Goose Bay Water Flow Study

Prepared For:

Goose Bay Reclamation Corporation
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Prepared By:

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July 10, 2014

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Executive Summary: Eurasian water-milfoil (*Myriophyllum spicatum*), a submerged aquatic invasive plant, has significantly altered the character of Goose Bay, New York. After careful consideration of the spectrum of potential management options, Goose Bay Reclamation Corporation (GBRC) considers the application of herbicide the technique most likely to be successful in controlling aquatic invasives in the Bay. GBRC is proposing an herbicide application pilot test of approximately 25 acres to initiate and further evaluate this method. New York State Department of Environmental Conservation (NYSDEC) has requested a water flow study to be included within this permit applications necessary to permit herbicide application in the Bay. It was determined in consultation with NYSDEC that an application of fluorescent dye within the proposed pilot test area followed by visual observations and sampling for dye concentrations and water flow velocities throughout Goose Bay and just outside its mouth would accomplish study objectives.

The three elements of the water flow study; visual dye observations, fluorescence concentrations, and water flow velocities; indicated that Goose Bay, especially in and around the proposed application area, is relatively free of directed water flow in the absence of significant wind. Dye plumes were observed slowly moving in the direction of the wind. Light visual dye signals could be observed in the application area ~21 hours post dye application. Fluorescence concentrations remained elevated in the proposed application area more than 24 hours post-dye application. Elevated concentrations were only recorded immediately adjacent to and downwind of the application area on Day 2 of the study. Water velocities were slow and shifted in direction over time depending on prevailing winds.

These data indicate that Goose Bay is a wind driven system absent substantial current when winds are calm.

1.0 Introduction

Goose Bay Reclamation Corporation's (GBRC) mission includes controlling and eradicating aquatic invasive species, particularly Eurasian water-milfoil (*Myriophyllum spicatum*) from Goose Bay, Jefferson County, New York (Figure 1). Aquatic invasives have significantly altered the character of the Bay, displacing native plants and significantly reducing fishing and other recreation opportunities for residents and visitors. Exactly how this invasion has affected the Bay's ecology (i.e. fishery production, wildlife usage, water quality parameters, etc.) is unknown.

After careful consideration of the spectrum of potential management options, GBRC currently considers the application of herbicide the technique most likely to be successful in controlling aquatic invasives in the Bay. GBRC is proposing an herbicide application pilot test of approximately 25 acres to initiate and further evaluate this method. Introduction of herbicide into Goose Bay will require a New York State Department of Environmental Protection (NYSDEC) Aquatic Pesticide Permit (Article 15 Part 327) among other permits. NYSDEC has requested a "water flow" study to be included within this permit application as a condition of permit approval.

1.1 Project Objectives

The intent of this water flow study is to generally characterize the water flow within the proposed pilot treatment area (Figure 2) and Goose Bay at large to support the permitting and planning of the pilot test. The objectives of the study were to collect data characterizing the following:

- The short term scale of hydrological connectivity of Goose Bay to the main stem of the St. Lawrence River;
- General water flow and residence time within the proposed application area which may contribute to the selection of herbicide type and inform application methods; and
- Whether Goose Bay can be considered "quiescent" as prescribed on certain herbicide labels.

2.0 Methods

Parkes Ecological developed study methodologies in consultation with GBRC, NYSDEC staff, other experts, and standard references. We determined that an application of fluorescent dye within the proposed pilot test area followed by sampling for dye concentrations and water flow velocities throughout Goose Bay and just outside its mouth, in combination with visual dye observations, would accomplish study objectives. It was also determined that the dye should be applied when winds were calm (<~12 mph) and no significant precipitation was forecasted as any herbicide application should be applied under similar conditions.

This study was originally planned to be completed in November 2013. At that time 27 points were planned to be sampled for fluorometric concentration and water flow velocity. On November 21st, 2013, 23 of these points were sampled. However, ice within the proposed treatment area precluded dye introduction and the study was postponed until Spring 2014. A summary of the Fall 2013 effort can be found in Appendix A.

2.1 Fluorescence

Using fluorescent dye is advantageous because at high concentrations it provides a visible signal while lower concentrations of fluorescence can be easily detected using a fluorometer (USEPA 2009). The fluorescent dye Rhodamine WT is commonly used in aquatic flow studies because it's water soluble, highly detectable, harmless, and reasonably stable in normal water environments (Wilson et al. 1986). It degrades via exposure to sunlight in 2- 5 days.

A primary technique used to evaluate the direction and scale of flow was to visually observe the intensity of the dye coloration and where it traveled after its introduction. Rhodamine WT provides a strong visible signal at concentrations >~1000 ppb and a light visible signal until concentrations fall below ~100 ppb in turbid waters, down to ~10 ppb in perfectly clear water (Table 1, Kingscote Chemicals 2013). The volume of water within the treatment area (~25 acres at an approximate average depth of 3 feet) is estimated at 977,559 gallons. The manufacturers of the fluorometer (Turner Designs: Cyclops- 7 Optical Rhodamine Dye Tracer) guarantee fluorescence detections to concentrations of 0.01 ppb. Therefore the uniform dye concentrations of one gallon of dye would produce a light visual signal over a majority of the proposed application area and a measurable signal throughout the majority of the Bay.

Table 1: Gallons of water one gallon of Rhodamine WT dye will treat to various concentrations of fluorescence.

Strong visual (>1000 ppb)	Light visual (~100 ppb)	Visual limit (~10 ppb)	Detection limit (~0.01 ppb)
25,000	250,000	2.5 M	2,500 M

One gallon of concentrated fluorometric dye (Bright Dyes FWT Red 25 Liquid) was separated into quarts and introduced at four points into the proposed pilot test area along a transect (A1-A4, Figure 2). These plumes were then visually observed regarding their color intensity and movement.

A sampling plan modified from what was utilized in November 2013 was employed in consultation with NYSDEC. This modified plan specified sampling for fluorescence concentrations and water flow velocities at the dye introduction points and 13 additional points of over the two days (n=17). Samples were collected at a depth of approximately 1.5 ft. below the surface of the water. A subset of points was sampled for both parameters prior dye introduction to achieve baseline measurements. The fluorometer was calibrated at the beginning of each day using deionized water.

Sampling intensity at individual points was modified in real time considering visual dye observations and fluorescence concentration readings. Therefore, it was expected that more sampling effort would be applied at points near the proposed pilot test area and then further away as warranted. Sampling points more distant from the application area were sampled once daily, at minimum.

Dye concentrations (point data) were evaluated by grouping sampling points into four groups for comparison; within the application area, directly adjacent to the application area, within the Bay but away from the application area, and outside of the Bay (Figure 3).

