## Level 3 Project Study Plan

## 2014 Greater Cleveland Area Lake Erie Nutrient Study

## (1) Objectives

Over the last few years, there has been a significant increase in the occurrence of harmful algal blooms within the central basin of Lake Erie. In 2011, an algal bloom, the majority of which consisted of *Microcystis*, spread east of Cleveland and persisted there until the middle of October. The increase in algae throughout the lake is thought to be due to increases in dissolved reactive phosphorus (Ohio EPA, 2011) coupled with favorable weather conditions. Northeast Ohio Regional Sewer District (NEORSD) facilities, such as its wastewater treatment plants and the combined sewer overflows (CSOs), could be a potential source of nutrients to the lake. The extent to which these potential sources, along with other ones within the study area, are contributing to the problem is not well known.

The purpose of this study is to monitor the levels of nutrients and algae in Lake Erie near the greater Cleveland area from April through October and attempt to establish temporal and spatial trends among them and potentially relate them to level of precipitation. Chlorophyll *a* will be measured as a means of determining the total quantity of algae present. Nutrient analyses will include both phosphorus and nitrogen. Other water quality parameters that may also influence algal production will also be measured (Section 3).

Point Sources	Nonpoint Sources
Easterly WWTP	Urban Runoff
Westerly WWTC	Spills
NEORSD-owned CSOs	Agricultural runoff
Cuyahoga River	
Rocky River	
Euclid Creek	
9-Mile Creek	
Dugway Brook	
Doan Brook	
Shaw Brook	
Green Creek	

(2) Point/Nonpoint Sources

A map has been provided in Section 6 to show point sources that may be influencing the water quality at each sample location. These sources, along with 2014 Greater Cleveland Area Lake Erie Nutrient Study March 3, 2014

the ones listed in the table above, may be impacting nutrient and algal levels within Lake Erie.

## (3) Parameters Covered

Water chemistry samples will be collected by boat at each site and analyzed by NEORSD's Analytical Services. Chemical and physical water quality parameters to be measured in conjunction with water column chlorophyll *a* samples include total phosphorus, dissolved reactive phosphorus, nitrate+nitrite, ammonia, alkalinity, turbidity and suspended solids. Appendix A lists the parameters to be tested, along with the detection limits and practical quantitation limits. Field measurements for dissolved oxygen (DO), pH, temperature, conductivity and turbidity will also be performed. A Lake Sampling Field Data Form will be completed at each site during each sampling event (Appendix B).

## (4) Field Collection and Data Assessment Techniques

Techniques used for water chemistry sampling and chemical analyses will follow the Ohio EPA Surface Water Field Sampling Manual (2013). Chemical water quality samples from each site will be collected by boat with one 4-liter disposable polyethylene cubitainer with disposable polypropylene lids and two 473-mL plastic bottles. An additional sample to be analyzed for dissolved reactive phosphorus will be filtered in the field using a 0.45-µm PVDF syringe filter and put into a 125-mL plastic bottle. All water quality samples will be collected as grab samples at a depth of six to twelve inches below the surface. Duplicate samples and field blanks will be collected at randomly selected sites at a frequency of not less than 5% of the total samples collected for this study plan. The acceptable relative percent difference (RPD) for field duplicate samples will be less than or equal to  $[(0.9465x^{-0.344})*100]+5$ , where x = sample result/detection limit; results above this range will be rejected. Acid preservation of the samples, as specified in the NEORSD laboratory's standard operating procedure for each parameter, will also occur in the field. Appendix A lists the analytical method, method detection limit and practical quantitation limit for each parameter analyzed. Field analyses include the use of either a YSI-556 MPS Multi-Parameter Water Quality Meter, YSI EXO1 sonde, YSI 600XL sonde, or YSI 6600EDS sonde to measure dissolved oxygen (DO), water temperature, conductivity and pH; and when necessary, a Hanna HI 98129 meter to measure water temperature, conductivity and pH and a Hach HQ30d meter with LDO101 probe to measure DO. Turbidity will be measured using either a Hach 2100P IS Portable Turbidimeter or a Hach 2100Q Portable Turbidimeter. Specifications for these meters have been included in Appendix C.

Water column chlorophyll *a* samples will be collected during each sampling event using a 1L glass amber-colored jar. All chlorophyll *a* samples will be collected as grab samples at a depth of six to twelve inches below the surface. One duplicate chlorophyll *a* sample will be collected at randomly selected sites at a frequency of not less than 5% of the total samples collected for this study plan. After returning to the NEORSD Environmental and Maintenance Services Center, each sample will be filtered in triplicate using 47 mm glass fiber filters and a vacuum with a pressure not exceeding 6 in. Hg. Filtered samples will be stored in a freezer at -37°C for storage prior to analysis.

Where possible, data assessment will include an analysis of spatial and temporal trends in the collected data. Water chemistry data collected will be compared to Ohio water quality standards to determine whether any excursions from the applicable water quality criteria have occurred. It will also be used to determine any relationships among individual parameters and chlorophyll *a* concentrations.

- (5) Stream Flow Measurements Not applicable.
- (6) Sampling Locations

The following sample locations on Lake Erie, listed from west to east, will be surveyed during the 2014 field season:

Water Body	Latitude	Longitude	Station ID	Location Information	USGS HUC 8 Number - Name	Purpose	
	41.49720	-81.86200	RR1B	Near Rocky River			
	41.59630 -	81.80000 BR	D17D	About 7 miles off shore of Lakewood			
	41.52080 -	81.80000	BRD17I	Near Lakewood			
	41.54800 -	81.76400	CW82	Near Garrett Morgan Water Intake	04120200- Lake Erie	04120200-	Determine spatial trends in algal
Lake Erie	e 41.50765 -8	81.72907	WTP1	Near Westerly WWTC Diffusers		densities and nutrient	
	41.52500 -	81.71170	CW88	Outside the City of Cleveland's Breakwall		con	concentrations in Lake Erie.
	41.54500 -	81.67500	CE92	Outside the City of Cleveland's Breakwall			
	41.60333 -	81.59717	CE100	2 miles north of Easterly WWTP outfall			







## Greater Cleveland Area Lake Erie Nutrient Study

- Study Site
- 👡 Stream
- CSO Outfall
- Outfall
- District Facility
- NEORSD CSO Comnbined Sewer
- NEORSD CSO Responsibility Sewer
- NEORSD Intercommunity Relief Sewer
- NEORSD INTERCEPTOR
- Local Combined Sewer
- Local Culverted Stream
- Local Sanitary Sewer
- Local Storm Sewer



This information is for display purposes only. The Northeast Ohio Regional Sewer District (NEORSD) makes no warranties, expressed or implied, with respect to the accuracy of and the use of this map for any specific purpose. This map was created to serve as base information for use in Geographic Information Systems (GIS) for a variety of planning and analysis purposes. The NEORSD expressly disclaims any liability that may result from the use of this map. For more information, please contact: NEORSD GIS Services, 3900 Euclid Avenue, Cleveland, Ohio 44115 ----(216) 881-6600 ---GIS@neorsd.org

## (7) Schedule

Water chemistry sampling will be attempted at least once per month in May, June, and July 2014 and twice per month in August, September, and October 2014. More frequent sampling may be conducted if deemed necessary based upon the extent of any algal blooms. Sampling may also occur in April in weather permits. Specific dates have not been chosen and will be dependent upon weather and lake conditions.

## $(8) \quad QA/QC$

Water samples obtained for chemical analyses will be collected, preserved [see section (4)], labeled and then placed on ice in a cooler on the boat until all samples are collected. The sample cooler will then be transferred to the field truck upon returning to shore. The field truck will remain locked at all times when not occupied/visible. Sampling activities, including sample time and condition of surface water sampled, will be entered in a field log book and on the Lake Sampling Field Data Form (Appendix B). The samples will then be delivered immediately to the NEORSD Analytical Services cooler, after which the door to the cooler will be locked, and the samples will be transferred to the custody of Analytical Services. The NEORSD Analytical Services Quality Manual and associated Standard Operating Procedures are on file with Ohio EPA. The Quality Assurance Officer at Analytical Services will send updates, revisions and any information on document control to Ohio EPA as needed.

