

January 10, 2019

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Town of Westford
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Submitted via e-mail to planner@westfordvt.us

Stone Project No. 18-021
Subject: Preliminary Aquatic Permitting Criteria Compliance Assessment, Jackson Farm Community
Wastewater Site, Westford, Vermont

Dear Melissa,

Stone Environmental, Inc. (Stone) is pleased to present a preliminary evaluation of the capacity of the Browns River to assimilate renovated effluent from the proposed 12,600 gallon per day (GPD) community wastewater disposal field on the Jackson Farm property while meeting the Aquatic Permitting Criteria (APC) under Vermont's Indirect Discharge Rules. This order-of-magnitude assessment determined that the design flow proposed can be treated and dispersed while meeting the nutrient-based APC for nitrate-nitrogen (nitrate-N) and total dissolved phosphorus (TDP) in the Browns River.

We recommend that the Town and consulting team meet with Indirect Discharge Program staff to review work completed to date and the results of this assessment, with the goal of obtaining concurrence that the work is sufficient to allow preliminary approval of a community alternative wastewater system. This approval is required in order for the Town to apply for Neighborhood Development Area designation with the Agency of Commerce and Community Development. We also recommend that the Town pursue development of a Capacity Application under the Indirect Discharge Rules.

1. Determination of Receiving Stream and Points of Compliance

This task was completed in coordination with Green Mountain Engineering, Vermont Department of Environmental Conservation (DEC) staff, and the Town. A site meeting was held on September 7, 2018 to review background information and walk over the property. The parties attending were:

- Melissa Manka, Town of Westford
- Aaron Moore and Jim Deshler, Vermont DEC
- Kevin Camara, PE, Green Mountain Engineering
- Amy Macrellis, Stone Environmental, Inc.

Topics of discussion during this meeting and site walk included the history and results of monitoring, testing, and preliminary design previously conducted at the site; an overview of the proposed community wastewater

system; and determination of whether the drainage channel adjacent to the proposed disposal field would be suitable for biological monitoring or use as a point of compliance for determining compliance with the APC. Following the site meeting, Aaron Moore confirmed that the biological compliance point for the project would be the Browns River. A precise compliance point was not established due to access and timing; the confluence of the drainage running from south to north away from the proposed leachfield and the Browns River is north of VT Route 128 and on private property.

Following determination of the receiving stream and estimated point of compliance, Stone conducted a preliminary assessment of the proposed community leachfield's potential for compliance with the APC for nitrate-N and TDP, using the Modified Site Specific Compliance (§14-908) method for demonstration of compliance. This method was chosen out of an abundance of caution as early in the determination process, the receiving stream, and thus the stream's low median monthly flow, were not known. This method "may be used to demonstrate compliance ...for septic tank/leachfield systems with capacities of 30,000 gpd or less that discharge to streams using default values for concentrations of in-ground effluent parameters" (§14-908(a)).

2. Watershed Delineation and Existing Data Review

Stone delineated the watershed area of the Browns River as related to the likely point of compliance under the Indirect Discharge Rules, based on the best existing topographic data and using Geographic Information Systems (GIS) spatial analysis tools (Figure 1). We collected and reviewed available in-stream water quality monitoring data for the Browns River, particularly as those data relate to the APC for nutrients (nitrate-N and TDP). We attempted to review existing Indirect Discharge wastewater permitting records for properties in the up-stream portions of the watershed, but no permitted properties exist in the area.

In-stream water quality data are available for the Browns River upstream of the proposed compliance point. Under the guidance of Kevin Sherman, an instructor at the Westford Elementary School, 5th and 6th-grade science students have been performing water quality testing and biological monitoring activities just downstream of the Westford Covered Bridge (near the intersection of Cambridge Rd. and Huntley Rd.) since approximately 1994. Compilation of these records is still in process. Chemical monitoring data collected by the students in the spring of 2018 indicated excellent water quality in the Browns River, with nitrate-N and total phosphorus concentrations typical of Vermont background conditions. Samples collected by the students in the fall of 2018 were taken after several days of rain, and showed slightly elevated turbidity and elevated nutrient concentrations, as might be expected following a series of substantial rain events.

