

# DOUBLE BAYOU WPP: INITIAL SAMPLING – BACTERIA



# BACTERIA

- *Escherichia Coli* (*E. coli*)
  - Rod shaped bacteria normally found in the digestive tracks of warm blooded animals
  - Fresh water samples
- Enterococcus
  - Spherical shaped bacteria normally found in the digestive tracks of warm blooded animals
  - Tidal water samples
- Both indicate possibility of presence of disease-causing pathogens
- Sampling Units for Bacteria
  - SELECT - Colony-forming units (CFUs)
  - Culture tests report results in Most Probable Number (MPN)/100 mL

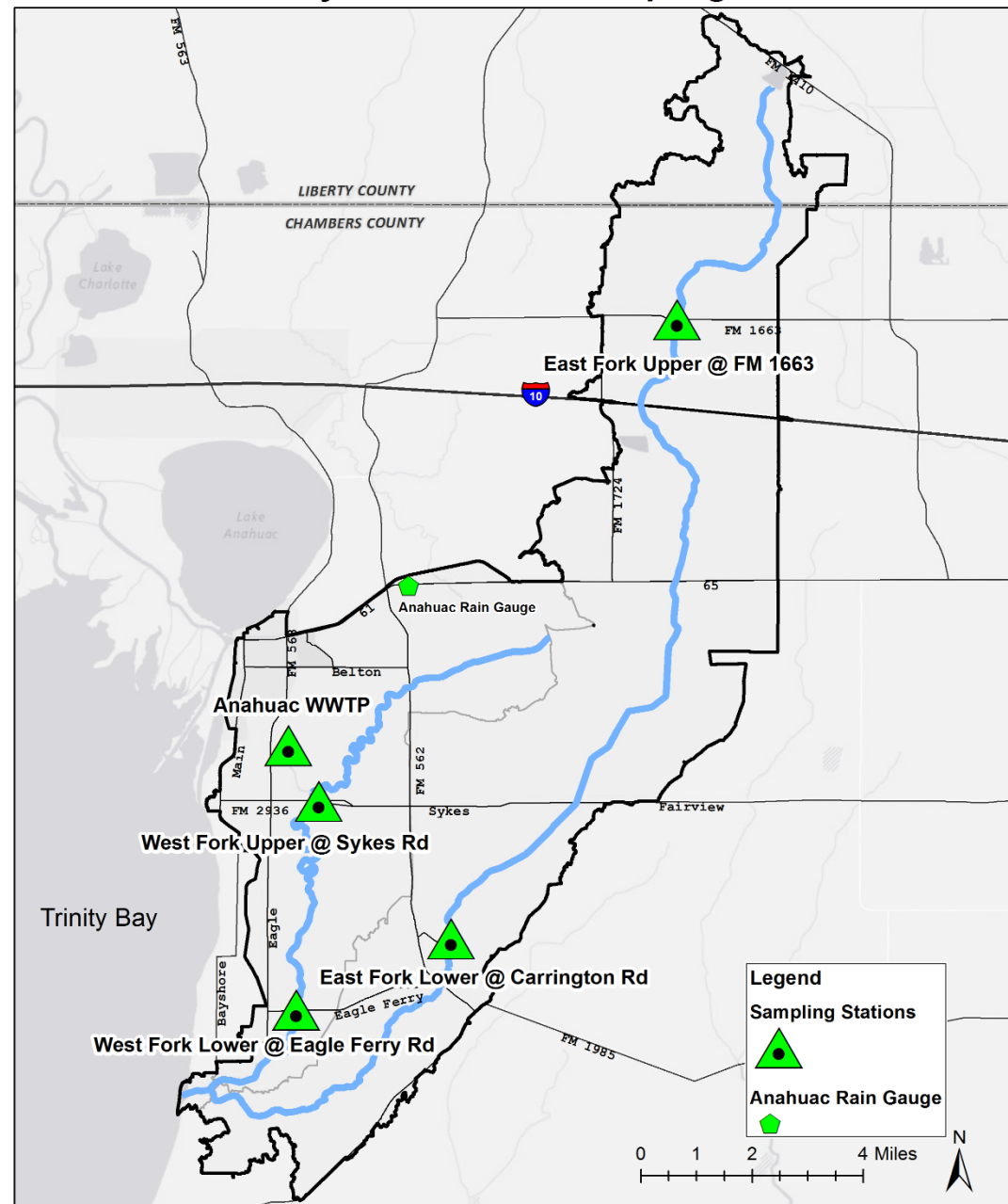
# SAMPLING

- Results shown from sampling period 10/22/13 – 8/12/14 (full Quality Assured data set)
- Includes Routine and Targeted Rain Event Sampling
  - Routine is scheduled sampling, currently includes approximately twice monthly sampling at all stations
    - Used to assess baseline conditions
  - Targeted Rain Event is unscheduled sampling, occurs as Rain Events occur
    - Often shows “worst-case” scenario of bacteria levels
    - Can identify sources of bacteria not seen during typical dry weather conditions

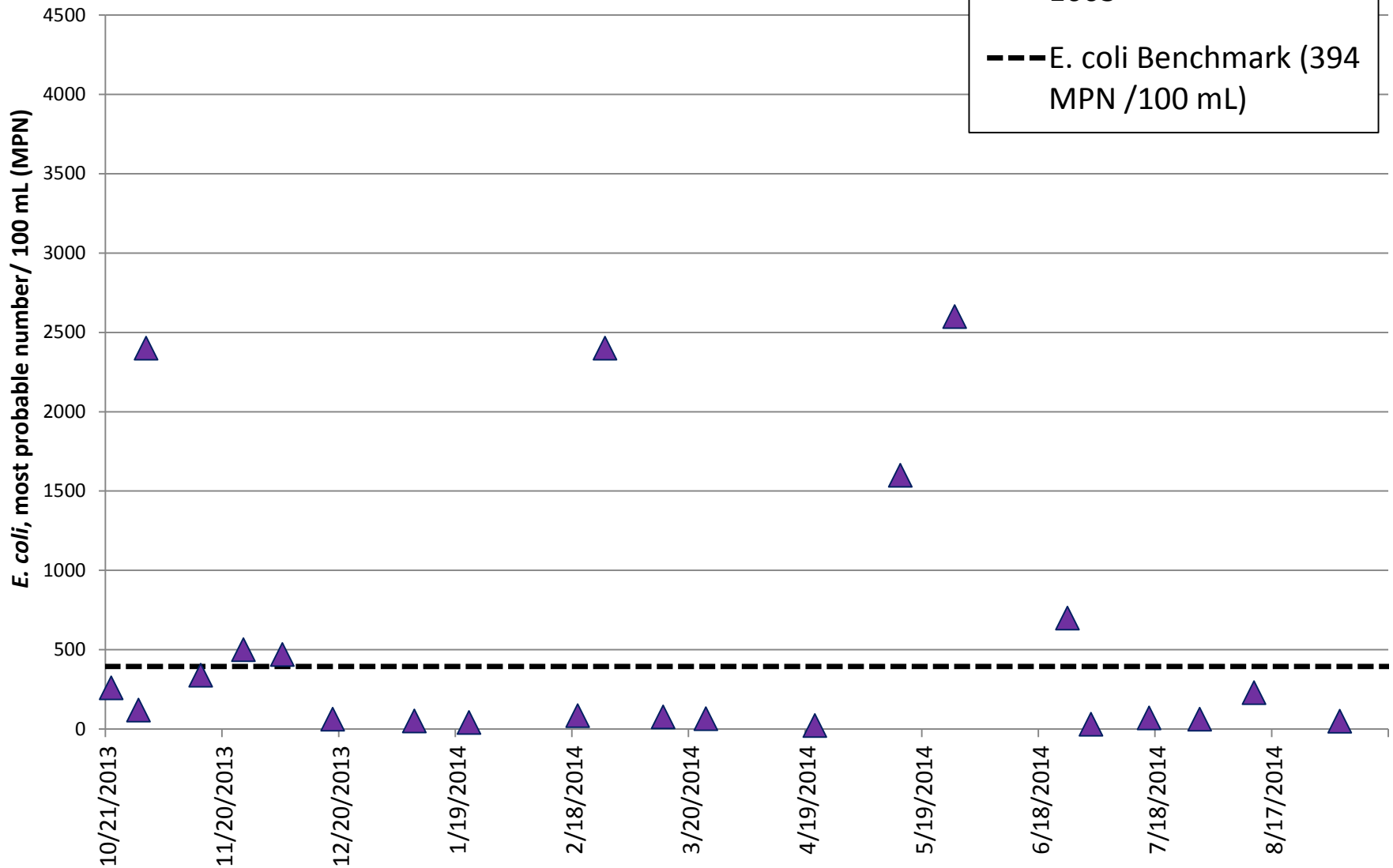
# SAMPLING STATIONS

- Five Sampling Stations
  - Two on each Fork, one at Anahuac Waste Water Treatment Plant
- Sampling began on October 22, 2013
- Initial Sampling results include 17 routine events and 4 targeted rain events at each station

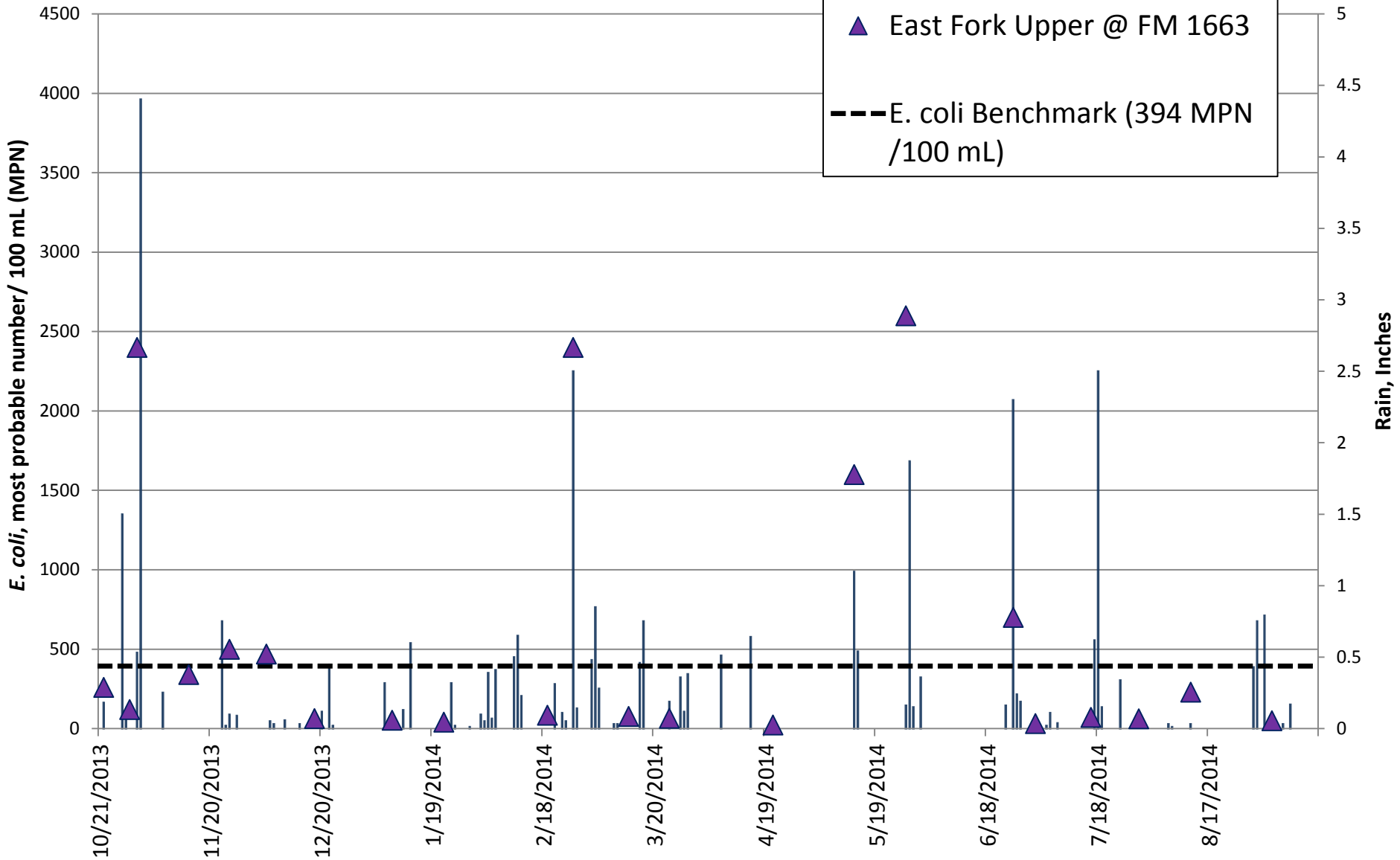
Double Bayou Watershed Sampling Stations



