Spring 2024

Rouge Education Project: Data Summary Report

Friends of the Rouge

Plymouth, Michigan

www.therouge.org

Published July 2024

Table of Contents

Introduction

History of the Rouge Education Project

The Rouge Education Project (REP) is a school-based watershed education and water quality monitoring program coordinated by Friends of the Rouge. Its mission is to promote awareness and stewardship of the Rouge River watershed through school-based water quality monitoring, investigation, and problem solving. The program's major objectives are to:

- Provide opportunities for schools to engage students in hands-on, real world science through water quality monitoring of the Rouge River;
- increase participants' awareness of the Rouge River watershed, how they impact it, and how it impacts them; and
- empower participants to apply knowledge and awareness gained through the REP to identify and address environmental issues in the Rouge River watershed and beyond

The Rouge Education Project began in 1987 with 16 high schools. During spring 2024, eight schools were able to visit the banks of the river for hands-on water quality monitoring. Sampling took place from April 29 – May 15, 2024.

Results throughout this report are organized by the seven subwatersheds that comprise the Rouge River basin: Lower 1 and Lower 2 (encompassing the Lower Branch of the river), Main 1-2 and Main 3-4 (encompassing the Main Branch of the river and the Main Stem downstream of the confluence of all branches), Middle 1 and Middle 3 (encompassing the Middle Branch of the river), and Upper (encompassing the Upper Branch of the river).

Friends of the Rouge and participating schools used a combination of *LaMotte* and *Hach* brand water test kits and/or digital testing probes and meters. This report, additional data, and program information also are available on the Friends of the Rouge website at www.therouge.org.

How Data are Used

As noted above, the REP mission is to promote and increase each student's environmental awareness and sense of stewardship within his or her local watershed. As such, data are not intended to meet the same standards of collection and use as other, more scientifically rigorous programs. While REP staff continues to develop effective quality assurance/quality control methods to ensure that the data are as consistent and reliable as possible, REP results are used primarily for educational awareness and demonstrate an exercise in field water quality monitoring and analysis for school groups.

Michigan Watersheds & the Rouge River Basin

Michigan is home to numerous wetlands, streams, and rivers. Figure 1 displays the general division of watersheds throughout the state. Areas that are left un-shaded are areas with many small streams and no major river body.

Figure 1: Major watersheds of Michigan. The red outline depicts the Rouge River basin. (Image courtesy of Michigan State University.)

Scaling down to the Rouge from the state level, the river is divided into seven smaller drainage basins called “sub-watersheds.” These subwatersheds (Figure 2) comprise the four branches of the Rouge River: the Main, Upper, Middle, and Lower branches. All four branches flow into the Main Stem, which empties into the Detroit River. The Rouge River watershed is approximately 467 square miles in area and is home to 1.35 million people in 47 communities.

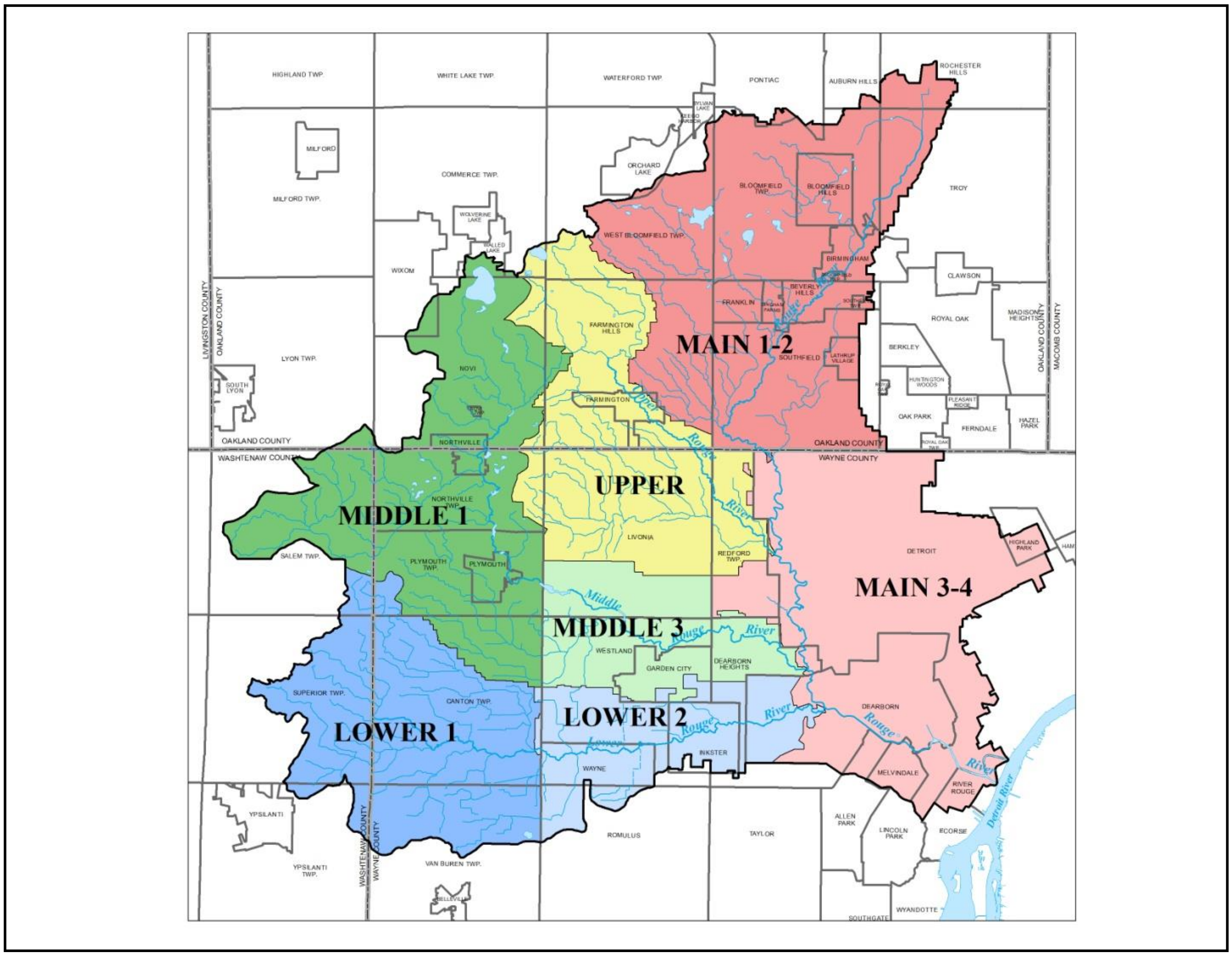

Figure 2: Seven subwatersheds that make up the Rouge River basin in Michigan

Water Quality Monitoring Parameters

Schools participating in the Rouge Education Project are encouraged to follow the procedures recommended in the Mark K. Mitchell & William B. Stapp *Field Manual for Water Quality Monitoring*. The Rouge Education Project was the first large-scale sampling event of its kind using this protocol.

Chemical Monitoring

Schools participating in the REP monitor up to nine chemical water quality parameters (described below). These include dissolved oxygen, fecal coliform bacteria, pH, biochemical oxygen demand (BOD), change in temperature, total phosphates, nitrates, turbidity, and total solids (though elementary schools do not conduct the latter).

Middle and high schools that monitor at least six chemical parameters calculate an overall water quality value (index) for their sampling site, which is based on all of their chemical test results. This value, dubbed the "Q" value, is on a scale of zero to 100, with higher numbers indicating relatively better water quality (Appendix II). Chemical testing techniques reveal a snapshot of water conditions at the time of sampling opposed to conditions over time.

Dissolved oxygen

Oxygen from the atmosphere is mixed into water by waves and turbulent motion. Algae and rooted aquatic plants also put oxygen into water through photosynthesis. Most aquatic plants and animals must have some amount of oxygen to survive. Waters with consistently high levels of dissolved oxygen (DO) are considered to be stable ecosystems and able to support diverse populations of organisms. DO results are commonly reported as milligrams of oxygen per liter of water (mg/L), and are considered in terms of the tolerance of certain organisms, particularly fishes, to low (*i.e.,* stressful) levels. DO levels below 3.0 mg/L are considered too low to sustain fish populations.

Fecal coliform bacteria

Feces of humans and other warm-blooded animals contain *E. coli* and other types of fecal coliform bacteria. These bacteria themselves do not normally cause disease or illness, but if levels are high, it is more likely that other pathogens are present in the water. Sources of fecal coliform in the river include discharged sewage, wildlife wastes, and runoff from pet waste and livestock. It is important to note that in the Rouge, fecal coliform levels tend to be much higher after rain or snowmelt than during dry periods. During heavy rains and snowmelt, animal wastes are washed into the river and combined sewer systems may overflow, releasing raw or partially treated sewage. Results are commonly reported as the number of colonies of fecal coliform bacteria per 100 milliliters of water.

pH

Water (H_2O) is composed of hydroxide (OH^-) and hydrogen (H^+) ions. The pH test, which stands for "potential of hydrogen," measures the concentration of H^+ ions in a given water sample (*i.e.,* the potential to "give away" excess hydrogen ions). pH values range from zero to 14. A pH of 7 is considered neutral, less than 7 is acidic, and greater than 7 is basic. The pH of water in the U.S. is usually between 6.5 and 8.5. Most organisms cannot live in water that has high or low pH values (more than 9.6 or less than 4.5). The pH is commonly reported as pH units. It is important to note that pH values are logarithmic (pH= $-\log[H^+]$) and, therefore, cannot be averaged to express central tendency (*i.e.,* mean). Instead, median values are used to express central tendency.

Biochemical oxygen demand

Biochemical oxygen demand (BOD) is the measure of the amount of oxygen used by aerobic (air-breathing) microorganisms, such as bacteria and fungi, as they feed upon decomposing organic matter, such as dead aquatic plants. Inputs of phosphates and nitrates to water bodies stimulate the growth of aquatic plants. As these plants die and decompose over time, more and more oxygen is removed from the water by the microorganisms that break them down. High BOD levels can lead to fish kills as the aerobic bacteria use up the dissolved oxygen that fish need to live. BOD results are commonly reported as milligrams of oxygen per liter of water.

