

October 20, 2015

Neil R. Fulton  
Town Manager  
Town of Norwich  
P.O. Box 376  
Norwich, VT 05055

In re: Town of Norwich Pool Dam Reconstruction, Stream Alteration Permit Application

Dear Mr. Fulton:

I am writing in response to the Town of Norwich Individual Permit Application received by the River Management Section of the Department of Environmental Conservation on August 27, 2015. The application requests a Stream Alteration Permit to replace a breached dam and create an impoundment for swimming. The proposed dam will create a 0.6 acre (340 feet long) instream impoundment on Charles Brown Brook for approximately 10 weeks per year. Charles Brown Brook is a tributary of Bloody Brook.

In order to qualify for a stream alteration permit, the application must meet the standards set forth in 10 V.S.A. § 1023 (a). In accordance with the statute, the Agency must find that the project:

- (1) will not adversely affect the public safety by increasing flood or fluvial erosion hazards;
- (2) will not significantly damage fish life or wildlife; and
- (3) will not significantly damage the rights of riparian owners.

The application fails to demonstrate that the proposed dam and its operation would not increase flood and erosion hazards to adjacent and downstream property and public infrastructure, as required by 10 V.S.A. § 1023 (a) (1) and (3). In addition, the application fails to demonstrate that the project will not significantly damage fish life or wildlife under § 1023 (a)(2). Therefore, the Vermont Agency of Natural Resources (Agency) has determined that the Town of Norwich Stream Alteration application does not meet the requirements of 10 V.S.A. § 1023 (a). The permit application cannot be approved for the reasons set forth below.

**Flood and Fluvial Erosion Hazards 10 V.S.A. § 1023 (a) (1) and (3)**

The application fails to demonstrate that the project will not adversely affect the public safety by increasing flood and fluvial erosion hazards and causing significant damage to the rights of riparian owners. In determining whether or not the proposed dam replacement will increase adverse fluvial erosion impacts to public safety, the Secretary must apply the equilibrium and connectivity performance standards in accordance with the Vermont Stream Alteration Rules (VSAR) §27-402(b). The application does not explain how the proposed dam and its operation will meet the equilibrium and

connectivity standards, and avoid threats to public safety and riparian owners from an increase in erosion hazards.

- The proposed dam is designed to withstand a 500 year flood from a flow standpoint.
  - It is uncertain however, whether the impoundment would fill with sediment and debris from a large flood, causing the river to erode and (again) outflank the proposed structures and bank armoring on river right (looking downstream). The narrative included in the application states that the sheet pile will extend to the right valley wall, but this is not demonstrated or evident in the application or the drawings provided by the applicant.
- The reach of Charles Brown Brook, which includes the area previously impounded by a dam that formed the Norwich Pool, is currently undergoing adjustments in channel width, depth, meander pattern, and slope as it re-approaches equilibrium conditions. As this channel evolution proceeds, the water flows, sediment, and woody debris being produced and transported from reaches upstream in the Charles Brown Brook watershed will pass through the segment and into downstream reaches and Bloody Brook. Equilibrium and sediment continuity are critical to minimizing erosion and maintaining stability in the proposed impoundment and downstream reaches of these brooks. The failure to maintain these standards can adversely affect public safety and cause significant fluvial erosion and damage to adjacent and downstream properties.

The application fails to demonstrate that the reaches of Charles Brown Brook and Bloody Brook affected by the project would meet the equilibrium and connectivity standards during the 42 weeks when the impoundment would be drained, and separately for the 10 week period when the Brook would be impounded.