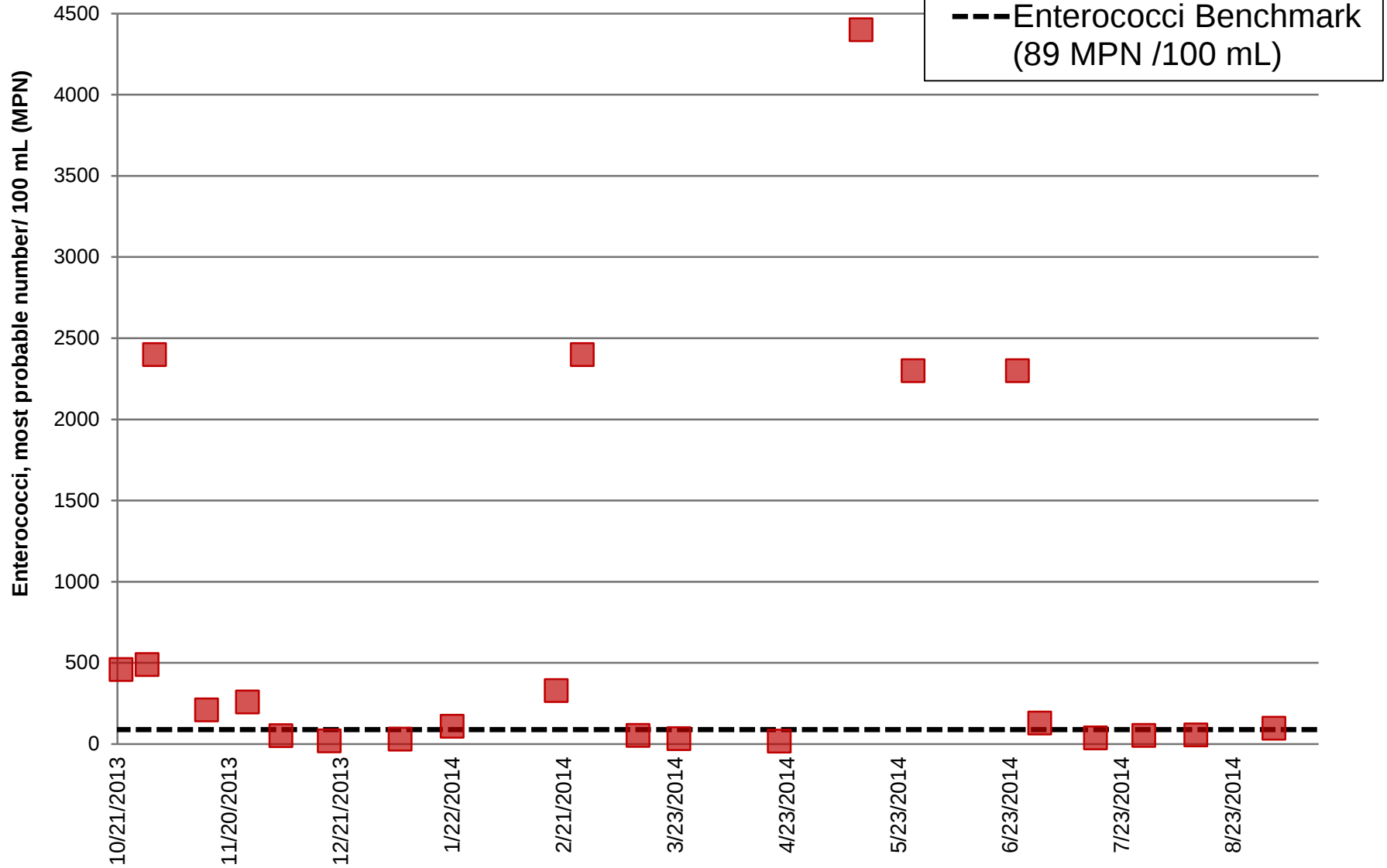
## Variation in Bacteria Levels Over Sampling Period: East Fork Upper @ FM 1663



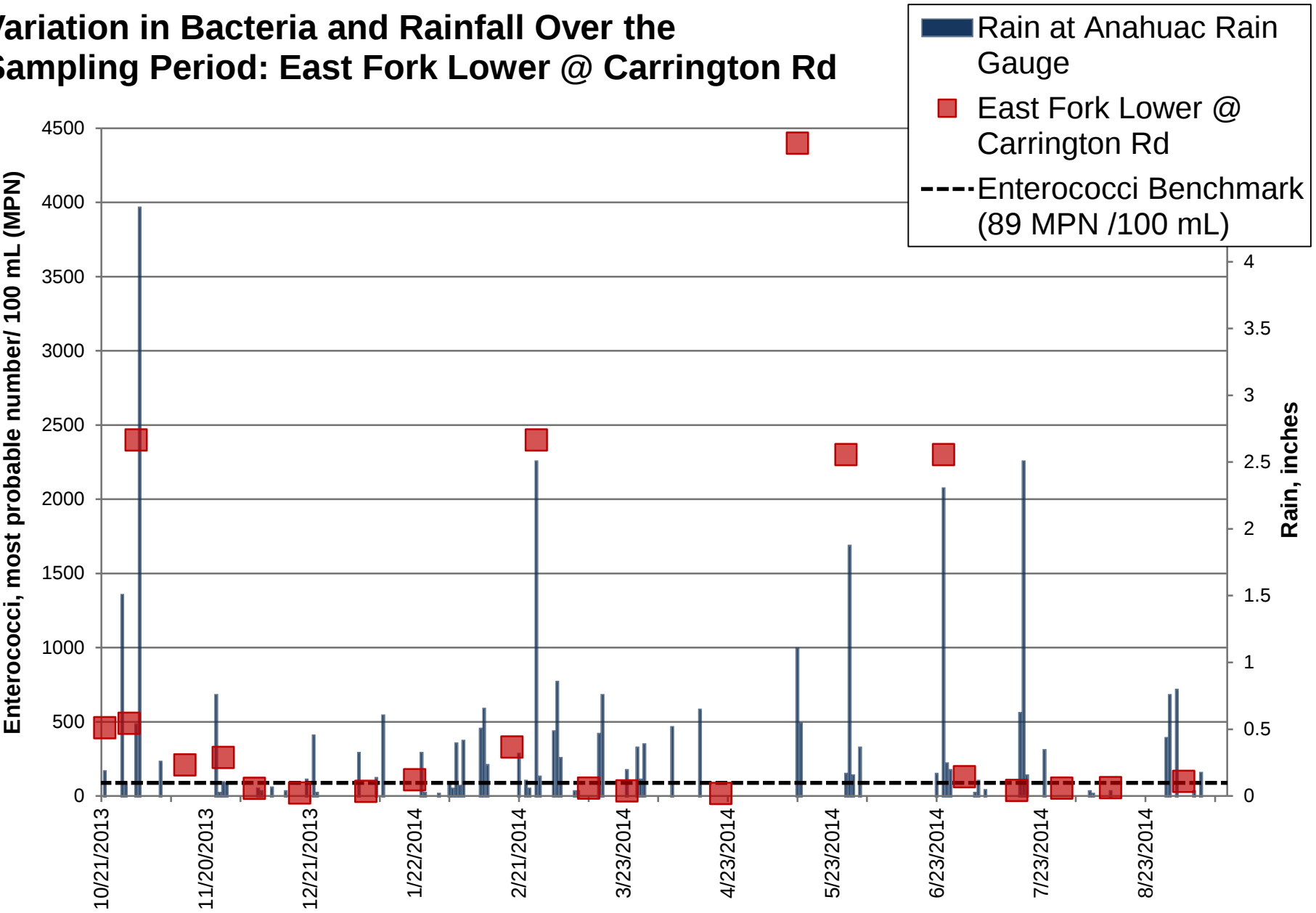
# Variation in Bacteria and Rainfall Over the Sampling Period: East Fork Upper @ FM 1663



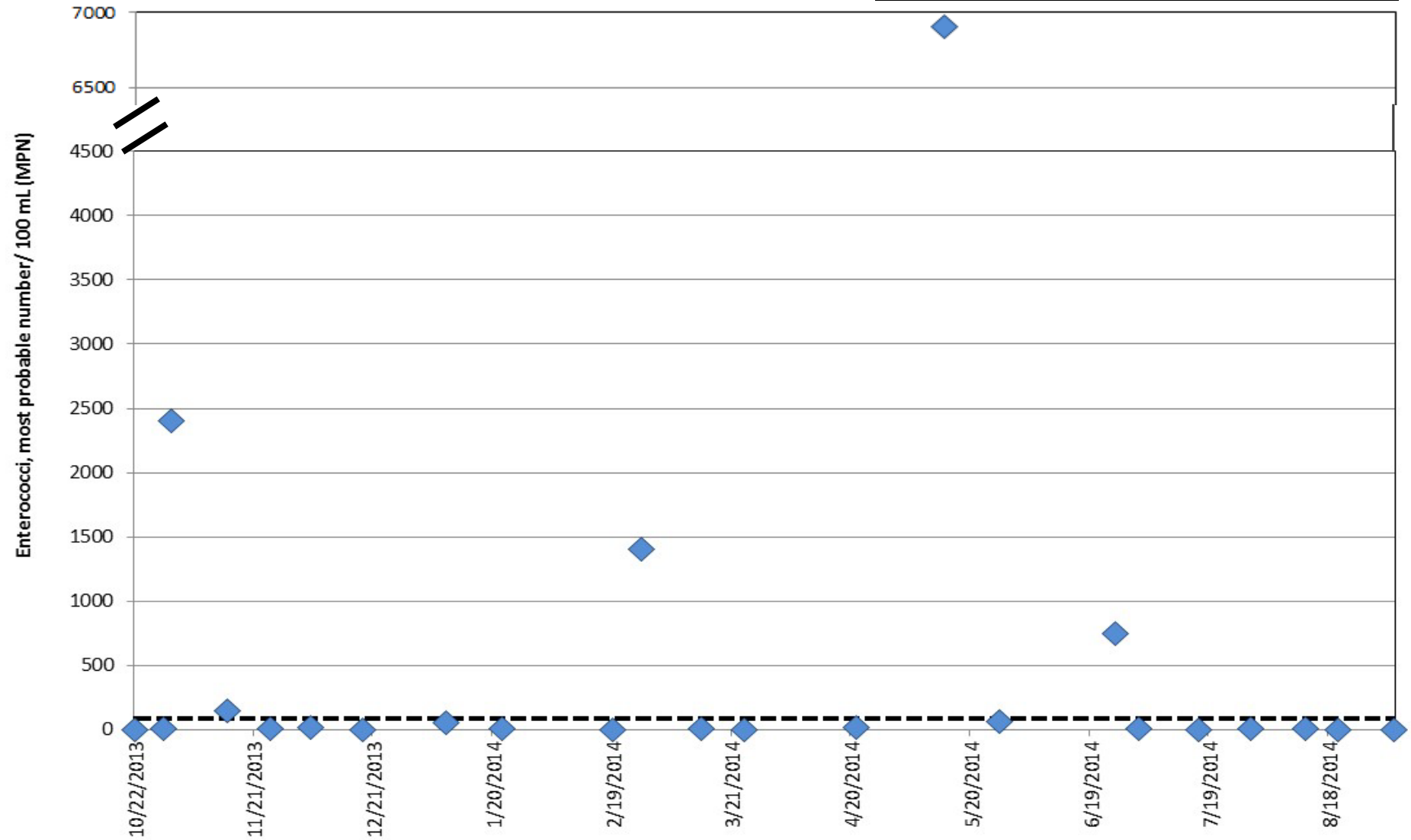
# Variation in Bacteria Over the Sampling Period: East Fork Lower @ Carrington Rd



