

NEORSD Beach Water Quality Forecast and Harmful Algal Bloom Monitoring

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NEORSD, Water Quality and Industrial Surveillance



**Northeast Ohio
Regional Sewer District**

NEORSD – What do we do?

- Regional management of wastewater and stormwater for all or part of 62 communities, >1 million customers
 - Most of Cuyahoga County, parts of Summit County, & small portion of Willoughby Hills in Lake County
 - 3 wastewater treatment plants, 225 million gallons/day (1.1 billion gallons/day wet weather)
 - 280 miles of large interceptor sewers
 - Environmental monitoring of surface waters in our service area
 - Monitoring and repair of stormwater infrastructure

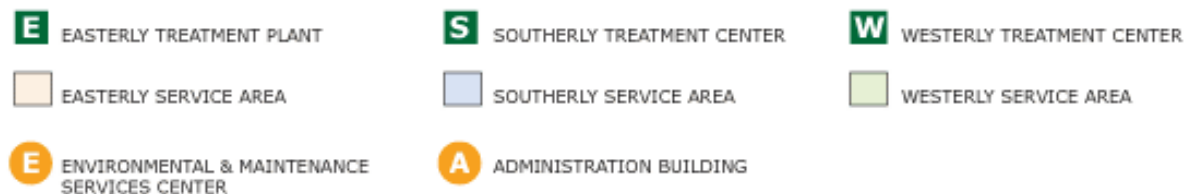
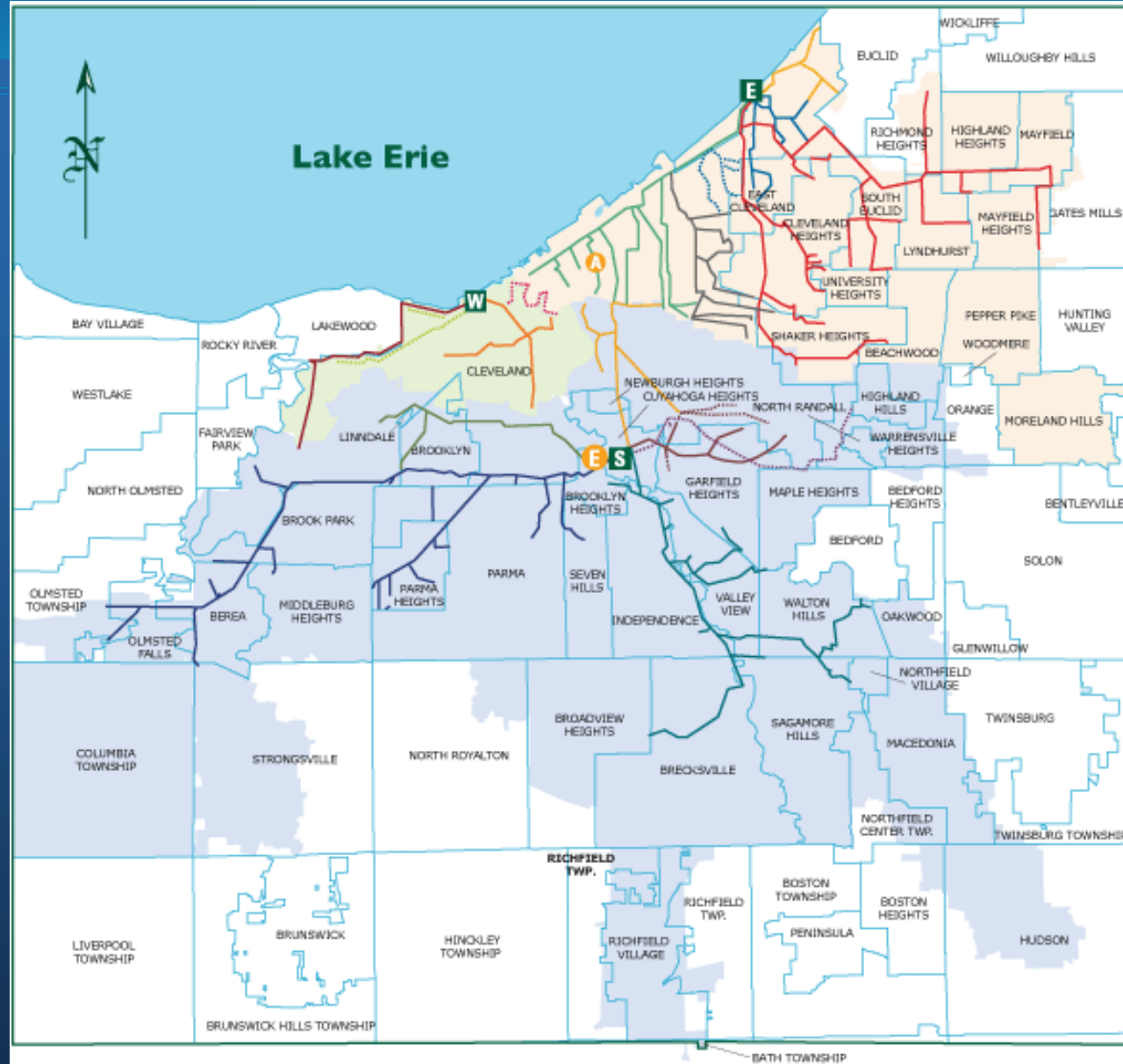


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Regional Sewer District**



Our Treatment Facilities

- Southerly WWTP
 - 125-400 mgd
 - 325 mgd (Primary)
- Westerly WWTP
 - 26 mgd
 - 300 mgd (Primary)
- Easterly WWTP
 - 94 mgd

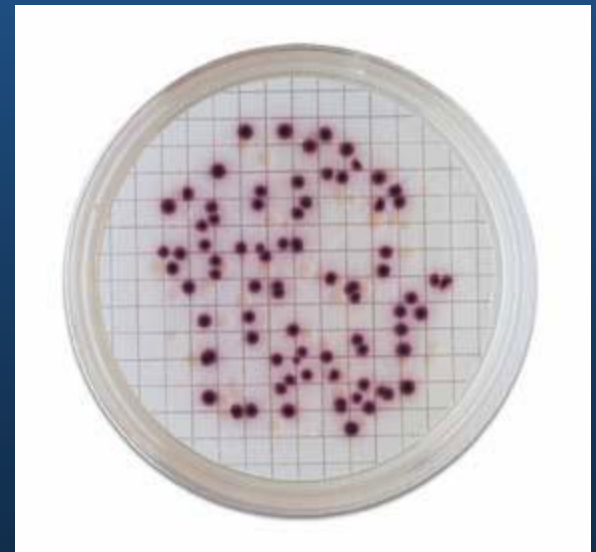
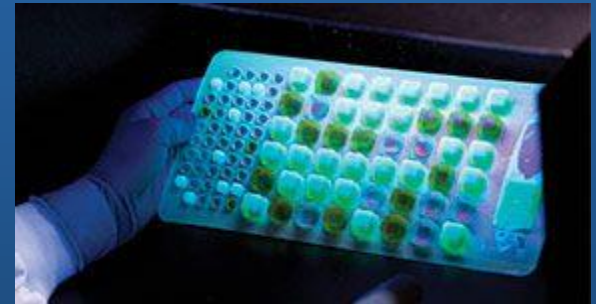


