

**VILLAGE OF ESSEX JUNCTION  
TRUSTEES  
REGULAR MEETING AGENDA**

2 Lincoln Street  
Essex Junction, VT 05452  
**Tuesday, December 10, 2019**  
**6:30 PM**

E-mail: [manager@essexjunction.org](mailto:manager@essexjunction.org)

[www.essexjunction.org](http://www.essexjunction.org)

Phone: (802) 878-6951

1. **CALL TO ORDER/PLEDGE OF ALLEGIANCE TO FLAG** [6:30 PM]
2. **AGENDA ADDITIONS/CHANGES**
3. **APPROVE AGENDA**
4. **PUBLIC TO BE HEARD**
  - a. Comments from Public on Items Not on Agenda
5. **BUSINESS ITEMS**
  - a. Consider funding request for Gather at the Table community event
  - b. Discussion of creating an advisory committee and funding for community events
  - c. Adopt ordinance regulating earth work in the Crescent Connector right-of-way
  - d. Update on Densmore Street Closure – Evan Teich
  - e. \*Discussion of real estate matter
6. **CONSENT ITEMS**
  - a. Approve minutes: December 4, 2019
  - b. Check Warrants #17176—12/6/19
7. **READING FILE**
  - a. Board Member Comments
  - b. Memo from Claudine C. Safar, Esq. re: Condemnation Hearing, Crescent Connector Parcels
  - c. Memo from James Jutras re: Vermont Phosphorus Innovation Challenge (VPIC)
  - d. Letter from Chittenden County Assistant Judges re: Pre-Budget Meeting
  - e. Email from Gwynn Zakov re: Vermont League of Cities & Towns Cannabis Resolution
  - f. Memo from Robin Pierce re: Village Center Development
  - g. Upcoming meeting schedule
8. **EXECUTIVE SESSION**
  - a. \*An executive session is anticipated to discuss real estate
9. **ADJOURN**

*This agenda is available in alternative formats upon request. Meetings of the Trustees, like all programs and activities of the Village of Essex Junction, are accessible to people with disabilities. For information on accessibility or this agenda, call the Unified Manager's office at 878-6951.*

Certification: 12/06/2019

Date Posted

  
Initials

Elaine, Andrew and Evan,

I'm writing to share news about an exciting event happening in January and to ask for your help in making it a success.

Gather at the Table will celebrate people coming together to just "BE" and enjoy great food and entertainment. The event, taking place January 11th at EWSD high school, will include dinner prepared by EWSD Child Nutrition Services and volunteers, an open gym with supervised activities for children of all ages, local entertainment, and much more. The evening is intended to gather our neighbors, to connect the non-school and school communities, and to enjoy an evening together.

**The Gather at the Table planning committee does need your help to make the evening a success. This is not a fundraiser or community meeting.** To ensure access to all, the dinner will be free. We are seeking donations from our municipalities, schools and local community organizations as well as volunteers from the schools, organizations and community.

Our goal is to host 500 community members and make this an annual event. With the closure of the Farmers Market and Steamfest we believe it is vital we have an avenue to bring the community together. We are hoping for your involvement with a \$1,500 donation from each the Town of Essex and the Village of Essex Junction for a total contribution of \$3,000, as well as, assistance with promoting the event through the municipalities various channels.

Thank you for the consideration and we look forward to hearing from you in the very near future.

Lori Houghton  
Bridget Meyer  
Liz Subin

**Memorandum**

**To:** Board of Trustees; Evan Teich, Unified Manager  
**Cc:** Sarah Macy, Finance Director/Assistant Manager; Brad Luck, Director of Essex Junction Recreation & Parks  
**From:** Greg Duggan, Deputy Manager *GD*  
**Re:** Advisory committee and funding for community events  
**Date:** December 6, 2019

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**Issue**

The issue is for the Trustees to discuss the creation of an advisory committee for community events, and whether to provide funding for such events.

**Discussion**

The Trustees have received a request from residents to provide funding for a community dinner in January. During the FY21 budget workshop, the Trustees had brief, informal discussions about the funding request, as well as the more general topic of various community events throughout the year. One of the ideas that came up during those discussions involved the creation of an advisory committee to provide guidance about community events.

Funding was also a topic of discussion. The Village budget for Economic Development has typically included money for Community Events & Programs. In recent years, the money has supported SteamFest and Five Corners Farmers' Market. Neither program is expected to take place in FY21.

**Cost**

The Manager's budget proposal for FY21 includes \$10,000 toward Community Events & Programs.

**Recommendation**

This memo is for discussion purposes.



Community Development Department

2 Lincoln Street  
Essex Junction, VT 05452  
[www.essexjunction.org](http://www.essexjunction.org)

Office: (802) 878-6950  
Fax: (802) 878-6946

## **MEMORANDUM**

**TO:** Evan Teich, Unified Manager, Trustees  
**FROM:** Robin Pierce, Community Development Director  
**DATE:** December 10, 2019  
**SUBJECT:** New Village Ordinance; Connector Road Right of Way

The issue is whether the Trustees wish to approve an addition to the Village Ordinances for the Connector Road ROW.

### **Discussion**

The Crescent Connector Right-of-Way is located within or adjacent to railroad property which has been in rail use for over 150 years. Testing on the site has identified concentrations of polycyclic aromatic hydrocarbons (PAHs) and the metals arsenic, antimony, lead, and mercury in excess of US EPA Region Screening Levels. These conditions are believed to be attributed to former coal-burning emissions and maintenance associated with the railroad. As such, this Ordinance sets standards and conditions for any earth work activities within the Crescent Connector Right-of-Way. Any work proposed within the Crescent Connector Right-of-Way requires the approval of the Village Manager or Agent and notification of the VT DEC, Sites Management Section.

A draft of the proposed ordinance is attached.

### **Cost**

Fixed cost to the Village as the work of reviewing proposals for work in the Village ROW will be undertaken by current staff.

### **Recommendation**

It is recommended that the Trustees adopt an Ordinance Regulating Earth Work Within the Crescent Connector Right-of-Way and authorize Staff to undertake the work necessary to add this new ordinance to the current Ordinances.



**VILLAGE OF ESSEX JUNCTION**

**MUNICIPAL CODE**

**CHAPTER \_\_\_\_\_**

**ORDINANCE REGULATING EARTH WORK WITHIN THE CRESCENT CONNECTOR**

**RIGHT-OF-WAY**

**PURPOSE:** The Crescent Connector Right-of-Way is located within or adjacent to railroad property which has been in rail use for over 150 years. Testing on the site has identified concentrations of polycyclic aromatic hydrocarbons (PAHs) and the metals arsenic, antimony, lead, and mercury in excess of US EPA Region Screening Levels. These conditions are believed to be attributed to former coal-burning emissions and maintenance associated with the railroad. As such, this Ordinance sets standards and conditions for any earth work activities within the Crescent Connector Right-of-Way.

**SECTION \_\_\_\_\_: DEFINITIONS.**

The following words and terms, when used in this Ordinance, shall for the purpose of this Ordinance, have the following meanings ascribed to them:

1. Earth Work – any activity which may result in the risk of exposure to contaminated soil, including but not limited to excavation, grading, resurfacing where the soil is exposed.
2. Corrective Action Plan – The Corrective Action Plan prepared by Stone Environmental Inc. for the Crescent Connector Roadway Project, SMS Number: 2012-4263, dated March 15, 2017, a copy of which is on file at the Village office and the VT Department of Environmental Conservation (VT DEC).
3. Crescent Connector Right-of-Way – the permanent Right-of-Way established and on file in the Land Records for the Crescent Connector starting at its intersection with Park Street and continuing along its entire length to its intersection with Main Street, including the properties leased from the railroad.

**SECTION \_\_\_\_\_: ADMINISTRATION AND ENFORCEMENT.**

The Village Manager or Agent shall be responsible for the administration of this Ordinance and shall have the authority to enforce compliance through the use of civil and criminal penalties as authorized by this Ordinance. Further, compliance with State and Federal regulations pertaining to the exposure, transport, or disposal of contaminated soils shall apply and be enforceable by such State or Federal

authorities having jurisdiction. Federal and or State authorities retain the right to inspect and or oversee compliance with applicable codes and standards.

**SECTION \_\_\_\_\_ : RIGHT-OF-WAY PROPERTY**

- (a) Any work proposed within the Crescent Connector Right-of-Way requires the approval of the Village Manager or Agent and notification of the VT DEC, Sites Management Section.
- (b) Earth work that disturbs contaminated soils shall be performed in Level D or Modified Level D personal protective equipment by workers trained and medically monitored in accordance with 29 CFR 1910.120.
- (c) In addition to any other conditions, obligations or requirements, any earth work conducted within the Crescent Connector Right-of-Way shall adhere to the conditions and requirements stipulated with the Corrective Action Plan.
- (d) The Contractor or entity performing the earth work, unless otherwise stipulated by the Village Manager or Agent under a written agreement, is responsible for obtaining the necessary approval and all cost associated with complying with all applicable provisions of the Corrective Action Plan or other State or Federal regulations pertaining to the exposure, handling, transporting and or disposal of contaminated soils.

**SECTION \_\_\_\_\_ : EQUITABLE REMEDIES.**

In addition to the penalty provided in the Ordinance, the Village Manager or Agent may initiate injunction, mandamus, abatement, or any other appropriate action to remediate, remove or prevent further violation of any of the provisions of this Ordinance. Any and all costs for such actions are the sole responsibility of the party responsible for the violation. This Ordinance in no way removes or exempts the parties from compliance with applicable State or Federal regulations or the fines or penalties which may be imposed by such agencies.

**SECTION \_\_\_\_\_ : PENALTY.**

In addition to what is presented in other section of this Ordinance, a violation of any provision of this Ordinance shall be punishable by a fine of up to \$500 per day until the unlawful condition is abated, corrected or removed.

**SECTION \_\_\_\_\_ : SEVERABILITY.**

If any section of this Ordinance is held by a court of competent jurisdiction to be invalid, such finding shall not invalidate any other part of the Ordinance.

**SECTION \_\_\_\_\_: APPEAL OF NOTICE OF VIOLATION PENALTY.**

A person or entity aggrieved by a revocation, suspension or penalty pursuant to this Ordinance may appeal as outlined in the Trustees' Policy regarding the Ordinance Appeal Board. An appeal of this Ordinance in no way voids or stays any other action of another entity such as the State or Federal authority which may have jurisdiction under a separate State or Federal regulation or action.

**Memorandum****To:** Board of Trustees**From:** Evan Teich, Unified Manager; Greg Duggan, Deputy Manager GSD**Re:** Update on Densmore Street Closure**Date:** December 6, 2019

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**Issue**

The issue is to inform the Trustees about the street closure on Densmore Drive.

**Discussion**

Last week, staffs from the Town and the Village got together to discuss what happened at Densmore Drive and what can be done in the interim to get it “fixed” so that stormwater can properly flow through the culverts and to investigate/plan for a more permanent fix.

The corrugated metal culverts (2) that run under Densmore are severely restricted by settling and corrosion. This is most likely causing water to back up and go around the culverts causing erosion and “washouts.” It is also causing a destabilization of the road bed and the sidewalk areas as the materials underneath the surfaces are being eroded. The Town has experience in filing for FEMA and state 404 grants so they are working with the Village on these two avenues but this is also where it gets complicated and our efforts will be slowed down. Indian Brook is a designated “impaired” waterway, so there are restrictions and permit requirements to work within that waterway and there are many rules to follow if you want to be funded by either the state or FEMA for storm related damages. We are working through all of that now.

The first thing is to stabilize, seek to open the culverts on the downstream side-as best we can to allow for more flow, close the downstream side of the sidewalk for the winter and neck Densmore down to one lane at the culverts; allowing travel through the upstream side as that side appears, at least at this point, to be more stable. We are engaging the state and our regional FEMA coordinator as well as staff and our engineers to develop plans for repairs, seek funding, and establish cost estimates so we know what’s what.

**Cost**

To be determined.

**Recommendation**

This memo is for informational purposes.

**Memorandum**

**To:** Board of Trustees; Evan Teich, Unified Manager

**Cc:** Robin Pierce, Community Development Director

**From:** Greg Duggan, Deputy Manager *gsd*

**Re:** Executive session for negotiating or securing of real estate purchase

**Date:** December 6, 2019

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**Issue**

The issue is whether the Trustees will enter executive session for negotiating or securing of real estate purchase or lease options.

**Discussion**

To have a complete and thorough discussion about this topic, it would appear that an executive session would be necessary because the premature disclosure of the information may put the Village at a substantial disadvantage.

**Cost**

None.

**Recommendation**

It is recommended that the Trustees enter into executive session for negotiating or securing of real estate purchase or lease options, pursuant to 1 V.S.A. § 313(a)(2), to include the Unified Manager, Finance Director/Assistant Manager, and Community Development Director.

**Village of Essex Junction Board of Trustees**  
**Meeting Minutes**  
**December 4, 2019**

**TRUSTEES:** Andrew Brown, President; George Tyler, Vice President; Raj Chawla; Dan Kerin; Amber Thibeault.

**ADMINISTRATION AND STAFF:** Evan Teich, Unified Manager; Sarah Macy, Finance Director/Assistant Manager; Greg Duggan, Deputy Manager; Courtney Bushey, Assistant Finance Director; Chris Gaboriault, Fire Chief; Robin Pierce, Community Development Director; Brad Luck, Essex Junction Recreation and Parks Director; Allyson Vile, Essex Parks and Recreation Director; Wendy Hysko, Brownell Library Director; Hannah Tracy, Brownell Library Assistant Director; Megan Allison, Brownell Librarian; Susan Pierce, Brownell Librarian; Jim Jutras, Water Quality Superintendent; Ricky Jones, Village Public Works Superintendent; Dennis Lutz, Public Works Director

**OTHERS PRESENT:** Irene Wrenner

**1. CALL TO ORDER/PLEDGE OF ALLEGIANCE TO FLAG**

Mr. Brown called the meeting to order at 8:30 AM and led the Pledge of Allegiance.

**2. AGENDA ADDITIONS/CHANGES**

No changes were made to the agenda.

**3. APPROVE AGENDA**

With no changes to the agenda, a motion to approve was not needed.

**4. PUBLIC TO BE HEARD**

No inquiries were made.

**5. BUSINESS ITEMS**

**a. FY21 Budget Work Session**

Sarah Macy provided the Village Trustees with a brief overview and highlights of the proposed budget. The proposed FY21 Village General Fund budget is \$5,344,193, a 3.47% or \$179,280 increase over the FY20 approved budget of \$5,164,913. This increase would be funded by a slight increase in funding from the enterprise funds (\$10,009), an increase in funding from the Town of Essex (\$82,435) and a 2.44% increase in the tax levy (\$86,835).

8:40 AM, Fire: Chris Gaboriault, Fire Chief presented a budget that is down approximately 1.5 percent. Chief Gaboriault explained that in order to maintain a paid call department, there is a need to plan for a new fire building with dorm space, or to add dorm space to the already existing building. Mr. Chawla asked Chief Gaboriault about a desired timeframe for completion of dorm space. Chief Gaboriault responded that within a 5-year time frame, hiring a consultant to take a look at the community as a whole would be the next step. Mr. Teich expanded on the discussion to inform the board that the recent space study covered building space only, where a fire study would be more specific to the work performed, staffing and the needs to maintain systems. Ms. Thibeault liked the idea for inclusion of a gym membership reimbursement for firefighters in the budget.

9:10 AM, Administration, Finance, Debt: Sarah Macy began with a presentation on the Village debt and capital projects. The Village Pool Debt has been retired in FY20, driving the large decrease in the debt segment. The funds from the Pool Debt of \$107,843 have been moved to the Transfers & Miscellaneous segment to help fund the proposed capital transfer increases for FY21.

For Administration, staffing and services levels are projected to remain stable with a 1.8% overall increase. To assist human resources with properly filing and archiving staff documents, changes and adjustments, the Administration department budget includes a new cost for a Human Resources Information System (HRIS) at \$3,075. This system is charged on a monthly, per employee basis and would be shared between the Town and Village based on the number of employees. FY21 has a reduction of approximately \$10,000 for the Pay & Classification Study, which is required every other year by the Essex Junction Employees Association Contract with the Village of Essex Junction. Finance is working internally to brainstorm ways in which to stabilize the budget impact of moderate cost items that recur on a timeline greater than annually.

For the Finance Department, Ms. Macy emphasized the need for proper budgeting software that will serve as a research and archiving database with a decreased opportunity for human error. Currently, the Finance Department uses Excel to budget. Ms. Macy asked for an authorization to pursue options. Several of the board members encouraged Ms. Macy to continue exploring options to replace the current system.

10:15 AM, Break: Mr. Brown excused the members to take a short break.

10:30 AM, Economic and Community Development: Robin Pierce, Community Development Director stated that as the work on the Crescent Connector continues, there will eventually be more room to host and plan events. Due to the loss of events such as steAmfest and the Five Corners Farmer's Market, Mr. Brown brought up a request by a couple of residents for the Town and the Village to put money together to host a winter community supper event. Mr. Brown suggested that a better idea might be to create a community advisory committee to bring in events such as art festivals and community gatherings. Mr. Kerin mentioned that there is a difference between events created for local residents and events that attract people from outside communities. The Trustees agreed to discuss the idea of an advisory committee further at a later time. Mr. Brown suggested that the topic could be discussed when Brad Luck, Recreation Director, presents later in the day. Mr. Pierce continued with his budget presentation and updated the Trustees on current projects.

11:00 AM, Recreation, Senior Center: Allyson Vile provided the Trustees with an overview of how the Senior Center operates with funding. Mr. Luck emphasized that as an enterprise fund, the funds are managed by the municipality. There was a brief discussion regarding how trips with the seniors impact the budget.

