DILLON CONSULTING

CITY OF LONDON

Invasive Species Control Program Results

Medway Valley Heritage Forest ESA

December 2016 – 14-9389

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Report History

Version	Date	Author	Reviewed By	Final Review	Description of Revision(s)
1.0	15/12/2015	Kelly McLean Dillon Consulting Limited	Jonathan Harris, Dillon Consulting Limited	Jennifer Petruniak, Dillon Consulting Limited	Results Report first drafted
2.0	20/12/2016	Jonathan Harris, Dillon Consulting Limited		Jennifer Petruniak, Dillon Consulting Limited	Results Report updated with 2016 Results

Executive Summary

In cooperation with the City of London (the City) and Upper Thames River Conservation Authority (UTRCA), the City retained Dillon Consulting Limited (Dillon) to prepare an Invasive Species Management Plan for the Medway Valley Heritage Forest (MVHF) Environmentally Significant Area (ESA). The Invasive Species Management Plan and Program in the MVHF ESA is fully funded by the City of London to protect and restore the City's Natural Heritage System. This management plan was in response to observations of invasive species competing with sensitive vegetation during the 2013 Natural Heritage Inventory and Evaluation (NHIE) completed by Dillon for the City in the MVHF South ESA.

Highly invasive flora, such as Goutweed and Japanese Knotweed were threatening to out-compete local native vegetation within the MVHF ESA and in particular, Species at Risk and Species of Conservation that are found in close proximity to severe infestations. This was a concern to several stakeholders, including the City of London and Upper Thames River Conservation Authority, who implemented efforts to control the encroachment of those invasive species within the ESA in 2014, 2015 and 2016.

The Invasive Species Management Plan was drafted in early 2014 to review and compile background literature and make recommendations for invasive species control. This report provides an overview of the methods used by the UTRCA to control Japanese Knotweed and Goutweed in 2014, 2015 and 2016 as well as outlining the effectiveness of those methods as documented during on-going monitoring of control efforts.

Although those control efforts have proven to be effective in reducing the density of invasive flora, the long-term management recommended in the Invasive Species Management Plan should still be implemented once the short-term management is complete to ensure managed invasive flora do not re-establish and that other invasive flora do not invade the controlled areas. This may include on-going monitoring of the control areas in identifying if follow-up effort may be required and/or if further threats to these sensitive flora species are present.

1.0 Introduction

In cooperation with the City of London (the City) and the Upper Thames River Conservation Authority (UTRCA), the City retained Dillon Consulting Limited (Dillon) to prepare an Invasive Species Management Plan for the Medway Valley Heritage Forest (MVHF) Environmentally Significant Area (ESA). The Invasive Species Management Plan and Program in the MVHF ESA is fully funded by the City of London to protect and restore the City's Natural Heritage System. This management plan was in response to observations of invasive species competing with sensitive vegetation during the 2013 Natural Heritage Inventory and Evaluation (NHIE) completed by Dillon for the City in the MVHF South ESA. Two highly invasive flora, Japanese Knotweed (*Fallopia japonica*) and Goutweed (*Aegopodium podagraria*), were identified in the NHIE as high priority species to control and manage as those species pose a direct threat to significant populations of Species at Risk (SAR) and/or Species of Conservation Concern (SCC). Populations of sensitive flora that are threatened by encroachment of Japanese Knotweed and Goutweed in the MVHF ESA include Striped Cream Violet (*Viola striata*), Green Dragon (*Arisaema dracontium*) and False Rue-anemone (*Enemion biternatum*).

The Invasive Species Management Plan was compiled in early 2014 to summarize methods reported to be effective in the control of target invasive species. Based on the environment in each of the areas of the MVHF ESA targeted for invasive species control, decisions were made as to the most-effective and least impactful method prior to control efforts carried out by UTRCA starting in July 2014 through October 2016. This report provides an overview of the methods used by the UTRCA to control Japanese Knotweed and Goutweed between 2014 and 2016 as well as outlining the effectiveness of those methods as documented during on-going monitoring of control efforts.

2.0 Overview of Control Methods Applied

2.1 Goutweed Control

High priority populations of Goutweed identified for control were those located in the bottomlands of the MVHF South ESA and in proximity to significant populations of False Rue-anemone and Striped Cream Violet. Site reconnaissance was completed by Dillon and the UTRCA on May 20, 2014 to assess whether chemical control methods would be feasible based on the proximity of the infestation to Medway Creek and locations of the sensitive species. The City retained the UTRCA to implement and supervise control efforts. Dillon was retained by the City to monitor and report on the control efforts.

It was determined that with the appropriate mitigation measures in place (i.e. covered spray wands and spray barriers); chemical control would be applied to the densest patches of Goutweed. Where the density of Goutweed was lower and sensitive native species present, Goutweed was scheduled to be controlled through manual methods (e.g. hand wicking). This occurred where Goutweed was found to be intermixed with False Rue-anemone in all ten False Rue-anemone colonies (see **Figure 1**).

2.1.1 Chemical Control

Where there was limited risk for chemicals to enter Medway Creek and/or damage adjacent populations of SAR/SCC through spray drift, chemical control was used. Potential risks were minimized by using spot treatments, including covers on spray wands to reduce spray drift and spraying during optimal conditions (e.g. winds <10 km/h). Barriers consisting of polyethylene sheets were installed around each of the ten False Rue-anemone colonies in addition to spraying outside of the flowering period for those species. The chemical sprayed used was Glyphosate (Roundup) and/or Garlon XRT.

2.1.2 Manual Control

Where application of herbicide was determined not to be feasible, especially in close proximity to Medway Creek and within the barricaded areas containing sensitive species, alternative methods were undertaken to minimize impacts. This included hand-pulling of Goutweed as well as cutting of Goutweed and manually applying herbicide to the cut stems in the fall as plants are entering dormancy. An outline of the management timeline for Goutweed is presented below in **Table 1**.

TABLE 1: OUTLINE OF MANAGEMENT COMPLETED TO DATE FOR GOUTWEED

Activity Component	Timing	Objective of Activity Component
Identification of SAR/ SCC Population Limits	**May 20, 2014** Completed in early spring when ephemeral species were flowering and more visible to promote identification.	To stake the limits of sensitive species populations and identify which areas of Goutweed infestation are suitable for chemical methods or whether manual efforts are required. Identification training of sensitive species for UTRCA also occurred concurrently.
Barrier Installation	**July 10, 2014** Temporary barriers consisting of polyethylene and wooden stakes were installed prior to herbicide application **May 12, 2015** Repairs to existing barriers and installation of additional barriers prior to 2015 activities.	Barriers were installed around each of the ten colonies of False Rue-anemone to minimize impacts during herbicide application.
Herbicide Application	Initial spraying of Glyphosate (Roundup) and/or Garlon XRT took place on the following dates: ▪ **July 10, 2014** ▪ **July 16, 2014** ▪ **August 7, 2014** ▪ **August 13, 2014** ▪ **August 27, 2014** ▪ **October 23, 2014** Follow-up spraying took place on the following dates: ▪ **June 2, 2015** ▪ **June 11, 2015** ▪ **July 15, 2015** ▪ **July 24, 2015** ▪ **May 11, 2016** ▪ **June 21, 2016** ▪ **June 23, 2016** ▪ **October 14, 2016**	Spot treatment of Goutweed with an herbicide application. Application of herbicide was completed outside of the flowering season for the False Rue-anemone and Striped Cream Violet.
Hand Pulling/ Manual application of herbicide to cut stems	Initial hand pulling of Goutweed in the barricaded areas took place on the following dates: ▪ **July 8, 2014** ▪ **July 10, 2014** Application of herbicide to cut goutweed stems with a foam wicking brush was carried out in mid to late September 2015 and October 2016.	Goutweed mixed in with sensitive species was attempted to be manually removed through the use of hand-pulling in early 2014. Goutweed within barricaded areas was manually cut and an herbicide applied with a foam wicking brush onto stems in the fall of 2015 and 2016.

Activity Component	Timing	Objective of Activity Component
Wildflower plug plantings and seeding	Shade tolerant wildflower seed mixes and wildflower plugs were ordered and planted/seeded in mid to late fall of 2015. Wildflower plug quantities included: ▪ 72 - **Canada Anemone** (*Anemone canadensis*) ▪ 72 - **Zigzag Goldenrod** (*Solidago flexicaulis*) ▪ 72- **Blue Vervain** (*Verbena hastate*) ▪ 72 - **Wild Columbine** (*Aquilegia canadensis*) ▪ 40 (1 gallon pots) - **Wild Ginger** (*Asarum canadense*)	Targeted planting and seeding of native wildflowers was in an effort to prevent Goutweed re-establishment and/ or other invasive flora from invading the area. UTRCA assessed the seed and plugs on June 21, 2016 and did not observe much seed germination. The wildflower plugs were observed to be struggling as well. The UTRCA intends to re-assess the growth in the spring of 2017 and potentially re-plant, if necessary.

