# Watershed Workshops

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COLLEGE OF
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# Table of Contents

# Watch Your Watershed

## Grades 3-5

Students will engage in inquiry practices to understand local watershed systems and human and natural impact on these systems. We will develop tools for students to act as citizen scientists to monitor their local watershed.

## Summary of Curriculum

| Day | Suggested Timing | Topic | Activities |
|---|---|---|---|
| 1 | **8:30** | Check In | Journal assigned |
| | **8:45** | Introductions | Two truths and a lie at tables<br>Go around room and tell name and one truth/lie while group guesses whether it is true or not<br>Instructor(s) will also do 2 truths and a lie for whole group |
| | **9:15** | Pre-Data* | mATSI<br>Pre-Concept map |
| | **10:00** | Intro NOS | Journal set-up<br>Science Questions for Elementary Students |
| | **10:30** | Stream Tables | Use stream tables to intro NOS |
| | **12:00** | Dismiss | Bring Bug Spray tomorrow! |
| 2 | **8:30** | Sign in | Students enter TOC topics |
| | **8:45** | Intro Watershed | What is a watershed (PPT) |
| | **9:15** | Meet the Creek | Brainstorm the type of data we can collect as citizen scientists and conduct initial observations, mapping, sketching, etc. |
| | **10:30** | What do we want to know | Types of test PPT<br>Brainstorm what topics we want to focus on |
| | **11:00** | Test Experts | Create expert groups for tests and students practice with water samples (all groups do temp, pH, and turbidity) |
| | **12:00** | Dismiss | |
| 3 | **8:30** | Check in | Journal TOC updates |
| | **8:45** | Review | Review each test procedure, make sure procedures are copied in to journals with clearly written titles.<br>Create initial data tables in journal |
| | **9:15** | To the creek | Students collect water samples & temperature, plus qualitative data |
| | **10:15** | Tests | Using water samples, expert groups test water samples. All students test temperature, pH and turbidity |

| Day | Suggested Timing | Topic | Activities |
|---|---|---|---|
| | **11:00** | Data share | Students begin to display data on large charts/computer |
| | **11:15** | Concept Map* | Revisit concept map. Brainstorm 5 topics to add to concept map that each student will add to their maps. |
| | **12:00** | Dismiss | |
| **4** | **8:30** | Check in | TOC updates |
| | **8:45** | Finish data display | Students finish reporting data |
| | **9:15** | MacroInvertebrates | Students observe and record present macroinvertebrates |
| | **10:45** | Interpret the data | Compile all data tested to begin to understand what it tells us |
| | **11:45** | Journal update | All data recorded<br>TOC updated |
| | **12:00** | Dismiss | |
| **5** | **8:30** | Check in | TOC updates |
| | **8:45** | Post Data* | mATSI |
| | **9:15** | Field Report | Create Field Reports |
| | **10:30** | Next steps | Respond to Mr. Smith's letter |
| | **11:00** | Concept Map* | Brainstorm 5 more topics to add to concept map for all students to write about. |
| | **11:30** | Research Fair | Present data/recommendations/field reports to parents and faculty |
| | **12:00** | Dismiss | |

*mATSI and Concept Map are used for data to investigate student perceptions of science and content understanding.

## Day 1: What is a Watershed?

| Day | Suggested Timing | Topic | Activities |
|---|---|---|---|
| 1 | **8:30** | Check In | Write names on journals<br>Begin decorating Title page |
| | **8:45** | Introductions | Use a fun introduction activity to get to know students (such as *Two Truths & a Lie* |
| | **9:15** | Pre-Data* | mATSI<br>Pre-Concept map |
| | **10:00** | Intro NOS | Journal set-up<br>Science Questions for Elementary Students |
| | **10:45** | Stream Tables | Use stream tables to intro NOS |
| | **12:00** | Dismiss | Bring Bug Spray and sunscreen tomorrow! |

*mATSI and Concept Map is used for data to investigate student perceptions of science and content understanding.

**Intro to NOS**

*Objective: Through small group and class discussions, students will identify and use observations and inferences presented in a 3-picture scenario. Class discussion will direct students to a basic understanding of the Nature of Science and rules of scientific investigation which they will use to conduct a scientific investigation.*

Engage: Ask students to discuss with their table groups, "What are some ways we learn about the world around us?" Give students plenty of time to discuss and be sure to listen in. As conversation slows, call on some table groups to share what was discussed. Prompt students with the second question, "How do you know if something is true or not?" Try to avoid leading students or giving students appropriate responses. Use this time to prompt their thinking and gauge the understanding of science they are bringing to the lesson.

Explore: Show students *Slide 5* and ask the question, "What can you say about this picture?" Have students write in their journal at least three things they can say about the picture. (Students will likely write down observations and inferences both, do not correct or lead them here.) Reveal the definitions of OBSERVATION and INFERENCE and take time to give students one or two examples of each that are NOT about the Tracks in the Snow image. Ask students to volunteer to share OBSERVATIONS they recorded in their list of three. As students share, use class discussion to clarify whether the statement is an observation and based on data collected using the senses. Follow similar procedures to have students share INFERENCES they recorded. Finally, have students mark their three statements with an O for

observation or I for inference. Check for understanding by looking at journals while they work.

Reveal *Slide 6* and have students write down two observations and two inferences based on the additional data. Use either table or large group discussion to share out and ensure students are correctly distinguishing between observations and inferences. Follow a similar procedure for *Slide 7*. At this point, the group may feel comfortable sharing verbally rather than recording their observations and inferences. Use the final slide to verify student understanding.

Explain: Using *Slide 8*, guide students through a discussion of questions science can and cannot answer as well as the "rules" of doing science. Use the discussion to have students explain their understanding of scientific procedures (beginning with making observations and defining a scientific question, forming a hypothesis, identifying necessary materials and procedures, collecting and organizing data, forming a conclusion, and communicating results). Be sure to address and respond to any misconceptions. Conclude with a discussion that highlights the need for fair tests in science as well as the importance of carefully recording data in an organized way.

Elaborate: Using a stream table set up, guide students through the process of designing a scientific investigation (*Slide 9* can be used as a journal page set-up guide). Potential student initiated questions may be *How does increasing the rate of "rainfall" impact the weathering and erosion of the stream table?* or *How does adding multiple rain sources impact the weathering and erosion of the stream table?* or *How does adding large gravel to the sand mixture impact the weathering and erosion of the stream table?* Be sure students utilize the previously discussed "rules" of science while they design and implement their investigation.

Evaluate: Have groups share out their scientific investigation (including question, hypothesis, procedures, etc) with the large group. Probe them with questions as needed to check their understanding of the nature of science as presented in their investigations.

## Day 2: Meet the Creek

| Day | Suggested Timing | Topic | Activities |
|---|---|---|---|
| 2 | **8:30** | Sign in | Students enter TOC topics |
| | **8:45** | Intro Watershed | What is a watershed (PPT) |
| | **9:15** | Meet the Creek | Brainstorm the type of data we can collect as citizen scientists and conduct initial observations, mapping, sketching, etc. |
| | **10:30** | What do we want to know | Types of test PPT<br>Brainstorm what topics we want to focus on |
| | **11:00** | Test Experts | Create expert groups for tests and students practice with water samples (all groups do temp, pH, and turbidity) |
| | **12:00** | Dismiss | |

*Prior to this day's lesson, locate and map the local creek, stream, river or pond you plan to access. Students will need printed copies of maps of the local watershed to refer to. Be sure to visit the area prior to the lesson to identify safe access points to the waterfront. At your visit, set up your Benthic Macroinvertebrates collection bag by submerging a large-holed mesh bag or net filled with leaves and other debris. You will collect this in a bucket prior to Day 4.*

**What is a Watershed**

*Objective: Using videos, discussion, and lecture students will gain a basic understanding of what constitutes a watershed and construct a student-determined definition. Then using maps they will identify components of their local watershed.*

Display *Slide 11* and have students brainstorm in small groups what they think a watershed is. Give them some time to talk and then ask groups to share out ideas. Ask groups to come up with one or two YES or NO questions about a watershed (such as: *Is a watershed a place that you store water?*) and record them on their journal page. At this point, do not offer the definition of a watershed, simply allow students to generate ideas and questions.

Show the video linked on *Slide 12*. When the video concludes, ask students to define a watershed using their own words and what they learned in the video. Go through their YES or NO questions they recorded and have them write the answer. While displaying *Slide 13*, have students record a definition of watershed in their journal. They may come up with their own or use the more formal definition provided.

*Slide 14* asks students to think about why a watershed is important and discuss ways we use and abuse our watershed. Using a discussion technique that gets students talking to someone new (such as stand up, hand up, pair up), have students brainstorm answers to those three questions. Once students are back in their seats, have them share some of the responses they came up with or heard. Then let them view the video linked on *Slide 14*. Lead a discussion that reviews any misconceptions or new information revealed in the video.

