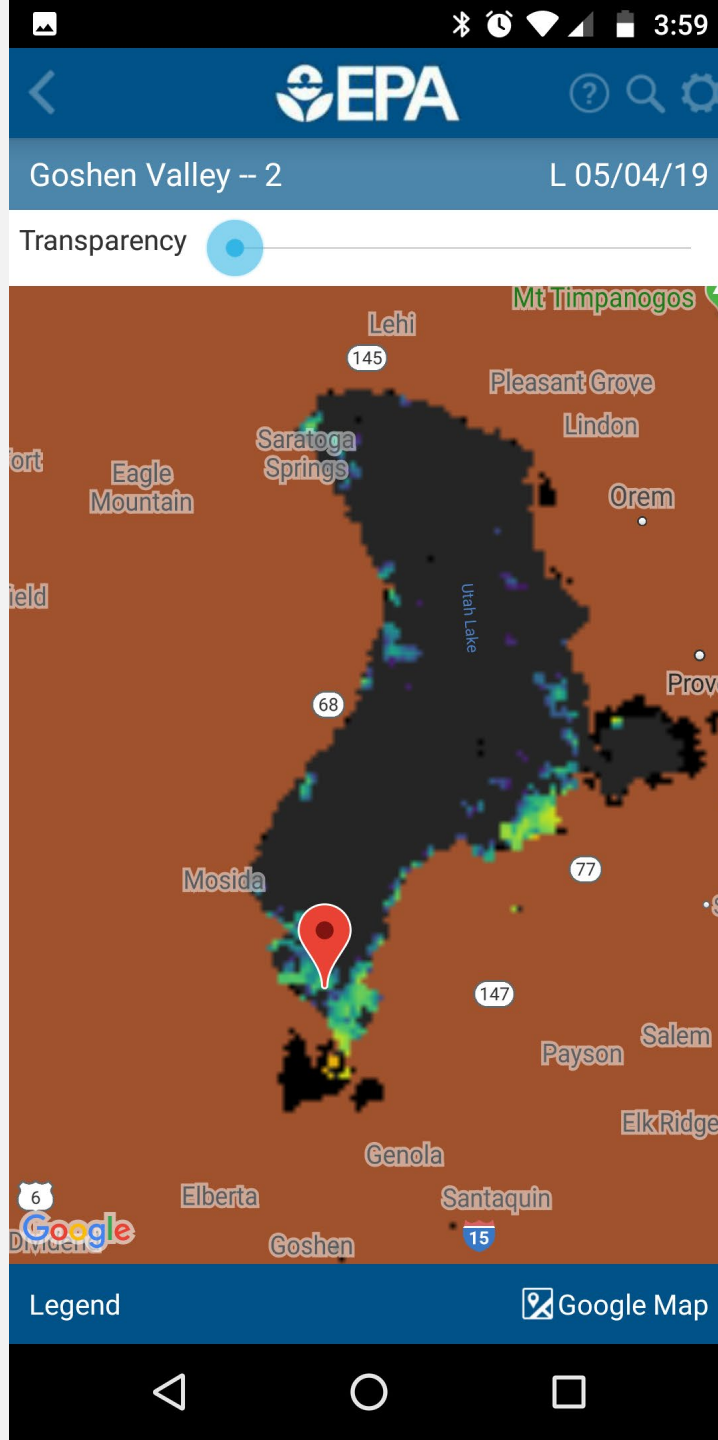


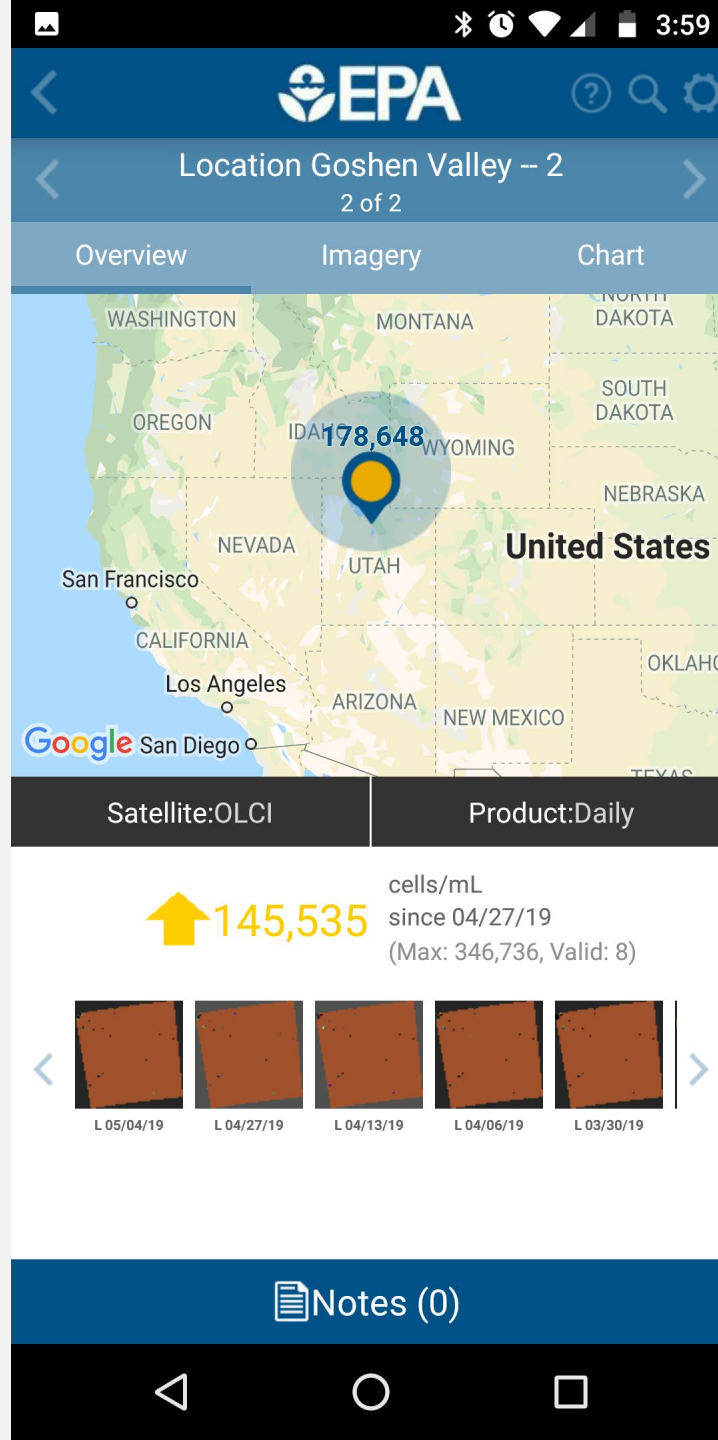


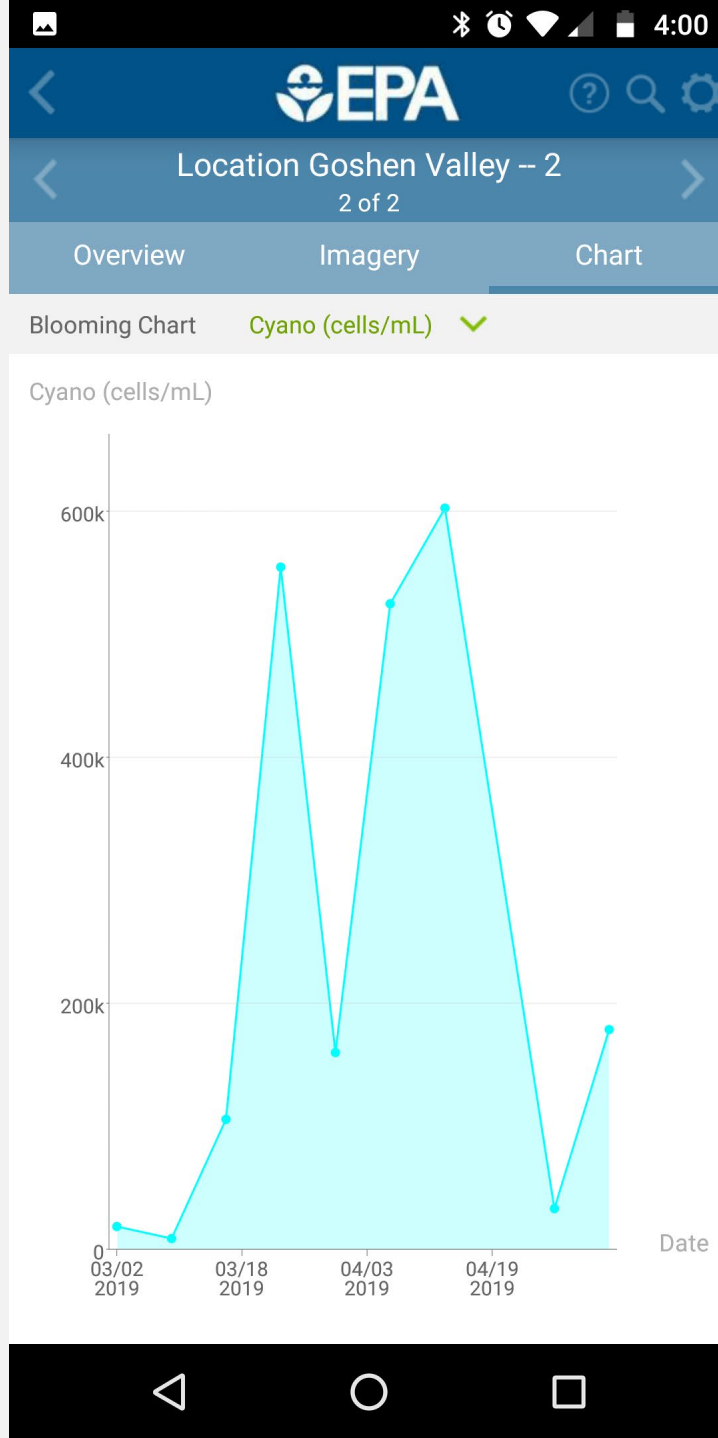


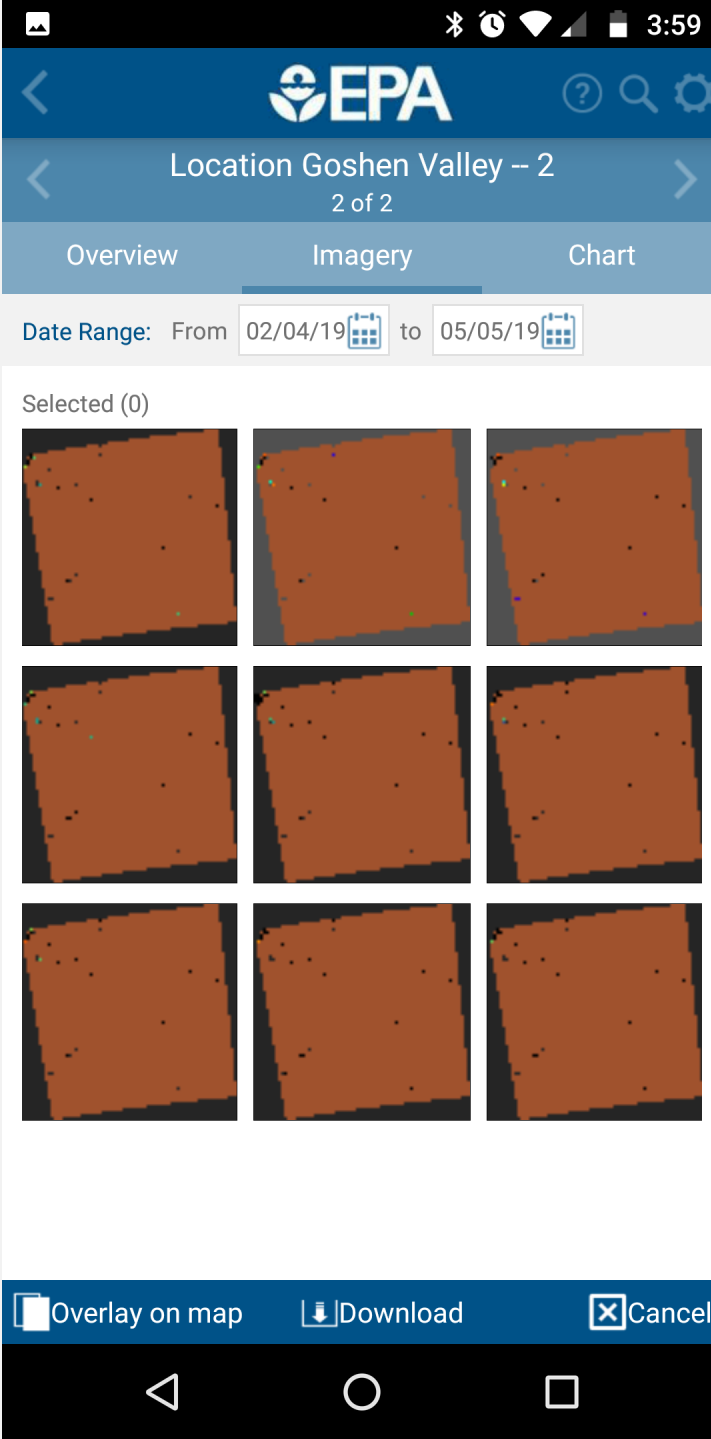













 **EPA**

Location Goshen Valley -- 2  
2 of 2

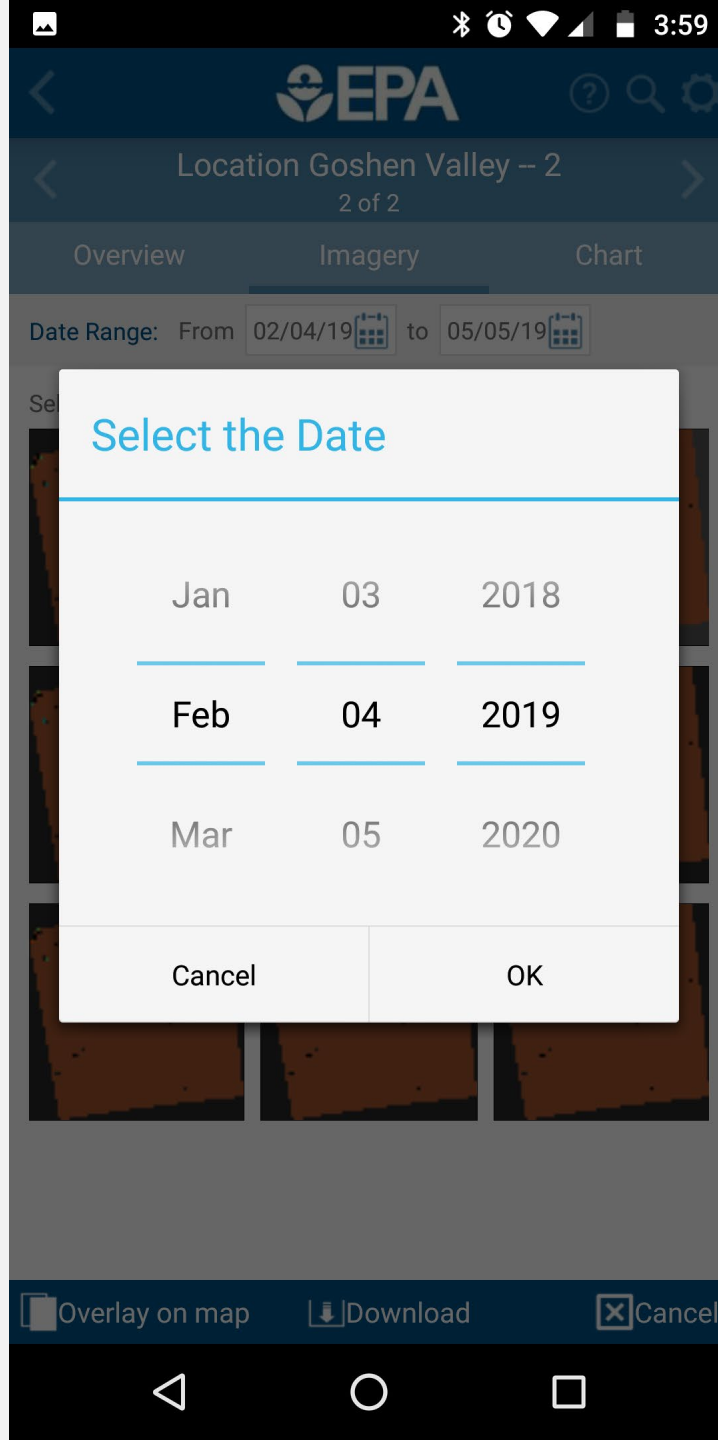
Overview Imagery Chart


Date Range: From 02/04/19 to 05/05/19

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Overlay on map Download Cancel









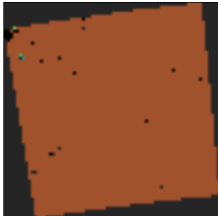

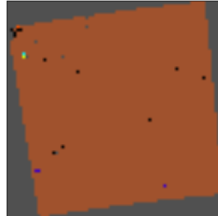
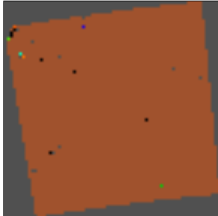