Change in temperature

For this test, water temperature is measured both at the sampling site and one mile upstream. The upstream temperature is then subtracted from the downstream temperature to determine the change in temperature. Most physical, biological, and chemical processes in a river are directly affected by temperature. For example, temperature affects the amount of dissolved oxygen in water (cold water holds more oxygen than warm water), the rate of photosynthesis in plants, the metabolic rate of aquatic animals, and the sensitivity of organisms to pollution, disease, and parasites. Changes in water temperature may be the result of thermal pollution (adding warm water to a body of water), changes in the amount of shade over the river, and soil erosion (soil particles suspended in water absorb heat from sunlight). Results for this metric are commonly reported as degrees Celsius.

Total phosphates

Phosphorus is a nutrient that plants need to grow. In most waters, phosphorus is present in very low concentrations, which limits plant growth. However, phosphorus is added to water through human and industrial wastes, fertilizers, and processes that disturb land vegetation. When human activities increase the rate of the supply of phosphorus (and/or other "organic matter") to a water body, it is called cultural eutrophication. The addition of excess nutrients, such as phosphorus, stimulates plant growth and can cause dramatic growth ("blooms") of resident algae and other vegetation. When this vegetation decomposes, dissolved oxygen levels drop dramatically, especially near the bottom of the body of water. Results are commonly reported as milligrams of total phosphate per liter of water.

Nitrates

All plants and animals require nitrogen to build protein. In freshwater systems, nitrogen is naturally more abundant than phosphorus and is most commonly found in its dissolved, atmospheric form (N_2 gas). However, this is not readily available for use by most aquatic plants and must be converted to ammonia (NH_3) and nitrates (NO_3^-). In these forms, nitrogen acts as a plant nutrient, loadings of which can contribute to eutrophication (see *Total phosphates* section above). Plants are less sensitive to changes in ammonia and nitrate levels than they are to phosphorus, however, because nitrogen so rarely limits plant growth (since it is naturally more abundant than phosphorus in freshwater environments). Excess nitrogen is added to rivers by humans through sewage, fertilizers, and runoff from dairies and barnyards. Results are commonly reported as milligrams of nitrates per liter of water.

Note that, as of spring 2013, results for this parameter are not comparable with nitrate findings from historical REP data. This is due to the fact that a conversion factor was introduced and used to account for the entire nitrate compound, as opposed to the isolated nitrogen molecule, which is solely what the LaMotte-brand testing kit measures.

Turbidity

Turbidity is a measure of water clarity; murky or cloudy water has a high turbidity, while clear water has a low turbidity. Suspended solids – such as soil particles, sewage, plankton, and industrial wastes – increase turbidity and decrease the transmission of light. Turbid waters are warmer (see *Change in temperature* section above) and allow less sunlight through for photosynthesis to occur in aquatic plants. In turn, warmer water contains less oxygen for organisms to utilize, which can lead to lower abundances of fishes and invertebrates. Also, suspended solids can harm aquatic organisms by clogging gills, increasing susceptibility to disease, slowing growth rates, and preventing the development of larvae and eggs.

REP schools choose one of three different methods to measure turbidity, which yield results in three different units: feet and inches (using a secchi disk), Jackson Turbidity Units (using a field test kit), and Nephlometer Turbidity Units (using a turbidimeter). Note that previous reports included the Q-value to compare these values. Since NTU = JTU (the units simply reference the method that was used, but are equal to each other), this and future reports will include the average NTU/JTU result.

Total solids

As opposed to turbidity, measuring total solids gives a more quantitative indication of the amount of dissolved and suspended material in water. Suspended solids are matter that can be trapped by a filter, such as soil particles, sewage, plankton, and industrial wastes. These are the materials typically considered to cause changes in turbidity and, as such, are associated with the effects listed above (*e.g.,* clogging gills, increasing disease susceptibility). Dissolved solids are matter that can pass through a filter, such as bicarbonate, calcium, phosphorus, iron, nitrogen, sulfur, and other ions. Dissolved solids can harm aquatic organisms in other ways. Among other effects, these materials control the flow of water to and from organisms' cells, and can affect their balance in the water column. Sources of total solids include urban runoff, lawn fertilizers, effluent from wastewater treatment plants, soil erosion, and decayed plant and animal matter. Results are commonly reported as milligrams of total solids per liter of water.

Biological Monitoring

Most elementary, middle, and high schools in the Rouge Education Project conduct biological monitoring by sampling for and identifying benthic macroinvertebrates. Teachers and select volunteers are trained in sampling and identification using protocol from the Michigan Clean Water Corps for volunteer water monitoring. Schools calculate a total stream quality score based on the type and quantity of benthic macroinvertebrates that they find; lower scores indicate better water quality. These data are not included in this report due to the often incorrect identification of the organisms. To find acceptable biological monitoring data, please refer to the Friends of the Rouge Benthic

Macroinvertebrate Sampling Program results which can be found on the Friends of the Rouge website. As of fall 2021, the Michigan Clean Water Corps initiated new sampling protocol.

Benthic macroinvertebrates

Benthic macroinvertebrates are bottom-dwelling organisms without a backbone that are visible to the naked eye, such as aquatic insect larvae, crayfish, clams, snails, leeches, and aquatic worms. Some benthic invertebrates are very sensitive to pollution and are only found in pristine areas, while others have a high tolerance for pollution and can live in both pristine and lower quality areas. Thus, the types and abundance of benthic organisms collected in the river can be a key indicator of the water quality of an area over time.

Physical Monitoring

Elementary, middle, and high schools in the Rouge Education Project conduct physical monitoring by completing a physical stream survey. Most of the survey is qualitative, based on observations of the immediate site and surrounding land uses. Schools use this information to assess stream site conditions, compare results to the previous year(s), if applicable, and then are encouraged to discuss and form conclusions in reference to benthic and chemical sampling results. Results are not included in this report, but are available on the Friends of the Rouge website.

Sampling Sites & School Locations

REP 2024 Schools & Sampling Sites

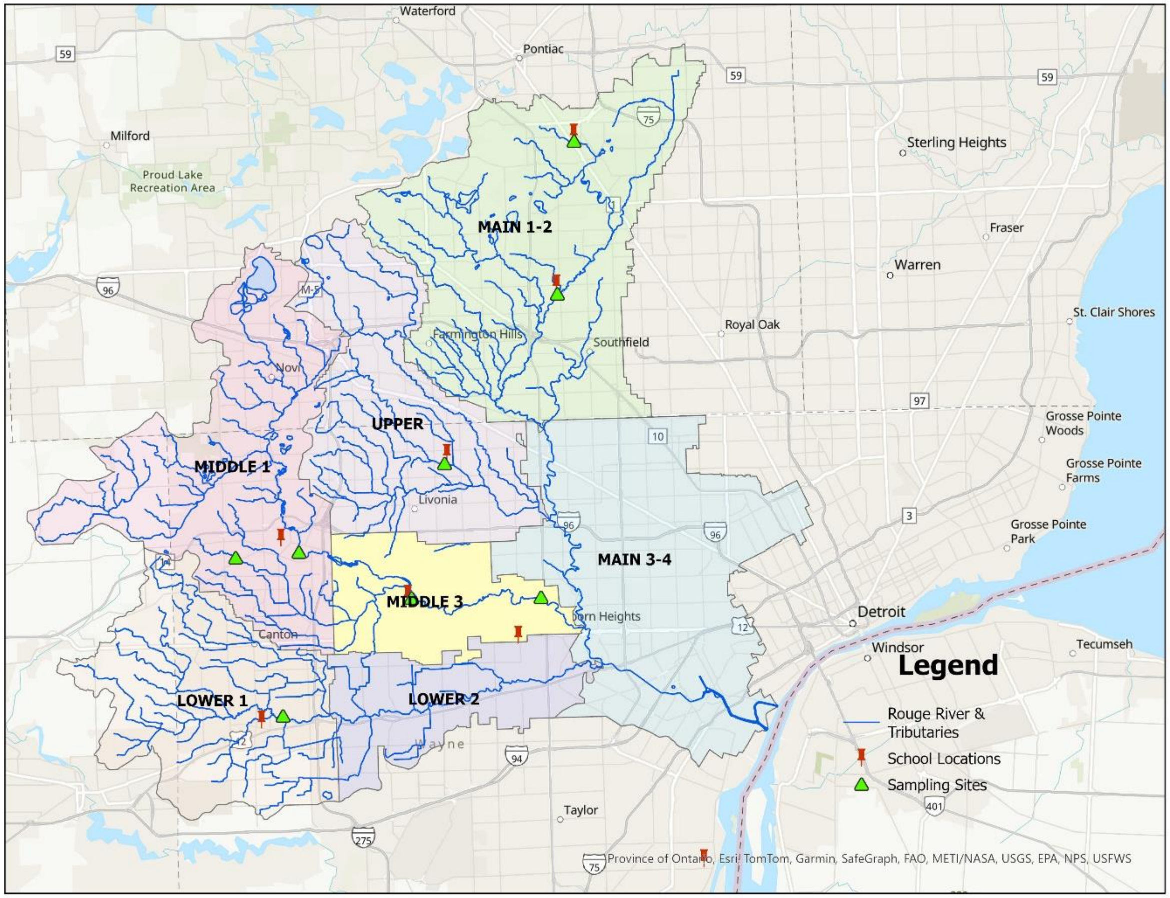

Figure 3: Distribution of the spring 2024 school and monitoring sites (N = 8). The shaded area delineates the Rouge River watershed (as in Figure 2, above). Green and black triangles indicate sampling sites. Red push-pins indicate the school locations.

Chemical Testing Results: Advanced Kits

The reporting data source is included with each subwatershed, and the resulting mean/median as appropriate. Raw data are available at www.therouge.org and at the end of this report. Please note that the entity reporting is only listed for spring 2024.