For chlorophyll *a* sampling, three filtrations will be performed for each sample. A field filtration blank will be submitted for every 20 samples.

(9) Work Products

Within one year of completion of the project, water chemistry results will be submitted to the Ohio EPA. Additionally, reports summarizing, interpreting, graphically presenting and discussing the chlorophyll *a* results and any excursions from water quality standards may be prepared for internal use.

## (10) Qualified Data Collectors

The following Level 3 Qualified Data Collectors (QDC) will be involved with this study:

Name	Address	Email Address	Phone Number	QDC Specialty(s)
John W. Rhoades <sup>1</sup>	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	rhoadesj@neorsd.org 2	16-641-6000	QDC - 00008 CWQA
Cathy Zamborsky	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	zamborskyc@neorsd.org 2	16-641-6000	QDC - 00009 CWQA
Seth Hothem	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	hothems@neorsd.org 2	16-641-6000	QDC - 00010 CWQA
Tom Zablotny	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	zablotnyt@neorsd.org 2	16-641-6000	QDC - 00018 CWQA
Ron Maichle	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	maichler@neorsd.org 2	16-641-6000	QDC - 00145 CWQA
Francisco Rivera	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	riveraf@neorsd.org 2	16-641-6000	QDC - 00262 CWQA
Jillian Novak	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	novakj@neorsd.org 2	16-641-6000	QDC – 00512 CWQA
<sup>1</sup> Lead Project Manage	er			

## 2014 Greater Cleveland Area Lake Erie Nutrient Study March 3, 2014

The following is a list of persons not qualified as level 3 QDCs who may be involved in the project. Prior to the start of sampling, the project managers will explain to each individual the proper methods for sampling. Sampling will only be completed under the direct observation of a QDC. The lead project manager will be responsible for reviewing all reports and data analysis prepared by qualified personnel prior to completion.

Name	Address	Email Address	Phone Number
Nick Barille	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	barillen@neorsd.org 2	16-641-6000
Joseph Carbonaro	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	carbonaroj@neorsd.org 2	16-641-6000
Mark Colvin	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	colvinm@neorsd.org 2	16-641-6000
Tim Dobriansky	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	dobrianskyt@neorsd.org 2	16-641-6000
Kyle Frantz	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	frantzk@neorsd.org 2	16-641-6000
Donna Friedman	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	friedmand@neorsd.org 2	16-641-6000
Rae Grant	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	grantr@neorsd.org 2	16-641-6000
Mark Matteson	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	mattesonm@neorsd.org 2	16-641-6000
Mario Meany	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	meanym@neorsd.org 2	16-641-6000
Denise Phillips	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	phillipsd@neorsd.org 2	16-641-6000
Brandy Reischman	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	reischmanb@neorsd.org 2	16-641-6000
Frank Schuschu	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	schuschuf@neorsd.org 2	16-641-6000
Eric Soehnlen	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	soehnlene@neorsd.org 2	16-641-6000

## 2014 Greater Cleveland Area Lake Erie Nutrient Study March 3, 2014

Name	Address	Email Address	Phone Number
William Stanford	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	stanfordw@neorsd.org	216-641-6000
Wolfram von Kiparski	4747 East 49 <sup>th</sup> Street Cuyahoga Hts., Ohio 44125	vonkiparskiw@neorsd.org	216-641-6000

## (11) Contract laboratory contact information

All chemical sample analysis will be completed by NEORSD's Analytical Services Division. Evidence of NEORSD's Analytical Services current accreditation and method dates can be found in Appendix D. The contact information for NEORSD's Analytical Service Division is:

NEORSD Analytical Services Mr. Mark Citriglia 4747 E. 49<sup>th</sup> Street Cuyahoga Heights, Ohio 44056 <u>citrigliam@neorsd.org</u> 216-641-6000

- (12) Copy of ODNR collector's permitNot applicable
- (13) Catalog Statement

A digital photo catalog of all sampling locations will be maintained for 10 years and will include photos of the specific sampling location(s), and, for those sites close to shore, the general land use in the immediate vicinity of the sampling location(s).

Date: 05/01/14

Print/Signature: John W. Rhoades /

(14) Voucher Specimen StatementNot applicable

(15) Sample Location Statement

I attest that I will make available any and all sampling location information, including but not limited to; the name of the water body sampled, sampling location latitude and longitude, sampling location, station ID, general location information, the U.S. geological survey HUC 8 number and name, and the purpose for data collection at each sampling location.

Date: 05 Print/Signature: John W. Rhoades / M

(16) Additional L3 Data Collector Statement

The Lead Project Manager for all NEORSD project study plans is approved for all project data types.

Date: 05/01/14

Print/Signature: John W. Rhoades /

(17) Trespassing Statement

I have not been convicted or pleaded guilty to a Violation of section 2911.21 of the Revised Code (criminal trespass) or a substantially similar municipal ordinance within the previous five years.

14	1/4/1/	1 1.1
Print/Signature:	John W. Rhoades / John W. Rhoades / John W. Rhoades /	Date: 05/01/14
Print/Signature:	Cathy Zamborsky /	Date:
Print/Signature:	Seth Hothem / Sec. How	Date: <u>5/1/14</u>
Print/Signature:	Tom Zablotny / Jon Zar	Date: 5-1-14
Print/Signature:	Ron Maichle Kound Hanh &	Date: 05-01-14
Print/Signature:	Francisco Rivera / Fran Thm	Date: <u>5/1/14</u>
Print/Signature:	Jillian Novak / Jun hand	Date: 5114

8

## References

- Ohio Environmental Protection Agency. (2009). *State of Ohio Water Quality Standards Ohio Administrative Code Chapter 3745-1* (Revision: Adopted July 9, 2009; Effective October 9, 2009). Columbus, OH: Division of Surface Water, Standards and Technical Support Section.
- Ohio Environmental Protection Agency. (2011). Draft Nutrient Reduction Strategy Framework for Ohio Waters. Columbus, OH: Division of Surface Water.
- Ohio Environmental Protection Agency. (2013). *Surface Water Field Sampling Manual*. Columbus, OH: Divisions of Surface Water and Environmental Services.

Appendix A

Parameter	Additional Name	Test	Minimum Detection Limit	Practical Quantitation Limit
Alkalinity		EPA 310.2	2.5 mg/L	10 mg/L
Ammonia	NH <sub>3</sub>	EPA 350.1	0.003 mg/L	0.010 mg/L
Nitrite + Nitrate	$NO_2 + NO_3$	EPA 353.2	0.003 mg/L	0.010 mg/L
Dissolved Reactive Phosphorus	DRPhos	EPA 365.1	0.003 mg/L	0.010 mg/L
Total Phosphorus	Total-P	EPA 365.1	0.001 mg/L	0.010 mg/L
Chlorophyll a	Chlorophyll a	EPA 445.0	0.03 <u>µ</u> g/L	0.15 µg/L
Total Suspended Solids	TSS	SM 2540 D <sup>1</sup>	0.5 mg/L	1.0 mg/L
Turbidity **		EPA 180.1	0.1 NTU	0.2 NTU
Field Parameter		Test	(Value 1	Reported in)
pH		EPA 150.1 <sup>1</sup>	s.u.	
Conductivity		SM 2510A <sup>1</sup>	μs/cm	
Dissolved Oxygen	DO	SM 4500-0 G <sup>1</sup>	mg/L	
Temperature	Temp	EPA 1701.1 <sup>1</sup>		°C
Turbidity *		EPA 180.1	]	NTU

\* Turbidity will either be completed in the field or at the laboratory.

<sup>1</sup> Standard Methods for the Examination of Water and Wastewater, Method approved by Standard Methods Committee, 1997. Editorial revisions, 2011.

