Fair Haven

DK
AP

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December 14, 2009

Serena Williams, Town Manager
Town of Fair Haven
3 North Park Place
Fair Haven, VT 05743

RE: Hydro Feasibility Study for Castleton River, Fair Haven, VT

Dear Serena:

This letter is the draft report of our Hydro Feasibility Study for the reach of the Castleton River between the Depot Street dam and the Adams Street dam in Fair Haven, VT. This study was done upon your request to determine whether it would be feasible to install a small run-of-river hydroelectric power generating station using one or more of the existing dams on the Castleton River. The study looked at three different scenarios for generating hydro power. Below are listed a general description of the three different scenarios.

Scenario I: Install a hydro generating station just downstream of the Depot Street Dam (a.k.a Water Street Dam) utilizing the drop available from the dam and with a similar configuration as the system which received a Federal Energy Regulatory Commission (FERC) license in the late 1980's.
Scenario II: Install a hydro generating station just downstream of the Adams Street Dam (a.k.a. Shirt Factory Dam) utilizing the drop available from the dam.
Scenario III: Install a hydro generating station just downstream of the Adams Street Dam (a.k.a. Shirt Factory Dam) utilizing the drop available from the Depot Street Dam and the entire reach of the Castleton River between the two dams.

Below are listed an executive summary of the ballpark production and cost for each of the three scenarios. A more detailed analysis of the costs and benefits for each scenario is provided later in the report.
Scenario I: A small hydro generating station just downstream of the Depot Street Dam, utilizing the drop at the dam, could potentially produce 378,000 kilowatt-hours per year. The system could be expected to earn approximately $57,887 the first year assuming benefits from net metering and the sale of Renewable Energy Credits (RECs). Permitting, design and installation of such a system could cost $1,664,000, before any available grants or incentives. The system could be expected to return approximately $3,246,595 over its first 30 years of operation.

Scenario II: A small hydro generating station just downstream of the Adams Street Dam, utilizing the drop at the dam, could potentially produce 144,000 kilowatt-hours per year. The system could be expected to earn approximately $25,459 the first year assuming benefits from net metering and the sale of Renewable Energy Credits (RECs). Permitting, design and installation of such a system could cost $1,576,000, before any available grants or incentives. The system could be expected to return approximately $1,226,452 over its first 30 years of operation.

Scenario III: A small hydro generating station just downstream of the Adams Street Dam utilizing the drop of the entire reach between the Depot Street Dam and the Adams Street Dam could potentially produce 543,000 kilowatt-hours per year. The system could be expected to earn approximately $76,571 the first year assuming benefits from net metering and the sale of Renewable Energy Credits (RECs). Permitting, design and installation of such a system could cost $2,996,000, before any available grants or incentives. The system could be expected to return approximately $4,294,470 over its first 30 years of operation.

Also attached are the following:

1. Rough site plan showing the layout of a potential hydro system for all three scenarios considered
2. Memo of communications with key State of Vermont personnel
3. Photos of the typical turbine/generator sets that could be installed for each of the scenarios considered.
4. A graph of the flow duration curve for the subject reach of the Castleton River as determined by our hydrologic analysis.
5. A document provided by Central Vermont Public Service (CVPS) describing the process of interconnecting to their utility grid for a project of the size of the proposed hydro generating scenarios.
6. An invoice for the services performed

Methods

Three site visits were planned and two were performed. The purpose of the first site visit was to meet with staff of the Town of Fair Haven as well as to have an opportunity for site orientation. During the meeting, town staff provided copies of past FERC applications and materials related to design and planning of the project previously licensed in the late 1980's. Also obtained were town tax maps in the vicinity of the proposed hydro projects and underground utility information provided by the town Public Works Department.

The goal of the second site visit was to perform a limited topographical survey of the entire reach of the Castleton River from the Depot Street Dam to the Adams Street Dam to determine the actual elevation drop available for hydro power generation for the different scenarios considered.

The purpose of the third site visit was to meet with key official from the US Army Corps of Engineers (USACE) Vermont office on site. The goal of this meeting was to give the official from the USACE an opportunity to offer an opinion of the minimum bypass flows they would be likely to accept for each of the three proposed scenarios. Unfortunately, the official from the USACE was unable to make the meeting appointment. As the next possible meeting date was well into the future, a decision was made, after consultation with you, our client, to complete the study without this site visit.

A visit to the VT ANR Dam Safety and Hydrology Division, Waterbury, VT office, was performed. The purpose of this visit was to discuss required bypass flows for the three proposed scenarios with Brian Fitzgerald, one of the key staff in this division who is involved in granting Section 401 Water Quality Certificates and with Rod Wentworth of the VT ANR Fish and Wildlife Division. After our conversation, Brian and Rod discussed these scenarios with Jeff Cueto, another key staff of the VT ANR Dam Safety and Hydrology Division as well as key staff from the regional office of U.S. Fish and Wildlife.

We initiated a telephone conversation with key staff at Central Vermont Public Service (CVPS) concerning the process and costs of interconnecting any of the proposed hydro generation scenarios to the utility grid. We were sent a detailed description of the process and some projected costs for non-utility generators (NUG).

The Town of Fair Haven provided copies of the recent reports of the VT ANR Dam Safety Division concerning the three dams possibly considered in this study and information from the Town Grand List concerning the names of property owners for properties in the vicinity of the proposed projects. The Town provided copies of the electric utility bills for the month of June 2009. These were used to determine the electric rates for the Town electric accounts. The electric consumption for the month of June was extrapolated by a simple multiplier to determine annual electric consumption.

Both net metering and the sale of renewable energy credits (RECs) were estimated as economic benefits from the power generated from the scenarios. As the net metering process would include several electric accounts, currently being billed at different rates, an average per KwH benefit rate was estimated based on the consumption information available as well as the current electric rates. Also considered in this estimation was the group net metering implementation process as it would be set up by CVPS. The benefit from the sale of RECs was estimated by researching current REC bid prices as available from internet sources. It was assumed that the retail cost of electricity and sale price of RECs would both increase 4% annually over the time period of the economic analysis performed. These topics are covered in more detail under Net Metering and Sale of Renewable Energy Credits, below.

The flow regime for the Castleton River at the proposed intake locations was estimated using standard hydrologic methodology correlating the flow of the stream at the proposed intake location to a surrogate gage location. This provided approximately 78 years of historical streamflow measurements for the project. The summary of this analysis is the flow duration curve attached to this report in graphical form.

Elevation information was determined by a limited on site topographical survey. The purpose of this survey was to determine the elevation drop available for hydro power generation. The VT ANR internet mapping website was consulted to determine if there were any Class II wetlands which could be impacted by the proposed hydro project. This was intended to determine if any of the proposed projects would be likely to require cutting, filling or construction of any civil works in a Class II wetland or its related buffer zone. Class II wetlands are under state jurisdiction. Any construction in these wetlands would require a VT ANR Conditional Use Determination (CUD) permit. This review was merely an initial screening and was based solely on the information available on the VT ANR internet mapping website.

The USDA Natural Resource Conservation Service (NRCS) website was consulted to obtain available information concerning soil types and depth to ledge in the potential areas for a power pipeline and other infrastructure for the proposed scenarios.

Intake Location

Scenario I: The intake of the hydroelectric system would likely take advantage of the existing Depot Street Dam with the addition of an intake structure.

Scenario II: The intake of the hydroelectric system would likely take advantage of the existing Adams Street Dam with the addition of an intake structure.

Scenario III: The intake of the hydroelectric system would likely take advantage of the existing Depot Street Dam with the addition of an intake structure.

For all scenarios, it is likely that upgrades to the dam at the upstream end of the reach of the river being used would be needed to meet the requirements of obtaining a Federal Energy Regulatory Commission (FERC) license. The next step in the feasibility process would be to hire a professional engineer with expertise in dam safety to provide a cost estimate for these repairs. In addition, a weir would need to be constructed which would serve as an intake structure. The resulting intake and related controls would be designed to provide for hydro generation flows while assuring that the minimum bypass flow (the flow which bypasses the hydro project intake and stays in the stream) requirements are met.

