Section 6:

Initial Efforts for Characterizing Seep Habitats within a Selected Portion of the Niagara Gorge Trail System

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Funding for this effort was provided by the New York State Office of Parks Recreation and Historic Preservation and by the Niagara River Greenway Ecological Standing Committee through a grant awarded to Buffalo Niagara Riverkeeper. Support in review of initial data was provided by Julie Lundgren, State Parks Ecologist (New York Natural Heritage Program).

Draft Seep Descriptions Provided to New York State Parks Office of Parks Recreation and Historic Preservation and the New York Natural Heritage Program for Review and Comment

Niagara Greenway Habitat Conservation Strategy Phase 2 – Initial Niagara River Corridor Seep Mapping

Introduction

Seep data in the Niagara Gorge is minimal and represented by geological and natural resource studies conducted in the recent past by academic institutions, state, and federal agencies. Many seep and surface water discharge points within the lower Niagara Gorge were the subject of contaminant sampling and pathway analysis associated with surface chemical landfills and chemical releases that have entered the substrate and eventually into the Niagara River as a combination of point and non-point source pollution.

There are numerous seep locations within the Niagara Gorge project area that have been previously identified which occur near or along the Niagara Gorge Trail System, managed by the New York State Office of Parks Recreation and Historic Preservation (OPRHP). With the exception of surveying these areas for rare, threatened, and endangered (RTE) species, no other work has been completed to support the characterization of the gorge seeps.

A prototype for a seep survey data sheet was developed to support the documentation of seep conditions, temporal and spatial characteristics, and the presence or absence of biotic and abiotic stressors. Identification of attributes and data associated with Ecological Communities of New York State that are known to occur in the project study area were/will be recorded. Binoculars and a variable power spotting scope (Nikon 20X to 60X magnification) were/will be used to record seep images during surveys. Digital photos of located seeps will be taken with close-up to telephoto lenses, as possible.

The prototype, or experimental, data sheet was used to record data from two seeps in September 2013. This effort was completed as a small portion of the Niagara River Regional Conservation Habitat Strategy being completed by Buffalo Niagara Riverkeeper (Riverkeeper), funded by the Niagara River Greenway Ecological Standing Committee.

The purpose, as discussed with Riverkeeper, Julie Lundgren (NYS Natural Heritage Program) and Meg Janis (NYS Office of Parks Recreation and Historic Preservation), is to initiate a process for more closely examining seep habitat characteristics and to document them in a fashion that resembles descriptions included in the Ecological Communities of New York State (Second Edition, January 2002).

The preliminary information collected to date and described herein is being provided to Ms. Lundgren for her review so that she may make suggestions with regards to:

- Additional data to be collected/additional measurements or observations to be made when surveying seeps in the gorge;
- Organization or content of the descriptions; and
- Any other information that would help to populate a gorge seep database that would support more detailed descriptions of seep habitats.

Upon receiving input from Ms. Lundgren, Ecology and Environment, Inc. (E & E) will re-visit the seeps previously sampled (as needed) and endeavor to map and collect data on two to four additional seeps this summer and early fall. Funding is being provided by OPRHP to complete this latter work. Ultimately, the data collected will be available to NHP, OPRHP, and will support Riverkeeper's NRRCHS work.

Seep Habitat Variables

As E & E contemplated the first field effort in September 2013, we developed a preliminary list of habitat variables that were likely prominent in describing seep habitats. The initial list of variables is provided below. We assume that the list will evolve over time as a result of further data collection. In other words, we understand that the following does not represent a comprehensive or "end all" list.