- Tropical Storm Irene deposited a large quantity of cobble size sediment in the old impoundment providing evidence that bedload transport is important during larger floods. The alteration of flood hydraulics at the old dam led to bed aggradation and then lateral erosion. The application and Vermont Phase 2 stream geomorphic data show that the reach downstream of the dam is incised and has not recovered from channel work done after the 1973 flood. This “lack of recovery” may be explained by the documented sediment discontinuity. The old dam has been trapping coarse sediment (P2 SGA data) and starving (preventing coarse sedimentation from reaching) the downstream reach. The application does not demonstrate that the project will not continue to starve downstream reaches, and contribute riverbed degradation, resulting in fluvial erosion.
- Charles Brown Brook, upstream and downstream of the old impoundment, ranges from 31 to 34 feet in width and has a mean bankfull depth of approximately 2.25 feet. The proposed project, in the removable stop log section, has a fixed dimension of 24 feet wide by 8 feet deep. The application fails to address whether this channel constriction would affect hydraulics at flood flows with the expected frequencies of every 2, 5, 10, 25, 50, and 100 years in such a manner that, in combination with dredging operations, would alter the sediment regime of the Brook. The alteration of the sediment regime (i.e., sediment size, quantity, sorting, and distribution) could cause an unnatural aggradation or unnatural degradation of the river channel bed within the impoundment area and in the downstream reaches of Charles Brown and Bloody brooks.

- The application does not provide design details for the in-channel structures (within the impoundment area) demonstrating their function and long-term stability during larger floods.

### **Significant Damage to Fish Life and Wildlife 10 V.S.A. § 1023 (a) (2)**

In accordance with 10 V.S.A. § 1023(a)(2), a stream alteration permit may be granted only if the proposed project will not significantly damage fish life or wildlife. Charles Brook is a tributary of Bloody Brook and supports a host of fish species including wild, self-sustaining populations of brook trout, blacknose dace, longnose dace, slimy sculpin, creek chub, white sucker and longnose sucker. Wild brook trout have stringent environmental and life cycle requirements, recreational and cultural importance and are a Species of Greatest Conservation Need in Vermont.

The Agency looks to the Vermont Water Quality Standards (VWQS) to inform the determination of whether a project will significantly damage fish life or wildlife. Under the VWQS, the Agency must manage waters to fully support designated uses, achieve water quality criteria and prevent degradation of high quality waters. Charles Brown Brook is designated as a Class B “coldwater stream” and must be managed to maintain high quality aquatic habitat, aquatic biota, and wildlife. VWQS § 3-04.A.4. and App. A and B. Changes “from the reference condition that would prevent the full support of aquatic biota, wild-life, or aquatic habitat uses” is prohibited. In addition, “biological integrity” and diversity must be maintained and all “life-cycle functions, including overwintering and reproductive requirements” are protected. VWQS § 1-01 B.39 and § 3-04.B.4. Finally, the VWQS Hydrology Criteria; Streamflow Protection requires that changes “from the natural flow regime shall provide for maintenance of flow characteristics that ensure the full support of uses and comply with the applicable water quality criteria.” VWQS § 3-01 C.

The project, as proposed, fails to demonstrate that there will be no significant adverse impacts to; aquatic biota (particularly wild brook trout), water quality, aquatic habitat, and aquatic habitat connectivity. The application does not show that the project will preclude a change from the reference condition that will adversely affect aquatic biota and habitat. Specifically, the application does not show that the project will: not adversely impact aquatic biota organism passage, result in a loss or degradation of habitat, meet the Hydrology standard and result in temperature variations that adversely impact aquatic biota. As such, the project proposal fails to satisfy the Stream Alteration Standards as informed by the VWQS.

#### **Aquatic Organism Passage (AOP):**

The application fails to demonstrate that the proposed dam will not result in significant harm through the creation of a barrier to aquatic passage.

- The applicant acknowledges that AOP will not be provided for the 10 week impounded period and suggest that due to the limited duration of the impoundment, the presence of smaller sized fish below the dam, and that resident fish species are not migratory during the summer months that the barrier created by the dam will not result in significant harm to fish life and wildlife. This interpretation is contrary to empirical studies of brook trout movement which indicate distinct summer movements of this species.

