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**EASt**  
AUTOMATION & ENGINEERING

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PUBLIC-PRIVATE RESEARCH NETWORK

# SMART RIVER WATER QUALITY MONITORING WITH AI-DRIVEN DECISION SUPPORT MANUAL BOOK

From sensor data to intelligent insight, prediction, and action

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# USER MANUAL

Access: [eastwater.com.my](https://eastwater.com.my)

## 1. Overview

iSENS-AIR is an AI-powered web-based system designed to monitor and analyze river water quality in real-time and historically. The system integrates IoT sensor data with artificial intelligence to provide:

- Water quality classification (Class I – V)
- AI-driven interpretation
- Pollution source prediction
- Actionable recommendations

## 2. Main Features

Key Capabilities:

Interactive map-based monitoring

AI-based water quality classification

Real-time and historical data visualization

Trend analysis and threshold indicators

Exportable reports (PDF)

## 3. Accessing the System

1. Open your browser
2. Go to: <https://eastwater.com.my>
3. The homepage will load automatically

## 4. Homepage Navigation

### Purpose

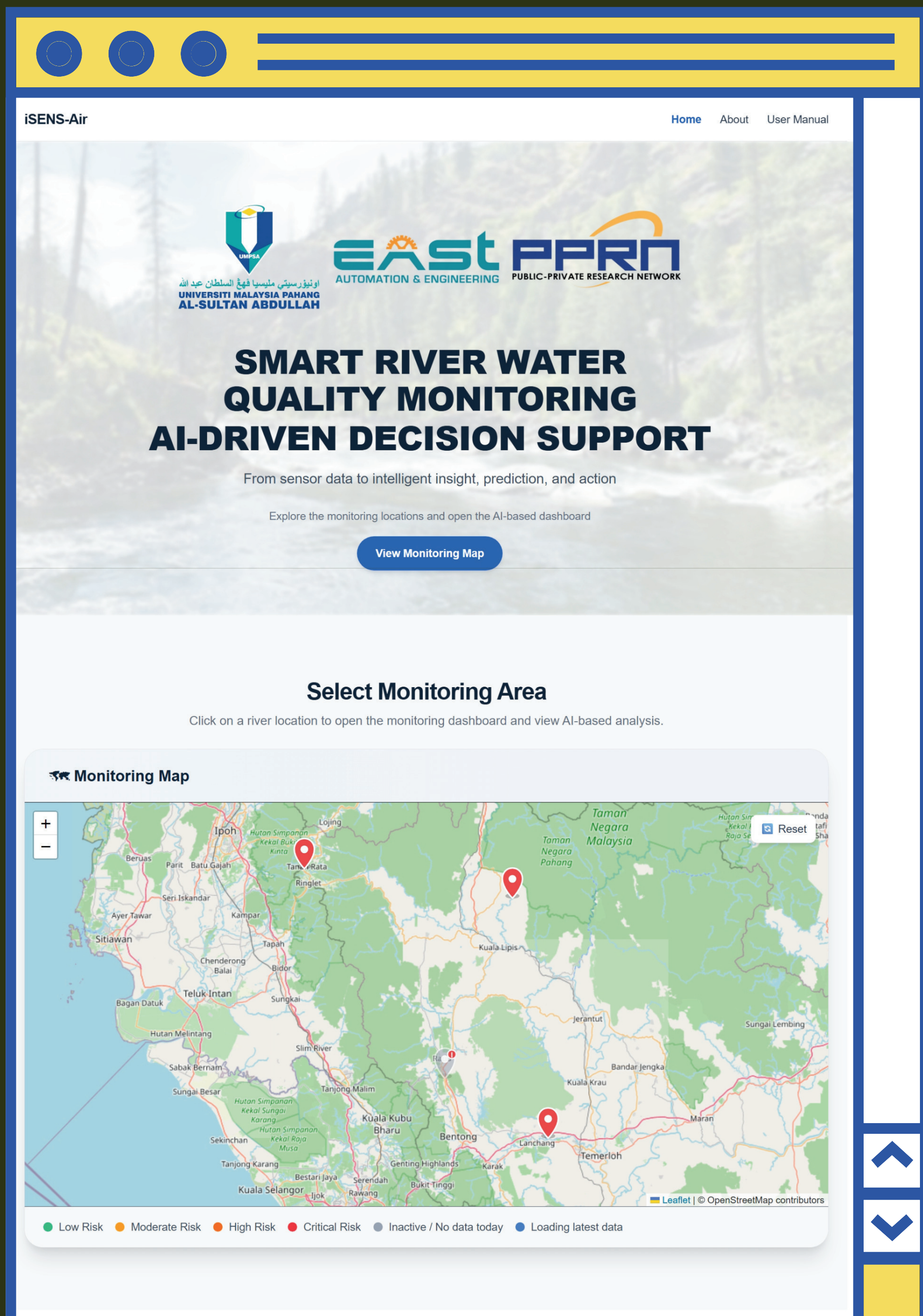
The landing page introduces the system and provides access to monitoring locations.

### Key Features

- System Title & Description
  - AI-driven river water quality monitoring platform
- View Monitoring Map Button
  - Direct access to monitoring locations
- Interactive Monitoring Map
  - Displays sensor locations (e.g., Semantan, Kechau, Bilut, Telum)