Hydrology

- Catchment Area
- Flow (Perennial, Intermittent, Ephemeral)
- Volume/Low Energy (Flow Channels, Dripping, Surface Hydration)
- Source (Rim, Cliff Face, Side Slope)
- Area of Influence
- Natural Recharge or Modified Input

Geology

- Elevation
- Stratum
- Composition (Sandstone, Limestone-Dolostone, Shale)
- NYS Ecological Community (Calcareous Cliff, Calcareous Talus Slope Woodland)
- Rock Outcrop, Ledge, or Bench

Vegetation

- Bryophytes
- Layers - Herbaceous, Shrub, Tree
- Species Assemblage
- Community

Soils/Substrates

- Smooth Cliff Face
- Fractured Cliff face with Interstitial openings
- Calcareous Talus Slope Woodland or Boulder Field

- Natural, Unconsolidated Sediment
- Fill or Unnatural Deposition

Preliminary Seep Descriptions

The initial, or "trial run", Niagara Gorge Seep Surveys were conducted on September 27, 2013, at two locations that were labeled as Seep No. 1 and Seep No. 2 through work completed for OHPRHP in 2007 through 2009. Observations occurred in Seep No. 2 first, followed by Seep No. 1.

Access and Location

Two seeps in the Niagara Gorge were surveyed on September 27, 2013, on NYS OPRHP property in the Niagara Falls State Park. Both seeps originate on the cliff face in an area south of the whirlpool and international railroad bridges. The primary access point is a trailhead under the elevated section of the Robert Moses Parkway that has a public parking area immediately south of the bridge facility. The trail descends along the cliff face to the Great Gorge Railway Trail (GGRT), which ends under the bridge facility and continues south along the old Great Gorge Railway line and up to the Gorge rim and parking area at the Gorge Discovery Center. The slope between the cliff face and the Niagara River which was crossed by the route of the old rail line has been identified as a Calcareous Talus Slope Woodland. The cliff face from the rim to the Calcareous Talus Slope Woodland has been identified by the NYSNHP as a Calcareous Cliff Community (NYSNHP 2001). Both seeps and discharge areas were first observed on the cliff face by binoculars and a spotting scope along the northern section of the GGRT prior to close-up observation. Access to the seeps is possible by climbing up from the GGRT and through the Calcareous Talus Slope Woodland community, which is comprised of loose boulders, rock aggregate and sediment (soil, coarse and fine mineral materials). A narrow ledge at the base of the cliff is passable in many sections to access each of the seep's area of influence. GPS coordinates are not currently available due to the seep's proximity to the cliff face, which limits access to GPS satellites.

Draft Description - Seep No. 2

See the field data sheet in Attachment 1as well as summary text below.

Physical Characteristics

Seep 2 is a perennial, low energy seep that has a consistent low flow discharge in the form of surface rock hydration and trickling or drip flow from rock outcrops below the smooth cliff face. The rock face is irregular but generally smooth in the upper portions with angular, fractured rock outcrops below that redirect flow and capillary moisture horizontally. There are multiple points of discharge from seams in platy rocks that moves across smooth rock face above the larger, fractured rock below. There is significant dripping from the angular rocks directly to narrow ledges or benches below without organized flow channels. Although some volume appears to enter the soil and sediment profile below the exposed rock face, water also migrates down slope through the Calcareous Talus Slope Woodland in a well-formed, eroded conveyance sluice or down-slope drainage. Numerous narrow ledges, fractures, and benches and small, shallow slope features have accumulated mineral and organic sediments eroded from the cliff face parent rock material or supplied by falling material from areas above, or wind. The benches and slopes are moist-to-fully hydrated and support herbaceous and some shrubby/woody vegetation during the

growing season. This hydrated ledge and slope complex allows seep moisture to wick and in some areas drip from overhang rocks and talus directly into the woodland. Water that percolates into side slope soils resurfaces at numerous points along the slope in a vertical pattern with little horizontal expansion to either side. Moisture and at times of greater discharge, surface water can be observed flowing over the GGRT trail tread to a steeper talus slope and into the Niagara River.

Groundwater recharge and subsequent seep discharge is subject to land use, road drainage, and other forms of landscape development along the gorge rim and inland. Additional information is required to determine catchment or capture areas for these seeps.