Power Pipeline

The table below describes the likely diameter and length of the pipeline for each scenario. The pipeline material, actual route and other details relating to pipeline construction would be determined during the design phase of the project. Pipeline size was approximated to minimize pressure losses due to friction given the maximum flows to be used by the hydro system and the approximate pipeline length for each scenario.

Table 1. Pipeline Sizes and Ballpark Lengths

	Scenario I	Scenario II	Scenario III
Pipeline Diameter	60 inches	48 inches	96 inches
Pipeline Length, Approx.	130 ft	50 ft	1,400 ft

Our research of available USDA Natural Resource Conservation Service (NRCS) soils information indicated that soils were generally deep without obstruction from ledge. There was, however, an area to the south of the Castleton River for the eastern half of the reach between the Depot Street and Adams Street dams that showed a shallow depth to ledge. Based on this information, our ballpark locations for the power pipelines for the proposed projects were all on the north side of the river.

We discussed the issue of easements with Town of Fair Haven relating to power pipeline location. We were provided with a list of the property owners in the vicinity of the proposed scenarios. However, there was no information available at the time as to which property owners would be likely to cooperate with any of the proposed projects. One of the next steps in the feasibility process would be to contact property owners who could potentially impacted by the proposed scenarios to judge their desire to cooperate with the permitting and construction of such a project.

Powerhouse

For each scenario, a newly constructed powerhouse would be needed to house the power generation equipment and related electrical controls and balance of system components. These would be located at a low point near the river at the downstream extent of the reach of the river used to generate power. Included in the powerhouse design would be a tail race which would route water leaving the powerhouse back to the stream so as to minimize erosion of the stream banks. See the attached rough site plans for more details of possible locations for a powerhouse for each scenario. During the design phase of the project, the location of property boundaries and the ownership of these properties in the vicinity of the technically appropriate locations for the powerhouse would be considered before deciding on a final location.

Available Head for Hydro Generation

The table below summarizes the elevation drop or head available for hydro generation for each of the three scenarios. Gross head was determined from our on site topographical survey. In addition, the estimated head or pressure loss due to pipeline friction is subtracted from the gross head to yield a value for net head. Net head is the pressure that would actually be available for hydro power generation.

Table 2. Available Head for Hydro Generation

	Scenario I	Scenario II	Scenario III
Gross Head	23.0 ft	8.0 ft	45.0 ft
Pipeline Losses	0.5 ft	0.5 ft	1.3 ft
Net Head	22.5 ft	7.5 ft	43.7 ft

Available Flow for Hydro Generation

The proposed reach of the Castleton River was correlated to a surrogate gaged site on the Poultney River below Fair Haven, VT. This gaged site on the Poultney River was in the same drainage basin (the Castleton River flows into the Poultney River upstream of the gaged site) and was relatively close to the reach of the Castleton River that was the subject of this study (less than 4 miles).

The gaged site and the proposed intake location were correlated based on the ratio of the drainage areas. Subtracted from these correlated flows were the minimum bypass flows (flows that must be left in the stream and not used for power generation) determined based on our communications with key staff at the VT ANR Dam Safety and Hydrology Division and at the VT ANR Fish and Wildlife Division. During our communications, the VT ANR did not offer an opinion concerning the required bypass flow for Scenario III. As such, a conservative assumption was made using a typical default for a stream the size of the Castleton River in Fair Haven. A table describing the assumed required bypass flows is included below. Keep in mind, these bypass flows are estimates only. There is always the chance that, during the process of permitting one of the proposed scenarios, lesser or greater bypass flows would be required.

Table 3. Required Bypass Flows for Castleton River

	Scenario I	Scenario II	Scenario III
Bypass Flow Standard	0.1 cfs/sq.mi.	0.1 cfs/sq.mi.	0.5 cfs/sq.mi.
Intake Drainage Area	98 sq. mi.	98 sq. mi.	98 sq. mi.
Site Specific Bypass Flow Standard	**10 cfs**	**10 cfs**	**47 cfs**

Note: cfs = cubic feet per second ≈ 450 gallons per minute

The ballpark production estimates for each scenario were based on systems that would run using different flows as available within a certain assumed flow range. The table below summarizes the flow ranges considered for each scenario. These were determined solely for the purpose of providing ballpark production estimates. During the design process more precise values for the range of flows used by the generating equipment would be determined. Keep in mind, that these are the flows actually used by the hydro turbines. To determine the actual streamflow required for these flows to be available, the minimum bypass flows described above need to be added.

Table 4. Range of Assumed Flows Used by Generating Equipment

	Scenario I	Scenario II	Scenario III
Minimum	40 cfs	40 cfs	40 cfs
Maximum	217 cfs	217 cfs	217 cfs

Note: cfs = cubic feet per second ≈ 448.8 gallons per minute

Generating Equipment

The generating equipment, including the turbines and generators would likely consist of two custom designed crossflow turbines each coupled to its own induction generator. Attached to this report is a photograph of a typical crossflow turbine of appropriate scale for the proposed projects. Each generator would be capable of producing a maximum of 115 KW at 480 Volts AC, 3-phase, utility grade power. As the size and type of the turbines and generators are largely determined by the quantity of water being handled by the turbines, the size and type of the turbines would be approximately the same for each scenario

Expected System Output (ballpark approximation)

Below is a table showing a ballpark estimation of the power output for each scenario. As the hydro projects being considered for all three scenarios are all for run-of-river systems, they would be designed to run while maintaining a minimum bypass flow in the stream. As such, there would be some times during the year when the system would not produce any power. At other times, the power being produced would vary depending on the stream flow. Lastly, the annual consumption amounts only include consumption from accounts that can be net metered. These amounts do not include consumption from the street light accounts, as described in more detail in the section entitled "Net Metering and Sale of Renewable Energy Credits".

Table 5. Approximate Annual System Outputs

	Scenario I	Scenario II	Scenario III
Annual System Output	378,000 KwH/year	130,000 KwH/year	543,000 KwH/year
Annual Consumption	492,000 KwH/year	492,000 KwH/year	492,000 KwH/year
Percent of Consumption	77.0%	26.5%	110.5%

Expected System Costs (ballpark approximation)

Below is a table showing a ballpark estimation of the costs of designing, permitting and installing a hydro project for each of the three scenarios. These are the estimated costs before any available grants or incentives. They also do not include the cost of interconnection studies required and performed by CVPS or any interconnection engineering and/or utility upgrade costs determined necessary by such a study. The interconnection process and related costs are described in detail in the next section. Lastly, the ballpark costs do not include costs associated with upgrades to one or more of the existing dams to meet FERC dam safety requirements or any work for the next steps of project feasibility as described below in the section entitled "Next Steps in Feasibility" near the end of this report.

Table 6. Approximate Turn-Key System Costs

	Scenario I	Scenario II	Scenario III
Generation Equipment	$786,000	$786,000	$786,000
Civil Works, Materials & Labor	$730,000	$650,000	$2,000,000
Electrical, Materials and Labor	$68,000	$60,000	$60,000
Design & Permit Consulting	$80,000	$80,000	$150,000
Total Cost	$1,664,000	$1,576,000	$2,996,000

Utility Interconnection

Our conversations with key staff at Central Vermont Public Service (CVPS) resulted in a document detailing the CVPS process for interconnection of non-utility generation projects greater than 15 KW in generating capacity. This document is attached to this report for more detailed information. The table below summarizes the process. Keep in mind, that each project is considered individually. Some of the steps listed below might not apply to some or all of the hydro power generating scenarios being considered. Also, the deposits required for each step of the process are not necessarily an indicator of the final costs of those steps. During our conversations with Marty Bowen of CVPS, he indicated that the total costs for interconnection for projects of the size considered in this study could be in the range of $150,000 - $200,000. Of course, he also said that it is impossible to accurately estimate these costs without going through the process described below.