Location Goshen Valley -- 2  
2 of 2

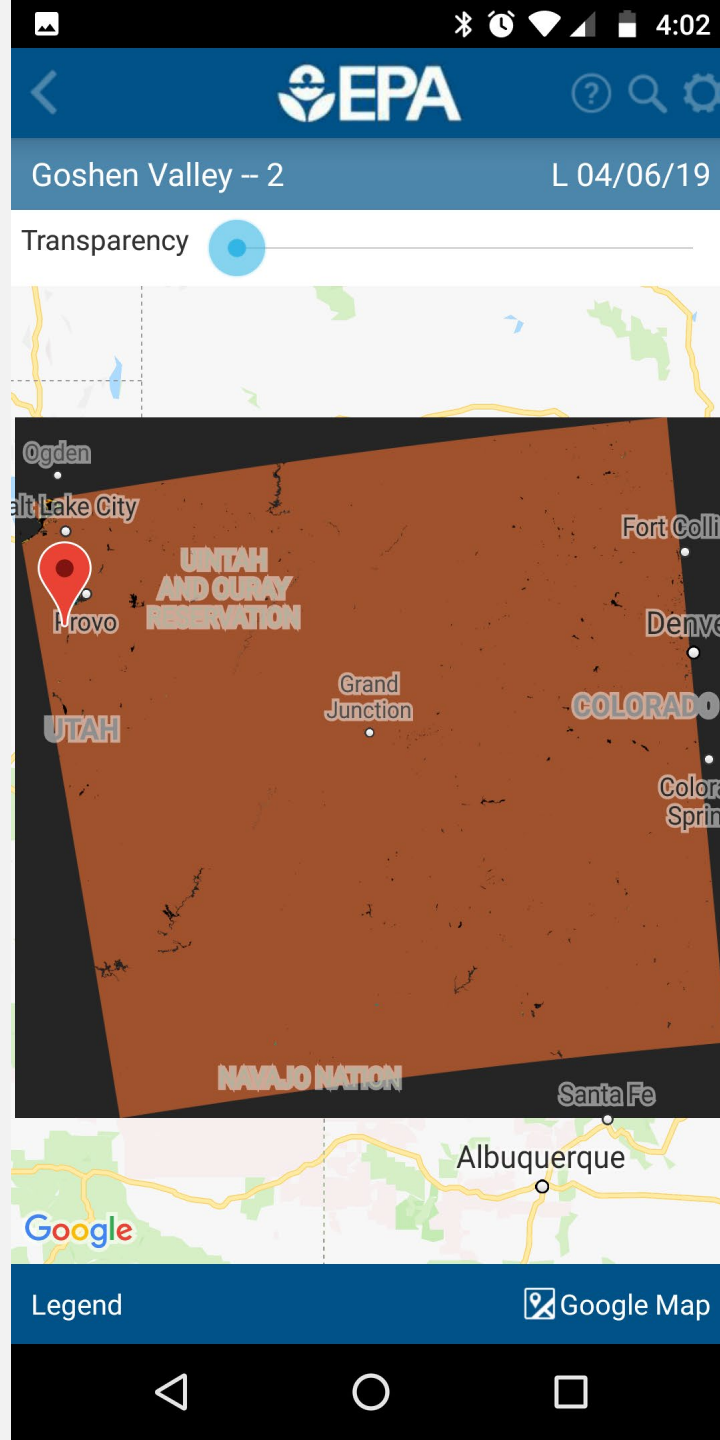
Overview Imagery Chart

Date Range: From 02/04/19 to 05/05/19

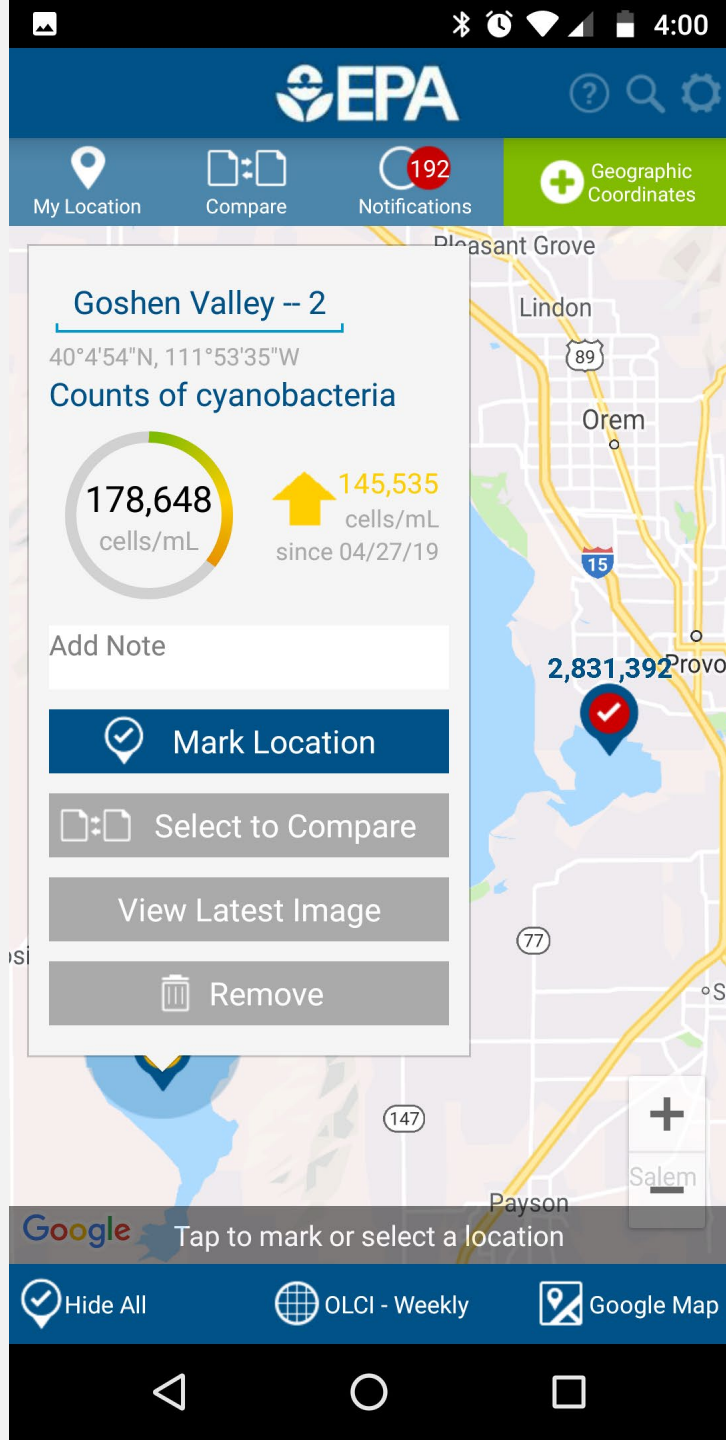
Selected (1)



 Overlay on map  Download  Cancel

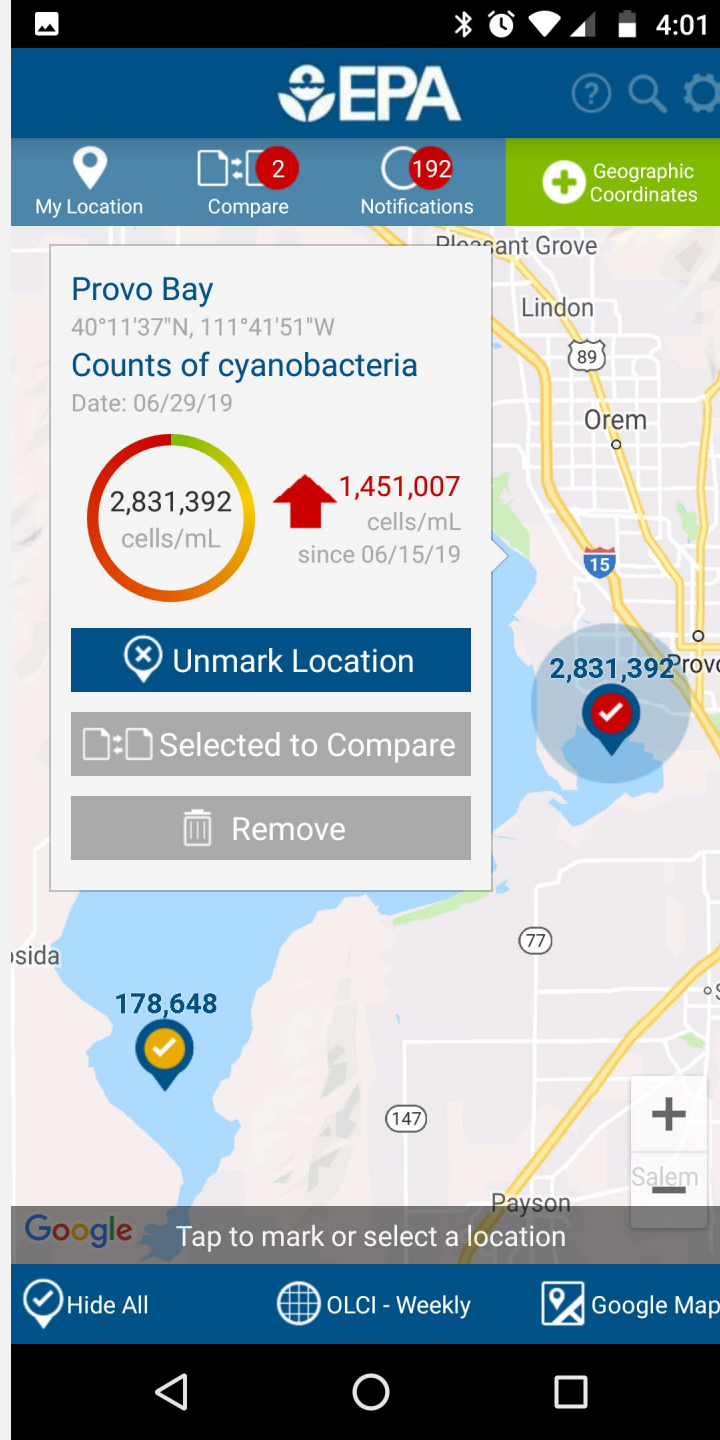


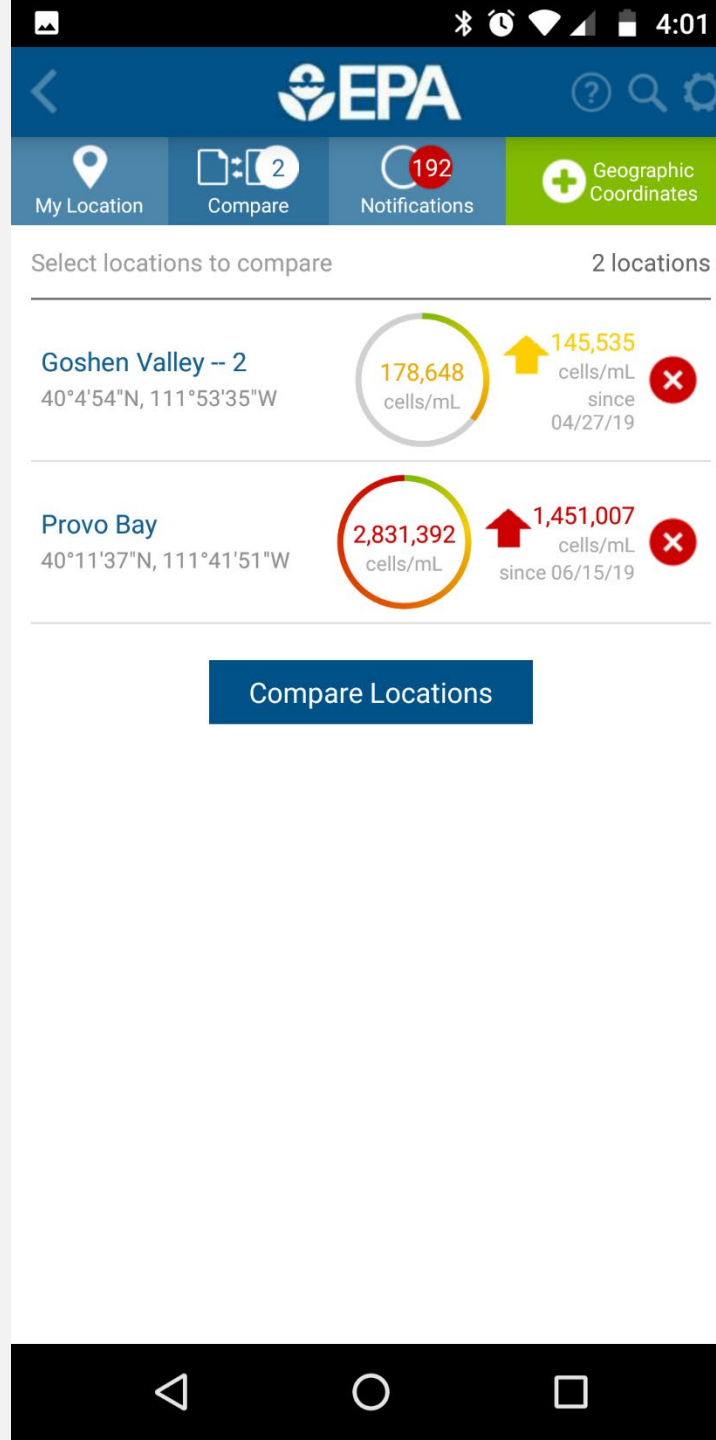
# Location Comparison

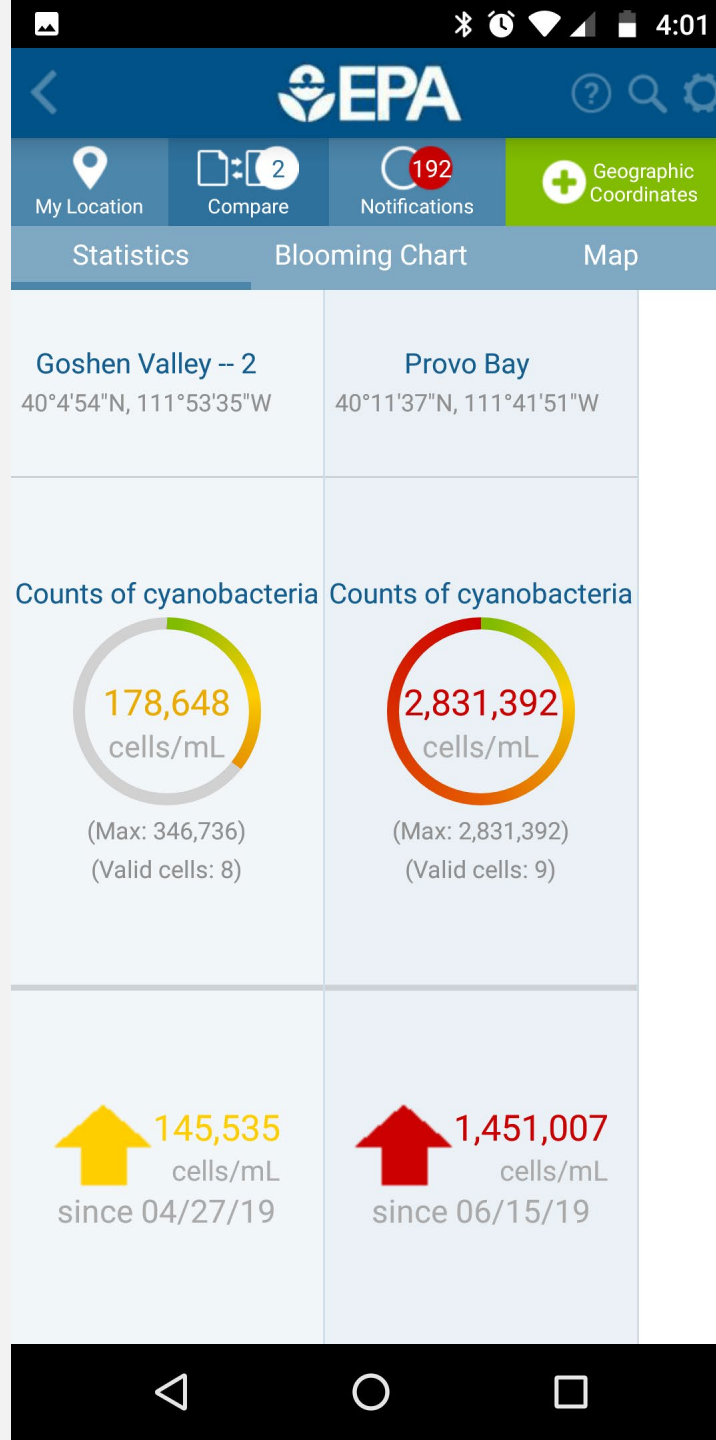


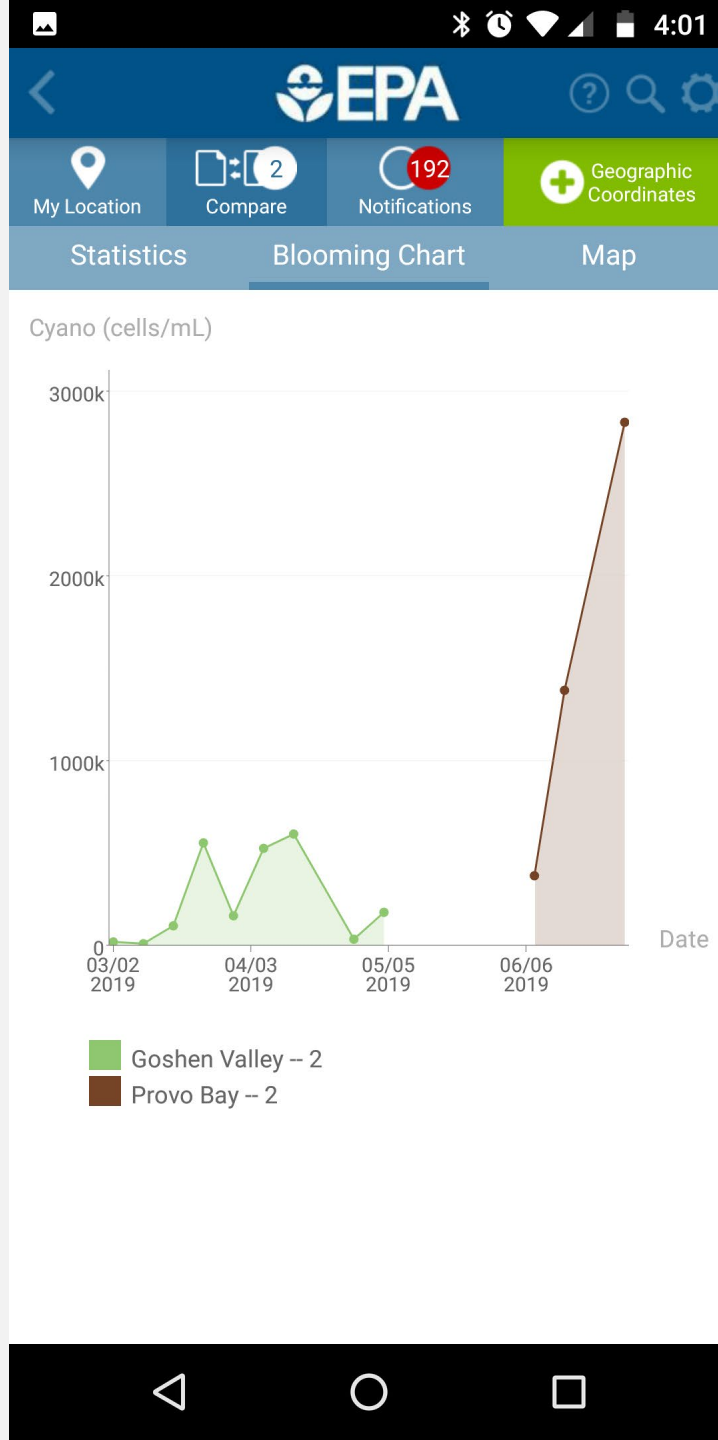





























# Notifications

      4:03

 My Location  2 Compare  192 Notifications  Geographic Coordinates

☐ Only show new notifications 192 new notifications

Clear

New data available for 07-03-2019 09:31 AM EDT; update y...

07/03/19, 10:09  
**New Location Data Available**  
New data available for 07-03-2019 10:09 AM EDT; update y...

07/04/19, 11:03  
**New Location Data Available**  
New data available for 07-04-2019 11:03 AM EDT; update y...


07/06/19, 10:14  
**New Location Data Available**  
New data available for 07-06-2019 10:14 AM EDT; update y...

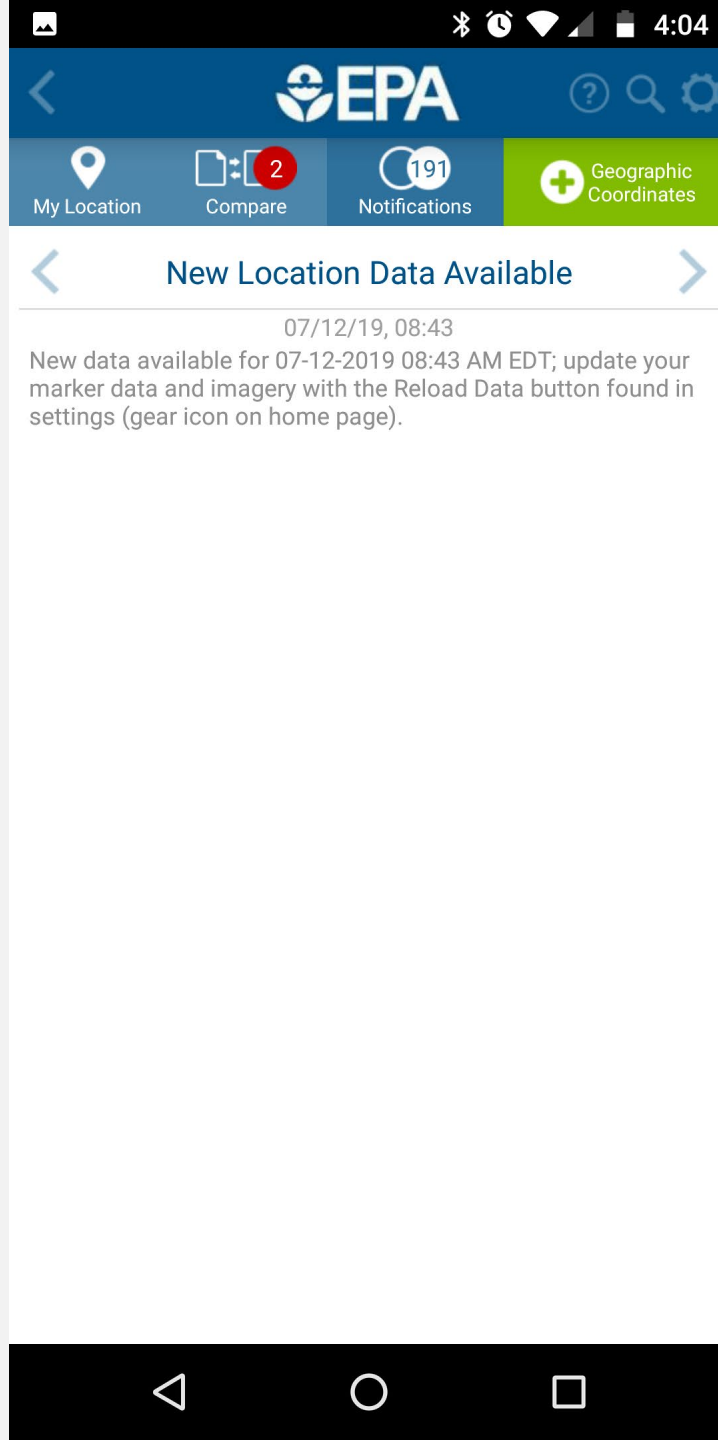
07/07/19, 10:44  
**New Location Data Available**  
New data available for 07-07-2019 10:44 AM EDT; update y...