Mr. Luck moved on to present the Recreation budget. The new communications position in the department has made a marked difference in planning and promoting activities. Mr. Brown brought up the concept of an advisory community events committee with Mr. Luck and asked if he thought that this would be a worthwhile idea. Mr. Teich, Mr. Chawla and Mr. Brown shared ideas regarding activities for the committee to undertake such as fundraising for events and handling event logistics. Mr. Brown said that he would like to see Mr. Luck come back to the next Trustees meeting to discuss further.

Mr. Luck continued to present the proposed budget for recreation, including funds set aside for an electronic sign and updating the playground and pool chairs. The board members discussed the need for signage not only at the recreation facility, but at the Town Offices at 81 Main Street and at Five Corners. Mr. Brown suggested a decision on signs should not be made at this time in order for further discussion to take place on a plan for the three locations that is cohesive and meets the needs for each location. Mr. Luck requested that the funds for the sign remain in the budget for capital use, whether for a sign or for other capital needs of the department. The board discussed the capital needs of recreation as well as the capital needs of other departments and budgeting transparency. Mr. Luck stated that reinvestment in capital needs according to the capital plan is necessary to prevent having to turn to bonding for upkeep projects. Moving on to the program budget, Mr. Luck reminded the board that all events such as Pumpkin Palooza, the Easter Egg Hunt and the Train Hop are all funded from recreation overhead and are not funded from taxpayer municipal program dollars.

12:15 PM, Break: Mr. Brown excused the members to take a lunch break.

12:45 PM, Library: Wendy Hysko, Brownell Library Director, and Hannah Tracy, Brownell Brownell Library Assistant Director, presented the Brownell Library budget. Ms. Macy added a few points about building needs. Ms. Hysko stated that structural work on the building has been addressed and now concentration can be more on building efficiencies. Mr. Tyler asked about future expansion needs. Ms. Hysko responded that she does not foresee the need to consider building renovations for expansion at this time.

1:20 PM, Revenues: Ms. Macy presented a draft revenues budget to the Trustees and stated that all but three of the revenue lines remain unchanged. The Trustees discussed capital projects at length.

2:10 PM, Waste Water Treatment Facility: Jim Jutras, Water Quality Superintendent, presented the Wastewater Treatment Facility's proposed budget and provided some updates from the department. Mr. Jutras explained that the Tri-town Joint Review Committee has not reviewed the draft budget and that there may be some adjustments.

2:30 PM, Sanitation: Ricky Jones, Public Works Superintendent, joined Mr. Jutras at the table to present the Sanitation budget. Ms. Macy explained several key points and changes. Mr. Jones updated the board on the use of the new Super Sucker 5000 truck.

2:45 PM, Water: Mr. Jones, Public Works Superintendent, continued presenting with the proposed budget for Water and provided updates from the department.

2:50 PM, Highway: Ms. Macy and Mr. Jones presented the proposed Highway budget and the most prominent changes and adjustments. Mr. Jones pointed out the increase to the Traffic Control line item is due to the additional time involved for needed line striping.

3:10 PM, Buildings: Ms. Macy began the presentation of the Buildings budget. Mr. Lutz provided a list of assessments the new Buildings Manager, Tom Yandow, has been working on for buildings in both the Town and the Village.

3:30 PM, Wrap-up: Mr. Tyler mentioned the importance of dealing with Lamoille Street. Ms. Macy and Mr. Teich thanked the Trustees for participating in the budget day process.



143 **6. CONSENT ITEMS**

144 **Amber Thibeault made a motion, seconded by George Tyler, to approve the Consent Agenda.**

145 **a. Check Warrant #17175—11/27/19**

146 **Motion passed 5-0.**

147  
148 **7. READING FILE**

149 **a. Board Member Comments**

150 Mr. Tyler confirmed the Finding of Local Necessity Hearing date and time was set for December 17<sup>th</sup>  
151 at 3:00 PM.

152  
153 Mr. Teich and the Trustees thanked Ms. Macy and Ms. Getchell for their efforts and work on the  
154 budget work session.

155  
156 **b. Letter from James Jutras and Dennis Lutz re: 3 Ac rule comments**

157 **c. Upcoming meeting schedule**

158  
159 **8. EXECUTIVE SESSION**

160 An executive session was not necessary.

161  
162 **9. ADJOURN**

163 **Raj Chawla made a motion, seconded by Amber Thibeault, to adjourn. Motion passed 5-0 at 3:40 PM.**

164  
165 Respectfully Submitted,  
166 Tammy Getchell, Assistant to the Manager

12/06/19

11:29 am

## Town of Essex / Village of EJ Accounts Payable

Page 1 of 7

Check Warrant Report # 17176 Current Prior Next FY Invoices For Fund (GENERAL FUND)

HPackard

For Check Acct 01(GENERAL FUND) All check #s 12/06/19 To 12/06/19 &amp; Fund 2

Vendor	Invoice Date	Invoice Description Invoice Number	Account	Amount Paid	Check Number	Check Date
05290	ADVANCE AUTO PARTS	11/27/19 PLIERS DIAGONAL 6" TLWRI 552933141491	210-43110.610 SUPPLIES	14.17	26249	12/06/19
20440	AINSWORTH CATHY L	12/02/19 VB AND JOINT MEETINGS 11/ 43	210-41320.530 COMMUNICATIONS	182.49	26250	12/06/19
07465	BIBENS ACE HARDWARE INC	11/26/19 cutting wheels 36279	210-43110.610 SUPPLIES	28.74	26258	12/06/19
07465	BIBENS ACE HARDWARE INC	12/02/19 BATTERIES FOR AUTO DOOR B 36319	210-41946.020 Gen Supplies - 2 Lincoln	19.18	26258	12/06/19
00530	BRODART CO	11/07/19 BOOKS B5811713	210-45551.641 JUVEN COLLECTION-PRNT & E	214.07	26261	12/06/19
00530	BRODART CO	11/07/19 BOOKS B5811713	210-45551.610 SUPPLIES	16.00	26261	12/06/19
00530	BRODART CO	11/07/19 BOOKS B5811945	210-49346.002 JUVEN COLLECTION-PRNT & E	7.81	26261	12/06/19
00530	BRODART CO	11/11/19 BOOKS B5813672	210-49345.000 LIBRARY DONATION EXPENDIT	16.97	26261	12/06/19
00530	BRODART CO	11/12/19 BOOKS B5814636	210-49345.000 LIBRARY DONATION EXPENDIT	63.14	26261	12/06/19
00530	BRODART CO	11/14/19 BOOKS B5816710	210-49345.000 LIBRARY DONATION EXPENDIT	16.45	26261	12/06/19
00530	BRODART CO	11/15/19 BOOKS B5817145	210-45551.610 SUPPLIES	0.80	26261	12/06/19
00530	BRODART CO	11/15/19 BOOKS B5817145	210-45551.641 JUVEN COLLECTION-PRNT & E	15.98	26261	12/06/19
00530	BRODART CO	11/18/19 BOOKS B5817909	210-45551.610 SUPPLIES	0.80	26261	12/06/19
00530	BRODART CO	11/18/19 BOOKS B5817909	210-45551.640 ADULT COLLECTION-PRINT &	11.97	26261	12/06/19
00530	BRODART CO	11/18/19 BOOKS B5818102	210-45551.641 JUVEN COLLECTION-PRNT & E	17.99	26261	12/06/19
00530	BRODART CO	11/18/19 BOOKS B5818102	210-45551.610 SUPPLIES	0.80	26261	12/06/19
00530	BRODART CO	11/18/19 BOOKS B5818218	210-49345.000 LIBRARY DONATION EXPENDIT	16.45	26261	12/06/19
00530	BRODART CO	11/21/19 BOOKS B5820720	210-45551.610 SUPPLIES	3.20	26261	12/06/19
00530	BRODART CO	11/21/19 BOOKS B5820720	210-45551.641 JUVEN COLLECTION-PRNT & E	46.94	26261	12/06/19
00530	BRODART CO	11/21/19 BOOKS B5820907	210-49345.000 LIBRARY DONATION EXPENDIT	41.62	26261	12/06/19
00530	BRODART CO	11/22/19 BOOKS B5822180	210-45551.610 SUPPLIES	0.80	26261	12/06/19
00530	BRODART CO	11/22/19 BOOKS B5822180	210-45551.641 JUVEN COLLECTION-PRNT & E	13.33	26261	12/06/19
00530	BRODART CO	11/22/19 BOOKS B5822323	210-45551.641 JUVEN COLLECTION-PRNT & E	27.55	26261	12/06/19
00530	BRODART CO	11/22/19 BOOKS B5822323	210-45551.610 SUPPLIES	1.60	26261	12/06/19
00530	BRODART CO	11/25/19 BOOKS B5823187	210-49345.000 LIBRARY DONATION EXPENDIT	25.75	26261	12/06/19

12/06/19

## Town of Essex / Village of EJ Accounts Payable

Page 2 of 7

11:29 am

Check Warrant Report # 17176 Current Prior Next FY Invoices For Fund (GENERAL FUND)  
For Check Acct 01(GENERAL FUND) All check #s 12/06/19 To 12/06/19 & Fund 2

HPackard

Vendor	Invoice Date	Invoice Description Invoice Number	Account	Amount Paid	Check Number	Check Date
00530	BRODART CO	11/26/19 BOOKS B5823621	210-45551.641 JUVEN COLLECTION-PRNT & E	136.03	26261	12/06/19
00530	BRODART CO	11/26/19 BOOKS B5823621	210-45551.610 SUPPLIES	6.40	26261	12/06/19
16030	BROWN ELECTRIC	11/23/19 pedestrian light 81 Main 34421	210-43115.610 Street Lights Supplies/Ma	149.00	26264	12/06/19
16030	BROWN ELECTRIC	11/23/19 remove gas lamp that fell 34422	210-43115.610 Street Lights Supplies/Ma	666.41	26264	12/06/19
22140	BSC INDUSTRIES INC	11/18/19 bearings 3659242	210-43110.432 R&M Services - Vehicles	45.00	26266	12/06/19
03000	CARGILL SALT EASTERN INC	11/22/19 salt 2905104283	210-43125.610 WINTER MAINTENANCE	2506.51	26267	12/06/19
26395	CCRPC	09/30/19 merger infographic from C 19-05-275	210-41320.560 TRUSTEES EXPENDITURES	220.00	26268	12/06/19
V04609	CENTER POINT LARGE PRINT	11/01/19 BOOKS 1735501	210-45551.640 ADULT COLLECTION-PRINT &	93.48	26269	12/06/19
21210	CINTAS LOC # 68M 71 M	11/27/19 supplies 4036136184	210-43110.610 SUPPLIES	61.46	26272	12/06/19
21210	CINTAS LOC # 68M 71 M	12/01/19 WATERBREAK COOLER AGRMENT 9070810994	210-43110.610 SUPPLIES	50.00	26272	12/06/19
25120	CLICKTIME.COM	11/07/19 EJRP Timesheets October 299131	210-45110.330 OTHER PROFESSIONAL SVCS	441.00	26273	12/06/19
04940	COMCAST	11/23/19 MSP Internet 0176315 1119	210-41945.026 Telephone - Maple St Park	564.78	26277	12/06/19
04940	COMCAST	11/23/19 Park St Internet 0210908 1119	210-41945.023 Telephone - Park St Sch	250.65	26278	12/06/19
25715	DONALD L. HAMLIN CONSULT	11/14/19 Various Village Projects 111419 19-81	210-43110.330 Professional Services	84.75	26285	12/06/19
V10576	ECOPIXEL LLC	12/01/19 Web hosting/support Nov 2705	210-41320.530 COMMUNICATIONS	129.00	26290	12/06/19
01010	ESSEX AGWAY	11/27/19 Holiday Decorations 329669	210-45220.610 SUPPLIES	30.38	26292	12/06/19
01010	ESSEX AGWAY	12/02/19 Winter Decorations 329697	210-45220.610 SUPPLIES	17.97	26292	12/06/19
23215	ESSEX EQUIPMENT INC	11/27/19 STAGING for shop roof 107324550001	210-43110.891 CAPITAL OUTLAY	1529.32	26294	12/06/19
05020	ESSEX JCT VILLAGE OF	10/30/19 Water Bill 1029009000 F	210-41941.022 W/S - Fire Station	195.49	26295	12/06/19
31875	ESSEX TOWN WATER DEPT	11/07/19 MSP Sewer 110719DA	210-41941.026 W/S - Maple St Park	84.00	26296	12/06/19
04640	FASTENAL INDUSTRIAL & CON	11/04/19 Work Gloves VTBUR270429	210-45220.610 SUPPLIES	44.72	26299	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19 EJRP CC November 5750 1119	210-45110.340 COMPUTER EXPENSES	186.00	26300	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19 EJRP CC November 5750 1119	210-45110.500 TRAINING, CONF, DUES	39.00	26300	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19 EJRP CC November 5750 1119	210-45110.550 PRINTING & ADVERTISING	35.00	26300	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19 EJRP CC November 5750 1119	210-45110.340 COMPUTER EXPENSES	160.00	26300	12/06/19

12/06/19

## Town of Essex / Village of EJ Accounts Payable

Page 3 of 7

11:29 am

Check Warrant Report # 17176 Current Prior Next FY Invoices For Fund (GENERAL FUND)

HPackard

For Check Acct 01(GENERAL FUND) All check #s 12/06/19 To 12/06/19 &amp; Fund 2

Vendor	Invoice Date	Invoice Description Invoice Number	Account	Amount Paid	Check Number	Check Date
25390	FIRST NATIONAL BANK OMAHA	11/19/19 EJRP CC November 5750 1119	210-45110.550 PRINTING & ADVERTISING	32.00	26300	12/06/19
21845	FIRST NATIONAL BANK OMAHA	11/19/19 YOUTH PROGRAMS ADULT MATE 0017 12/19	210-45551.837 CHILDRENS PROGRAMS	95.29	26301	12/06/19
21845	FIRST NATIONAL BANK OMAHA	11/19/19 YOUTH PROGRAMS ADULT MATE 0017 12/19	210-45551.640 ADULT COLLECTION-PRINT &	50.00	26301	12/06/19
21845	FIRST NATIONAL BANK OMAHA	11/19/19 YOUTH PROGRAMS ADULT MATE 0017 12/19	210-45551.340 COMPUTER EXPENSES	11.55	26301	12/06/19
21840	FIRST NATIONAL BANK OMAHA	11/04/19 Macs Employee refreshment 110419D	210-43110.610 SUPPLIES	64.95	26305	12/06/19
34895	GAUTHIER TRUCKING, INC.	12/01/19 Rubbish Removal on Jackso 1440350	210-43110.565 RUBBISH REMOVAL	96.23	26309	12/06/19
34895	GAUTHIER TRUCKING, INC.	12/01/19 TRASH REMOVAL 1440351	210-41942.020 R&M Bldg - 2 Lincoln St	203.18	26309	12/06/19
34895	GAUTHIER TRUCKING, INC.	12/01/19 Rubbish removal on Railro 1440352	210-43110.565 RUBBISH REMOVAL	440.67	26309	12/06/19
34895	GAUTHIER TRUCKING, INC.	12/01/19 Rubbish removal on BEECH 1440489	210-43110.565 RUBBISH REMOVAL	60.00	26309	12/06/19
34895	GAUTHIER TRUCKING, INC.	12/01/19 MSP Trash Removal 1441117	210-41943.026 Contractual Svcs - Maple	305.66	26309	12/06/19
09375	GOOGLE INC	11/30/19 TECH ACCESS 3667077865	210-45551.530 TECHNOLOGY ACCESS	90.00	26311	12/06/19
21055	GREEN MOUNTAIN MESSENGER,	11/30/19 COURIER 4018A	210-45551.536 POSTAGE/DELIVERY	85.00	26316	12/06/19
21055	GREEN MOUNTAIN MESSENGER,	11/30/19 COURIER 4018A	210-49340.006 LIBRARY GRANT EXPENDITURE	20.00	26316	12/06/19
33495	INGRAM LIBRARY SERVICES I	11/08/19 BOOKS 42668305	210-45551.640 ADULT COLLECTION-PRINT &	20.55	26321	12/06/19
33495	INGRAM LIBRARY SERVICES I	11/08/19 BOOKS 42668306	210-45551.640 ADULT COLLECTION-PRINT &	28.94	26321	12/06/19
33495	INGRAM LIBRARY SERVICES I	11/08/19 BOOKS 42668307	210-45551.640 ADULT COLLECTION-PRINT &	16.30	26321	12/06/19
37715	INTEGRITY COMMUNICATIONS	11/26/19 TELEPHONE ACCESS 37586	210-41945.021 Telephone - Brownell	206.00	26322	12/06/19
23445	MATTHEW BENDER & CO., INC	11/21/19 BOOKS 14978628	210-45551.640 ADULT COLLECTION-PRINT &	115.43	26331	12/06/19
25140	PIKE INDUSTRIES INC	12/03/19 asphalt 1063343	210-43120.610 Summer Const - Supplies	892.16	26343	12/06/19
18010	REYNOLDS & SON, INC.	11/20/19 Flashlight Rchrgble PolyS 3362348	210-43110.610 SUPPLIES	139.00	26348	12/06/19
18010	REYNOLDS & SON, INC.	11/20/19 flashlight holder 3362350	210-43110.610 SUPPLIES	59.68	26348	12/06/19
18010	REYNOLDS & SON, INC.	11/25/19 Glove Heatkeep Pigskin Sa 3362629	210-43110.612 UNIFORMS,BOOTS,ETC	402.04	26348	12/06/19
05280	S & D LANDSCAPES LLC	11/30/19 MSP Summer Turf Care 172188	210-45220.330 OTHER PROFESSIONAL SVCS	376.33	26352	12/06/19
05280	S & D LANDSCAPES LLC	11/30/19 MSP Fall Cleanup 172194	210-45220.330 OTHER PROFESSIONAL SVCS	2019.84	26352	12/06/19
03180	SAFETY SYSTEMS OF VT LLC	10/01/19 fire alarm contract 19167	210-43110.434 MAINT. BUILDINGS/GROUNDS	250.00	26354	12/06/19