Finally, our review of existing data showed that stream flow in the Browns River is not gaged. Additional literature review and data collection were needed to complete an assessment of the proposed system's potential for compliance with the APCs, as described below.

3. Browns River Low Median Monthly Flow (LMMF) Evaluation

Stone reviewed electronic datasets available from the US Geological Service and others, to select the most appropriate low flow conditions for the Browns River for use in the mass balance calculations.

Our primary data source was daily stream discharge records downloaded from the United States Geologic Survey's (USGS) National Water Information System website at <http://waterdata.usgs.gov/nwis/sw>. Stream flow records were collected using the following screening criteria:

- Only watersheds located in eastern New York, Vermont, New Hampshire, and inland Maine were considered.
- At least five years of daily stream discharge values were available for the watershed (minimum of 1,825 records).
- The watershed had an area of approximately 50 square miles (32,000 acres) (query range 45-55 square miles).
- The average slope of the watershed was within 3% of the Browns River's mean slope (calculated at 3.5%, given a watershed length of 17.9 miles and elevation change of 3,308 feet).

A total of nine watersheds were identified using these initial screening criteria (Table 1), and the full stream flow datasets were downloaded for analysis. For each dataset, all daily stream flow values for each full month were grouped together, and a monthly median was calculated (so, for example, a median monthly flow was calculated for all January values regardless of year). Once median stream flow values were calculated for each month, the minimum or low monthly median flow was selected for each stream and is reported in Table 1. This LMMF value was divided by each watershed's area to calculate a 'unitized' LMMF.

During the calculation process, five of the original nine watersheds were found to be unusable (Table 1). The Peabody River drains the eastern slopes of Mt. Washington and the western slopes of Carter Dome and Wildcat Mountain, and most of the watershed does not contain conditions representative of those in the Browns River watershed. The stream gage on Wilson Stream in East Wilton, Maine is located just below an impoundment. It was not clear how much flow is controlled by the impoundment, so the watershed was removed from consideration. Records for three additional watersheds meeting the initial screening criteria did not contain a full year of observations collected within the last 50 years (1968 or later).

The four remaining watersheds are located in Vermont and eastern New York. These watersheds, with areas ranging from 50 mi² to 54 mi², have unitized LMMF values ranging between 0.09 cfs/mi² and 1.04 cfs/mi² (Table 1). We recommend that the average unitized LMMF for the four identified watersheds (0.51 cfs/mi²), which results in a LMMF of 25.5 cfs for the Browns River at the estimated compliance location north of the Westford Town Center, be used to complete the mass balance compliance calculations.

Table 1. Summary of Watershed Characteristics and Stream Flows.

USGS ID	Stream Name and Location	Period of Record	Watershed Area (mi ²)	Watershed Slope	LMMF (cfs)	Unitized LMMF (cfs/mi ²)
Reference Watershed						
n/a	Browns River north of Westford Town Center	n/a	50	0.035	25.5	0.51
Watersheds with Acceptable Data						
04276842	Putnam Creek East of Crown Point Center, NY	1990-2018	52	0.026	8.6	0.17
04271815	Little Chazy River near Chazy, NY	1990-2018	50	0.013	4.6	0.09
01133000	East Branch Passumpsic River near East Haven, VT	1938-2018	54	0.047	39.5	0.73
04281500	East Creek at Rutland, VT	1940-1977	51	0.064	53	1.04
Watersheds Evaluated With Unusable Data						
01054114	Peabody River at Gorham, New Hampshire ^a	2012-2018	46	0.088	n/c	n/c
01047730	Wilson Stream at East Wilton, Maine ^b	1977-1984	46	n/c	n/c	n/c
04286500	Dog River at Northfield, Vermont ^c	1909-1943	52	n/c	n/c	n/c
04274500	Black Brook at Black Brook, New York ^c	1924-1969	49	n/c	n/c	n/c
04268600	E. Branch St. Regis River Near Meacham Lake, New York ^c	1958-1968	52	n/c	n/c	n/c
Recommended Estimated LMMF for Browns River^d					25.5	0.51

Sources: USGS, 2018; Stone Env. analysis, 2018.

