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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Office of Water Management

Susquehanna River Smallmouth Bass Disease Investigation

May 9, 2013

Dial-in number for Audio: 1-877-668-4493
Event Number: 647 572 664
WebEx Technical Support: 866-229-3239

Note: You will not hear any audio until the beginning of the webinar. To receive a call back, provide your phone number when you join the event.


AGENDA

1. Welcome
2. Review of 2012 Study
3. Preview of 2013 Study
4. Questions & Comments

Note: WebEx Technical Support is available at 866-229-3239

Integrated Reporting Process

- DEP continually assesses streams, rivers, and lakes across the state.
- The Federal Clean Water Act requires DEP to report on the condition of all waters in Pennsylvania every two years.
- The report is a known as the Integrated Report. It is large and consists of many parts.
- The part that interests most is Category 5, the list of impaired waters. This is also known as the 303(d) list

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Impairment: The Definition

Impairment - All waters where required pollution controls are not sufficient to attain or maintain applicable water quality.

- In other words, there is more pollution entering the water than can be assimilated causing damage to the aquatic life, water supply, recreation, or consumption of fish.

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Impairment: The Consequences

Impaired water is placed on the impaired waters list of the biennial Integrated Report.

- A TMDL (pollution budget) must be developed for every impaired water.
- EPA recommends a TMDL be completed and approved within 13 years of the listing.
- A TMDL determines how much pollution must be removed by each source to fix an impairment.

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Impairment: The Consequences

- There can be substantial costs to achieve the needed pollution reductions.
- The impaired listing and the TMDL can be legally challenged by affected parties.
- All listings and TMDLs must be based on science that justifies the pollution reductions and can withstand legal challenge.
- The information available during the evaluation for the 2012 Integrated Report did not meet the standards required to impair 98 miles of the river.

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Impairment: the Facts

- No special monetary funds come with an impairment listing.
- Should at some point the river be determined to be impaired, TMDL development would take many years to complete.
- An impairment is not needed for cooperation. DEP is cooperating with any one concerning the river with or with out an impaired listing.
- The decision not to impair the river was based solely on the recommendation of DEP technical staff after review of the data and not on politics.

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Susquehanna: The Responsibility

- The proper course was to expand and intensify studies to determine if there is an impairment caused by pollution and if so what are the cause(s).
- DEP has committed as many staff and funds as possible to the studies.
- The remainder of this presentation will be about what was done in 2012 and what is being done in 2013.

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2012 Water Quality Monitoring

- Continuous Instream Water Quality Monitoring (CIM)
- Water Chemistry Grab Sampling
- Discrete Water Quality Transect Characterization
- Periphyton (Algae)Monitoring
- Macroinvertebrate Sampling (Aquatic Insects)
- Androgenicity/Estrogenicity Passive Sampler Deployment

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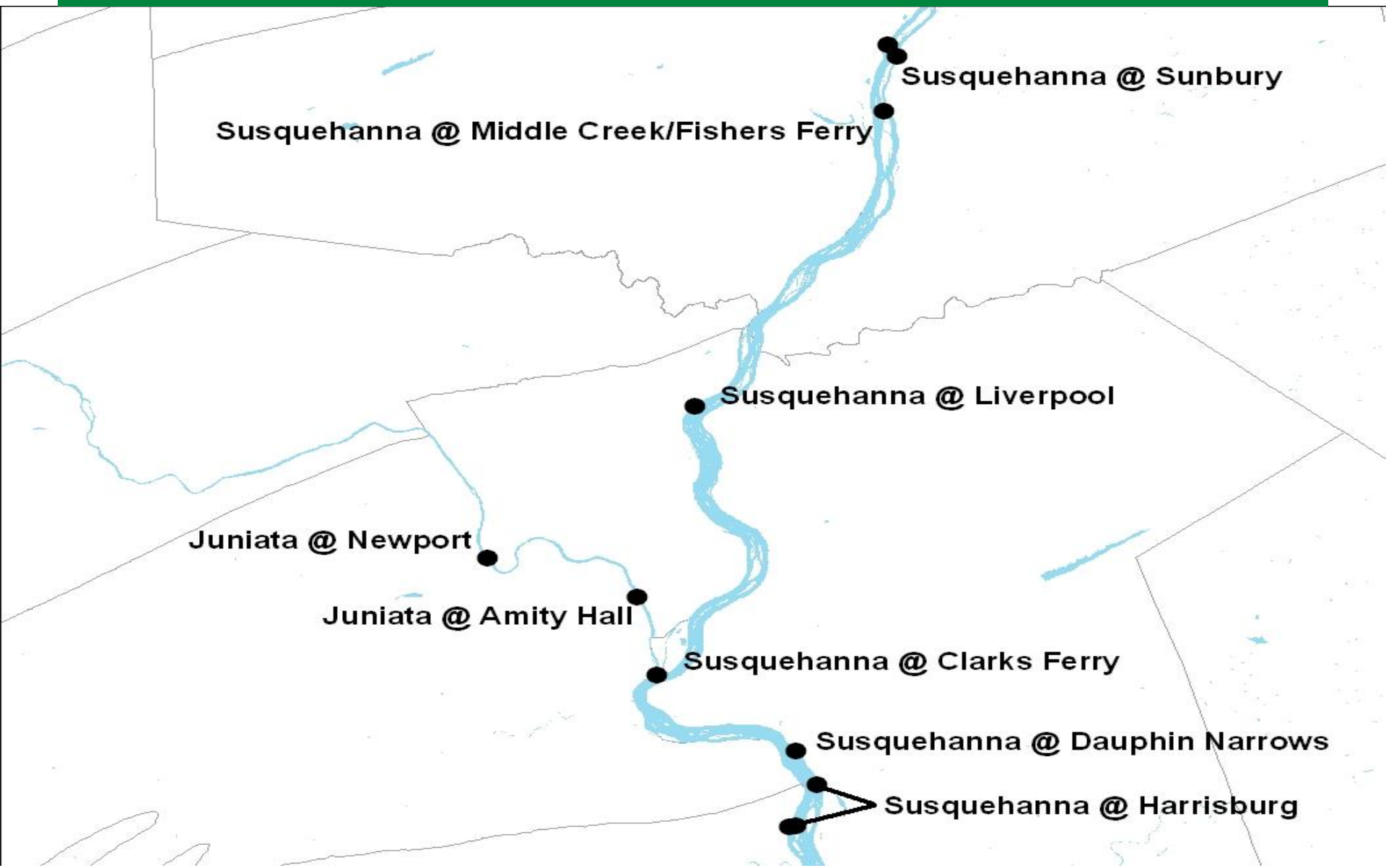
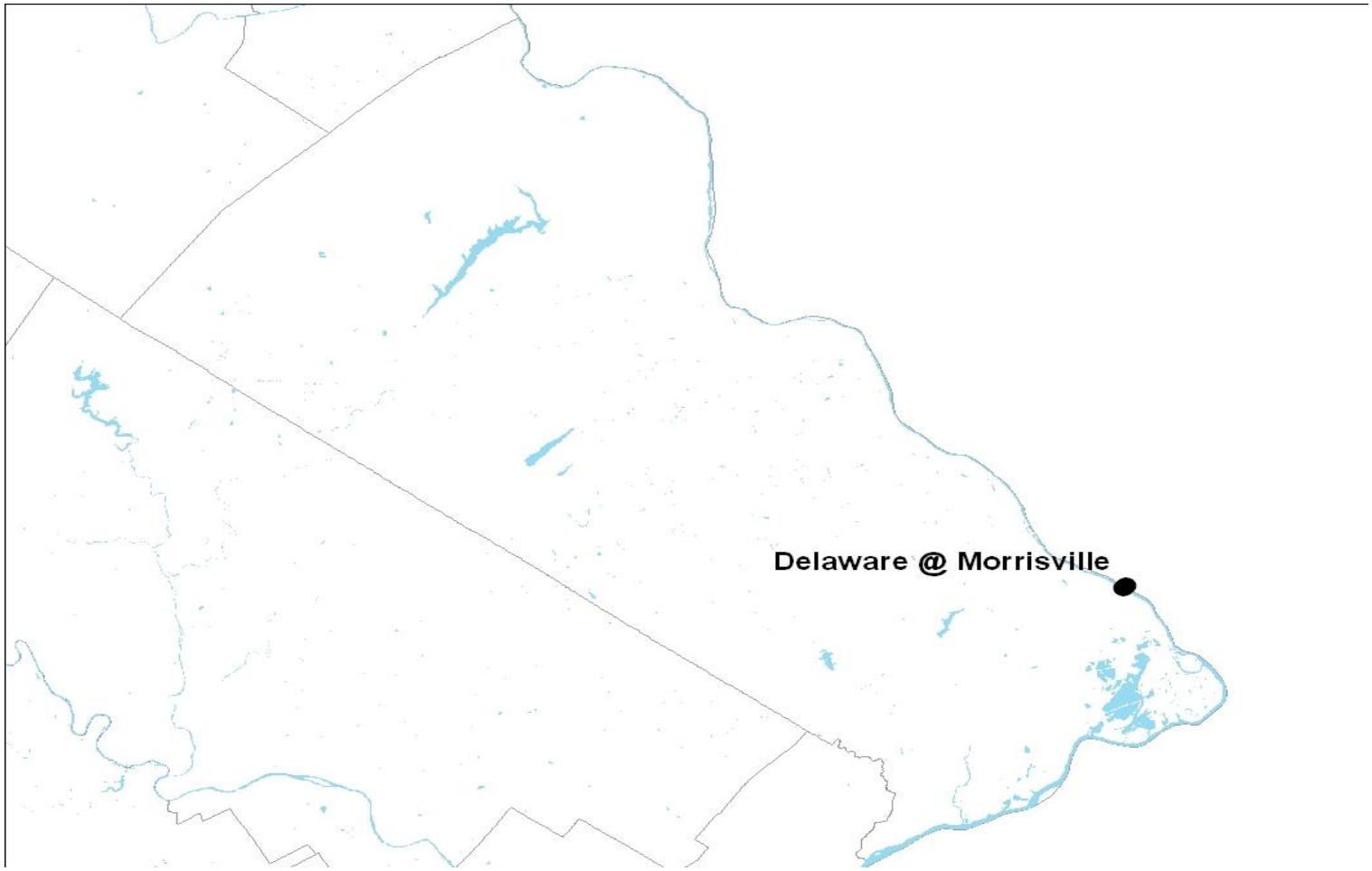
2012 Monitoring Locations