2.2 Japanese Knotweed Control

Three infestations of Japanese Knotweed were identified in the MVHF, all in association with the Elsie Perrin Williams Estate. The suspected initial parent colony is located along the edge of the estate driveway and is considered a small infestation (0.1 to 0.5 ha) of low density (<10% cover) according to the Best Management Practices in Ontario for Japanese Knotweed (Anderson, 2012). Due to the presence of a Species at Risk (Green Dragon, listed of *Special Concern*) within 10 m and Medway Creek in close proximity to the infested area, the stem injection method was used for the smaller parent colony and a combination of cutting/foliar spray and stem injection used for the offshoot colonies. Injecting the parent colony was deemed a feasible task since the population has a lower density (<200 stems). The two offshoot colonies are much denser so stems were cut in the fall of 2014 and then foliar sprayed with follow-up visits in the fall of 2015 to inject any new stems. Additional injections and foliar spraying occurred between May and July 2016 to control new stems. The City retained the UTRCA to implement and supervise control efforts. Dillon was retained by the City to monitor and report on the control efforts. An outline of the management timeline for Japanese Knotweed is presented below in **Table 2.**

TABLE 2: OUTLINE OF MANAGEMENT COMPLETED TO DATE FOR JAPANESE KNOTWEED

Activity Component	Timing	Objective of Activity Component
Cutting back of stems	The two larger colonies requiring foliar spraying were cut on **September 10, 2014**. Follow-up cutting of the colonies took place on the following dates: ▪ **May 21, 2015** ▪ **June 3, 2015**	The two off-shoot colonies were cut back in anticipation of foliar spraying later in the fall of 2014
Foliar Spray	The two large colonies were sprayed on the following dates: ▪ **May 20, 2015 - Garlon** ▪ **June 3, 2015 - Garlon** ▪ **June 24, 2015 - Garlon** ▪ **July 24, 2015 - Garlon** ▪ **May 30, 2016 – Arsenal** ▪ **June 23, 2016 – Garlon** ▪ **July 27, 2016 - Garlon**	Larger colonies were sprayed with Garlon XRT at 2.5% in 2015. Colonies were sprayed again in 2016 with Arsenal Powerline at 2.5% and again with Garlon XRT at 2.5%.
Stem Injection	**September 11, 2014** The parent colony was injected. Follow-up injections took place on the following dates: ▪ **May 21, 2015** ▪ **June 3, 2015** ▪ **May 30, 2016**	Injection of Japanese Knotweed stems with a concentrate of Glyphosate herbicide (5:1). The parent colony was injected first and then any remaining or new stems in the off-shoot colonies after foliar spraying efforts. The parent colony was re-assessed in 2016 and required a follow-up injection for 16 new stems. Stems were injected in 2016 with 7 millilitres of RoundUp Weathermax per stem.

3.0 Effectiveness of Control Methods

Efforts to control Goutweed and Japanese Knotweed began in July 2014 with on-going monitoring and documentation of the control method effectiveness during these efforts. Overall, control efforts have appeared to be successful with reductions of Goutweed and Japanese Knotweed densities in the control areas. Mitigation measures put in place to minimize potential adverse impacts to sensitive species also appear to be successful based on observations of those species at similar densities in 2015 and 2016 compared to pre-control densities.

3.1 Goutweed Control

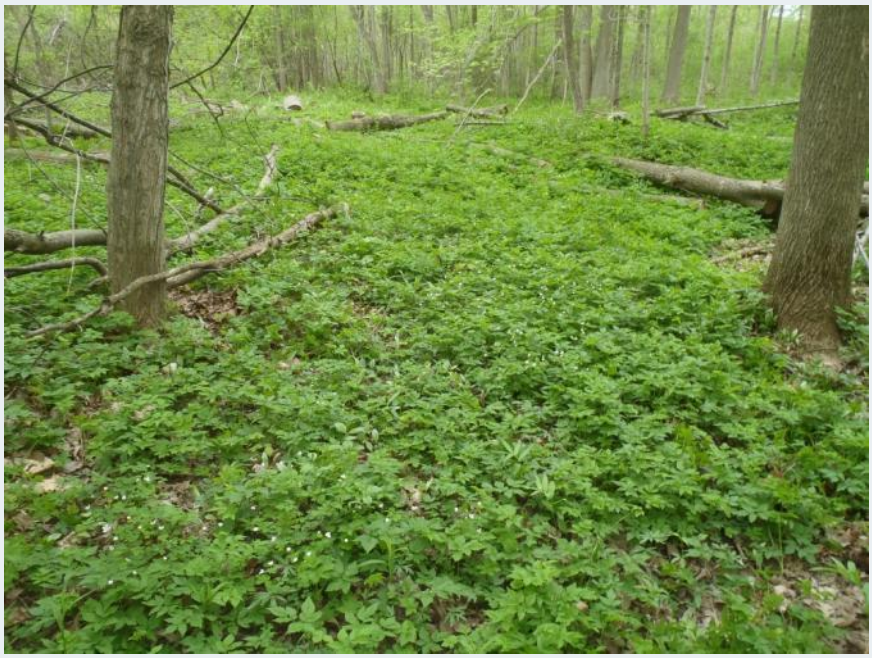
Control of Goutweed included a combination of chemical and manual efforts to reduce the densities of this invasive groundcover and minimize future encroachment into populations of sensitive species. To date, chemical control efforts, which included application of herbicide (Glyphosate and Garlon XRT) in 2014, 2015 and 2016 has proven very effective. Limited manual removal (i.e. hand-pulling) was completed in 2014. Cutting of goutweed and manually applying herbicide to stems also occurred in September 2015 and October 2016. Monitoring post-control will not be completed until the spring of 2017 to assess effectiveness.

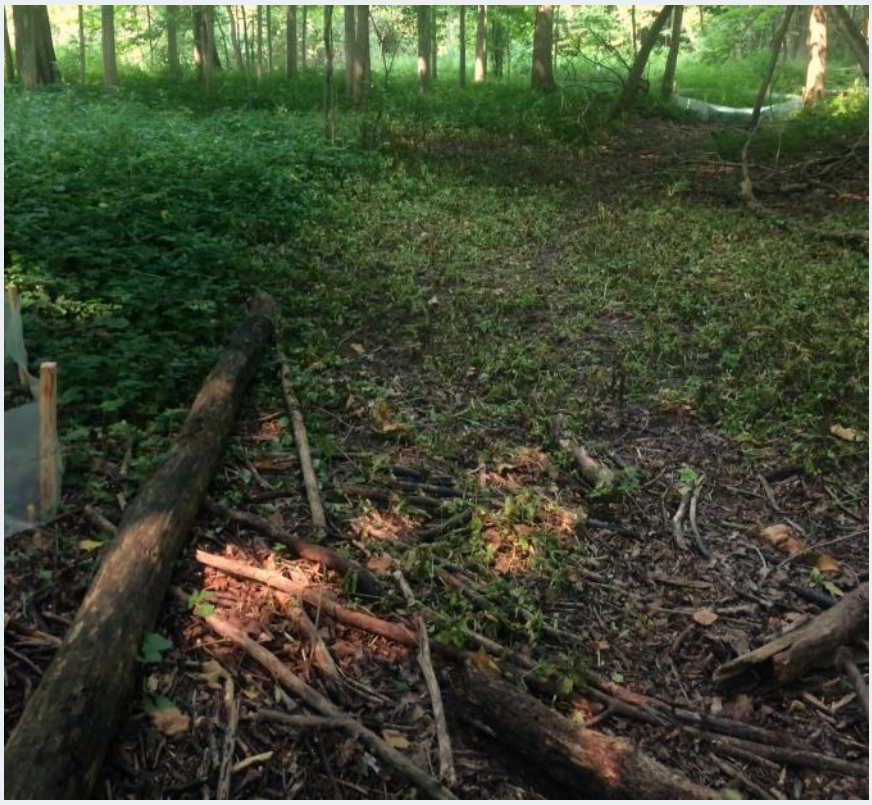
Goutweed that was sprayed in early summer of 2014 was observed to wilt, turn brown and dieback generally within 7-10 days of herbicide application. Application of Glyphosate resulted in the same effects as Garlon XRT but generally took a few days longer to show the full effects.

3.1.1 2014 Monitoring

Initial spraying in 2014 resulted in the wilting and browning of Goutweed in the controlled areas. Observations of the controlled areas in the fall of 2014 showed large patches of bare soil with limited Goutweed presence. Goutweed that was visible was wilted and brown. **Table 3** provides photographic documentation of the control efforts.