Seep discharge is undetectable on cliff faces and talus slopes in years or drought or when precipitation is below normal. Moss communities as well as other plants in this seep have exhibited severe die back or fail to regenerate by seed or vegetative propagation due to desiccation during hot, dry growing seasons. Aspect, rock face morphometry, and local vegetation growth provide direct shade to the westward facing cliff surface during morning hours; thermal loading during afternoon periods, combined with wind and low flow, can desiccate rock surfaces and plant communities. There is a routine cycle of disturbance in the form of varying degrees of hydration (or lack thereof), bench or ledge collapse, rock fall, and infestation by invasive plant species. This seep is subject to extensive ice buildup during winter, dormant conditions. Seep ice collapse occurs due to weight and normal thawing processes has disturbed benches and some side slope surfaces in normal winters; plant communities on the cliff face and angular rock outcrops have been observed to be resilient. Although seep ice collapse has disturbed plant communities on ledges and some side slope surfaces in normal winters, plant communities on the cliff face and angular rock outcrops survive essentially intact with the exception of some spalling of fractured rock and loss of attached moss and other vegetation. Although physically destructive, the seep freeze and thaw regime could be part of seed or propagule dispersal mechanism where plant communities can expand across the seep area of influence.

Seep Area of Influence

The exposed cliff face is hydrated over an area of approximately 20- to 30 feet in height and 80 feet wide, with discharge beginning approximately 6 feet from the rim. The wetter portion of the rock face is in the lower half which broadens as it descends to the ledges, benches and into the substrate of the Calcareous Talus Slope Woodland (see sketch of side angle view). Seep flow is diffuse along the rock face but becomes organized during higher flow periods along the saddle shaped drainage formation that flows down the steep slope toward the GGRT and Niagara River. Total length of this seep is variable based on seasonal precipitation and surface occurrence within the Calcareous Talus Slope Woodland. At times there is evidence of seep flow and saturation of surface rock and sediment in areas 100 feet to 200 feet below the base of the cliff.

Vegetation

Plant communities are present and cover approximately 50% of the cliff face within and around the extent of this seep. Individual plants associated with seams or interstices mature and persist through extreme freeze-thaw cycles during winter months. Up to 100% coverage occurs in areas where moist angular platy rocks collect mineral and organic material and on ledges or benches. It is along these hydrated (saturated to moist) areas where herbaceous plants and bryophytes are

dominant and abundant. All cover types (herbs, shrubs and trees) are represented around the seeps, with some shrubs and tree saplings occurring upslope of the wettest areas, along the peripheral fringes, and in the general woodland slope community. One of the RTE plant species identified along the Niagara Gorge Trail System – the lesser fringed gentian (*Gentianopsis virgata*) – was observed on the narrow ledges, fracture planes, and in the interstices of platy rock that receive water via trickling and dripping flows that are characterized by mineral – organic substrates and moss communities.

Invasive plant communities within Seep No. 2 include purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*). Common reed is the primary threat to native plant communities and especially the RTE species that occur on moist ledges or benches when sediment accumulates as well as saturated slopes below the cliff face in this seep.

Common nearby overstory and talus slope woodland species include sugar maple, Norway maple, and box elder. Other tree and shrub species include white ash, bush honeysuckle, and American hop hornbeam (see field data sheet in Attachment 1).

More taxonomic work needs to be completed to describe species composition, especially the grasses, herbs, and forbs found within the wettest areas.

Draft Description - Seep No. 1

See the field data sheet in Attachment 1as well as summary text below.

Physical Characteristics

Seep 1 is a large, perennial low energy seep that has perennial drip or trickle discharge. The rock face is smooth in the upper portions with discharge from horizontal seams that flow down into angular, fractured rock outcrops below that redirect flow to narrow ledges or benches below. There are multiple points of discharge from seams in platy rocks that moves across smooth rock face above the larger, fractured rock below. The area of saturation is broad without organized flow channels. As in Seep No. 2, the narrow benches and small, shallow slope features support sediment and small aggregate eroded from the cliff face parent rock material. Seep No. 1 flow regime is similar to that of Seep No. 2 with the exception of its aerial extent. More surface area is hydrated by discharge across more flat cliff face surface and less angular rock outcrops in this seep. Hydrated seams and narrow interstices are more numerous across the cliff face in this seep. Most volume appears to be discharged from seams on the rim and fractured rock outcrops below the smooth cliff face above the Calcareous Talus Slope Woodland. Some water migrates through platy rocks in areas where the cliff face joins the talus or boulder field and moves through the substrate to the Calcareous Talus Slope Woodland below. Below the cliff face and bench complex, seep flow percolates into the substrate of the talus slope and resurfaces at numerous points along the slope in a vertical pattern with little horizontal expansion to either side. Moisture and at times of higher discharge, surface water can be observed on the GGRT, which wicks and sometimes flows across the trail tread to a steeper Calcareous Talus Slope Woodland and into the river.