Walk students through the mapping of their local watershed using *Slides 16-22* (*Slides 17-22* will need to be replaced with maps of your local watershed). Assess students' map-reading abilities and geographical awareness by having them locate where they are on the maps as they move from national to very local. Provide students with color copies of maps of the local watershed to glue into their journal.

**Meet the Creek**

*Objective: Students will determine appropriate data to collect at the creek (stream, pond, or river access) and conduct initial observations, sketches, and mapping.*

Display *Slide 23* and ask students what they can learn, as citizen scientists, about Frog Creek (*Slide 23* will need to be replaced to reflect your local water access point). Use this time to discuss with students the roles of citizen scientists (see Materials and Resources for additional information). Use questioning to guide students to appropriate questions, such as bank quality, water quality, evidence of wildlife, plant growth, pollution evidence, etc.

Guide students as they set up a 2-page journal spread to collect their initial observations and data of Frog Creek (you may use the template found in Materials and Resources). Once journals are ready, walk students to your water access point and allow them to collect their initial observations and create their map or sketch of the area. *Please remind students of safety rules and be sure they are prepared for the outdoor elements*

*(have water, sunscreen, bug spray etc). Encourage students to work in their teams for safety and thorough data collection.*

Once you have returned to the classroom, have groups share their observations. Consider recording these on a large piece of paper or white board to refer to later.

**Water Testing**

Before beginning this lesson, be sure you have supplies required for testing pH, temperature, turbidity, Nitrate, Phosphate, Dissolved Oxygen, and Coliform Bacteria as well as safety materials such as goggles and gloves. This lesson also requires a clean water sample for practice testing. We suggest filling a small fish tank or terrarium with tap water prior to student arrival so they do not know the source of the water. The more authentic the experience, the more likely they are to carefully attend to procedures and safety measures.

*Objective: Given an overview of water quality measures, students will learn and practice the procedures for testing the temperature, pH, and turbidity of water. In addition, using expert groups students will learn and practice the procedures for testing either Nitrates, Phosphates, Coliform Bacteria, or Dissolved Oxygen. Using water quality data, students will draw conclusions about a test site and make recommendations regarding the quality of water at the site.*

Engage: Ask students, "What do we need to know about the water at Frog Creek to determine its quality?" Students will likely respond with responses related to their experiences such as presence of pollution, types of living organisms, etc. Record their responses on a white board or large sheet of paper. Use *Slides 24-32* to introduce students to ways to measure water quality. Use this as merely an introduction. It is not necessary for students to record notes or have a thorough understanding at this point, only that they be introduced to the types of tests they will be working with over the next few days.

Explore: Guide students to create a Water Testing section of their journal. They may want to create a section title page. *Slides 33-35* display information and the procedures for testing temperature, pH, and turbidity. Either have students record these steps in their journals or provide pre-printed instruction sheets for them to record in their journal. Be sure to review and demonstrate the procedures with students before moving to next steps.

Divide your students into Expert Test Groups and assign each group one of the following water quality tests: Nitrate, Phosphate, Coliform Bacteria, or Dissolved Oxygen (it is advised, if possible, to have more than one group for each test). Students will use test information sheets or instruction books to create a page in their journal, refer to *Slide 36* for instructions (see Materials and Resources for more information). *Expert test groups* may *be different than the*

*teams you have had students in prior to this point. Use this opportunity to create heterogeneous groups that will ensure success and inclusion of all students.*

Once students have recorded and can verbally describe the procedures for their expert group test and have created a data table to record temperature, pH, turbidity and their expert test results (see *Slide 37*), allow them to begin practicing each test with your clean water sample. Be sure to carefully monitor groups as they move through the procedures. *Although the results of these tests are not necessarily important, ensuring students have a clear understanding of procedures and safety practices is important before they move on to test Frog Creek.*

## Day 3: Collecting Data

| Day | Suggested Timing | Topic | Activities |
|---|---|---|---|
| 3 | **8:30** | Check in | Journal TOC updates |
| | **8:45** | Review | Review each test procedure. Create initial data tables in journal |
| | **9:15** | Testing the creek | Students collect water samples & temperature, plus qualitative data |
| | **11:00** | Data share | Students begin to display data on large charts/computer |
| | **11:15** | Concept Map* | Revisit concept map. Brainstorm 5 topics to add to concept map that each student will add to their maps. |
| | **12:00** | Dismiss | |

*Day 3 lessons require all water testing materials as well as vessels to carry water samples to the lab for each group. We advise creating one bag per group that contains a leak-proof jar, thermometer, extra pencils, and gloves to carry to your water site.*

Explain: Have expert test groups copy information about their test and procedures onto large sheets of paper to display in the room to refer to throughout the week. Expert test groups should present information about their test and procedures to the class. Have students create subsequent journal pages of the additional water tests, or provide printed pages for them to glue in their journal to refer to. Be sure to respond to and correct any misconceptions or incorrect procedures before moving forward. Students will rely on this information as they move to evaluating Frog Creek in coming experiences.

Display *Slide 39* and guide students through a discussion where they set up their journal for Frog Creek data collection. Ensure that *each* student is prepared to record data for Frog Creek before leaving the classroom (see Materials and Resources for a template). Remind your dissolved oxygen group that they will need to conduct their test at the water site in addition to bringing a sample to the lab for turbidity and pH testing. All students should be prepared to collect all qualitative data as well as temperature data at the water site.

Elaborate: Return to your water site and release groups to collect data and water samples. Allow plenty of time for qualitative data recording and for the dissolved oxygen group to collect their data. Most water quality tests will be concluded in the lab, so once samples are collected return with students to the classroom or lab.

In the lab, allow students to conclude their water quality tests using procedures practiced on Day 2 and record results in their data table. As groups finish, they should record their findings in a class data table (you will need to pre-construct this on a white board, large sheet of paper, or on the computer for students to fill in, see Materials and Resources for template).

## Day 4: Interpreting Results

| Day | Suggested Timing | Topic | Activities |
|---|---|---|---|
| 4 | **8:30** | Check in | TOC updates |
| | **8:45** | Finish data display | Students finish reporting data |
| | **9:15** | MacroInvertebrates | Students observe and record present macroinvertebrates |
| | **10:45** | Interpret the data | Compile all data tested to begin to understand what it tells us |
| | **11:45** | Journal update | All data recorded<br>TOC updated |
| | **12:00** | Dismiss | |

*Prior to Day 4, remember to collect your macroinvertebrates net from your water site. Using a bucket of water from your site, return the net and all debris to the lab for sorting. Each group will require a sorting tray, several petri dishes, soft tweezers, pipettes, and hand lenses to conduct their sorts.*

Elaborate (cont): Display *Slide 42* and walk students through the process of sorting the Benthic Macroinvertebrates. Use the poster provided in your water quality testing kit or create your own to allow students to refer to pictures or drawings of common macroinvertebrates they will find (see Materials and Resources). As the class concludes the sort, provide the Pollution Tolerance Index seen in *Slide 43* for students to calculate the pollution tolerance of your water site and record in their data table.

Once students have a complete data table, encourage groups to discuss what the data means and come to a conclusion regarding the quality of water at your water site. They may need to refer back to test information pages to remind them what the tests mean. Have expert groups communicate their conclusion to the class using the class data table. (*Slides 47-54* may be printed as handout sheets to help groups form a conclusion from their data.)

*Depending on timing of student work, you may move in to Day 5 activities.*

## Day 5: Communicating Results

| Day | Suggested Timing | Topic | Activities |
|---|---|---|---|
| 5 | **8:30** | Check in | TOC updates |
| | **8:45** | Post Data* | mATSI |
| | **9:15** | Field Report | Create Field Reports |
| | **11:00** | Concept Map* | Brainstorm 5 more topics to add to concept map for all students to write about. |
| | **11:30** | Research Fair | Present data/recommendations/field reports to parents and faculty |
| | **12:00** | Dismiss | |

*mATSI and Concept Map is used for data to investigate student perceptions of science and content understanding.

*It is recommended to have computers, iPads, or other technology available for students to use to create their presentations. If technology is not available large, poster-sized paper and/or paper for fliers will work.*

Evaluate: Arrange students into new groups. Each group should have one member of each expert test group. Display the letter found on *Slide 45* (or you may construct your own letter more personalized to your location/scenario). Students will now construct a formal field report regarding the quality of your water site to help them respond to Mr. Smith's letter as well as plans to continue as citizen scientists. Before they begin, use *Slides 56-58* to guide students through a discussion regarding their conclusions. You may want to have students jot down their ideas on a journal page to help them construct their field reports. Use the template found in Materials & Resources to guide students through creating a field report. It is recommended to have each student create a field report but to work together with their group to construct responses.


