Introduction to Indicators

Dissolved Oxygen

Dissolved Oxygen is the amount of oxygen gas (O2) present in a liquid/ body of water. Dissolved oxygen is essential for the survival of aquatic life and it is relied on for respiration. Reasons it can vary across different ecosystems include water temperature, altitude, time of day or across different seasons. Without a sufficient amount of dissolved oxygen, biodiversity is reduced and dead zones are formed which most organisms cannot survive. Low dissolved oxygen can also lead to the release of harmful substances from sediments. When there is too much dissolved oxygen, aquatic life can be harmed by gas bubble disease and the balance of the ecosystem can be disrupted. Therefore, if dissolved oxygen is either too high or low, it can result in harmful consequences for the ecosystem which is why there is an optimal range where organisms can thrive. This optimal range for most aquatic environments is typically between 6-9 mg/L. The dissolved oxygen meter records the dissolved oxygen mg/L, percent saturation, and the temperature. This indicator is essential as it allows organisms to get the energy they need to survive.

Turbidity

Turbidity is the measure of clarity in a body of water and how much the material suspended in the water (often sediment) decreases the passage of light through it. This is a clear indicator as it shows us the quality of the water. Turbidity can vary with erosion, wave action, light intensity and even anthropogenic activity like logging and clear cutting. When turbidity is too high, light penetration can be reduced which decreases photosynthesis from aquatic plants and algae. High turbidity can also clog fish gills, reduce visibility and negatively impact spawning sites. Turbidity is measured by NTU's which are Nephelometric Turbidity Units. The optimal range for supporting healthy aquatic life is 1-10 NTU. Turbidity is measured with a sample from the middle of the water column which is then read by a meter to help you assess water quality and stream health.

PH

PH tells us how acidic or basic a certain body of water is. PH is shown on a scale from 0-14, where 7 means neutral and anything below is basic. Anything 8 or above is considered acidic. These ranges serve as certain conditions that aquatic organisms can tolerate and live in. For example, in freshwater, PH usually ranges from 6 to 8. Multiple factors can cause PH to fluctuate such as respiration and photosynthesis of organisms, runoff, and rock types. To measure PH, a PH meter with an electric probe is typically used for a more accurate reading.

Conductivity

Conductivity is the measure of how well water can conduct an electrical current. This depends on the amount of dissolved ions in the water, which can be salts, minerals, and other various particles. So the more ions in the water, the higher the conductivity is. Conductivity is important to measure because it shows the amount of dissolved substances in the water. Water passing through clay or limestone could have higher conductivity than water flowing through granite, as an example. Human activities also affect conductivity measures like runoff, fertilizers, and road salts. These factors all increase ions while rain or

snow can decrease it. Conductivity is measured using a meter or a probe, which places a small electrical current through the water and measures how easily it flows. These measurements are recorded in microsemens per centimeter (μS/cm), where potable water usually has a measure of 50-1500μS/cm.

Nutrients

Nutrients in water refer to essential minerals that are present in water. These nutrients play a crucial part in maintaining the health of aquatic ecosystems. Even the smallest increase in nutrients can set off a chain of undesirable events in an ecosystem, which is why it gets measured. Nutrients can vary due to multiple reasons such as runoff from fertilizer, manure, septic systems, industries, and disturbed wetlands. Some acceptable ranges for drinking water is below o.05ppm for N and for freshwater 1m/ for N. Consequences from a change in nutrient levels consist of algal blooms, low dissolved oxygen, death of certain fish, temp changes.

Bacteria

Bacteria is a member of a large group of microorganisms including some bacteria that cause diseases. Bacteria like total coliform, E. coli and Enterococcus are measured and essential to understanding water quality and potential health risks if the water is used recreationally. Reasons for varying measurements include temperature and PH. The optimal/ acceptable ranges vary as some bacteria may be beneficial and a pond can benefit from a diverse population of bacteria. However, drinking water should have no bacteria. But if there is too much bacteria in a body of water it could be contaminating, increasing risk of disease or in extreme cases, the bacteria could become antibiotic resistant.

Flow Rate

Flow rate is the measurement of the volume of a fluid passing through a specific area over a period of time. Flow rate is measured to quantify the movement of fluids through a system, a healthy rate is essential for aquatic health. A healthy rate/ optimal range is 1.0-3.0 GPM (gallons per minute). Flow rate can vary due to fluid properties, system geometry and external influences. If flow rate goes beyond or below the optimal range, habitat can be reduced or even lost, mortality of aquatic life increases and migration barriers can be created. To measure flow, you measure the cross section total width and divide it by 10. Then you move in increments across the width of the stream to measure depth, and average velocity.

