

**Final Report to Lower Delaware Wild and Scenic River Management Council
2022 Aquetong Creek Volunteer Water Monitoring Program
September 1, 2022**

I. Project Description:

With funding from the Lower Delaware Wild and Scenic River Management Council and the US National Park Service, the Aquetong Watershed Association, an all-volunteer 501(c)3 non-profit membership organization (www.aquetongwatershed.org/) further expanded its watershed monitoring program with the purchase of additional in-stream water quality data monitoring equipment. This included 5 Bluetooth enable temperature pendants and a dissolved oxygen (DO) in-stream data logger.

The Aquetong watershed has a drainage area of 7.6 square miles and has approximately 23 stream miles (Figure 1). Aquetong Creek and its tributaries discharge directly into the Delaware River near the Bucks County Playhouse in New Hope Borough. There are over 3,000 residences and businesses in the Aquetong watershed. About 30% of the watershed, primarily in the upper reaches, is protected by conservation easements. The lower portion has seen extensive development in the last thirty years. The entire population of the watershed and of Solebury Township and New Hope Borough depend upon groundwater wells for their drinking water.

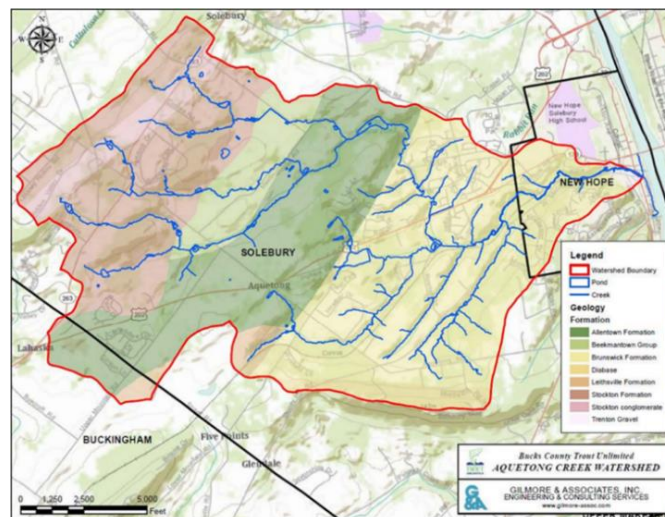


Figure 1: The Aquetong Watershed

The AWA has been monitoring water quality in Aquetong Creek since 2010. The overall goal of this program is to assess and monitor existing water quality conditions along the main stem of Aquetong Creek and ensure this waterway remains designated as HQ-CWF. The monitoring program helps identify any sources of disturbances within the watershed that may pose risk to its classification. Furthermore, this program helps track longitudinal changes in water quality that may arise from changes in land use or land management policy. The AWA maintains a long-term monitoring database and provides data to its partners accordingly. Data can be used to identify stream and riparian restoration opportunities, inform land management decisions, or catalyzing deeper investigations.

I. Project Description (con't):

The AWA Aquetong Creek Volunteer Water Monitoring Program includes both an intensive stream bio-survey and in-situ water quality measurements. The intensive stream bio-survey is based on the habitat assessment and macroinvertebrate sampling approach developed by EPA in its Rapid Bioassessment Protocols for Streams and Rivers (Protocol II) and adapted by volunteer monitoring programs. In-situ water quality measures will be performed by a suite of aquatic data logging instruments (<https://www.onsetcomp.com/>) deployed into the stream for prolonged intervals.

The overall goals of the AWA Watershed Monitoring Program are as follows:

- Annually monitor water quality at multiple locations along the main stem of Aquetong Creek (Figure 2).
- Identify any spatial and/or temporal gradients in water quality moving downstream from the headwaters of the Aquetong.
- Monitor and identify longitudinal changes in water quality as the Traditional Neighborhood Commercial Zone within Solebury Township (Rt 202 Corridor) is improved and developed.

II. Methods

In 2022, the AWA established five additional stream monitoring stations (for a total of seven) within the watershed (Figure 2). Funds received in 2022 from the LDWS mini-grant were used to purchase continuous temperature monitoring probes which were deployed in the additional sites. The AWA also increased its capacity to monitor dissolved oxygen with the purchase of an addition DO data logger, installed in one of the additional monitoring sites. Table 1 outlines the water quality parameters (and biological indices) measured in the field for each station and at which time.

