MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
SUB-DIRECTORATE RESEARCH AND INNOVATION
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Water quality technical report for surface water resources in Suriname

January - March 2024

Hydraulic Research Division

GCCA+
THE GLOBAL CLIMATE CHANGE ALLIANCE PLUS INITIATIVE

Funded by the European Union

UNDP

Document: Water quality technical report for surface water resources in Suriname – third report

Head Department: Hydraulic Research Division; Mr. Kosso Frits; frkosso@gmail.com

This document was authored by Goncalves Vanity, Sheonarain Kereshma and Owen Shannon

Sampling date	Final date	Analyst	Researcher	Support team	Email
January-March 2024	May 2024	Goncalves Vanity Sheonarain Kereshma	Owen Shannon	Sewnath Sharita	v.goncalves_wla@hotmail.com shannonowen_5834@hotmail.com K.Sheonarain_wla@hotmail.com

Acknowledgements
The authors would like to thank the following individuals for their helpful contributions in the development of this document: Jonathan Cox (Caribbean Institute for Meteorology and Hydrology (CIMH)), Truusje Warsodikromo (Ministry of Public Works), Gillian Babb (GCCA+ phase 2/ UNDP Suriname) and Frits Kosso (Head of the Department). For guidance during water quality sampling in the field: Amar Nakchedi, Björn Welzijn, Ravija Chandarsing, Anjani Jainath, Charinie Karijoötoemo, Rianto Wongsoredjo, Ravindra Patandin and Shareen Koenjbiharie from Water Forum Suriname.

For additional information, please contact:
Sub-Directorate Research and Innovation
Directorate for Research and Services
Ministry of Public Works of Suriname
Paramaribo, Suriname
Jaggernath Lachmonstraat no. 167
Telephone: +597- 490777
Email: wlaodoi@gmail.com

Contents

Abbreviations

WLA	Hydraulic Research Division
UNDP	United Nations Development Program
GCCA	Global Climate Change Alliance
ILACO	International Land Development Consultants
Temp	Temperature
Cond	Conductivity
Sal	Salinity
Turb	Turbidity
TDS	Total Dissolved Solids
DO	Dissolved Oxygen

List of Figures

List of tables

Executive Summary

Overview
This report presents a comprehensive assessment of water quality in Suriname's surface water sources for the period of January to March 2024. Conducted by the Hydraulic Research Division (WLA) under the Ministry of Public Works, the study focuses on major rivers, including the Corantijn, Coppename, Saramacca, Nickerie, and Coronie districts. The primary objectives were to evaluate the current water quality, identify pollution sources, and determine the suitability of these water sources for various uses.

Key Findings

1. **Diverse Water Sources**: Coastal areas feature diverse water sources, both freshwater and saltwater, each critical for agriculture, industry, drinking water, and ecological balance.
2. **Seasonal Fluctuations**: Observed fluctuations in river water levels were due to natural processes (e.g., saltwater intrusion, sedimentation) and human activities (e.g., agriculture, mining).
3. **Dependence on Freshwater**: Settlements along waterways heavily rely on freshwater for daily needs. Freshwater from Nani Swamp in Nickerie is essential for rice irrigation, while freshwater from Coronie Swamp is vital for preserving mangrove populations.
4. **Threats from Pollution**: Downstream turbidity from small-scale mining threatens fish populations. Elevated salt levels in Nickerie and Coronie pose challenges for freshwater availability.
5. **Impact of El Niño**: The El Niño climate phenomenon, causing higher sea levels and reduced rainfall, exacerbates saltwater intrusion, threatening freshwater supplies.

Water Quality Parameters
The study employed the Hydrolab 7 instrument to monitor key parameters: pH, temperature, dissolved oxygen (DO), total dissolved solids (TDS), turbidity, conductivity, and salinity. Measurements revealed fluctuations that often do not meet the standards set by the US EPA for freshwater and FAO for irrigation water:

- **Dissolved Oxygen**: Frequently below the freshwater standard of 6 mg/L, influenced by factors like flow rate and temperature.
- **Total Dissolved Solids**: High values often exceeding recommended standards for freshwater and irrigation water.
- **Conductivity**: Elevated levels making water unstable for irrigation and freshwater use.

Conclusions

The data indicates significant variability in water quality, highlighting the need for continuous monitoring and robust management strategies. Key conclusions include:

- Coastal ecosystems' reliance on both freshwater and saltwater sources.
- The necessity of maintaining adequate sanitation along waterways.
- The importance of understanding climatic impacts (e.g., El Niño) on water quality.

Recommendations

To ensure sustainable water quality management, the following actions are recommended:

1. **Comprehensive Testing**: Large-scale evaluations of pesticides, heavy metals, nutrients, and potential contaminants.
2. **Stakeholder Collaboration**: Joint efforts among government agencies, businesses, and local communities to develop effective water resource management strategies.
3. **Public Awareness**: Initiatives to educate communities about water quality issues and promote sustainable practices.
4. **Enhanced Monitoring Systems**: Increased monitoring points, data collection frequency, and advanced technologies to track seasonal variations.
5. **Financial Resources**: Sufficient funding to support sustainable management measures and ongoing monitoring, tailored to community-specific needs.

Implementing these recommendations will contribute to improved water quality management, ensuring that Suriname's water resources continue to support ecological, economic, and social functions effectively.

Foreword

We are excited to present this comprehensive report on water quality in Suriname, with a special focus on our surface water sources. This document is the result of extensive collaboration among various stakeholders, and we are proud to share its findings and recommendations with you.

Our sincere gratitude goes to the Global Climate Change Alliance (GCCA+) phase 2 project, funded by the European Union (EU) and United Nations Development Programme (UNDP) Suriname for their continuous (financial and technical) support and cooperation in our efforts to improve water quality in our country.

We especially wish to acknowledge Dr. Jonathan Cox for his invaluable training, which has significantly enhanced our understanding of water quality analysis. Furthermore, we extend our thanks to the Water Forum Suriname for their dedication over six months (in 2022) of collaboration in collecting and analyzing water quality data in Coronie and Nickerie.

Thank you for your interest in this report. We hope that the findings and recommendations herein will contribute to a deeper understanding and improvement of water quality in Suriname.

1. Introduction

The Hydraulic Research Division (WLA) is pivotal in managing hydrological and water quality data for surface water sources in Suriname. Operating under the Research and Services Directorate of the Ministry of Public Works, WLA comprises three main sections: Scientific Research, Basic Measurement & Logistics, and Administration. The Scientific Research section is primarily responsible for processing, storing, and analyzing collected measurement data, publishing findings, and conducting scientific investigations. The Basic Monitoring Network and Logistics section focuses on preparing and implementing fieldwork, data collection and processing, and managing the service's logistical needs.

WLA collaborates with several key stakeholders, including:

- Water Forum Suriname
- Anton de Kom University (A.D.E.K.)
- Agricultural Research Suriname (Celos)
- Ministry of Health (Central Laboratory)
- Ministry of Agriculture, Livestock, and Fisheries (L.V.V.)

This report presents the findings of a comprehensive assessment of water quality in Suriname, focusing on surface water sources. The assessments, conducted between October and December 2023, covered several rivers, including the Corantijn River, Coppename River, Saramacca River, Nickerie River, and the Coronie district. The primary objectives were to evaluate the current water quality of major rivers, identify potential pollution sources, and determine the suitability of these water sources for various uses.

Building on a previous collaborative pilot project with ILACO/Water Forum Suriname, conducted between July and December 2022, this report extends the monitoring of the water quality network in the Coronie and Nickerie districts.

A standardized procedure using the advanced instrument Hydrolab 7 was employed to monitor water quality. Key parameters measured included pH, temperature, dissolved oxygen (DO), total dissolved solids (TDS), turbidity, conductivity, and salinity. These data are essential for understanding the dynamics of our water sources and formulating effective water management and preservation strategies.

The subsequent chapters of this report provide detailed measurements and findings for specific rivers, including the Corantijn, Coppename, Saramacca, Coronie, and Nickerie. Our goal is to

enhance the understanding of water quality in Suriname and contribute to efforts to protect and preserve our water resources.

Findings: This report offers a comprehensive analysis of water quality in Suriname, with particular attention to surface water sources.

Conclusions: The data and analyses presented enhance our understanding of the current state of water quality in Suriname during the reporting period. This information serves as a foundation for further measures to improve water management and supports evidence-based decision-making regarding surface water in Suriname.

1.1 Limitations

The absence of established water quality standards for surface water in our policy framework represents a critical gap. Water quality standards are indispensable for ensuring the cleanliness and safety of our surface water sources. These standards should form a core part of national environmental protection and public health policies, being both practical and specific, tailored to local conditions and water bodies. Their primary aim is to protect public health and the ecosystem by preventing pollution, such as wastewater or toxic discharges.

Effective water quality assessment requires comprehensive data on various parameters, including physical-chemical, bacteriological, and toxicological characteristics. Currently, the available water quality data are based on on-site measured parameters, such as pH, temperature, dissolved oxygen (DO), total dissolved solids (TDS), turbidity, conductivity, and salinity. However, the ability to conduct detailed laboratory tests is constrained by the lack of a dedicated water quality laboratory at WLA.

The water quality standards proposed in this document are an initial step towards establishing a comprehensive framework. These standards should be revisited and expanded as more data becomes available, allowing for the development of more robust and informed policies. Establishing and continuously updating water quality standards is crucial for guiding future monitoring efforts, ensuring the long-term health of our water resources, and safeguarding public health and the environment.

2. Proposed International Water Quality Guidelines

Global standards for water quality

Water quality standards are established guidelines that define the desired condition of water bodies such as rivers, lakes, or coastal areas. These standards encompass various parameters to evaluate water suitability for different purposes, forming the foundation for water management and regulatory frameworks. Water quality standards primarily aim to uphold surface water quality, safeguard public health, preserve the environment, and facilitate diverse water uses like drinking, recreation, and industry.

The recommended water quality standards given by Water Forum Suriname in their report "1.2 WFS-Technical Report #2_Proposed WQ standards" for different water bodies include:

1) Standards for freshwater, including recreational use.
2) Standards for irrigation water intended for agricultural use.

The water quality standards of two international organizations, the United States Environmental Protection Agency (US EPA) and the Food and Agriculture Organization (FAO), are selected for further application. USEPA standards describe guidelines for human health, water consumption, and organism health, while FAO standards describe guidelines for water use in agriculture.

Table 1: Overview of the proposed international standards for the selected physical parameters

Parameters	Irrigation water, agriculture (FAO)	Freshwater (US EPA)
Temperature	-	-
Conductivity	<3000 uS/cm	0 – 1500 uS/cm
Turbidity	-	-
Salinity	-	-
Total Dissolved Solids	<2000 mg/L	<500 mg/L
Dissolved Oxygen	-	> 6 mg/L
pH	6.0 - 8.5	5.0 – 9.0

The measured values in this report are compared to the international standards of the US EPA and FAO to determine if the collected data falls within the predefined ranges for agricultural and recreational usage.

NOTE: Due to technical problems at some locations, the turbidity (Turb) and Dissolved Oxygen (DO) readings are not available.

3. The Saramacca River

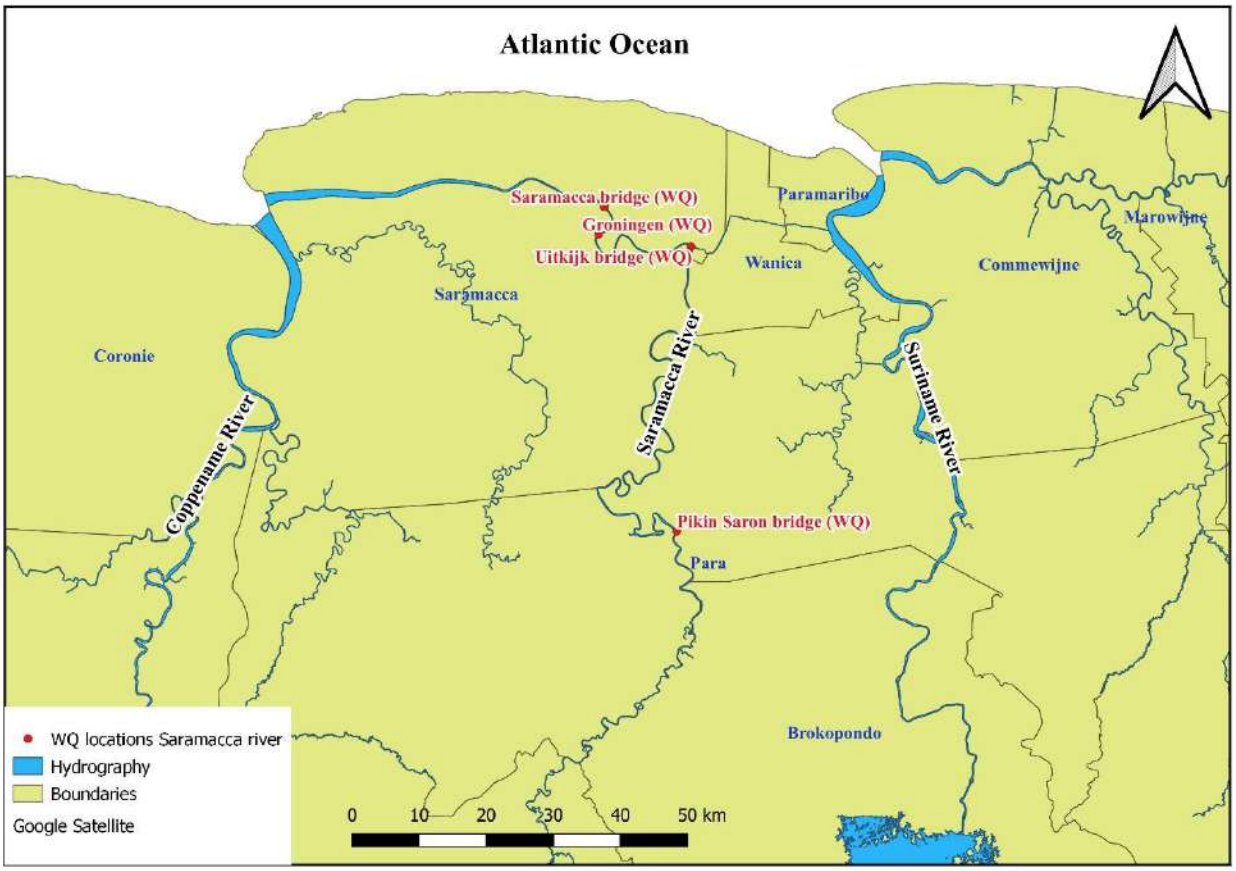

Figure 1: Water quality location along the Saramacca River

The Saramacca River, flowing through the districts of Sipaliwini, Para, and Saramacca in Suriname, is of significant importance to the region. Spanning a length of 255 km and encompassing a drainage basin of 9,400 km², the river is a vital artery for transporting goods and people to the adjacent agricultural areas. However, the presence of sandbanks in the estuary poses challenges to accessibility, affecting navigation.

Primarily utilized for navigation, transportation, and local fishing, the Saramacca River also supports various economic activities. Nevertheless, parts of the river basin are impacted by gold mining and small-scale gold extraction activities, which can adversely affect both water quality

and quantity. These activities introduce pollutants and sediments, posing risks to the river's ecological health and the communities that rely on it.

The water level in the estuary is influenced by the semi-daily movement of Atlantic seawater, which penetrates far upstream. The salt wedge in the river is affected by tides, freshwater discharge, irrigation for agriculture, and discharges from rice paddies and other agricultural areas.

Table 2: Para district: overview of locations along the Saramacca River and their use of river water, including coordinates.

River	Location	Water use	Coordinates
Saramacca	Pikin Saron	- Navigation - Transportation - Local fishery	5°23'29.52"N 55°22'10.13"W
	Uitkijk Bridge	- Navigation - Transportation - Local fishery - Agriculture activities (Irrigation)	5°46'31.85"N 55°20'58.00"W
	Groningen	- Navigation - Transportation - Local fishery - Agriculture activities (Irrigation)	5°47'32.90"N 55°28'25.92"W
	Saramacca Bridge	- Navigation - Transportation - Local fishery - Agriculture activities (Irrigation)	5°49'45.64"N 55°27'58.08"W

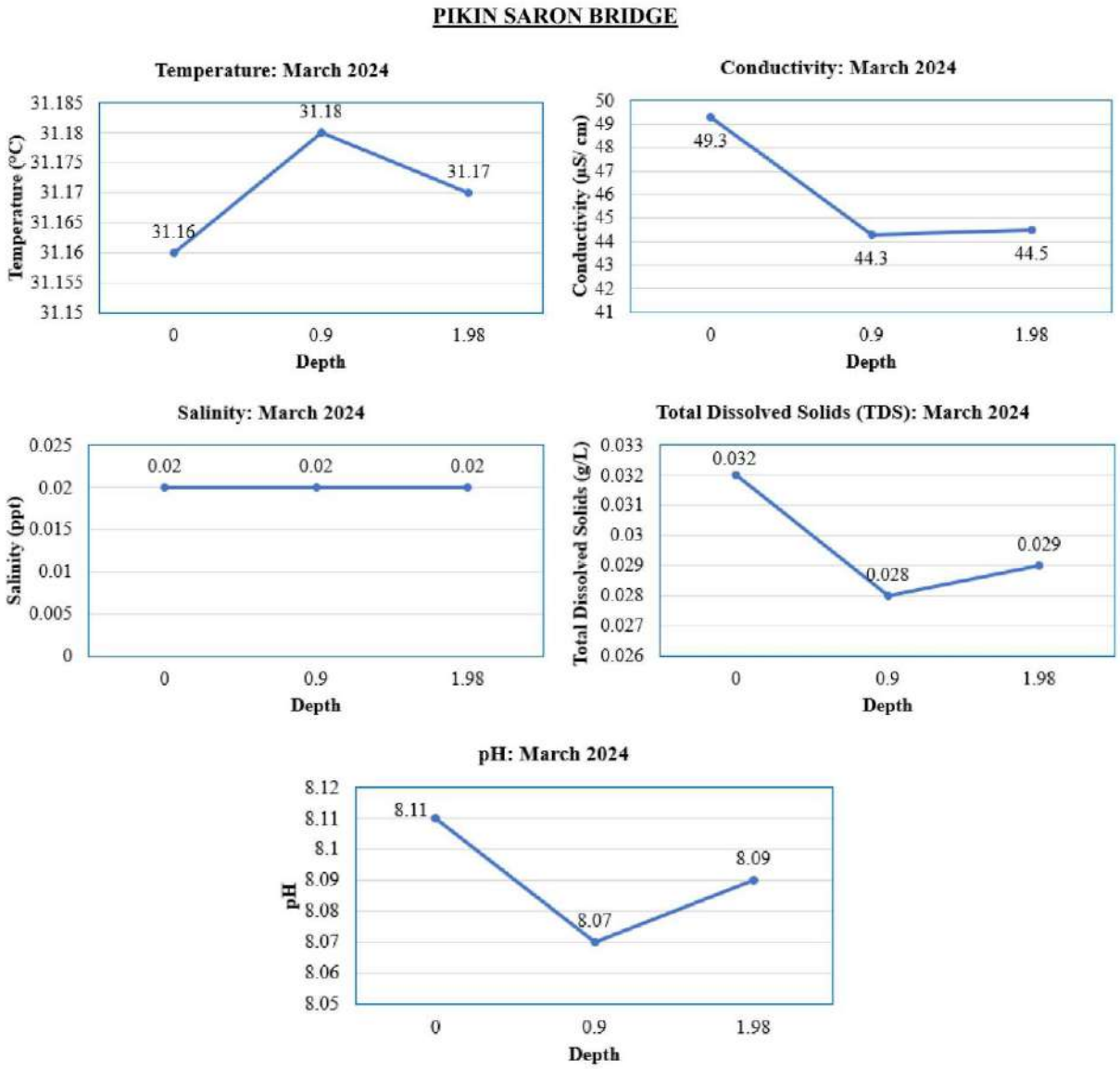

Figure 2: Graphical representation of water quality parameters at Pikin Saron Bridge

Notes figure 2:

- Conductivity: Lower than average values suggest less pollution in the water.
- Salinity remains low and constant, primarily from freshwater sources without salt infiltration.
- Total Dissolved Solids (TDS): Show no significant difference
- pH: The pH values show a slight decrease as depth increases, which may be caused by biological processes in deeper water.

Table 3: Water Quality Measurements and Standards Comparison for Pikin Saron Bridge

Water quality standards	Depth (M)	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
	0.00	31.16	-	49.3	0.02	0.032	-	8.11
	0.90	31.18	-	44.3	0.02	0.028	-	8.07
	1.98	31.17	-	44.5	0.02	0.029	-	8.09
							-	
Freshwater (US EPA)		-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)		-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 3:

- The measurements taken at 'Pikin Saron' in the Saramacca River indicate that the water meets the standards for both irrigation water and freshwater.

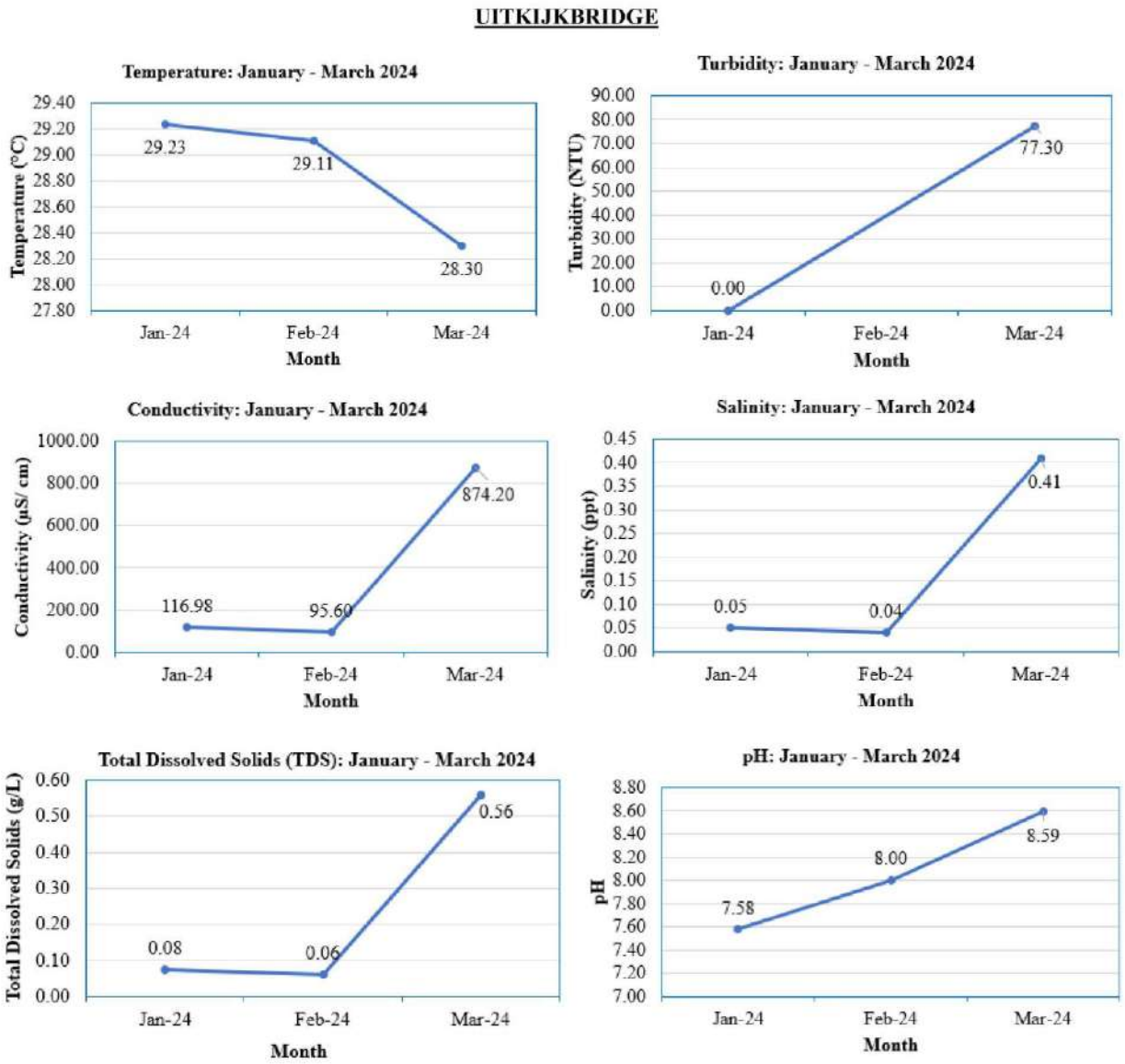

Figure 3: Graphical representation of water quality parameters at Uitkijk Bridge

Notes for Figure 3:

- **Turbidity:** Turbidity increases from January to March, corresponding with the transition from the rainy season to the dry season.
- **Conductivity:** There is a gradual increase in conductivity, attributed to natural processes such as soil erosion and the seasonal shift from rainy to dry conditions.
- **Salinity:** Salinity levels rise due to reduced precipitation, increased evaporation, and agricultural practices.
- **Total Dissolved Solids (TDS):** A consistent decrease in TDS is observed, likely due to seasonal changes, such as increased precipitation leading to dilution.
- **pH:** An increasing trend in pH is noted, which may be due to reduced acid precipitation, increased alkalinity, and a possible reduction in organic contamination.

Table 4: Water Quality Measurements and Standards Comparison for Uitkijk Bridge

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.23	0.00	116.98	0.05	0.08	-	7.58
Feb-24	29.11	-	95.60	0.04	0.06	-	8.00
Mar-24	28.30	77.30	874.20	0.41	0.56	-	8.59
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 4:

- All measured parameters meet the required standards for freshwater and irrigation water usage

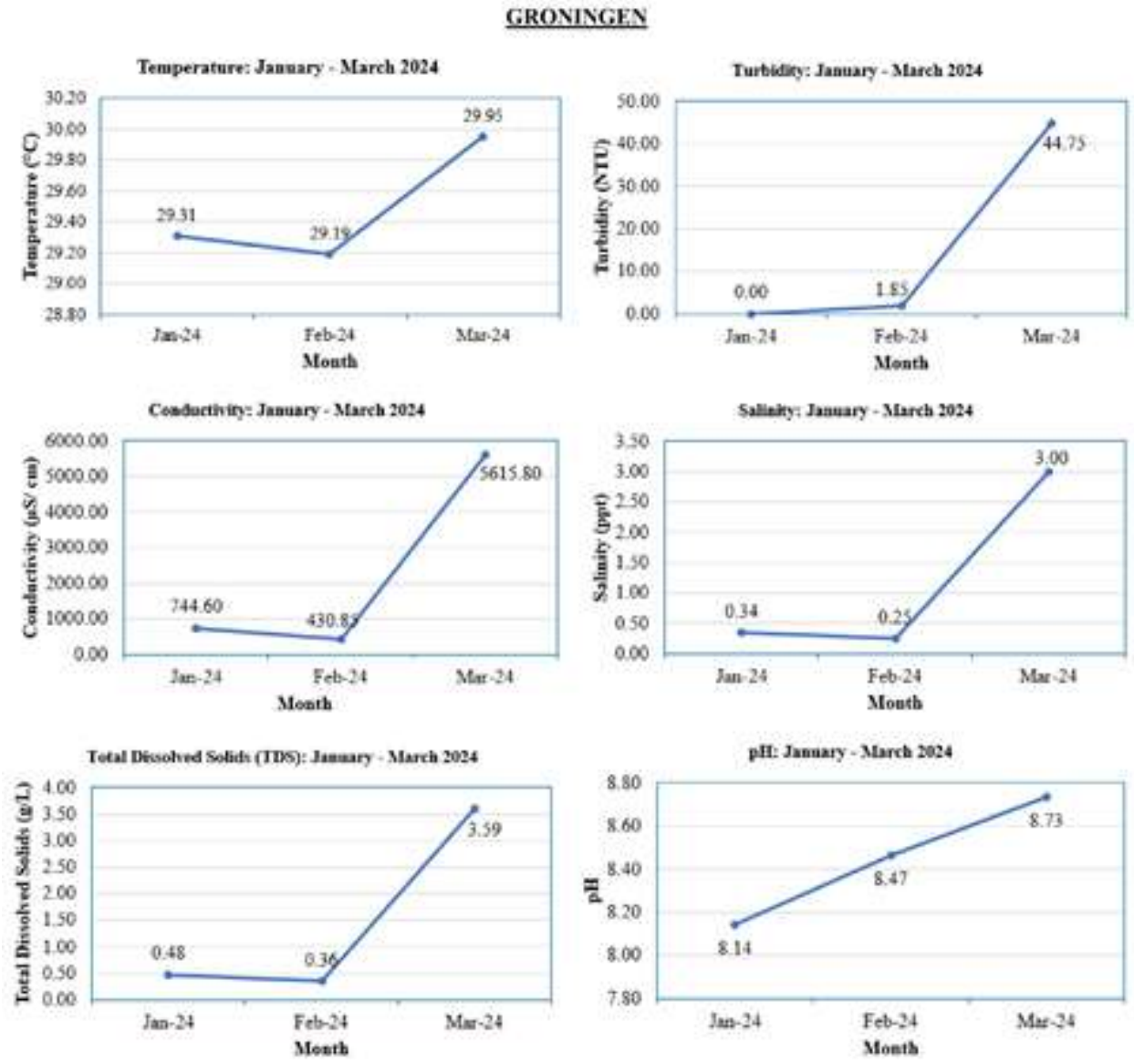

Figure 4: Graphical representation of water quality parameters at Groningen

Notes for Figure 4:

- **Temperature:** Exhibits overall stability with minor fluctuations, indicating a consistently warm environment that is beneficial for aquatic life.
- **Turbidity:** Variations in turbidity suggest changes in water clarity, likely due to sedimentation or fluctuations in rainfall.
- **Conductivity:** Largely stable, with temporary decreases likely due to rainfall and increases potentially linked to seasonal or environmental changes.
- **Salinity:** Remains consistently low, staying within the freshwater range throughout the measurement period.
- **Total Dissolved Solids (TDS):** Values remain within acceptable limits, with a notable increase in March, likely due to reduced precipitation and increased evaporation.
- **pH:** The graph shows no significant change, indicating stable pH levels throughout the measurement period.

Table 5: Water Quality Measurements and Standards Comparison for Groningen

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.31	0.00	744.60	0.34	0.48	-	8.14
Feb-24	29.19	1.85	430.85	0.25	0.36	-	8.47
Mar-24	29.95	44.75	5615.80	3.00	3.59	-	8.73
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 5:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

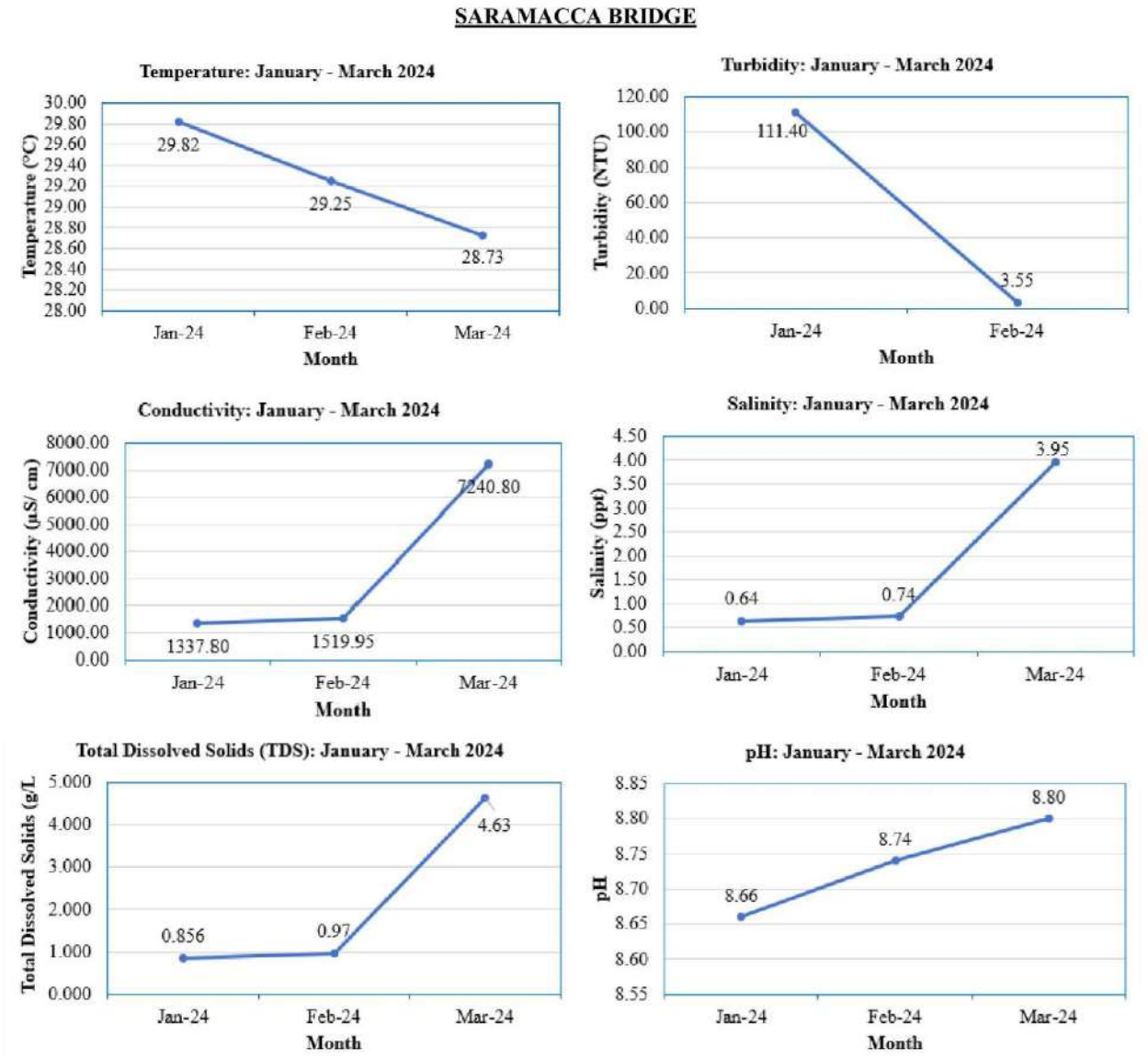

Figure 5: Graphical representation of water quality parameters at Saramacca bridge

Notes for Figure 5:

- **Turbidity:** Exhibits fluctuations, likely influenced by the dry season and human activities such as the presence of fishing boats, which affect sediment discharge and water supply.
- **Conductivity:** Predominantly stable, with temporary decreases likely due to rainfall and increases possibly linked to seasonal or environmental changes.
- **Salinity:** Remains consistently low, within the freshwater range throughout the measurement period.
- **Total Dissolved Solids (TDS):** Values remain within acceptable limits, with a notable increase in March, likely due to reduced precipitation and increased evaporation.
- **pH:** The graph shows no significant variation, indicating stable pH levels throughout the measurement period.