### How to Use

1. Click “View Monitoring Map”
2. Select a monitoring location
3. The dashboard for the selected area will open



## 5. Monitoring Map

### Purpose

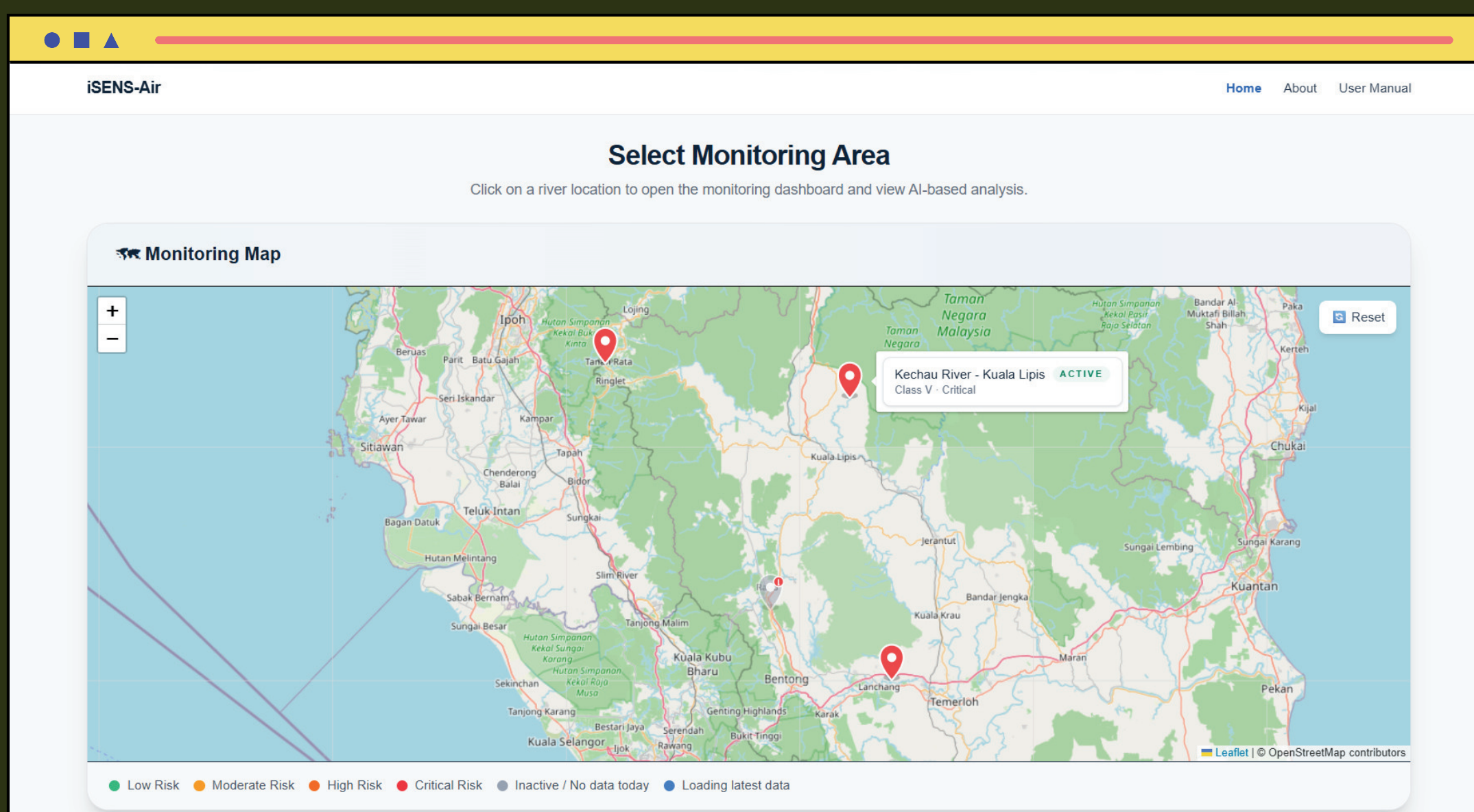
Allows users to select a river monitoring location.

### Key Features

- Interactive map with location markers
- Risk-level legend:
  - Low Risk
  - Moderate Risk
  - High Risk
  - Critical Risk

### How to Use

1. Click a marker → open detailed dashboard
2. Hover → preview location info



## 6. Daily Water Quality Summary (NWQS-Based)

### Purpose

Provides a daily overview of river water quality, summarizing the overall condition based on data collected throughout the day.

### Key Features

- Daily Classification Result
  - Displays overall water quality class (Class I – V)
- Summary Description
  - Explains the river condition for the day
- NWQS-Based Evaluation
  - Classification follows Malaysia National Water Quality Standards (NWQS)
- Dominant Parameter Insight
  - Highlights the parameters contributing most to pollution

### How it Works

- The system aggregates data collected over a full day
- Key parameters analyzed:
  - DO, BOD, COD, NH<sub>3</sub>, pH, etc.
- Each parameter is evaluated against NWQS thresholds
- The most critical parameter determines the final class

### Output

- Daily Water Quality Class
- Short Explanation of River Condition
- Dominant Pollution Indicators

### NWQS Classification Reference

Table 1. DOE Water Quality Index Classification

Class	Status	Description
Class I	Excellent	Conservation / very clean water
Class II	Good	Suitable for conventional treatment
Class III	Moderate	Requires extensive treatment
Class IV	Polluted	Limited use
Class V	Critical	Severely polluted

## 7. Real-Time Monitoring

### Purpose

Displays the most recent (real-time) sensor readings for the selected monitoring area.

### Parameters

- Temperature
- Electrical Conductivity (EC)
- Dissolved Oxygen (DO)
- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Ammonia (NH<sub>3</sub>)
- Turbidity (TR)
- Conductivity (CT)
- pH