The AWA Volunteer Water Monitoring Program follows its Quality Assurance Project Plan, submitted to the LDWS Management Council in July of 2021.

Figure 2: Locations of each monitoring site within the Aquetong Watershed.



II. Methods (con't)

Table 1: 2022 Data Collection Overview- Aquetong Creek Volunteer Water Monitoring Program

	April	May	June	July	August	September	October
Upper Aquetong (Main Stem)							
Temperature							
pH							
DO							
Conductivity							
Biotic Indices							
Middle Aquetong (Main Stem)							
Temperature							
pH							
DO							
Conductivity							
Biotic Indices							
Lower Aquetong (Main Stem)							
Temperature							
DO							
Upper Northern Branch							
Temperature							
Middle Northern Branch							
Temperature				Above Waterline			
Lower Northern Branch							
Temperature				Instrument Failure			
Lower Honey Hollow Creek							
Temperature							
							Anticipated

III. Results: 2022 Water Quality Data

Figure 3: Biotic indices at the Upper and Middle Aquetong monitoring stations for 2021 and 2022.

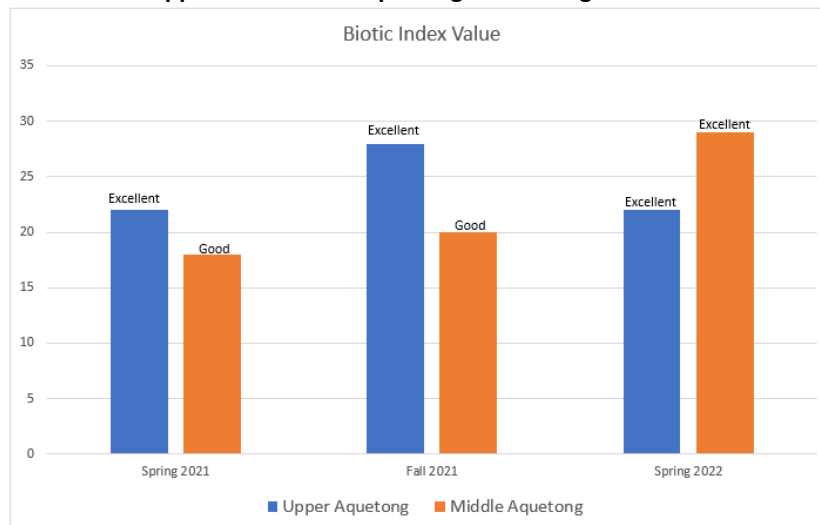


Table 2: Tabulated data from Macroinvertebrate Surveys for 2021 and 2022.

Location	Spring 2021		Fall 2021		Spring 2022	
	Upper Aquetong	Middle Aquetong	Upper Aquetong	Middle Aquetong	Upper Aquetong	Middle Aquetong
Total Organisms in Sample	100	100	100	42	100	100
Number of Taxa	10	9	14	9	11	14
Biotic index value	22	18	28	20	22	29
Biotic index score	excellent	good	excellent	good	excellent	excellent
EPT Index	52	36	26	26	44	35
Fish observed?	no	yes	Yes	yes	no	no
Salamander observed?	yes	yes	Yes	yes	yes	yes

Figure 4: 2022 real time temperature among all seven creek monitoring stations within the Aquetong Watershed

