

E-MEXICO

LERMA–SANTIAGO ENVIRONMENTAL FLOWS MONITORING DASHBOARD

User Manual

Environmental Flows Monitoring Dashboard

Watershed Mapping · Compliance Analysis · Scenario Comparison

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1. Introduction

The E-México Lerma-Santiago Environmental Flows Dashboard is a web-based platform for monitoring river flow regimes, evaluating compliance with environmental (ecological) flow targets, and assessing the sustainability of freshwater ecosystems across the Lerma-Santiago basin in Mexico. Developed by the International Water Management Institute (IWMI) in collaboration with CONAGUA and funded by Google.org, the dashboard provides water resource managers, researchers, and policy stakeholders with interactive tools to monitor and analyze environmental flow compliance across the Lerma-Santiago watershed system.

Environmental flows (e-flows) refer to the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems. The dashboard operationalize e-flow monitoring by integrating hydrological modelling, remote sensing, and in situ data on climate, river discharge, and biodiversity into a unified interface. This integrated approach supports informed decision-making for water resource management and environmental conservation.

This manual explains how to navigate the platform, interpret the results it displays, and use its analytical tools, including the scenario comparison feature.

1.1 System Requirements

The dashboard is fully web-based and requires no installation. Recommended environment:

- Modern web browser: Google Chrome 100+, Mozilla Firefox 100+, or Microsoft Edge 100+
- Internet connection (for map tiles and data loading)
- Screen resolution: 1280 x 800 or higher

1.2 Language Support

The dashboard supports two interface languages, switchable at any time using the EN / ES toggle in the top-right corner of the navigation bar:

- ES - Español (Spanish)
- EN - English

Metric	Value
Sub-basins covered	58
River segments modeled	> 3,000
Climate scenarios available	3 (SSP126, SSP245, SSP585) plus Historical
Endangered native fish species tracked	8

2. Getting Started

2.1 Accessing the Platform

Open the platform landing page in a web browser. The landing page introduces the system's purpose and core capabilities and provides two entry points:

- Launch Dashboard: opens the interactive dashboard.
- Documentation: opens the PDF User Manual (this document) in a new browser tab.

2.2 Choosing a Language

A language switcher (EN / ES) is available in the top-right corner of both the landing page and the dashboard header. Click the desired language code to toggle all interface labels between English and Spanish. The active language is highlighted in white.

2.3 Dashboard Layout at a Glance

Once launched, the dashboard opens on the DASHBOARD tab by default. A second tab, COMPARISON, is available in the header for side-by-side scenario analysis (see Section 8). The header also contains:

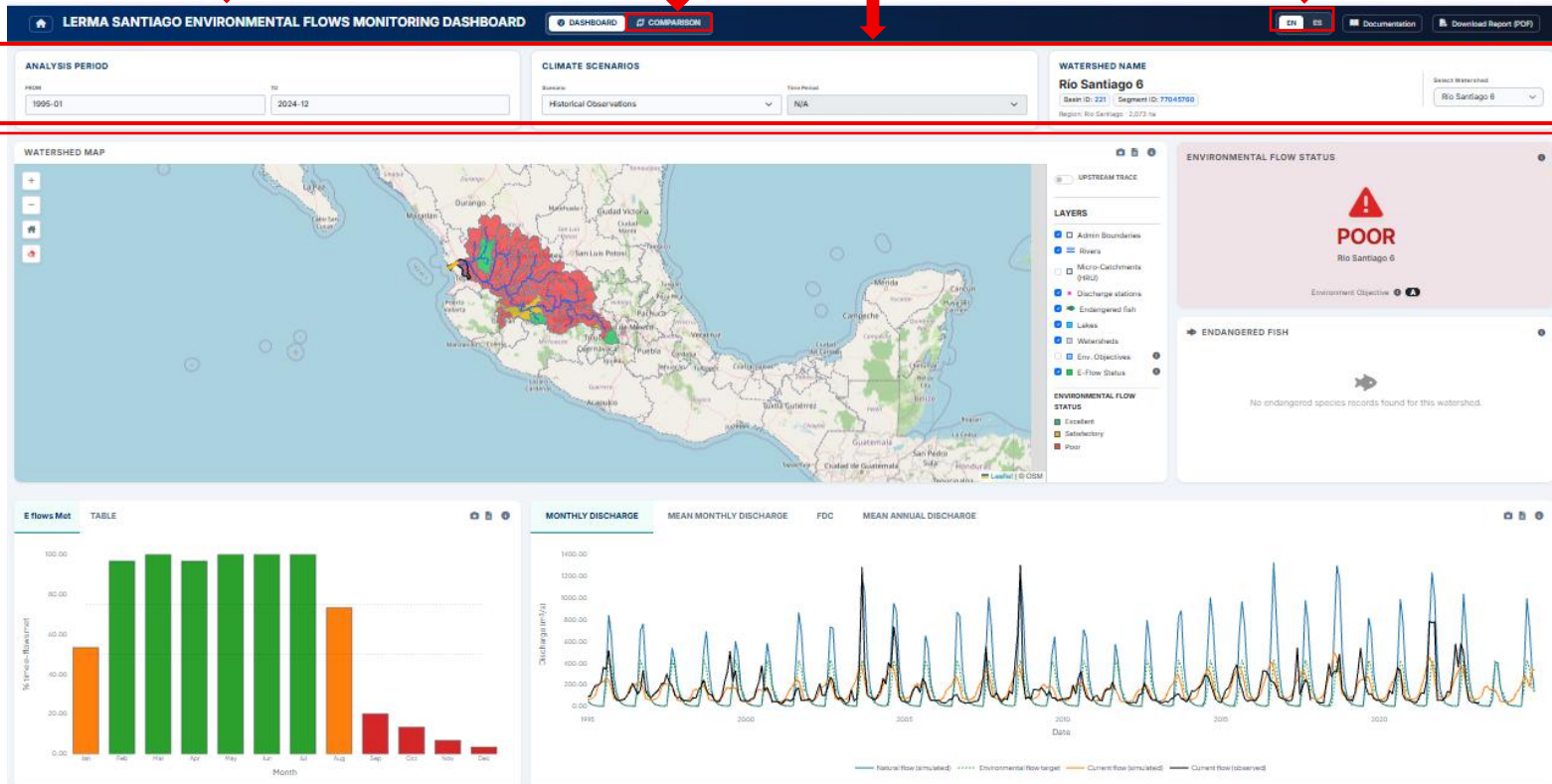
- A Home button (house icon) to return to the landing page.
- A Documentation button linking to this manual.
- A Download PDF button that exports the current dashboard view as a scientific PDF report.

Note: Most charts, map, and comparison cards now include their own camera and file icons for exporting individual figures and data; this is in addition to the full-page PDF export in the header.

Title Bar

Comparison
Tab

Filter Bar

Language
switch

Footer

Main
Content Area

3. Dashboard Controls

The top row of the Dashboard tab (Filter bar) contains three control cards used to define the data shown throughout the page: the analysis period, the climate scenario, and the active watershed.

3.1 Analysis Period

Use the FROM and TO month selectors to define the date range for the time-series charts and compliance calculations.

- Historical data is available from January 1995 to December 2024.
- The selected range updates all charts and the compliance status automatically.

3.2 Climate Scenarios and Model

The Scenario dropdown lets you choose the discharge basis used across the dashboard:

Scenario	Description
Historical	Observed/naturalized historical flow record (1995–2024); no GCM model required.
SSP126	Low-emissions climate change projection (2025–2035).
SSP245	Intermediate-emissions climate change projection (2025–2035).
SSP585	High-emissions climate change projection (2025–2035).

A second dropdown, TIME PERIOD, lets you focus the projection on a specific future horizon once a climate scenario is selected:

Time Period	Years Covered
Near Future	2025 – 2040
Mid Future	2041 – 2070
Far Future	2071 – 2100
Full Horizon	2015 – 2100

Note: When a climate change scenario (SSP126/245/585) is selected, the Model dropdown becomes active and lets you choose one of eight Global Climate Models (GCM1–GCM8) driving that scenario. For Historical, the Model field is disabled and shows N/A.