12/06/19

## Town of Essex / Village of EJ Accounts Payable

Page 4 of 7

11:29 am

Check Warrant Report # 17176 Current Prior Next FY Invoices For Fund (GENERAL FUND)  
For Check Acct 01(GENERAL FUND) All check #s 12/06/19 To 12/06/19 & Fund 2

HPackard

Vendor	Invoice Date	Invoice Description Invoice Number	Account	Amount Paid	Check Number	Check Date
36130	11/18/19	VERIZON WIRELESS cell Oct19-Nov 18 2019 9842386453	210-42220.535 TELEPHONE SERVICES	120.03	26365	12/06/19
36130	11/18/19	VERIZON WIRELESS cell Oct19-Nov 18 2019 9842386453	210-41970.535 TELEPHONE SERVICES	40.01	26365	12/06/19
36130	11/18/19	VERIZON WIRELESS WIRELESS CELL SERVICE 9842427100	210-43110.530 Communications	35.01	26366	12/06/19
22825	08/10/19	VT DOOR CO BUILDING MAINTENANCE 26868	210-41942.021 R&M Bldg - Brownell	140.00	26373	12/06/19
29825	11/21/19	VT GAS SYSTEMS MSP Gas 1578756 1119	210-41948.026 Natural Gas - Maple St	197.64	26374	12/06/19
29825	11/21/19	VT GAS SYSTEMS 10/17/2019-11/19/2019 19260	210-43110.623 HEATING/NATURAL GAS	263.10	26375	12/06/19
29825	11/21/19	VT GAS SYSTEMS 10/17/2019-11/19/2019 19260	210-41948.021 Natural Gas - Brownell	653.86	26375	12/06/19
29825	11/21/19	VT GAS SYSTEMS 10/17/2019-11/19/2019 19260	210-41948.023 Natural Gas - Park St Sch	314.47	26375	12/06/19
29825	11/21/19	VT GAS SYSTEMS 10/17/2019-11/19/2019 19260	210-41948.020 Natural Gas - 2 Lincoln	537.20	26375	12/06/19
29825	11/21/19	VT GAS SYSTEMS 10/17/2019-11/19/2019 19260	210-41948.022 Natural Gas - Fire Statio	325.61	26375	12/06/19
29825	11/21/19	VT GAS SYSTEMS MSP Gas 810044 1119	210-41948.026 Natural Gas - Maple St	166.69	26377	12/06/19
00975	12/02/19	VT HISTORICAL SOCIETY Membership renewal 12312019VHS	210-45551.640 ADULT COLLECTION-PRINT &	50.00	26379	12/06/19
30210	11/21/19	VT LEAGUE OF CITIES & TOW Unemployment Village 30553-Q1	210-41510.250 Unemployment Insurance	1120.77	26380	12/06/19
30210	11/21/19	VT LEAGUE OF CITIES & TOW Unemployment Village 30553-Q1	210-43151.250 UNEMPLOYMENT INSURANCE	11.31	26380	12/06/19
30210	11/21/19	VT LEAGUE OF CITIES & TOW Unemployment Village 30553-Q1	210-43110.250 UNEMPLOYMENT INSURANCE	71.52	26380	12/06/19
07565	11/26/19	W B MASON CO INC Maint cleaning Supplies 205402893	210-45220.610 SUPPLIES	35.49	26384	12/06/19
21850	12/04/19	BOUCHER CLEANING SERVICES Sr Ctr Cleaning November 550	225-45122.330 OTHER PROF SERVICES	200.00	26260	12/06/19
04330	11/20/19	EWSD CHILD NUTRITION Sr Luncheon 11/20 112019D	225-45122.812 Meals Expenses	36.00	26297	12/06/19
25190	11/10/19	A C MOORE ARTS & CRAFTS A VK Fleming Supplies 111019D	226-45120.610 SUPPLIES	27.44	26248	12/06/19
25190	11/22/19	A C MOORE ARTS & CRAFTS A VK Fleming Supplies 112219D	226-45120.610 SUPPLIES	115.98	26248	12/06/19
25955	11/23/19	AT&T MOBILITY Cell Phones 287279923111	226-45120.535 Telephone	274.30	26256	12/06/19
42360	11/26/19	ECHO AT THE LEAHY CENTER Vac Camp Field Trip 12089594	226-45120.580 TRAVEL	392.00	26289	12/06/19
23215	11/19/19	ESSEX EQUIPMENT INC Boom Lift Rental 107309010001	226-45220.442 Equipment Rental	1563.85	26294	12/06/19
25390	11/19/19	FIRST NATIONAL BANK OMAHA EJRP CC November 5750 1119	226-45120.610 SUPPLIES	30.62	26300	12/06/19
25390	11/19/19	FIRST NATIONAL BANK OMAHA EJRP CC November 5750 1119	226-45115.610 SUPPLIES	74.75	26300	12/06/19

12/06/19  
11:29 am

Town of Essex / Village of EJ Accounts Payable  
Check Warrant Report # 17176 Current Prior Next FY Invoices For Fund (GENERAL FUND)  
For Check Acct 01(GENERAL FUND) All check #s 12/06/19 To 12/06/19 & Fund 2

Page 5 of 7  
HPackard

Vendor		Invoice Date	Invoice Description Invoice Number	Account	Amount Paid	Check Number	Check Date
25390	FIRST NATIONAL BANK OMAHA	11/19/19	EJRP CC November 5750 1119	226-45115.610 SUPPLIES	64.87	26300	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19	EJRP CC November 5750 1119	226-45115.610 SUPPLIES	8.00	26300	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19	EJRP CC November 5750 1119	226-45115.610 SUPPLIES	55.59	26300	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19	EJRP CC November 5750 1119	226-45120.580 TRAVEL	109.80	26300	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19	EJRP CC November 5750 1119	226-45120.610 SUPPLIES	11.00	26300	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19	EJRP CC November 5750 1119	226-45115.610 SUPPLIES	398.37	26300	12/06/19
25390	FIRST NATIONAL BANK OMAHA	11/19/19	EJRP CC November 5750 1119	226-45115.610 SUPPLIES	277.00	26300	12/06/19
24830	REINHART FOODSERVICE	11/18/19	VK MSP Snack 254488	226-45120.610 SUPPLIES	66.40	26347	12/06/19
24830	REINHART FOODSERVICE	11/18/19	VK Hiawatha Snack 254818	226-45120.610 SUPPLIES	71.92	26347	12/06/19
24830	REINHART FOODSERVICE	11/18/19	VK Summit Snack 256321	226-45120.610 SUPPLIES	151.00	26347	12/06/19
24830	REINHART FOODSERVICE	11/19/19	Enrichment Snack 256646	226-45120.610 SUPPLIES	89.11	26347	12/06/19
24830	REINHART FOODSERVICE	11/25/19	Vac Camp Food 258106	226-45120.610 SUPPLIES	105.42	26347	12/06/19
24830	REINHART FOODSERVICE	12/02/19	VK Hiawatha Snack 262801	226-45120.610 SUPPLIES	60.98	26347	12/06/19
24830	REINHART FOODSERVICE	12/02/19	VK MSP Snack 262887	226-45120.610 SUPPLIES	53.93	26347	12/06/19
24830	REINHART FOODSERVICE	12/02/19	VK Summit Snack 263146	226-45120.610 SUPPLIES	144.78	26347	12/06/19
10435	SCREENMYLOGO.COM	11/29/19	Basketball Jerseys 17767	226-45115.610 SUPPLIES	3311.50	26357	12/06/19
45825	SPARE TIME	11/27/19	Vac Camp 4-6 Field Trip 005653	226-45120.580 TRAVEL	219.00	26359	12/06/19
23495	STUDENT TRANSPORTATION OF	11/11/19	VK Hiawatha Field Trip 70083632	226-45120.580 TRAVEL	208.09	26361	12/06/19
23495	STUDENT TRANSPORTATION OF	11/30/19	Vac Camp Field Trip 70086398	226-45120.580 TRAVEL	361.08	26361	12/06/19
25315	VESPA'S PIZZA PASTA & DEL	10/16/19	VK Food 101619D	226-45120.610 SUPPLIES	99.00	26368	12/06/19
25315	VESPA'S PIZZA PASTA & DEL	10/24/19	VK Food 102419D	226-45120.610 SUPPLIES	55.00	26368	12/06/19
25315	VESPA'S PIZZA PASTA & DEL	11/20/19	VK Food 112019D	226-45120.610 SUPPLIES	22.00	26368	12/06/19
25315	VESPA'S PIZZA PASTA & DEL	11/21/19	VK Food 112119D	226-45120.610 SUPPLIES	110.00	26368	12/06/19
10915	WHITCOMB'S LAND OF PUMPKI	09/24/19	VK Summit Field Trip 092419D	226-45120.580 TRAVEL	282.00	26385	12/06/19
29825	VT GAS SYSTEMS	11/21/19	10/17/2019-11/19/2019 19260	254-43200.623 HEATING/NATURAL GAS	221.40	26375	12/06/19

12/06/19

## Town of Essex / Village of EJ Accounts Payable

Page 6 of 7

11:29 am

Check Warrant Report # 17176 Current Prior Next FY Invoices For Fund (GENERAL FUND)

HPackard

For Check Acct 01(GENERAL FUND) All check #s 12/06/19 To 12/06/19 &amp; Fund 2

Vendor		Invoice Date	Invoice Description Invoice Number	Account	Amount Paid	Check Number	Check Date
30210	VT LEAGUE OF CITIES & TOW	11/21/19	Unemployment Village 30553-Q1	254-43200.250 UNEMPLOYMENT INSURANCE	29.60	26380	12/06/19
38680	VT RURAL WATER ASSOC	12/29/19	Annual membership Dues 102919D	254-43200.500 TRAINING, CONFERENCES, DU	520.00	26382	12/06/19
05290	ADVANCE AUTO PARTS	11/22/19	ORANGE PUMICE HAND 552932653619	255-43200.570 MAINTENANCE OTHER	25.54	26249	12/06/19
05290	ADVANCE AUTO PARTS	12/02/19	WASHER FLUID-25F 1 552933641520	255-43200.432 VEHICLE MAINTENANCE	27.54	26249	12/06/19
V10033	AQUA SOLUTIONS INC	11/12/19	Blower Oil Filters IN-19-186	255-43200.570 MAINTENANCE OTHER	1195.41	26254	12/06/19
07465	BIBENS ACE HARDWARE INC	12/05/19	supplies 36368	255-43200.612 UNIFORMS,BOOTS,ETC	20.77	26258	12/06/19
07465	BIBENS ACE HARDWARE INC	12/05/19	supplies 36368	255-43200.570 MAINTENANCE OTHER	45.98	26258	12/06/19
07465	BIBENS ACE HARDWARE INC	11/25/15	Hardware Strapping 822118	255-43200.570 MAINTENANCE OTHER	9.90	26258	12/06/19
04940	COMCAST	11/23/19	Internet 0316028 1119	255-43200.535 TELEPHONE SERVICES	151.80	26279	12/06/19
V9624	DEZURIK WATER CONTROLS	11/20/19	Plant H2O replacement val RPI/65020289	255-43200.570 MAINTENANCE OTHER	1064.00	26282	12/06/19
17960	EASTERN RELIABILITY	11/21/19	DOUBLE MALE FTG/ EPDM 109	255-43330.012 ALKALINITY CNTRL INSTALLA	257.05	26287	12/06/19
V10734	ENCORE ESSEX JUNCTION SOL	11/19/19	November Monthly Payment 1911-WWTP	255-43200.622 ELECTRICAL SERVICE	2969.11	26291	12/06/19
21740	FIRST NATIONAL BANK OMAHA	11/19/19	ww visa charges 01241119	255-43200.500 TRAINING, CONFERENCES, DU	94.43	26302	12/06/19
21740	FIRST NATIONAL BANK OMAHA	11/19/19	ww visa charges 01241119	255-43200.610 SUPPLIES	92.88	26302	12/06/19
21740	FIRST NATIONAL BANK OMAHA	11/19/19	ww visa charges 01241119	255-43200.612 UNIFORMS,BOOTS,ETC	976.85	26302	12/06/19
07010	GREEN MOUNTAIN POWER CORP	11/19/19	39 Cascade 10/18-11/19/19 0132407 1119	255-43200.622 ELECTRICAL SERVICE	12059.28	26317	12/06/19
V1093	HOLLAND CO., INC.	11/25/19	Sodium Aluminate 22106	255-43200.619 CHEMICALS	11185.30	26320	12/06/19
V10347	J.C. EHRLICH	04/18/19	COMMERCIAL PEST GENERAL M 2805300	255-43200.570 MAINTENANCE OTHER	70.00	26325	12/06/19
V9454	LENNY'S SHOE & APP	12/04/19	uniform P Boutin 3283718	255-43200.612 UNIFORMS,BOOTS,ETC	243.98	26330	12/06/19
20040	RAB CONSULTING & SERVICES	12/02/19	Ordinance consulting serv 075	255-43200.330 OTHER PROFESSIONAL SERVIC	1115.44	26346	12/06/19
25480	SAC FASTENER COMPANY	11/25/19	hit pins 48202	255-43200.570 MAINTENANCE OTHER	26.50	26353	12/06/19
36130	VERIZON WIRELESS	11/18/19	cell Oct19-Nov 18 2019 9842386453	255-43200.535 TELEPHONE SERVICES	145.00	26365	12/06/19
29825	VT GAS SYSTEMS	11/21/19	10/17/2019-11/19/2019 19260	255-43200.623 HEATING/NATURAL GAS	2011.06	26375	12/06/19
30210	VT LEAGUE OF CITIES & TOW	11/21/19	Unemployment Village 30553-Q1	255-43200.250 UNEMPLOYMENT INSURANCE	106.73	26380	12/06/19
38955	F W WEBB COMPANY	11/21/19	River St Vent line 65380389	256-43200.434 PUMP STATION MAINTENANCE	313.26	26298	12/06/19

12/06/19

11:29 am

## Town of Essex / Village of EJ Accounts Payable

Page 7 of 7

Check Warrant Report # 17176 Current Prior Next FY Invoices For Fund (GENERAL FUND)

HPackard

For Check Acct 01(GENERAL FUND) All check #s 12/06/19 To 12/06/19 &amp; Fund 2

Vendor	Invoice Date	Invoice Description Invoice Number	Account	Amount Paid	Check Number	Check Date
38955	F W WEBB COMPANY	11/22/19 Vent Line work	256-43200.434	23.64	26298	12/06/19
		65393587	PUMP STATION MAINTENANCE			
28005	RUSSELL SUPPLY	11/20/19 River St Vent Line	256-43200.434	173.67	26351	12/06/19
		134036	PUMP STATION MAINTENANCE			
36130	VERIZON WIRELESS	11/23/19 Pump Station Communicatio	256-43220.001	37.53	26367	12/06/19
		9842857954	SUSIE WILSON PS COSTS			
36130	VERIZON WIRELESS	11/23/19 Pump Station Communicatio	256-43200.434	145.70	26367	12/06/19
		9842857954	PUMP STATION MAINTENANCE			
36130	VERIZON WIRELESS	11/23/19 Pump Station Communicatio	256-43220.002	37.53	26367	12/06/19
		9842857954	WEST ST PS COSTS			
29825	VT GAS SYSTEMS	11/21/19 10/17/2019-11/19/2019	256-43220.002	46.26	26375	12/06/19
		19260	WEST ST PS COSTS			
29825	VT GAS SYSTEMS	11/21/19 10/17/2019-11/19/2019	256-43200.623	85.17	26375	12/06/19
		19260	HEATING/NATURAL GAS			
29825	VT GAS SYSTEMS	11/21/19 10/17/2019-11/19/2019	256-43220.001	44.05	26375	12/06/19
		19260	SUSIE WILSON PS COSTS			
30210	VT LEAGUE OF CITIES & TOW	11/21/19 Unemployment Village	256-43200.250	31.07	26380	12/06/19
		30553-Q1	UNEMPLOYMENT INSURANCE			
Report Total				63348.67		

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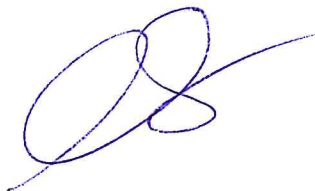
Edward G. Adrian (Of Counsel)  
Christian Chorba  
James F. Conway, III\*  
Steven R. Ducham  
Brian P. Monaghan  
Claudine C. Safar\*

*\*Also licensed in New Hampshire  
and Maine*

*\*Also licensed in Massachusetts*

# Memorandum

To: Robin Pierce  
From: Claudine C. Safar, Esq.  
Date: December 5, 2019  
Re: Condemnation Hearing  
Crescent Connector Parcels



Robin:

You requested a memorandum about the condemnation hearing procedure for the Crescent Connector Project.

The hearing should be convened and anyone wishing to testify at the hearing should be sworn in collectively. Everyone should proceed to the site visit. The site visit should again allow the experts to point out where the Connector is to be situated and where the portions of the property to be taken that belong to Mr. Kalanges are. Persons should have the opportunity to point out on the site visit anything specific that they want the trustees to take note of. The site visit should not be a place where testimony is taken, but merely to allow the Trustees to make observations.

After the site visit, everyone should come back and the hearing should be started. Village staff should be allowed to first present the project and evidence on the issues of necessity. They should present evidence on what was done to notify those with the property interests and how the statute was followed.

After the staff (including engineers and any witnesses they wish to call) has put on their evidence, then the property owners- Mr. Kalanges and any others with an interest- should have an opportunity to cross examine. Then they should have an opportunity to present their evidence and testimony.

The necessity portion of the hearing can then be closed. The trustees may take either a short break to stretch or they may deliberate on the necessity issue. My suggestion is that we proceed straight to compensation after a short recess.