Lower 1 Subwatershed

Reporting: None

Lower 2 Subwatershed

Reporting: None

Main 1-2 Subwatershed

Reporting: Detroit Country Day Middle School

Parameter	Spring 2023	Spring 2024	State of Michigan Standard (EGLE)
Dissolved oxygen (mg/L)	8.82	8.33	5 mg/L for warm water fish (bass, bluegill, pike)--most of Rouge River.
Fecal coliform (colonies/100 mL water)	100	100	<300 colonies *E. coli*/100 ml for total body contact (swimming), <1,000 colonies *E. coli*/100 ml for partial body contact (boating, fishing).
pH (pH units)*	7.5	8.0	6.5 to 9.0, any discharge into the river must not change the natural pH more than 0.5 units.
Biochemical oxygen demand (mg/L)	2.45	5.88	No state standard; effluent limitations must be restrictive enough to ensure the receiving water will meet standards for dissolved oxygen.
Change in temperature (°C)	0	0	Any discharge into the river should not warm the water more than 2.8°C (5°F).
Total phosphates (mg/L)	0.1	0.1	No state standard; level of phosphates must not stimulate excessive growth of aquatic plants, fungi, or bacteria. Point-source discharges must not exceed 3.0 mg/L as a maximum monthly average unless other limits, either higher or lower, are deemed necessary and appropriate by EGLE. The EPA recommends that total phosphates should not exceed 0.15 mg/L in a stream at the point where it enters a lake or reservoir, and should not exceed 0.3 mg/L in streams that do not enter a lake or reservoir.
Nitrates (mg/L)	4.4	1.5	No state standard; level of nitrates must not stimulate the growth of aquatic rooted, attached, suspending, and floating plants, fungi, or bacteria which are or may become injurious to designated uses**.
Turbidity (JTU or NTU)	10	10	Cannot have unnatural quantities injurious to designated uses**.
Total solids (mg/L)	100	120	Cannot have unnatural quantities injurious to designated uses**.
Overall water quality index	77.12	76.15	No state standard; generally 91-100 excellent, 71-90 good, 51-70 medium, 26-50 fair, 0-25 poor

*pH values reported are the median, not the mean.
**At minimum, all surface waters of the state are designated and protected for all of the following uses: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, fish consumption.

Main 3-4 Subwatershed

Reporting: None

Middle 1 Subwatershed

Reporting: Roosevelt High School, Steppingstone School

Parameter	Spring 2023	Spring 2024	State of Michigan Standard (EGLE)
Dissolved oxygen (mg/L)	9.7	8.1	5 mg/L for warm water fish (bass, bluegill, pike)--most of Rouge River.
Fecal coliform (colonies/100 mL water)	100	50.5	<300 colonies *E. coli*/100 ml for total body contact (swimming), <1,000 colonies *E. coli*/100 ml for partial body contact (boating, fishing).
pH (pH units)*	7.75	7.6	6.5 to 9.0, any discharge into the river must not change the natural pH more than 0.5 units.
Biochemical oxygen demand (mg/L)	1.2	6.5	No state standard; effluent limitations must be restrictive enough to ensure the receiving water will meet standards for dissolved oxygen.
Change in temperature (°C)	0.4	0.8	Any discharge into the river should not warm the water more than 2.8°C (5°F).
Total phosphates (mg/L)	0.25	0.28	No state standard; level of phosphates must not stimulate excessive growth of aquatic plants, fungi, or bacteria. Point-source discharges must not exceed 3.0 mg/L as a maximum monthly average unless other limits, either higher or lower, are deemed necessary and appropriate by EGLE. The EPA recommends that total phosphates should not exceed 0.15 mg/L in a stream at the point where it enters a lake or reservoir, and should not exceed 0.3 mg/L in streams that do not enter a lake or reservoir.
Nitrates (mg/L)	1	1	No state standard; level of nitrates must not stimulate the growth of aquatic rooted, attached, suspending, and floating plants, fungi, or bacteria which are or may become injurious to designated uses**.
Turbidity (JTU or NTU)	4.25	11	Cannot have unnatural quantities injurious to designated uses**.
Total solids (mg/L)	480	465	Cannot have unnatural quantities injurious to designated uses**.
Overall water quality index	81.96	78.16	No state standard; generally 91-100 excellent, 71-90 good, 51-70 medium, 26-50 fair, 0-25 poor

*pH values reported are the median, not the mean.
**At minimum, all surface waters of the state are designated and protected for all of the following uses: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, fish consumption.

Middle 3 Subwatershed

Reporting: Crestwood High School, Hope Christian Academy (no data reported)

Parameter	Spring 2023	Spring 2024	State of Michigan Standard (EGLE)
Dissolved oxygen (mg/L)	7.54	7.58	5 mg/L for warm water fish (bass, bluegill, pike)--most of Rouge River.
Fecal coliform (colonies/100 mL water)	400	400	<300 colonies *E. coli*/100 ml for total body contact (swimming), <1,000 colonies *E. coli*/100 ml for partial body contact (boating, fishing).
pH (pH units)*	7.58	7.58	6.5 to 9.0, any discharge into the river must not change the natural pH more than 0.5 units.
Biochemical oxygen demand (mg/L)	1.94	2.07	No state standard; effluent limitations must be restrictive enough to ensure the receiving water will meet standards for dissolved oxygen.
Change in temperature (°C)	0	0	Any discharge into the river should not warm the water more than 2.8°C (5°F).
Total phosphates (mg/L)	0.36	0.83	No state standard; level of phosphates must not stimulate excessive growth of aquatic plants, fungi, or bacteria. Point-source discharges must not exceed 3.0 mg/L as a maximum monthly average unless other limits, either higher or lower, are deemed necessary and appropriate by EGLE. The EPA recommends that total phosphates should not exceed 0.15 mg/L in a stream at the point where it enters a lake or reservoir, and should not exceed 0.3 mg/L in streams that do not enter a lake or reservoir.
Nitrates (mg/L)	2.2	4.0	No state standard; level of nitrates must not stimulate the growth of aquatic rooted, attached, suspending, and floating plants, fungi, or bacteria which are or may become injurious to designated uses**.
Turbidity (JTU or NTU)	12	12	Cannot have unnatural quantities injurious to designated uses**.
Total solids (mg/L)	860	672	Cannot have unnatural quantities injurious to designated uses**.
Overall water quality index	71.04	65.62	No state standard; generally 91-100 excellent, 71-90 good, 51-70 medium, 26-50 fair, 0-25 poor
*pH values reported are the median, not the mean. **At minimum, all surface waters of the state are designated and protected for all of the following uses: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, fish consumption.			

Upper Subwatershed

Schools reporting: None

Figures

Mean results for each parameter are shown below. Results with zero or one colored bar(s) present indicate that data were not available in one or both sampling seasons. Data depicted are from the advanced set of chemical data. Not every school reporting could associate the same degree of confidence in their data collection and calculation of final values, therefore standard error bars have been excluded from figures.

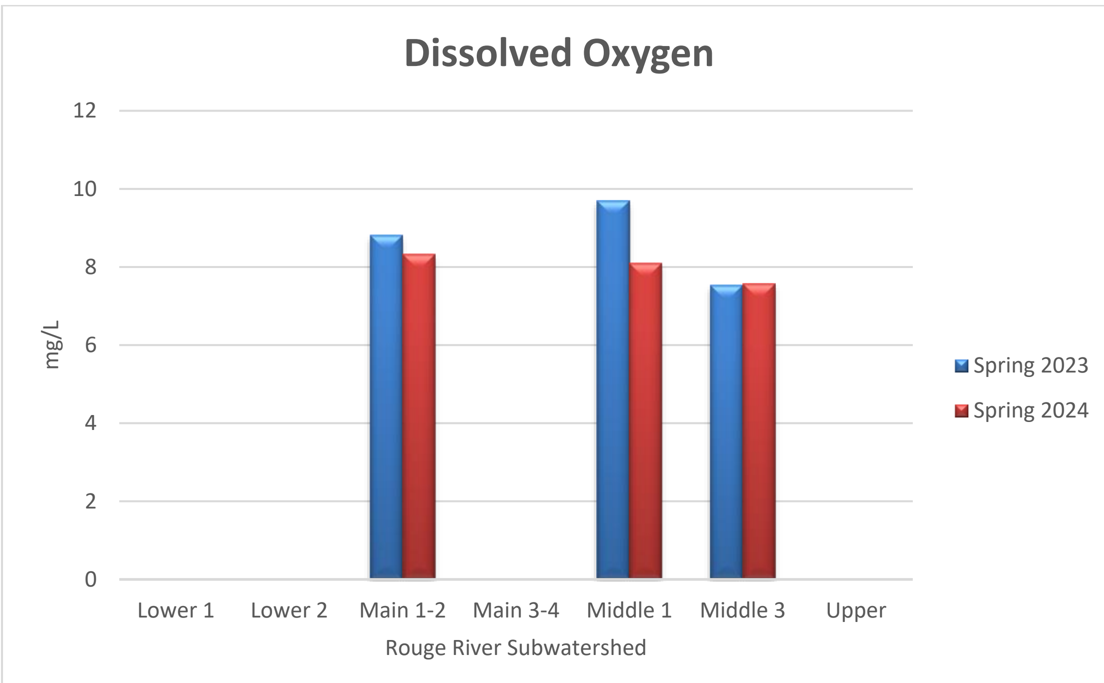

Figure 4: DISSOLVED OXYGEN results from spring 2023 and 2024 monitoring. Results were not available for the Lower 1, Lower 2, or Main 3-4, or the Upper either year.

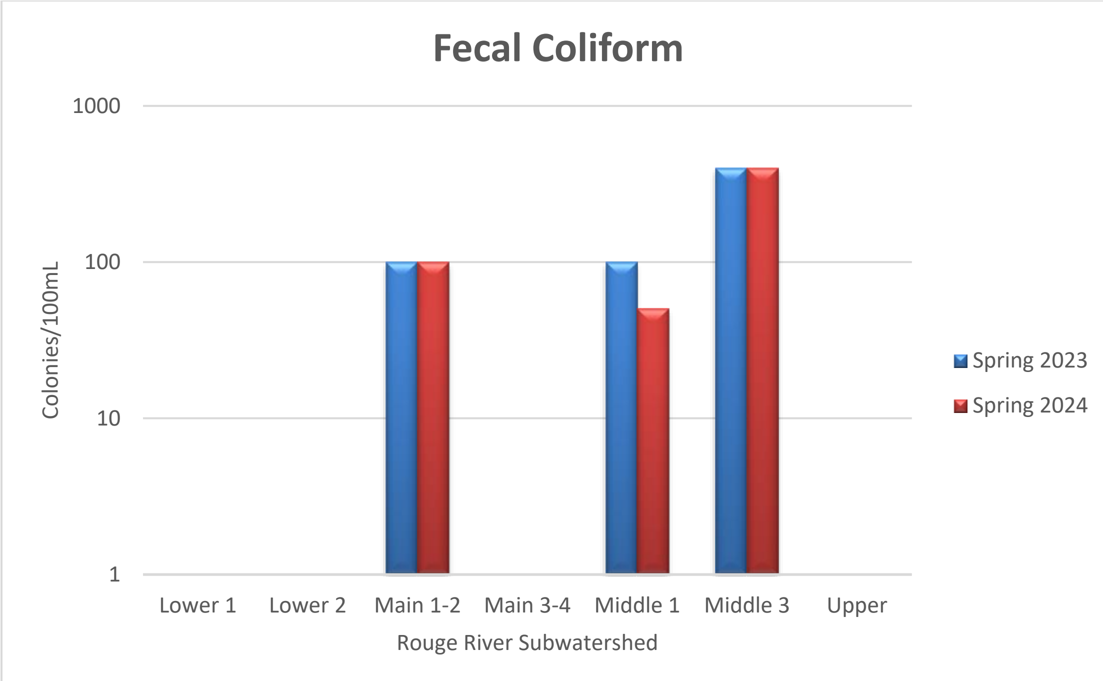

Figure 5: FECAL COLIFORM results for spring 2023 and 2024 monitoring. Results are presented on a logarithmic scale. Results were not available from the Lower 1, Lower 2, Main 3-4, or Upper either year.

