Senior Environment Corps

1997-2017:
20 Years of Protecting Pennsylvania’s Natural Resources
The volunteers of the Pennsylvania Senior Environment Corps (SEC) have been protecting Pennsylvania’s natural resources since 1997. The SEC consists of volunteers, mainly 55 years of age and older, that come together for the betterment of their communities as well as the planet.

For the last twenty years, SEC volunteers have been engaged in a multitude of projects. Some volunteers monitor water quality and assess stream habitat while others mentor youth through intergenerational programming. Other SEC volunteers have monitored air quality, started a recycling program in their community, or identified abandoned gas and oil wells.

Trails and public lands have been restored trails thanks to the SEC volunteers and brought awareness of various environmental issues with their community leaders. Whatever activities the SEC volunteers are engaged in, they serve with passion for their community as well as a desire for future generations to have clean air and healthy water.

At the state level, the SEC program is operated by Nature Abounds, a national 501c3 environmental nonprofit, who also operates several other volunteer programs including Watch the Wild, Ice-Watch USA, Keepers of the Forest, and Knitters for Nature’s Critters as well as environmental education opportunities for volunteer Ambassadors on various topics such as watershed health, wildlife, and climate change. Nature Abounds also operates SEC programs in other states beyond Pennsylvania, including New Jersey, Maryland, Montana, and Alabama.

Nature Abounds relies on local “host” organizations to help coordinate volunteer efforts. For example, the SEC has a variety of community partners from conservation districts to senior groups to environmental education centers. We also work with water authorities, including the Philadelphia Water Authority and the Altoona Water Authority.

The Pennsylvania SEC program has also had some strong financial supporters. The program has received funds from the United States Environmental Protection Agency’s 319 Non-point Source Program, the Pennsylvania Department of Environmental Protection’s Growing Greener Program, and the Foundation for Pennsylvania Water Shed.

As of December 2017, the SEC program has volunteers engaged across twenty-six Pennsylvania counties, and we have stream data on over two-thirds of Pennsylvania waterways. To date, these trained volunteers have dedicated over 2,000,000 hours to protecting and restoring the Commonwealth’s environment. The estimated value of the Pennsylvania SEC program is estimated at $3,051,428.57 per year.

Among accolades, the Pennsylvania SEC program was recognized by the United Nations Environment Programme on its Global 500 Honour Roll for the program’s contribution to protecting the environment, joining the work of individuals like Jacques Cousteau and Jane Goodall. The PaSEC also received awards from the President's
The Water Quality Monitoring program is the most known aspect of the Pennsylvania SEC. Volunteers monitor pH, temperature (air and water), conductivity, sulfates, nitrates, phosphates, alkalinity, and dissolved oxygen, in addition to stream measurements monthly to obtain baseline data. Some groups also monitor other parameters like manganese, iron, chlorine, bacteria, e-coli, and turbidity. One group is looking to do lead sampling and two others participate in a Marcellus Shale sampling project, while three groups are involved in an AMD pilot project. Macroinvertebrate identification and stream assessments are done in the fall and the spring. SEC volunteers may also aid with assessments of EPA 319 sites, CREPS sites, and Riparian Buffers.

Since the inception of the SEC Water Quality Monitoring program in 1997, SEC volunteers have monitored water quality at over 750 sites. The map below shows the counties where those sites are located. More specifics can be found at www.secofusa.org.
Why Monitor Water Quality?

Citizens, including the SEC volunteers, monitor water for a variety of reasons:

1. Perhaps they live near a waterway and are personally impacted by its quality.
2. Monitoring may be part of an educational experience.
3. Some communities use water monitoring to raise public awareness about personal and organizational actions that impact water quality.
4. Businesses and communities may monitor to be sure that their actions do not have a negative impact on water quality.

The SEC water quality monitoring effort is undertaken for all of these reasons. But there are additional important, underlying motivations for this statewide effort.

Pennsylvania’s citizens have monitored water quality in the state for decades, often calling attention to needed changes in water management programs. Recognizing the value of these long-term efforts, government agencies like the Pennsylvania Department of Environmental Protection, support the monitoring effort. Ultimately, the goal is to offer standardized protocols at various levels. Past individual monitoring efforts have collected significant data but that data is not necessarily consistent with data collected elsewhere in the watershed. Through the SEC program, consistent, high quality data provides a statewide picture about the condition of Pennsylvania’s watersheds.