Notes: mi² = square miles; cfs = cubic feet per second; n/a = not applicable; n/c = not calculated.

^a Much of the watershed is steeply sloping. Includes Mt. Washington eastern slopes, Carter Dome, Wildcat Mountain. Not representative of Browns River watershed conditions.

^b Gage is located below an impoundment - not representative of Browns River conditions.

^c Period of record does not include any data in last 50 years, calculations not completed.

^d The recommended unitized low median monthly flow (LMMF) was calculated as the average for the four watersheds with acceptable flow data. init: 11/26/18, anm

The LMMF of 25.5 cfs proposed for the Browns River translates to a daily flow value of 16,473,000 GPD. Given the Browns River's large watershed area and the correspondingly large LMMF, the Dilution method (§14-902 of the IDRs) may also be used to determine compliance with the APCs. It is a simpler method, and is allowed for septic tank/leachfield systems with design capacity of 20,000 gpd or less that indirectly discharge to streams. Under this method, a system is presumed to meet the APCs and the Vermont Water Quality Standards "if the ratio of the low median monthly flow of the receiving stream to the design capacity is 120:1 or greater" (§14-902(b)). The ratio of the Browns River LMMF to the proposed indirect discharge is 1,307:1 – substantially greater than the required 120:1 ratio.

4. In-Stream Water Quality Sampling

Surface water samples were collected at one location in the Browns River, as near as possible to the compliance location identified by Vermont DEC without requiring access to private property. The location was on the east bank of the river off Huntley Road, south of the intersection with Drinkwine Road (Figure 2). Samples were collected in accordance with Section 14-910(2)(A) of the Indirect Discharge Rules with a deviation on the number of samples collected. This late in the season, it was not possible to collect enough samples to fully satisfy the requirements of this section. Meeting these requirements will require collection of at least 10 surface water samples within a year's time, and those samples must be collected according to a Quality Assurance / Quality Control (QA/QC) Plan approved by Indirect Discharge Program staff.

Samples were collected on October 10 and October 26, 2018. Care was taken to avoid sampling surface water within 24 hours of precipitation. All samples were collected in accordance with Stone's Standard Operating Procedures for surface water sampling. Temperature, pH, and conductivity were measured in the field, and each sample was analyzed for chloride, nitrate-nitrogen (nitrate-N), and total dissolved phosphorus (TDP) (collected in duplicate) at the Endyne, Inc. laboratory facility in Williston, Vermont. Results of the surface water sampling are presented in Table 2.

Table 2. Surface Water Sampling Results, Browns River Above Compliance Point

Date	Temperature (deg. C)	pH	Conductivity (uS)	Chloride (mg/L)	Nitrate- N (mg/L)	TDP (mg/L)	Total P (mg/L)
10/10/2018	18.4	7.87	179.90	12	<0.20	0.011	
10/10/2018 - duplicate						0.010	
10/26/2018	4.3	7.62	183.90	8.7	<0.20	0.012	0.014
10/26/2018 - duplicate						0.015	0.016

Source: Stone Environmental assessment and field notes and Endyne Inc. analytical results, 2018

Date/init: 11/29/2018 anm

5. Aquatic Permitting Criteria Preliminary Compliance Assessment

The potential compliance of the proposed indirect discharge system with the Aquatic Permitting Criteria was evaluated per §14-911 and §14-912 of the Indirect Discharge Rules under the proposed 12,600 gpd design flow. The details of each analysis, and the analysis results, are described below for nitrate-N and TDP.

5.1.1 Soil renovated effluent data

Soil renovated effluent results for nitrate-N and TDP in the downgradient groundwater are not available, so default concentrations for each of the in-ground effluent quality parameters listed in Table 5 of the Indirect Discharge Rules were applied, consistent with the Modified Site Specific Compliance Method (§14-908) of

the IDRs. The default concentration for nitrate-N is 60 mg/L, while the default concentration for TDP is 0.14 mg/L.