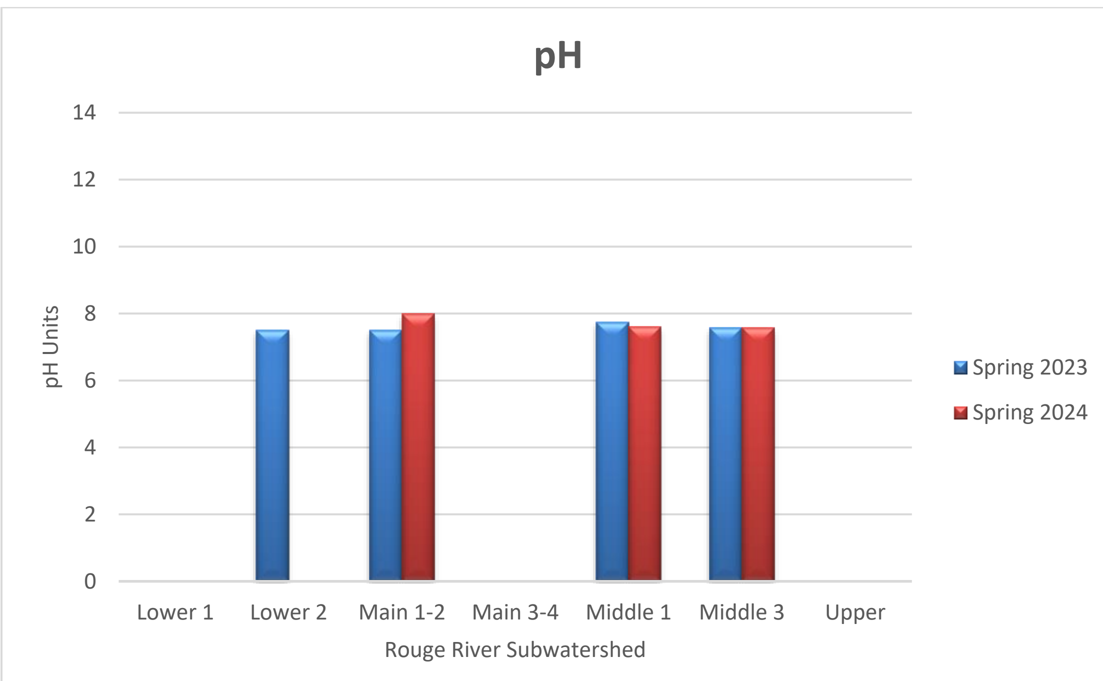

Figure 6: pH results for spring 2023 and 2024 monitoring. Results depict the median value of those collected in each subwatershed. Results were not available for Lower 1, Main 3-4, or Upper either year, or for the Lower 2 in 2024.

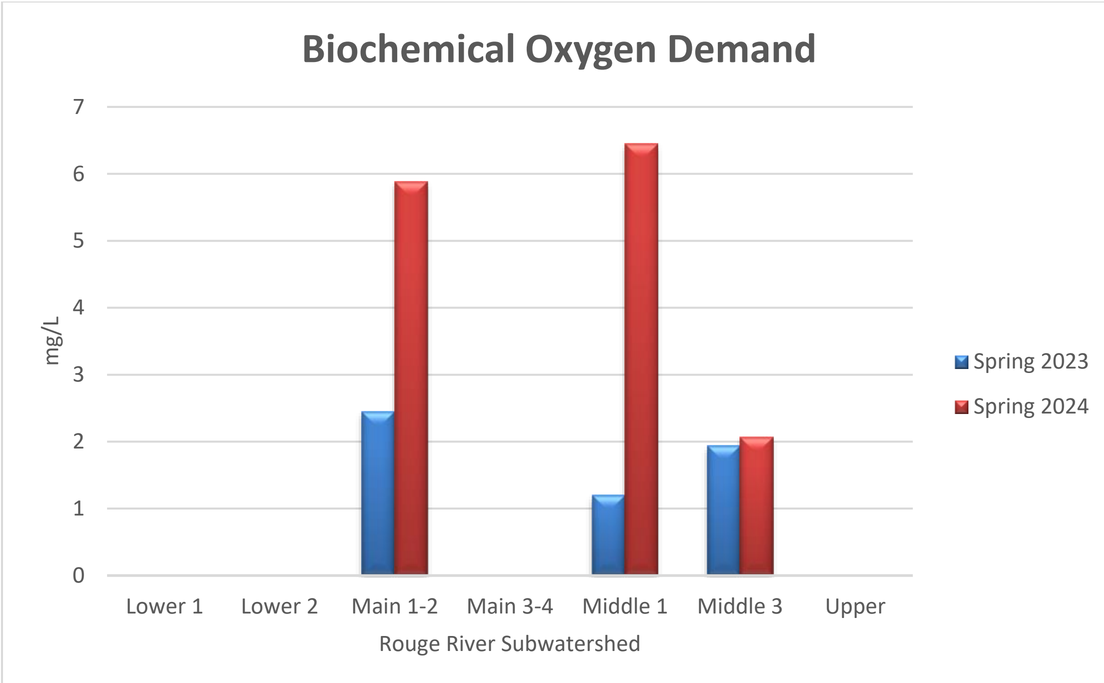

Figure 7: BIOCHEMICAL OXYGEN DEMAND results for spring 2023 and 2024 monitoring. Results were not available for the Lower 1, Lower 2, Main 3-4, or Upper either year.

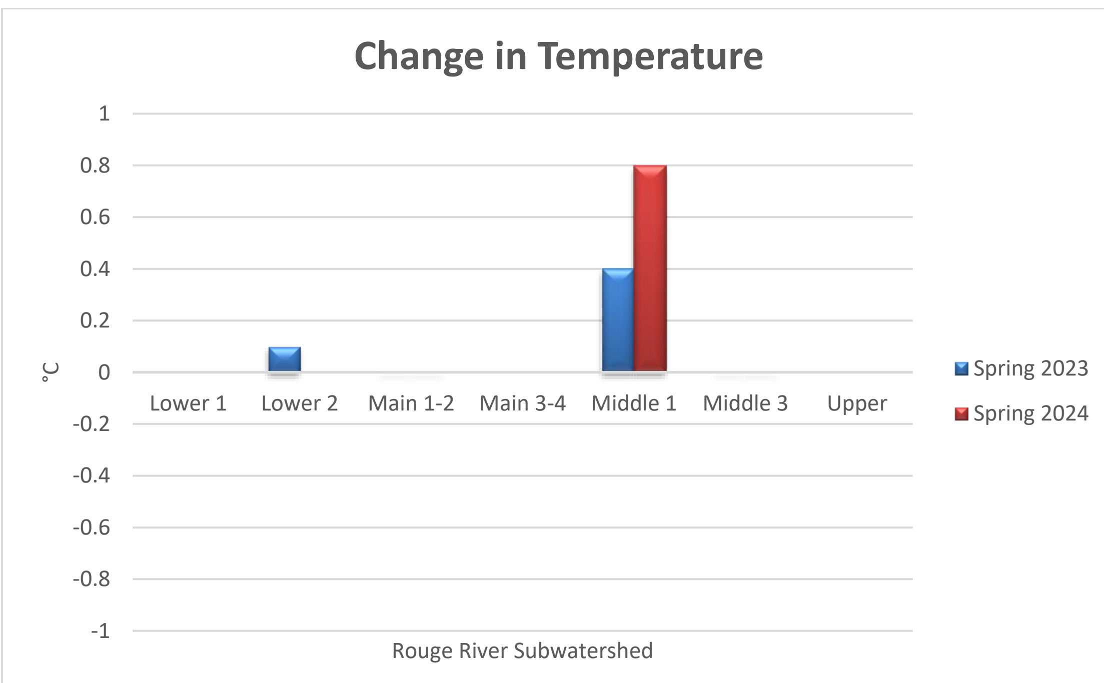

Figure 8: CHANGE IN TEMPERATURE results for spring 2023 and 2024 monitoring. Results were not available for the Lower 1, Main 3-4, or the Upper either year, or for the Lower 2 in 2024. Values of 0 were found for the Main 1-2 and Middle 3 both years.

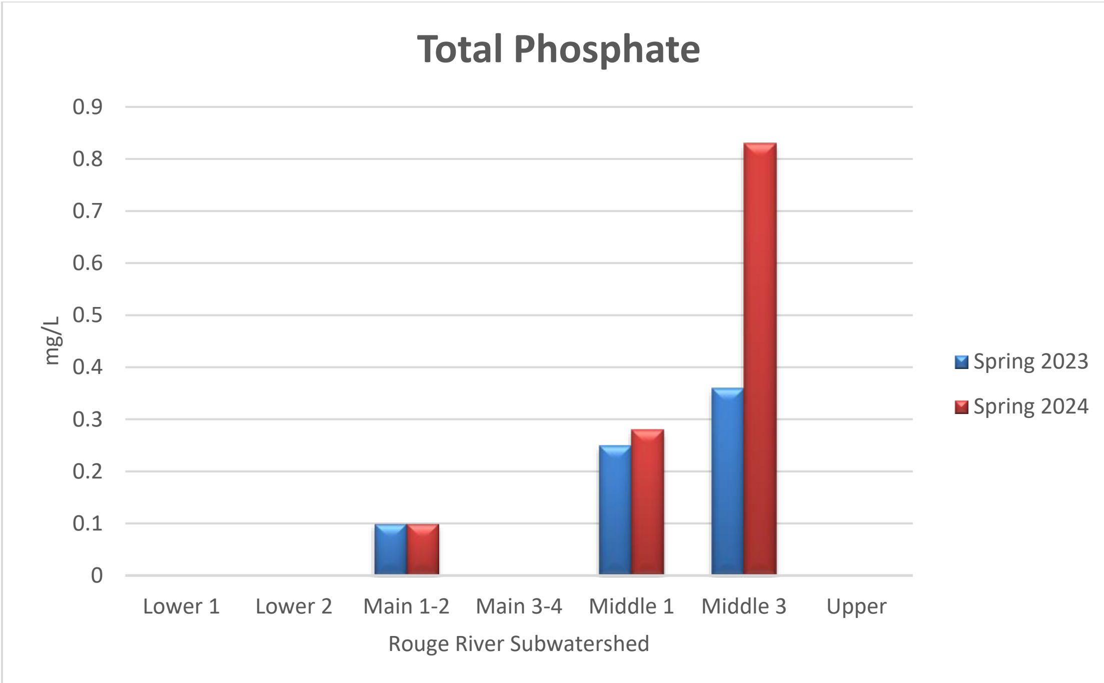

Figure 9: TOTAL PHOSPHATE results for spring 2023 and 2024. Results were not available from the Lower 1, Lower 2, Main 3-4, or Upper either year.