Methodology

Procedures:
        At each site, we utilized certain procedures and data collection methods to guarantee accurate results when collecting data.

Data Collection Methods:
- Data was collected in the middle of the stream at each location
- Meters were always placed at 60% depth to collect data
- Meters never touched sediment or rock when collecting data
- If there was an increase or decrease in data, more data would be collected to avoid inaccurate data due to the meters still calibrating
- Turbidity sample data bottle was always cleaned before placed in the meter
- Multiple measurements were taken of each meter's data, to identify decreasing or increasing trends
- Temperature had to be constant for data to be accurate and taken into account
- Site conditions were taken, including type of flow algae coverage, water color, odor, and amount of garbage
- Photos were taken upstream and downstream at each location

Measurements taken: turbidity, dissolved oxygen, pH, conductivity, site conditions, and photos.

Supplies:
- Turbidity meter (HACH 21000 turbidity meter): measured in NTU
- pH meter (OAKION pH 450): measured in pH
- Dissolved oxygen (DO) meter (HO30 flexi) : measured in mg/L, % saturation, and degrees Celsius
- Conductivity meter (OAKION CON 150): measured in us or mS
- Flow meter: measured in average ft^3/second
- Bacteria indicator/meter

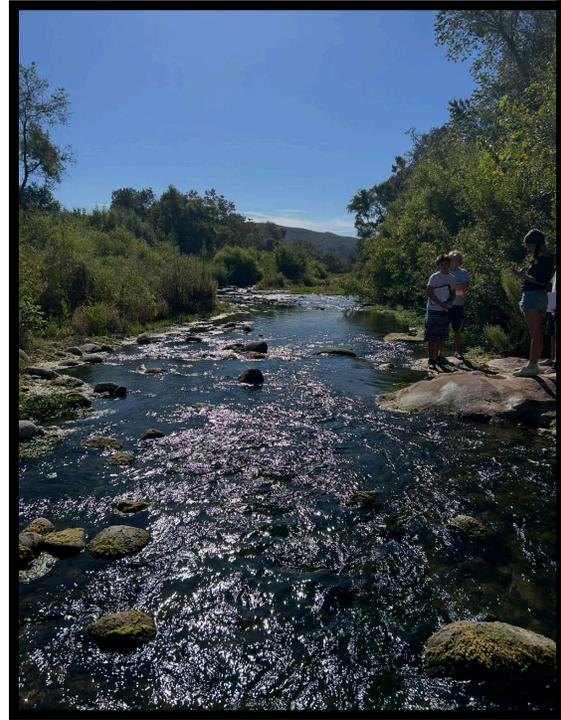## Time of Data Collection:
        Data was always collected between 8:30 am and 9:45 am during the end of the week.

Calibration:
        Meters calibrated seasonally before collecting data.

Big Rock
By: Ezra and Seb

Type of Flow	Algae Coverage	Water color	Garbage	Odors
Steady	Moderate	Clear	None	None

	DO Mg/L	DO %	DO °C	pH	Conductivity	Turbidity
Average	10.8	118.7	20.0	7.8	965.1	3.0
Standard Deviation	0.4	3.9	0.4	0.1	8.2	0.6
Confidence interval	10.5 - 11.2	115.7 -121.7	19.7-20.1	7.7 - 7.8	958.8 - 971.5	2.5 - 3.5

Dissolved O2:

The average DO was 10.8 Mg/L for Big Rock. A safe level for this type of stream is above 6.5-8 Mg/L and levels above 10 are ideal for species like trout which are common in the Ventura river.

pH:

The average pH was 7.7758, which is slightly basic but well within the healthy range of 6.5–8.5. This shows that the water chemistry is stable and safe for most freshwater species.

Conductivity (μS/cm):

The average conductivity was 1919.222 μS/cm, which is a bit higher than the usual range for freshwater rivers (150–1500 μS/cm). This could indicate a higher presence of dissolved minerals or ions, possibly from surrounding rocks or runoff, but it is not necessarily harmful.

Turbidity (NTU):

The average turbidity was 3.034 NTU, which indicates relatively clear water. Low turbidity means there are few suspended particles, allowing sunlight to penetrate and support healthy aquatic plant growth.