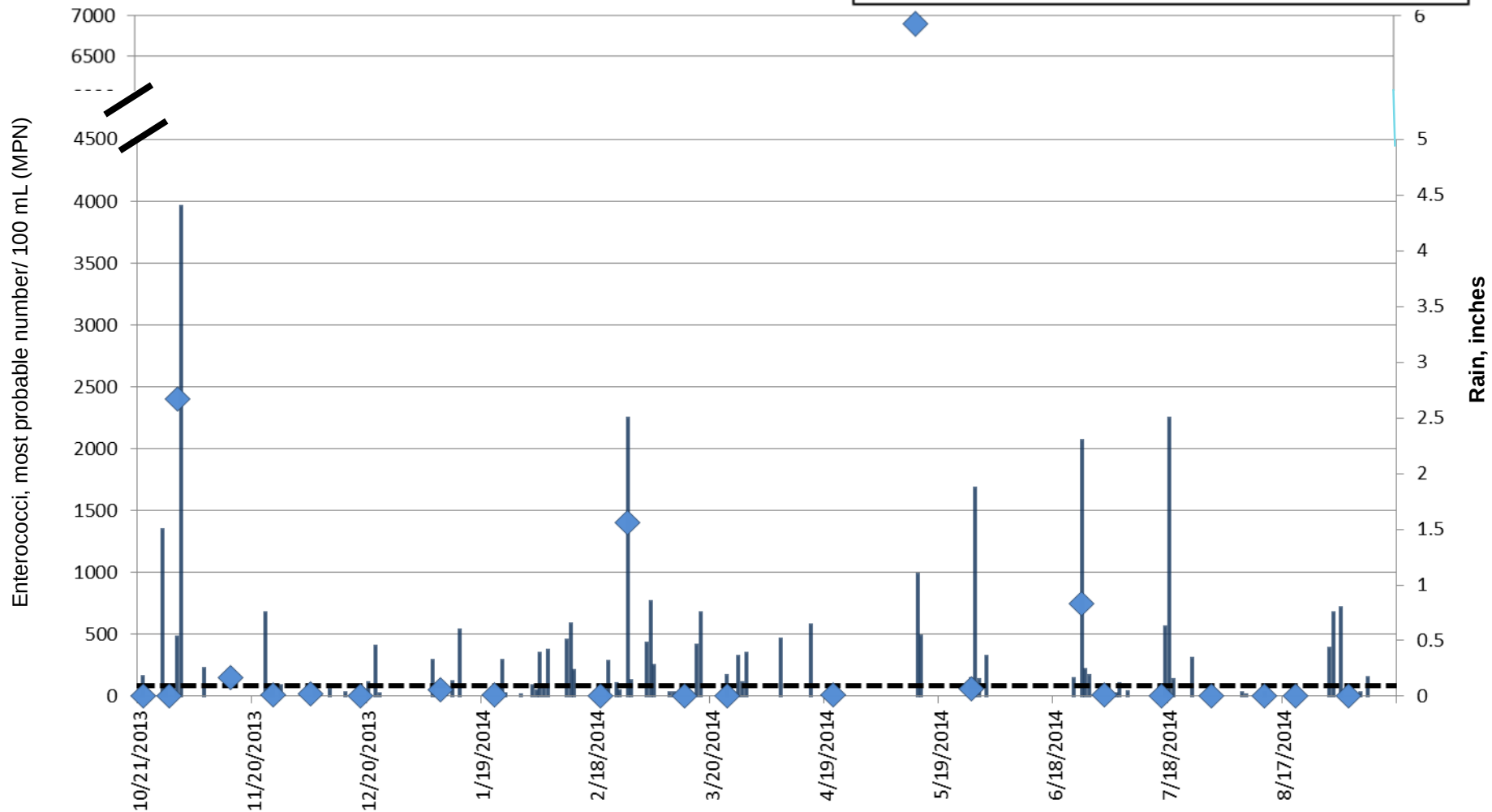
# Variation in Bacteria and Rainfall Over the Sampling Period: East Fork Lower @ Carrington Rd



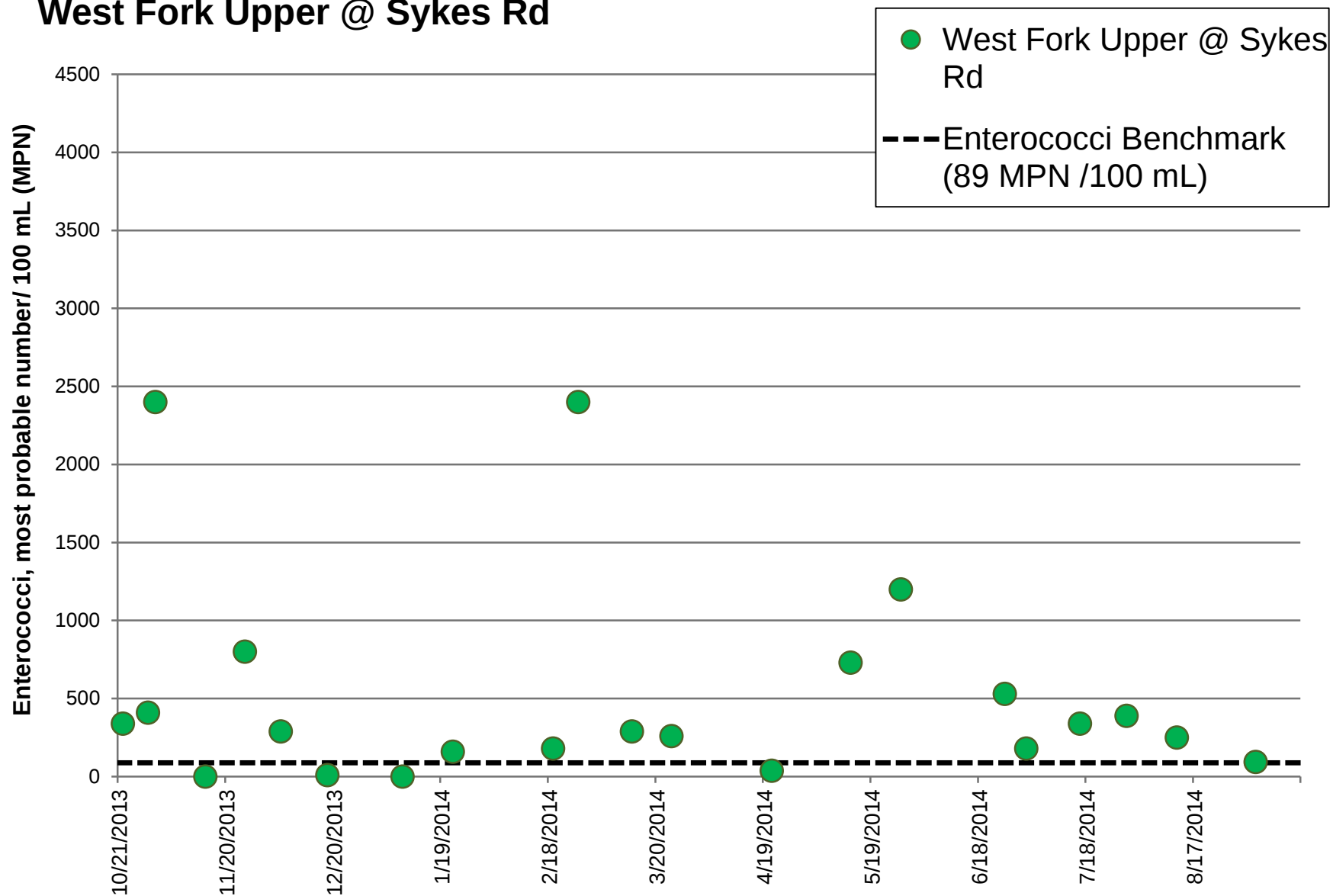
# Variation in Bacteria Over the Sampling Period: Anahuac WWTP



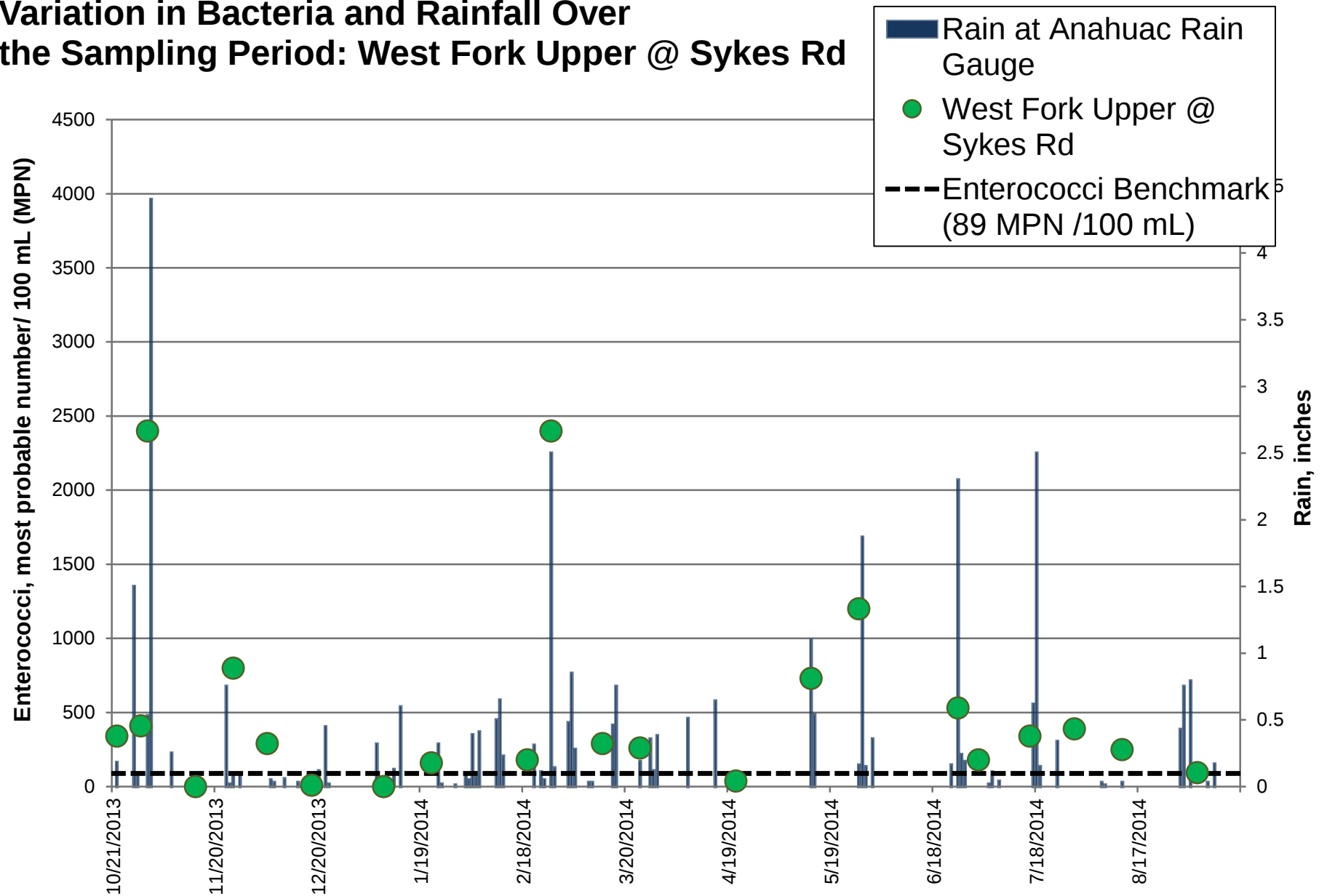
# Variation in Bacteria and Rainfall Over the Sampling Period: Anahuac WWTP