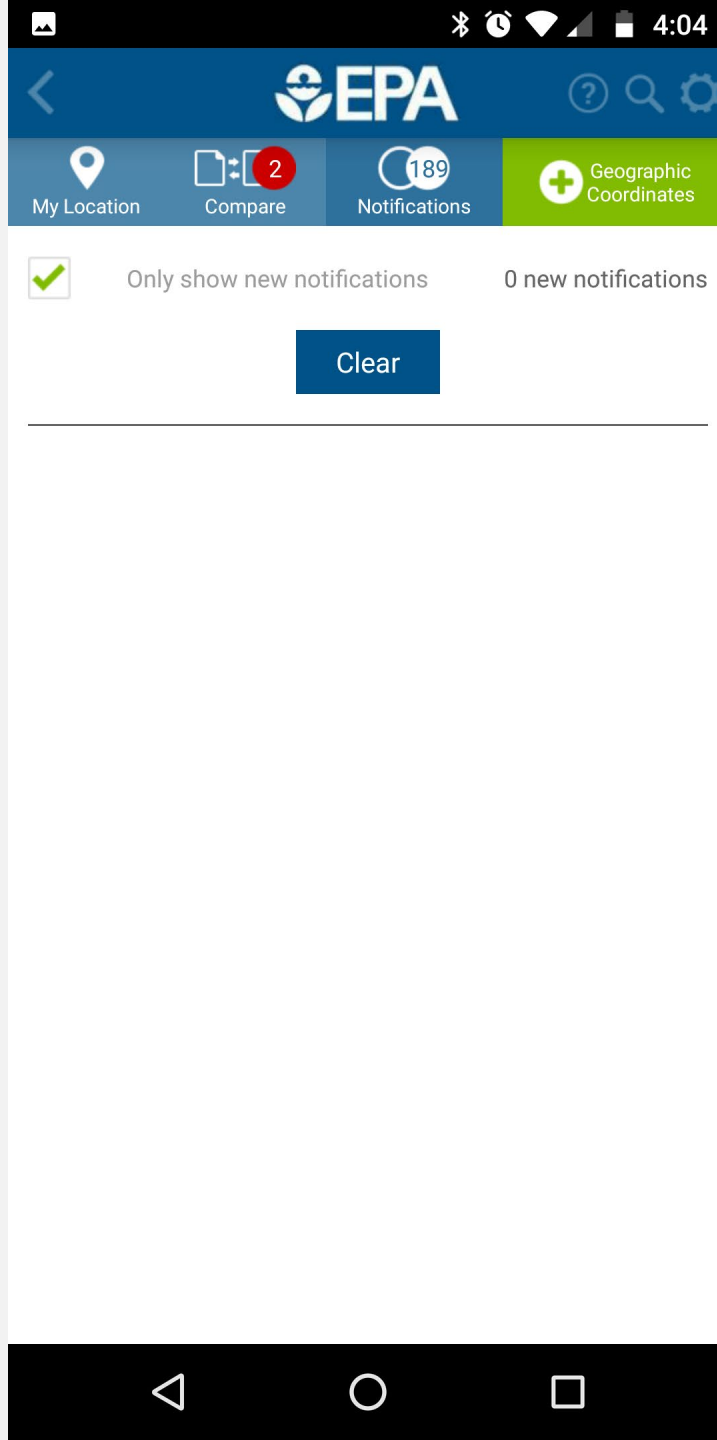
07/07/19, 10:49  
**New Location Data Available**  
New data available for 07-07-2019 10:49 AM EDT; update y...

07/08/19, 08:31  
**New Location Data Available**  
New data available for 07-08-2019 08:31 AM EDT; update y...

07/12/19, 08:43  
**New Location Data Available**  
New data available for 07-12-2019 08:43 AM EDT; update y...














# Specific GPS location















4:14









My Location



Compare 2



Notifications



Geographic  
Coordinates

Enter the latitude and longitude below to find a new location

Latitude

Deg°

Min'

Sec"

N


Longitude


Deg°

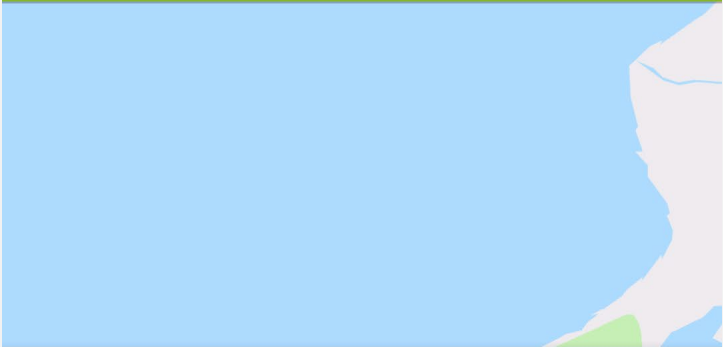
Min'

Sec"

W

 Select to Compare

 Mark Location





123—


456┐





789⌫





,0.→









   

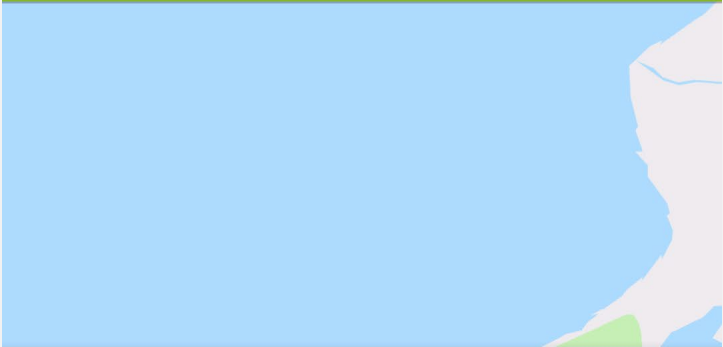
 My Location  2 Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location








Latitude °  " N





Longitude   " W





 Select to Compare  Mark Location



1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . →

       4:15



   

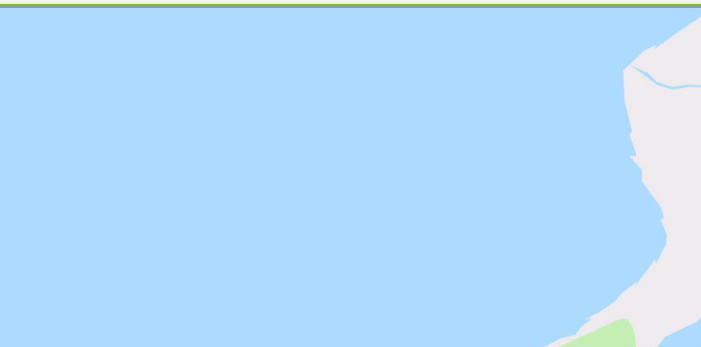
 My Location  Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location


Latitude °  Min'  Sec" N








Longitude  Deg°  Min'  Sec" W





 Select to Compare  Mark Location







1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . →



       4:15



   

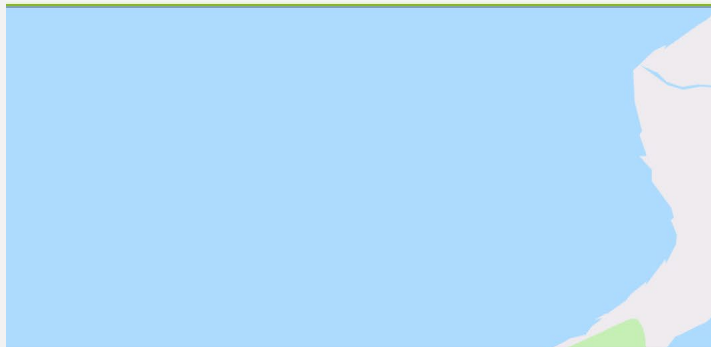
 My Location  Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location


Latitude    N








Longitude    W





 Select to Compare  Mark Location







1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . →



       4:15



   

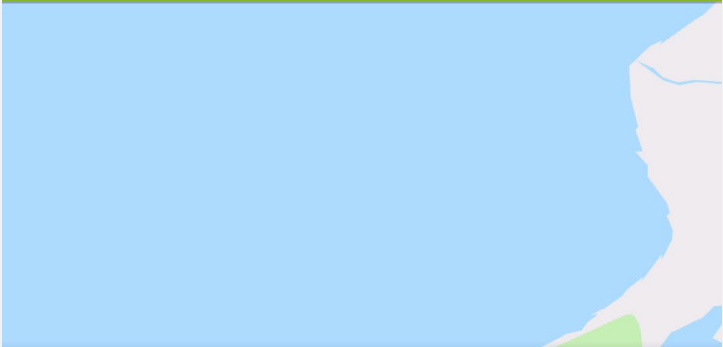
 My Location  Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location


Latitude    N

Longitude    W








 Select to Compare  Mark Location











1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . →





       4:15



   


 My Location  2 Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location


Latitude    N








Longitude    W





 Select to Compare  Mark Location







1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . →



       4:15



   

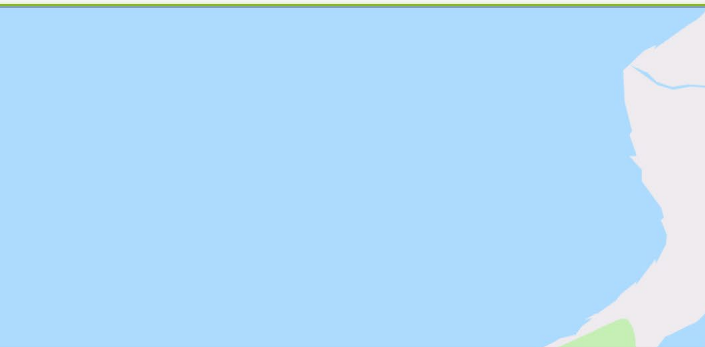
 My Location  Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location


Latitude    N








Longitude    W





 Select to Compare  Mark Location







1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . →



       4:15



   

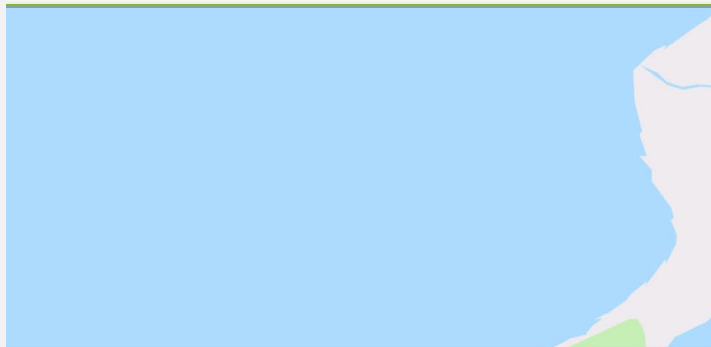
 My Location  Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location


Latitude ° ' " N





Longitude °  Min'  Sec" W





 Select to Compare  Mark Location



1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . →





   

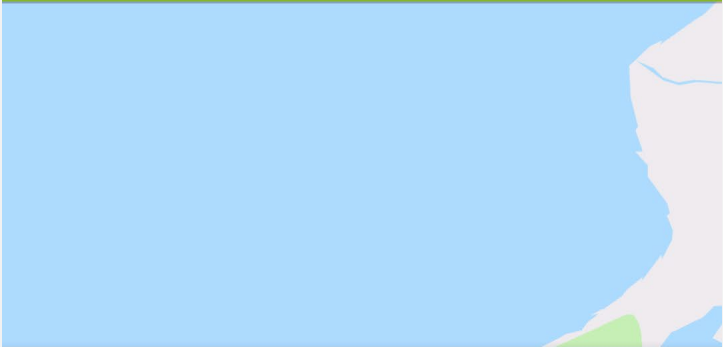
 My Location  **2** Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location





Latitude    N





Longitude    W

 Select to Compare  Mark Location



1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . →



   

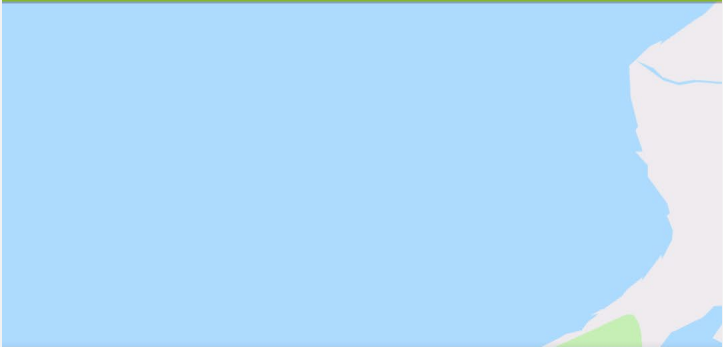
 My Location  2 Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location

Latitude ° ' " N


Longitude ° '  Sec" W





 Select to Compare  Mark Location



1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . →

☰ 📶 ⚙️ 🔋 4:15



 ? 🔍 ⚙️

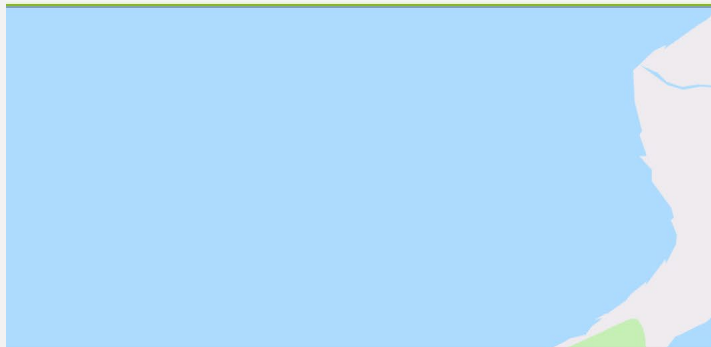
 My Location  2 Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location

Latitude ° ' " N

Longitude ° ' " W








 Select to Compare  Mark Location











1 2 3 -  
4 5 6 \_  
7 8 9 ⌫  
, 0 . ✓

▽ ○ □



       4:16



   

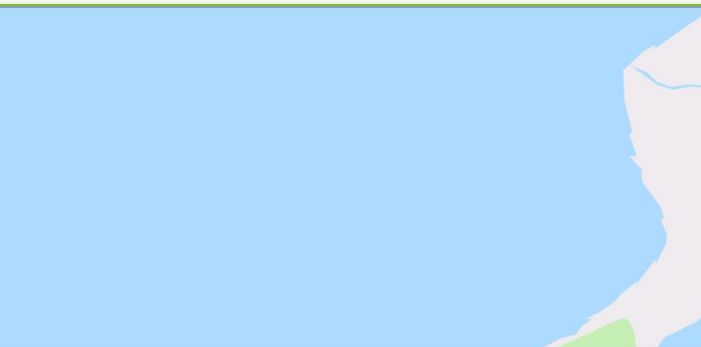
 My Location  Compare  Notifications  Geographic Coordinates