TABLE 3: PHOTO DOCUMENTATION OF 2014 GOUTWEED CONTROL EFFORTS

May 20, 2014 Pre-control	
July 16, 2014 Spray barriers in place prior to herbicide application Photo is representative of typical barricaded False Rue-anemone colony	

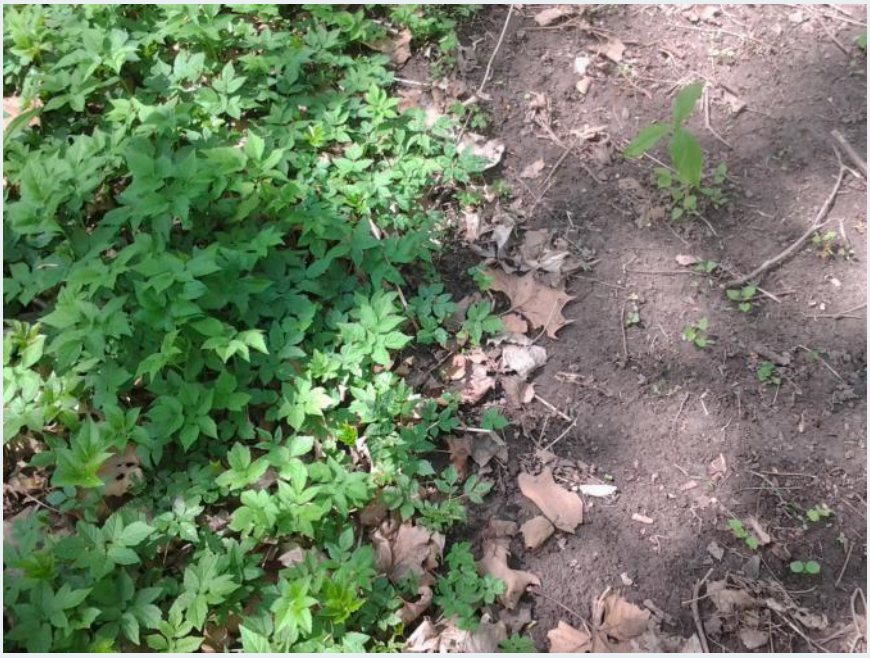
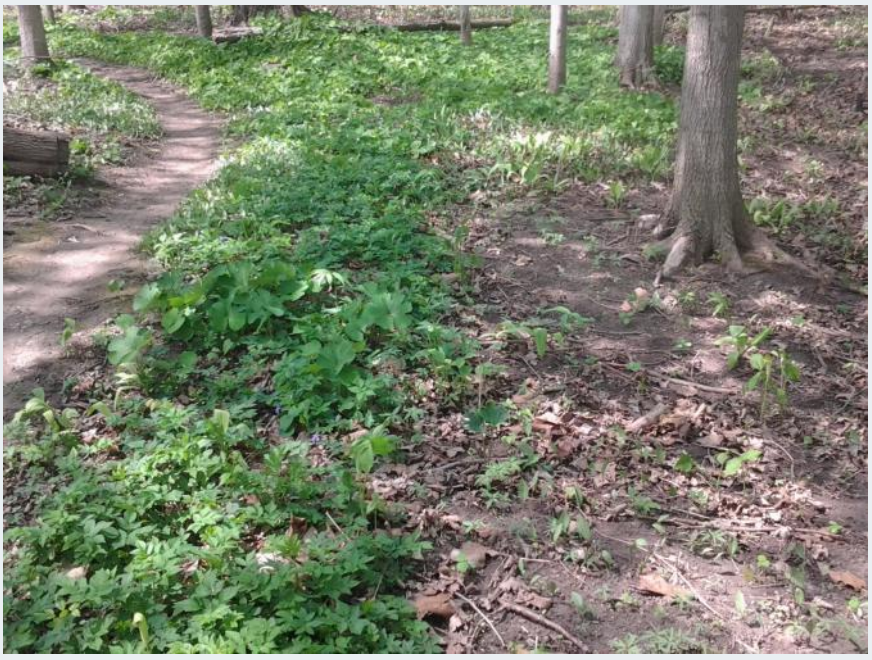
July 16, 2014 Herbicide application (Glyphosate)	
August 7, 2014 Twelve days after herbicide application (Glyphosate)	

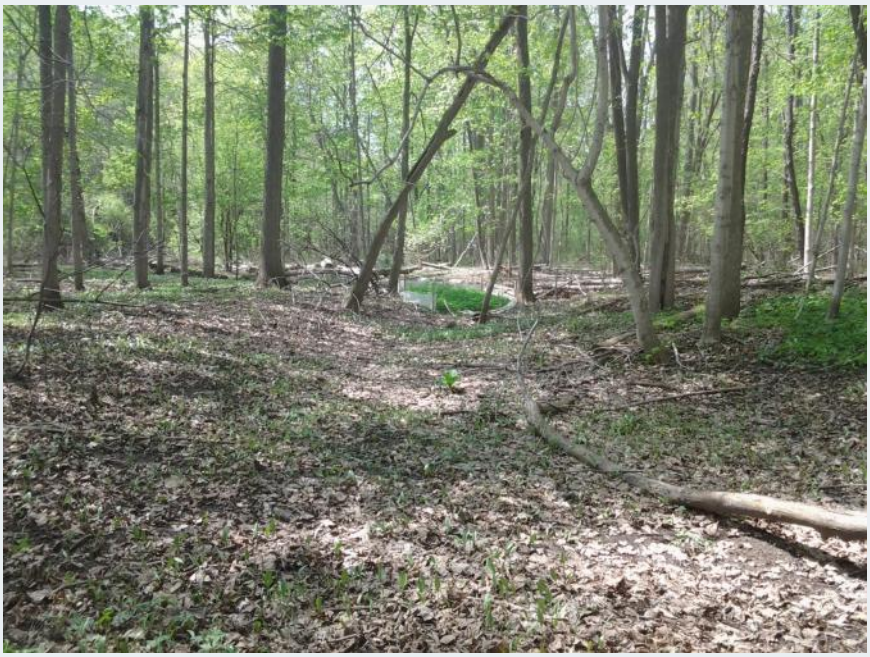
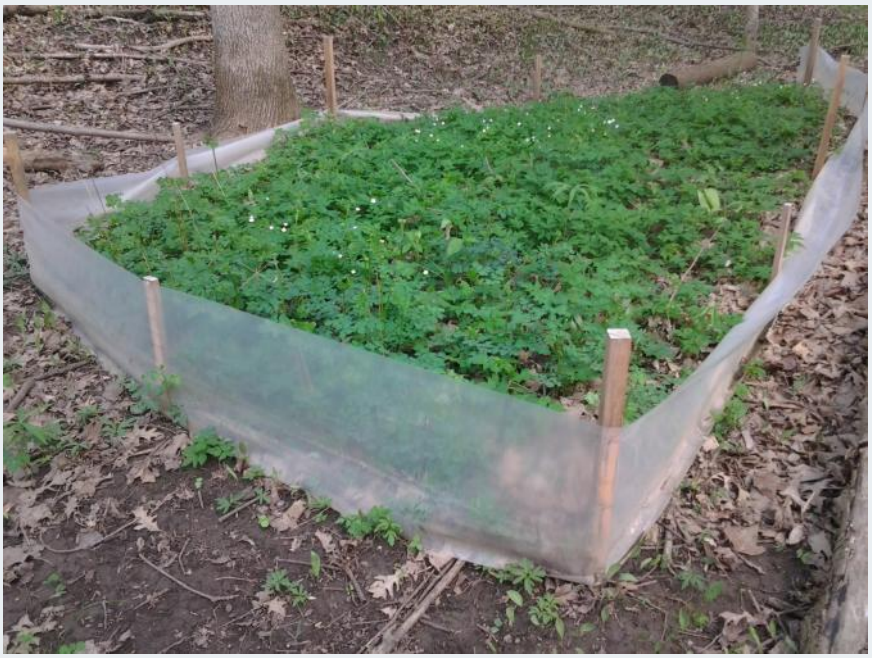
August 14, 2014 Nineteen days after herbicide application (Glyphosate)	