The final question of the Field Report challenges students to continue their scientific investigations through a related Citizen Science Project. Refer to the

resources to identify one or more Citizen Science projects in your area that students could commit to collect data for regularly on their own.

As they finish their field reports, groups will need to determine a method to share their data. They may make choose to create a powerpoint presentation, a TV commercial, a poster, or flyer (or any other medium) to present their findings.  At the close of the workshop, students will present their findings to parents and other visitors in any appropriate format.

## Materials and Resources

Defining Citizen Science: http://www.birds.cornell.edu/citscitoolkit

Why Citizen Science for Water Quality: https://terra.nasa.gov/citizen-science/water-quality

Water Quality Testing Kit: http://www.lamotte.com/en/education/water-monitoring/5848.html or http://www.lamotte.com/en/education/water-monitoring/3-5886.html

Macroinvertebrate Poster: http://clean-water.uwex.edu/pubs/pdf/riverkey.pdf

**Suggested Citizen Science Projects:**

http://www.streamselfie.org/

https://freshwaterwatch.thewaterhub.org/

http://www.monitorwater.org/

http://www.creekfreaks.net

https://www.epa.gov/citizen-science/citizen-science-projects-supported-epa

**Water Testing Student Kits:**

- Immersion Thermometer http://www.carolina.com/lab-thermometers/immersion-thermometers--20-to-110-c-0-to-230-f-pack5/745512.pr
- pH Test Strips http://www.carolina.com/lab-thermometers/immersion-thermometers--20-to-110-c-0-to-230-f-pack5/745512.pr
- Hand Lens http://www.carolina.com/stc-science-elementary-replacement-parts/lens-dual-hand-pack-of-16/972946.pr
- Petri dish http://www.carolina.com/lab-dishes/petri-dishes-polystyrene-disposable-sterile-100-x-15-mm-pk-20/741250.pr
- Turbidity Tube: Laminated card (below) and plastic test tube http://www.carolina.com/stc-science-elementary-replacement-parts/cylinder-graduated-plastic/972110.pr

Date:
Time

Location
Temperature or Weather

# About Frog Creek

## Observations

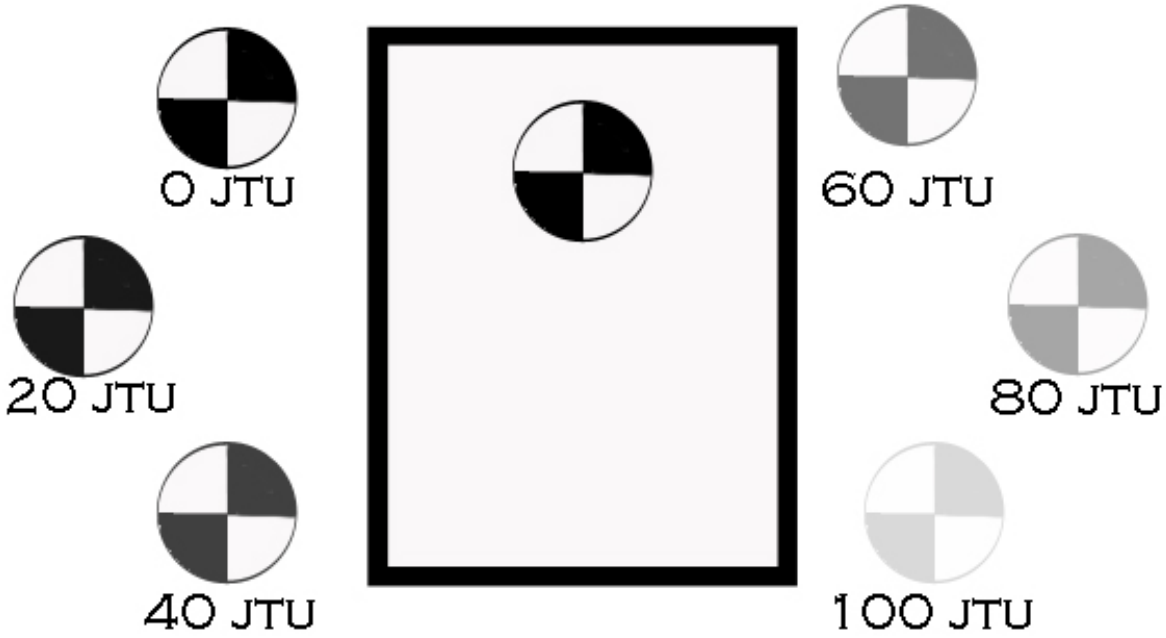
What do I see?

What do I hear?

What do I smell?

Map

# Turbidity



Data Table Template

| Test | Results |
|---|---|
| Temperature 1 | ºC |
| Temperature 2 | ºC |
| Difference (Temp 1 - Temp 2) | ºC |
| pH | |
| Turbidity | |
| Nitrate | |
| Phosphate | |
| Dissolved Oxygen | |
| Coliform Bacteria | |
| Pollution Tolerance Index | |

Class Data Table Template

| Group | Temp 1 | Temp 2 | pH | Turbidity | Dissolved Oxygen | Nitrate | Phosphate | Coliform Bacteria |
|---|---|---|---|---|---|---|---|---|
| | ºC | ºC | | | | | | |
| | ºC | ºC | | | | | | |
| | ºC | ºC | | | | | | |
| | ºC | ºC | | | | | | |
| | ºC | ºC | | | | | | |
| | ºC | ºC | | | | | | |
| **Conclusion** | | | | | | | | |

# FIELD REPORT

PREPARED BY:

## SITE DESCRIPTION

**QUALITATIVE DESCRIPTION**

- **SOIL, EROSION, ODOR, WATER, POLLUTION, VEGETATION, WILDLIFE, MAP, PICTURES, ANYTHING ELSE**

WHY IS OUR WATER SITE IMPORTANT? (GIVE 3 REASONS)

SOME PROBLEMS WITH THE AREA (GIVE 3 EXAMPLES)

SOME GOOD THINGS ABOUT THE AREA (GIVE 3 EXAMPLES)

## WATER QUALITY ISSUES

### DATA COLLECTED

| Test | Data | What does it mean? |
|---|---|---|
| Temperature difference | | |
| pH | | |
| Turbidity | | |
| Nitrate | | |
| Phosphate | | |
| Dissolved Oxygen | | |
| Coliform Bacteria | | |
| Pollution Tolerance Index | | |

### WHAT THE DATA MEANS FOR WATER QUALITY

**WOULD YOU SAY THE WATER IS EXCELLENT, GOOD, FAIR, OR POOR? EXPLAIN WHY YOU THINK SO.**

## OUR RECOMMENDATIONS

**WRITE YOUR OWN, PERSONAL LETTER TO MR. SMITH ANSWERING HIS QUESTIONS ABOUT FROG CREEK. WHAT DID YOU LEARN ABOUT THE WATER? WHAT RECOMMENDATIONS WOULD YOU MAKE?**

## CITIZEN SCIENTISTS

**AFTER READING ABOUT THE CITIZEN SCIENCE PROJECT, HOW WILL YOU CONTINUE TO MONITOR AND COLLECT DATA FROM YOUR LOCAL WATERSHED?**

# Presentation Slides

# Watch Your Watershed

- Welcome! We are glad you are here.
- Please begin creating a Title Page on the first page of your journal.
  - The title of our workshop is “Watch Your Watershed”
  - You may design your title page any way you would like, but make sure it has:
    - A Title
    - Your Name

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# Introductions

# Introductions

- On your notecard, write down:
  - TWO things about you that are TRUE
  - ONE thing about you that is a LIE
  - Do not tell anyone in your group!