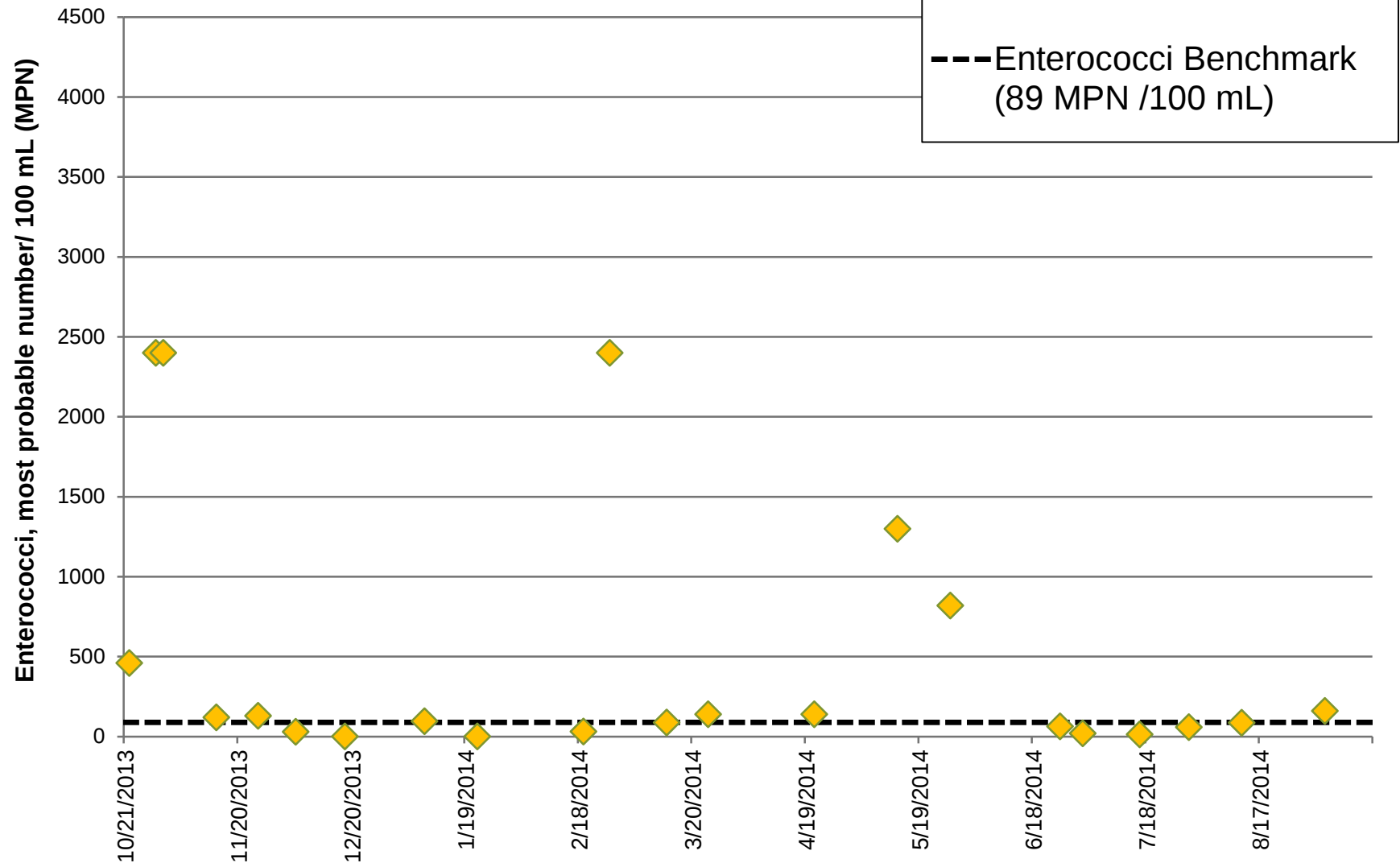
## Variation in Bacteria Over the Sampling Period: West Fork Upper @ Sykes Rd



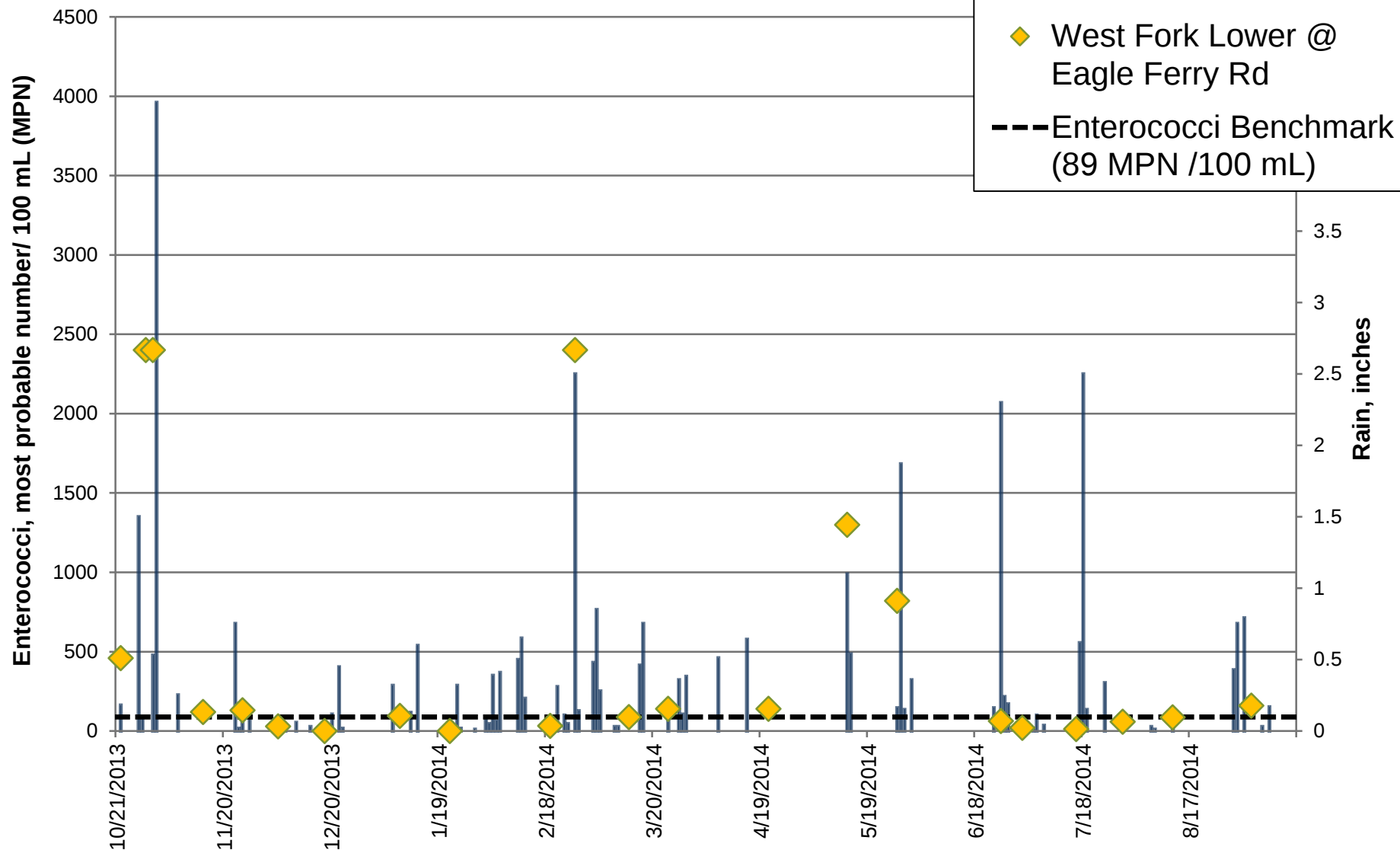
# Variation in Bacteria and Rainfall Over the Sampling Period: West Fork Upper @ Sykes Rd



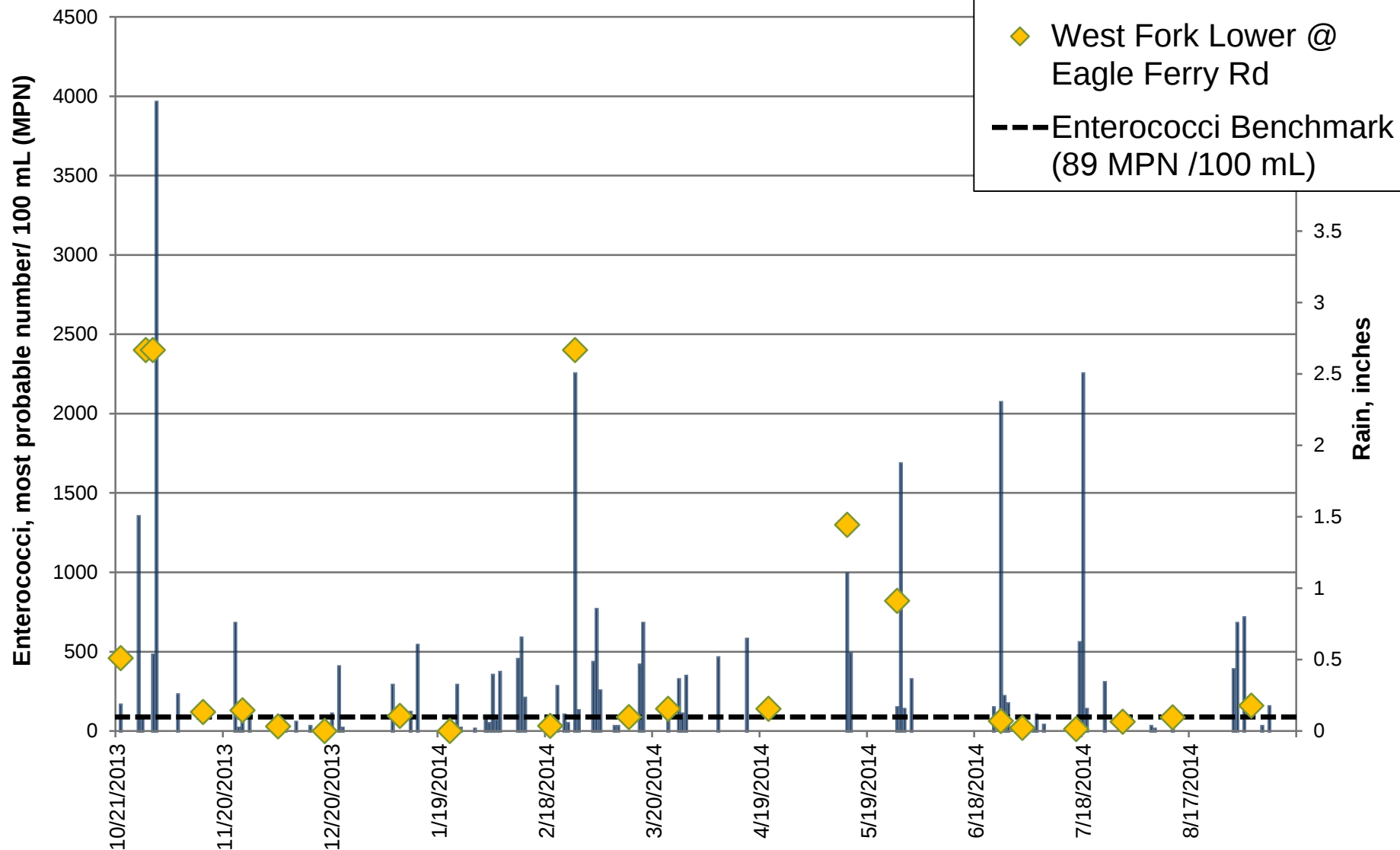
## Variation in Bacteria Over the Sampling Period: West Fork Lower @ Eagle Ferry Rd



