

**Geology 120**  
**Introduction to Environmental Geology**  
**Spring 2008**

**Questions and Appendices for hometown project**

When Sandra Steingraber wrote *Living Downstream*, she included an epilogue listing sources of information about environmental health in the U.S. and Canada. Since she wrote her book, the number of web sites and the amount of information publically available has burgeoned. The following prompting questions and web sites provide places to start your research (and you'll find Steingraber's choices helpful, too). The questions are intended to help guide your research, but you don't need to attempt to answer all of them. The starting web sites will also lead you to other sources of information. Many of the sites I've listed here are government sites with maps and statistics. The information from even these sites needs close examination and assessment, as you would do for any source you use. Such assessing is doubly necessary when the authors of a site have a particular bias.

**1. Drinking Water Supply**

Some questions to consider:

- What is the source of the drinking water in your home town? Is it surface water, ground water? A river? Rainfall and runoff captured in a reservoir? A mixture of sources? If an aquifer or river, what is the aquifer or river?
- How long has the source of drinking water been in operation? If it has changed, why has it changed?
- What are the source characteristics of the water (chemical composition, pH, turbidity, etc.)? What does the municipality or public water supplier do to the water before sending it to customers?
- What does the "consumer confidence report" say about contaminants in the drinking water supply? (Note that all public drinking water suppliers must submit a yearly CCR to all customers – but they don't need to put it on a web site).
- What is the average yearly water use in your home town? Are there concerns about scarcity of water?
- Are there concerns about pollution of drinking water? What are the concerns?

A useful way to think about water is to construct a diagram that has an open faucet in the lower right. Working backward from the open faucet, illustrate how the water that comes out gets there. This diagram is rather like a model of a system like the one Trimble constructed for sediment in Coon Creek, in that it will show storage elements or reservoirs (possibly quite literally) and flows. Note on the diagram where the water is modified in any way, such as by chemical treatments like chlorination or fluoridation, mechanical treatments to remove sediment,

etc. You will also want to think about the chemical characteristics of the water and about your own water use. Some of the sites below will also help you determine if there are problems with water supply and water quality in your region and how they are being addressed.

### **Where to Look: Online Data for Drinking Water Sources**

This handout was put together by one of my students a few years ago. I've double-checked most of the links and they seem to be OK. I've also added a few things.

#### **epa.gov:**

- Ground/drinking water page (<http://www.epa.gov/safewater/index.html>) has (mostly public consumption-level) info on source water, drinking water standards, and so forth. Some interesting stuff:

- for example, local drinking water info:

- <http://www.epa.gov/safewater/dwinfo/index.html>

- eg. In MN: <http://www.epa.gov/safewater/dwinfo/mn.htm>

- ... which has textual information on MN water programs, water quality reports, etc. (presumably the same info is available for other states). It is also searchable by county, where it provides spreadsheets of water system names (e.g. Carleton College) and their primary water sources, populations served, violation reports, etc.

- drinking water data and databases page:

- <http://epa.gov/ogwdw/databases.html>

- ... a wealth of mostly textual databases, as far as I can tell, and info on rules and regulations. Has interesting stuff like drinking water "factoid" sheets

- (<http://epa.gov/ogwdw/data/getdata.html>) which list water system data by state (several years available).

- If you can access your drinking water supplier's most recent CCF (consumer confidence report), here's a site (one of several) that helpfully explains some of the code:

- [http://www.nsf.org/consumer/drinking\\_water/dw\\_quality.asp?program=WaterTre](http://www.nsf.org/consumer/drinking_water/dw_quality.asp?program=WaterTre)

- The Office of Water page (<http://www.epa.gov/OW/index.html>) has lots of links to textual information, and also Map Your Waters (below)

- There's a neat downloadable consumer-quality booklet filled with drinking water information at (<http://www.epa.gov/safewater/wot/>); it has nice pictures and diagrams, a glossary of terms, and charts of contaminant regulations.

- Surf Your Watershed (<http://www.epa.gov/surf/>) has a nice clickable map (also searchable by other info, including zip code) that allows you to find your watershed; it gives linked info from local citizen groups to Science in Your Watershed (includes GIS data sets supposedly, but Northfield only had one).