3.3 Selecting a Watershed

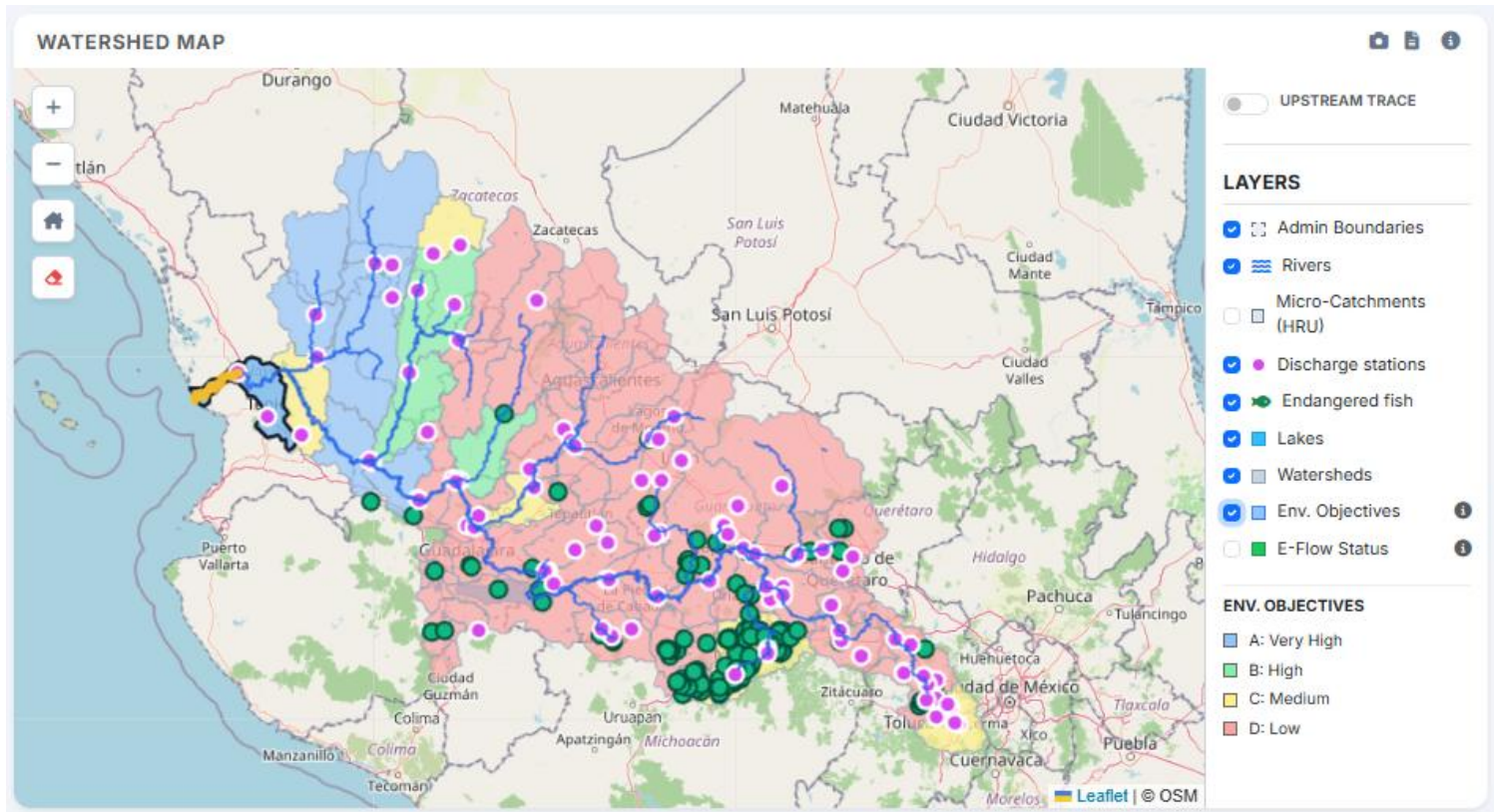
The Active Watershed card displays the currently selected sub-basin: its name, Basin ID, Segment ID, region, and area. To change the selection, use either method:

1. Click a sub-basin or river segment directly on the map (Section 4).
2. Use the Search Watershed field at the top right of the Active Watershed card, type a name or ID, and choose a match from the dropdown list that appears.

All other panels (map focus, status card, fish list, charts) refresh automatically to reflect the newly selected watershed.

4. The Watershed Map

The map panel is the primary spatial navigation tool. It renders 58 sub-basins and the river network, including hydrometric stations, water bodies, and upstream tracing:



4.1 Map Controls

Control	Function
+ (Zoom In)	Increases the map zoom level.
– (Zoom Out)	Decreases the map zoom level.
Home	Resets the map to its full default extent.
Eraser (Clear Selection)	Deselects the current watershed/segment.

4.2 Upstream Trace

Toggling UPSTREAM TRACE highlights all river segments and sub-basins located upstream of the currently selected point, which is useful for understanding cumulative watershed effects and identifying contributing areas.