Consistent with many Niagara Gorge seeps previously observed, the water budget of Seep No. 1 is variable and dependent on rainfall recharge of the water table and groundwater hydraulic flow within a seep catchment or capture area. This variability was noted in this seep during plant

surveys in 2008 and 2009 conducted for the NYS OPRHP in preparation for gorge rock scaling. During the surveys it was been observed that seep discharge can be undetectable on cliff faces and talus slopes in years or drought or when precipitation is below normal. It was observed that moss communities and other plants exhibited die back or failed to regenerate by seed or vegetative propagation due to desiccation during hot, dry growing seasons.

Aspect provides direct shade to the wet facing cliff surface during morning hours; thermal loading during afternoon periods combined with wind and low flow can desiccate rock surfaces and plant communities. Conversely, perennial seeps are subject to massive ice buildup in winter conditions. Seep ice collapse occurs due to weight and normal thawing processes. Although seep ice collapse has disturbed benches and some side slope surfaces in normal winters, plant communities on the cliff face and angular rock outcrops have been observed to be resilient. Most survive essentially intact with the exception of some spalling of fractured rock and loss of attached moss and other vegetation. Although physically destructive, the seep freeze and thaw regime could be part of seed or propagule dispersal mechanism where plant communities can expand across the seep area of influence.

Seep Area of Influence

Seep No. 1 covers the exposed cliff face which is approximately 20 feet in height with discharge beginning approximately 6 feet from the rim. Length of this seep is approximately 165 feet and with distinct vertical undulations in the rock face above the Calcareous Talus Slope Woodland. The wetter portion of the rock face is in the upper half which narrows as it descends to the fractured and platy rock area above the benches and talus slope. There is a bowl or saddle shaped formation near the southern end of Seep No. 1. This feature is an opening with full sun exposure at mid-day. Sheet flow and trickle or dripping was observed across this steep slope of small fractured rock mixed with smaller aggregate and hydrated sediment. Surface flow percolates into the substrate of the talus slope and resurfaces near the GGRT before becoming subterranean and moving down the slope towards the river. Total length of this seep is variable based on seasonal precipitation and surface occurrence within the Calcareous Talus Slope Woodland. Qualitative observations suggest that seep flow and saturation of surface soils occurs in areas 100 feet to 200 feet below the base of the cliff.

Vegetation

Plant communities on the smooth cliff face in Seep No. 1 are sparse or limited to individual plants and associated with seams or interstices where roots have penetrated and persist through extreme freeze thaw cycles during winter months. Moss represents 50% to 100% coverage and occurs in areas where moist angular platy rocks collect sediment as well as numerous small ledges or benches that occur at the base of the cliff face and in areas above the Calcareous Talus Slope Woodland below. The thickness of moss “mats” has been observed to be approximately 1 inch to 8 inches thick and composed of living and dead plant tissue. Hydrated moss supports a number of herbaceous species including rare, threatened, and endangered (RTE) plants. All cover types (herbs, shrubs and trees) are represented in Seep No. however, moss communities and herbaceous plant associations are dominant. RTE plant species (elk sedge [*Carex garberii*] and lesser fringed gentian [*Gentianopsis virgate*]) are found in hydrated to trickling or dripping flows in sediment and moss communities within interstices of fractured rocks, benches and, to lesser extent, on narrow seams on moist cliff faces.

Invasive plant communities are well established within Seep No. 2. Invasive plant species in Seep No. 2 include purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*). Common reed is the primary threat to native plant communities in this seep and especially the RTE species that occur on moist ledges or benches. Expansion of these invasive plants has been observed since initial data collection in 2008.