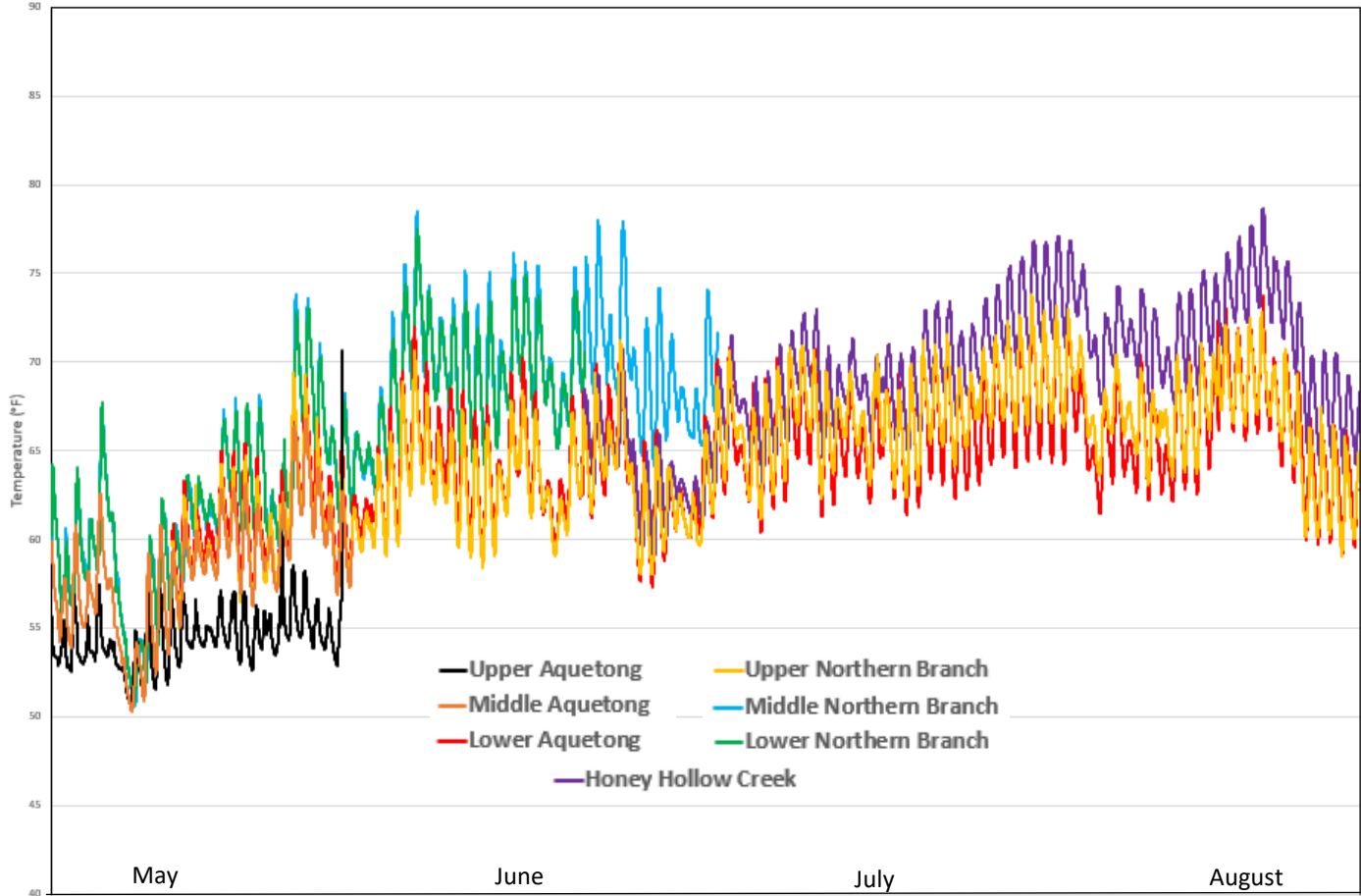


Figure 5: 2022 average monthly stream temperatures among all seven creek monitoring stations within the watershed.