4.3 Map Features

- River channels and tributaries are displayed as blue line features.
- Sub-watersheds are shown as polygon layers across the basin.
- Locations of endangered fish species are represented by point markers.
- River gauging stations indicate monitoring and discharge measurement locations.
- Environmental objectives and E-flow status are available as alternative thematic layers and can be viewed one at a time
- A built-in legend explains colour classifications
- Standard pan (click-drag) and zoom (scroll wheel or pinch) controls are available

4.4 Legend

A legend panel on the right side of the map explains the color coding used for river segments, sub-basin boundaries, and any active thematic layer.

4.5 Exporting the Map

The Watershed Map card header includes three icons: a camera (figure export), a document/lines icon (CSV data export), and an info icon (top right corner).

4.5.1 Scientific Map Figure Generator (camera icon)

Opens a dedicated modal for producing a publication-ready map figure. Available options include:

- Catchment / Subbasin: export all 58 sub-basins or a single selected catchment.
- Year / Date Range: A From/To month range, with quick presets: Full Period, Current Selection, Last 5 Years, Last 10 Years.
- Area Scope / View: Selected Catchment Only (isolated), Full Lerma-Santiago Basin, or Current Map View/Zoom.
- Thematic Layer Fill: E-Flow Compliance Status (Excellent/Satisfactory/Poor), Environmental Objectives (NMX-AA-159-SCFI-2012), or a plain hydrographic map with no fill.
- Hydrographic & Base Layers: toggle a base map (None, Light/Carto, OpenStreetMap, or Satellite) plus River Network, Micro-Catchments (HRU), Basin Boundaries, Lakes/Reservoirs, Gauging Stations, and Endangered Fish points.
- Scientific Annotations: Subbasin Info Card, Cartographic Legend, and Scale & North Arrow, each independently toggled.
- Format: PNG, JPEG, or PDF.
- Resolution: Standard (1x), Publication High-Def (2x), or Ultra 300 DPI Journal (3x).

A live preview updates on the right side of the modal as options change. Click Download Scientific Figure to export.

4.5.2 Download Spatial & Watershed Data (file icon)

Opens a modal for exporting the underlying data as a CSV file. Available options include:

- Data Scope: Selected Subbasin Only, or All 58 Subbasins Summary & Compliance.
- Time Resolution: Monthly Time Series, Annual Summary, or Both.
- Date Range: with presets for Full Period, Current Selection, Last 5/10/20 Years.
- Datasets to Include: Subbasin Metadata, Monthly Discharge & E-Flow Targets, Annual Aggregated Discharge & Volumes, Monthly Climatology/Seasonality, Flow Duration Curve percentiles, and Endangered Fish Species records — each toggled independently.
- Delimiter: comma or semicolon.
- Metadata Header: optionally include a commented header row with basin, scenario, and date information.

Click Download CSV File to export.

5. Environmental Flow Status and Compliance

5.1 How Compliance Is Assessed

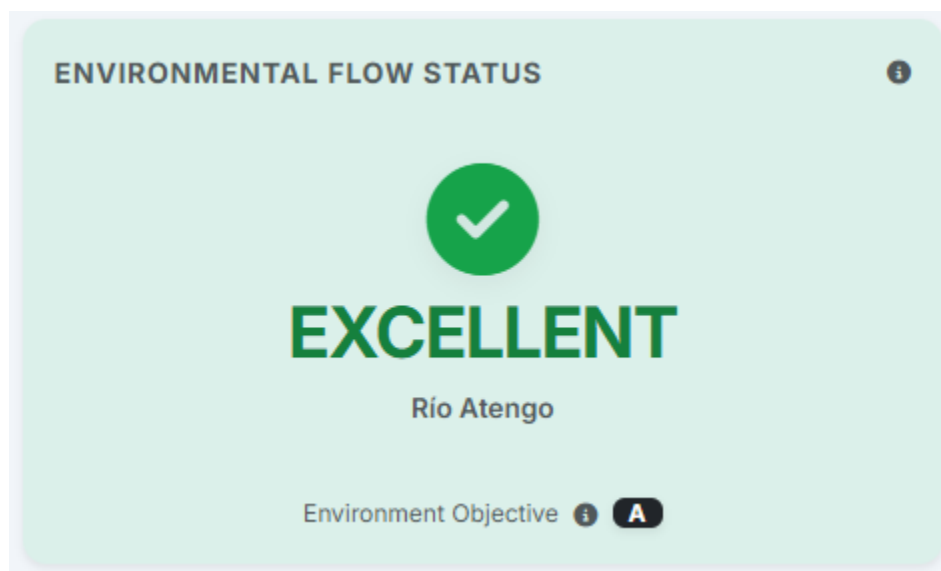
The platform evaluates environmental flow compliance using a four-step method:

3. Flow Modeling: Monthly naturalized flows are modeled, representing discharge without anthropogenic structures, diversions, or abstractions.
4. Environmental Flow Calculation: Recommended environmental flow targets are computed per the Mexican Norm NMX-AA-159-SCFI-2012, which assigns environmental objectives based on a combination of ecological importance and hydrological pressure.
5. Monthly Compliance: For each month, the observed/simulated flow (Q) is compared against two thresholds: the Recommended Environmental Flow and the Naturalized Flow.
6. Status Classification: The two compliance percentages are combined to assign a final status for the watershed.

5.2 Status Categories

Status	Criteria
Excellent	Environmental Flow Met $\geq 75\%$ AND Natural Flow Met $\geq 75\%$
Satisfactory	Environmental Flow Met $\geq 75\%$ AND Natural Flow Met $< 75\%$
Poor	Environmental Flow Met $< 75\%$

The Environmental Flow Status card on the dashboard's right-hand column displays the current watershed's status as a color-coded icon and label (green = Excellent, yellow = Satisfactory, red = Poor), along with the environmental objective assigned to that segment under the Mexican Norm:



6. Endangered Freshwater Fish Panel

The Endangered Fish card lists native freshwater fish species associated with the selected watershed, cross-referenced with:

- NOM-059-SEMARNAT-2010 — the Mexican official standard for species at risk.
- IUCN Red List conservation categories.

ENDANGERED FISH			
SPECIES	IUCN STATUS	MEXICAN CONSERVATION STATUS	NUMBER OF OCCURRENCE IN SUB WATERSHED
Neotoca bilineata	Endangered (EN)	in danger of extinction (P)	2
Skiffia lermæ	Endangered (EN)	Threatened (A)	1

Select a watershed to populate this list. Click a species entry to open a detail view with additional information relevant to ecohydrological management.

7. Charts and Data Tables

7.1 Compliance Chart / Table

The lower-left card shows the percentage of time environmental flow targets were met, by month, for the selected watershed and period. Use the tabs to switch between:

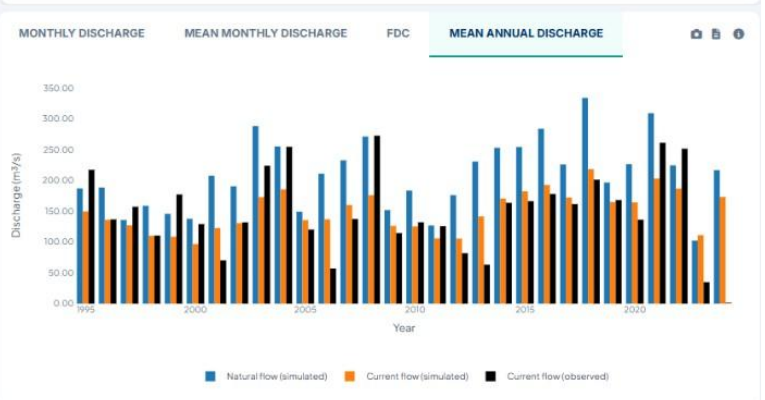
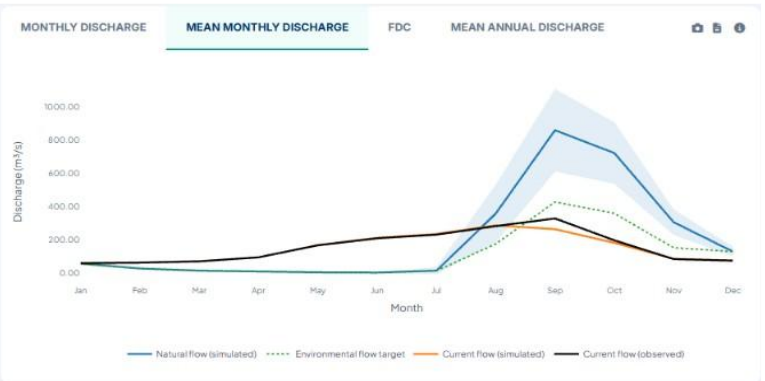
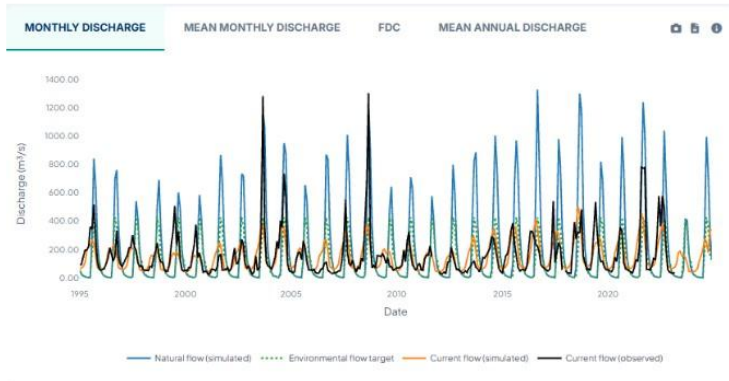
- Chart view: a monthly bar/line chart of % time compliant.
- Table view: the same data on a scrollable, month-by-month table.