Enter the latitude and longitude below to find a new location


Latitude    N

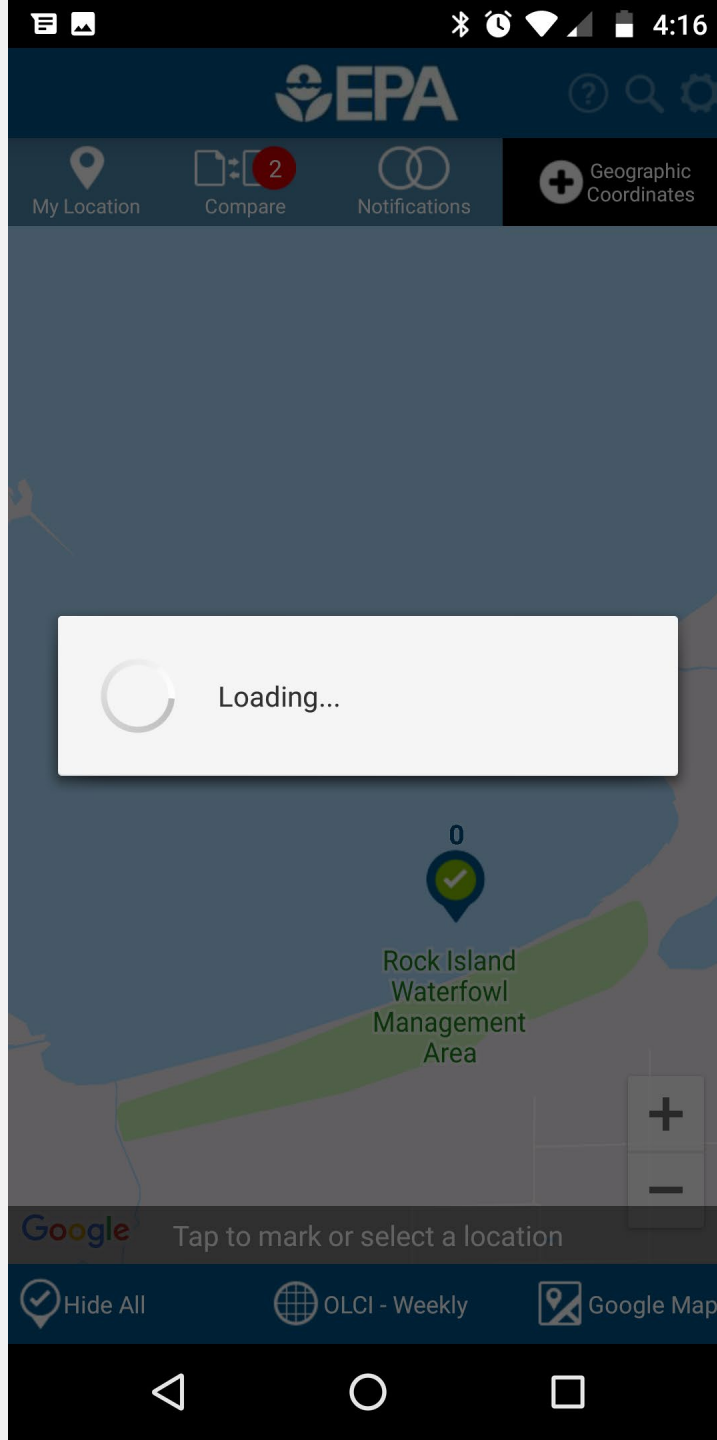
Longitude    W

 Select to Compare  Mark Location



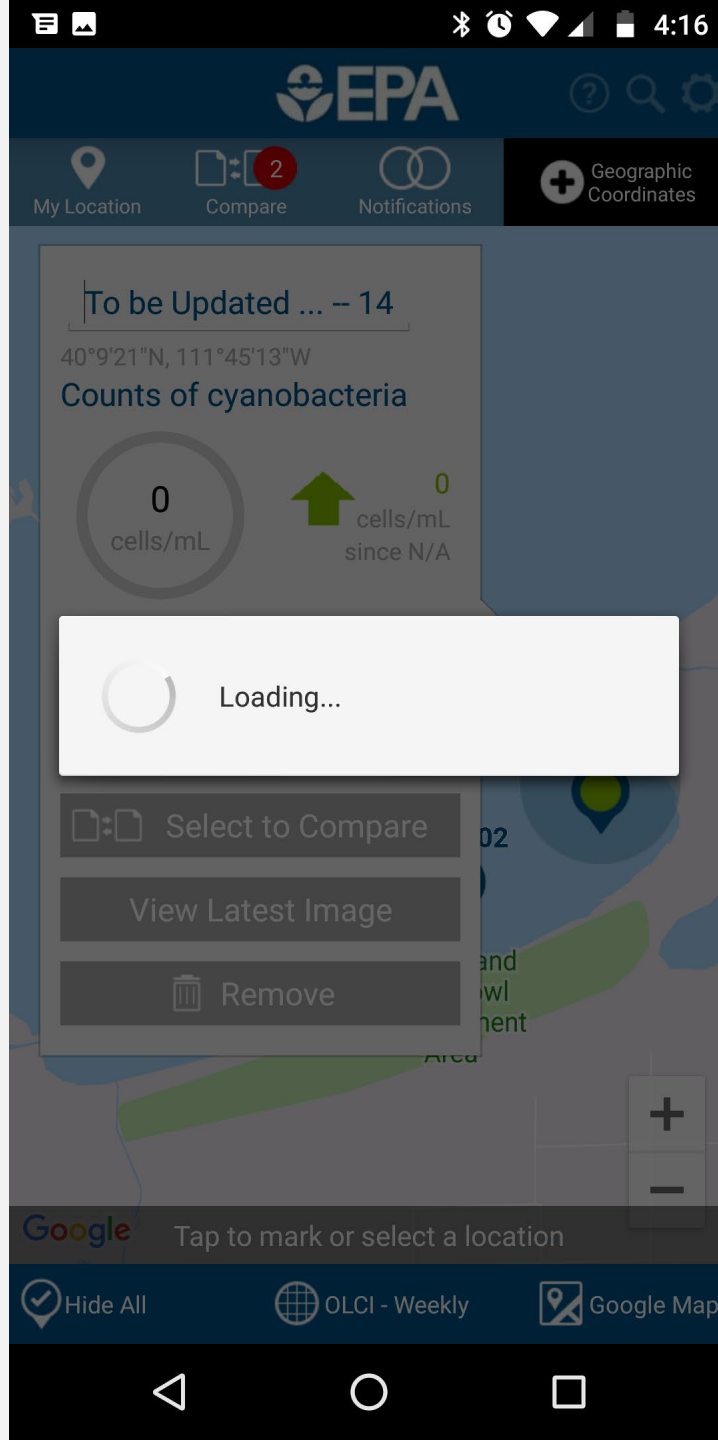
1 2 3 -  
4 5 6 \_  
7 8 9 ×  
, 0 . ✓

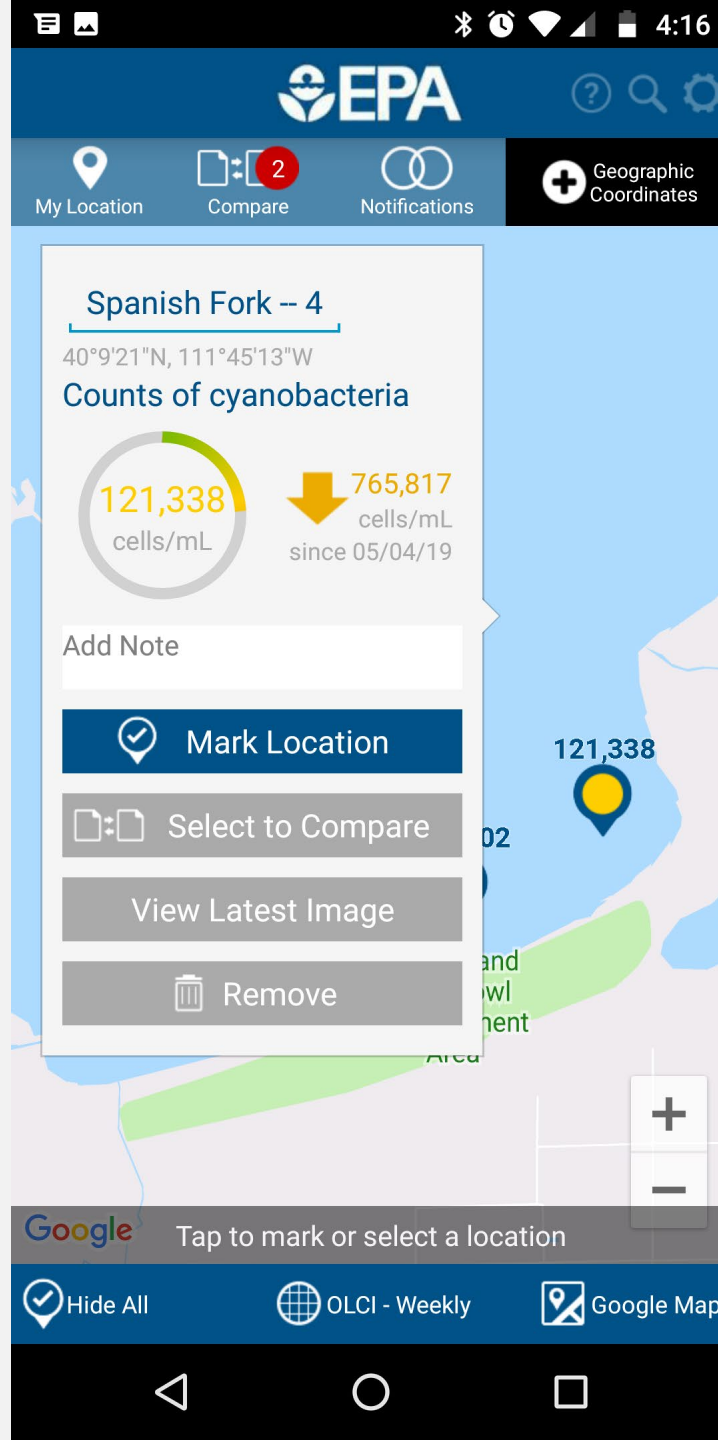


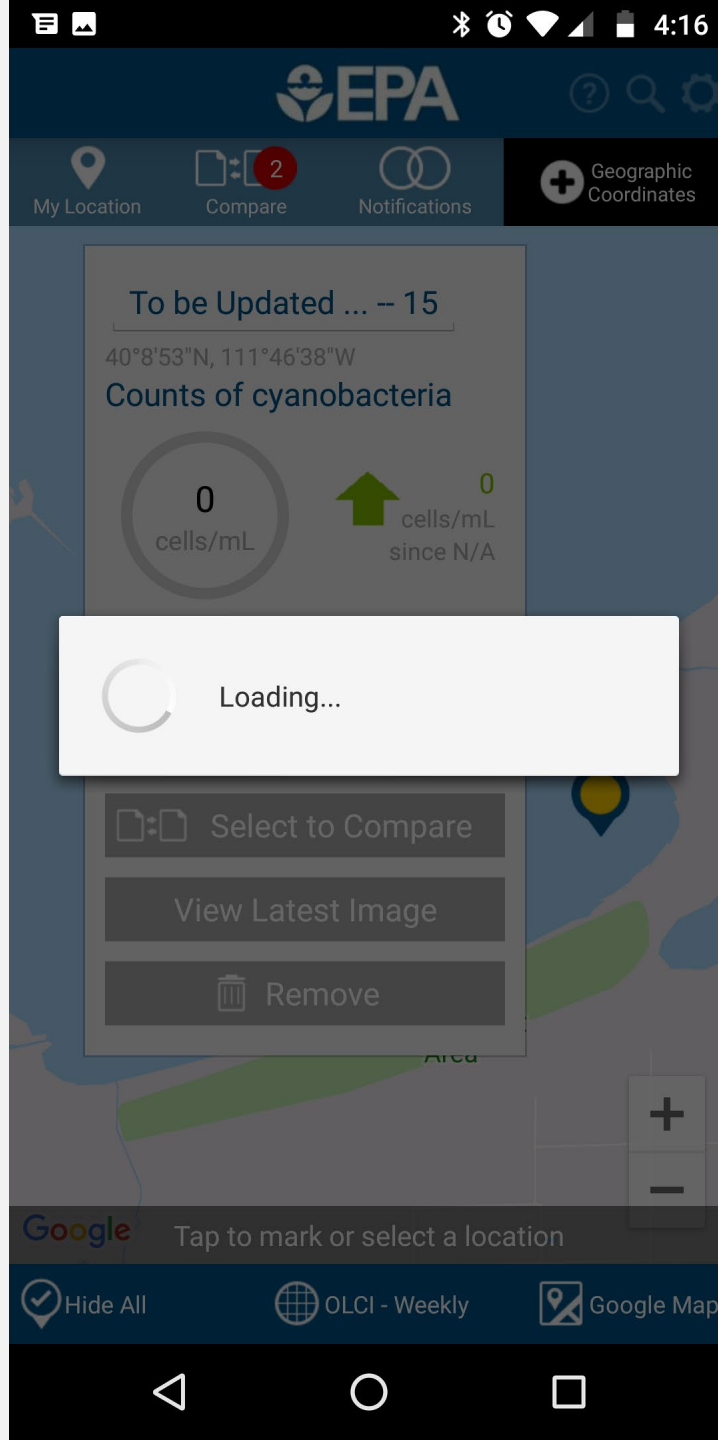




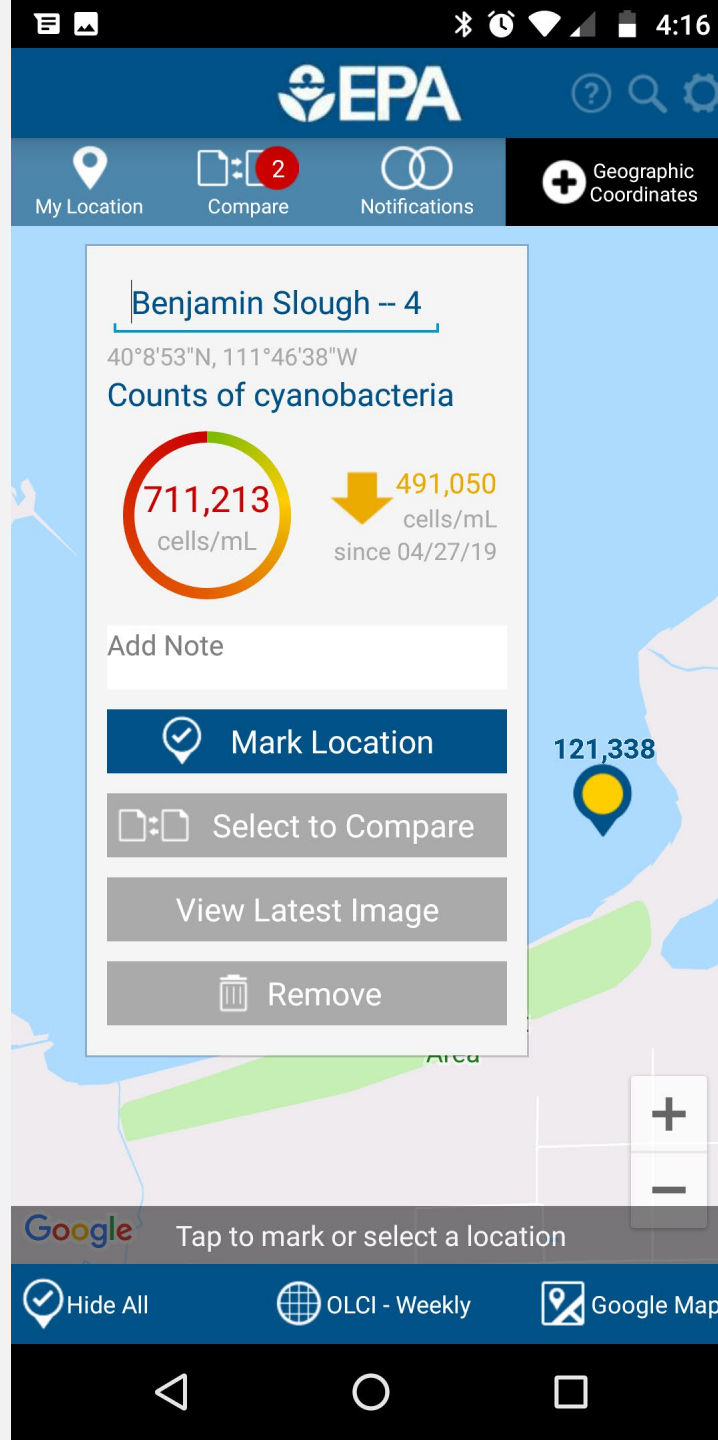
# Recreation area











Messages • now ▾

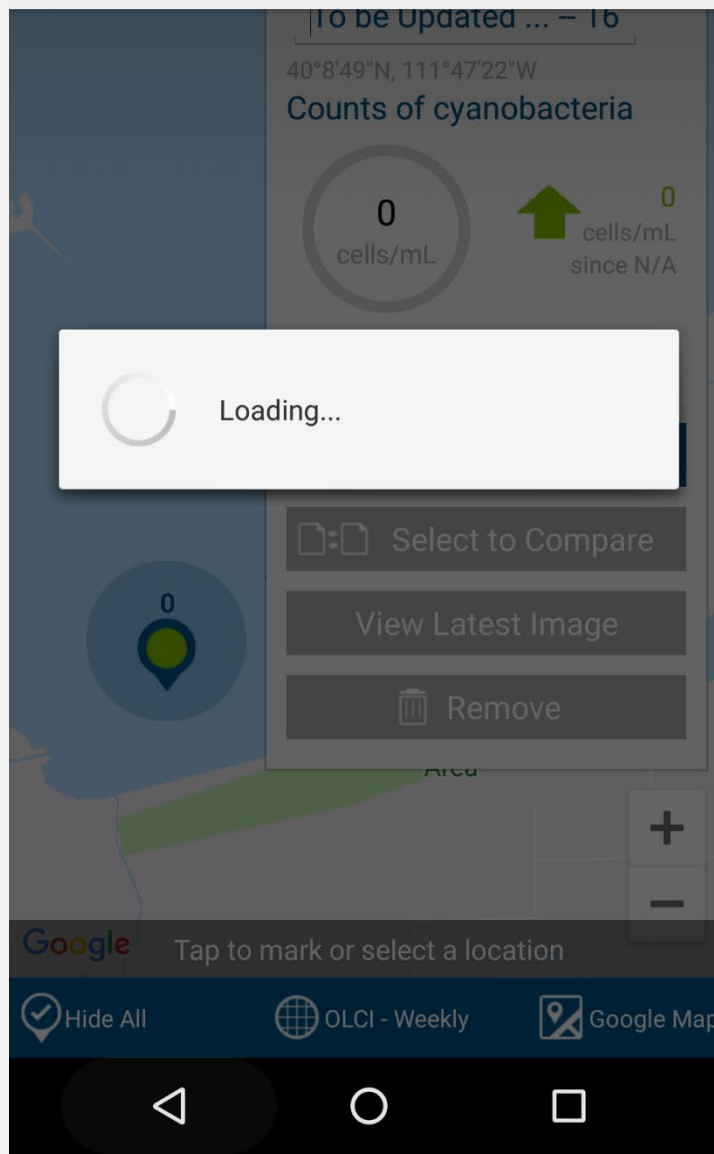
Kelly, Yoomi

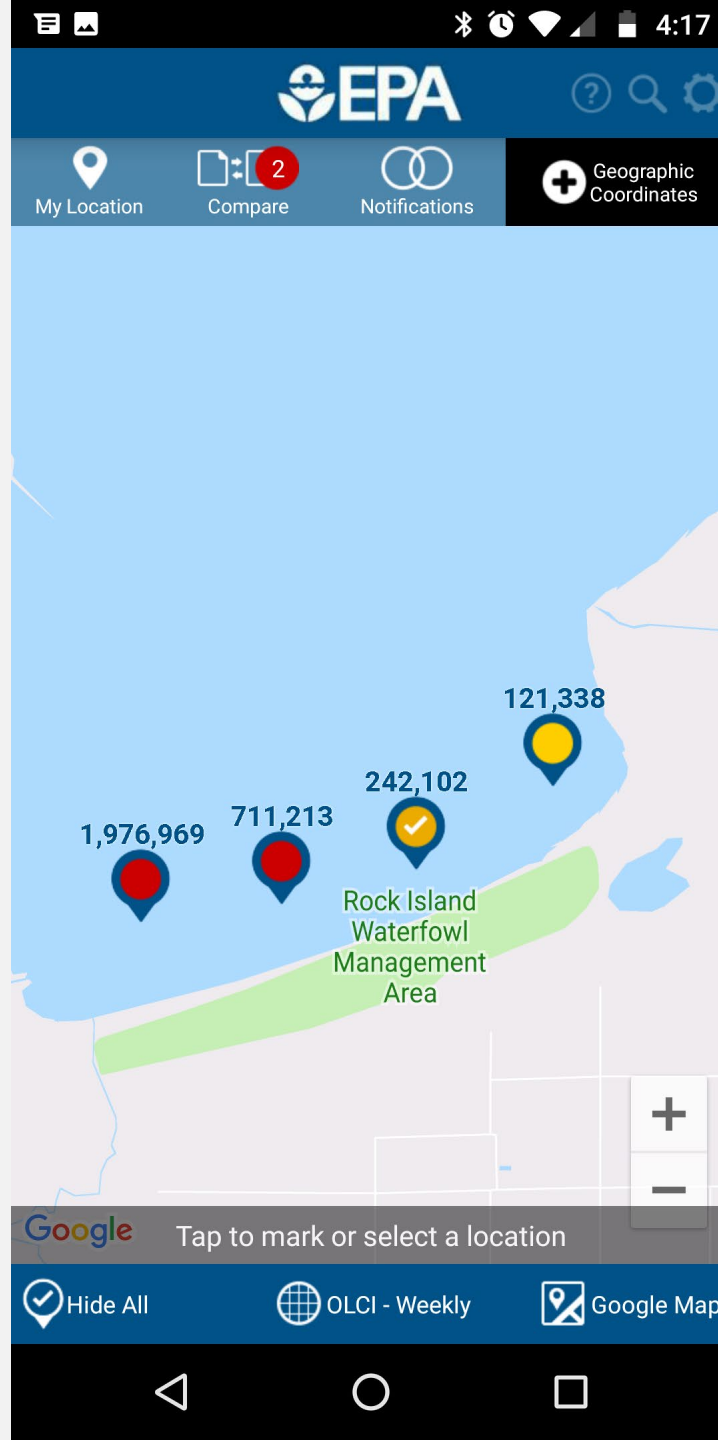
Yoomi Hi,...