Attachment 1

Field Data Sheets

Lower Niagara River Seep Mapping

Niagara County, New York

E & E Surveyors: K. Erickson, P. Fuhrmann

Seep ID	Survey Date	Landscape Position	Exposure *	Aspect	Flow**	Cover Type	Stressors
"Seep 1"	09/27/13	High on gorge wall where exposed rock face become vertical	Filtered light to shady	Westerly	Low energy, dripping	Within forested cover type	Invasive species, rock fall, ice (freeze – thaw)

***** **F – Full Sun, FLT - Filtered Sun, S – Shade**

****** **P – Perennial, I - Intermittent, E - Ephemeral**

Seep and Plant Community Description

Seep Geology and Strata - Cliff Face limestone with sandstone outcrops. The seep occurs along the exposed rock wall that is approximately 20' – 30' in height. The wetted rock face is between approximately 12 feet to 20 feet above the point of where the exposed rock wall emerges from the side slope soils. Rock wall morphometry creates differences in water flow/drip characteristics (see sketches). The overall morphometry or shape of the rock wall also influences the character of areas below. There are variable width "shelves" or benches near where the exposed rock face meets the side slope. These have been created by years of rock fall, soil and organic material falling over the rock face rim, which in turn has provided surfaces where plant have been able to become established. The receiving drip zone area containing mosses and herbaceous plants ranges from 3' to 8' feet in wetted height. Total length of seep was measured to be approximately 165 feet at base.

Description of Hydrology – Hydrology is low flow, weeping, dripping seam discharge. Seams seem to originate from rock layer transition. There are no distinct flow channels across the rock face. Water source unknown. Water both flows over smooth rock face and drips off of platy rock and shelves, falling on the narrow ledge that extends toward the slope, just above the slope-soil line (see sketch). It appears that flow and permanence of flow along this seep expanse is due to variability of rock and seam morphometry and organization and thus the ability to discharge and/or convey water.

Plant Community Characteristics (% Cover, Health, Invasive Species) – Vegetation growth does not occur on smooth rock face portion of seep. Scattered vegetation occurs within cracks and on ledges, shelves, and other surfaces where organic-mineral-soil substrate has accumulated over time, providing a growth medium and medium for root growth and penetration. The medium allows for mosses, grasses, Phragmites, and other plant growth on narrow and small ledges. The width and/or depth of the small shelves appear to influence the depth of the moss and organic-mineral-soil substrate. Depths of the material were noted to be <1" to 2" – 4" thick.

Presence of vegetation influenced by rock face structure and light exposure. Lines of Aster

