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Your Trusted
Water Resource

Comprehensive Nutrient Data Collection to Establish Baseline Conditions

Elizabeth Edgerton, Natalie Hickman, and Jack Frank; GBRA Water Quality

Overview

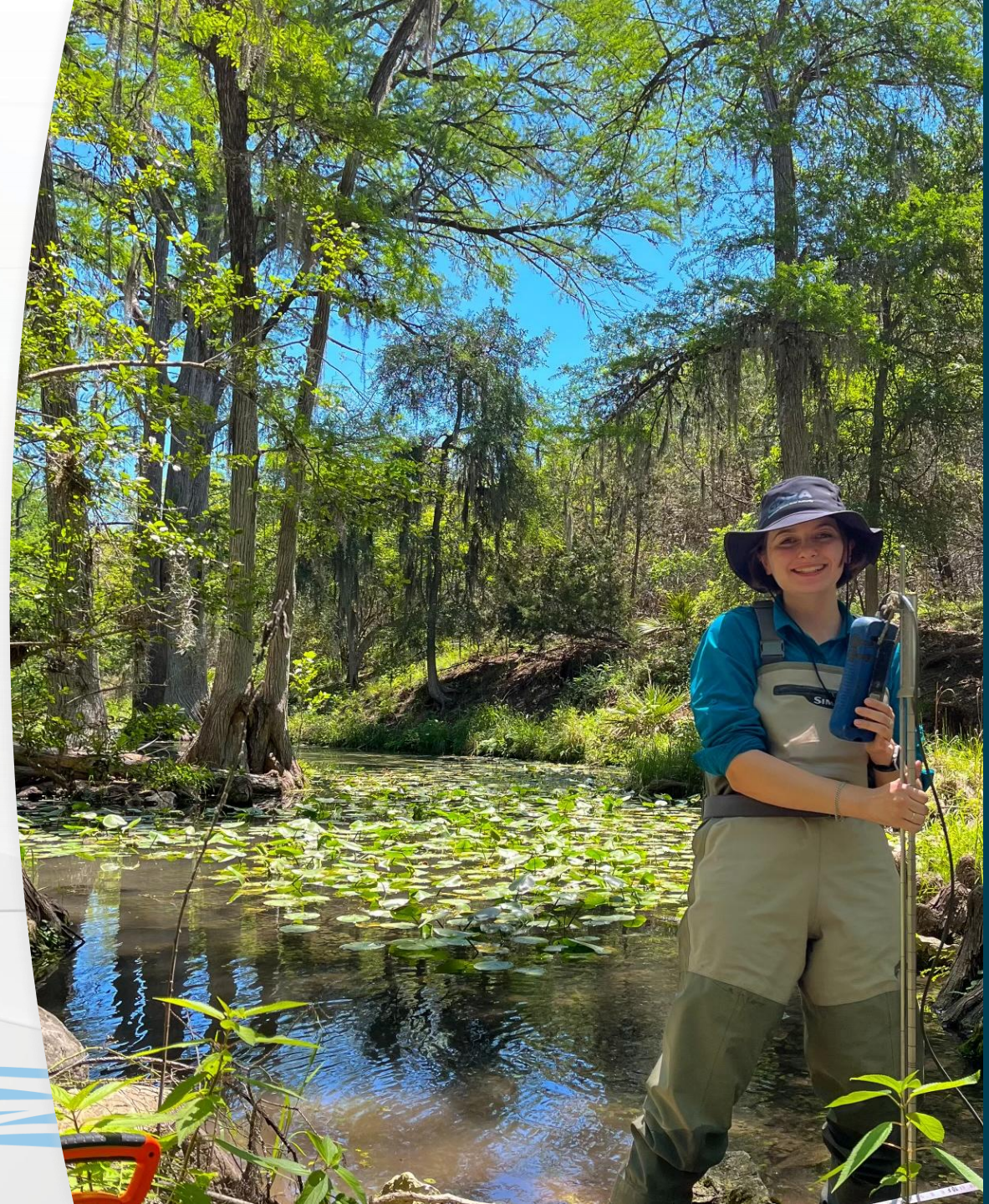
- What, Why, and How
- Special Considerations – TP Sampling
- Where – Site Locations
- Next Steps
- Periphyton – What Is It?
- Procedure Development & Implementation
- Final Thoughts

Why Focus on Nutrients?