Table 6: Water Quality Measurements and Standards Comparison for Saramacca bridge

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.82	111.40	1337.80	0.64	0.856	-	8.66
Feb-24	29.25	3.55	1519.95	0.74	0.97	-	8.74
Mar-24	28.73	-	7240.80	3.95	4.63	-	8.80
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 6:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

4. The Coppename River

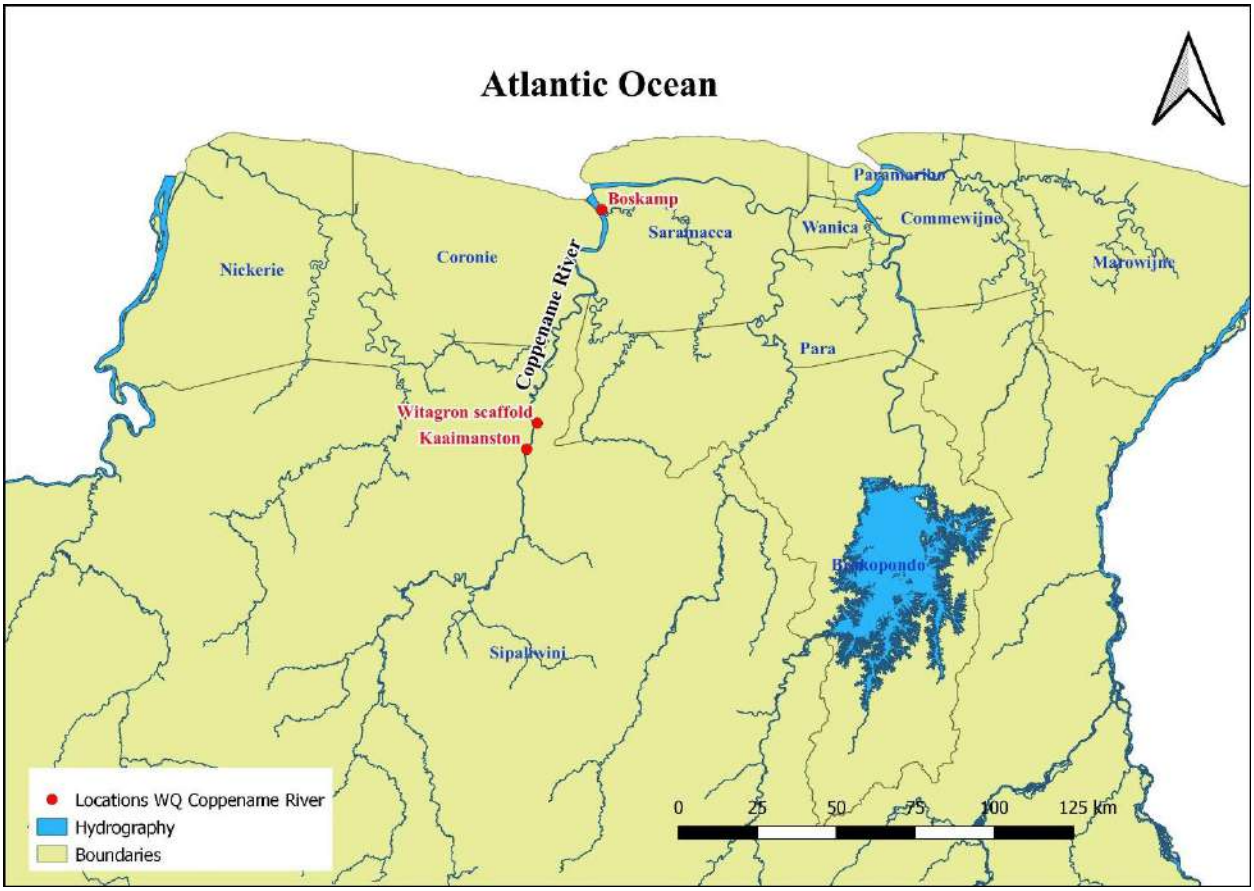

Figure 6: Water quality locations along the Coppename River

The Coppename River in Suriname is essential for the local economy and the communities along its banks. Spanning an area of 21,700 square kilometers, the river supports a variety of activities.

In the lower tidal area, the river remains largely undeveloped, featuring extensive marshlands. Upstream, the calmer waters are utilized for daily activities such as bathing, washing, and transportation, with less impact from tidal influences.

Water levels in the river are influenced by tides, with high tides allowing water to flow far inland. The river is a crucial resource for livelihoods, navigation, and transportation.

With an average discharge of 500 m^3/s at its mouth and natural attractions such as the Raleigh Falls, the Coppename River is invaluable to Suriname.

Table 7: Sipaliwini and Saramacca districts: overview of locations along the Coppename River and their use of river water, including coordinates

River	Location	Water use	Coordinates
Coppename	Kaaimanston	- Hygiene and sanitation - Drinking water - Fishery - Recreation	5°05'26.67"N 56°06'25.82"W
	Witagron		5°09'54.00"N 56°04'36.54"W
	Boskamp	- Navigation - Transportation - Fishery	05°46'31.68" N 055°53'30.29" W

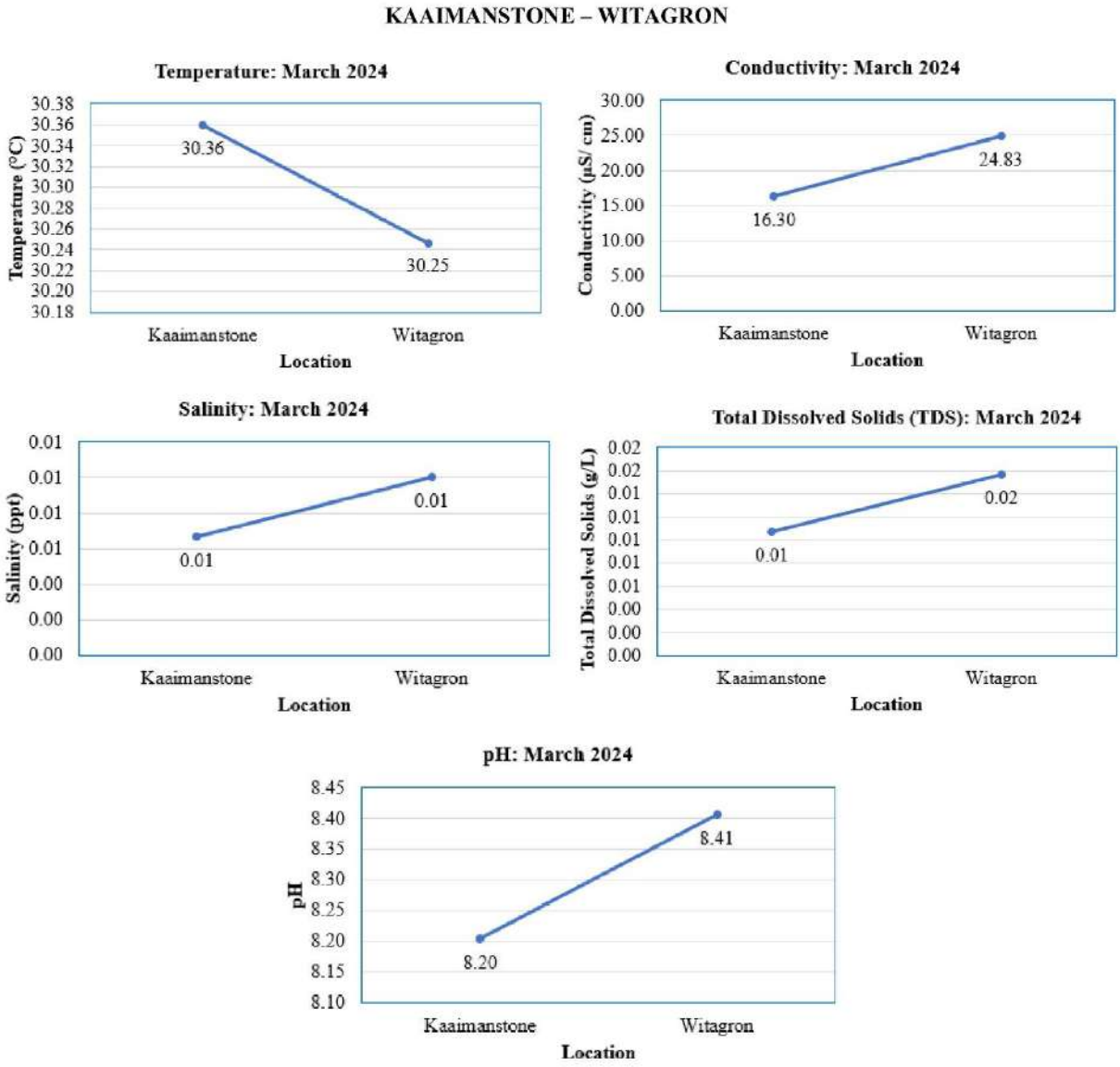

Figure 7: Graphical representation of water quality parameters at Kaaimanstone and Witagron

Notes figure 7: `

- Temperature: The temperature decreases slightly as depth increases, likely due to reduced exposure to sunlight and a greater influence of cooler underlying layers.
- Conductivity: Higher conductivity with increasing depth suggests the presence of dissolved salts and minerals, possibly due to sedimentation.
- Salinity: Increasing salinity with depth indicates higher salinity, possibly due to saltwater intrusion and sediments.
- Total Dissolved Solids (TDS): Increasing TDS values indicate more dissolved solids in deeper water, possibly due to sedimentation and salts.
- pH: The pH remains slightly basic in general, suitable for saltwater environments,

Table 8: Water Quality Measurements and Standards Comparison for Kaaimanstone and scaffold Witagron

Location and water quality standards	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Kaaimanstone	30.36	-	16.30	0.01	0.01	-	8.20
Witagron Scaffold	30.25	-	24.83	0.01	0.016	-	8.41
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 8:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

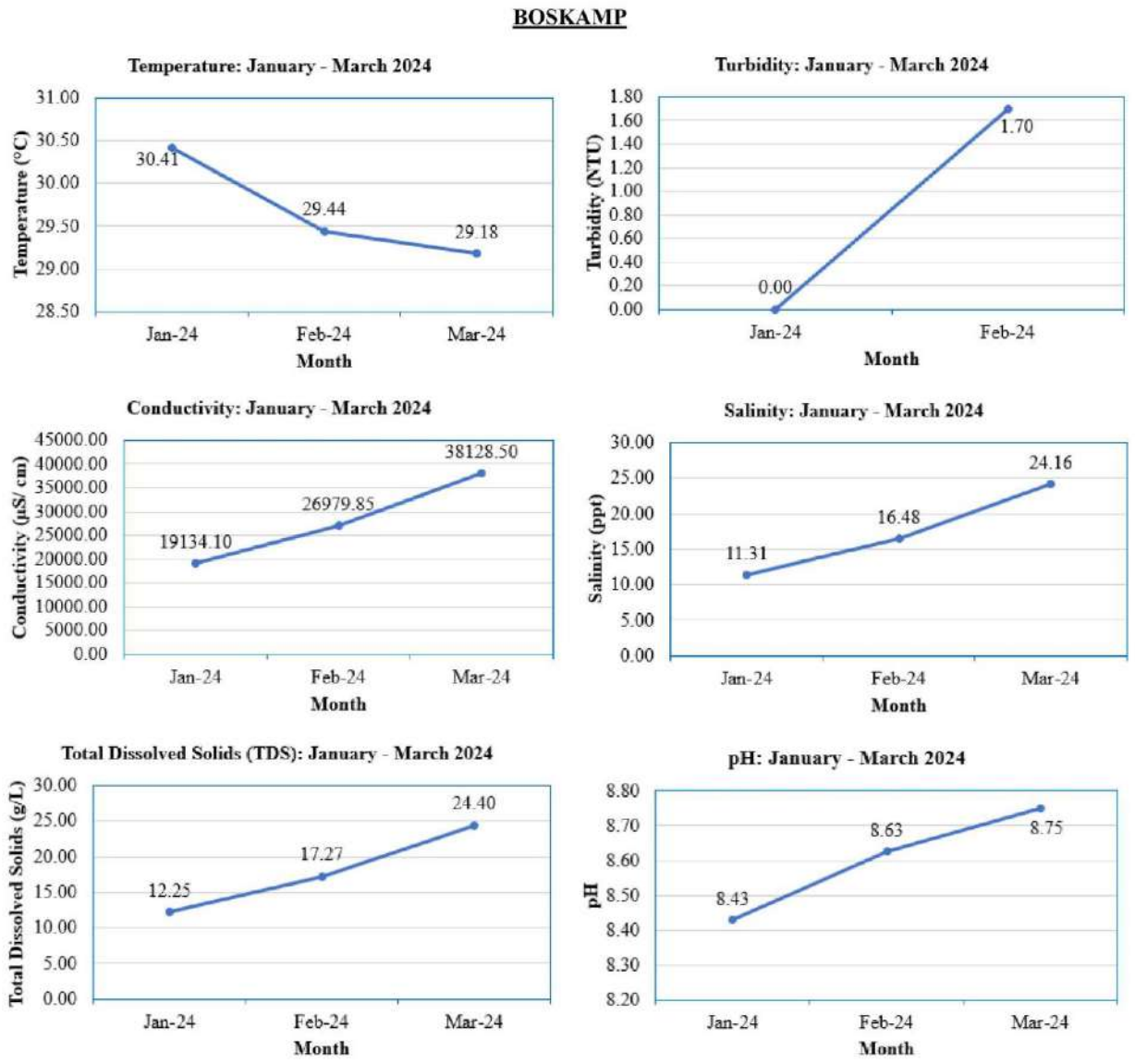

Figure 8: Graphical representation of water quality parameters at Boskamp

Notes figure 8:

- Conductivity and Total Dissolved Oxygen have the sign progression an increasing trend
- Salinity: Salinity shows a significant increase during the dry season due to increased evaporation and decreased water flow, exacerbated by human activities such as fishing.
- pH: pH levels show a gradual increase, indicating potential changes in the water environment. Fluctuations outside the optimal range could harm aquatic life, but the gradual increase may suggest a restoration of pH balance or environmental changes.

Table 9: Water Quality Measurements and Standards Comparison for Boskamp

water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	30.41	0.00	19134.10	11.31	12.25	-	8.43
Feb-24	29.44	1.70	26979.85	16.48	17.27	-	8.63
Mar-24	29.18		38128.50	24.16	24.40	-	8.75
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 9:

- The measured conductivity does not meet the required standards for freshwater and irrigation water usage.

5. District Coronie

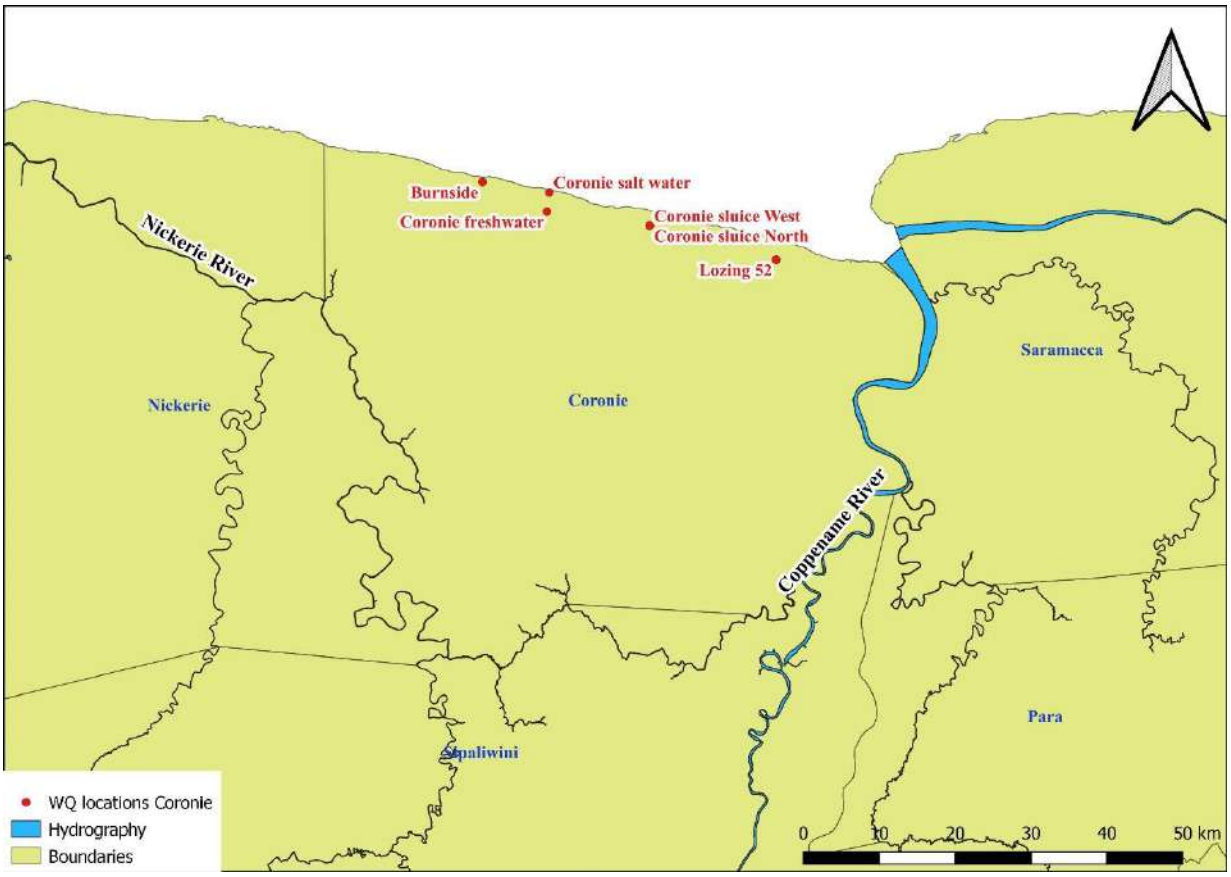

Figure 9: Water quality locations in Coronie district

Coronie is a district in Suriname located on the coast, with Totness as its capital. It borders the Atlantic Ocean to the north, Saramacca to the east, Sipaliwini to the south, and Nickerie to the west. The district is divided into two parts: a northern area accessible by vehicle through roads and dams, and a southern area primarily reachable by boat or swamp boat via existing paths due to its swampy nature.

The living situation in Coronie is characterized by ribbon development, mainly along the East-West connection. The district boasts three protected nature reserves: Peruvia Nature Reserve (31,000 ha), Bigi Pan Special Management Area (67,900 ha), and North Coronie Special Management Area (27,200 ha). Peruvia Nature Reserve is situated near the Coppename estuary

and is crucial for freshwater coastal habitats. The North Coronie Special Management Area consists of 35% forest and 65% wetlands, primarily used for fishing and important for sea level rise protection.

The Coronie Swamp, a natural freshwater reservoir covering approximately 250,000 hectares, is a key feature of the coastal area. It is flat and low-lying, bordered by rivers and the East-West Corridor. The swamp's waters drain eastwards via locks and culverts and westwards, benefiting rice cultivation along the Nickerie River. The Coronie Swamp plays a critical role in the ecosystem, supporting mangroves and serving as a habitat for migratory birds.

Table 10: overview of locations along the canal, swamp and their use of water, including coordinates in the Coronie district.

District	Location	Water use	Coordinates
Coronie	Lozing 52		
	Lozing 49 North	- Transportation - Recreational - Agriculture activities (discharge and irrigation) - Fishery	5°50'57.70"N 56°12'58.48"W
	Lozing 49 South		5°50'57.45"N 56°12'58.23"W
	Coronie fresh water	- Recreational (swimming, tourism) - Agriculture activities - Fishery - Sandmining	5°51'59.71"N 56°20'18.00"W
	Coronie salt water	- Salt mining - Aquaculture - Sea fishing - Tourism	5°53'21.15"N 56°20'08.10"W
	Burnside	- Agriculture activities - Recreational	5°54'06.47"N 56°24'54.63"W

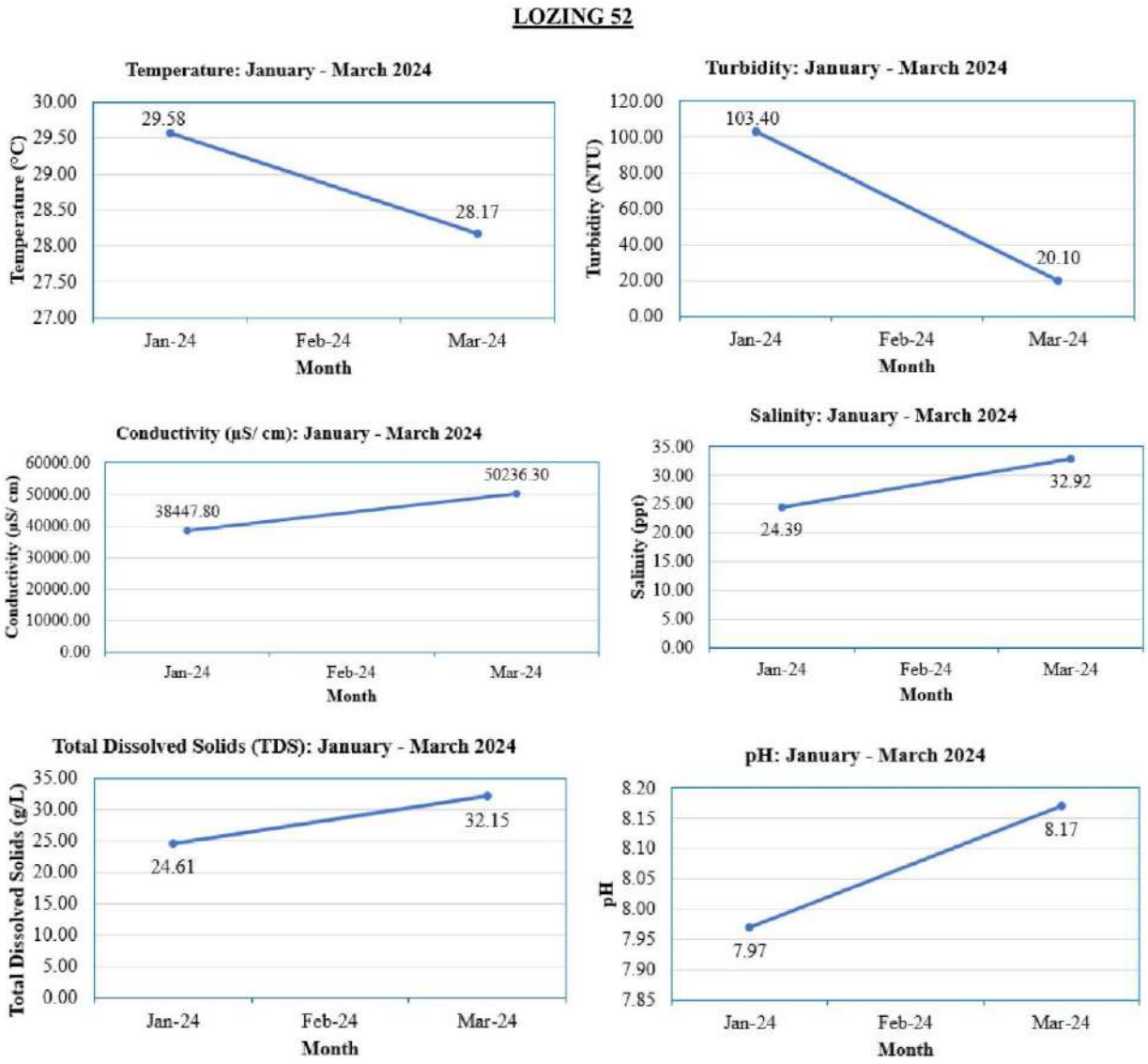

Figure 10: Graphical representation of water quality parameters at Lozing 52

Notes figure 10: `

- **Dry Season Impact**: From January to March this year, it was exclusively the dry season, significantly affecting water quality measurements.
- **Temperature Variation**: In March, temperatures are lower compared to January, likely due to the onset of the rainy season.
- **Turbidity:** There is a notable decrease in turbidity measurements. This could be attributed to reduced rainfall. Heavy rain causes sediment runoff and erosion, leading to higher turbidity. Conversely, decreased rainfall results in lower turbidity levels.
- **Conductivity:** Conductivity values vary considerably and are notably above the average standard. This indicates a high concentration of salt ions or other contaminants in the water.
- **Salinity:** Salinity values in January and March are high, potentially indicating salt intrusion from the sea and significant human activities affecting this part of the river.
- **pH:** There is a slight increase in pH from January to March.

Table 11: Water Quality Measurements and Standards Comparison for Lozing 52

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	29.58	103.40	38447.80	24.39	24.61	-	7.97
Mar-24	28.17	20.10	50236.30	32.92	32.15	-	8.17
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 11:

- The measured conductivity does not meet the required standards for freshwater and irrigation water usage.

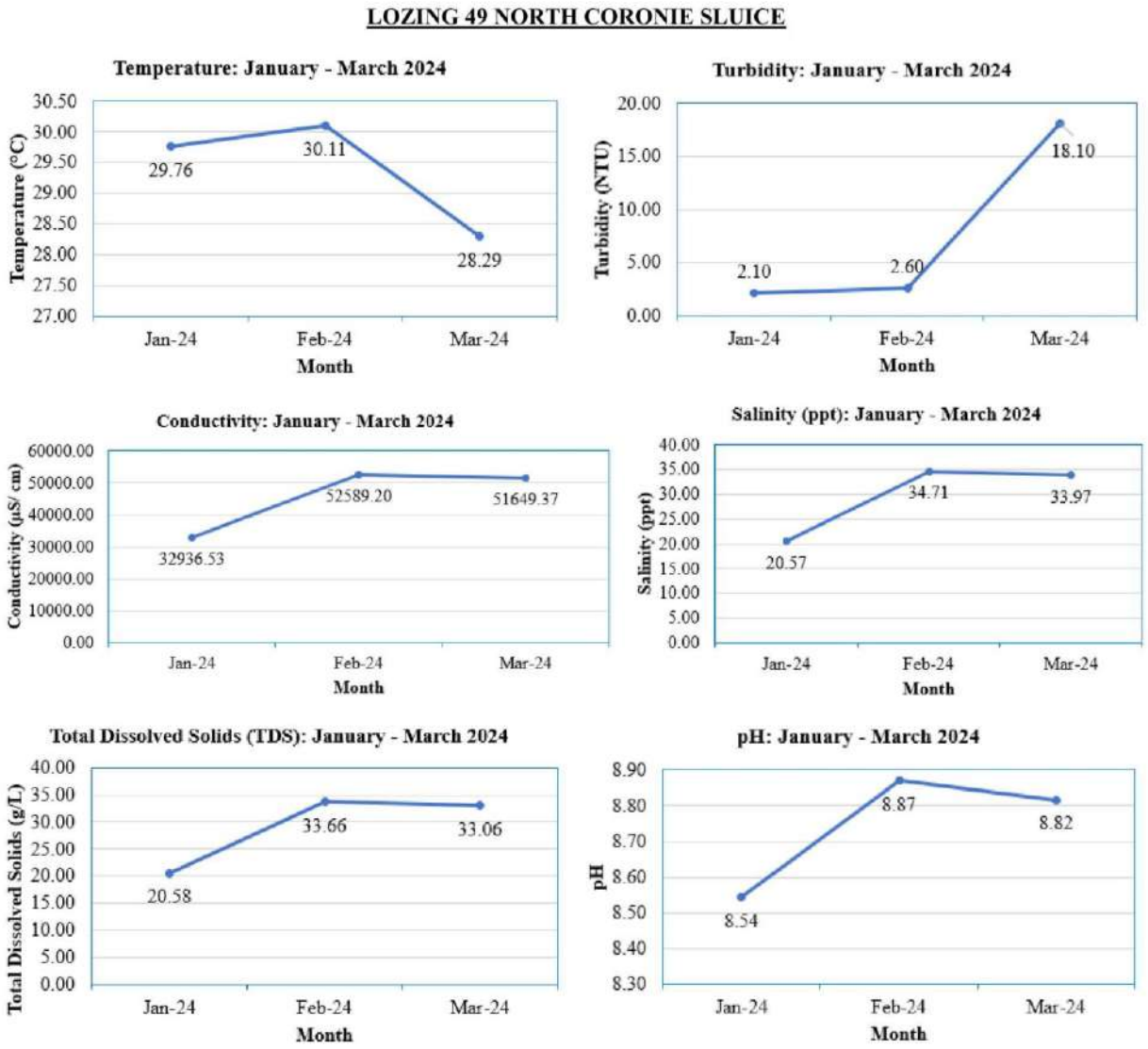

Figure 11: Graphical representation of water quality parameters at Lozing 49 North Coronie sluice

Notes figure 11:

- Turbidity: the cloudiness of the water, increases with depth, as suspended particles settle.
- Conductivity: rises with depth, indicating more dissolved salts and minerals in deeper waters. This increase is mirrored by the rising salinity, showing higher salt concentrations in deeper saltwater layers.
- Total Dissolved Solids (TDS) levels follow a similar pattern, increasing with depth as more salts and minerals dissolve into the water.
- The pH of the water remains slightly alkaline overall, with minor variations in deeper layers.

Table 12: Water Quality Measurements and Standards Comparison for Lozing 49 North Coronie sluice

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	29.76	2.10	32936.53	20.57	20.58	-	8.54
Feb-24	30.11	2.60	52589.20	34.71	33.66	-	8.87
Mar-24	28.29	18.10	51649.37	33.97	33.06	-	8.82
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 12:

- The measured conductivity does not meet the required standards for freshwater and irrigation water usage.

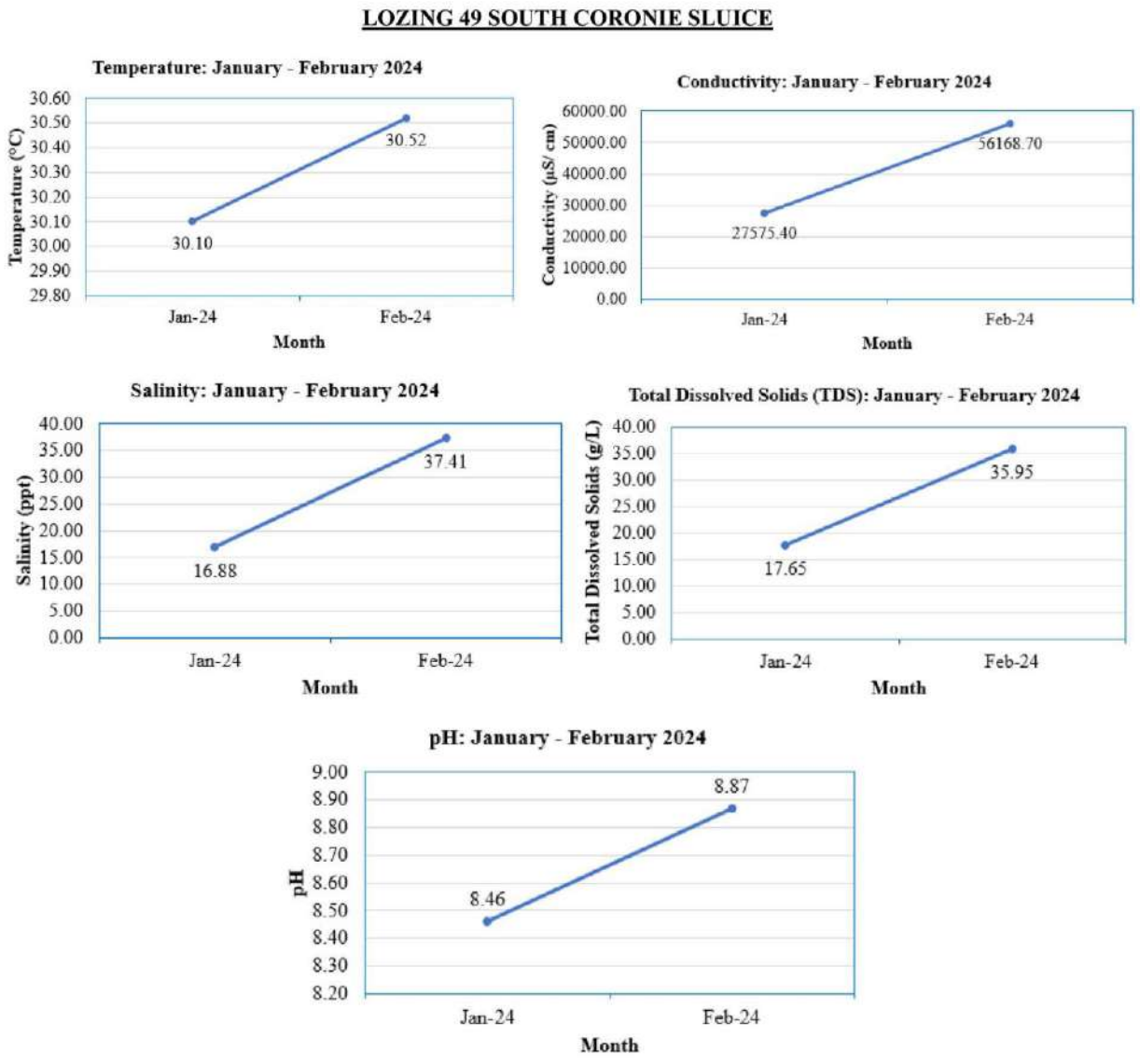

Figure 12: Graphical representation of water quality parameters at Lozing 49 South Coronie sluice

Note figure 12:

- The graphs of Lozing 49 South Coronie water show a gradual increase from low to high values for several parameters. In general, the measurements show higher values as depth increases. This trend can be attributed to local variations and factors, such as sedimentation, currents and possibly the specific characteristics of this location in the river.