The hearing should then reconvene and the staff and engineers should present evidence on compensation. It is anticipated that the state will present the appraiser to testify. Again, Mr. Kalanges and his counsel should be entitled to cross examine. Kalanges should then have the right to present his own evidence on the issue of compensation/valuation of his property being proposed to be taken.

The hearing and the evidence should be closed. The Trustees can deliberate after the hearing and instruct counsel to draft a decision on both necessity and compensation, if necessity is found in the affirmative.

If the Trustees find in the affirmative, under 19 V.S.A. § 713, the Trustees' order must fix the time within which the owner must vacate, and remove buildings, fences, timber, wood, or trees. Without the owner's consent, the time shall not be less than 2 months, and if the land has buildings, not less than 6 months. Also, compensation must be paid prior to the time to vacate. 19 V.S.A. § 713. If the landowners agreed to the taking without going through the hearing process, the owner could waive this time period.

Should the Trustees determine the property owner is entitled to damages, the Village shall pay damages as the Trustees determine reasonable. 19 V.S.A. § 712. If the damages are not acceptable to the property owner, the property owner and Trustees may agree to arbitration, or the property owner may appeal to the Superior Court.

# MEMORANDUM

TO: Essex Junction Trustees and Evan Teich Unified Municipal Manager  
FROM: James Jutras, Water Quality Superintendent  
cc: Greg Duggan, Deputy Manager  
Tri Town Sewer Committee  
DATE: December 3, 2019  
SUBJECT: Vermont Phosphorus Innovation Challenge (VPIC)



On November 14, the Governor Phil Scott recognized Vermont Phosphorus Innovation Challenge (VPIC) candidates that have moved to the next round of grant funding. Included was the Essex Junction project with partners UVM, Efficiency Vermont, CSWD and James Morris LLC. During development of this project, it has since been renamed **Pe<sup>-</sup>Phlo**.

Early in 2018, the Trustees approved participation in this 'market based solution' grant program for phosphorus removal. This recently announced round grant funding will provide for a mid-scale pilot size to be operated at the Essex Junction WWTF. Included with this memo, please find the early phase final report as well as a business plan that served as the next step for evaluation of this innovative process.

The facility considered commercial options in 2015 – 2017. National vendors were non responsive to smaller system such as ours. Our only other option was expensive, conventional engineering approaches that would increase our operational and capital costs. While researching additional options, we generated the concept that led to **Pe<sup>-</sup>Phlo**. Then came the VPIC grant opportunity.

The VPIC started with in 2018 with over 27 applicants. **Pe<sup>-</sup>Phlo** was accepted as one of six grantees. With completion of the first grant cycle in September, **Pe<sup>-</sup>Phlo** was one of five projects selected for implementation funding. UVM will continue to serve as the primary grantee with some financial assistance (in kind testing, etc.) by Essex Junction. The limits of this in kind are under development and review as are other sources of grant revenue. The next stage or pilot stage funding will provide nearly \$60,000 with a 50% match requirement. UVM is firming up its commitment to providing most of the match funding. An additional \$5,000 expected from the CSWD. With this grant and matches pledged, most of the budgetary needs are met.

**COST:** No direct cost to the Village. Some ancillary costs may fall within my management discretion.

UVM has strong interest in the research and patents for the filter technology employed here. Dr. Raju Badireddy is the UVM project partner who also developed the electrical micron filtration element of the system. This filter enhancement allows the performance that is achieved by the system piloted in the lab. Essex Junctions interest lies in pulling parties together to reduce internal Phosphorus recycle at the facility. Thus, reducing phosphorus recycle and enhance will maintain long term permit compliance without major capital construction.

Evan, Greg and I have had discussions regarding the interest of the village should the scale up of this project be successful. We have contacted the Village attorney and we are exploring what that interest might be. This type of basic research to develop a market based solution is not new to UVM and we are exploring any potential revenue stream for the Village should this turn into a viable business for somebody. Patents on proprietary equipment are already applied for or held by Dr. Badireddy for his technology.

# Vermont Phosphorus Innovation Challenge Business and Market Development Plan

## Pe<sup>-</sup>Phlo

September 30, 2019

### **Pe<sup>-</sup>Phlo** VPIC Project Partners:

UVM Department of Civil & Environmental Engineering  
Village of Essex Junction  
Efficiency Vermont  
Chittenden Solid Waste District  
James W. Morris & Associates, Inc.



**James W. Morris & Associates, Inc.**  
ENVIRONMENTAL ENGINEERING CONSULTANTS

# Vermont Phosphorus Innovation Challenge

## **Pe<sup>-</sup>Phlo**

### Business and Market Development Plan

#### **Project Overview**

The need for small-scale Phosphorus reduction technologies is a growing market in the United States. Improved water quality standards for compliance with EPA TMDL (Total Maximum Daily Limit) nutrient management requirements on the state and federal level have raised the compliance bar at the local level. This has occurred at a time where there are few mechanisms to fund the development and implementation of processes to meet these needs.

Many developing commercial Phosphorus removal nutrient solutions are only economically feasible for larger scale applications. In rural settings, these solutions are often not financially viable. The **Pe<sup>-</sup>Phlo** (pronounced P Flow) is a mobile, flexible and scalable solution for Phosphorus capture and removal. **Pe<sup>-</sup>Phlo** applications focus on reduced installation and operational costs without the investment needed for conventional Phosphorus removal “brick and mortar” approaches.

Proprietary pipe descaling technology (PDT) is widely used throughout the United States in thousands of successful scale formation control applications. This technology may well prove cost effective for Phosphorus removal in Vermont sized wastewater applications. The technology induces an oscillating electric field of variable amplitude and specific frequency that promotes formation and precipitation of crystalline minerals (i.e. Struvite) without dangerous and damaging adhesion normally associated with the formation of these compounds. **Pe<sup>-</sup>Phlo** uses PDT coupled with an electric-filtration membrane filtration cell, to enhance Phosphorus capture and removal from the waste stream. Early data indicates an enhanced purity of the material formed by this process. The innovative **Pe<sup>-</sup>Phlo** pretreatment and electric enhanced ultrafilter process operates at a lower pressure and improved reliability over other similar processes.

Research by the University of Vermont has confirmed the viability of applying descaling technology to aggregate dissolved Phosphorus in waste streams into particulate or crystalline forms for capture and removal. Work is ongoing to optimize laboratory parameters needed for full scale application required to prove out the innovative application of this technology.

#### **Description of Project**

Struvite (magnesium ammonium phosphate hexahydrate or  $\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$ ) is a crystalline compound formed when magnesium ammonium phosphate ions are dissolved in a waste stream's water phase above saturation concentrations. In many instances, Vivianite or hydrated ferrous phosphate;  $\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$  may also be formed. Both of these compounds can be present in a wastewater treatment system's unit processes. Left unchecked, the formation of these crystals can lead to problematic scale formation on treatment plant surfaces clogging pipes, fouling valves and otherwise creating severe maintenance problems. The **Pe<sup>-</sup>Phlo** system allows for controlled formation and removal of Struvite and Vivianite outside of the treatment process. The collected Struvite can be processed as a fertilizer resource outside of the wastewater facility and outside of the Lake Champlain Basin.

Struvite generation systems are employed to remove Phosphorus from waste streams. Commercial scale proprietary Struvite generation systems on the market are geared towards larger farm and municipal wastewater systems. Their profitability is based on a scale 10 times (or more) larger than applicable to the majority of facilities in Vermont. **Pe<sup>-</sup>Phlo** is viable on a small scale application because it uses an innovative application of pipeline descaling technology (PDT) as a means of enhancing crystalline Struvite generation and Phosphorus removal. This makes it cost-effective for smaller facilities. **Pe<sup>-</sup>Phlo** also couples an innovative oscillating electric-field assisted membrane filtration technology to capture and recover Struvite and/or Vivianite from the stream exposed to PDT. Re-processing the treated **Pe<sup>-</sup>Phlo** provided a more complete removal of nutrients captured by this process.

**Pe<sup>-</sup>Phlo** enhanced Struvite generation and capture improves the scalability to Vermont-sized water resource recovery facilities and Vermont sized farms. It does this at lower capital, operating and chemical costs than conventional innovative or proprietary systems. **Pe<sup>-</sup>Phlo** does this at lower pressure to operate, reducing operating costs.

### **Pe<sup>-</sup>Phlo**

The **Pe<sup>-</sup>Phlo** technology is a start-up-business in this quickly developing market. Process scale-up will determine the final configuration and capital equipment necessary for installation. Most potential installations are retrofits. The installations will utilize existing buildings and ancillary equipment, when feasible, to keep capital costs down. Typical installations are shown in Figure 1 below. **Pe<sup>-</sup>Phlo** can be sold directly to a facility or installed by a general contractor. Start-up services and warranty included in the purchase price.

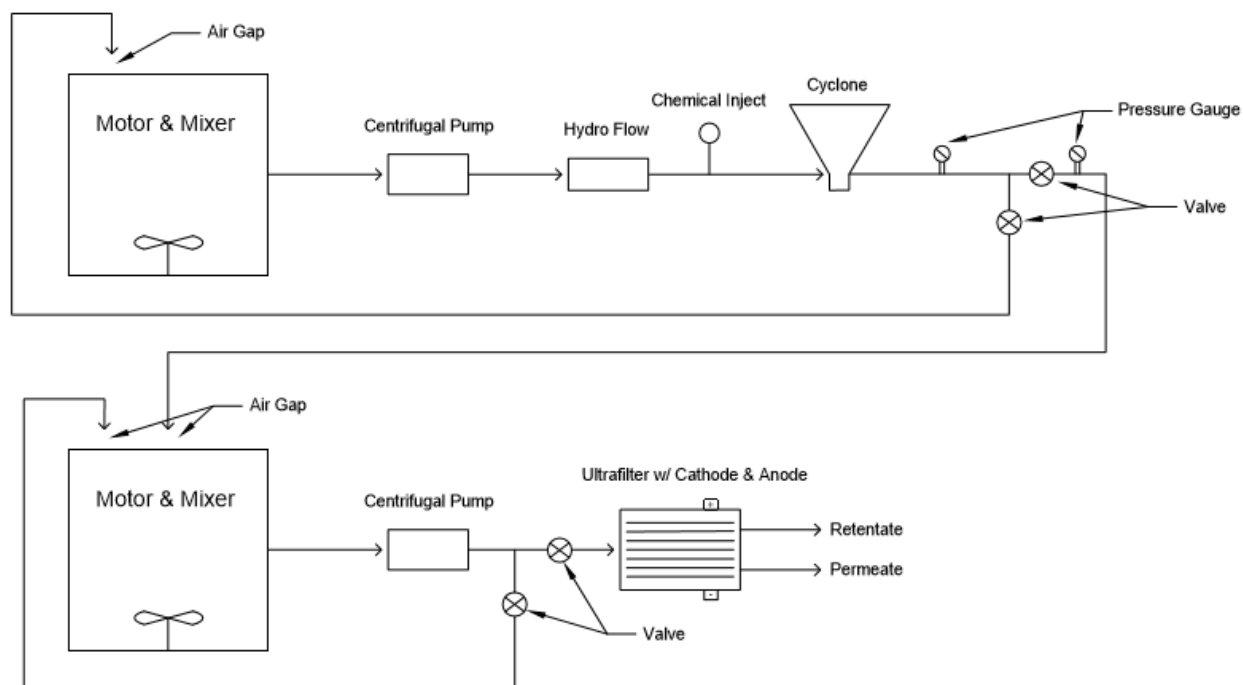


Figure 1: **Pe<sup>-</sup>Phlo** Process Flow Schematic  
(UVM Capstone Team Schultz, Hugo, Hancock)

The **Pe<sup>-</sup>Phlo** application is unique in that the final installations can be very flexible and take advantage of underutilized space or equipment. This flexibility gives **Pe<sup>-</sup>Phlo** a competitive edge over conventional P removal technology. Its low operating cost and reduction of Water Resource Recovery Facilities (WRRF) sludge generation provides additional benefit and reduced lifecycle costs, making this installation highly cost competitive.

#### **Market Niche: DEFERRED WRRF CAPITAL**

There are over 15,000 Water Resource Recovery Facilities <sup>(1)</sup>, many of which use industry specific conventional biological, physical and chemical processes to remove Phosphorus. These processes generate increased amounts of sludge for further treatment and disposal. Greenhouse gas reduction potential is important to many potential end users of the **Pe<sup>-</sup>Phlo** system. Chemical coagulation and flocculation of Phosphorus is also costly to the facility and to the environment. The coagulants used to bind and remove Phosphorus generate proportionally large amount of greenhouse gas emissions during the manufacture of these chemicals. (WRRFs are in the top ten of energy consumers and greenhouse gas producers.)

Biological treatment processes use “mixed liquor” or naturally occurring micro-organisms that collect Phosphorus and Nitrogen as part of their metabolism. When the treatment process is complete, waste micro-organisms are removed as sludge and then digested or forced to decompose, releasing a significant portion of those nutrients back to the process for treatment again. The constant recycling of P within conventional wastewater facilities is squandering valuable treatment capacity and increasing operating costs.

**Pe<sup>-</sup>Phlo** breaks this vicious WRRF nutrient re-cycle by:

- Removing the Phosphorus from the digested sludge and frees Phosphorus and Nitrogen treatment capacity at the same time.
- Reduces sludge production
- Reduces the chemicals needed for Nitrogen and Phosphorus treatment
- Improves the process reliably for maintaining effluent Phosphorus concentrations below regulatory limits (0.2 mg/L Total Phosphorus in VT Lake Champlain basin).

At the Essex Junction, VT WRRF, sludge production and chemical use have increased  $\pm 30\%$  since running at a discharge of 0.2 mg/L total Phosphorus. This costs the facility approximately \$150,000 per year. As flows and pollution loads increase, more sludge will be produced and the cycle continues with decreasing potential for reliable effluent Phosphorus compliance. By application of the **Pe<sup>-</sup>Phlo** process, we interrupt this expensive nutrient re-cycle with a unique Phosphorus separation and isolation process that preserves valuable existing treatment capacity and stabilizing sewer user rate. Additional treatment capacity could then become available for the processing of high strength wastes generated by Vermont’s expanding food and beverage facilities or ensure that there is sufficient capacity to treat the waste from our connected and growing communities.

Many WRRFs are nearing the end of their design life cycle and need capital maintenance or process improvement. Even more WRRFs are approaching organic treatment capacity at a faster rate than they are approaching their hydraulic capacity. Nearly all facilities are facing increasingly stringent discharge requirements for Phosphorus and Nitrogen. Over time, the **Pe<sup>-</sup>Phlo** process is one inexpensive tool for process enhancement that may have broad and innovative application in the hands of WRRF engineers and operators.



## **Food and Beverage Production**

Vermont has the highest per capita density of breweries and microbreweries in the country with over 100 microbreweries, wineries, meaderies and distilleries (2). These breweries and distilleries generate a high Phosphorus waste stream that gets further treatment at WRRFs or co-digestion with cow manure treatment systems on farms.

Vermont is also home to many value-added food and dairy product manufacturers that convert raw milk to cheese, ice cream and many other consumer products. These large manufacturers often rely on farm-based digesters for management of their manufacturing byproducts. While Vermont leads the country in farm-based anaerobic digestion per capita (3), there is diminishing capacity to handle these high Phosphorus waste streams with seasonal farm nutrient spreading restrictions. With added farm nutrient management planning requirements and a trend towards increased farm herd density on large farms, the capacity to handle these waste supplemental waste streams can be impacted. **Pe<sup>-</sup>Phlo** nutrient removal system expands capacity where it is applied. Further work is needed to determine if **Pe<sup>-</sup>Phlo** may well be a viable pretreatment system at the point of food waste generation.

Often, food manufacturing wastes generated by these producers introduce up to 400 ± ppm soluble (dissolved) Phosphorus to WRRFs and farm-based digesters. These facilities are often designed for 5-7 ppm. This concentrated Phosphorus waste increases the total mass load of Phosphorus in the digestate which is most often applied to the land as a fertilizer on farms or turned into a value-added fertilizer for specific markets. Farms have been identified as a significant source of Phosphorus in the Lake Champlain TMDL. As noted earlier, farms are required to develop nutrient management plans that require close monitoring of Phosphorus in the soil and fertilizer applied to fields. Importing additional Phosphorus to the farm by accepting food and beverage waste may create nutrient limits to the farm.

## **DEFERRED CAPITAL EXPENDITURE**

The primary markets for the **Pe<sup>-</sup>Phlo** installation are deferred capital expenditure and process Phosphorus removal enhancement. The **Pe<sup>-</sup>Phlo** process is also less energy intensive and less land intensive than conventional treatment approaches. A secondary market is installation into existing facilities to aid in Phosphorus control within existing operations. Other markets to be explored include but are not limited to pretreatment of farm manure pit treatment, farm yard and silage nutrient treatment and Phosphorus removal at food and beverage manufacturers.

Municipal and agricultural pollution control installations often use similar equipment from the same manufacturers for environmental mitigation work. Conventional municipal mechanisms for Phosphorus removal often employ expensive technologies in a redundant manner to reduce Phosphorus concentrations to meet more stringent environmental discharge requirements. As agriculture is increasingly regulated, equipment technology is being used to further process animal waste to remove Phosphorus and reduce soluble Phosphorus on agricultural fields for environmental compliance.

Both municipal and agricultural applications often result in high capital expense and labor-intensive operations that generate more waste byproduct in order to achieve Phosphorus reduction targets. The **Pe<sup>-</sup>Phlo** process provides an alternative Phosphorus removal mechanism in a cost-effective way.