- Nutrients in streams can lead to excess algal blooms and eutrophication
- Recurring topic in the media
  - Summertime algae blooms
- Utility but also an environmental stewards
  - Be proactive rather than reactive
- Inform conversation with data
  - Facts vs. Feelings
- Can’t prioritize streams without robust data

Water Quality Data Collection

- Data collection began in the 1980s
- Joined CRP at inception
- WPP monitoring
- Limited sampling sites
  - Funding
  - Personnel



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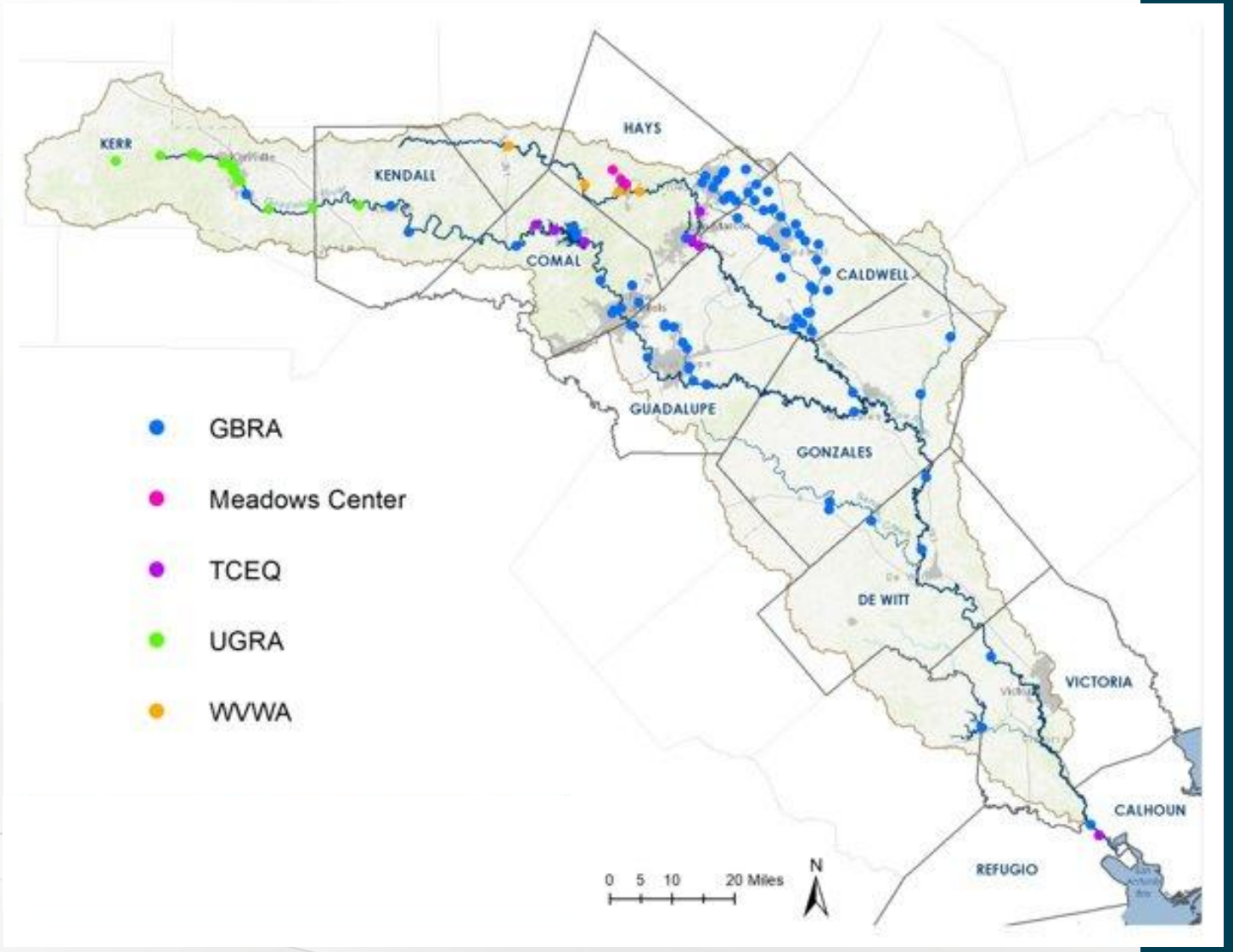
Basin Wide Sampling Efforts