### Features

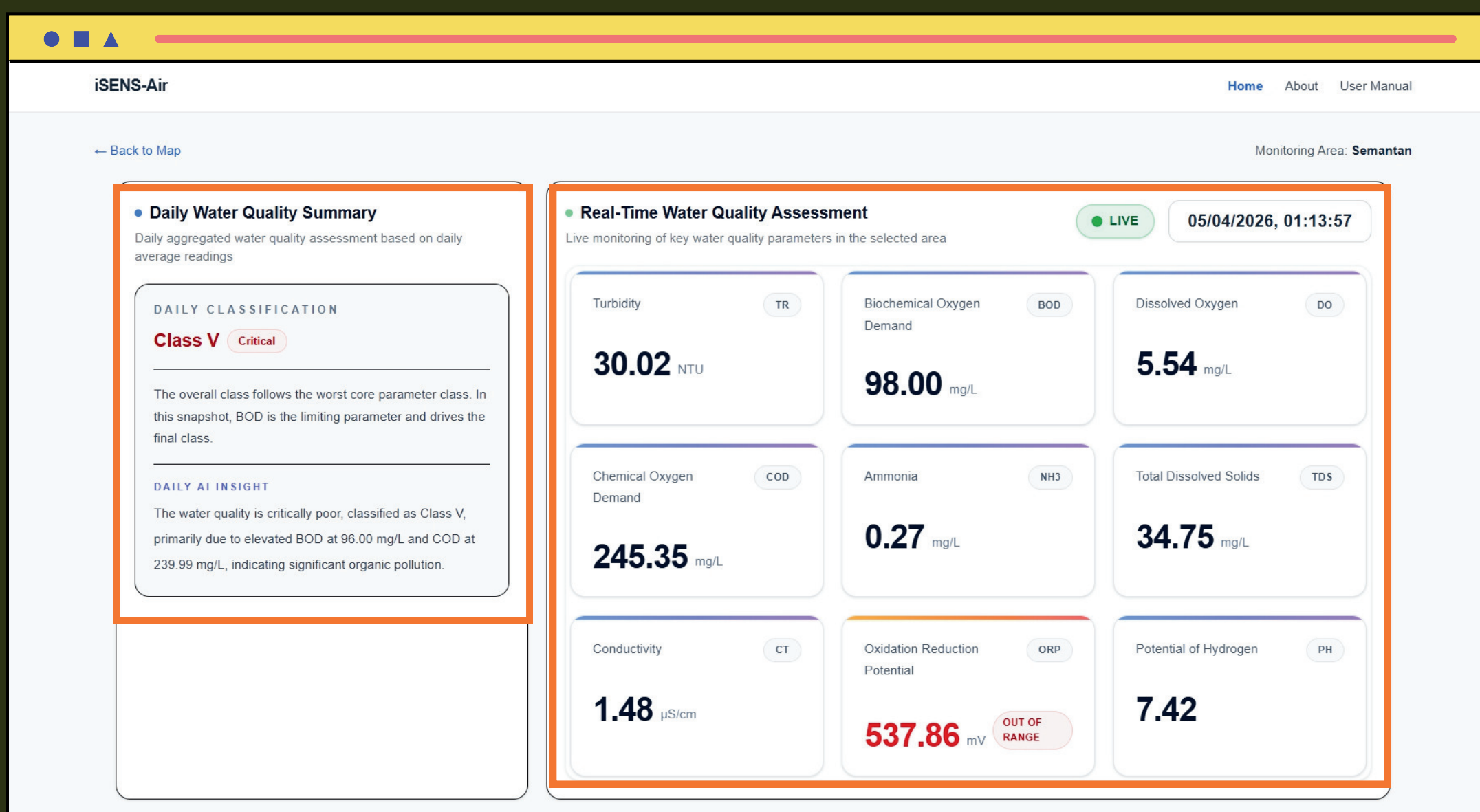
- Real-time values displayed in card format
- Automatic updates (live monitoring)
- Visual anomaly indication:
  - Normal
  - Out-of-range (exceeds acceptable limits)

### How it Works

- Data is collected continuously from IoT sensors
- The latest valid reading is displayed instantly
- Each parameter is checked against its valid range

### Interpretation

- High BOD / COD / NH<sub>3</sub> → indicates organic or chemical pollution
- Low DO → indicates poor oxygen levels for aquatic life
- Extreme pH → possible chemical contamination



## 8. AI Insight (7-Day Analysis & Decision Support)

### Purpose

Provides an AI-generated interpretation of river water quality trends based on historical data over the last 7 days to support environmental decision-making.

### Data Scope

- Analysis is based on 7-day historical data
- Time range:
  - From yesterday (Day -1)
  - Back to 7 days before (Day -7)
- Today's data is NOT included to avoid incomplete or unstable readings

### Key Features

- AI Interpretation
  - Concise explanation of water condition
- Dominant Parameters
  - Identifies key contributors (e.g., NH<sub>3</sub>, COD, BOD)
- Pollution Indication
  - Suggests possible contamination patterns
- Trend Awareness
  - Reflects consistent patterns over multiple days (not just snapshot)

### How it Works

- The system aggregates hourly-representative data per day
- Computes:
  - Average values
  - Maximum values
  - Exceedance rates (%)
- Compares values with NWQS thresholds
- AI generates interpretation based on:
  - Severity
  - Trend consistency
  - Parameter dominance

### Output

- Short AI-generated summary
- Key parameters influencing water quality
- General pollution indication

## 9. More AI Insight (Detailed 7-Day Analysis)

### Purpose

Provides a detailed breakdown of the 7-day analysis when users request deeper insights.

### How to Access

1. Click "Get More AI Insight"
2. A popup modal will appear with detailed analysis

### Key Features

1. Overall Narrative
  - Full explanation of river condition over 7 days
  - Includes severity and urgency
2. 7-Day Water Quality Summary
  - Final classification (NWQS-based)
  - Based on aggregated historical data
3. Likely Pollution Source
  - AI-estimated causes:
    - Industrial discharge
    - Chemical contamination
    - Agricultural runoff
4. Recommended Follow-Up
  - Suggested actions:
    - Immediate inspection
    - Source identification
    - Pollution mitigation
5. Parameter Evidence Table
  - Displays detailed metrics for each parameter:
    - Average (Avg)
    - Latest Value
    - Maximum Value
    - Trend (Increasing / Stable / Decreasing)
    - Exceedance Rate (%)
6. Key Anomalies
  - Highlights abnormal spikes
  - Identifies critical parameters
7. 7-Day Pattern Analysis
  - Shows whether pollution is:
    - Persistent
    - Increasing
    - Intermittent

iSENS-Air Home About User Manual

AI Decision Support (7-Day Analysis)

Class V
Critical Risk
Confidence 84%

**AI 7-DAY INTERPRETATION**

Water quality is critically impaired with consistent exceedances in BOD and COD levels. The average BOD is 101.13 mg/L and COD is 252.83 mg/L, indicating severe organic pollution.