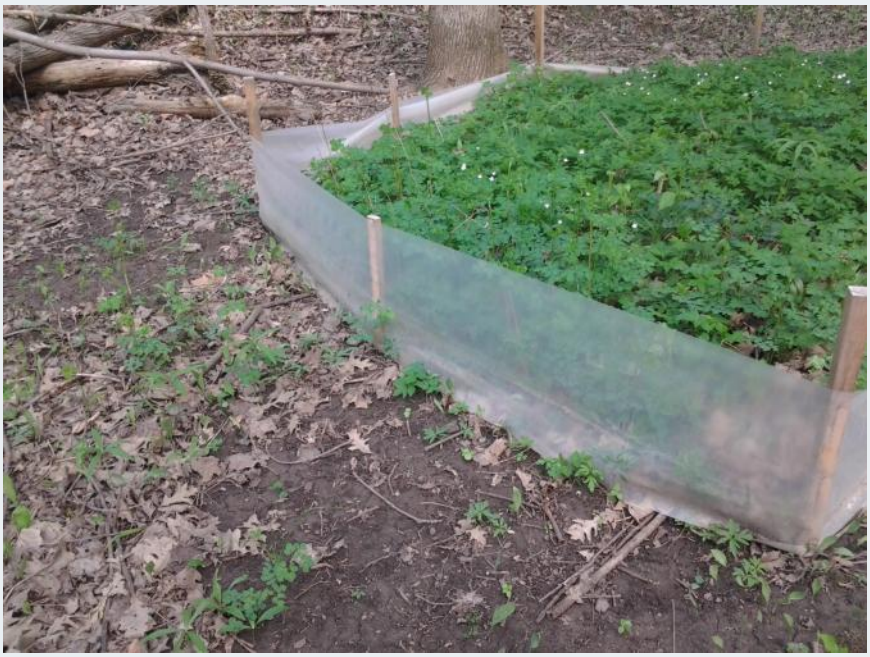
3.1.2 2015 Monitoring

Control areas that were sprayed in 2014 were monitored in early spring of 2015 to assess the effects of herbicide application and whether there were any visible adverse effects to sensitive species. Areas of dense Goutweed that were sprayed in 2014 appeared to be free of Goutweed growth when observed on May 10, 2015. Sprayed areas were clearly defined due to the absence of Goutweed when compared to adjacent areas, in particular the areas within barricaded sensitive species. Although appearing to lack Goutweed growth, sprayed areas were observed not to be completely bare. Early season flora such as trout lily (*Erythronium* sp.), wild leek (*Allium tricoccum*), wild ginger (*Asarum canadense*), toothwort (*Dentaria* sp.), jack-in-the-pulpit (*Arisaema triphyllum*) were present in the sprayed area, possibly re-establishing from the seed bank. **Table 4** provides photographic documentation of the control efforts.

TABLE 4: PHOTO DOCUMENTATION OF 2015 GOUTWEED POST-CONTROL RESULTS

May 10, 2015 Post-control – clear distinction between control and non-control areas. Uncontrolled areas were observed to have thick growth of Goutweed in early spring vs. the control areas.	
May 10, 2015 Post-control – clear distinction between control and non-control areas	

May 10, 2015 Post-control – sprayed area abundant trout lily but no Goutweed observed	
May 10, 2015 Post-control – Goutweed lush and healthy within barricaded area (mixed presence with False Rue-anemone) but absent in sprayed area. Similar conditions for all barricaded False Rue-anemone colonies.	

May 10, 2015 Post-control – few Goutweed stems poking out under the barrier	

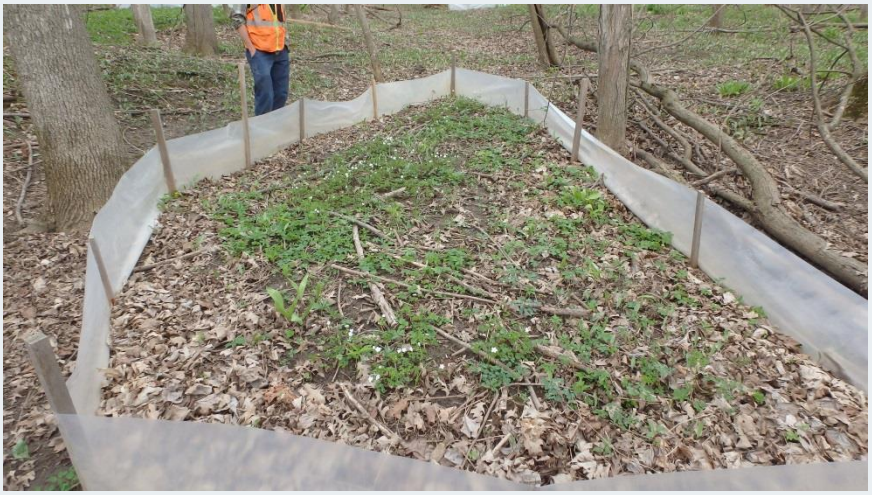
3.1.3 2016 Monitoring

Control areas that were initially sprayed in 2014 were monitored in early spring of 2016 to assess the effects of herbicide re-application and whether there were any visible adverse effects to sensitive species. Areas of dense Goutweed that were sprayed in 2014 and 2015 appeared to be free of Goutweed growth when observed on May 5, 2016. Sprayed areas were still clearly defined due to the absence of Goutweed when compared to adjacent areas, in particular the barricaded areas containing sensitive species.

In the areas controlled for Goutweed, observations of other vegetation growth were similar in 2016 as reported in 2015. Early season flora such as white trout lily (*Erythronium albidum*), wild leek (*Allium tricoccum*), wild ginger (*Asarum canadense*), toothwort (*Dentaria* sp.), jack-in-the-pulpit (*Arisaema triphyllum*) were present in the sprayed area, possibly re-establishing from the seed bank and/or from the wildflower plugs planted by UTRCA. Additional native species observed in 2016 include red trillium (*Trillium erectum*), skunk cabbage (*Symplocarpus foetidus*), solomon's seal (*Polygonatum* sp.), and blue cohosh (*Caulophyllum thalictroides*). Another invasive species, Garlic Mustard (*Alliaria petiolata*), was observed growing in the control areas that was not observed in 2015. The UTRCA had observed the growth of this invasive species during 2016 control activities and implemented manual control (i.e. pulling) of this invasive species on May 11, 2016 to reduce its establishment. **Table 5** provides photographic documentation of the 2016 control efforts. Further documentation of the control effort effectiveness is provided in ***Appendix A*** (False Rue-anemone Monitoring Record).

TABLE 5: PHOTO DOCUMENTATION OF 2016 GOUTWEED POST-CONTROL RESULTS

May 5, 2016 Post-control – area with more abundance growth of native species and occasional patches of Garlic Mustard (circled).	

May 05, 2016 Post-control – sprayed area abundant trout lily but no Goutweed observed outside of barricaded areas	
May 05, 2016 Post-control – Goutweed was hand-wicked with herbicide in the fall of 2015, very few Goutweed remaining, mostly native species. False-rue Anemone still present in the same density as previously observed.	

May 05, 2016 Close-up of previous photo to show extent of Goutweed remaining within the plot. False Rue-anemone visible (white flowers)	

3.2 Japanese Knotweed Control

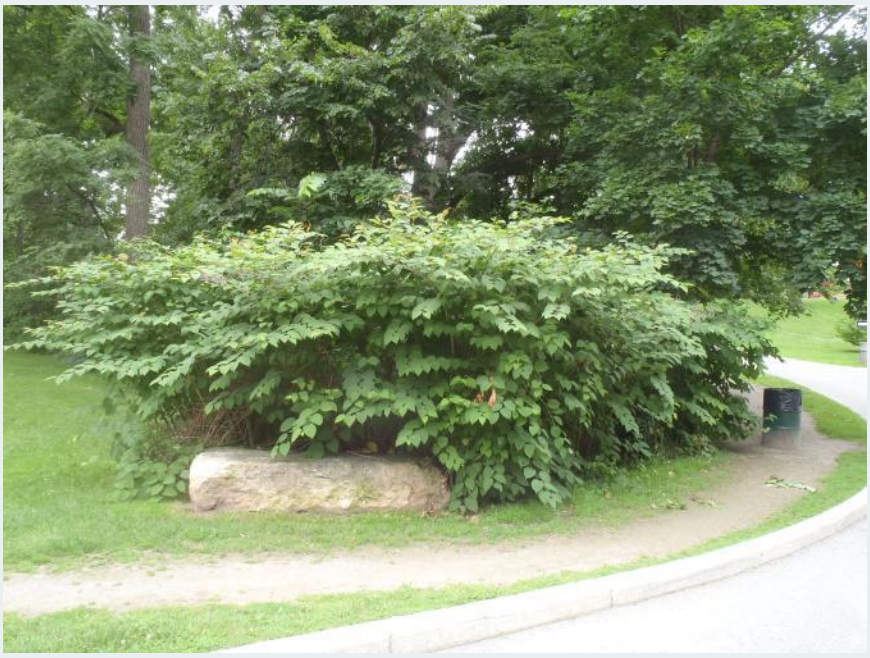
Control of Japanese Knotweed included a combination of chemical and manual efforts to reduce the densities of this invasive species and minimize future encroachment into populations of sensitive species. To date, chemical control efforts, which included stem injection of herbicide (Glyphosate) in 2014, has proven to be very effective in reducing the density of stems of the parent colony. The parent colony was monitored by UTRCA for new stems establishing and additional injections were conducted in 2016 for sixteen (16) new stems. The off-shoot colonies that were cut back in the early fall of 2014 were further subject to foliar spraying in the spring/summer of 2015 and 2016. Foliar spraying of the colonies has proved effective in reducing the density of knotweed. To reduce the likelihood of reoccurrence, monitoring the sites along and conducting follow-up spraying/injections of new stems, if required, is required for the long-term.