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Project Development

- Priorities in Data Collection:
  - Upstream and downstream of point source discharges
  - Sample springs where able
  - Septic and other NPS
- Hill Country Sampling
  - Kerr County
  - Later added San Marcos River
- Total Phosphorus
- Nitrate
- Nitrite
- Total Kjeldahl Nitrogen
- Chlorophyll a/ Pheophytin
- Field data using YSI probe
  - Temperature, DO, pH, conductivity, salinity

Project Development

Standard Operating Procedure (SOP)

- Developed to ensure data integrity and continuity between partners

Project Partners

- UGRA
- GBRA Lab
- Back Up Lab

Discussions with TCEQ throughout later planning process

- Useful insights and suggestions
- Periphyton method

Special Considerations: TP

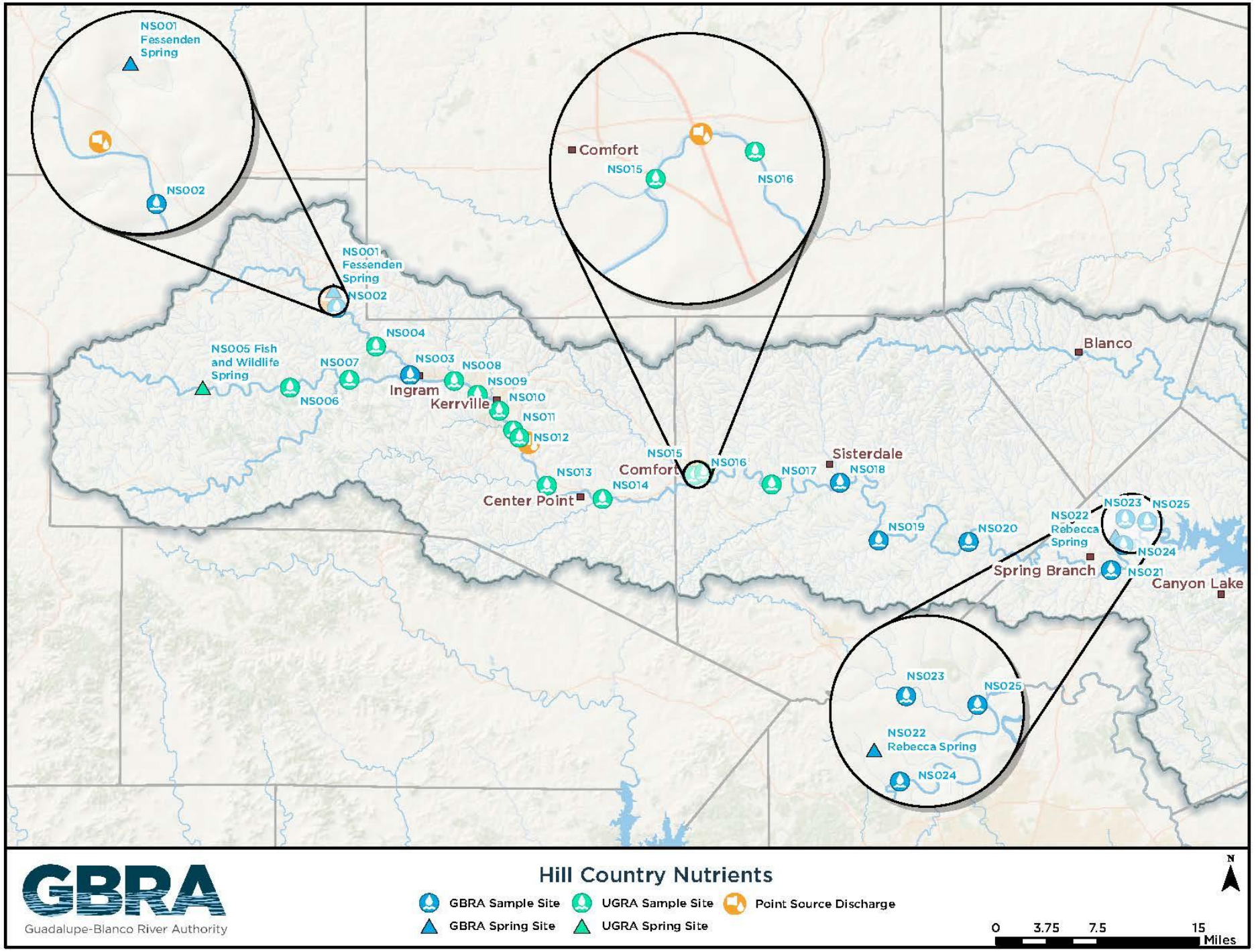
- Total Phosphorus – a limiting nutrient for algae growth
- Current lower detection limit in GBRA lab: 0.02 mg/L
- Data below the LOQ not reportable to TCEQ