# Variation in Bacteria and Rainfall Over the Sampling Period: West Fork Lower @ Eagle Ferry Rd



# Variation in Bacteria and Rainfall Over the Sampling Period: West Fork Lower @ Eagle Ferry Rd

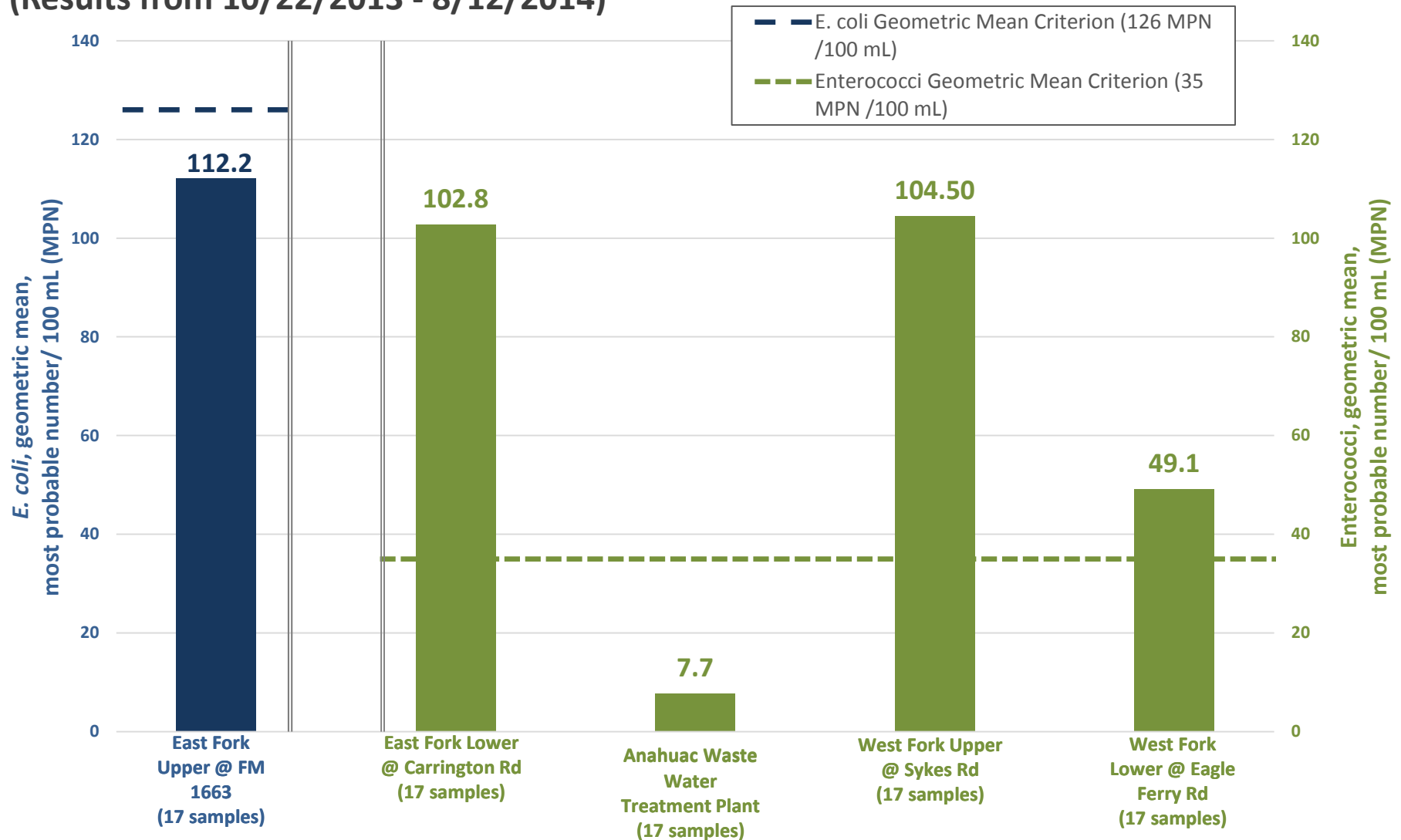


# Double Bayou Watershed:

## How sampling station results compare to state bacteria criteria

(Results from 10/22/2013 - 8/12/2014)

\* Geometric means include routine samples only



# VARIATION IN BACTERIA OVER SEASON – SAMPLES FROM 10/22/13 – 8/12/14

| Station                                         | Fall (September- November) |                                 |                                       |                                             | Winter (December - February) |                                 |                                       |                                             |
|-------------------------------------------------|----------------------------|---------------------------------|---------------------------------------|---------------------------------------------|------------------------------|---------------------------------|---------------------------------------|---------------------------------------------|
|                                                 | Number of Routine Samples  | Routine Samples Above Benchmark | Number of Targeted Rain Event Samples | Targeted Rain Event Samples Above Benchmark | Number of Routine Samples    | Routine Samples Above Benchmark | Number of Targeted Rain Event Samples | Targeted Rain Event Samples Above Benchmark |
| East Fork Upper @ 1663                          | 4                          | 1                               | 1                                     | 1                                           | 5                            | 1                               | 1                                     | 1                                           |
| Anahuac WWTP                                    | 4                          | 1                               | 1                                     | 1                                           | 5                            | 0                               | 1                                     | 1                                           |
| West Fork Upper @ Sykes                         | 4                          | 3                               | 1                                     | 1                                           | 5                            | 3                               | 1                                     | 1                                           |
| East Fork Lower @ Carrington                    | 4                          | 4                               | 1                                     | 1                                           | 5                            | 2                               | 1                                     | 1                                           |
| West Fork Lower @ Eagle Ferry                   | 4                          | 4                               | 1                                     | 1                                           | 5                            | 1                               | 1                                     | 1                                           |
| Total                                           | 20                         | 13                              | 5                                     | 5                                           | 25                           | 7                               | 5                                     | 5                                           |
| Total Watershed Samples Percent Above Benchmark | 65%                        |                                 | 100%                                  |                                             | 28%                          |                                 | 100%                                  |                                             |

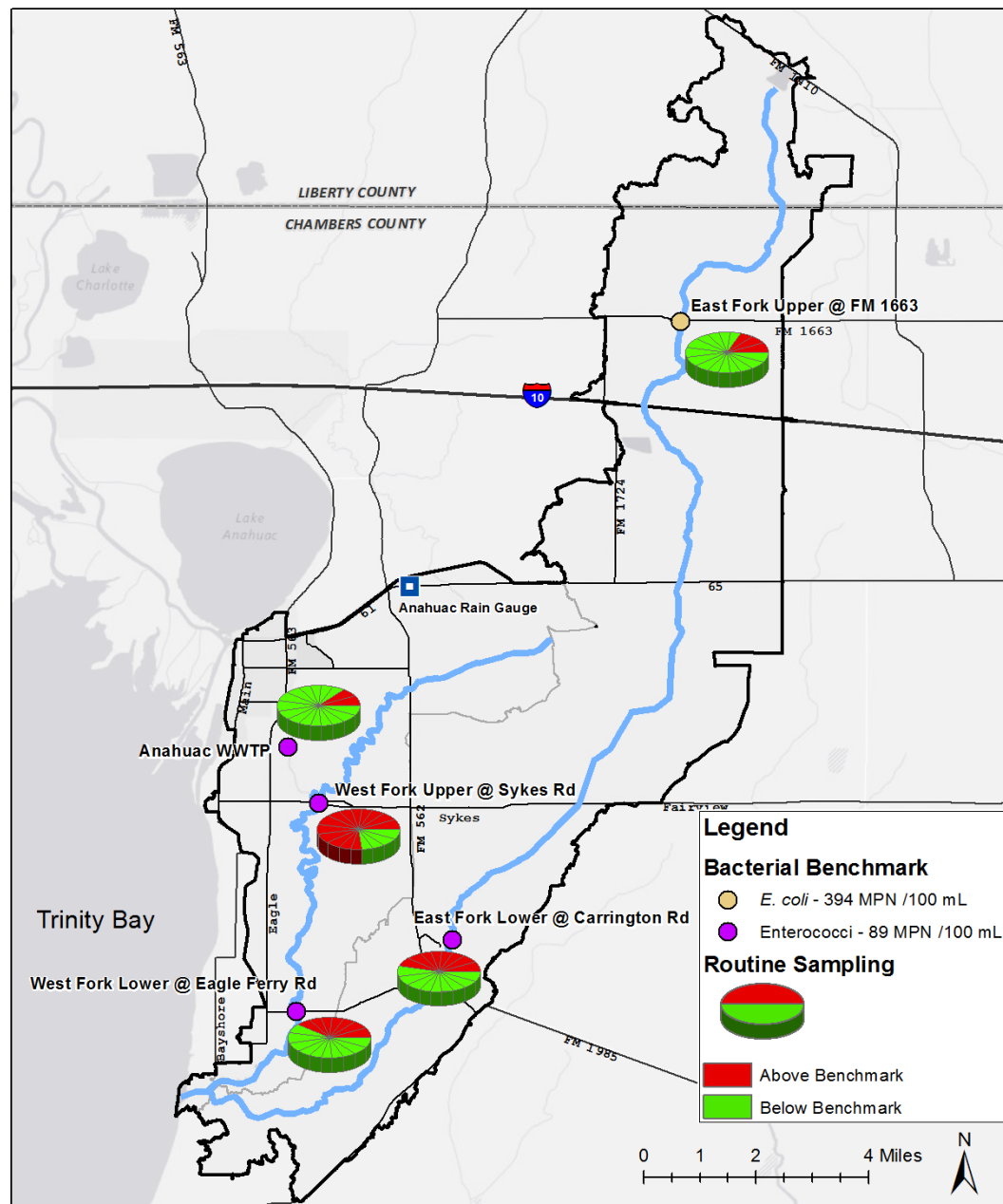
East Fork Upper: *E .coli* Benchmark (394 MPN /100 mL)

Anahuac WWTP, West Fork Stations and East Fork Upper: Enterococci Benchmark (89 MPN/100 mL)

| Station                                         | Spring (March - May)      |                                 |                                       |                                             | Summer (June - August)    |                                 |                                       |                                             |
|-------------------------------------------------|---------------------------|---------------------------------|---------------------------------------|---------------------------------------------|---------------------------|---------------------------------|---------------------------------------|---------------------------------------------|
|                                                 | Number of Routine Samples | Routine Samples Above Benchmark | Number of Targeted Rain Event Samples | Targeted Rain Event Samples Above Benchmark | Number of Routine Samples | Routine Samples Above Benchmark | Number of Targeted Rain Event Samples | Targeted Rain Event Samples Above Benchmark |
| East Fork Upper @ 1663                          | 3                         | 0                               | 2                                     | 2                                           | 5                         | 1                               | 0                                     | 0                                           |
| Anahuac WWTP                                    | 3                         | 0                               | 2                                     | 1                                           | 5                         | 1                               | 0                                     | 0                                           |
| West Fork Upper @ Sykes                         | 3                         | 2                               | 2                                     | 2                                           | 5                         | 1                               | 0                                     | 0                                           |
| East Fork Lower @ Carrington                    | 3                         | 0                               | 2                                     | 2                                           | 5                         | 2                               | 0                                     | 0                                           |
| West Fork Lower @ Eagle Ferry                   | 3                         | 2                               | 2                                     | 2                                           | 5                         | 0                               | 0                                     | 0                                           |
| Total                                           | 15                        | 4                               | 10                                    | 9                                           | 25                        | 5                               | 0                                     | 0                                           |
| Total Watershed Samples Percent Above Benchmark | 26.7%                     |                                 | 90%                                   |                                             | 20%                       |                                 |                                       |                                             |