Table 13: Water Quality Measurements and Standards Comparison for Lozing 49 South Coronie sluice

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	30.10	-	27575.40	16.88	17.65	-	8.46
Feb-24	30.52	-	56168.70	37.41	35.95	-	8.87
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 13:

- The measured conductivity does not meet the required standards for freshwater and irrigation water usage.

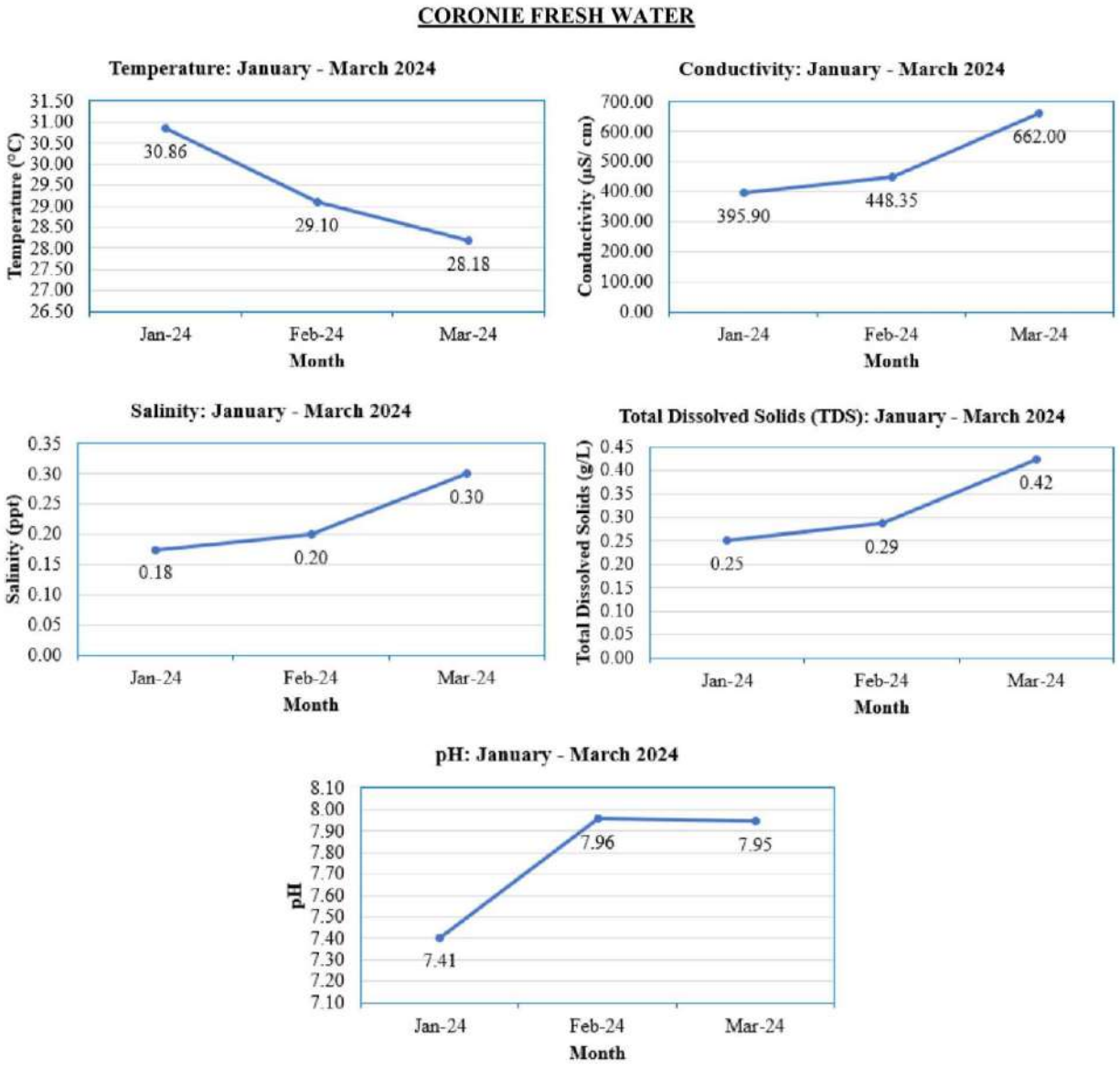

Figure 13: Graphical representation of water quality parameters at Coronie fresh water

Notes figure 13:

- Temperature: The temperature decreases slightly as depth increases, likely due to reduced exposure to sunlight and a greater influence of cooler underlying layers.
- Conductivity: Higher conductivity with increasing depth suggests the presence of dissolved salts and minerals, possibly due to sedimentation.
- Salinity: Increasing salinity with depth indicates higher salinity, possibly due to saltwater intrusion and sediments.
- Total Dissolved Solids (TDS): Increasing TDS values indicate more dissolved solids in deeper water, possibly due to sedimentation and salts.
- pH: The pH remains slightly basic in general.

Table 14: Water Quality Measurements and Standards Comparison for Coronie fresh water

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	30.86	-	395.90	0.18	0.25	-	7.41
Feb-24	29.10	-	448.35	0.20	0.29	-	7.96
Mar-24	28.18	-	662.00	0.30	0.42	-	7.95
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 14:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

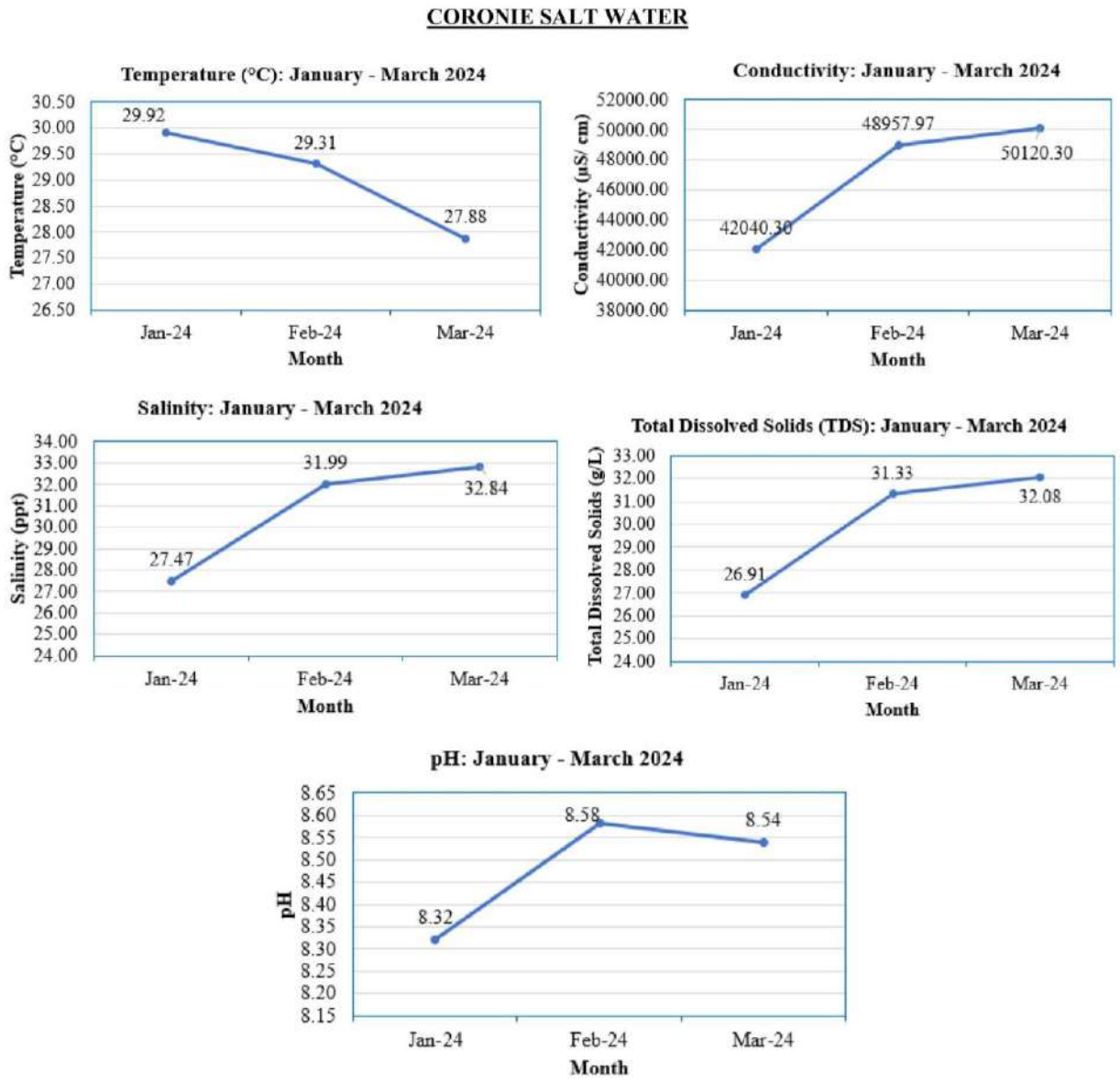

Figure 14: Graphical representation of water quality parameters at Coronie salt water

Notes figure 14:

- In the saltwater of Coronie, temperature decreases as we go deeper, which is a common characteristic in saltwater layers due to reduced sunlight exposure. Turbidity, the cloudiness of the water, also decreases with depth, as suspended particles settle.
- Conductivity rises with depth, indicating more dissolved salts and minerals in deeper waters. This increase is mirrored by the rising salinity, showing higher salt concentrations in deeper saltwater layers.
- Total Dissolved Solids (TDS) levels follow a similar pattern, increasing with depth as more salts and minerals dissolve into the water.
- The pH of the water remains slightly alkaline overall, with minor variations in deeper layers.

Table 15: Water Quality Measurements and Standards Comparison for Coronie salt water

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	29.92	-	42040.30	27.47	26.91	-	8.32
Feb-24	29.31	-	48957.97	31.99	31.33	-	8.58
Mar-24	27.88	-	50120.30	32.84	32.08	-	8.54
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 15:

- The measured conductivity does not meet the required standards for freshwater and irrigation water usage.

BURNSIDE

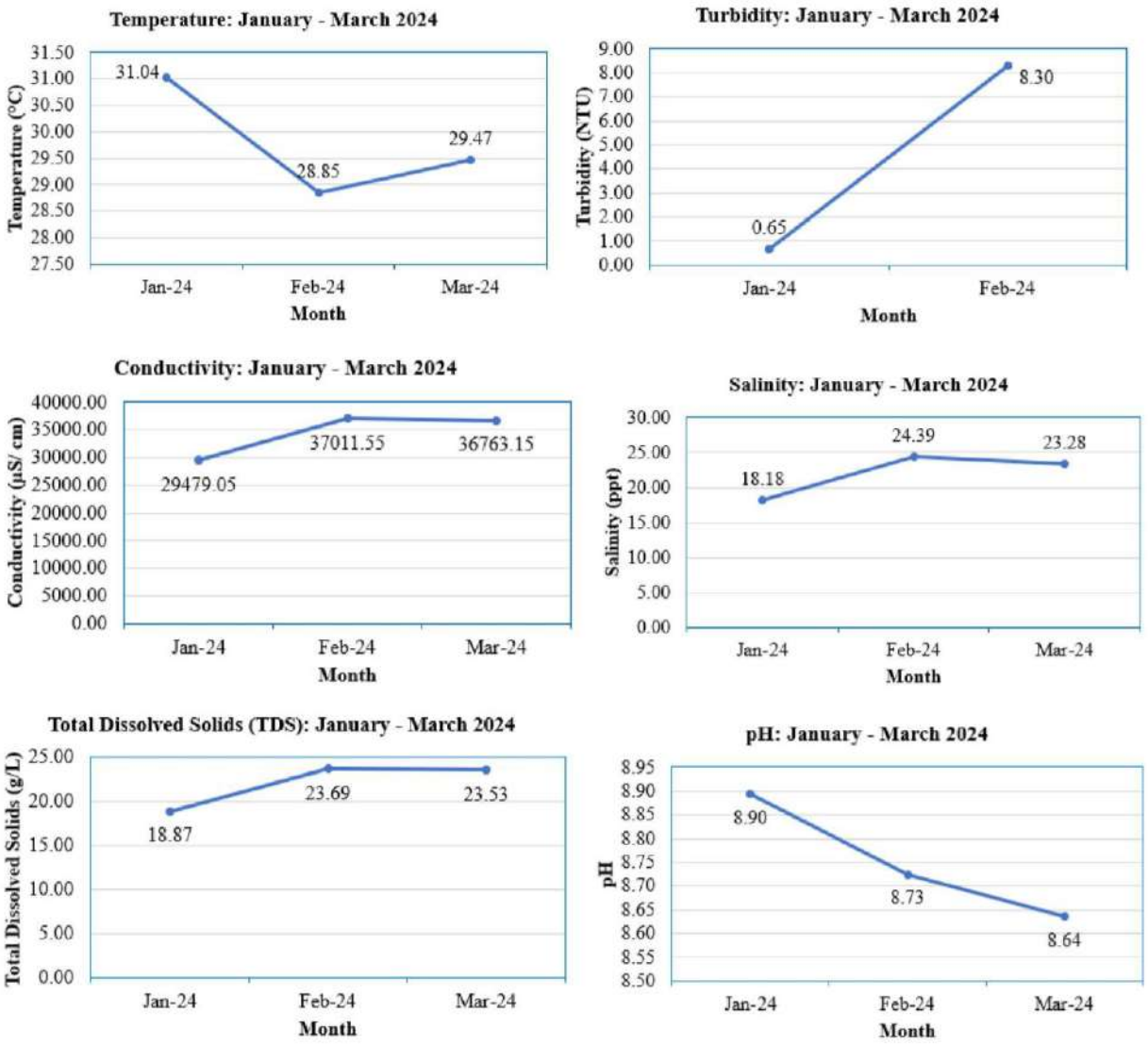

Figure 15: Graphical representation of water quality parameters at Burnside

Notes figure 15:

- Temperature: The temperature decreases slightly as depth increases, likely due to reduced exposure to sunlight and a greater influence of cooler underlying layers.
- Turbidity: Turbidity increases with depth, indicating the presence of suspended particles and sediments.
- Conductivity: Higher conductivity with increasing depth suggests the presence of dissolved salts and minerals, possibly due to sedimentation.
- Salinity: Increasing salinity with depth indicates higher salinity, possibly due to saltwater intrusion and sediments.
- Total Dissolved Solids (TDS): Increasing TDS values indicate more dissolved solids in deeper water, possibly due to sedimentation and salts.
- pH: The pH remains slightly basic in general, suitable for saltwater environments, but can vary with depth.

Table 16: Water Quality Measurements and Standards Comparison for Burnside

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	31.04	0.65	29479.05	18.18	18.87	-	8.90
Feb-24	28.85	8.30	37011.55	24.39	23.69	-	8.73
Mar-24	29.47	-	36763.15	23.28	23.53	-	8.64
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 16:

- During this El Niño-influenced period, intensified drought has led to increased salinity and conductivity in the water, surpassing norms for irrigation and freshwater.

6. The Nickerie River

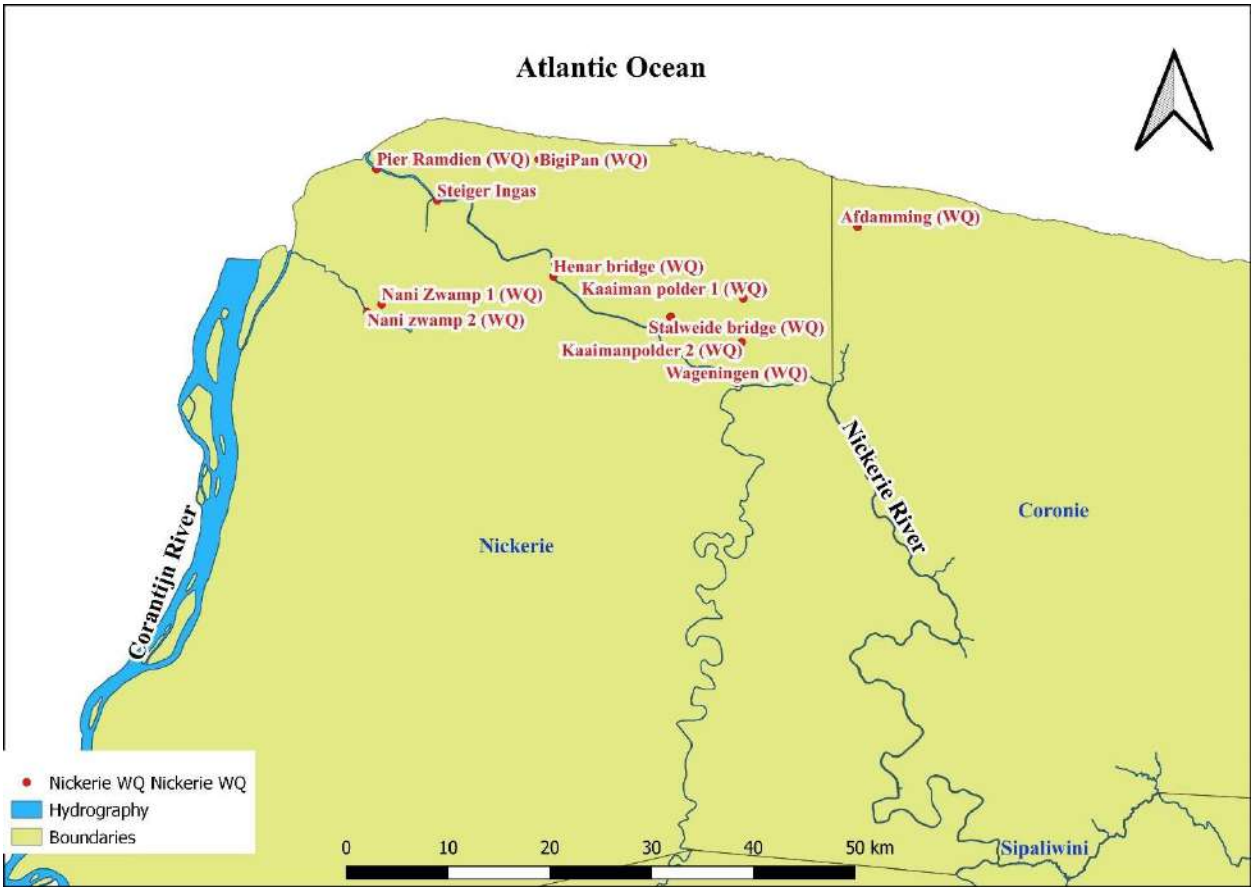

Figure 16: Water quality locations in district Nickerie

The Nickerie River, situated in the northwest of Suriname, plays a pivotal role in various activities essential to the region. It serves as a crucial source for irrigation and drainage of rice paddies and agricultural lands. Local communities heavily rely on the river for daily necessities such as bathing, washing clothes and dishes, transportation, cultural events, and fishing. Originating from the Bakhuis Mountains, the river primarily flows northward, covering an expansive watershed of approximately 10,100 km².

The watershed of the Nickerie River can be delineated into three distinct parts: the lower region characterized by rice paddies and settlements, the middle section featuring marshy areas, and the upper part located beyond the tidal zone. At its mouth, the river varies in width from approximately 50 meters to 150 meters, with an average depth of around 20 meters.

Rice cultivation thrives along the banks of the Nickerie River, supported by irrigation systems that draw water directly from the river. Riverboats are utilized for transporting rice and other commodities, with Nieuw-Nickerie serving as a prominent export hub. Beyond economic activities, the river offers recreational and tourism opportunities such as boat tours and birdwatching along its scenic banks.

The water level of the Nickerie River is influenced by tidal movements from the Atlantic Ocean, resulting in saltwater intrusion during the dry season that affects the local ecosystem. Preserving the water quality and overall health of the Nickerie River is crucial due to its significant economic and ecological importance. Implementing measures for sustainable management and careful development is essential to mitigate pollution and ensure the river's long-term viability.

Table 17: In Nickerie district: overview of locations along the Nickerie River and their use of river water, including coordinates

River	Location	Water use	Coordinates
Nickerie	Nani swamp	- Agriculture activities (irrigation) - Recreation (swimming) - Fishery	05°50'01.94" N 057°00'13.41" W
	Stalweide Bridge	- Agriculture activities (irrigation) - Fishery	05°45'23.84" N 056°41'10.71"W
	Kaaimanpolder Bridge	- Fishery	5°50'18.0"N 56°40'55.3"W
	Ramdien Pier	- Fishery	5°57'12.4"N 57°00'28.0"W
	Scaffold Ingas		5°55'31.7"N 56°57'14.0"W
	Henar bridge	- Navigation - Transportation - Fishery	5°51'28.5"N 56°51'02.4"W
	Wageningen	- Livelihood (washing of clothes and dishes etc.) - Agriculture activities - Fishery	05°45'43.87" N 056°41'12.00" W
	Afdamming	- Fishery - Hunting	05°54'07.75" N 056°34'49.58" W

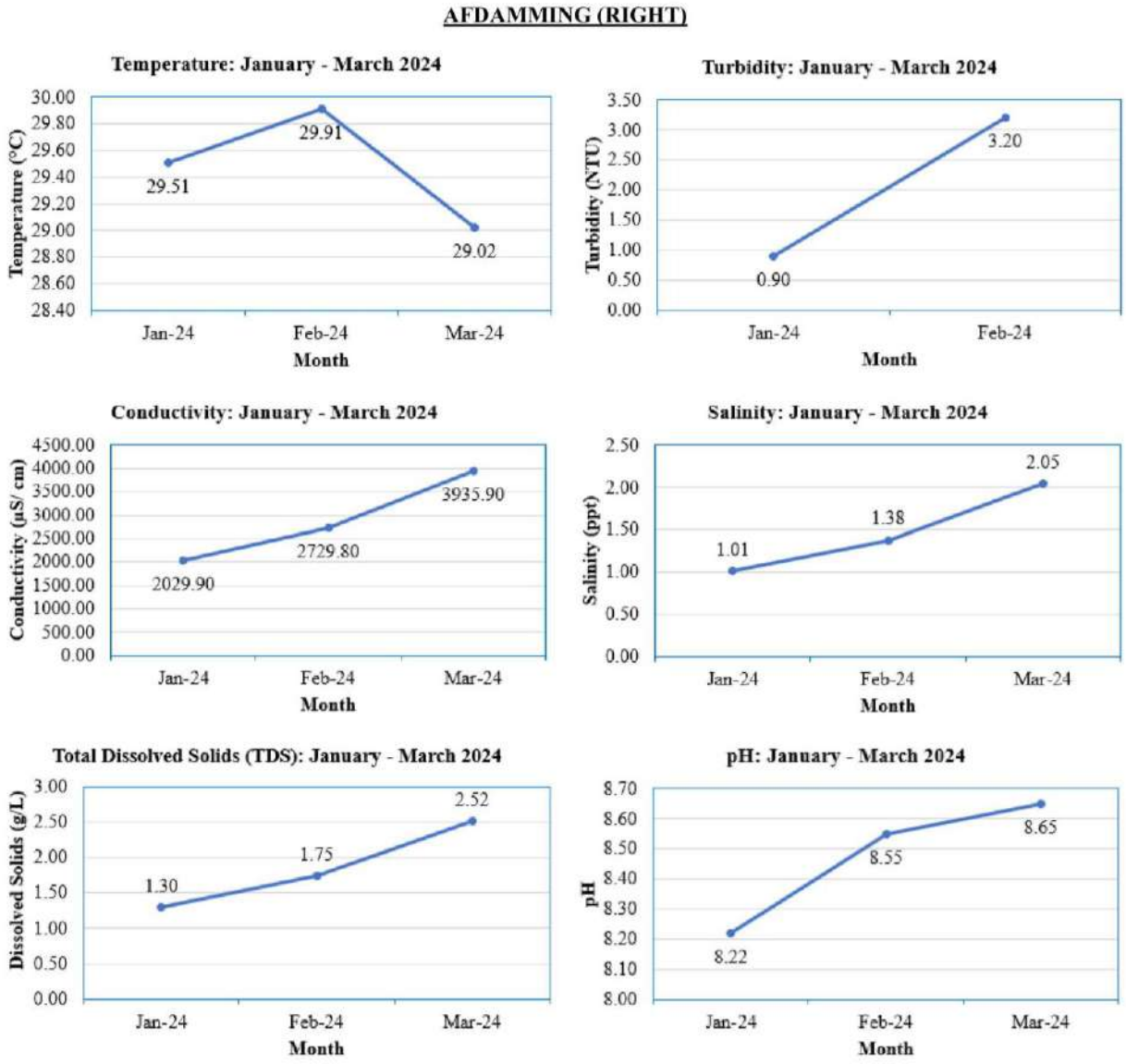

Figure 17: Graphical representation of water quality parameters at Afdamming (right)

Notes figure 17:

- Temperature: Overall stability with minor fluctuations indicating a consistent, warm environment beneficial for aquatic life.
- Turbidity: Fluctuations suggest variations in water clarity, possibly due to sedimentation or reduced rainfall.
- Conductivity: Predominantly stable with temporary decreases attributed to rainfall and increases possibly linked to seasonal or environmental changes.
- Salinity: Consistently low, staying within the freshwater range throughout the measurement period.
- Total Dissolved Solids (TDS): Values remain within acceptable limits, with a notable increase in September likely due to reduced precipitation and increased evaporation.
- The pH of the water remains slightly alkaline overall, with minor variations in deeper layers.

Table 18: Water Quality Measurements and Standards Comparison for Afdamming (right)

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.51	0.90	2029.90	1.01	1.30	7.31	8.22
Feb-24	29.91	3.20	2729.80	1.38	1.75	-	8.55
Mar-24	29.02	-	3935.90	2.05	2.52	--	8.65
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 18:

- The measured conductivity does not meet the required standards for freshwater and irrigation water usage.

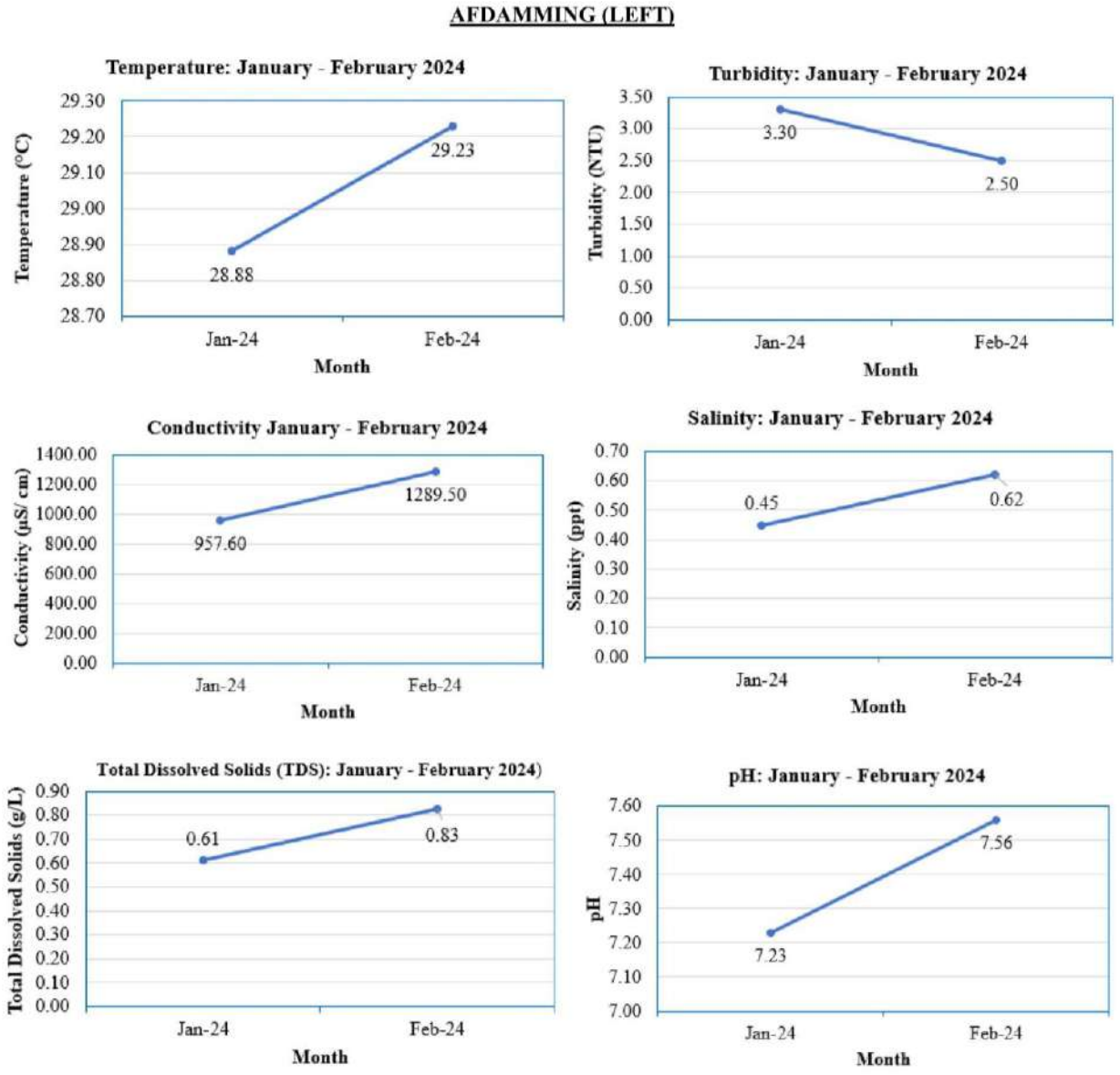

Figure 18: Graphical representation of water quality parameters at Afdamming (left)

Notes figure 18:

- Temperature: Overall stability with minor fluctuations indicating a consistent, warm environment beneficial for aquatic life.
- Turbidity: from high to low measured water clarity, possibly due to sedimentation or reduced rainfall.
- Conductivity: Predominantly stable with temporary decreases attributed to rainfall and increases possibly linked to seasonal or environmental changes.
- Salinity: Consistently low, staying within the freshwater range throughout the measurement period.
- Total Dissolved Solids (TDS): Values remain within acceptable limits, with a notable increase in September likely due to reduced precipitation and increased evaporation.
- The pH of the water remains slightly alkaline overall, with minor variations in deeper layers.