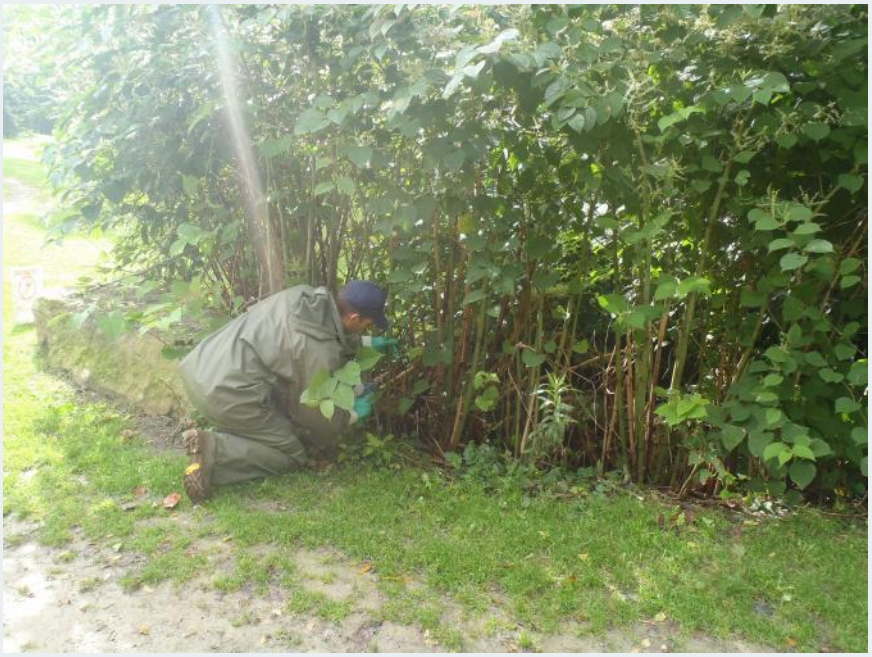
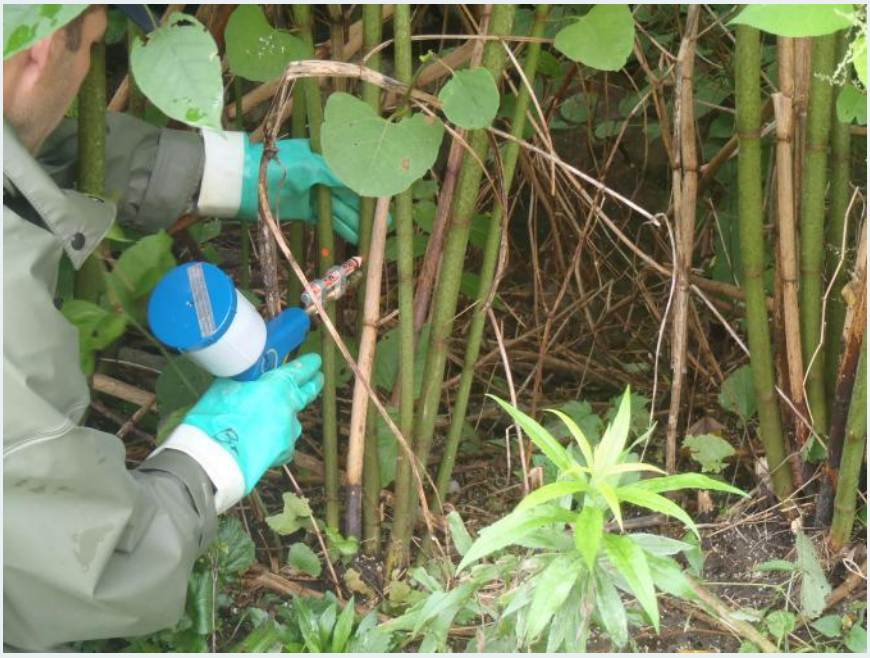
3.2.1 Parent Colony

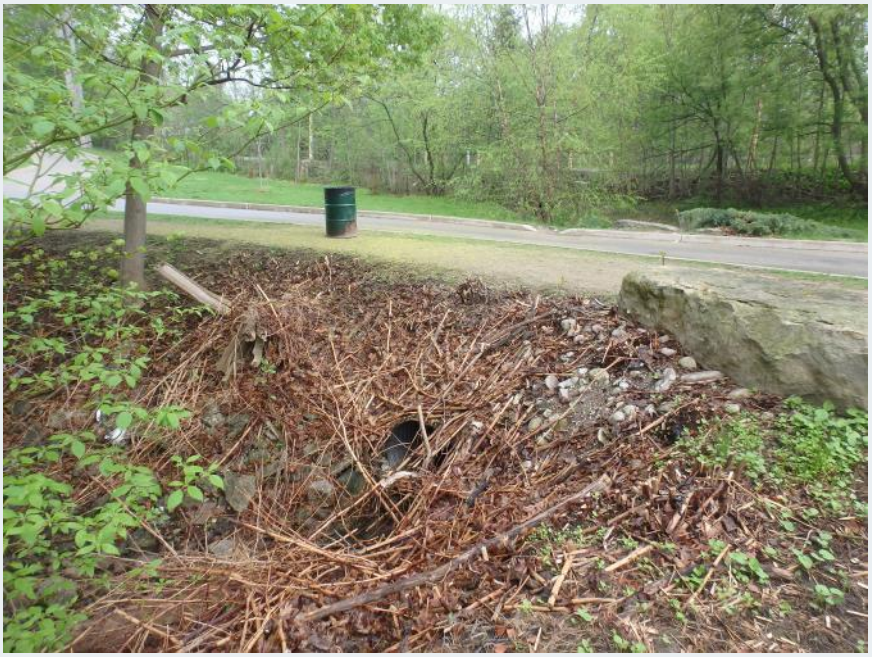
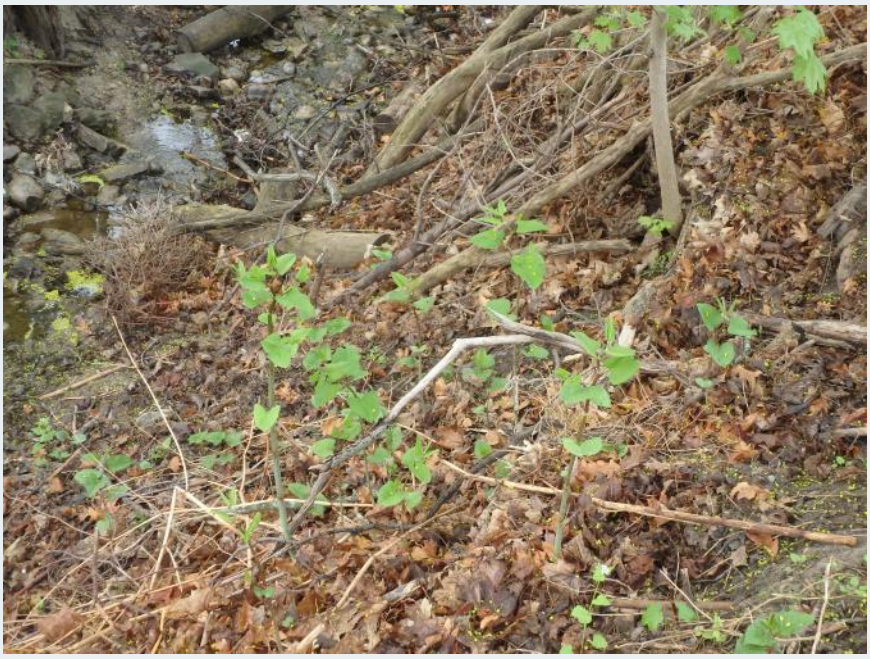
One-hundred and thirty one (131) stems in the parent colony of Japanese Knotweed were injected in September 2014 with Glyphosate. These stems were observed to quickly dieback after the initial injections. The 2014 growth was cut back and removed to allow for inspection of the colony in 2015 and assess the density of new growth prior to follow-up injections. The colony was monitored on May 10, 2015 and found to have approximately 50-60 new stems which were spread out in the original footprint of the colony. Follow-up injections were completed in the spring of 2015 and 2016 in conjunction with foliar spraying when the plants were beginning to emerge.

