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**Report on Jackson Bridge Dam
Answers to Questions and Concerns Raised by the Public**

**Vermont Natural Resources Council
November 1, 2001**

Introduction

The Jackson Dam is on the Lamoille River near the village of Hardwick and is owned by the Hardwick Electric Department. The dam creates a 180-acre impoundment called Hardwick Lake. It has no power generating capability and provides nominal storage benefits for the downstream hydroelectric facility in Wolcott.

The Hardwick Electric Department, the Hardwick Select Board and the Vermont Natural Resources Council (VNRC), a conservation group, have agreed to conduct studies and evaluate the costs and benefits of removing Jackson Dam. These organizations have also initiated a public participation program to hear what residents of Hardwick and surrounding communities think about dam removal and river restoration.

The first public meeting about Jackson Dam occurred on May 3, 2001. Members of the public raised many questions and concerns during that meeting. Additional questions have also been raised by citizens of Hardwick and the surrounding communities since that meeting.

In order to answer these questions, VNRC conducted several studies over the summer to collect information regarding the engineering feasibility of dam removal, the dam's flood control capability, and the impact of dam removal on Hardwick Lake and the stability of the Lamoille River. VNRC also collected information regarding the economic and energy impacts of Jackson Dam removal, the impact on property values on Hardwick Lake and the impact on groundwater levels of local wells.

All of the information from these studies is provided in summary in this report in a question and answer format.

1. What is the economic value of Jackson Dam?

The Jackson Dam currently has little economic value. There is no hydroelectric facility associated with the Jackson Dam. The dam was originally built around 1914 for the purpose of storing water for the downstream hydroelectric generating facility at Wolcott. Today, the storage benefits of Hardwick Lake are nominal in part because the lake has filled in with sediment and in part because large daily drawdowns of the lake would not be allowed

because they would not be consistent with Vermont's Water Quality Standards. The Hardwick Electric Department (HED) estimates that the storage benefits of the dam generate approximately \$4,000 of power cost savings per year, but the costs for operation and maintenance of the old dam equal or often exceed that amount.

2. What is the cost to upgrade Jackson Dam?

In the future, the Jackson dam will require a major overhaul similar to the Mackville Dam in Hardwick. Repairs to the Mackville Dam cost rate payers of HED \$500,000 for construction and permitting. Jackson dam is significantly larger and would likely cost in excess of \$850,000 to overhaul.

3. What about dam safety?

Jackson Dam is not unsafe at this time, but it is nearing 100 years old and will require a major overhaul in the future. As noted in Question #2, we estimate the costs for overhaul to be over \$850,000.

4. What is the energy impact of removing Jackson Dam?

There is no hydroelectric facility at Jackson Dam. The dam was originally built to store water for the downstream hydroelectric facility at Wolcott. Today, HED still uses the Jackson Dam and Hardwick Lake for storage. If a large rain storm is anticipated, HED can draw down the Lake to supply water to the downstream Wolcott project. This storage benefit of Hardwick Lake is not significant. As noted in question #1, the Hardwick Electric Department estimates that the storage benefits of the dam generate approximately \$4,000 of power cost savings per year, but the costs for operation and maintenance of the old dam equal or often exceed that amount.

5. Has HED tried to find ways to use the dam?

Constructing a hydroelectric facility at Jackson Dam has been considered in the past, but has never been economically feasible. In other words, the expense of building a generating facility is not worth the power and financial benefits that a facility would provide.

6. What about our current political situation, if our country loses its ability to import oil from the Middle East, would Jackson Dam be considered a resource for power?

It is unlikely that rebuilding Jackson Dam and constructing a hydroelectric facility would ever be economically feasible at this site. This site is not ideal for hydropower production because there is limited hydraulic capacity based on current technology. Hydraulic capacity is a function of reservoir storage capacity and hydraulic head or the drop in elevation of the water. Hardwick Lake has limited storage capacity, and there is not a large head drop at the Jackson Dam site. In contrast a large head drop (the waterfall) is present at the Wolcott site.

The other fact to keep in mind regarding imported oil is that very little oil is used for electricity production. Imported oil is primarily refined and used in transportation and heating. The risk of losing our ability to import oil would have virtually no effect on electrical power generation in New England.