This program collects water quality monitoring data about a waterway’s specific characteristics, as determined by the state, allowing data to be compared stream-to-stream, throughout a watershed. Because the program collects high quality data, the program documents two very important concepts:

1. Seniors, and all citizen volunteer water quality monitors, do indeed produce monitoring results that are credible and useful to water quality agencies. In this era of limited governmental financial resources, this concept is particularly important for environmental protection efforts.
Parameters Monitored

As mentioned earlier, the SEC program monitors specific parameters for specific reasons. The following is a brief run-down:

**Temperature**
The four main influences on temperature are sun, air, land and water. Each of these contributes to the temperature of an environment. Aquatic plants and organisms require a certain water temperature in order to survive. The temperature of the water affects their ability to carry out their life functions in several ways:
1) The rate of photosynthesis by algae and other aquatic plants increases in warm waters and decreases in cooler waters.
2) Aquatic life requires a specific level of dissolved oxygen in order to survive. Temperature has a direct effect on the level of dissolved oxygen in the water. The colder the water, the higher the dissolved oxygen level will be; the warmer the water, the lower the dissolved oxygen level.

**pH**
The strength of acids and bases is measured on the “pH scale.” The scale runs from 0-14. A solution rated below 7 is an acid, and a solution above 7 is a base. Seven (7) is the neutral point and is neither an acid or a base. Movement away from the neutral point shows an increase in the strength of an acid or a base. Some examples of acids are oranges, lemons, and vinegar. Acids are materials that can sting or burn the skin. Some examples of bases are baking soda, soap, ammonia and milk. Bases are often materials that have a slippery feel.

*Where does pH come from?* There are many factors that affect the pH of water. In an aquatic system, the pH value is affected by the plants, soils and organisms found there. This pH value can also be affected by human actions.

*Why do we study pH?* Aquatic organisms require a specific pH in order to survive. When pH becomes too high or low, it can stress the aquatic animals and cause them to become sick or to die. Very high and low levels of pH can be a sign of severe pollution. Most aquatic organisms have adapted to survive in water that has a pH range between 6 and 9.

**Dissolved Oxygen (DO)**
Oxygen is a gas that almost all organisms need to survive. Oxygen that is mixed into water is called dissolved oxygen.

*Where does dissolved oxygen come from?* Dissolved oxygen comes from two places:
1) The Air: Both wind and wave action take oxygen from the air and mix it into the water.
2) Algae and Aquatic Plants: During the process of photosynthesis, oxygen is given off by algae and other aquatic plants.

*Why do we study dissolved oxygen?* All aquatic organisms need dissolved oxygen to survive.

Many types of water pollution affect the amount of dissolved oxygen in the water. If the level falls too low, aquatic life cannot exist. Aquatic organisms need different levels of dissolved oxygen to survive. Dissolved oxygen is measured in parts per million (ppm*). Most organisms need at least 5 ppm of dissolved oxygen to survive.

**Conductivity (Specific Conductance)**
Conductivity is a measure of the ability of water to pass an electrical current.

*Where does conductivity come from?*
Conductivity in rivers is affected primarily by the geology of the area through which the water flows. Granite bedrock tends to lower the conductivity of rivers, because granite is composed of more inert materials that do not ionize (dissolved into ionic components) when washed into the river. Clay soils tend to have higher conductivity because of the presence of materials that ionize when washed into the water. Think about salt as an example of ionization. When salt is dissolved in water, it ionizes into Sodium (Na+) ions and Chloride (Cl-) ions. Salt water would be a conductor of electricity, and would have a high conductivity reading.

*Why do we study conductivity?*
- Discharges into rivers can change the conductivity depending on their make-up.
- A failing sewage system would raise the conductivity due to the presence of chloride, phosphate and nitrate.
Salts spread on the road after a snowstorm would raise the conductivity due to the presence of ionized materials washing into the nearest waterway.

An oil spill would not increase the conductivity, because oil is an organic compound that does not ionize.

**Phosphates**

Phosphorus is an essential element, usually present in aquatic ecosystems as phosphate. All aquatic organisms need phosphorus to grow.