2012 Delaware Monitoring Location



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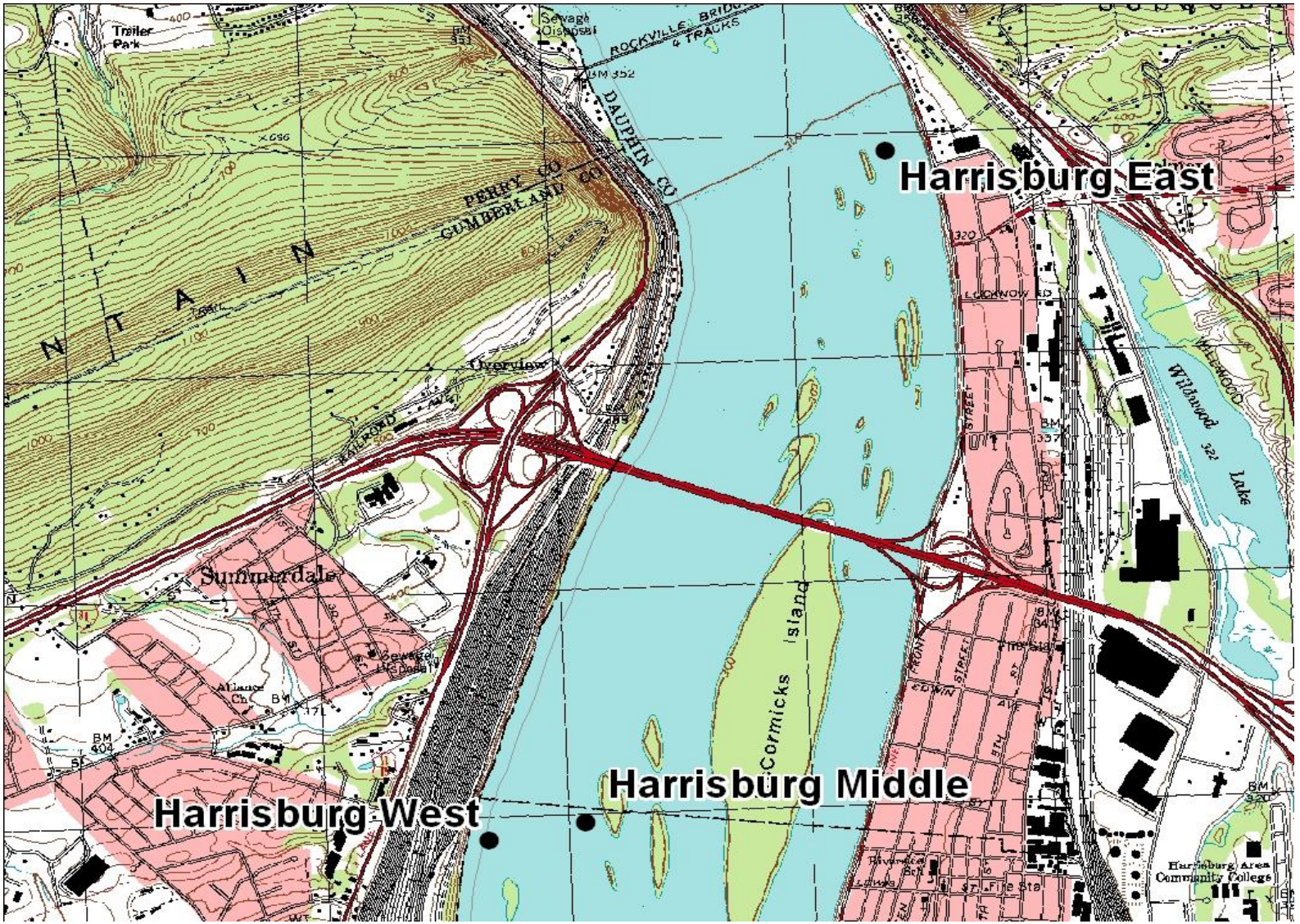
2012 Harrisburg Monitoring Location



Cont. Instream Water Quality Monitoring (CIM)

Deployed at 8 locations over the period Mid-July to early September

- **Dissolved Oxygen**
- **Water Temperature**
- **Specific Conductance**
- **pH**

Cont. Instream Water Quality Monitoring (CIM)

Next four slides show 30-minute reading from each CIM at the three Harrisburg sites

- There were differences in water quality comparing the Harrisburg West, Middle, and East sites.
- Susquehanna partitions into three rivers as a result of upstream influences. More on this later in the presentation.
- Temperature did not vary as much as dissolved oxygen, pH, and specific conductance.

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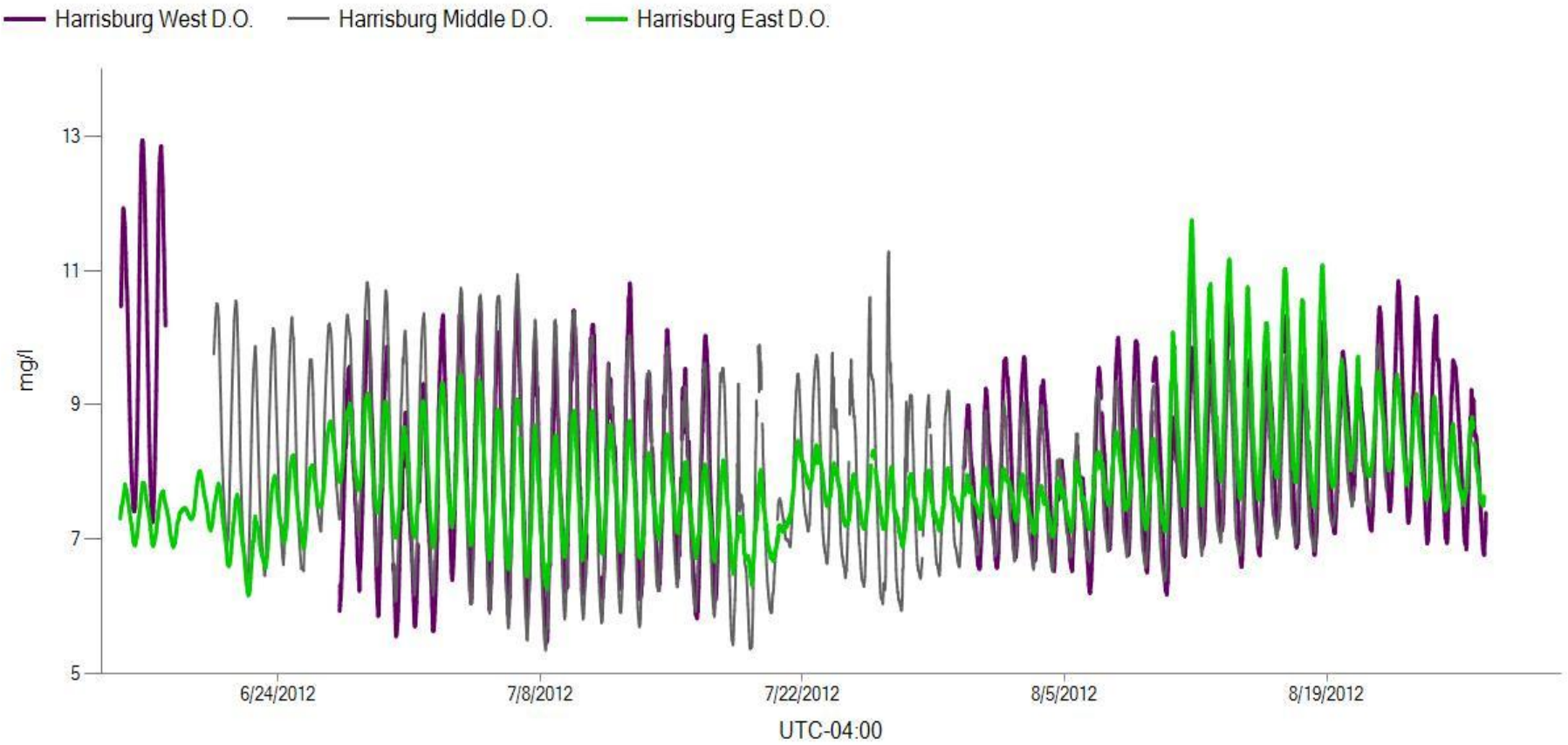
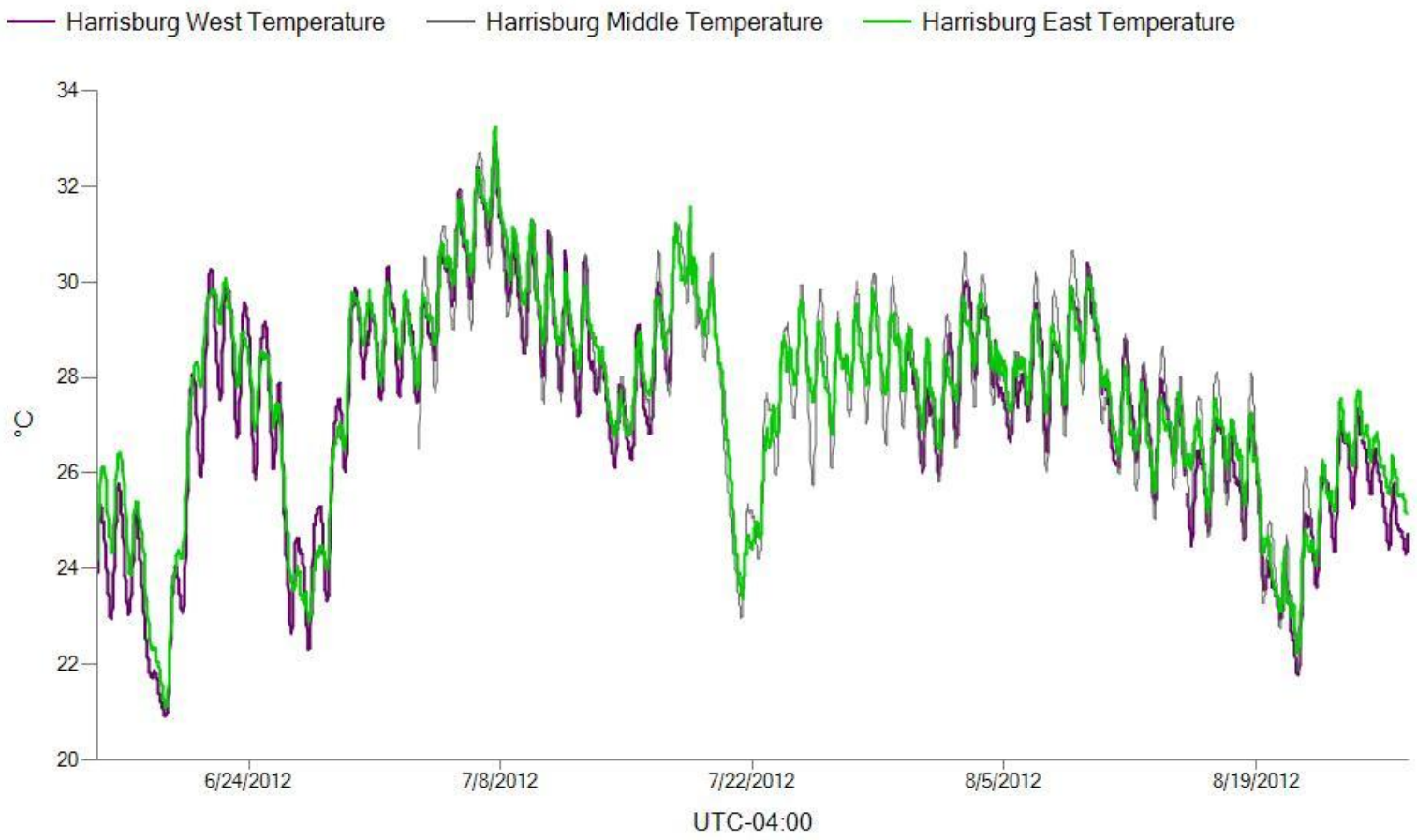
Cont. Instream Water Quality Monitoring (CIM)