Appendix B

## **NEORSD Lake Sampling Field Data Form**

Water Body:	Date:	Collectors	:
Water Quality Meters	s Used:		
Time Arrived (hrs):	Time Left (hrs):	Site:	
<u>Coordinates:</u> La	titude:	Longitude	:
Weather: Clear	Partly Cloudy Overcast	Light Rain/Showers	s Heavy Rain
Steady Rain	Other:	Wind	Direction:
Lake Surface Condition	ion: Calm Ripples	Moderate Waves	Whitecaps Other:
<u>Color:</u> Cle	ear Muddy Tea	Milky	Other:
Surface Coating:	None Other:	Odor:	Normal Other:
Field Parameters:	Conductivity (µmhos/cm):		Temperature (°C):
	Dissolved Oxygen (mg/L):_		pH (s.u.):
General Comments:			
Time Arrived (hrs):_	Time Left (hrs):	Site:	
<u>Coordinates:</u> La	titude:	Longitude	
<u>Weather:</u> Clear	Partly Cloudy Overcast	Light Rain/Showers	s Heavy Rain
Steady Rain	Other:	Wind	Direction:
Lake Surface Conditi	ion: Calm Ripples	Moderate Waves	Whitecaps Other:
<u>Color:</u> Cle	ear Muddy Tea	Milky	Other:
Surface Coating:	None Other:	Odor:	Normal Other:
Field Parameters:	Conductivity (µmhos/cm):		Temperature (°C):
	Dissolved Oxygen (mg/L):_		pH (s.u.):
General Comments:			

Sample ID:

Modified: March 6, 2013

Appendix C



## **YSIEnvironmental**

# **YSI 556 Multiparameter System**

## Versatile, multiparameter handheld instrument

Rugged and reliable, the YSI 556 MPS (Multiprobe System) combines the versatility of an easy-to-use, easy-to-read handheld unit with all the functionality of a multiparameter system.

- Simultaneously measures dissolved oxygen, pH, conductivity, temperature, and ORP
- Field-replaceable electrodes
- Compatible with EcoWatch' for Windows' data analysis software
- Stores over 49,000 data sets, time and date stamped, interval or manual logging
- Three-year warranty on the instrument; one-year on the probes
- GLP assisting, records calibration data in memory
- Available with 4, 10, and 20-m cable lengths
- IP-67, impact-resistant, waterproof case
- Easy-to-use, screw-on cap DO membranes
- RS-232 interface for PC connection

## **Options to Fit Your Applications!**

• Battery Options – The unit is powered by alkaline batteries or an optional rechargeable battery pack with quick-charge feature.

• Optional Barometer – Internal barometer can be user-calibrated and displayed along with other data, used in dissolved oxygen calibrations, and logged to memory for tracking changes in barometric pressure. (Choose 556-02)

• Optional Flow Cell - The 5083 flow cell can be used for ground water applications or anytime water is pumped for sampling.

• Carrying Case – The instrument comes standard with YSI 5061, a soft-sided carrying case with enough space for the 556, a 20-meter cable, and calibrating supplies. An optional 5080 hard-sided carrying case is also available.

• Confidence Solution<sup>•</sup> - Quality assurance ensured. Quickly check conductivity, pH, and ORP readings with one solution.



A rugged, cost-effective multiparameter handheld system designed for the field!

The 556 has multiple language capabilities and

graphing!



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## 5563 MPS Sensor Specifications

Dissolved Oxygen (% saturation)	Sensor Type Range Accuracy whichever is grea Resolution	Steady state polarographic 0 to 500% air saturation 0 to 200% air saturation, ± 2% of the reading or ±2% air saturation, ater; 200 to 500% air saturation, ± 6% of the reading 0.1% air saturation
Dissolved Oxygen (mg/L)	Sensor Type Range Accuracy Resolution	Steady state polarographic 0 to 50 mg/L 0 to 20 mg/L, ± 2% of the reading or ±0.2 mg/L, whichever is greater; 20 to 50 mg/L, ± 6% of the reading 0.01 mg/L
Temperature	Sensor Type Range Accuracy Resolution	YSI Temperature Precision <sup>*</sup> thermistor -5 to 45°C ± 0.15°C 0.1°C
Conductivity	Sensor Type Range Accuracy ± 1.0% of reading Resolution	4-electrode cell with autoranging 0 to 200 mS/cm ± 0.5% of reading or ± 0.001 mS/cm; whichever is greater (4-meter cable) g or ± 0.001 mS/cm; whichever is greater (20-meter cable) 0.001 mS/cm to 0.1 mS/cm (range-dependent)
Salinity	Sensor Type Range Accuracy Resolution	Calculated from conductivity and temperature 0 to 70 ppt ± 1.0% of reading or ±0.1 ppt, whichever is greater 0.01 ppt
pH (optional)	Sensor Type Range Accuracy Resolution	Glass combination electrode 0 to 14 units ±0.2 units 0.01 units
ORP (optional)	Sensor Type Range Accuracy Resolution	Platinum button -999 to +999 mV ± 20 mV 0.1 mV
Total Dissolved Solids (TDS)	Sensor Type Range Resolution	Calculated from conductivity (variable constant, default 0.65) 0 to 100 g/L 4 digits
Barometer (optional)	Range Accuracy Resolution	500 to 800 mm Hg ± 3 mm Hg within ± 10°C temperature range from calibration point 0.1 mm Hg

## **YSI 556 Instrument Specifications**

Size	11.9 cm width x 22.9 cm lenth (4.7 in. x 9 in.)
Weight with batteries	2.1 lbs. (916 grams)
Power	4 alkaline C-cells; optional rechargeable pack
Cables	4-, 10-, and 20-m (13.1, 32.8, 65.6 ft.) lengths
Worranty	3-year instrument; 1-year probes and cables
Communication Port	RS-232 Serial
Data Logget	49,000 data sets, date and time stamp, manual or logging, with user-selectable intervals

## 556 Ordering Information (Order all items separately)

556-01	Instrument (with 5061 large, soft-sided carrying case)	
556-02	Instrument with barometer option (with 5061 carrying case)	
5563-4	4-m cable and DO/temp/conductivity	3.1
5563-10	10-m cable and DO/temp/conductivity	
5563-20	20-m cable and DO/temp/conductivity	7.1
5564	pH Probe for any 5563 cable	
5565	pH/ORP Probe for any 5563 cable	
5118	Rechargeable battery pack kit (includes battery, adapter, charger)	
514	Ultra clamp, C-clamp mount	
516	Charger, cigarette lighter	
4654	Tripod (small tripod for instrument)	
5060	Small carrying case, soft-sided (fits instrument and 4-m cable)	÷
5065	Form-fitted carrrier with shoulder strap	12
5080	Small carrying case, hard-sided (fits instrument, 4-m cable, flow cell, batteries, membrane kit, calibration bottles)	
5083	Flow cell	
5085	Hands-free harness	1.71
5580	Confidence Solution <sup>®</sup> (insure probe accuracy with a simple field- check for conductivity, pH, and ORP)	



The 5080 carrying case with 556, 5563-4 cable, and 5083 flow cell.





The YSI 600XL and 600XLM

# YSI 600XL and 600XLM Sondes

## Measure multiple parameters simultaneously

The YSI 600XL and YSI 600XLM compact sondes measure eleven parameters simultaneously:

Temperature Conductivity Specific Conductance Salinity Resistivity TDS pH ORP Depth or Level Rapid Pulse<sup>™</sup> DO (% and mg/L)

## **Connect with Data Collection Platforms**

Either sonde can easily connect to the YSI 6200 DAS (Data Acquisition System), YSI EcoNet<sup>™</sup> or your own data collection platform, via SDI-12 for remote and real-time data acquisition applications.

## **Economical Logging System**

The YSI 600XLM is an economical logging system for long-term, *in situ* monitoring and profiling. It will log all parameters at programmable intervals and store 150,000 readings. At one-hour intervals, the instrument will log data for about 75 days utilizing its own power source. The 600XL can also be utilized in the same manner with user-supplied external power.

- Either sonde fits down 2-inch wells
- Horizontal measurements in very shallow waters
- Stirring-independent Rapid Pulse\* dissolved oxygen sensor
- Field-replaceable sensors
- Easily connects to data collection platforms
- Available with detachable cables to measure depth up to 200 feet
- Compatible with YSI 650 Multiparameter Display System
- Use with the YSI 5083 flow cell for groundwater applications



Economical, multiparameter sampling or logging in a compact sonde

## Sensor performance verified\*

The  $6820 \vee 2$  and  $6920 \vee 2$  sondes use sensor technology that was verified through the US EPA's Environmental Technology Verification Program (ETV). For information on which sensors were performance-verified, turn this sheet over and look for the ETV logo.