**LIKELY MAIN CONTRIBUTORS**

**BOD and COD levels are persistently high, indicating significant organic pollution.**

Dominant parameters over the last 7 days

**PREDICTED SOURCE OF POLLUTION**

**Mixed-source pollution requiring field verification.**

Historical pollution source hypothesis

**RECOMMENDED ACTION**

**Immediate investigation and remediation of pollution sources are necessary.**

Primary response based on the 7-day pattern

[Get More AI Insight](#)

**More AI Insight** ✕

Focused 7-day interpretation of the main abnormal parameters, likely pollution source, and operational follow-up

**OVERALL NARRATIVE**

Water quality is critically impaired with severe exceedances in BOD and COD levels. Immediate action is required to address the pollution sources.

**7-DAY WATER QUALITY SUMMARY**

**Class V**

Average BOD is 101.13 mg/L, and COD is 252.83 mg/L, both exceeding safe limits. Consistent exceedance rates of 100% indicate ongoing pollution.

**LIKELY POLLUTION SOURCE**

**Mixed-source pollution requiring field verification.**

The pollution is likely due to mixed-source pollution requiring field verification. This suggests multiple contributing factors rather than a single source.

**RECOMMENDED FOLLOW-UP**

**Immediate investigation and remediation of pollution sources are necessary.**

Conduct immediate field verification of pollution sources and implement measures to reduce organic load.

**MAIN PARAMETER EVIDENCE**

BOD levels have consistently exceeded safe limits, averaging 101.13 mg/L, with a maximum of 202.43 mg/L. COD levels are also critically high, averaging 252.83 mg/L, peaking at 507.22 mg/L.

**7-DAY PATTERN**

The 7-day pattern shows critical water quality with consistent high levels of BOD and COD. This trend indicates a significant and ongoing pollution issue.

**KEY ANOMALIES**

Both BOD and COD show persistent exceedances, with BOD at an average of 101.13 mg/L and COD at 252.83 mg/L. The exceedance rate for both parameters is 100%.

**PARAMETER EVIDENCE**

Parameter	Avg	Latest	Max	Trend	Exceedance
COD	252.83 mg/L	238.30 mg/L	507.22 mg/L	Fluctuating	100%
BOD	101.13 mg/L	95.32 mg/L	202.43 mg/L	Fluctuating	100%
NH3	0.24 mg/L	0.26 mg/L	0.28 mg/L	Increasing	0%
DO	5.85 mg/L	5.63 mg/L	6.28 mg/L	Decreasing	0%
ORP	543.12 mV	536.79 mV	558.68 mV	Stable	0%

**More AI Insight** ✕

Focused 7-day interpretation of the main abnormal parameters, likely pollution source, and operational follow-up

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ORP	543.12 mV	536.79 mV	558.68 mV	Stable	0%

**SOURCE HYPOTHESES**

**Mixed-source pollution requiring field verification**

The recent pattern shows combined stress across several parameters, but the signal is not specific enough to isolate a single dominant source.

## 10. Supporting Data Visualization Analysis & Historical Data

### Purpose

Provides interactive data exploration, analytical summaries based on the selected date range, supporting AI interpretation, and display historical raw data.

### 10.1 Date Range & Data Control

### Purpose

Allows users to control which data is analyzed and visualized.

### Key Features

- Start Date & End Date Picker
- Load Data Button
- Export PDF Button

### Behavior

- Users can select a custom date range
- However, the system limits analysis to **maximum of the last 7 days only**
- If more than 7 days are selected, the system automatically uses the most recent 7 days within the selected range

The screenshot displays the iSENS-Air web application interface. At the top, there is a navigation bar with 'Home', 'About', and 'User Manual' links. The main content area is titled 'Supporting Data Visualization' and includes a sub-header 'AI decision uses the last 7 days, graphs remain available for supporting interpretation'. A date range picker is highlighted with an orange box, showing 'Start' and 'End' dates both set to '05/04/2026'. Below the date picker are 'Load Data' and 'Export PDF' buttons. The interface is divided into three columns of analysis results: 'TREND HIGHLIGHTS' (e.g., TDS increasing), 'PARAMETER COMPARISON' (e.g., COD highest pressure score), and 'THRESHOLD EXCEEDANCE INDICATORS' (e.g., COD 100% points exceed Class IV-V threshold). A 'Hide Visualization' button is located at the bottom right of the analysis section. Below this, there is a 'Visualizations' section with tabs for 'Parameter Trend', 'Histogram', and 'Scatter Plot'. The 'Parameter Trend' tab is active, showing a 'Parameter Trend Over Time' chart with dropdown menus for 'Select Parameter' (set to 'All Parameters') and 'Aggregation' (set to 'All time').

## 10.2 Supporting Summary

### Purpose

Displays a data-driven analytical summary based on the selected date range (max 7 days).

### Key Features

#### 1. Trend Highlights

- Shows key parameter movements within selected period
- Includes average value, latest value, and percentage change