Dissolved Oxygen, Susquehanna at Harrisburg Sample Location
6/14/12-8/31/2012



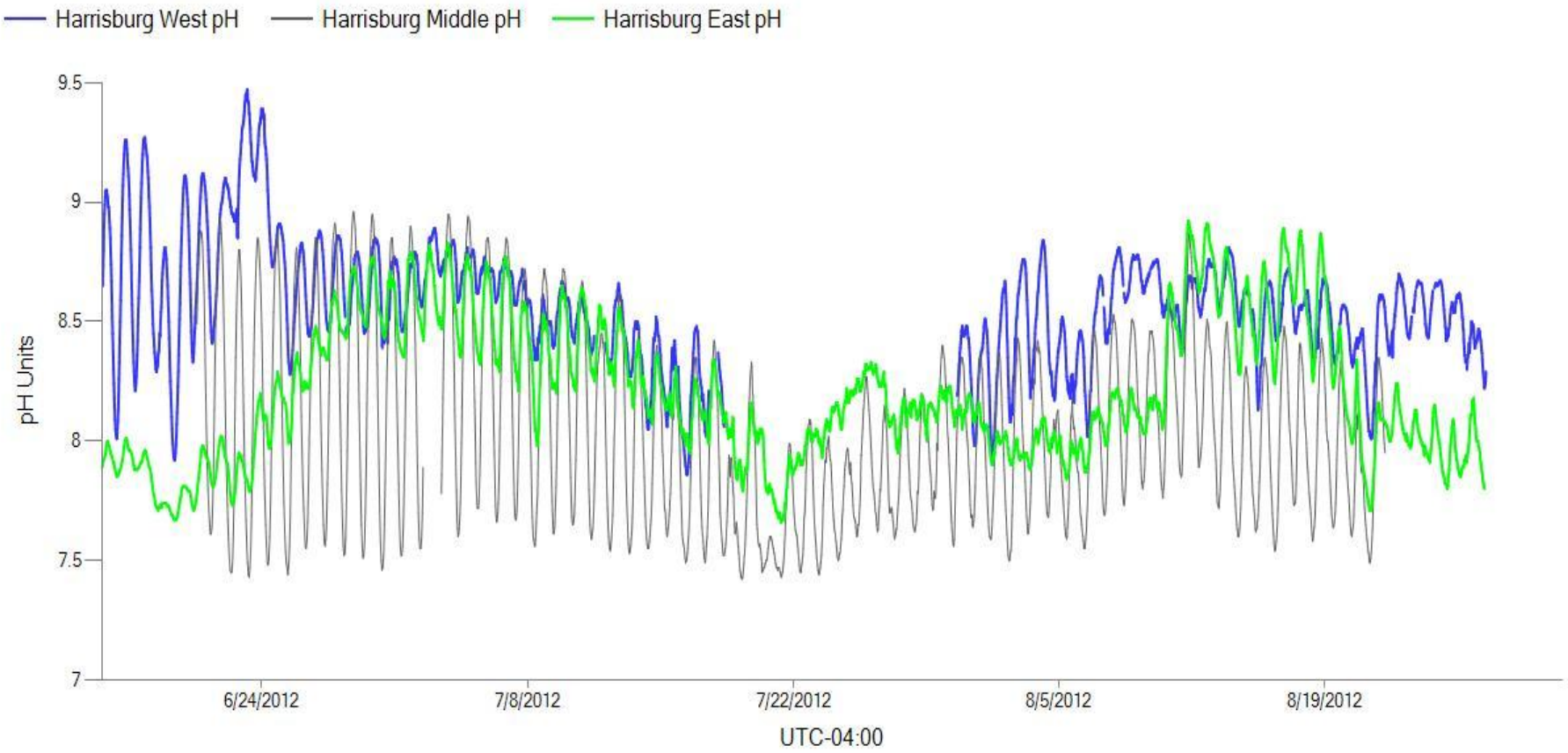
Cont. Instream Water Quality Monitoring (CIM)

Temperature, Susquehanna at Harrisburg Sample Location
6/14/12-8/31/2012



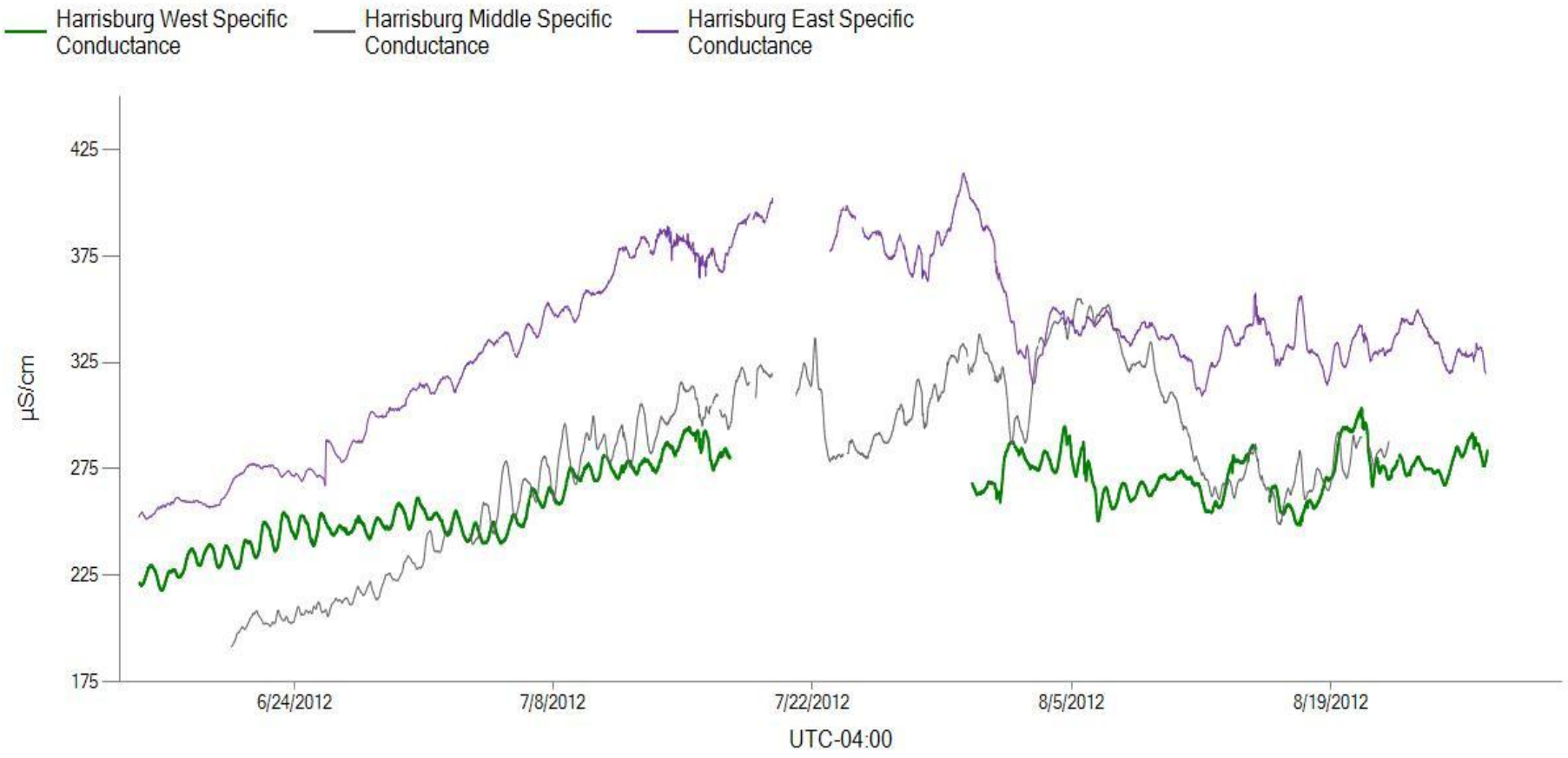
Cont. Instream Water Quality Monitoring (CIM)

pH, Susquehanna at Harrisburg Sample Location
6/14/12-8/31/2012



Cont. Instream Water Quality Monitoring (CIM)

Specific Conductance, Susquehanna at Harrisburg Sample Location
6/14/12-8/31/2012



CIM Dissolved Oxygen

Minima dissolved oxygen for the period occurred on July 8, 2012

- Harrisburg West - 5.45 mg/l
- Harrisburg Middle - 5.35 mg/l
- Harrisburg East - 6.26 mg/l
- Juniata at Newport North - 4.79 mg/l
- Sunbury East - 5.93 mg/l
- Delaware River Morrisville West - 6.74
- Delaware River Morrisville East - 6.72 mg/l.

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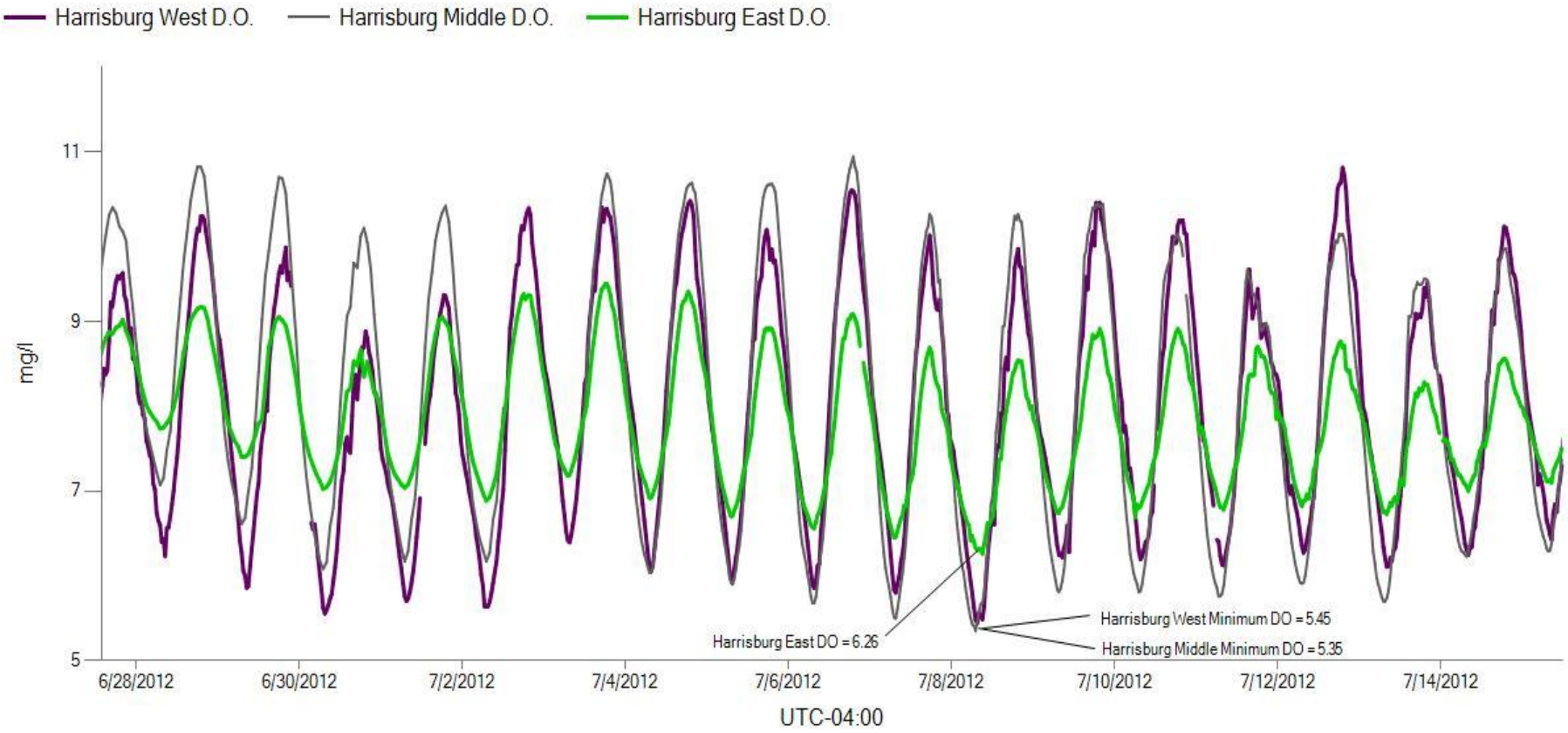
CIM Dissolved Oxygen

Example showing dissolved oxygen daily fluctuations at the three Harrisburg sites and the minimum that occurred on July 8, 2012



CIM pH

- Maxima pH for the period across sample locations and sample sites varied temporally.
- Values were consistently higher at Juniata River Newport North and Delaware River Morrisville East and West.
- The highest maxima (9.61) occurred at Delaware River Morrisville East and the lowest (8.43) occurred at Susquehanna Sunbury West.

