PEDERNALES RIVER WATER QUALITY MONITORING AND MODELING

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LCRA Water Quality Protection

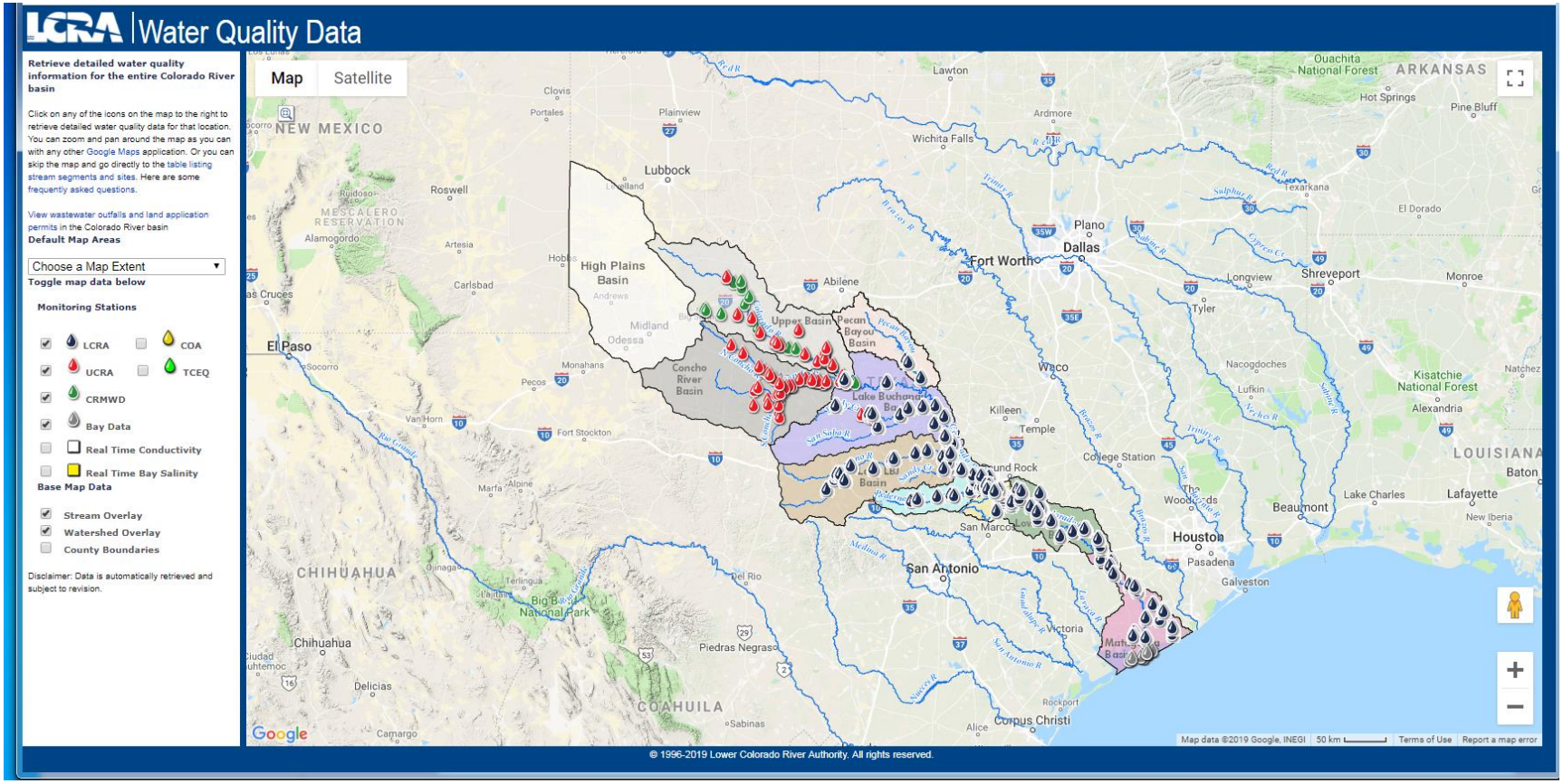
ENERGY • WATER • COMMUNITY SERVICES

Agenda

Focus on the Pedernales River

- LCRA water quality monitoring:
  - Where, when, what, why
  - Data review
  - Trend analysis
- LCRA water quality modeling:
  - What, why, which model
  - Example scenario
  - Future directions