5.1.2 System Discharge Flows

The proposed design flow of 12,600 gpd was utilized in the mass balance compliance calculations.

5.1.3 In-stream water quality data

Given the limited number of in-stream water quality results available at this stage, the data were not evaluated in accordance with §14-911 of the IDRs. Instead, the average of the two available surface water results were utilized as a proxy for the 95% confidence values, which would normally be used as the basis for calculation and determination of compliance with the APCs. The average in-stream values of 0.20 mg/L for nitrate-N and 0.012 mg/L for TDP were utilized as the existing in-stream receiving water concentrations for purposes of the mass balance calculations (Table 1).

In addition to the proposed indirect discharge meeting the Aquatic Permitting Criteria in the IDRs, water quality in the stream must also meet the relevant Vermont Water Quality Standards¹ (WQS). The standard for nitrate-N in Class B(2) waters is “not to exceed 5.0 mg/l as NO₃-N at flows exceeding low median monthly flows”. The applicable WQS for total phosphorus is not clear, as the Browns River is a medium-gradient stream and a cold-water fishery. Table 2 in the WQS indicates that for Class B(2) waters, the nutrient criteria for total phosphorus in medium, high-gradient streams is 0.015 mg/L, while in warm-water, medium-gradient streams it is 0.027 mg/L. In all cases, water in the Browns River above the proposed compliance point, as sampled in October 2018, appears to be in compliance with the WQS for nutrients.

5.1.4 Stream Flow Data

As described in Section 2.1, daily stream flow records were collected for nine watersheds with watershed areas and other characteristics reasonably similar to those of the Browns River. An estimated unitized LMMF of 0.51 cubic feet per second per square mile of watershed area (cfs/mi²), resulting in a LMMF of 25.5 cfs, was applied in the mass balance calculations.

5.1.5 Compliance with Aquatic Permitting Criteria

Compliance with the Aquatic Permitting Criteria (APC) for nitrate-N and TDP was evaluated in accordance with §14-912 of the IDRs.

¹ https://dec.vermont.gov/sites/dec/files/documents/wsmd_water_quality_standards_2016.pdf

The Aquatic Permitting Criteria for nitrate-N is that “indirect discharge will not raise the in-stream concentration of nitrate nitrogen at the point of compliance at the designated stream flow above 2.0 mg/L. The 2.0 mg/L limitation must include the background concentration of nitrate nitrogen and is applicable to all upland waters (§14-701(b)(4))”. The mass balance compliance calculations for nitrate-N are shown in Table 2. The calculation completed for the proposed design flow of 12,600 gpd results in a calculated in-stream nitrate-N concentration of 0.25 mg/L, which is 1.75 mg/L below the APC.

Table 3. Aquatic Permitting Criteria Compliance Calculations, Nitrate-Nitrogen.

Mass Balance Equation for Calculating Resulting In-Stream Concentrations (per §14-912):	
$\frac{[E_c \times E_q + D_c \times D_q]}{(E_q + D_q)} = \text{Resulting in-stream concentration, where:}$	
E_c = existing in-stream water concentration (estimated based on October 2018 sampling, mg/L) E_q = Appropriate stream flow at point of compliance, for annual release rate (gal/day) D_c = In-ground effluent concentration (estimated per §14-908, Table 5 in the IDRs), mg/L D_q = Proposed discharge flow (design capacity, gal/day)	
Proposed Permitted Capacity Wastewater Flow Scenario:	
Existing in-stream receiving water concentration (E_c)	0.20 mg/L
Appropriate stream flow (E_q)	16,473,000 gal/day or 25.5 ft ³ /sec
In-ground effluent concentration (D_c)	60 mg/L
Proposed discharge flow (D_q)	12,600 gal/day or 0.020 ft ³ /sec
Resulting In-stream Concentration at 12,600 gal/day =	0.25 mg/L
APC Standard, <2.0 mg/L downstream, including background =	2.0 mg/L