#### 2. Parameter Comparison

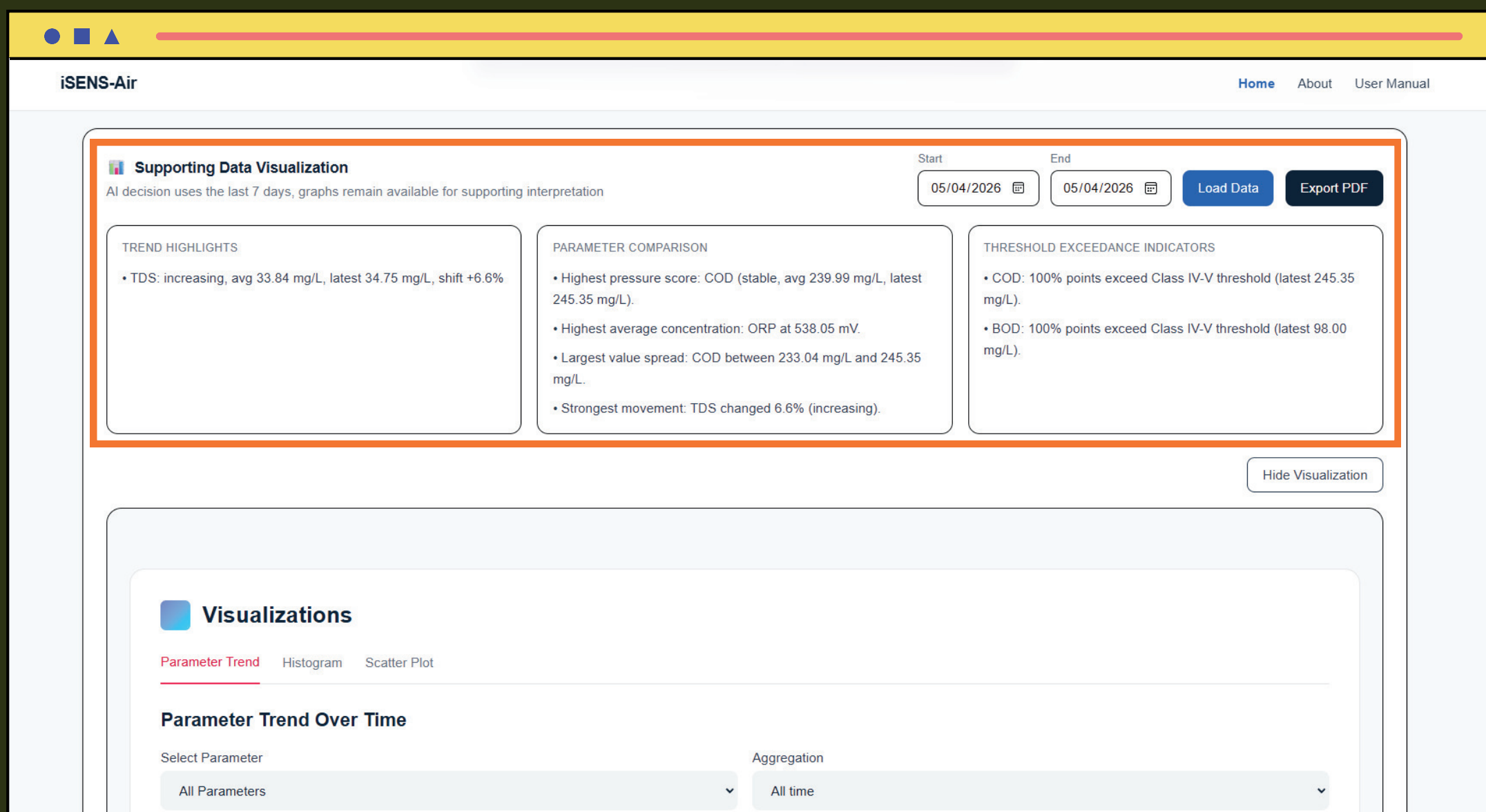
- Identifies:
  - Highest pressure parameter
  - Highest average concentration
  - Largest variation
  - Strongest movement

#### 3. Threshold Exceedance Indicators (NWQS-Based)

- Measures how often parameters exceed NWQS thresholds
- Expressed as percentage (%)

### How It Works

- Uses filtered data based on date picker
- Limits to maximum 7 days
- Computes:
  - Avg, Max, Latest
  - Trend direction
  - Exceedance rate
- Evaluated against NWQS Malaysia standards



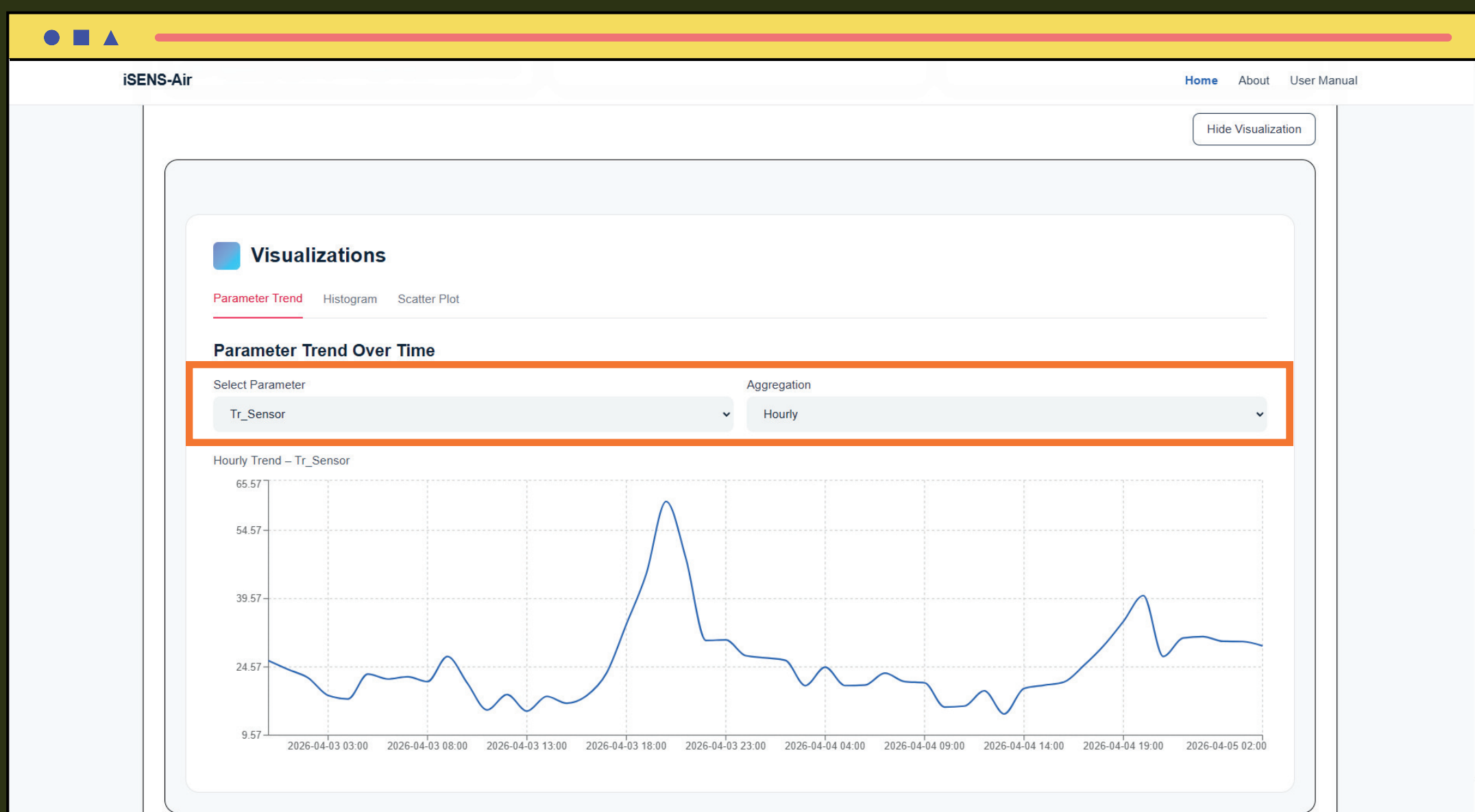
## 10.3 Trend Analysis (Aggregation-Based Visualization)