Reduced capital and operational savings are the market niche for **Pe<sup>-</sup>Phlo**. A potential revenue from sale of Struvite collected in a **Pe<sup>-</sup>Phlo** installation is added incentive. The Phosphorus market is based on the sale of sequestered Phosphorus as an offsetting revenue to operation. These emerging Phosphorus markets are not yet considered a reliable revenue source. However, as the markets mature, revenue from Struvite sale will reduce the overall life cycle cost of a **Pe<sup>-</sup>Phlo** installation

### **MARKETING PLAN and IMPLEMENTATION STRATEGY**

The marketing and application of this technology will be similar to many other industry standard process equipment suppliers. WRRF design engineers will work with the **Pe<sup>-</sup>Phlo** design team manufacturer's representative as Engineers would with other industry equipment manufacturers' representative. A 'job' shop will assemble the components as designed for each specific application and ship them to the purchasers site for installation by the project general contractor. Startup services will be provided by **Pe<sup>-</sup>Phlo**.

The use of a manufacturer's representative is anticipated to be the primary product education and outreach mechanism for sales. This follows the WRRF and agriculture industry path with technical information provided to WRRF design engineers and facility managers. Prepared specifications will be developed to aid potential customers in developing requests for proposals.

Mobile point of use application is also a strong potential market. P&H Senesac Environmental Services, a Milton Vermont Environmental Services company with extensive experience in the fitting and application of mobile technology in the water quality industry. Senesac has expressed interest in teaming up with the **Pe<sup>-</sup>Phlo** project team for the in-field application. P & H Senesac Environmental Services provides water and wastewater dewatering services throughout the country. They have extensive experience in the setup and application of mobile environmental services, thus have the experience and knowhow in full scale field applications. They also demonstrate the flexibility needed to apply technology at a wide assortment of facilities and based on the individual application needs.

Early stages of market development for the **Pe<sup>-</sup>Phlo** system is based on sludge generation reduction, enhanced treatment capacity and avoided capital costs. Over time the sale of Struvite captured to fertilizer blenders will offset facility capital and operating costs.

### **EMERGING PHOSPHORUS MARKETS**

Phosphorus (P) and Nitrogen (N) fertilizers have revolutionized food production creating farm enhanced crop yields. Production of both P and N fertilizers require raw materials and energy to create these valuable crop nutrients. The scientific community has recognized that Phosphates used as fertilizer are a finite source. Markets for recycling Phosphorus as a nutrient are seen as unreliable at this time. As the market develops, revenue estimates for the sale of struvite are estimated to be \$100 to \$600 per ton depending on the area of the country.

Struvite derived from WRRF processes may require certification as an alternative process to achieve Class A status for unregulated distribution and marketing of the **Pe<sup>-</sup>Phlo** Struvite. Class A determination is important in improving direct marketability of the captured Struvite. However, one regional biosolids processor has expressed interest in **Pe<sup>-</sup>Phlo** Struvite as a tool to provide custom fertilizer blending options for them in their Class A products. This blending option would provide the further treatment needed for distribution.

A third marketing tool for consideration of some is the green environmental sector for environmental credit trading. Climate change, local agricultural movements and environmental compliance converge to develop an emerging market for Phosphorus supplemental sources. Unlike energy carbon offset markets, this nutrient trading commodity is in its infancy and experiencing ebbs and flows in pricing. Over time and as reliable rock phosphate reserves diminish, the market for P derived from Water Resource Recovery Facilities (WRRF) and agriculture will improve. Revenue from this emerging market is not a factor for consideration in this implementation plan.

### **Interest to farms, tax payers and rate payers**

Vermont is a small state in terms of population, but a BIG state in terms of innovation and problem solving. Vermont interest in a market-based approach to Phosphorus reduction is huge in applying cost effective solutions for small facilities. The technology is transferrable to thousands of small facilities throughout the country.

Vermonters also have significant challenges in meeting the requirements of the Lake Champlain TMDL. The Vermont Phosphorus Innovation Challenge recognizes that small size does matter in addressing Phosphorus removal challenges. EPA focus is on all sectors of pollution identified including but not limited to farms, timber operations, stormwater discharges, WRRF discharges, etc. That noted, EPA's only direct permit enforcement capability is to those entities with an NPDES Point Source Permit, which are municipal stormwater permits and WRRF discharge permits.

During a series of public hearings prior to release of the Lake Champlain TMDL, Stephen Perkins of EPA (retired) made it abundantly clear that if Vermont efforts for TMDL compliance did not meet the mark, the only recourse the EPA has is to tighten standards on NPDES point source permit holders. These two sectors are heavily invested now in Phosphorus reduction and will reach diminishing return for dollars invested per pound of P removed. **Pe<sup>-</sup>Phlo** provides an alternative for consideration.

Effective and cost-efficient removal of P and resale of waste products derived will greatly reduce the application cost per pound of Phosphorus removed. Many of the TMDL non-point Phosphorus removal projects are based on derived calculated Phosphorus values, not hard quantifiable and verifiable Phosphorus removal numbers. The **Pe<sup>-</sup>Phlo** process generates a measurable and quantifiable product removed from the waste stream. **Pe<sup>-</sup>Phlo** offers a potential offsetting revenue to support operations.

Should Vermont continue on a path of aggressive Phosphorus removal via offset and trading, the opportunity for a flexible and low implementation cost installation such as **Pe<sup>-</sup>Phlo** can be very desirable. A sewer district that installs **Pe<sup>-</sup>Phlo** would have less capital for rate payers to absorb. **Pe<sup>-</sup>Phlo** technology may potentially be applied in two general approaches. One approach could be retrofitting to existing WRRF operations as noted earlier. There is also potential for regional distributed application. A group of small operations, perhaps a group of small WRRF's and/or several on-farm operators with or without digesters in an appropriately defined area could form a Co-Operative. A Co-Op approach or a shared **Pe<sup>-</sup>Phlo** unit could be used by nearby municipalities or a collective of nearby farms for use of a mobile version of the installation.

The municipal and farm market are highly competitive and funding constrained. Profitability would be based on industry averages of 10% net margin for the total design and installation package. Experience with the development and installation of multiple units would allow for some increase in margin up to 20% by means of increased performance and more market share as a result of successful installations. The **Pe<sup>-</sup>Phlo** benefit is reduced capital, reduced energy cost and potential revenue from sale of collected struvite.

#### **Business Launch (needs and hurdles)**

Currently the project requires migration from the UVM laboratory to the Essex Junction WRRF for **Pe<sup>-</sup>Phlo** scale-up application. A scaled up version of the application will allow the research team to analyze performance in a commercial application while allowing for a lot of process variables that are not typically encountered in a laboratory setting.

A project time line for further product and market development can be established after successful completion of this first application scale-up. The budget presented is to scale up the application with installation and product monitoring at the Essex Jct. VT WRRF for a period of up to 6 months.

This business plan will be updated after successful field demonstration. A budget for the next stages of **Pe<sup>-</sup>Phlo** is attached for the VPIC consideration.

**Budget:** Attached

1. One Water for America State Policymakers' Toolkit, US Water Alliance and The Council of State Governments
2. BrewVeiw Vermont, 2019 Issue 2
3. [www.NEWMOA.org](http://www.NEWMOA.org)

## UVM, Essex Jct WRRF et al.

	<u>Overall</u> <u>Budget</u>	<u>Next Stage</u> <u>Grant</u> <u>Request</u>	<u>UVM et al</u> <u>Match</u>
Laboratory Testing	\$6,000	\$3,000.0	\$3,000.0
Membrane purchase	\$12,000	\$6,000.0	\$6,000.0
Ultrafilter Equipment Rental	\$27,600	\$13,800.0	\$13,800.0
Ultrafilter micron filters	\$5,000	\$2,500.0	\$2,500.0
Frac Tank Rental	\$5,000	\$2,500.0	\$2,500.0
Miscellaneous	\$1,000	\$500.0	\$500.0
Outside Consulting Services	\$6,000	\$3,000.0	\$3,000.0
UVM Grad Student Stipend (X-Months salary +12% Fringe + Tuition)	\$44,094	\$22,047.0	\$22,047.0
UVM F & A Charged at 25%	<u>\$11,120</u>	<u>\$5,560.0</u>	<u>\$5,560.0</u>
Total	\$117,814		
50% Match		\$58,907.0	
Grant Total Request		\$58,907.0	

# Vermont Phosphorus Innovation Challenge Final Technical Report

## Pe<sup>-</sup>Phlo

September 30, 2019

Pe <sup>-</sup> Phlo VPIC Project Partners:	
Appala Raju Badireddy, Ph.D. Assistant Professor	UVM Dept. of Civil & Environmental Engineering Email: <a href="mailto:raju.badireddy@uvm.edu">raju.badireddy@uvm.edu</a>
Jim Jutras	Village of Essex Junction
James W. Morris, Ph.D., P.E.	James W. Morris & Associates, Inc.
Jeffrey Hullstrung	Efficiency Vermont
Josh Tyler	Chittenden Solid Waste District



James W. Morris & Associates, Inc.  
ENVIRONMENTAL ENGINEERING CONSULTANTS

## 1.0. INTRODUCTION

The investigation activities described herein were conducted by Civil and Environmental Engineering graduate students and the PIs from the University of Vermont, Essex Wastewater Resource Recovery Facility (WRRF), James Morris & Associates Inc., Efficiency Vermont, and Chittenden Solid Waste District.

The purpose of this investigation was to develop and test an innovative phosphorus recovery device ( $Pe^-Phlo$ ) for phosphorus reduction in wastewater streams in a cost-effective manner. The  $Pe^-Phlo$  device is composed of two units that are critical for successful recovery of dissolved phosphorus: 1) commercial particle descaling technology a.k.a. “*HydroFlow*”, and 2) a custom-built electric filtration cell. These units can be operated individually or in tandem as per treatment requirements dictated by dissolved phosphorous, ammonia, and magnesium concentrations, and the size of colloidal phosphorus-containing crystals formed during the treatment. In addition, the pulsed-electric fields generated by *HydroFlow* should avoid scale build-up in distribution pipes carrying the wastewater streams. The enhanced phosphorous recovery in the form of struvite or struvite-like minerals (i.e., magnesium ammonium phosphate (MAP) hexhydrate or  $MgNH_4PO_4 \cdot 6H_2O$ ) using  $Pe^-Phlo$  device would improve the scalability to Vermont sized water resource recovery facilities and Vermont sized farms.

The hypothesis of this study is that the *HydroFlow* coupled with oscillating electric-field assisted membrane filtration can precipitate struvite, and consequently enhance the phosphorus removal from wastewaters. In addition, the wastewaters treated with *HydroFlow* exhibit a lower tendency to generate hard scale on surfaces of the conduits (or distribution pipes and membranes). To test this hypothesis, a bench-scale  $Pe^-Phlo$  device was developed and tested in the batch as well as continuous mode treatment using dewatering centrate obtained from Essex WRRF. Additionally, the role of seed additives (e.g., magnesium ions) on struvite precipitation was examined. The seeding approach was employed to induce precipitation and thereby enhance struvite recovery efficiency. The dewatering centrate samples before and after treatments were analyzed using APHA Standard Methods (SM), Environmental Protection Agency (EPA) methods, colorimetric assays, and inductively coupled plasma-atomic emission spectroscopy (ICP-AES). The struvite crystals formed under various treatments were characterized using scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), X-ray diffraction (XRD) spectroscopy, X-ray fluorescence (XRF) spectroscopy, and brightfield microscopy.

## 2.0. LABORATORY METHODOLOGY

**2.1. Raw Source Water:** The dewatering centrate was obtained from the Essex WRRF located at Essex Junction, Essex, Vermont. 10 L of centrate was collected and transported to Dr. Badireddy's laboratory within 1 h and stored at 4 °C until further experimentation. The centrate sample was settled and stored at room temperature prior to the experimentation. At the time of sampling, a portion of the sample was sent to Endyne Inc. laboratory (Vermont) for the chemical composition analysis. A duplicate sample was also analyzed in Dr. Badireddy's lab at UVM. Table 1 shows the chemical composition of the centrate employed for this investigation. The results showed the presence of magnesium (21 mg/L), ammonia (990 mg/L), and phosphorus (130 mg/L, dissolved) in the centrate sample. These three components are collectively known as MAP and are responsible for struvite precipitation under appropriate conditions. The centrate has a pH of 7.54 at 22.7 °C.

**Table 1.** The characteristics of centrate sample obtained from the Essex WRRF on 03/13/2019

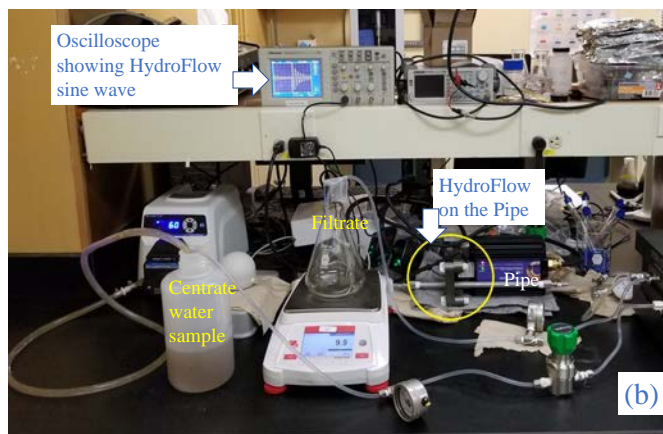
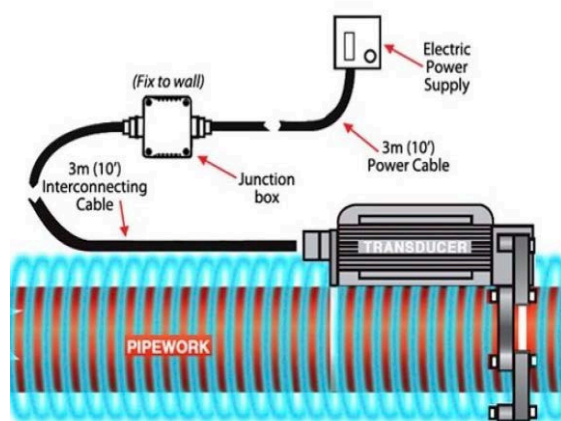
Parameter	Result	Units	Method
BOD-5 day	99,000	mg/L	SM 5210B(11)
COD	110,000	mg/L	Hach8000/EPA410.4
Conductivity at 25 °C	8,720	µmhos/cm	EPA 120.1
Ammonia as N	990	Mg/L	EPA 350.1, R.2
pH	7.54	SU at 22.7 °C	SM18 4500- H B
<b>Phosphorus, Total Dissolved</b>	<b>130</b>	mg/L	EPA 365.1, R.2
Phosphorus, Total	150	mg/L	EPA 365.1, R.2
Solids, Total Dissolved	1,690	mg/L	SM 2540C-97
Solids, Total Suspended	220	mg/L	SM 2540D-97
Metals Digestion	Digested		EPA 3015A
Calcium, Total	48	mg/L	EPA 6010C
Iron, Total	7.1	mg/L	EPA 6010C
Magnesium, Total	21	mg/L	EPA 6010C
Potassium, Total	170	mg/L	EPA 6010C
Sodium, Total	150	mg/L	EPA 6010C

## STAGE I

Pre-development stage includes the purchase of particle descaling technology (*HydroFlow Inc. USA*) and building a custom-designed electric filtration cell. These two units were assembled and developed into an innovative **Pe<sup>-</sup>Phlo** technology for the VPIC project.

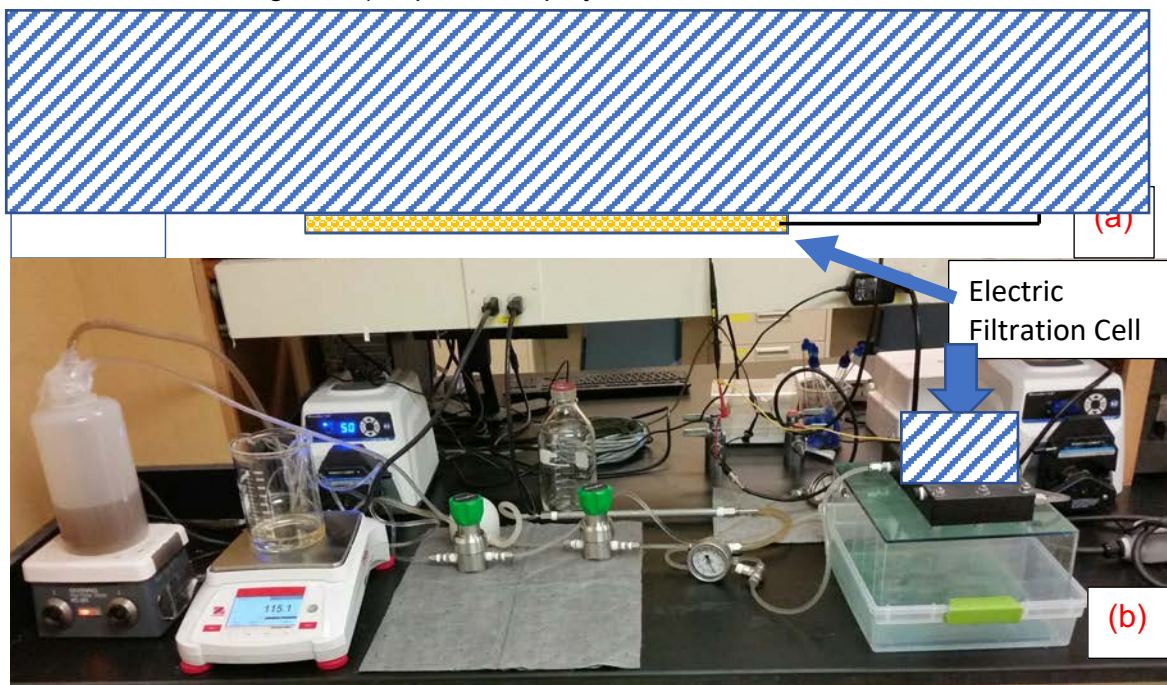
**2.2. Development and Operation of Pe<sup>-</sup>Phlo device:** The Pe<sup>-</sup>Phlo device is composed of two units that are critical for successful recovery of dissolved phosphorus: 1) commercial particle descaling technology (PDT) a.k.a. “*HydroFlow*”, and 2) a custom-built electric filtration cell. The description and working principle of the components is described below.