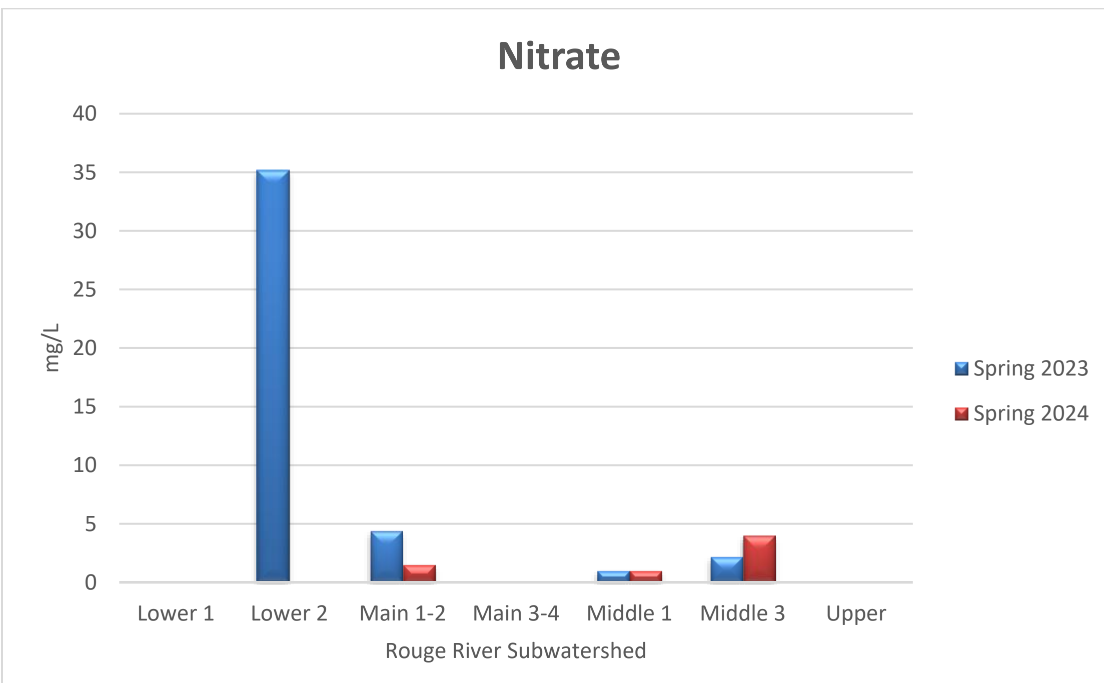

Figure 10: NITRATE results for spring 2023 and 2024 monitoring. Results were not available for Lower 1, Main 3-4, or Upper either year, or for the Lower 2 in 2024.

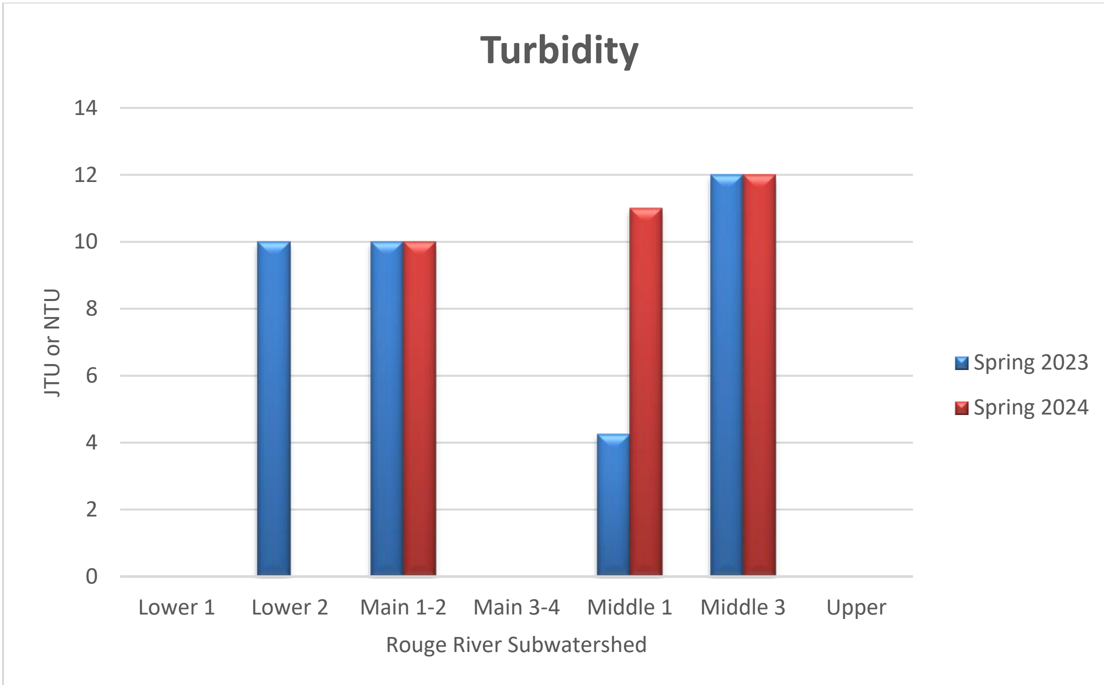

Figure 11: TURBIDITY results for spring 2023 and 2024 monitoring. Results were not available for the Lower 1, Main 3-4, or Upper either year, or for the Lower 2 in 2024.

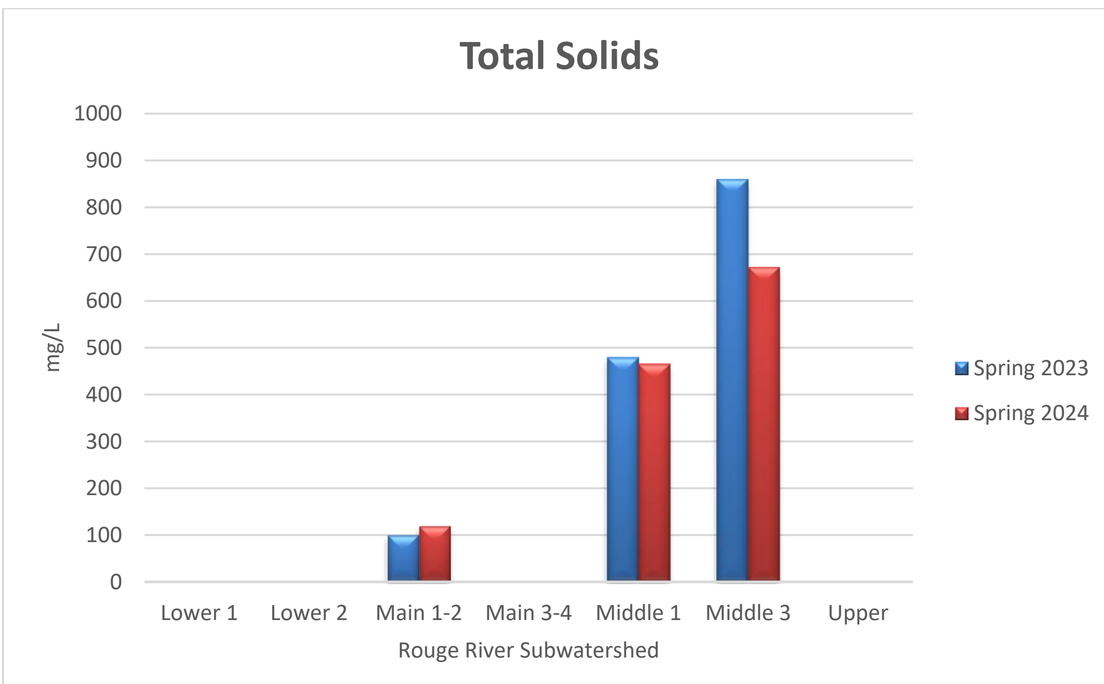

Figure 12: TOTAL SOLIDS results for spring 2023 and 2024. Results were not available for the Lower 1, Lower 2, Main 3-4, or Upper either year.

Overall Water Quality

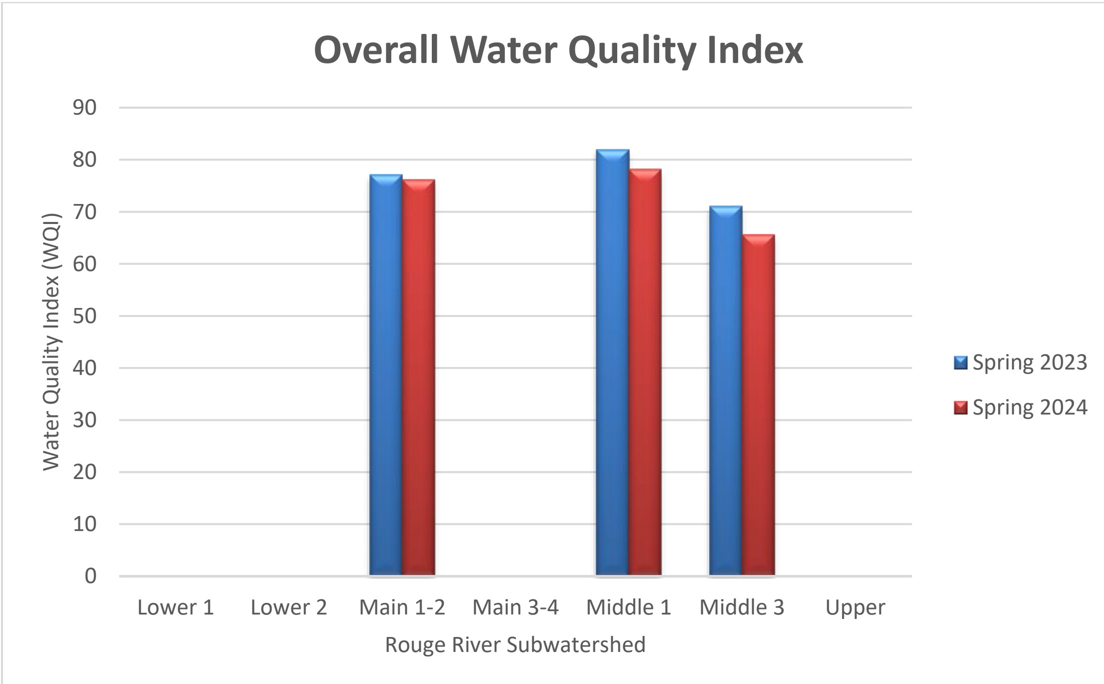

Figure 13: OVERALL WATER QUALITY INDEX for the seven subwatersheds of the Rouge River basin for spring 2023 and 2024. Water quality is measured on a 0-100 scale, with higher numbers reflecting relatively better water quality conditions. Water quality categories based on Q-values are as follows: 91-100 = Excellent; 71-90 = Good; 51-70 = Medium; 26-50 = Fair; 0-25 = Poor. Data were not available for the Lower 1, Lower 2, Main 3-4, or Upper either year.

