

Subjects/Target Grades

Science and Social Studies
Grades 7-12

Duration/ Location

30 minutes
Classroom setting

Materials

Per class

- River Monitoring Sampling Locations teacher resource

Per small group or individual student

- Fecal Coliform Levels (colonies/mL) at Sites in the Grand River Watershed resource
- Exploratory Data Analysis student activity

Lesson Three Elaborate: Managing Pathogens- pages 11 & 12 from lesson 3

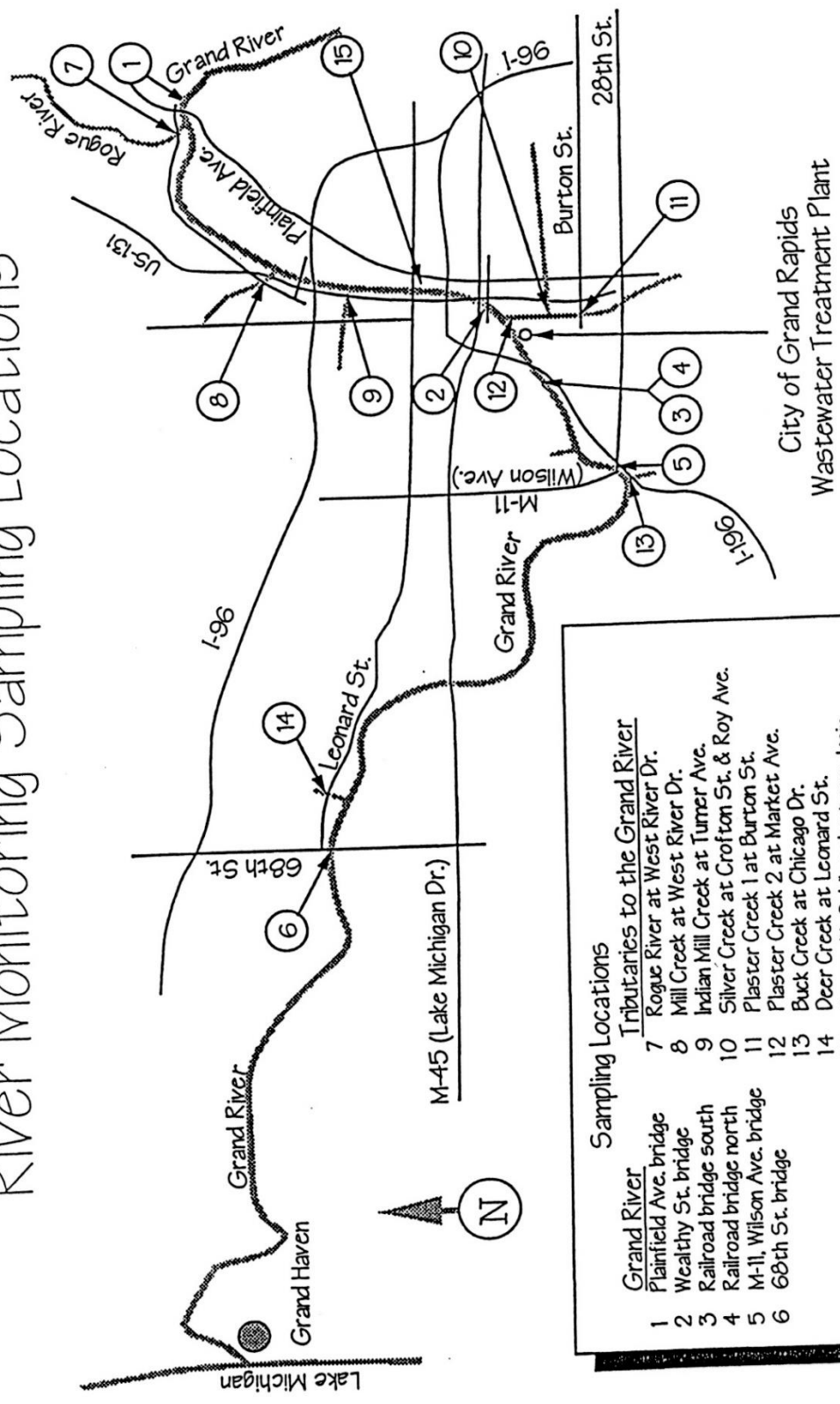
Activity Overview

Students examine fecal coliform data sets for various locations in the Grand River watershed.

