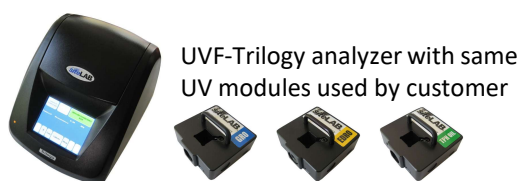
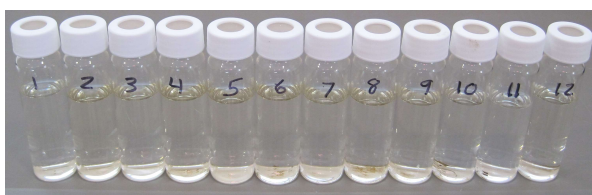


## Project Description:

This study was performed to help support a customer in Washington State looking to distinguish if surface water contains oil sheens or bio sheens using their UVF-Trilogy analyzer. Bio sheens can look like oil sheens but are naturally occurring and are not caused by petroleum spills. Water high in organic content from algae, decayed plant matter or from bacteria in stormwater and combined sewer overflows (CSOs), can contribute to interference using fluorescence based instruments. Solvent extraction is required for hydrocarbon analysis.

To mimic the types of conditions they have, a variety of samples were analyzed locally by Sitelab using it's two UVF instruments. The Merrimack River is often polluted by discharges of sewage and features a large number of marinas and commercial fishing boats where spills of gasoline, diesel and oil could occur. Samples were also collected from several reservoirs and a pond, where motor boats and swimming is prohibited (oil free water).



UVF-Trilogy analyzer with same UV modules used by customer



UVF-500D Handheld analyzer

| Sample Results in PPM (mg/L)<br>Water Extracts in Hexane Solvent                                 | Total PAHs          | Heavy PAHs              | GRO (BTEX)         | EDRO            | TPH Oil         |
|--|---------------------|-------------------------|--------------------|-----------------|-----------------|
| <b>Fresh water locations (no boats or swimming permitted)</b>                                    |                     |                         |                    |                 |                 |
| 1. Kenoza Lake, Haverhill  | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 2. Mill Pond Dock, West Newbury  | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 3. Artichoke Reservoir, Newburyport  | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| <b>Brackish water and ocean water locations</b>  |                     |                         |                    |                 |                 |
| 4. Kazmiera Marina, Haverhill  | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 5. Ferry Park, West Newbury  | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 6. Deer Island, Amesbury   | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 7. Cashman Park Dock, Newburyport  | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 8. Waterfront Park, Newburyport  | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 9. Plum Island Refuge Salt Marsh   | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 10. Plum Island Beach, Newbury   | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 11. Salisbury State Beach, Ocean   | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| 12. Salisbury State Beach, River   | ND <0.05            | ND <0.05                | ND <0.5            | ND <0.1         | ND <0.5         |
| <b>Dirty foam and bio slick locations</b>  |                     |                         |                    |                 |                 |
| 12. Salisbury Beach, Foam in River<br>● Water scooped from surface<br>● Gauze pad from surface   | ND <0.05<br>0.16    | ND <0.05<br>ND <0.05    | ND <0.5<br>ND <0.5 | ND <0.1<br>0.33 | ND <0.5<br>2.84 |
| 7. Cashman Park Shoreline, Bio Slick<br>● Water scooped from surface<br>● Gauze pad from surface | 0.10<br><b>0.46</b> | ND <0.05<br><b>0.16</b> | ND <0.5<br>ND <0.5 | 0.22<br>0.92    | 3.34<br>12.18   |

| TPH Oil   | TPH Oil, No Solvent Used |
|---|--------------------------|
| <b>Fresh water locations (no boats or swimming permitted)</b> |                          |
| ND <5   | 8.0                      |
| ND <5   | 24.2                     |
| ND <5   | 20.2                     |
| <b>Brackish water and ocean water locations</b>               |                          |
| ND <5   | 22.8                     |
| ND <5   | 21.6                     |
| ND <5   | 20.9                     |
| ND <5   | 20.5                     |
| ND <5   | 18.2                     |
| ND <5   | 20.7                     |
| ND <5   | 7.3                      |
| ND <5   | 3.4 J                    |
| ND <5   | 14.1                     |
| <b>Dirty foam and bio slick locations</b>                     |                          |
| 4.5 J   |                          |
| 3.2 J   |                          |
| 5.4   |                          |
| 17.4  |                          |

Tap water 0.0 J

### PAH Ratio = 2.9X Hydrocarbon Fingerprinting Ratios:

When Total PAH results are less than 1 ppm and no GRO is detected, PAH ratios of 4X or lower indicate sample has high organic content only (no oil).