**2.2.1. Commercial particle descaling technology a.k.a. “*HydroFlow*”:** *HydroFlow* is powered by the patented Hydropath technology. When properly installed on any type of pipe material (Figure 1), it induces a ±150 kHz, oscillating sine wave, alternating current (AC) signal. The electric induction is performed by a special transducer connected to a ring of ferrites. The unit attaches around an existing pipe made of any material and no plumbing or cutting of the piping system required (Figure 1a). It uses 120 V power and consumes less than \$10 of electricity per year. The pipe and the flowing fluid act as a conducting medium, which allows the signal to propagate. The induced AC signal is believed to cause the mineral ions that make up **struvite** to form **loosely held together clusters**. When certain conditions are created (e.g., pressure change, temperature change, and high mixing intensity (i.e., turbulence or shear forces)) the clusters precipitate out of solution and form stable crystals of struvite that remain in suspension. The crystals are not stable to adhere to surfaces as hard scale and are carried away with the flow. Because hard scale no longer accumulates, the shear forces created by the flowing liquid erode and soften existing scale deposits over time. **It is important to note that constant liquid flow is required to remove scale deposits from a system.** The bench scale *HydroFlow* device used in this investigation is shown in Figure 1b.



**Figure 1.** The pipe and flowing liquid act a conducting medium, which allows the electric signal generated by the *HydroFlow* device to propagate in the liquid (a); the electric signal interacts with the ionic species present in water to induce particle cluster formation. A bench-scale  $Pe^-Phlo$  device with the *HydroFlow* installed on the pipe is shown in (b).

**2.2.2. Custom-built Electric Filtration Cell:** A bench-scale electric filtration cell was developed at UVM. This filtration cell is designed to withstand transmembrane pressure up to 70 psi, which means microfiltration or ultrafiltration can be implemented depending on the treatment requirement. The filtration cell was equipped with two graphite electrodes with one on the feed side (wastewater) and the other on the permeate (filtered water or filtrate) side. A membrane is situated between the two electrodes separating the feed and permeate side (Figure 2a). The platinum wire leads connect the electrodes with the external power source (alternating or direct current) through the alligator clips. Each electrode was located at a distance of 1 cm from the membrane surface. The schematic and actual electric filtration cell set up used in this investigation is shown in Figure 2a and 2b, respectively. All crossflow microfiltration experiments were carried out using 0.22  $\mu m$  pore-size polysulfone membrane.



**Figure 2.** The schematic (a) and actual set up (b) of the custom-built electric filtration cell. Note PDT refers to particle descaling technology, a.k.a *HydroFlow*.



## STAGE II

**Pe<sup>-</sup>Phlo** technology development stage includes testing the technology's ability to recover dissolved phosphorus in the form of struvite or struvite-like crystals (P-product) from dewatering centrate water. In addition, develop business model and identify the market opportunities for the P-product.

### 3.0. TEST PROCEDURE AND DISCUSSION

The dewatering centrate was studied for struvite precipitation and recovery under the experimental conditions described in Table 2.

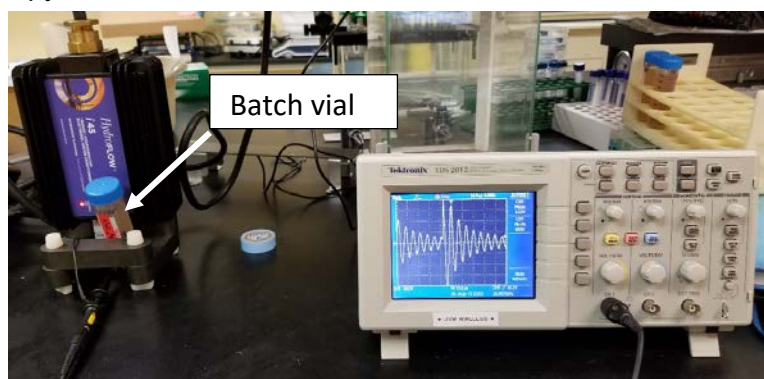
**Table 2.** The experimental test conditions investigated in this project.

	Test Condition 1		Test Condition 2		Test Condition 3		
	Control	HydroFlow	Control	HydroFlow	Control	HydroFlow + Electric field filtration OFF	HydroFlow + Electric field filtration ON
	Batch + Dead-end Filtration	Batch + Dead-end Filtration	Batch + Dead-end Filtration	Batch + Dead-end Filtration	Batch + Crossflow Filtration	Batch + Crossflow Filtration	Batch + Crossflow Filtration
	Time (h)= 4	Time (h)= 4	Time (h)= 1, 4, 24	Time (h)= 1, 4, 24	Time (h)= 0-6	Time (h)= 0-6	Time (h)= 0-6
Centrate	√	√	√	√	√	√	n/a
Centrate + Mg <sup>2+</sup> ions	n/a	n/a	n/a	n/a	√	√	√

**3.1. Centrate sample preparation:** 1 L of raw dewatering centrate sample was taken out from 4 °C storage and kept on the workbench for an hour to allow the centrate to reach ambient room temperature. Meanwhile, the settleable solids in the centrate sample settled to the bottom of the bottle and the supernatant was transferred to a clean beaker. The collected supernatant centrate sample was used for further experimentation under the test conditions described in Table 2.

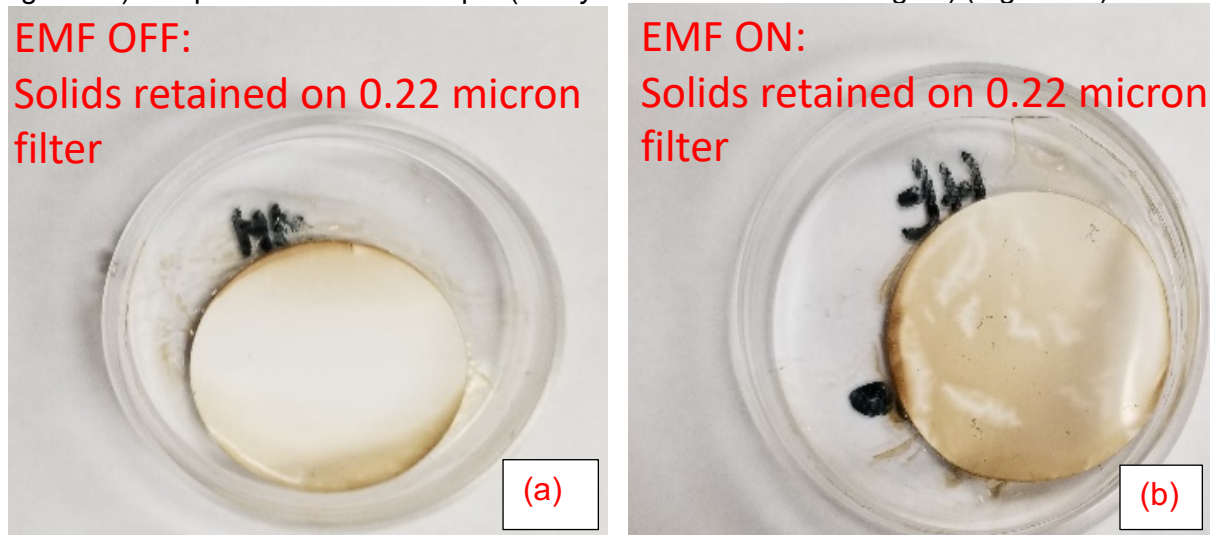
**3.1.1. Test Condition 1:** Batch mode treatment without and with *HydroFlow* for 4 h and dead-end filtration.

The experimental set up for the batch treatment with the *HydroFlow* is shown Figure 3. A 40 mL of centrate sample in a 50 mL polypropylene vial was treated under batch conditions for 4 h without (control) and with  $\pm 150$  kHz *HydroFlow* electric field signal. The samples were then filtered using 0.22  $\mu$ m-pore size polycarbonate filter to recovery precipitated crystals. The filters were air dried and the retained solids were analyzed for elemental composition using energy dispersive X-ray spectroscopy and X-ray fluorescence spectroscopy. The crystal morphologies were examined using the scanning electron microscopy.



**Figure 3.** Batch experiments treating centrate with *HydroFlow*.

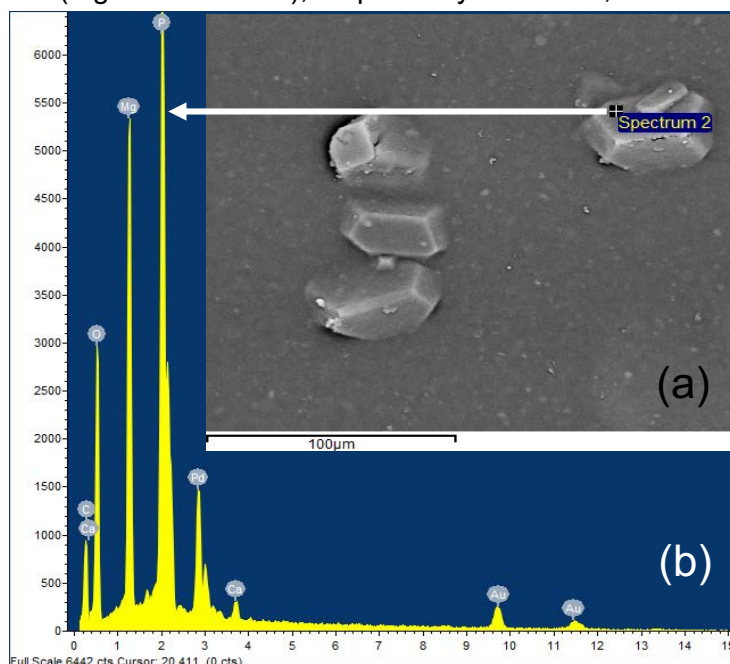
A photograph of air dried solids on the membrane filter is shown in Figure 4. The solids that were exposed to 4 h of  $\pm 150$  kHz *HydroFlow* electric field signal (EMF) appeared to be dark brown, which is likely composed of a mixture of crystals and organics at a higher concentration (Figure 4b) compared to control sample (no *HydroFlow* electric field signal) (Figure 4a).



**Figure 4.** Control centrate solids (EMF OFF) (a), and *HydroFlow* (EMF ON) treated solids (b). The exposure time was 4 h.

A high-resolution scanning electron microscopy analysis revealed crystals that resembled struvite morphology and energy dispersive X-ray spectroscopy confirmed the presence of phosphorus and magnesium in the crystals (Figure 5a and 5b), respectively. However, it appeared that the number of crystals per unit area were low while the crystal sizes were as large as 50  $\mu\text{m}$ . These 50  $\mu\text{m}$ -sized could be settled by gravity and recovered from the solution.

The centrate and settled solids from the control sample (no *HydroFlow*) as well as the settled solids after treatment with  $\pm 150$  kHz *HydroFlow* were centrifuged and filtered using 0.22  $\mu\text{m}$  polycarbonate filter. The solids were air-dried for X-ray fluorescence analysis. It was anticipated that the phosphorus-containing crystals will increase in the solids due to interactions with the *HydroFlow* electric field. The elemental composition of the solids was analyzed using a semi-quantitative X-ray fluorescence technique. The results from X-ray fluorescence analysis are summarized in Table 3.



**Figure 5.** Scanning electron microscopy image of solids on the filter (a). The energy dispersive X-ray spectroscopy analysis of the solids (b). The exposure time was 4 h.

**Table 3.** X-ray fluorescence analysis of solids.

**X-ray fluorescence (XRF) Analysis of settled and centrifuged**

	%P	%S	%K	%Fe	%Cu	%Ca
Settled solids	8.14 ± 0.08	3.09 ± 0.04	13.36 ± 0.05	<b>3.36 ± 0.07</b>	0.03 ± 0.01	12.71 ± 0.05
Solids w/o EMF exp. (centrifuged)	9.23 ± 0.07	5.31 ± 0.05	<b>17.97 ± 0.06</b>	0.92 ± 0.05	0.03 ± 0.01	11.15 ± 0.05
Solids after EMF exp. (centrifuged)	<b>13.13 ± 0.07</b>	<b>12.16 ± 0.05</b>	11.84 ± 0.04	0.71 ± 0.03	<b>0.32 ± 0.01</b>	<b>12.34 ± 0.04</b>
EMF effect On Solids composition	<b>Increase</b>	<b>Increase</b>	Decrease	Decrease	<b>Increase</b>	Slight Increase

Based on the Table 3 results, the changes in the elemental composition of the settled solids exposed to  $\pm 150$  kHz *HydroFlow* for 4 h are as follows:

- 1) the percent **phosphorus** in the settled solids increased from 9% to **13%**
- 2) the percent sulfur in the settled solids increased from 5% to **12%**
- 3) the percent calcium in the settled solids slightly increased from 11% to **12%**
- 4) the percent copper in the settled solids increased from 0.03% to **0.32%**

Above results suggest that 4 h treatment with  $\pm 150$  kHz *Hydroflow* electric signal was likely responsible for the observed increases shown in Table 3.

Furthermore, analysis of filter weights with retained solids on the control and *Hydroflow* treated indicated the following:

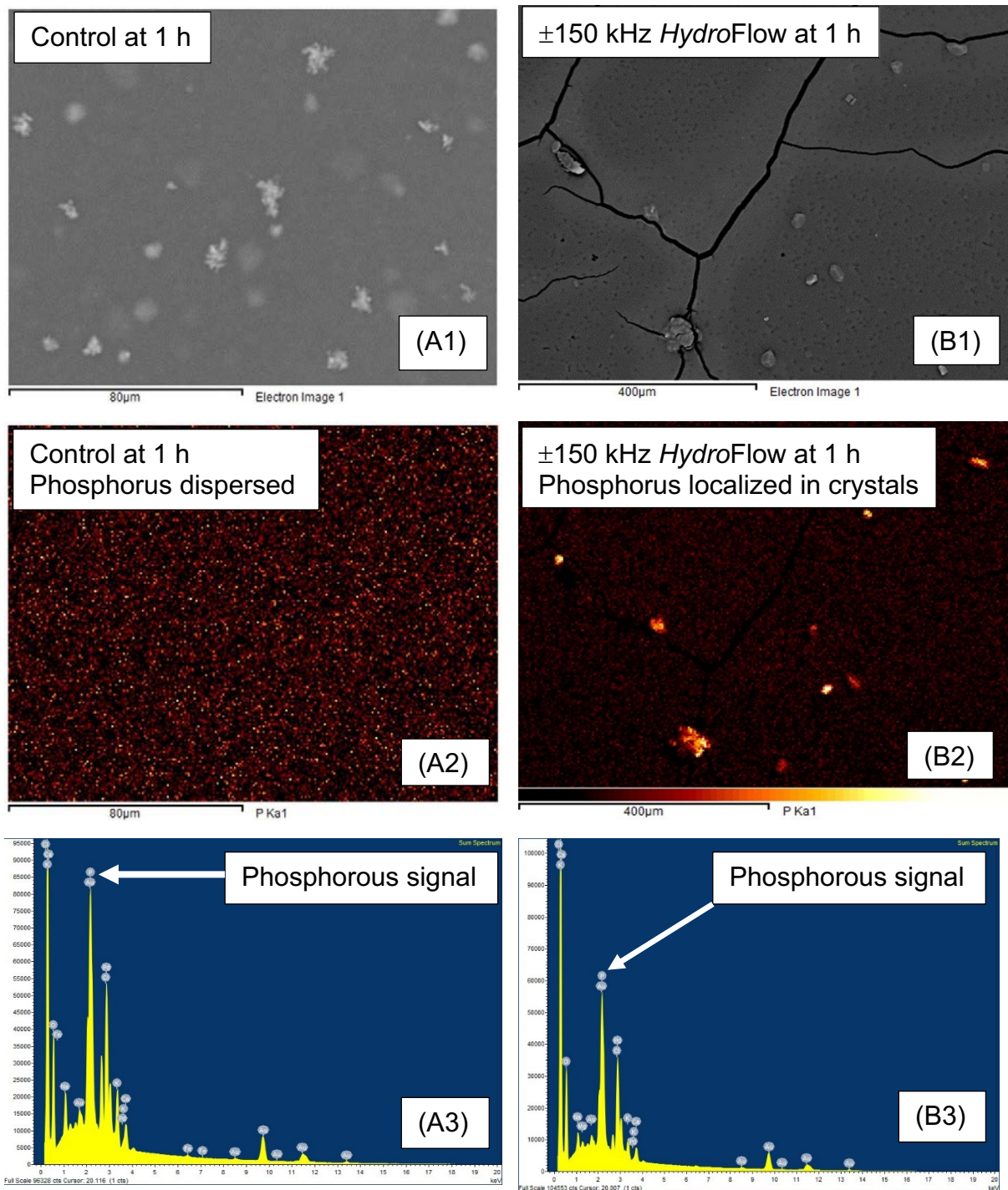
- 1) Control sample: weight of solids retained on the membrane surface was **0.1722 g/80 mL** filtered
- 2) *HydroFlow*-treated sample: weight of solids retained on the membrane surface was **0.4576 g/80 ml** filtered

These results confirm that *HydroFlow* treatment likely increased the concentration of settleable solids and possibly a fraction of them are phosphorus-containing struvite crystals. After the *HydroFlow* treatment, **the total solids recovered on the filter were remarkably increased by 165% compared to the control samples.**

**3.1.2 Test Condition 2.** Batch mode treatment without and with *HydroFlow* for time 1 h, 4 h, and 24 h.

The effect of exposure time on the formation and growth of crystalline solids and the phosphorus-containing crystals was investigated in the Test Condition 2. The samples were filtered and the solids were analyzed using scanning electron microscopy, and energy dispersive X-ray spectrometer. The results are shown in Figure 5 (1 h time) and Figure 6 (4 h time). The