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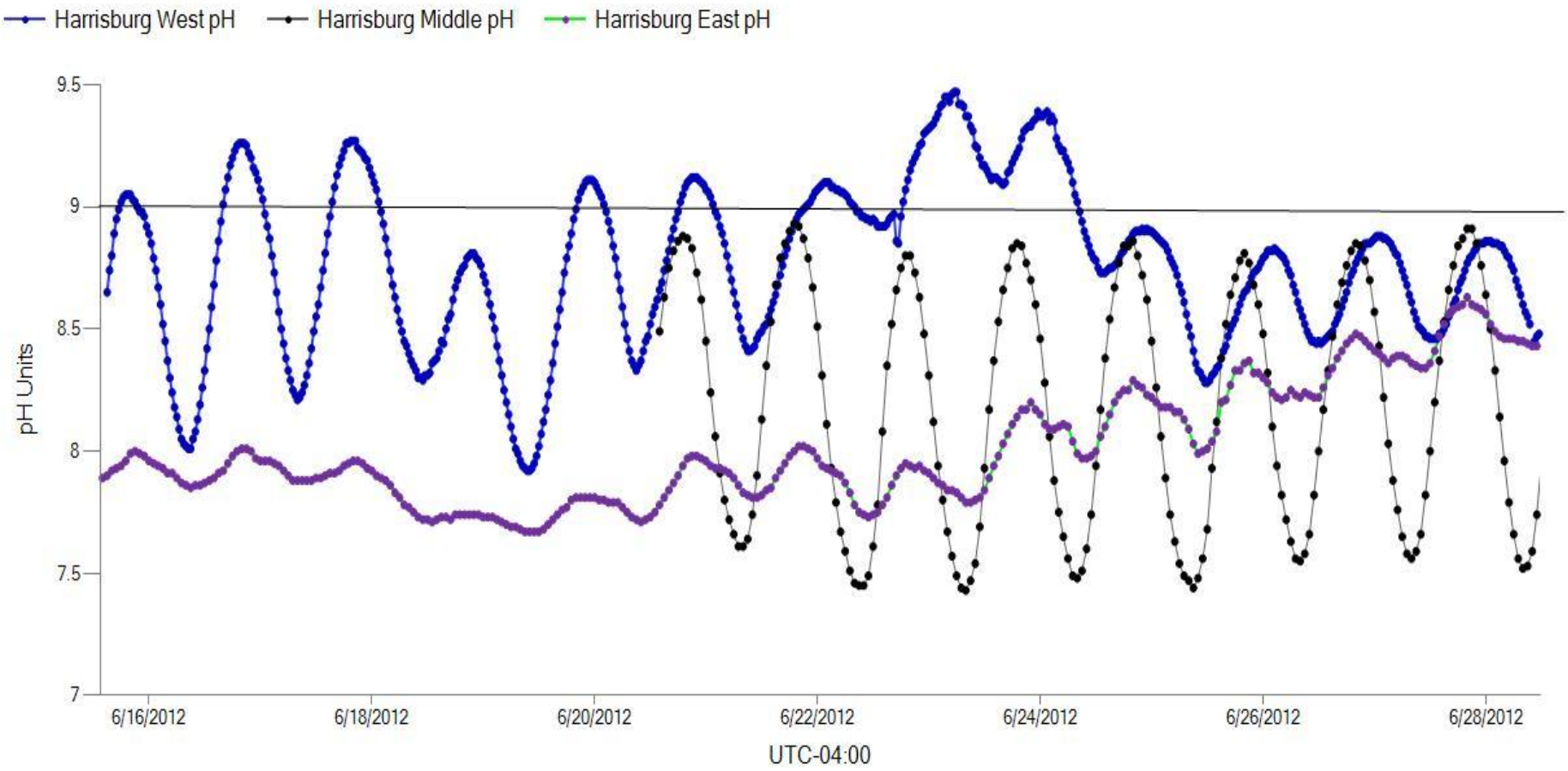
CIM pH

- As will be discussed later, both the level and the amount of time that a pH level persists must both be taken into account when assessing pH.
- The next slide shows an example of pH readings using the data collected by the CIMs at the Harrisburg location.

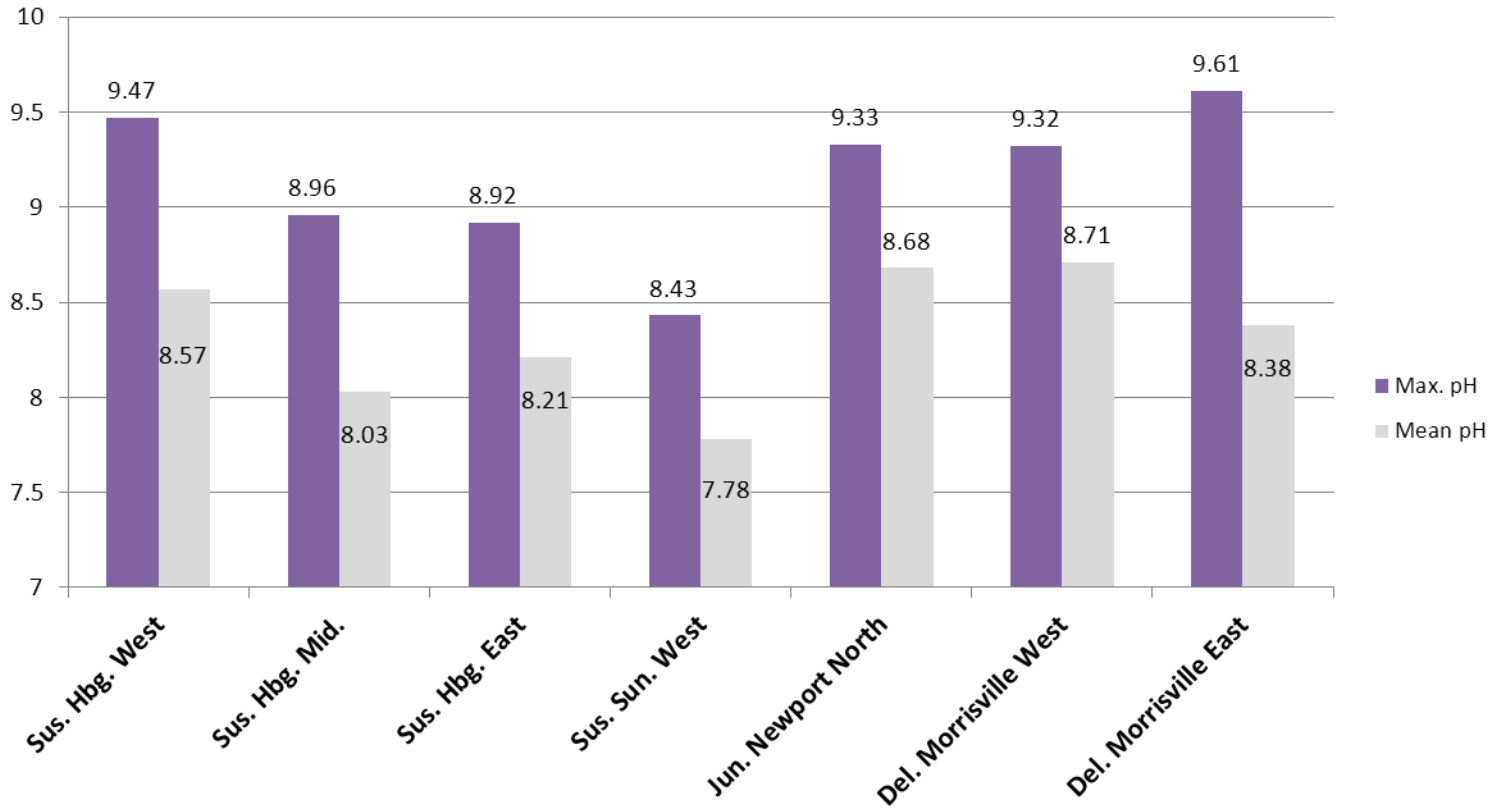
CIM pH



Maxima pH, Susquehanna at Harrisburg Sample Location – 6/15/12-6/29/2012

CIM pH

Summary of maximum and mean pH at each site



Maxima and Mean pH, All Sites

Evaluation of CIM Data

Certain standards must be met in order to properly assess data from CIMs.

- Quality assurance protocols must be followed.
- Instruments must be periodically calibrated and the final readings corrected for drift.
- The analytical uncertainty is the ability of the instrument to discriminate between small differences in a measurement. This uncertainty must be considered when an ambient measurement is compared to a numeric WQS criterion.
- The CIMs must be placed in an area that is representative of the stream segment as a whole.

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Defining Criteria Exceedance

- Dissolved Oxygen and pH criteria are defined in Pennsylvania's water quality standards in Chapter §93.7.
- These criteria must be met 99% of the time as defined in Chapter §96.3(c) of the water quality standards.
- CIM data is unique in that data can be continuously recorded at 15-, 30- or 60-minute intervals.
- Period of evaluation is one year. If a CIM is not deployed for an entire year then there must be justification for extrapolating the available results to a year. In this case, the CIMs were deployed during the critical time of year (low flows and warm temperatures) when dissolved oxygen is lowest and pH highest.

Defining Criteria Exceedance

The table below characterizes common sampling rates or how often data is recorded and the number of criteria exceedances that would be expected for impairment of a water.