Source: Stone Environmental assessment and field notes and Endyne Inc. analytical results, 2018

Date/init: 11/27/2018 anm

The Aquatic Permitting Criteria for TDP is that “the indirect discharge will not increase the in-stream concentration of Total Dissolved Phosphorus at the point of compliance at the designated stream flow by more than 0.001 mg/L above existing background concentration. The applicant shall also demonstrate the indirect discharge will not increase the in-stream Total Phosphorus above any limit established in the Water Quality Standards (§14-701(b)(1))”. The mass balance compliance calculations for TDP are shown on Table 3. The calculation completed for the proposed design flow of 12,600 gpd results in a calculated in-stream TDP concentration of 0.011 mg/L—essentially no change from the existing in-stream receiving water concentration, and in compliance with both the APC and the WQS.

Table 4. Aquatic Permitting Criteria Compliance Calculations, Total Dissolved Phosphorus.

Mass Balance Equation for Calculating Resulting In-Stream Concentrations (per §14-912):

$$\frac{[E_c \times E_q + D_c \times D_q]}{(E_q + D_q)} = \text{Resulting In-stream concentration, where:}$$

E_c = existing in-stream water concentration (estimated based on October 2018 sampling, mg/L)

E_q = Appropriate stream flow at point of compliance, for annual release rate (gal/day)

D_c = In-ground effluent concentration (estimated per §14-908, Table 5 in the IDRs), mg/L)

D_q = Proposed discharge flow (design capacity, gal/day)

Proposed Permitted Capacity Wastewater Flow Scenario:

Existing in-stream receiving water concentration (E_c)	0.012 mg/L	
Appropriate stream flow (E_q)	16,473,000 gal/day or	25.5 ft ³ /sec
In-ground effluent concentration, (Table 5, §14-908) (D_c)	0.140 mg/L	
Proposed discharge flow (D_q)	12,600 gal/day or	0.020 ft ³ /sec
Resulting In-stream Concentration at 12,600 gal/day =	0.012 mg/L	
APC Standard, <0.001 mg/L increase from upstream =	0.013 mg/L	

Source: Stone Environmental assessment and field notes and Endyne Inc. analytical results, 2018

Date/init: 11/29/2018 anm

Thank you for the opportunity to work with the Town to advance this important project. We stand ready to answer any questions you may have about our work and look forward to meeting with Green Mountain Engineering and the Vermont Indirect Discharge Program staff on your behalf.