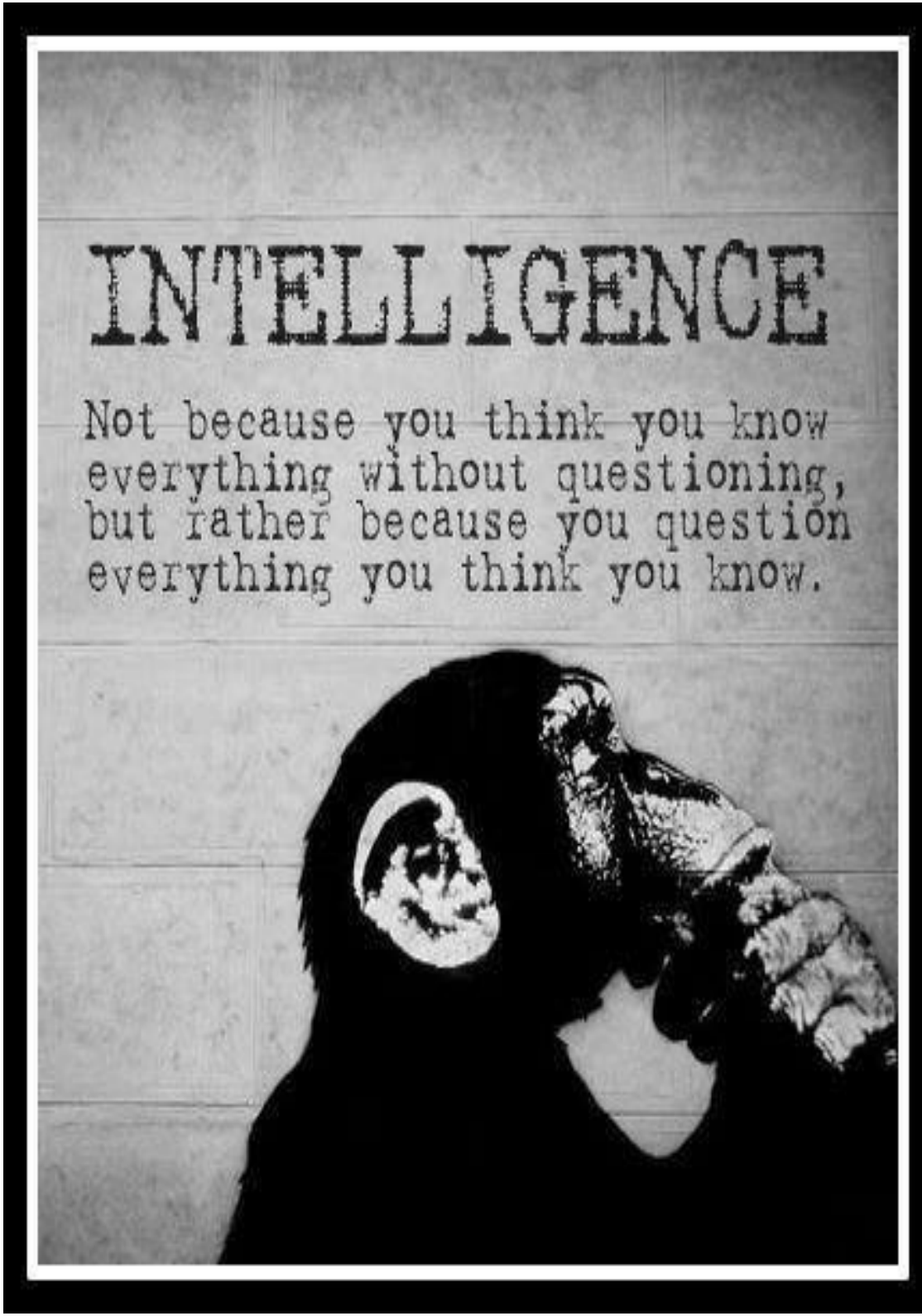
# Introductions

- On your notecard, write down:
  - TWO things about you that are TRUE
  - ONE thing about you that is a LIE
  - Do not tell anyone in your group!

- Go around your table, tell everyone your name and read the statements from your card. Let your table mates guess which of your statements is a LIE.

# Next page of journal

Title: Nature of Science



# Talk with your table…

# Talk with your table…

What are some ways we learn about the world around us?

# Talk with your table…

What are some ways we learn about the world around us?

How do you know if something is true or not?

# Talk with your table…

What are some ways we learn about the world around us?

How do you know if something is true or not?

# Tracks in the Snow

# Tracks in the Snow

Write down 3 things you can say about this picture.

# Tracks in the Snow

Write down 3 things you can say about this picture.

An OBSERVATION is based on what we can learn using our senses (something we've seen, heard, smelled, touched, or tasted).

# Tracks in the Snow

Write down 3 things you can say about this picture.

An OBSERVATION is based on what we can learn using our senses (something we've seen, heard, smelled, touched, or tasted).

An INFERENCE is a conclusion we make based on data collected or observations.

# Tracks in the Snow

# Tracks in the Snow

# Tracks in the Snow

# Tracks in the Snow

# Tracks in the Snow

# What do you know about doing  science?

# What do you know about doing science?

- What are some questions science cannot answer?

# What do you know about doing science?

- What are some questions science cannot answer?
- What are some questions science can answer?

# What do you know about doing science?

- What are some questions science cannot answer?
- What are some questions science can answer?
- What are the rules of doing science?

# Next page of journal

# Next page of journal

- Title: Stream Table Investigation

# Next page of journal

- Title: Stream Table Investigation

- Question:

# Next page of journal

- Title: Stream Table Investigation
- Question:
- Procedures:

# Next page of journal

- Title: Stream Table Investigation
- Question:
- Procedures:
- Results:

# Watch Your Watershed, Day 2

- Welcome back!
- Please use this time to make sure your table of contents is updated.

| Date | Title | Page |
|---|---|---|
| | Nature of Science | |
| | Stream Table Investigation | |
| | | |

# NEXT PAGE TITLE:
# WHAT IS A WATERSHED?

# A watershed is…

https://www.youtube.com/watch?v=QOrVotzBNto&feature=youtu.be

# A watershed is…

- IT'S THE AREA OF LAND THAT CATCHES RAIN AND SNOW AND DRAINS OR SEEPS INTO A MARSH, STREAM, RIVER, LAKE OR GROUNDWATER.

# WHY IS A WATERSHED IMPORTANT?

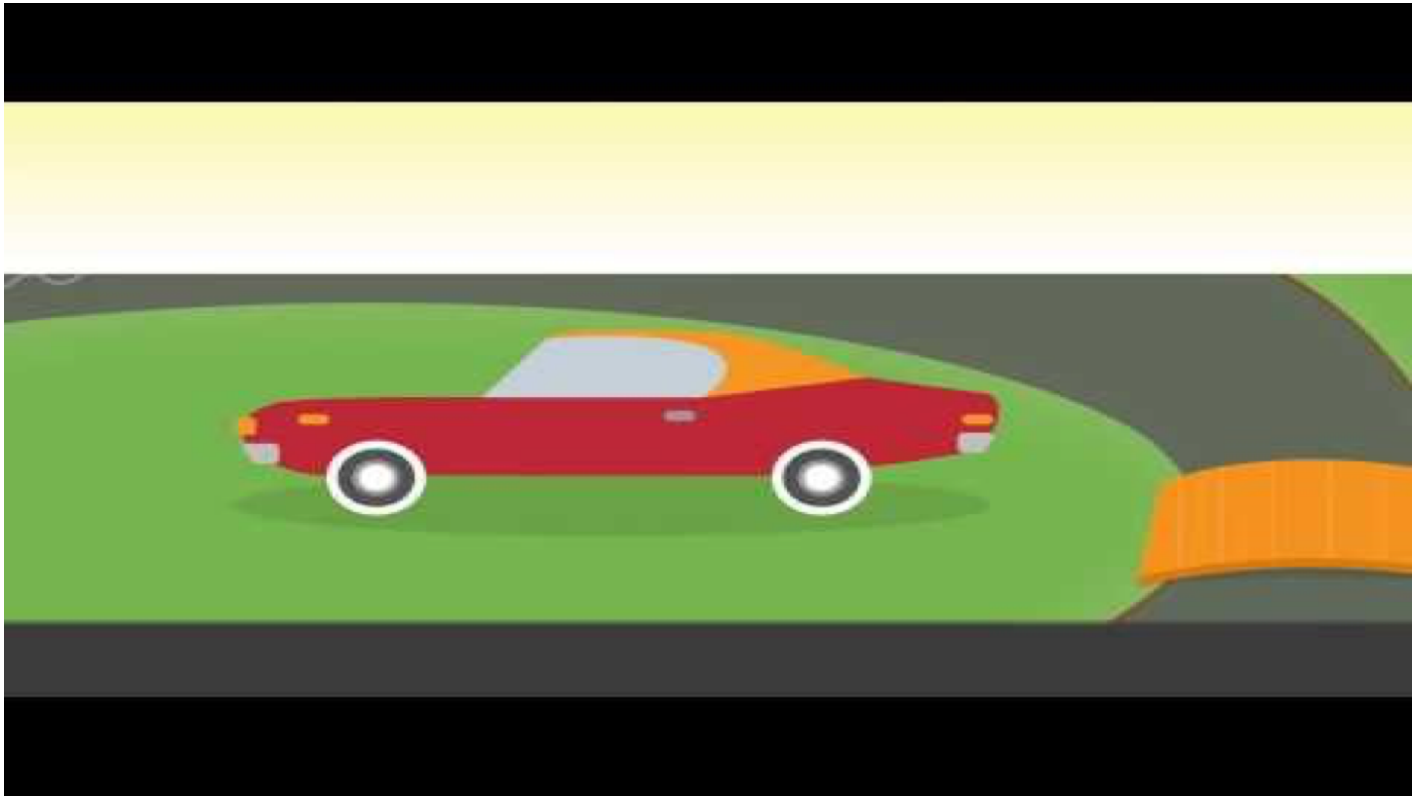
# WHY IS A WATERSHED IMPORTANT?