To order, or for more info, contact YSI Environmental.

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Senses with latted with the EUV lagstwere submitted in the EUV papersion like V314902B. It is the transitions on the parameters are been under the end of the end of the sense ranked from all survival, upper block of the TV meen submitted with the transition of th

YS1 incorporated Who's Minding the Planet?

T SI OUUAL & OUUALIYI SENSOR SDECITICOTION	YSI 600XL	& 600XLM	Sensor S	pecification
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	Range	Resolution	Accuracy
Dissolved Oxygen % Saturation 6562 Rapid Pulse" Sensor*	0 to 500%	0,1%	0 to 200%: ±2% of reading or 2% air saturation, whichever is greater; 200 to 500%: ±6% of reading
Dissolved Oxygen mg/L 6562 Rapid Pulse" Sensor*	0 to 50 mg/L	0.Q1 mg/L	0 to 20 mg/L: ± 0.2 mg/L or 2% of reading, whichever is greater; 20 to 50 mg/L: ±6% of reading
Conductivity" 6560 Sensor* ETV	0 to 100 mS/cm	0.001 to 0.1 mS/cm (range dependent)	±0.5% of reading + 0,001 m\$/cm
Salinity	0 to 70 ppt	0.01 ppt	±1% of reading or 0.1 ppt, whichever is greater
Temperature 6560 Sensor*	-5 to +50°C	0.01°C	±0.15°C
pH 6561 Sensor* ETV	Ø to 14 units	0.01 init	±0.2 unit
ORP	+999 to +999 mV	0.1 mV	±20 mV
Depth & Level Medium Shallow Vented Level	0 to 200 ft, 61 m 0 to 30 ft, 9.1 m 0 to 30 ft, 9.1 m	0.001 ft, 0.001 m 0.001 ft, 0.001 m 0.001 ft, 0.001 m	±0,4 fl, ±0.12 m ±0,06 fl, ±0.02 m ±0,01 fl, 0.003 m

Report outputs of specific conductance (conductivity corrected to 25° C), resistivity, and total dissolved solids are
also provided. These values are automatically calculated from conductivity according to algorithms found in Shindard
Methods for the Examination of Water and Wastewater (ed 1989).

YSI 600XL & 600	YSI 600XL & 600XLM Sonde Specifications			
Medium	Fresh, set or polluted water			
Temperature Øpératir St	ng -5 to +50°C proge -10 to +60°C			
Communications	RS-232, SDI-12			
Software	EcoWatch*			
Dimensions Dia 490xt   400xt/M E	meter 1.65 in, 4.19 cm   1.65 in, 4.9 cm ength 16 in, 40.6 cm   21.3 in, 54.1 cm 1.3 lbs, 0.59 kg   1.5 lbs, 0.69 kg			
Power Ext Internal (600XLM	ernol 12 V DC only) 4 AA-size alkaline batteries			





# HI 98129 Combo pH/EC/TDS/Temperature Tester with Low Range EC



## Description

The HI 98129 Combo waterproof tester offer high accuracy pH, EC/TDS and temperature measurements in a single tester! No more switching between meters for your routine measurements. The waterproof Combo (it even floats) has a large easy-to-read, dual-level LCD and automatic shut-off. pH and EC/TDS readings are automatically compensated for the effects of temperature (ATC). This technologically advanced tester has a replaceable pH electrode cartridge with an extendable cloth junction as well as an EC/TDS graphite electrode that resists contamination by salts and other substances. This gives these meters a greatly extended life. Your tester no longer needs to be thrown away when the pH sensor is exhausted.

The EC/TDS conversion factor is user selectable as is the temperature compensation coefficient (ß). Fast, efficient, accurate and portable, the Combo pH, EC/TDS and temperature tester brings you all the features you've asked for and more!

Range	pН	0.00 to 14.00 pH
Range	EC	0 to 3999 µS/cm
Range	TDS	0 to 2000 ppm
Range	Temperature	0.0 to 60.0°C / 32 to 140.0°F
Resolution	pН	0.01 pH
Resolution	EC	1 µS/cm
Resolution	TDS	1 ppm
Resolution	Temperature	0.1°C / 0.1°F
Accuracy	pН	±0.05 pH
Accuracy	EC/TDS	±2% F.S.
Accuracy	Temperature	±0.5°C / ±1°F
Temperature		pH: automatic; EC/TDS: automatic with ß adjustable
Compensation		from 0.0 to 2.4% / °C
Calibration	рН	automatic, 1 or 2 points with 2 sets of memorized
		buffers
		(pH 4.01 / 7.01 / 10.01 or 4.01 / 6.86 / 9.18)
Calibration	EC/TDS	automatic, 1 point
<b>TDS Conversion Facto</b>	br	adjustable from 0.45 to 1.00
pH Electrode		HI 73127 (replaceable; included)
Environment		0 to 50°C (32 to 122°F); RH max 100%
Battery Type / Life		4 x 1.5V / approx. 100 hours of continuous use;
		auto-off after 8 minutes of non-use
Dimensions		163 x 40 x 26 mm (6.4 x 1.6 x 1.0")
Weight		100 g (3.5 oz.)

#### **Specifications**

HACH HQ30d Portable pH, Conductivity, Dissolved Oxygen (DO), ORP, and ISE Multi-Parameter Meter Product #: HQ30D53000000 Quantity USD Price: \$790.00 ★★★★★ 5/5 群 Read 1 miniow White a review # ollow this product Portable meter measures critical water quality parameters - without the need for multiple single imput channel for factble measurement of pH, Conductivity, Dissolved Ozygen (DO), BOD, ORP, Ammonia, Ammonium, Fluoride, Chloride, Sodium, and temperature - any IntelliCAL<sup>IM</sup> smart probe Intuitive tiser interface for simple operation and accurate results divided calibration and check standard routines reduce calibration errors. Stabilize on alerts and visual measurement lock Guided calibration and check standard routines reduce calibra ensure that you can trust the accuracy of the results. Trust your measurements - IntellIGAL<sup>IN</sup> smart probes store all cellbrations in the probe Calibration history allows quick and eavy drange out of probes whold re-calibration. The HOd<sup>III</sup> smart system records serial numbers, current calibration data, user ID, sample ID time, and data submatically in the data log for complete GLP transability Designed for demanding conditions Rugged, waterprool (IP67) meter provides worry-tree, reliable operation in lab or field environm Convenient kit includes everything you need to start testing Meter kit includes, 4 AA batteries, quick-start guide, user manual, and documentation CD Specifications AC and USB Operation optional Automatic Buffer Recognition UPAC 1 479 4 005 7 000, 19 01 2, 12 45 DIN 1 09 4 65, 9323 User-defined custom buffer sets Baromatric Pressure Measurement For extomatic compensation of DO when using an LDO or LBOD probe Battery Requirements 4 44 Benchtop with stand BOD5/CBOD resolution Available when used with Hach WIMS BOD Manager software Cable resistance correction Digital - not needed Calibration curves display Calibration summary data logged and displayed Calibration intervals/Alerts/Reminder 2 hours to 7 days Compliance CE WEEE Conductivity Accuracy 2 0 5 % from (1µS/cm - 200 mS/cm) Conductivity measurement 5 different stability modes Conductivity Measurement Range 0 01 µS/cm to 200 mS/cm 0 01 µS/cm with 2 digits Conductivity resolution Custom Calibration Standards User-defined standard sets Download via USB connection to PC or flash stick. Automatically transfer entire data log or as readings are taken Data Export Data Memory 500 results Digital (intelligent) electrode inputs. 2 Dimensions (H x W x D) 7.8 in x 3 7 in x 1.4 in ( 197 mm x 95 mm x 36 mm) Display readings from the or how probes Simultaneous readings from two probes (4)44d ordy) pH pH, vH, vH semperature Conductivity Conductivity TUS, salindy reability ismperature LDO disadved oxyse, pressure, temperature LBOD disadved oxyse, pressure, temperature CRVR/dear, wH temperature Sodium, Sodium, mV, temperature Display Display Lock Function Continuous measurement or press to read mode available with averaging function for LDO measurement. and the second second service of the second second service of the second Display Type DO Measurement Range 0 01 to 20 mo/L (0 to 200%) DO Resolution 0 01 mg/L Fixed Buffer Selecton (UPAC standards (DIN 19265) or Technical buffer (DIN 19257) or 4-7-10 series or user M12 digital (1) for intelliCAL probes Inputs. Interface Languages 13\*\* Internal Data Storage 500 IP Rating (P67 English, Franch, German (talian Spanish, Danish, Dutch, Polish, Portuguese, Turkish, Sweedish, Czech, Russian Languages: mV Accuracy ±01mV mV Measurement at Stable Reading 5 (auto) stabilization settings mV Resolution 0 1 mV Operating Error Messages Text messages displayed

Operating Humidity 90 % relative humidity (non-condensing) Operating Interface Keyped Operating Temperature 5 to 45 °C ORP Electrode Calibration Predefined ORP standards (including Zobell's sitution) Outputs USB to PC / flash stick PC Data Transfer Software Included pH Measurement at stable reading 5 stabilization settings Printer Optional accessory Salinity Resolution 0 01 ppl Warranty 3 years Water Resisitance Meter Cesing 1 meter submersion for 30 minutes (iP67)

0 74 lbs (0 335 kg)

Weight.