2.2 Water Velocity

Water velocity was measured using an OTT MF Pro Flow Meter. Meters of this type are normally employed in systems where the general direction of water flow is rather obvious (i.e. there is an observable current traveling in a specific direction). Goose Bay doesn't exhibit an obvious directed current, rather the water appears to flow in whatever direction the wind pushes it.

To determine whether the water was flowing and in which direction, the water flow velocity meter was first positioned to record flow in direction of the prevailing wind direction. Then the meter was rotated 90, 180, and 270 degrees until the largest observed velocity was reached and then recorded to the nearest 0.1 ft. /s. Direction of flow was estimate to the closest degree using a compass.

3.0 Results and Discussion

The study was conducted during the daylight hours of June 7 and 8, 2014. Skies were mostly clear both days and there was no precipitation during sampling (Appendix B: Project Photos). Winds were calm (<10 mph) and variable in direction. The wind was out of the northeast the morning of the 7th before changing to the southwest in late morning. The wind was out of the northeast on the 8th. Water temperatures were between 58° and 62°F depending on the time of day and depth. Air temperature varied between 52° and 75°F, including nighttime low temperatures.

Baseline sampling was conducted between 0800 and 1100 on June 7. Dye application began at 1100 on June 7. Sampling continued until 1600 on Day 1. Sampling was conducted from 0800 to 1300 on Day 2. Our work was observed by Rob Freese, NYSDEC Pesticide Control Specialist, between approximately 1000 and 1230 on June 7.

3.1 Visual Dye Observations

Four distinct highly visible plumes were observed for the first hour post-dye application. These plumes moved slowly to the north and east until reaching shore, likely pushed there by the prevailing southwest wind. The plumes became less distinct and lighter in color as they spread along the shoreline or disappeared into the marsh north and east of A4. Upon arrival on the morning of Day 2 a light visible signal could still be observed along the shoreline to the east of A3. No visible dye observations were made outside of the application area on either day.

3.2 Fluorescence Concentrations

Mean fluorescence concentrations grouped by area and categorized before dye application (Baseline), Day 1 after dye application (Day 1), and Day 2 are summarized in Table 2 and given in full in Appendix C.

Table 2: Mean Fluorescence Concentrations (ppb)

Area	*Baseline*	*Day 1*	*Day 2*
Application Area (AA)	96±69	1389±3125	148±56
Adjacent to AA	59±21	46±15	75±45
Other points within the Bay	29±22	16±13	33±24
Outside the Bay	6.5±0.7	5.0±1	6.0±1.4

Collecting baseline measurements before introducing the dye was necessary because some aquatic plants release fluorometric compounds. Baseline concentrations were highest within the application area likely because of the density of aquatic plants found there. Baseline concentrations were much lower outside the Bay likely due to increasing water depth and a lack of vegetation.

As expected, the highest fluorescence concentrations were recorded within the application area. These were highly variable on Day 1 with the highest/lowest recorded concentrations being 12,500 ppb and 50 ppb respectively. Additional data were collected closer to shore to further document the visual dye observations (Figure 4). There was no evidence from fluorometric concentrations that the dye drifted outside the application area during Day 1 (1100-1600). Fluorescence concentrations trended lower outside the application area throughout the day, potentially due to their breakdown via sunlight.

On Day 2 concentrations within the application area remained elevated when compared with baseline, but were much less intense and variable than Day 1. The highest concentration was 230 ppb (A2') and concentrations were generally higher in the southwestern portion of the area. The lowest concentration in the area was 48 ppb (AA5) and concentrations were generally lower in the northern sampling points. This was likely due to a shift in wind direction from southwest to northeast overnight.

Concentrations were slightly higher adjacent to the application area on Day 2 than on the previous day due to high readings at B2 (150 ppb) and AA2 (100 ppb) further suggesting drifting to the south and west due to wind generated current. There was no evidence of elevated fluorescence concentrations in other parts of the Bay or outside the Bay.

3.3 Water Velocity

Water velocities were difficult to measure due to the lack of a distinct current. At the majority of velocity sampling points a clear direction of flow could not be ascertained as the meter would either read very low velocities (<0.05 ft./s) and/or would jump between positive and negative readings. In these cases a velocity of 0.0 ft. /s was recorded. 0.1 ft. /s was recorded where significant velocities were observed (>0.05 ft. /s, <0.15ft/s). One reading of flow was recorded greater than this outside of the Bay (0.3 ft. /s). Significant velocities that were recorded changed direction over time, seemingly in correlation with wind direction.

Table 3: Water Velocity Summary: max velocity (ft. /s) (direction of flow)

Area	Baseline	Day 1	Day 2
Application Area (AA)	0.1 (235°)	0.1 (75°)	0.1 (237°)
Adjacent to AA	0.1 (235°)	0.1 (75°)	0.1 (233°)
Other points within the Bay	0.1 (270°)	0.1 (87°)	0.1 (250°)
Outside the Bay	0.0	0.3 (60°)	0.0

4.0 Conclusion

The three elements of the water flow study; visual dye observations, fluorescence concentrations, and water flow velocities; indicate that Goose Bay, especially in and around the proposed application area, is relatively free of directed water flow (e.g. is a quiescent body) in the absence of significant wind. Dye plumes were observed slowly moving in the direction of the wind. Light visual dye signals could be observed in the application area ~21 hours post dye application. Fluorescence concentrations remained elevated in the proposed application area more than 24 hours post-dye application suggesting a lack of flushing. Elevated concentrations were only recorded immediately adjacent to and downwind of the application area on Day 2. Water velocities were slow and shifted in direction over time depending on prevailing winds.

These data suggest that Goose Bay is a wind driven system absent substantial current when winds are calm.

5.0 References

Kingscote Chemicals. 2013. Water Tracing Dye FWT Products: Technical Data Bulletin (http://www.brightdyes.com/technical/TDBRed.pdf). Accessed June 2014.

USEPA 2009 (Revised 2013). Operating Procedures: Dye Tracer Measurements (SEDPROC-514-R1). Athens, Georgia. U.S. Environmental Protection Agency Science and Ecosystem Support Division.

Wilson Jr., J.F., E.D. Cobb, and F.A. Kilpatrick. 1986. Chapter A12: Fluorometric Procedures for Dye Tracing. *In* Applications of Hydraulics, Book 3. U.S. Government Printing Office, Washington D.C.