Monitoring: Where



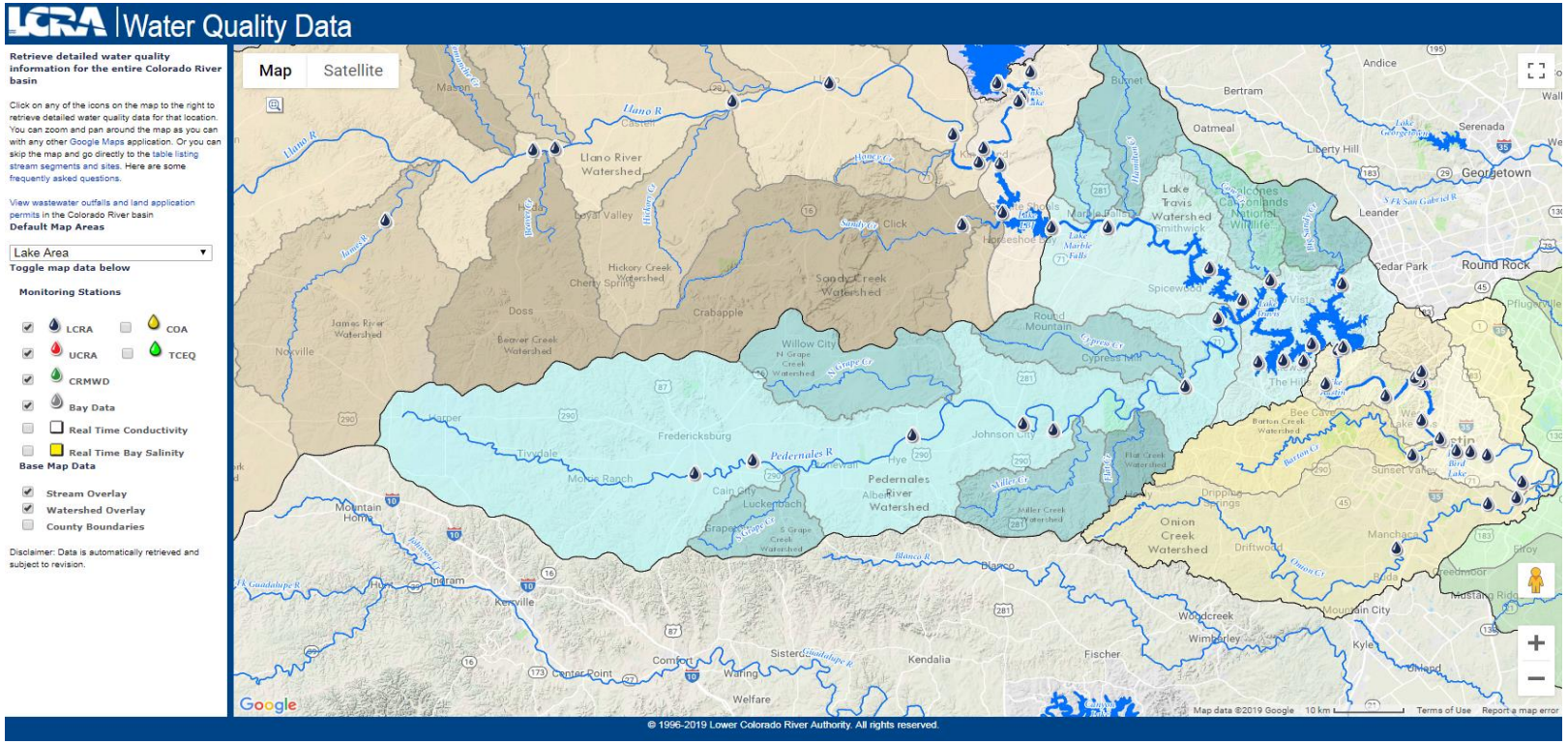
waterquality.lcra.org

Monitoring: Where

- Five current locations on the Pedernales River (plus one in the Pedernales arm of Lake Travis)
  - U.S. 87 crossing
  - Goehman Lane crossing
  - FM 1320 crossing
  - Pedernales Hills Road crossing
  - Hamilton Pool Road crossing

Monitoring: When

- Every other month (six times per year) at each of five active monitoring sites



Monitoring: What

- Temperature
- Dissolved oxygen
- pH
- Turbidity
- Total dissolved solids
- Total ammonia
- Specific conductance
- Alkalinity
- Total Kjeldahl nitrogen
- Nitrite plus nitrate
- Total phosphorus
- Chlorides
- Sulfate
- Total suspended solids
- Chlorophyll-A

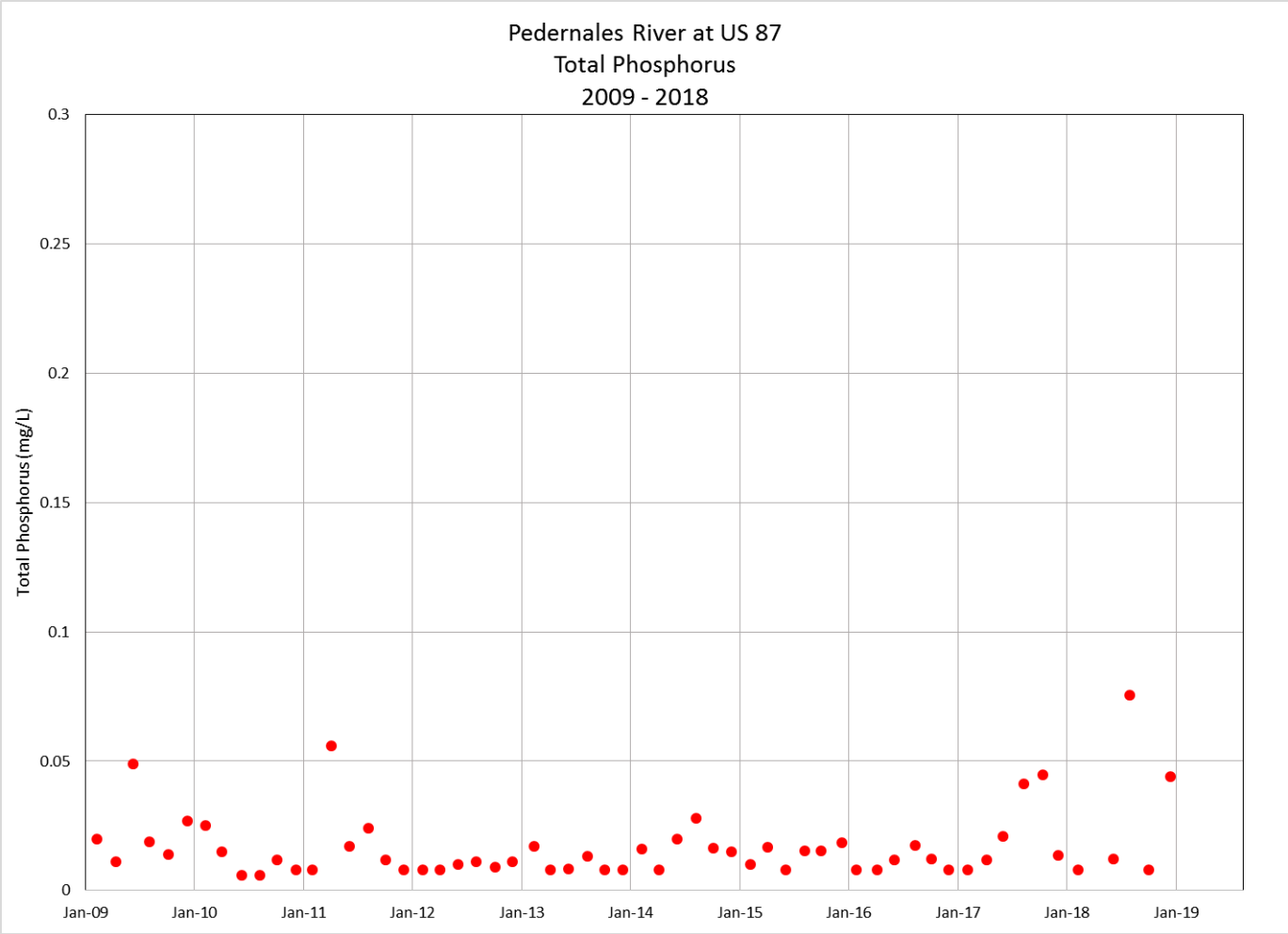
Monitoring: Why

- A “fitbit” for water
- Snapshot in time of overall health and composition of our streams, rivers and lakes
- Objective evidence to support decision making
- Identify current or emerging issues
- Evaluate compliance with Texas surface water quality standards
- Help protect other beneficial uses of water