- How do we use our watershed?

# WHY IS A WATERSHED IMPORTANT?

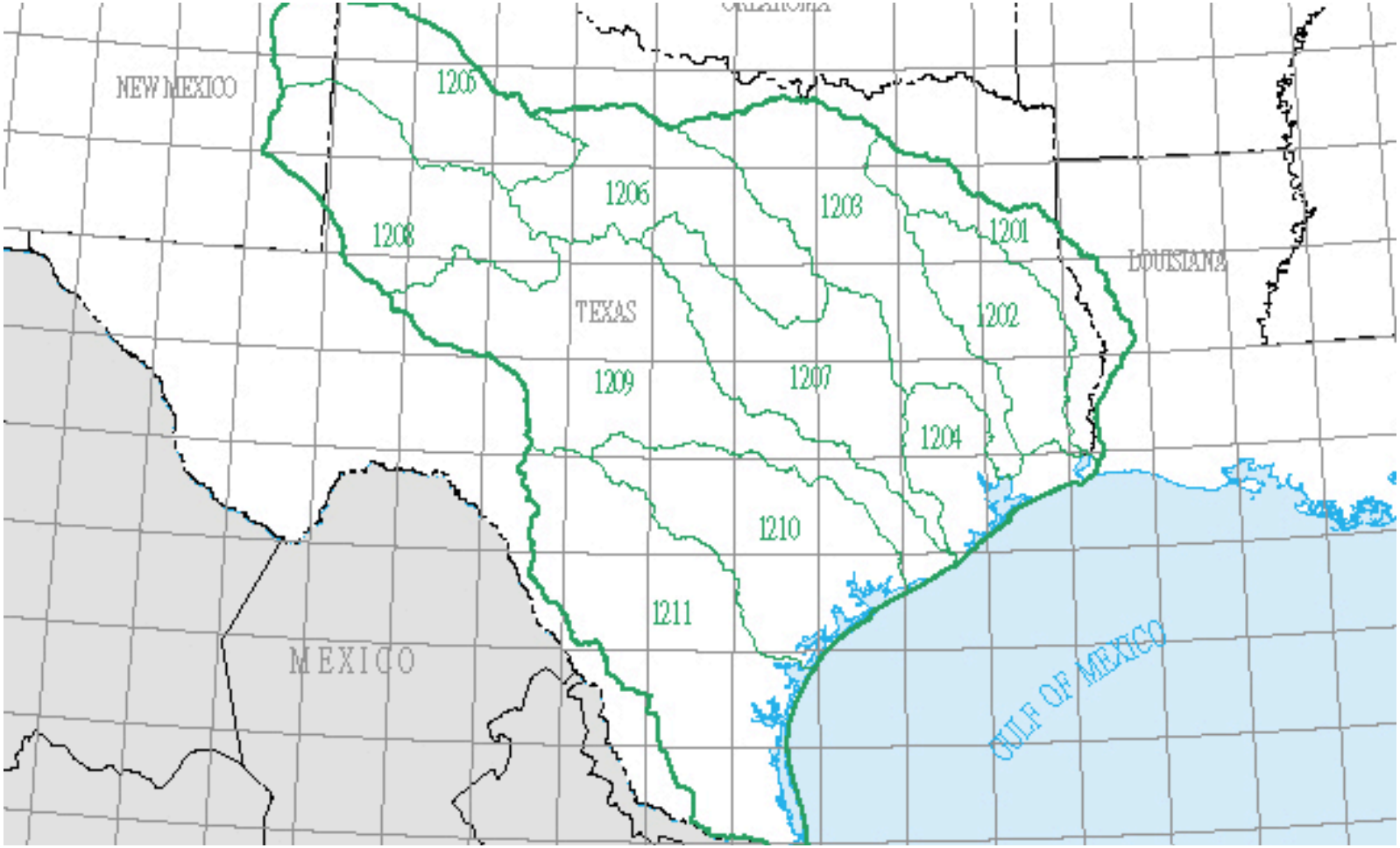
- How do we use our watershed?
- How do we abuse our watershed?