FIGURES

Figure 1: Location of Goose Bay, Jefferson County, New York

Figure 2: Goose Bay Sampling Plan, Spring 2014

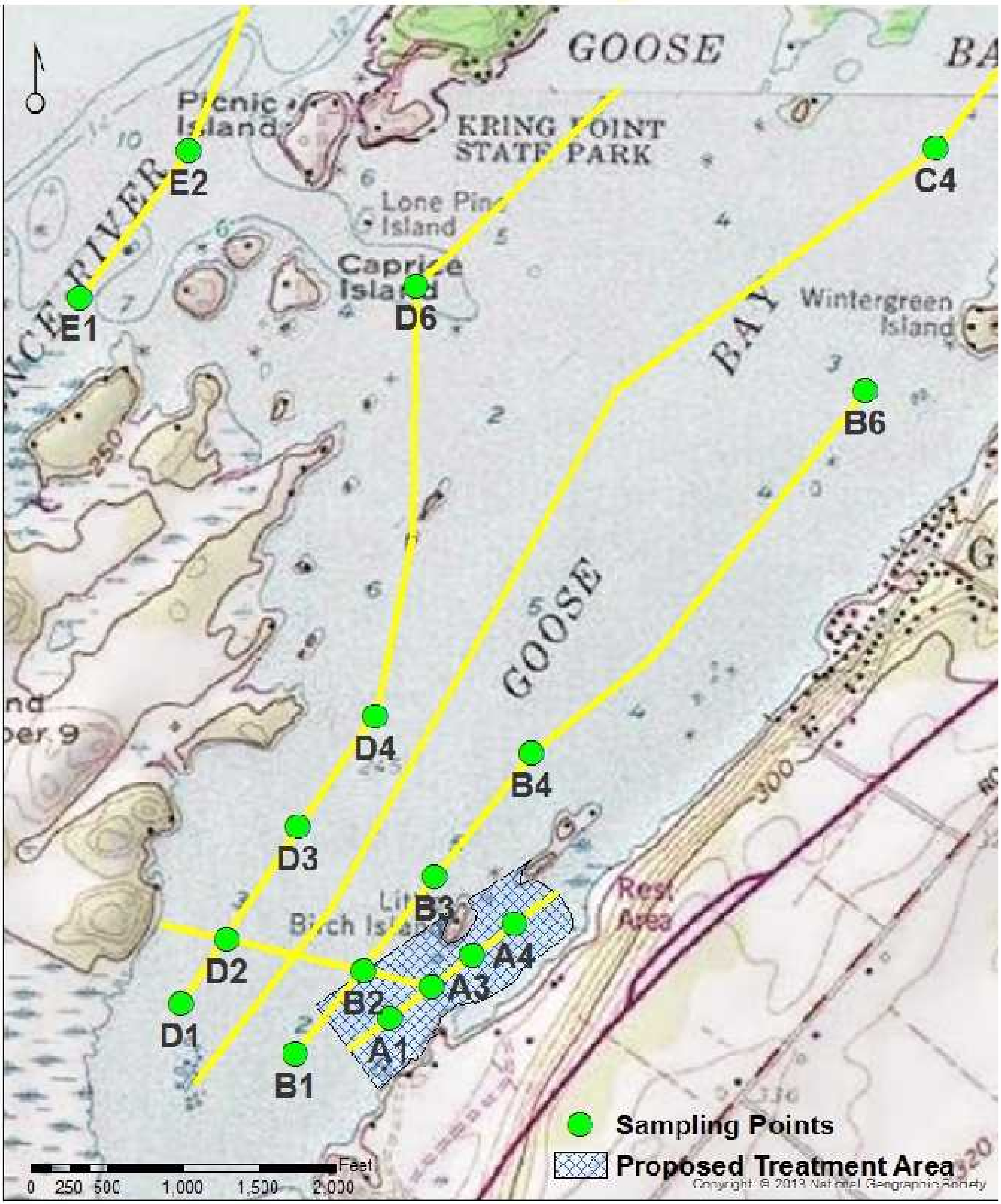

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Figure 3: Categories of sampling points for anayisis