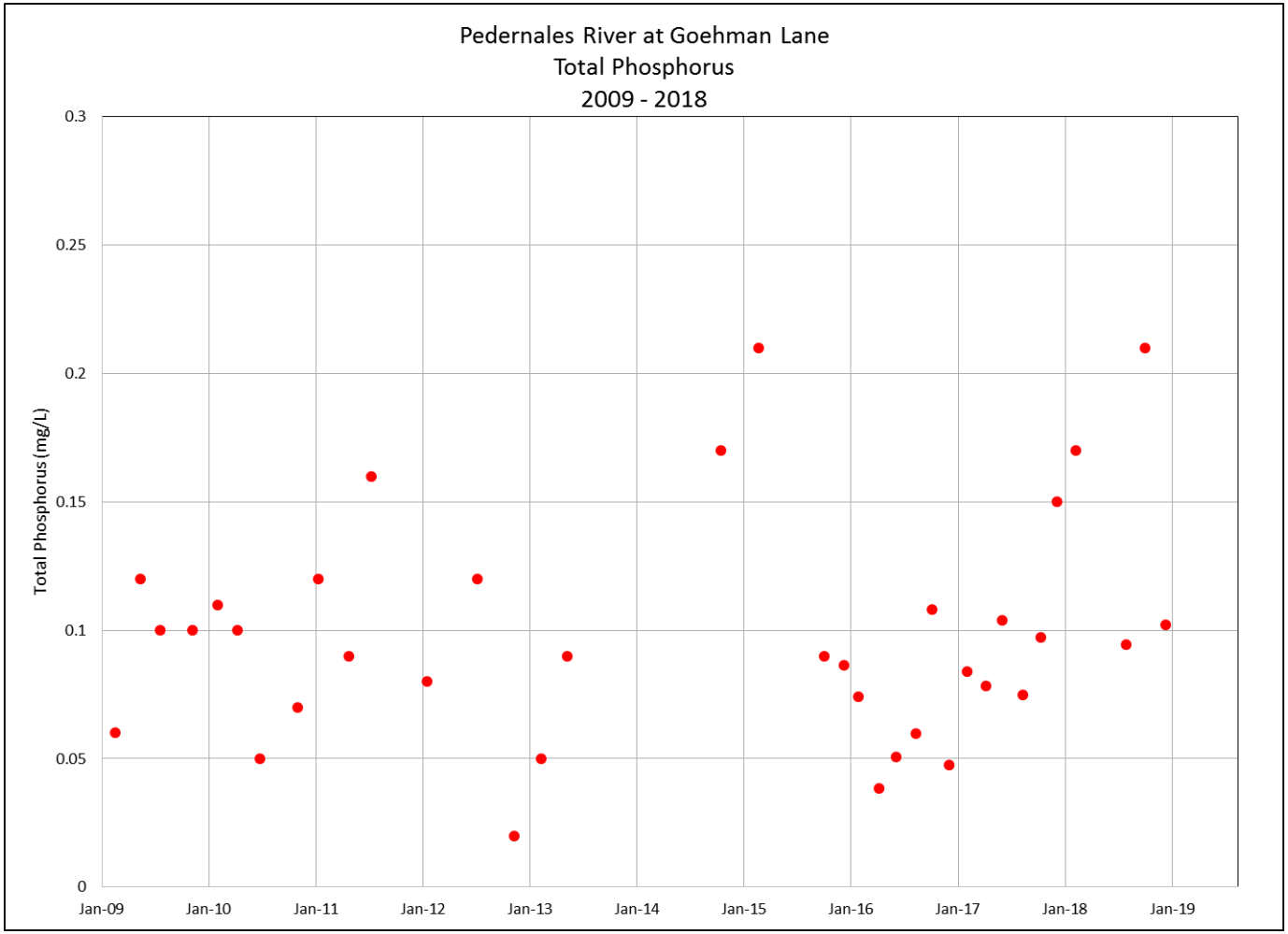
Monitoring: Data Review

- Total phosphorus (TP) data from 2009-2018
- Graphical analysis
  - Scatterplots
  - Boxplots

Data Review: Scatterplots



Data Review: Scatterplots



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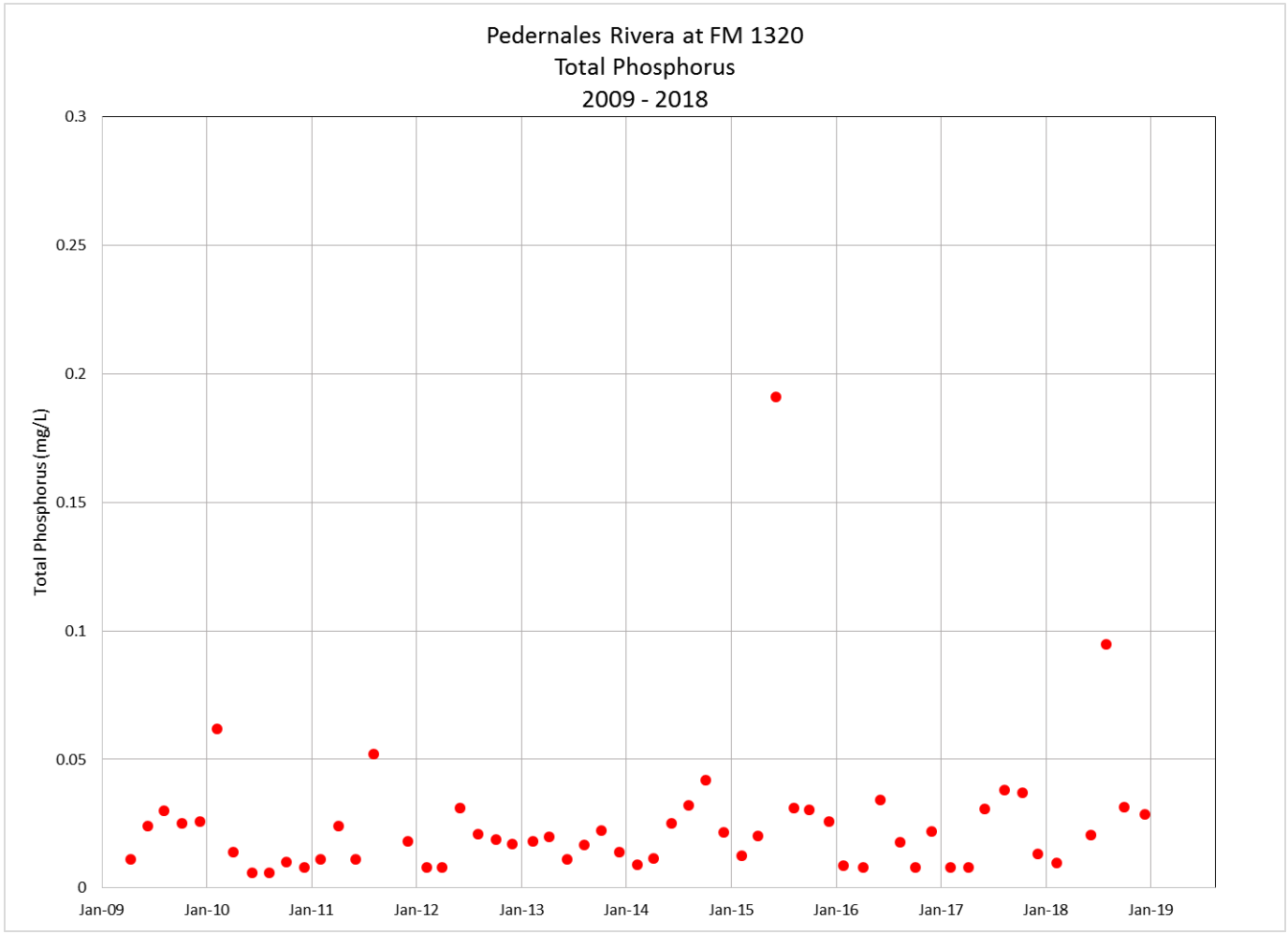