Foster Park

Type of Flow	Algae Coverage	Water color	Garbage	Odors
Steady	Moderate	Clear/Green	Light	None

	DO Mg/L	DO %	DO °C	pH	Conductivity	Turbidity
Average	6.0	66.6	19.8	7.3	955.3	0.7
Standard Deviation	0.1	1.4	0.07	0.22	26.8	0.3
Confidence interval	5.91 - 6.1	65.5 - 67.7	7.33 - 19.9	7.2 - 7.5	934.7 - 974.4	0.49 - 0.95

pH:

Our class average came out to be 7.348. This average is quite neutral regarding other pH readings we have observed at different locations; this reading is very normal. The typical pH for

freshwater rivers is 6.5-8.5, and the reading our class got fits perfectly into that. This shows a healthy aquatic life and allows fish and other organisms to thrive.

Dissolved O2:

Our class came to an average of 5.443833333 mg/L of dissolved oxygen, 61.955% saturated, and 21.517. These averages support a healthy aquatic ecosystem. Just above 5 mg/L is adequate for warm water fish; however, cold water fish may struggle to survive. Anything below 5 mg/L may be stressful for fish to live in. Since the temperature is very warm at 21.517 °C, there is naturally less oxygen in the water, which can put stress on aquatic organisms.

Conductivity:

Our class got an average of 985.7 μS. The average conductivity of a freshwater river generally ranges from 50 to 1500 μS/cm, meaning our results are on the higher end but not at a dangerous level, so aquatic organisms can survive.

Turbidity:

After testing the water three times for turbidity, our class average was 4.795, indicating a safe and thriving ecosystem. This high reading is actually considered unsafe for drinking use and might be unsafe food organisms. Although this reading is not safe for drinking, since its natural water, it is common for rivers and streams. However, in the long run, this may cause stress on the organisms and make life hard to live.

W. Estuary
By: Griffin Reynolds, Theodore Southor Pasquarella

Type of Flow	Algae Coverage	Water color	Garbage	Odors
Steady	Sparse (10%)	Clear	Moderate (3-5)	Sewage, earthy, musty

	DO Mg/L	DO %	DO °C	pH	Conductivity	Turbidity
Average	6.7	76.9	22.2	7.8	17.3	4.1
Standard Deviation	0.02	0.3	0.1	0.3	0.6	0.5
Confidence interval	6.69 - 6.7	N/A	N/A	7.5 - 7.9	16.8 - 17.8	3.8 - 5.4

Dissolved Oxygen (mg/L):

The average dissolved oxygen level at the Estuary was 6.70 mg/L, which falls within the healthy range of 6–12 mg/L for freshwater rivers. This indicates that the water is well-oxygenated. This data exceeds the standard.

Dissolved Oxygen (% Saturation):

The average oxygen saturation was 76.85%, which is slightly low but close to being within the normal range of 80–120%. This suggests that the water is receiving lower amounts of oxygen.

Temperature (°C):

The average water temperature was 22.30 °C, which is slightly high for a cold river environment but still suitable for organisms.

pH:

The average pH was 7.75, which is well within the healthy range of 6.5–8.5. This shows that the water chemistry is stable and safe for most freshwater species.

Conductivity (mS/cm):

The average conductivity was 17.29 mS/cm, which is slightly higher than the typical range for freshwater rivers (6.5-8 mS/cm). This could indicate a higher presence of dissolved minerals or ions, possibly from surrounding rocks or runoff, but it is not necessarily harmful.

Turbidity (NTU):

The average turbidity was 4.12 NTU, which indicates relatively clear water. Low turbidity means there are few suspended particles, allowing sunlight to penetrate and support healthy aquatic plant growth.

Willoughby				
Type of Flow	Algae Coverage	Water color	Garbage	Odors
Steady	Sparse	Clear	Light	Musty, rotten smell

	Do mg/l	DO %	DO C	pH	Conductivity	Turbitidy
Average	5.4	61.9	21.5	7.7	13.7	4.7
S.D.	0.021	0.29	0.14	0.26	0.64	0.49
Confidence Interval	5.3 - 5.6	N/A	N/A	7.5 - 7.95	16.8 -17.8	3.8 - 5.406

pH:

The average pH was 7.7, which is well within the healthy range of 6.5–8.5. This shows that the water chemistry is stable and safe for most freshwater species.

Dissolved O2:

The average oxygen saturation was 61.9%, which is very low from the healthy range of 80–120%. This suggests that the water is receiving lower amounts of oxygen.

Conductivity:

The average conductivity was 13.7 mS, which is slightly higher than the typical range for freshwater rivers (6.5-8 mS). This indicates a higher presence of dissolved minerals or ions, possibly from surrounding rocks or runoff, but it is not necessarily harmful.

Turbidity:

The average turbidity was 4.7 NTU, which indicates relatively clear water. Low turbidity means there are few suspended particles, allowing sunlight to penetrate and support the healthy growth of aquatic plants.