Lesson Procedure

- 1) Pose the question: *How can monitoring data be translated into a usable format for understanding and decision-making?* Answers might include making graphs and charts, generating statistics, illustrating trends, incorporating maps, and other means of telling a story in an understandable way.
- 2) Provide students with datasets showing fecal coliform bacteria monitoring results from the Lower Grand River sites monitored by the Grand Rapids Water Resource Recovery Facility. See the *Fecal Coliform Levels (colonies/mL) at Sites in the Grand River Watershed* resource. Show students the map of the sites that have been monitored (*River Monitoring Sampling Locations* teacher resource). Using the *Exploratory Data Analysis* student activity, have them analyze one of the sites found in the dataset. Pose the question: *So what do the data indicate?*
- 3) Prior to 1994, the water quality standard in Michigan required that levels not exceed 200 fecal coliform colonies per 100 mL. Compliance with the fecal coliform standard was determined based on the geometric mean of any series of five or more consecutive samples taken over a 30-day period. For their site, have students determine the percent exceedance based on how many times a sample exceeds 200 fecal coliform colonies per mL. (*Teacher Note:* Geometric and arithmetic means are calculated differently. In this activity students are calculating arithmetic means.) Have students compare the values for the various sites in the Lower Grand River Watershed.

River Monitoring Sampling Locations



Source: Vail, J.H. 1998. An Analysis of Fecal Coliform Bacteria as a Water Quality Indicator, PhD Thesis

Exploratory Data Analysis

Site Location: _____

1. Select a site in the Lower Grand River Watershed for analysis.
3. Examine data graphically. (line graphs, bar graphs, scatterplots, box plots)
4. Look for relationships and trends. (How many times were the fecal coliform levels above 200 mL per 100 mL? Were there seasonal trends?)
5. Compare results with other geographic areas.

Optional: Calculate basic descriptive statistics. (arithmetic average, geometric mean, median, range)

Questions:

1. What trends did you see at your site?
2. In what percentage of sampling events were the fecal coliform levels above 200 colonies/100 mL?
3. Does the time of the year influence what was happening at your site?
4. How did your site compare with other sites?
5. Based on the monitoring data alone, should this be a priority area to address for bacterial contamination? Why or why not?
6. How would information on stream flow and land use help to answer Question 5?

Fecal Coliform Levels (colonies/100 mL) at Sites in the Grand River Watershed

Source: Grand Rapids Wastewater Treatment Plant

Date	Buck Creek	Eastmanville	Indian Mill Creek At Turner	Mill Creek	Northland Drive (Plainfield)	Plaster Creek 1 – at Burton	Plaster Creek 2- at Market	Rogue River At West River
2/15/12	155	20	109	36	10	380	260	36
5/16/12	770	77	970	230	62	950	2,400	340
8/15/12	360	120	900	230	22	780	920	82
11/14/12	230	80	260	136	3	320	260	64
3/13/13	82	290	2,300	164	250	191	200	127
4/29/13	73	152	36	91	49	270	36	82
6/12/13	460	80	710	490	97	290	630	127
9/18/13	270	147	670	280	25	400	1,320	73
12/11/13	45	50	440	9	32	2,700	145	45
1/15/14	182	145	100	127	70	680	820	91
4/16/14	109	68	164	182	43	1,180	640	173
6/18/14*	>15,000	>1,500	>15,000	>15,000	97	>15,000	>15,000	7,000
7/16/14	833	143	700	500	123	1,200	600	100
8/13/14	6,500	>1,500	5,300	2,300	690	>15,000	>15,000	480
9/17/14	370	210	No data	280	60	650	2,200	127
10/15/14	4,700	>1,500	3,500	6,100	>660	5,600	5,100	3,000
2/18/15	9	No data	590	9	20	36	No data	9
5/13/15	200	670	1,500	1,300	100	1,800	1,190	400
6/17/15	750	420	2,100	780	670	1,030	560	191
7/15/15	3,700	710	2,700	670	>1,500	4,600	5,600	300
8/12/15	880	340	6,700	2,100	>500	940	1,300	650
9/16/15	460	90	660	250	52	290	2,200	155
11/18/15	700	137	320	>15,000	28	460	3,800	127
3/23/16	100	10	45	18	10	45	560	27
5/18/16	164	55	1,340	200	40	300	250	82
6/14/16	1,400	107	4,200	460	12	470	4,000	164
7/20/16	690	5	840	350	28	1,170	2,400	64

Note: There was 2.08 inches of rain on 6/18/14.