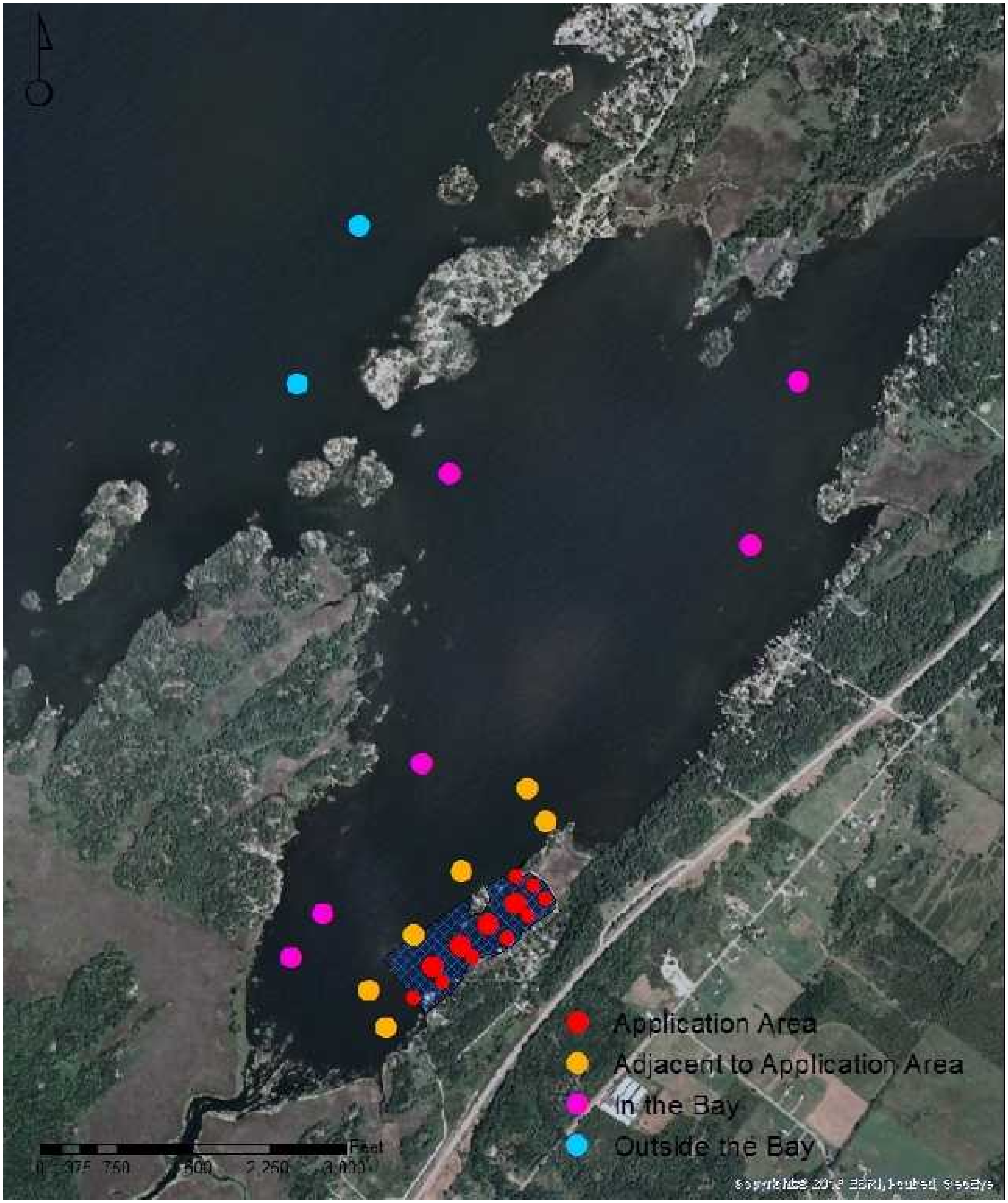
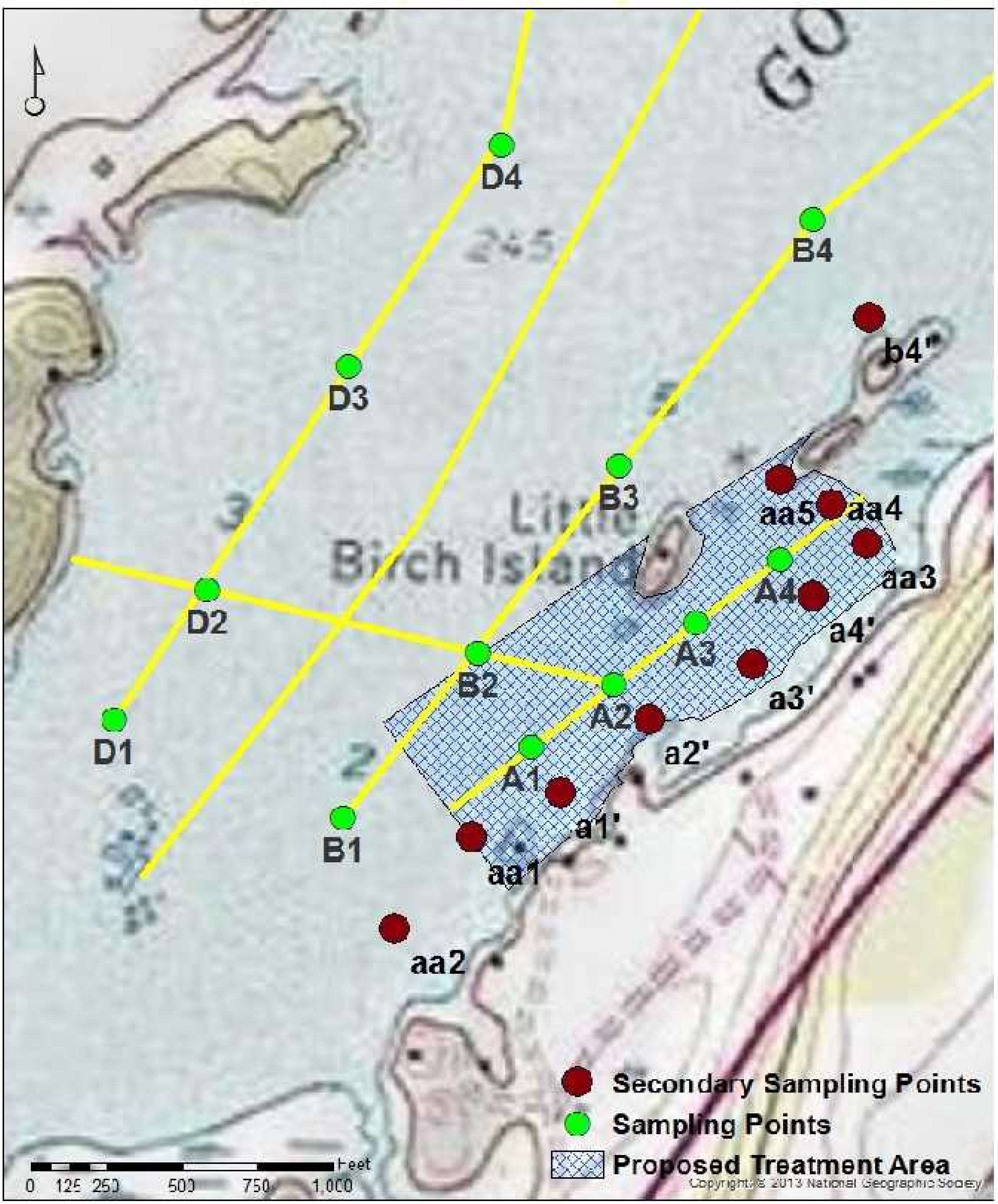


Figure 4: Secondary sampling points used to track plume migration.



APPENDIX A: November 2013 Field Summary

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MEMORANDUM

January 14, 2014

Goose Bay Water Flow Study

To: Robert Lamoureux, GBRC President

From: Michael Parkes, Parkes Ecological LLC

RE: Summary of Field Work; November 21 2013

Introduction:

This memorandum is a summary of Parkes Ecological LLC's field work to date for the Goose Bay Reclamation Corporation (GBRC). This study is designed to support of GBRC's anticipated permit submission for herbicide application to the New York Department of Environmental Conservation (NYSDEC) in the spring of 2014.

The field work completed thus far was initiated after review, revision, and approval of general study protocols by NYSDEC staff (Rob Freese, Pesticide Control Specialist) and GBRC board members. Consultation with NYSDEC staff included a conference call and follow up e-mails incorporating their comments into the proposed sampling plan (Figure 1) and study procedures.

Through this consultation it was agreed that the objectives of the water flow study were to collect data to better characterize the following:

- The hydrological connectivity of Goose Bay to the main stem of the St. Lawrence River;
- Water flow and residence time in the Bay which would likely inform the selection of herbicide and the methodology for its application; and
- Which property owners would require notification of herbicide application as part of public noticing during the permitting process.

Parkes Ecological proposed the following tasks to meet these objectives:

- Introduction of fluorometric dye (rhodamine WT, hereafter rhodamine) into Goose Bay within the proposed pilot test area;
- Measurement of dye concentrations within and outside the Bay over two days;
- Measurement of water current velocity of the two main creeks that connect the Bay to the surrounding watershed; and

- Presentation of analysis, results, and conclusions in a short report to be provided to NYSDEC as part of GBRC's permit application.

Methods:

More detailed descriptions of these methods will be provided in the final study report to be completed in spring 2014.

Parkes Ecological mobilized equipment (e.g. boat, monitoring equipment, GPS, dye, safety equipment, etc.) and staff to Goose Bay on the morning of November 21, 2013. We arrived at 0800 to find a layer of skim ice at the boat launch. The skies were partly cloudy, air temperature was 31° F, and winds were out of the southwest at approximately 0-5 mph. Winds remained out of the southwest the entire day, gradually increasing to approximately 15 mph. The water temperature averaged approximately $3.0^{\circ}C$ within the Bay and $7.5^{\circ}C$ in the river proper.