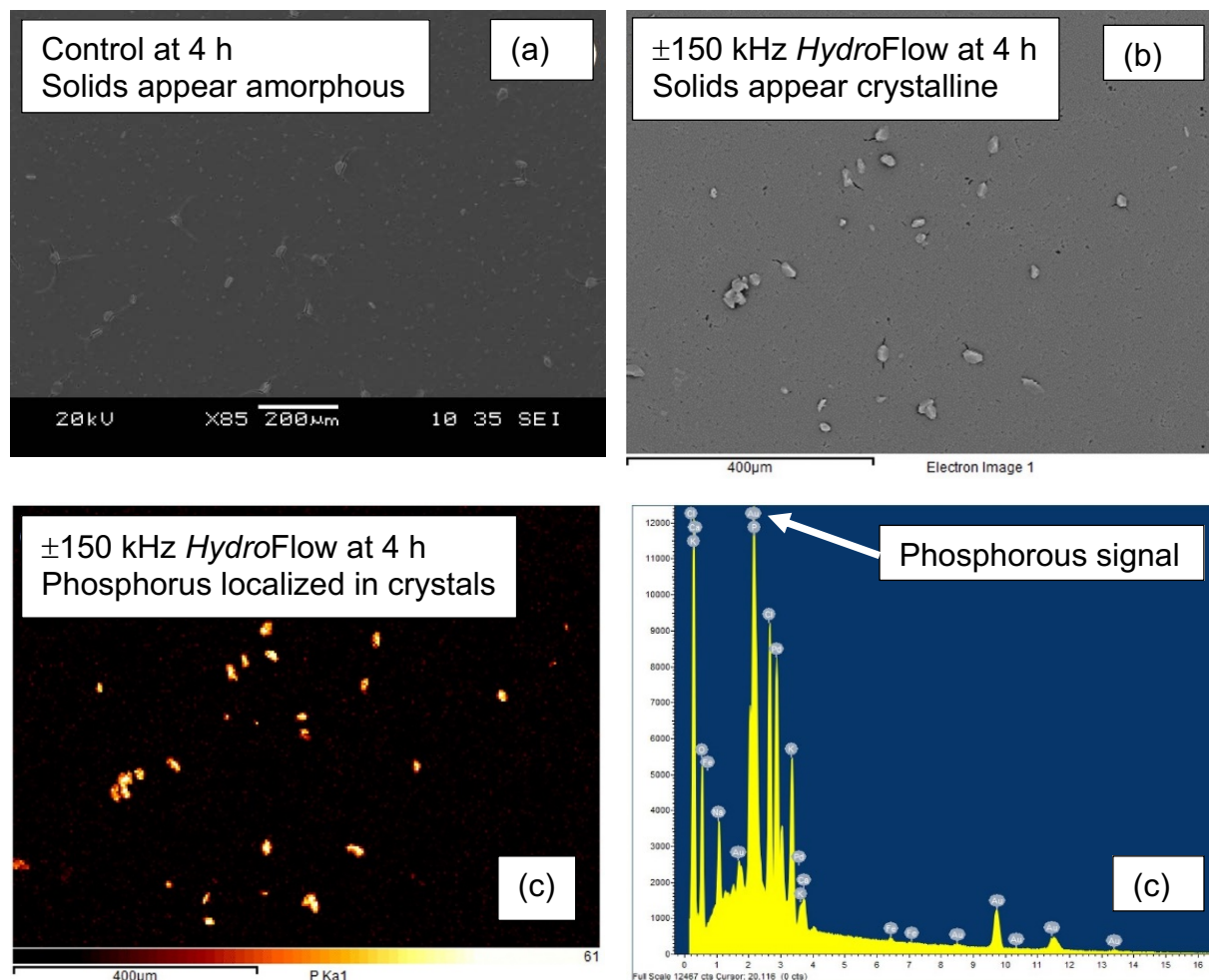
compositional differences between 4 h and 24 h samples were insignificant so data corresponding to 24 h are not shown in Figures 5 and 6.



**Figure 5.** Scanning electron micrographs (A1 and B1), phosphorous elemental maps (A2 and B2), and energy dispersive X-ray spectra of control and  $\pm 150$  kHz HydroFlow treated samples (A3 and B3). Time: 1h.



Phosphorous-containing solids appeared amorphous and dispersed across all solids retained on the membrane surface (Figure 5: A1 and A2 (1 h); Figure 6a (4 h)), as revealed by the scanning electron microscopy and energy dispersive X-ray spectrometer analysis. On the contrary, solids retained on the filter appeared crystalline and the phosphorus was remarkably localized in the crystalline solids just after 1 h as well as 4 h of treatment with  $\pm 150$  kHz *HydroFlow* treatment (Figure 5: B1 and B2, and Figure 6b and 6c).



**Figure 6.** Scanning electron micrographs of the control (a) and  $\pm 150$  kHz *HydroFlow* solids (b), phosphorous elemental map of the *HydroFlow* solids (c), and energy dispersive X-ray spectrum of the *HydroFlow* solids (d). Time: 4h.

### 3.1.3 Test Condition 3. Batch treatment with *HydroFlow* for 6 h followed by crossflow electric microfiltration.

The effect of magnesium ions ( $Mg^{2+}$ ) as seed species and the *HydroFlow* field on struvite formation was investigated. The hypothesis was that the  $Mg^{2+}$  ions can increase the struvite formation and  $\pm 150$  kHz *HydroFlow* treatment will decrease the nucleation time required for struvite formation. Furthermore, the struvite exposed to  $\pm 150$  kHz *HydroFlow* electric field will result in soft scale, which can be easily removed and recovered from the surfaces. The suspensions containing struvite crystals were captured and recovered using crossflow microfiltration in the presence and absence of electric fields across the membranes.

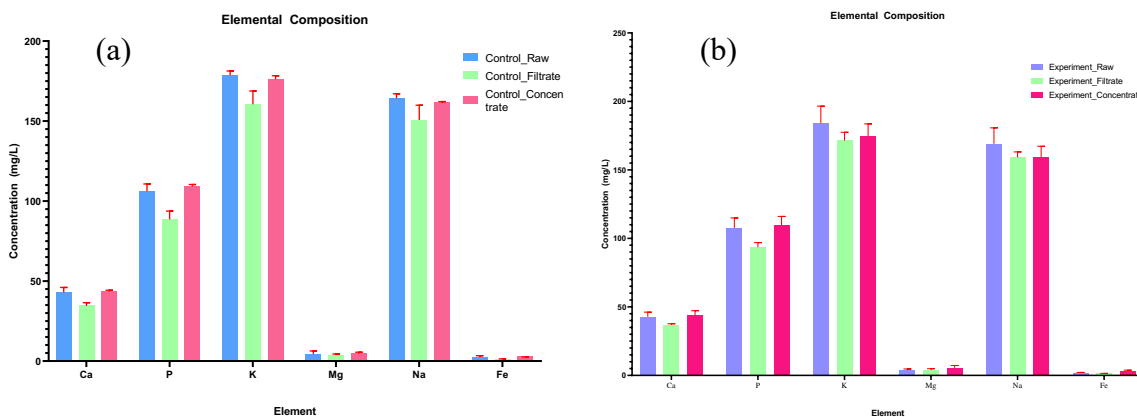
The centrate samples were treated for a maximum of 6 h, to mimic the residence time at Essex WRRF, and the struvite crystal formation was monitored and analyzed during that period. Two centrate samples, one obtained in March and the other in June, were exposed to Test Condition 3. The parameters including pH, conductivity, crystal nucleation time, and phosphorus concentration and recovery were measured. The phosphorus concentrations in the filtrate and concentrate from crossflow electric microfiltration were also measured.

#### Batch and Crossflow Treatment- Seeding with $Mg^{2+}$ ions

**Seeding solution:** 0.3525 g of magnesium chloride ( $MgCl_2$ ) was dissolved in 100 mL of ultrapure water by stirring at 400 rpm. The stock solution concentration of  $Mg^{2+}$  ions was 900 mg/L.

**Procedure:** 45 g of centrate water in 50 mL polypropylene vials were exposed to  $\pm 150$  kHz *HydroFlow* electric signal for 6 h. Another set of samples were set aside for 6 h but without exposure to the *HydroFlow* field, which served as the controls. At the end of 6-h period the samples were filtered using 0.22  $\mu m$  polysulfone membranes (Millipore) using crossflow microfiltration. The centrate samples were spiked with  $Mg^{2+}$  ions at 100 mg/L prior to activating the  $\pm 150$  kHz *HydroFlow* electric field. The controls were also spiked with  $Mg^{2+}$  ions at 100 mg/L. The two different centrate samples, which were obtained in March and June, were tested under these conditions.

After filtration the membrane was air dried overnight and analyzed using scanning electron microscopy and energy dispersive X-ray spectroscopy for crystal morphology and elemental composition, respectively. The raw centrate, filtrate, and concentrate samples were analyzed for phosphorus and other elemental concentrations using ICP-AES (Figure 7). All samples were measured in triplicate.



**Figure 7.** Elemental composition of centrate feedwater (raw), filtrate, and concentrate from microfiltration without (a) and with 6 h *HydroFlow* electric signal (b). The differences in elemental composition in the presence and absence of *HydroFlow* treatment were statistically insignificant ( $p > 0.05$ ).

In absence of additional  $Mg^{2+}$  ions (i.e., spike solution), and 6-h continuous crossflow microfiltration conditions the  $\pm 150$  kHz *HydroFlow* electric signal did not result in crystals that were large enough to be captured by 0.22  $\mu m$  membrane, and therefore, the observed change in phosphorus concentration between the raw centrate and permeate (filtrate) was not that remarkable (Figure 7). On the contrary, the results from Test Conditions 1 and 2 suggest that although the number of struvite crystals per unit area of the membrane was small the crystal sizes

were as large as 50  $\mu\text{m}$  after 4 h of *HydroFlow* treatment. At these sizes the struvite crystals can readily settle to the bottom of the vial.

Centrate samples were thoroughly investigated with  $\text{Mg}^{2+}$  spike solutions and combination *HydroFlow* and microfiltration. The most interesting results were obtained when both  $\text{Mg}^{2+}$  and  $\pm 150$  kHz *HydroFlow* electric field was applied simultaneously. A summary of the results from these experiments with spiked  $\text{Mg}^{2+}$  ions are shown in Table 4.

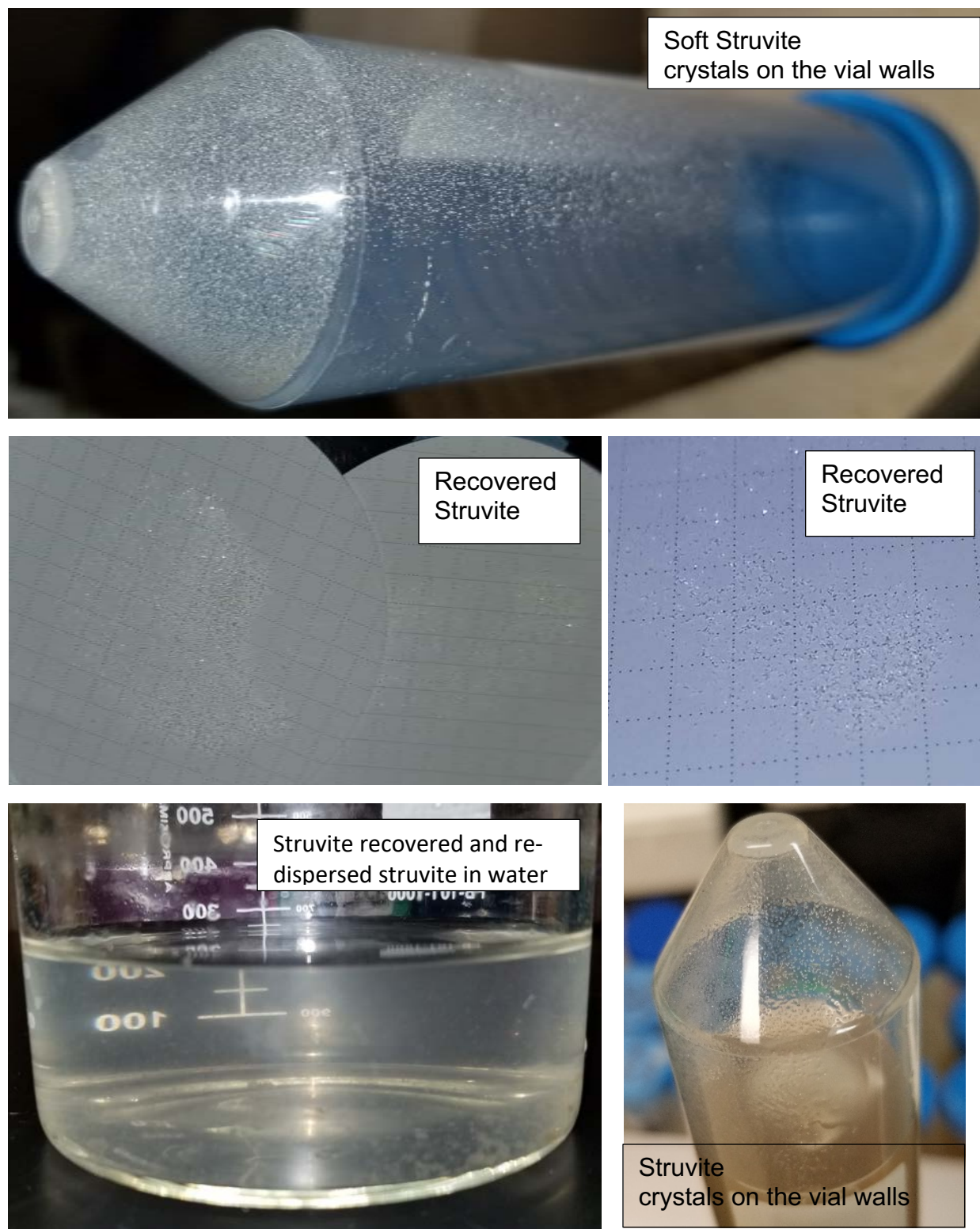
**Table 4.** *HydroFlow* treatment and crossflow microfiltration

Sample	Visual Crystal Nucleation Time (h)	Phosphorus Recovery Efficiency (%)	pH
<b>March 2019</b>			
Centrate sample	n/a	n/a	8.23
Centrate sample treated <b>with</b> $\pm 150$ kHz <i>HydroFlow</i> electric field signal	No visible crystal growth	9.53	8.19
Centrate sample treated <b>without</b> $\pm 150$ kHz <i>HydroFlow</i> electric field signal	No visible crystal growth	4.73	8.36
<b><math>\text{Mg}^{2+}</math> spiked</b> into Centrate sample and treated <b>with</b> $\pm 150$ kHz <i>HydroFlow</i> electric field signal	2.5	84.63	8.15
<b><math>\text{Mg}^{2+}</math> spiked</b> into Centrate sample and treated <b>without</b> $\pm 150$ kHz <i>HydroFlow</i> electric field signal	4	88.07	7.78
<b>June 2019</b>			
Centrate sample	n/a	n/a	7.41
Centrate sample treated <b>with</b> $\pm 150$ kHz <i>HydroFlow</i> electric field signal	No visible crystal growth	4.5	7.69
Centrate sample treated <b>without</b> $\pm 150$ kHz <i>HydroFlow</i> electric field signal	No visible crystal growth	10.97	7.97
<b><math>\text{Mg}^{2+}</math> spiked</b> into Centrate sample and treated <b>with</b> $\pm 150$ kHz <i>HydroFlow</i> electric field signal	5.5	78.61	7.81
<b><math>\text{Mg}^{2+}</math> spiked</b> into Centrate sample and treated <b>without</b> $\pm 150$ kHz <i>HydroFlow</i> electric field signal	6.5	76.26	7.94

Key findings from Table 4 are as follows:

1.  $\text{Mg}^{2+}$  ions and  $\pm 150$  kHz *HydroFlow* electric field significantly decreased the struvite nucleation time from 4 h to 2.5 h.
2. Struvite crystals were formed more rapidly in the presence of both  $\text{Mg}^{2+}$  ions and *HydroFlow* electric field compared to  $\text{Mg}^{2+}$  ions only.
3. **85% of dissolved phosphorous was recovered in the form of struvite within 2.5 h.**
4. Physical examination of struvite crystals revealed that **Struvite formed a soft scale (a loosely held together crystal clusters) on the surfaces.**
5. Struvite nucleation time and recovery appears to be sensitive to slight changes in pH.