Sample Rate	Sample Exceedances Expected for Impairment
15 Minutes	351
30 Minutes	176
60 Minutes	89

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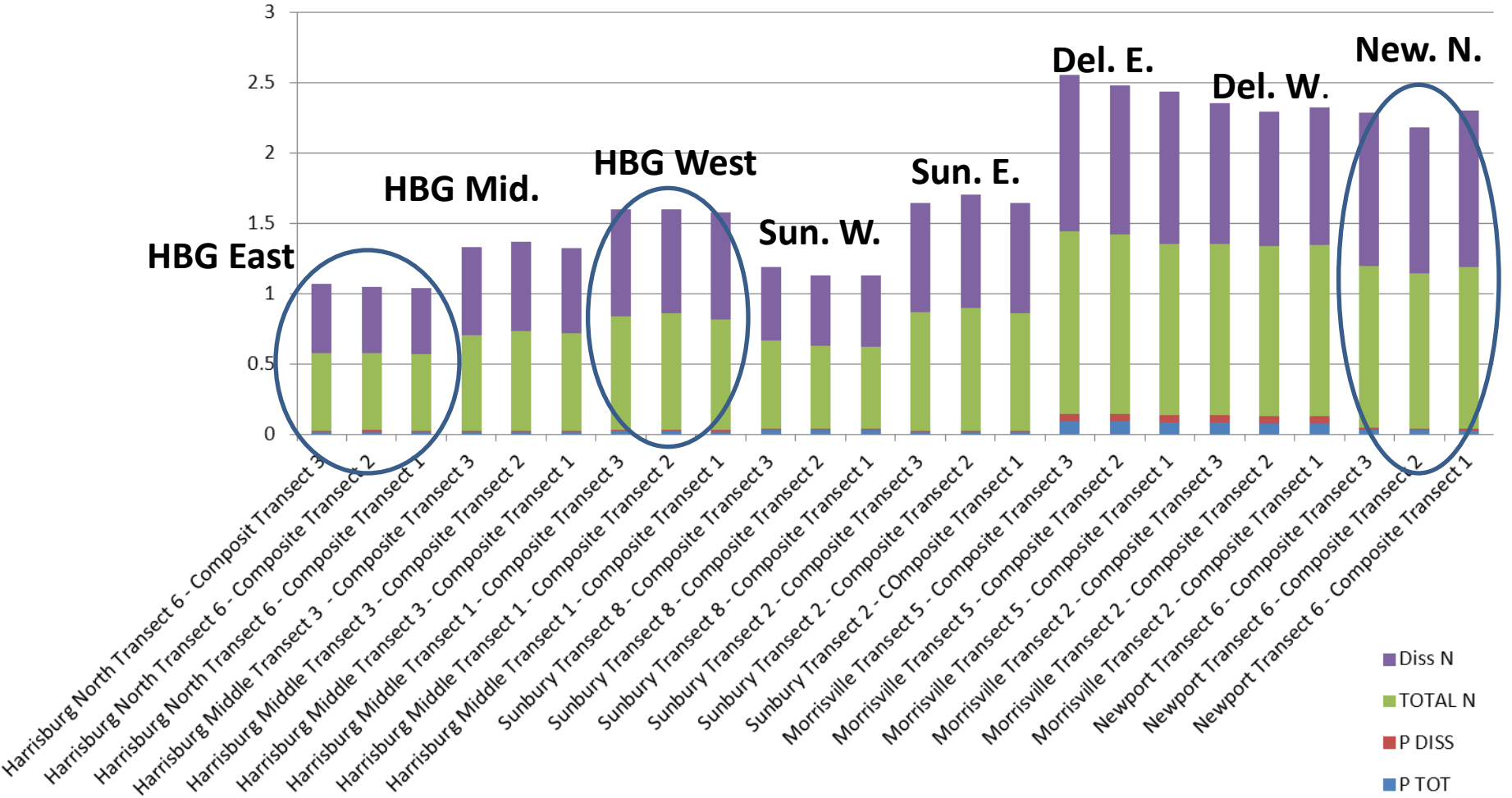
Summary of CIM Data

Percent Criteria Exceedances for pH and Dissolved Oxygen CIM data. Percentage greater than 1.00 is impairment.

Sample Site 2012	Parameter	% Criteria Exceedance
Delaware East	pH	1.81
Delaware East	Dissolved Oxygen	0
Delaware West	pH	0.23
Delaware West	Dissolved Oxygen	0
Juniata Newport	pH	0.7
Juniata Newport	Dissolved Oxygen	0
Susquehanna Harrisburg West	pH	0.36
Susquehanna Harrisburg West	Dissolved Oxygen	0
Susquehanna Harrisburg Middle	pH	0
Susquehanna Harrisburg Middle	Dissolved Oxygen	0
Susquehanna Harrisburg East	pH	0
Susquehanna Harrisburg East	Dissolved Oxygen	0
Susquehanna Sunbury West	pH	0
Susquehanna Sunbury West	Dissolved Oxygen	0
Susquehanna Sunbury East	pH	0
Susquehanna Sunbury East	Dissolved Oxygen	0

Water Chemistry Grab Sampling



(Dissolved Ortho-Phosphorous was not detectable all Susquehanna sites)

Discrete Water Quality Transect Characterization

- The Susquehanna at Harrisburg sample location exhibited the most discernible differences in water quality moving across the river from bank to bank.

- The Harrisburg North transect data is used as the example in the following slides. The other Harrisburg sites showed a similar pattern.

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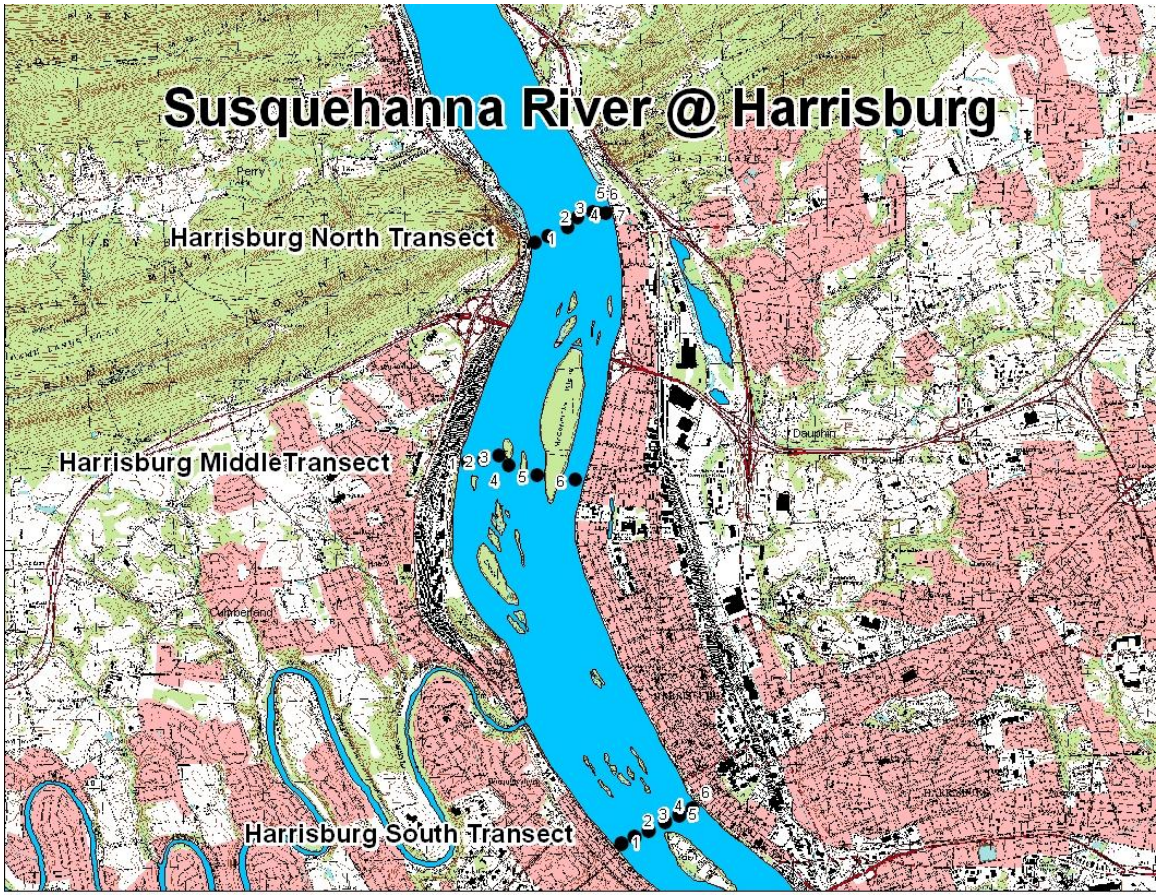
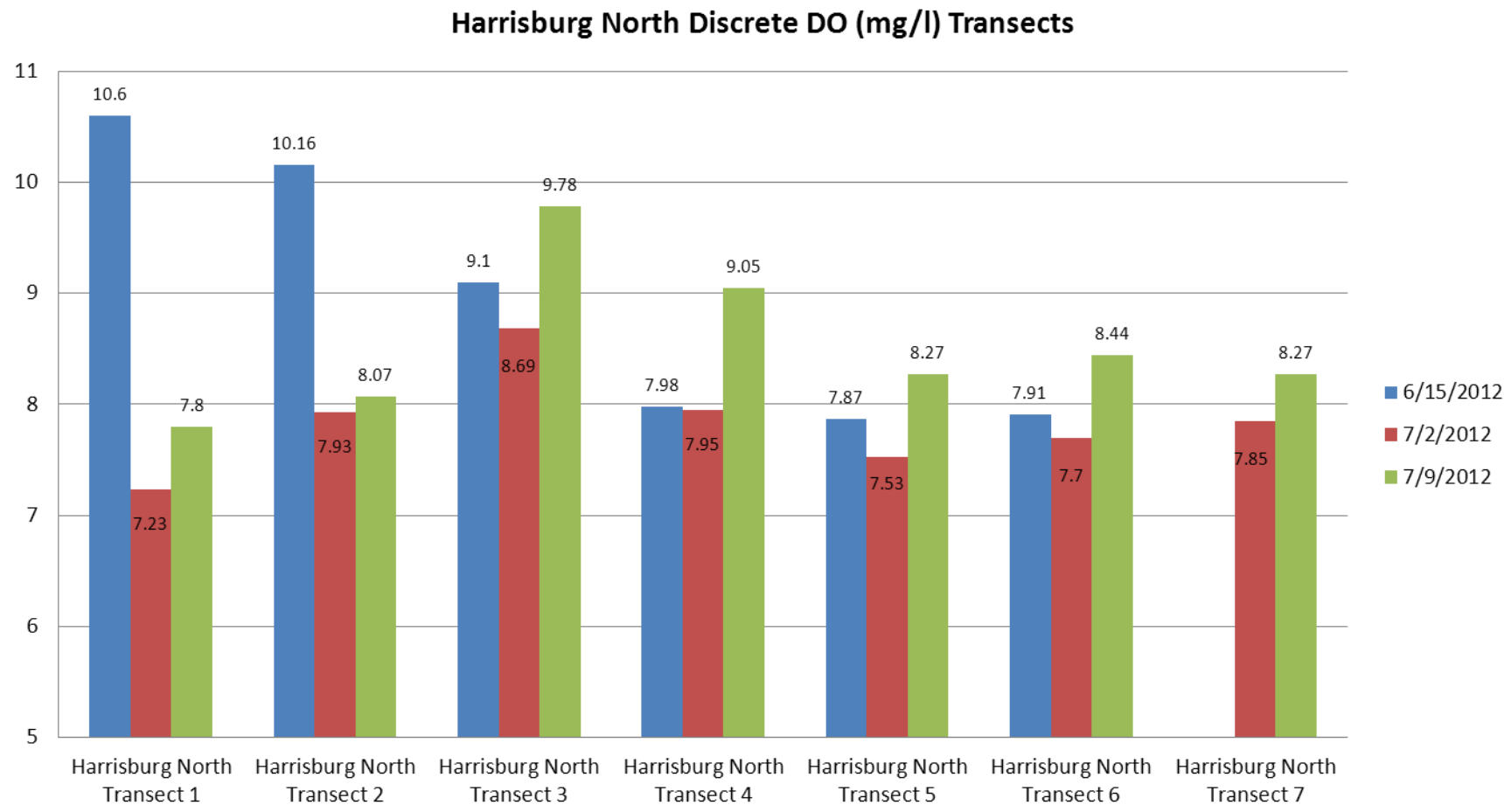
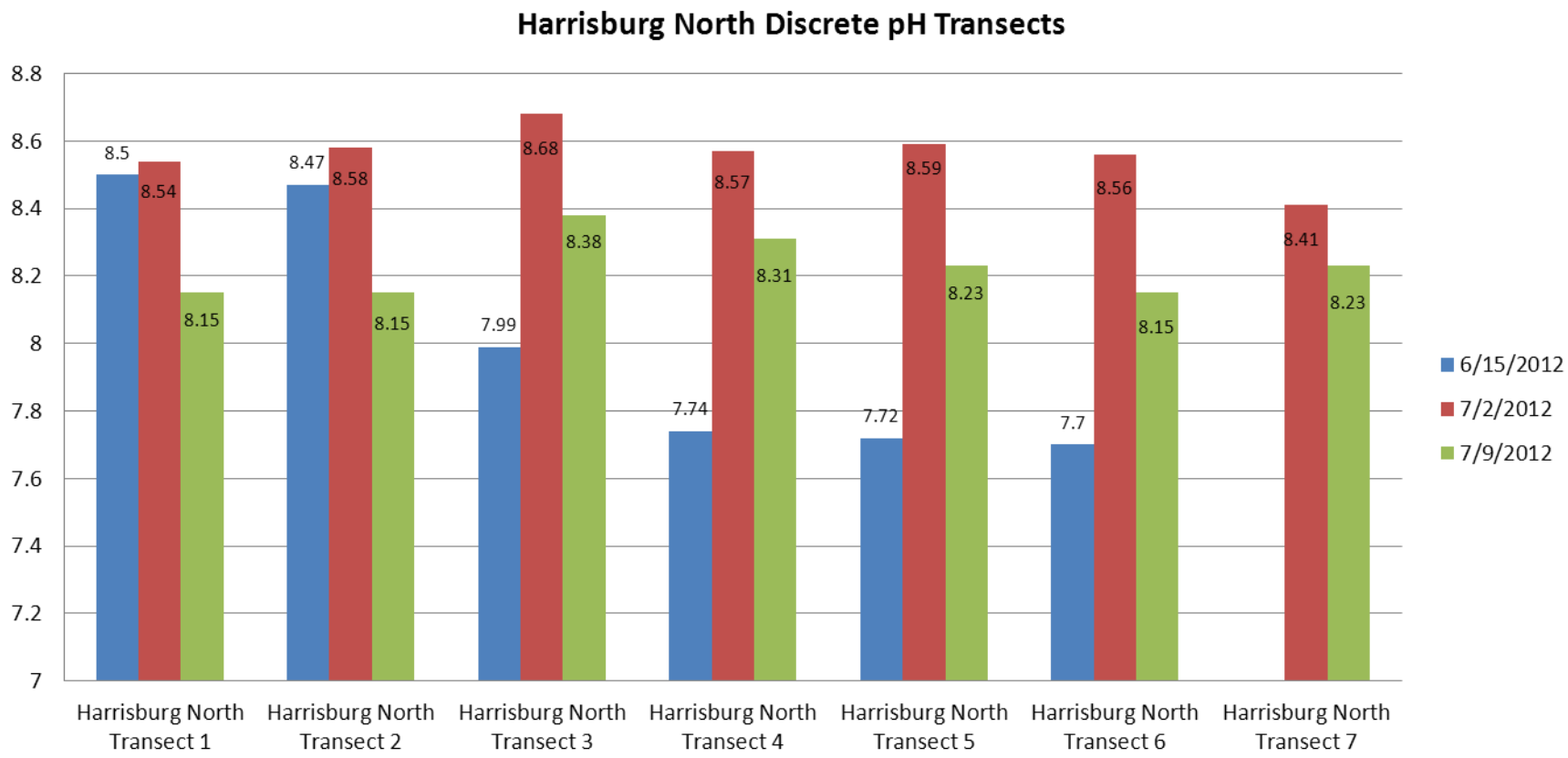
Discrete Water Quality Transect Characterization