- EnviroMapper ("for Water" version below) allows you to generate a map of your area by zip code and download some layers through a different link

- EPA's Where You Live page (<http://www.epa.gov/epahome/whereyoulive.htm>) contains searchable environmental information of interest to smaller communities, such as:

-The Envirofacts warehouse (<http://www.epa.gov/enviro/>), which lets you search by topic and state for environmental information; e.g. a search under water shows (among other things) water microbial and disinfection byproduct data for your state; for MN it gives state levels of *Cryptosporidium*, *Giardia*, etc. It also has a nice Queries page which allows you to search for data through all sorts of filters—e.g. the Safe Drinking Water Information Systems (SDWIS) filter will give you water system information (same as ground/drinking water page above).

-Window to My Environment (<http://www.epa.gov/enviro/wme/>) also gives a layered map manipulable online; clicking on one of the linked layers brings you to a page of map legend descriptions, which explains the layer and where it came from (at the bottom are a list with links directly to the map data sources—most seem to have metadata too).

#### **epa.gov/water:**

•Map Your Waters (<http://www.epa.gov/waters/>) has lots of cool looking tools:

-EnviroMapper for Water (<http://www.epa.gov/waters/enviromapper/index.html>) lets you map water data; some of the layers are available for download from data downloads (see below), The WATERS Expert Query Tool ([http://www.epa.gov/waters/tmdl/expert\\_query.html](http://www.epa.gov/waters/tmdl/expert_query.html)) also supposedly lets you combine data into a tabular report for downloading, but it's definitely not self-explanatory.

-Data Downloads (<http://www.epa.gov/waters/data/downloads.html>) has GIS shapefiles and metadata available, in apparently large amounts, for water quality assessments, standards, and impaired waters.

#### **water.usgs.gov/owq/dwi:**

•Groundwater info pages (<http://water.usgs.gov/ogw/>) has stuff like a groundwater atlas (<http://capp.water.usgs.gov/gwa/gwa.html>), which has jpeg maps (unfortunately no GIS maps, as far as I can tell, nor metadata).

•Drinking water links ([http://water.usgs.gov/owq/dwi/other\\_links.htm](http://water.usgs.gov/owq/dwi/other_links.htm)) shows the homepages of several state/nationwide institutions from the USGS Environment and Human Health page to Emergency Disinfection of Drinking Water to the National Atlas.

•USGS Environment and Human Health page (<http://health.usgs.gov/>) includes links to multiple reports, fact sheets, and programs, particularly:

-Human Health Database ([http://health.usgs.gov/health\\_database.html](http://health.usgs.gov/health_database.html)) which has links to many government agencies in a spreadsheet-format; these include the National Hydrography Dataset, National Water Quality Assessment Program, Water Use in the US. Some appear to have maps.

•National land cover data page has a nice clickable US map that give land use layers by state; according to its metadata, this includes water source data.

<http://edc2.usgs.gov/scripts/mapserv.exe?map=d%3A%5Cinetpub%5Cwwwroot%5Ciccp%5Cnlcd%5Cnlcd.map&zoomsize=2>

<http://nwis.waterdata.usgs.gov/nwis/qw> (National Water-Quality Assessment Program information)

On both of these USGS sites, it's helpful to make use of the pull-down menus.

[http://water.usgs.gov/nawqa/studies/study\\_units\\_listing.html](http://water.usgs.gov/nawqa/studies/study_units_listing.html) (Map with links below to more detailed water-quality assessment data organized by watershed. Note that not all areas in the US are covered.)

### **[water.usgs.gov/maps.html](http://water.usgs.gov/maps.html): Water resources maps and GIS info**

\*Several search engines are available. I looked at the following:

- Full list of water GIS datasets (<http://water.usgs.gov/lookup/getgislist>) shows a long list of links to the metadata of various spatial data sets; these mostly seem to have download links at the bottom of the metadata page. For example:

- “Raster dataset showing the probability of detecting atrazine/desethyl-atrazine in ground water in Colorado, hydrogeomorphic regions and atrazine use estimates included” is at [http://water.usgs.gov/GIS/metadata/usgswrd/XML/atra\\_hyd\\_use.xml](http://water.usgs.gov/GIS/metadata/usgswrd/XML/atra_hyd_use.xml); you can apparently download the layer at [http://water.usgs.gov/GIS/dsdl/atra\\_hyd\\_use.tgz](http://water.usgs.gov/GIS/dsdl/atra_hyd_use.tgz).

- The Federal Geographic Data Committee’s geographic data clearinghouse lets you click a region then search for data by state, data servers (lots available), etc. Searching with MN and the servers beginning with Minnesota, I found the National Hydrography Dataset and a map of MN ground water provinces, downloadable free of charge from the MN DNR (you’re linked directly).