Table 7. CVPS Non-Utility Generator Interconnection Process

Step	Description	Req'd Deposit	Time Frame for Completion
Initial Application	Fill out application, meet with utility. Goal is to determine whether project can be fast-tracked or needs to go through the remaining steps.	$300	N/A
Feasibility Study	Initial study as to whether the interconnection is feasible.	$15,000	Not Stated
System Impact Study	Evaluates the impact of the proposed project on the safety, reliability, and stability of the electric system. Report gives a ballpark estimate of cost and time to construct any required upgrades.	$15,000	60 days
Facilities Study	Determines the design of any additional electric facilities and any required system upgrades to existing facilities. Report gives a ballpark estimate of cost and time to construct any required new facilities or upgrades.	$15,000	45 days
Interconnection Design	Design of utility part of interconnection.	To Be Determined	10 weeks
Interconnection Construction	Construction of utility part of interconnection.	To Be Determined	4 weeks
Three-Phase Line Study	Determines design of power line upgrades to bring 3-phase power to point of interconnection.	To Be Determined	8 – 16 weeks
Three-Phase Line Upgrade Construction	Actual construction of power line upgrades to bring 3-phase power to point of interconnection.	To Be Determined	4 – 16 weeks

Dam Renovations and Repairs

In 2004, the VT Dam Safety Division performed a voluntary inspection of the three dams on the Castleton River at the request of the Town of Fair Haven. All three dams were considered in poor condition. Under their current use, the Dam Safety Division does not have jurisdiction to require that any renovations or repairs be performed for any of the dams. However, dam safety and aesthetics are considerations in the FERC license or small hydro exemption processes. It is likely that renovation and/or repair work would be required for any of the dams used for hydro power, if a license or exemption was issued. It is recommended that the services of a professional structural engineer, with expertise in dam construction, be retained to determine the approximate cost of the necessary renovations or repairs.

Potential Opportunities for Project Financial Assistance

- ***Vermont Clean Energy Development Fund (CEDF)*** - In addition to providing the funding for this feasibility study, the CEDF also provides for grants up to $250,000 (for the scale of projects being examined in this study) or up to 50% of project cost, whichever is less. In addition, the CEDF can also provide low interest loans for $50,000 to $500,000 or up to 90% of project cost, whichever is less. The loans for the projects being examined would be for a term of 7 years at a current interest rate of 2% fixed. The loan process also includes application fees if the application is accepted. As one would expect, the CEDF does not have unlimited funds available. As such, the application process could possibly be quite competitive.
- ***Municipal Leasing Consultants*** – This private business assists municipalities with leasing options for capital investments, such as a proposed hydro project. It is possible that the lease payments could be less than the energy savings offered by the installed system. At the end of the lease agreement, the municipality typically takes full ownership of the property for a nominal fee. The link to the website for this company is http://www.powerofleasing.com. One of the next steps for feasibility would be to contact this company after project costs are determined more precisely.

Net Metering and Sale of Renewable Energy Credits

Net metering means that the power produced by a renewable energy project causes the electric meter to run backwards; thereby offsetting electric usage. The owner of the project essentially receives retail rate for the power produced, assuming they have the electric demand to offset. This proposed project would qualify for net metering to offset the Town of Fair Haven's electric costs through group net metering. Group net metering allows a renewable energy project to offset electric usage for any group of electric accounts for buildings located in the same utility district (with account owner's permissions). What this means is that the power produced by the proposed project would benefit the Town of New Haven at the retail rates that they pay to Central Vermont Public Service (CVPS) for the power.

We also discussed exactly how the group net metering process would work with key staff at CVPS. When group net metering is setup, the meters in the group are billed as one meter. They would be billed at one rate, most likely, their Rate 2. This rate is currently $0.14428 per kilowatt-hour (KwH). Some accounts have an additional capacity charge which shows up on the bill as a charge per kilowatt (KW). The $0.14428 per KwH rate would take the place of both the current charges per KwH and the capacity charges per KW. For some of the existing Town accounts, this new rate would be significantly different than what is currently being charged. It would therefore be important to choose wisely the accounts to include in the group to get the maximum benefit from the group net metering.

Lastly, the utility accounts for lighting and other uses which are not billed by KwH and include costs of equipment rental or leasing, could not be net metered at all.
For purposes of estimating project economic benefit, an average price per KwH derived from the net metering process was estimated. This was based on the utility cost and consumption information provided by the Town as well as our understanding of the group net metering process as explained above.

Any of the proposed scenarios could benefit from the sale of renewable energy credits (RECs). These are essentially the sale of the "green" part of the electricity that is being generated. The net metering described above compensates the generator for the production of electricity ignoring the fact that the power is generated from a clean, renewable source of energy. The RECs compensate the generator for the fact that the power is from a clean, renewable source. The market rate for RECs varies. In northern New England there is a market for selling RECs to Massachusetts utilities who have a renewable energy portfolio standard requirement to meet. A current average rate for the sale of RECs, as of December 2009, is approximately $.0275 per KwH.

Net Cost Summary and Economic Analysis
The table below summarizes the net costs and returns of each scenario based on full utilization of the available Clean Energy Development Fund (CEDF) grants and maximum benefits from net metering and the sale of RECs.

Table 8. Approximate Net Costs and Returns

	Scenario I	Scenario II	Scenario III
Total Turn-Key Costs	$1,664,000	$1,576,000	$2,996,000
CEDF Grant (maximum)	$250,000	$250,000	$250,000
Net Cost	$1,414,000	$1,326,000	$2,746,000
Esimated Annual Production	378,000 KwH/year	144,000 KwH/year	543,000 KwH/year
Assumed Average Electricity Retail Rate (1st year)	$0.126/KwH	$0.148/KwH	$0.113/KwH
Market Rate for RECs (1st year)	$.0275	$.0275	$.0275
Estimated Annual Benefit (1st year)	$57,887	$25,459	$76,571
Estimated Return – First 30 years of System Operation	$3,246,595	$1,226,452	$4,294,470
Estimated Time to Payback Net Cost	18 years	>30 years	23 years

State and Federal Permits:

- ***Certificate of Public Good*** – Issued by the VT Department of Public Service for connection to the utility grid. This certificate requires that all other required permits or licenses be obtained.
- ***Federal Energy Regulatory Commission (FERC) license or Small Hydro Exemption*** - This is required for virtually all hydro projects in the continental United States. The environmental review process is not significantly different whether a license or exemption is obtained. Once application is made to FERC for the project, an application for other permits, described below, is made concurrently.