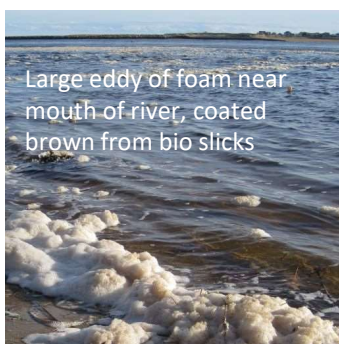
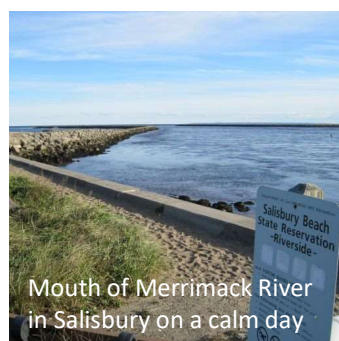
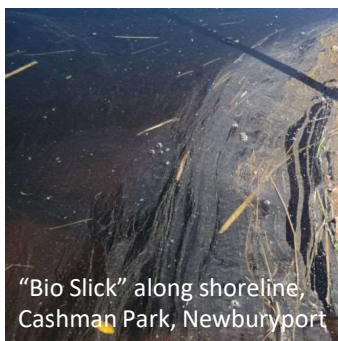
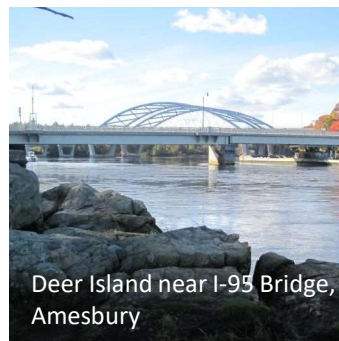
### Water Soluble Organics

Samples screened on-site without solvent extraction. Elevated results indicate higher bacteria or oil content. Drinking water has zero ppm response.

ND = Non Detect. "J" values reported between zero and the detection limit.

## Sample Locations & Photos

Samples of fresh water, brackish water and salt water were chosen to mimic customer’s application. Water was collected at high tide with the tide flowing out from Haverhill to the Atlantic Ocean. No sheens were observed, but brown slicks and foam were found.



Foam occurs naturally in stream rapids, below dams or in high surf and is caused by surfactants from dissolved organic carbon (DOC). This material contributes to the river’s dark tea like color. The brown slicks are fairly common - an ugly nuisance for boaters - and are likely caused by decayed plant matter, untreated sewage or both.

Where did the foam come from? Photo taken 1 week earlier in local newspaper...

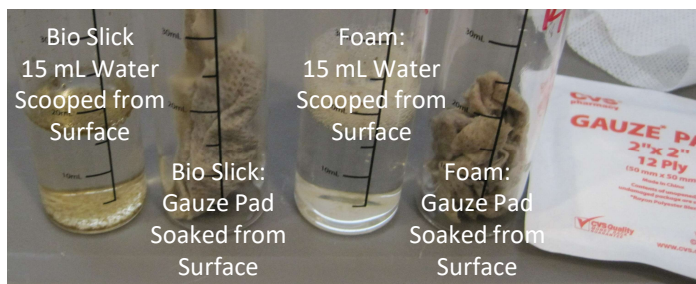
The Daily News, November 3, 2021  
 “RIDE THE WILD SURF”  
[https://www.newburyportnews.com/ride-the-wild-surf/image\\_f9833ce8-3ce2-11ec-8f06-27a4bb4a82f0.html](https://www.newburyportnews.com/ride-the-wild-surf/image_f9833ce8-3ce2-11ec-8f06-27a4bb4a82f0.html)

“The bow of the U.S. Coast Guard’s surf rescue boat pitches up as the crew heads into heavy surf for training last weekend at the mouth of the Merrimack River.”