We were able to launch the boat, break through this ice, and approach within 150 ft. of the area where dye was planned to be introduced (Figure 1, Transect A). However the ice in this area was thicker and could not be traversed using the boat. Five other sampling points (B1, C1, D1, WF1, and WF2), including where flow velocities in the two creeks were planned to be measured were also inaccessible due to ice.

However, the 23 remaining sampling areas were accessible and therefore available for background rhodamine concentration and rudimentary water flow velocity sampling (Table 1). Data was collected at approximately 1.5 ft. below the water's surface. Some aquatic plants release fluorometric compounds, so gaining background measurements before introducing the dye is essential. The weather forecast called for warming temperatures later that day and the next, so we were hopeful that the ice would dissipate and the dye could be applied the following day.

Water flow velocities were previously planned to only be collected at the creek connections and where Goose Bay meets the river proper (WF1-WF4). We acquired a stream flow velocity meter to accomplish this. A meter of this type measures flow unidirectionally when the major direction of flow, as in a stream channel, is obvious. When collecting these data in the Bay we assumed that the current was mostly wind driven, consequently the flow sensor was placed perpendicular to the wind direction. These velocities should mainly be interpreted relative to each other as the exact primary direction of flow was not known. Due to water depths and waves, velocities for the River proper are not reported here. Values for river velocity will be better collected from other, more rigorous studies of the river previously conducted by others.

Results and Conclusions:

After we had completed sampling for the day, NYSDEC informed us that they would prefer the water flow study to be completed in the spring of 2014. Therefore, we did not attempt to introduce dye into the Bay on November 22nd and discontinued the study.

Background rhodamine sampling indicated minimal levels of rhodamine concentration in the Bay, ranging from 0.0 to 0.7 ppb. This background sampling should be performed again prior to dye introduction.

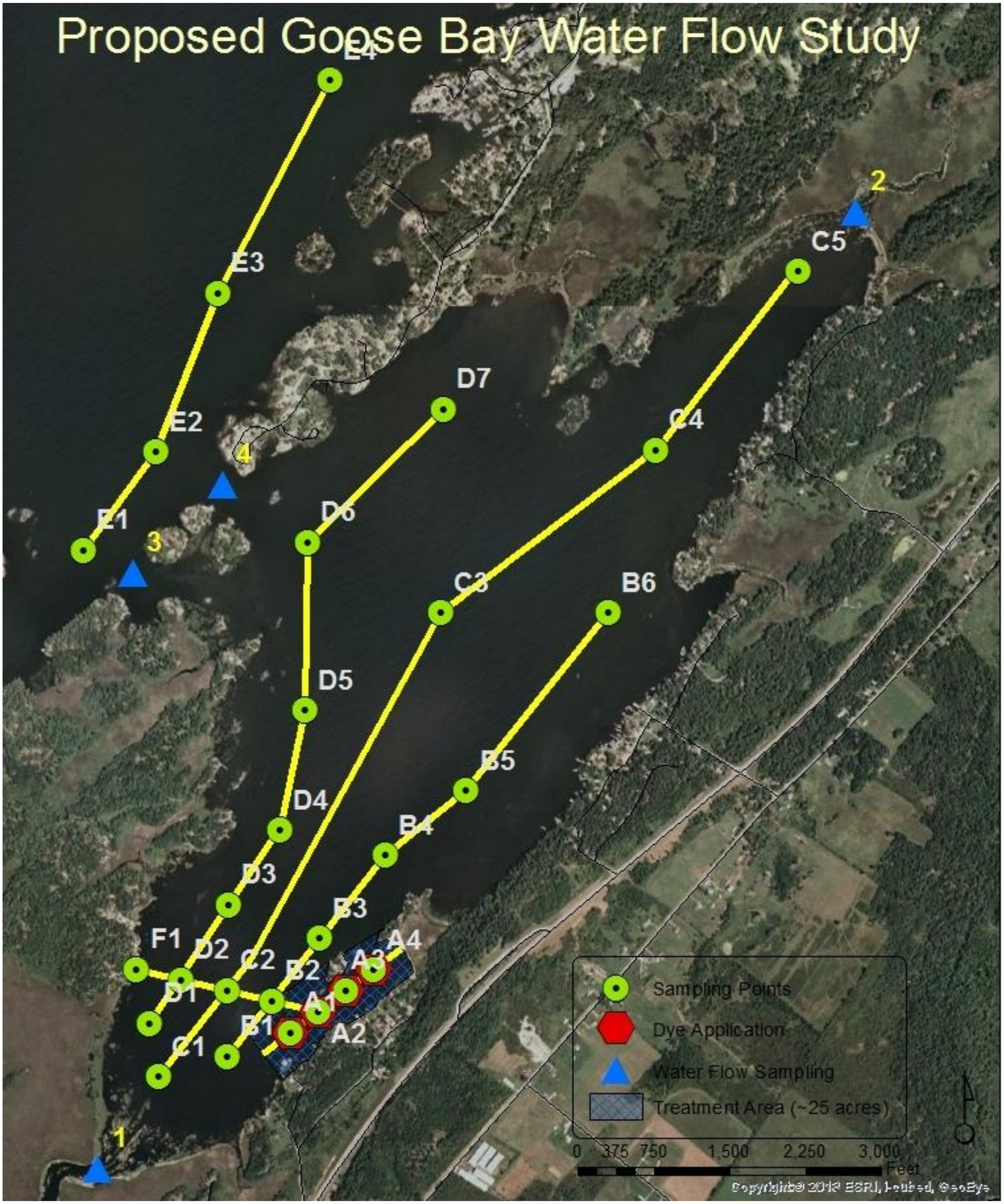
Water flow velocity data indicated a relatively stagnant system with velocities ranging from -0.105 to 0.204 ft/s along the axis of the prevailing wind (SW; 225^{o}). The average water current along this axis was 0.037 (±0.086) ft/s.

Table 1: Rhodamine WT concentrations and water current velocities from Goose Bay, NY collected on November 21st, 2013.