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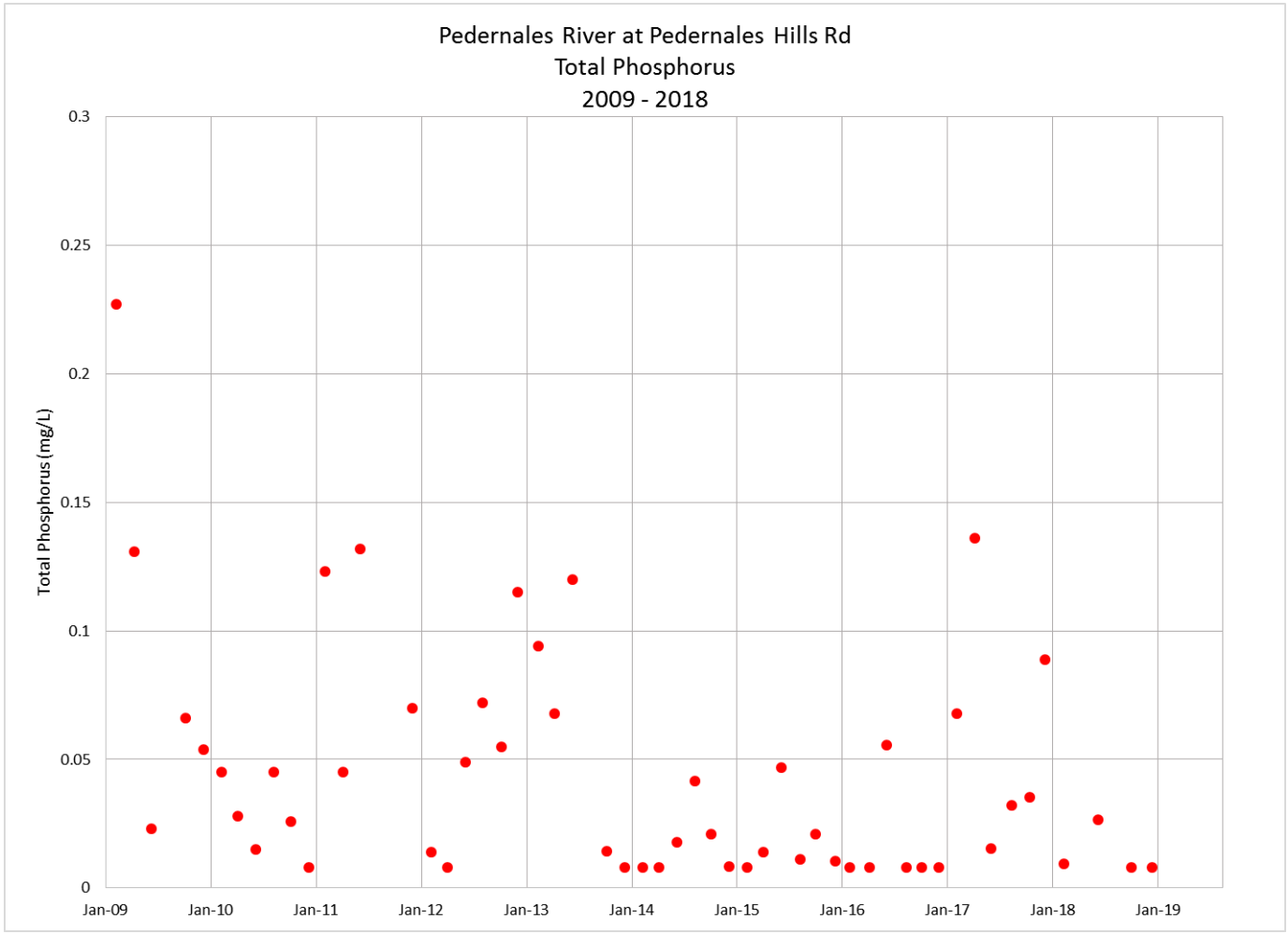