### Summary of Analysis:

Water samples were extracted in hexane solvent and analyzed using Sitalab's two UVF analyzers. No oil or fuel was detected. Readings were close to zero in all 12 water samples, well below the minimum detection limit reported for each test. The hydrocarbon fingerprinting signatures exhibited in the bio slick sample results indicate a natural organic source. Using both analyzers in tandem proved useful for this study.

As an alternative to using sheen nets, which were not available to collect surface contaminants, absorbent gauze pads were used and work well for this application. Gauze pads are typically used for wiping oil on metal for analysis. Oil is very sticky and should cling to floating slicks, foam or boat hulls. For quality control, a gauze pad solvent blank was performed and tested using both instruments and no - or very little - response was detected caused by the hexane. Brands made with a rayon polyester blend are the most solvent resistant.

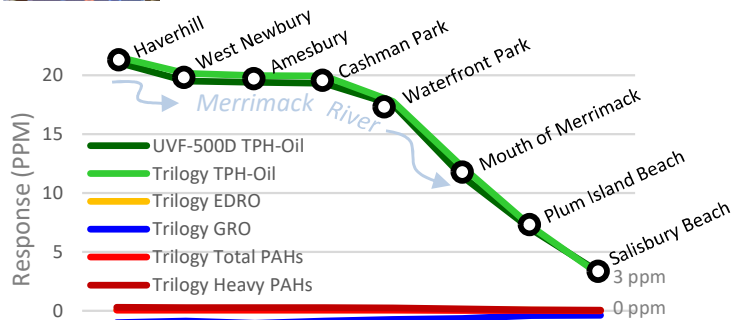


Samples were collected in glass vials (above) and then extracted in 15 mL of hexane solvent for 10 minutes, filtered and then analyzed. Extracts were clear in color and no oil was detected.

### Monitoring Water Soluble Organics:



Water measured on-site without solvent extraction exhibited elevated results which drop from dirty to cleaner water. Readings can indicate if high e-coli bacteria is present.



UVF-500D and UVF-Trilogy response detecting organic content in the six tests performed. The UVF-500D and the Trilogy's TPHOIL UV module are fitted with similar LEDs and optical filters.



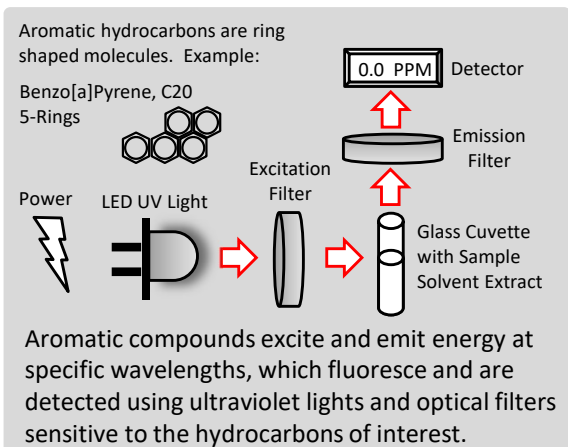
"MERRIMACK RIVER MAKES TOP 10 LIST OF NATION'S MOST ENDANGERED WATERWAYS"

The Eagle Tribune, April 17, 2016

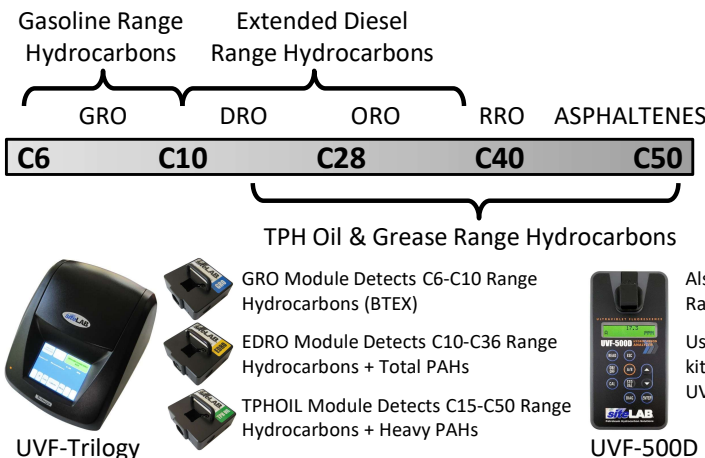
[https://www.eagletribune.com/news/merrimack-river-makes-top-10-list-of-nations-most-endangered-waterways/article\\_f21236ba-9491-52b1-ba92-bfee7675e5b4.html](https://www.eagletribune.com/news/merrimack-river-makes-top-10-list-of-nations-most-endangered-waterways/article_f21236ba-9491-52b1-ba92-bfee7675e5b4.html)

"Courtesy photo: An aerial view of brown water flowing out of mouth of the Merrimack River in 2011, in the wake of a tropical storm that passed through the region. In the foreground is Salisbury Beach; in the distance is Plum Island."

