Field Crew Supervisor's Report 2020

Prepared for the Wheatley River Improvement Group

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Table of Contents

Table of Figures

Table of Tables

1 Introduction

The Wheatley River Improvement Group (WRIG) is a non-profit watershed group based in Cymbria, Prince Edward Island, responsible for six local catchments totalling 8991.1 hectares. This includes the Wheatley River, Horne's Creek, Chapel Creek, Cymbria, Luke's Creek, and Oyster Bed Bridge Watersheds, listed by decreasing area Figure 1). The following statement, from the 2007 Watershed Stewardship Plan, outlines the purpose and vision of the improvement group.

"The primary purpose of the group is to restore and protect the environmental quality of the Wheatley River and its tributaries. Its vision is one of a healthy watershed with a rich diversity of aquatic and terrestrial plant and animal life. Since the early years, the group has recognized the need to engage other community members, to encourage their sense of being connected and their shared responsibility for maintaining and enhancing the health of the watershed."[1]

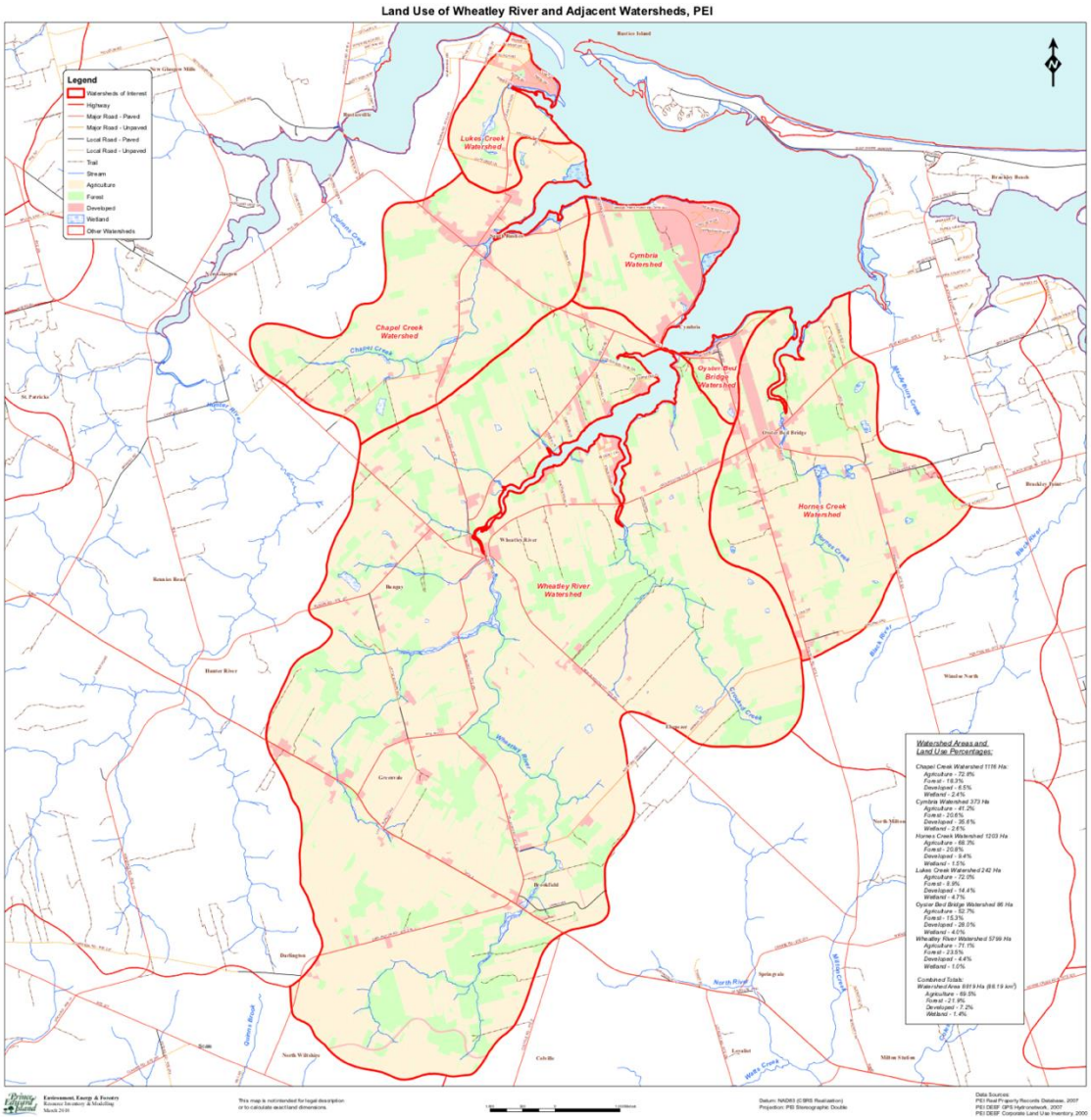

Figure 1. Areas and land use percentages of watersheds managed by the Wheatley River Improvement Group.