7.2 Analytical Charts

The lower-right card provides four tabbed, in-depth hydrological views:

Tab	Shows
Monthly Discharge	Full time-series of monthly discharge over the selected analysis period.
Mean Monthly Discharge	Average seasonal flow regime (climatology) by calendar month.
FDC	Flow Duration Curve shows the percentage of time a given discharge is equaled or exceeded.
Mean Annual Discharge	Average discharge aggregated by year.



Note: Every card includes a small info icon ⓘ in its header. Click it to view a short explanation of that specific indicator or chart.

7.3 Exporting Charts and Tables

Both the Compliance card and the Analytical Charts card now include a camera icon and a file icon in their header, next to the info icon. These export whichever tab is currently active.

Download Figure (camera icon)

Opens a modal to export the active chart as an image or document:

- Chart to Export: a dropdown pre-filtered to the charts available in the active card/tab.
- Figure Title (optional): a custom title to print on the exported figure.
- Format: PNG, JPEG, SVG (vector), or PDF.
- Resolution: Standard (1200×600), High Def (2400×1200), or Ultra HD (3600×1800).
- Background: white or transparent.
- Include Title & Basin Metadata Banner and Include Legend — both optional toggles.

Download CSV Data (file icon)

Opens a modal to export the underlying chart data:

- Chart Data Source: select which chart's data to export.
- Time Resolution: Monthly, Annual, or Both.
- Date Range: with quick presets (Full Period, Current Selection, Last 5/10 Years).

- Columns / Series to Include: a checklist that adapts to the selected chart's available data series.
- Delimiter and metadata header options, matching the map CSV export.