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Water Quality Parameters for Recreation

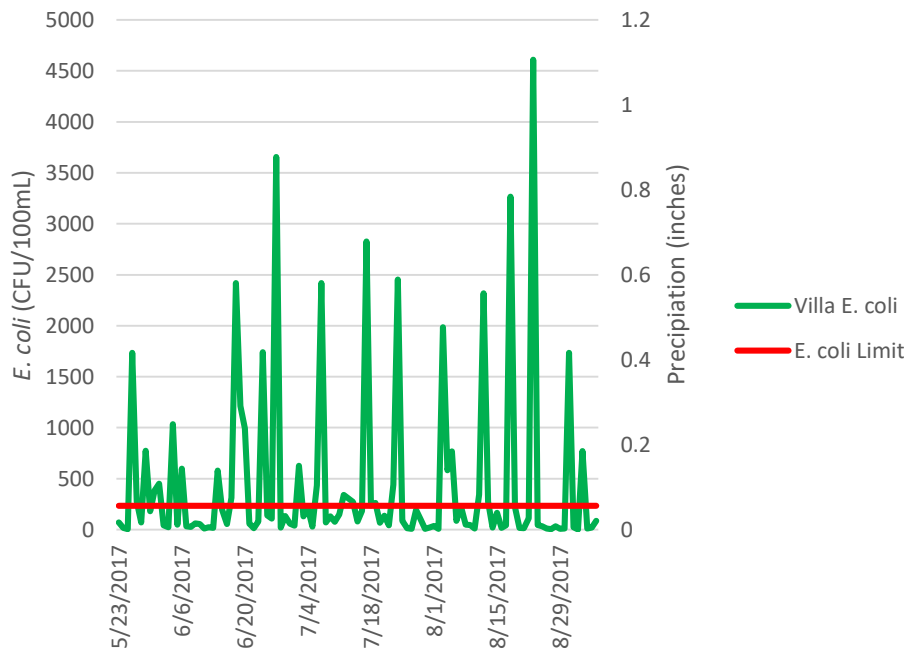
E. coli

- Water quality reporting limit
E. coli >235 cfu/100mL
- Problems
 - 1) Tests require 18-24 hours
 - 2) *E. coli* varies greatly day to day
- Historical Method – Persistence Model
- Current Method – Multi-Linear Regression Model

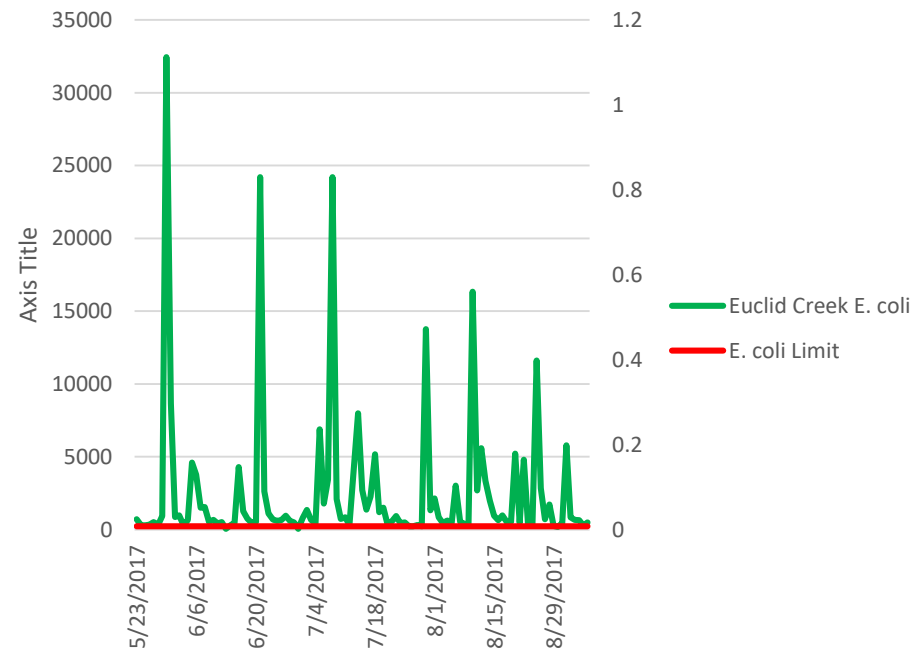


Problem with Persistence Method – *E. coli* Spikes

Villa Angela Beach E. coli



Euclid Creek RM 0.55 E. coli

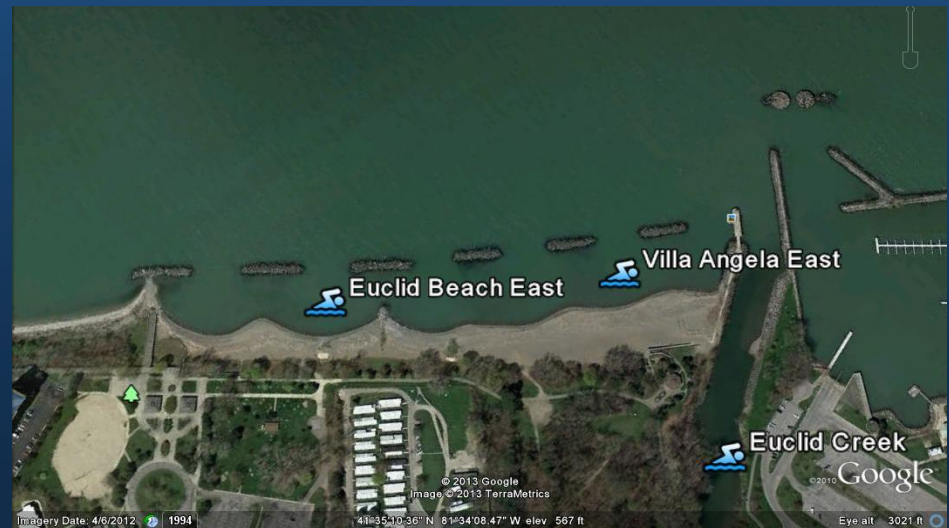
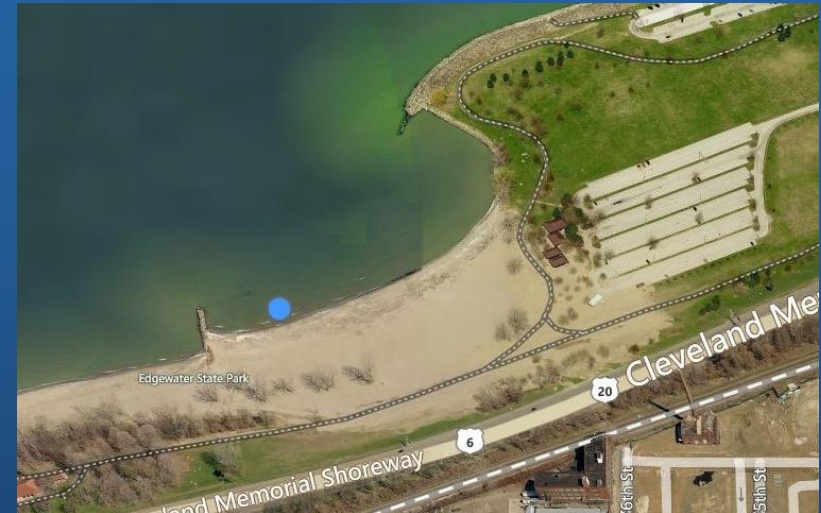