Guadalupe River at FM 474 in Kendall County

6/5/2019	11:07	Total Phosphorus	< 0.020	mg/L
9/9/2019	10:48	Total Phosphorus	< 0.020	mg/L
12/16/2019	11:02	Total Phosphorus	< 0.020	mg/L
3/2/2020	10:28	Total Phosphorus	< 0.020	mg/L
6/1/2020	11:17	Total Phosphorus	0.033	mg/L
10/28/2020	10:15	Total Phosphorus	< 0.020	mg/L
2/10/2021	13:00	Total Phosphorus	< 0.020	mg/L
5/10/2021	13:15	Total Phosphorus	< 0.020	mg/L
7/14/2021	12:01	Total Phosphorus	< 0.020	mg/L
10/26/2021	11:48	Total Phosphorus	< 0.020	mg/L
1/19/2022	11:15	Total Phosphorus	< 0.020	mg/L
4/21/2022	11:34	Total Phosphorus	< 0.020	mg/L
7/14/2022	10:35	Total Phosphorus	< 0.020	mg/L
11/21/2022	11:14	Total Phosphorus	< 0.020	mg/L
2/21/2023	10:30	Total Phosphorus	< 0.020	mg/L
5/24/2023	11:53	Total Phosphorus	0.02	mg/L
8/24/2023	13:10	Total Phosphorus	0.032	mg/L
10/9/2023	11:23	Total Phosphorus	0.028	mg/L