The 2020 field season began on June 15th with the arrival of myself, Tessa Craig, and Isabelle Fitzpatrick (Izzy). I am a recent First-Class Biology Honours graduate from Mount Allison University and joined WRIG as the Field Crew Supervisor. Izzy is a communications student at the University of Prince Edward Island and was this summer's Riparian Health Technician. We were welcomed by Maggie McConnell, who is in her second year as watershed manager. On July 6th, we were joined by the final two members of our team: high school students Sam Pastoor and Kale Parnham. They were our 2020 Field Crew Technicians and entered grade 11 in the fall (Figure 2).

Figure 2. The 2020 WRIG crew. From left to right: Maggie McConnell, watershed manager; Kale Parnham, field crew technician; Izzy Fitzpatrick, riparian health technician; Tessa Craig, field crew supervisor; and Sam Pastoor, field crew technician.

The 2020 WRIG team had a very successful summer season, accomplishing native tree and shrub plantings, major stream restoration, water quality, depth, and anoxia monitoring throughout the watershed areas, as well as the enhancement of Rackham's Pond.

2 The Acadian Forest

Canada is home to eight major forest regions characterized by the composition of dominant tree species. Prince Edward Island (PEI) belongs to the Acadian Forest Region, which ranges from the maritime provinces and southern Quebec to the northern New England states[2]. Being an incredibly diverse forest, it has many dominant conifers and deciduous trees. Key species of old growth Acadian Forests include sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), eastern hemlock (*Tsuga canadensis*), red spruce (*Picea*

rubens), eastern white pine (*Pinus strobus*), yellow birch (*Betula alleghaniensis*), and white ash (*Fraxinus americana*)[2,3]. Planting tree and shrub species that evolved to succeed in this area helps restore native ecosystems and improve ecological stability. WRIG aims to re-establish Acadian Forest species within our area, with help from the MacPhail Woods Ecological Forestry Project, the PEI J. Frank Gaudet Nursery, and the PEI Watershed Alliance (PEIWA).

WRIG's motto this summer was "plant less, plant better". In early July, we took part in Woodland Ecology Training at the Devil's Punchbowl with Gary Schneider of MacPhail Woods. WRIG joined a few other local watershed groups in learning about native plant identification, planting techniques, and the importance of pruning and staking correctly. The team was especially struck by the hands-on pruning lesson and implemented the techniques in our work: we assessed each sapling we planted and established one main vertical stem, or leader. Maggie and I also referenced MacPhail Woods planting guides to determine the appropriate species for each parcel[4].

Native tree and shrub species were planted on private properties (see section 2.1) and around Rackham's Pond (see section 3.3 Riparian Zone Enhancement). We regularly returned to each planting site to water and weed as needed. In total, the team devoted around one month planting and caring for the 718 trees and shrubs purchased from the PEI J. Frank Gaudet Nursery.

2.1 Private Property Plantings

Collaborating with local landowners helps WRIG monitor and manage a higher proportion of the watersheds' areas. As an Island watershed group, we have access to information, resources, and programs that can help reduce barriers the public faces when planting trees and shrubs. WRIG assists local land stewards with assessing their property, creating remedial action plans, and providing the tools and labour to help actualize said improvements[5].

This summer, eight private properties were involved with WRIG's tree planting program (Figure 3). Twenty different native species were planted, for a total of 587 trees and shrubs (Table 1). The landowners approached WRIG with specific objectives, such as the naturalisation of former farmland, shoreline stabilization, creation of privacy and windbreak hedgerows, and attracting wildlife. Additional benefits include beautification, supporting wildlife, increasing biodiversity, and improved air, water, and soil quality[2]. Hedgerows for privacy or wind protection also act as conservation corridors, providing food, habitat, and cover for wildlife[6].

Table 1. Total of each native tree and shrub species involved in 2020 private property plantings.

Species	Total
Shrubs	
Aronia prunifolia	18
Bayberry	30
Dogwood, Red Osier	39
Mountain holly	12
Rose, Wild	27
Sumac	6
Willow, Native	42
Coniferous Trees	
Cedar	3
Fir, Balsam	36
Larch, Eastern	49
Pine, White	36
Spruce, Black	12
Spruce, Red	18
Spruce, White	72
Deciduous Trees	
Ash, White	61
Birch, White	36
Maple, Red	12
Maple, Sugar	30
Mountain Ash	18
Serviceberry	30

Figure 3. The eight private properties involved in the 2020 tree planting program. Created using Google Earth.

2.1.1 *Parcel: 1049170*

Our first planting site was along the bottom of a sloped pasture bordering Ross Creek, just off the Church road. As a dry area receiving full sun, the four native tree species we chose were white ash, white spruce, white birch, and balsam fir. Thirty-six of each species were planted, for a total of 144 trees. Izzy and I created a three-row hedgerow with a random species distribution, as requested by the property owners and recommended by MacPhail Woods[6]. Thank you to these landowners for mowing the tall grass before we planted, assembling hundreds of meters of hose and a trough to facilitate watering the trees, and providing mulch for around the trees. On this property, we also installed a project sign at Jack's Bridge, a Ross Creek crossing built by WRIG in 2018.