Aquatic organism passage during draw down periods has not been satisfactorily addressed in the proposal. Flows will pass through a 24-foot opening over a fixed concrete sill which supports removable dam boards. This opening represents approximately 75% of the bankfull width at this location and will result in a constriction and increased velocities during high flow events. The fixed, channel spanning concrete sill constructed at streambed elevation will not allow for vertical adjustment of the stream channel through the structure. As commonly observed with culverts sized smaller than bankfull width, downstream bed degradation leads to exposed outlets, resulting in aquatic passage barriers. Barriers to aquatic population movement and migration can result in a change from the reference condition of a waterbody and cause significant impacts to aquatic communities, thereby undermining the full support of aquatic biota during life cycle stages, such as migration and reproduction. For example, the biological impacts resulting from fish passage barriers include:

- Preventing resident populations from upstream habitat recolonization after catastrophic events, such as floods or toxic discharges;
- Reduction or loss of migrant species populations because of reduced access to critical spawning, rearing, feeding or refuge habitats;
- Altered aquatic community structure (e.g. species composition, distribution);
- Reduced genetic fitness of aquatic populations that subsequently reduces the ability of communities to survive changing or extreme conditions; and
- Significant migration delays leaving fish vulnerable to predation, disease and overcrowding and potentially affecting reproductive success.

#### Loss/Degradation of Riverine Habitat:

The application materials fail to demonstrate that there will not be a significant degradation and loss of aquatic habitat or that the project will not result in a change to the reference condition in a manner that adversely affects habitat and the life stages of aquatic biota supported by that habitat. The proposed reconstructed Norwich Pool Dam will create a 340 foot long impoundment during the summer months which will decrease stream channel velocities and promote the deposition of stream bed material. Slowed velocity and resulting deposition will produce additional substrate embeddedness, smother necessary benthic macroinvertebrate and fish spawning habitat. Therefore, the resulting channel will be wider and more homogeneous than adjacent stream reaches and will exhibit degraded habitat conditions for riverine species. Under drawn down conditions, the impoundment channel will cut through deposited sediments to reestablish a stream channel, re-suspending and transporting fine sediment, and resulting in unstable habitat conditions.

The loss of habitat diversity and complexity has been well studied and is directly linked to decreased diversity and abundance of macroinvertebrate and fish populations. Degraded habitat conditions resulting in direct impacts to aquatic populations within the impounded reach will be perpetuated for an extended time period with the construction of the proposed project. Under the current free flowing condition, a single thread stream channel with diverse aquatic habitat features will be naturally restored over time.

- The application proposes the construction of a series of rock weirs to form and maintain a single thread channel during drawn down conditions. It is highly unlikely that the upstream channel can be consistently “trained” to enter the constructed impoundment channel without regular and intrusive stream channel management activities. Stream channels are dynamic features and naturally migrate vertically and laterally and cannot be fixed in place over the long term.

- There is the potential for sediment deposition under high flow events if the proposed dam is constructed. The application proposes dredging as a solution, a practice associated with degradation of aquatic habitat and water quality.
- The timing of the impoundment dewatering and potential discharge of accumulated sediments precedes the onset of brook trout spawning which normally occurs in late September – early October, increasing the risk of impacts to reproductive success of wild brook trout.

### Hydrology

The application materials fail to demonstrate that the hydrology criteria will be met. Natural hydrology influences necessary life cycle functions and movements of aquatic populations.

- The Application fails to demonstrate that conservation flows will be maintained at all times during the summer period, in accordance with the Agency of Natural Resources Procedure for Determining Acceptable Minimum Flows (1993).
- The proposed operation of the project during fill and draining activities, fails to demonstrate that substantial aquatic habitats will not be dewatered resulting in the likelihood of stranding and associated mortality of aquatic species. The proposed operation also fails to demonstrate that substantial aquatic habitats downstream of the proposed impoundment will not be scoured during dewatering.

### Temperature:

The application fails to demonstrate that the project will not significantly change the diurnal thermal regime of the Norwich pool or down-stream reaches of Charles Brown Brook. The application does not adequately address the temperature impacts of the impoundment and the significant adverse impacts on aquatic biota and habitat. The VWQS prohibit any increase of more than 1 degree F in cold water habitat; and require that any temperature change continue to fully support aquatic biota and habitat. VWQS Section 3-01 B.1.a and b.