Upper Guad. River Sampling

- 8 CRP sites
- 23 new river sites
- 3 springs



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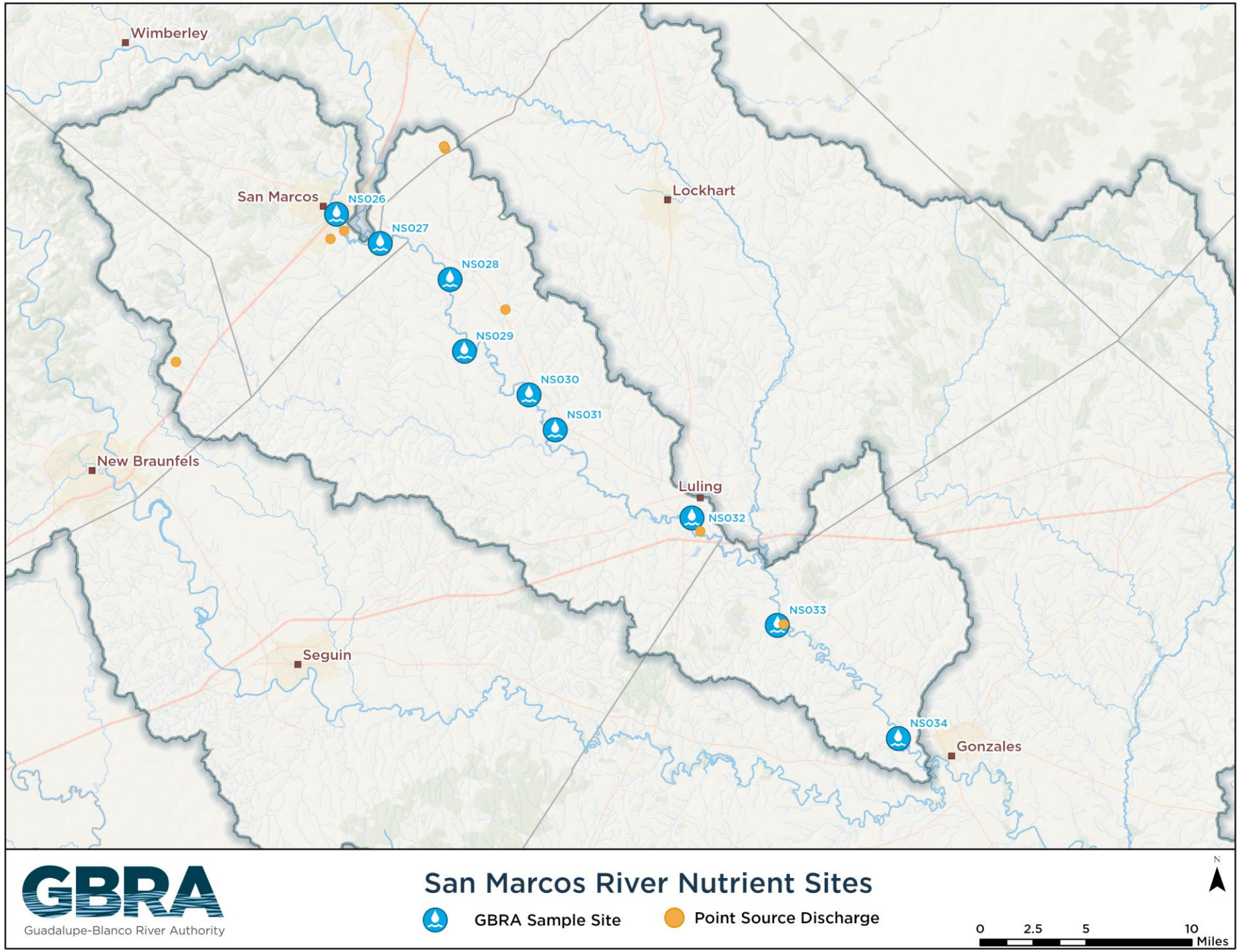
San Marcos River Sampling

- 3 CRP sites
- 6 new sites



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Sample of Total Phosphorus Data

Select Hill Country Sites

10/24/24	NS Guadalupe River at 474 CRPQ	0.00678	mg/L
11/14/24	NS Guadalupe River at 474 CRPQ	0.01231	mg/L
12/17/24	NS Guadalupe River at 474 CRPQ	0.00899	mg/L
10/22/24	NS Guadalupe River at Bear Creek Road	0.00254	mg/L
11/12/24	NS Guadalupe River at Bear Creek Road	0.00870	mg/L
12/3/24	NS Guadalupe River at Bear Creek Road	0.00724	mg/L
10/24/24	NS Guadalupe River at Center Point Road	0.00862	mg/L
11/14/24	NS Guadalupe River at Center Point Road	0.01362	mg/L
12/4/24	NS Guadalupe River at Center Point Road	0.00994	mg/L
10/16/24	NS Guadalupe River at FM 3351	0.01207	mg/L
11/25/24	NS Guadalupe River at FM 3351	0.01471	mg/L
12/11/24	NS Guadalupe River at FM 3351	0.00901	mg/L

Final Thoughts

- Currently a pilot project
  - Assess results throughout the year and possibly continue sampling
- Limitations in sampling
  - TP data that is below the LOQ for our lab method
- Considering a lab study that could lower the LOQ
  - Use current method?
  - Look at new methods?