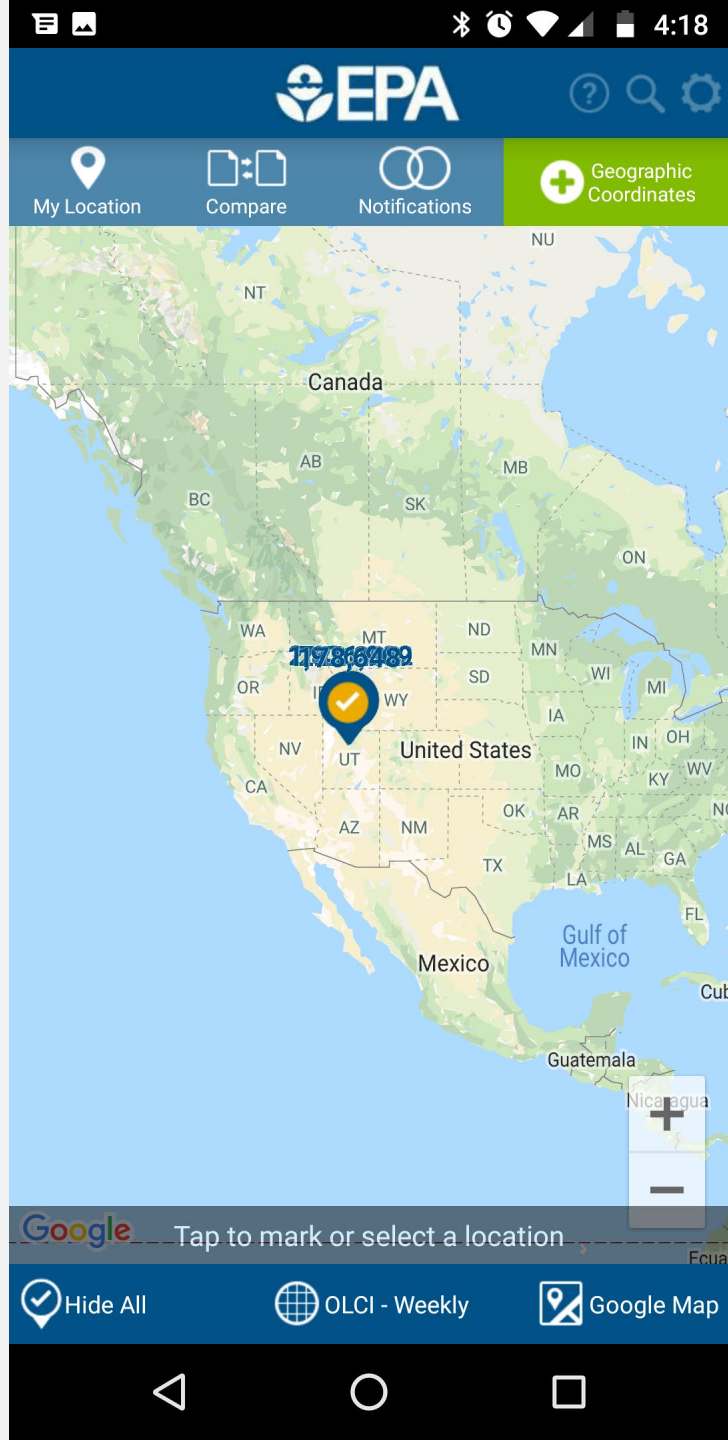
MARK AS READ

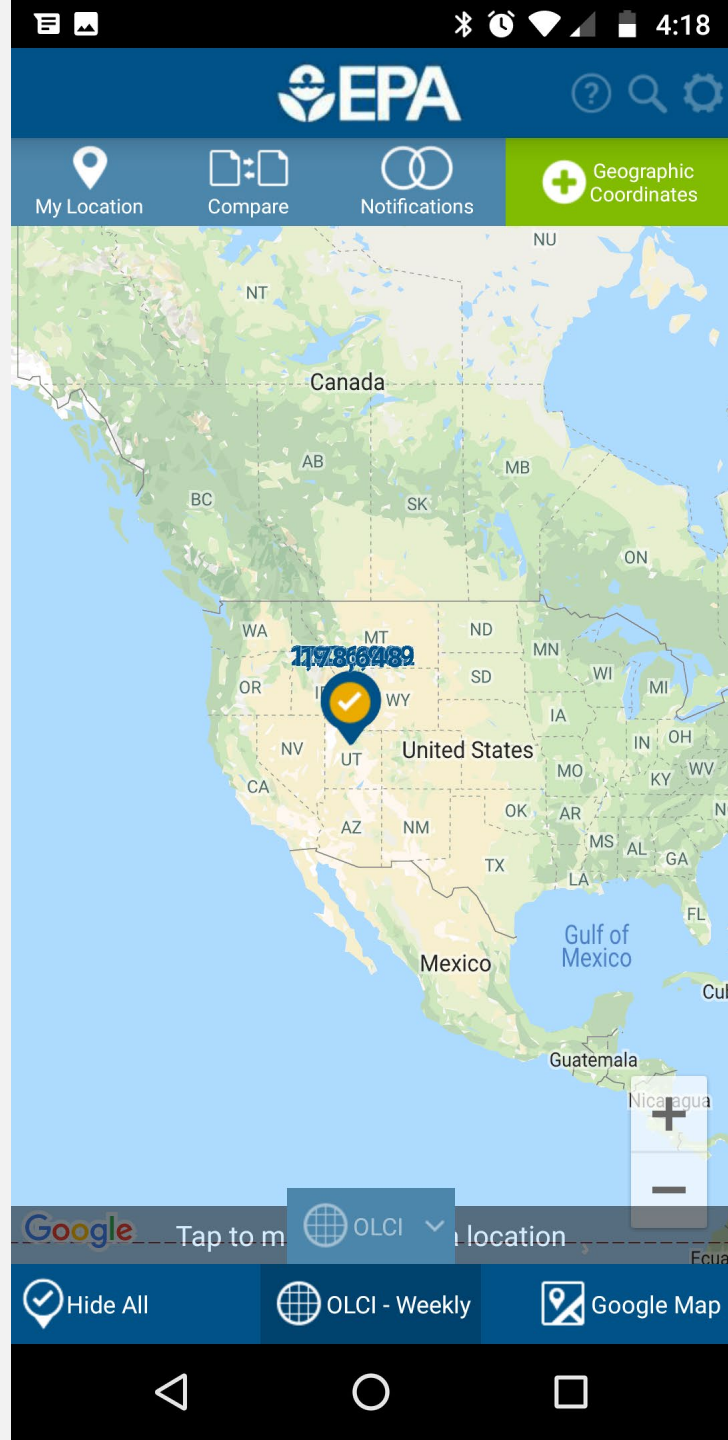
REPLY

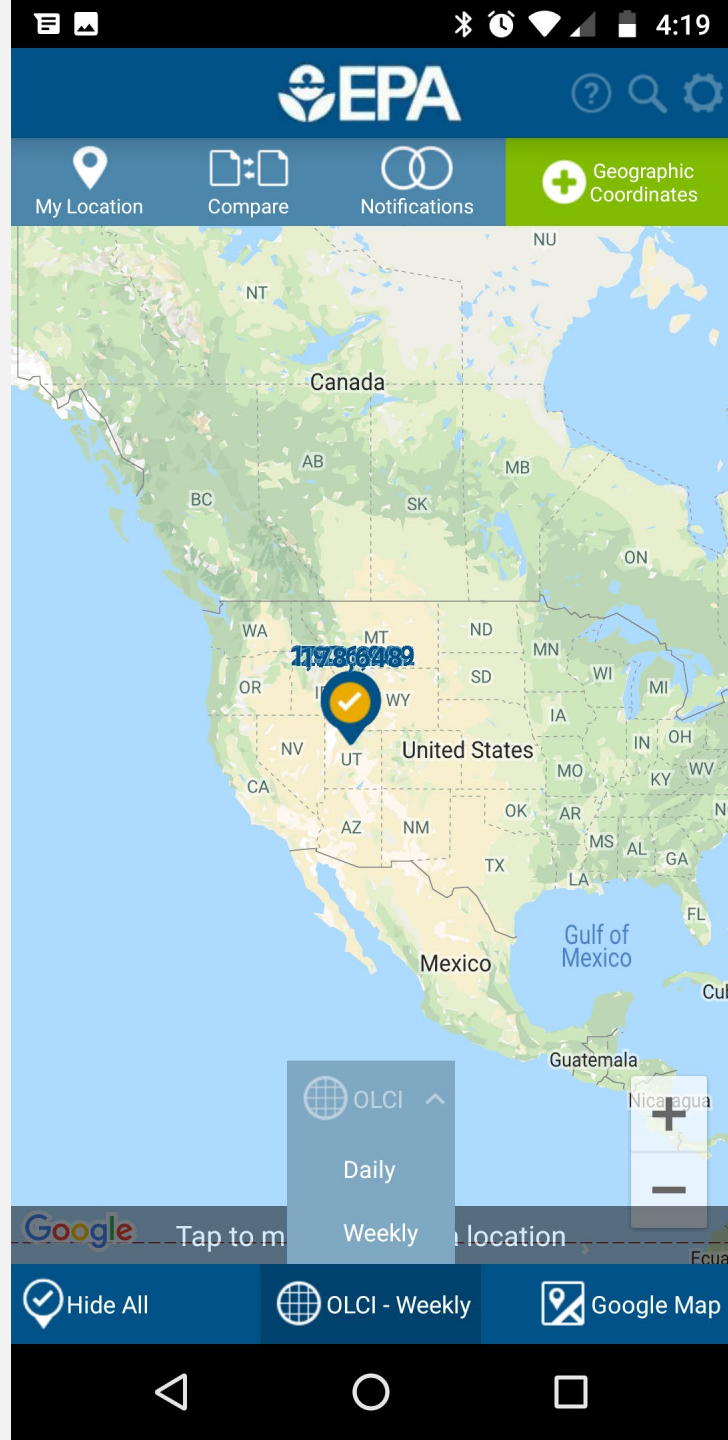




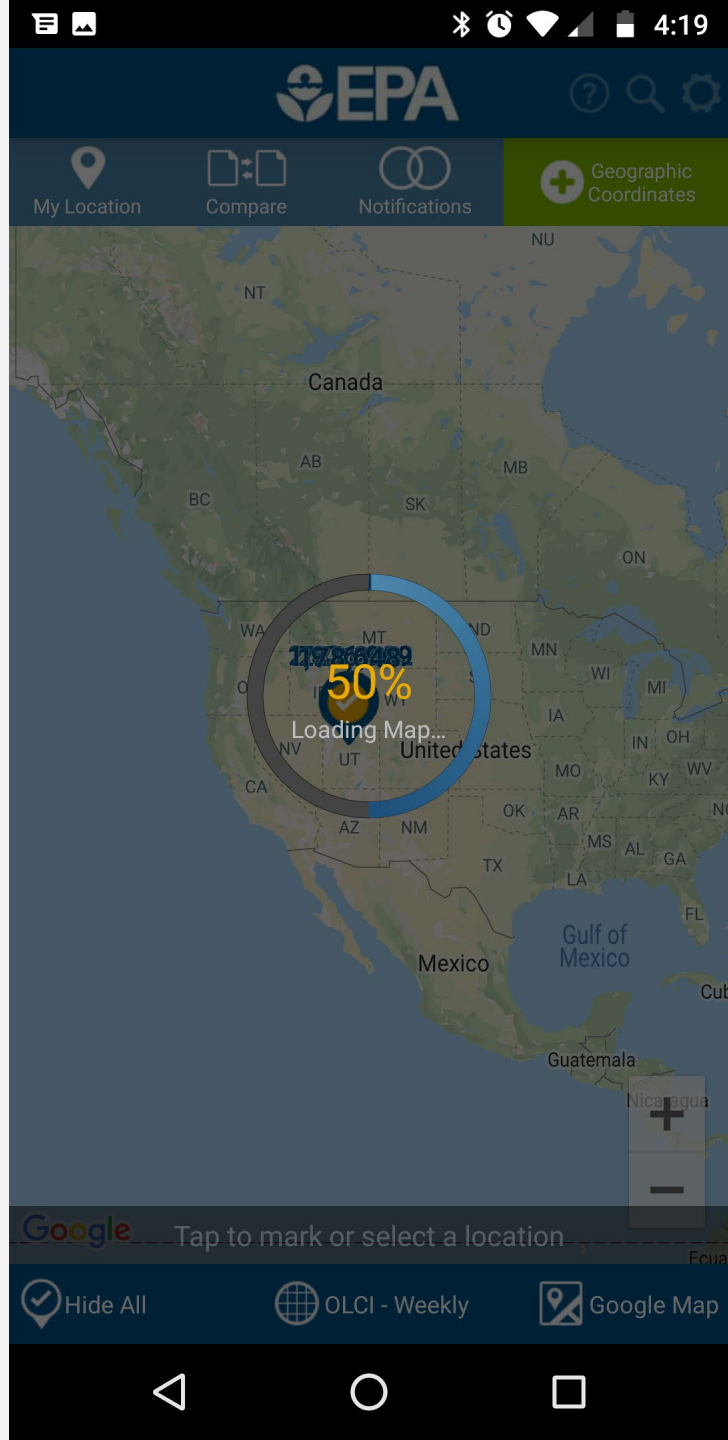
# Daily imagery for event responses

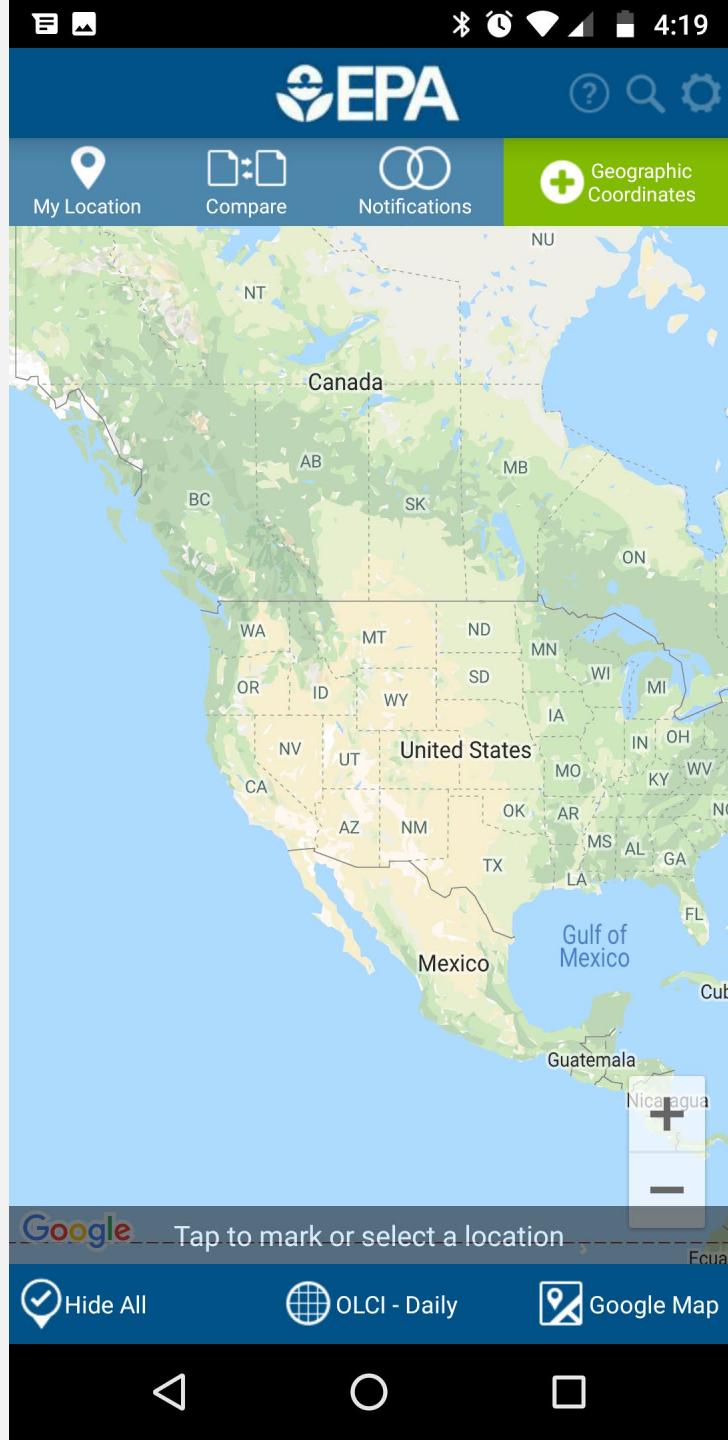


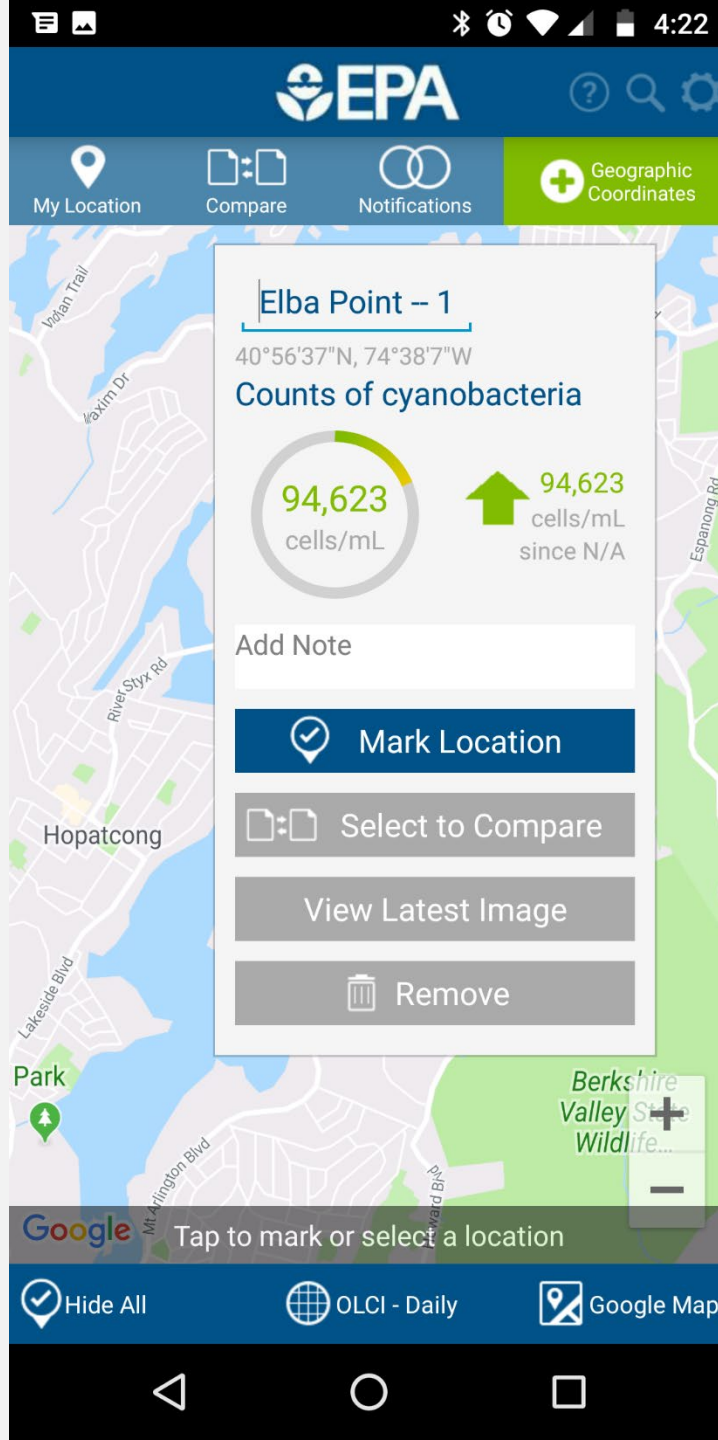