- ***US Environmental Protection Agency (EPA) Clean Water Act Section 401 Water Quality Certificate*** – although this is a federal requirement, these certificates are administered and issued by state agencies. In VT, the VT ANR issues these certificates. The Water Quality Certificate is a requirement of the FERC license or exemption. This certificate and its related environmental review is part of what regulates the minimum bypass flows for the project. The 401 Water Quality Certification application process can sometimes require site specific hydrological and/or biological studies. These studies can significantly increase the cost of permitting the project. However, during our communications with staff from the VT ANR, an initial verbal agreement was reached that these would be unlikely to be required if the agreed upon minimum bypass flows were maintained.
- ***VT ANR Conditional Use Determination (CUD) or Wetlands Permit*** - It is possible that a VT ANR wetlands permit could be required for the project. This study included a preliminary examination of available data on locations of wetlands under state jurisdiction in the vicinity of the three proposed scenarios. There did not appear to be any state jurisdictional wetlands in the vicinity of the proposed projects from our preliminary examination. However, during the next step of the feasibility process, the VT ANR Wetlands Division would be contacted for a written opinion concerning this. If necessary, a professional wetlands delineator could be hired to offer a detailed, on-site, opinion as to the locations of Class II wetlands and related buffer zones potentially impacted by the hydro project.
- ***US Army Corps of Engineers (USACE) Vermont General Permit*** – This general permit administers Section 404 of the EPA Clean Water Act. The project would most likely be considered Category 2 under the Vermont General Permit. As such, an application and accompanying materials would need to be submitted to the USACE to approve the project under the General Permit. The CWA Section 404 process primarily considers the impacts of dredging, filling and construction in and near waterways. The impacts of water withdrawls is also considered as a secondary impact. The General Permit also considers wetland impacts for all wetlands, including those not under state jurisdiction. Some or all of these issues could apply to a hydro project on the Castleton River. As stated above, our preliminary examination did not seem to indicate that wetlands would be a concern for any of the proposed scenarios. However, during the next step of the feasibility process, the USACE would be contacted for a written opinion concerning this. If necessary, a professional wetlands delineator could be hired to offer a detailed, on-site, opinion as to the locations of all wetlands potentially impacted by the hydro project.
- ***Stream Alteration Permit*** – This is another permit that would likely be required. It is a permit required by VT state regulations and administered by the VT ANR Water Quality Division. It is required if the drainage area at the location of the proposed project is greater than 10 square miles.
- ***Fish & Wildlife Input*** – throughout the FERC permitting process both state and federal Fish & Wildlife personnel are consulted for their opinion on impact to fisheries by the proposed hydro project.
- ***Permitting Timeline*** – the entire permitting process typically takes 18 – 24 months from the time of initial application.

Property Ownership Obstacles
As you are aware, the latest study performed for the Town of Fair Haven, determined that the town does not have sole ownership for any of the three dams being considered for hydropower in this study. In addition, routing of a power pipeline and locating of a powerhouse for any of the proposed projects would likely entail construction on property not owned by the town. Our communications with the Federal Energy Regulatory Commission (FERC) have indicated that when a FERC license is granted, it gives the right of eminent domain to the licensee to obtain easements for construction and operation of the project. However, one of the next steps in the feasibility process could be a review of the property owners who would be impacted by the potential hydro project. If possible, these property owners could be contacted to ask for their cooperation in helping the project be permitted and constructed.

Ongoing Maintenance
The proposed hydro system would be designed so as to minimize any required ongoing maintenance. However, some maintenance will undoubtedly be required for the system to continue to operate properly over time. The majority of ongoing maintenance would most likely be needed at the proposed intake location. Removal of accumulated sediment and debris on a regular basis is likely to be necessary. As with any type of equipment some parts are likely to need replacement over the life of the system. We would estimate that maintenance and ongoing operations could be managed by the equivalent of one part-time employee. The scope of required maintenance would be determined in more detail during the design phase of the project.

Next Steps in Feasibility
Below are listed some next steps for proceeding further with this project. These steps, which were outside of the scope of this feasibility study, should yield the remaining information necessary for the Town of Fair Haven to decide whether to go ahead with the design and permitting of one of the proposed scenarios. The order in which these steps are listed is intended to be a recommended order of execution. However, many of the steps can be executed concurrently or in a different order than listed.

1. The services of a professional engineer with expertise in dam construction should be retained to obtain a cost estimate for required dam repairs and/or renovations.
2. Property owners impacted by the projects should be contacted to judge their willingness to cooperate with the permitting and construction of the proposed scenarios.
3. The VT ANR Wetlands Division and the US Army Corps of Engineers should be contacted to request a written opinion as to whether there would be any wetlands under their jurisdiction impacted by the proposed project. If necessary, a professional wetlands delineator could be hired to offer a detailed, on-site, opinion of this. The determinations concerning wetlands could also impact the final locations of project civil works and related infrastructure.
4. A more detailed system design is performed. This would yield a more accurate estimate of system production as well as a more accurate estimate of the final cost of the project. Also, it would yield a more accurate location for the proposed civil works and related infrastructure.
5. An application should be submitted to the VT Clean Energy Development Fund (CEDF) to determine if a grant and/or loan from the CEDF would be available to help fund the desired project. (Step 4 is prerequisite).
6. Municipal Leasing Consultants should be contacted to determine the potential benefits of a lease program they could offer to help fund the project. (Step 4 is prerequisite).

7. An application is submitted to CVPS to determine the scope of engineering studies that would be required by the utility for interconnection of the desired project. (Step 4 is prerequisite).
8. A Pre-Application Document (PAD) is submitted to the VT ANR Dam Safety and Hydrology Division and FERC. This will yield more detailed information as to the obstacles in permitting the desired project. (Step 4 is prerequisite).

Standard Disclaimers

The results and conclusions of the feasibility study described in this letter are derived from the information and means available, as described above under "Methods". The ballpark costs are based on current costs of equipment and labor. It is likely that costs of the project will increase between the date of this report and the time that a formal cost proposal for design and construction of the system is submitted. It is also possible that the grant opportunities mentioned above might no longer be available or the amounts provided could change between the date of this report and the time an application is made for the grant. The estimation of increases in electric rates by CVPS as well as the estimates of the increase in the market rate for renewable energy credits (RECs) are estimates only. No guarantee is made that this estimate will come to fruition. Also, it is possible that changes in the electric consumption by the Town of Fair Haven, not reflected in the June 2009 electric bills, would affect the results of the economic analysis provided in this report.

It is possible, that more detailed information available from further on site flow measurements, or other site specific information not yet provided would change the expected system output or expected system cost. It is possible, that on site hydrological and/or biological studies will be required by the FERC application process; increasing the estimated cost of permitting the projects. It is also possible that a change in the approach taken by the VT ANR Water Quality Division in determining minimum bypass flows could change the expected system output.

Earthbound Services, LLC has made substantial efforts to determine all the potential permits required for the proposed project. It is possible, although unlikely, that there are permitting obstacles to the project not yet discovered. Earthbound Services, LLC makes no certification as to the existence of hazardous waste on any of the properties on which project infrastructure is or could be located. Earthbound Services, LLC makes no certification as to the extent of wetlands on any of the properties on which project infrastructure is or could be located.

Thank you for the opportunity to assist you in determining if a small hydro project makes sense for the Town of Fair Haven at the Castleton River. Please don't hesitate to call if you have any questions or need any further services.

Sincerely,

Ben Gordesky

Attachments

EARTHBOUND SERVICES, LLC

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BURLINGTON, VT 05401
(802) 355-3049
info@earthboundservices.com

Memorandum of Communications
Fair Haven Hydro Feasibility Study

Date: 8/18/09
Met With: Brian Fitzgerald, VT ANR Dam Safety and Engineering and Rod Wentworth, VT Fish & Wildlife, in Waterbury.

- The Depot Street dam has a failing abutment wall on river left. The state would have some interest in removing this dam as the state owned dam at Lake Bomoseen, which is upstream of Fair Haven, needs some modification that would allow more water to flow over the dam. With the Depot Street dam in place, this could cause flooding in the area around the dam.
- The project licensed in 1988 by FERC at the Depot Street dam was never built within the 4 year timeline required by the license. The developers reapplied in 1992 for the same project. The application was rejected. Brian and Rod did not know why FERC rejected the reapplication. Their guess was that it was procedural (not meeting expected time frame for information) and not resource based.
- As a general rule, a 1" – 2" spillage over a dam generally addresses aesthetics issues as well as D.O. where needed.
- 7Q10 is often equivalent to 0.1 cfsm for a river the size of the Castleton in Fair Haven.
- The Castleton River is relatively flat in the stretch being considered. As such, there is not much fish movement and a hydro project would likely not need to provide fish passage.
- The requirements of reconstruction of a dam to get a FERC license is completely under FERC jurisdiction – not related to state dam safety requirements.
- The 22A dam, was part of the 1988 project, most likely to provide for more D.O. by the spillage over the dam. That dam is now breached and in very poor shape.
- I repeated what I had read in the old WQ cert app that the river was considered Class B waters and a warm water fish habitat. It provided habitat for rainbow trout, brown trout, northern pike, bass and suckers. Rod thought this was odd as trout habitat is generally cold water.
- When I mentioned a project with a longer bypass reach than the old one, this did not seem to be impossible. More of a concern is whether the longer reach would involve some good fish habitat. i.e. parts of the stream that did not have much ledge or slabs or rock and that contained some pools.
- A potential project significantly below the Adams Street dam might involve fish spawning habitat and would require a higher bypass flow.