- The National Hydrography Dataset (<http://water.usgs.gov/maps.html>) has a great set of data available—under Data one can find its viewer (<http://nhdgeo.usgs.gov/viewer.htm>), which shows a layered map of the US with layers directly extractable. V. nice ☺

## **2. Local water sources and watersheds**

Many of the sources listed above in the section on drinking water supplies, especially the USGS sites, the Hydrographic Dataset and the EPA “surf your watershed” site, can be used to help locate your watershed.

### **Some questions to consider:**

- In which watershed (drainage basin) is your home town located? (Note: it’s possible for a town to be in more than one). In which larger drainage basin is your local watershed? (e.g. Northfield’s in the Cannon River drainage basin, which in turn is part of the Upper Mississippi drainage basin).
- What size or sizes of streams go through your community? Are they perennial (do they flow all year round)?
- Does your community have lakes and/or wetlands? Are these natural, artificial or both?
- Have the rivers and streams in your community been managed? For instance, are there dams?
- Is surface water from rivers, lakes or reservoirs used for drinking water?
- Are any of the natural surface waters in your community identified as “impaired” by the EPA? If so, why?
- What information is available about the chemical composition of surface water bodies?
- Are the bodies of surface water rated for recreational uses?

- What is known, if anything, about the presence of endangered species in these waters?
- What is known, if anything, about the presence of, or threats from exotic invasive species in these waters?

### 3. Natural Hazards:

#### Climatic/water-related:

Hurricanes  
Tornadoes  
Floods  
Drought  
Extreme heat  
Fires

#### Geologic:

Seismic risk (including fault rupture, ground shaking, earthquake-related landslides, liquefaction, mass movement)  
Volcanoes  
Landslides  
Land subsidence

#### Some questions to consider:

- Is your hometown particularly at risk for certain kinds of natural hazards? Pretty much immune to some of these hazards?
- For the hazards that affect your community, what information is available to citizens defining the zones of the hazards?
- If the hazard is episodic, how frequently do large events occur? How large is large? (What is the largest event of a particular type to affect your community in historic times)?
- If the hazard has affected your community in recent years, what have been the effects? How have government and citizens responded?

#### Some places to start:

USGS Natural Hazards Gateway: <http://www.usgs.gov/hazards/>

National Atlas: <http://nationalatlas.gov/> (check out the map layers lists)

FEMA "Are you Ready?": [http://www.fema.gov/areyouready/natural\\_hazards.shtm](http://www.fema.gov/areyouready/natural_hazards.shtm)

National Drought Mitigation Center: <http://drought.unl.edu/>; drought monitor:

<http://drought.unl.edu/dm/index.html>

Land Subsidence: <http://water.usgs.gov/ogw/subsidence.html>

Floods and maybe some other things:

[https://hazards.fema.gov/femaportal/wps/portal!/ut/p/.cmd/cs/.ce/7\\_0\\_A/s/7\\_0\\_CM9/s.7\\_0\\_A/7\\_0\\_CM9](https://hazards.fema.gov/femaportal/wps/portal!/ut/p/.cmd/cs/.ce/7_0_A/s/7_0_CM9/s.7_0_A/7_0_CM9)

#### Specifically about earthquakes:

Earthquake probability map generation – by zip code:

<http://eqint.cr.usgs.gov/eq/html/eqprob.html>

Map viewer: <http://eqmaps.cr.usgs.gov/website/nshmp/viewer.htm>

Recent US earthquakes: <http://earthquake.usgs.gov/recenteqs/>

Shake Maps: <http://earthquake.usgs.gov/shakemap/>

Homepage for earthquake probabilities: <http://earthquake.usgs.gov/hazards/probability.html>

#### 4. Pollution and waste

##### Some questions to consider:

- What are the sources of pollution in your community? These could be industries, agriculture, waste deposit sites (especially older ones), and others.
- The EPA (or the equivalent state agencies) give permits for discharges into the air and water. Who are the major permittees in your community?
- As you think about the history of your community, what occupations and industries existed there in the past, though not now, that might have affected people's health?
- How does your community dispose of solid waste? Hazardous waste? Have the disposal practices changed through time?
- What does the Scorecard (see below) and/or similar sites suggest about environmental justice in your community, county and state?