Table 19: Water Quality Measurements and Standards Comparison for Afdamming (left)

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	28.88	3.30	957.60	0.45	0.61	0.59	7.23
Feb-24	29.23	2.50	1289.50	0.62	0.83	-	7.56
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 19:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

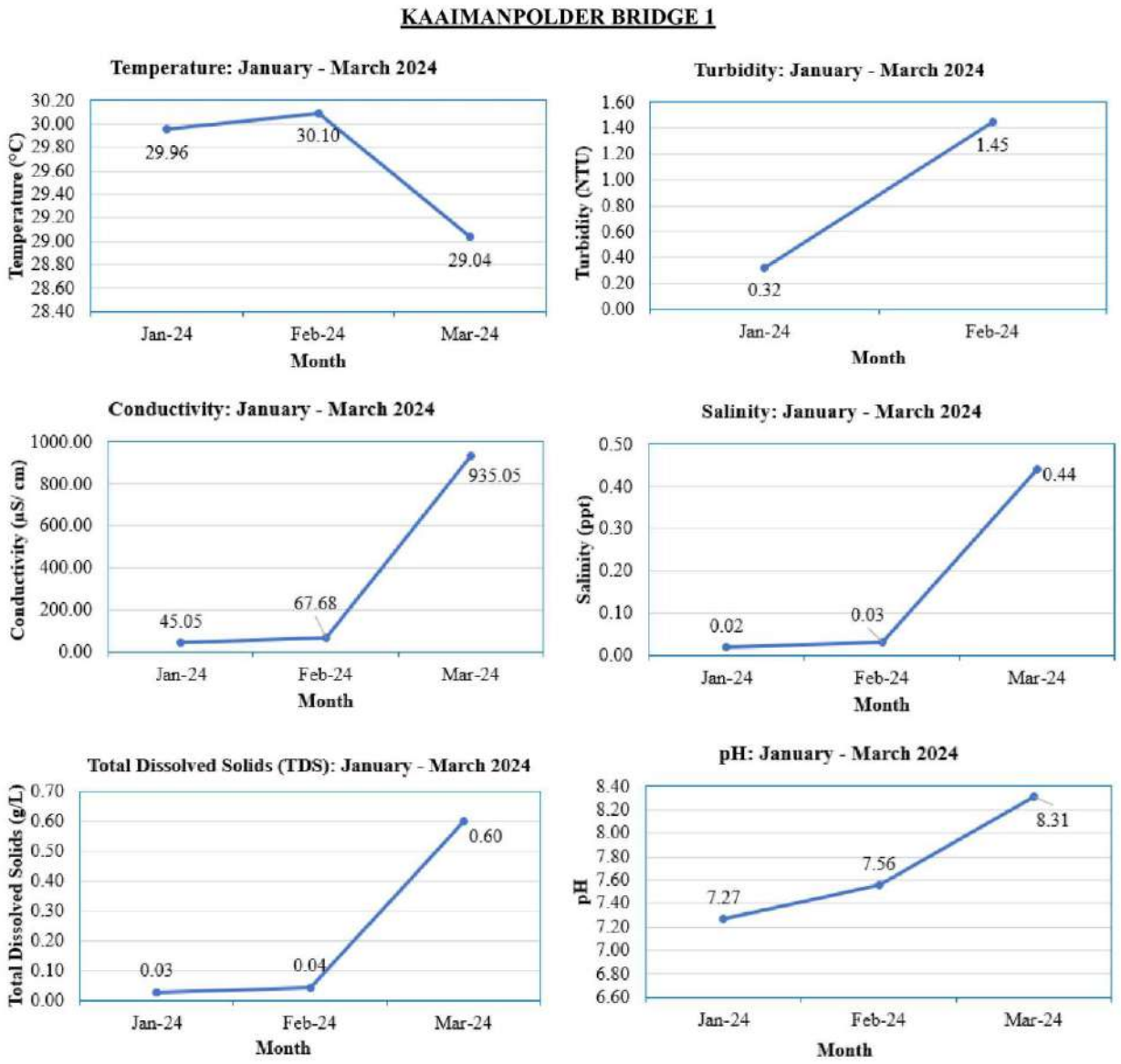

Figure 19: Graphical representation of water quality parameters at Kaaimanpolder Bridge 1

Notes figure 19:

- Turbidity: Fluctuations suggest variations in water clarity, possibly due to sedimentation or reduced rainfall.
- Conductivity**:** Gradual increase from June to March, attributed to seasonal changes and increased concentration of dissolved minerals in the dry season. When the dry season reaches its peak, reduced precipitation leads to a sharp increase in minerals in the water, significantly increasing conductivity.
- Salinity**:** Shows a gradual increase due to seasonal changes (transition from wet to dry season).
- Total Dissolved Solids (TDS)**:** Gradual increase possibly due to evaporation, reduced water drainage, and human activities like gas bomb filling introducing dissolved substances.
- pH**:** Gradual increase attributed to dilution effects during rainy season and increased biological activity like photosynthesis, reducing carbon dioxide and raising pH.

Table 20: Water Quality Measurements and Standards Comparison for Kaaimanpolder Bridge 1

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	29.96	0.32	45.05	0.02	0.03	3.36	7.27
Feb-24	30.10	1.45	67.68	0.03	0.04	-	7.56
Mar-24	29.04	-	935.05	0.44	0.60	-	8.31
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 20:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

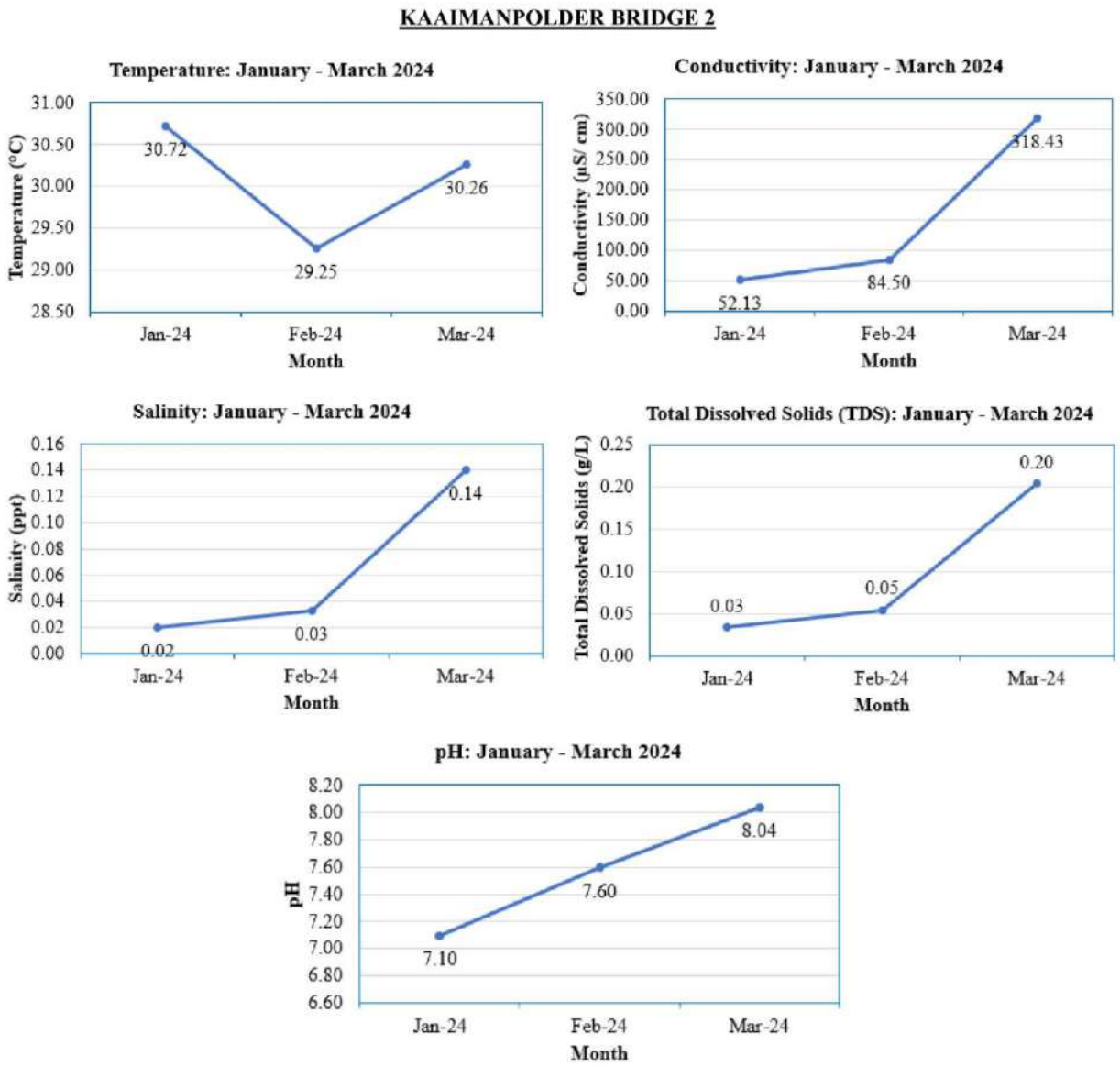

Figure 20: Graphical representation of water quality parameters at Kaaimanpolder Bridge 2

Notes figure 20:

- Conductivity**:** Gradual increase from January to March, attributed to seasonal changes and increased concentration of dissolved minerals in the dry season. When the dry season reaches its peak, reduced precipitation leads to a sharp increase in minerals in the water, significantly increasing conductivity.
- Salinity**:** Shows a gradual increase due to seasonal changes (transition from wet to dry season).
- Total Dissolved Solids (TDS)**:** Gradual increase possibly due to evaporation, reduced water drainage, and human activities like gas bomb filling introducing dissolved substances.
- pH**:** Gradual increase attributed to dilution effects during rainy season and increased biological activity like photosynthesis, reducing carbon dioxide and raising pH.

Table 21: Water Quality Measurements and Standards Comparison for Kaaimanpolder Bridge 2

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	30.72	-	52.13	0.02	0.03	-	7.10
Feb-24	29.25	-	84.50	0.03	0.05	-	7.60
Mar-24	30.26	-	318.43	0.14	0.20	-	8.04
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 21:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

WAGENINGEN

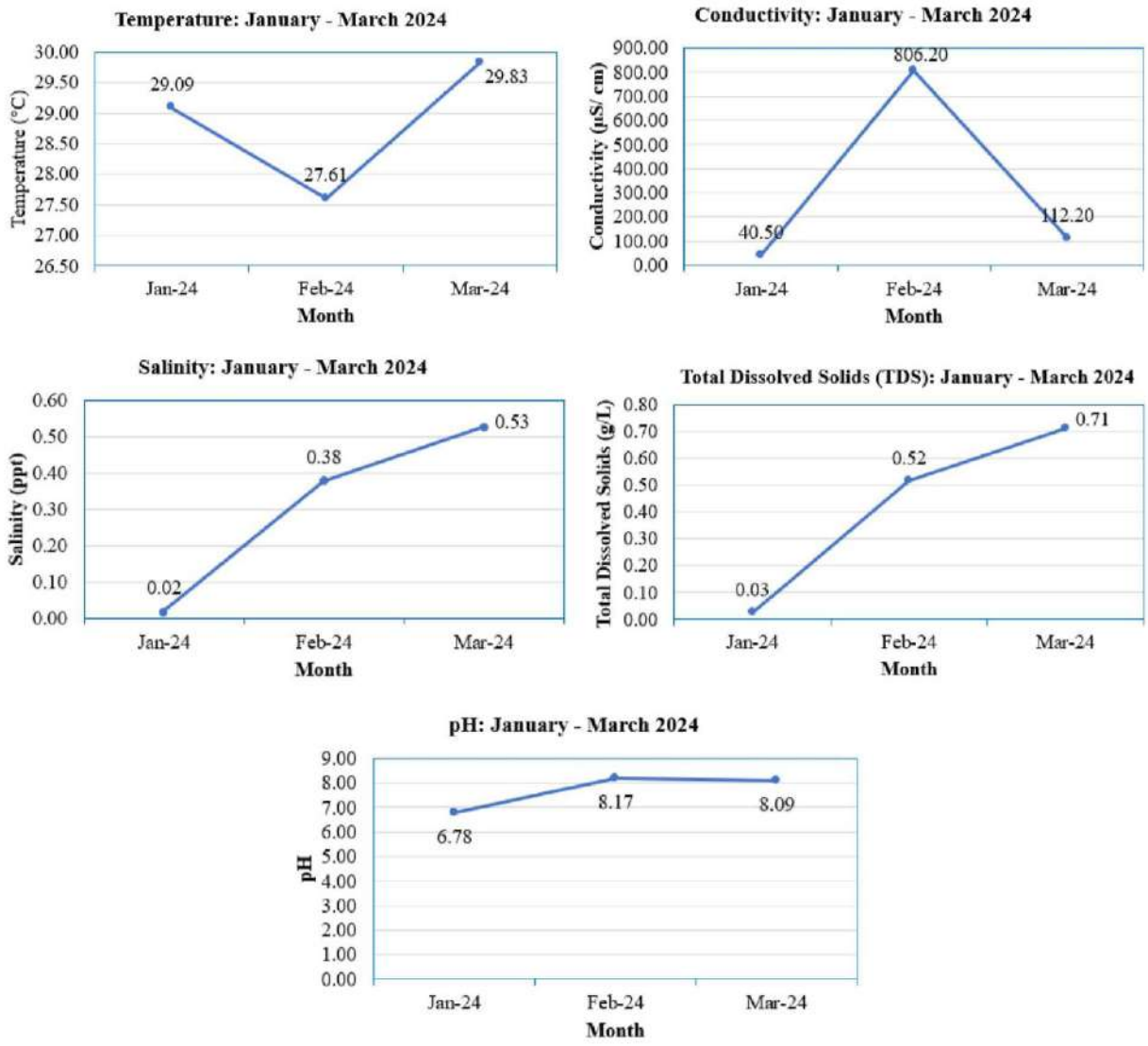

Figure 21: Graphical representation of water quality parameters at Wageningen

Notes figure 21:

- Conductivity**:** rises notably during the dry season, possibly influenced by natural changes and human activities like industrial operations.
- Salinity**:** Shows a gradual increase due to seasonal changes (transition from wet to dry season).
- Total Dissolved Solids (TDS)**:** Gradual increase possibly due to evaporation, reduced water drainage, and human activities like gas bomb filling introducing dissolved substances.
- pH**:** Gradual increase attributed to dilution effects during rainy season and increased biological activity like photosynthesis, reducing carbon dioxide and raising pH.

Table 22: Water Quality Measurements and Standards Comparison for Wageningen

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.09	-	40.50	0.02	0.03	-	6.78
Feb-24	27.61	-	806.20	0.38	0.52	-	8.17
Mar-24	29.83	-	112.20	0.53	0.71	-	8.09
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 22:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

STALWEIDE BRIDGE

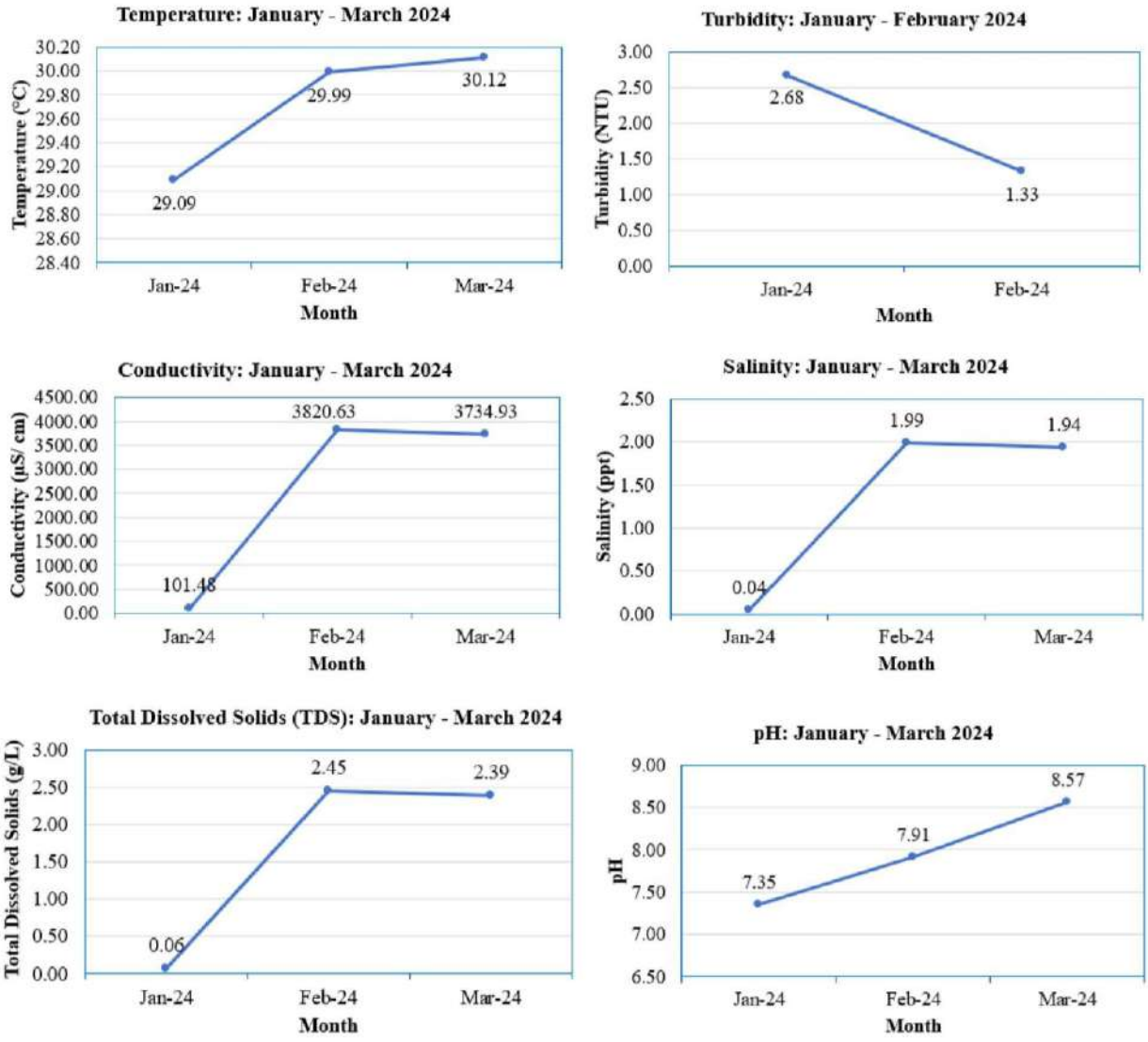

Figure 22: Graphical representation of water quality parameters at Stalweide Bridge

Notes figure 22:

- Turbidity, Conductivity, Salinity and TDS decrease significantly with depth, mainly due to reduced exposure to sunlight and thermal fluctuations, sediments, agricultural runoff, and reduced oxygen supply in deeper waters.
- pH values are stable and suitable for freshwater habitats at all depths.

Table 23: Water Quality Measurements and Standards Comparison for Stalweide Bridge

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.09	2.68	101.48	0.04	0.06	-	7.35
Feb-24	29.99	1.33	3820.63	1.99	2.45	-	7.91
Mar-24	30.12	-	3734.93	1.94	2.39	-	8.57
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 23:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

HENAR BRIDGE

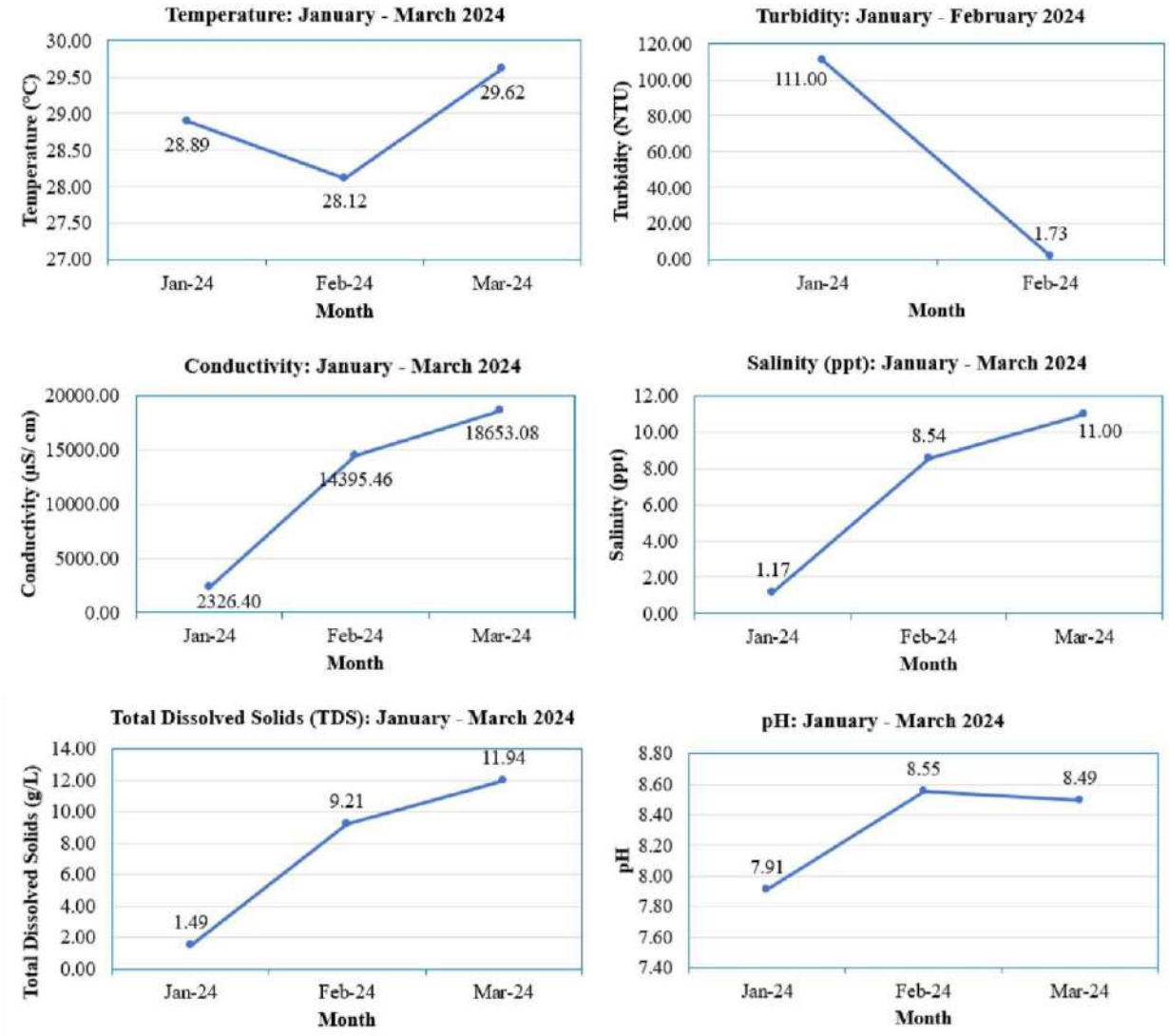

Figure 23: Graphical representation of water quality parameters at Henar Bridge

Notes figure 23:

- Turbidity, Conductivity, Salinity and TDS decrease significantly with depth, mainly due to reduced exposure to sunlight and thermal fluctuations, sediments, agricultural runoff, and reduced oxygen supply in deeper waters.
- pH values are stable and suitable for freshwater habitats at all depths

Table 24: Water Quality Measurements and Standards Comparison for Henar Bridge

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	28.89	111.00	2326.40	1.17	1.49	-	7.91
Feb-24	28.12	1.73	14395.46	8.54	9.21	-	8.55
Mar-24	29.62	-	18653.08	11.00	11.94	-	8.49
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 24:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

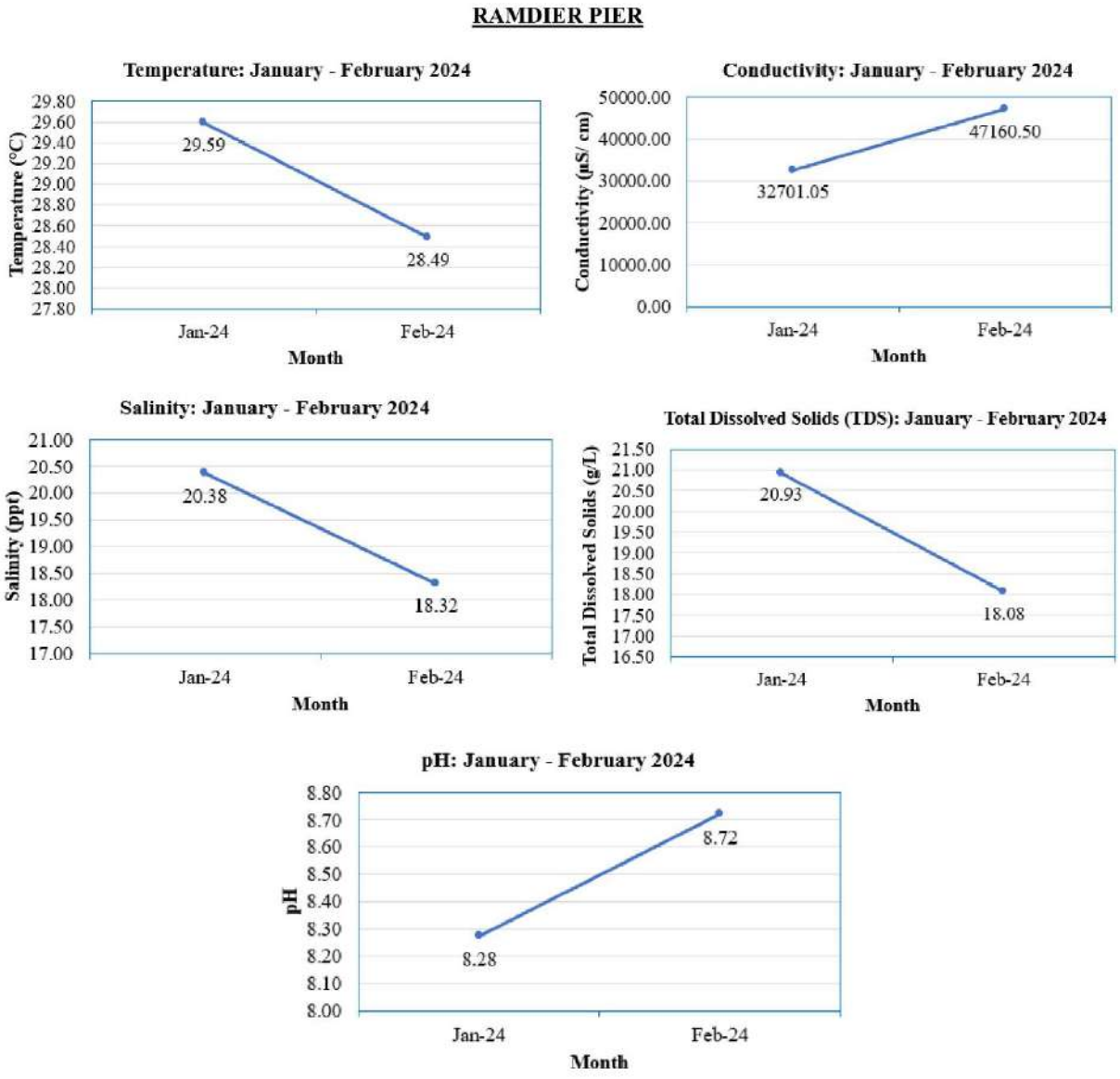

Figure 24: Graphical representation of water quality parameters at Ramdien pier

Notes figure 24:

- The Temperature, Salinity and TDS decrease with increasing depth, possibly due to salt infiltration from the environment, resulting in higher salinity, reduced oxygen supply and biological activity.
- Conductivity: Reduced dilution from rain and increased evaporation during drought can increase conductivity.
- pH values remain stable, indicating that the water still has a mildly alkaline character.

Table 25: Water Quality Measurements and Standards Comparison for Ramdien pier

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.59	-	32701.05	20.38	20.93	-	8.28
Feb-24	28.49	-	47160.50	18.32	18.08	-	8.72
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 25:

- Additionally, the measured Conductivity at Ramdien pier is high at different depths, rendering the water unstable for irrigation and freshwater, but falling within the normal range for seawater, typically around 50,000 microsiemens per centimeter (uS/cm).

INGAS SCAFFOLD

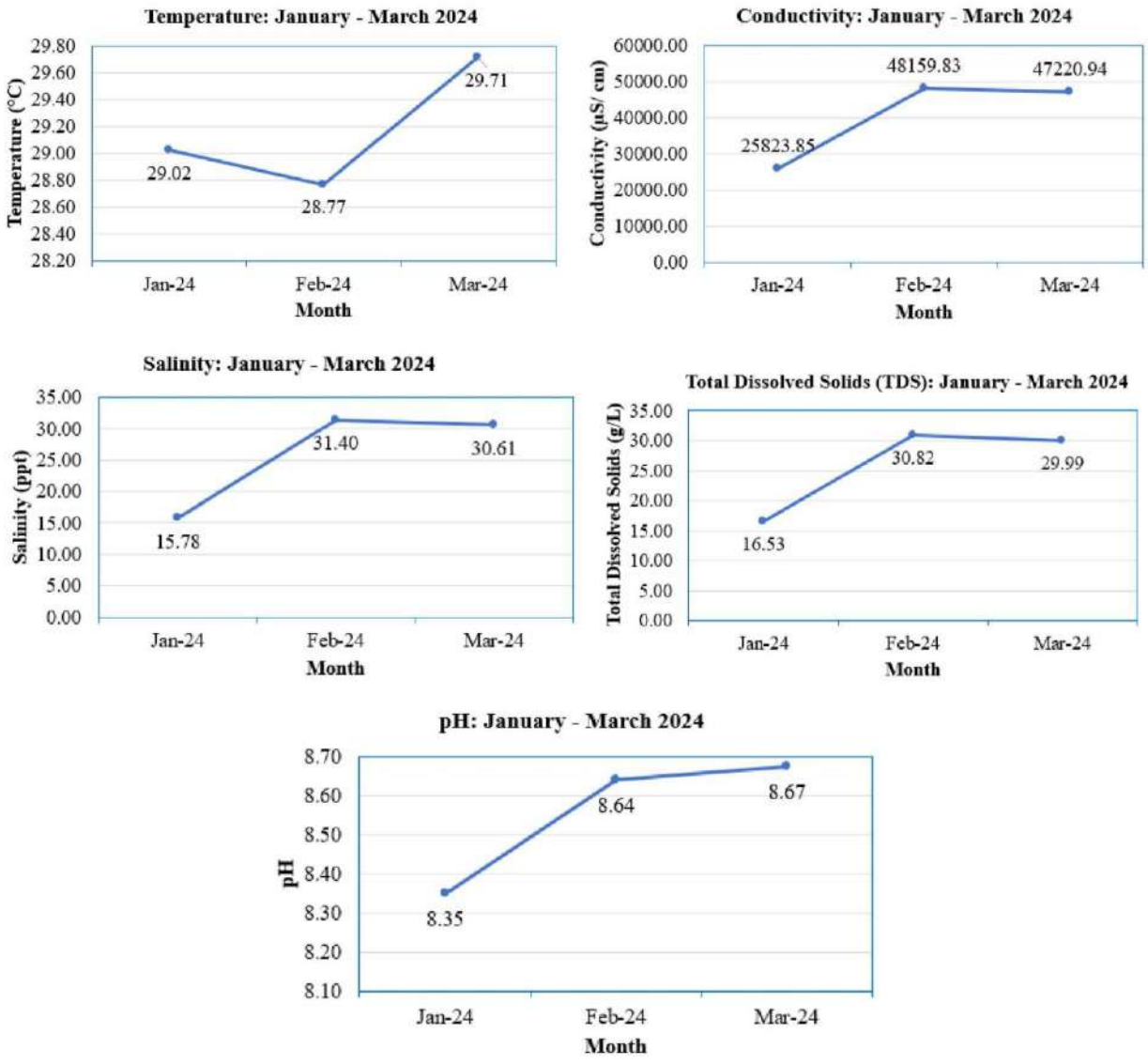

Figure 25: Graphical representation of water quality parameters at Ingas Scaffold

Notes figure 25:

- Conductivity, Salinity and TDS decrease significantly with depth, mainly due to reduced exposure to sunlight and thermal fluctuations, sediments, agricultural runoff, and reduced oxygen supply in deeper waters.
- pH values are stable and suitable for freshwater habitats at all depths

Table 26: Water Quality Measurements and Standards Comparison for Ingas Scaffold

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.02	-	25823.85	15.78	16.53	-	8.35
Feb-24	28.77	-	48159.83	31.40	30.82	-	8.64
Mar-24	29.71	-	47220.94	30.61	29.99	-	8.67
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 26:

- Additionally, the measured Conductivity at Ingas Scaffold is high at different depths, rendering the water unstable for irrigation and freshwater, but falling within the normal range for seawater, typically around 50,000 microsiemens per centimeter (uS/cm).