Date: 10/22/09
Telephone Conversation with Marty Bowen, CVPS.

Can net meter projects up to 250 KW. However, CVPS can charge extra for interconnection studies and interconnection fees for performing upgrades recommended by the interconnection studies for projects greater than 15 KW. Cost of initial interconnection study is typically about $5,000. That study determines the costs of engineering and construction necessary to accommodate the project on the grid. The total costs can be as much as $150,000 - $200,000.

11/9/09
Telephone Conversation with Martha Abair at US Army Corps of Engineers (USACE)

USACE has jurisdiction over placement of fill in waterways and wetlands.
They have jurisdiction over class II and III wetlands. If fill is placed on less than 3,000 sf of wetland it falls under the general permit as non-reporting. Greater than 3,000 sf to one acre still falls under the Vermont general permit but it must be reported. Beyond one acre it must get an individual permit.
A secondary effect of this is the water withdrawl which is also looked at separately by the USACE. Generally, if you get a VT ANR Stream Alteration Permit, the USACE will agree with the VT ANR and approve the issue of fill. However, the USACE does not always agree with the VT ANR on the issue of water withdrawl. The USACE jurisdiction over water withdrawls is EPA Clean Water Act Section 404. The VT ANR jurisdiction is under EPA Clean Water Act Section 401.

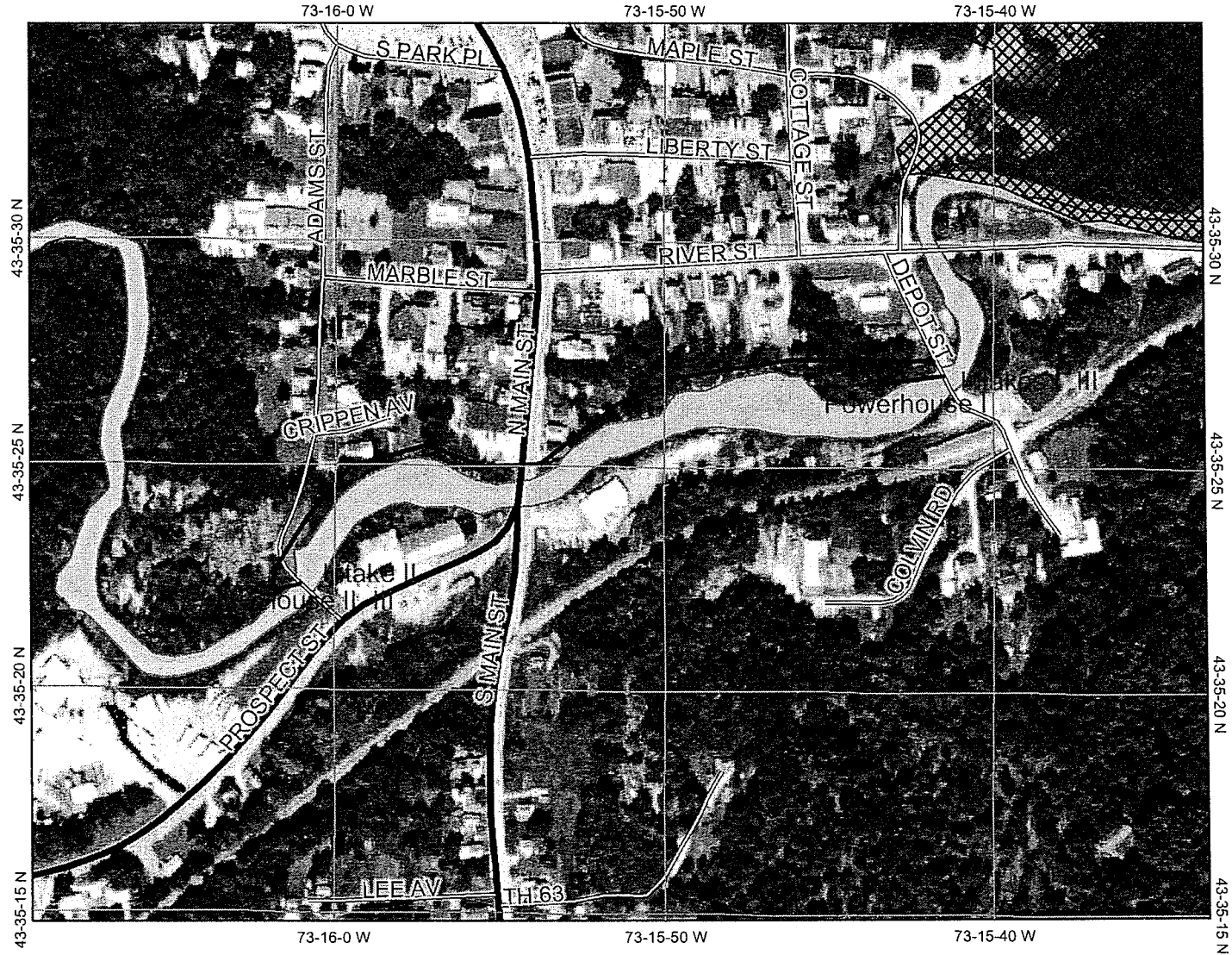
12/11/09 and 12/14/09
Telephone conversation with Marty Bowen, net metering staff at CVPS
Street lights or other accounts that are not per KwH cannot be net metered. You can choose which meters are in the group net meter, otherwise. When this is set up, all the group meters are billed as one bill and at one rate. They would be rate 2 which is currently $0.14428/KwH. Any capacity charges ($/KW) would no longer apply for accounts with these charges. So, this might change the electric rates for some of these accounts significantly.

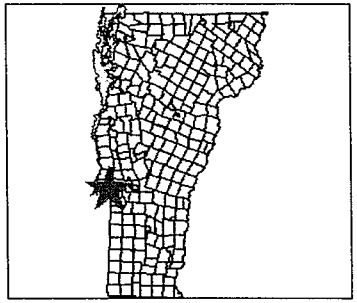
VERMONT

ANR Environmental Interest Locator

Vermont Agency of Natural Resources (ANR)

Fair Haven Hydro Site Plan ANR Base





Legend

Roads
- US Highway
- Vermont State Highway
- Class One
- Class Two
- Legal Trail
- Emergency U-Turn Area
- Proposed Class Two
- Proposed Class Three
- Proposed Vermont State Highway
- Proposed US Highway
- Proposed Interstate
- Discontinued
- Interstate
- Class Three
- Class Four
- State/National Forest Highway
- Military Road (No Public Access)
- Private Road

Wetland Advisory Layer: Town Wetland Mapping

VSWI
- Class 1 Wetland
- Class 2 Wetland
- Class 3 Wetland

Proposed VSWI
- Class 1 Wetland
- Class 2 Wetland
- Class 3 Wetland

Hydrography Lakes and Ponds (VHD 5k)

Hydrography (VHD 5k)

VT County Boundary

VT Town Boundaries (No Fill)

NAIP Color Orthophotos

VT State Boundary (Fill)

VT State Plane Meters (NAD83)