The effectiveness of the combined injections and foliar spraying has reduced the number of new stems emerging, although the invasive species hasn't been completely removed to date. Additional monitoring and control is recommended in the long-term to prevent the colony from reaching its pre-control density. **Table 6** provides photographic documentation of the control efforts.

TABLE 6: PHOTO DOCUMENTATION OF JAPANESE KNOTWEED PARENT COLONY CONTROL EFFORTS

July 16, 2014 Pre-control	

September 11, 2014 Stem injection	
September 11, 2014 Stem injection	

May 10, 2015 Post-control – colony cut back, very few new stems (in comparison with 2014 density)	
May 10, 2015 Post-control – few new stems	

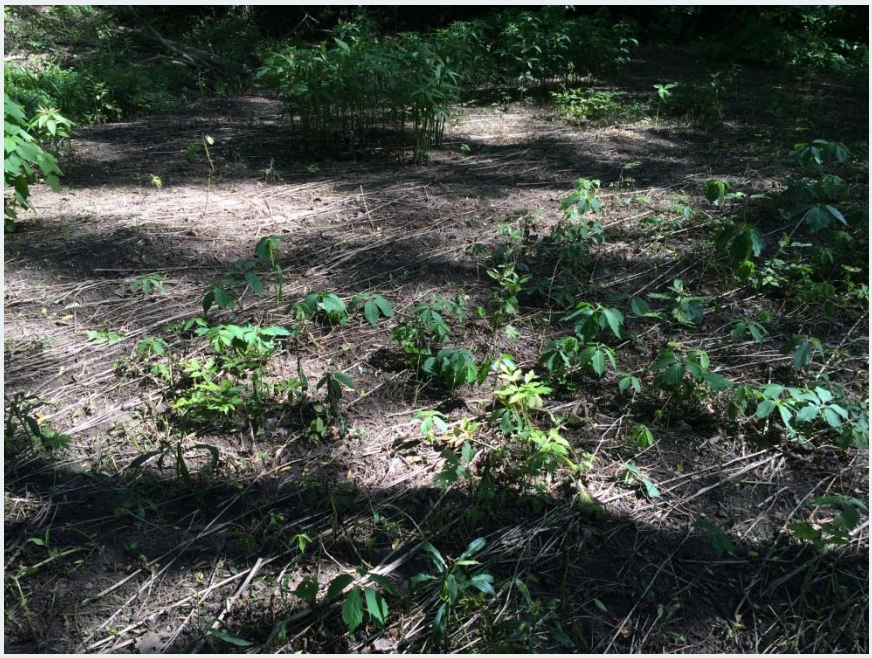
3.2.2 Off-shoot Colonies

The two off-shoot colonies located downslope of the parent colony of Japanese Knotweed were observe to be much denser and therefore not feasible candidates for stem injection as a primary control. The two off-shoot colonies were cut back in the fall of 2014 with anticipation of foliar spraying when re-growth emerges. Re-growth of stems was limited in the fall of 2014 so spraying was postponed until the spring of 2015 with follow-up spraying occurring throughout the summer months of 2015 and 2016. **Table 7** provides photographic documentation of the control efforts.

TABLE 7: PHOTO DOCUMENTATION OF OFF-SHOOT COLONY CONTROL EFFORTS

July 16, 2014 Pre-control off-shoot colony at base of slope	

September 11, 2014 Cut back off-shoot colony located on the side of the slope	
June 18, 2015 Colony at the base of slope after two initial spraying events. Density greatly reduced when compared with pre-control conditions.	

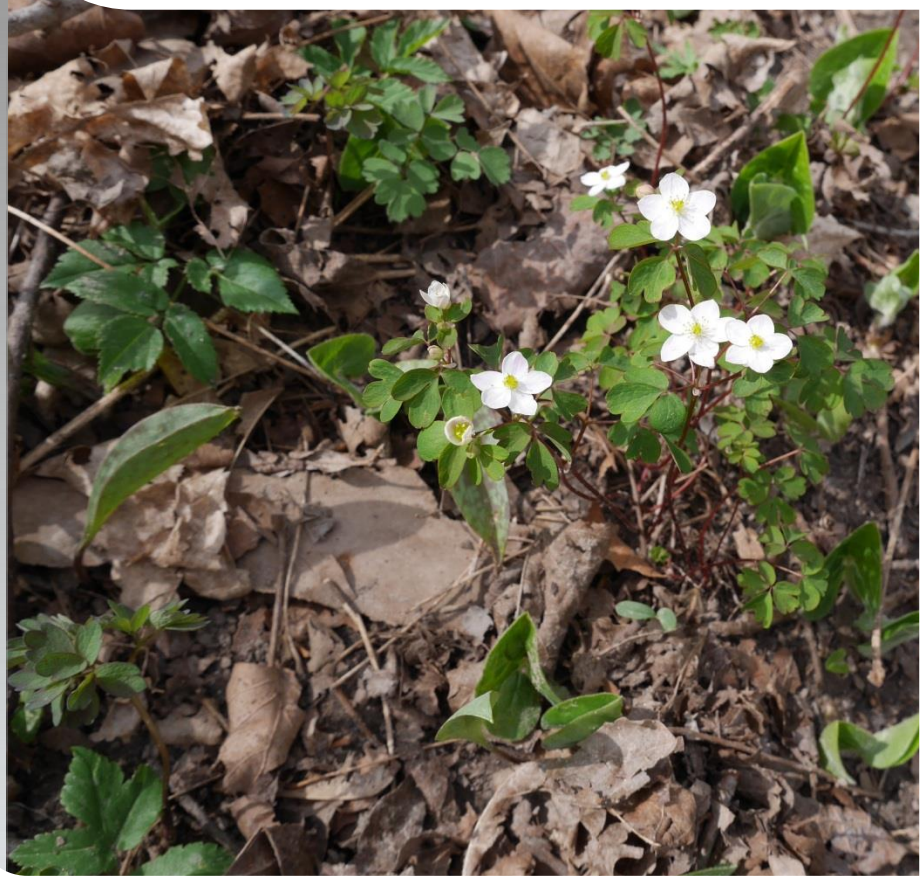
June 10, 2016 Colony at the base of slope in early June. Native species such as Thicket Creeper (*Parthenocissus vitacea*), Toothwort, and Joe-pyeweed species (*Eutrochium maculatum*) were observed re-establishing in the controlled area.	

4.0 Conclusion

Highly invasive flora, such as Goutweed and Japanese Knotweed were threatening to out-compete local native vegetation within the MVHF ESA and in particular, Species at Risk and Species of Conservation that are found in close proximity to severe infestations. This was a concern to several stakeholders, including the City of London who retained the Upper Thames River Conservation Authority to undertake efforts to control the encroachment of those invasive species within the ESA in 2014. Although those control efforts have proven to be effective in reducing the density of invasive flora, the long-term management recommended in the Invasive Species Management Plan should still be implemented once the short-term management is complete to ensure managed invasive flora do not re-establish and that other invasive flora do not invade the controlled areas. This may include on-going monitoring of the areas where control efforts have been undertaken to identify if follow-up effort may be required and/or if further threats to these sensitive flora species are present.

Appendix A

False Rue-anemone Monitoring Record



1.0 Introduction

In cooperation with the City of London (the City) and the Upper Thames River Conservation Authority (UTRCA), the City retained Dillon Consulting Limited (Dillon) to prepare an Invasive Species Management Plan for the Medway Valley Heritage Forest (MVHF) Environmentally Significant Area (ESA). The Invasive Species Management Plan and Program in the MVHF ESA is fully funded by the City of London to protect and restore the City's Natural Heritage System. The Invasive Species Management Plan was created to review and compile background literature and make recommendations for invasive species control.

As part of that plan, Goutweed (*Aegopodium podagraria*) was identified as a high priority species to control and manage as it poses a threat to a significant population of False Rue-anemone (*Enemion biternatum*), a species listed as *Threatened* on the Species at Risk in Ontario list (see **Figure 1**). Goutweed has also been identified in the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) *Assessment and Update Status Report on False Rue-anemone Enemion biternatum in Canada* (2005) as a direct threat to the decline of the species through encroachment.