## Visual and Quantitative Observations of Struvite Crystals

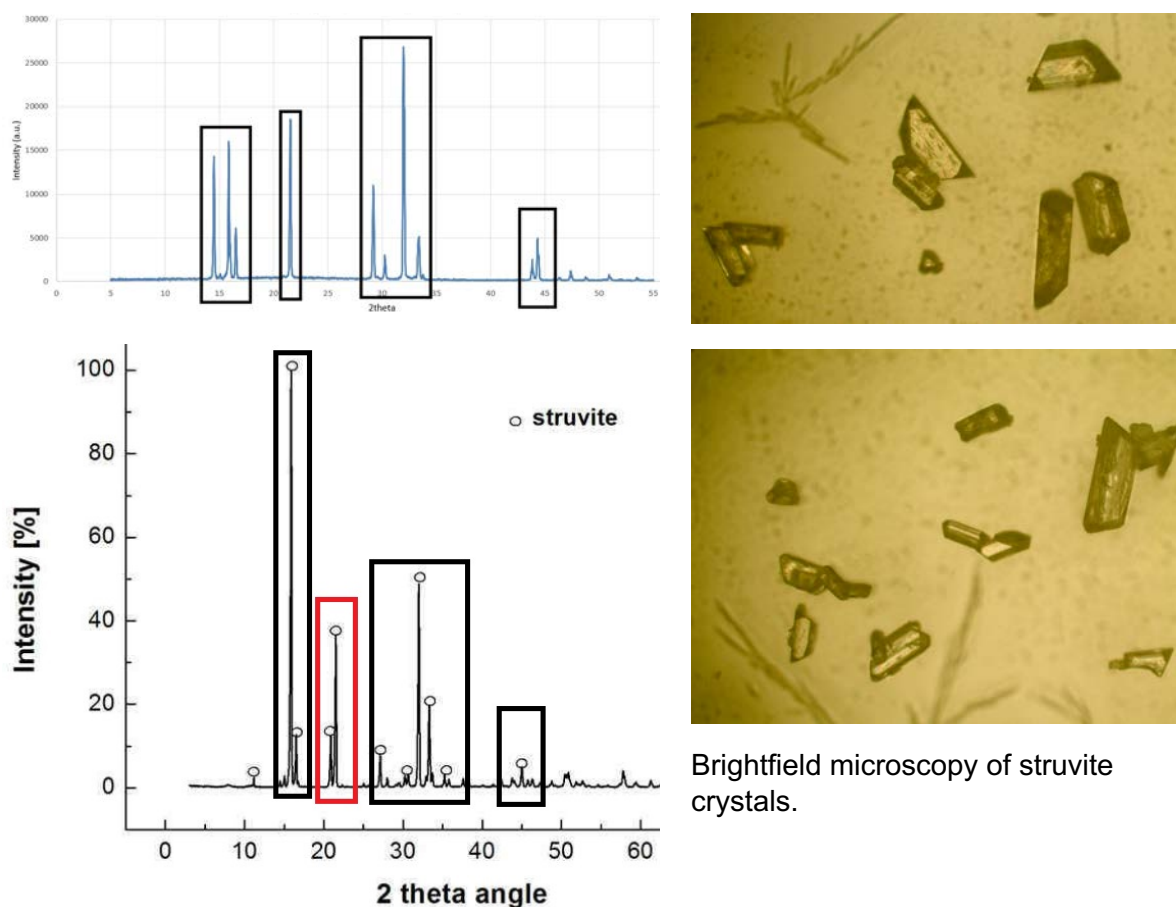


**Figure 8.** Struvite crystals formed by  $\text{Mg}^{2+}$  and  $\pm 150$  kHz *HydroFlow* electric field signal.



Struvite crystals were found to be a form of soft scale on vial surfaces and they were easily recovered by simple scraping or high intensity rinsing.

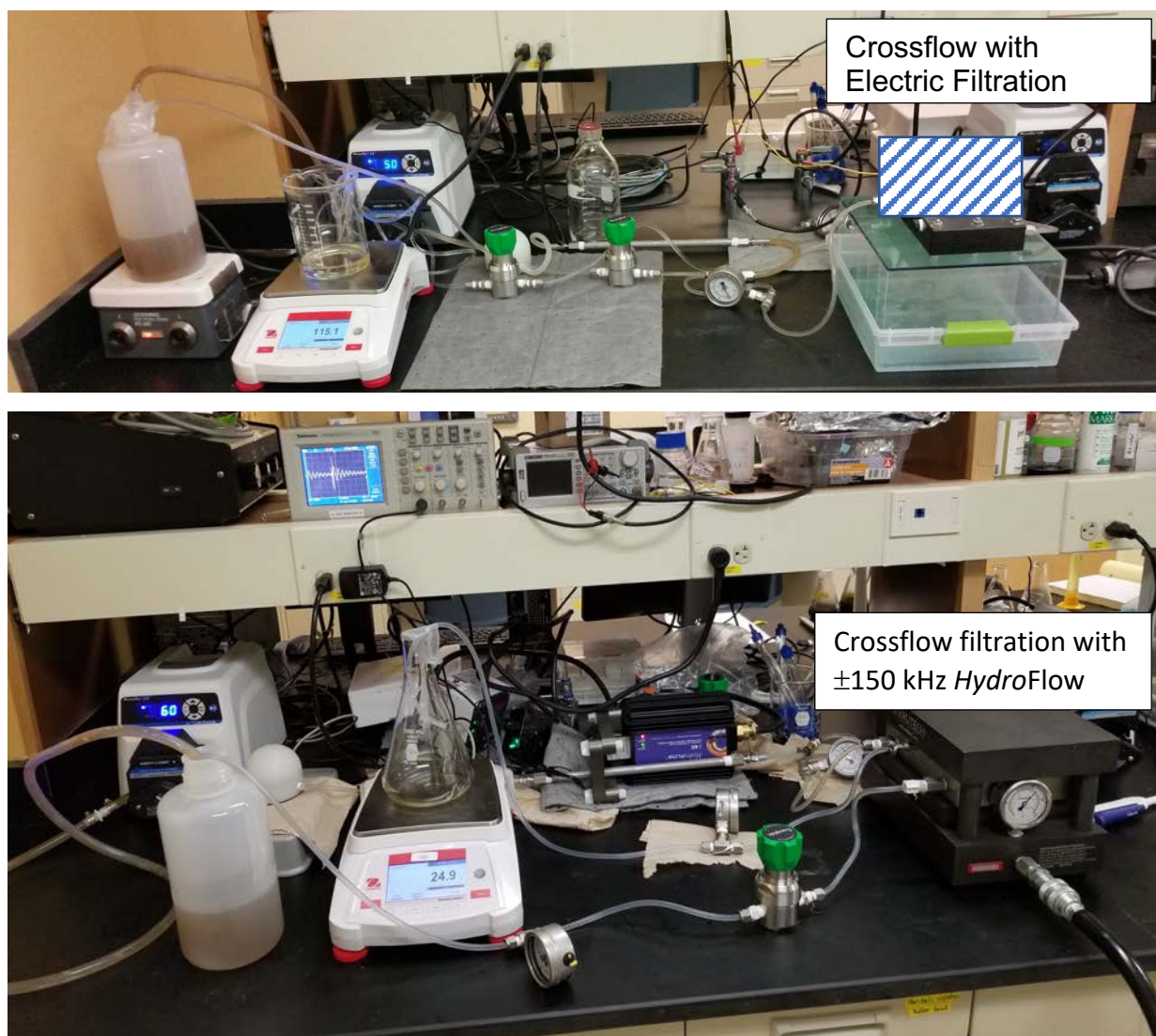
X-ray diffraction analysis confirmed that the crystals were struvite (Figure 9). The crystal structure of struvite is consistent with the struvite structure that was precipitated under similar wastewater conditions. However, the crystal structure was different from pure struvite. This change in structure was likely the result of treatment with  $\pm 150$  kHz *HydroFlow* and was probably responsible for the transformation of “hard scale” nature of struvite into “soft scale”. This “soft scale” nature of struvite is important because it would allow easy recovery with minimal energy from any technical surface including holding tanks, distribution pipes, membrane surfaces, and others.



Brightfield microscopy of struvite crystals.

**Figure 9.** XRD spectrum of struvite (current work) (A); XRD spectrum of struvite (Zhang, T. et al 2014, 21 (1) *Ecol Chem Eng S*) (B); Brightfield images of struvite crystals that were recovered from the vial (C-D).

The experimental set up for crossflow electric filtration is shown in Figure 10. The centrate with spiked  $Mg^{2+}$  was filtered using  $0.22 \mu m$  polysulfone membrane at a transmembrane pressure of 5 psi. The oscillating electric field was applied at 100 kHz, 1 A, and 3 V peak-peak across the membrane. During the filtration the clear filtrate was collected. At the end of 6 h operation, the samples of raw centrate, filtrate, and concentrate were collected and sent to Endyne Lab for the phosphorus and other elemental analysis. We are still waiting on these results.



**Figure 10.** Test condition 3: Schematic of crossflow electric filtration without and with *HydroFlow* systems.

#### 4.0 CONCLUSIONS

- A combination of  $\text{Mg}^{2+}$  ions and  $\pm 150$  kHz *HydroFlow* electric field was found to be most effective at capturing phosphorus in the form of struvite. **The phosphorus recovery in the form of “soft scale” (i.e., loosely held together clusters) struvite was about 85% at pH 8.12.** The 7.0-8.5 pH is typical of dewatering centrates.
- Above treatment rapidly, about 38% less time, precipitated struvite in the form of “soft scale” compared to controls that were not treated with  $\pm 150$  kHz *HydroFlow* electric field. The nucleation time appears to be sensitive to slight changes in pH.
- It appears that higher pH will lead to greater and rapid precipitation. Further investigation is required to determine the effects of pH,  $\text{Mg}^{2+}$  dosage (concentration and contact time), operation conditions (batch vs continuous).
- In the absence of  $\text{Mg}^{2+}$ ,  $\pm 150$  kHz *HydroFlow* electric field alone was able to agglomerate suspended solids to a level that was easily captured by filters. When compared with controls

(no *HydroFlow*), the percentage of solids retained by the filter increased to 165% due to  $\pm 150$  kHz *HydroFlow* electric field.

- Based on the above findings, we suspect that at significantly lower nucleation time ( $< 2.5$  h) the struvite crystal sizes may be in the range of few microns or sub-microns that can be easily retained by microfilter or ultrafilters depending on the treatment requirements.
- The X-ray diffraction analysis confirmed that struvite formed under *HydroFlow* electric signal had an altered crystal structure that might have given the “**soft scale**” nature to the struvite. This characteristic allows easy recovery of struvite as well as easy cleaning of technical surfaces including holding tanks, distribution pipes, reactors, and membrane surfaces.

County of Chittenden



(802) 951-1641  
(802) 951-5121

CHITTENDEN COUNTY COURTHOUSE

Assistant Judge Suzanne Brown  
Assistant Judge Connie C. Ramsey

P.O. Box 187

175 Main Street  
Burlington, VT 05402

TO: Members of the Legislative Bodies of the Town and Cities in Chittenden County

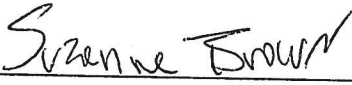
FROM: County Assistant Judges

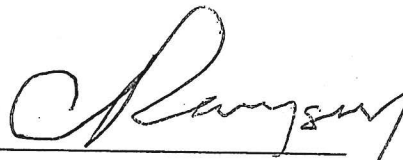
DATE: November 22, 2019

RE: Pre-Budget Meeting

It is time for us to begin the process of preparing our proposed budget for the fiscal year 2021. We feel that you are an important part of this process. Should you have any questions or concerns, we would like to invite you to our Pre-Budget meeting on Friday December 20, 2019 at noon, held at the Chittenden County Courthouse. As required by law, our annual budget meeting will be held in January 2020.

We are looking forward to seeing you on the 20<sup>th</sup> because your input is important to us.

  
Suzanne Brown  
Assistant Judge

  
Constance C. Ramsey  
Assistant Judge

Dear Municipal Officials:

As many of you are aware, there is pending legislation before the state legislature that would establish a commercial cannabis marketplace in Vermont. S.54, an act relating to the regulation of cannabis, passed the Senate last year and is currently working its way through the relevant House committees. Legislative leadership has expressed a desire to take up S.54 very soon after returning to Montpelier in January.

Over the years, VLCT has followed and testified to the interests of Vermont municipalities as they relate to a regulated commercial market for recreational cannabis. After having learned from municipalities in states that have a taxed and regulated system in place, VLCT has advocated for all the necessary authority, autonomy, resources and taxing power at the local level.

VLCT has significant concerns with the current version of S.54 and potential amendments that will be considered when the legislature returns in January.

The resolution we are asking all cities, towns and villages to consider, support, and circulate to representatives and senators in your districts before the 2020 legislative session begins can be found [here](#). VLCT Advocacy would also appreciate a PDF copy of your signed resolutions of support.

If you have any questions regarding S.54 and its impacts on municipalities, please contact Gwynn Zakov at [gzakov@vlct.org](mailto:gzakov@vlct.org). We also recommend you read [this VLCT News article](#) that outline the details of the bill. We appreciate your commitment to informing your legislators of your municipality's needs. Thank you for your efforts and service to local government.



**Gwynn Zakov, Esq.**

*Municipal Policy Advocate*

Vermont League of Cities and Towns

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Community Development Department

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[www.essexjunction.org](http://www.essexjunction.org)

Office: (802) 878-6950  
Fax: (802) 878-6946

## **MEMORANDUM**

**TO:** Evan Teich, Unified Manager; Trustees  
**FROM:** Robin Pierce, Community Development Director  
**DATE:** December 10, 2019  
**SUBJECT:** Village Center Development

The issue is to inform the Trustees about development in the Village Center District.

### **Discussion**

Restaurants: Continue to populate the Village Center. We have gone from one or two restaurants a few years ago to 10. Mark BBQ, Comfort Food by Mark BBQ and the Firebird café are the most recent additions. These are all local restaurants, no national corporations.

New Buildings: The Planning Commission approved new buildings on the east side of Park Street and the south side of Maple Street. The first one, 3 Maple Street, has started construction. One of the commercial spaces has already been rented to a wood fired pizza restaurant. This building will have 11 studios, 12 one bedrooms, and 7 two bedroom apartments. Parking will be under the rear of the building.

The senior building on Park Street is substantially complete. I anticipate a new street number being issued. A temporary Certificate of Occupancy was issued this month and apartments are available for rent. Landscaping, which includes hard and soft landscaping, will be complete by June 2020. After the fact negotiations moved the trash area off site and enabled a pergola to be installed in place of the trash receptacle to the north of the pedestrian entrance to the building. This building has 43 apartments: 40 one bedroom and three efficiencies. There is underground parking. The rents for this building including heat and electricity and are in the \$1,000 - \$1,200 range, which puts them squarely in the affordable sector for Chittenden County. The applicant did not take any subsidy for this rental point. The applicant reconfigured the path to Park Street School and created 11 new public parking spaces at no cost to the Village. At Staff's request, and EJRP's agreement, the applicant entered into an agreement with the Village to have shared trash pickup with Park Street School. The applicant will pay for all the trash pickup saving Park Street School this cost.

Pearl Street, hotel: The applicant is still negotiating with hotel groups to decide which franchise they will work with prior to commencing construction. The building at the rear has been demolished to make way for the new construction.

**Cost**

There is no cost to the Village for any of the work mentioned in this memo.

**Recommendation**

This is an information only memo.



# MEETING SCHEDULES

12/05/2019

TOWN SELECTBOARD MEETINGS 	VILLAGE TRUSTEES MEETINGS 	JOINT MEETINGS 
December 10, 2019—6:30 PM	VB Regular	
December 16, 2019—7:00 PM	SB Regular	
December 17, 2019—3:00 PM	VB Special—Public Hearing for Crescent Connector Project	
December 17, 2019—6:30 PM	VB Regular	
December 17, 2019—7:15 PM	JT Special, 2 Lincoln	
January 6, 2020—8:00 AM to 3:30 PM	SB Special, Budget Day	
January 13, 2020—7:00 PM	SB Regular, Budget Meeting	
January 14, 2020—6:30 PM	VB Regular	
January 14, 2020—7:15 PM	JT Special, 2 Lincoln	
January 21, 2020—7:00 PM	SB Regular, Budget Public Hearing	
January 21, 2020—7:45 PM	JT Special, 81 Main	
January 28, 2020—6:30 PM	VB Regular	
February 3, 2020—7:00 PM	SB Regular	
February 3, 2020—7:45 PM	JT Special, 81 Main	
February 11, 2020—6:30 PM	VB Regular	
February 18, 2020—7:00 PM	SB Regular	
February 25, 2020—6:30 PM	VB Regular	
February 25, 2020—7:15 PM	JT Special, 2 Lincoln	
March 2, 2020—7:30 PM	Essex Community Dinner at 6:30; Annual Meeting at 7:30	
March 3, 2020—7:00 AM to 7:00 PM	Essex Voting	
March 10, 2020—6:30 PM	VB Regular	
March 16, 2020—7:00 PM	SB Regular	
March 24, 2020—6:30 PM	VB Regular	
March 24, 2020—7:15 PM	JT Special, 2 Lincoln	
April 1, 2020—7:00 PM	Essex Junction Community Supper at 6:00; Annual Meeting at 7:00	
April 6, 2020—7:00 PM	SB Regular	
April 6, 2020—7:45 PM	JT Special, 81 Main	
April 14, 2020—7:00 AM to 7:00 PM	Essex Junction Voting	
April 14, 2020—6:30 PM	VB Regular	



# December 2019

SB = Town Selectboard

VB = Village Board of Trustees

JT = Joint Meeting of SB and VB



Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 SB Regular 7:00 PM JT Special 7:45 PM	3	4 VB Budget Day 8:30 AM	5	6	7
8	9	10 VB Regular 6:30 PM	11	12 JT Governance Sub 7:00 PM, 2 Lincoln	13	14
15	16 SB Regular 7:00 PM	17 VB Special 3:00 PM VB Regular 6:30 PM JT Special 7:15 PM	18	19 JT Governance Sub 7:00 PM, 2 Lincoln	20	21
22	23	24 Christmas Eve OFFICES CLOSED	25 Christmas OFFICES CLOSED	26	27	28
29	30	31	1	2	3	4
5	6	Notes				

# January 2020

SB = Town Selectboard

VB = Village Board of Trustees

JT = Joint Meeting of SB and VB



Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29	30	31	1 New Year's Day OFFICES CLOSED	2	3	4
5	6 SB Budget Day 8:00 AM	7	8	9	10	11
12	13 SB Regular, Budget Mtg 7:00 PM	14 VB Regular 6:30 PM JT Special 7:15 PM	15	16	17	18
19	20 Martin Luther King Jr. OFFICES CLOSED	21 SB Regular, Budget Public Hearing, 7:00 PM JT Special 7:45 PM	22	23	24	25
26	27	28 VB Regular 6:30 PM	29	30	31	1
2	3	Notes				