### Purpose

Displays how parameters change over time with flexible aggregation.

### Key Features

- Parameter selector (single or all parameters)
- Aggregation options:
  - All Time
  - Hourly
  - Daily
  - Weekly



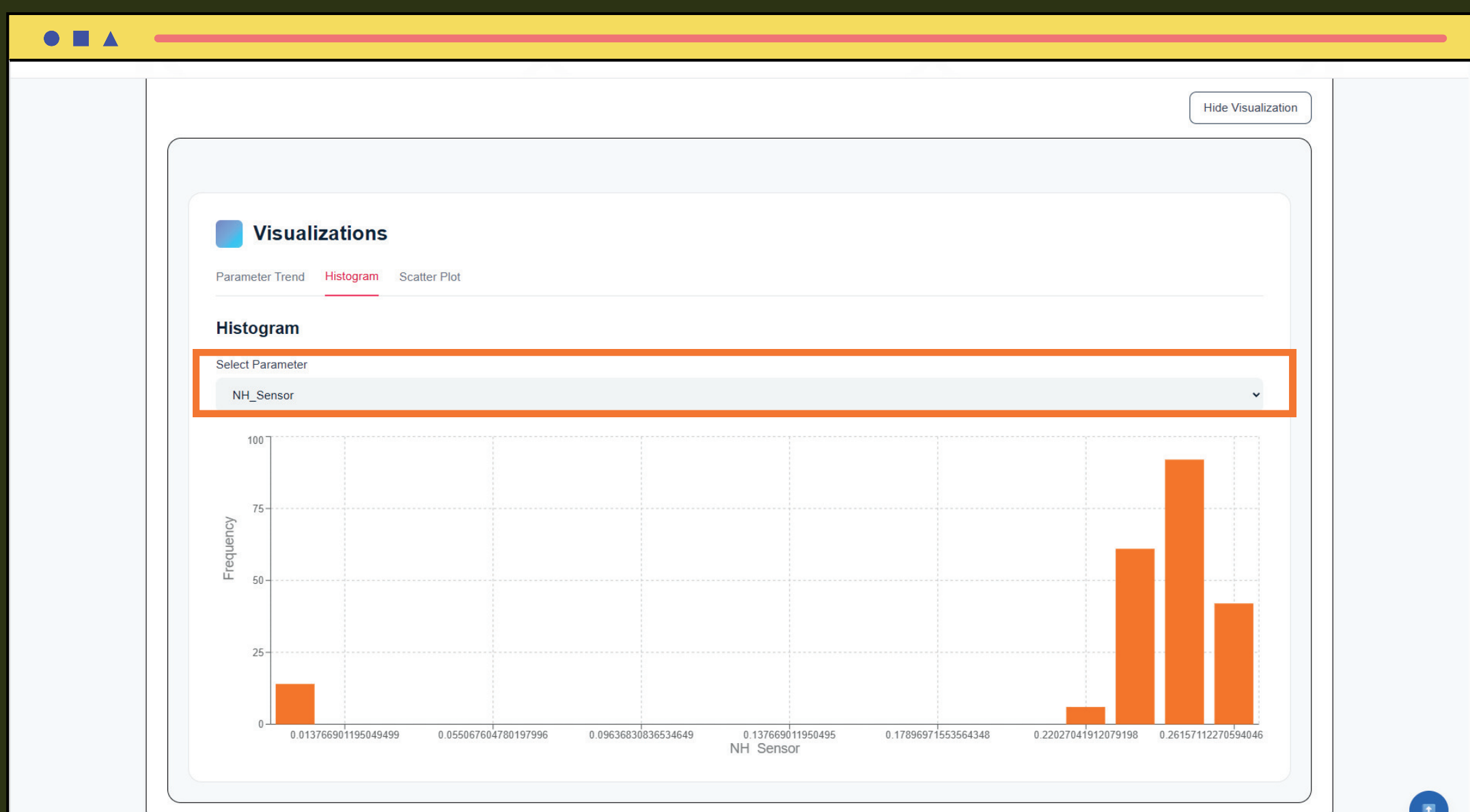
## 10. 4 Histogram (Distribution Analysis)

### Purpose

Shows value distribution of selected parameters within chosen date range.