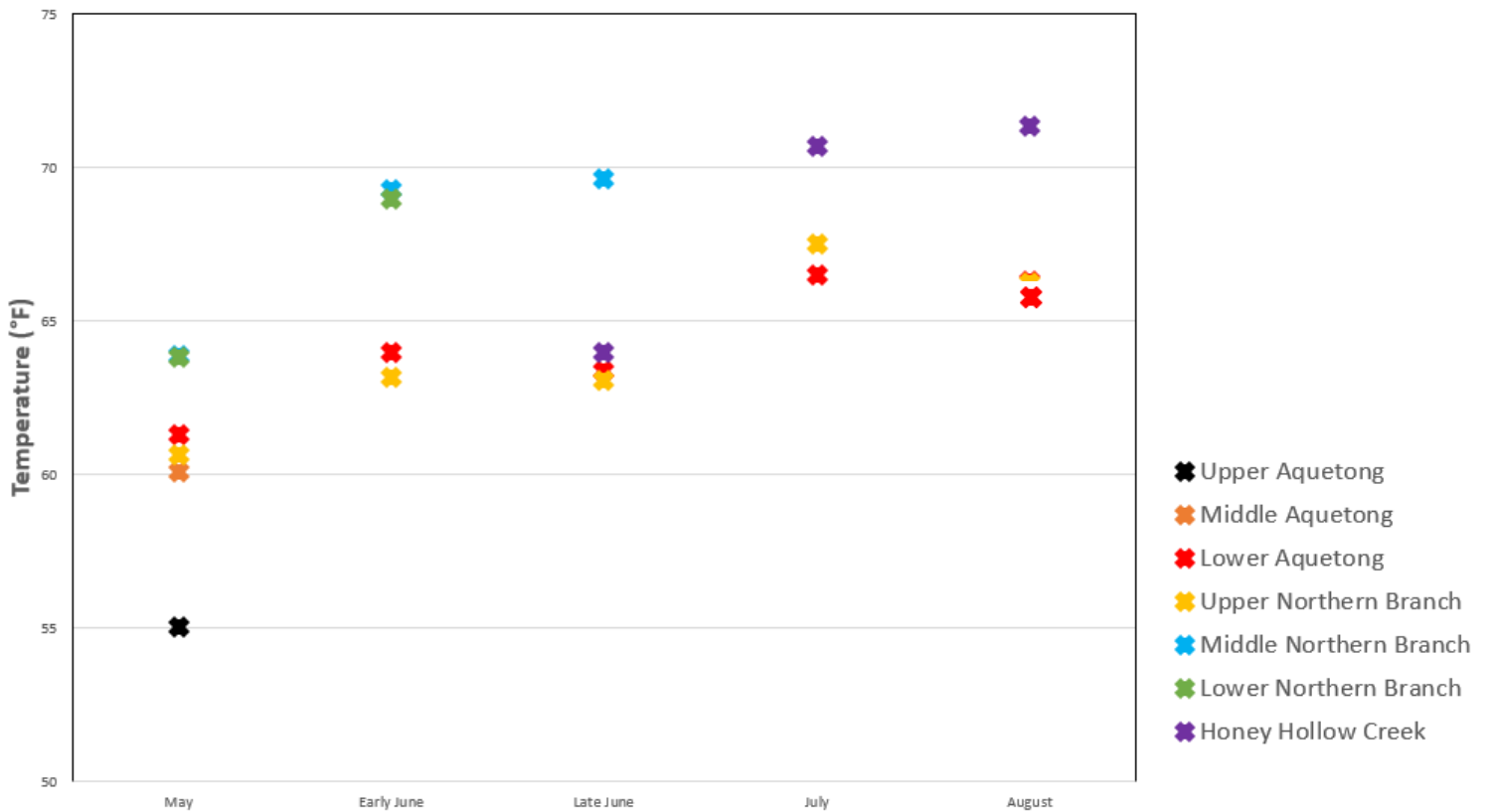


Table 3: Longitudinal results from in-stream data loggers (including data collected during LDWS grant period (2021-2022))