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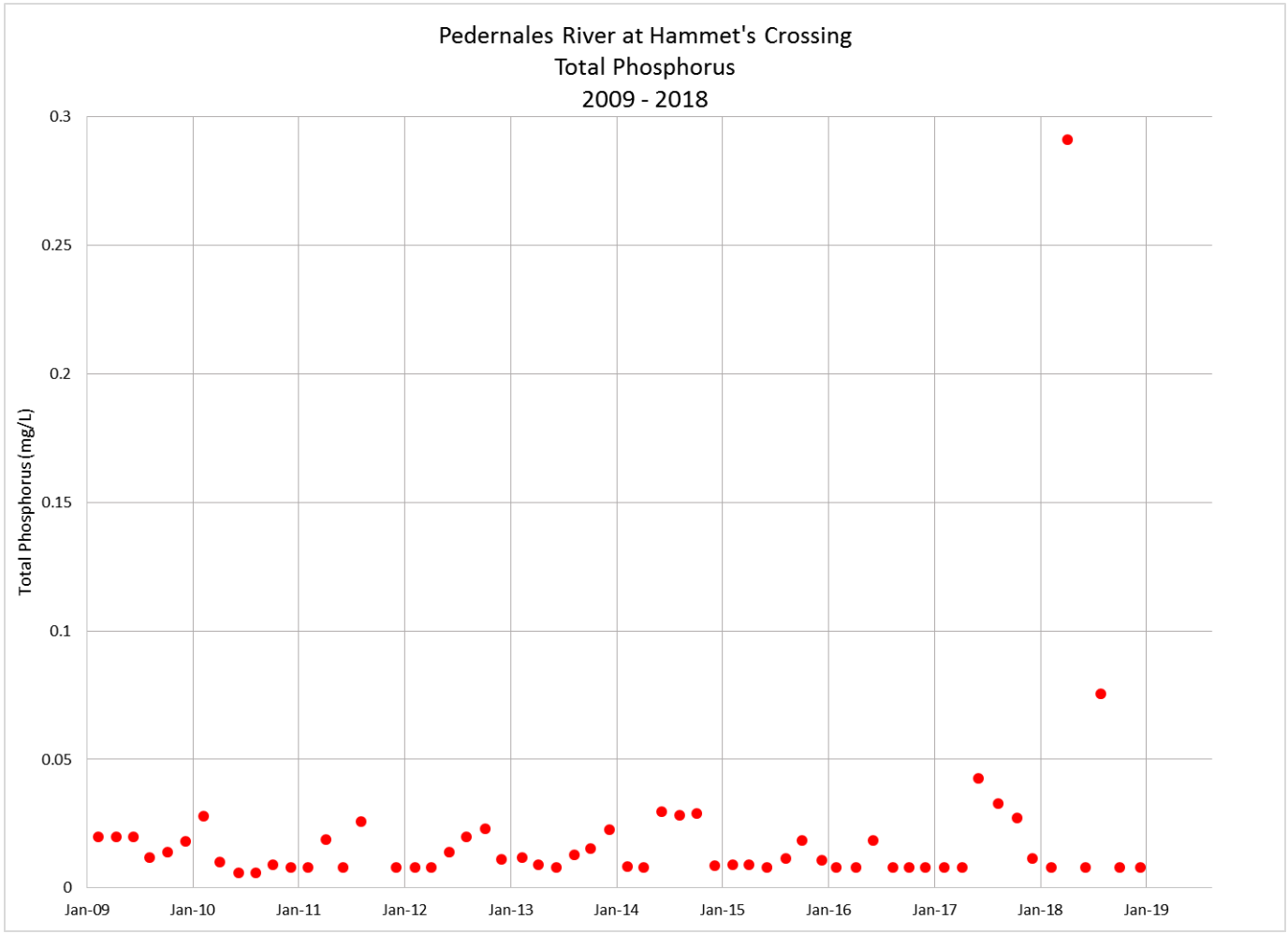
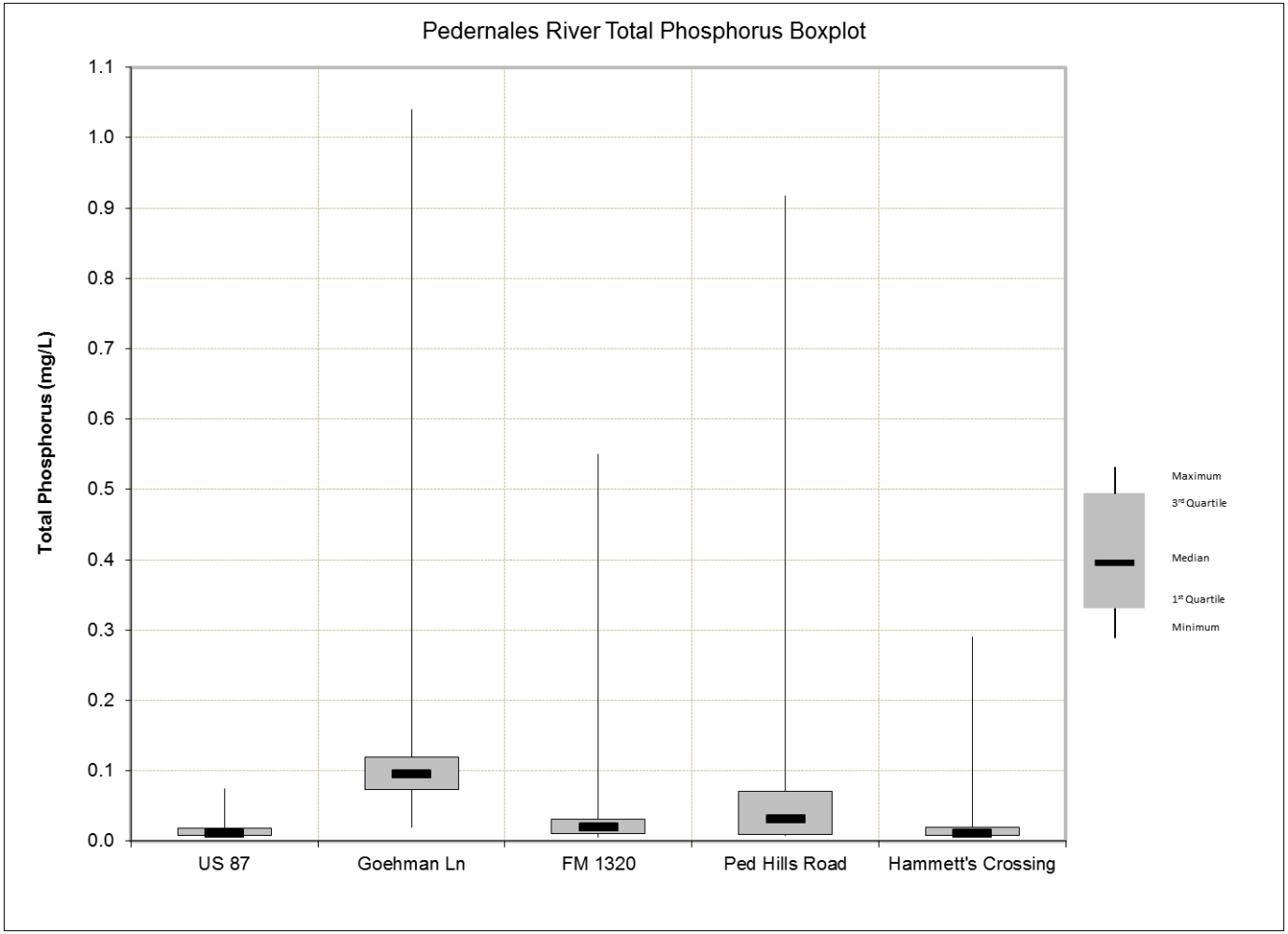
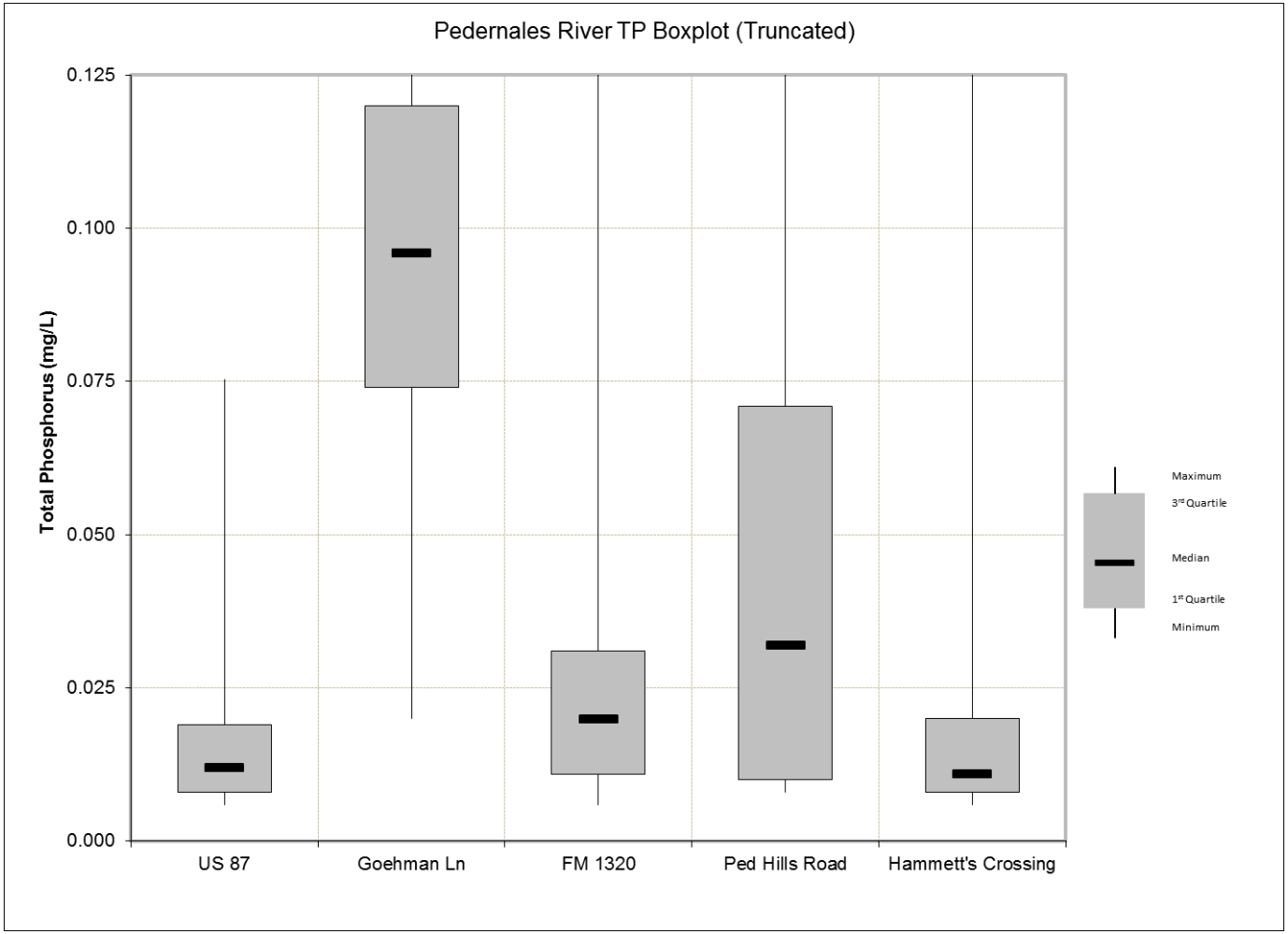