##### Some places to start looking:

Envirofacts Warehouse:

[http://www.epa.gov/enviro/html/ef\\_overview.html](http://www.epa.gov/enviro/html/ef_overview.html)

“other” gets you to a list of EPA regulated facilities, but please note that these include all facilities with permits to handle hazardous wastes, including dentists' offices, schools and colleges – not many of whom are polluting.

The RCRA <http://www.epa.gov/rcraonline/> hazardous wastes act

Superfund: <http://www.epa.gov/region01/superfund/index.htm> and

<http://www.epa.gov/oerrpage/superfund/sites/npl/npl.htm>

Surf your watershed: <http://www.epa.gov/surf/>

Toxic release inventory: <http://www.epa.gov/tri/>

Two non-government sites: Scorecard: <http://www.scorecard.org/index.tcl> (Note that it can be challenging at this site to distinguish information that applies to one facility from information that applies to an entire county. Please check with me or a lab assistant if you have questions because you will want to get the facts straight).

Toxmap: <http://toxmap.aquilent.com/toxmap/main/index.jsp>

#### 5. Cancer

##### Some questions to consider:

- How does the mortality rate for cancers overall in your community compare to the national average?
- Has the mortality rate (in common scale) for all cancers changed through the years of record?
- Are the mortality rates different for different ages and genders?

- Are there any particular outliers, e.g., types of cancers that are much more prevalent or much less prevalent in your community?
- Is there any indication that cancer rates in your area are correlated with environmental factors?

**Place to start looking:**

<http://www3.cancer.gov/atlasplus/index.html>

This site has recently come on line (I heard about it in April). It allows you to map customizable mortality maps, with age, gender, and date control. You can tell, for instance, whether the incidence of particular kinds of cancer in a particular area have increased or decreased through time (be sure to choose the “maps with common scale” option). There are a few annoying things, like the fact that the legend which includes the mortality rate doesn’t carry through from map to map. Also, you may not be able to look specifically at your county. Instead, you may need to find the “state economic area” that includes your county.

For display purposes, you have a choice of red monochrome or red/blue maps – but look carefully at the numbers, whichever you pick (both at the mortality figures and the dates of the maps).

**6. Energy: Where does your community’s energy come from?**

**Some questions to consider:**

- How many people live in your household full-time? part-time (like you!)?
- How many utilities (or other sources) supply you with energy? In what form? (You’ll want to consider energy for electricity, heating and cooling, hot water and possibly other uses. You’ll also want to consider what kind of material is consumed to produce this energy. For example, my home is heated and the hot water is heated with natural gas; my other energy consumption is electric.)
- What are the names of the utilities? (At my house, it is XCEL Energy (formerly Northern States Power) for both gas and electricity). Do you use any energy not supplied “through the grid” by a utility?
- On a recent bill you’ve brought from home (or corresponded with parents or housemates), what is the electric use in that month? (What month is it)? What is the average kwh per day? (Most utilities will report electric use in kilowatt-hours). What is the cost per day of this electricity? What period of the year does the bill cover?
- If this information is provided, how does the electric usage compare with the same month last year? How about the cost?
- If you used other forms of energy in addition to electricity, how much did you use? (For instance, on my NSP bill for March 1998, I used 147 ccf of natural gas, and the back of the bill tells me that one ccf is 100 cubic feet of gas. This amount has been slightly adjusted for the heat content of the gas so I find that I used 149 therms in March.) What

is the average daily usage for these other energy sources? What is the cost per day of this energy?

- Where does the energy come from? Where are the power plants located that supply your electricity? How does it get to your home? Usually, it is most interesting to ask the question separately for electrical energy and for other forms of energy. You will at least want to look at the information on primary energy sources, energy use by sector (residential, commercial, etc.), and by utility (which will give you the information on how your electricity is generated) for your state.
- Where does the material come from that is used to make the electricity (the nuclear fuel, coal, water, oil, etc.)? Again, for some of you, this information will be easy to find. Others of you may know in general terms (don't worry about specific percents).
- What is the source for the other kinds of energy used in your home? How does that material get to your home?
- How much is your household contributing to atmospheric CO<sub>2</sub>? Several organizations have developed web sites with CO<sub>2</sub> calculators. This site uses a calculator based on the article "Carbon Debt: Restoring the Balance," by Dan Smith, American Forests, Autumn 1996:

#### **Some places to start looking:**

Here are some Department of Energy sites with state-by-state information about energy sources and consumption. Try to report 2005 data so we can get a comparison around the class.