### Key Features

- Parameter selection dropdown
- Multi-card histogram display
- Frequency-based visualization



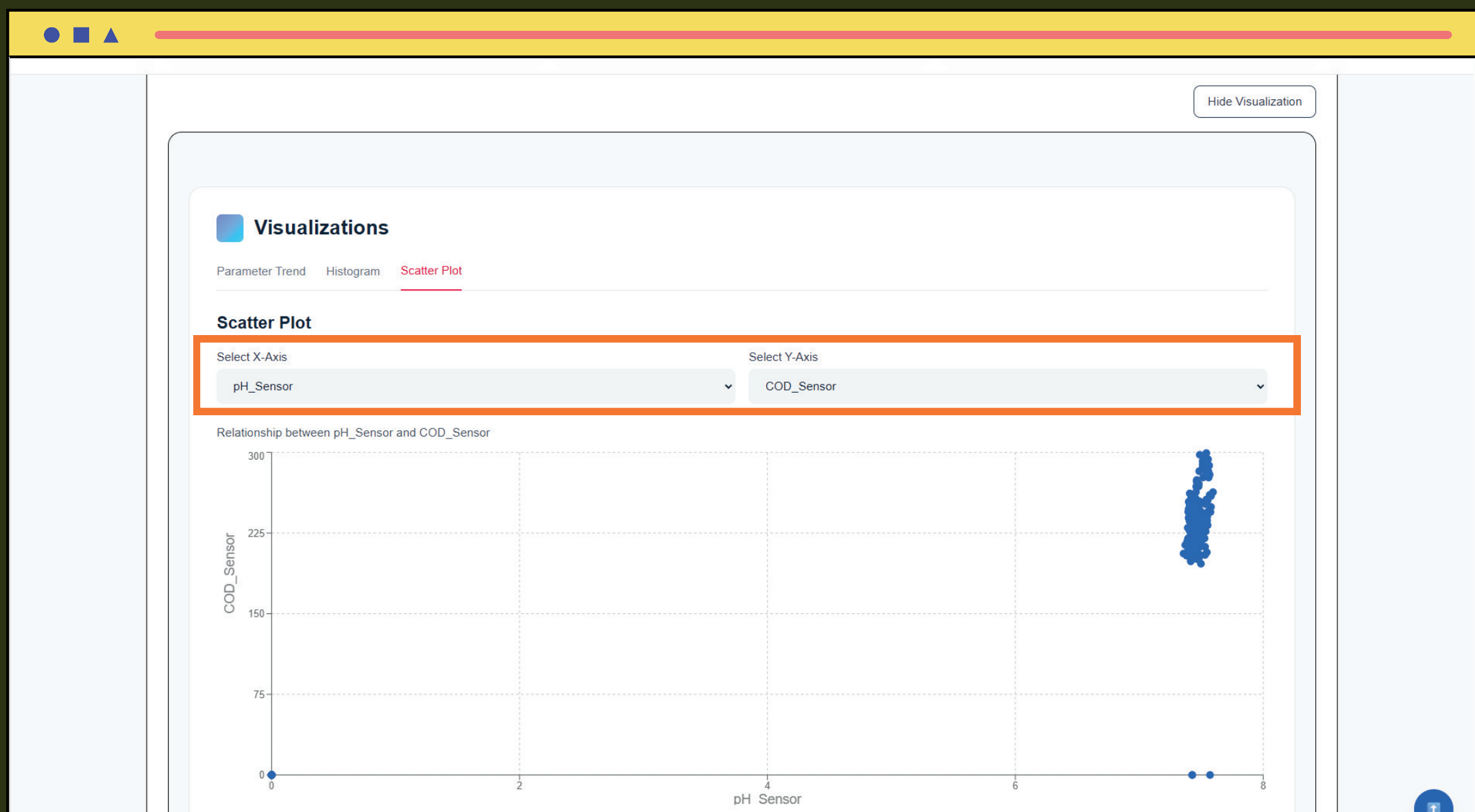
## 10. 5 Scatter Plot (Relationship Analysis)

### Purpose

Analyzes relationships between two parameters.

### Key Features

- Select X-axis parameter
- Select Y-axis parameter
- Dynamic plotting based on selected date range



## 10. 6 Export Report

### Purpose

This report provides a comprehensive assessment of river water quality by combining:

- Daily monitoring data
- Real-time sensor readings
- AI-driven analysis (7-day historical)
- Supporting statistical insights

It is designed to support environmental monitoring, decision-making, and reporting.

### Key Features

- Overall Classification (NWQS-Based)
- Executive Summary
- Daily Water Quality Summary
- Real-Time Water Quality Assessment
- AI Decision Support (7-Day Analysis)
- Supporting Data Visualization Summary
- Historical Data Summary

### How to Use

1. Select Start Date & End Date
2. Click Load Data
3. Click Export PDF

The screenshot displays the iSENS-Air web application interface. At the top, there's a navigation bar with 'Home', 'About', and 'User Manual' links. The main content area is titled 'Supporting Data Visualization' and includes a sub-header 'Supporting Data Visualization' and a note: 'AI decision uses the last 7 days, graphs remain available for supporting interpretation'. Below this, there are three columns of data: 'TREND HIGHLIGHTS' (TDS: increasing, avg 33.84 mg/L, latest 34.75 mg/L, shift +6.6%), 'PARAMETER COMPARISON' (Highest pressure score: COD (stable, avg 239.99 mg/L, latest 245.35 mg/L), Highest average concentration: ORP at 538.05 mV, Largest value spread: COD between 233.04 mg/L and 245.35 mg/L, Strongest movement: TDS changed 6.6% (increasing)), and 'THRESHOLD EXCEEDANCE INDICATORS' (COD: 100% points exceed Class IV-V threshold (latest 245.35 mg/L), BOD: 100% points exceed Class IV-V threshold (latest 98.00 mg/L)). A 'Load Data' button and an 'Export PDF' button (highlighted with a red box) are visible. Below the data is a 'Visualizations' section with a 'Parameter Trend Over Time' chart and dropdown menus for 'Select Parameter' and 'Aggregation'.