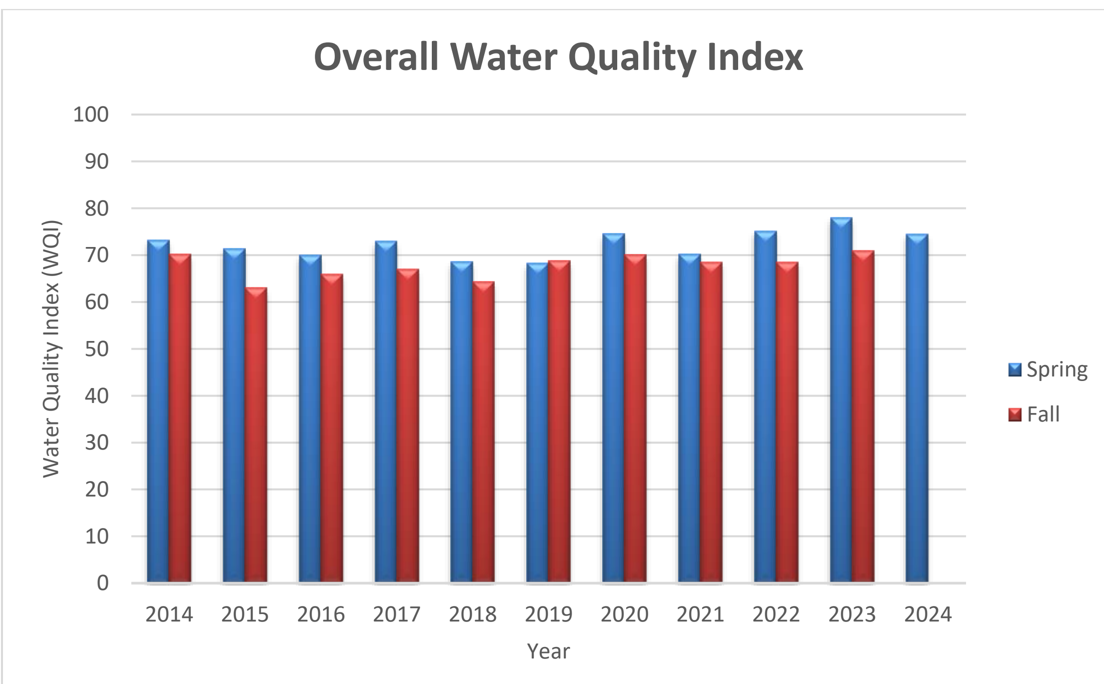

Figure 14: OVERALL WATER QUALITY INDEX for the entire Rouge River watershed (as sampled by REP participants) from spring 2013 through spring 2023. Water quality categories based on Q-values are as follows: 91-100 = Excellent; 71-90 = Good; 51-70 = Medium; 26-50 = Fair; 0-25 = Poor.

Chemical Testing Results: EZ-Tab Kits

EZ-Tab results are categorized for each parameter measured according to a range of possible results. Schools used the LaMotte brand GREEN Low-Cost Water Quality Monitoring Kit. The "Overall Water Quality" score is ranked on a 1-4 scale (4.0 = Excellent; 3.0 = Good; 2.0 = Fair; 1.0 = Poor). Results in the tables below represent the mean (or raw in the case of only one school representing a subwatershed). As of fall 2016, a new data sheet reflecting measured results (instead of the resulting "Excellent / Good / Fair / Poor" values) was introduced.

Lower 1 Subwatershed

Schools reporting: Star International Academy - Canton

Parameter	Spring 2023 Mean	Spring 2024 Mean
Dissolved oxygen (% saturation)		47
Fecal coliform (Presence: Y=Poor; N=Good)		Positive
pH*		7
Biochemical oxygen demand (mg/L)		4
Change in temperature (°C)		0
Total phosphates (mg/L)		2
Nitrates (mg/L)		5
Turbidity (JTU)		>0-40
Overall water quality index		2.63
*pH values reported are the median, not the mean.		

Lower 2 Subwatershed

Schools reporting: None

Main 1-2 Subwatershed

School reporting: The Roeper Lower School

Parameter	Spring 2023 Mean	Spring 2024 Mean
Dissolved oxygen (% saturation)		42
Fecal coliform (Presence: Y=Poor; N=Good)		Positive
pH*		8
Biochemical oxygen demand (mg/L)		
Change in temperature (°C)		2
Total phosphates (mg/L)		1
Nitrates (mg/L)		0
Turbidity (JTU)		>0-40
Overall water quality index		2.86
*pH values reported are the median, not the mean.		

Main 3-4 Subwatershed

Schools reporting: None

Middle 1 Subwatershed

Schools reporting: None

Middle 3 Subwatershed

Schools reporting: None

Upper Subwatershed

Schools reporting: Coolidge Elementary School*

**

benthic macroinvertebrate data only (not included)

Notable Results & Discussion

Spring Monitoring 2024

It is important to note that some subwatersheds had very few sites monitored, and not every school that participated reported data for each water quality parameter. Hence, these results may not fully represent the overall health of each subwatershed. Please note chemical data are not available from Coolidge Elementary School or Hope Christian Academy.

Overall, most parameters fell within the defined standards for the state of Michigan (and within ranges expected for the Rouge River). Raw data are included at the end of this report. The BOD ranges seemed a little on the higher level for the Main and Middle branches. A fecal coliform level of 1 is unusual and perhaps they did not do the proper division to get the final result.

All other parameters in these subwatersheds were within relatively "normal" ranges. Chemical analysis reflects a snapshot of conditions at the time of sampling.

Water levels were fairly average for most sampling events (Figure 15). Southeast Michigan experienced generally dry weather conditions this fall with rainfall averages 2-3" lower than typical for May (Figure 16).

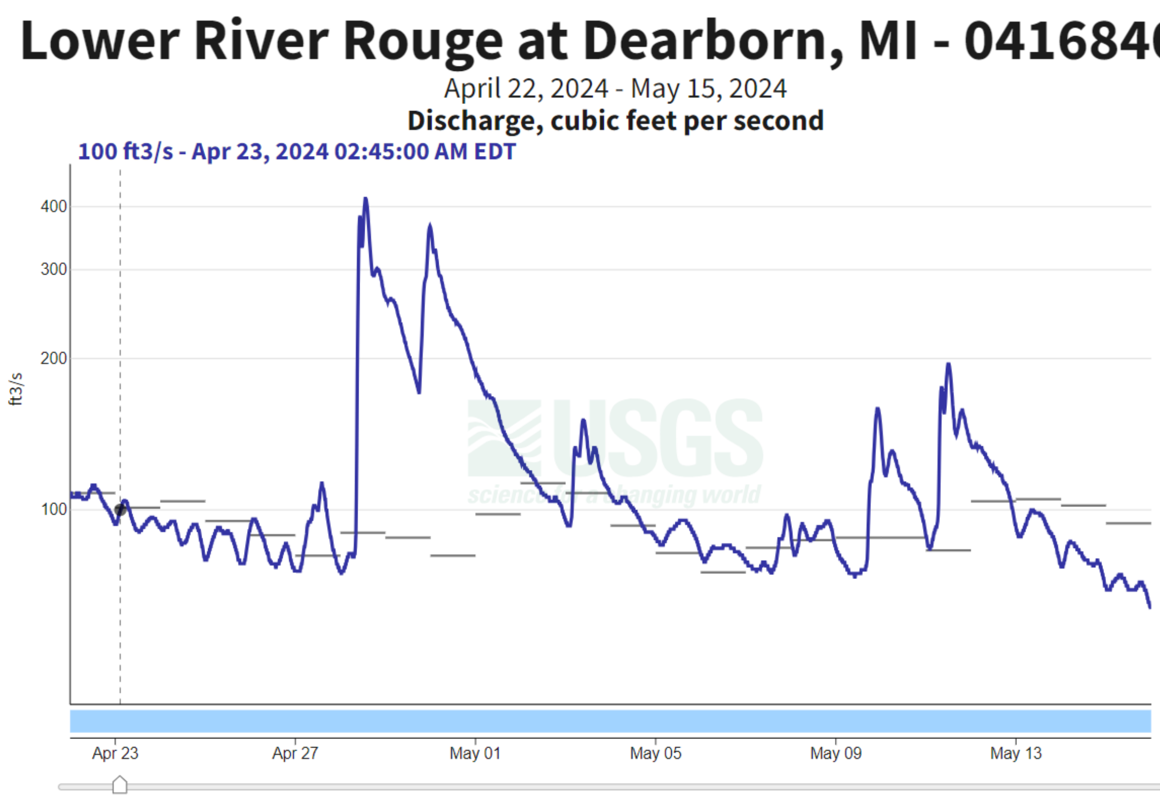

Figure 15: Streamflow data from the United States Geological Survey gage on the Lower Rouge River. Data are shown for the week prior to data collection (April 23, 2024) to the conclusion of all sampling events (May 15, 2024). Twenty five (25) year median data are depicted by the gray dashes, and the daily mean of stream discharge for the time period under consideration is depicted by the solid blue line.