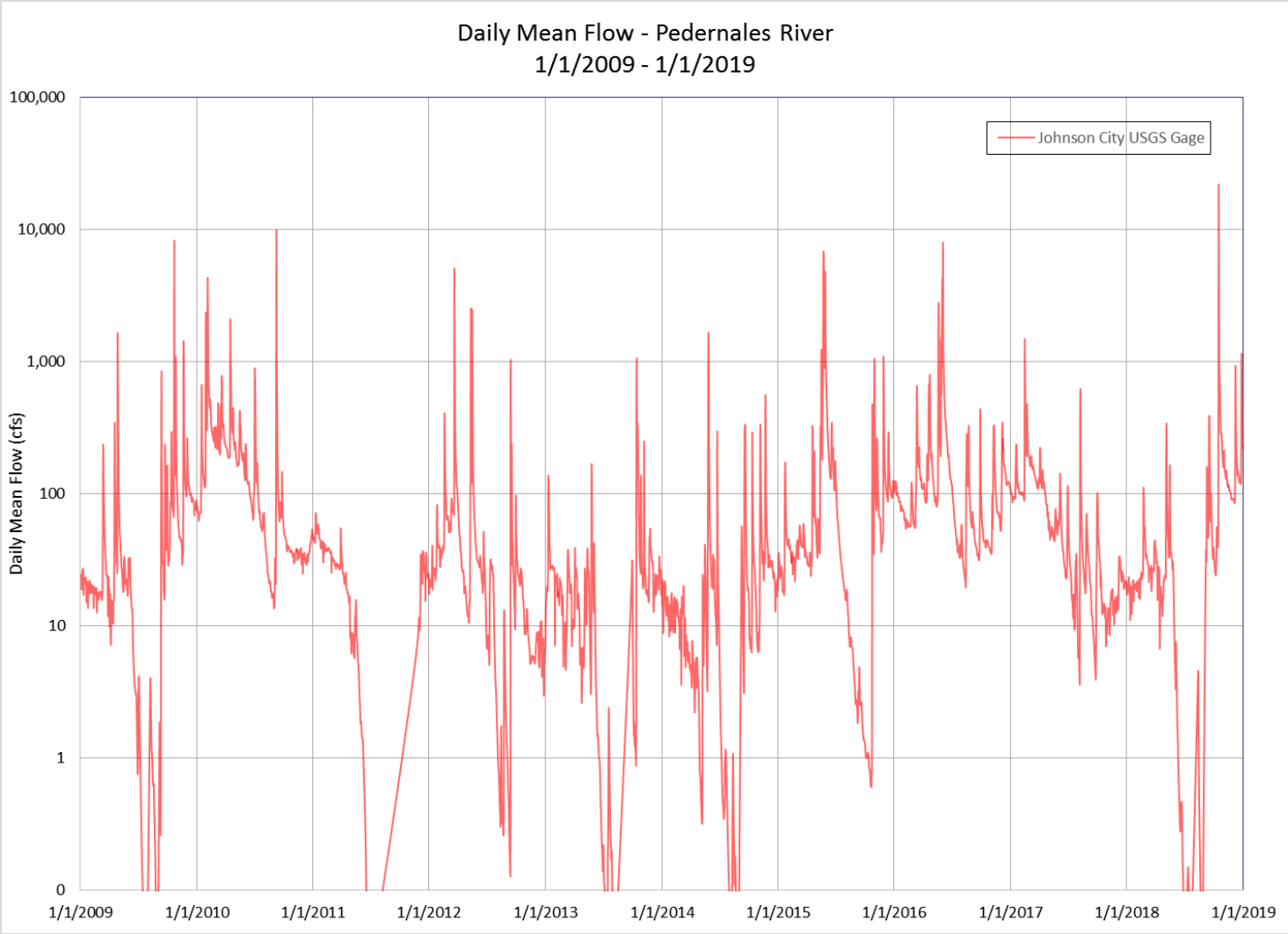
Data Review: Boxplots



Data Review: Boxplots



Data Review: Flow



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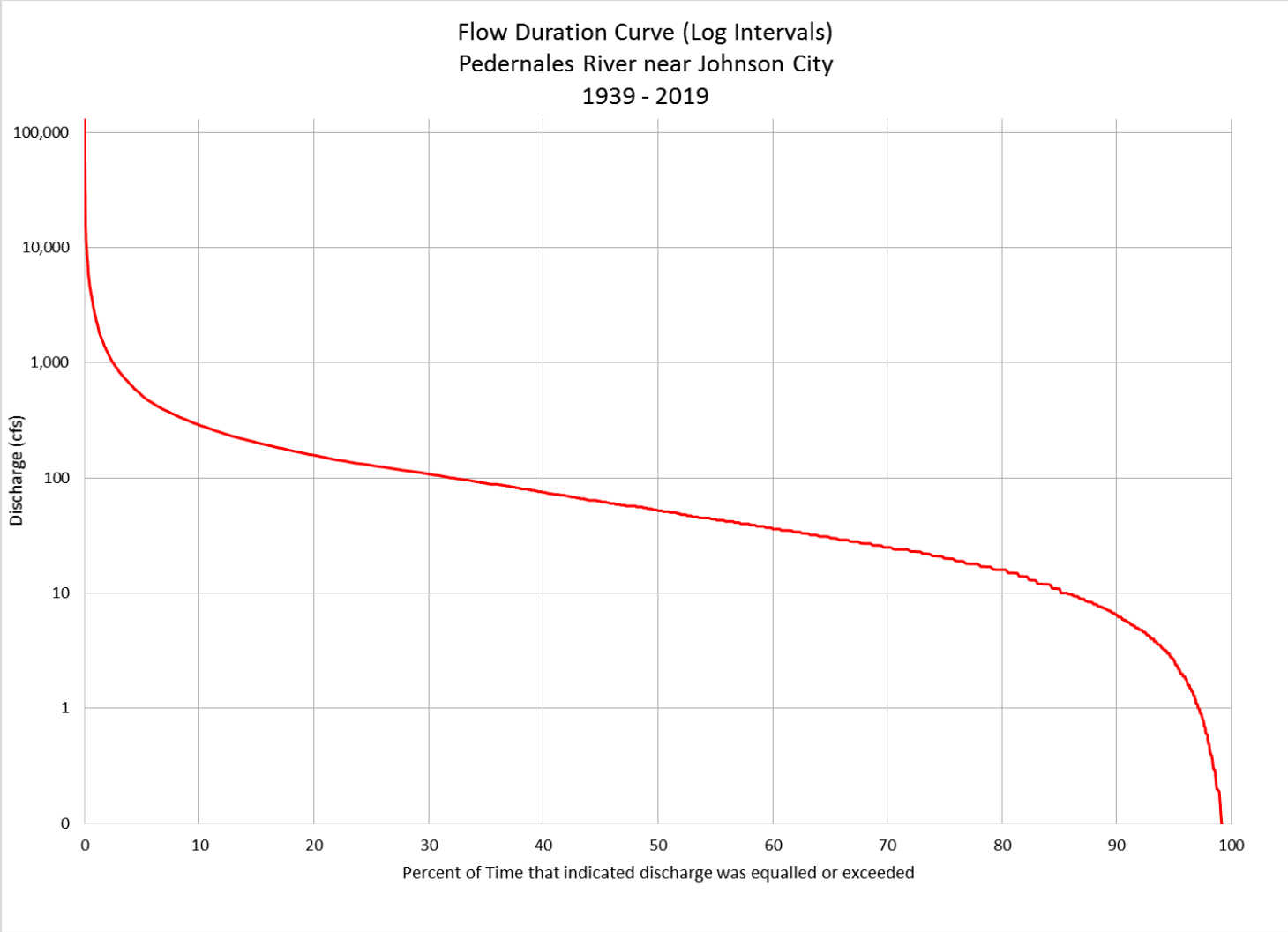