## 10.7 Historical Data Table

### Purpose

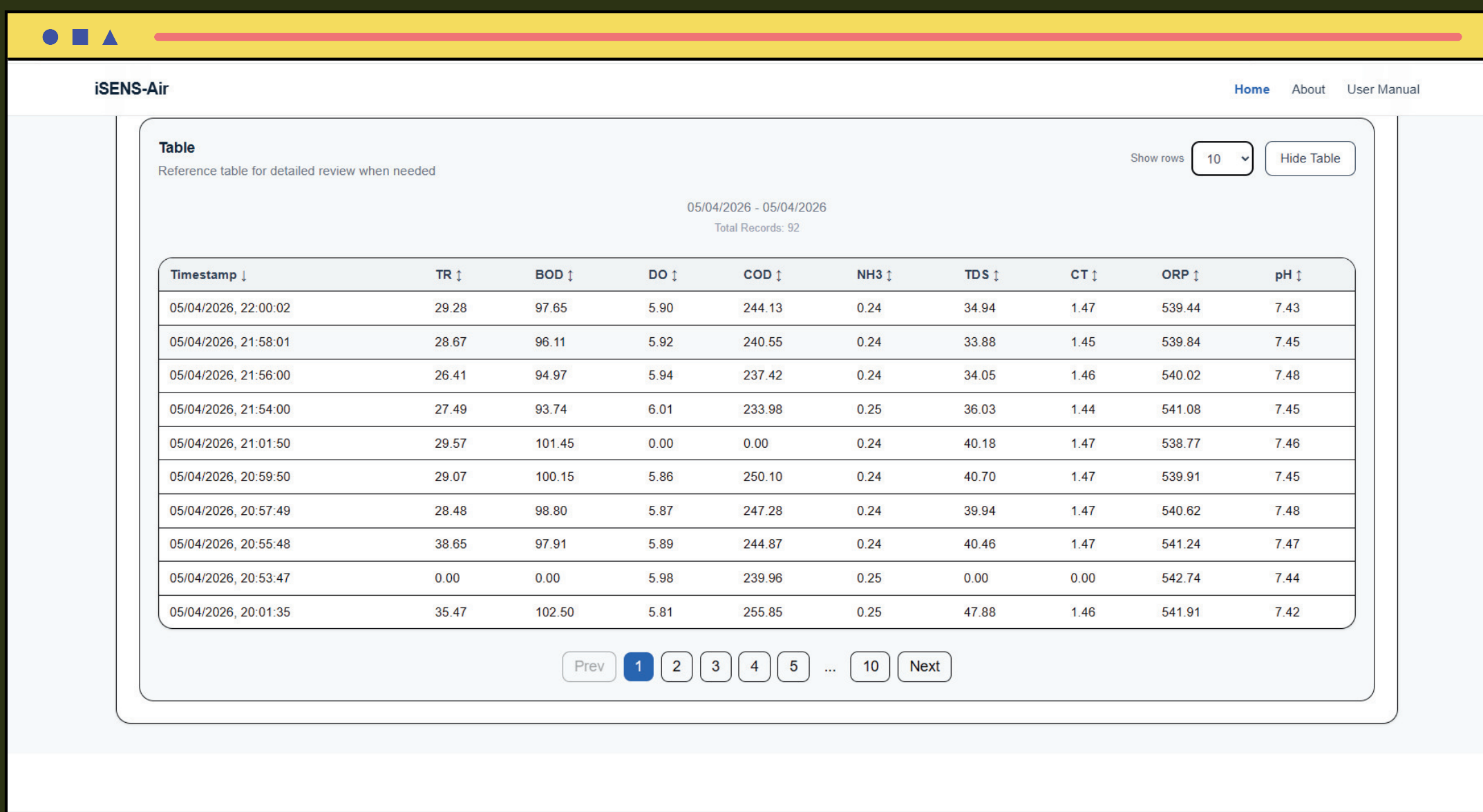
Displays raw sensor data for detailed inspection.

### Key Features

- Date range filtering
- Sorting (timestamp)
- Pagination

### Columns

1. Timestamp
2. All sensor parameters



The screenshot displays the iSENS-Air web application interface. At the top, there are navigation links for Home, About, and User Manual. The main content area features a table titled "Table" with a subtitle "Reference table for detailed review when needed". The table is filtered for the date range "05/04/2026 - 05/04/2026" and shows "Total Records: 92". The table has 10 columns: Timestamp, TR, BOD, DO, COD, NH3, TDS, CT, ORP, and pH. The data rows show various sensor readings for different timestamps on May 4, 2026. Below the table is a pagination control with buttons for "Prev", "1", "2", "3", "4", "5", "...", "10", and "Next".

Timestamp ↓	TR ↓	BOD ↓	DO ↓	COD ↓	NH3 ↓	TDS ↓	CT ↓	ORP ↓	pH ↓
05/04/2026, 22:00:02	29.28	97.65	5.90	244.13	0.24	34.94	1.47	539.44	7.43
05/04/2026, 21:58:01	28.67	96.11	5.92	240.55	0.24	33.88	1.45	539.84	7.45
05/04/2026, 21:56:00	26.41	94.97	5.94	237.42	0.24	34.05	1.46	540.02	7.48
05/04/2026, 21:54:00	27.49	93.74	6.01	233.98	0.25	36.03	1.44	541.08	7.45
05/04/2026, 21:01:50	29.57	101.45	0.00	0.00	0.24	40.18	1.47	538.77	7.46
05/04/2026, 20:59:50	29.07	100.15	5.86	250.10	0.24	40.70	1.47	539.91	7.45
05/04/2026, 20:57:49	28.48	98.80	5.87	247.28	0.24	39.94	1.47	540.62	7.48
05/04/2026, 20:55:48	38.65	97.91	5.89	244.87	0.24	40.46	1.47	541.24	7.47
05/04/2026, 20:53:47	0.00	0.00	5.98	239.96	0.25	0.00	0.00	542.74	7.44
05/04/2026, 20:01:35	35.47	102.50	5.81	255.85	0.25	47.88	1.46	541.91	7.42

## 11. Tips for Users

**Always select a monitoring area first**

**Use date filters for deeper analysis**

**Use Get More AI Insight for detailed interpretation**

**Pay attention to Critical alerts (Class V)**

## 12. Disclaimer

- **Data is intended for research and monitoring purposes**
- **AI predictions may vary depending on data quality**
- **Users are responsible for interpreting results appropriately**

# CONTACT

**For more information, please contact:**  
**[kamarul@umpsa.edu.my](mailto:kamarul@umpsa.edu.my)**