# 2100P and 2100P IS Portable Turbidimeter

## Features and Benefits

#### Laboratory Quality in a Portable Unit

The Hach 2100P and 2100P IS Portable Turbidimeters offer a level of performance previously possible only with laboratory instruments. Microprocessor-controlled operation and Hach's unique Ratio<sup>™</sup> optics bring great accuracy, sensitivity, and reliability to field and in-plant testing.

#### **Two Models for Specific Requirements**

- 2100P Turbidimeter—Get fast, accurate turbidity testing in the field or the lab, over a wide range of samples. Compliant with USEPA Method 180.1 design criteria.
- 2100P IS Turbidimeter—Designed to meet international standards that mandate measurement using an LED light source.

#### **Two-detector Optical System**

The two-detector optical system compensates for color in the sample, light fluctuation, and stray light, enabling analysts to achieve laboratory-grade performance on a wide range of samples, even under difficult, onsite conditions.



The Hach 2100P and 2100P IS Portable Turbidimeters bring laboratory-level performance on-site, offering fast, accurate results and the ease-of-use analysts demand in the field. With a measurement range of 0 to 1000 NTU and a resolution of 0.01 NTU, the 2100P turbidimeter is ideal for regulatory monitoring, process control or field studies.



## Specifications\*

	2100P	2100P IS			
Measurement Method	Nephelometric Ratio				
Regulatory	Meets EPA Method 180.1	Meets EN ISO 7027			
Light Source	Tungsten lamp	Light-emitting diode (LED) @ 860 nm			
Range					
Automatic Range Mode	0 to 1000 NTU	0 to 1000 FNU			
Manual Range Selection	0 to 9.99, 0 to 99.9 and 0 to 1000 NTU	0 to 9.99, 0 to 99.9 and 0 to 1000 FNU			
Accuracy	±2% of reading plus stray light				
Repeatability	±1% of reading, or 0.01 NTU, whichever is greater	±1% of reading, or 0.01 FNU, whichever is greater			
Resolution	0.01 on lowest range				
Signal Averaging	Selectable on/off	<i>y</i>			
Power Requirement	4 AA alkaline batteries or optional battery eliminator				
Battery Life, Typical	300 tests with signal average mode off				
	180 tests with signal average mode on				
Operating Temperature	0 to 50°C (32 to 122°F)				
Sample Required	15 mL (0.5 oz.)				
Sample Cells	60 x 25 mm (2.36 x 1 in.) borosilicate glass with screv	60 x 25 mm (2.36 x 1 in.) borosilicate glass with screw caps			
Dimensions	22.2 x 9.5 x 7.9 cm (8.75 x 3.75 x 3.12 in.)	22.2 x 9.5 x 7.9 cm (8.75 x 3.75 x 3.12 in.)			
Weight	0.5 kg (1.1 lb.); shipping weight 2.7 kg (6 lb.)				
Warranty	2 years	······································			

\*Specifications subject to change without notice.

DW = drinking water WW = wastewater municipal PW = pure water / power IW = industrial water E = environmental C = collections FB = food and beverage



# 2100Q and 2100Q is Portable Turbidimeter





## Features and Benefits

#### **Easy Calibration and Verification**

Hach 2100Q and 2100Q *is* Portable Turbidimeters provide confidence your measurements are right every time. On-screen assisted calibration and verification save you time and ensure accuracy. With an easy-to-follow interface, complicated manuals are not needed to perform routine calibrations. Single-standard RapidCal<sup>™</sup> calibration offers a simplified solution for low level measurements.

#### Simple Data Transfer

Data transfer with the optional USB + Power Module is simple, flexible, and doesn't require additional software. All data can be transferred to the module and easily downloaded to your computer with a USB connection, providing superior data integrity and availability. With two different module options, you can customize connectivity and power to meet your unique needs.

#### Accurate for Rapidly Settling Samples

The Hach 2100Q Portable Turbidimeter incorporates an innovative Rapidly Settling Turbidity<sup>™</sup> mode to provide accurate, repeatable measurements for difficult to measure, rapidly settling samples. An exclusive algorithm that

calculates turbidity based on a series of automatic readings eliminates redundant measurements and estimating.

## **Convenient Data Logging**

0

Up to 500 measurements are automatically stored in the instrument for easy access and backup. Stored information includes: date and time, operator ID, reading mode, sample ID, sample number, units, calibration time, calibration status, error messages and the result.

#### **Optical System for Precision in the Fleld**

The two-detector optical system compensates for color in the sample, light fluctuation, and stray light, enabling analysts to achieve laboratory-grade performance on a wide range of samples, even under difficult site conditions.

#### **Two Models for Specific Requirements**

- 2100Q Turbidimeter—Compliant with USEPA Method 180.1 design criteria.
- 2100Q is Turbidimeter—Compliant with ISO 7027 design criteria.

DW = drinking water WW = wastewater municipal PW = pure water / power IW = Industrial water E = environmental C = collections FB = food and beverage





## Specifications\*

Measurement Method

Ratio turbidimetric determination using a primary nephelometric light scatter signal (90°) to the transmitted light scatter signal.

Regulatory 2100Q: Meets EPA Method 180.1 2100Q is: Meets ISO 7027

Light Source 2100Q: Tungsten filament lamp 2100Q is: Light-emitting diode (LED) @ 860 nm

Range 0 to 1000 NTU (FNU)

Accuracy ±2% of reading plus stray light from 0 to 1000 NTU

Repeatability  $\pm 1\%$  of reading, or 0.01 NTU (FNU), whichever is greater

Resolution 0.01 NTU on lowest range

Stray Light <0.02 NTU (FNU)

Signal Averaging Selectable on/off

Detector Silicon photovoltaic

Reading Modes (user selectable) Normal (Push to Read) Signal Averaging Rapidly Settling Turbidity

Data Logger 500 records

*Power Requirement* 110-230 Vac, 50/60 Hz (with Power or USB+Power Module) 4 AA alkaline batteries Rechargeable NiMH (for use with USB+Power Module) Operating Conditions Temperature: 0 to 50°C (32 to 122°F) Relative Humidity: 0 to 90% @ 30°C, 0 to 80% @ 40°C, 0 to 70% @ 50°C, noncondensing

Storage Conditions -40 to 60°C (-40 to 140°F), instrument only

Languages English, French, German, Italian, Spanish, Portuguese (BR), Portuguese (PT), Bulgarian, Chinese, Czech, Danish, Dutch, Finnish, Greek, Hungarian, Japanese, Korean, Polish, Romanian, Russian, Slovenian, Swedish, Turkish

Interface Optional USB

Instrument Enclosure Rating IP67 (closed lid, battery compartment excluded)

Protection Class Power Supply: Class II

Certification CE certified

Sample Required 15 mL (0.3 oz.)

Sample Cells 60 x 25 mm (2.36 x 1 in.) borosilicate glass with screw cap

Dimensions 22.9 x 10.7 x 7.7 cm (9.0 x4.2 x 3.0 in.)