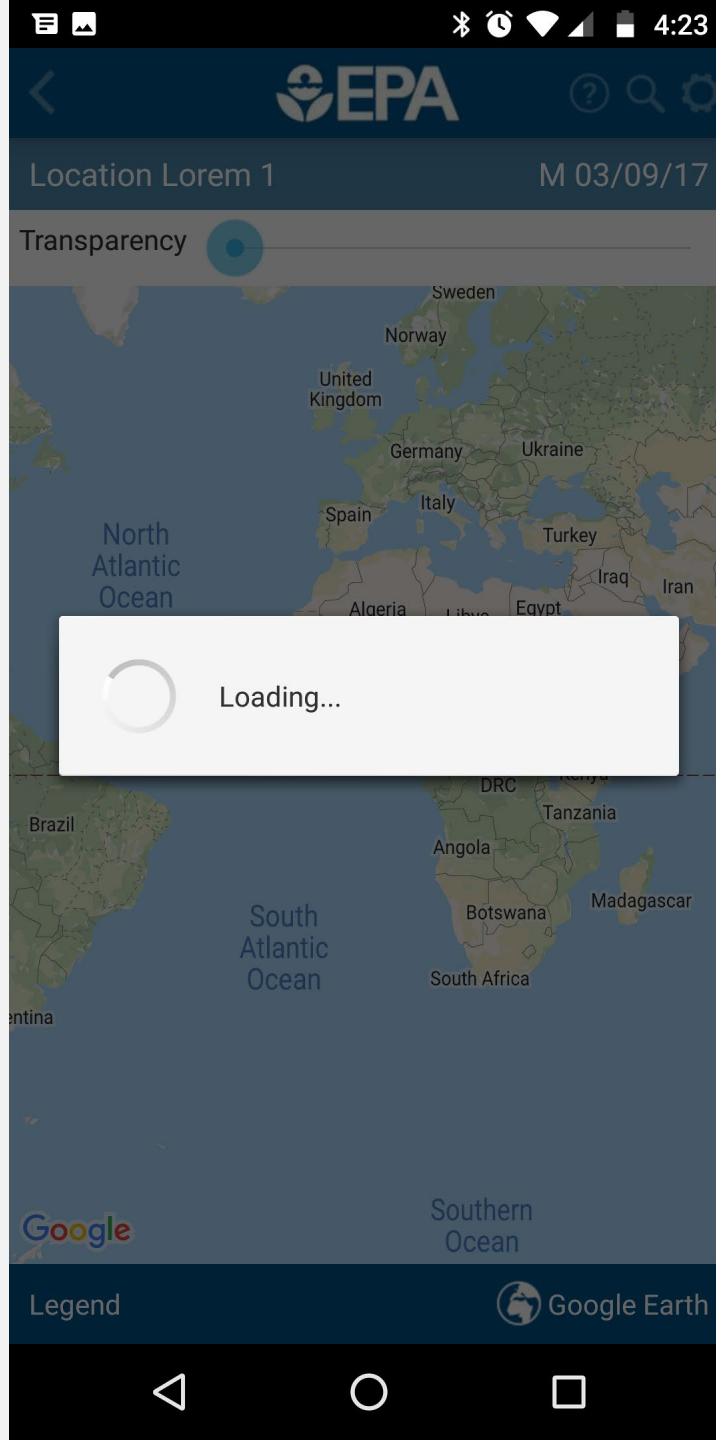


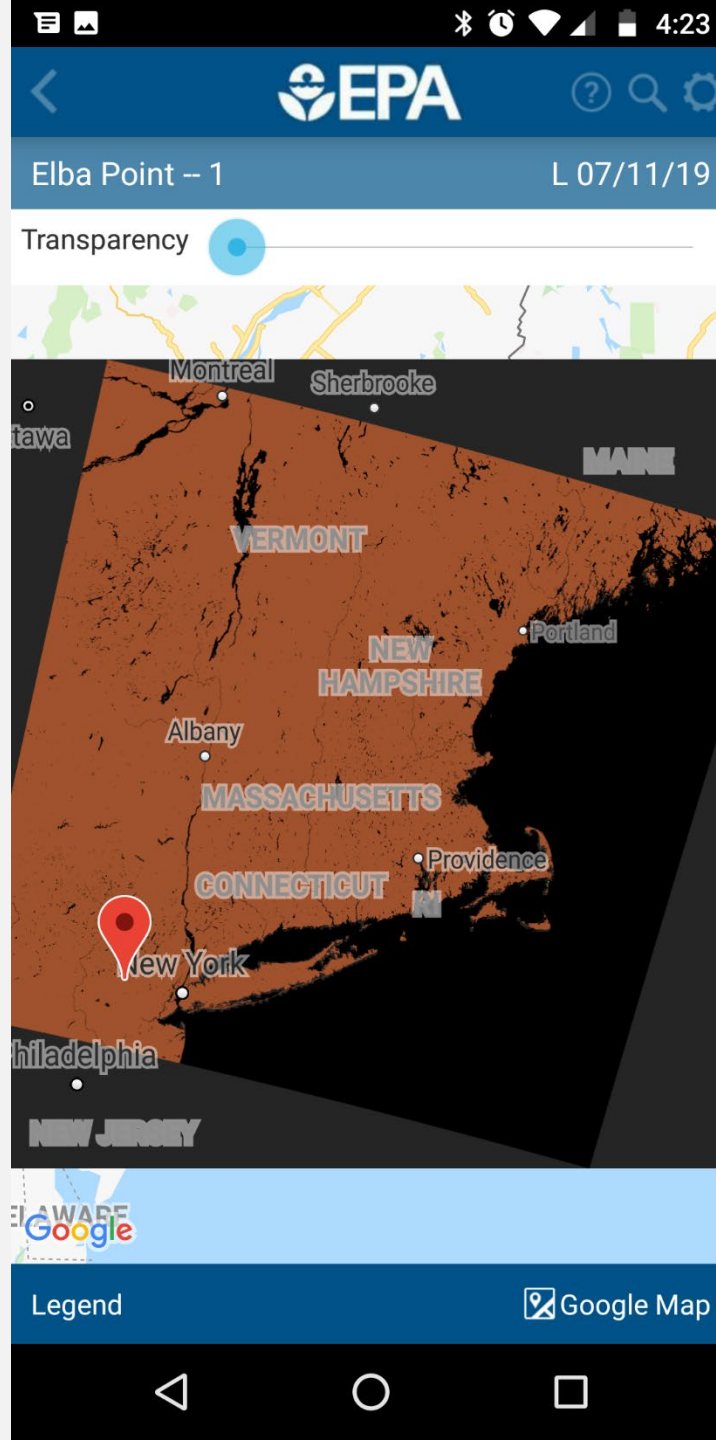




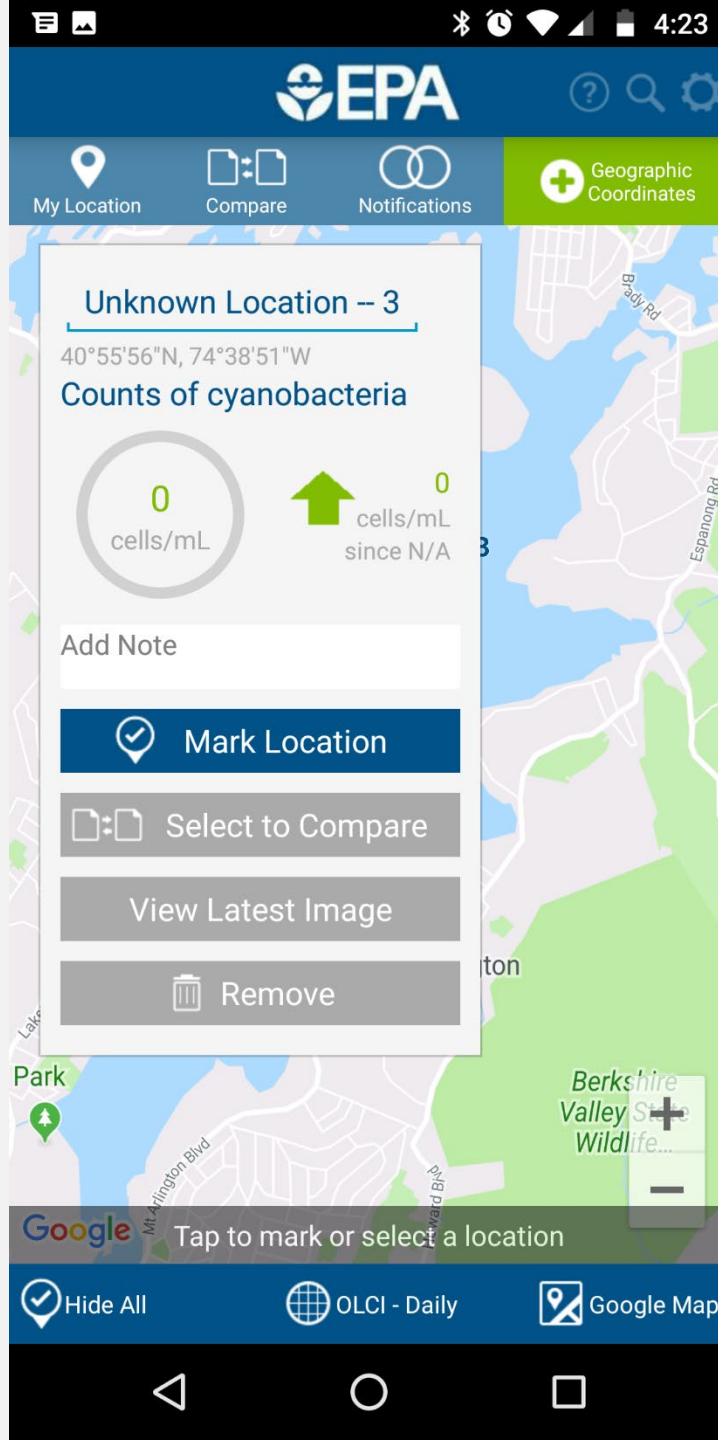




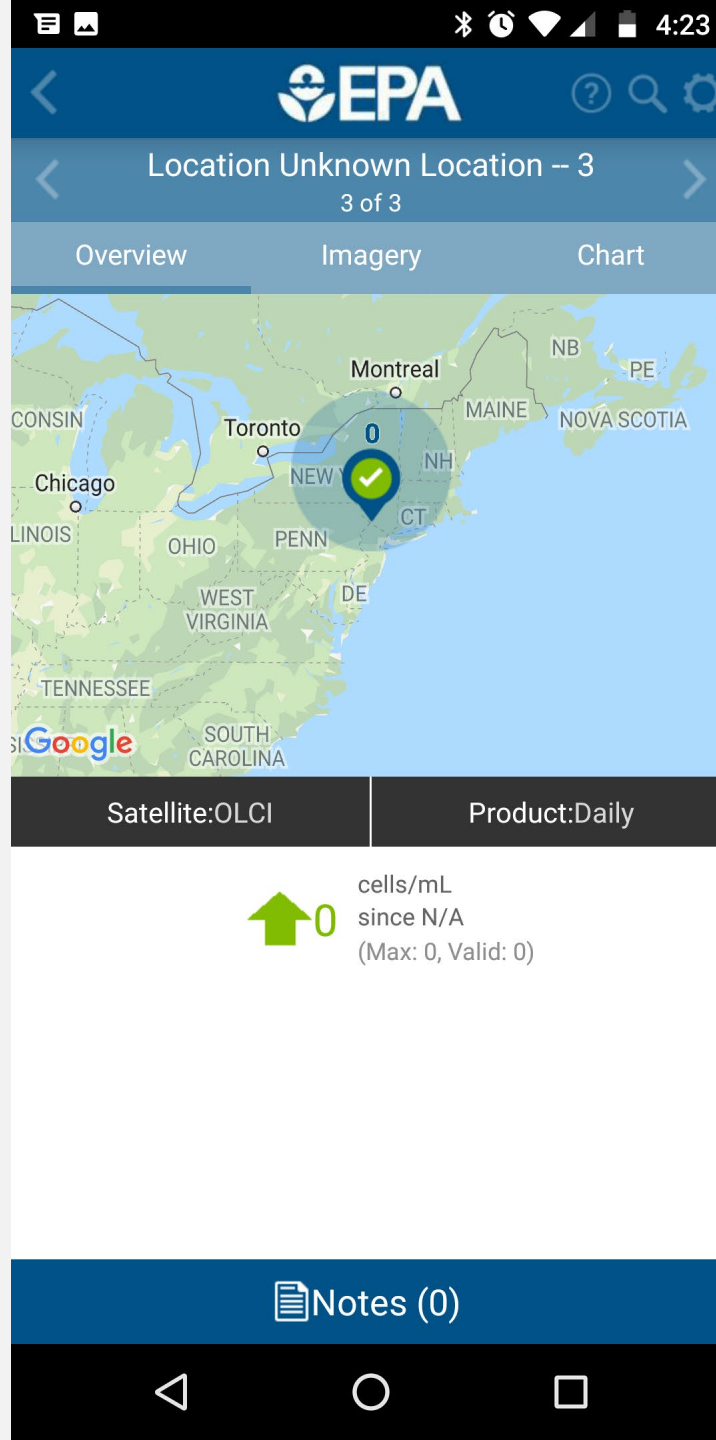




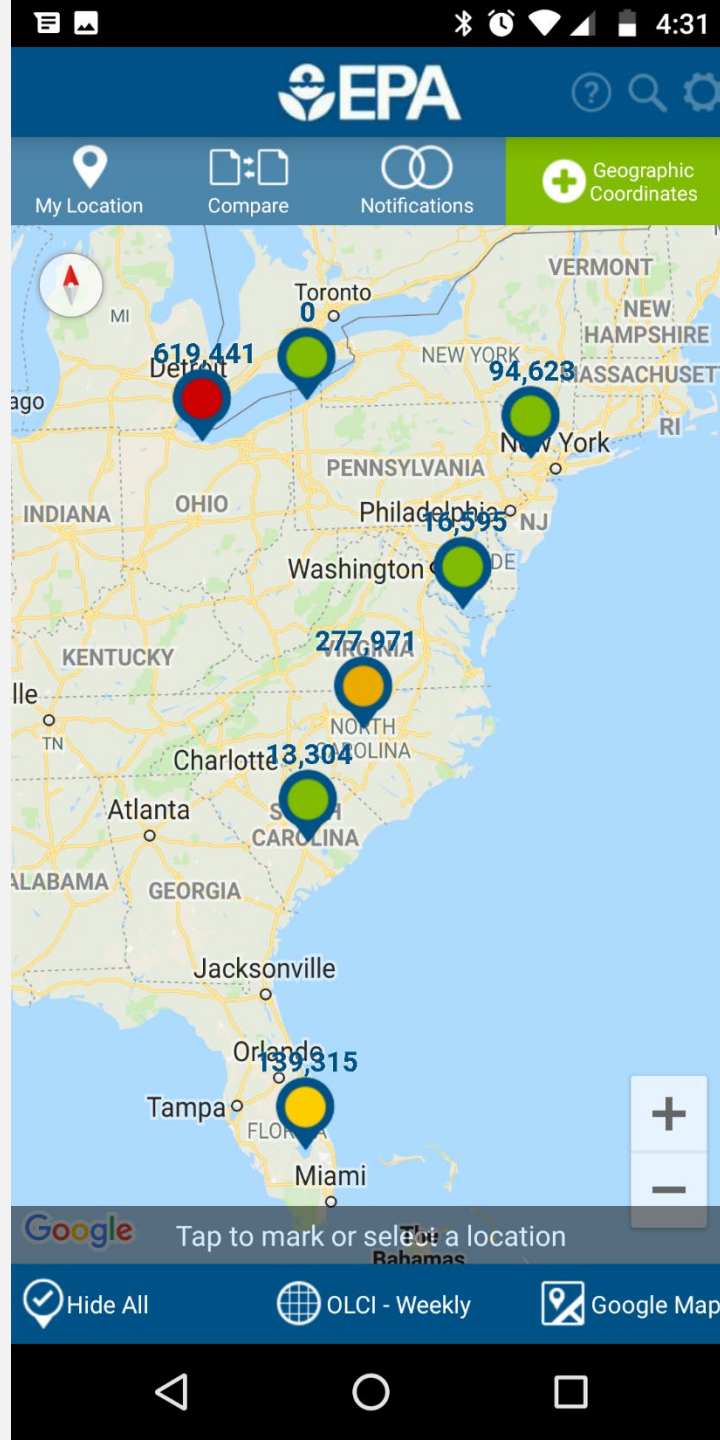
# No Data

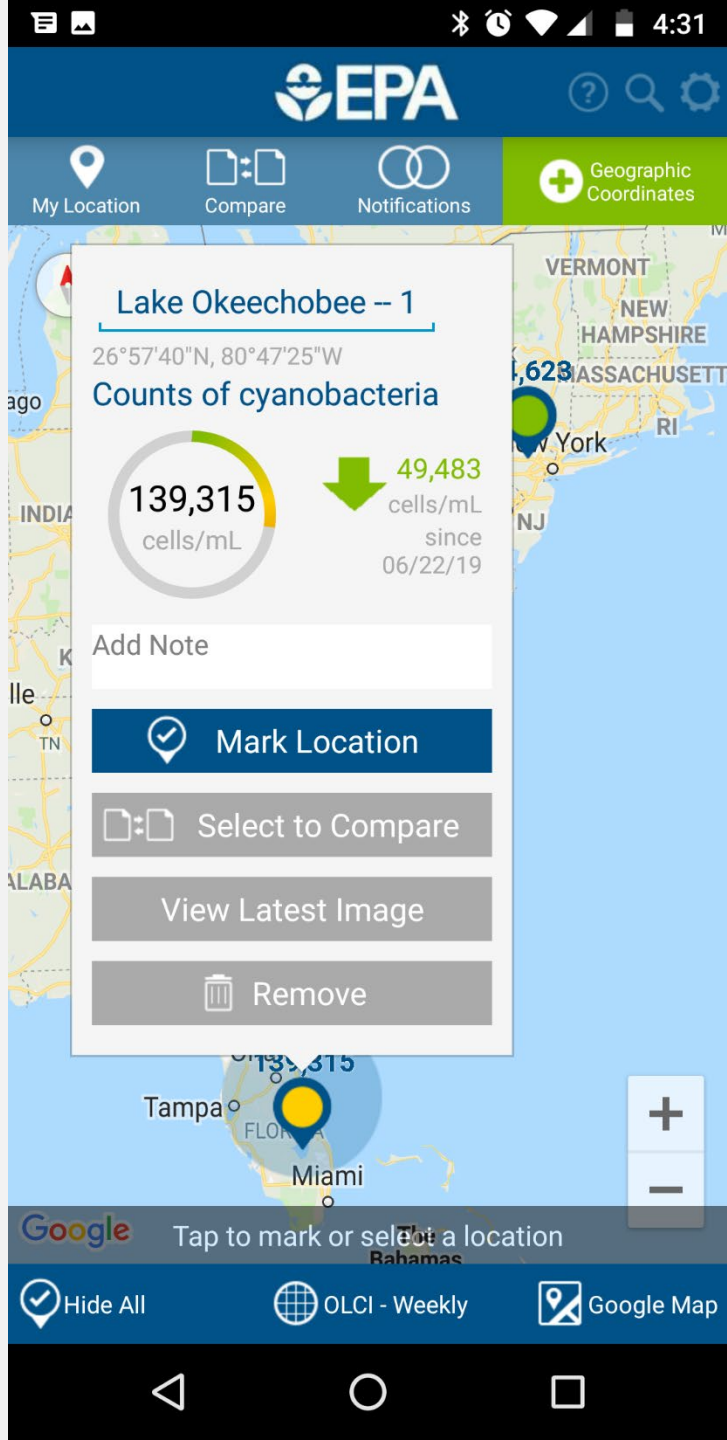


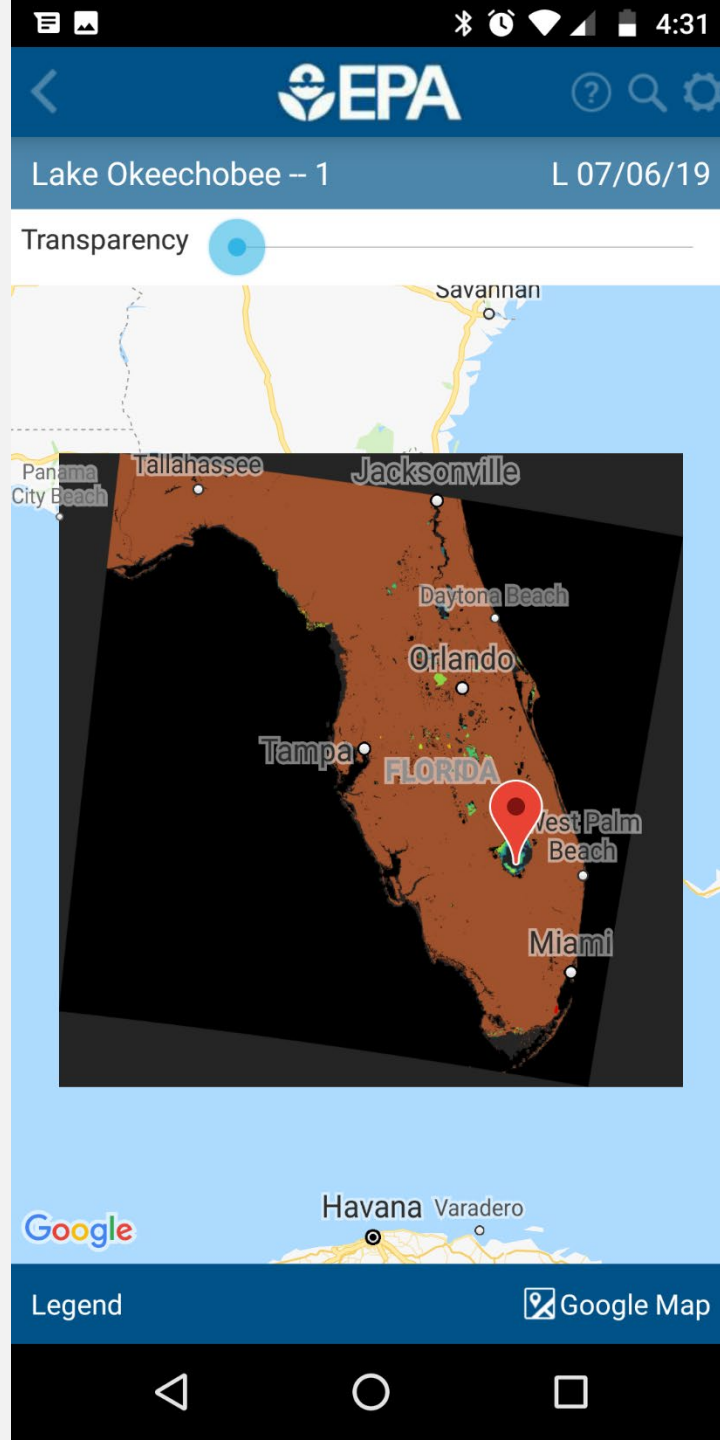


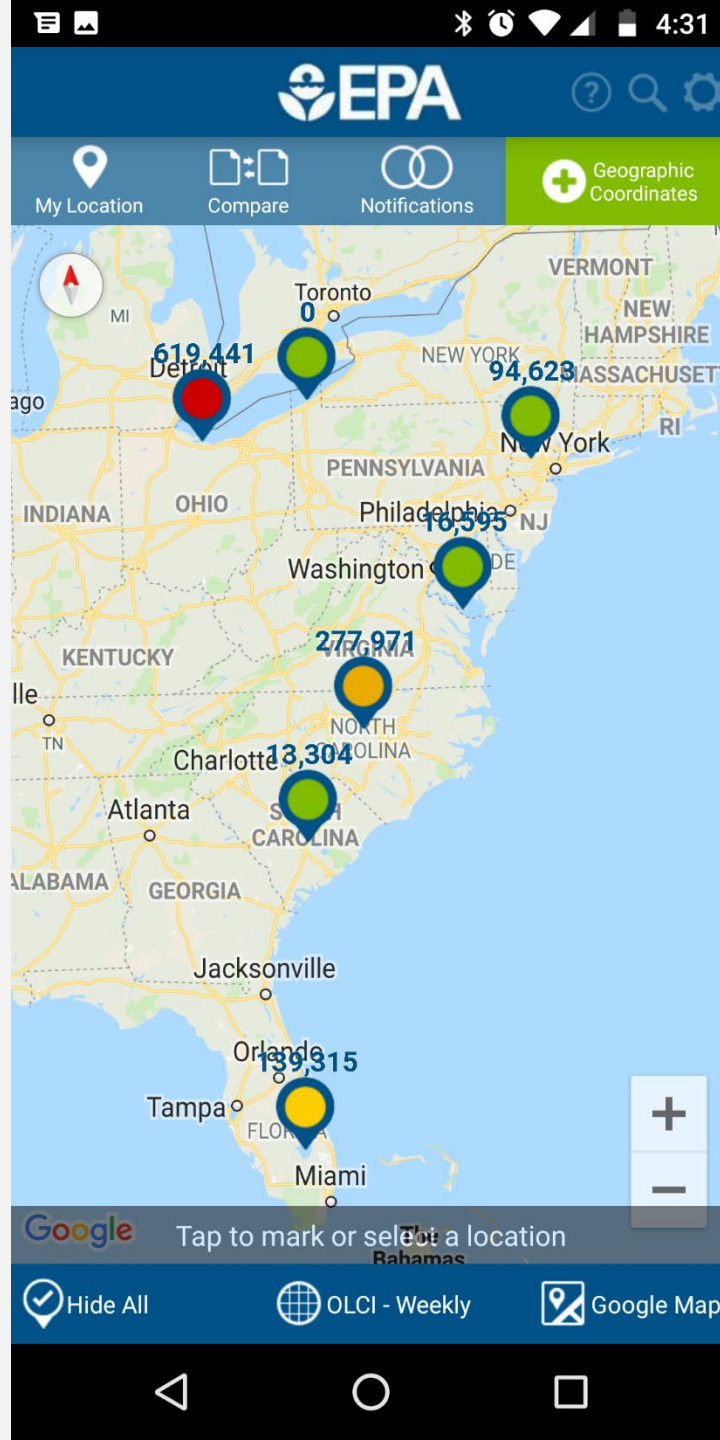