2.1.2 *Parcel: 527986*

This landowner contacted WRIG with concerns regarding shoreline erosion and water runoff along a coastal property in the Chapel Creek estuary. Red-osier dogwood (39), willow (36), bayberry (18), and wild rose (9) were planted along the top of the bank to help stabilize the cliffs[7]. Eastern larch (12) and black spruce (12) were planted in a boggy area to enhance the natural drainage basin[7]. This was our first planting site as a team of four. We whipper snipped a circle at each planting site to help prevent the tall grass choking out the new trees and shrubs. A total of 126 trees and shrubs, comprised of six native species, were planted on the property. Thank you to the property owner for his involvement and dedication to watering the trees and shrubs.

2.1.3 *Parcel: 940916*

At this property we created a northern windbreak and filled gaps in an existing hedgerow with red spruce (18). Sugar maples (30) were planted in between a double hedgerow along the north-western side of the property. Thickening the hedgerows provides more wind protection for the property and cover for wildlife[6]. Wild rose (18) were planted in two staggered rows to help provide wind protection for a garden. *Aronia prunifolia* (18), bayberry (12), and serviceberry (12) were planted along a pathway for beautification and biodiversification. Reintroducing a variety of Acadian Forest species will help this former farmland re-establish more diversely.

2.1.4 *Parcel: 237966*

We returned to this site to restore a 2018 planting that had a low success rate. As a coastal property, it is subject to strong, salt-laden winds that are hard on young trees and shrubs. Unfortunately, the majority of the native shrubs planted did not survive. This summer, we filled gaps in the windbreak and privacy hedgerows with

eastern larch (10), white spruce (6), and white pine (6)[6]. These species had the highest success from the previous planting, due to their wind and salt tolerance. If the windbreak is successful, it will help protect the property from salt spray and support the natural regeneration of woody vegetation. It was a pleasure working on this property, as the natural lawn was a haven for wildflowers, pollinators, insects, and birds.

2.1.5 *Parcel: 1013101*

This property owner requested a coniferous hedgerow for privacy, so we planted white spruce (30), larch (9), and white pine (10) in two staggered rows. As the trees grow, they will also provide excellent cover for wildlife. We also helped the landowner prune birch trees and remove white spruce that were naturally regenerating in the ditch. The conifers (4) were transplanted into the hedgerow, making a total of 34 white spruce. Thank you to this property owner for her commitment to watering the trees and generously giving the crew ice cream sandwiches!

2.1.6 *Parcel: 587550*

This former farmland is regenerating into a gorgeous Acadian Forest stand. It was wonderful to see a diverse number of native species already established, such as black ash, beaked hazelnut, and jack pine. The goal of this planting was to further diversify the property and make it more attractive to wildlife[8]. White pine (6), white ash (9), red maple (6), mountain ash (9), serviceberry (9), staghorn sumac (3), and mountain holly (6) were planted in various areas within the field according to their light and water requirements. Thank you to these property owners for their hard work over the past few years planting native species on their property and their dedication to watering the trees and shrubs we planted this summer.

2.1.7 *Parcel: 993394*

These landowners also wanted to diversify the vegetation on their property and improve its ecological stability. The pond central to the property is filling in with sediment, a natural process accelerated by high rates of soil erosion[9]. Willow (6), mountain holly (6), larch (18), red maple (6), and white ash (12) were planted within a drainage depression and alongside the pond to reduce runoff[7]. Mountain ash (9) and serviceberry (9) were planted in the upland region to increase woody vegetation. Gaps in an existing hedgerow were filled with white pine (10)[6]. Thank you to these landowners for their commitment to making their property a refuge for wildlife.

2.1.8 *Parcel: 1025139*

This property owner wanted to increase native woody vegetation in her open lawn and add to previous years' plantings along the roadside buffer so Eastern white cedar (3) and white ash (3) were planted in these areas.

3 Stream Restoration

Natural streams typically have a meandering path and alternating riffle-pool pattern[9]. Human activity can disrupt this configuration, thereby weakening the ecosystem and impeding local wildlife populations. Severely degraded streams may require intervention to help restore a natural stream pattern. This summer, stream restoration techniques employed were flow deflector construction, brush matting, planting native trees and shrubs in the riparian zone, and invasive species removal.

3.1 Flow Deflectors

Flow deflectors are in-stream structures that concentrate low water flow in the channel center to create pools and sinuosities[9]. During the 2017 field season, three of deflectors were built upstream from Rackham's Pond (Figure 4). Three years post-installation, the structures have had limited impact on the stream pattern. This summer, with the help of the Bedeque Bay and Hunter Clyde watershed groups, WRIG returned to the deflector project in hopes of improving results. In July, Maggie and I consulted with Mary Finch (PEIWA) and Rosie MacFarlane (Fish and Wildlife PEI) to discuss the deflector build project. Per their recommendations, one new log crib deflector was built, and adjustments were made to the 2017 structures. Over the fall and winter, a detailed Deflector Report will be created.