Control efforts for Goutweed were in proximity to, and in some cases within, patches of False Rue-anemone. Therefore, management activities were registered on the Ministry of Natural Resources and Forestry (MNRF) Registry provided under Section 23.17 (Species Protection or Recovery Activities) of Ontario Regulation 242/08 of the *Endangered Species Act,* 2007. Confirmation of the activity registration was received from the MNRF on June 19, 2014 (Confirmation ID # X-102-0000000251). A mitigation plan was also drafted in support of the management activities (Dillon Consulting Limited, July 7, 2014) and in accordance with subsections (7) and (8).

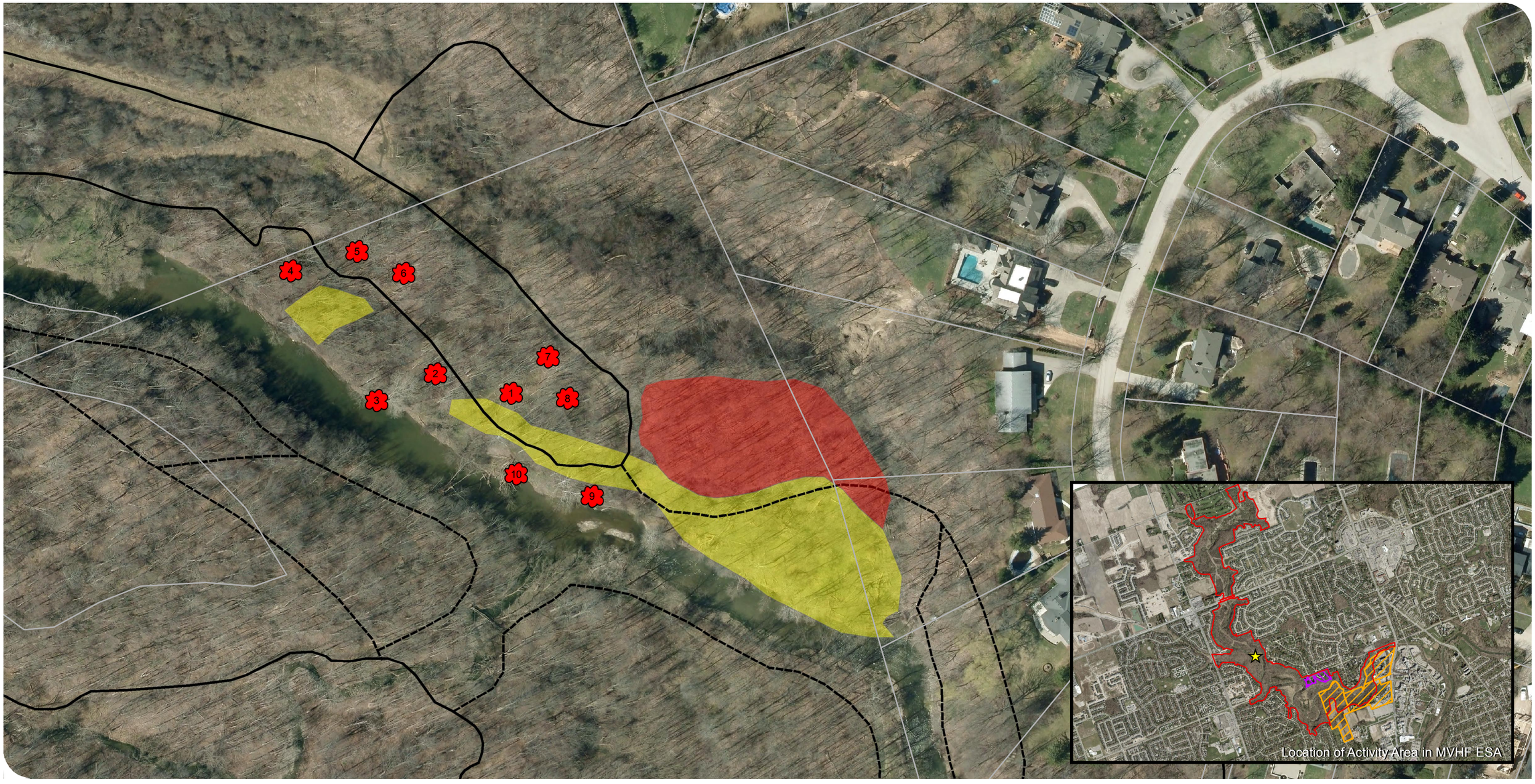
As part of the requirements for the registration (see paragraph 7 of subsection (6) under Section 23.17), a record was created to outline the following while carrying out the control efforts:

i. the effects of the activity on each species that is the object of the activity

ii. the steps that are taken by the person carrying out the activity to minimize the adverse effects of the activity on each species that is the object of the activity, including the locations where the steps are taken, and an assessment of the effectiveness of those steps

iii. the names of each individual with expertise who was responsible for carrying out or supervising the activity

The purpose of this monitoring record is to provide this record.



CITY OF LONDON
Medway Valley Heritage Forest ESA
False Rue-anemone Monitoring Record

MVHF SOUTH ESA
UTRCA GOUTWEED CONTROL AREA & FALSE RUE-ANEMONE COLONY LOCATIONS
FIGURE 1

- Closed Trail
- Managed Trail (UTRCA, 2013)
- Informal Trail (Unmanaged Trail)
- Property Line
- Elsie Perrin Williams Estate (City Owned Land)
- UWO & Huron College Property
- False Rue Anemone Sub-colony (#1 to 10)
- False Rue-anemone Main Colony
- Goutweed (*Aegopodium podagraria*)

DILLON CONSULTING

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNR & CITY OF LONDON

MAP CREATED BY: JWH
MAP CHECKED BY: JP
MAP PROJECTION: NAD 1983 UTM Zone 17N

1:1,500
0 12.5 25 50 m
N

PROJECT: 14-9389 STATUS: DRAFT DATE: 7/27/2015

FILE LOCATION: I:\GIS\137560 - Medway MVHF ESA\Mapping\Invasive Species Mgm. Plan\Figure1_Monitoring Record.mxd

2.0 Contacts for the Activity

The UTRCA was the primary organization responsible for carrying out the physical control efforts such as application of herbicide, hand-pulling and barrier installation. Dillon was retained to develop and oversee the management efforts and reporting on behalf of the City and provide the required expertise.

2.1 City of London

The contact at the City of London who is responsible for the overseeing the overall activity is:

Linda McDougall, MES, OALA, RPP
Ecologist
Environmental & Parks Planning – Planning Services
Tel: 519-661-2500 ext. 6494
Email: lmcdouga@london.ca

2.2 Upper Thames River Conservation Authority

The contacts at UTRCA responsible for carrying out and/or supervising the control efforts, including herbicide application, are:

Brandon Williamson
Land Management Technician
Tel: 519-451-2800 ext. 296
Email: williamsonb@thamesriver.on.ca

Dan Jones
Land Management Supervisor
Tel: 519-451-2800 ext. 281
Email: jonesd@thamesriver.on.ca

2.3 Dillon Consulting Limited

The contacts at Dillon responsible for overseeing the management efforts and reporting on behalf of the City are:

Jonathan Harris, Adv. Dip.
Biologist
Tel: 416-229-4647 ext. 2389
Email: Jharris@dillon.ca

Jennifer Petruniak, M.Sc.
Lead Biologist
Tel: 416-229-2627 ext. 2432
Email: jpetruniak@dillon.ca

3.0 Mitigation of Potential Adverse Effects

The infestation of Goutweed located in the bottomland of the MVHF South ESA and within proximity to a significant population of False Rue-anemone received initial control efforts in 2014. Several steps were taken to mitigate adverse effects to the False Rue-anemone as a result of chemical and manual control methods. The steps are listed in the below chart and detailed in **Table 1** along with the dates of implementation.