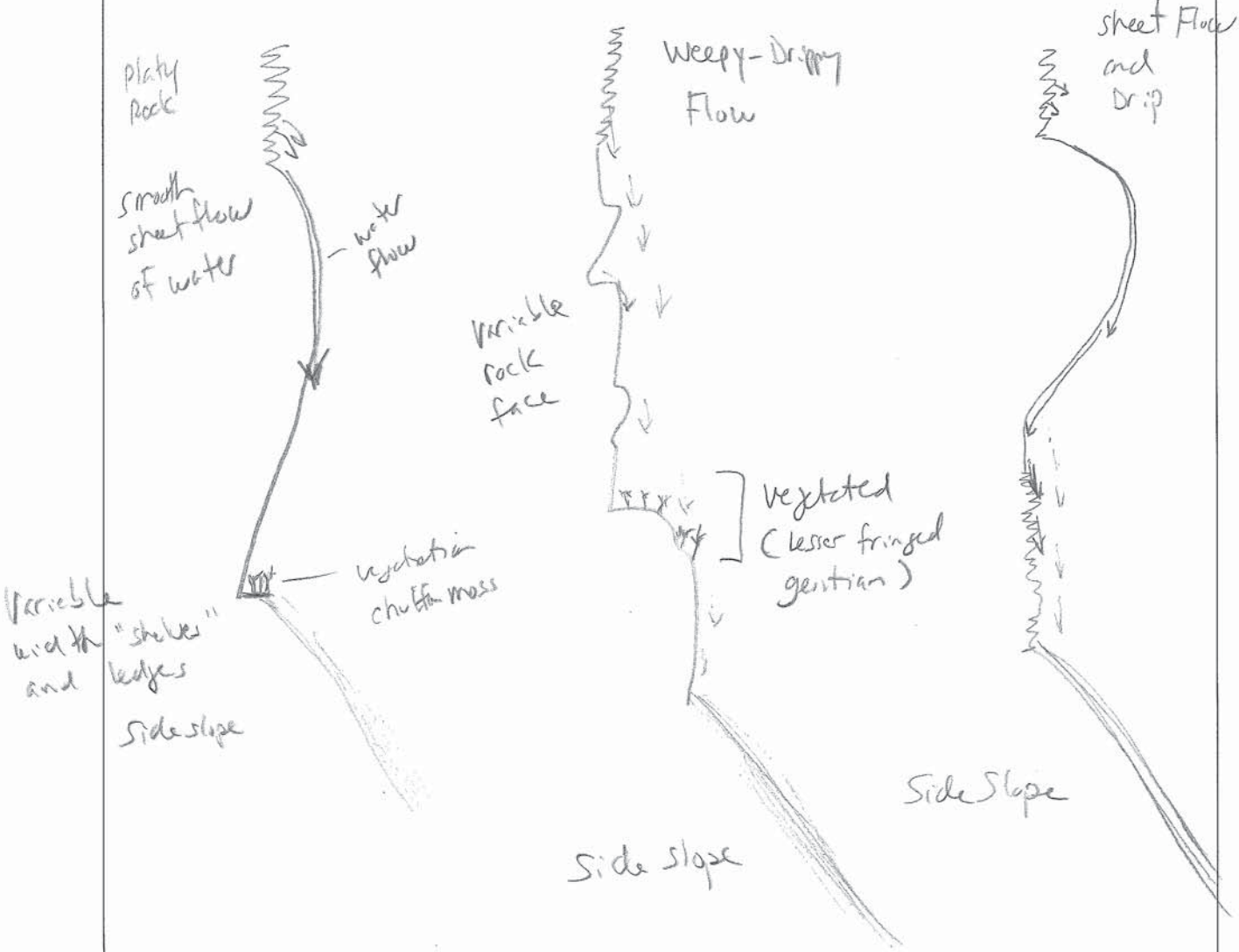
sp. growth follow seam discharge line. Greater permanence and availability of water seems to influence greater numbers of plants. Plant growth within the seep is predominantly herbaceous with shrubby trees (Sumac) located on higher and drier areas on the rock face. Species on the rock face included bent grass, Phragmites, purple loosestrife, Aster sp., stag horn sumac, and a common buckthorn tree at the base.
The side slope immediately adjacent and below the exposed rock face is densely vegetated. Species in this zone include Norway maple, Roundleaf dogwood, multiflora rose, Prunus sp., green ash, riverbank grape, and zig zag goldenrod. Lesser fringed gentian occurs on small, wet ledges and shelves within drip line and grasses (bent grass, to be identified), occurring on lowest portion of exposed rock face in moss substrate. > 20 gentians observed. Seems to grow in association with the grass species.
Dense Phragmites patch on shelf where there is abundance of direct sunlight.

Stressors, Disturbance – freeze – thaw cycle, rock fall, invasive species

Observed Plant Species			
Botanical Name	**Common Name**	**Layer***	**Invasive**
Box elder	*Acer negundo*	T	
Norway maple	*Acer platanoides*	T	
Sugar maple	*Acer saccharum*	T	
Roundleaf dogwood	*Cornus rugosa*	T	
White ash	*Fraxinus americana*	T	
American hop hornbeam	*Ostrya virginiana*	T	
Bush honeysuckle	*Lonicera spp.*	S	✓
Multiflora rose	*Rosa multifora*	S	✓
Poison ivy	*Toxicodendron radicans*	V	
Riverbank grape	*Vitis riparia*	V	
Aster	*Aster sp.*	H	
Lesser fringed gentian	*Gentianopsis virgata*	H	
Grass			✓
Purple loosestrife	*Lythrum salicaria*	H	✓
Common reed	*Phragmites australis*	H	✓
Kentucky bluegrass	*Poa Pratensis*	H	
Zigzag goldenrod	*Solidago flexicaulis*	H	
Moss species/Bryophytes			
*** T – Tree, S – Shrub, V- Vine, H - Herb**			

Notes:

Field Sketch: Seep 1



Vertical heights of wetted rock face ~ 12'-20'

Various side views of rock face in Seep 1.