Figure 4. Stream restoration near Rackham's Pond including pinch flow deflectors (blue), brushmats (purple), and native species plantings (red).

3.1.1 *Deflector Construction*

The new structure mirrors the downstream log crib wing deflector, “pinching” the stream (Figure 5). Narrowing the channel increases flow rate, which helps excavate sediment to create a scour pool for fish refuge. The walls of the structures are built from 6”x 6” juniper beams sourced from Betts Mills in O’Leary. Juniper, also known as larch or tamarack, is durable and naturally rot resistant: an important factor for a submerged structure[10]. The cribwork is attached with galvanized steel spikes (12”), keyed into the bank (3-4’), and anchored to the stream bottom with steel rebar. Five cubic yards of granite rock were used to back-fill the new deflector and armour the base.

Figure 5. The downstream 2017 (near) and 2020 (far) log crib deflectors.

3.1.2 *Deflector Enhancement*

Undermining of the deflector point is a common long-term issue. Sediment had washed out from under the 2017 downstream log crib deflector and the rock fill hadn’t fallen to the substrate, resulting in a small cavity. This bypass reduces the deflector’s effectiveness, so we filled the cavity with extra rock and armoured the upstream base (Figure 5). The upstream log crib deflector was expanded two beam widths (i.e. one foot) on the upstream side. On the opposite bank, one cubic yard of granite rock was used to reinforce the log wing deflector, as there was little rock still in place from 2017 (Figure 6).

Figure 6. The upstream log wing (near) and log crib (far) deflectors built in 2017, pictured after the 2020 enhancements.

3.1.3 *Acknowledgements*

An enormous thank you to the Bedeque Bay Environmental Management Association (BBEMA) and the Hunter-Clyde Watershed Group (HCWG) for their expertise and hard work (Figure 7). We couldn't have done it without their knowledge and muscle power! Thank you to Mary Finch and Rosie MacFarlane for their guidance in assessing and designing the 2020 deflector project. We are also very grateful to Charles & Laura of the Island Honey Wine company for permission to access the worksite through their land – it made transporting our materials much easier and facilitated the construction process.

Figure 7. WRIG, HCWG, and BBEMA crews standing in front of the new log crib deflector. The deflector was filled with the granite rock shown in the foreground the following day.

3.2 Brush matting

Sediment influx is one of the primary concerns for most PEI watersheds[9]. Soil erosion leads to sediment deposition in waterways, which in excess, can overwhelm stream reaches, by filling in pools, aggrading streams, and degrading fish and invertebrate habitat [9]. When soil erosion prevention and uncontained sediment interception have failed, habitat remediation is necessary[9]. Brush mats capture in-stream sediment and accelerate its deposition on the inside of stream bends. They can also narrow streams, encourage sinuosities, and provide fish and invertebrate habitat[9]. Over time, successful brush mats are naturalized by bank encroachment.

During the 2020 summer season, WRIG installed two brush mats on point bars upstream of Rackham's Pond. The first brush mat was constructed where the removal of bittersweet nightshade, an invasive species, had left exposed sediment (Figure 8). Red-osier dogwood was planted along the edge of the bank to provide vegetative cover and accelerate the encroachment process. The second site was recommended by Mary Finch and Rosie MacFarlane during the deflector consultation.

Figure 8. A cluster of bittersweet nightshade, an invasive species (top). Exposed sediment after the nightshade was removed (middle). The finished brush mat with dogwood plantings (bottom).

To improve the environmental footprint of the brush mats, we made stakes out of branches pruned from trees at Rackham's and other planting sites. The second, larger brush mat was constructed with conifer boughs donated by the Asplundh Tree Expert Company (Figure 9). Asplundh was contracted to prune trees along ditches on the Stead and Bungay Roads for utilities/government agencies. We were pleased to recycle the boughs, as it prevented the trimming of conifers near the stream. It was decided to use jute to secure the boughs to prevent plastic twine from becoming part of the bank. The brush mats are in a highly trafficked area so will be monitored regularly, with repairs being made as needed (Figure 4).

Figure 9. The second brush mat constructed during the 2020 field season.

3.3 Riparian Zone Enhancement

Natural riparian zones are the most diverse part of any forest and are crucial to healthy wildlife communities [2]. Watershed groups Island-wide improve riparian zones through the strategic planting of native species. Apart from the private property plantings previously described in 2.1, WRIG planted 76 native trees and shrubs in the riparian zone along 200m of stream.