# WHY IS A WATERSHED IMPORTANT?



https://youtu.be/ZlyKhwagkI4

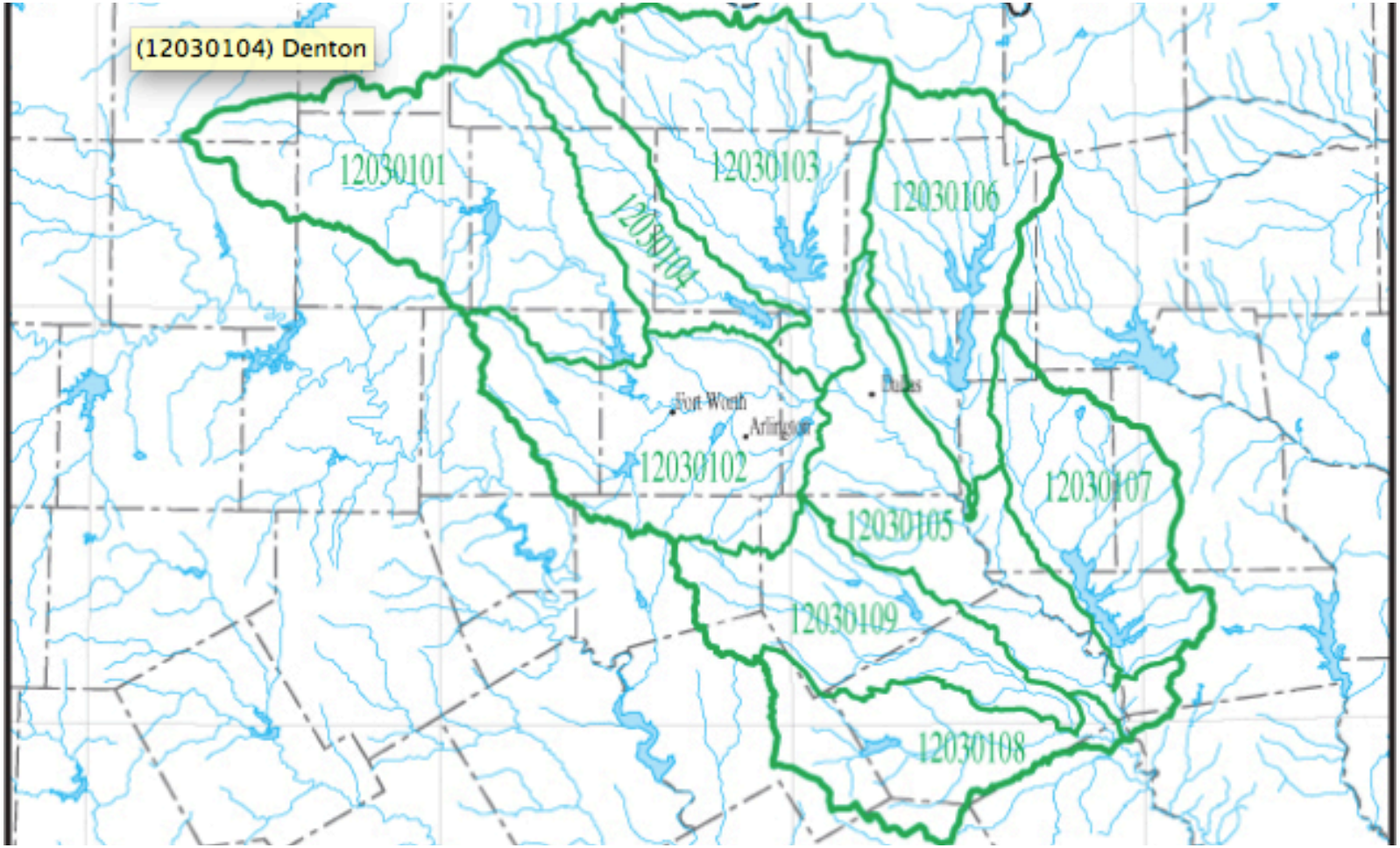

# NATIONAL WATERSHED REGIONS




# TEXAS GULF COAST

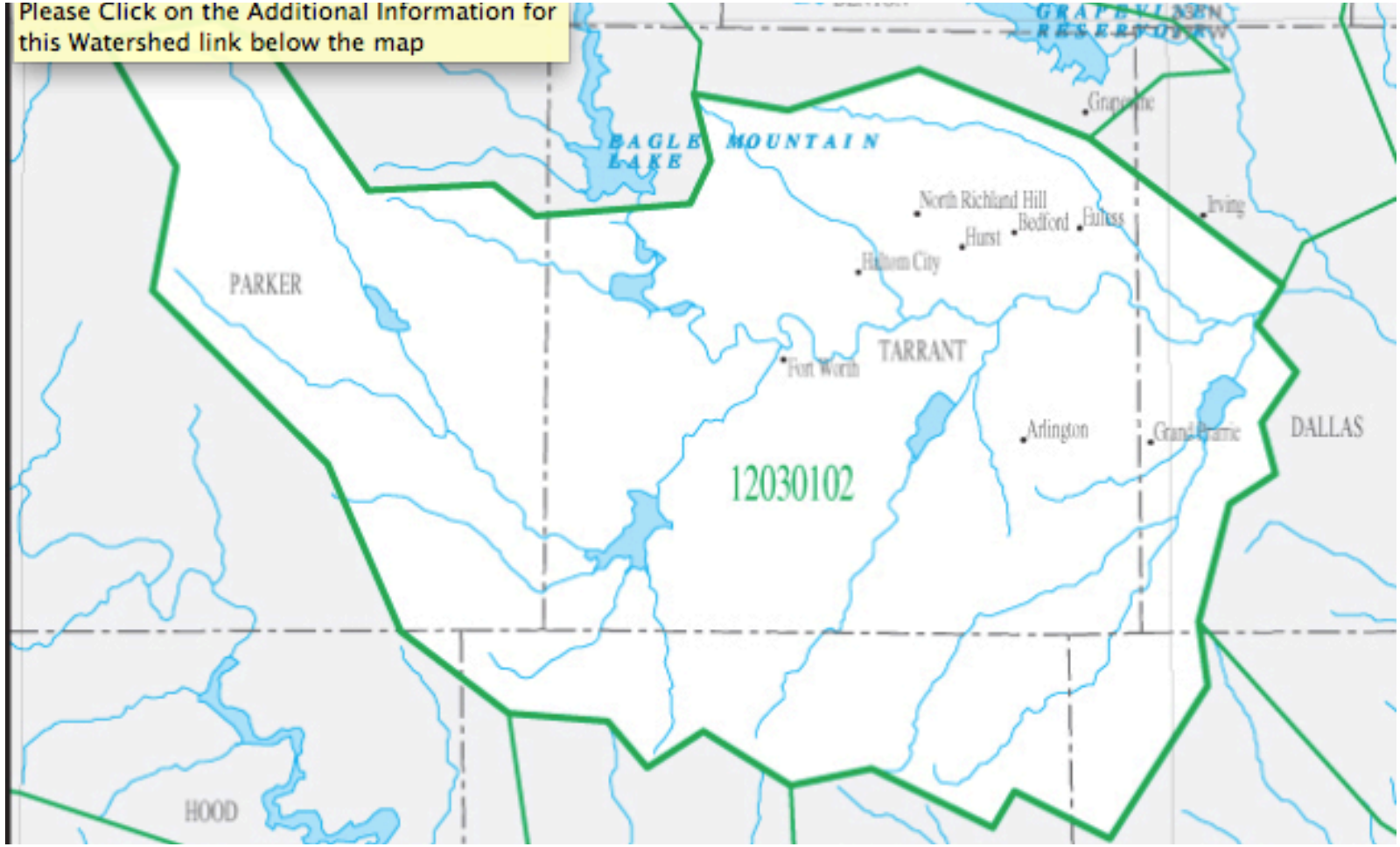

# TRINITY RIVER WATERSHED

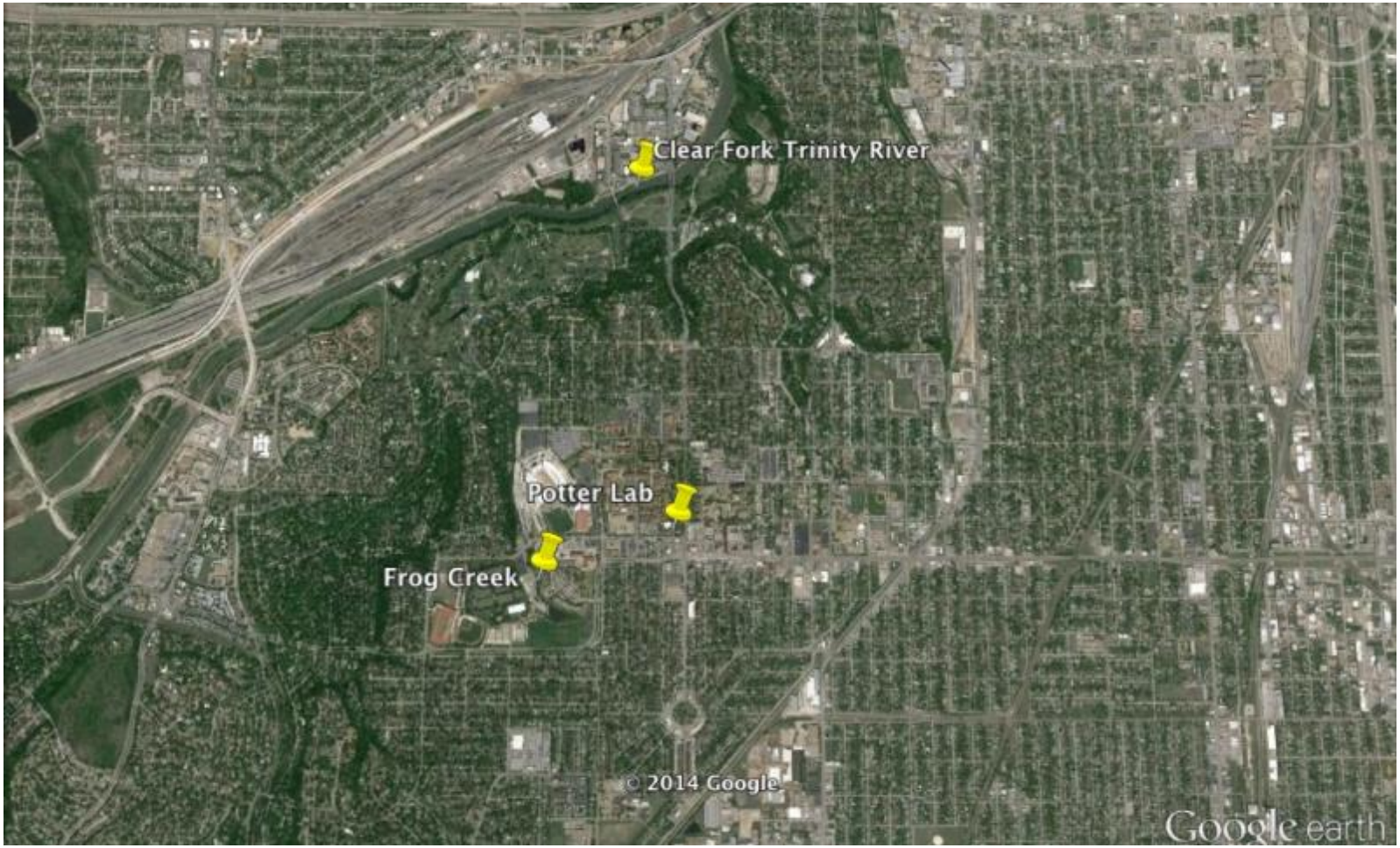



# UPPER TRINITY

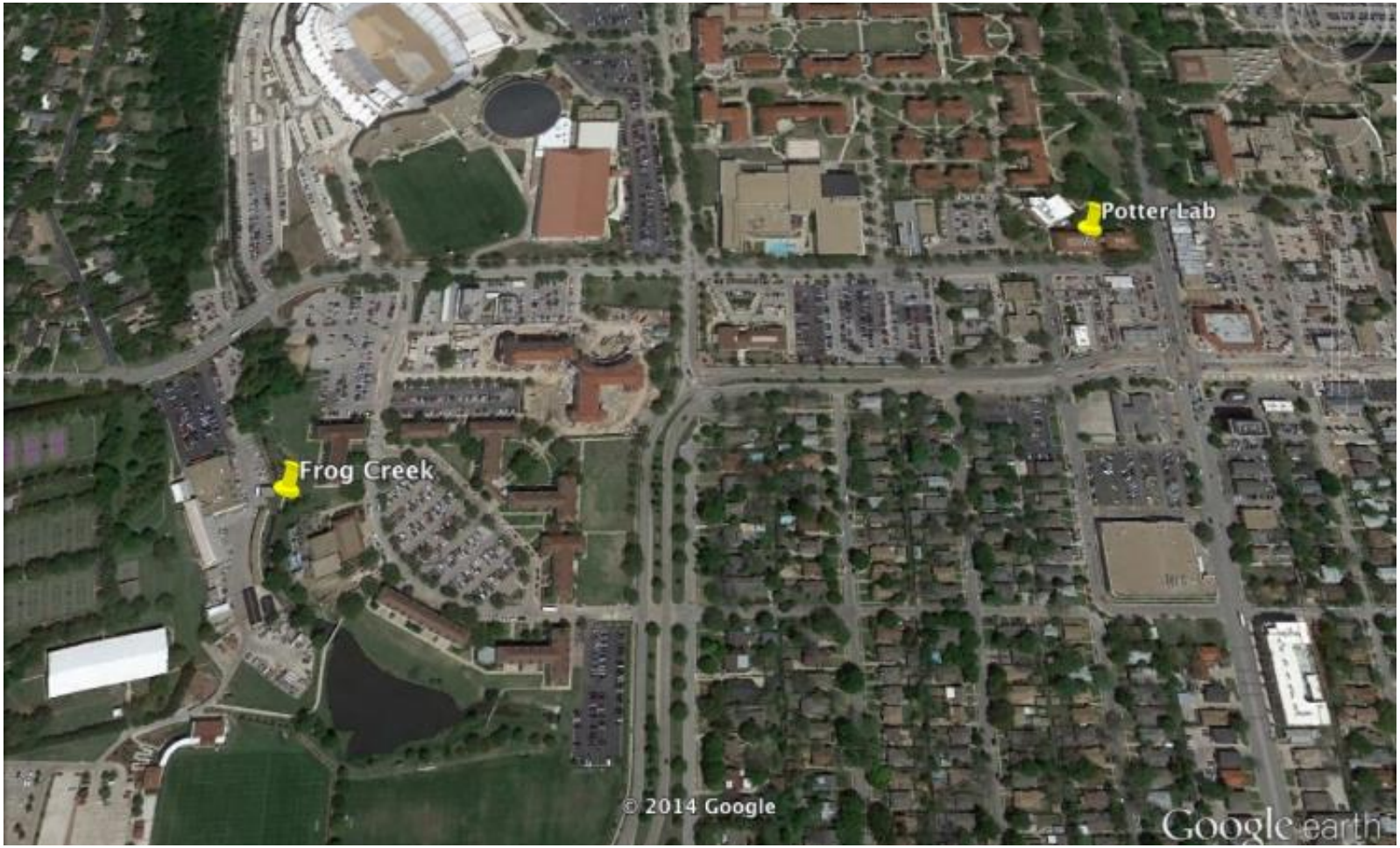



# LOWER WEST FORK TRINITY RIVER




# TCU AREA – FORT WORTH




# SOUTH CAMPUS

# Next Page Title: About Frog Creek

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- What can we, as citizen scientists, learn about Frog Creek?

 

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- What can we, as citizen scientists, learn about Frog Creek?
- Organize this page in your journal so that you have a place to record all of your observations about Frog Creek (You may want to use more than one page for this).

 

# RIVER BANK EVALUATION

- BARE SOIL
- EROSION
- WATER & SOIL ODOR
- WATER APPEARANCE

# PH

- MEASURES THE ACTIVITY OF HYDROGEN IONS
- PH BELOW 7.0 = ACIDIC
- PH ABOVE 7.0 = BASIC
- PH OF 7.0 = NEUTRAL
- PH RANGE OF 6.5-8.2 IS IDEAL FOR MOST ORGANISMS

# TEMPERATURE

- TEMPERATURE IS IMPORTANT TO WATER QUALITY
- AFFECTS THE AMOUNT OF DISSOLVED $O_2$, RATE OF PHOTOSYNTHESIS, AND ORGANISM SENSITIVITY TO POLLUTANTS

# TURBIDITY

- MEASURES HOW CLEAR THE WATER IS
- TURBID WATER IS CAUSED BY ORGANIC AND INORGANIC MATERIALS AND MICROSCOPIC ORGANISMS
- MAY BE CAUSED BY EROSION, RUN-OFF, ALGAL BLOOMS, AND DISTURBANCES

# BENTHIC MACROINVERTEBRATES

- IMMATURE AQUATIC STAGES OF INSECTS
  - BENTHIC = BOTTOM MACRO = SEEN WITH NAKED EYE INVERTEBRATE = ANIMAL THAT LACKS A BACKBONE
- LIVE ON SUBMERGED MATERIAL ON BOTTOM OF RIVER OR STREAM
- REQUIRE A SPECIAL ENVIRONMENT TO SURVIVE
- THEIR PRESENCE OR ABSENCE INDICATES THE HEALTH OF THE WATER

# COLIFORM BACTERIA

- PRESENT IN HUMAN DIGESTIVE TRACT
- ABSENT IN UNPOLLUTED WATERS

# DISSOLVED OXYGEN

- AQUATIC ANIMALS NEED DISSOLVED OXYGEN ($O_2$) TO LIVE!
- $O_2$ DISSOLVED IN WATER DIFFUSES SLOWLY AND IS MOVES IN THE WATER
- AQUATIC PLANTS, ALGAE, AN PHYTOPLANKTON PRODUCE ALGAE THROUGH PHOTOSYNTHESIS TOO

# NITRATE

- NITROGEN (N) ACTS AS A FERTILIZER FOR AQUATIC PLANTS.
- HIGH N LEVELS CAUSE WATER QUALITY PROBLEMS FROM TOO MUCH PLANT AND ALGAE GROWTH
- N ENTERS THE WATER FROM ANIMAL WASTE, DECOMPOSITION, AND FERTILIZER RUN-OFF

# PHOSPHATE

- PHOSPHORUS (P) ACTS AS A FERTILIZER FOR AQUATIC PLANTS
- HIGH P LEVELS CAUSE WATER QUALITY PROBLEMS THROUGH EXCESSIVE PLANT AND ALGAE GROWTH
- P OCCURS NATURALLY, BUT MOST COMES FROM DETERGENTS (SOAPS)

# WATER TESTING

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- Page title: Temperature

 

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- Temperature affects the amount of dissolved oxygen, the rate of photosynthesis, and organism sensitivity to pollutants
- Temperature procedures
  1. Wear protective gloves.
  2. Place the thermometer 4 inches below the surface (if possible) for one minute.
  3. Remove the thermometer from the water. Read the temperature and record the results as degrees Celsius
  4. Repeat the test approximately 10 meters upstream

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- pH procedures
  1. Wear protective gloves.
  2. Dip the pH test strip halfway into the water sample and leave it for 5 seconds