Beach Monitoring

Edgewater Beach

Euclid and Villa Angela Beaches

- Daily Sampling: Memorial Day – Labor Day
- Parameters
 - *Escherichia coli* (*E. coli*)
 - pH
 - Turbidity
 - Conductivity
 - Temp
 - Wave Height
 - Wind Speed
- Daily HAB monitoring
 - Pigment Analysis
 - Visual Inspection
 - Sampling if HAB is Observed



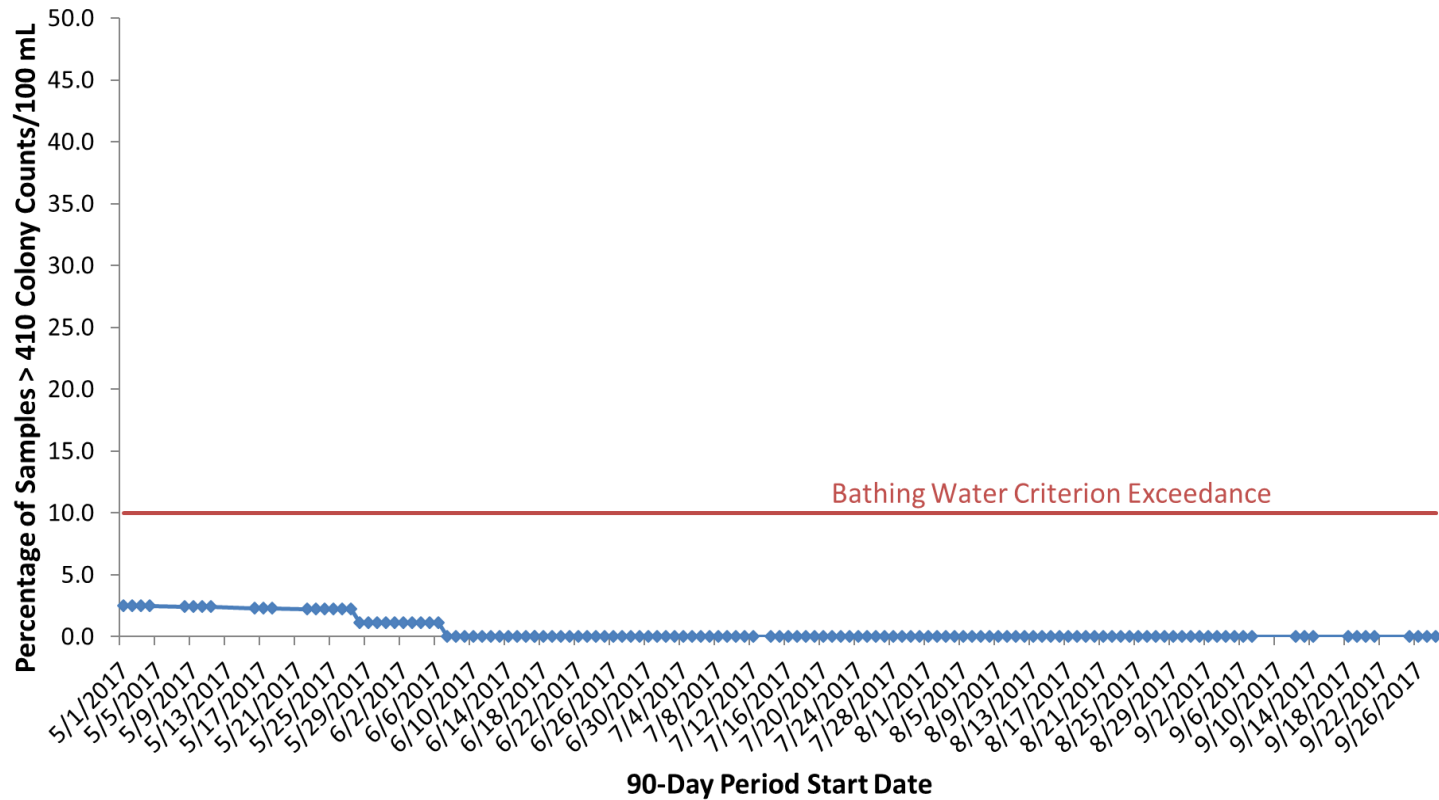






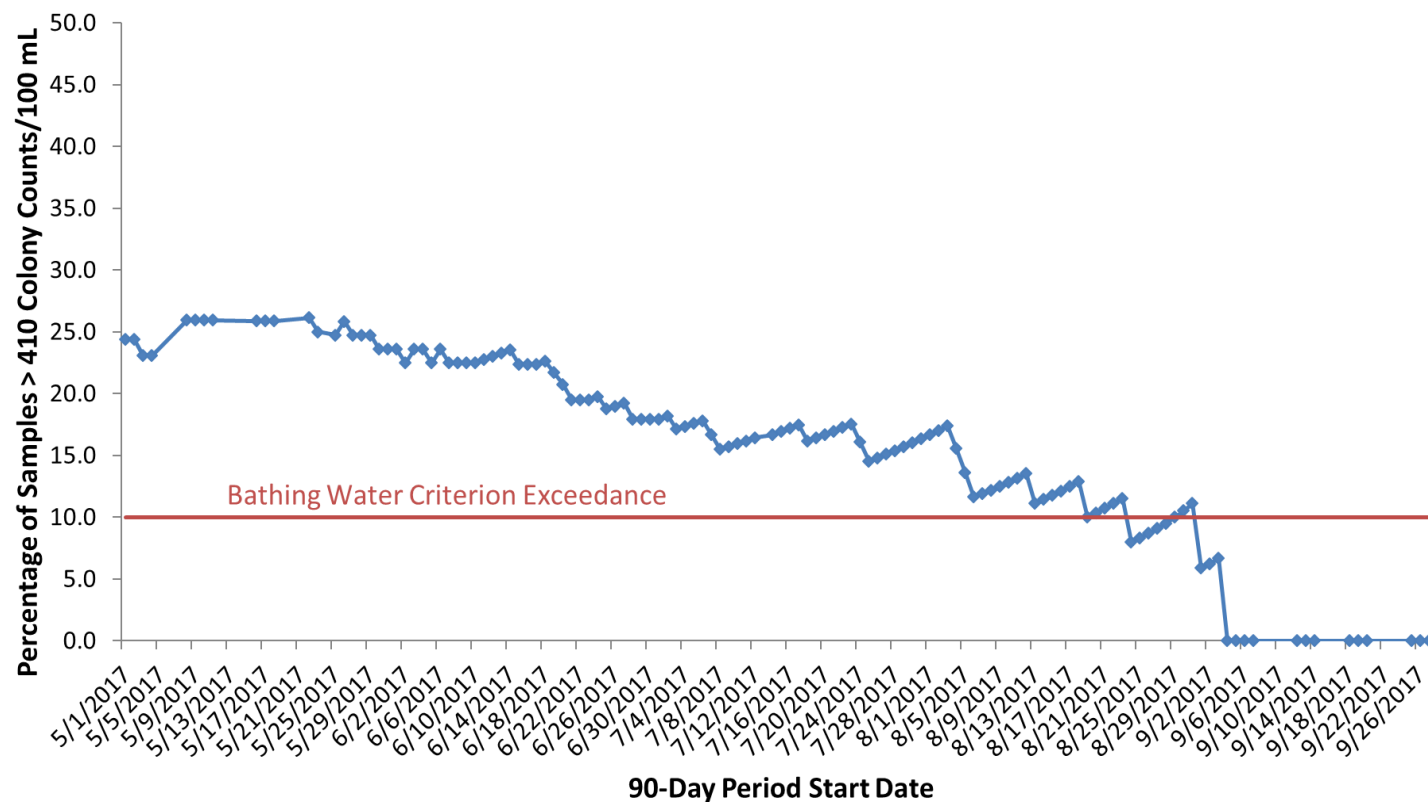
Edgewater Water Quality

Figure 2. 2017 Edgewater Beach East Site - Attainment of Bathing Water STV Criterion



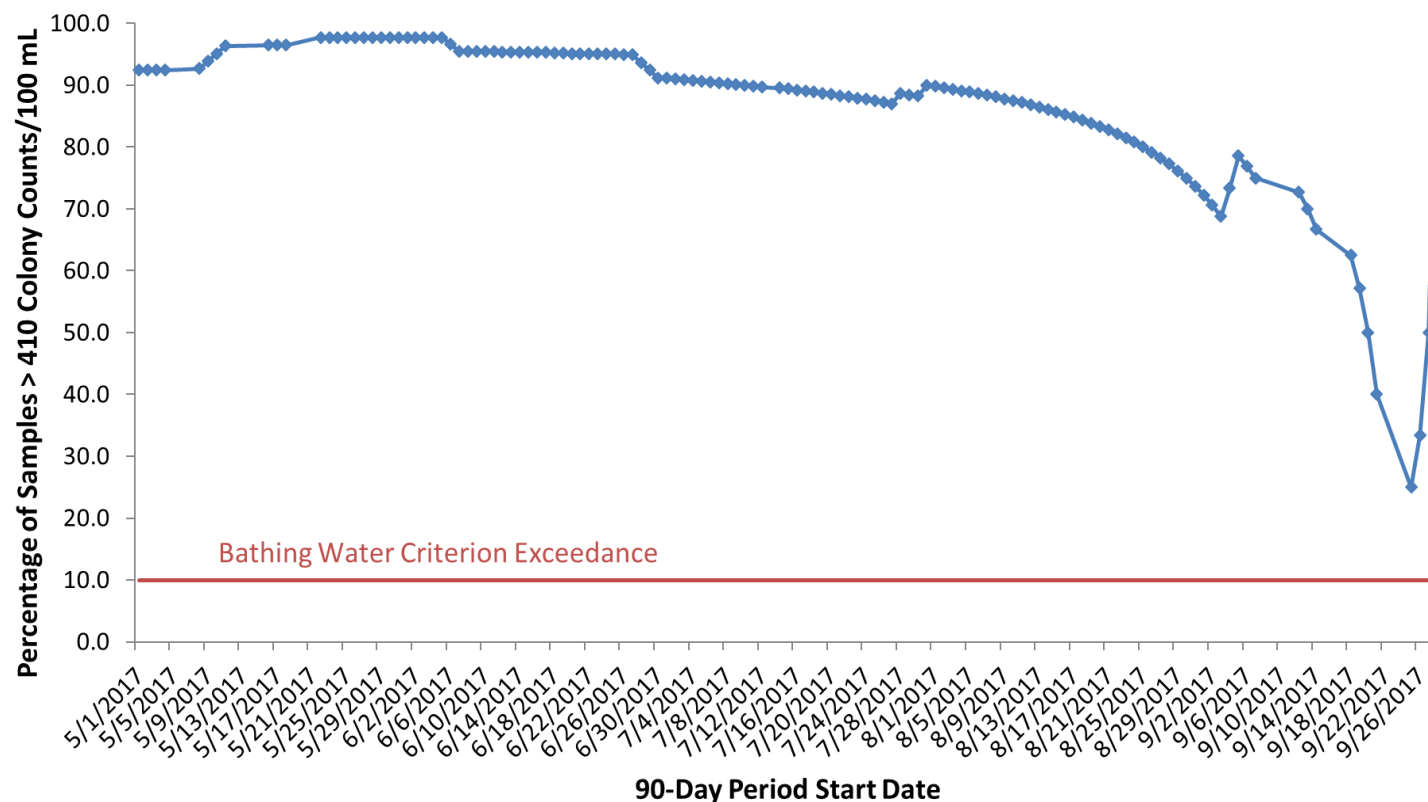
Villa Angela Water Quality

Figure 6. 2017 Villa Angela Beach East Site - Attainment of Bathing Water STV Criterion