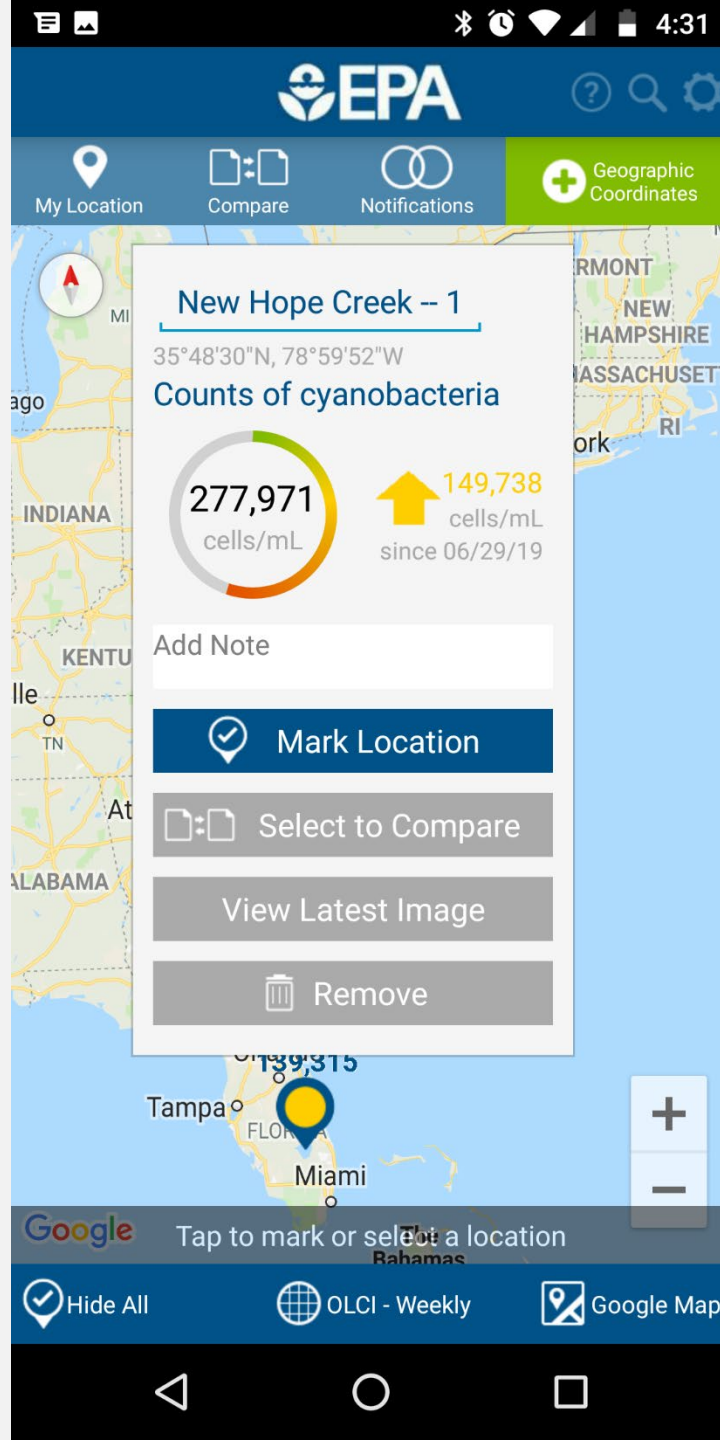
# View the country in minutes



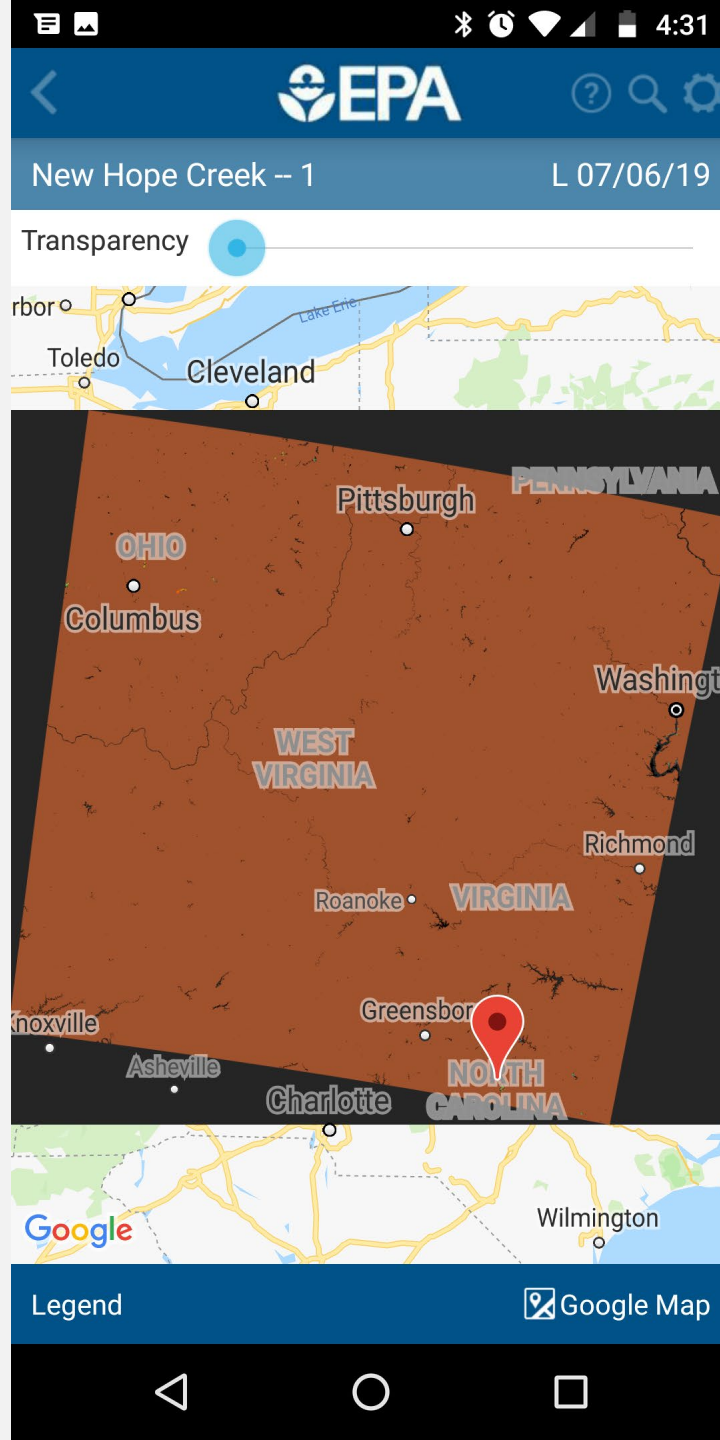


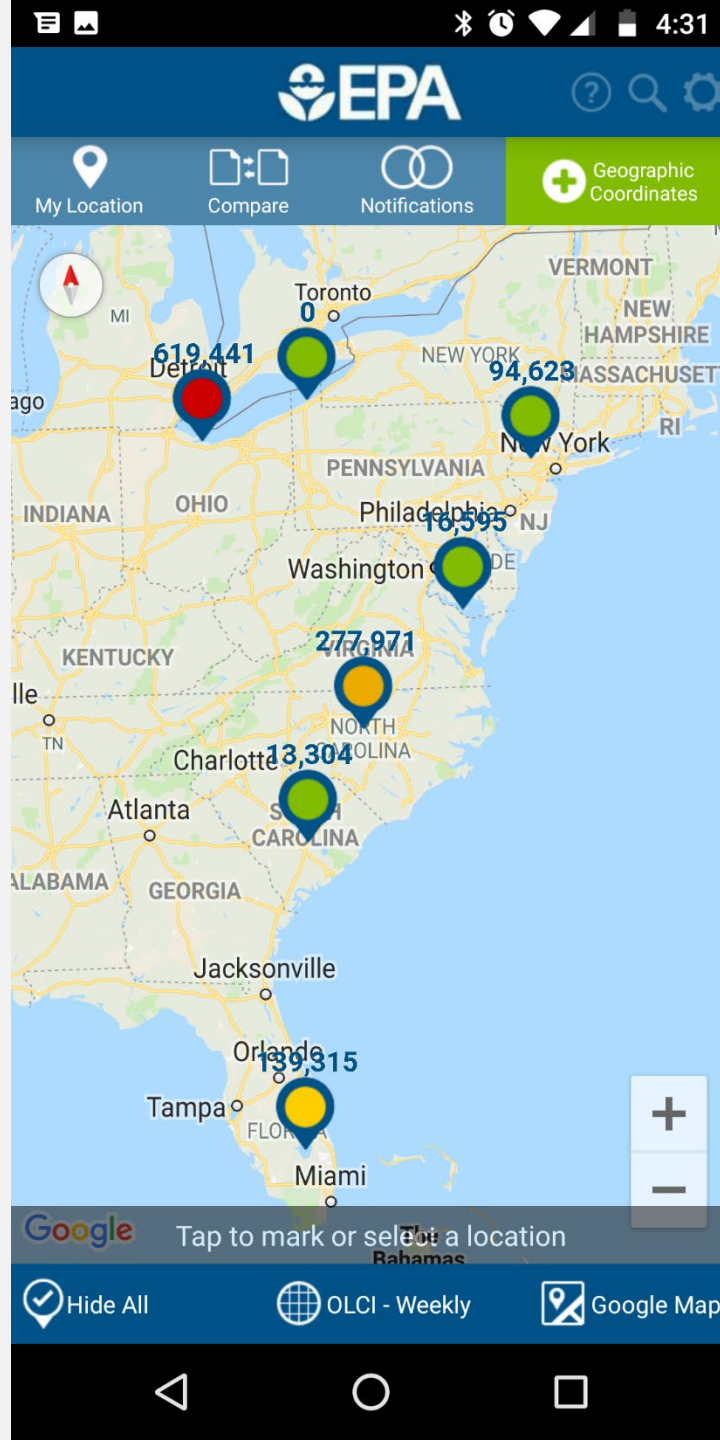


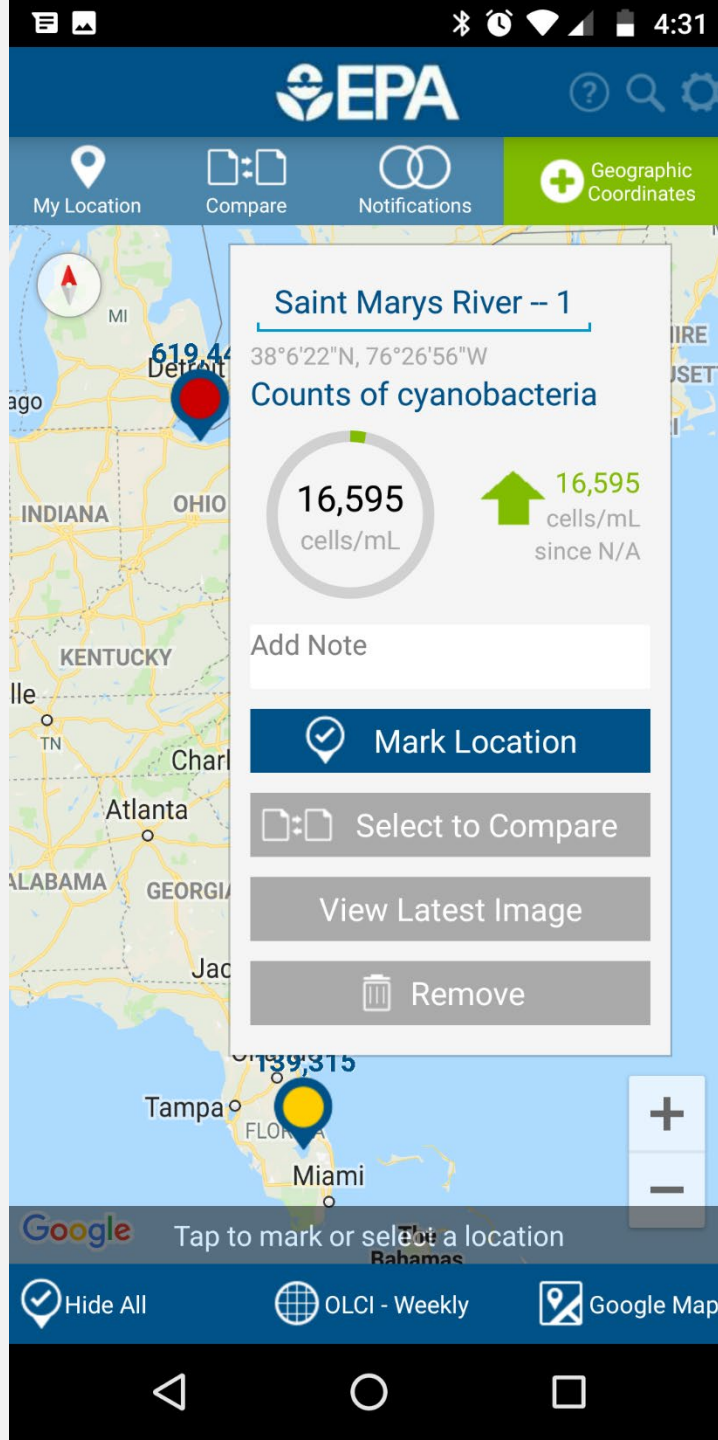


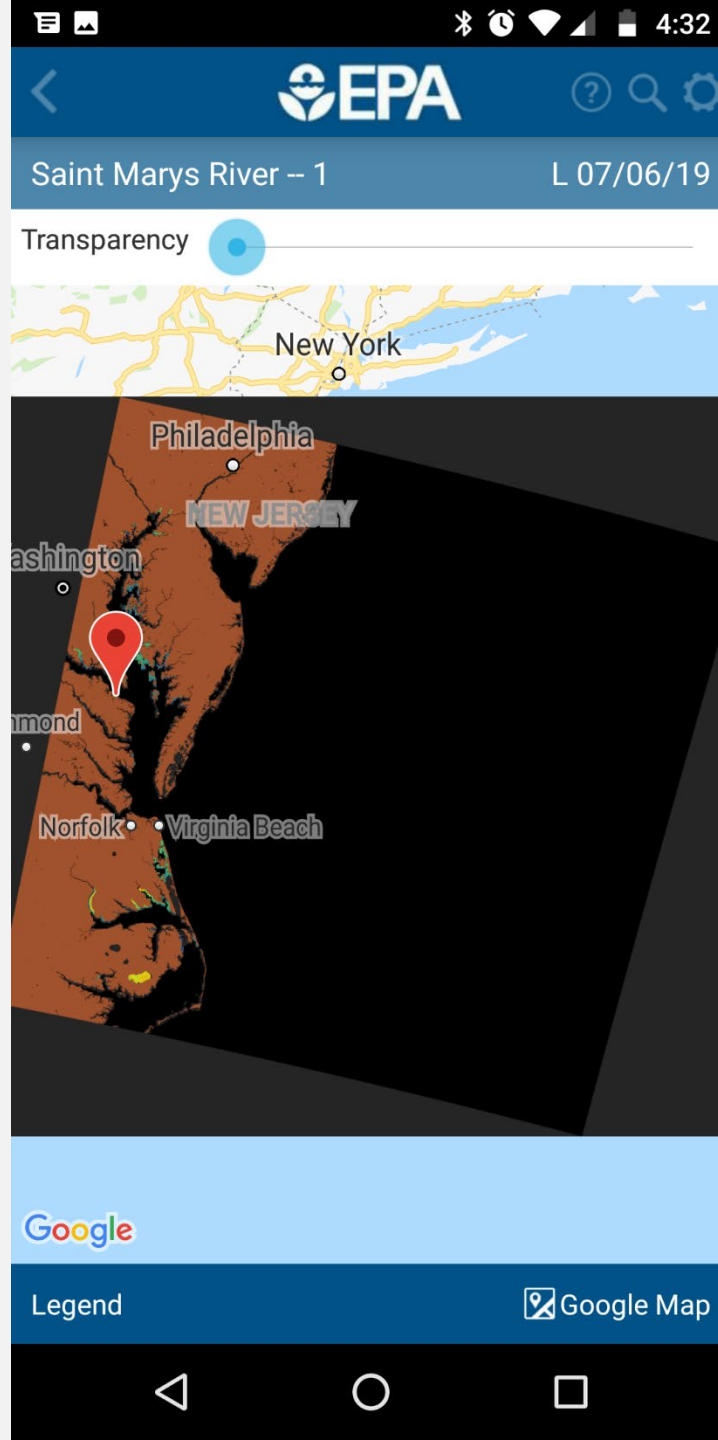


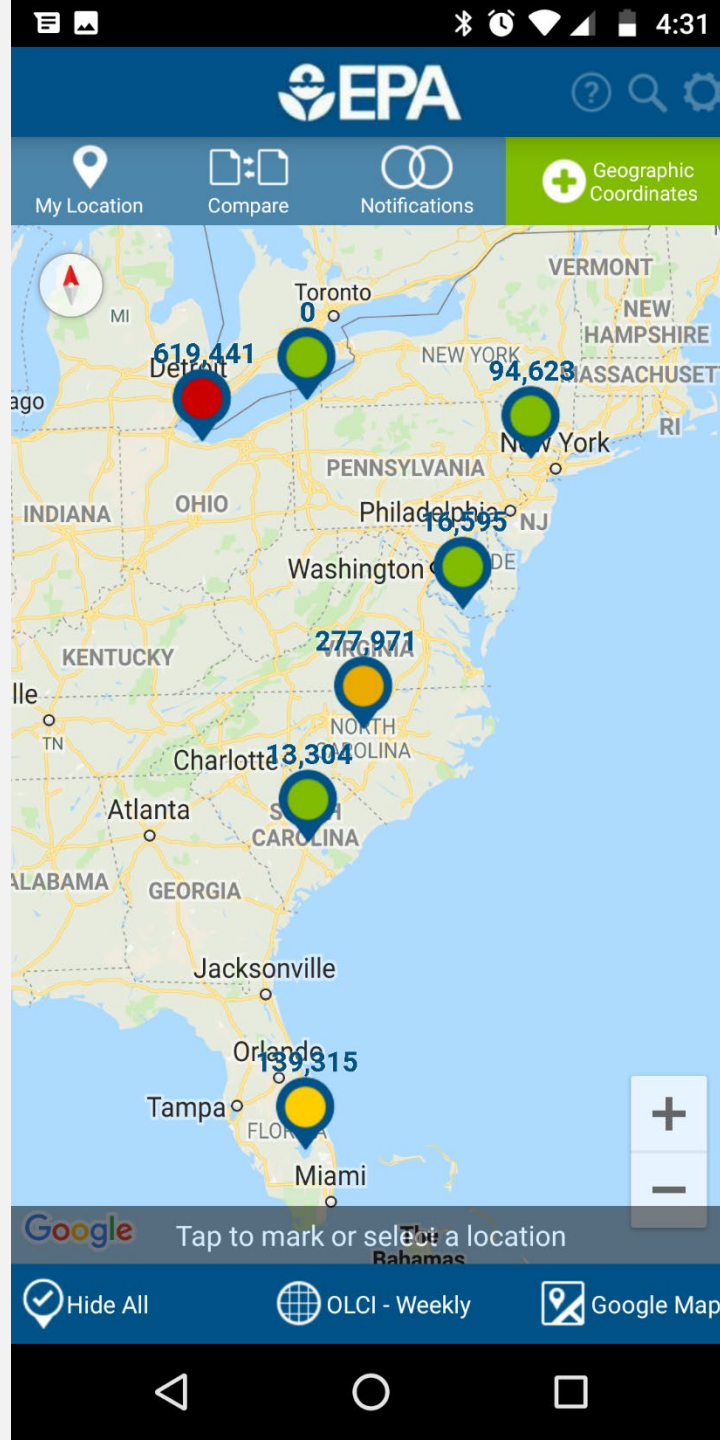