Our efforts were focused near Rackham's Pond, alongside the main branch of the Wheatley River (Figure 4). We planted black spruce (5) and larch (5) just upstream from the Wheatley River bridge, in an artificially narrowed riparian zone lacking woody vegetation. We also planted shrubs on the exposed banks downstream from the Rackham's Pond outlet. Without vegetation cover, rainfall washes the bare soil into the stream. The erosion is exacerbated by the steepness of the cliff. Red-osier dogwood (8), mountain holly (4), and willow (4) were planted to help stabilize the steep bank. We would like to return to these two cliff sites in the spring to plant dogwood and willow cuttings. We also planted red osier dogwood (19), mountain holly (5), eastern larch (8), black spruce (7), white ash (5), and mountain ash (6) further upstream. Some of the dogwood, mountain holly, and mountain ash were planted near the new wing deflector to provide vegetative cover and accelerate the revegetation of the soil disturbed during the deflector build (Figure 5 and Figure 6).

Table 2. Total of each native tree and shrub species involved in 2020 riparian zone plantings near Rackham's Pond.

Species	Total
Shrubs	
Dogwood, Red Osier	27
Mountain holly	9
Willow, Native	4
Coniferous Trees	
Larch, Eastern	13
Spruce, Black	12
Deciduous Trees	
Ash, White	5
Mountain Ash	6

3.4 Invasive Species Control

Any species that are not native to an area, tend to spread, and threaten the area's environmental, economic, or social health are considered invasive [11]. On PEI, the introduction of invasive terrestrial vegetation is closely related to the importation of exotic plants for ornamental gardening or agriculture[11]. Aquatic invasive species generally arrived via ballast water[11]. Key characteristics of invasive species that promote their success are listed below in Table 3.

Table 3. Common advantageous traits of invasive species [11].

Trait	Advantage
Habitat generalists	More likely to find suitable habitat
Opportunists	Establishment in disturbed environments
Early germination	Early use of limited resources
High seed production	Rapid population growth
Small seed mass	Facilitated seed dispersal
Seed adaptations	Enhanced dispersal ability
Vegetative reproduction	Rapid population growth
Vine-like growth	Out-compete other vegetation

In August, I had the opportunity to attend Invasive Species Training through the PEIWA. Julie-Lynn Zahavich, from PEI Fish and Wildlife and the PEI Invasive Species Council, taught a group of watershed staff about identifying, documenting, and managing invasive species. The monitoring and management of invasive species can help minimize their ecological impacts; however, they are inherently difficult to eradicate. Invasive species can outcompete native species, thereby reducing biodiversity, degrading wildlife habitat, and compromising ecosystem structure and function.

Within our watershed, the primary invasive species that we encounter is bittersweet nightshade, *Solanum ducamara*. This perennial climbing vine can invade stream margins, choking out native vegetation in the riparian zone. When bittersweet nightshade grows in streams, the roots form thick mats that impede water flow and increase sediment deposition, thereby degrading fish and invertebrate habitat (Figure 8)[12]. It propagates either by birds consuming the berries, or by stems, seeds, and roots spreading via wind and/or water.

Bittersweet nightshade removal is an intensive, long-term process. If done incorrectly, vegetative reproduction can amplify the problem[11]. Pulling, bagging, and packing out the thick clusters of woody vines and extensive root system is time-consuming and physically demanding. Wearing gloves to prevent skin irritation, the nightshade is pulled by hand and placed in industrial garbage bags. We try to

remove as much of the root system as possible, to prevent vegetative reproduction. The bags are labelled “invasive species” and taken to PEI Energy Systems for incineration. Thank you to the Trout River Environmental Committee (TREC) summer students for teaching Izzy and I how to identify bittersweet nightshade during our first week.

3.4.1 *Parcel: 993394*

While tree planting on this property (2.1.7), we noticed that the inflow and outflow of the pond were overrun by bittersweet nightshade. Ten industrial-sized garbage bags full of bittersweet nightshade were removed from this site in just a few hours. Due to the magnitude of the invasion, the complete removal of the nightshade by WRIG staff was not feasible this season. The property owners were informed of the situation and resources were provided for future management.

3.4.2 *Rackham’s Pond*

Since Rackham’s Pond is a natural space maintained for the community, it is our highest priority area for invasive species management. Many dense clusters of bittersweet nightshade were removed from the stream margins between the pond and the forks. At one site, a brush mat was also installed (see section 3.2). Once full, the bags were floated/canoed downstream and carried up to the parking area, where they were kept until a load could be taken to the incinerator.

3.5 Stream Clearing and Riparian Health Assessments

WRIG successfully completed the 2020 goals of clearing 3km of stream and assessing the health of the accompanying riparian zone. This summer, we focused on the main branch of the Wheatley River system, as this particular stretch had not been assessed since 2017. Beginning at the Wheatley River Bridge and walking upstream, we followed the main branch of the Wheatley River by continuing above Rackham’s Pond and going left at the forks (Figure 10).

Figure 10. Sections of the main branch of the Wheatley River where stream clearing and riparian health assessments occurred.