**Where do phosphates come from?**

1) Rocks: Rain and wave action break down and dissolve phosphate rich rocks, releasing the phosphates into the soil and water.

2) Human and animal waste: The human body and animals release phosphates through their waste, and it enters the soil and water.

3) Decaying plants and animals: Phosphates are released into the soil by fungi and bacteria as they decompose dead plant and animal matter.

**Why do we study phosphates?**

Phosphates stimulate the growth of plankton and aquatic plants. Too much can “choke” the waterway and when the plants die, their decomposition uses up much of the oxygen. Many fish and organisms then die. This process of excessive plant growth is called eutrophication, and can be greatly sped up by human actions. All aquatic organisms need phosphate to grow. Phosphate is measured in parts per Million (ppm). Most unpolluted streams have levels below 0.03 ppm. Total phosphate levels should be 0.1 ppm or lower.
Nitrates
Nitrates are compounds containing the element nitrogen. Nitrogen is an essential protein component required by both plants and animals.

Why do we study nitrates? High levels of nitrates in water can cause excessive algae and aquatic plant growth. As the algae and aquatic plants die, their decomposition by oxygen-using bacteria uses up oxygen faster than oxygen can be put into water, so fish and other organisms die. This natural process of excessive plant growth is called eutrophication, and high levels of nitrates added to the water by human activity greatly speeds up this process. All aquatic organisms need nitrate to form required proteins to live. Nitrate is measured in parts per million (ppm). Unpolluted waters have nitrate levels below 4.4 ppm.

Total Alkalinity
Alkalinity is a measure of the capacity of water to neutralize acids. It is the buffering capacity, or the water’s ability to resist changes in pH.

Where does alkalinity come from?
Alkalinity in streams is influenced by rocks and soils, salts, and certain plant activities that bring alkaline compounds into the stream such as bicarbonates, carbonates and hydroxides. These compounds remove H\(^+\) ions and decrease the acidity of the water. For example, limestone (calcium carbonate, or CaCO\(_3\)) is a very water-soluble material. A stream in a geographic area containing limestone will have a high alkalinity and a good buffering capacity. Pollutants such as acid rainfall, which would tend to decrease the pH of the water, would be buffered by the presence of the limestone preventing the pH from becoming too acidic.

Why do we study alkalinity?
Measuring alkalinity is important in determining a stream’s ability to neutralize (buffer) acidic pollution from rainfall, wastewater or other industrial effluents. Without a high buffering capacity, the water’s pH could be affected by acidic effluents that could kill the organisms within the stream.

Sulfates
Sulfates are the second most common anions (compounds with a negative charge) in natural waters, derived largely from sedimentary rocks. Sulfates are the most common form of sulfur that is taken up by plants.

Where do sulfates come from?
Sulfates enter the water in three ways:
1. Breakdown of detritus (debris) - When detritus breaks down, hydrogen sulfide is released by the oxygen lacking sediments, which is the common rotten egg smell of decaying vegetation.
2. Acid Rain—When sulfur dioxide emissions are released from automobiles and factories, they are converted to sulfuric acid in the atmosphere. These acids combine with moisture in the air, and then fall to the earth as rain or snow.
3. Acid Mine Drainage—This is very common in the coal regions of Pennsylvania. Coal contains naturally occurring amounts of iron sulfide, called pyrite. When pyrite reacts with oxygen in the water it forms sulfuric acid, which is extremely acidic.

Why do we study sulfates?
As sulfates in the form of sulfuric acid enter streams and rivers they can decrease the pH of the body of water making it intolerable for certain species of aquatic life. Acid mine drainage alone can potentially cause the pH of the water to fall into a range of 1 to 5, which is very acidic.
How Is SEC Data Used

The consistency of how the data is collected across Pennsylvania and the quality control procedures in place make the data collected by the SEC volunteers credible and valuable. The SEC Quality Assurance Protection Plan (QAPP) which spells out the SEC protocols and procedures, everything from equipment to the way the volunteers are trained, is reviewed every two years by the Pennsylvania Department of Environmental Protection and approved by the United States Environmental Protection Agency. The SEC data is used in a variety of ways and has been used by a variety of groups, such as government agencies, educational institutions, and watershed groups as well as recreational groups like anglers.