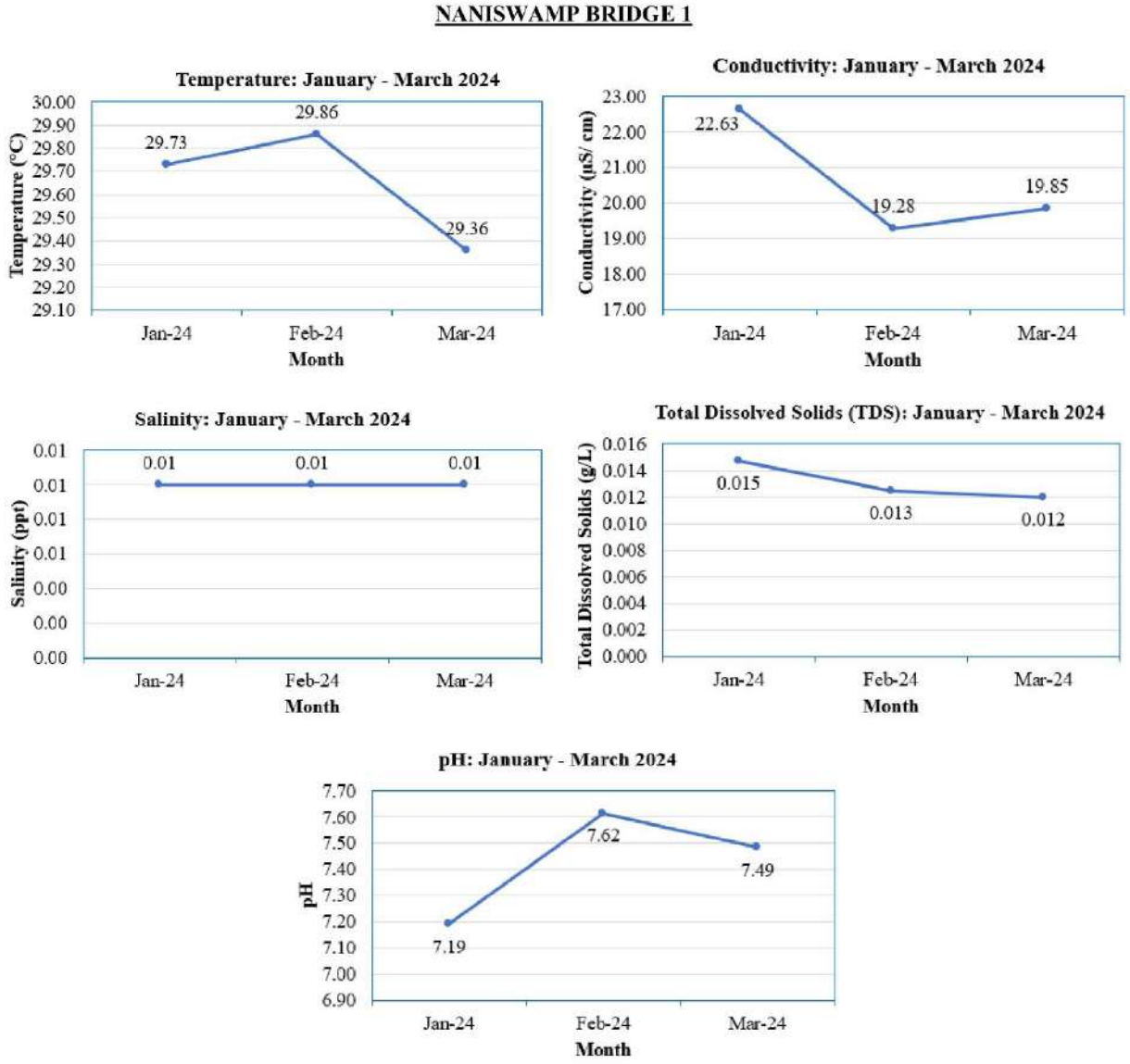

Figure 26: Graphical representation of water quality parameters at Nani swamp Bridge 1

Notes figure 26:

- Total Dissolved Solids (TDS): TDS remains consistently the same at all depths, suggesting stable levels of dissolved solids in the water.
- Conductivity decrease significantly with depth, mainly due to reduced exposure to sunlight and thermal fluctuations, sediments, agricultural runoff, and reduced oxygen supply in deeper waters.
- Salinity: Salinity remains consistently low at all depths, suggesting stable salt concentration.
- pH values are stable and suitable for freshwater habitats at all depths.

Table 27: Water Quality Measurements and Standards Comparison for Nani swamp Bridge 1

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	29.73	-	22.63	0.01	0.015	-	7.19
Feb-24	29.86	-	19.28	0.01	0.013	-	7.62
Mar-24	29.36	-	19.85	0.01	0.012	-	7.49
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 27:

- All measured parameters meet the required standards for freshwater and irrigation water usage.

NANISWAMP BRIDGE 2

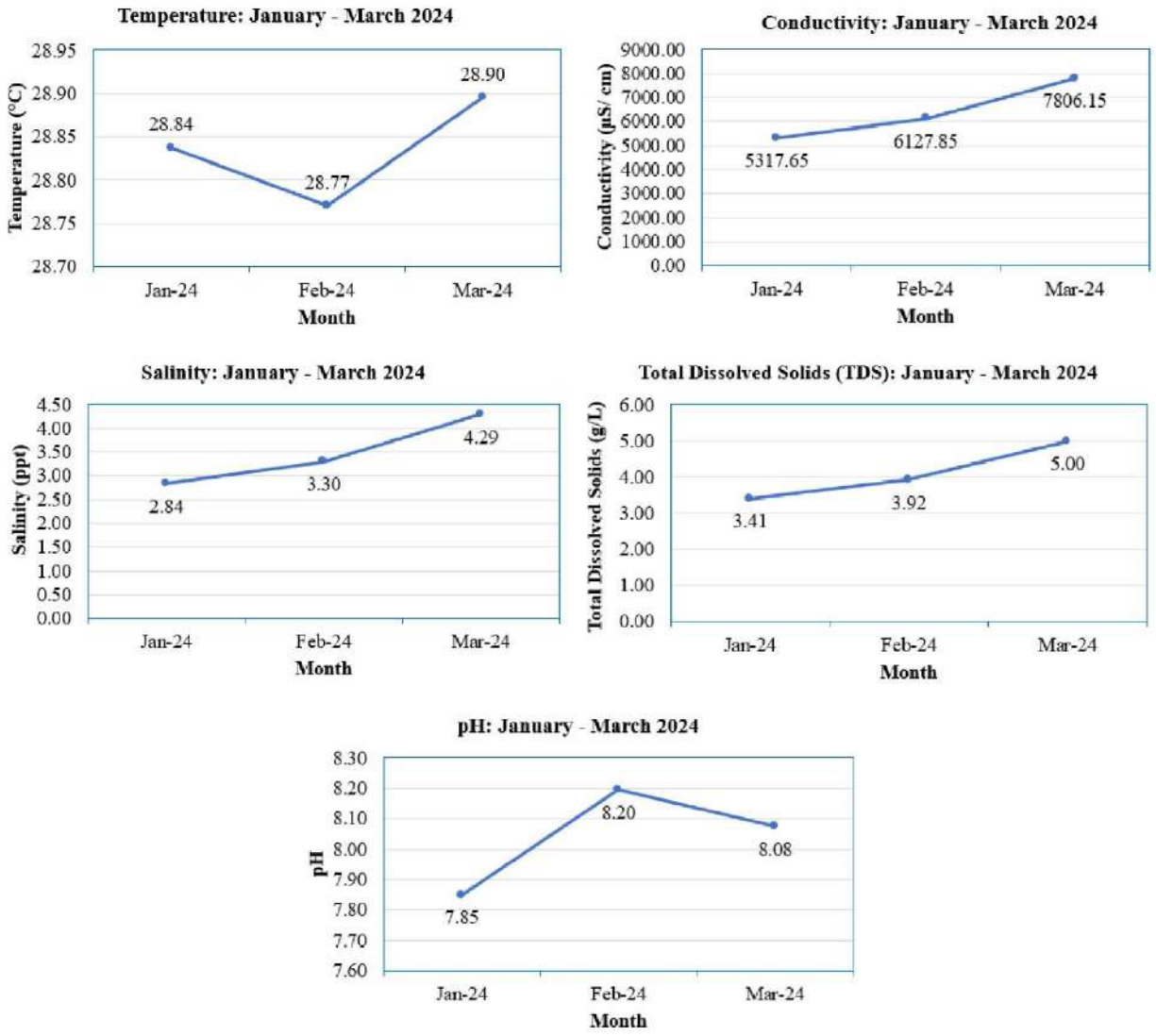

Figure 27: Graphical representation of water quality parameters at Nani swamp Bridge 2

Notes figure 27:

- Conductivity: Higher conductivity with increasing depth suggests the presence of dissolved salts and minerals, possibly due to sedimentation.
- Salinity: Increasing salinity with depth indicates higher salinity, possibly due to saltwater intrusion and sediments.
- Total Dissolved Solids (TDS): Increasing TDS values indicate more dissolved solids in deeper water, possibly due to sedimentation and salts.
- pH: The pH remains slightly basic in general, suitable for saltwater environments, but can vary with depth.

Table 28: Water Quality Measurements and Standards Comparison for Nani swamp Bridge 2

Water quality standards and months	**Temperature (°C)**	**Turbidity (NTU)**	**Conductivity (µS/ cm)**	**Salinity (ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**
Jan-24	28.84	-	5317.65	2.84	3.41	-	7.85
Feb-24	28.77	-	6127.85	3.30	3.92	-	8.20
Mar-24	28.90		7806.15	4.29	5.00	-	8.08
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 28:

- During this El Niño-influenced period, intensified drought has led to increased salinity and conductivity in the water, surpassing norms for irrigation and freshwater.

7. The Corantijn River

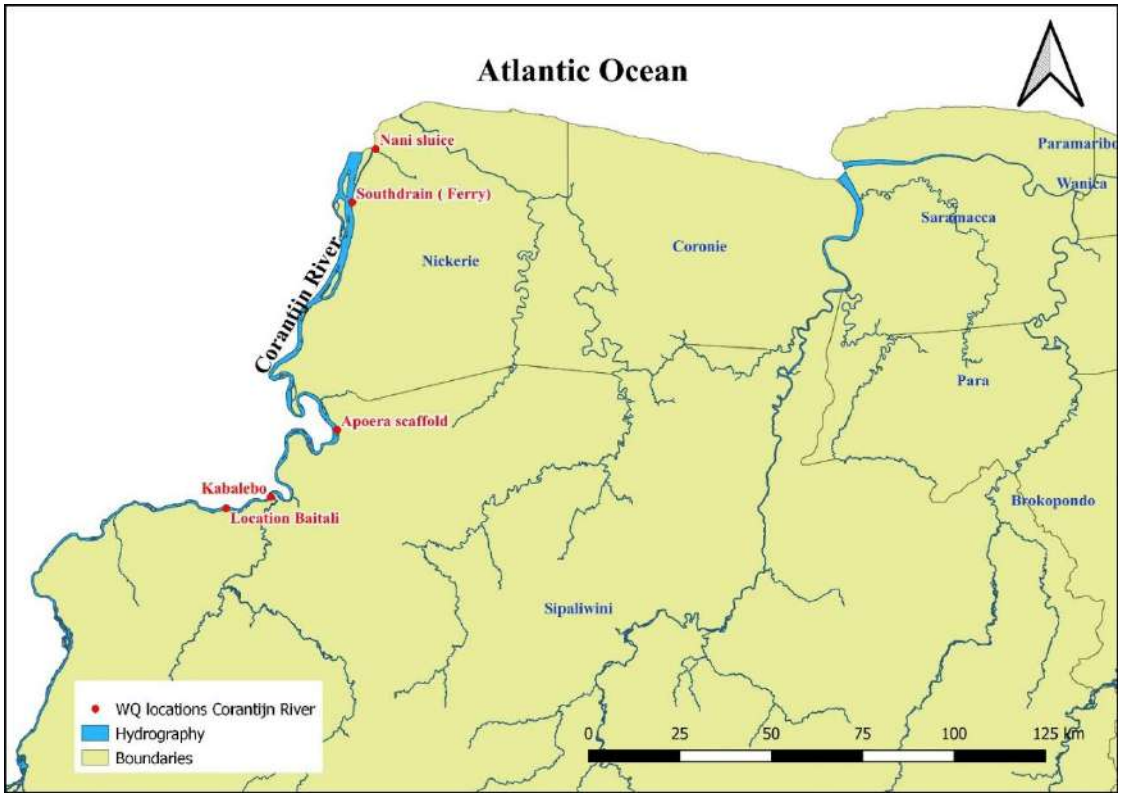

Figure 28: Water quality locations along the Corantijn River

The Corantijn River, situated in northern South America, serves as a vital lifeline for communities along its course and forms the border between Guyana and Suriname. It facilitates essential services such as the regular ferry service between Moleson Creek and South Drain, while also supporting local fishing activities and daily routines such as bathing, washing, and cultural events.

Originating from two headstreams, the Boven-Corantijn or Nieuw River begins in the Acarai Mountains near the Brazilian border in the west. The river basin spans approximately 67,600 km². In Wakay, on the river's right bank, a pumping station provides irrigation water to rice fields, particularly crucial during dry seasons. However, extensive use of river water raises concerns about increased saltwater intrusion, impacting both water quality and agricultural viability.

As the Corantijn River flows upstream into Suriname's inland areas, its pace generally slows, widening along the way. Downstream towards its mouth at the Atlantic Ocean, especially during high tide, the current can be swift. The river's width and depth fluctuate with tides and rainfall, making it a vital waterway for navigation and transportation.

Supporting a diverse ecosystem, the Corantijn River is integral to local communities and the district's biodiversity. Effective management and conservation efforts are essential for ensuring its sustainable development and preserving its ecological integrity.

Table 29: Sipaliwini and Nickerie districts: overview of locations along the Corantijn River and their use of river water, including coordinates

River	Location	Water use	Coordinates
Corantijn	Baitali	- Transportation - Industrial purposes	4°59'36.27"N 57°26'15.72"W
	Kabalebo	- Drinking water - Agricultural irrigation	5°01'21.32"N 57°20'09.53"W
	Apoera	- Drinking water - Agriculture activities (irrigation) - Transportation - Recreation - Fishery	5°11'21.47"N 57°10'19.19"W
	Southdrain Ferry (Canawaima)	- Transportation - Agriculture activities (irrigation)	05°51'29.53" N 056°51'05.90" W
	Nani sluice		5°52'55.3"N 57°04'39.5"W

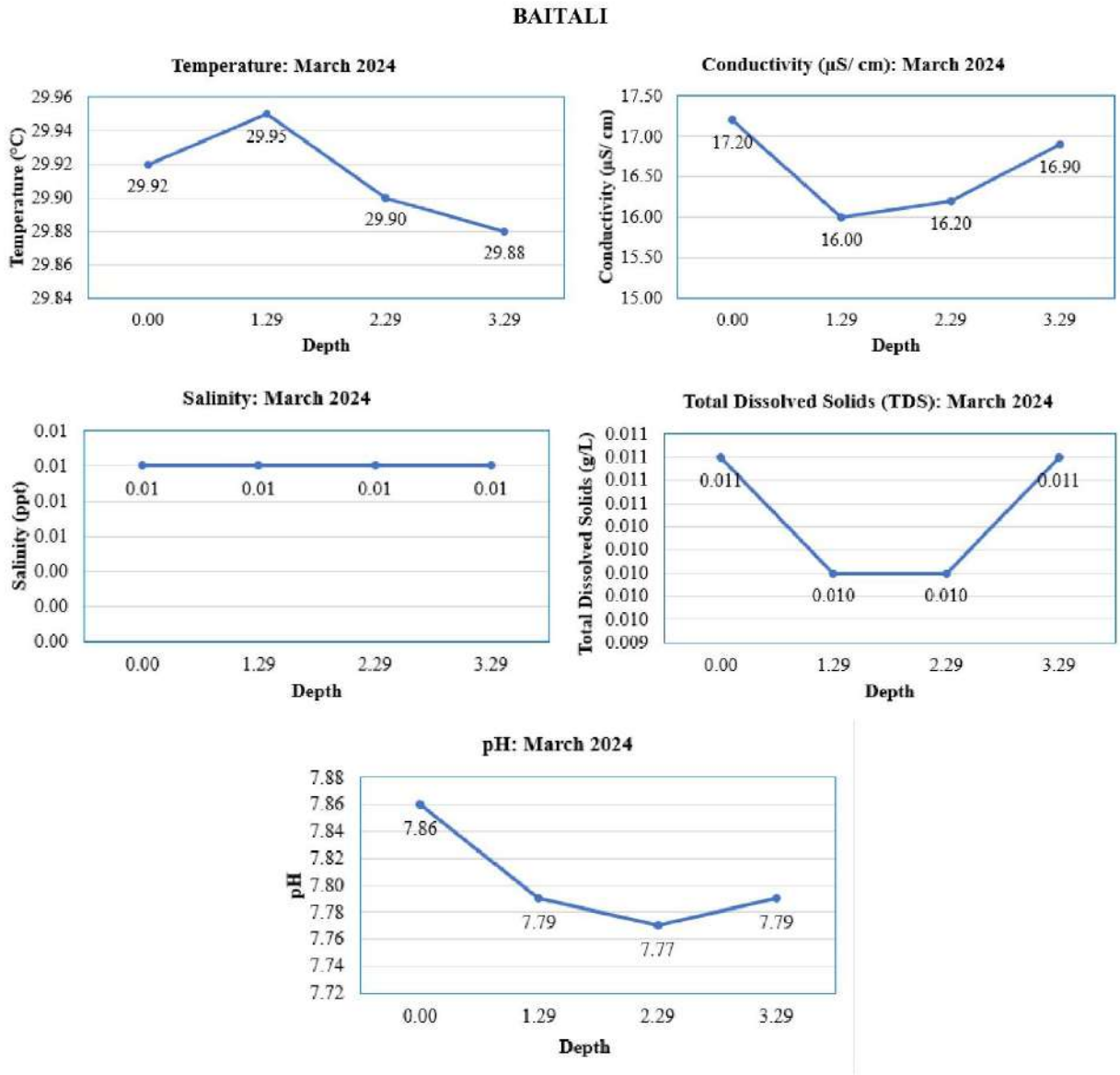

Figure 29: Graphical representation of water quality parameters at Baitali

Notes figure 29:

- The temperature shows a gradual decrease as depth increases. This can be explained by changes in water flow and depth. Deeper flowing water tends to be slightly cooler.
- Despite lower water levels, the salinity appears to remain constant, which may indicate a freshwater source.
- The conductivity of the water decreases as you go deeper, because the amount of contaminants decreases.
- The TDS values remain stable at different depths, which can show that the solutes in the water are homogeneously distributed regardless of the depth.
- The pH values show a slight decrease with increasing depth, which may indicate changes in the acidity of the water as you go deeper into the river.

Table 30: Water Quality Measurements and Standards Comparison for Baitali

Water quality standards	Depth(m)	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
	0.00	29.92	-	17.20	0.01	0.011	-	7.86
	1.29	29.95	-	16.00	0.01	0.010	-	7.79
	2.29	29.90	-	16.20	0.01	0.010	-	7.77
	3.29	29.88	-	16.90	0.01	0.011	-	7.79
Freshwater (US EPA)		-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)		-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 30:

- The measurements taken Baitali in the Corantijn River indicate that the water meets the standards for both irrigation water and freshwater.

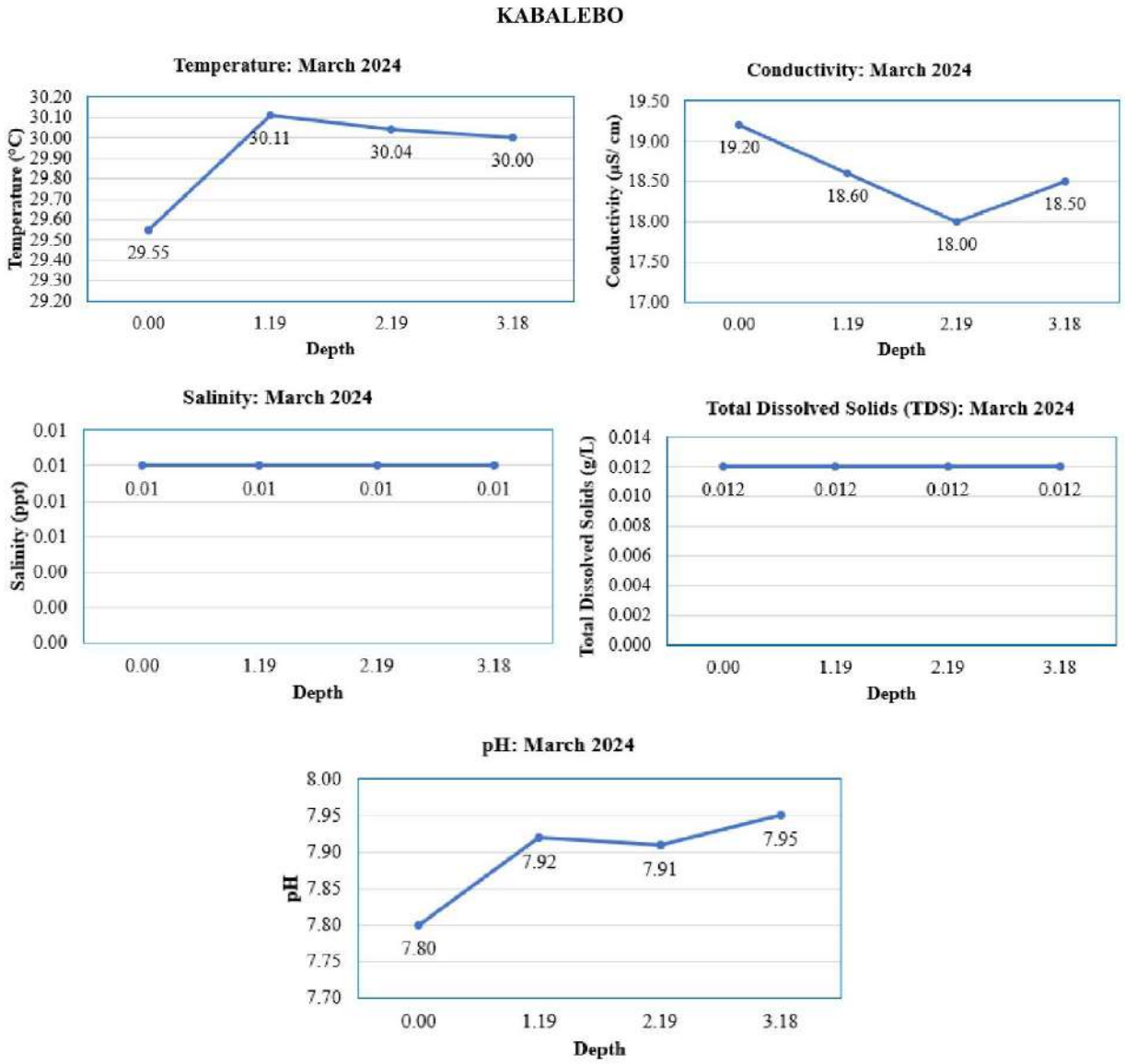

Figure 30: Graphical representation of water quality parameters at Kabalebo

Notes figure 30:

- The temperature shows a slight increase as depth increases. This means that the water becomes slightly warmer the deeper you go into the river, which can be caused by factors such as solar radiation, heat release and water flow.
- Despite lower water levels, the salinity appears to remain constant, which may indicate a freshwater source.
- The conductivity of the water decreases as you go deeper, because the amount of contaminants decreases.
- The TDS values remain stable at different depths, which can show that the solutes in the water are homogeneously distributed regardless of the depth.
- The pH value gradually increases with increasing depth, indicating a slight increase in the alkalinity of the water.

Table 31: Water Quality Measurements and Standards Comparison for Kabalebo

Water quality standards	Depth(m)	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
	0.00	29.55	-	19.20	0.01	0.012	-	7.80
	1.19	30.11	-	18.60	0.01	0.012	-	7.92
	2.19	30.04	-	18.00	0.01	0.012	-	7.91
	3.18	30.00	-	18.50	0.01	0.012	-	7.95
Freshwater (US EPA)		-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)		-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 31:

- The measurements taken Kabalebo in the Corantijn River indicate that the water meets the standards for both irrigation water and freshwater.

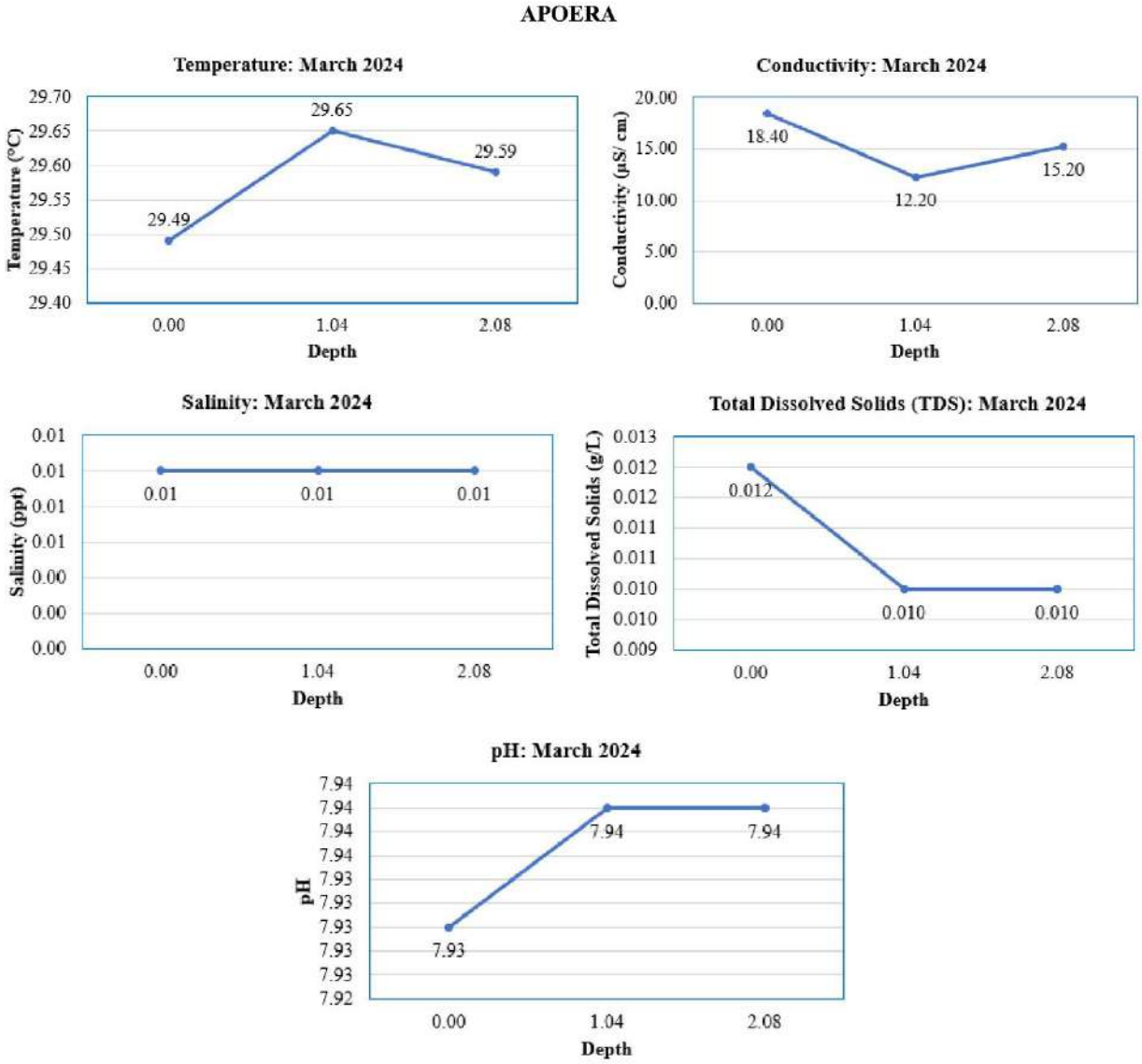

Figure 31: Graphical representation of water quality parameters at Apoera

Notes figure 31:

- The temperature shows a slight increase as depth increases. This means that the water becomes slightly warmer the deeper you go into the river, which can be caused by factors such as solar radiation, heat release and water flow.
- Despite lower water levels, the salinity appears to remain constant, which may indicate a freshwater source.
- The conductivity of the water decreases as you go deeper, because the amount of contaminants decreases.
- The TDS values remain stable at different depths, which can show that the solutes in the water are homogeneously distributed regardless of the depth.
- The pH value gradually increases with increasing depth, indicating a slight increase in the alkalinity of the water.

Table 32: Water Quality Measurements and Standards Comparison for Apoera

Water quality standards	Depth(m)	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
	0.00	29.49	-	18.40	0.01	0.012	-	7.93
	1.04	29.65	-	12.20	0.01	0.010	-	7.94
	2.08	29.59	-	15.20	0.01	0.010	-	7.94
Freshwater (US EPA)		-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)		-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 32:

- The measurements taken Apoera in the Corantijn River indicate that the water meets the standards for both irrigation water and freshwater.

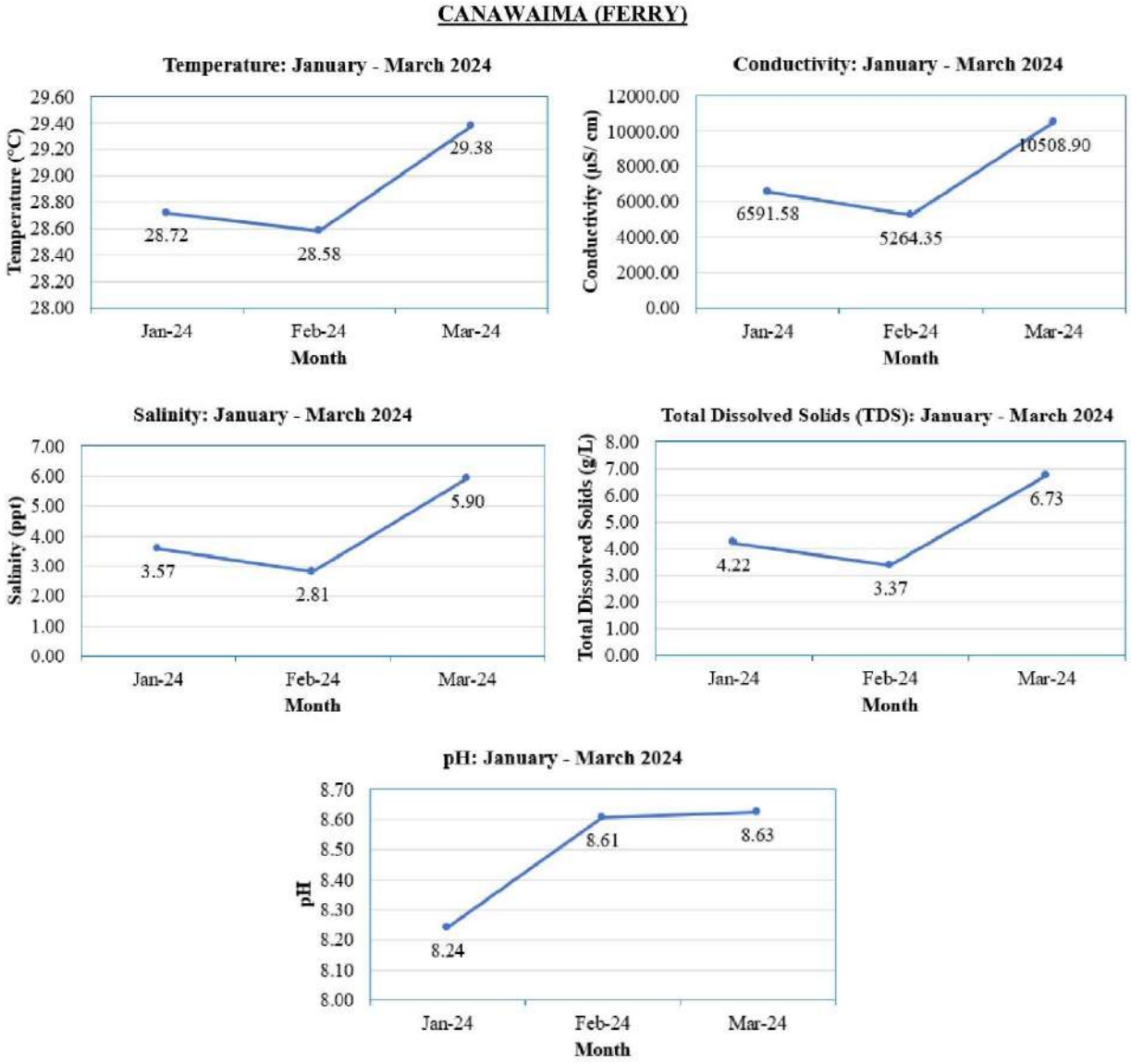

Figure 32: Graphical representation of water quality parameters at Canawaima (Ferry)

Notes figure 32:

- The temperature shows a slight increase during these months, which is common during dry periods. Higher temperatures can increase evaporation, which may contribute to this increase.
- Salinity shows a variation between months and increases each time. These changes may be caused by seasonality and distance from the coast, where saltwater from the ocean can affect river water.
- The conductivity shows variations between months and increases each time. These changes are caused by dissolved salts and minerals, exacerbated by the extreme drought without precipitation. Shipping activity and natural sedimentation may also play a role.
- The TDS shows variations between months and increases each time. This is probably due to a higher concentration of dissolved substances in the water, caused by reduced dilution due to lower river discharge during the dry period.
- The slight increase in pH values can be explained by changes in the environment, such as reduced precipitation during dry periods. This can lead to less organic matter in the water, causing pH levels to rise.

Table 33: Water Quality Measurements and Standards Comparison for Canawaima (Ferry)

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	28.72	-	6591.58	3.57	4.22	-	8.24
Feb-24	28.58	-	5264.35	2.81	3.37	-	8.61
Mar-24	29.38	-	10508.90	5.90	6.73	-	8.63
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 33:

- The conductivity level measured Canawaima (Ferry) is much higher than acceptable for both freshwater and irrigation water use.