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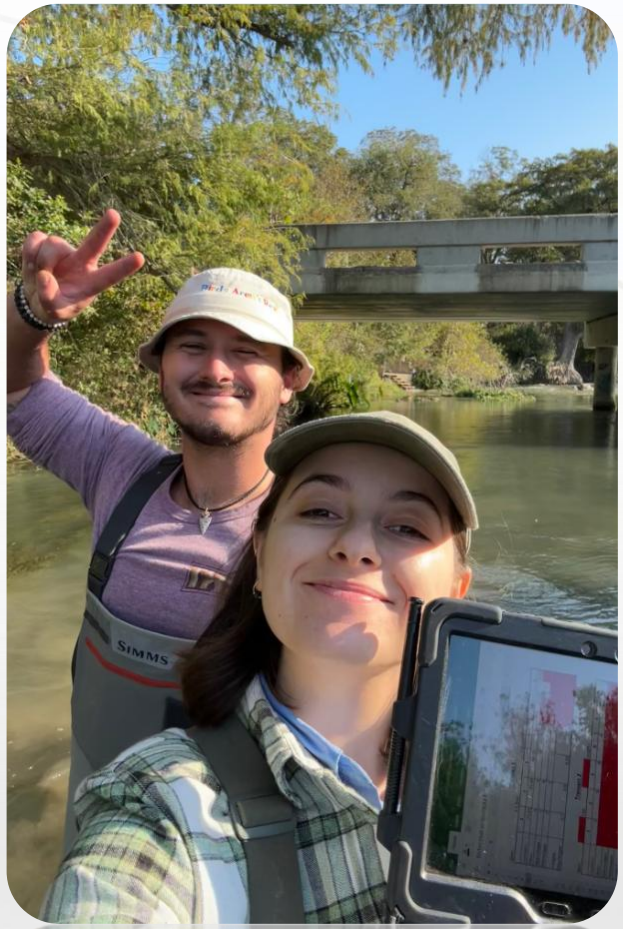
Qualitative Periphyton Study in the Texas Hill Country

Natalie Hickman & Jack Frank

GBRA Water Quality Technicians



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Understanding Periphyton

- What is Periphyton?
  - A complex mixture of algae (macroalgae and microalgae), moss, and other microbes attached to submerged surfaces.
- Why is it Important?
  - Acts as a nutrient sink
  - Indicators of water quality and nutrient dynamics
  - Helps understand stream health and ecosystem function
- Types Sampled:
  - Macroalgae
  - Microalgae
  - Moss

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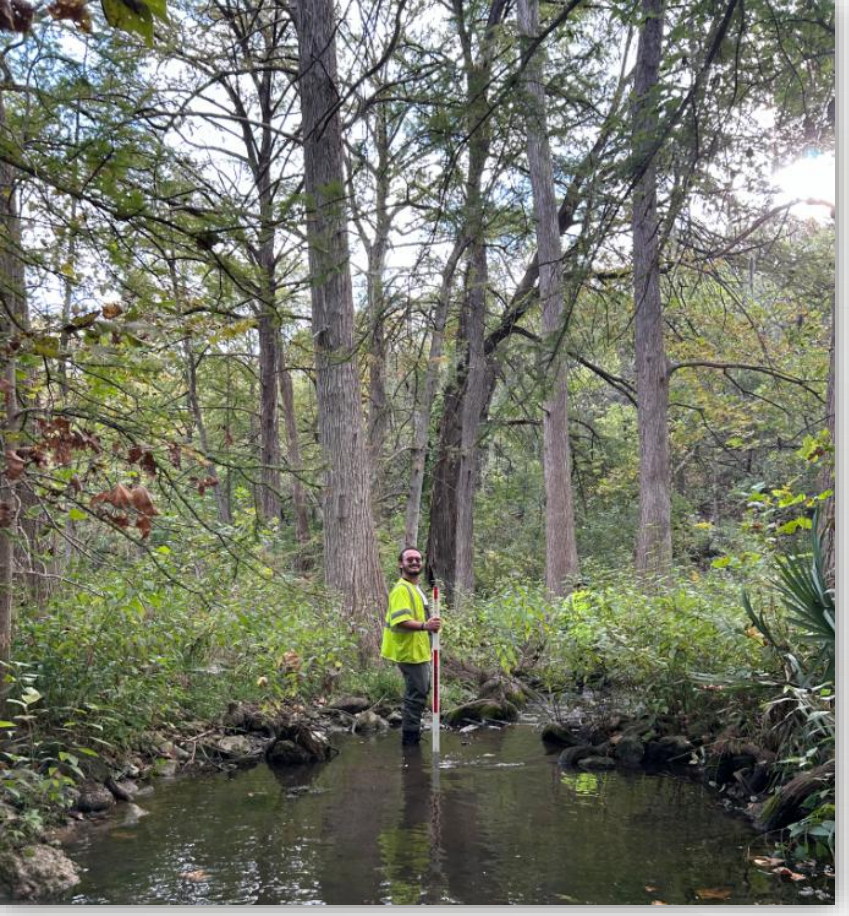
Study Design