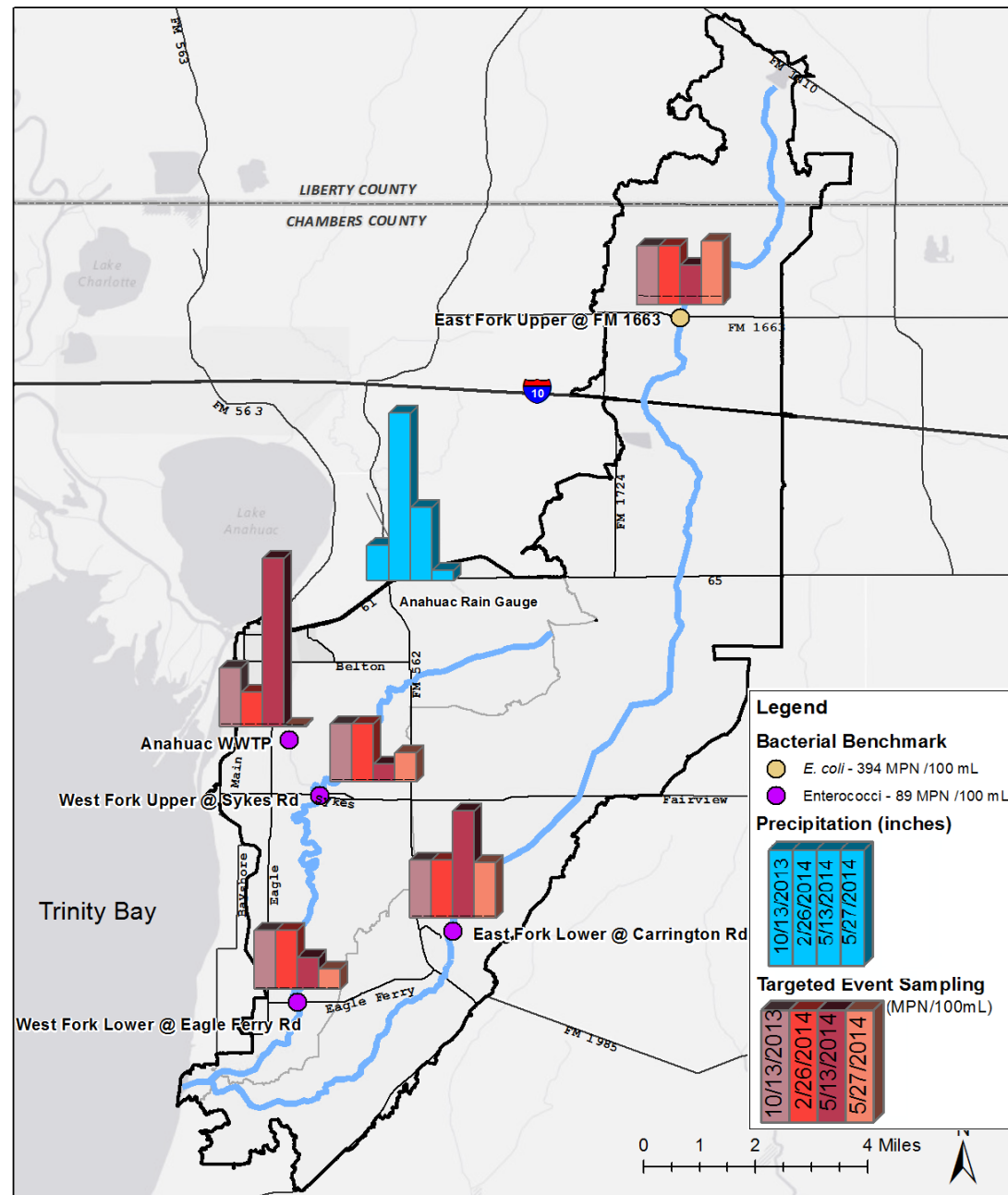
# VARIATION IN BACTERIA BY SAMPLING STATION

- Routine Sampling
- Represents 17 total sampling events (# of samples = 17 per station)



# VARIATION IN BACTERIA BY SAMPLING STATION

- Targeted Rain Event Sampling
- Represents 4 total sampling events (# of samples = 4 per station)



# BACTERIA

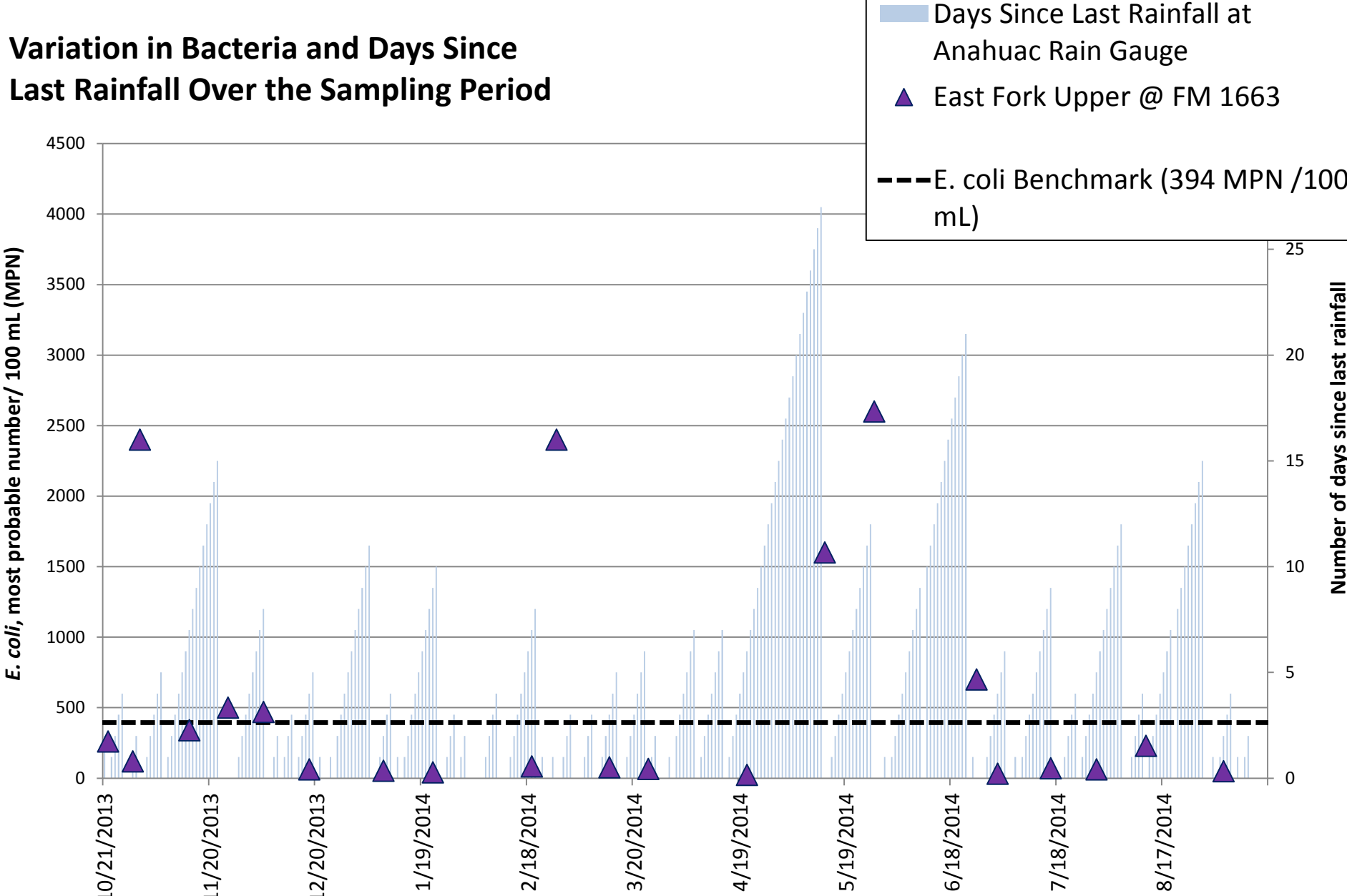
- Initial Sampling Results indicates:
  - Geomean Criteria (State) – 4 of 5 stations have high dry weather geomeans
  - Targeted Rain Event showed higher numbers, also showed importance of not just precipitation event but also days since last rain event
  - Variation in Bacteria Over Season - possible Fall pattern for routine sampling
- Future Sampling
  - Presentation on other constituents (dissolved oxygen, nutrients, etc)
  - Sampling will continue
    - Both routine and targeted rain events
    - Introduction of 24-hour sampling events for Dissolved Oxygen

# BACKUP SLIDES

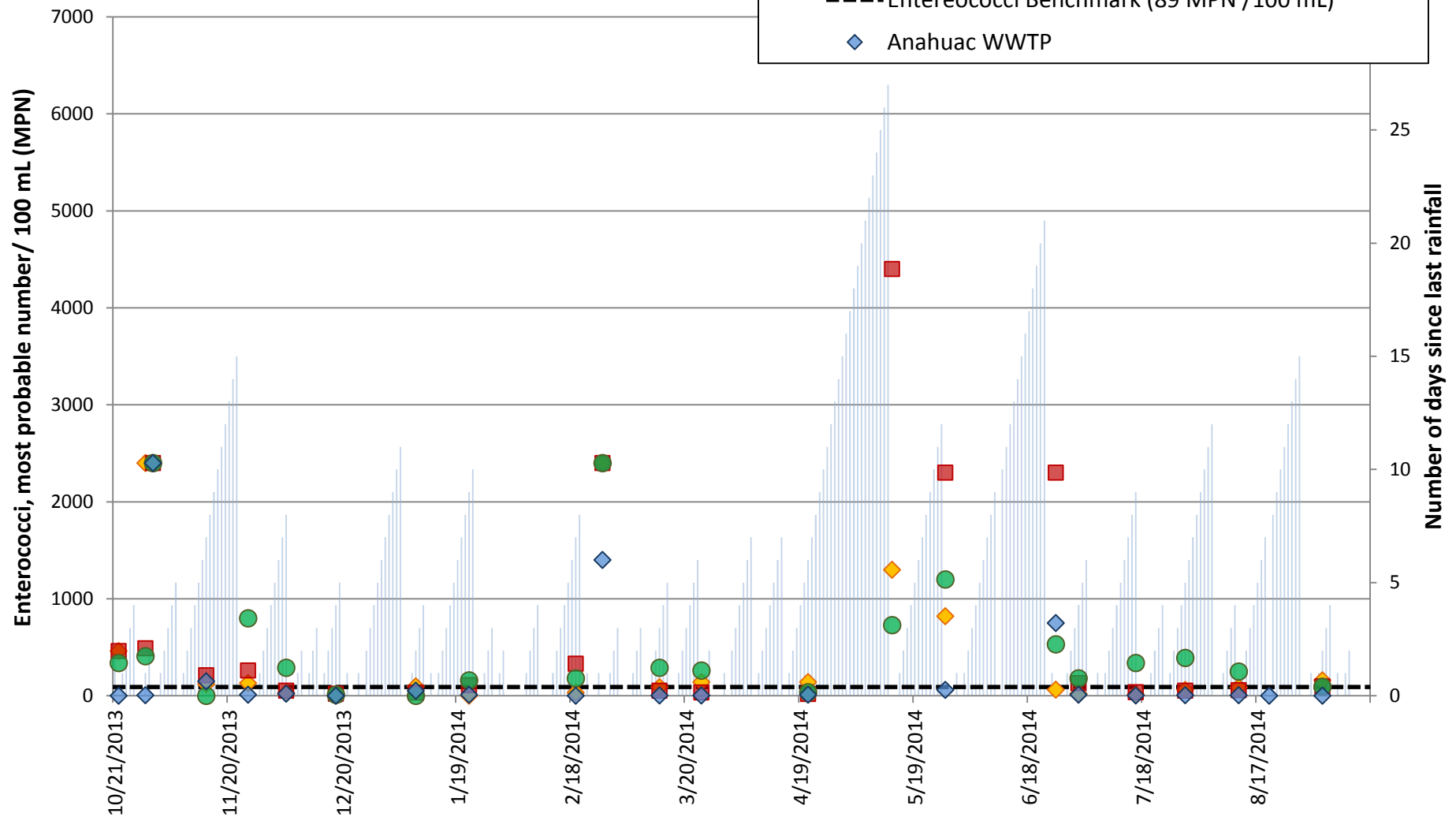
## Anahuac Rain Gauge (10/1/2013 - 9/10/2014)