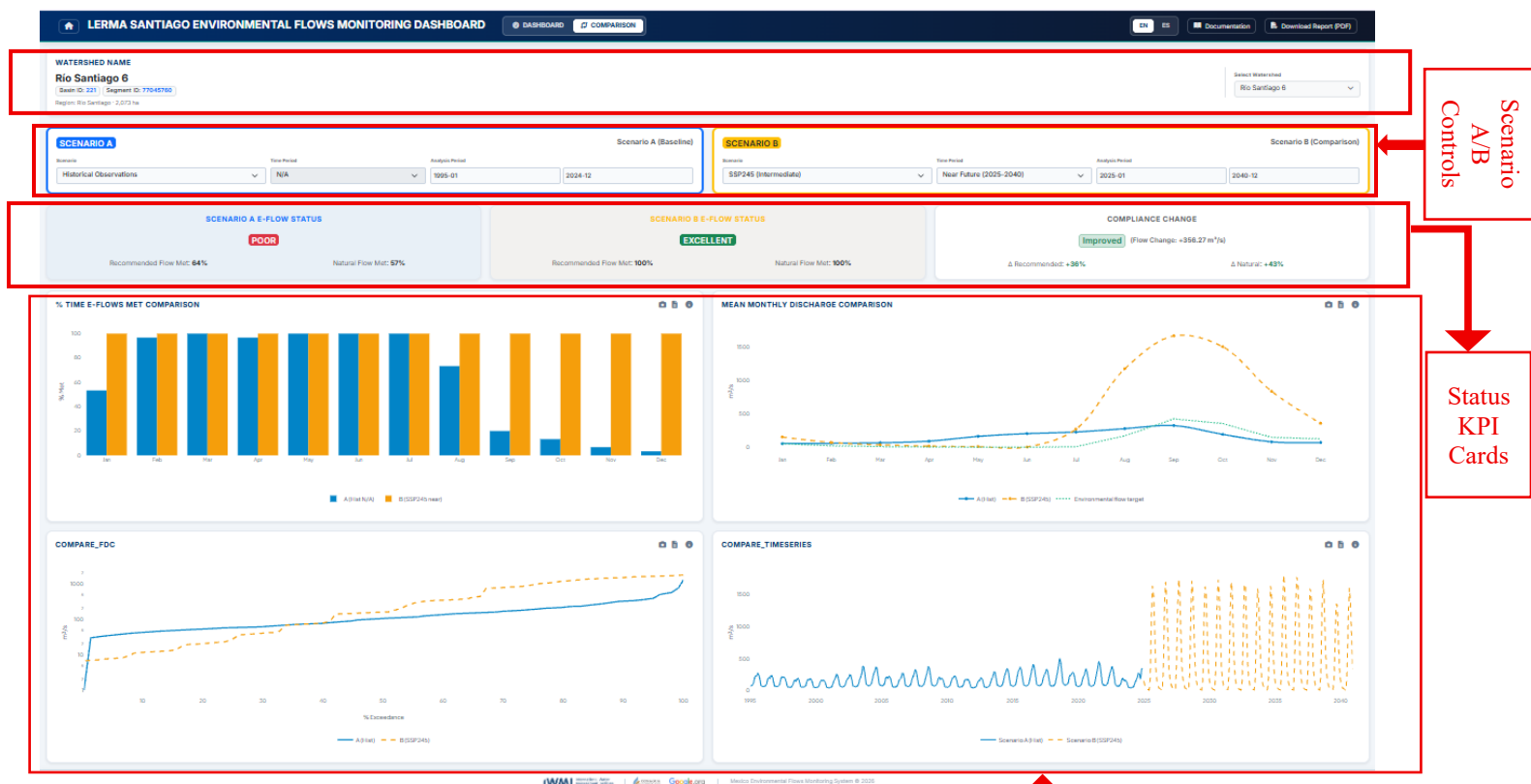
8. Scenario Comparison

The Comparison view is the second top-level tab in the dashboard header, located next to the DASHBOARD tab. It allows users to evaluate two independently configured scenarios (A and B) for the same watershed side by side, making it possible to compare, for example, historical conditions with a future climate projection or two different SSP pathways. Unlike the main Dashboard view, the Comparison view does not include a map and instead provides a dedicated analytics interface comprising shared KPI cards and four overlaid charts for directly examining differences between the two scenarios.

8.1 Navigating to the Comparison View

- Click the COMPARISON button in the top navigation bar (next to Dashboard) to switch views. The active tab is highlighted white against the dark header.
- The view is organized top-to-bottom into four sections: Watershed Context, Scenario A/B Controls, Status KPI Cards and the 2×2 Charts Grid.

Watershed Context



2×2 Charts Grid

8.1.1 Watershed Context & Search

A single full-width card at the top shows the watershed currently being compared:

- Selected Watershed — name of the active watershed.
- Basin ID and Segment ID badges.
- Región and area, shown as small, muted text below the badges.

On the right side of this card is a Search Watershed field:

- Type a name or ID into the input box.
- Click the chevron (▼) icon, or start typing, to open an autocomplete dropdown listing matching watersheds.
- Selecting an entry updates the watershed context and refreshes every downstream panel (KPI cards and all four charts) for both Scenario A and Scenario B.

Note: This search box is independent from the one on the Dashboard tab; selecting a watershed on one tab does not automatically change the other tab's selection in this source.

8.1.2 Scenario A and Scenario B Controls

Two side-by-side cards let you define the two scenarios being compared. They are visually distinguished by a colored left border and badge:

	Scenario A	Scenario B
Badge color	Blue ("SCENARIO A")	Yellow/amber ("SCENARIO B")
Label	Baseline	Comparison
Default Scenario	Historical	SSP245
Default Model	N/A (disabled)	GCM1
Default Period	Jan 1995 – Dec 2024	Jan 2025 – Dec 2035

Each card contains three controls:

- Scenario dropdown: Historical, SSP126, SSP245, or SSP585.
- Model dropdown: One of GCM1–GCM8. This is disabled automatically whenever "Historical" is selected (shown as N/A), since historical data doesn't depend on a climate model. It becomes active as soon as a climate-change scenario (SSP1xx/2xx/5xx) is chosen.

- Period fields (From / To): Two month-pickers. Scenario A is bounded to the historical range (1995–2024); Scenario B is bounded to the projection range (2025–2035), matching the min/max on each input.