Trend Analysis: What is it?

- Trend analysis looks for changes in environmental parameters over time periods (e.g. last 10 years) or is space (e.g. as you move downstream)
- Trends can be gradual (monotonic trend) or abrupt (step trend)
- More effective with longer, consistent periods of record
- Seasonality is not a trend

Trend Analysis: How to Find a Trend

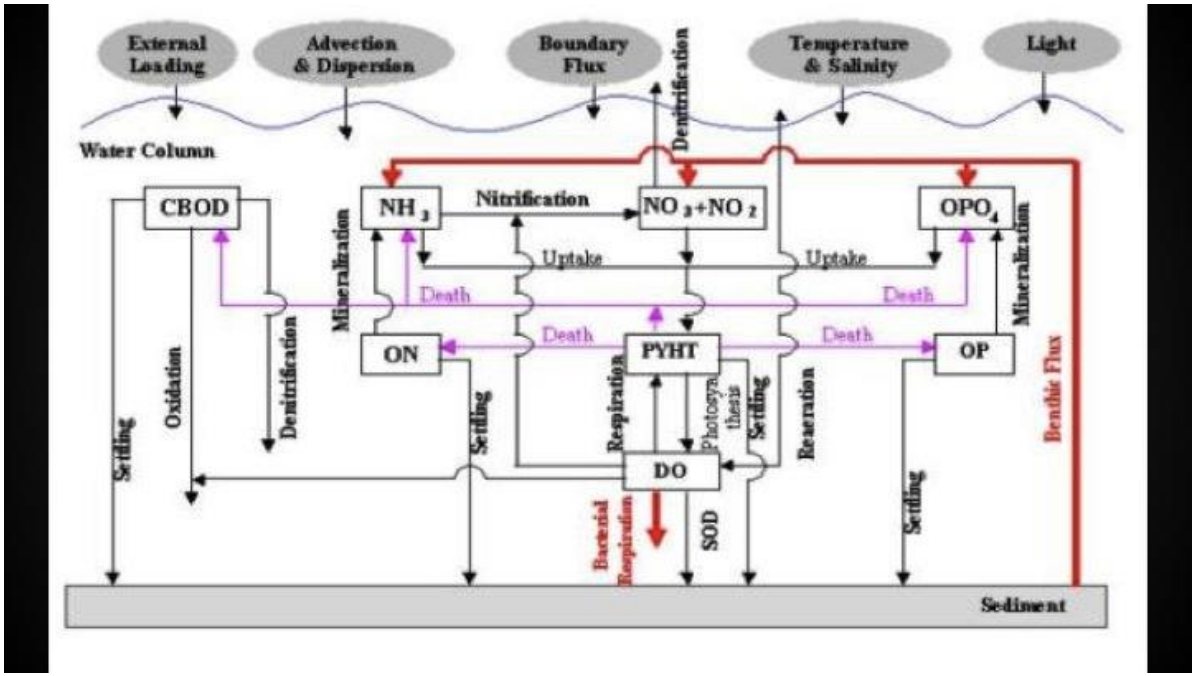
- Problems with graphical methods:
  - Easy to see distinct trends, hard to spot gradual trends
  - Human eye is drawn to outliers and not on subtle changes
- Statistical:
  - Can identify and quantify hard to see trends
  - Easy to do wrong and difficult to present

Trend Analysis: Method and Results

- Nonparametric Mann-Kendall Test – each later measured value is compared to all values measured earlier
- For Pedernales sites, total phosphorus and total nitrogen were analyzed from 2009 - 2018
- At 5% significance level (95% confidence level) no statistically significant trend was found
- Finding no trend may only mean the data was insufficient to find the trend, or there was too much natural variability

Water Quality Modeling: What is a Water Quality Model?

- Collection of mathematical equations that translates a conceptual understanding of a system or process into quantitative terms