Sample ID	*Rhodamine WT (ppb)*	*Water Velocity (ft/s)*
A1	*	*
A2	*	*
A3	*	*
A4	*	*
B1	*	*
B2	0.1	0.001
B3	0.3	0.050
B4	0.3	*
B5	0.6	0.041
B6	0.6	0.024
C1	*	*
C2	0.2	0.241
C3	0.7	-0.040
C4	0.1	0.092
C5	0.4	0.055
D1	*	*
D2	0.0	-0.017
D3	0.1	0.149
D4	0.0	0.002
D5	0.0	-0.034
D6	0.0	-0.012
D7	0.6	0.115
D7	0.0	*
E1	0.0	*
E2	0.0	*
E3	0.0	*
E4	0.1	*
F1	0.2	-0.105
WF1	*	*
WF2	*	*
WF3	0.2	*
WF3	*	-0.053
WF3	*	-0.074
WF4	0.0	-0.171

*No Data (due to ice, velocities not reported for the river proper, and multiple measurements of one parameter but not the other at a sampling point)

Figure 1: Sampling plan for Goose Bay, NY water flow study, November 21st 2013



APPENDIX B: Project Photos

Photo 1: Dye application, very strong signal

Photo 2: Dye plume after application

Photo 3: Dye plume after application

Photo 4: Dye plume after application

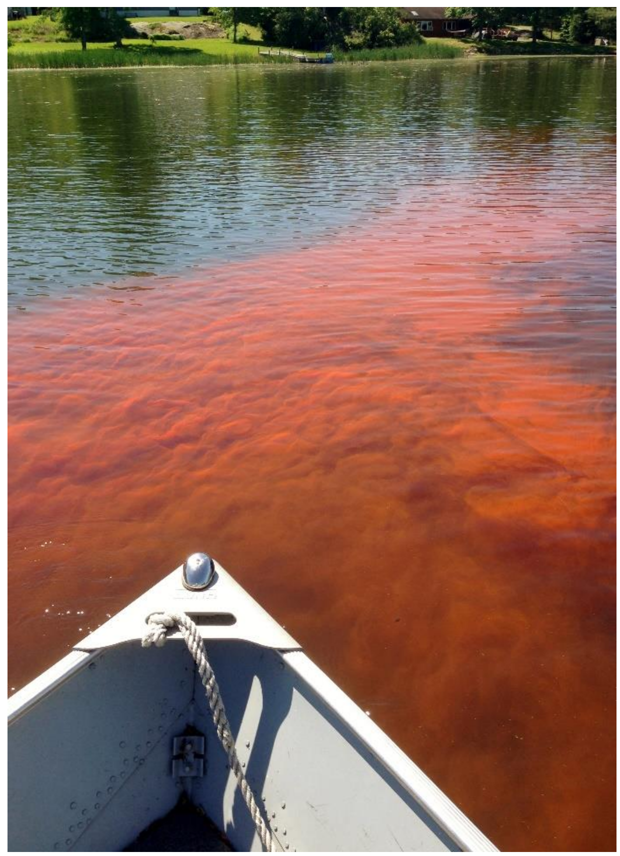


Photo 5: Dye plume after application

Photo 6: Goose Bay looking north (no wind)

Photo 7: Application area (no wind)

Photo 8: Dye plume observation

Photo 9: Dye plume observation

Photo 10: Goose Bay from Town Launch

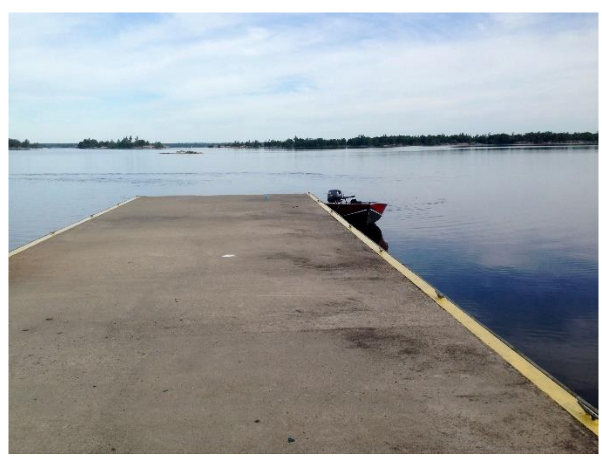


Photo 11: Plume observation, strong signal

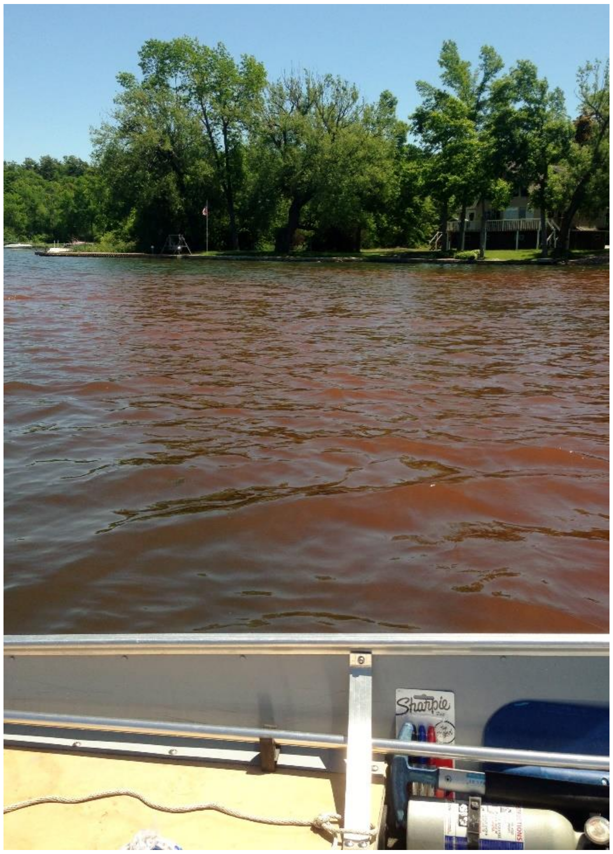


Photo 12: Plume observation, strong signal

APPENDIX C: June 2014 Raw Data

		Sample ID	Date	Time (hhmm)	Concentration (ppb)	Water Velocity* (ft/s)	direction of flow
Application Area							
	Day 1						
		A1	7-Jun	1036	57	0.1	235.0
		A2	7-Jun	1040	42	0.0	
		A3	7-Jun	1045	195	0.0	
		A4	7-Jun	1053	90	0.0	
		A4	7-Jun	1059			
		A3	7-Jun	1103			
				avg	96		
				s.d.	69.0		
	Dye applied						
		A2	7-Jun	1109			
		A4	7-Jun	1137	65	0.0	
		A3	7-Jun	1144	58	0.0	
		A2	7-Jun	1154	12500	0.0	
		A1	7-Jun	1209	2300	0.0	
		A4	7-Jun	1301	50		
		A3	7-Jun	1308	7700	0.1	
		A2	7-Jun	1313	190	0.1	75.0
		A1	7-Jun	1326	93	0.0	
		A4	7-Jun	1420	265		
		A3	7-Jun	1428	65		
		A2	7-Jun	1431	71		
		A1	7-Jun	1433	52		
		AA1	7-Jun	1435	430		
		A1'	7-Jun	1440	485		
		A2'	7-Jun	1450	295		
		A3'	7-Jun	1455	195		
		A4'	7-Jun	1500	1130		
		AA3	7-Jun	1507	650		