Because A and B are configured independently, you can compare, for example:

- Historical vs. a future SSP scenario (the default setup).
- Two different SSPs against each other (e.g., SSP126 vs. SSP585) to see divergence between emissions pathways.
- Two different GCMs under the same SSP, to see model-driven uncertainty.

Changing any control in either card triggers a refresh of the KPI cards and charts below, there is no separate "Apply" button.

8.1.3 Status KPI Cards

Three cards summarize the comparison numerically:

1. Scenario A E-Flow Status (blue-tinted background)

- A status badge (Excellent / Satisfactory / Poor), matching the same compliance classification used on the Dashboard tab).
- E-Flow Met %: percentage of months meeting the recommended environmental flow target.
- Natural Met %: percentage of months meeting the naturalized flow threshold.

2. Scenario B E-Flow Status (amber-tinted background)

- Same three indicators, computed independently for Scenario B's chosen scenario/model/period.

3. Compliance Change (B – A) (neutral white card)

- A large delta value showing the percentage-point change in environmental flow compliance between B and A.
- An impact badge (e.g., "STABLE") that qualitatively labels the direction/magnitude of change, improving, declining, or stable, based on that delta.
- Flow Change, showing the absolute discharge difference between the two scenarios in m³/s.

This card set is the fastest way to see, at a glance, whether a future/alternative scenario represents an improvement or degradation relative to the baseline.

8.2 Setting Up a Comparison

1. Confirm or change the selected watershed using the search field at the top of the Comparison view.
2. Configure Scenario A (Baseline): choose its climate scenario, GCM model (if applicable), and analysis period.
3. Configure Scenario B (Comparison): choose its climate scenario, GCM model, and analysis period independently of Scenario A.

By default, Scenario A is set to Historical (1995–2024) and Scenario B is set to SSP245 with GCM1 (2025–2035), but both are fully customizable.

8.2 Reading the Comparison Results

Three KPI cards summarize the comparison:

- Scenario A E-Flow Status: status badge, Environmental Flow Met, and % Natural Flow Met for Scenario A.
- Scenario B E-Flow Status: the same indicators for Scenario B.
- Compliance Change (B – A): the percentage-point change in compliance and the absolute flow change (m³/s) between the two scenarios, with an impact badge (e.g., Stable, Improved, Declined).

8.3 Comparison Charts

Four charts, arranged in a 2×2 grid, visualize the differences between Scenario A and Scenario B:

Chart	Purpose
% Time E-Flows Met Comparison	Compares monthly compliance rates between the two scenarios.
Mean Monthly Discharge Comparison	Compares seasonal flow regimes side by side.
Flow Duration Curve (FDC) Comparison	Compares the overall flow distribution of each scenario.
Monthly Discharge Time Series Overlay	Overlays the full discharge time series of both scenarios for direct visual comparison.

8.4 Exporting Comparison Charts

Each of the four comparison charts now has its own camera, file, and info icons in its card header, working the same way as the Dashboard tab's chart export tools described in Section 7.3:

- Camera icon opens the Download Chart Figure modal, pre-selected to that chart, with format, resolution, background, title, and legend options.
- File icon opens the Download Chart Data (CSV) modal, pre-selected to that chart, with time resolution, date range, and series-selection options.
- Info icon opens a short explanation of that specific comparison chart.

9. Exporting a Full PDF Report

From the Dashboard tab, click Download PDF in the header to generate a print-ready scientific report of the current view (selected watershed, period, scenario, status, and charts). The exported layout is optimized for A4 landscape printing; interactive-only elements (language switcher, search box, info buttons) are automatically hidden in the exported version.

Tip: Set your period, scenario, and watershed selections before exporting, since the PDF captures the dashboard exactly as currently configured.

10. Troubleshooting and FAQ

The status card shows “INITIALIZING...”

This is the default state before a watershed has finished loading. Select a watershed on the map or via search; the status will update automatically once data loads.

The Model dropdown is disabled

The GCM Model selector is only active for climate change scenarios (SSP126, SSP245, SSP585). It is intentionally disabled and set to N/A when Historical is selected, since historical data does not depend on a climate model.

The Endangered fish list is empty

Select a watershed first, the Endangered Fish panel is populated based on the active watershed selection.

Charts appear blank after changing the period or scenario

Charts refresh automatically after any control change. If a chart remains blank, confirm that a watershed is selected and that the chosen date range falls within the supported bounds (1995–2024 for Historical; 2025–2035 for climate scenarios).