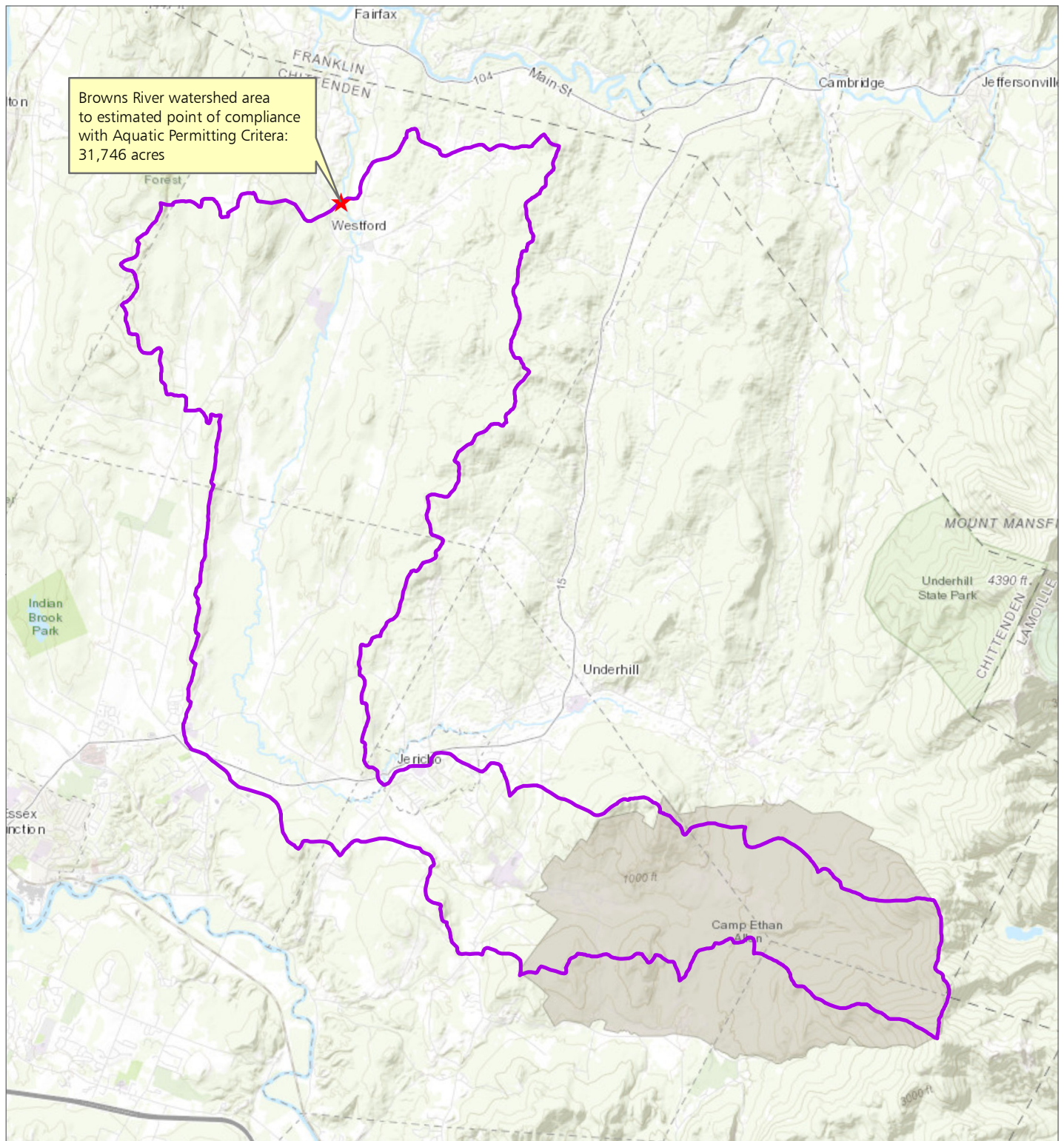
Sincerely,



Amy Macrellis
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Direct Phone / 802.229.1884
Mobile / 802.272.8772
E-Mail / amacrellis@stone-env.com

cc: Alan Huizenga, Green Mountain Engineering
Mary Clark and Bryan Harrington, Vermont DEC Indirect Discharge Program