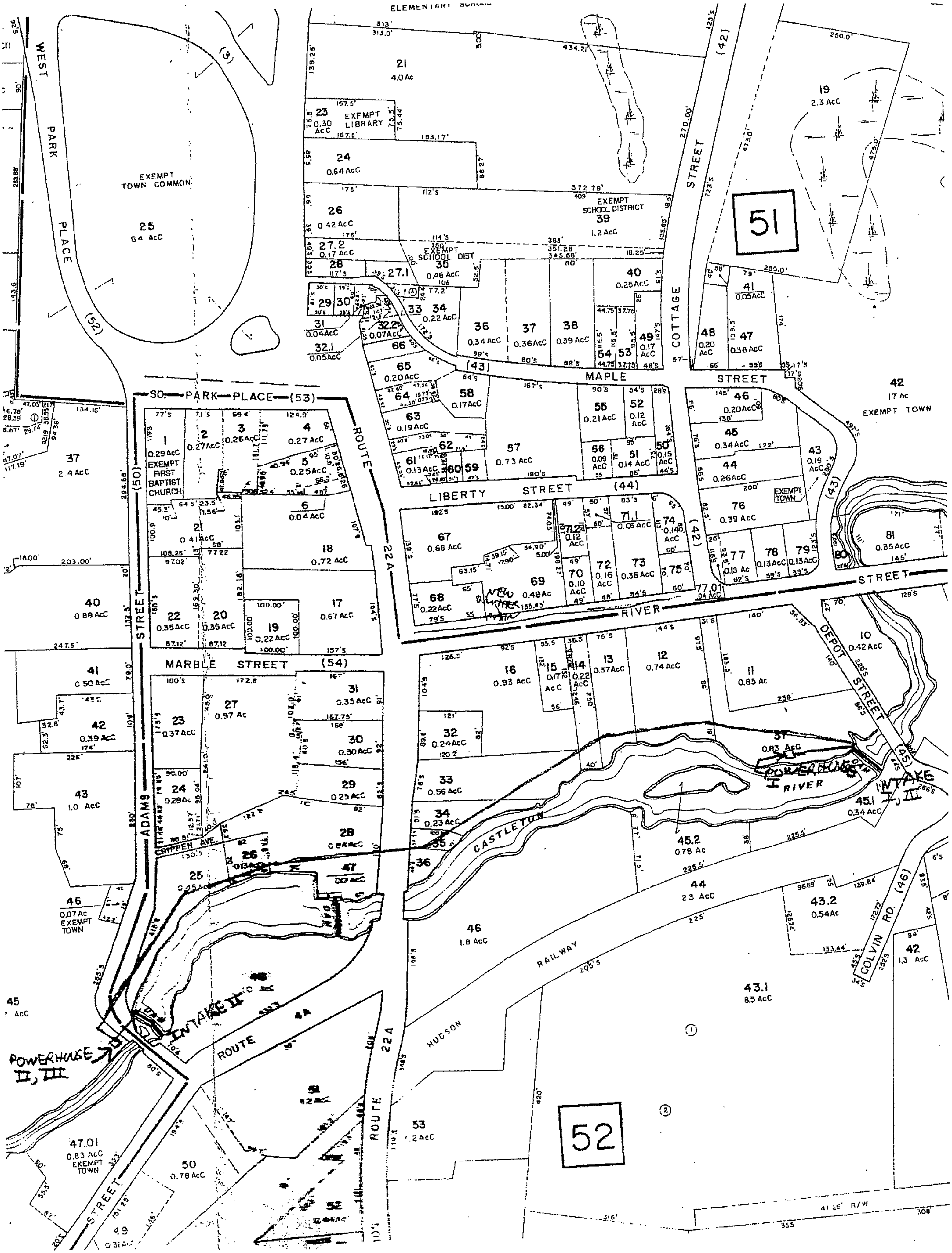
Scale: 1:4,318

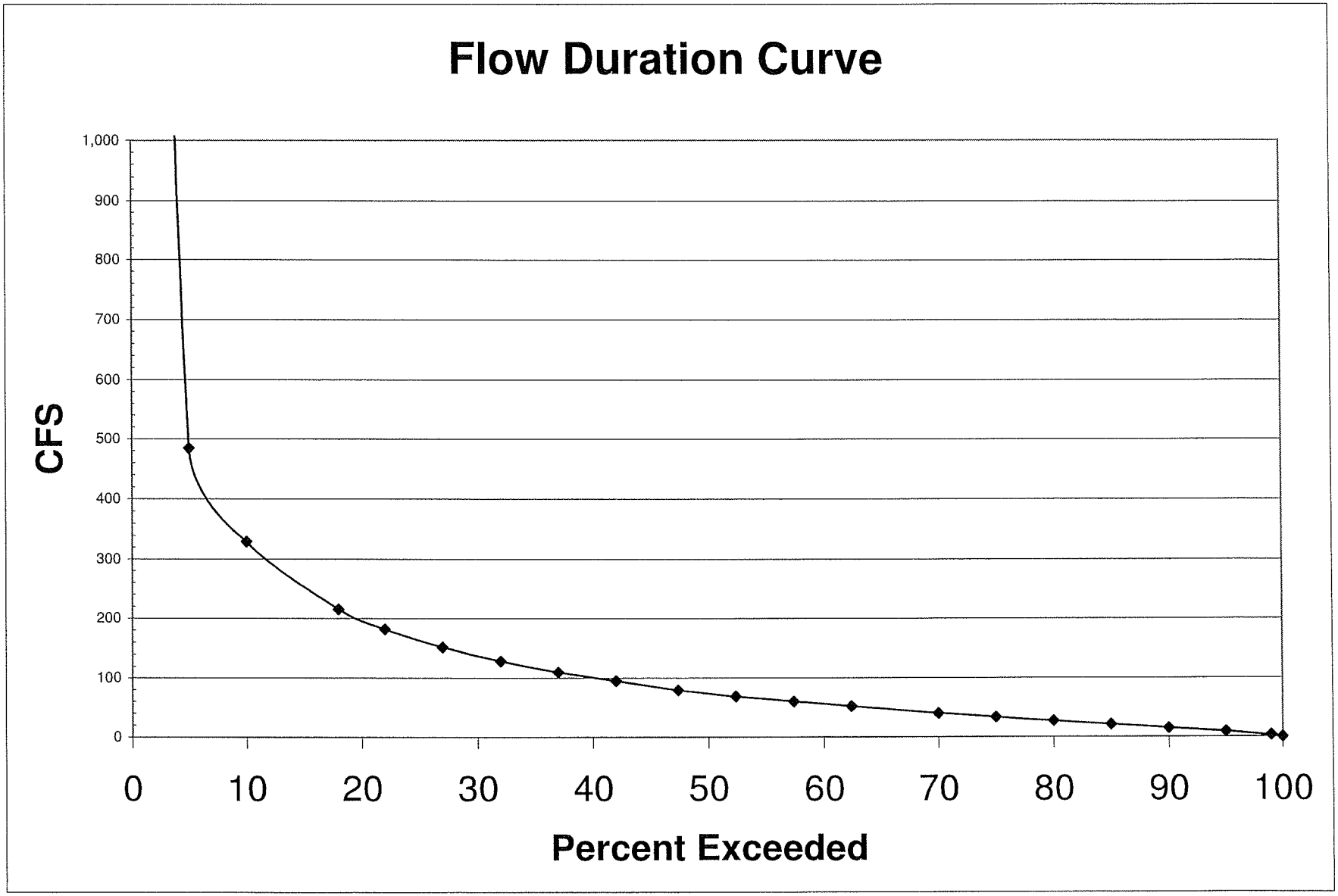
0 400 800 1200 ft.