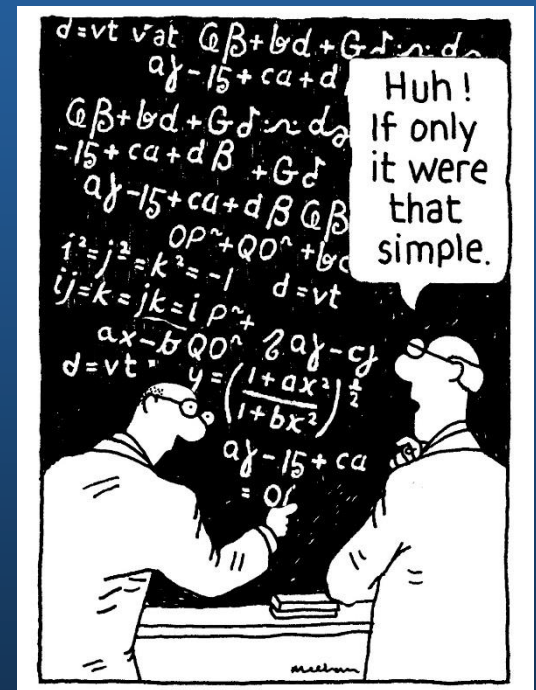
Euclid Creek Water Quality

Figure 8. 2017 Euclid Creek RM 0.55 - Attainment of Bathing Water STV Criterion



Multiple Linear Regression Modeling

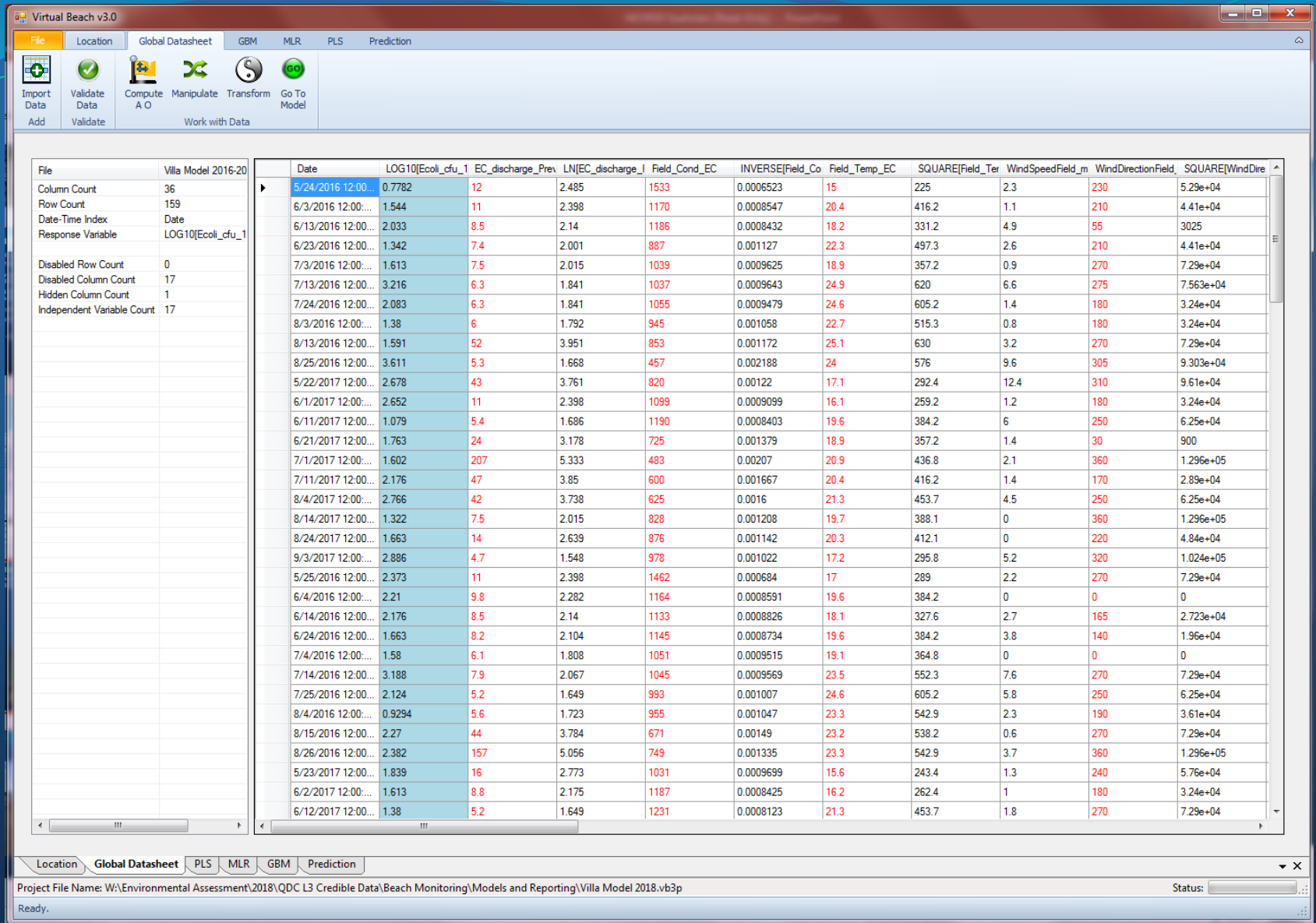
- Linear Regression
$$Y = mX + b$$
- Multiple Linear Regression
$$Y = mA + mB + mC + b$$



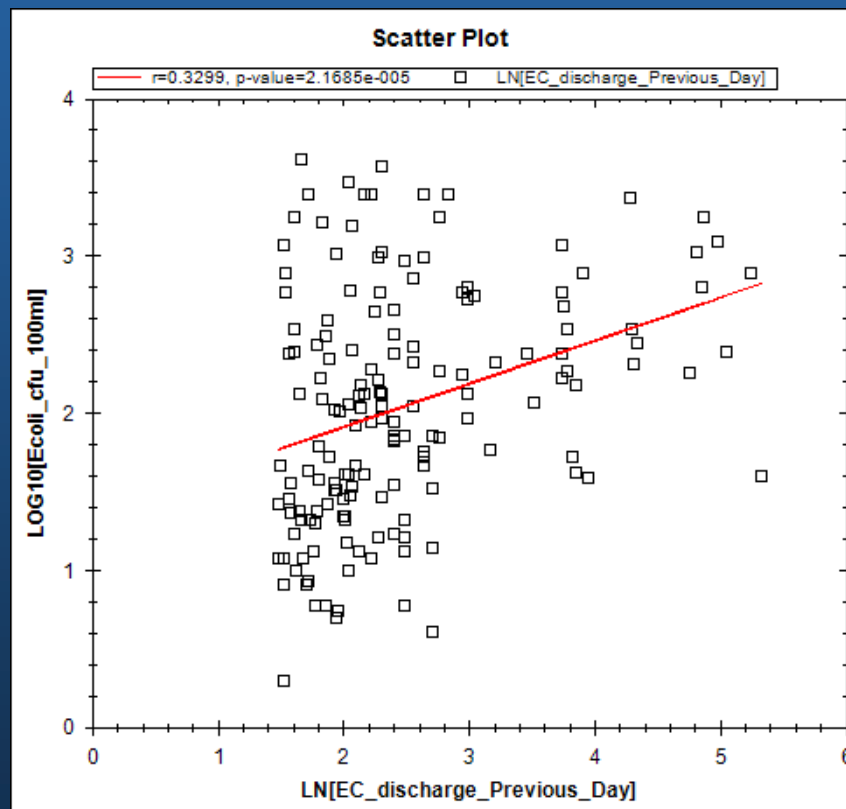
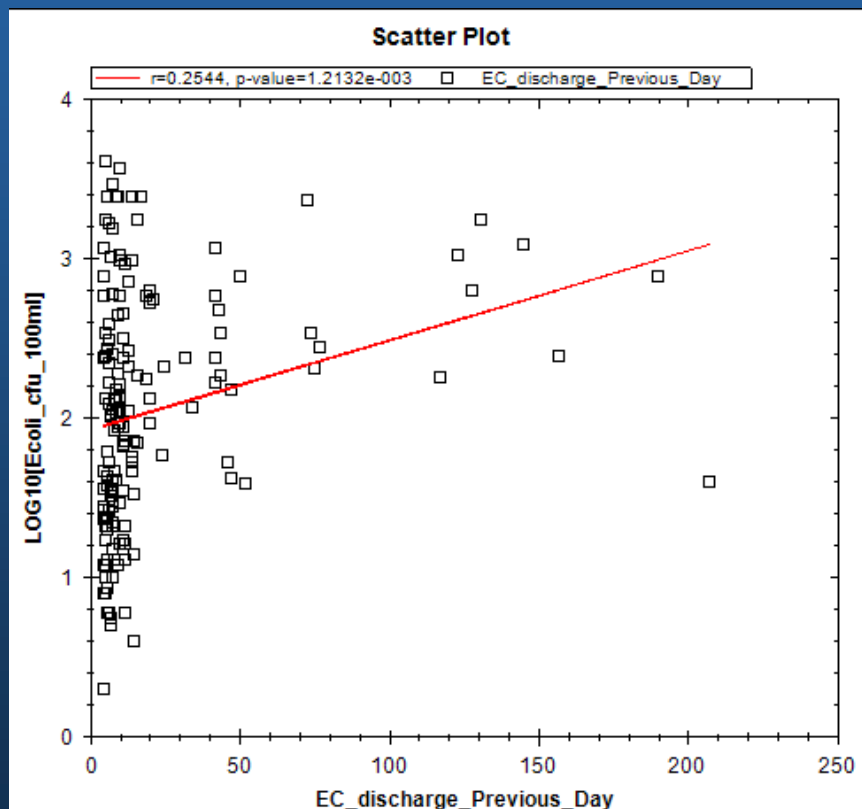
Modeling Software