Lower Niagara River Seep Mapping

Niagara County, New York

E & E Surveyors: K. Erickson, P. Fuhrmann

Seep ID	Survey Date	Landscape Position	Exposure *	Aspect	Flow**	Cover Type	Stressors
"Seep 2"	09/27/13	High on slope where exposed rock face become vertical	FLT, Filtered light due to adjacent woodland tree canopy	Westerly	P – I, appears to be perennial, may be intermittent in driest of years; low energy, dripping	Within forested cover type	Invasive species, rock fall, ice (freeze – thaw)

* **F – Full Sun, FLT - Filtered Sun, S – Shade**

** **P – Perennial, I - Intermittent, E - Ephemeral**

Seep and Plant Community Description

Seep Geology and Strata - Cliff Face Limestone with smooth surface, sandstone strata with platy or angular rock outcrops below limestone. The seep occurs along the exposed rock wall that is approximately 20' – 30' in height. Due to the rock morphometry the wet rock face is limited to the upper portions of the wall, from top to approximately 6' below the "local" rim. The receiving drip zone area containing mosses and herbaceous plants ranges from 5' to 7' feet in wetted height. See hand drawn sketch.

Description of Hydrology – Hydrology is low flow, weeping, dripping. There are no channels across the rock face. Water source unknown; water flows over the rim of the cantilevered rock face. Assume seam discharge from platy rock stratum that flows in sheet flow fashion across the smooth rock face and into the gorge slope. Because of the angle of cantilevered rock, most water drips down onto the side slope within the gorge than flowing down the entire rock face (see sketch). In the downstream direction and portion of the seep, flow discharges from platy rock seams.

Plant Community Characteristics (% Cover, Health, Invasive Species) – well-established moss community in hydrated sediments and moist rock faces with diverse herbaceous plant community. Common reed is expanding rapidly in this seep and expected to be the dominant species in the near future. No vegetation on smooth rock face and along the inverted rock face below the overhanging rim (see sketch). Plants occurring where there are angles, fracture, small ledges, water, and growth medium. Most of the vegetation occurs at the margin where the talus slope meets the lower part of the exposed gorge wall.

The area in general is shaded by woodland trees – some trees are directly adjacent to the rock face.