Map center: 438281, 121398

URL: http://maps.vermont.gov/imf/sites/ANR_NATRESViewer/jsp/launch.jsp

12/14/09


ELEMENTARY SCHOOL
WEST PARK PLACE
EXEMPT TOWN COMMON
25
64 AcC
21
4.0 Ac
23
0.30 AcC
EXEMPT LIBRARY
24
0.64 AcC
26
0.42 AcC
27.2
0.17 AcC
28
EXEMPT SCHOOL DISTRICT
39
1.2 AcC
EXEMPT SCHOOL DIST
35
0.46 AcC
COTTAGE STREET
51
19
2.3 AcC
40
0.25 AcC
41
0.05 AcC
36
0.34 AcC
37
0.36 AcC
38
0.39 AcC
48
0.20 AcC
47
0.38 AcC
MAPLE STREET
42
17 Ac
EXEMPT TOWN
SO. PARK PLACE (53)
ROUTE 22A
1
0.29 AcC
EXEMPT FIRST BAPTIST CHURCH
2
0.27 AcC
3
0.26 AcC
4
0.27 AcC
5
0.25 AcC
6
0.04 AcC
18
0.72 AcC
17
0.67 AcC
19
0.22 AcC
22
0.35 AcC
20
0.35 AcC
37
2.4 AcC
40
0.88 AcC
41
0.50 AcC
42
0.39 AcC
43
1.0 AcC
46
0.07 Ac
EXEMPT TOWN
LIBERTY STREET (44)
67
0.68 AcC
68
0.22 AcC
69
0.48 Ac
NEW WATER
57
0.73 AcC
55
0.21 AcC
52
0.12 AcC
46
0.20 AcC
45
0.34 AcC
44
0.26 AcC
76
0.39 AcC
EXEMPT TOWN
81
0.35 AcC
RIVER STREET
10
0.42 AcC
DEPOT STREET
MARBLE STREET (54)
ADAMS STREET (50)
16
0.93 AcC
13
0.37 AcC
12
0.74 AcC
11
0.85 Ac
27
0.97 Ac
23
0.37 AcC
31
0.35 AcC
30
0.30 AcC
29
0.25 AcC
28
32
0.24 AcC
33
0.56 AcC
34
0.23 AcC
24
CRIPPEN AVE.
25
57
0.83 AcC
POWERHOUSE I
DAM
INTAKE I, II
CASTLETON RIVER
45.1
0.34 AcC
45.2
0.78 Ac
44
2.3 AcC
43.2
0.54 Ac
COLVIN RD. (46)
42
1.3 AcC
46
1.8 AcC
HUDSON RAILWAY
43.1
8.5 AcC
INTAKE II
POWERHOUSE II, III
ROUTE 4A
ROUTE 22A
53
52
47.01
0.83 AcC
EXEMPT TOWN
50
0.78 AcC
49
STREET
R/W


Flow Duration Curve
CFS
1,000
900
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
Percent Exceeded

NUG Project Planning

Introduction

Central Vermont Public Service (CVPS) is teaming up with generation developers to support renewable energy in Vermont. The process of bringing a "Non-Utility Generator" (NUG) online is a complex and time consuming process. NUG's, depending on size and prime mover, can connect and sell power either under a standard "Purchase Power Agreement" (PPA) or under the Vermont Standard offer "Feed In Tariff" (FIT) as outlined in Vermont Act 45
The following pages provide an example of a NUG project with examples of the major steps in the process, estimated costs, timeframes, and contracts that must be signed

Applicability

This document is intended for generation systems that will be connected to the CVPS distribution or sub-transmission system and will be selling power to CVPS through a "Purchase Power Agreement" (PPA) or under the Vermont Standard Offer "Feed In Tariff" (FIT). This process does not apply to NET Metered generation or generation under the control of ISO-NE for FERC.

Project Planning

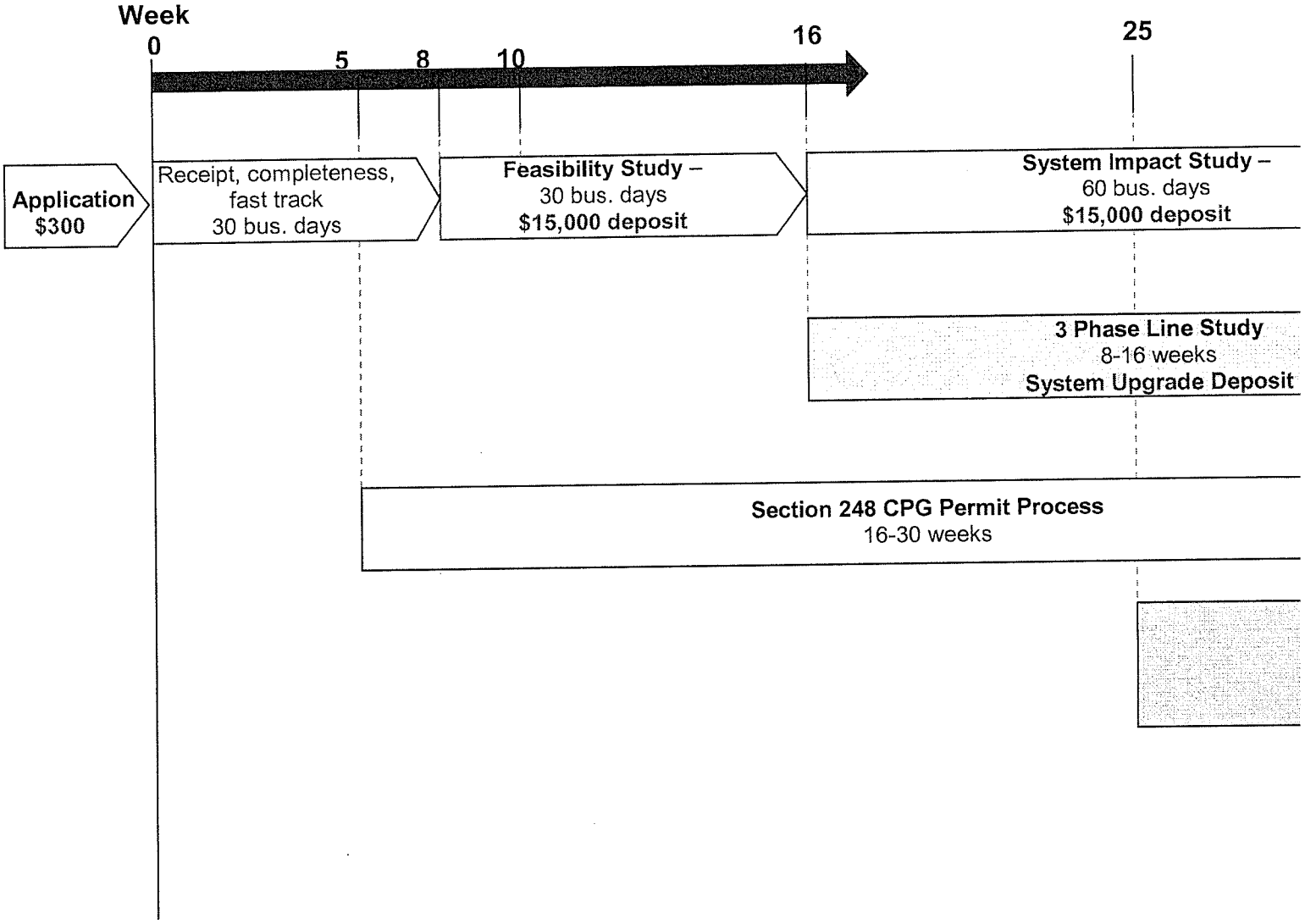
If you are interested in the CVPS generation program, this information will help you understand the process of setting up a generation system. The interconnection of a generation resource for a NUG project is governed by the Public Service Board's Rule 5.500. Many of the steps described in the rule are provided as a guideline with recommended timeframes. If mutually agreed upon, you and CVPS can decide to exclude certain steps and/or use different timeframes.