NANISLUICE

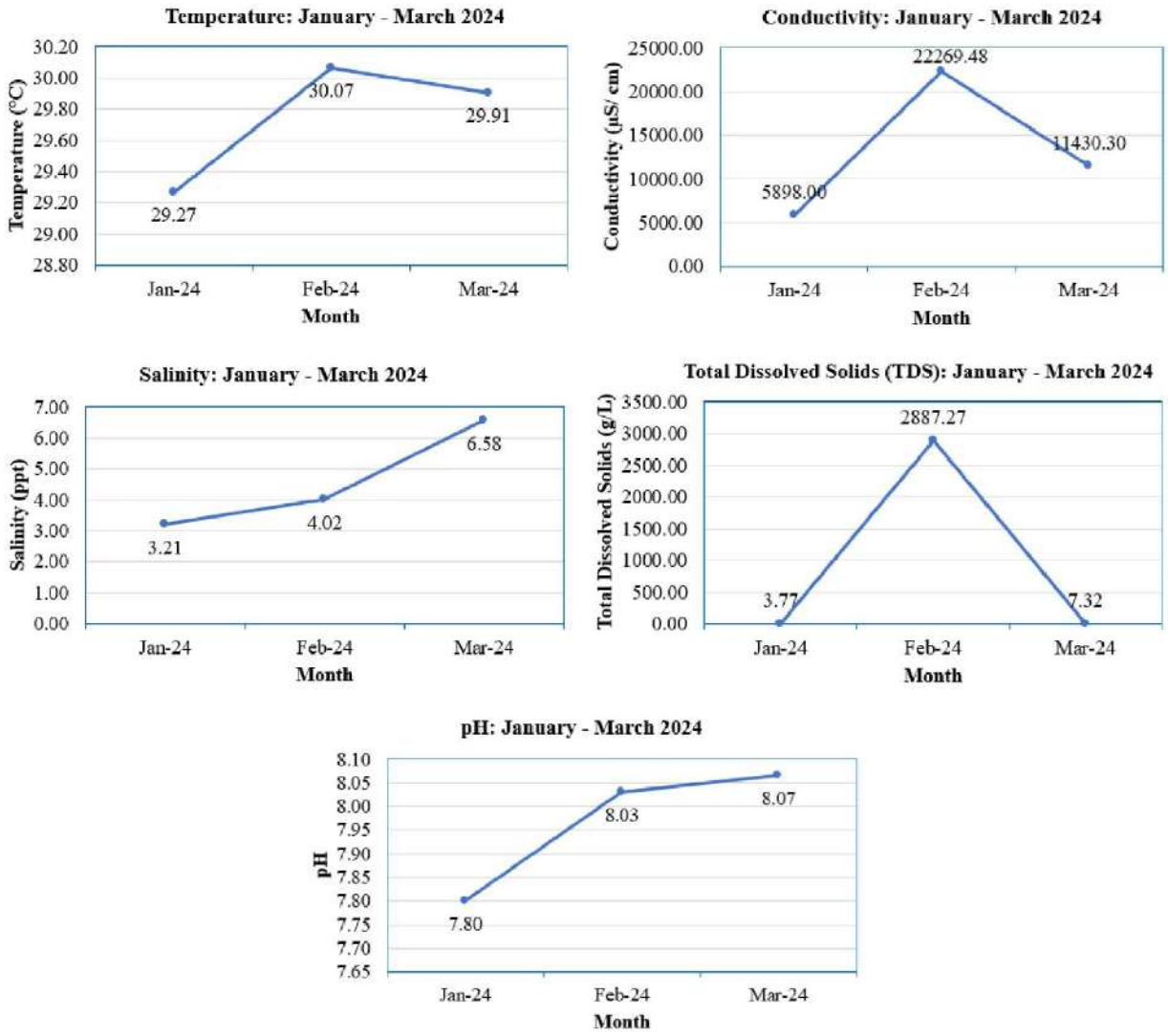

Figure 33: Graphical representation of water quality parameters at Nani sluice

Notes figure 33:

- Significantly higher values for Temperature, Conductivity and Total Dissolved Solids were measured in February compared to other months. This may be due to the drier season, reduced water dilution due to reduced rainfall, agricultural activities such as irrigation and fertilization, and enhanced erosion due to reduced vegetation and drier conditions.
- Salinity may have increased due to saltwater intrusion, where saltwater enters freshwater areas from the sea due to factors such as too much groundwater pumping, rising sea levels, and human activities that alter natural water flows.
- This slight increase in February and March may be due to factors such as reduced precipitation, which can lead to lower dilution of acids and bases in the water.

Table 34: Water Quality Measurements and Standards Comparison for Nani sluice

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.27	-	5898.00	3.21	3.77	-	7.80
Feb-24	30.07	-	22269.48	4.02	2887.27	-	8.03
Mar-24	29.91	-	11430.30	6.58	7.32	-	8.07
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 34:

- The conductivity level measured Nani sluice is much higher than acceptable for both freshwater and irrigation water use.
- The TDS level measured in February is higher higher than acceptable for both freshwater and irrigation water use.

8. The Suriname River

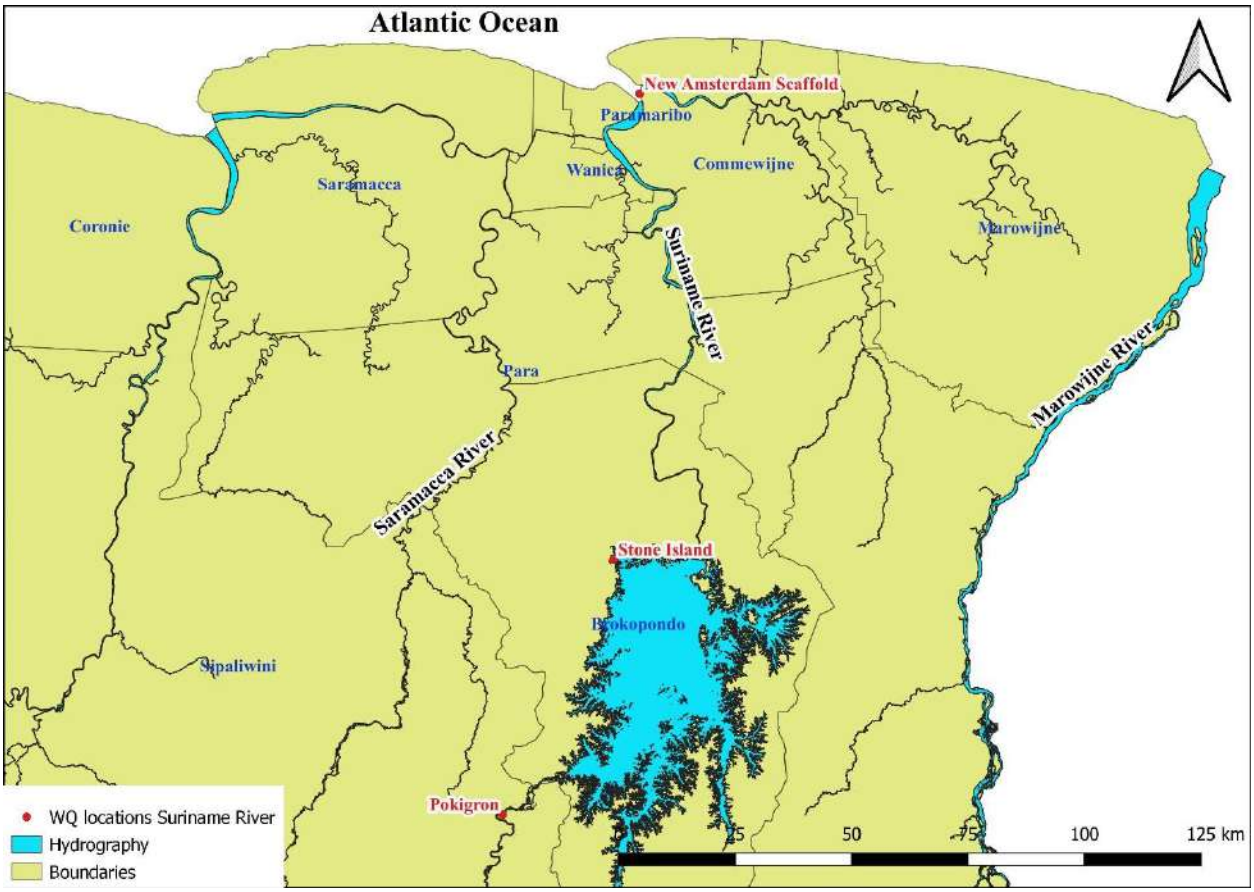

Figure 34: Water quality locations along the Suriname River

The Suriname River, stretching 480 km in length, holds immense significance for Suriname, serving as a crucial lifeline for various purposes. Its expansive 16,500 km² catchment area encompasses three distinct regions:

Lower Basin: Extending from its mouth to the artificial Lake Brokopondo, this area is influenced by tidal movements from the Atlantic Ocean. It includes major cities like Paramaribo and requires ongoing dredging to maintain navigable water depths.

Brokopondo Lake: Covering approximately 1600 km², this reservoir serves as a vital source of hydropower and recreational activities. However, gold mining in the surrounding areas poses challenges to water quality.

Upper Basin: Centered around Pokigron, this part of the basin supports local communities in their daily activities and cultural practices. Despite challenges such as tidal impacts and human activities, the Suriname River remains a cornerstone of life and prosperity in the region. Protecting and conserving the Suriname River is paramount for future generations, considering its integral role in sustaining livelihoods, providing resources, and supporting biodiversity throughout its course.

River	Location	Water use	Coordinates
Suriname	Pokigron	- Fishery - Drinking Water - Household Use - Transportation - Navigation - Agricultural Irrigation - Cultural Activities	4°29'18.6"N 55°21'54.4"W
	Stone Island	- Fishery - Recreation (swimming)	4°58'56.39"N 55°08'54.45"W
	New Amsterdam scaffold	- Fishery - Transportation	5°53'08.98"N 55°05'41.24"W

Table 35: In Sipaliwini and Commewijne district: overview of locations along the Suriname River and their use of river water, including coordinates

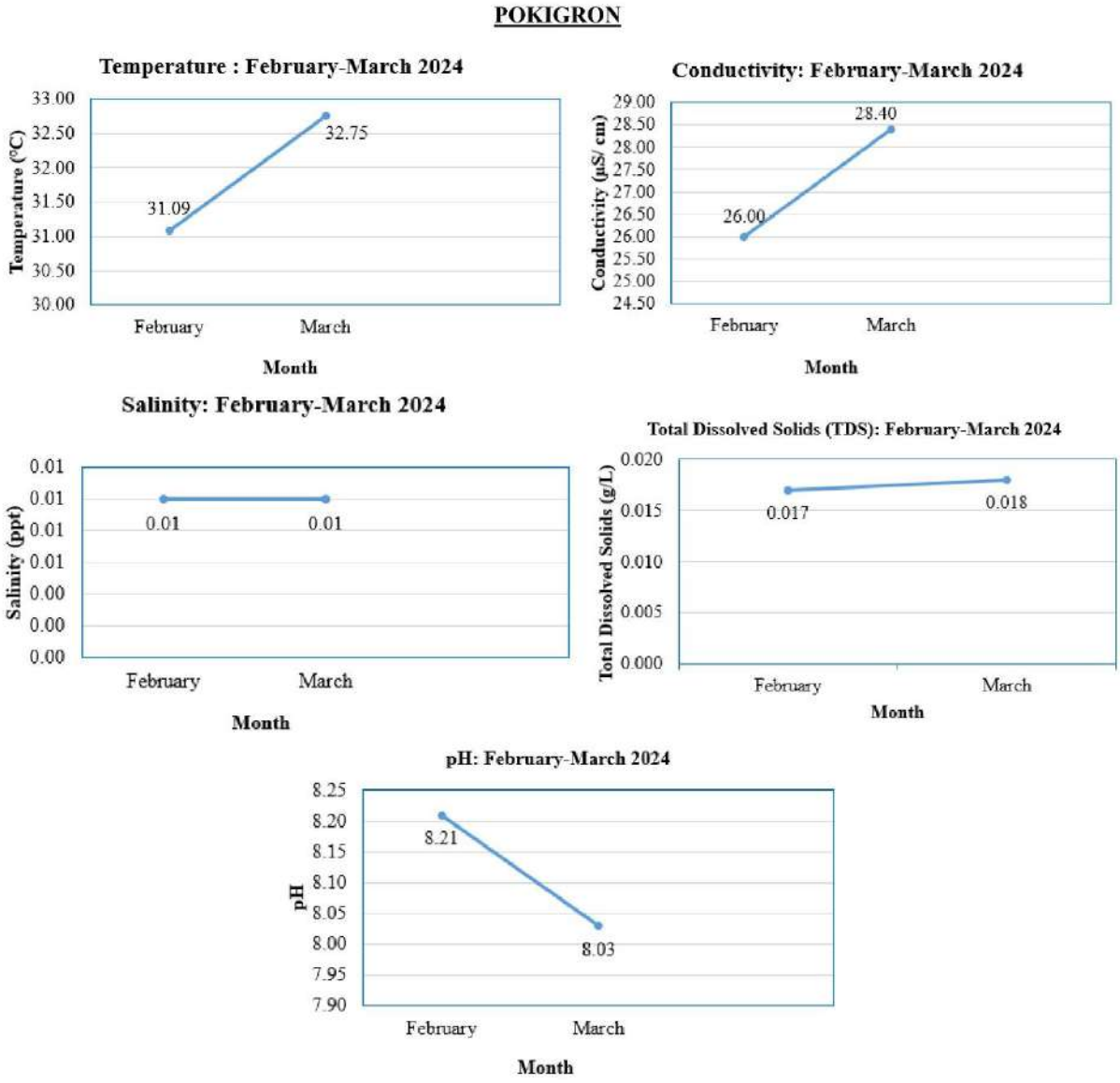

Figure 35: Graphical representation of water quality parameters at Pokigron

Notes figure 35:

- The increase in water temperature may be caused by seasonal changes, local weather conditions such as increased solar radiation and reduced cloud cover.
- The salinity is stable, indicating freshwater sources, indicating a consistency in the sources of water supply. This suggests that the river is mainly fed by freshwater sources that remain relatively constant over time.
- Conductivity and TDS show a slight increase, but remain generally stable. The slight increase in conductivity and TDS in freshwater may be caused by natural minerals and solutes in the environment, variations in location and environmental factors, and possible human influences.
- The pH drops slightly, but remains within the standards. The decrease can be caused by seasonal variations, for example temperatures that rise over time can lead to a lower pH

Table 36: Water Quality Measurements and Standards Comparison for Pokigron

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	31.09	-	26.00	0.01	0.02	-	8.21
Feb-24	32.75	-	28.40	0.01	0.02	-	8.03
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 36:

- The measurements taken at Pokigron in the Suriname River indicate that the water meets the standards for both irrigation water and freshwater.

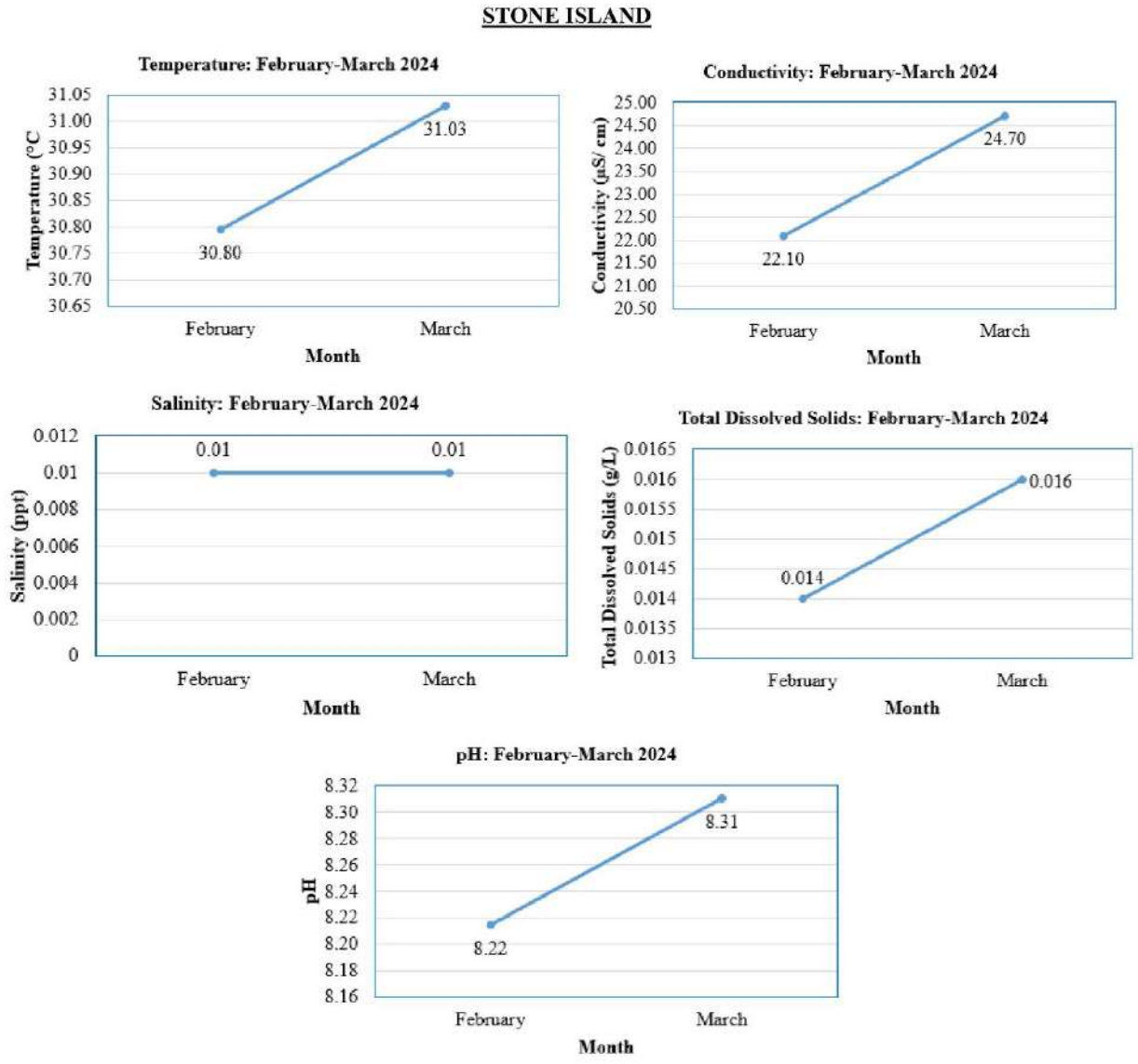

Figure 36: Graphical representation of water quality parameters at Stone Island

Notes figure 36:

- The increase in water temperature could possibly be caused by drought that causes lower water levels, causing the water surface to receive more sunlight and heat up more quickly.
- The measured conductivity values indicate that this is most likely freshwater. The slight increase may possibly be caused by the drought that is present during this period, indicating an increase in ions, which is consistent with a situation in which there is still a low concentration of dissolved substances in the water.
- Despite lower water levels, the salinity appears to remain constant, which may indicate a freshwater source.
- The TDS values have become a little higher, which is normal as water evaporates and the substances in it become more concentrated because there is less water.
- The slight increase in pH may mean that more basic substances, such as carbonates, are present. This can happen when there is less water and biological activity changes.

Table 37: Water Quality Measurements and Standards Comparison for Stone Island

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	30.80	-	22.10	0.01	0.01	-	8.22
Feb-24	31.03	-	24.70	0.01	0.02	-	8.31
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 37:

- The measurements taken at Stone Island in the Suriname River indicate that the water meets the standards for both irrigation water and freshwater.

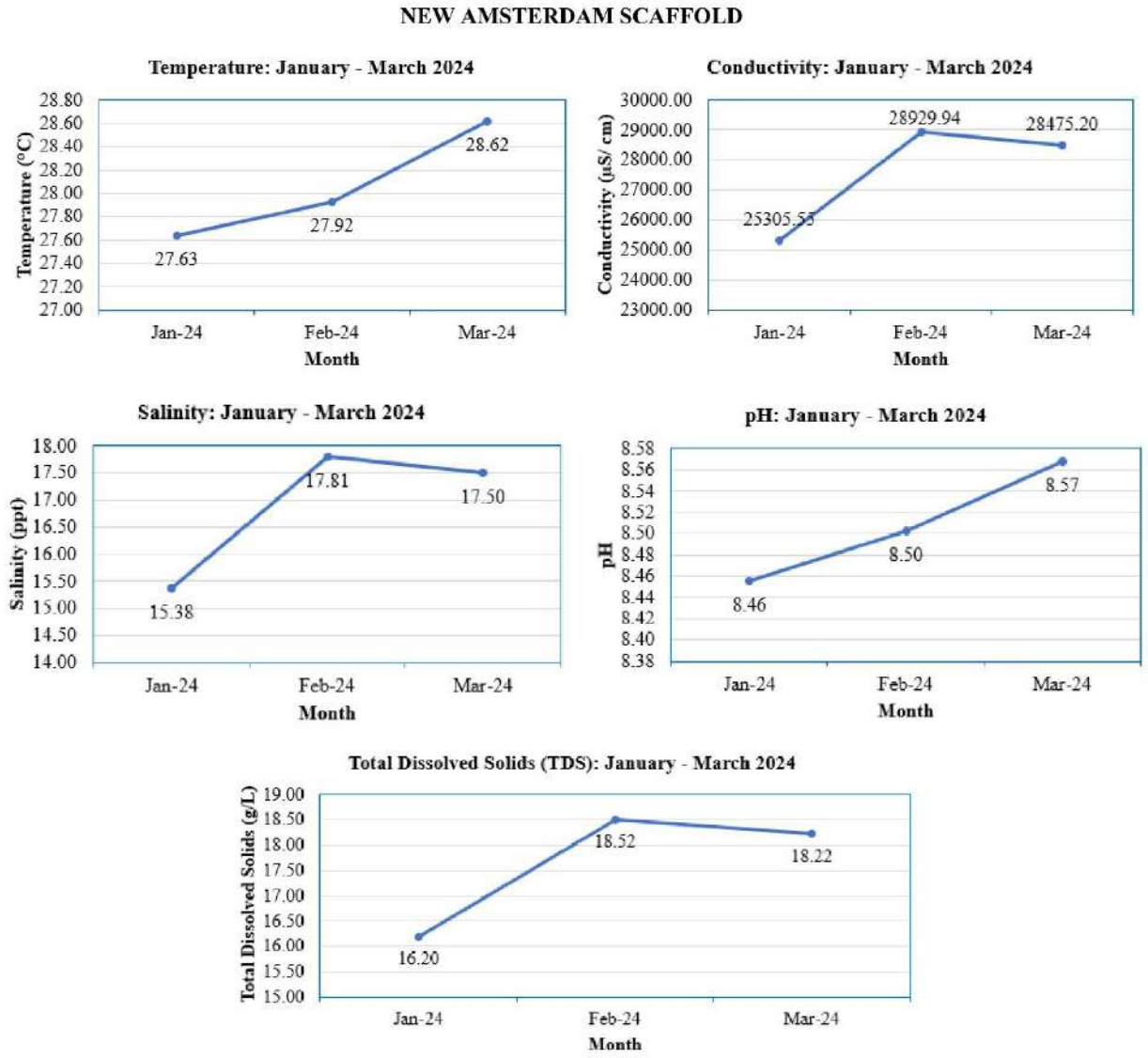

Figure 37: Graphical representation of water quality parameters at New Amsterdam scaffold

Notes figure 37:

- The water temperature graph shows a slight, gradual increase over the period studied, which may be due to increasing solar radiation during the dry season.
- The conductivity, salinity and TDS show a remarkable increase during the study period. Observing the area, it has been found that various activities take place there, including fishing, shipping, small-scale agriculture and industrial discharges, along with domestic sewage. These activities can contribute to the pollution of the river and lead to increases in dissolved solids in the water. In addition, the influence of saltwater intrusion should be considered, especially during periods of low river discharge such as drought and low tide.
- The pH increases gradually, possibly due to the increasing values of the other parameters. These parameters, which indicate the presence of dissolved substances, contribute to the pH increase.

Table 38: Water Quality Measurements and Standards Comparison for New Amsterdam scaffold

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	27.63	-	25305.55	15.38	16.20	-	8.46
Feb-24	27.92	-	28929.94	17.81	18.52	-	8.50
Mar-24	28.62	-	28475.20	17.50	18.22	-	8.57
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 38:

- The conductivity level measured at New Amsterdam scaffold is much higher than acceptable for both freshwater and irrigation water use.

9. Commewijne- and Cottica River

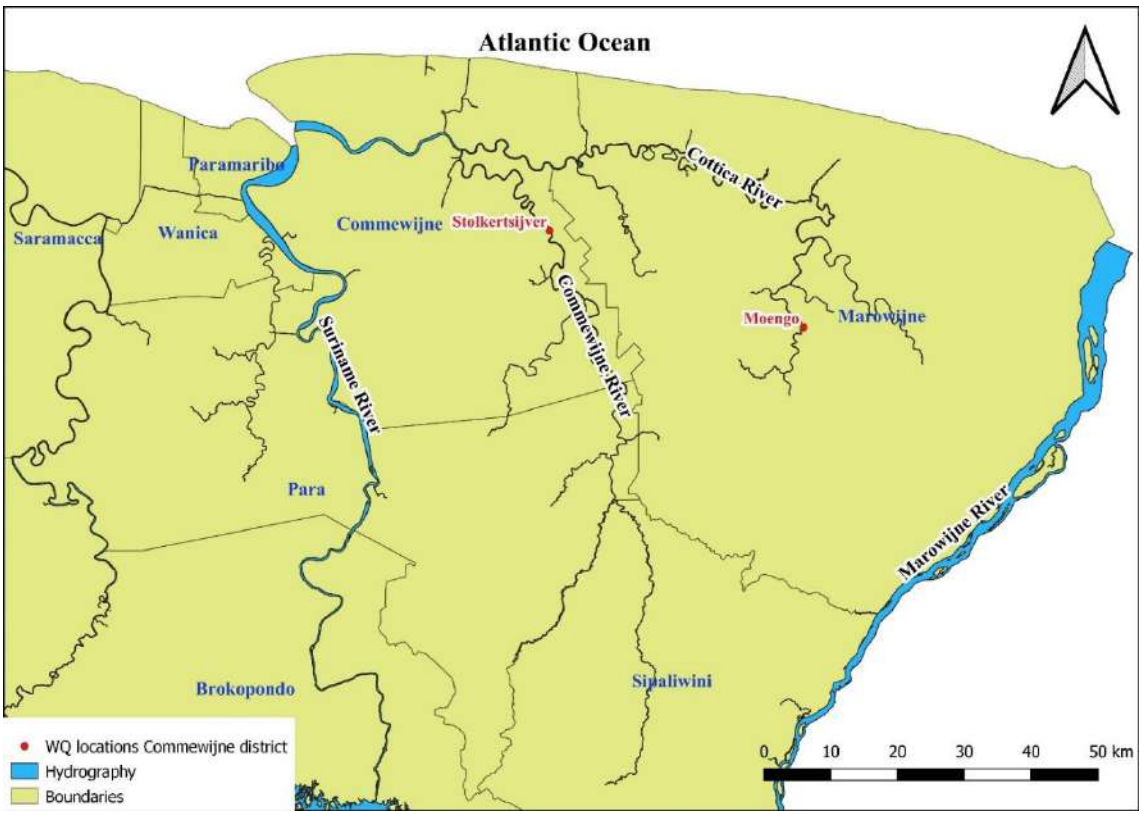

Figure 38: Water quality locations along the Commewijne- and Cottica River

The Commewijne River is primarily used for navigation, transport, tourism, and local fishing. Its source lies in the Hok-A-Hing Mountains near the Brokopondo Lake. This river flows predominantly northward and eventually empties into the Atlantic Ocean via the Suriname River. The Commewijne River basin, covering approximately 6,600 km², includes tributaries such as the Cottica, Cassewinica, Mapane, and Tempati Creeks. This waterway is influenced by the tidal regime of the Atlantic Ocean and human activities such as gold mining.

The Cottica River is of great importance to local communities for transportation, fishing, and economic activities. Its course begins in the east of Suriname, flowing through dense forests and ultimately joining the Commewijne River. The Cottica River basin covers approximately 2900

km². Like the Commewijne River, the water quality of the Cottica River is influenced by the tidal regime of the Atlantic Ocean and freshwater discharge.

River	Location	Water use	Coordinates
Commewijne	Stolkertsijver	- Agricultural Irrigation - Fishery	5°45'18.5"N 54°44'56.7"W
Cottica	Moengo	- Fishery - Drinking Water - Household Use	5°37'20.2"N 54°24'22.8"W

Table 39: In Commewijne and Marowijne districts: overview of locations along the Commewijne- and Cottica River and their use of river water, including coordinates

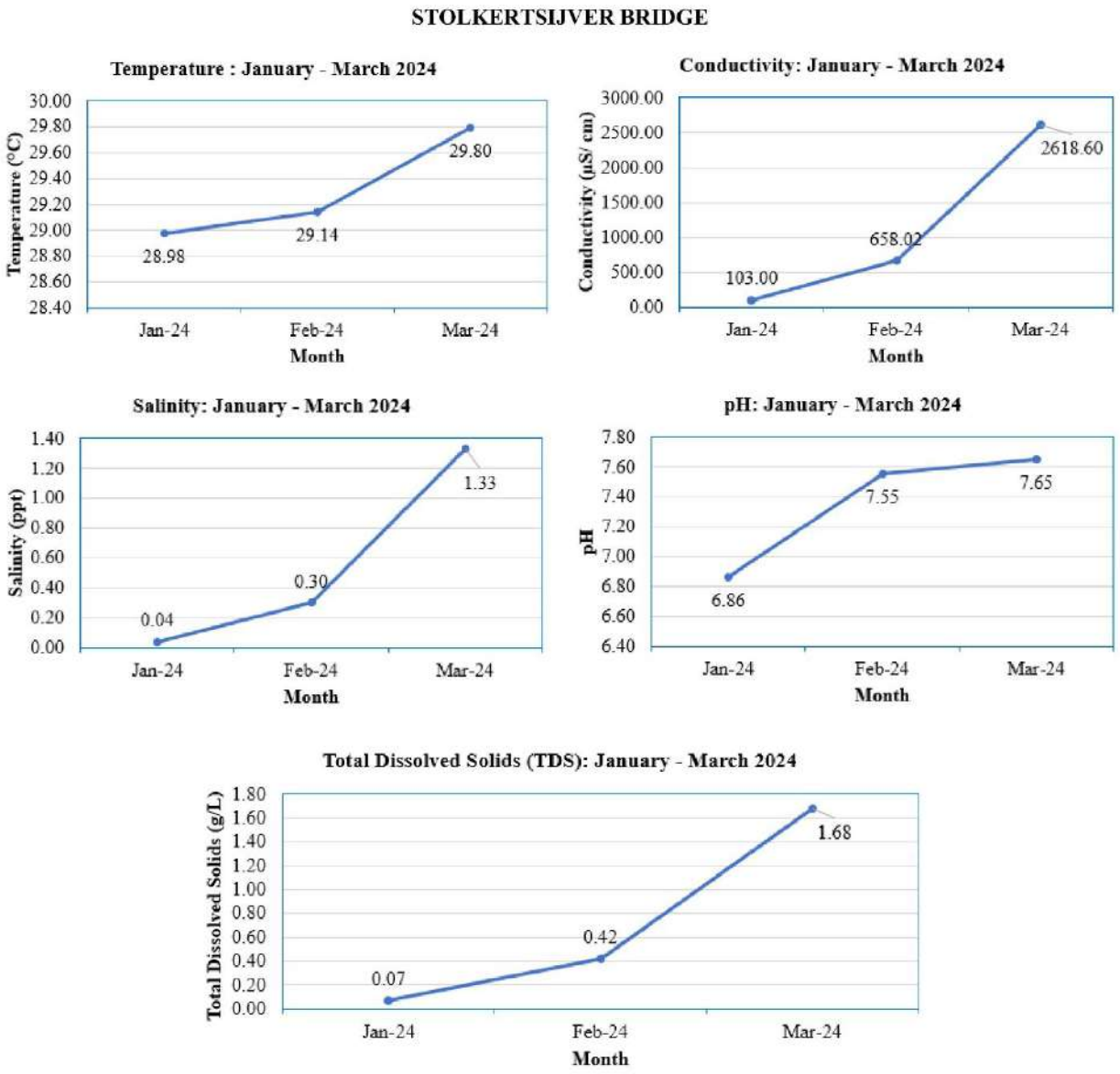

Figure 39: Graphical representation of water quality parameters at Stolkertsijver Bridge

Notes figure 39:

During January to March the graphs show a gradual increase in all measured parameters.

- The increase in water temperature may be caused by local factors such as:
  - Solar radiation: changes in the weather, such as rain and cloud cover, and the geographical orientation of the river in relation to the sun.
  - Flow patterns: movement and direction of water currents in a river.
- The increase in conductivity, salinity and TDS could possibly be caused by saltwater infiltration that can increase the concentration of dissolved salts in the water from the sea and local seasonal influences.
- The pH generally remains stable, but shows a slight increase over time. This may indicate a relatively stable acidity in the water over the measured period, with possible minimal influence of external factors on the pH values.

Table 40: Water Quality Measurements and Standards Comparison for Stolkertsijver Bridge

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	28.98	-	103.00	0.04	0.07	-	6.86
Feb-24	29.14	-	658.02	0.30	0.42	-	7.55
Mar-24	29.80	-	2618.60	1.33	1.68	-	7.65
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 40:

- The measurements taken at Stolkertsijver Bridge in the Commewijne River indicate that the water meets the standards for both irrigation water and freshwater.