As a watershed group, one of our responsibilities is assessing the health of the riparian zone: the land region bordering the water[9]. We evaluate the vegetation cover, plant community composition, stream bank stability, and extent of human impact and use the information collected to guide the management of our watershed[13]. Riparian areas in need of improvement are analyzed and possible remediation techniques are identified. Thank you to TREC for providing Izzy and I the opportunity to shadow the crew during an assessment day. For a detailed review of the reaches assessed, please see the 2020 report prepared by the Riparian Health Technician, Izzy Fitzpatrick.

4 Community Involvement

4.1 Celebrate our River Event

The annual Celebrate Our River Event took place on August 15th at Rackham's Pond. This year, the event was slightly modified due to the outbreak of severe acute respiratory syndrome coronavirus 2, commonly referred to as the Corona Virus or COVID 19. To minimize risk, a maximum of 50 people could attend the event and shared foods (i.e. a barbecue lunch and ice cream) were unable to be served, following PEI Public Health guidelines.

Thank you to our food sponsors, Lucky Fox Snack Co., Sobeys, Superstore, ADL and Gallant's Clover Farm for providing single serving chip bags, granola bars, mini candy bars, chocolate milk, pop and ice. The first, second, and third place finishers received cash prizes, and went to ducks 101, 219, and 277, respectively (Figure 11). Duck race ticket sales and donations raised a net total of $983.42, setting a new WRIG fundraising record! For a detailed description of the event, including the preparation, expenses, and recommendations for future years, please see the report prepared by Watershed Manager Maggie McConnell. Red maples (24), eastern white cedar (2), and tree swallow nesting boxes (5) were given to attendees. A video of the event created by WRIG board member Micah Gallant can be viewed at https://youtu.be/yj1fcpc1l9E.

Figure 11. The top three finishers from WRIG's 2020 duck race.

4.2 North Rustico Information Booth

This summer, WRIG continued our partnership with HCWG to provide a weekly information booth to connect with community members and share information about watershed-related topics. Each watershed group took turns creating an interactive, informative table display alongside the North Rustico boardwalk. Due to COVID-related postponements and poor weather, WRIG was only able to host two information booths. Our topics, in chronological order, were the Acadian Forest and Water Quality Monitoring.

Our first, and most successful topic, was the Acadian Forest. We brought resources about native species[7], planting from container stock, and the spruce budworm tracker program (see section 5.6). Everyone had a blast trying to identify the five native tree species we brought with us (Figure 12)! Even individuals from outside the community got involved; we helped put people in contact with their local watershed groups to discuss native tree plantings. For our second topic, we explained how and why we monitor water quality throughout our watershed. We explained the different parameters that we monitor and compared healthy and unhealthy river measurements. Thank you to HCWG for lending us their YSI device as an interactive display.

Figure 12. Sam and me at the first North Rustico information booth, focused on the Acadian Forest.

4.3 Seine Netting

Twice this summer, WRIG had the opportunity to help a UPEI master's student with his research sampling the fish community in the Oyster Bed Bridge estuary. He taught us how to deploy and haul-in a seine net, collecting hundreds of small fish Figure 13). We also learned how to identify many different fish species such as Silversides, multiple stickleback species, and Mummichogs, which were the most plentiful. The most exciting thing we saw were pipefish, which belong to the same family as seahorses.

Figure 13. The WRIG field crew helping UPEI master's student Mark seine netting in the Rustico Bay.

4.4 Beach Cleanup

On Friday, July 31st, the WRIG and HCWG summer field crews joined forces for a beach cleanup in Oyster Bed Bridge. We removed many buoys, plastic mesh bags, rope segments, and rusted metal parts from the shoreline. Thank you to the local fisherman who kindly volunteered to dispose of the garbage bags and Maggie for organizing the barbecue lunch afterward.

4.5 Nesting Boxes

During the second week of August, the Hunter-Clyde Watershed Group came to Cymbria for a bird nesting box build day. The WRIG team built 13 tree swallow nesting boxes in just a few hours Figure 14). Thank you to Hunter-Clyde for letting us build one of their barn swallow nesting platforms and for joining us for the morning.

Later in the summer, a wood duck box constructed the year prior was installed near the pond on parcel 993394 and a tree swallow box was installed on parcel 1027598.

Figure 14. WRIG holding the tree swallow nesting boxes built during the nesting box build day with HCWG.

5 Rackham's Pond

5.1 Maintenance

Once a week during the summer, the WRIG crew cut the grass at Rackham's Pond. We emptied the garbage cans regularly, and also removed trash from the trail and stream. Tree swallow and eastern bluebird nesting boxes placed around the park were cleaned out and repaired. We also put our new pruning skills to use and pruned the trees around the pond.

5.2 The Stump

In the fall of 2019, Hurricane Dorian blew a large tree down in the Rackham's Pond park area. When the temperature warmed, community members kindly volunteered to limb the tree and block the trunk. When WRIG's summer staff began work, all that remained was the stump, some large sections of the trunk, and a trench filled with weeds. We decided to beautify the remnants of the fallen tree by turning it into a living playground and garden feature Figure 15). Once "The Stump"

area was weeded and filled with topsoil, we rearranged the logs and mulched the area. Chokeberry (*Aronia melanocarpa*) was planted around the back and sides of the stump as well as in two clusters, one between the Rackham's sign and the stump, and one between the stump and the pollinator garden. Clematis, a flowering vine, was planted in hopes of it climbing the stump.