### How Fluorescence Works

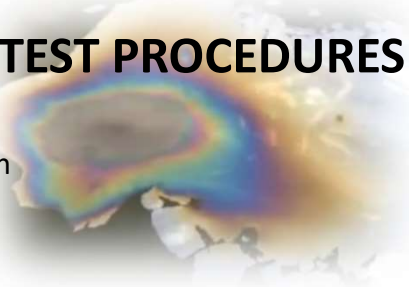


### Types of Hydrocarbons Detected



# siteLAB UVF-TRILOGY OIL IN WATER TEST PROCEDURES

Use for clean, less oily water samples which do not require filtration and/or dilution for analysis. Procedures shown here use Sitelab's Sample Extraction Vials, part no. EXTR72-WATER. The solvent dispenser bottle, glass cuvette and tissue wipes are included with all UVF-Trilogy models.



**1**

Shake water sample prior to use to mix contents thoroughly. Quickly pour 15 mL of water into a glass sample extraction vial. The vials have 5 mL graduations, be precise. If you do not have a container or bottle to collect your water sample, use an extraction vial to collect sample.

**2**

Add Hexane to the solvent dispenser bottle. Add 15 mL of hexane into the vial. Hexane will float on top of the water, so squirt up to the 30 mL line. Be precise. This creates a 1:1 or "1X" Extract. Screw and tighten the cap. Shake Extract for two minutes. The oil will dissolve into the solvent.

**3**

After shaking, allow time to settle so the solvent and water separate. Remove cap and pour top solvent layer into the glass cuvette about 1/2 full. Avoid water from bottom of vial! The Extract should be clear in color. If the Extract is yellow, readings may quench and a dilution is required.

**4**

Turn analyzer on, select "UV" then "Calibrate" followed by "Use Stored Calibration" and select the test you want to use from the menu. Be sure the correct UV Module is installed. Clean cuvette using a tissue to remove any fingerprints or liquids and place into the UV module. Avoid spills!

**5**

Close the lid and press the green "Measure Fluorescence" button. The concentration is displayed after a few seconds. Measure again several times to check repeatability. 1X Extracts are not diluted, no multiplier is used to calculate results, so record the concentration as is. When finished, pour back into the extraction vial after analysis to save for future use.

**6 Non Detect Sample Results**

| Test         | Cal Kit Used | MDL      |
|--------------|--------------|----------|
| PAHs         | PAH-060H     | 0.05 ppm |
| EDRO         | EDRO-042H    | 0.1 ppm  |
| GRO          | GRO-025H     | 0.5 ppm  |
| TPH-Oil Low  | TPH-057H     | 0.5 ppm  |
| TPH-Oil High | TPH-056H     | 5 ppm    |

Readings close to zero ppm, negative readings or readings below the test's minimum detection limit should be reported as "ND" for Non Detect. The UVF-Trilogy detection limits vary depending on which calibration is used for analysis. Examples shown above are Sitelab factory calibrations.

**QC Quality Control Tests**

Fill the cuvette with hexane and test a blank to make sure the solvent is clean. Readings should be close to zero ppm. If the calibration kit is available, test the standards to check for drift and accuracy. Readings should be close to each standard's concentration (within +/- 20%).

**QC Check for Quenching**

"Quenching" can occur when the detector is swamped by too many hydrocarbons which can produce low, nonlinear concentrations. Extract and test the water at a 2:1 or "2X" Dilution to confirm results are linear and accurate. Extract 10 mL of water with 20 mL of hexane, shake and analyze. Multiply reading by "2" to report final concentration.

**Using Sitelab UVF-500D Analyzer?**

The handheld UVF-500D analyzer uses the same test procedures shown here for the UVF-Trilogy, but uses smaller, 8 mm disposable glass cuvettes instead. Cuvettes are included in the UVF-500D water test kits or can be purchased separately. Sold online: [UVF-500D.COM](http://UVF-500D.COM).