Year	Season	Location	Mean Temp (C/F)	pH	DO (mg/L)	Conductivity (µ Siemens)
2010	Summer	Upper Aquetong	18.6 / 65.4	8.4	8.7	399
2011	Fall	Upper Aquetong	21.8 / 71.2	8.22	8.6	320
2012	Summer	Upper Aquetong	21.3 / 70.3	8.4	8.2	
2013						
2014						
2015	Spring	Upper Aquetong	14.4 / 57.9	8.6	10.7	396
2016	Spring	Upper Aquetong	11.5 / 52.7	8.4	11.23	319
2017	Spring	Upper Aquetong	12.1 / 53.7	8.3		442
2018	Summer	Upper Aquetong	13.4 / 56.1	8.4	10.3	454
2019	Fall	Upper Aquetong	12.0 / 53.6	8.2		221
2020						
2021 (LDWS Grant Period)	Summer	Upper Aquetong	13.1 / 55.6	7.9	10.6	344
		Middle Aquetong	17.3 / 63.1	7.9	9.2	276
	Fall	Upper Aquetong	12.1 / 53.8	7.9	10.9	338
		Middle Aquetong	15.0 / 59.1	8	9.2	
2022 (LDWS Grant Period)	Spring	Upper Aquetong	12.7 / 55.0	7.8	10.3	341
		Middle Aquetong	15.6 / 60.1	7.9	9.9	308
		Lower Aquetong	16.3 / 61.3		8.3	
		Honey Hollow				
		Upper Northern	15.9 / 60.6			
		Middle Northern	17.7 / 63.9			
		Lower Northern	17.7 / 63.8			
	Summer	Upper Aquetong				
		Middle Aquetong				
		Lower Aquetong	18.3 / 65.0			
		Honey Hollow	19.8 / 67.6			
		Upper Northern	18.3 / 65.0			
		Middle Northern	20.8 / 69.4			
Lower Northern		20.6 / 69.0				
Fall	Upper Aquetong		Anticipated			
	Middle Aquetong					
	Lower Aquetong					
	Honey Hollow					
	Upper Northern					
	Middle Northern					
	Lower Northern					

IV. Project Photos

Figure 6: The AWA Volunteer Water Monitoring Team



Figure 7: Blue Tooth enable temperature pendants (www.onsetcomp.com) purchased with mini-grant funding



Figure 8: Deployed temperature pendant



Figure 9: Deployed Data Loggers (DO, Conductivity, pH)



V. Future Work

To better understand and interpret these data, the AWA plans to conduct further analyses, included correlating with seasonal weather events. Areas in the watershed susceptible to thermal pollution during severe storm events may warrant mitigation efforts, especially as our environment continues to experience the impacts of global climate change. Mitigation efforts include partnering with municipal and regional stake holders to evaluate storm water management infrastructure and the need to restore watershed floodplains. The AWA will continue to annually monitor these seven study sites as well as consider seeking additional funding to further increase its capacity to assess the ecological health of its watershed.

VI. Acknowledgement

On behalf of the board and volunteers for the Aquetong Watershed Association we are grateful to be a recipient of the 2022 Wild and Scenic mini-grant award. This final report describes the work accomplished under this award during 2022. The generous funding from the LDWS has allowed the AWA to continue supporting its mission to conserve, preserve, and protect the natural resources of the Aquetong Watershed, part of the greater Lower Delaware River Valley and Watershed.

VII. Final Project Budget:

	Sub-Total	Wild & Scenic Funds Requested	*Other Sources of Funds or In-Kind Support
Contractor (AWA Volunteer) Services: <i>(Approx. 50 hours @ \$100 /hour including overhead expenses)</i> Hourly estimate for trained volunteer staff	\$5000.00		\$5000.00
Travel: <i>(Approx. _____miles @ \$0.575/mile)</i> Not applicable			
Project Expenses: <i>(including costs, quantities, and description of expense)</i> Biological Surveying Equipment - 2 Kick net Wildco Tapered Kick Net, 243µm, 13" x 20" frame and two-piece handle Part# 41104000	\$ 693.00	\$ 580.00	\$ 113.00
Other Expenses: HOBO® Pendant MX Water Temperature Part # MX2201 (\$59.00 each – Quantity = 5)	\$ 346.50	\$ 295.00	\$ 51.50
HOBO Dissolved Oxygen Data Logger Part # U26-001 (\$1250 each – Quantity = 1)	\$ 1485.00	\$ 1290.00	\$ 195.00
HOBO Pendant® Mounting Boot - Pack of 5 Part #BOOT-MX2201-2202	\$ 29.00	\$ 29.00	
Replacement DO Sensor Caps Part # U26-RDOB-1 (\$250 each – Quantity = 2)			\$ 500.00
Copper Anti-Fouling Guard for pH Logger Part # 2500-GUARD (\$22 each – Quantity = 2)			\$ 44.00
Anti-Fouling Guard for DO Logger Part # U26-GUARD-2 (\$105 each – Quantity = 1)			\$ 105.00
Misc Tax and Shipping Fees			\$ 285.52
TOTAL:	\$ 7,194	\$2,194.00	\$6294.02