Step 1
- Site reconnaissance completed in early spring to confirm the boundaries of ten False Rue-anemone colonies
- Limits of each colony staked

Step 2
- Barriers installed around each of the ten False Rue-anemone colonies to minimize adverse effects from herbicide application

Step 3
- Herbicide application planned for after the False Rue-anemone flowering season when plants are dormant
- Spot application spraying used along with covers on spray wands
- Spraying events timed for optimal conditions (e.g. winds <10km/h and no rain)

Step 4
- Goutweed located within colonies is hand-pulled and completed outside of the flowering period for False Rue-anemone
- Hand-pulling is supervised by someone qualified to identifiy False Rue-anemone when not in flower

Step 5
- Targeted native wildflower planting and seeding

TABLE 1: OUTLINE OF MANAGEMENT COMPLETED TO DATE FOR GOUTWEED

Activity Component	Timing	Objective of Activity Component
Identification of SAR/ SCC Population Limits	**May 20, 2014** Completed in early spring when ephemeral species were flowering and more visible to promote identification.	To stake the limits of sensitive species populations and identify which areas of Goutweed infestation are suitable for chemical methods or whether manual efforts are required. Identification training of sensitive species for UTRCA also occurred concurrently.
Barrier Installation	**July 10, 2014** Temporary barriers consisting of polyethylene and wooden stakes were installed prior to herbicide application **May 12, 2015** Repairs to existing barriers and installation of additional barriers prior to 2015 activities. **2016** The barrier was found to be intact and suitable for use in 2016.	Barriers were installed around each of the ten colonies of False Rue-anemone to minimize impacts during herbicide application.
Herbicide Application	Initial spraying of Glyphosate (Roundup) and/or Garlon XRT took place on the following dates: ▪ **July 10, 2014** ▪ **July 16, 2014** ▪ **August 7, 2014** ▪ **August 13, 2014** ▪ **August 27, 2014** ▪ **October 23, 2014** Follow-up spraying took place on the following dates: ▪ **June 2, 2015** ▪ **June 11, 2015** ▪ **July 15, 2015** ▪ **July 24, 2015** ▪ **May 11, 2016** ▪ **June 21, 2016** ▪ **June 23, 2016** ▪ **October 14, 2016**	Spot treatment of Goutweed with an herbicide application. Application of herbicide was completed outside of the flowering season for the False Rue-anemone and Striped Cream Violet.
Hand Pulling/ Manual application of herbicide to cut stems	Initial hand pulling of Goutweed in the barricaded areas took place on the following dates: ▪ **July 8, 2014** ▪ **July 10, 2014** Application of herbicide to cut goutweed stems with a foam wicking brush was carried out in mid to late September 2015 and October 2016.	Goutweed mixed in with sensitive species was attempted to be manually removed through the use of hand-pulling in early 2014. Goutweed within barricaded areas was manually cut and a herbicide applied with a foam wicking brush onto stems in the fall of 2015 and 2016.

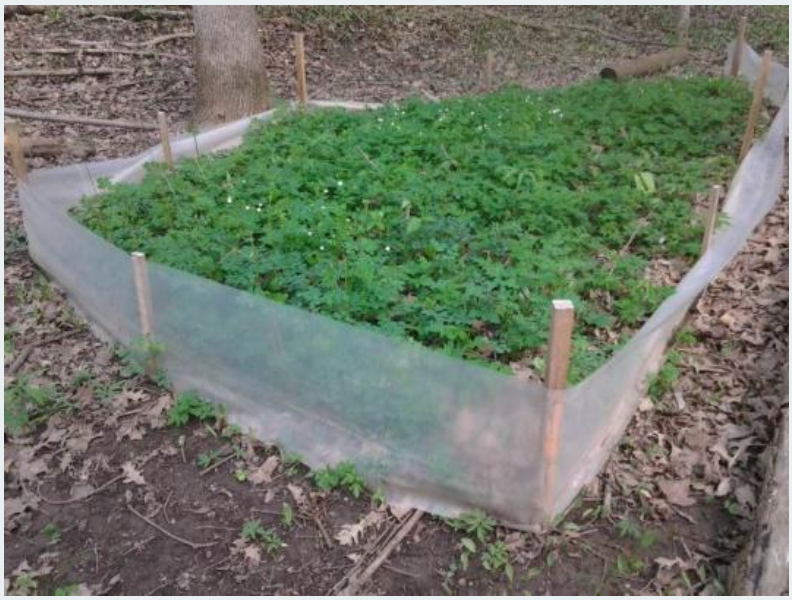
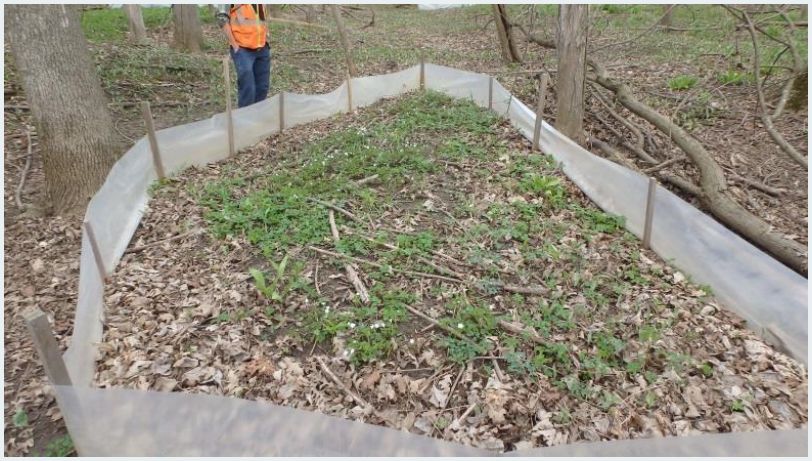
Activity Component	Timing	Objective of Activity Component
Wildflower plug plantings and seeding	Shade tolerant wildflower seed mixes and wildflower plugs were ordered and planted/seeded in mid to late fall of 2015. Wildflower plug quantities included: ▪ 72 - **Canada Anemone** (*Anemone canadensis*) ▪ 72 - **Zigzag Goldenrod** (*Solidago flexicaulis*) ▪ 72- **Blue Vervain** (*Verbena hastate*) ▪ 72 - **Wild Columbine** (*Aquilegia canadensis*) ▪ 40 (1 gallon pots) - **Wild Ginger** (*Asarum canadense*)	Targeted planting and seeding of native wildflowers was in an effort to prevent Goutweed re-establishment and/ or other invasive flora from invading the area. UTRCA assessed the seed and plugs on June 21, 2016 and did not observe much seed germination. The wildflower plugs were observed to be struggling as well. The UTRCA intends to re-assess the growth in the spring of 2017 and potentially re-plant, if necessary.

4.0 Effectiveness of Mitigation

Control efforts for Goutweed were implemented following the False Rue-anemone flowering period. Therefore, monitoring the effectiveness of the mitigation measures implemented prior to herbicide application occurred in 2015 and 2016. Mitigation measures included installation of spray barriers around each of the ten colonies of False Rue-anemone (see **Figure 1**), use of covers on spray wands and timing herbicide application outside of the flowering period. These measures appeared to be effective in preserving the colonies of False Rue-anemone. The density of flowers observed on May 5, 2016 and May 10, 2015 was similar to those observed on May 20, 2014 (see **Table 2**). Additional monitoring of mitigation was carried out on May 5, 2016 to assess the effectiveness of manual methods (i.e. hand-pulling, hand-wicking application of herbicide to cut goutweed) used to control Goutweed present within colonies of False Rue-anemone in the fall of 2015 (see representative photographs in **Table 2**).

TABLE 2: COMPARISON OF PRE & POST-CONTROL CONDITIONS

Goutweed **Pre-Control** – barrier around False Rue-anemone colony #1, Goutweed right up to barrier both inside and outside - July 16, 2014 Similar conditions occurred for each of the nine other colonies	

Goutweed Post-Control (2015) – barrier around False Rue-anemone colony #1, Goutweed restricted to inside the barrier – May 10, 2015. White flowers present in the photo are False Rue-anemone in similar abundance to that observed in 2014 (reported as between 50 and 70)	
Goutweed Post-Control (2016) – False Rue-anemone colony #1 after first application of hand-wicking of herbicide to Goutweed in the fall of 2015. The Goutweed is still present; a few individual plants were observed near the middle of the plot – May 5, 2016. White flowers present in the photo are False Rue-anemone in similar abundance to that observed in 2014/2015 (reported as between 50 and 70)	

5.0 Conclusion

Goutweed, a highly invasive flora species was threatening to out-compete local native vegetation within the MVHF ESA and in particular False Rue-anemone, a Species at Risk that was observed in proximity to a severe infestation. This was a concern to several stakeholders, including the City of London who retained the Upper Thames River Conservation Authority to undertake efforts to control the encroachment of Goutweed within the ESA in 2014.

FALSE RUE OBSERVED ON MAY 2, 2015.

Although those control efforts have proven to be effective in reducing the density of Goutweed while maintaining the integrity of False Rue-anemone colonies, long-term management is recommended to be implemented once the short-term management is complete in an effort to prevent Goutweed from re-establishing and/or other invasive flora from invading the area. This may include targeted planting and/or seeding of native vegetation and on-going monitoring of the False Rue-anemone population to identify if follow-up control effort(s) are required to preserve the species in the MVHF ESA.

It is recommended that this monitoring record be updated in 2017 following re-emergence of the False Rue-anemone population to document the control efforts undertaken in the fall of 2016. Once control efforts are complete, this monitoring record is to be submitted in its entirety to the Natural Heritage Information Centre within 180 days. The record should include a detailed assessment of the extent to which the overall activity achieved its purpose.

6.0 References

Dillon Consulting Limited. July 7, 2014. False Rue-Anemone Mitigation Plan. City of London. 16 pp.