- Sampling Protocol
  - The Transect Method
- Adapted from Utah State University protocols:
  - Three diagonal (zig-zag) transects per stream site
  - 6 uniform points per transect → 18 observations per station
  - "Big toe" method used to assess periphyton cover
- Micro-TI, Macro-CI, and Moss-CI cover index calculated



Initial Process

- Startup:
  - First trial run
  - Coordination with TCEQ
  - Site scouting for optimal locations
  - Considerations: stream width and depth, canopy cover, dominant substrate type, habitat type, safe to access

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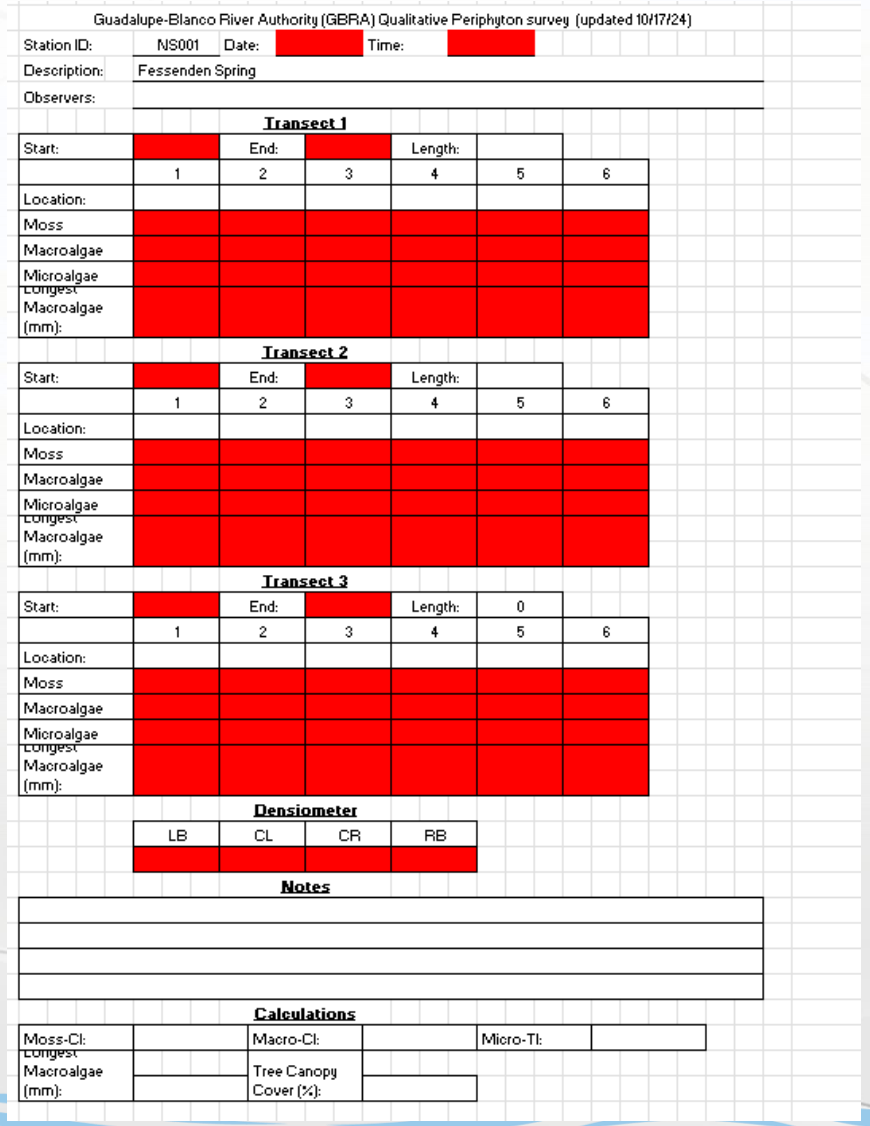
Field Procedure