Stressors, Disturbance – freeze – thaw cycle, rock fall, invasive species

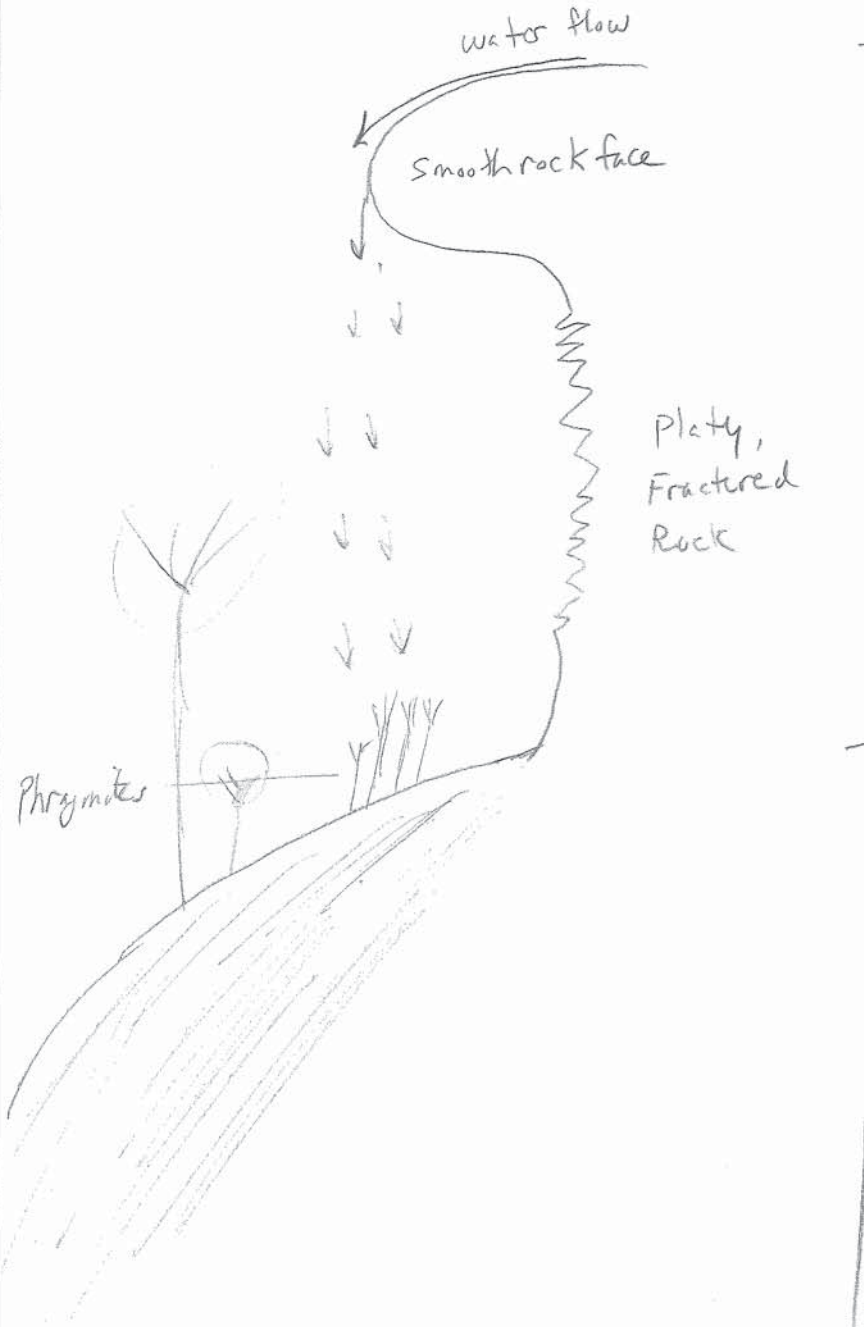
Observed Plant Species

Botanical Name	Common Name	Layer*	Invasive
Box elder	*Acer negundo*	T	
Norway maple	*Acer platanoides*	T	
Sugar maple	*Acer saccharum*	T	
Roundleaf dogwood	*Cornus rugosa*	T	
White ash	*Fraxinus americana*	T	
American hop hornbeam	*Ostrya virginiana*	T	
Bush honeysuckle	*Lonicera spp.*	S	✓
Multiflora rose	*Rosa multifora*	S	✓
Poison ivy	*Toxicodendron radicans*	V	
Riverbank grape	*Vitis riparia*	V	
Aster	*Aster sp.*	H	
Purple loosestrife	*Lythrum salicaria*	H	✓
Common reed	*Phragmites australis*	H	✓
Kentucky bluegrass	*Poa pratensis*	H	
Zigzag goldenrod	*Solidago flexicaulis*	H	
Moss species/Bryophytes			

*** T – Tree, S – Shrub, V- Vine, H - Herb**

Notes:

Field Sketch: Seep 2



Side view of rock face in Seep 2.

Attachment 2

Photos of Seep 1 and Seep 2

Photo 1: Seep 1 facing cliff base from talus slope woodland above the Great Gorge Railway Trail.

Photo 2: Seep No. 1 at cliff base from upper talus slope above the Great Gorge Railway Trail.

Photo 3: Seep No. 2 at cliff base from talus slope woodland along above the Great Gorge Railway Trail.