|                                             | Fall (September - November) | Winter (December - February) | Spring (March - May) | Summer (June - August) |
|---------------------------------------------|-----------------------------|------------------------------|----------------------|------------------------|
| <b>Anahuac Rain Gauge Days with Rain</b>    | 12                          | 26                           | 19                   | 16                     |
| <b>Anahuac Rain Gauge Days without Rain</b> | 52                          | 62                           | 72                   | 74                     |
| <b>Total Days</b>                           | <b>64</b>                   | <b>88</b>                    | <b>91</b>            | <b>90</b>              |
| <b>Percent of Days with Rain</b>            | <b>19%</b>                  | <b>30%</b>                   | <b>21%</b>           | <b>18%</b>             |

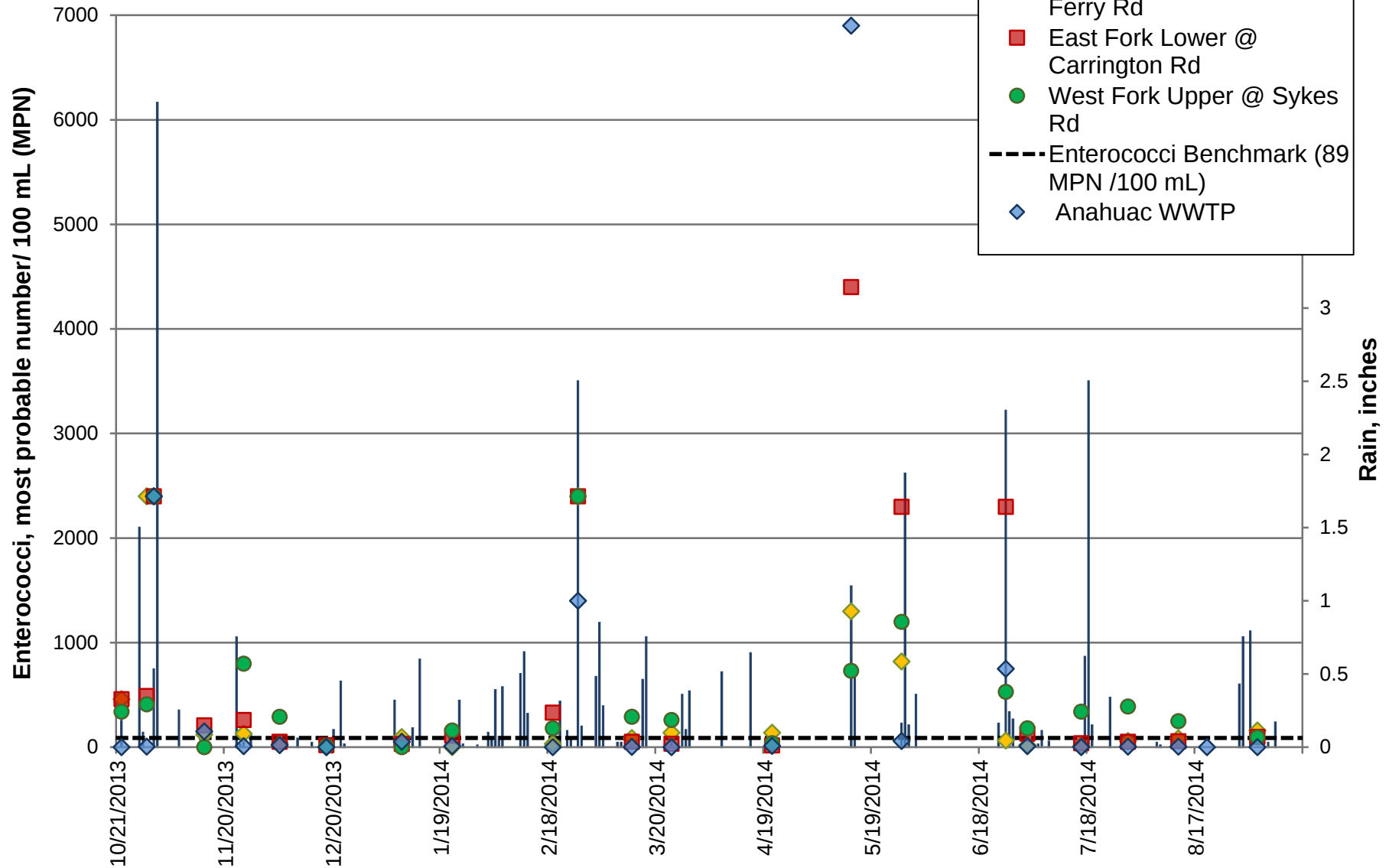
# Variation in Bacteria and Days Since Last Rainfall Over the Sampling Period



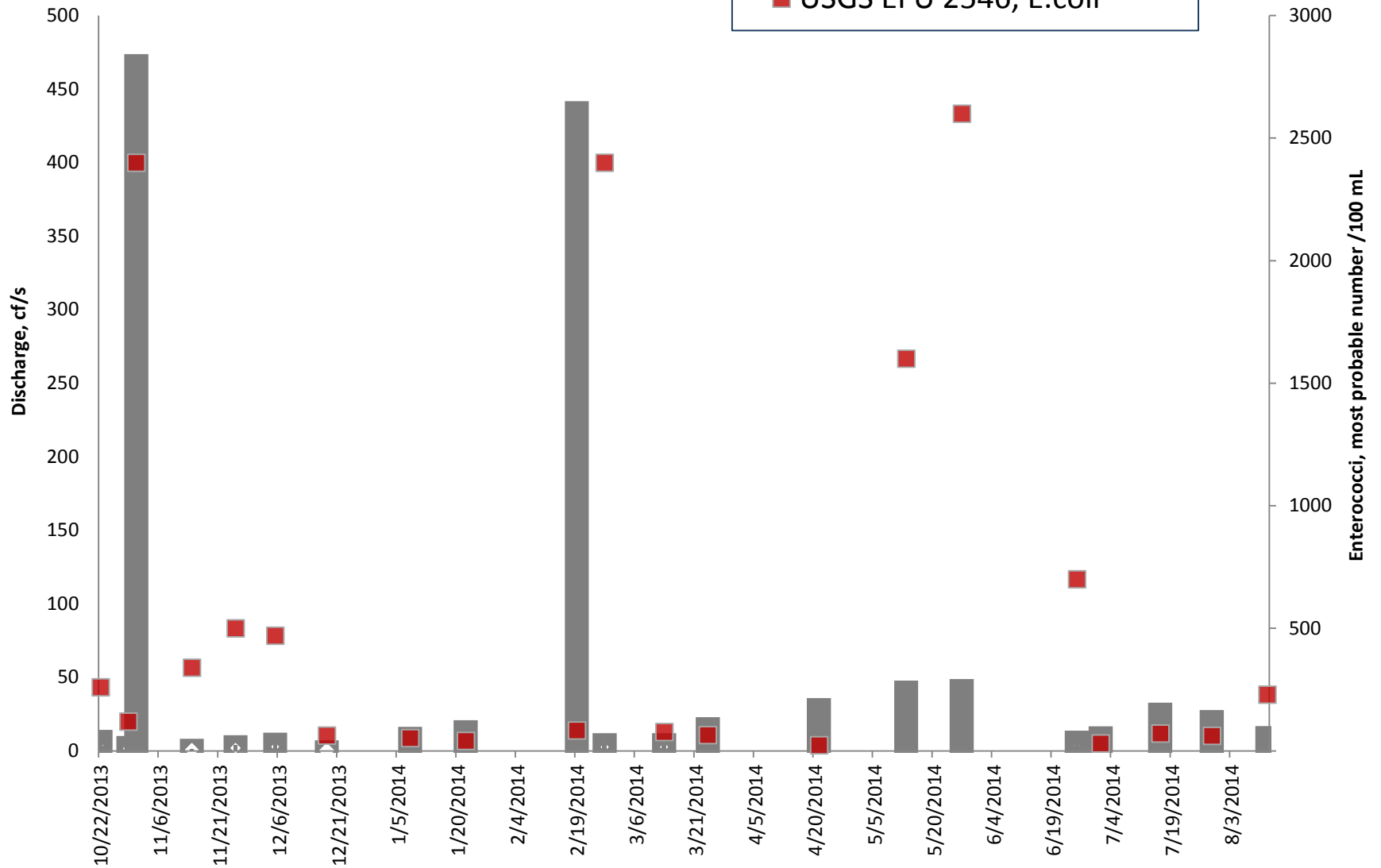
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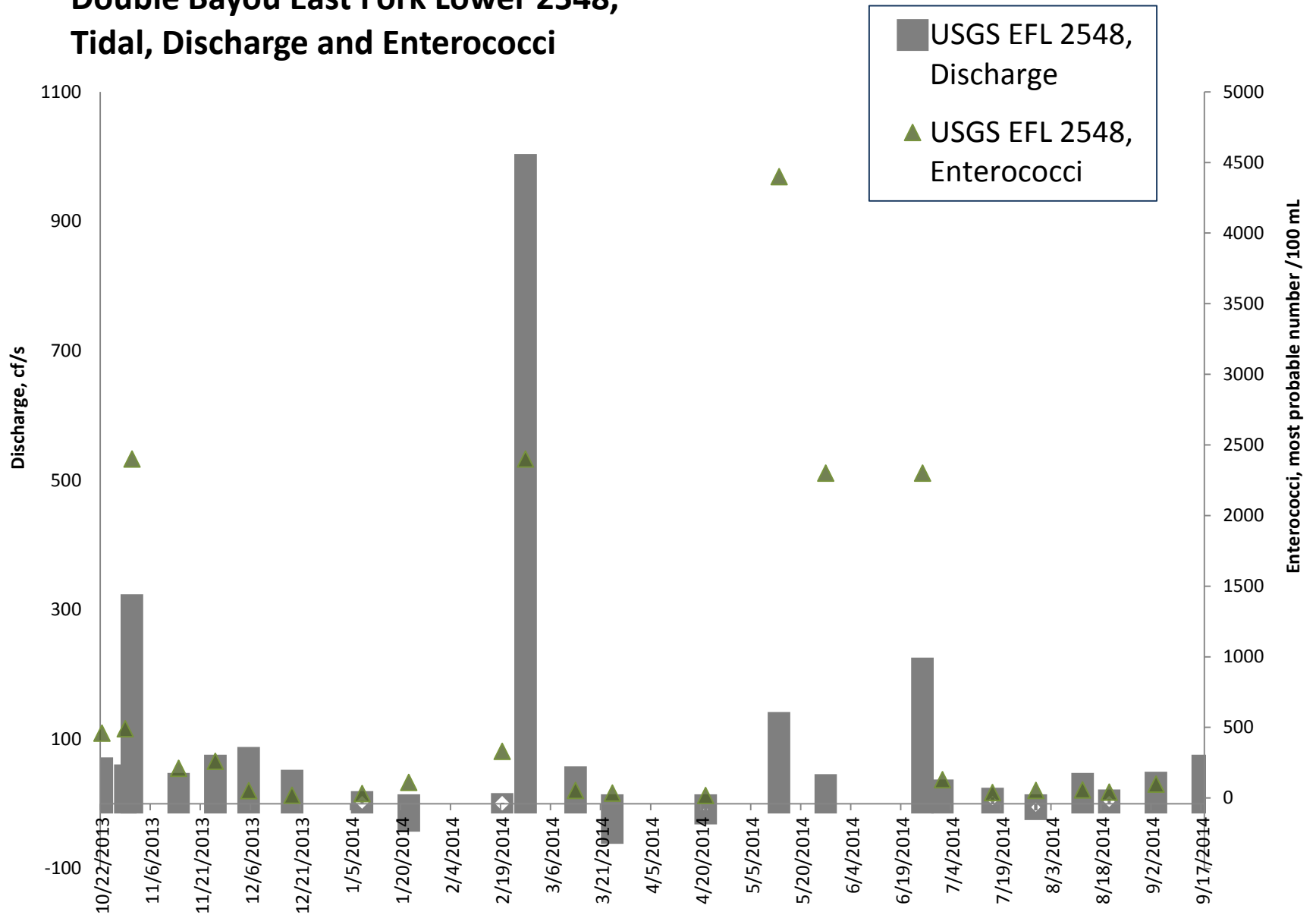
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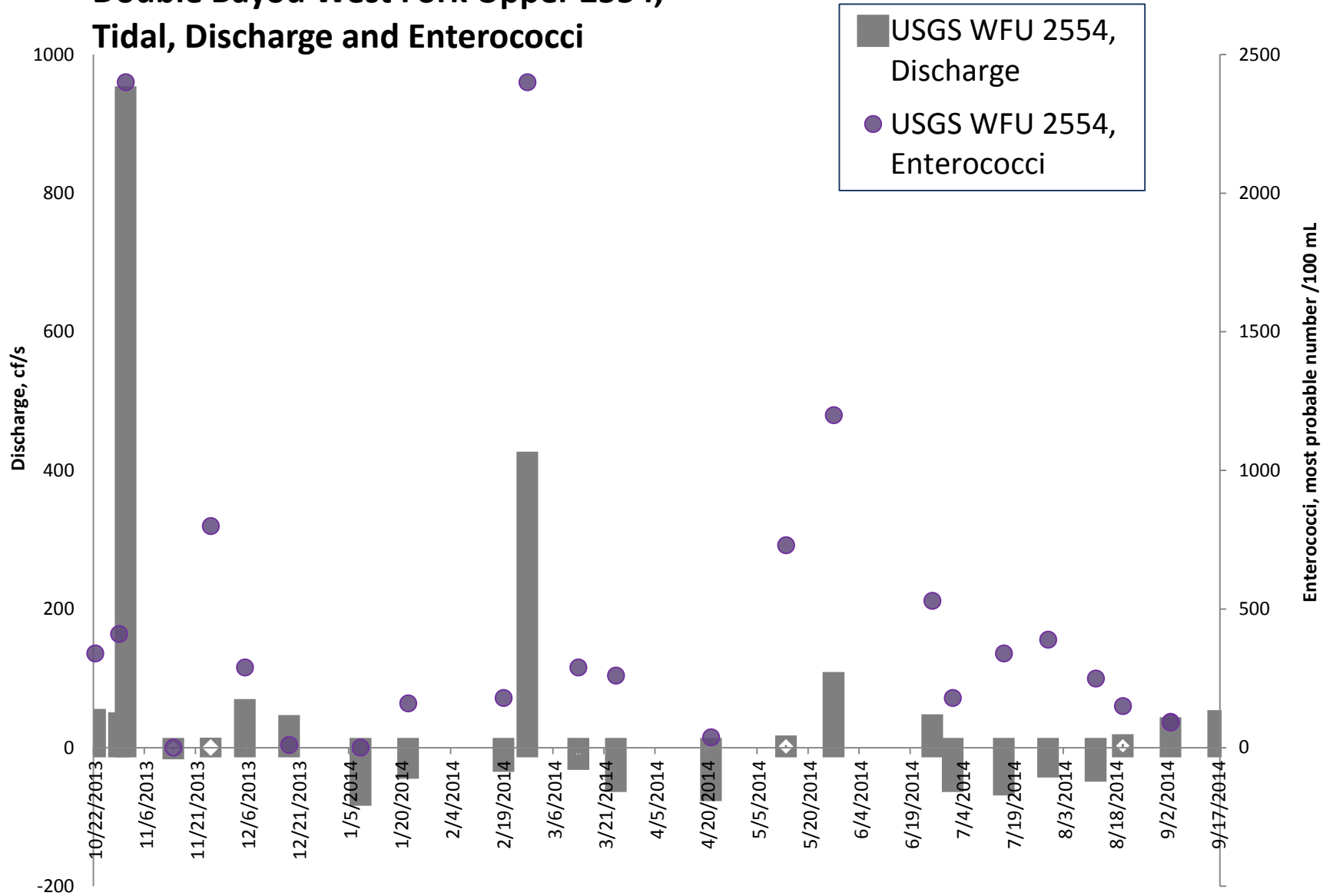
# Double Bayou East Fork Upper 2546, Non-Tidal, Discharge and E. coli