The main reason for the SEC’s Water Quality Monitoring program is to gather “baseline data”, or a history of the site. With baseline data collected, it’s easier to tell when a stream has a problem or if the stream quality is improving. Below are a few examples of how the SEC “baseline data” has been utilized.

Adams County

SEC data collected over ten years show a relatively consistent reduction in nitrates on both Marsh and Rock Creeks as seen in the charts below. While a reason for the differences cannot be narrowed down to one change, there probably are a few contributing factors. First, a sewer plant replaced on lot systems, and a sewer plant was upgraded. Likewise, many more farmers are doing no-till planting and have implemented other Agriculture Best Management Practices (BMPs). Likewise, land has been preserved.

![Marsh Creek Nutrients Chart](chart1.png)

![Rock Creek Nutrients Chart](chart2.png)
**Philadelphia**

When SEC volunteers monitor water quality, sometimes they discover an issue. This is the case of the volunteers of the Center of the Park SEC. In 2004, the group raised awareness after noticing a significant number of dead animals and struggling plant life. The cause ended up being untreated sewage in the Monoshone Creek, a watershed that runs into the Wissahickon Creek.

The discovery led the Philadelphia Water Authority to undertake emergency repair, costing over $1 million, to reline the sewer to prevent possible contamination of the city’s water supply. The SEC still monitors this site, and their overall monitoring efforts have been documented in the Emmy-nominated documentary *Knee Deep*.

**Clearfield County**

The volunteers of the Clearfield County SEC have been monitoring streams in around Clearfield County since 2001, including in the Moshannon State Forest, an area historically known for woodlands full of wildlife, including high grade fishing streams, as well as the occasional cabin. About 2008 the natural gas boom brought in gas industry trucks, rigs, and equipment to the forest.

In 2009, a visitor to the forest noticed the water tasted funny and called one of the SEC members who he knew had been monitoring in the area. A nearby camper also noticed something off with the water, noticing an oily substance while washing dishes. Luckily, the SEC had baseline data for this area, so it was obvious something was amiss. The conductivity reading for the area streams was usually between 30-50 and this time, it was off the charts.

Eventually, the problems were connected to several gas industry accidental discharges from fracking nearby by EOG. The accidental discharges included leakage from a pit over a two-month period and a small hole in a drilling wastewater hose that allowed gas and flowback water to leak and percolate onto the ground.

Not long after these incidents, EOG reported another accident in October 2009, when almost 8,000 gallons of water and fracking fluids leaked from a tank and into the Alex Branch and Trout Run. Likewise, in the same area, the company had a well “blowout” in June 2010, spewing 35,000 gallons of chemical-laden "fracking fluid" into the atmosphere for 16 hours.

The SEC continues to monitor this area. The group is also working with Lock Haven University, as is the Centre County SEC, on a water quality monitoring project with a focus on the Marcellus Shale area.
For information about SEC water quality monitoring data collected in your area, or if you are interested in hosting or donating to the program, please contact the Senior Environment Corps at either 814-765-1453 or at sec@natureabounds.org.

**Current SEC Host Organizations:**

- Adams County—Adams County Office for Aging
- Allegheny County—Allegheny County Conservation District & Allegheny County Watershed Alliance
- Beaver County (part of Butler County)—Beaver County Conservation District
- Blair County—Blair County Conservation District
- Cambria County—Cambria County Conservation District
- Centre County—Centre County RSVP Program & Clearwater Conservancy
- Clearfield County—Clearfield County Conservation District
- Crawford County—Crawford County Conservation District
- Delaware River (Bucks County/Trenton) - S.P.L.A.S.H. Boat
- DuBois-Jefferson County—Nature Abounds
- Harrisburg Area (Capital Region SEC) - Capital Region RSVP
- Indiana County—Indiana County Area Agency on Aging
- Lancaster County—Lancaster County Conservation District
- McKean County—McKean County Conservation District
- Philadelphia—Center in the Park Senior Center - Schuylkill Center for Educational Programs
- Schuylkill County—Schuylkill County RSVP
- Somerset—The League of Human Decency, Environmental Committee
- Venango County (operates independently) — Venango County Conservation District
- York County—York County Audubon Society

www.secofusa.org