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LEGEND

- ★ Compliance Point (estimated)
- ▭ Browns River Watershed to Compliance Point

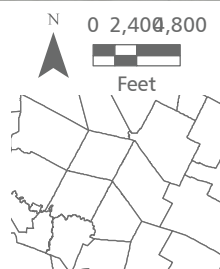
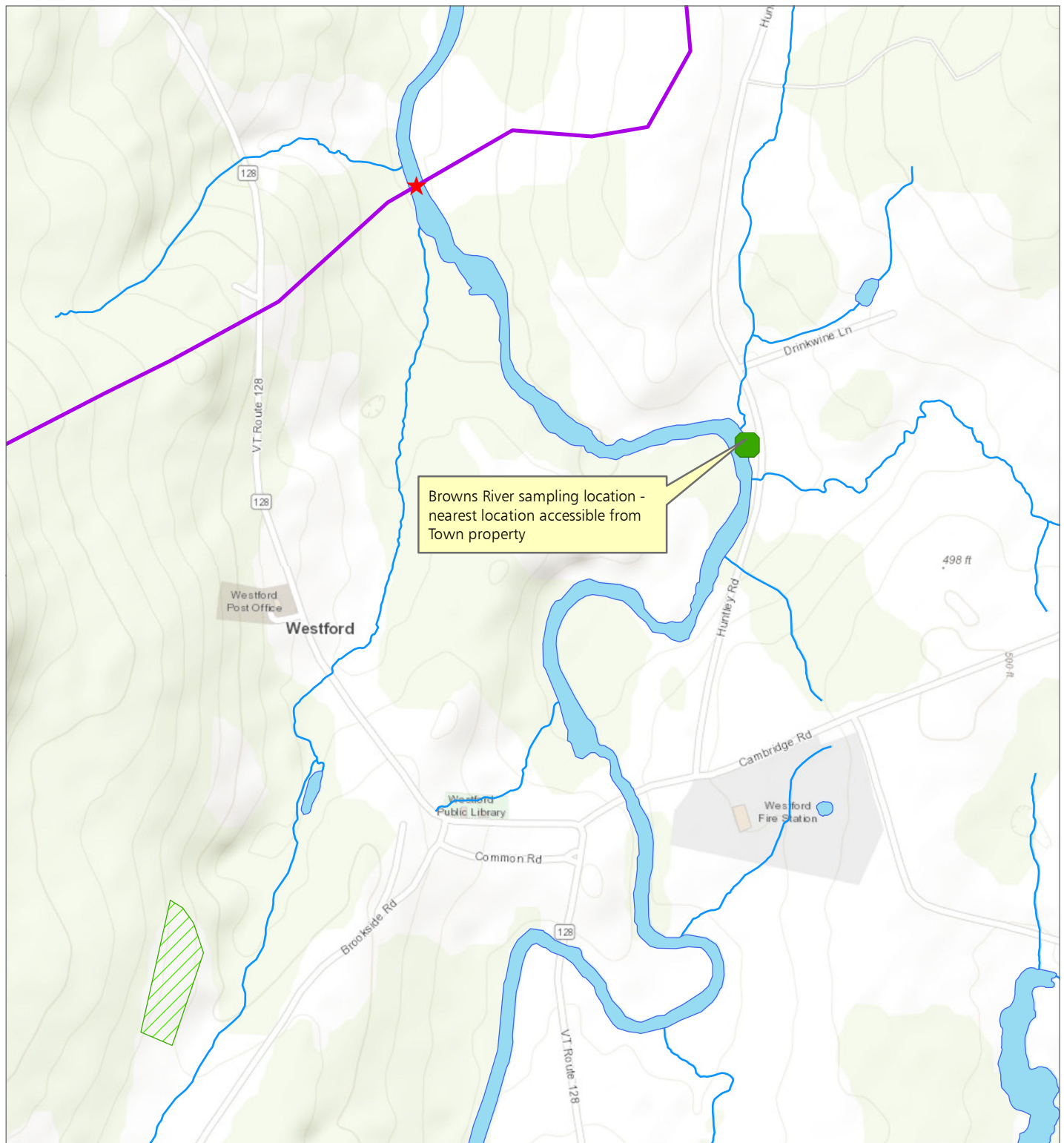


Figure 1, Browns River Watershed to Estimated Compliance Point
 Preliminary Aquatic Permitting Criteria Compliance Assessment

Prepared for the Town of Westford



LEGEND

- Sampling Location
- Town Center Community WW Disposal Area
- Browns River Watershed to Compliance Point
- Compliance Point (estimated)

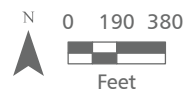


Figure 2, Browns River, Surface Water Sampling Location

Preliminary Aquatic Permitting Criteria Compliance Assessment

Prepared for the Town of Westford

STONE ENVIRONMENTAL

Sources: Watershed boundary: Vermont Hydrography Dataset (VHD), NHDPlus v2, Stone. Topographic base map: Esri World Imagery

Path: O:\PROJ-18\WRM\18-021 Westford WW APC Assessment\GIS\Westford_BrownsRiverSamplingLocation.mxd Saved: 11/29/2018 by AmyM

Notes: Watershed boundary to compliance point delineated from VHD WBD12 boundary for