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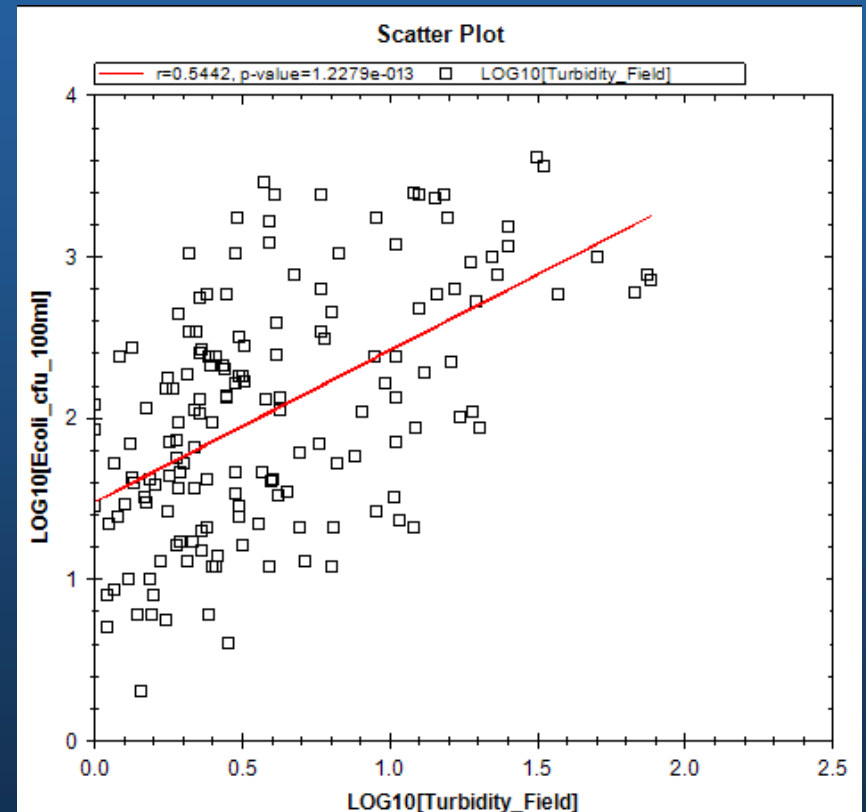
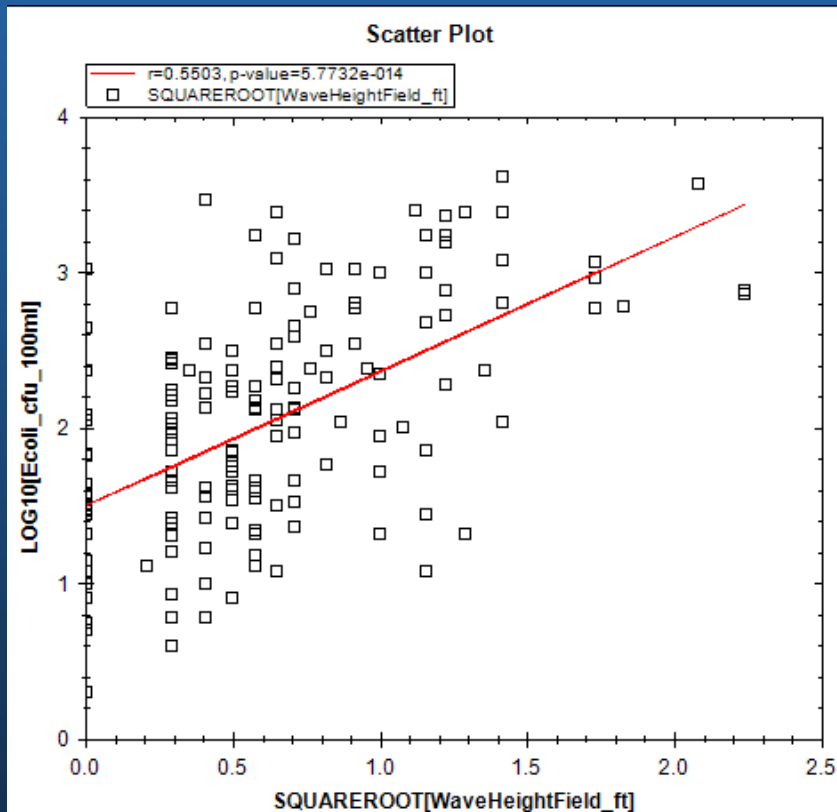