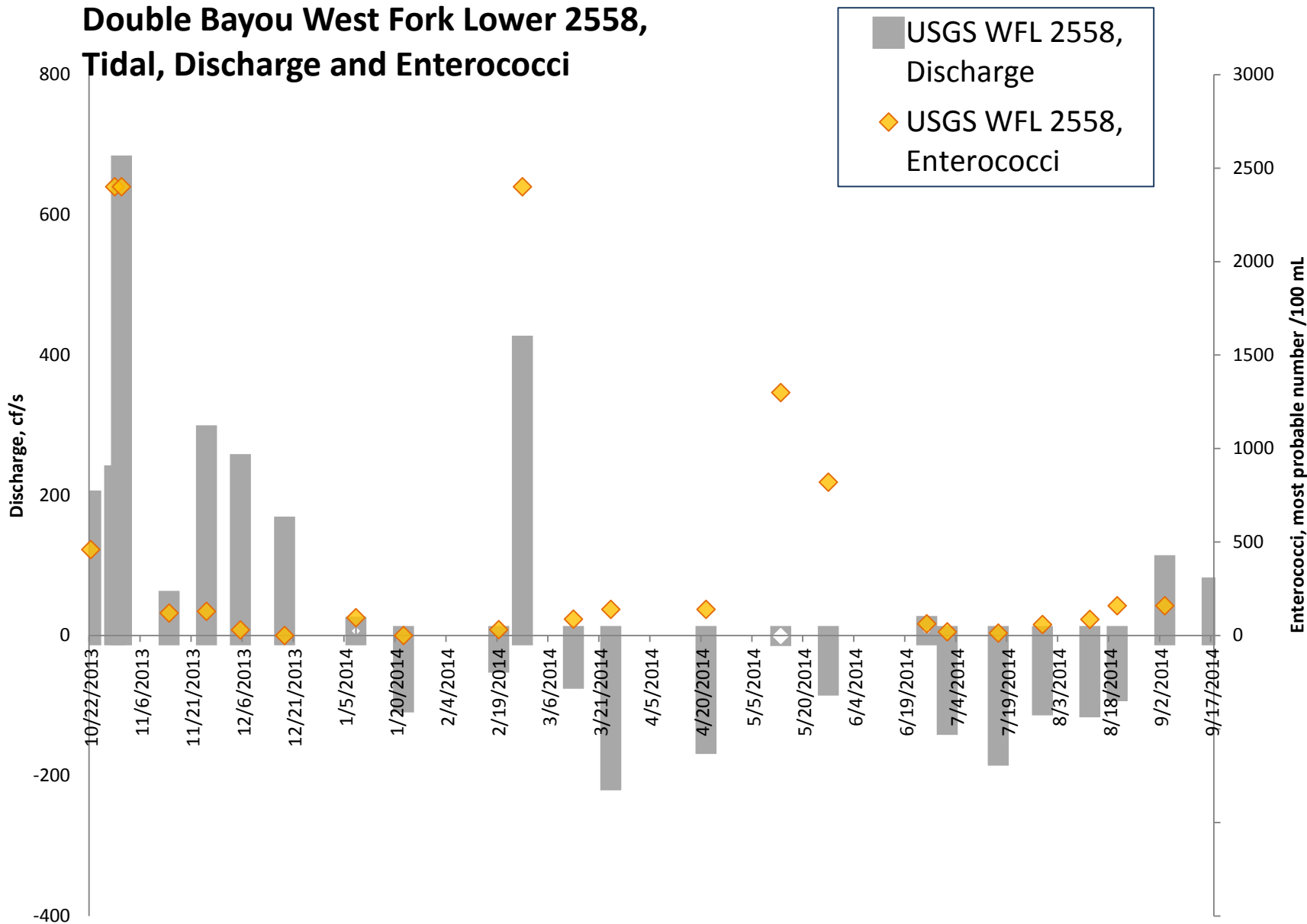
# Double Bayou East Fork Lower 2548, Tidal, Discharge and Enterococci



# Double Bayou West Fork Upper 2554, Tidal, Discharge and Enterococci



# Double Bayou West Fork Lower 2558, Tidal, Discharge and Enterococci



# VARIATION IN BACTERIA TYPES

| Single Sample Bacteria Benchmarks |                 |
|-----------------------------------|-----------------|
| <i>E. coli</i> (Freshwater)       | 394 MPN /100 mL |
| <b>Enterococci</b> (Saltwater)    | 89 MPN /100 mL  |

\* Bold bacteria values may be higher than indicated

| Sampling Station                  | Enterococci<br>(Single Sample Value) | E. coli<br>(Single Sample Value) | Sample Date |
|-----------------------------------|--------------------------------------|----------------------------------|-------------|
| Anahuac WWTP                      | 0.5                                  | 0.5                              | 10/22/2013  |
|                                   | 6                                    | 2                                | 10/29/2013  |
|                                   | 2400                                 | 2400                             | 10/31/2013  |
|                                   | 150                                  | 0.5                              | 11/14/2013  |
|                                   | 10                                   | 41                               | 11/25/2013  |
|                                   | 20                                   | 0.5                              | 12/5/2013   |
|                                   | 0.5                                  | 0.5                              | 12/18/2013  |
|                                   | 52                                   | 460                              | 1/8/2014    |
|                                   | 10                                   | 0.5                              | 1/22/2014   |
|                                   | 1                                    | 4                                | 2/19/2014   |
|                                   | 1400                                 | 2400                             | 2/26/2014   |
|                                   | 4                                    | 4                                | 3/13/2014   |
|                                   | 2                                    | 0.5                              | 3/24/2014   |
|                                   | 12                                   | 170                              | 4/21/2014   |
|                                   | 6900                                 | 24000                            | 5/13/2014   |
|                                   | 60                                   | 16                               | 5/27/2014   |
|                                   | 750                                  | 8700                             | 6/25/2014   |
|                                   | 10                                   | 73                               | 7/1/2014    |
|                                   | 2                                    | 5                                | 7/16/2014   |
|                                   | 6                                    | 8                                | 7/29/2014   |
|                                   | 6                                    | 0.5                              | 8/12/2014   |
| Total Number of Samples           | 21                                   | 21                               |             |
| Number of Samples Above Benchmark | 5                                    | 5                                |             |