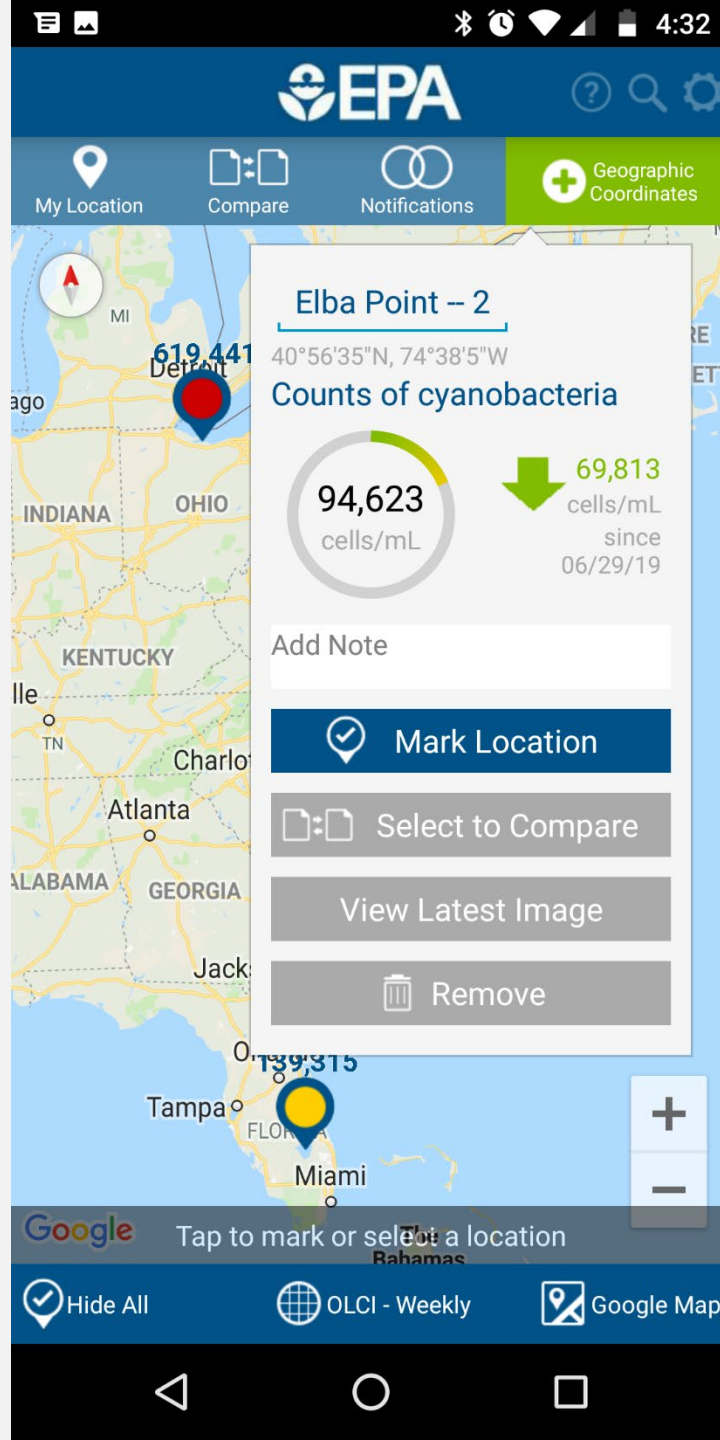


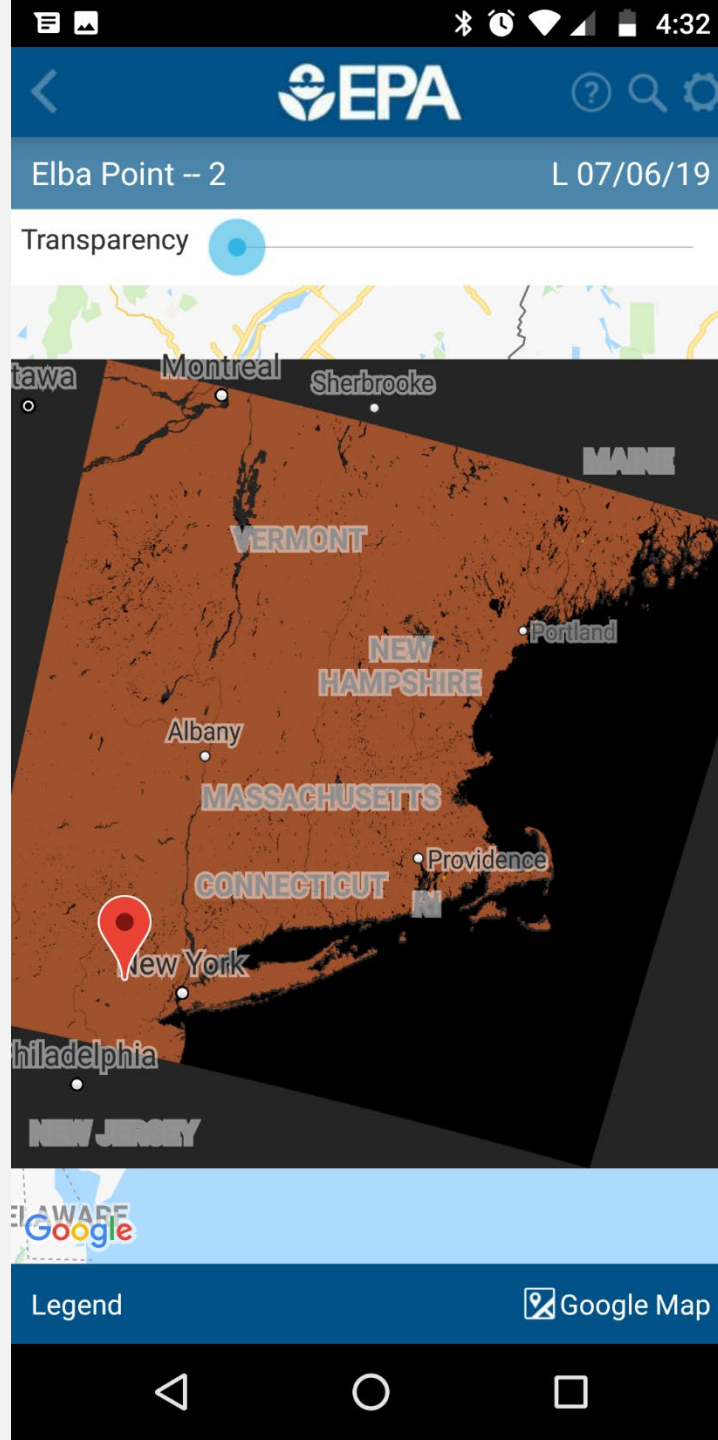




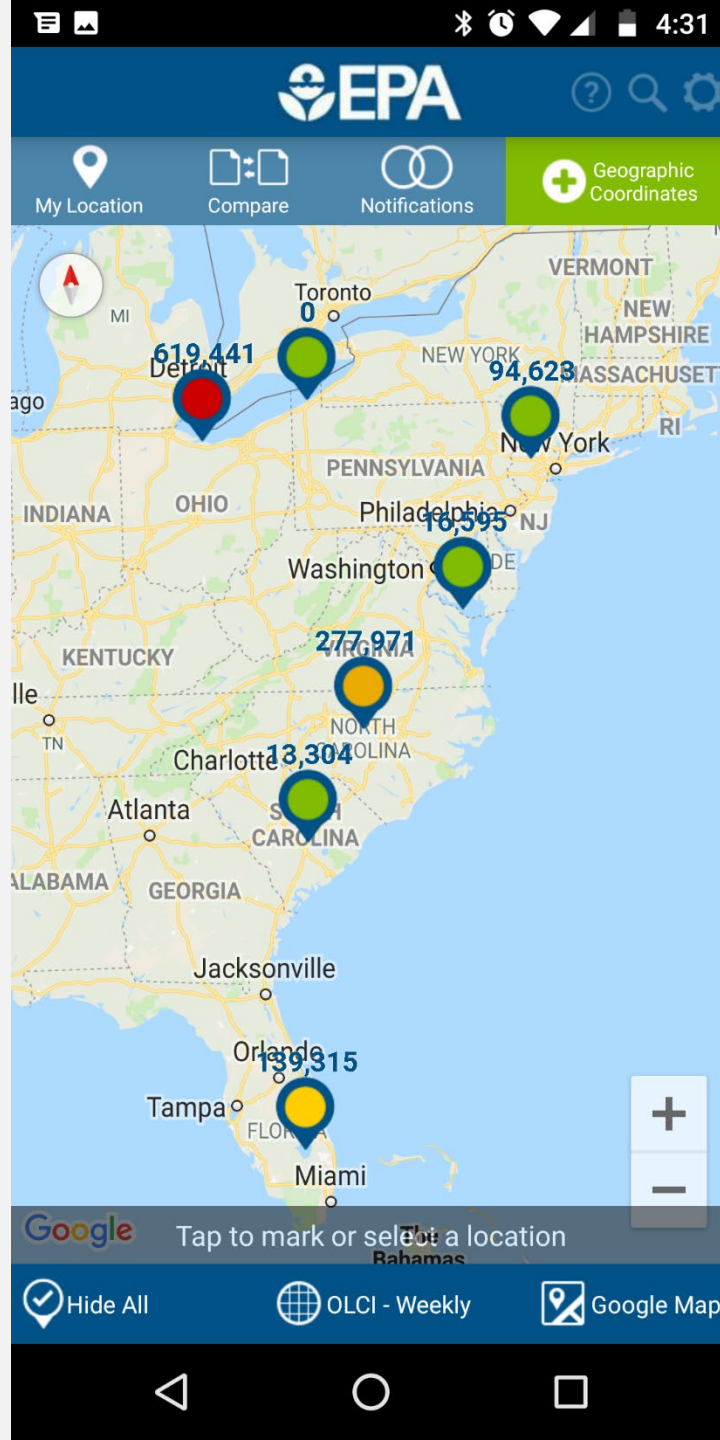


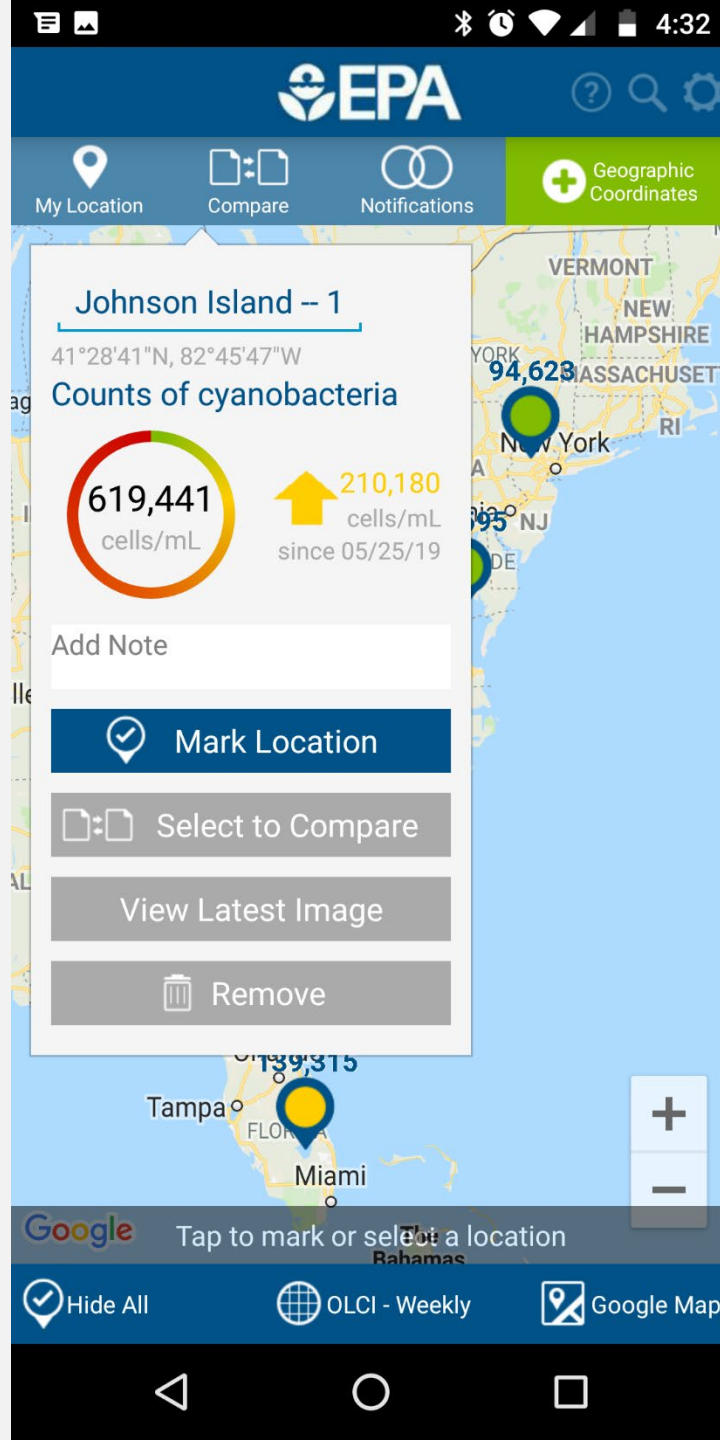


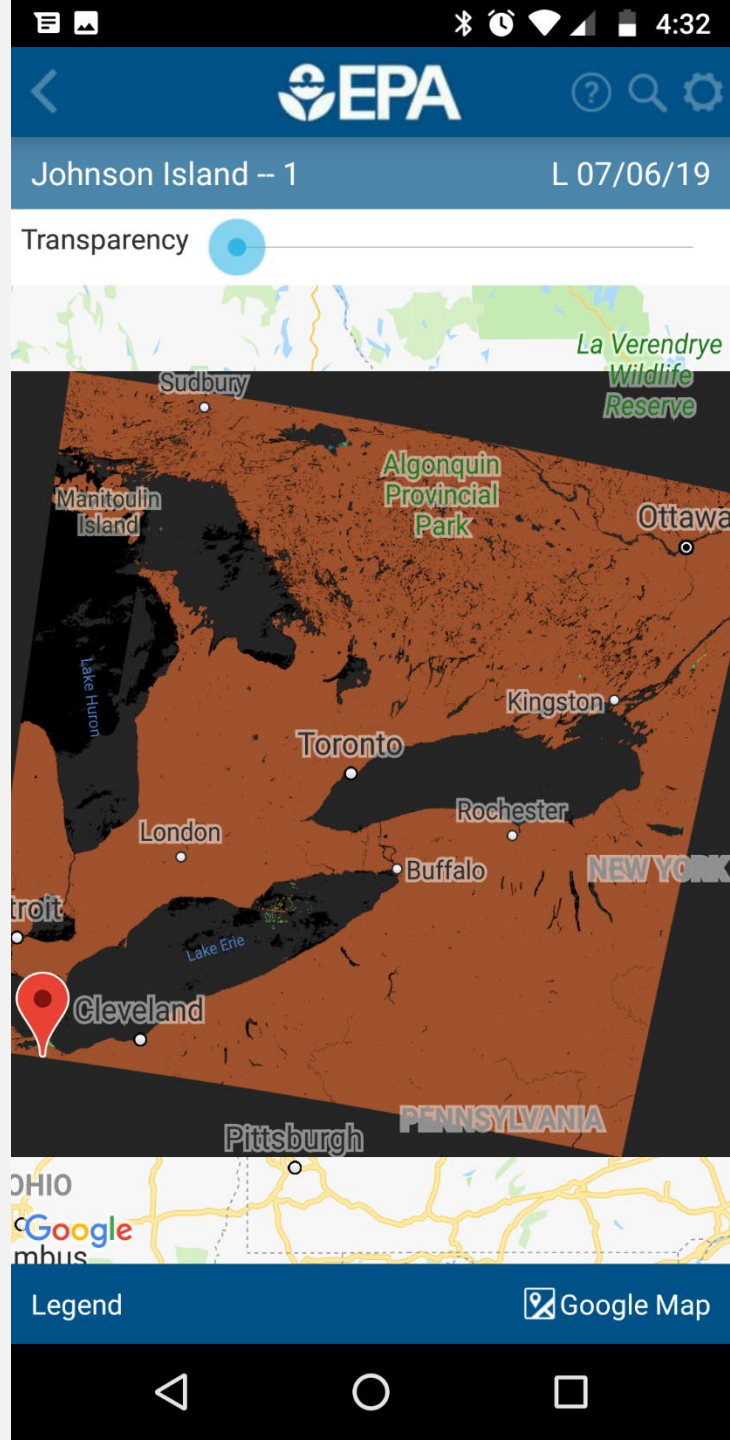


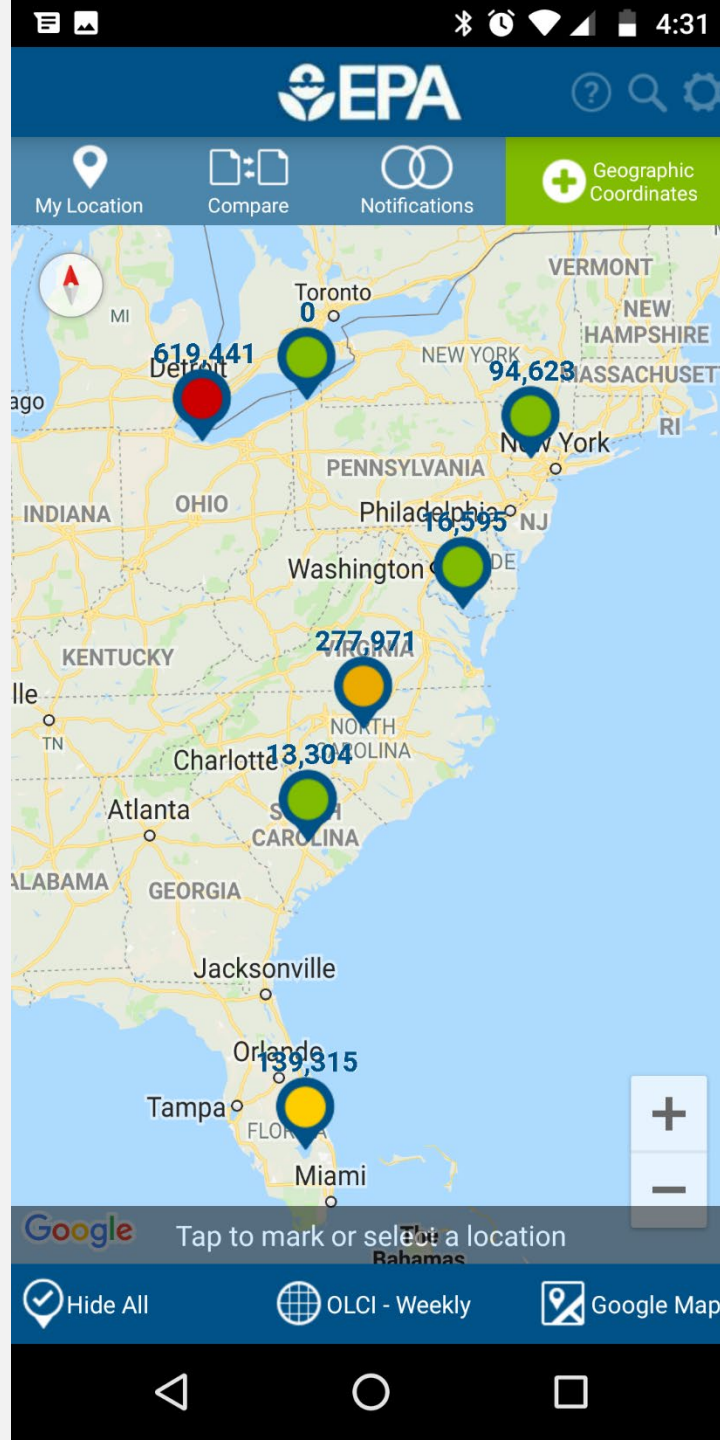














# Q&A Session 2

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