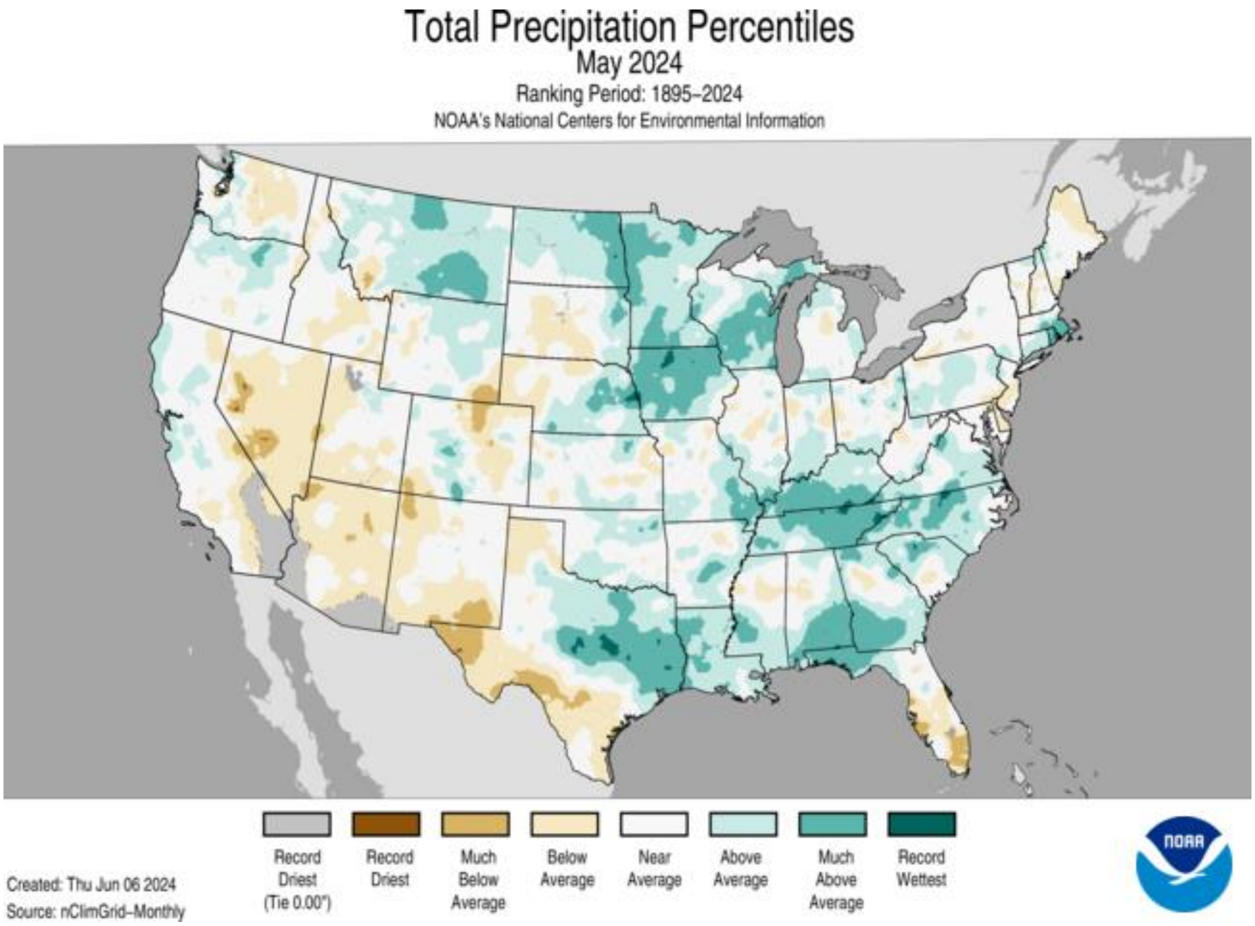

Figure 16: Total precipitation percentiles for the continental United States for May 2024 from the National Oceanic and Atmospheric Administration.

Overall Summary & Conclusions

Overall water quality results from spring 2024 appear to fall in line with results observed over the past 10 years (Figure 14). The Rouge River system remained in the "Good" water quality category (water quality index between 71-90). There was a high Total Phosphate value at Parr Wayside Recreation Area, where a point source is unclear. Water levels were slightly above average; precipitation for the month was near average as well. Participation in this monitoring event was lower than usual with at least four schools that planned to sample forced to cancel in the spring.

As mentioned previously in this report, not every school used the same set of water quality monitoring equipment, performed the same number of trials for each parameter, or conducted sampling at the same day and time.

Highlighted throughout this report, it is important to note that REP data are strictly intended to be used as part of the program's mission to promote environmental awareness and stewardship of the Rouge River watershed through long-term monitoring efforts. While REP staff makes every effort to verify with participating teachers and correct data as necessary, results are not yet collected or recorded with a level of accuracy or confidence so as to allow them to be used for scientific or analytical purposes. This data summary report represents one of many possible methods of water quality monitoring investigation and analysis, and schools are encouraged to conduct their own study and report. The REP continues to strive to find methods that make data collection, reporting, and interpretation as straightforward as possible.

2024 marked the 37^{th} year of the Rouge Education Project. The staff of the Rouge Education Project wish to thank the educators that worked very hard to make this experience happen for their students, and for the sponsors and grantors who made the program possible. Circumstances in the formal education sector are ever-changing, and the Rouge Education Project will continue to adapt to bring water quality monitoring and results to young people the best that we can.

Partners

							Dissolved Oxygen			pH		Change in Temperature		Total Phosphate		Nitrate		Turbidity			Total Solids		Biochemical Oxygen Demand		Fecal Coliform		Overall Water Quality	
School Name	Date Sampled	Site ID	Subwatershed	River Branch	Location	Water Temperature (°C)	mg/L	% Saturation	Q-value	pH	Q-Value	(°C)	Q-Value	mg/L	Q-Value	mg/L	Q-Value	Turbidity	Units	Q-Value	mg/L	Q-Value	mg/L	Q-Value	(col/100 mL)	Q-Value	Index	Value
Crestwood High School	5/12/2024	MR-10	Middle 3	Middle	Parr Recreation Area	15.1	7.58	75	81	7.58	92	0.0	93	0.83	46	4.0	71	12	NTU	71	672	20	2.07	79	400	31	65.62	Medium
Detroit Country Day Middle School	5/7/2023	Nott	Main 1-2	Main	Detroit Country Day Middle School Grounds	11.0	8.33	76	82	8.00	84	0.0	93	0.10	96	1.5	96	10	JTU	76	120	82	5.88	51	100	44	76.15	Good
Roosevelt High School	5/1/2023	Ton1	Middle 1	Middle	Plymouth Township Park (Ann Arbor Trail & Beck)	13.3	7.70	74	80	7.20	92	0.5	91	0.15	94	1.0	97	8	JTU	81	465	37	6.90	46	100	44	73.09	Good
Steppingstone School	5/1/2023	MR-20	Middle 1	Middle	Waterford Bend	16.0	8.50	86	92	8.00	84	1.0	89	0.40	71	1.0	97	15	JTU	67			6.00	51	1	99	83.22	Good

Appendix I: Spring 2024 Participating Schools

Rouge Education Project: Spring 2024				
Organization/School	**City**	**Educator First Name**	**Last Name**	**# students**
Coolidge Elementary School	Livonia	Kellie	Stark	50
Crestwood High School	Dearborn Heights	Diana	Johns	70
Detroit Country Day Middle School	Beverly Hills	Daniel	Case	550
		Joe	Case	
		Jennifer	Gabrys	
		Nicole	Jakubowski	
		Meghan	Kurleto	
		Nicole	Lowe	
		Cari	Zabolotny	
Hope Christian Academy	Westland	Steve	Grosinske	29
		Megan	Martin	
Roeper Lower School	Bloomfield Hills	Jennifer	Carlson	24
Roosevelt High School	Wyandotte	Sarah	Barnes	40
		Jeff	Weller	
		Tina	Weller	
Star International Academy	Canton	Diana	Chamalia	30
		Linda	Ballout	
Steppingstone School	Plymouth	Shari	Dudek	12
		Curtis	Lee	
		Reef	Morse	
	TOTALS		**20**	**805**

Appendix II: Rouge Education Project Data Forms

Below are examples of REP data forms.

-Understanding “Q-Value” and “Overall Water Quality”

-Advanced Chemical Data Worksheet

-Calculating Overall Water Quality

-Calculating Overall Water Quality Tests Adjustment Formula

-LaMotte Earth Force GREEN low cost water monitoring kit data sheet

UNDERSTANDING Q-VALUE & OVERALL WATER QUALITY

After each chemical test is completed a "Q-Value" must be determined for that specific test. What is a Q-Value?

According to the Friends of the Chicago River,

> *A Q-value is a way of standardizing all the different water quality test results so that they can be combined and used to find an overall water quality value for the river. You can think of the Q-value like a score on a test. Less than 50 is like a failing grade, whereas 90 or more is like an "A."*

For example, please refer to the "pH Test Results" Q-value chart. It can be noted that a pH of 7 results in a Q-value of approximately 90. By thinking of the Q-value as a grade on a test, it would appear rivers with a pH of 7 score a 90%, or an A. This makes sense since a pH of 7 would be neither too basic nor too acidic for most wildlife to live in. A pH of 10, on the other hand, receives a Q-value of 20 while a pH of 4 receives a Q-value of 10. Both of these Q-values are very low (a failing grade!), indicating that the water is either too basic or too acidic.

Once the Q-value is identified for a particular test that Q-value must be multiplied by that particular test's 'weighting factor'. The weighing factor is a number that indicates the importance of each parameter (D.O., pH, etc.) in determining overall water quality. Parameters with higher weighing factors are considered more important in determining the water quality than parameters with smaller weighing factors.

For example, please refer to the "Calculating Overall Water Quality" worksheet. Dissolved oxygen and fecal coliform have the highest weighting factors, with .17 and .16 respectively. These numbers indicate that water quality, or the health of the river, is greatly dependant on how much oxygen is present in the water and how many colonies of fecal coliform are present. Using a 'weighting factor' is necessary to demonstrate that some parameters have a greater effect on water quality than other parameters. Dissolved oxygen has a greater influence on water quality than turbidity.

Finally, add up all of the numbers in the last column (on the "Calculating Overall Water Quality" page). This sum will result in the Overall Water Quality. The chart below matches Overall Water Quality scores with actual overall water quality.