	AA4	7-Jun		1513	870		
	AA5	7-Jun		1519	310		
			avg		1389		
			s.d.		3124.6		
Day 2	AA1	8-Jun		854	200		
	A1	8-Jun		911	205		
	A1'	8-Jun		915	240		
	A2'	8-Jun		918	230		
	A2	8-Jun		920	183	0.1	237.0
	A3	8-Jun		927	104		
	A3'	8-Jun		932	135		
	A4'	8-Jun		939	120		
	A4	8-Jun		944	105	0.0	
	AA3	8-Jun		950	140		
	AA4	8-Jun		954	127		
	AA5	8-Jun		957	48		
	A4''	8-Jun		1009	90		
			avg		148		
			s.d.		56		

Adjacent to Application Area

Day 1							
	B2	7-Jun		1023	73	0.0	
	B3	7-Jun		1031	44	0.1	235.0
					59		
					20.5		
Dye applied							
	B1	7-Jun		1220	33	0.0	

	B2	7-Jun		1237	75	0.0	
	B3	7-Jun		1242	48	0.0	
	B4	7-Jun		1250	36	0.1	75.0
	B1	7-Jun		1351	35	0.0	
	B2	7-Jun		1358	57	0.0	
	B3	7-Jun		1402	42	0.1	75.0
	B4	7-Jun		1413	30	0.1	
	AA2	7-Jun		1437	50		
	B4'	7-Jun		1525	73		
	B4	7-Jun		1529	30		
					46		
					15		
Day 2							
	AA2	8-Jun		850	102	0.0	
	B1	8-Jun		859	40		
	B2	8-Jun		908	150		
	B4'	8-Jun		1003	53		
	B5						
	B4	8-Jun		1013	32	0.1	233.0
	B3	8-Jun		1022	75		
			avg		75		
			s.d.		45		
In Bay, Away from Treatment Area							
Day 1	B6	7-Jun		920	32	0.0	
	D6	7-Jun		942	13	0.1	276.0
	D4	7-Jun		1008	12	0.1	265.0
	D1	7-Jun		1017	60	0.0	
			avg		29	22.5	
			s.d.		22		

	Dye added	D6	7-Jun		1535	7	0.1	87.0
		B6	7-Jun		1604	25	0.0	
				avg		16		
				s.d.		13		
	Day 2	C4	8-Jun		930	35	0.1	240.0
		D1	8-Jun		1041	74		
		D3						
		D2	8-Jun		1045	45		
		D4	8-Jun		1051	11	0.1	267.0
		D5						
		D6	8-Jun		1102	14		
		B6	8-Jun		1141	20	0.0	
				avg		33		
				s.d.		24		
River								
		E2	7-Jun		953	7	0.0	
		E3	7-Jun		1000	6	0.0	
				avg		6.5		
				s.d.		0.7		
		E2	7-Jun		1544	5	0.1	60
		E3	7-Jun		1552	4	0.3	60
				avg		5		
				s.d.		1		
	Day 2	E2	8-Jun		1106	7	0.0	
		E3	8-Jun		1134	5		
						6.0		
						1.4		

APPENDIX D: Qualifications of Primary Investigator

MICHAEL L. PARKES, M.S
CHIEF ECOLOGIST/PRINCIPAL

EDUCATION

Texas A&M University, M.S. Ecology
Virginia Tech, B.S. Wildlife Ecology

YEARS EXPERIENCE: 13

SUMMARY OF QUALIFICATIONS

I am a Certified Ecologist who serves as the Chief Ecologist/Principal of a consulting firm I founded in 2013 following 11 years of professional experience. The firm's scope of services mirrors my expertise and interests; wetland ecology, wildlife ecology, and Geographical Information Systems (GIS).

My familiarity with projects of various scales and types (e.g. remediation, linear development, municipal projects, residential, corporate, not-for-profit) facilitates the delivery of the tailored support our clients require to effectively obtain their objectives. The projects I find most appealing are complex; involving politics, economics, regulation, and numerous stakeholders. These projects consist of multiple drivers that must be appropriately balanced in order to produce creative solutions and achieve success.

MY SKILLS

Project Management
- Staff oversight
- Quality assurance of data
- Project planning and budgets
- Deliverable production
- Client relations

Computer
- Microsoft Office
- ArcGIS
- Statistical Software
- Population Models
- Systems Simulation Modeling

Field
- Wetland delineation
- Garmin and Trimble GPS
- Aquatic investigation
- Operation of mist nets
- Bird banding and handling

SELECT PROFESSIONAL EXPERIENCE

Wetlands

Brownfield Remediation, Restoration and Redevelopment Project, Fords, NJ – Project manager for ecological components of a 180-acre brownfield cleanup for a large natural gas company. Personally performed the wetland delineation (>85 acres) and was the lead author for numerous approved permit applications including New Jersey Department of Environmental Protection Letter of Interpretation, General Permits 4 and 12, Freshwater Wetland Individual Permit, Mitigation Plan, Waterfront Development Permit, Flood Hazard Permit and Tidelands License as well as U.S. Army Corps of Engineers Jurisdictional Determination, Nationwide Permit 38 and Mitigation Plan. Other tasks managed included ecological investigations, water level monitoring (transducer) program, wetland mitigation design, mitigation construction oversight, ecological risk assessment and stakeholder coordination.

Marine Terminal Mitigation Planning, Staten Island, NY – Project manager leading data collection and conceptual restoration design of a 40+ acre salt marsh mitigation for a private client. Project included gathering ecological information from the site, public data sources, and GIS portals then incorporating these with a design team into a comprehensive restoration plan.

Tidal Wetland Mitigation Restoration Design and Permitting, New York, NY – Lead ecological designer for a New York City Parks Department ecological park along the East River in the Bronx, NY. Designed grading, planting, soils, specifications, and details for a 1.6 acre tidal restoration to satisfy a municipal wetland mitigation requirement submitted to New York Department of Environmental Conservation. In addition, the plants, soils, maintenance and monitoring for the upland habitats to be installed in the park were specified.

Huntington Delineation, South Huntington, NY – Project manager for the delineation and development of mitigation plans for project activities associated with a cell phone tower taking place within the NYS DEC regulated areas. Completed wetland delineation and detailed assessment report submitted for an U.S. Army Corps of Engineers Jurisdictional Determination and a NYSDEC Freshwater Wetlands Permit. Provided onsite construction expertise and guidance to ensure permit compliance.

Randalls Island Salt Marsh Restoration, New York, NY – Oversaw a salt marsh restoration from an ecological perspective. This included ensuring proper grading in relation to tide levels, inspection of plants and planting, and adjustment of barrier placement for the reduction of tidal scour.