  3. Pull the test strip out of the water sample and compare it to the color guide on the container. Record the result.

# WATER TESTING

# WATER TESTING

- Page title: Turbidity

 

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  2. Place the base of the tube on the outline on the Turbidity Chart
  3. Look down through the sample water at the Secchi disk icon under the tube
  4. Compare the appearance of the Secchi disk icon under the tube to the gray Secchi disks on the either side of the tube to determine the turbidity in JTU (Jackson Turbidity Units).

# WATER TESTING

 

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  - What do the results mean?
  - What are the procedures of the test?

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  - What are the procedures of the test?
- In your journal, create a page for your test that includes the answers to those three questions. Make sure to give it a title!

# TITLE: TESTING PRACTICE

- Create a data table in your journal where you can record the results of your practice tests. Remember, you will be measuring: Temperature, pH, Turbidity, and your expert group test.

# DAY 3

| Date | Title | Page |
|---|---|---|
| | Nature of Science | |
| | Stream Table Investigation | |
| | What is a Watershed? | |
| | TCU area Fort Worth Map | |
| | South Campus TCU Map | |
| | About Frog Creek | |
| | Temperature | |
| | pH | |
| | Turbidity | |
| | (Your expert group test title) | |

# TITLE: FROG CREEK DATA

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- What tests need to be performed AT Frog Creek? (Don't forget qualitative observations!)
- What tests should we conduct back in the lab?
- In your group, determine how you want to record your data and set up your data table before we leave for the creek.
  - Each group member needs to have a place to record data in their journal.

# DAY 4

| Date | Title | Page |
|---|---|---|
| | TCU area Fort Worth Map | |
| | South Campus TCU Map | |
| | About Frog Creek | |
| | Temperature | |
| | pH | |
| | Turbidity | |
| | (Your expert group test title) | |
| | Frog Creek Data | |

# Share what you learned

| Test | Group 1 | Group 2 | Group 3 | Group 4 | Group 6 | Group 7 |
|---|---|---|---|---|---|---|
| Temp A<br>Temp B | | | | | | |
| pH | | | | | | |
| Turbidity | | | | | | |
| Nitrate | | | | | | |
| Phosphate | | | | | | |
| D.O. | | | | | | |
| Coliform Bacteria | | | | | | |

# TITLE: BENTHIC MACROINVERTEBRATES

- Immature aquatic stages of insects
  - Benthic = bottom Macro = seen with naked eye Invertebrate = animal that lacks a backbone
  - Live on submerged material on bottom of river or stream
  - Require a special environment to survive
  - Their presence or absence indicates the health of the water
- Sorting the Organisms
  - Use a spoon to separate the organisms from the leaves in the tray
  - Place each organism in the petri dish next to the drawing that it resembles.
    - Use the hand lens to examine the organisms

# POLLUTION TOLERANCE

Put an X in Column A next to the organisms that are in our samples

Count the Total number of "X"s for each group. Write that number in column B

Multiply the number in Column B by the appropriate index in Column C and enter the result in Column D. Add them all together to determine the Pollution Tolerance Index.