Table 4. Species planted around the stump at Rackham's Pond.

Species	Total
Shrubs	
Aronia melanocarpa	12
Herbaceous Plants	
Clematis	45

Figure 15. The fallen tree post hurricane Dorian (top) and after WRIG's hard work (bottom).

5.3 Pollinator Garden

This summer, WRIG staff tended to the pollinator garden created at Rackham's Pond during the 2019 work season. In early June, fifteen swamp

milkweed plants were thoughtfully donated by Denise Motard of Stratford. This milkweed, along with twelve more purchased from the provincial nursery, were planted in the garden. Joe Pye Weed (12) purchased from the nursery and Tall Phlox (4) donated by my mom were also added (Table 1). Regular watering by the WRIG crew helped the new plants establish and the garden flourish despite the hot, dry summer. A number of plants with staggered bloom times meant the pollinator garden was always buzzing with activity Figure 16). This summer we also created a map of the pollinator garden to facilitate work by future staff (Figure 17).

Table 5. Species added to the pollinator garden at Rackham's Pond.

Species	Total
Shrubs	
Rose, Wild	3
Herbaceous Plants	
Milkweed	27
Joe Pye Weed	12
Tall Phlox	4

Figure 16. The pollinator garden at Rackham's Pond in full bloom on August 13th, 2020.

Figure 17. A map of the Rackham's Pond Educational Pollinator Garden

5.4 Depth Survey

Ponds naturally accumulate sediment as the reduction in flow facilitates the settling out of suspended particles[9]. 2020 marks the fourth year that WRIG has conducted a depth survey of Rackham's Pond to monitor changes in the pond bathymetry. By tracking the trends in depth over time, we can determine the rate at which the pond is filling in. To minimize the impact of seasonal variation in water level, the survey takes place at a similar time each year. On August 17th, WRIG conducted the annual depth survey of Rackham's Pond. The average difference in depth measurements between the 2017 and 2020 surveys was -0.088m, indicating that the pond has filled in close to 10cm over the past three years. Further analysis of this data over the fall and winter will guide the watershed management staff in planning restoration efforts, such as dredging, for future seasons.

5.5 Trail Improvement

In the summer, WRIG whipper snipped the trail at Rackham's Pond, and it was greatly appreciated by the community. Not only did it make for a more enjoyable walk, it also helped some community members feel safer from ticks. We continue trimming the trail as needed to make it a more accessible space. Thank you to the Pastoor family for letting us borrow their whipper snipper; it was a much faster job

with two trimmers on the go! Mid-August, we began mulching the trail with woodchips donated from Asplundh Tree Services. Due to time constraints, we were unable to mulch the entirety of the trail, but it was an improvement, nonetheless. Plans were also made to have the footbridge re-installed over the outlet of the pond. WRIG is going to explore the building a trail on the opposite bank to create a loop, per community interest.

5.6 Spruce Budworm Monitoring

The spruce budworm is a forest defoliating insect native to North America. The caterpillars primarily feed on white spruce and balsam fir needles; five consecutive years of intense feeding can cause the trees die off [14]. The spruce budworm has cleaned out entire swaths of forests in Quebec, Ontario, the Maritime provinces, and parts of the states. Between 1970 to 1990, the spruce budworm population surged and consumed over 50 million hectares (124 million acres) of forests, that's 100 times the surface area of Prince Edward Island [15]!

When an outbreak occurs and the spruce budworms hatch, the moths disperse into a wider area. Trapping the moths can provide insight into how and where they are spreading; even empty traps provide important data, because then we know where they are absent. This summer, WRIG took part in a community science program organized by the Healthy Forest Partnership[16]. We installed and monitored a spruce budworm trap with a synthetic mating pheromone lure. We checked the trap at least once a week and would collect, bag, and freeze any moths that had been caught. The date, number of moths, and other notes are recorded and submitted through an online portal. The frozen moths will be mailed to the program headquarters for identification sometime in the fall.

6 Water Quality Monitoring

For the 8th summer in a row, WRIG performed weekly water quality testing in the main tributaries of the Wheatley River watershed. A YSI, borrowed from the Watershed Alliance, was used to monitor temperature, dissolved oxygen, specific conductance, conductivity, total dissolved solids, salinity, pH, and nitrates at 20 different sites (Figure 18). By tracking short- and long-term changes in water quality parameters, WRIG is better equipped to make informed management decisions.

This season, some of the water quality monitoring sites were reassessed for pertinence. Two sites along Crooked Creek were removed from regular testing due to a consistent lack of water flow and an 11th testing site was added along the Wheatley River. Luke's Creek (1), Crooked Creek (2), Horne's Creek (2), and Chapel Creek (1) were also monitored. Low water levels were observed early in the work

season; the Crooked Creek headwaters had already shrunken to individual pools near the Parker Cross Road by our first week of work, June 15th to 19th.