A Queue, or list of competing project, will be maintained by CVPS. This queue is for the CVPS process only and does not necessarily correspond with any other queue (ISO Queue, VEPPI FIT Queue, etc). Your project will be worked on in a timely manner in the queue in a "first in first completed" progression. However if information is missing or incorrect, or if designs are changed after the application is filed your project may loose its position in the queue until the deficiencies are corrected. All timeframes listed in this document are examples of "best case minimums" for planning purposes only, your project time in the process may be significantly longer.

Note: This document does not include the process or costs for you to design and build the generation system.

NUG Sample Timeline

(Note: Timeframes will vary)



NUG Timeline

Application

Description

The process begins when you contact CVPS to express interest in setting up a NUG generation system. An initial "scoping" meeting may be held to discuss the project. At this meeting the CVPS Project Leader:

- Reviews your plans for interconnection
- Recommends that you designate an Engineer representative
- Describes how you can access PSB Rule 5.500
- Emphasizes the importance of submitting a *complete* application
- Asks you for your tax exemption status certificate, if applicable
- Asks you to sign a confidentiality agreement for the process

You must submit a completed **Standard Application** to CVPS with a $300 application fee. See Appendix A for a copy of the form for you to use.

Fee

$300

The application fee is non-refundable and is not applied to the costs of future studies, should the project proceed.

Feasibility Study

Description

If the project does not pass the fast track and you wish to proceed, **Feasibility Study** may be needed. This study is a high level review of the project to look for early fatal flaws. This is the initial engineering analyses regarding the "feasibility" of interconnecting the generation resource

$15,000

Fee

The cost of conducting the Feasibility Study is reconciled at the end of the study. An invoice or refund reflecting the actual cost of the study is prepared for you within a reasonable time following the completion of the Feasibility Study Report.

System Impact Study

Description

If you decide to proceed with the NUG project, you submit a **System Impact and Facilities Studies Agreement** to CVPS with a $15,000 deposit. This initiates the process for the System Impact Study, which must be completed within 60 business days, unless otherwise agreed upon by you and CVPS. See Appendix B for a copy of the form for you to use.

The System Impact Study evaluates the impact of the proposed project on the safety, reliability, and stability of the electric system. The study consists of a short circuit analysis, a power flow analysis, and, if necessary, a stability analysis.

The System Impact Study Report states the results of the analyses and provides the requirements for interconnecting the project with the electric system. It includes a preliminary, non-binding list of facilities required, an estimate of cost, and time to

construct.

Fee **$15,000**

The cost of conducting the System Impact Study is reconciled at the end of the study. An invoice or refund reflecting the actual cost of the study is prepared for you within a reasonable time following the completion of the System Impact Study Report.

Estimated Duration 60 business days

Facilities Study

Description If you decide to proceed with the NUG project, you submit a written request for a **Facilities Study** to CVPS with an $8000 deposit. This initiates the process for the Facilities Study, which must be completed within 45 business days, unless otherwise agreed upon by you and CVPS.

The Facilities Study is used to design the transmission and/or distribution system interconnection facilities and any required system upgrades.

The Facilities Study Report includes a description of any system upgrades required to connect the generator to a 3-phase distribution system. It also includes a list of interconnection protection facilities required and an estimate of cost and time to construct.

Fee **$15,000**

The cost of conducting the Facilities Study is reconciled at the end of the study. An invoice or refund reflecting the actual cost of the study is prepared for you within a reasonable time following the completion of the Facilities Study Report.

Estimated Duration 45 business days

Interconnect Design

Description This phase involves ordering the materials, completing the generator drawings, calculating settings, testing and setup, and scheduling the construction.

Estimated Duration 10 weeks

Interconnect Construction

Description Interconnect construction can begin once all interconnection testing is complete. It can overlap with system upgrade construction.

Estimated Duration 4 weeks

3 Phase Line Study

Description CVPS creates a Work Request for the type of work needed to bring a 3-phase line to the point of interconnection. The Work Request includes the labor and materials required to design and build any system upgrades. This design information is needed for the System Impact Study and the Section 248 "Certificate of Public Good" (CPG) permit.

The CVPS Work Request provides you with a list of materials required, a detailed cost estimate, and a contract to sign before upgrade construction can begin. The

Work Request may also include the labor and materials costs for telecommunications, relay protection, and metering.

Fee **System Upgrade Deposit**

10 percent of the estimated system upgrade cost is submitted as a deposit at the beginning of the 3-Phase Line Study.

Estimated Duration 8-16 weeks

3 Phase Line Construction

Description System upgrade construction can not begin until you have obtained the Section 248 CPG permit and submitted payment for the total estimated cost. It can overlap with interconnect construction.

Fee **System Upgrade/Interconnection Balance**

The total estimated system upgrade and interconnection cost must be paid in full (minus the 10% deposit made) before construction can begin. The costs on the Work Request are reconciled at the end of the project. An invoice or refund reflecting the actual cost of the system upgrades, interconnection, and metering is prepared for you after your system generation begins.

Estimated Duration 4-16 weeks

Section 248 CPG Permit Process

Description You must obtain a Section 248 Certificate of Public Good (CPG) permit from the Public Service Board (PSB) for the generator that supplies power to the CVPS system. You initiate this process by submitting an application for approval to the PSB. CVPS participates in this process by providing testimony to the PSB regarding the impacts of the required distribution and/or transmission upgrades.

Estimated Duration 16-30 weeks

Purchase Power Agreement (PPA)

Description This agreement is between you and CVPS and specifies the expected power to be generated by your project and purchased by CVPS. It specifies the price that CVPS will pay for the generated power and the price paid to you for environmental benefits. See Appendix C for an example of the agreement that CVPS will prepare for you.

Or, if your project qualifies for the Vermont Standard Offer, or "Feed In Tariff" (FIT), then the PPA will be administered through the SPEED administrator at VEPPI. See link to VEPPI website for more details http://www.veppi.org/

Estimated Duration 8 weeks

Interconnect and Metering Agreement

Description This agreement is between you and CVPS and specifies the operating terms and conditions covering protection, generator tripping, lockout, and re-start. The Interconnect and Metering Agreement includes Technical Requirements and Operator Protocols.

This agreement also specifies the payment and ownership of metering equipment

	used to measure your generation and retail service usage. It specifies the percentage of CVPS's actual cost that you will pay for future maintenance, testing, and/or repair on the various types of metering equipment. See Appendix D for an example of the agreement that CVPS will prepare for you.
Estimated Duration	10 weeks

Generation equipment Order & Delivery, Switchgear Construction, and Protection Setting

Description	You and your engineering firm determine the type of engine, wind turbine, solar array, or other generation equipment and associated material required for your generation system. You must acquire the Section 248 CPG permit from the Vermont Public Service Board before ordering the generation equipment and materials. CVPS reviews, inspects, and tests the customer side of the interconnection before the system goes online. Since the process typically involves multiple vendors, there may be delays related to backorders and shipping.
Estimated Duration	30 weeks

Generation Construction

Description	You and your engineering firm set up a project plan for the construction of the generation. CVPS is not involved with this process.
Estimated Duration	Check with your vendors

Customer Live

Description	You and CVPS agree upon a live date for your generation system. On that date, CVPS begins saving the generation data it collects and generates a monthly payment for you based on the amount generated.
Fee	The fee for reading and processing the data to reflect a payment for the generation is built into the Purchase Power Agreement.
Duration	Ongoing

Appendix A – Standard Application
Use the form provided and submit it to CVPS

Appendix B – System Impact and Facilities Studies Agreement
Use the form provided and submit it to CVPS

Appendix C – Purchase Power Agreement
Example of the contract that will be prepared for you by CVPS

Appendix D – Interconnect and Metering Agreement
Example of the contract that will be prepared for you by CVPS

www.veppi.org
VEPP Inc. is the Purchasing Agent appointed by Order 4.100 of the Vermont Public Service Board. VEPP Inc. purchases electric power from renewable resources. Power is then sold to all 20 Vermont utilities on a pro-ration to their in-state retail sales.