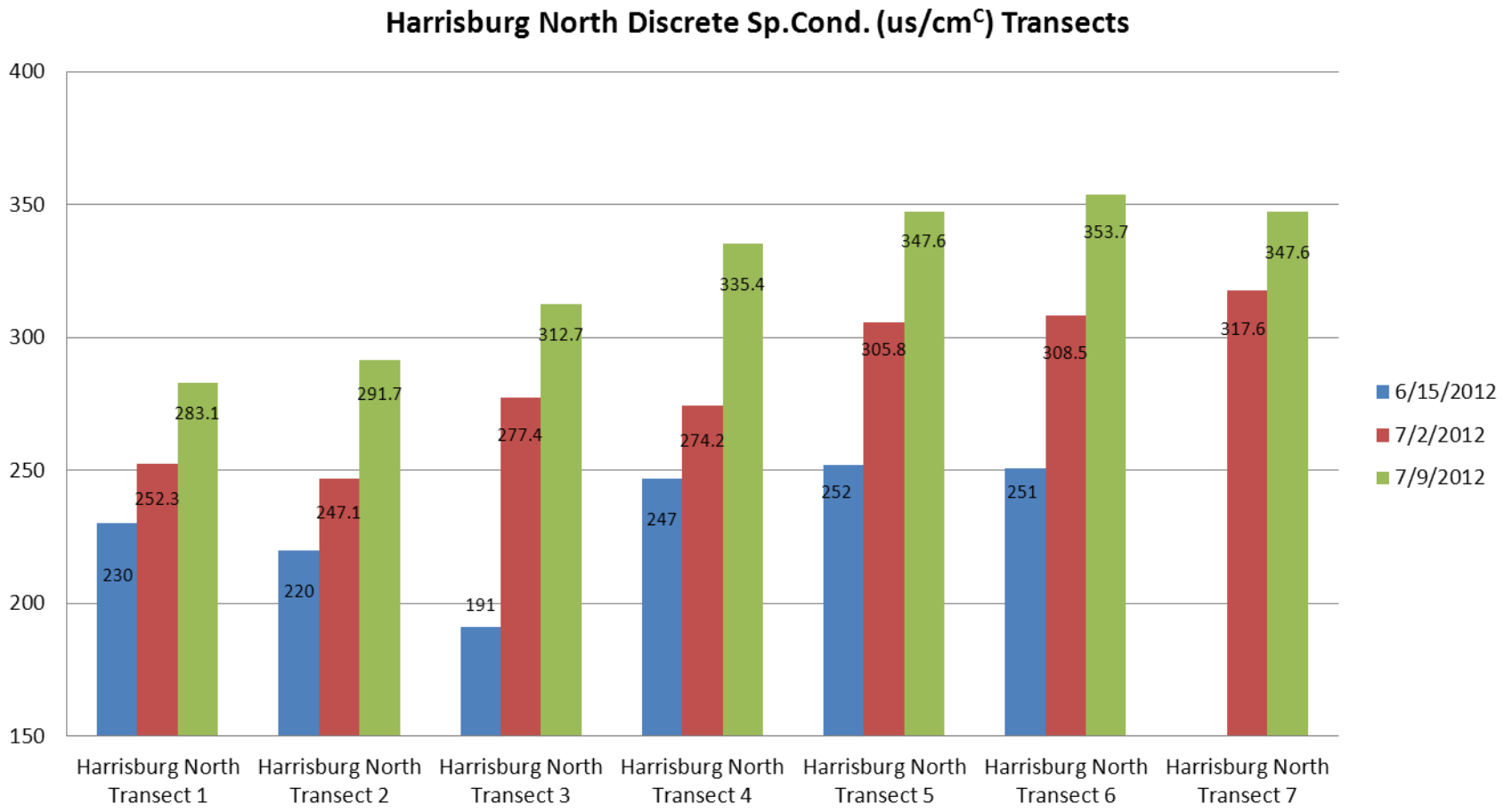
Susquehanna River @ Harrisburg Discrete Water Quality Transects



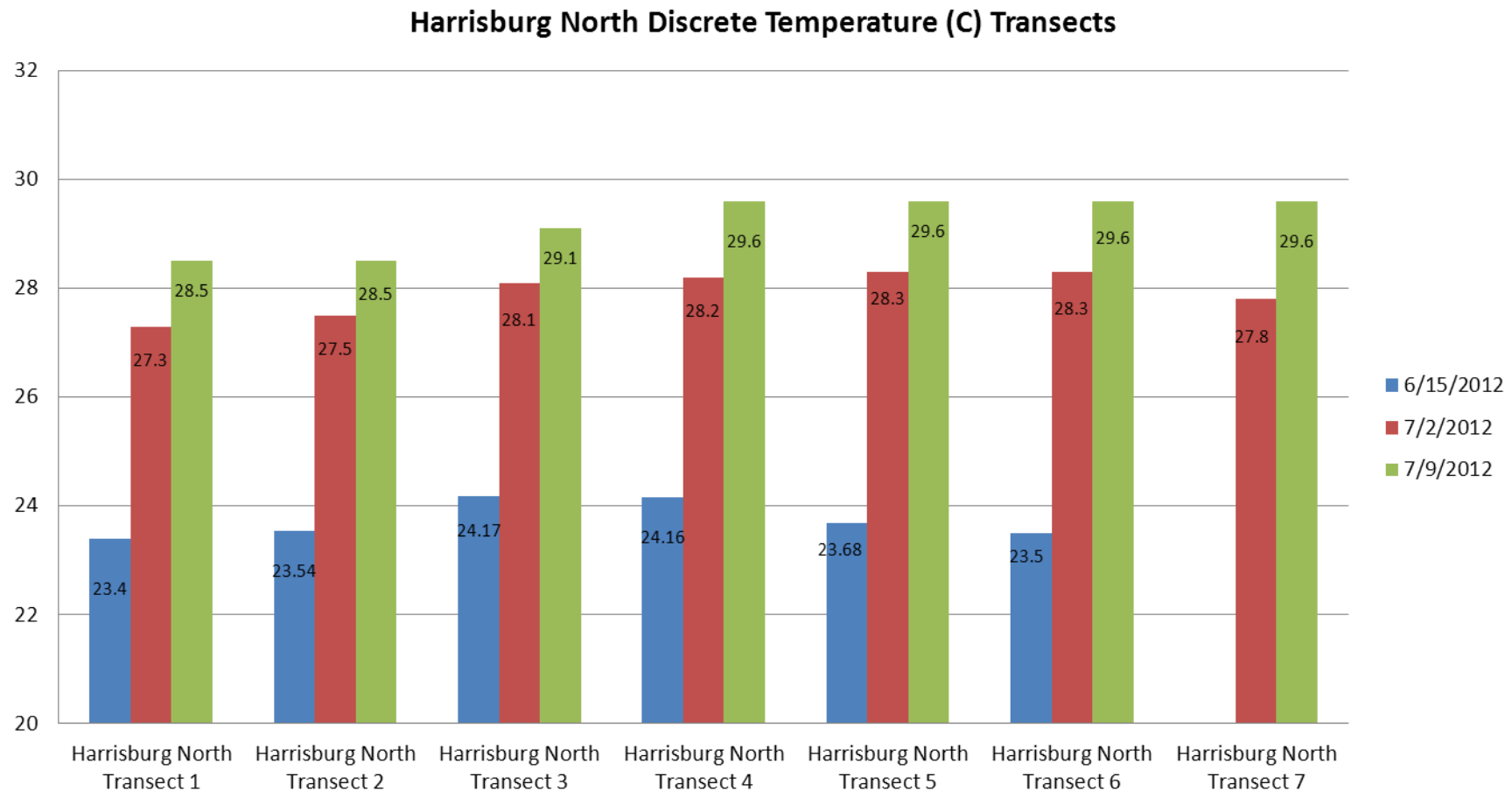
Susquehanna River @ Harrisburg Discrete Water Quality Transects