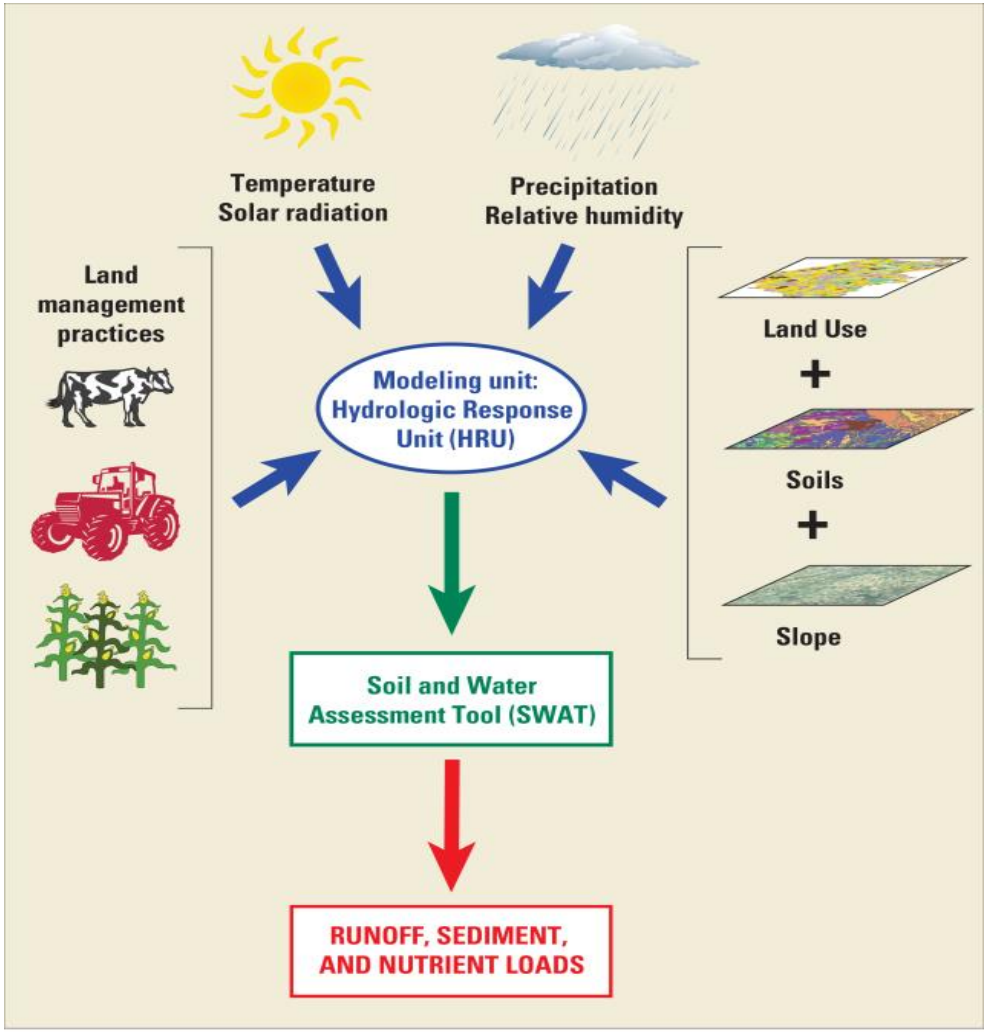
Modeling: Why

- Improves our understanding of processes and the system as a whole
- Integrated with monitoring to provide better information
- Assesses potential scenarios (what if's)
- Anticipates system responses
- Determines causes of environmental issues

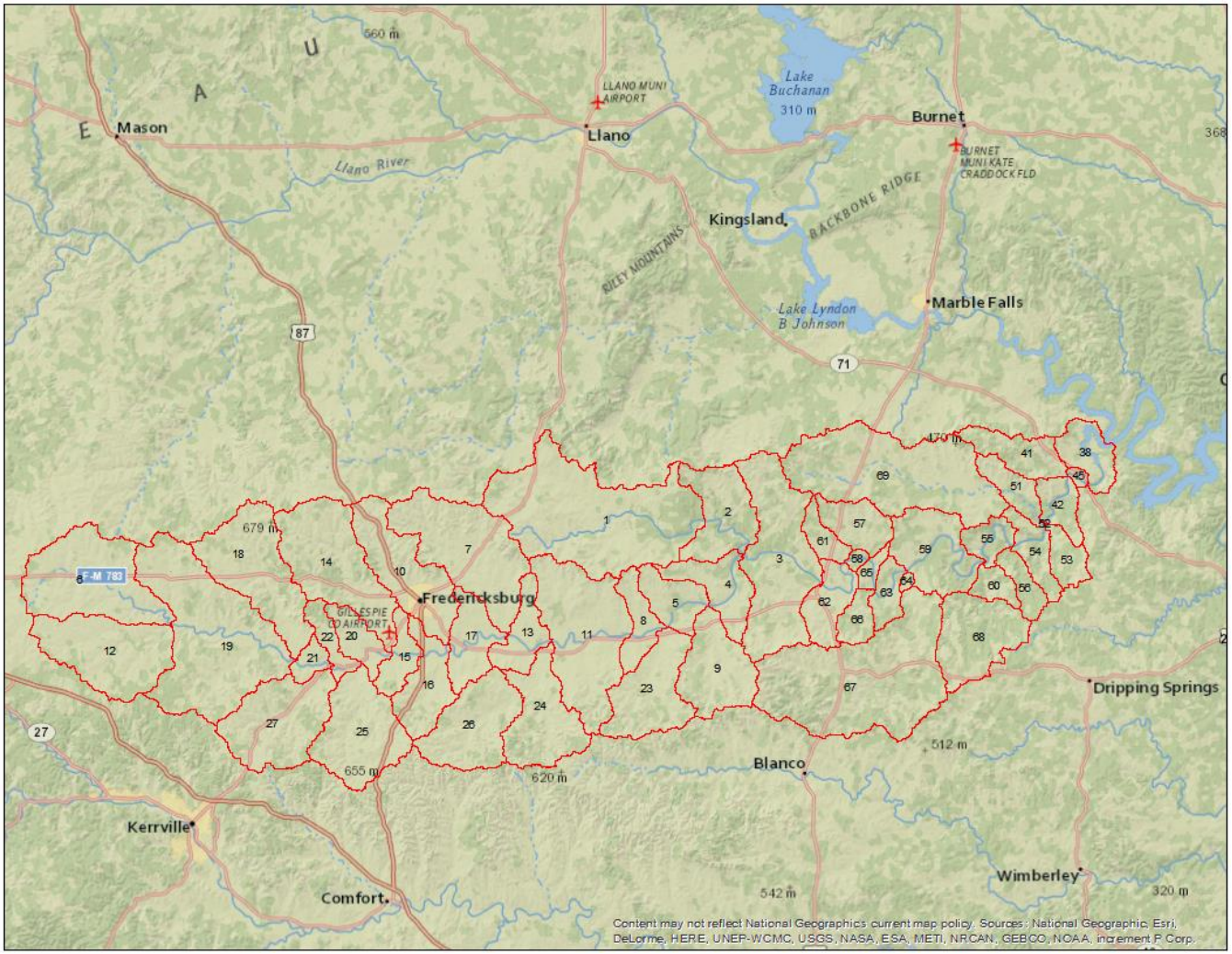
Modeling: Which Model is Used

- Public domain
- Physically based – readily available input
- Continuous, long-term yield model

Modeling: SWAT Inputs and Outputs



Pedernales River Watershed SWAT Subareas



Modeling: Example Scenario Run Results

Scenario: 10% increase in impervious cover over the entire watershed

For subareas:

- Average yearly phosphorus and nitrogen loads increased about 7%

In the river at the confluence with Lake Travis:

- Average yearly phosphorus loads increased about 15%
- Average yearly nitrogen loads increased about 20%

Modeling: Items of Note

Modeling has shown:

- Hill Country streams, rivers and lakes have a very limited ability to assimilate (process) nutrients
- Point-source discharges have a greater impact on water quality than other potential nutrient sources
- Cumulative effects of small increases can create water quality issues downstream

Modeling: Ongoing and Future Work

- SWAT web-based platform – more accessible to public – will include:
  - Ready-to-run calibrated models
  - Analysis for all or just a portion of watershed
  - Ability to quickly run “what if” scenarios
  - Automatically generated output charts for easier graphical analysis
- New model (WASP) under development for instream processes

Questions?

“It is impossible to live on this land without being a part of it, and without being shaped by its qualities.”
- Lyndon Baines Johnson