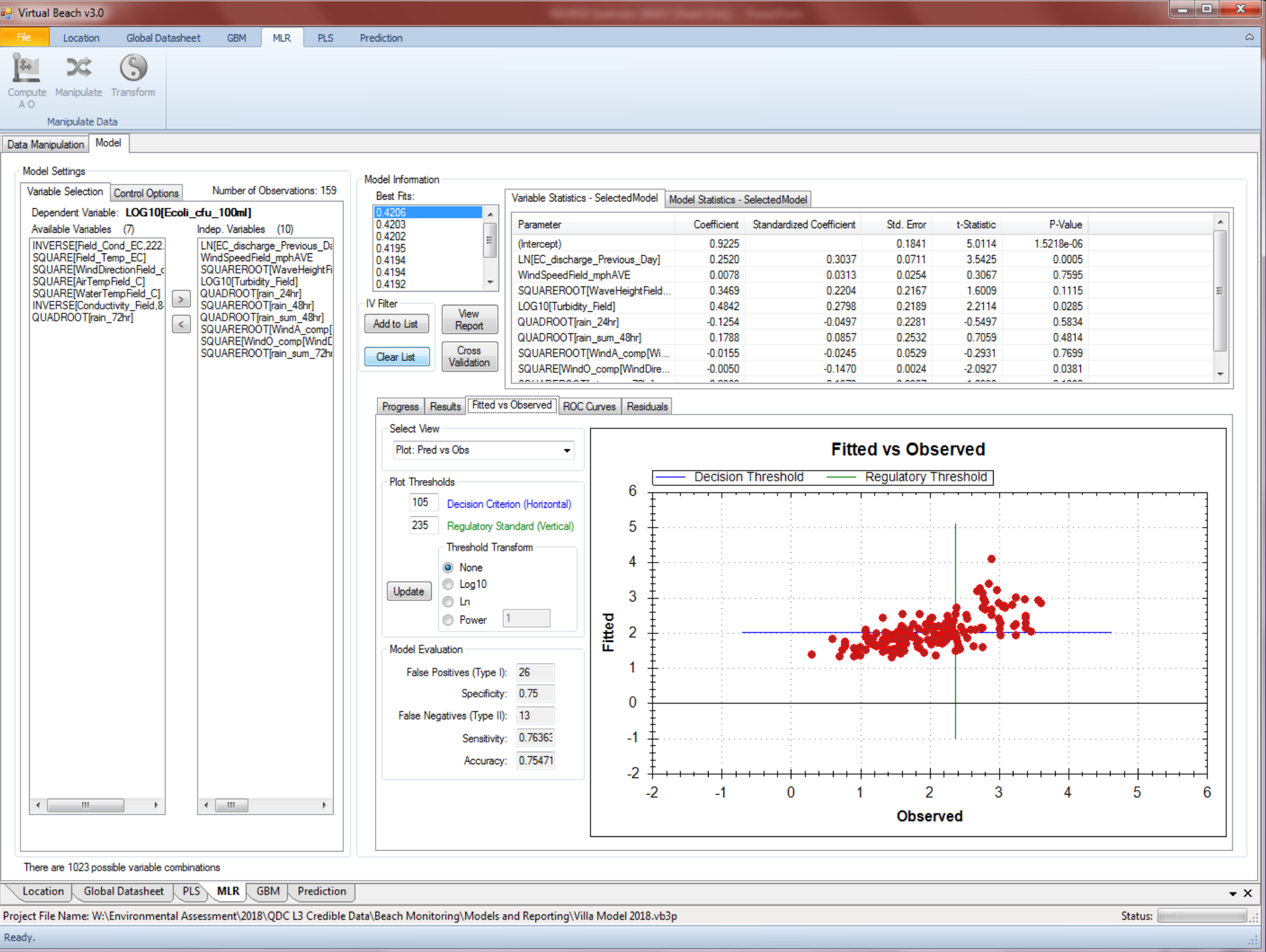
Data Transformations

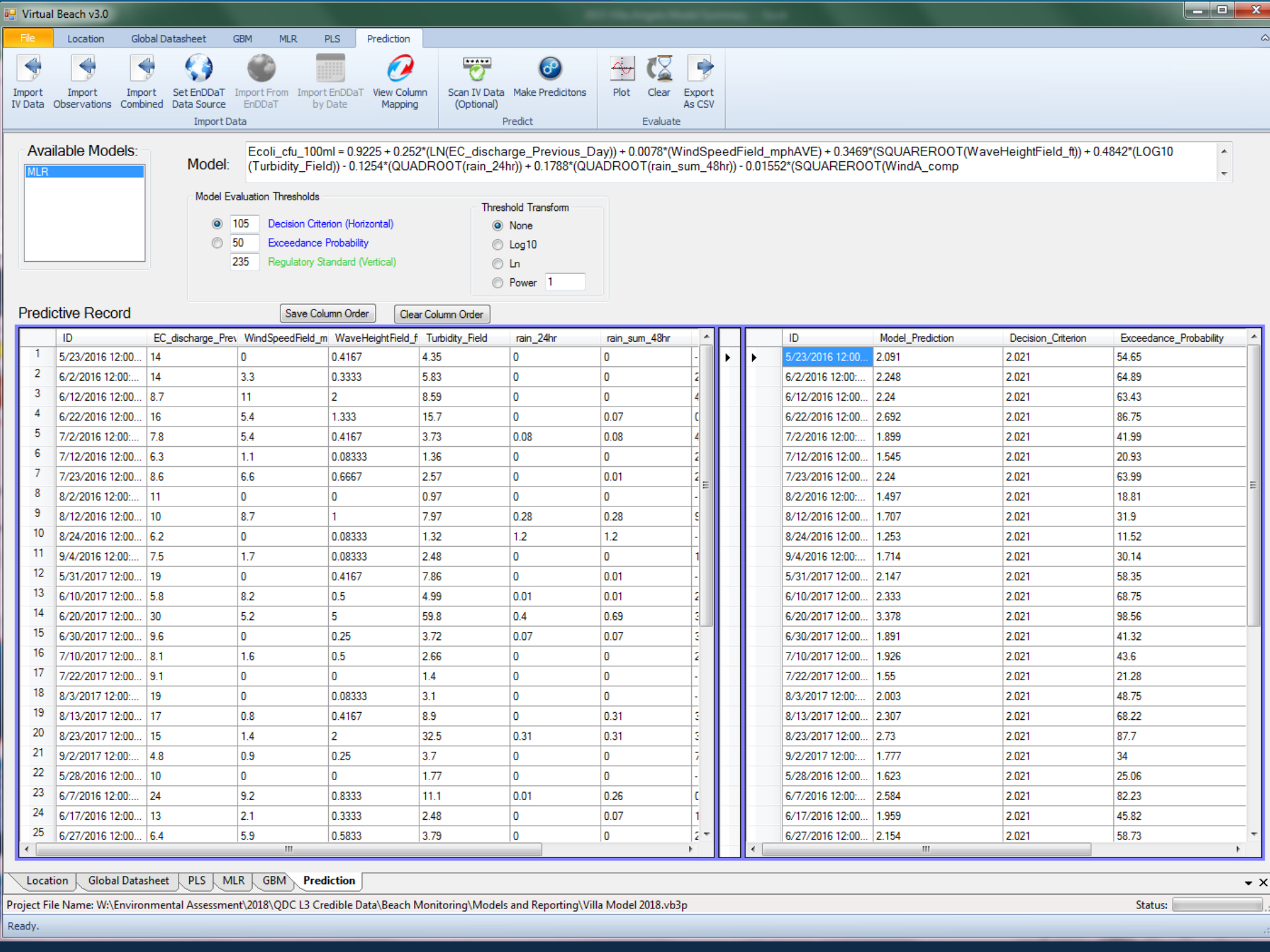


Best Fitting Parameters

Wave Height and Turbidity







Persistence vs MLR Model Performance

2016 Model Performance			
Site (Model)	Accuracy	Sensitivity	False Negatives / Total Exceedances
Edgewater (Persistence Model)	80%	10%	9 / 10
Edgewater (MLR Model)	84%	50%	5 / 10
Villa Angela (Persistence Model)	59%	41%	22 / 37
Villa Angela (MLR Model)	76%	76%	9 / 37