- <http://tonto.eia.doe.gov/state/>
- <http://www.eia.doe.gov/emeu/states/seds.html>
- [http://www.eia.doe.gov/cneaf/electricity/st\\_profiles/e\\_profiles\\_sum.html](http://www.eia.doe.gov/cneaf/electricity/st_profiles/e_profiles_sum.html) You should be able to find states ranked by energy production and use, a breakdown of energy use and locations of the major power plants, as well as emissions data.
- Try to find the web sites for your energy utility (or utilities) has a web site. If so, see if you can find out from your energy utility whether the general breakdown of energy sources for your state applies to their utility, too. A state agency or up-to-date reference book may have it too. (Move on if you can't find it quickly.)

Carbon footprint calculator sites:

<http://www.carbonfund.org/site/pages/individuals/category/Carbon%20Calculators/?gclid=CPHntdSYtpMCFRcfsgodDDFDA>

[http://www.epa.gov/climatechange/emissions/ind\\_calculator.html](http://www.epa.gov/climatechange/emissions/ind_calculator.html)

(There are lots of others; these two specifically ask about energy use, which I think is important).

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**Drinking water: Bottled or not**

**For the bottled water collected by your group:**

Determine the sources of the bottled water:

What do the labels say about composition of the water?

What processes have happened to it on its way to being bottled?

How does it compare with drinking water at Carleton  
([http://apps.carleton.edu/campus/facilities/environmental/water\\_report/](http://apps.carleton.edu/campus/facilities/environmental/water_report/)) and in Northfield  
(<http://www.ci.northfield.mn.us/assets/n/Nfld-Water-CCR-2006.pdf>)?

How does it compare with drinking water from your home town?

<http://www.epa.gov/safewater/dwinfo/index.html> (The EPA site that has links to information about public drinking water supplies in each state).

If you can access your drinking water supplier's most recent CCF (consumer confidence report), here's a site that helpfully explains some of the code:

[http://www.nsf.org/consumer/drinking\\_water/dw\\_quality.asp?program=WaterTre](http://www.nsf.org/consumer/drinking_water/dw_quality.asp?program=WaterTre)

**More general questions:**

What is the range of properties of bottled water?

What are the other environmental effects of bottled water? (Think about transportation, packaging, marketing, etc.)

**Useful bottled water sites:**

[http://www.epa.gov/safewater/faq/pdfs/fs\\_healthseries\\_bottlewater.pdf](http://www.epa.gov/safewater/faq/pdfs/fs_healthseries_bottlewater.pdf)

<http://www.bottledwater.org/default.htm> (this is a web site for an industry group).

<http://www.drinktap.org/consumerdnn/> (this is a site linked from the American Water Works Association, a trade group for public water supply operators).

<http://www.nrdc.org/water/drinking/bw/bwinx.asp> NRDC report on bottled water

<http://www.cfsan.fda.gov/~dms/botwatr.html>

<http://www.cfsan.fda.gov/~lrd/bot-h2o.html>

(two FDA sites on bottled water; the FDA regulates bottled water and established the categories listed below:)

**FDA Definitions for Bottled Water, established in 1995:**

(<http://www.cfsan.fda.gov/~dms/botwatr.html>)

Type	Definition
Artesian Water	Water from a well tapping a confined aquifer in which the water stands at some height above the top of the aquifer.
Mineral Water	Water containing not less than 250 ppm total dissolved solid originates from a geologically and physically protected underground water source. Mineral water is characterized by constant level relative proportions of minerals and trace elements at the source. Minerals may be added to mineral water.
Purified Water	Water that is produced by distillation, deionization, reverse osmosis or other suitable processes and that meets the definition of "purified water" in the U.S. Pharmacopeia, 23d Revision, Jan. 1, 1995. Purified water, appropriate, also may be called "demineralized water," "deionized water," "distilled water," and "reverse osmosis water."
Sparkling Bottled Water	Water that, after treatment and possible replacement of carbon dioxide, contains the same amount of carbon dioxide that it contains at its natural emergence from the source.
Spring Water	Water derived from an underground formation from which water flows naturally to the surface of the earth at an identified location. Spring water may be collected at the spring or through a borehole tapping the underground formation feeding the spring, but it must meet additional requirements for use of a bore hole.
	<i>(For complete regulatory definitions, see 21 CFR 165.110(a))</i>