91-100	Excellent
71-90	Good
51-70	Medium or average
26-50	Fair
0-25	Poor

NOTE: *Please remember this is simply a tool for environmental education. It is a way to help participants understand the chemical test results.*

Friends of the ROUGE

Rouge Education Project: Chemical Data Worksheet

Name of group ______________________________	Date ________/______/________
Location/Site ID ______________________________	Time __________:________ am or pm
City/Township ______________________________	

Chemical Test Results

Dissolved Oxygen	1. Titrator Reading_______mg/L 2. Titrator Reading_______mg/L 3. Titrator Reading_______mg/L 4. Titrator Reading_______mg/L 5. Titrator Reading_______mg/L	Throw out the high and low value, average the remaining three.	Water temperature _______°C Correction Factor ________ Calculate the average of the remaining three: (1)_______ + (2)_______ + (3)_______ = _______ ÷ 3 = _______ Average titrator reading _______mg/L (uncorrected DO) x correction factor__________ = _______ mg/L (corrected DO) _____% saturation _____Q-Value

Fecal Coliform	_______ # of colonies / sample size (mL)	=	X / 100mL	X =	Use highest value	_____# of colonies/100mL _____Q-Value
	_______ # of colonies / sample size (mL)	=	X / 100mL	X =		
	_______ # of colonies / sample size (mL)	=	X / 100mL	X =		
	_______ # of colonies / sample size (mL)	=	X / 100mL	X =		
	_______ # of colonies / sample size (mL)	=	X / 100mL	X =		

pH	1. Comparator reading_______ 2. Comparator reading_______ 3. Comparator reading_______ 4. Comparator reading_______ 5. Comparator reading_______	Find median value	Line up results from lowest to highest and circle the median: (1)_____ (2)_____ (3)_____ (4) _____ (5) _____ _____pH _____Q-Value

Friends of the ROUGE

Rouge Education Project: Chemical Data Worksheet

Chemical Test Results (continued)

Biochemical Oxygen Demand	Run the dissolved oxygen test on a water sample that has not been exposed to light for five days. No correction factor necessary.	DO result from sample that has been incubated five days 1. mg/L 2. mg/L 3. mg/L 4. mg/L 5. mg/L	Throw out the high and low values, average the remaining three	Calculate the average: _____mg/L _____Q-Value (1)_______ + (2)_______ + (3)_______ = _______ ÷ 3 = _______ Uncorrected DO in mg/L _______ (original sample) - Average DO result in mg/L_______ (incubated sample) = ______
Change in Temperature	_______°C (Downstream) - _______°C (Upstream one mile) = _______°C (Downstream) - _______°C (Upstream one mile) = _______°C (Downstream) - _______°C (Upstream one mile) = _______°C (Downstream) - _______°C (Upstream one mile) = _______°C (Downstream) - _______°C (Upstream one mile) =		Throw out the high and low values, average the remaining three	Calculate the average: (1)_______ + (2)_______ + (3)_______ = _______ ÷ 3 = _______ _____°C _____Q-Value
Total Phosphate	1. _______mg/L PO_4 2. _______mg/L PO_4 3. _______mg/L PO_4 4. _______mg/L PO_4 5. _______mg/L PO_4		Throw out the high and low value, average the remaining three.	Calculate the average of the remaining three: _____mg/L _____Q-Value (1)_______ + (2)_______ + (3)_______ = _______ ÷ 3 = ______

Friends of the ROUGE

Rouge Education Project: Chemical Data Worksheet

Nitrates	1. Comparator reading_______mg/L x 4.4 = 2. Comparator reading_______mg/L x 4.4 = 3. Comparator reading_______mg/L x 4.4 = 4. Comparator reading_______mg/L x 4.4 = 5. Comparator reading_______mg/L x 4.4 =	Throw out the high and low value, average the remaining three.	Calculate the average of the remaining three: _____mg/L (1)_______ + (2)_______ + (3)_______ = _______ ÷ 3 = _______ _____Q-Value
Turbidity	1. # of additions_____ = _____JTU 2. # of additions_____ = _____JTU 3. # of additions_____ = _____JTU 4. # of additions_____ = _____JTU 5. # of additions_____ = _____JTU	Throw out the high and low value, average the remaining three.	Calculate the average of the remaining three: _____JTU (1)_______ + (2)_______ + (3)_______ = _______ ÷ 3 = _______ _____Q-Value
Total Solids	___________weight of residue / 100mL x 1000mg / 1 gram x 1000mL / 1 liter = ___________mg/L ___________weight of residue / 100mL x 1000mg / 1 gram x 1000mL / 1 liter = ___________mg/L ___________weight of residue / 100mL x 1000mg / 1 gram x 1000mL / 1 liter = ___________mg/L ___________weight of residue / 100mL x 1000mg / 1 gram x 1000mL / 1 liter = ___________mg/L ___________weight of residue / 100mL x 1000mg / 1 gram x 1000mL / 1 liter = ___________mg/L	Throw out the high and low value, average the remaining three.	Calculate the average of the remaining three: (1)_______ + (2)_______ + (3)_______ = _______ _____mg/L ÷ 3 = _______ _____Q-Value

Congratulations! You've completed all of the tests.
Please complete the Calculating Overall Water Quality Data Sheet to determine your site's overall water quality score.

If you were not able to complete one to three of the tests, please use the adjustment formula on the back of the Calculating Overall Water Quality Data Sheet.

Rouge Education Project: Calculating Overall Water Quality Data Sheet

Name of group ______________________
Location/Site ID ______________________
City/Township ______________________

Date ____ / ____ / ____
Time ____ : ____ am or pm

Chemical Test Results

Water Test		Test Result		Q-value		Weighting Factor		Water Quality Index
1. Dissolved Oxygen – DO	mg/L		% saturation		X	0.17	=	
2. Fecal Coliform—FC			colonies/100mL		X	0.16	=	
3. pH			units		X	0.11	=	
4. Biochemical Oxygen Demand—BOD			mg/L		X	0.11	=	
5. Change in Temperature—Temp			°C		X	0.10	=	
6. Total Phosphate—TP			mg/L		X	0.10	=	
7. Nitrates—NO_3			mg/L or ppm		X	0.10	=	
8. Turbidity—Turb			NTU/JTU or feet		X	0.08	=	
9. Total Solids—TS			mg/L		X	0.07	=	

-To determine Q-value, use the weighting curve charts from the *Field Manual for Water Quality Monitoring.*
-Multiply the Q-value by the weighting factor to get your water quality index.
-Add up the nine water quality index values to determine your overall water quality score.
Note: If you're missing up to three test results, please use the adjustment formula (on back) to calculate an adjusted overall water quality index.

91-100	Excellent
71-90	Good
51-70	Medium
26-50	Fair
0-25	Poor

Overall Water Quality	
Adjusted Value (if applicable)	

Friends of the ROUGE Rouge Education Project: Calculating Overall Water Quality Adjustment Formula

If you're missing one to three test results, use the adjustment formula. The adjustment formula provides you with an Overall Water Quality value that is relative to the value you would have gotten if you performed all nine water quality tests. If you're missing more than three test results, leave the Water Quality Index blank and do not use the adjustment formula.

1. Add together the Water Quality Index Values from the tests you performed.					
2. Add together the weighting factors from the tests you performed.					
3. Divide 1 by the weighting factor total you found in Step 2.	1	÷		=	
4. Multiply your total from Step 1 by the number you found in Step 3. This is your adjusted water quality index.		x		=	

EXAMPLE

Water Test	Q-value		Weighting Factor		Water Quality Index
1. DO	90	X	0.17	=	15.30
2. FC	44	X	0.16	=	7.04
3. pH	84	X	0.11	=	9.24
4. BOD	67	X	0.11	=	7.37
5. Temp		X	0.10	=	
6. TP	40	X	0.10	=	4.00
7. NO_3	26	X	0.10	=	2.60
8. Turb	57	X	0.08	=	4.56
9. TS		X	0.07	=	

1. Add together the Water Quality Index Values from the tests you performed.	15.30 + 7.04 + 9.24 + 7.37 + 4.00 + 2.60 + 4.56 = 50.11				
2. Add together the weighting factors from the tests you performed.	0.17 + 0.16 + 0.11 + 0.11 + 0.10 + 0.10 + 0.08 = 0.83				
3. Divide 1 by the weighting factor total you found in Step 2.	1	÷	0.83	=	1.20
4. Multiply your total from Step 1 by the number you found in Step 3. This is your adjusted water quality index.	50.11	x	1.20	=	60.13 ≈ 60

LaMotte Earth Force® GREEN Low Cost Water Monitoring Data Sheet

Name of group ______________________
Location /Site ID ______________________
City/Township ______________________
Date ____ / ____ / ____
Time ____ : ____ am or pm

Chemical Test Results

	4 (excellent)	3 (good)	2 (fair)	1 (poor)
Coliform bacteria		☐ Negative (<20 colonies/100mL)		☐ Positive (>20 colonies/100mL)
Dissolved oxygen (DO) Water temperature_____°C Result: _____ppm **Percent saturation** *(from chart in booklet)*: ___%	☐ 91-110%	☐ 71-90%	☐ 51-70%	☐ <50%
Biochemical oxygen demand (BOD) DO original sample: _____ppm DO incubated sample: _____ppm **Difference = _____ppm**	☐ 0 ppm	☐ 4 ppm	☐ 8 ppm	
Nitrate **Result: _____ppm**	☐ 0 ppm or ~1 ppm	☐ ~2 ppm - <5ppm	☐ 5 ppm	☐ >5 ppm
pH **Result *(circle one)*: 4 5 6 7 8 9 10**	☐ 7	☐ 6 or 8		☐ 4, 5, 9 or 10
Phosphate **Result: _____ppm**	☐ 0 ppm or 1 ppm	☐ 2 ppm	☐ 4 ppm	
Temperature change Downstream result: _____°C Upstream result: _____°C **Difference: _____°C**	☐ 0-2°C	☐ 3-5°C	☐ 6-10°C	☐ >10°C
Turbidity **Result: _______JTU**	☐ 0 JTU	☐ >0-40 JTU	☐ >40-100 JTU	☐ >100 JTU
Totals:	# Excellent ___	# Good ___	# Fair ___	# Poor ___

Calculating Overall Water Quality

Excellent ________ x 4 = ________

Good ________ x 3 = ________

Fair ________ x 2 = ________

Poor ________ x 1 = ________

Add above totals: ________

Divide total by number of tests performed: ________ ÷ ________

= Overall water quality: ________

Number of tests performed: ________

Overall Water Quality
4 = Excellent
3 = Good
2 = Fair
1 = Poor