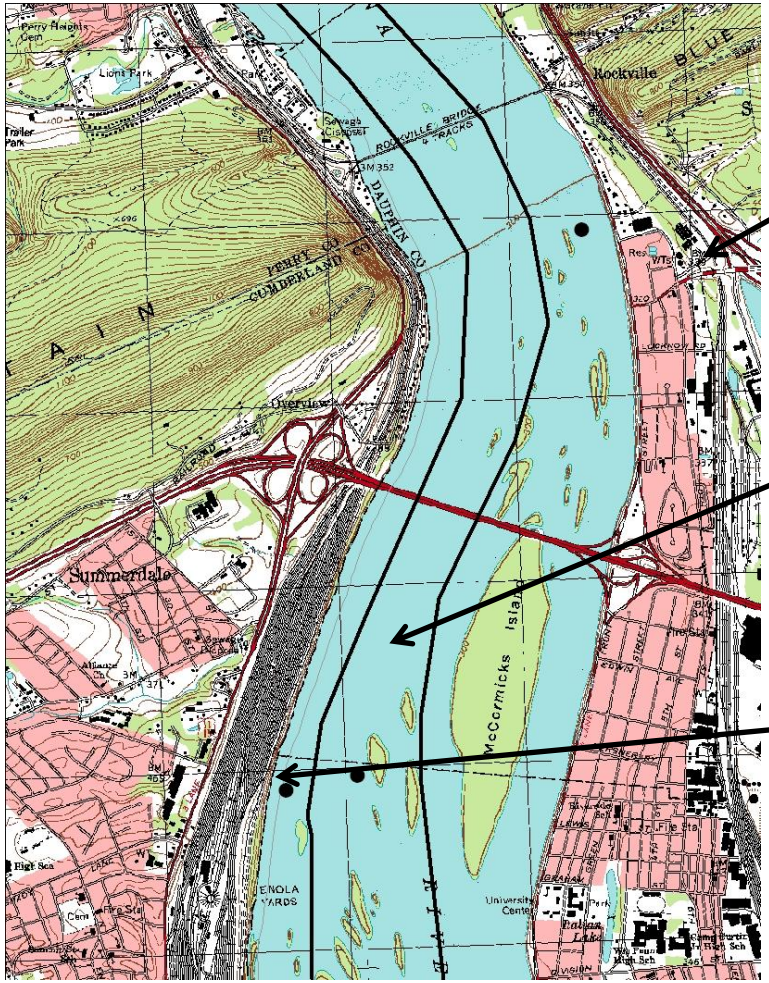
Susquehanna River @ Harrisburg Discrete Water Quality Transects



Susquehanna River @ Harrisburg Discrete Water Quality Transects



Susquehanna River @ Harrisburg (Three Distinct Influences)



- Harrisburg East is heavily influenced by the Susquehanna Mainstem
- Harrisburg Middle is heavily influenced by the West Branch Susquehanna
- Harrisburg West is heavily influenced by the Juniata River

Periphyton Monitoring (Fixed Transect & Random)

A nutrient study plan was implemented at each sample location to:

- Characterize nutrient levels in surface water
- Measure nutrient levels in algae
- Measure algal biomass
- Identify the types of algae in the river

The study was divided into two phases:

- Phase 1 – intense targeted transect nutrient and algal sampling conducted during the summer low-flow critical condition.
- Phase 2 - random site selection, artificial substrate nutrient and algal sampling effort, also conducted during the summer low-flow.

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Random Periphyton Block & Tile Sampler

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Fixed Transect Periphyton Sampled Rocks

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Periphyton Monitoring (Fixed Transect & Random)

Samples are now being analyzed and interpreted by:

Dr. Hunter Carrick

Central Michigan University

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Benthic Macroinvertebrate Sampling

Macroinvertebrates (aquatic insects, snails, clams, etc.) were collected mid-July through mid-August at each Phase 1 sample site

- The Susquehanna is a wide river and there is variation in water quality across the width. As a result, multiple macroinvertebrate samples collected across the width are required to properly characterize the river at a location.
- As an example, the Susquehanna at Harrisburg sample location had three sets of samples collected, one each at the Susquehanna at Harrisburg East, Middle and West sites.
- The collections are summarized by calculating biological index scores. The next slide shows two relevant individual indicies; taxa richness and intolerant taxa. The index of biological integrity (IBI) score is a composite of several important indicies.
- The indices ranged from fair to good.

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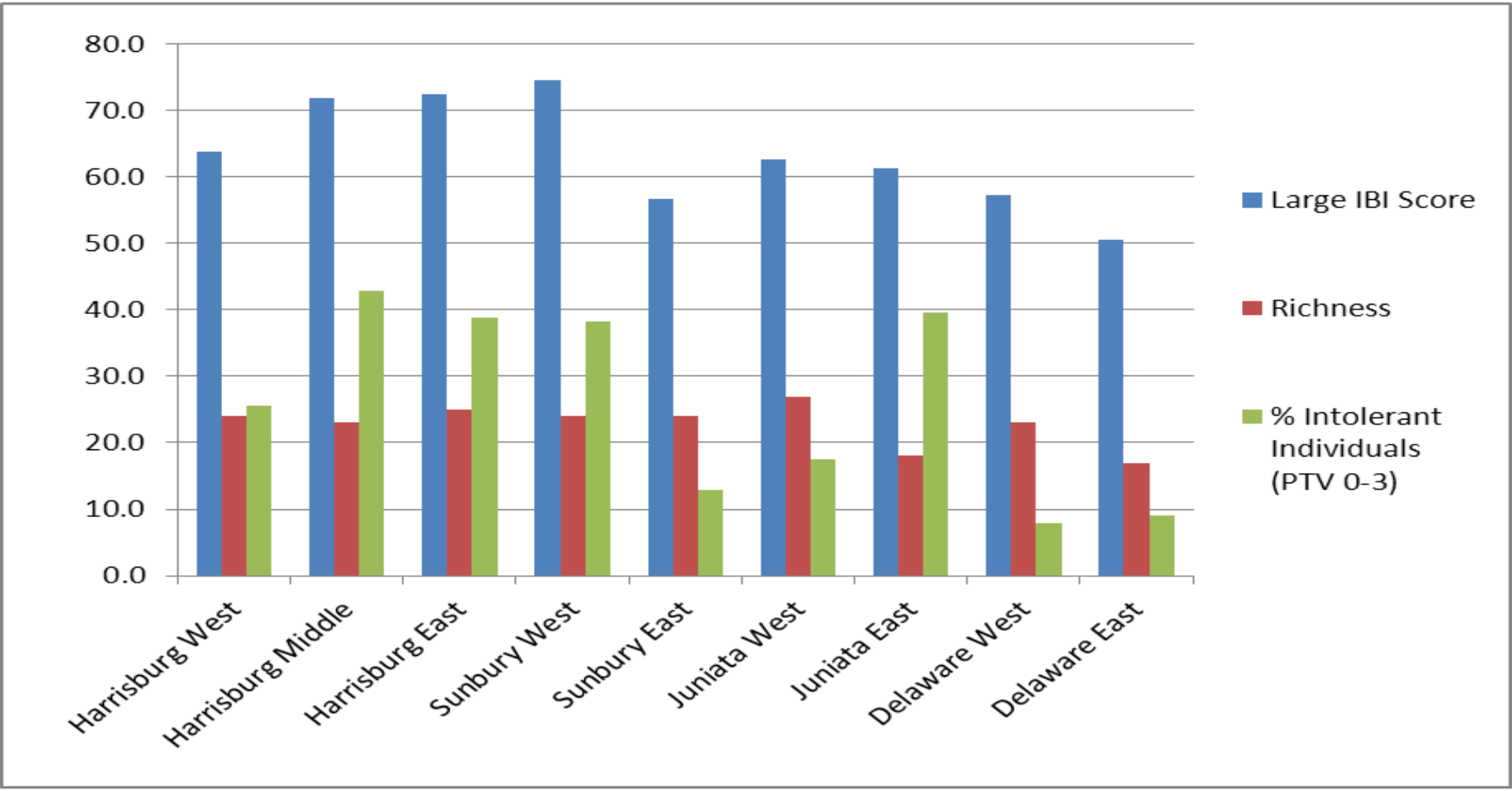
Benthic Macroinvertebrate Sampling



Relationship between selected metrics and the large IBI score at sample locations.

Androgenicity/Estrogenicity Passive Sampler Deployment

- POCIS samplers collect water quality data that are not always detectable in grab water samples, because some pollutants can be harmful at less than detectable levels.
- Pollutant data were collected as total androgenicity and estrogenicity.
- They were placed at all three Susquehanna River at Harrisburg sites and at the Delaware River at Morrisville East site (control).
- Grab water samples were also collected during sampler deployment and sampler retrieval.
- Total estrogenicity results are reported but the androgenicity is still to be analyzed by the National Cancer Institute.

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Sampling

POCIS in Susquehanna River August 2012

Total Estrogenicity Sample Results

Location	Site	Grab Water Sample @ Deployment EEQ* (ng/L)	Grab Water Sample @ Retrieval EEQ (ng/L)	ng/POCIS
Susquehanna River @ Harrisburg	Harrisburg East	BD**	BD	0.879
Susquehanna River @ Harrisburg	Harrisburg Middle	BD	BD	0.617
Susquehanna River @ Harrisburg	Harrisburg West	0.174	BD	2.948
Delaware River @ Morrisville	Morrisville	BD	BD	1.222
Fabrication Blank	N/A	--	--	BD
Field Blank	All	--	--	BD
*EEQ = estrogen equivalents				
**BD = below detection; detection limit = 0.35 ng/L				

- All grab samples were either below detection or less than one.
- POCIS results represent an accumulation over a 30-day period. Estrogenicity was over one at the Harrisburg West and Delaware Trenton sites. But since the results are a 30-day total it cannot be determined if the exposure was ever over one on a daily or hourly basis.