Weight 527 g (1.16 lb) without batteries 618 g (1.36 lb) with four AA alkaline batteries

*Warranty* 1 year

# Sondes: EXO1 EXO2





Cable connector, battery valve, and expansion port for an additional sensor



EXO2 sonde contains 6 universal sensor ports plus a central port for an anti-fouling wiper

**Battery Compartment** 

Cutaway: Reinforced internal structure



Anti-fouling wiper keeps sensors clear of biofouling and lengthens deployment times by 25%

Welded Titanium Housing



EXO1 sonde contains 4 universal sensor ports

## Instrument Specifications\*

EXO1 Sonde				
Ports	4 sensor ports Peripheral port: 1 power communication	port		
Size	Diameter: 4.70 cm (1.85 in) Length: 64.77 cm (25.50 in)			
Weight	1.42 kg (3.15 lbs) with 4 probes, guard a	nd batteries installed		
EXO2 Sonde	3, , , , , , , , , , , , , , , , , , ,			
Ports	7 sensor ports (6 ports available when ce Peripheral ports: 1 power communication	entral wiper used) n port; 1 auxiliary expansion port		
Size	Diameter: 7.62 cm (3.00 in) Length: 71.10 cm (28.00 in)			
Weight	3.60 kg (7.90 lbs) with 5 probes, guard a	nd batteries installed		
Sondes				
Operating Temperature	-5 to 50°C			
Storage Temperature	-20 to 80°C (except 0 to 60°C for pH and	pH/ORP sensors)		
Depth Rating	0 to 250 m (0 to 820 ft)			
Communications	Computer Interface: Bluetooth wireless t Output Options: USB with signal output a	echnology, RS-485, USB Idapter (SOA); RS-232 & SDI-12 with DCP-SOA		
Sample Rate	Up to 4 Hz			
Battery Life	90 days**			
Data Memory	512 MB total memory; >1,000,000 logged readings			
Sensors		Calculated Parameters		
Ammonium	ORP	Salinity		
Chloride	рН	Specific Conductance		
Conductivity	Temperature	Total Dissolved Solids		
Depth	Total Algae (Chlorophyll + BGA-PC or PE)	Total Suspended Solids		
Dissolved Oxygen	Turbidity			
Fluorescent Dissolved Organic Matter (fDOM)	Vented Level			
Nitrate				
EXO Handheld				
Size	Width: 12.00 cm (4.72 in) Height: 25.00 cm (9.84 in)			
Weight	0.71 kg (1.56 lbs) without batteries			
Operating System	Windows CE 5.0			
Operating Temperature	-10 to 50°C			
Storage Temperature	-20 to 80°C			
IP Rating	IP-67			
Data Memory	2 GB total memory; >2,000,000 data sets			
Accessories				
Cables (vented and non-vented)	Flow cells	Sonde/sensor guard		
Carrying case	KOR software	Calibration cup		
DCP Signal Output Adapter	USB Signal Output Adapter	Anti-fouling components		
Warranty				
3 months	Replaceable reagent modules for ammo	nium, chloride, and nitrate		
1 Year	Optical DO membranes and replaceable reagent moldules for pH and pH/ORP			
2 Years	Cables; sonde bulkheads; handheld; conductivity, temperature, depth, and optical sensors; electronics base for pH, pH/ORP, ammonium, chloride, and nitrate sensors; and accessories			

\* Specifications indicate typical performance and are subject to change.

Please check EXOwater.com for up-to-date information.

EXO Bluetooth modules comply with Part 15C of FCC Rules and have FCC, CE Mark and C-tick approval. Bluetooth-type approvals and regulations can be country specific. Check local laws and regulations to insure that the use of wireless products purchased from Xylem are in full compliance.

\*\* Typically 90 days at 20°C at 15-minute logging interval; temperature/conductivity, pH/ ORP, DO, and turbidity sensors installed on EXO1; or temperature/conductivity, pH/ORP, DO, total algae, and turbidity sensors installed with central wiper that rotates once per logging interval on EXO2. Battery life is heavily dependent on sensor configuration. 10

## Sensor Specifications\*

Sensor	Range	Accuracy*	Response	Resolution	
Ammonium <sup>11</sup> (ammonia with pH sensor)	0 to 200 mg/L <sup>1</sup>	±10% of reading or 2 mg/L-N, w.i.g.	-	0.01 mg/L	
Barometer	375 to 825 mmHg	±1.5 mmHg from 0 to 50°C	-	0.1 mmHg	
Blue-green Algae Phycocyanin (PC) (part of Total Algae sensor)	0 to 100 RFU; 0 to 100 µg/L PC	Linearity: $R^2 > 0.999$ for serial dilution of Rhodamine WT solution from 0 to 100 µg/mL PC equivalents	T63<2 sec	0.01 RFU; 0.01 µg/L PC	
Blue-green Algae Phycoerythrin (PE) (part of Total Algae sensor)	0 to 100 RFU; 0 to 280 µg/L PE	Linearity: R <sup>2</sup> > 0.999 for serial dilution of Rhodamine WT solution from 0 to 280 µg/mL PE equivalents	T63<2 sec	0.01 RFU; 0.01 μg/L PE	
Chloride <sup>11</sup>	0 to 1000 mg/L-Cl <sup>2</sup>	±15% of reading or 5 mg/L-Cl, w.i.g.	-	0.01 mg/L	
Chlorophyll (part of Total Algae sensor)	0 to 400 μg/L Chl; 0 to 100 RFU	Linearity: R <sup>2</sup> > 0.999 for serial dilution of Rhodamine WT solution from 0 to 400 µg/L Chl equivalents	T63<2 sec	0.01 μg/L Chl; 0.01 RFU	
Conductivity <sup>3</sup>	0 to 200 mS/cm	0 to 100: ±0.5% of reading or 0.001 mS/cm, w.i.g.; 100 to 200: ±1% of reading	T63<2 sec	0.0001 to 0.01 mS/cm (range dependent)	
	0 to 10 m (0 to 33 ft)	±0.04% FS (±0.004 m or ±0.013 ft)			
Depth ⁴ (non-vented)	0 to 100 m (0 to 328 ft)	±0.04% FS (±0.04 m or ±0.13 ft)	T(2, 2) and	0.001 m (0.001 ft) (auto-ranging)	
(	0 to 250 m (0 to 820 ft)	±0.04% FS (±0.10 m or ±0.33 ft)	103<2 Sec		
Vented Level	0 to 10 m (0 to 33 ft)	±0.03% FS (±0.003 m or ±0.010 ft)			
Dissolved Oxygen	0 to 500% air saturation	0 to 200%: ±1% of reading or 1% saturation, w.i.g.; 200 to 500%: ±5% of reading ⁵	T() (F 6	0.1% air saturation	
Optical	0 to 50 mg/L	0 to 20 mg/L: $\pm$ 0.1 mg/L or 1% of reading, w.i.g.; 20 to 50 mg/L: $\pm$ 5% of reading <sup>5</sup>	103<5 Sec *	0.01 mg/L	
fDOM	0 to 300 ppb Quinine Sulfate equivalents (QSE)	Linearity: R <sup>2</sup> > 0.999 for serial dilution of 300 ppb QS solution Detection Limit: 0.07 ppb QSE	T63<2 sec	0.01 ppb QSE	
Nitrate <sup>11</sup>	0 to 200 mg/L-N <sup>1</sup>	±10% of reading or 2 mg/L-N, w.i.g.	-	0.01 mg/L	
ORP	-999 to 999 mV	±20 mV in Redox standard solutions	T63<5 sec 7	0.1 mV	
рН	0 to 14 units	±0.1 pH units within ±10°C of calibra- tion temp; ±0.2 pH units for entire temp range <sup>8</sup>	T63<3 sec <sup>9</sup>	0.01 units	
Salinity (Calculated from Conductivity and Temperature)	0 to 70 ppt	±1.0% of reading or 0.1 ppt, w.i.g.	T63<2 sec	0.01 ppt	
Specific Conductance (Calculated from Cond. and Temp.)	0 to 200 mS/cm	±0.5% of reading or .001 mS/cm, w.i.g.	-	0.001, 0.01, 0.1 mS/cm (auto-scaling)	
Temperature	-5 to 50°C	-5 to 35°C: ±0.01°C <sup>10</sup> 35 to 50°C: ±0.05°C <sup>10</sup>	T63<1 sec	0.001 °C	
Total Dissolved Solids (TDS) (Calculated from Conductivity and Temperature)	0 to 100,000 g/L Cal constant range 0.30 to 1.00 (0.64 default)	Not Specified	-	variable	
Total Suspended Solids (TSS) (Calculated from Turbidity and user reference samples)	0 to 1500 mg/L	Not Specified	T63<2 sec	variable	
Turbidity <sup>11</sup>	0 to 4000 FNU	0 to 999 FNU: 0.3 FNU or $\pm 2\%$ of reading, w.i.g.; 1000 to 4000 FNU: $\pm 5\%$ of reading $^{12}$	T63<2 sec	0 to 999 FNU: 0.01 FNU; 1000 to 4000 FNU: 0.1 FNU	

All sensors have a depth rating to 250 m (820 ft), except shallow and medium depth sensors and ISEs. EXO sensors are not backward compatible with 6-Series sondes.