- At Each Observation Point:
  - % Coverage of:
    - Macroalgae
    - Microalgae
    - Moss
  - Thickness of microalgae (Index 0–5; includes 0.5 for slimy substrate)
  - Longest length of macroalgae strands (mm)
  - Periscope used in deep/turbid water
- Field Considerations:
  - Safe Access
  - Presence of Rocks
  - Canopy Cover
  - Secchi and Sonde data



Guadalupe-Blanco River Authority (GBRA) Qualitative Periphyton survey (updated 10/17/24)

Station ID:	NS001	Date:		Time:		
Description:	Fessenden Spring					
Observers:						

Transect 1

Start:		End:		Length:		
	1	2	3	4	5	6
Location:						
Moss						
Macroalgae						
Microalgae						
Longest Macroalgae (mm):						

Transect 2

Start:		End:		Length:		
	1	2	3	4	5	6
Location:						
Moss						
Macroalgae						
Microalgae						
Longest Macroalgae (mm):						

Transect 3

Start:		End:		Length:	0	
	1	2	3	4	5	6
Location:						
Moss						
Macroalgae						
Microalgae						
Longest Macroalgae (mm):						

Densiometer

LB	CL	CR	RB

Notes

Calculations

Moss-CI:		Macro-CI:		Micro-TI:	
Longest Macroalgae (mm):		Tree Canopy Cover (%):			

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Measurement & Scoring

- Scoring Metrics:
  - Moss coverage
  - Stringy (macro)algae coverage
  - Slimy (micro)algae thickness
  - Length of longest algae strands
- Scores averaged to create an overall stream health profile.

Sampling Reference Notes

General Setup and Sampling

3 diagonal transects at 70 degree angle from shore
sample 6 locations equally spaced along tape measure
look for rock nearest to big toe at sample location (even if tiny)
if substrate is too small or too large, view in-situ

Scale used for Moss and Macroalgae indices

0 = no moss or macroalgae present
1 = some (but <5% coverage) moss or macroalgae present
2 = 5 to 25% cover of substratum by moss or macroalgae
3= >25 to 50% cover of substratum by moss, or macroalgae present
4 =>50 to 75% cover of substratum by moss or macroalgae
5 =>75 to 100% cover of substratum by moss or macroalgae

Scale used for Microalgae index

0 = substrate is rough with no apparent growth
0.5 = substrate is slimy, but biofilm is not visible
1 = a thin layer of microalgae is visible
2 = accumulation of microalgae to a thickness of 0.5 to 1 mm
3 = accumulation of microalgae to a thickness of 1 to 5 mm
4 = accumulation of microalgae to a thickness of 5 to 20 mm
5 = accumulation of microalgae to a thickness > 20 mm

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Adjustments

- Focused on safe/practical sampling areas (e.g., shallow, rocky areas away from bridges)
- Rotating field team for consistency
- Modified approach for tough terrain (e.g., no rock lifting when not feasible)

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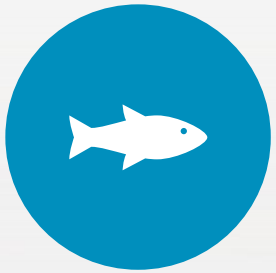
What We've Gained



RICHER UNDERSTANDING OF STREAM ECOSYSTEMS

BETTER INSIGHT INTO NUTRIENT FLOW AND ALGAE DYNAMICS

CONSISTENT DATA COLLECTION TECHNIQUES

FOUNDATION FOR ONGOING MONITORING IN THE HILL COUNTRY

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Thank you!

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