Persistence vs MLR Model Performance

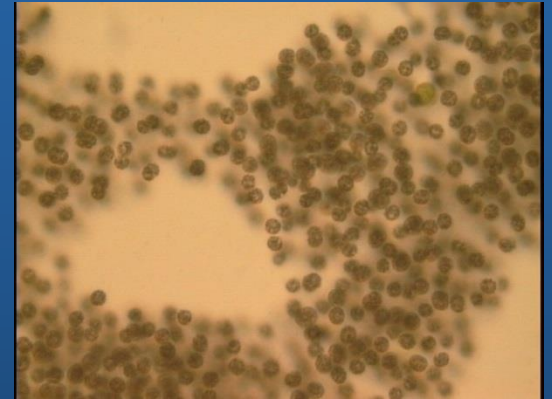
2017 Model Performance			
Site (Model)	Accuracy	Sensitivity	False Negatives / Total Exceedances
Edgewater (Persistence Model)	87%	0%	7 / 7
Edgewater (MLR Model)	77%	71%	3 / 7
Villa Angela (Persistence Model)	56%	36%	23 / 36
Villa Angela (MLR Model)	71%	81%	7 / 26



Harmful Algal Blooms

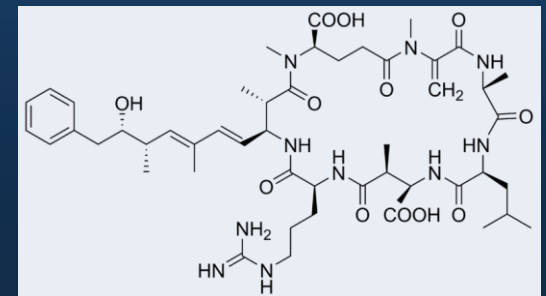
Microcystis and Aenabena

- Many species and strains of cyanobacteria exist
 - Not all produce toxins
- Microcystin (toxin)
 - The most common in Lake Erie, this is our laboratory indicator for HABs
 - Produced by Microcystis (cyanobacterial genus)
 - Hepatotoxin-toxic to the liver
 - Cyclic peptide
 - quantified using ELISA
 - Can be detected at 0.3 µg/L
 - Public Advisory Threshold- 6 µg/L



HAB Monitoring Methods

- Field fluorimeter
 - Detects fluorescent pigments of algae in the field
- Microscopic Identification
- ELISA Assay for Microcystin
- Shimadzu 8050 HPLC-MS
 - Highly Sensitive Quantification of Multiple Toxins
- Shimadzu MALDI-TOF
 - Accurately identify species and subspecies of many pathogenic microorganisms



Anabaena/Microcystis Bloom July 2013

Microcystin (µg/L)			
	Edgewater	Euclid Beach	Villa Angela
7/15/2013	2.31	--	--
7/16/2013	0.09	4.68	6.41
7/17/2013	0.06	0.04	0.06
7/21/2013	--	--	<0.3



Water Quality Advisory Postings

6 µg/L

20 µg/L

WARNING

High levels of algal toxins
have been detected.

Swimming and wading are not
recommended for the very old,
the very young or those
with compromised
immune systems.

DANGER

Avoid all contact with the water.

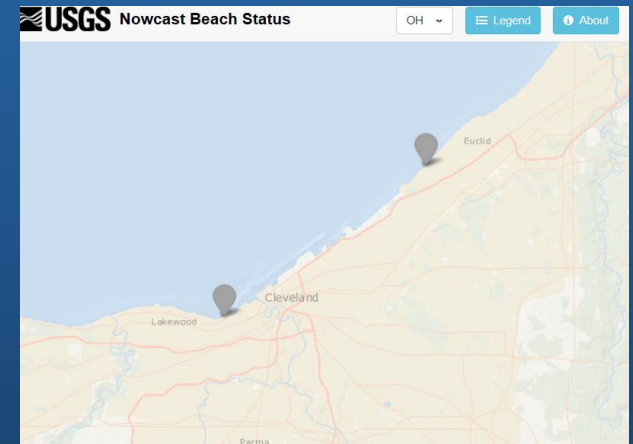
Algal toxins at **UNSAFE**
levels have been detected.



**Northeast Ohio
Regional Sewer District**

Where We Report

- Ohio Nowcast
 - USGS website
- Ohio Beachguard
 - ODH website
- NEORSD Website
- Cleveland News Channel 3
- WTAM 1100 iHeartMedia



K PATRONS

OS PARQUES

WATER QUALITY NOWCAST: GOOD
CALIDAD DEL AGUA PREDECITADO DEL TIEMPO BUENO

A "Nowcast" system is being tested on this beach to predict bacterial levels that may be present in the water.
Se está probando un sistema basado en el "Pronóstico del Tiempo" en esta playa para predecir los niveles bacterianos que pueden estar presentes en el agua.

GOOD WATER QUALITY IS PREDICTED TODAY
SE PREVEE UNA MUY BUENA CALIDAD DE AGUA

based on conditions observed this morning. This means that bacteria levels are likely to be low. Weather changes can result in a rapid change in water quality.
basado en las condiciones observadas esta mañana. Esto significa que es probable que los niveles bacterianos sean bajos. Los cambios climáticos pueden dar como resultado un cambio abrupto en la calidad del agua.

Nowcast data collected by: Northeast Ohio Regional Sewer District
For more information, visit www.clevelandmetroparks.org

Nowcast support provided by: Cleveland Metroparks
Cleveland Metroparks is a public agency. All services are provided by the agency.

**THURSDAY IN JUNE THROUGH SECOND SUNDAY IN AUGUST;
SECOND SUNDAY IN AUGUST, 11 AM - 7 PM ON
S ONLY THROUGH LABOR DAY.**

**HASTA EL SEGUNDO DOMINGO DE AGOSTO; DESPUÉS
DOS DÍAS DE SEMANA, HASTA EL DÍA DEL TRABAJO**

LIFEGUARDS ON DUTY ONLY IN SHADED AREAS DURING POSTED DATES AND TIMES
SALVAVIDAS DE TURNO SOLO EN LAS ÁREAS CON SOMBRÍA DURANTE LAS FECHAS Y HORARIOS PUBLICADOS

LIFEGUARDS MAY REDUCE AND/OR CLOSE SHADED/GUARDED AREAS AT THEIR SOLE DISCRETION
LOS SALVAVIDAS PUEDEN REDUCIR Y/O CERRAR LAS ÁREAS PROTEGIDAS CON SOMBRAS, SEGÚN SU CRITERIO

YELLOW SHADED AREA REPRESENTS WHERE LIFEGUARDS ARE ON DUTY
EL ÁREA AMARILLA CON SOMBRÍA REPRESENTA EL LUGAR EN DONDE LOS SALVAVIDAS SE ENCUENTRAN DE TURNO

LIFEGUARDS ON DUTY: 11 A.M. - 7 P.M. DAILY
Will Saturday in June through second Sunday in August; following second Sunday in August, 11 a.m. - 7 p.m. on weekends only through Labor Day.
ENCUENTRÁNSE DE TURNO DE 11 a.m. a 7 p.m. todos los días, desde el primer sábado de junio hasta el segundo domingo de agosto. Después del segundo domingo de agosto de 11 a.m. a 7 p.m. los fines de semana hasta el día del trabajo.



K PATRONS

LOS PARQUES

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WATER QUALITY NOWCAST: POOR

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POOR WATER QUALITY IS PREDICTED TODAY

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EL AREA AMARILLA REPRESENTA EL LUGAR DONDE LOS SALVAGUARDAS SE ENCONTRARAN EN TURNO



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Sometimes folks just don't listen...