\* Specifications indicate typical performance and are subject to change. Please check EXOwater.com for up-to-date information. Accuracy specification is attained immediately following calibration under controlled and stable environmental conditions. Performance in the natural environment may vary from quoted specification.

<sup>2</sup> 0-40°C <sup>1</sup> 0-30°C w.i.g. = whichever is greater

<sup>1</sup>0-30 C
 <sup>3</sup> Outputs of specific conductance (conductivity corrected to 25°C) and total dissolved solids are also provided. The values are automatically calculated from conductivity according to algorithms found in *Standard Methods for the Examination of Water and Wastewater* (Ed. 1989).

<sup>4</sup> Accuracy specifications apply to conductivity levels of 0 to 100,000 μS/cm.
 <sup>5</sup> Relative to calibration gases
 <sup>6</sup> When transferred from air-saturated water to stirred deaerated water
 <sup>7</sup> When transferred from water-saturated air to Zobell solution

<sup>8</sup> Within transferred from water-saturated air to Zoben solution
 <sup>8</sup> Within the environmental pH range of pH 4 to pH 10
 <sup>9</sup> On transfer from water-saturated air to rapidly stirred air-saturated water at a specific conductance of 800 µS/cm at 20°C; T63<5 seconds on transfer from water-saturated air to slowly-stirred air-saturated water.</li>
 <sup>10</sup> Temperature accuracy traceable to NIST standards
 <sup>11</sup> Cellinet 1.002 performentation water before the based on the standards

<sup>11</sup> Calibration: 1-, 2-, or 3-point, user-selectable <sup>12</sup> Specification is defined in AMCO-AEPA Standards



## FH950 Portable Velocity Meter with 20' Cable



Product #: FH950.10020 Quantity USD Price: \$4,585.00 Ships within 2 weeks

#### Reduce manhours 50%

The step-by-step user interface simplifies programming, delivers real-time data, and downloads directly to PC allowing a single person to take the readings and eliminating post site visit manual data transfer from logbook to PC

Automatically calculates total discharge based on USGS and ISO methods Reduces time to manually calculate and likelihood of errors

#### Real-time velocity graphed on color display Visualize velocity trends quickly

Lowest maintenance solution on the market Electromagnetic velocity sensor with no moving parts never requires mechanical maintenance

#### Lightweight, rugged portable meter

Only 1.5 pounds

#### What's in the box

FH950.1 System Includes:

- Portable Velocity Meter
- Electromagnetic Sensor with 20' cable
- Fabric Carrying Case
- Adjustable Meter Rod Mount
- Universal Sensor Mount
- Battery Charger with Domestic/International Plug Adapters
- USB Cable
- Lanyard
- Sensor Screw Kit
- Absorbent Wipe

#### Specifications

Accuracy 2:	$\pm$ 2% of reading $\pm$ 0.05 ft/s ( $\pm$ 0.015 m/s) through the range of 0 to 10 ft/s (0 to 3.04 ms/s); $\pm$ 4% of reading from 10 to 16 ft/s (3.04 to 4.87 m/s)
Battery Life:	heavy typical day use; 68°F (20°C)
Display: LCD:	Color, LCD 3.5 QVGA transflective (readable in direct sunlight)
Keypad:	Alpha-numerica
Operating Temperature Range:	-20 to 55 °C
Range:	to ft/s
Resolution:	Measurement Resolution - <10: 0.001; <100: 0.01; >100: 0.1
Storage Conditions:	-20 °C to 60 °C

Appendix D

# DEPARTMENT OF ENVIRONMENTAL PROTECTION COMMONWEALTH OF PENNSYLVANIA

BUREAU OF LABORA TORIES

LABORATORY ACCREDITATION PROGRAM

**Certifies** That

LELVE RECOGNIC

68-03670

DEPARTMENT OF ENVIRONMENTAL pennsylvania

PROTECTION

Northeast Ohio Regional Sewer District Analytical Services 4747 East 49th Street, Cuyahoga Heights, OH 44125

National Environmental Laboratory Accreditation Program Standard dealing with Environmental Laboratories Accreditation The act of June 29, 2002 (P.L. 596, No. 90) Having duly met the requirement of (27 Pa. C.S. §§4104-4113) and the

is hereby approved as an

As more fully described in the attached Scope of Accreditation Accredited Laboratory

Expiration Date: 11/30/2014 Certificate Number: 007

> Continued accreditation status depends on successful ongoing participation in the program Shall not be used to imply endorsement by the Commonwealth of Pennsylvania Customers are urged to verify the laboratory's current accreditation status Not valid unless accompanied by a valid Scope of Accreditation Certificate not transferable Sumender upon revocation PA DEP is a NELAP recognized accreditation body To be conspicuously displayed at the Laboratory

haven alge

Aaren S. Alger, Chief Laboratory Accreditation Program Bureau of Laboratories





Attached to Certificate of Accreditation 007-001 expiration date November 30, 2014. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 68-03670

EPA Lab Code: OH00300

(216) 641-6000

TNI Code:

Northeast Ohio Regional Sewer District Analytical Services

4747 East 49th Street

Cuyahoga Heights, OH 44125

## Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1000.0		Pimephales promelas	NELAP	PA	1/8/2009
EPA 1002.0		Ceriodaphnia dubia	NELAP	PA	1/8/2009
EPA 160.4		Residue, volatile	NELAP	PA	10/22/2008
EPA 1600		Enterococci	NELAP	PA	11/22/2010
EPA 1603		E. coli (Enumeration)	NELAP	PA	11/29/2007
EPA 1631	E	Mercury	NELAP	PA	3/31/2008
EPA 180.1		Turbidity	NELAP	PA	12/31/2007
EPA 200.7	4.4	Aluminum	NELAP	PA	11/29/2007
EPA 200.7	4.4	Antimony	NELAP	PA	11/29/2007
EPA 200.7	4.4	Arsenic	NELAP	PA	11/29/2007
EPA 200.7	4.4	Barium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Beryllium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Cadmium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Calcium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Chromium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Cobalt	NELAP	PA	11/29/2007
EPA 200.7	4.4	Copper	NELAP	PA	12/31/2007
EPA 200.7	4.4	lron	NELAP	PA	11/29/2007
EPA 200.7	4.4	Lead	NELAP	PA	11/29/2007
EPA 200.7	4.4	Magnesium	NELAP	PA	11/17/2010
EPA 200.7	4.4	Manganese	NELAP	PA	11/29/2007
EPA 200.7	4.4	Molybdenum	NELAP	PA	11/29/2007
EPA 200.7	4.4	Nickel	NELAP	PA	11/29/2007
EPA 200.7	4.4	Potassium	NELAP	PA	12/31/2007
EPA 200.7	4.4	Selenium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Silver	NELAP	PA	11/29/2007
EPA 200.7	4.4	Sodium	NELAP	PA	12/31/2007
EPA 200.7	4.4	Tin	NELAP	PA	11/29/2007
EPA 200.7	4.4	Titanium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Vanadium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Zinc	NELAP	PA	12/31/2007
EPA 245.1	3.0	Mercury	NELAP	PA	11/29/2007
EPA 300.0	2.1	Bromide	NELAP	PA	11/22/2010
EPA 300.0	2.1	Chloride	NELAP	PA	11/22/2010
EPA 300.0	2.1	Fluoride	NELAP	PA	11/22/2010
EPA 300.0	2.1	Nitrate as N	NELAP	PA	11/22/2010
EPA 300.0	2.1	Nitrite as N	NELAP	PA	11/22/2010
EPA 300.0	2.1	Orthophosphate as P	NELAP	PA	11/22/2010
EPA 300.0	2.1	Sulfate	NELAP	PA	11/22/2010
EPA 3005	Α	Preconcentration under acid	NELAP	PA	11/29/2007