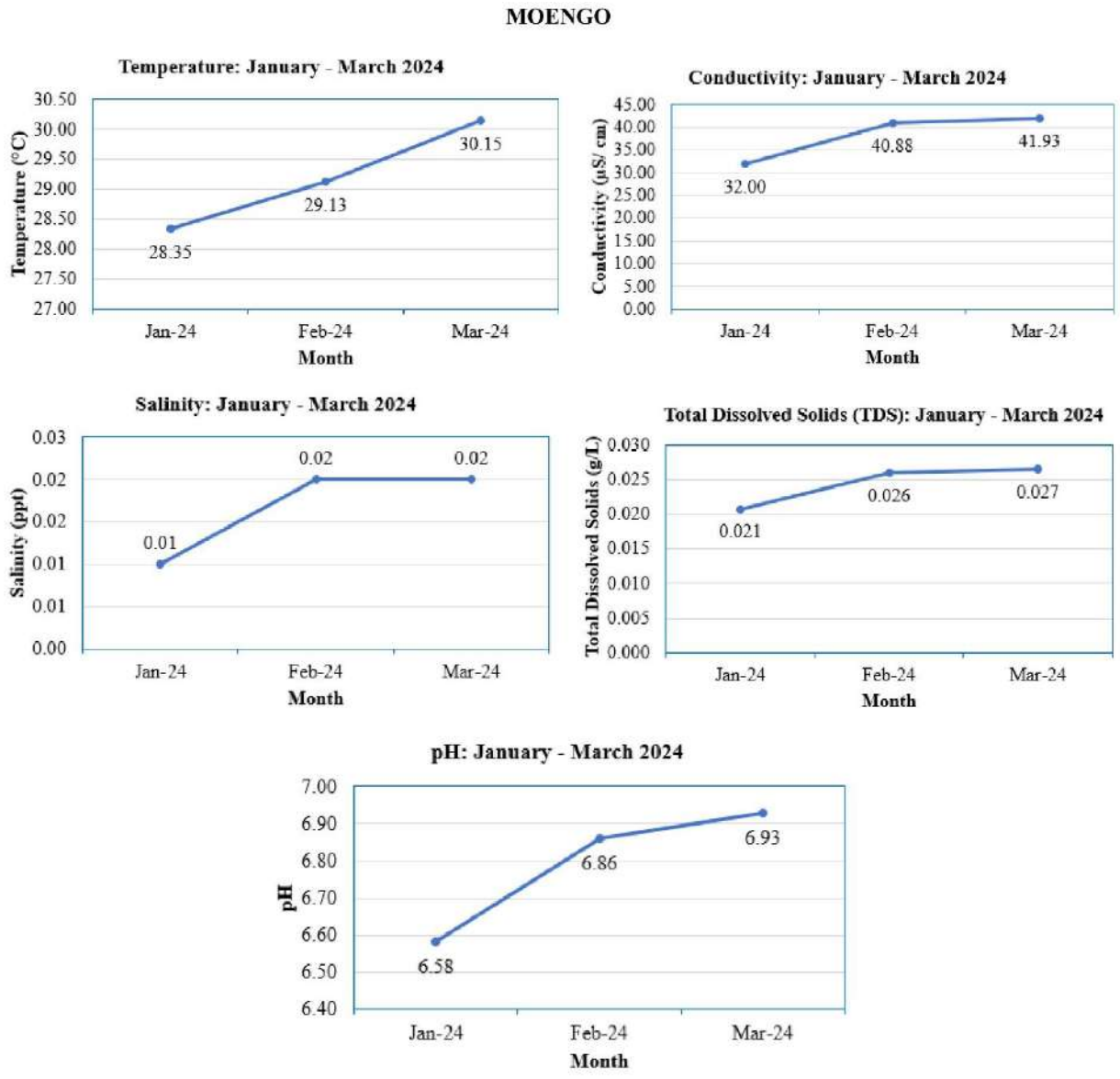

Figure 40: Graphical representation of water quality parameters at Moengo

Notes figure 40:

During January to March the graphs show a gradual increase in all measured parameters.

- The increase in water temperature may be caused by local factors such as:
  - Solar radiation: changes in the weather, such as rain and cloud cover, and the geographical orientation of the river in relation to the sun.
  - Flow patterns: movement and direction of water currents in a river.
  - Geographic features: the geography of a river, such as its latitude and depth, can influence the warming of the water.
- The salinity is stable, indicating freshwater sources, indicating a consistency in the sources of water supply. This suggests that the river is mainly fed by freshwater sources that remain relatively constant over time.
- The conductivity and Total Dissolved Solids continue to give stable values, but increase with time. This may indicate human activities such as agriculture, industrial activities (for example the Port of Traymore N.V.) where contamination of the water can occur due to leakages of fuels and oils, discharges of waste water and waste materials.
- The pH generally remains stable, but shows a slight increase over time. This may indicate a relatively stable acidity in the water over the measured period, with possible minimal influence of external factors on the pH values.

Table 41: Water Quality Measurements and Standards Comparison for Moengo

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	28.35	-	32.00	0.01	0.021	-	6.58
Feb-24	29.13	-	40.88	0.02	0.026	-	6.86
Mar-24	30.15	-	41.93	0.02	0.027	-	6.93
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 41:

- The measurements taken at Moengo in the Cottica River indicate that the water meets the standards for both irrigation water and freshwater.

10. The Marowijne River

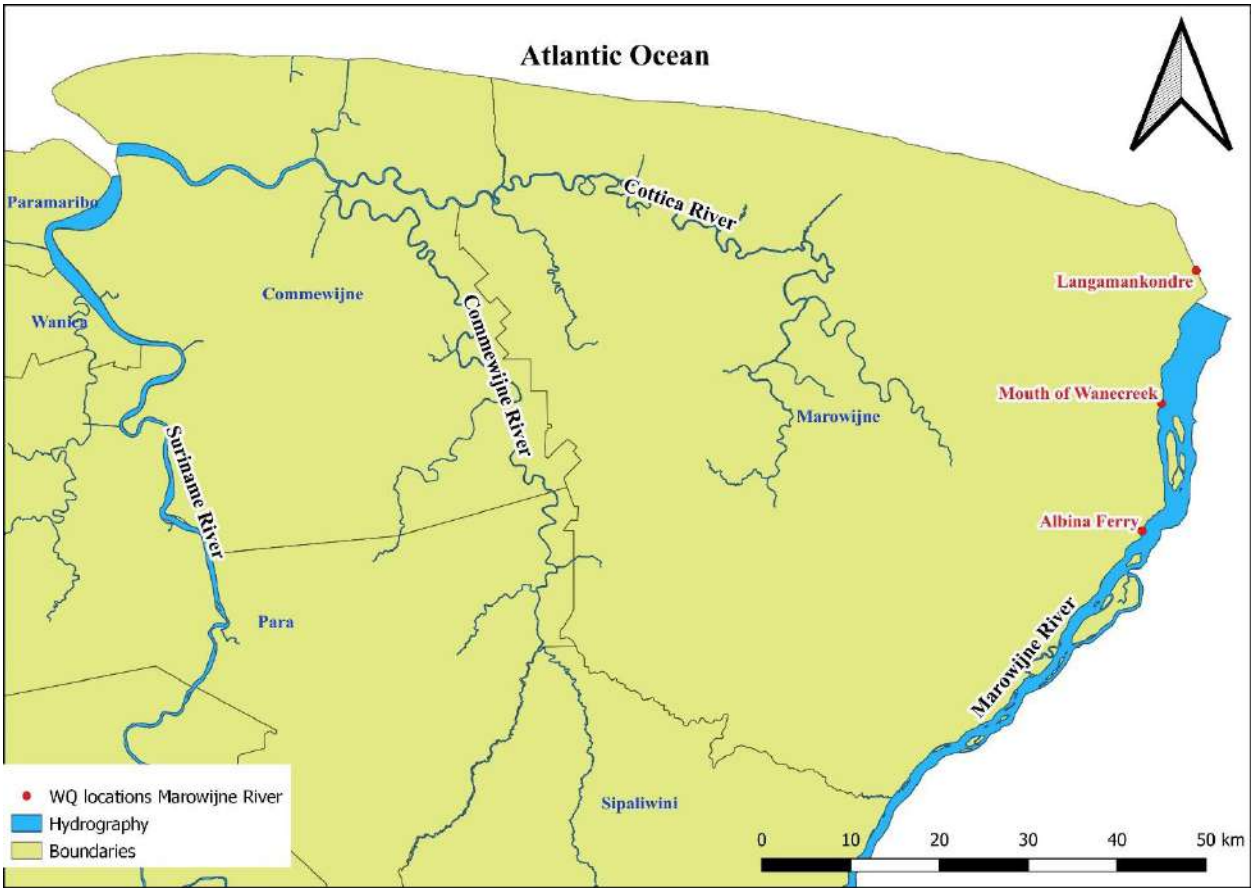

Figure 41: Water quality locations along the Marowijne River

Marowijne River, located in the eastern part of Suriname on the border with French Guiana, is an important waterway used for navigation and transportation. Small boats and ferries cross the river daily between Albina and Saint Laurent, French Guiana. Commercial activities are observed near the dock in Albina, and upstream, gold mining activities are conducted using skalianen, which affect water quality and the livelihoods of surrounding communities. The Marowijne River is also utilized for tourism and recreational activities, such as turtle spotting downstream.

The river primarily originates in the southern half of Suriname, divided by the Eilerts de Haan Mountains, with approximately 40% of its watershed located in French Guiana.

The Lange Tabbetje measurement station monitors the river's discharge, covering an area of approximately 63,500 km², representing 92% of the total watershed. The estimated average discharge at the mouth of the Marowijne River is 1780 m³/s.

The Marowijne River, also known as Marowini, Maroni, Marwina-liba, and Lawa, spans approximately 609-612 kilometers, depending on the definition. Its watershed includes parts of the Marowijne district in Suriname and provides habitat for diverse plant and animal species, alongside its crucial role in the culture and traditions of local indigenous communities.

Table 42: In Marowijne districts: overview of locations along the Marowijne River and their use of river water, including coordinates

River	Location	Water use	Coordinates
Marowijne	Albina Ferry	- Tourism & recreation - Fishery - Transportation - Household use - Drinking water	5°30'17.6"N 54°03'07.5"W
	Mouth of Wanecreek	- Tourism & recreation - Fishery - Transportation	5°38'04.56"N 54°01'53.92"W
	Langamankondre		5°45'50.84"N 54°00'32.37"W

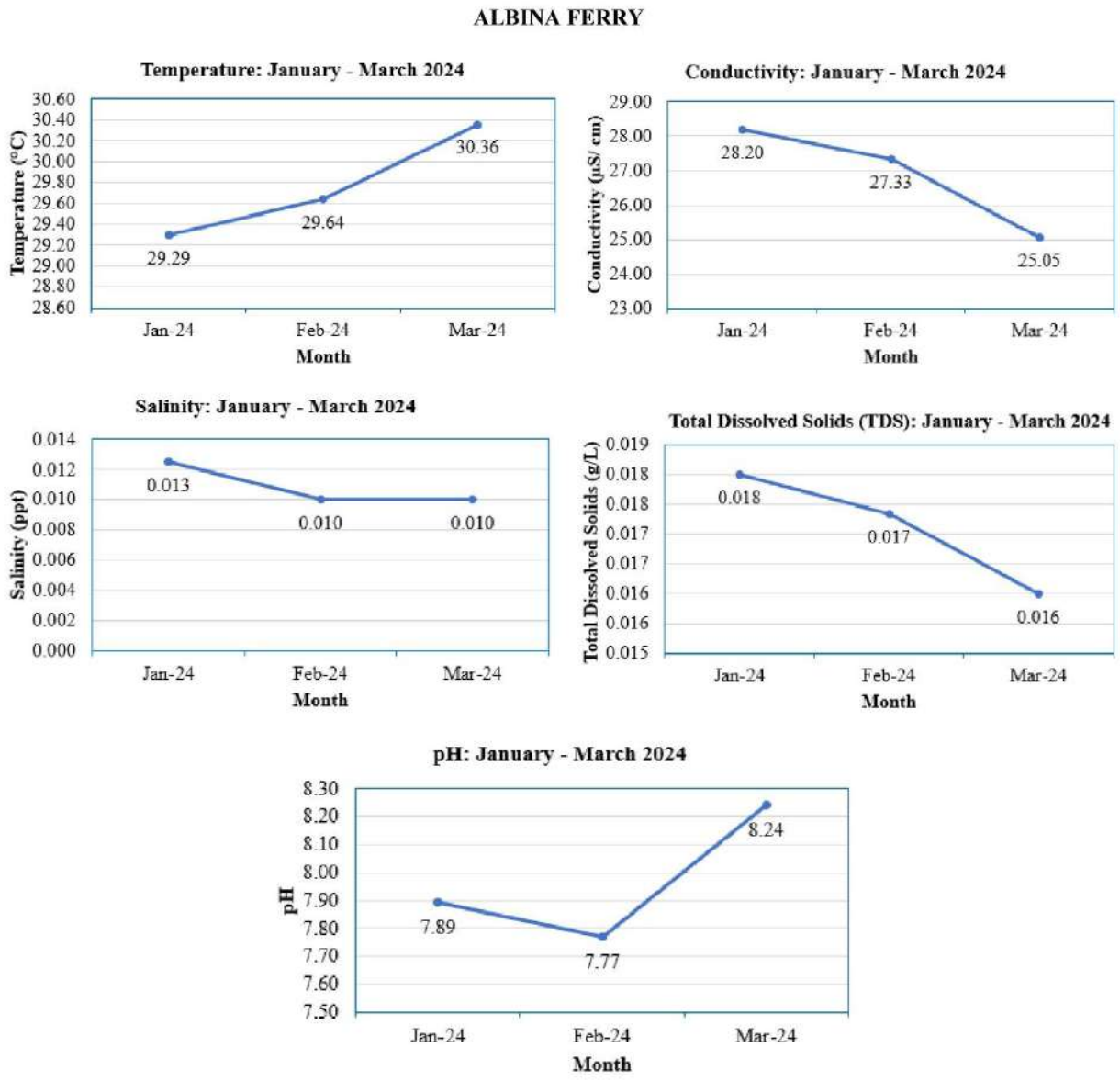

Figure 42: Graphical representation of water quality parameters at Albina Ferry

Notes figure 42:

- The temperature rises slightly. This may be due to more sunlight during these months.
- The conductivity, salinity and TDS decrease. This decrease may indicate a reduced influence of saltwater infiltration
- The pH remains generally stable but shows slight variations. This indicates that the water remains slightly alkaline, despite minor fluctuations

Table 43: Water Quality Measurements and Standards Comparison for Albina Ferry

Water quality standards and months	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
Jan-24	29.29	-	28.20	0.013	0.018	-	7.89
Feb-24	29.64	-	27.33	0.010	0.017	-	7.77
Mar-24	30.36	-	25.05	0.010	0.016	-	8.24
Freshwater (US EPA)	-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)	-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 43:

- The measurements taken at 'Albina Ferry' in the Marowijne River indicate that the water meets the standards for both irrigation water and freshwater.

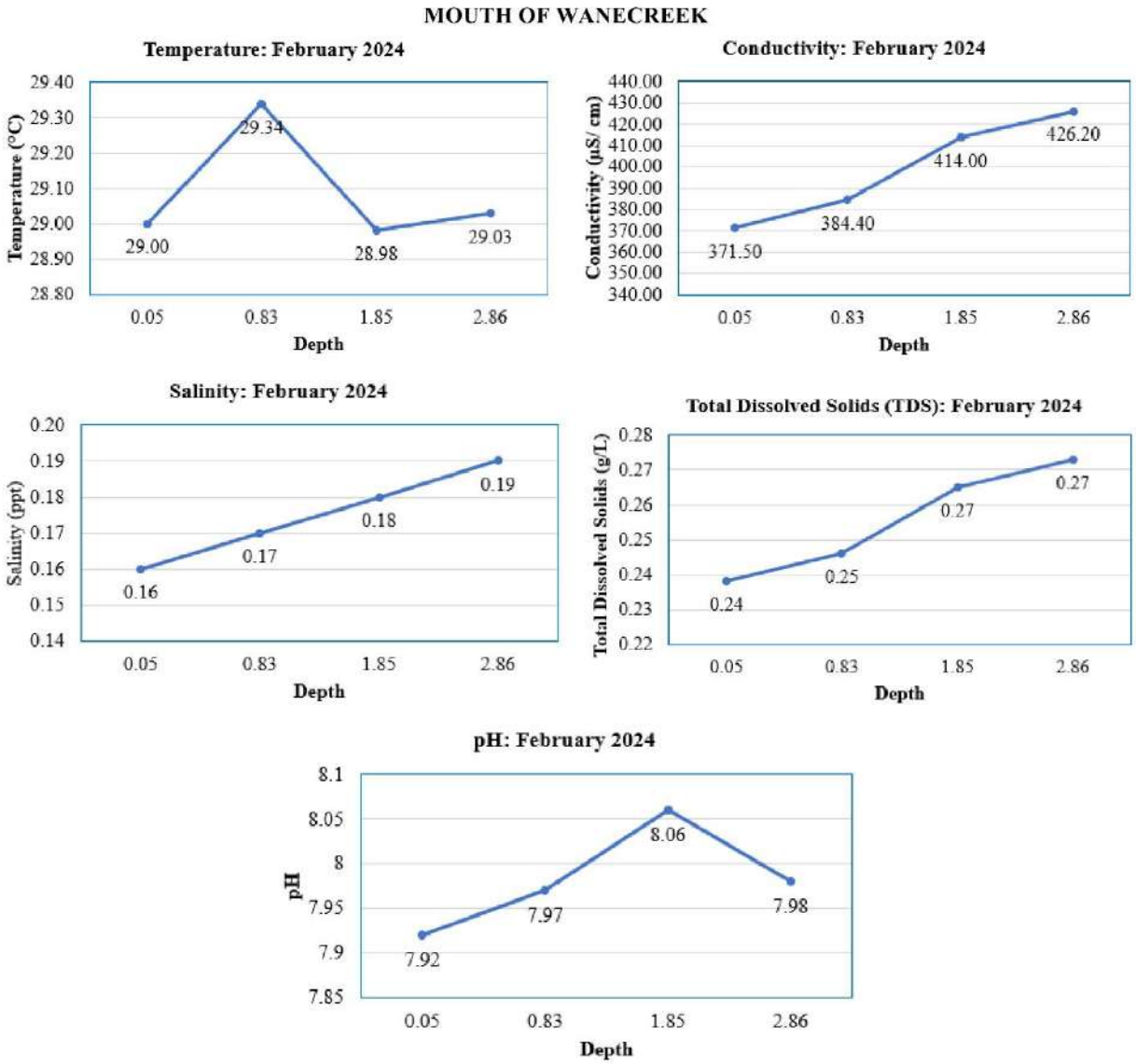

Figure 43: Graphical representation of water quality parameters at Mouth of Wanecreek

Notes figure 43:

- The temperature shows a varying trend with depth, indicating warm water at the mouth, possibly due to sunlight that can warm the surface water or due to currents that can spread the heat.
- The increase in conductivity (Cond), salinity (Sal), and total dissolved solids (TDS) with increasing depth suggests that:
    - Saltwater infiltration from the ocean can occur in deeper parts of the river.
    - Minerals dissolved in the water can accumulate in deeper layers.
    - The concentration effect of evaporation can lead to higher concentrations of solutes in deeper water layers.
    - Human activities such as agriculture and industry can also contribute to the increase in solutes.
- The pH remains generally stable, but shows a slight decrease as depth increases.

Table 44: Water Quality Measurements and Standards Comparison for Mouth of Wanecreek

Water quality standards	Depth(m)	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
	0.05	29.00	-	371.50	0.16	0.24	-	7.92
	0.83	29.34	-	384.40	0.17	0.25	-	7.97
	1.85	28.98	-	414.00	0.18	0.27	-	8.06
	2.86	29.03	-	426.20	0.19	0.27	-	7.98
Freshwater (US EPA)		-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)		-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 44:

- The measurements taken at 'Mouth of Wanecreek' in the Marowijne River indicate that the water meets the standards for both irrigation water and freshwater.

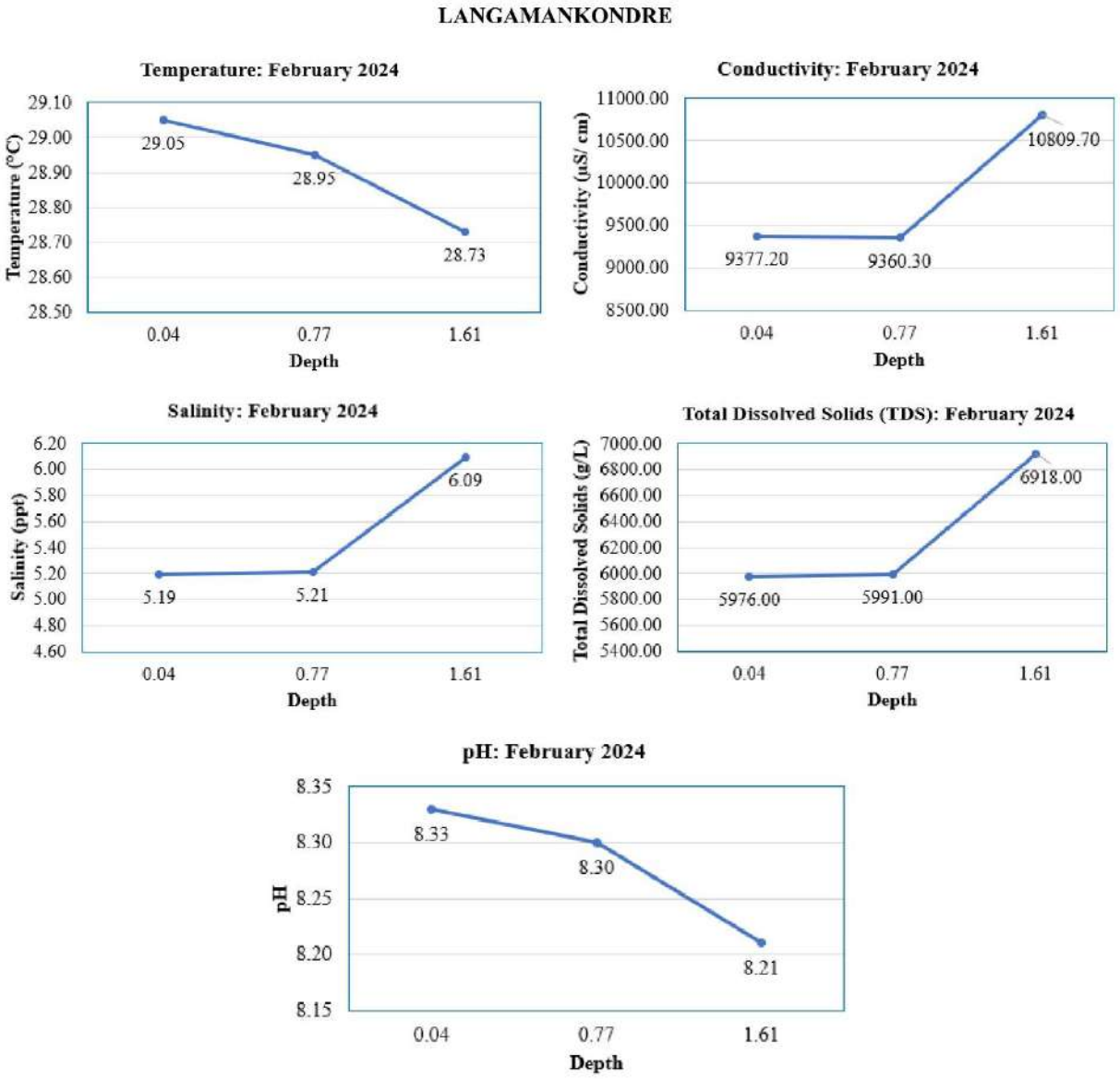

Figure 44: Graphical representation of water quality parameters at Langamankondre

Notes figure 44:

- The temperature decreases slightly with depth, possibly due to sunlight heating mainly the surface and the heat slowly penetrating to deeper layers. This makes the surface warmer than the deeper water.
- The increase in conductivity (Cond), salinity (Sal), and total dissolved solids (TDS) with increasing depth suggests that:
    - Saltwater infiltration from the ocean can occur in deeper parts of the river.
    - Minerals dissolved in the water can accumulate in deeper layers.
    - The concentration effect of evaporation can lead to higher concentrations of solutes in deeper water layers.
    - Human activities such as agriculture and industry can also contribute to the increase in solutes.
- The pH remains generally stable, but shows a slight decrease as depth increases.

Table 45: Water Quality Measurements and Standards Comparison for Langamankondre

Water quality standards	Depth(m)	Temperature (°C)	Turbidity (NTU)	Conductivity (µS/ cm)	Salinity (ppt)	Total Dissolved Solids (g/L)	Dissolved Oxygen (mg/L)	pH
	0.04	29.05	-	9377.20	5.19	5976.00	-	8.33
	0.77	28.95	-	9360.30	5.21	5991.00	-	8.30
	1.61	28.73	-	10809.70	6.09	6918.00	-	8.21
Freshwater (US EPA)		-	-	0 - 1500	-	<500	> 6.00	5.00 - 9.00
Irrigation water (FAO)		-	-	0 - 3000	-	0 - 2000		6.00 - 8.50

Notes table 45:

- However, the measured TDS values at all the depths are high, but do not meet the recommended standards for irrigation water and freshwater.
- The measured conductivity at Langamankondre is high at various depths, making the water unstable for irrigation and freshwater, but within the normal range for seawater, typically around 50,000 microsiemens per centimeter (uS/cm).

Conclusions and Recommendations

Coastal areas feature diverse water sources including freshwater and saltwater, each playing crucial roles in various activities. Freshwater sources such as rivers, marshes, man-made waterways, and lakes support agriculture, fishing, industry, shipping, drinking water, recreation, and habitation. Simultaneously, saltwater sources like seawater and tidal areas are utilized for shipping, fishing, industry, and recreation, contributing significantly to the ecological balance of coastal ecosystems.

During the January to March period, observed fluctuations in river water levels stem from natural processes such as saltwater intrusion, sedimentation, seasonal changes, and human activities like agriculture and mining.

Key findings from the research include:

- Settlements along waterways heavily depend on freshwater for daily needs.
- Downstream turbidity, attributed to small-scale mining, poses potential threats to fish populations.
- Freshwater from Nani Swamp in Nickerie is indispensable for rice irrigation due to its nutrient richness compared to water from the Corentyne River.
- Freshwater from the Coronie Swamp in Coronie plays a vital role in preserving mangrove populations along the coast, crucial for maintaining the freshwater-saltwater balance.
- Elevated salt levels in Nickerie and Coronie may hinder freshwater availability, posing challenges to settlements and coastal ecological habitats.
- El Niño, a periodic climate phenomenon, increases Pacific Ocean surface temperatures, causing global weather changes such as droughts and floods.
- During El Niño events, coastal areas may experience higher sea levels and reduced rainfall, intensifying saltwater intrusion and threatening freshwater supplies.
- Adequate sanitation facilities along waterways are essential for maintaining water quality suitable for recreational activities.

Information regarding El Niño originates from Suriname's meteorological service, offering valuable insights into climate phenomena.

The comprehensive water quality assessment conducted in regions including the Corantijn River, Coppename River, Nickerie River, and Coronie district reveals fluctuations that do not consistently meet desired standards for various purposes. Some parameters show values exceeding or falling below USEPA standards for freshwater and FAO standards for irrigation. Notably, measurements of dissolved oxygen concentration (DO) often fall significantly below

the freshwater standard of 6 mg/l. It's crucial to note that DO levels are influenced by factors such as flow rate, temperature, depth, and aquatic life presence. Thus, low DO values require thorough assessment in conjunction with other relevant parameters rather than signifying immediate high risk.

To effectively address these fluctuations and ensure sustainable water quality management, a proactive approach involving regular monitoring and robust management strategies is imperative. Continuous surveillance can adeptly accommodate long-term variations, ensuring consistent water quality standards in coastal water bodies.

Recommendations:

Concrete Actions for Improving Water Quality: Recommendations from the Hydraulic Research Division

1. **Conduct Comprehensive Water Quality Testing:** Perform large-scale tests to evaluate a wide range of parameters including pesticides, heavy metals (e.g., lead, mercury), nutrients, and potential contaminants.
2. **Promote Stakeholder Collaboration:** Foster collaboration among government agencies, businesses, and local communities to develop effective water resource management strategies and address water-related challenges.
3. **Increase Public Awareness:** Launch public awareness initiatives to educate communities about water quality issues, promote water conservation practices, reduce pollution, and encourage sustainable water use.
4. **Expand Monitoring Systems:** Enhance existing monitoring systems by adding more monitoring points, increasing data collection frequency, and utilizing advanced monitoring technologies to monitor seasonal variations in water quality.
5. **Allocate Adequate Financial Resources:** Allocate sufficient financial resources to implement sustainable water management measures and ongoing monitoring. Tailor funding to address community-specific needs and long-term goals for sustainable water management, informed by thorough analysis and stakeholder consultation.

Implementing these recommendations will contribute to improved water quality management and sustainability in coastal water bodies, ensuring they continue to support diverse ecological, economic, and social functions.

References

- ILACO WFS Technical Report #1_Assessment current uses of surface water
- Food and Agriculture Organization (FAO) (2015). The State of Suriname's Biodiversity for Food and Agriculture
- Water quality standards from the US EPA

Annex 1: Procedure Water Quality measurement

- ✓ Step 1 the date and time of the instrument must first be synchronized with the tablet or laptop.
- ✓ Step 2 lower the sensor into the water so that all sensors are just covered, check the depth reading.
- ✓ Step 3 Slowly lower the sensor to the bottom of the location to be measured and measure the depth.
- ✓ Step 4 Raise the sensor 10 cm from the bottom using the depth sensor and record the depth.
- ✓ Step 5 The second measurement should be taken at 80% of the depth
- ✓ Step 6 Is followed by the third measurement. This measurement takes place at 60% of the depth.
- ✓ Step 7 The fourth measurement is taken at 40% of the depth.
- ✓ Step 8 The fifth measurement is taken at 20% of the depth.
- ✓ Step 9 The next measurement is taken at 0.50 meters from the surface.
- ✓ Step 10 The sensor is lowered to the 1st measurement to take a sample. This will serve as the first check.
- ✓ Step 11 The sensor is then returned to just below the surface and another measurement is taken. This will be the second check.

Workflow for Water Depth Measurement

- ➢ Synchronize Date and Time:
- ➢ Ensure that the instrument's date and time are synchronized with the tablet or laptop.

- ➢ Initial Depth Check:
- ➢ Lower the sensor into the water until all sensors are just covered, and check the depth reading.

- ➢ Depth Measurement Process:
- ➢ Slowly lower the sensor to the bottom of the measurement location and record the depth.

- ➢ 10 cm Above Bottom:
- ➢ Raise the sensor 10 cm from the bottom using the depth sensor and record the depth.

- ➢ 80% Depth Measurement:
- ➢ Take the second measurement at 80% of the depth.

- 60% Depth Measurement:
- Take the third measurement at 60% of the depth.

- 40% Depth Measurement:
- Take the fourth measurement at 40% of the depth.

- 20% Depth Measurement:
- Take the fifth measurement at 20% of the depth.

- 0.50 Meters from Surface:
- Take the next measurement at 0.50 meters from the water surface.

- Sample Check - 1st Measurement:
- Lower the sensor to the depth of the first measurement and take a sample for the initial check.

- Surface Measurement - Second Check:
- Return the sensor just below the water surface and take another measurement for the second check.

This clear and concise workflow ensures systematic and accurate water depth measurements, allowing for proper checks and data validation at each step.

Depths may vary depending on tides, environment and specific conditions. This procedure is carried out to check the river stratification. The last two checks are performed to ensure that there has been no change in the previous sampling times

Depth variations are contingent upon tide fluctuations, environmental factors, and specific conditions. This protocol is enacted to assess the stratification of the river. The final two validations are executed to ascertain the absence of alterations in the preceding sampling instances.