Stream temperature has a profound effect on the distribution and abundance of aquatic populations. Brook trout, slimy sculpin and other species inhabiting Charles Brown Brook and Bloody Brook require cold water temperatures for their long term persistence. Maximizing cold water in smaller tributary streams is important for moderating temperatures and providing thermal refuges in downstream receiving waters such as larger streams, rivers and lakes. The damming of streams promotes increased temperatures as the wider, slower impoundment is exposed to increased solar radiation and heating. Empirical studies of small impoundments report degraded aquatic habitat from increased temperatures resulting in significant impacts to macroinvertebrate communities and coldwater fish populations. Studies indicate that vegetation along the stream and pond is insufficient to avoid adverse effects from increased temperatures. These studies indicate that temperature impacts below small dams have resulted in shifts in aquatic communities and reductions in brook trout, brown trout and slimy sculpin densities.

- The Applicant's temperature modeling and conclusions are inconsistent with empirical studies of similar situations in Vermont and elsewhere, and fail to demonstrate that there will not be a temperature increase which will significantly impact aquatic biota and result in a deviation from the reference condition of Charles Brown Brook and Bloody Brook.

### **Additional information**

The following information is required in order for the Agency to determine whether the proposed project will not increase flood and fluvial erosion hazards to adjacent and downstream property and public infrastructure, as required by 10 V.S.A. § 1023 (a) (1) and (3).

1. Detailed hydraulics write-up describing the modeling process, derivation of roughness values, method/assumptions in modelling the proposed structure.
2. Map showing the number and location of modelled cross-sections.
3. Write-up on the methods used to derive the flow values (Qs) justifying parameters and assumptions. The Agency needs to understand the rationale for using the NRCS curve number (CN) method in developing Q2-Q500 (page 27), relative to other flow estimation methods such as the 2014 USGS Regression Equations.
4. HEC-RAS input files for existing and proposed conditions (both full and empty impoundment).
5. Flood profiles for all flood frequencies (Q2, Q5, Q10, Q25, Q50, and Q100 flows) for existing and proposed conditions—with both a full and empty impoundment.
6. Detailed HEC-RAS sediment transport analysis to analyze whether the replacement dam and its operation (with both a full and empty impoundment) would result in unnatural aggradation or degradation under the above flood flow frequencies.
7. Detailed HEC-RAS hydraulic output tables for existing and proposed conditions—with both a full and empty impoundment.

Please be advised however, that the submission of these materials may not show that the statutory requirements as to flood and fluvial erosion hazards have been met. In addition, these materials are very unlikely to address the requirement that the project not significantly damage fish life or wildlife pursuant to 10 V.S.A. § 1023 (a) (2).

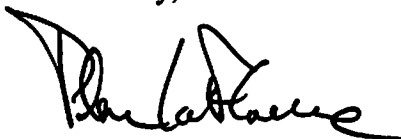
In conclusion, the project, as proposed, fails to demonstrate that it will not adversely affect public safety and damage the rights of riparian landowners. In addition, the project has failed to demonstrate that it will not result in adverse impacts to water quality, aquatic habitat, aquatic habitat connectivity and aquatic biota. As such, the proposed project does not meet the standards in 10 V.S.A. § 1023 (a), and the application must be denied.

This permit denial may be appealed to the Environmental Division of the Vermont Superior Court within 30 days of the receipt of this decision, in accordance with 10 V.S.A. Chapter 220. The following is the address and contact information for the Court:

Vermont Superior Court  
Environmental Division  
32 Cherry Street  
2nd Floor, Suite 303  
Burlington, VT 05401  
Voice: 802-951-1740  
Fax: 802-657-4292

If you have any questions regarding this decision, please do not hesitate to contact Jen Duggan, at [jen.duggan@vermont.gov](mailto:jen.duggan@vermont.gov) or 802-461-5309.

Sincerely,

A handwritten signature in black ink, appearing to read "Peter LaFlamme". The signature is fluid and cursive, with a large initial "P" and "L".

Peter LaFlamme  
Director, Watershed Management Division  
Department of Environmental Conservation