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TNI Code:

DEP Laboratory ID: 68-03670

EPA Lab Code: OH00300

(216) 641-6000

## Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 3010	A	Hot plate acid digestion (HNO3 + HCl)	NELAP	PA	11/29/2007
EPA 3015	0507	Microwave-assisted acid digestion	NELAP	PA	11/29/2007
EPA 310.2		Alkalinity as CaCO3	NELAP	PA	9/20/2012
EPA 325.2		Chloride	NELAP	PA	11/17/2010
EPA 350.1		Ammonia as N	NELAP	PA	11/29/2007
EPA 351.2		Kieldahl nitrogen, total (TKN)	NELAP	PA	11/17/2010
EPA 353 2		Nitrate as N	NELAP	PA	11/29/2007
EPA 353 2		Total nitrate-nitrite	NELAP	PA	11/17/2010
EPA 365 1		Orthophosphate as P	NELAP	PA	11/29/2007
EPA 365 1		Phosphorus total	NELAP	PA	10/22/2008
EPA 410 4		Chemical oxygen demand (COD)	NELAP	PA	11/29/2007
EPA 420 4		Total phenolics	NELAP	PA	11/17/2010
EDA 445		Chlorophyll A	NELAP	PA	11/22/2010
EPA 6010		Aluminum	NELAP	PA	11/29/2007
EPA 6010		Antimony	NELAP	PA	11/29/2007
EPA 6010		Arsenic	NELAP	PA	11/29/2007
EDA 6010		Barium	NELAP	PA	11/29/2007
ELA 6010		Beryllium	NELAP	PA	11/29/2007
EFA 0010		Cadmium	NELAP	PA	11/29/2007
EFA 0010		Calcium	NELAP	PA	11/29/2007
EFA 0010		Chromium	NELAP	PA	11/29/2007
EFA 0010		Cobalt	NELAP	PA	11/29/2007
EPA 0010		Copper	NELAP	PA	12/31/2007
EFA 0010		Iron	NELAP	PA	11/29/2007
EFA 0010		Lead	NELAP	PA	11/29/2007
EPA 0010		Magnasium	NELAP	PA	11/29/2007
EPA DUIU		Mangapare	NELAP	PA	11/29/2007
EPA 0010		Molubdenum	NELAP	PA	11/29/2007
EPA 0010		Niekal	NELAP	PA	11/29/2007
EPA OUIU		Potasejum	NELAP	PA	12/31/2007
EFA 0010		Selenium	NELAP	PA	11/29/2007
EPA OUIU		Silver	NFLAP	PA	11/29/2007
EPA OUIU		Sadium	NELAP	PA	12/31/2007
EPA 6010		Tim	NELAP	PA	11/29/2007
EPA 6010		Tita-ium	NEL AP	PA	11/29/2007
EPA 0010		Vanadium	NELAP	PA	11/29/2007
EPA 0010		Zina	NELAP	PA	12/31/2007
EPA 6010		Zinc	NEL AP	PA	11/29/2007
EPA /4/0		Entercory	NEL AP	PA	11/22/2010
Enteroiert		Cuentide	NELAP	PA	11/17/2010
Lachat 10-204-00-1X		Cyanide Austilable suspide	NELAP	PA	11/29/2007
OIA 16/7		Available cyanide	NELAP	ΡΔ	11/29/2007
SM 2540 B		Residue, fotar	NEL AP	PA	11/29/2007
SM 2540 C		Residue, nonfiltemble (TDS)	NEL AP	PA	11/29/2007
5M 2540 D		Residue settleshle	NELAP	PA	11/29/2007
SM 2340 P		Temperature des C	NEL AP	PA	10/22/2008
SM 2550 B	20.22	Chromium VI	NEL AP	PA	11/29/2007
SM 3500-Cr B	20-22	Chromium VI	NELAL	1.0	11/2//2007

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DEP Laboratory ID: 68-03670

EPA Lab Code: OH00300

(216) 641-6000

## Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
SM 4500-CN- C/E		Total cyanide	NELAP	PA	11/29/2007
SM 4500-CN- G		Amenable cyanide	NELAP	PA	11/29/2007
SM 4500-C1 E		Total residual chlorine	NELAP	PA	11/29/2007
SM 4500-C1- C		Chloride	NELAP	PA	11/19/2012
SM 4500-H+ B		рН	NELAP	PA	11/29/2007
SM 4500-NO2- B		Nitrite as N	NELAP	PA	11/29/2007
SM 4500-Norg B		Kieldahl nitrogen, total (TKN)	NELAP	PA	10/22/2008
SM 4500-P B		Preliminary treatment of phosphate samples	NELAP	PA	11/13/2013
SM 4500-P E		Orthophosphate as P	NELAP	PA	11/13/2013
SM 4500-S D		Sulfide	NELAP	PA	11/22/2010
SM 5210 B		Biochemical oxygen demand (BOD)	NELAP	PA	11/29/2007
SM 5210 B		Carbonaceous BOD (CBOD)	NELAP	PA	11/29/2007
SM 9222 D		Fecal coliform (Enumeration)	NELAP	PA	11/29/2007
SM 9223 Colilert MPN or QT		E. coli (Enumeration)	NELAP	PA	11/29/2007
SM 9223 Colilert MPN or QT		Total coliform (Enumeration)	NELAP	PA	11/22/2010

## Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 245.1	3.0	Mercury	NELAP	PA	11/22/2010
EPA 3051		Microwave digestion of solids (HNO3 only)	NELAP	PA	11/17/2010
EPA 6010		Aluminum	NELAP	PA	11/22/2010
EPA 6010		Antimony	NELAP	PA	11/13/2013
EPA 6010		Arsenic	NELAP	PA	11/22/2010
EPA 6010		Barium	NELAP	PA	11/22/2010
EPA 6010		Bervllium	NELAP	PA	11/22/2010
EPA 6010		Boron	NELAP	PA	11/22/2010
EPA 6010		Cadmium	NELAP	PA	11/22/2010
EPA 6010		Calcium	NELAP	PA	11/22/2010
EPA 6010		Chromium	NELAP	PA	11/22/2010
EPA 6010		Cobalt	NELAP	PA	11/22/2010
EPA 6010		Copper	NELAP	PA	11/22/2010
EPA 6010		Iron	NELAP	PA	11/22/2010
EPA 6010		Lead	NELAP	PA	11/22/2010
EPA 6010		Magnesium	NELAP	PA	11/22/2010
EPA 6010		Manganese	NELAP	PA	11/22/2010
EPA 6010	В	Metals by ICP/AES	NELAP	PA	1/22/2013
EPA 6010		Molvbdenum	NELAP	PA	11/22/2010
EPA 6010		Nickel	NELAP	PA	11/22/2010
EPA 6010		Potassium	NELAP	PA	11/22/2010
EPA 6010		Selenium	NELAP	PA	11/22/2010
EPA 6010		Silver	NELAP	PA	11/22/2010
EPA 6010		Sodium	NELAP	PA	11/22/2010
EPA 6010		Thallium	NELAP	PA	11/22/2010
EPA 6010		Tin	NELAP	PA	4/15/2013

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DEP Laboratory ID: 68-03670

EPA Lab Code: OH00300 TNI Code:

(216) 641-6000

## Matrix: Solid and Chemical Materials

Method	Revision Analyte	Accreditation Type	Primary	Effective Date
EPA 6010	Titanium	NELAP	PA	11/22/2010
EPA 6010	Vanadium	NELAP	PA	11/22/2010
EPA 6010	Zinc	NELAP	PA	11/22/2010

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