Annex 2: Pictures of various locations

1. Water quality measurement at Witagron 	2. Water quality measurements at Coronie (Afdamming left) 

3. Water quality measurement at Uitkijk brigde 	4. Water quality measurement at Saramacca brigde 

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Annex 3: Tables of all measurements

Saramacca River												
Location	**Date**	**Time (H)**	**Weather (sunny, rainy, cloudy)**	**Depth (m)**	**Temperature(°C)**	**Turbidity(NTU)**	**Conductivity(µS/cm)**	**Salinity(ppt)**	**Total Dissolved Solids(g/L)**	**Dissolved Oxygen(mg/L)**	**pH**	**Color**
Pikin Saron Bridge	Mar-24	15:45	sunny	1.98	31.17		44.5	0.02	0.029		8.09	transparent
				0.9	31.18		44.3	0.02	0.028		8.07	
				0	31.16		49.3	0.02	0.032		8.11	
Uitkijk Bridge	Jan-24	14:05	sunny	4.20	29.15		118.50	0.05	0.076		7.61	milkey brown
				3.32	29.15		117.60	0.05	0.075		7.59	
				2.34	29.19		116.60	0.05	0.075		7.58	
				1.33	29.19		116.50	0.05	0.075		7.58	
				0.00	29.55		116.70	0.05	0.075		7.58	
				4.05	29.16		116.00	0.05	0.074		7.54	
AVERAGE					29.23		116.98	0.05	0.075		7.58	
Uitkijk Bridge	Feb-24	10:26	sunny	1.21	29.11		94.10	0.04	0.06		8.01	milkey dark brown
				0.64	29.11		94.10	0.04	0.06		8.00	
				0.03	29.11		98.60	0.04	0.06		8.00	
AVERAGE				0.63	29.11		95.60	0.04	0.06		8.00	
Uitkijk Bridge	Mar-24	8:48	sunny	Bucket	28.30		874.20	0.41	0.56		8.59	milkey dark brown
Groningen	Jan-24	13:03	sunny	3.94	29.28		724.80	0.33	0.464		8.13	milkey dark brown
				2.94	29.32		730.60	0.34	0.468		8.12	
				1.83	29.23		751.90	0.35	0.481		8.15	
				0.02	29.46		776.40	0.36	0.497		8.18	
				3.81	29.26		739.30	0.34	0.473		8.13	
AVERAGE				2.51	29.31		744.60	0.34	0.477		8.14	

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Saramacca River												
Location	**Date**	**Time (H)**	**Weather (sunny, rainy, cloudy)**	**Depth (m)**	**Temperature(°C)**	**Turbidity(NTU)**	**Conductivity(µS/cm)**	**Salinity(ppt)**	**Total Dissolved Solids(g/L)**	**Dissolved Oxygen(mg/L)**	**pH**	**Color**
Groningen	Feb-24	12:48	sunny	3.25	29.22		572.4	0.26	0.366		8.47	milkey dark brown
				2.28	29.24		55.40	0.25	0.355		8.46	
				1.23	29.26		559.50	0.25	0.358		8.46	
				0.00	29.99		563.70	0.26	0.361		8.47	
				3.25	28.26		544.80	0.25	0.349		8.47	
AVERAGE				2.00	29.19		430.85	0.25	0.36		8.47	
Groningen	Mar-24	9:17	sunny	4.50	29.92		5675.30	3.04	3.63		8.73	milkey dark brown
				2.51	29.93		5651.40	3.02	3.62		8.73	
				1.58	29.94		5576.90	2.98	3.57		8.73	
				0.00	30.00		5542.60	2.96	3.55		8.74	
				4.31	29.93		5632.80	3.01	3.61		8.73	
AVERAGE				2.58	29.94		5615.80	3.00	3.59		8.73	
Saramacca Bridge	Jan-24	11:53	sunny	Bucket	29.82	111.40	1337.80	0.64	0.856		8.66	milkey dark brown
Saramacca Bridge	Feb-24	11:20	sunny	0.49	29.51	4.20	1448.90	0.70	0.927		8.72	milkey dark brown
				0.00	28.98	2.90	1591.00	0.78	1.018		8.76	
AVERAGE				0.25	29.25	3.55	1519.95	0.74	0.97		8.74	
Saramacca Bridge	Mar-24	11:15	sunny	Bucket	28.73		7240.80	3.95	4.63		8.80	milkey light brown

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Coppename River												
Location	**Date**	**Time (H)**	**Weather(sunny, rainy, cloudy)**	**Depth(m)**	**Temperature(°C)**	**Turbidity(NTU)**	**Conductivity(µS/ cm)**	**Salinity(ppt)**	**Total Dissolved Solids(g/L)**	**Dissolved Oxygen(mg/L)**	**pH**	**Color**
Kaaimanstone	Mar-24	13:08	sunny	1.79	30.35		13.60	0.00	0.009		8.26	transparent
				0.81	30.36		15.00	0.01	0.010		8.17	
				0.00	30.37		20.30	0.01	0.013		8.18	
				1.81	30.38		13.30	0.00	0.009		8.17	
AVERAGE				1.10	30.37		15.55	0.01	0.010		8.20	
Witagron	Mar-24	11:38	sunny	1.24	30.08		25.00	0.01	0.016		8.51	transparent
				0.62	30.29		24.60	0.01	0.016		8.37	
				0.00	30.37		24.90	0.01	0.015		8.34	
				1.16	30.32		22.90	0.01	0.015		8.25	
AVERAGE					30.27		24.35	0.01	0.016		8.37	
Boskamp	Jan-24	16:05	sunny	Bucket	30.41		19134.10	11.31	12.25		8.43	milkey light brown
Boskamp	Feb-24	12:33	sunny	0.34	29.42		27139.80	16.58	17.369		8.62	milkey brown
				0.00	29.46		26819.90	16.37	17.165		8.63	
AVERAGE				0.17	29.44		26979.85	16.48	17.27		8.63	

District Coronie

Hydraulic Research Division

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Location	Date	Time (H)	Weather(sunny, rainy, cloudy)	Depth (m)	Temperature(°C)	Turbidity(NTU)	Conductivity(µS/ cm)	Salinity(ppt)	Total Dissolved Solids(g/L)	Dissolved Oxygen(mg/L)	pH	Color
Lozing 52	Jan-24	12:13	sunny	Bucket	29.58	103.40	38447.80	24.39	24.61		7.97	milkey light brown
	Mar-24	8:56	sunny		28.17	20.10	50236.30	32.92	32.15		8.17	milkey light brown
Lozing 49 North Coronie	Jan-24	13:00	cloudy/sunny	1.54	29.78	3.70	38100.90	24.14	24.385		8.51	light brown
				0.70	30.36	1.90	27140.50	16.58	17.370		8.55	
				0.00	29.44	0.70	29107.50	17.91	16.629		8.53	
				1.57	29.45	2.10	37397.20	23.65	23.934		8.58	
AVERAGE				0.95	29.76	2.10	32936.53	20.57	20.580		8.54	
Lozing 49 North Coronie	Feb-24	11:32	sunny	1.28	29.56	2.40	49194.40	32.16	31.48		8.46	light brown
				0.64	30.61	2.60	55002.00	36.53	35.20		9.09	
				0.02	30.17	2.80	53571.20	35.43	34.29		9.06	
AVERAGE				0.65	30.11	2.60	52589.20	34.71	33.66		8.87	
Lozing 49 North Coronie	Mar-24	9:16	sunny	1.48	28.18	18.10	51833.60	34.11	33.17		8.80	light brown
				0.64	28.27		51791.40	34.08	33.15		8.82	
				0.03	28.42		51323.10	33.73	32.85		8.83	
AVERAGE					28.29	18.10	51649.37	33.97	33.06		8.82	
Lozing 49 South Coronie	Jan-24	12:40	cloudy/sunny	1.84	30.10		27575.40	16.88	17.648		8.46	light brown
	Feb-24	11:26	sunny	Bucket	30.52		56168.70	37.41	35.95		8.87	light brown
Coronie fresh water	Jan-24	14:16	sunny	0.71	29.01		386.60	0.17	0.247		7.40	light brown
				0.00	32.70		405.20	0.18	0.257		7.41	
AVERAGE					30.86		395.90	0.18	0.25		7.41	
Coronie fresh water	Feb-24	12:15	sunny	0.57	28.32		443.10	0.20	0.284		8.00	brown
				0.03	29.88		453.60	0.20	0.29		7.92	
AVERAGE				0.30	29.10		448.35	0.20	0.29		7.96	
Coronie fresh water	Mar-24	10:03	sunny	0.52	27.66		660.50	0.30	0.42		8.05	brown
				0.04	28.70		663.50	0.30	0.43		7.84	
AVERAGE				0.28	28.18		662.00	0.30	0.42		7.95	
District Coronie												

Hydraulic Research Division

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Location	Date	Time (H)	Weather(sunny, rainy, cloudy)	Depth (m)	Temperature(°C)	Turbidity(NTU)	Conductivity(µS/ cm)	Salinity(ppt)	Total Dissolved Solids(g/L)	Dissolved Oxygen(mg/L)	pH	Color
Coronie salt water	Jan-24	14:40	sunny	2.28	29.04		40705.80	25.99	26.052		8.08	milkey light brown
				1.30	29.75		40674.30	27.97	26.032		8.12	
				0.00	31.42		46254.50	30.05	29.603		8.83	
				2.23	29.47		40526.60	25.87	25.937		8.25	
AVERAGE				1.45	29.92		42040.30	27.47	26.906		8.32	
Coronie salt water	Feb-24	12:40	sunny	1.78	28.12		49644.30	32.49	31.77		8.47	milkey light brown
				0.86	29.60		48830.10	31.89	31.25		8.56	
				0.03	30.20		48399.50	31.59	30.98		8.72	
AVERAGE					29.31		48957.97	31.99	31.33		8.58	
Coronie salt water	Mar-24	10:25	sunny	1.74	27.59		49952.80	32.72	31.97		8.48	milkey light brown
				0.73	27.89		50257.90	32.94	32.17		8.55	
				0.03	28.30		50218.10	32.91	32.14		8.60	
				1.73	27.74		50052.40	32.79	32.03		8.53	
AVERAGE					27.88		50120.30	32.84	32.08		8.54	
Burnside	Jan-24	15:21	sunny	0.63	30.56	0.20	29698.90	18.32	19.007		8.82	milkey light brown
				0.03	31.51	1.10	29259.20	18.03	18.726		8.97	
AVERAGE					31.04	0.65	29479.05	18.18	18.87		8.90	
Burnside	Feb-24	13:18	sunny	0.69	27.17	8.30	38472.30	24.41	24.62		8.59	milkey light brown
				0.02	30.52		35550.80	24.36	22.75		8.86	
AVERAGE					28.85	8.30	37011.55	24.39	23.69		8.73	
Burnside	Mar-24	11:44		0.63	28.88		44059.70	28.40	28.20		8.37	milkey light brown
				0.02	30.06		29466.60	18.16	18.86		8.90	
AVERAGE					29.47		36763.15	23.28	23.53		8.64	

Nickerie Rivier

Hydraulic Research Division

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Location	Date	Time (H)	Weather(sunny, rainy, cloudy)	Depth(m)	Temperature(°C)	Turbidity(NTU)	Conductivity(µS/ cm)	Salinity(ppt)	Total Dissolved Solids(g/L)	Dissolved Oxygen(mg/L)	pH	Color
Afdamming (right)	Jan-24	15:47	sunny	Bucket	29.51	0.90	2029.90	1.01	1.30		8.22	milkey dark brown
	Feb-24	13:53	sunny	Bucket	29.91	3.20	2729.80	1.38	1.75		8.55	milkey dark brown
	Mar-24	11:47	sunny	Bucket	29.02		3935.90	2.05	2.52		8.65	milkey brown
Afdamming (left)	Jan-24	16:00	sunny	Bucket	28.88	3.30	957.60	0.45	0.613		7.23	light brown
	Feb-24	14:05	sunny	bucket	290.23	2.50	1289.50	0.62	0.825		7.56	brown
Kaaimanpolder bridge 1	Jan-24	16:16	sunny	1.23	29.90	0.10	45.10	0.02	0.029		7.47	milkey light brown
				0.67	29.92	0.70	44.10	0.02	0.028		7.17	
				0.00	30.12	0.40	46.50	0.02	0.030		7.16	
				1.21	29.90	0.09	44.50	0.02	0.028		7.28	
AVERAGE				0.78	29.96	0.32	45.05	0.02	0.03		7.27	
Kaaimanpolder bridge 1	Feb-24	14:35	sunny	1.44	30.04	1.10	67.20	0.03	0.043		7.65	milkey dark brown
				0.74	30.10	1.10	66.90	0.03	0.043		7.54	
				0.00	30.10	1.60	69.60	0.03	0.047		7.52	
				1.46	30.14	2.00	67.00	0.03	0.043		7.53	
AVERAGE				0.91	30.10	1.45	67.68	0.03	0.04		7.56	
Kaaimanpolder bridge 1	Mar-24	12:05	sunny	1.30	28.44		978.40	0.46	0.63		8.23	milkey brown
				0.63	29.00		838.20	0.39	0.54		8.24	
				0.00	30.18		948.30	0.45	0.61		8.47	
				1.32	28.54		975.30	0.46	0.62		8.29	
AVERAGE				0.81	29.04		935.05	0.44	0.60		8.31	
Kaaimanpolder bridge 2	Jan-24	16:37	sunny	1.19	30.72	0.00	50.80	0.02	0.033		7.15	milkey light brown
				0.55	30.75	0.00	50.70	0.02	0.032		7.10	
				0.02	30.69	0.00	55.80	0.02	0.036		7.07	
				1.16	30.71	0.00	51.20	0.02	0.033		7.07	
AVERAGE				0.73	30.72	0.00	52.13	0.02	0.03		7.10	
Nickerie River												

Hydraulic Research Division

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Location	Date	Time (H)	Weather(sunny, rainy, cloudy)	Depth(m)	Temperature(°C)	Turbidity(NTU)	Conductivity(µS/ cm)	Salinity(ppt)	Total Dissolved Solids(g/L)	Dissolved Oxygen(mg/L)	pH	Color
Kaaimanpolder bridge 2	Feb-24	14:50	sunny	1.45	28.78	2.50	137.80	0.06	0.088		7.52	brown
				0.75	28.71	1.00	63.50	0.02	0.041		7.53	
				0.02	30.68	1.40	66.50	0.02	0.043		7.58	
				1.40	28.84	1.30	70.20	0.03	0.045		7.77	
AVERAGE				0.91	29.25	1.55	84.50	0.03	0.05		7.60	
Kaaimanpolder bridge 2	Mar-24	12:27	sunny	1.34	30.14		325.10	0.14	0.21		8.13	brown
				0.65	30.17		316.10	0.14	0.20		8.02	
				0.03	30.49		317.00	0.14	0.20		8.02	
				1.23	30.22		315.50	0.14	0.20		8.00	
AVERAGE				0.81	30.26		318.43	0.14	0.20		8.04	
Wageningen	Jan-24	17:10	cloudy	bucket	29.09		40.50	0.02	0.03		6.78	milkey dark brown
	Feb-24	10:00	sunny	bucket	27.61		806.20	0.38	0.516		8.17	dark brown
	Mar-24	12:42	sunny	bucket	29.83		112.20	0.53	0.71		8.09	milkey dark brown
Stalweide bridge	Jan-24	10:49	cloudy	1.60	28.99	3.20	123.70	0.05	0.079		7.46	milkey dark brown
				0.81	29.09	2.40	100.70	0.04	0.064		7.35	
				0.03	29.13	1.40	95.10	0.04	0.061		7.33	
				1.55	29.15	3.70	86.40	0.03	0.055		7.27	
AVERAGE				1.00	29.09	2.68	101.48	0.04	0.06		7.35	
Stalweide bridge	Feb-24	15:15	sunny	1.87	29.67	1.80	4069.20	2.12	2.60		8.11	milkey brown
				0.94	29.85	1.80	3775.50	1.96	2.42		8.23	
				0.01	30.63	0.60	3302.00	1.70	2.11		7.17	
				1.86	29.80	1.10	4135.80	2.16	2.65		8.13	
AVERAGE				1.17	29.99	1.33	3820.63	1.99	2.45		7.91	
Stalweide bridge	Mar-24	12:42	sunny	1.54	29.09		3894.00	2.03	2.49		8.39	milkey brown
				0.71	29.23		3913.80	2.04	2.51		8.37	
				0.02	32.43		3464.60	1.79	2.22		8.95	
				1.50	29.71		3667.30	1.90	2.35		8.57	
AVERAGE				0.94	30.12		3734.93	1.94	2.39		8.57	
Nickerie River												

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Location	Date	Time (H)	Weather(sunny, rainy, cloudy)	Depth(m)	Temperature(°C)	Turbidity(NTU)	Conductivity(µS/ cm)	Salinity(ppt)	Total Dissolved Solids(g/L)	Dissolved Oxygen(mg/L)	pH	Color
Henar brdige	Jan-24	10:19	cloudy	bucket	28.89	111.00	2326.40	1.17	1.489	4.65	7.91	milkey dark brown
Henar bridge	Feb-24	9:00	sunny	4.06	28.96	2.30	20100.60	11.93	12.86		8.52	mikey dark brown
				3.01	29.00	2.60	20062.60	11.91	12.84		8.53	
				2.04	29.01	1.40	20100.20	11.93	12.86		8.54	
				1.02	29.02	1.20	20243.20	12.03	12.97		8.54	
				0.00	26.34	2.50	106.10	0.04	0.07		8.57	
				3.97	29.00	1.40	20140.20	11.96	12.89		8.57	
				0.00	25.49	0.70	15.30	0.01	0.01		8.61	
AVERAGE				2.01	28.12	1.73	14395.46	8.54	9.21		8.55	
Henar bridge	Mar-24	8:31	sunny	4.56	29.62		18642.30	10.99	11.93		8.49	mikey dark brown
				2.56	29.63		18707.60	11.03	11.97		8.48	
				0.02	29.56		18183.80	10.70	11.64		8.50	
				4.53	29.66		19078.60	11.27	12.21		8.50	
AVERAGE				2.92	29.62		18653.08	11.00	11.94		8.49	
Ramdien pier	Jan-24	16:06	sunny	0.53	29.57		33558.30	20.97	21.477		8.29	milkey brown
				0.01	29.61		31843.80	19.78	20.380		8.26	
AVERAGE				0.27	29.59		32701.05	20.38	20.929		8.28	
Ramdien pier	Feb-24	10:28	sunny	0.92	28.49		52280.60	34.44	33.46		8.72	milkey light brown
				0.02	28.48		42040.40	2.20	2.69		8.72	
AVERAGE				0.47	28.49		47160.50	18.32	18.08		8.72	
Ingas scafold	Jan-24	9:05	cloudy	7.25	28.91		35478.10	22.30	22.706		8.38	milkey light brown
				5.22	28.98		30021.50	18.54	19.214		8.38	
				3.21	29.07		21356.30	12.75	13.668		8.33	
				1.26	29.10		18806.50	11.10	12.036		8.30	
				0.03	29.11		18495.70	10.90	11.837		8.30	
				7.16	28.95		30785.00	19.06	19.702		8.41	
AVERAGE				4.02	29.02		25823.85	15.78	16.527		8.35	
Nickerie River												

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Location	Date	Time (H)	Weather(sunny, rainy, cloudy)	Depth(m)	Temperature(°C)	Turbidity(NTU)	Conductivity(µS/ cm)	Salinity(ppt)	Total Dissolved Solids(g/L)	Dissolved Oxygen(mg/L)	pH	Color
Ingas scaffold	Feb-24	9:52	sunny	1.77	28.62	2.00	49447.50	32.34	31.65		8.63	milkey light brown
				0.76	28.73	2.70	48190.20	31.42	30.84		8.64	
				0.02	28.95	0.70	46841.80	30.43	29.98		8.65	
AVERAGE				0.85	28.77	1.80	48159.83	31.40	30.82		8.64	
Ingas scaffold	Mar-24	9:37	sunny	2.85	29.53		49892.50	32.68	31.93		8.69	light brown
				1.84	29.60		48025.10	31.30	30.74		8.68	
				0.84	29.89		45181.80	29.22	28.21		8.66	
				0.00	29.89		44804.10	28.43	28.21		8.66	
				2.81	29.65		48201.20	31.43	30.85		8.68	
AVERAGE				1.67	29.71		47220.94	30.61	29.99		8.67	
Nani swamp Bridge 1	Jan-24	12:06	cloudy/sunny	2.29	29.72		21.40	0.01	0.014		7.31	milkey light brown
				1.23	29.73		21.40	0.01	0.014		7.17	
				0.01	29.74		26.10	0.01	0.017		7.16	
				2.21	29.73		21.60	0.01	0.014		7.13	
AVERAGE				1.44	29.73		22.63	0.01	0.015		7.19	
Nani swamp Bridge 1	Feb-24	11:50	sunny	2.43	29.83		18.30	0.01	0		7.72	very light brown
				1.38	29.86		18.20	0.01	0		7.59	
				0.00	29.87		22.30	0.01	0.014		7.60	
				2.38	29.89		18.30	0.01	0.012		7.55	
AVERAGE				1.55	29.86		19.28	0.01	0.01		7.62	
Nani swamp Bridge 1	Mar-24	9:23	sunny	2.45	29.33		19.20	0.01	0.01		7.56	transperant
				1.49	29.36		18.80	0.01	0.01		7.47	
				0.00	29.38		22.50	0.01	0.01		7.47	
				2.42	29.37		18.90	0.01	0.01		7.44	
AVERAGE				1.59	29.36		19.85	0.01	0.01		7.49	
Nickerie River												

Hydraulic Research Division

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Location	Date	Time (H)	Weather(sunny, rainy, cloudy)	Depth(m)	Temperature(°C)	Turbidity(NTU)	Conductivity(µS/ cm)	Salinity(ppt)	Total Dissolved Solids(g/L)	Dissolved Oxygen(mg/L)	pH	Color
Nani swamp bridge 2	Jan-24	12:24	cloudy/sunny	1.36	28.51		5342.00	2.85	3.419		7.81	light brown
				0.64	28.81		5253.00	2.80	3.362		7.82	
				0.01	29.34		5357.60	2.86	3.439		7.86	
				1.37	28.69		5318.00	2.83	3.404		7.91	
AVERAGE				0.85	28.84		5317.65	2.84	3.406		7.85	
Nani swamp bridge 2	Feb-24	11:13	sunny	0.83	28.81		6414.00	3.47	4.11		8.14	light brown
				0.00	28.73		5841.70	3.13	3.74		8.25	
AVERAGE				0.42	28.77		6127.85	3.30	3.92		8.20	
Nani swamp bridge 2	Mar-24	9:45	sunny	0.82	28.95		8689.80	4.81	5.56		7.91	milkey light brown/green
				0.02	28.84		6922.50	3.76	4.43		8.24	
AVERAGE				0.42	28.90		7806.15	4.29	5.00		8.08	

Corantijn River

Hydraulic Research Division

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Location	Date	Time (H)	Weather(sunny, rainy, cloudy)	Depth(m)	Temperature(°C)	Turbidity(NTU)	Conductivity(µS/ cm)	Salinity(ppt)	Total Dissolved Solids(g/L)	Dissolved Oxygen(mg/L)	pH	Color
Baitali	Mar-24	10:35	sunny	3.29	29.88		16.90	0.01	0.011		7.79	transparent
				2.29	29.90		16.20	0.01	0.010		7.77	
				1.29	29.95		16.00	0.01	0.010		7.79	
				0.00	29.92		17.20	0.01	0.011		7.86	
Kabalebo	Mar-24	10:00	sunny	3.18	30.00	34.80	18.50	0.01	0.012		7.95	transparent
				2.19	30.04	35.80	18.00	0.01	0.012		7.91	
				1.19	30.11	33.70	18.60	0.01	0.012		7.92	
				0.00	29.55		19.20	0.01	0.012		7.80	
Apoera	Mar-24	9:11	sunny	2.08	29.59		15.20	0.01	0.010		7.94	transparent
				1.04	29.65		12.20	0.01	0.010		7.94	
				0.00	29.49		18.40	0.01	0.012		7.93	
				2.08	29.61		15.20	0.01	0.010		7.86	
Canawaima(Ferry)	Jan-24	13:10	cloudy	2.32	28.63	1.00	7120.20	3.88	4.557	6.04	8.18	milkey light brown
				1.27	28.67	2.70	7059.10	3.84	4.518	5.99	8.27	
				0.00	28.91	2.00	5169.20	2.75	3.308	5.97	8.26	
				2.27	28.67	2.10	7017.80	3.82	4.491	6.01	8.25	
AVERAGE				1.47	28.72	1.95	6591.58	3.57	4.219	6.00	8.24	
Canawaima(Ferry)	Feb-24	10:31	sunny	0.96	28.46	2.00	5756.30	3.09	3.68		8.60	milkey brown
				0.02	28.70	4.10	4772.40	2.52	3.05		8.61	
AVERAGE				0.49	28.58	3.05	5264.35	2.81	3.37		8.61	
Canawaima(Ferry)	Mar-24	10:53	sunny	0.84	29.18		10932.90	6.16	7.00		8.60	milkey dark brown
				0.00	29.58		10084.90	5.64	6.45		8.65	
AVERAGE				0.42	29.38		10508.90	5.90	6.73		8.63	
Nani sluice	Jan-24	14:15	sunny	1.30	28.97	2.80	8139.80	4.48	5.209	3.27	7.83	light brown
				0.69	29.35	0.90	6092.50	3.28	3.899	2.93	7.75	
				0.02	29.86	2.60	1171.70	0.56	0.750	3.16	7.81	
				1.31	28.90	1.00	8188.00	4.51	5.240	3.00	7.81	
AVERAGE				0.83	29.27	1.83	5898.00	3.21	3.775	3.09	7.80	
Corantijn River												

Hydraulic Research Division

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Location	Date	Time (H)	Weather(sunny, rainy, cloudy)	Depth(m)	Temperature(°C)	Turbidity(NTU)	Conductivity(µS/ cm)	Salinity(ppt)	Total Dissolved Solids(g/L)	Dissolved Oxygen(mg/L)	pH	Color
Nani sluice	Feb-24	14:00	sunny	1.44	29.18	6.20	71153.20	6.29	7.14		7.99	light brown
				0.74	30.15	2.00	3865.10	2.01	2.47		7.91	
				0.03	31.70	2.50	3015.50	1.54	1.93		7.92	
				1.42	29.23	2.00	11044.10	6.23	7.07		8.03	
AVERAGE				0.91	30.07	3.18	22269.48	4.02	4.65		7.96	
Nani sluice	Mar-24	12:00	sunny	0.87	29.27		18178.30	10.69	11.63		8.14	milkey light brown
				0.01	30.54		4682.30	2.47	3.00		7.99	
AVERAGE				0.44	29.91		11430.30	6.58	7.32		8.07	

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Commewijne River													
Location		**Time (U)**	**Weather**	**Depth (m)**	**Temperature(°C)**	**Turbidity (NTU)**	**Conductivity ((µS/ cm)**	**salinity(ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**	**Color**	**Observation**
Jan	**Date**												
Nieuw amsterdam stijger	Jan-24	10:00	Sunny	1.50	27.46	91.90	27684.60	16.97	17.718	5.09	8.44	milkey dark brwon	
				0.60	27.70	92.00	24533.40	14.86	15.701	5.20	8.45		
				0.02	27.77	92.30	22152.70	13.28	14.178	5.32	8.47		
				1.61	27.60	0.00	26851.50	16.40	17.185	5.11	8.46		controle
AVERAGE				0.93	27.63		25305.55	15.38	16.196		8.46		
Nieuw Amsterdam	Feb-24	10:43	Sunny	2.56	27.69	2.6	29918.2	18.48	19.15		8.47	milkey dark brown	
				1.55	28.01	3.1	29103.2	17.92	18.63		8.5		
				0.76	28.1	2.9	28590.4	17.57	18.30		8.5		
				0.03	28.13	0.7	27011.3	16.51	17.29		8.52		
				2.52	27.69	2.1	30026.6	18.55	19.22		8.52		
Average					27.92		28929.94	17.81	18.515		8.50		
Nieuw Amsterdam	Mar-24	10:04	sunny/cloudy	2.32	28.45		29779.00	18.38	19.059		8.55	milkey dark brown	
				1.28	28.49		28928.70	17.80	18.51		8.57		
				0.00	29.00		26427.00	16.11	16.91		8.57		
controle				2.34	28.54		28766.10	17.69	18.41		8.58		
AVERAGE					28.62		28475.20	17.50	18.22		8.57		

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Commewijne River													
Stolkertsijver brug	Jan-24	11:30	Sunny	1.52	28.95	0.00	101.60	0.04	0.065	5.22	6.85	milkey light brown	
				0.05	29.00	0.00	104.40	0.04	0.067	5.13	6.87		
					28.98		103.00	0.04	0.066		6.86		
Stolkertsijver	Feb-24	9:02	Sunny	5.78	28.8	2.8	692	0.32	0.443		7.63	milkey brown	
				3.83	29.15	2.8	658.5	0.3	0.421		7.57		
				1.75	29.18		658.3	0.3	0.421		7.55		
				0.85	29.28	0.1	639.3	0.29	0.409		7.54		
				0.03	29.25	4	644.1	0.29	0.412		7.52		
controle				5.73	29.2	5.6	655.9	0.3	0.42		7.51		
Average					29.14		658.02	0.30	0.42		7.55		
Stolkertsijver	Mar-24	11:46	sunny	0.32	29.70	103,5	2667.60	1.35	1.707		7.67	milkey light brown	
				0.04	29.89		2569.60	1.31	1.66		7.63		
AVERAGE					29.80		2618.60	1.33	1.68		7.65		

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Suriname River													
Location	**Date**	**Time (U)**	**Weather**	**Depth (m)**	**Temperature(°C)**	**Turbidity (NTU)**	**Conductivity ((µS/ cm)**	**salinity(ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**	**Color**	**Observation**
Stone eiland	Feb-24	11:11	Sunny	0.75	30.71	108.90	22.20	0.01	0.014	0.22	8.35	very light brown	low water
				0.01	30.88	0.00	22.00	0.01	0.014	0.02	8.08		
AVERAGE				0.01	30.80	54.45	22.10	0.01	0.014	0.12	8.22		
Pokigron	Feb-24	13:00	Sunny	bucket	31.09	108.20	26.00	0.01	0.017	6.64	8.21	very light brown	low water
Stoneiland	Mar-24	12:14	cloudy	bucket	31.03	104.40	24.70	0.01	0.016		8.31	light brown	
Pokigron	Mar-24	14:10	sunny/ cloudy	bucket	32.75	105.00	28.40	0.01	0.018		8.03	light brown	

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Marowijne River													
Location	**Date**	**Time (U)**	**Weather**	**Depth (m)**	**Temperature(°C)**	**Turbidity (NTU)**	**Conductivity ((µS/ cm)**	**salinity(ppt)**	**Total Dissolved Solids (g/L)**	**Dissolved Oxygen (mg/L)**	**pH**	**Color**	**Observation**
Moengo	Jan-24	12:40	Sunny	2.10	28.30	1.50	30.60	0.01	0.020	4.18	6.69	light brown	
				1.17	28.32	0.60	30.60	0.01	0.020	4.21	6.56		
				0.01	28.50	0.00	35.70	0.01	0.023	4.22	6.59		
				2.10	28.26	0.00	31.10	0.01	0.020	4.18	6.49		controle
AVERAGE				1.35	28.35		32.00	0.01	0.021		6.58		
Moengo	Feb-24	14:15	zon	1.89	28.95	15.2	40.9	0.02	0.026		6.91	light brown	
				0.88	29.09		40.8	0.02	0.026		6.86		
				0	29.21		40.9	0.02	0.026	5.56	6.86		
controle				1.85	29.26		40.9	0.02	0.026	3.63	6.81		
Average					29.13		40.88	0.02	0.03		6.86		
Moengo	Mar-24	12:14	sunny	1.98	30.13		41.00	0.02	0.026		6.97	light brown	
				1.00	30.14		41.10	0.02	0.026		6.91		
				0.02	30.23		44.40	0.02	0.028		6.98		
controle				1.95	30.10		41.20	0.02	0.026		6.86		
AVERAGE					30.15		41.93	0.02	0.027		6.93		
Albina Ferry	Jan-24	14:00	Sunny	1.50	29.31	2.00	28.00	0.02	0.018	7.24	7.92	light brown	
				0.66	29.26	1.90	28.30	0.01	0.018	7.24	7.92		
				0.04	29.37	1.50	28.50	0.01	0.018	7.34	7.88		
				1.44	29.23	1.80	28.00	0.01	0.018	7.29	7.85		controle
AVERAGE				0.91	29.29		28.20	0.013	0.018		7.89		

MINISTRY OF PUBLIC WORKS
DIRECTORATE RESEARCH AND SERVICES
Mr. JaggernathLachmonst. 167
Paramaribo – Suriname

Marowijne River													
Ferry Albina	Feb-24	12:58	Sunny	1.40	29.62		27.00	0.01	0.017		7.27	light brown	
				0.73	29.61		27.20	0.01	0.017		8.01		
				0.00	29.69		27.80	0.01	0.018		8.03		
AVERAGE				0.71	29.64		27.33	0.01	0.017		7.77		
Albina	Mar-24	14:00	sunny	1.57	30.26		23.40	0.01	0.015		8.27	light brown	
				0.79	30.35		23.70	0.01	0.015		8.23		
				0.00	30.54		29.50	0.01	0.019		8.27		
				1.54	30.28		23.60	0.01	0.015		8.20		
AVERAGE					30.36		25.05	0.010	0.016		8.24		
Monding Wanekreek	Feb-24	17:21	Sunny	2.86	29.03	33.60	426.20	0.19	0.273		7.98	milky light brown	
				1.85	28.98	32.60	414.00	0.18	0.265		8.06		
				0.83	29.34	24.20	384.40	0.17	0.246		7.97		
				0.05	29.00	21.20	371.50	0.16	0.238		7.92		
AVERAGE				1.40	29.09	27.90	399.03	0.18	0.256		7.98		
Langamankondre	Feb-24	18:07	Sunny	1.61	28.73	5.50	10809.70	6.09	6.918		8.21	milky brown	
				0.77	28.95	6.90	9360.30	5.21	5.991		8.30		
				0.04	29.05	7.60	9377.20	5.19	5.976		8.33		
AVERAGE				0.81	28.91	6.67	9849.07	5.50	6.295		8.28		