Croton Water Treatment Plant Wetland System, Bronx, NY – Collaborated on design of a wetland system that treats and detains water while acting as an educational, ecological, and design amenity. The depth and roof area of the new Croton Water Treatment Plant cause significant excesses of storm and ground water on site. This water is directed to created emergent marsh, rocky glens, bioswales, and irrigation ponds on-site.

Center for Environmental Impacts on Military Lands, Fort Drum, NY – Large scale (parcels of 500+ acres) delineation of wetlands on Fort Drum, NY. Duties included producing GIS maps and operating Geographic Positioning System (GPS) units, plant identification, soil core evaluation, quality assurance and control, assessment of mitigation banks, and restoration compliance evaluation.

Wildlife

Endangered Species Monitoring, Bayshore, NY – Developed and implemented a plan to monitor endangered birds during beach and dune construction to repair damage from Hurricane Sandy. This monitoring allowed construction to continue in a normally restricted season and facilitated area beaches being reopened to the public for the summer tourist season.

Revere Smelting and Refining Facility Ecological Investigation, Middletown, NY. Project Manager for biota collection to conduct a NYSDEC mandated Step 2C Fish and Wildlife Impact Analysis to establish site remediation goals. Tasks included coordination with laboratories, small mammal trapping and euthanasia, electrofishing, collection of soil invertebrates and sediments, stream assessment, and reporting.

Endangered Species Monitoring; West Islip, NY. Project manager providing construction support for NYSDEC mandated monitoring of nesting Peregrine Falcons (*Falco peregrinus*) during bridge resurfacing. Construction was completed on schedule with no disturbance to the nesting birds or delays in construction activities over two breeding seasons.

Expert Witness, Fairfield, CT – Represented Hoyden's Hill Environmental Trust and Neighborhood Association in effort to preserve a site at Hoyden Hill and its natural resources. Reviewed case proceedings, permit applications, proposed site plans, and literature to evaluate the environmental impacts of the proposed activities, then attended a public hearing and testified on behalf of the Trust.

Nuisance Heron and Egret Colony Study, College Station, TX – Designed, implemented, presented, and published results of research regarding why large colonies of egrets and herons are often located in residential areas of Central Texas. The project consisted of two main parts; comparing reproductive success of colonies and performing a landscape GIS analysis of colony locations across the study area. Funding and logistical support were provided by the U.S. Geologic Service (USGS) and the U.S. Fish and Wildlife Service (USFWS).

PROFESSIONAL AFFILIATIONS

Ecological Society of America
Society of Wetland Scientists
Society of Ecological Restoration
Wildlife Society
International Society of Waterbirds

CERTIFICATIONS

Certified Ecologist – Ecological Society of America
Graduate GIS Certificate – Texas A&M University
OSHA 40-hour HAZWOPER
NYSDEC Erosion and Sediment Control Training

PROFESSIONAL AWARDS & HONORS

Helen Pratt Research Fellowship: Audubon Canyon Ranch

PEER REVIEWED PUBLICATIONS

Parkes, M.L., M.A. Mora, and R. Feagin. 2012. Using scale, cover type, and GIS to evaluate nuisance egret colony site selection. Waterbirds 35: 56-63.

Kelly, J.P., K. Etienne, C. Strong, M. McCaustland, and **M.L. Parkes**. 2007. Status, trends and implications for the conservation of heron and egret nesting colonies in the San Francisco Bay Area. Waterbirds 30: 455- 478.

Parkes, M. L. 2005. Inter-nest infanticide in Ardeids. Waterbirds 28: 256-257.

OTHER SELECT PUBLICATIONS

Parkes, M.L. and E. DeCelles. NYSDEC Freshwater Wetland Permit for construction of a cell tower for T-Mobile, Huntington, NY (File # 1-4726-02247/00001). Approved May 2011.

Parkes, M.L., J. Epstein, and E. DeCelles 2011. USACE Nationwide Permit 38 for EPEC Polymers Site, Fords, NJ (File # NAN-2010-00412-ESO). Approved September 2011.

Parkes, M.L., J. Epstein, and E. DeCelles 2011. NJDEP Department of Land Use Regulation Multi-permit for the Former Nuodex Corporation Site, Fords, NJ (File # 1225-02-0016.4). Freshwater Wetland Individual Permit, Flood Hazard Area Permit, Waterfront Development Permit, Wetland Mitigation Plan, and Tidelands License. Approved June 2011.

Parkes, M.L. NJDEP Department of Land Use Regulation Freshwater Wetland General Permits 12 and 14 and Letter of Interpretation for the Former Nuodex Corporation Site, Fords, NJ (File # 1225-02 0016.2). Approved March 2009.

Kelly, J.P., K. Etienne, C. Strong, M. McCaustland, and **M.L. Parkes**. 2007. Annotated Atlas and Implications for the Conservation of Heron and Egret Nesting Colonies in the San Francisco Bay Area. Point Reyes Printing, Point Reyes CA. 236p. http://www.egret.org/atlas

Parkes, M.L. 2007. Residential Cattle Egret Colonies in Central Texas: Geography, Reproductive Success and Management. Unpublished Masters Thesis. Texas A&M University, College Station TX.

Parkes, M.L., and K. Heath. 2002. Great Captains Island heron and egret study. Greenwich (CT): Audubon Greenwich. 47p

SELECT PRESENTATIONS

Parkes, M.L. March 2014. Wetland Functional Analysis and Its Use in Wetland Mitigation Design. Lecture given at University of Pennsylvania, Philadelphia PA.

Parkes, M.L. February 2013. Integrated remediation and restoration: A case study in Woodbridge, New Jersey. Lecture given at University of Pennsylvania, Philadelphia PA.

Parkes, M.L. and E. DeCelles. April 2012. Integrated remediation and restoration: A case study in Woodbridge, New Jersey. An oral presentation to the Society of Ecological Restoration Mid-Atlantic/ New England Chapters Conference, Brooklyn, New York.

Parkes, M.L. and E. DeCelles. November 2010. Habitat restoration and innovative strategies within Natural Resource Damage Assessment. An oral presentation to the Sixth Annual Advanced Conference on Natural Resource Damages, Newark, New Jersey.

Parkes, M.L., M. A. Mora, and R. Feagin. November 2009. Using scale, cover type, and GIS to evaluate nuisance egret colony site selection. An oral presentation to the Waterbird Society, Cape May, New Jersey.

Parkes, M.L. April 2007. “A Comparison of Residential and Non-residential Heronries in the Post Oak Savannah and Blackland Prairie Ecoregions of Central Texas.” An oral presentation to the Southwestern Association of Naturalists, Stephenville TX.

Parkes, M.L. and M. A. Mora. October 2005. “Characteristics and Management of Residential Heronries in Texas.” A poster presented to the Waterbird Society, Jekyll Island, Georgia.