## POLLUTION TOLERANCE INDEX WORKSHEET

| | COLUMN A | | COLUMN B | COLUMN C | COLUMN D |
|---|---|---|---|---|---|
| GROUP 1 | _____ Mayflies<br>_____ Stoneflies<br>_____ Dobsonflies<br>_____ Caddisflies | } | _____ | x 4 = | _____ |
| GROUP 2 | _____ Dragonflies<br>_____ Damselflies<br>_____ Beetles<br>_____ Crane Flies<br>_____ Planarians<br>_____ Sowbugs<br>_____ Scuds | } | _____ | x 3 = | _____ |
| GROUP 3 | _____ Midges<br>_____ Black Flies<br>_____ Leeches | } | _____ | x 2 = | _____ |
| GROUP 4 | _____ Earthworms<br>_____ Snails | } | _____ | x 1 = | _____ |
| | | | | POLLUTION TOLERANCE INDEX | _____ |

20

# Communicate your findings

- Each group of experts should decide how you will communicate the results of your test to the rest of us.

- You need to tell us:
  - What you tested
  - Why it is important
  - What you found
  - What your data says about Frog Creek

To Whom it May Concern,

During recent construction we have discovered several issues with the water behind Amon Carter Stadium. We are currently evaluating the problems and determining the best course of action.

It has come to my attention that you have students doing some work at the creek that flows behind Amon Carter Stadium. I am interested to know what recommendations you and your students would make regarding state of the water and suggestions for possible improvements.

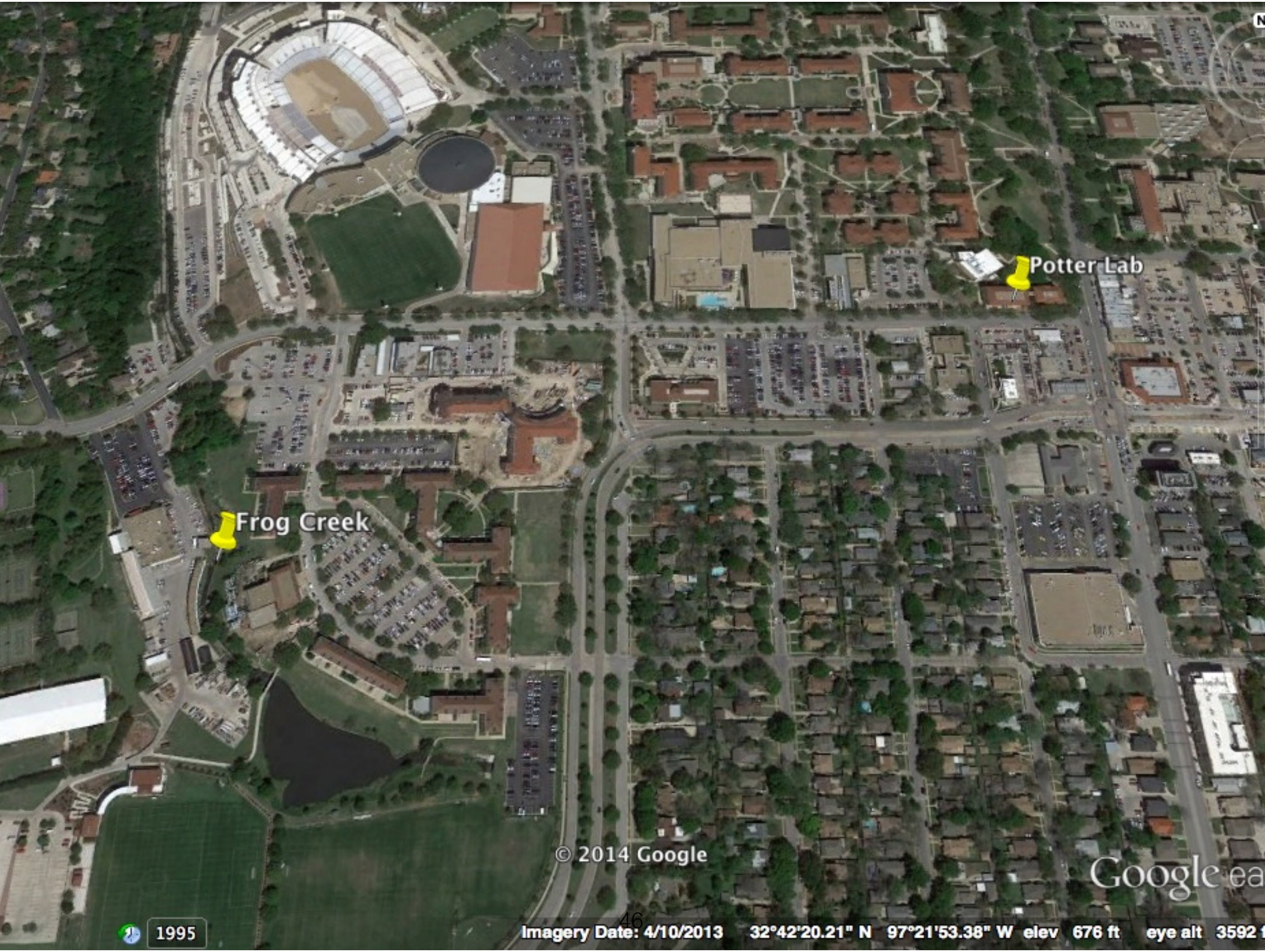
If you have any information that would help our efforts, it would be greatly appreciated.

Thank you.

Sam Smith

TCU Physical Plant


Potter Lab
Frog Creek
© 2014 Google
Google ea
1995
Imagery Date: 4/10/2013 32°42'20.21" N 97°21'53.38" W elev 676 ft eye alt 3592 f

# Temperature

Difference in temperature

- Excellent
  - Difference = 0-2
- Good
  - Difference = 3-5
- Fair
  - Difference= 6-10
- Poor
  - Difference >10

# pH

- Excellent
  - 7
- Good
  - 6 or 8
- Poor
  - 4, 5, 9, 10, 11

# Turbidity

- Excellent
  - 0 JTU
- Good
  - >0 to 40 JTU
- Fair
  - 40 to 100 JTU
- Poor
  - >100 JTU

# Benthic Macroinvertebrates

Pollution Tolerance Index

(from worksheet)

- Excellent
  - 16 and above
- Good
  - 12-15
- Fair
  - 8-11
- Poor
  - 7 or less

# Nitrate

- Fair
  - 5 ppm
- Poor
  - 20, 40 ppm

# Phosphate

- Excellent
  - 1 ppm
- Good
  - 2 ppm
- Fair
  - 4 ppm

# Dissolved Oxygen

Percent Saturation

- Excellent
  - 91-110
- Good
  - 71-90
- Fair
  - 51-70
- Poor
  - <50

# Coliform Bacteria

- Good
  - Negative
- Poor
  - Positive

# TITLE: FROG CREEK AREA PROFILE

- Qualitative Description
  - Soil, erosion, odor, water, pollution, vegetation, wildlife, anything else
- Using what you know about ecosystems, can you describe the health of Frog Creek?

# DAY 5

| Date | Title | Page |
|---|---|---|
| | TCU area Fort Worth Map | |
| | South Campus TCU Map | |
| | About Frog Creek | |
| | Temperature | |
| | pH | |
| | Turbidity | |
| | (Your expert group test title) | |
| | Frog Creek Data | |
| | Benthic Macroinvertebrates | |
| | Frog Creek Area Profile | |

# TITLE: FROG CREEK AREA

| Test | Data | What does it mean? |
|---|---|---|
| Temperature | | |
| pH | | |
| Turbidity | | |
| Nitrate | | |
| Phosphate | | |
| Dissolved Oxygen | | |
| Coliform Bacteria | | |
| Pollution Tolerance Index | | |

# ANALYZE THE RESULTS

- What can our test data tell us?

- Using what you know about what each test measures, can you describe the health of Frog Creek?

# FIELD REPORT

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- Begin with a "Stake-holder's Statement"
  - Describe the area and what you think about it.
  - Why is the area important?
  - What are some problems you can identify?
  - What are some good things about the area?

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  - Describe the data we collected and what it means for water quality.

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  - What are some good things about the area?
- Describe the water quality issues
  - Describe the data we collected and what it means for water quality.
- End with any recommendations you would make
  - What do you think would help Frog Creek?