Proposed Water Quality Monitoring 2013

- Water Chemistry Grab Sampling
- Discrete Water Quality Transect Characterization
- Continuous Instream Water Quality Monitoring (CIM)
- Periphyton Monitoring (Fixed Transect & Random)
- Experimental Periphyton Growth Studies at Varying Nutrient Levels.
- Benthic Macroinvertebrate Sampling
- Androgenicity/Estrogenicity Passive Sampler Deployment
- Routine Fish Tissue Sampling
- Semi-Quantitative Fish Sampling (Great River and Wadable)
- Herbicide/Pesticide Storm Sampling @ WQN Stations

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Proposed Water Quality Monitoring 2013

Multi-Agency Cooperation

DEP will continue to cooperate with:

- PFBC on its young-of-year smallmouth bass studies.
- USGS studying the fish pathology.
- USGS Northern Appalachian Research Laboratory with an experiment involving nutrients, sediment, and their effect on stream periphyton.
- The Susquehanna River Basin Commission during its river studies.

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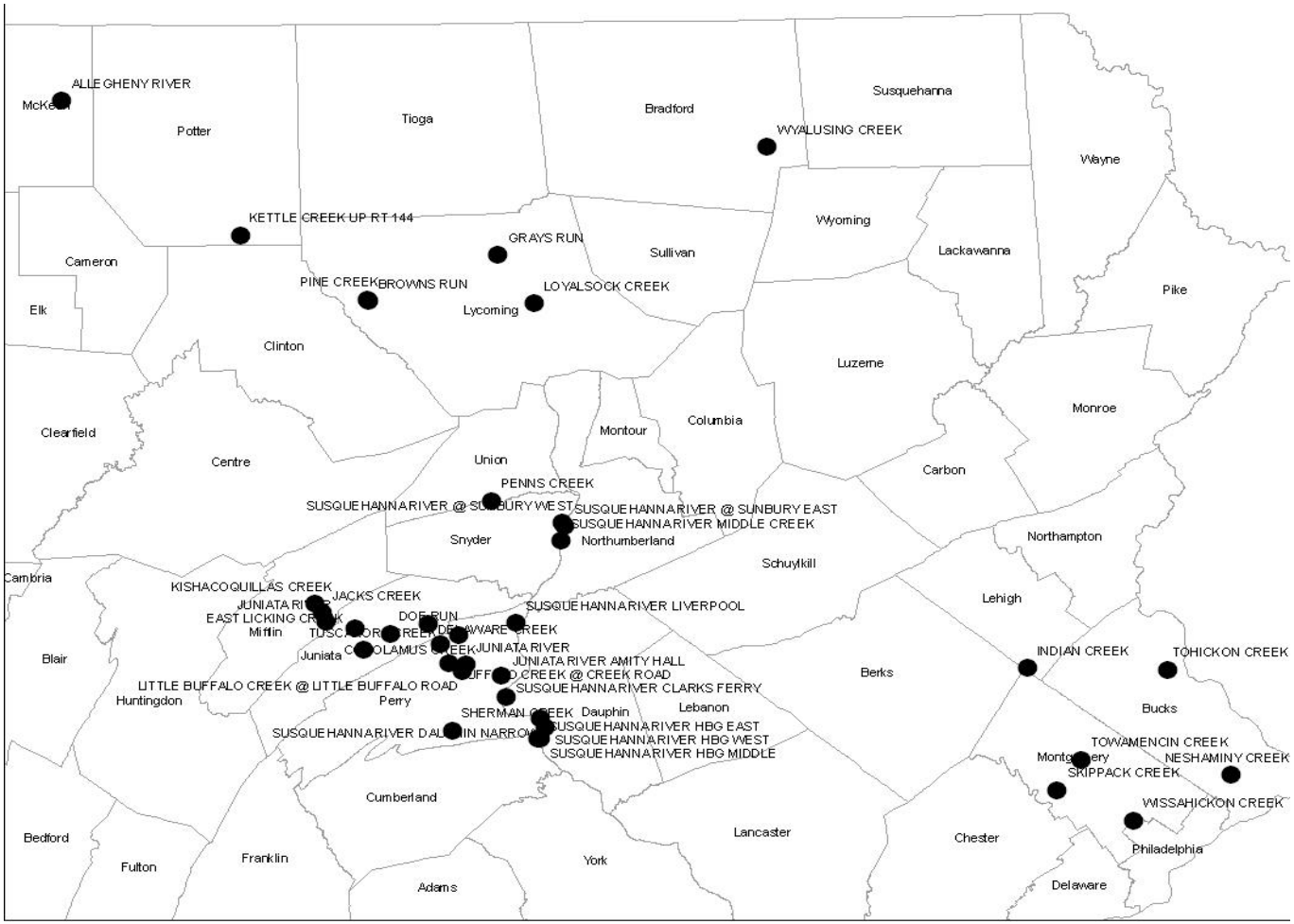
Proposed Water Quality Monitoring 2013



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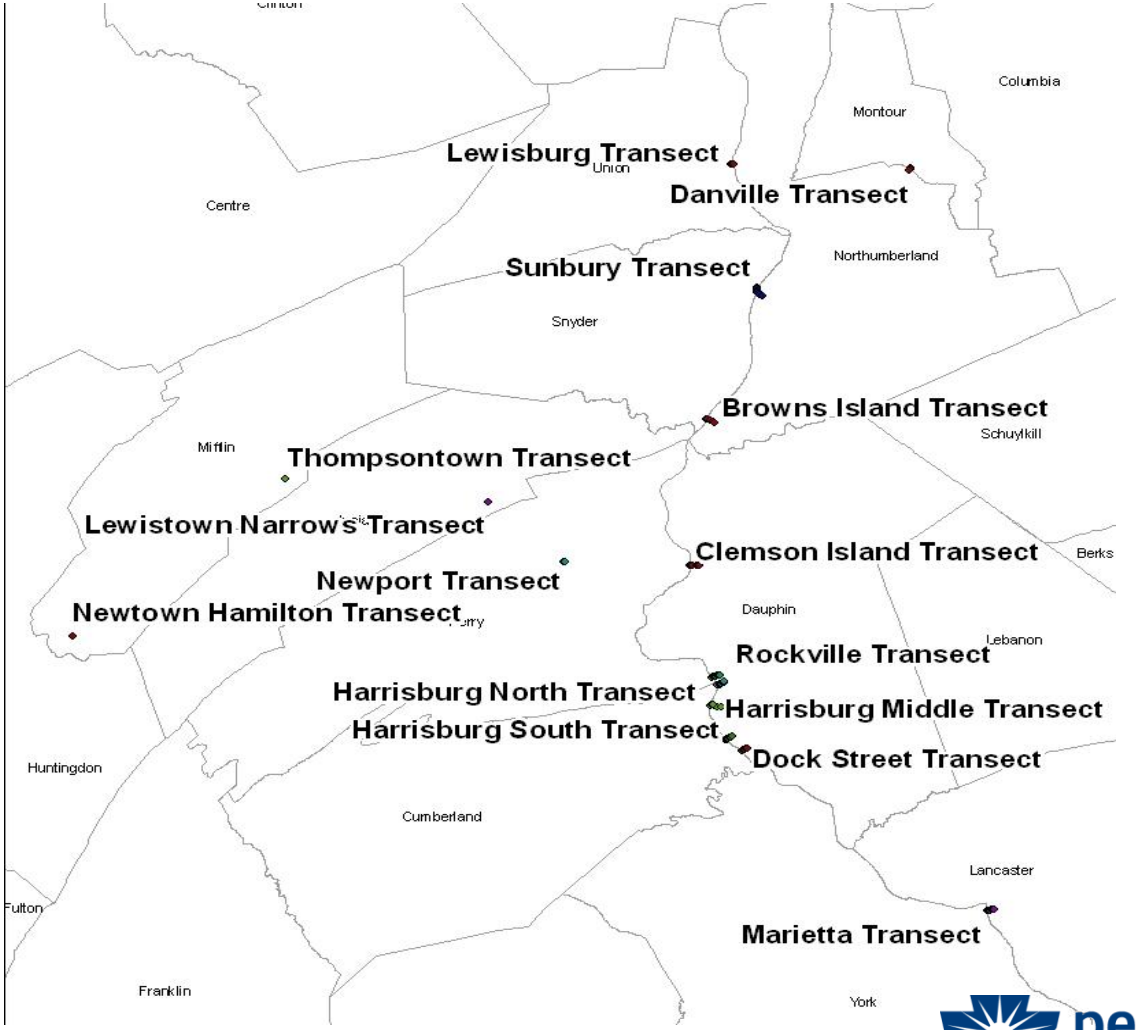
Proposed Water Quality Transects 2013



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Proposed Water Quality Transects 2013

Discrete Water Quality Transect	CIM	Algae Phase 1 (Site)	Algae Phase 2	Sediment (Site)	PFBC YOY (Site)	WQN (Site)
Susquehanna - Danville	X				Danville	WQN0301
West Branch Sus. - Lewisburg	X				Lewisburg	WQN0401
Susquehanna - Sunbury	X	West & East		West	Shady Nook	WQN0203
Susquehanna - Browns Island	X		X		Mahantango	
Susquehanna - Clemson Island	X		X		New Buffalo	
Juniata - Newtown Hamilton	X		X		Newtown Hamilton	
Juniata - Thompsontown	X		X		Thompsontown	
Juniata - Lewistown Narrows	X	X	X	X	Tony's	TBD
Juniata - Newport	X	South & North		South	?	WQN0214
Susquehanna - Rockville	X		X	West	Rockville	TBD
Susquehanna - Harrisburg North	X	East				
Susquehanna - Harrisburg Middle	X	Middle & West				
Susquehanna - Harrisburg South	X				Fairview	WQN0202
Susquehanna - Dock Street						
Susquehanna - Marietta	X	West & East		West	Wrightsville	WQN0201
Delaware - Morrisville	X	West & East		East		WQN0101
Allegheny – Franklin	X	West		West	Franklin	WQN0804(Intactive)

Great River Fish Sampling 2013

Large River Fish Sampling	CIM	Site(s)/Location	Site Description(s)	PFBC YOY (Site)	WQN (Site)
Susquehanna - Great Bend TBD		TBD		Hallstead	WQN0306
Susquehanna - Falls TBD		TBD		Falls	WQN0307
Susquehanna - Danville TBD	X	TBD		Danville	WQN0301
West Branch Sus. - Karthaus TBD	X	TBD			WQN0404
West Branch Sus. - Jersey Shore TBD		TBD			WQN0448
West Branch Sus. - Lewisburg	X	TBD		Lewisburg	WQN0401
Susquehanna - Sunbury	**X**	**2**	**West & East**	**Shady Nook**	**WQN0203**
Susquehanna - Browns Island TBD	X	2	West & East	Mahantango	
Susquehanna - Clemson Island TBD	X	2	West & East	New Buffalo	
Juniata - Newtown Hamilton TBD	X	TBD		Newtown Hamilton	
Juniata - Thompsontown TBD	X	TBD		Thompsontown	
Juniata - Lewistown Narrows	**X**	**TBD**	**X**	**Tony's**	**TBD**
Juniata - Newport	**X**	**2**	**South & North**	**?**	**WQN0214**
Susquehanna - Harrisburg North	**X**	**1**	**East**		
Susquehanna - Harrisburg Middle	**X**	**2**	**Middle & West**		
Susquehanna - Marietta	**X**	**2**	**West & East**	**Wrightsville**	**WQN0201**
Delaware - Morrisville	**X**	**2**	**West & East**		**WQN0101**


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QUESTIONS?

Please type your questions into the chat window.