San Antonio Creek:

Site Conditions	Type of flow	Algae Coverage	Water Color	Odors	Garbage
	Steady	Sparse (<10%)	Clear, Brown	None	Light 1-2

	DO Mg/L	DO %	DO °C	pH	Conductivity	Turbidity
Average	8.6	97.3	19.9	7.1	1096.1	0.5
Standard Deviation	0.2	2.6	0.04	0.04	438.5	0.1
Confidence interval	8.8 - 8.4	N/A	N/A	8.1 - 8.4	1462.8 - 729.5	0.6 - 0.4

Canada larga

Type of Flow	Algae Coverage	Water color	Garbage	Odors
Steady	Moderate	Clear/Green	Light	None

	DO Mg/L	DO %	DO °C	pH	Conductivity	Turbidity
Average	7.69	87.95	22.61	7.9	1067.3	1.74
Standard Deviation	0.12	1.5	0.08	0.2	26.8	0.3
Confidence intervals	6.128 to 5.9116	67.785 to 65.5	19.903 to 7.331	7.562 to 7.221	974.434 to 934.744	0.9566 to 0.493

<u>Dissolved Oxygen (mg/L):</u>

The class average dissolved oxygen at Canada Larga was 7.69mg/L. This is an average, which indicates that the river is healthy for aquatic ecosystems. The typical dissolved oxygen levels for a river are between 6-8 mg/L. The class average falls into the typical range, which indicates the river has healthy thriving organisms.

<u>Dissolved Oxygen sat%:</u>

The class average percent saturation at Canada Larga is 87.95%, which is slightly under normal levels (90%-100%).

<u>Temperature (°C):</u>

The class average temperature in Canada Larga was 22.61°C, which is a healthy temperature.

<u>Ph average:</u>

The pH class average is 7.9, which is a healthy average.

<u>Conductivity:</u>

The class conductivity average at Canada Larga was 1067 µS,

<u>Turbidity</u>:

The class average for turbidity at Canada Larga was 1.74 NTU, which is a healthy level.

Comparison to Last Years Data

Comparison to last year's data:

Only three sites were tested by both last years' and this years' field studies class. Thus, we were only able to compare water quality indicators from Site VR6 Foster Park, VR0W, and San Antonio tributary sites.

VR6 Foster Park:

The DO at VR 6 has dropped by nearly 3.4 mg/L, from 9.34 to 6.02. Ph at VR 6 Foster Park was on average 8.21 last year, and 7.39 this year, a considerable difference. The conductivity dropped from to 955.36 from 978.9 last year, a drop of (roughly 20 uS). Turbidity at site VR 6 Foster Park was 0.58 last year, and this year slightly higher at .72. Site conditions last year included a steady flow, moderate algae coverage, clear water, moderate garbage and a musty odor. Site conditions this year included a steady flow, moderate algae coverage, clear-green water, light garbage and no odor.

VR0W:

The DO levels at VR0W have dropped by nearly 1.8 mg/L since 2024. Ph at VR0W last year was on average 7.93, according to our previous class' data. It seems as though VR0W has become 5 times less conductive, with the lack of salt water from the ocean possibly playing a role in its decline. Turbidity at site VR0W was 2.8 last year, compared to 4.13 this year
 Site conditions this year included an observed generally steady flow, sparse algae coverage, clear water, no garbage and no odors.

San Antonio creek 7A/ Camp Comfort:

DO at site 7A was 9.87 last year and 8.64125 this year, following the general trend of lower dissolved oxygen levels this year. Ph at Site 7A was on average 8.17 last year and 7.97 this year. Conductivity at site 7A was 1212.88 last year and 1247.63 this year. Turbidity at site 7A was 1.74 last year and 0.50 this year. Although water quality testing at last year's san Antonio creek 7A and this year's site camp comfort did not occur in the exact same area, they are both valid indicators of water quality in the same tributary. Site conditions last year included an observed generally steady flow, moderate algae coverage, clear water, 1-2 pieces of garbage and a musty odor. Site conditions this year included an observed generally steady flow, sparse algae coverage, clear water, no garbage and no odors. Thus, we can draw a comparison of the water quality between last year and this year in the san antonio tributar

Conclusion:

Essentially, this general downward trend of dissolved oxygen levels is not ideal, but the decrease in conductivity levels in the water does give us hope that the river is beginning to become clearer. Turbidity levels were higher for both sites, excluding the San Antonio tributary sites, which had higher turbidity this year. However, the site comparison is not as accurate for this case, as they are two different sites.