2020 marks the 8th consecutive field season that WRIG has monitored water quality at the majority of these sites. A lot of data has been recorded over this time, yet long-term analyses have not occurred. This winter, WRIG aims to upload the data to a secure online platform (Atlantic Data Stream) that simplifies its analysis. This program will also facilitate the sharing of our data with other groups of interest.

Figure 18. A map of the 20 water quality monitoring sites tested weekly from June 15th to August 28th, 2020.

7 Estuary Anoxia Monitoring

Soil erosion and surface water runoff can lead to an influx of nitrogen in bodies of water[9]. In PEI waterways, the increased nitrogen levels let sea lettuce grow profusely. After a bloom, the dead algal material is broken down by bacterial decomposers that deplete dissolved oxygen. In extreme cases, this can create hypoxic or anoxic conditions that are often lethal for fish, shellfish, and invertebrates.

This summer, fifteen Island estuaries experienced anoxic events. The Wheatley River estuary turned anoxic in the beginning of July, earlier in the season than previous years[17]. WRIG staff conducted a monthly canoe survey of the Wheatley River estuary to monitor for signs of anoxia. Eight sites between Wheatley River and Oyster Bed Bridge were assessed using the qualitative survey from the citizen scientist anoxia tracker program (Figure 19). We recorded water clarity and colour, sea lettuce coverage and condition, and the strength of sulphuric odour. We also measured water temperature, dissolved oxygen, specific conductance, conductivity, total dissolved solids, salinity, and pH using a YSI borrowed from the PEI Watershed Alliance.

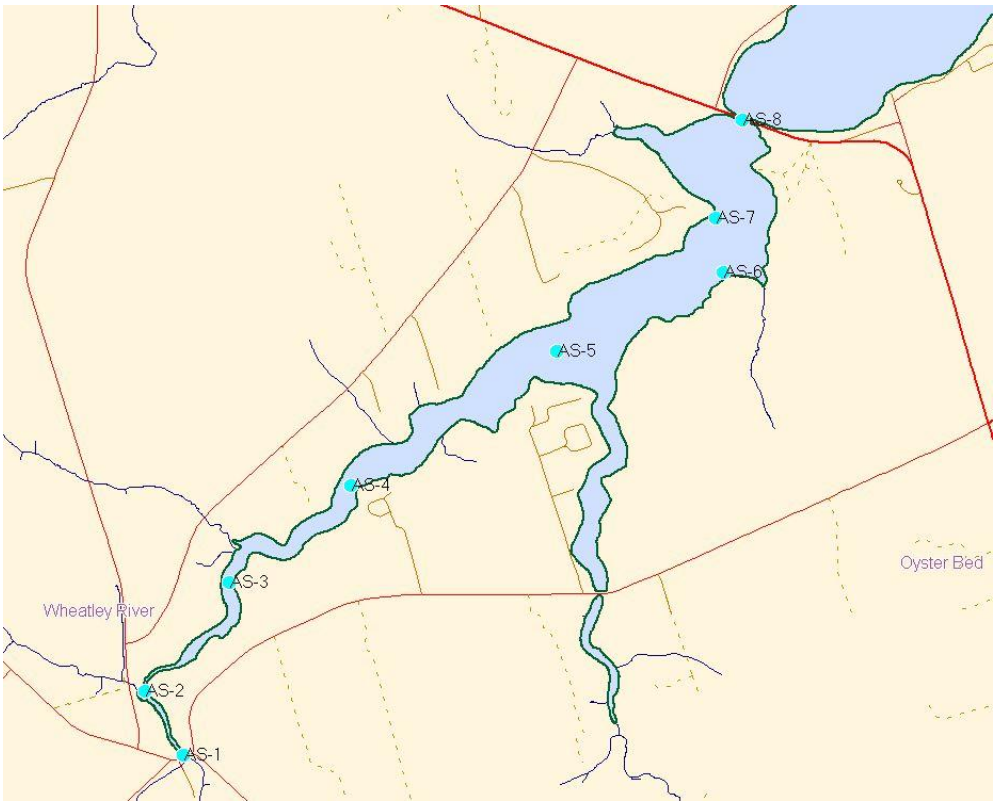

Figure 19. A map of the eight anoxia survey sites tested monthly from June to August, 2020.

8 Conclusion

The Wheatley River Improvement Group had a very successful 2020 summer season, thanks to the hard work of watershed manager Maggie McConnell and our team of students: Izzy, Sam, and Kale. We achieved our tree planting, stream clearing, and riparian health assessment goals, as well as surpassing our fundraising and community engagement expectations. I thoroughly enjoyed my time as WRIG's field crew supervisor and have a newfound appreciation for watersheds and their stewards. I am grateful for being offered this position despite my lack of watershed experience and all the incredible learning opportunities I have had along the way. I am so excited to see what we accomplish in the next six months during my professional internship funded through Environmental Careers Organization Canada.

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