7. How much would dam removal cost and who would pay for it?

Dam removal would cost significantly less than dam repair. However, a final cost figure for dam removal will not be calculated until the engineering design is complete. If Hardwick decides to remove Jackson Dam, VNRC has committed to bringing together funding from a variety of private and public sources not only for dam removal, but also for river restoration, landscaping and public access amenities such a boat launch, walking path, parking lot and picnic area for the Hardwick community to better enjoy the river. Dam removal would not cost the Electric Department or the Town of Hardwick any money.

8. What is the flood prevention potential of the dam?

The dam provides no functional flood prevention potential because the capacity of Hardwick Lake to store floodwaters is relatively small. Much of the year, the lake is managed at full pond with no available storage for floodwaters. Even assuming a drained lake, with the onset of the 10-year flood, Hardwick Lake would fill (to the secondary spillway) in less than 3 hours; for the 50-year flood, in less than 2 hours. These estimates assume low flow conditions in the river prior to the flood. If higher flow conditions were present, the lake would fill faster. In other words, Hardwick Lake does not have the storage capacity to protect downstream areas from flooding. The reservoir was not built and is not managed for flood control. Removal of Jackson Dam would in no way increase downstream flooding.

9. Does Jackson Dam create a flood hazard for the village of Hardwick?

Jackson Dam does create a flood hazard because of potential ice build up behind the dam; however, this risk is minimized by drawing down Hardwick Lake in the winter. If the lake were not drawn down in the winter, thick ice cover could develop in the lake-like environment behind the dam. This ice build-up can back up water and lead to flooding upstream in the Village. Drawing down the lake in the winter prevents thick ice from developing. The Cold Regions Research and Engineering Laboratory of the U.S. Army Corps of Engineers recommends that Hardwick Lake be drawn down each winter to prevent this flood hazard.

For clarification the ice control structures upstream of town serve an added benefit of retaining the breakup of ice allowing time for mechanical removal of ice at downstream locations. The ice control structures and the winter drawdown of Hardwick Lake work in concert to reduce the ice jam threat in Hardwick.

10. What will Hardwick Lake look like if the dam is removed?

Many townspeople have expressed concern that the lake will look like a mud pit after dam removal. Hundreds of dams have been removed in other communities across the country. These communities have observed that revegetation after dam removal occurs within one growing season. In fact, grasses and other vegetation covered all the mud flats of the Mackville Pond only a few months after it was drained this summer for dam repairs (see photos on next page). Over the long term vegetation will continue to grow.

VNRC conducted a study of the topography and hydrology of Alder Brook and Hardwick Lake to estimate how the land would look over the long term. Currently, Hardwick Lake covers approximately 180 acres. After dam removal, we anticipate that about 30 acres out of the 180 acres will remain ponded and provide habitat for waterfowl, wading birds and a variety of wildlife include bear, moose and mink. Another 50 acres will remain as a seasonally wet meadow. Finally, 100 acres out of 180 will grow back into forest. A portion of this acreage could be used to create public access to the river including a walking path, picnic area, parking lot and other amenities to fit Hardwick's needs. A map showing Hardwick Lake post-dam removal is included following the Mackville Pond photos.

11. Will beavers create a dam if Jackson Dam is removed?

Beavers often try to dam up major rivers like the Lamoille, but these dams typically wash out during any large storm. Beavers would be unable to sustain a dam on the Lamoille River.

Beavers do have the capacity to influence smaller streams like Alder Brook. It is likely that over time beavers would influence the ponded areas and the wet meadows that will form if the Jackson dam is removed. Beavers come into an area when there is a food source. Favorite beaver foods include tubers, roots and the inner bark of trees. Beavers leave an area when the food sources run out. Beaver dams result in raising the water levels in a pond. Beaver-influenced ponds provide some of the best habitat for waterfowl, wading birds, other fur bearers like mink and especially for moose and bear. Beaver ponds and other wetlands provide a critical source of food (aquatic plants) in the spring for moose and bear when there is little else to eat.

Because of the topography of the Hardwick Lake area, beaver activity would be confined to the flat low areas of the lake. Because the Electric Department would own these lands, we do not anticipate any conflicts caused by beaver activity on private property. Beaver activity may have to be controlled if it should interfere with the potential road that would be developed over Alder Brook for access to the town gravel pit.

12. Who would own the land under Hardwick Lake if the dam were removed?

The most likely scenario is that the land would revert to the Hardwick Electric Department and remain as town land over the long term.

13. How will dam removal effect the highway bridge downstream of the dam?

Dam removal will not in any way effect the highway bridge located immediately downstream. In general, removal of a structure in a river can affect downstream conditions by changing water flow volume, velocities, or elevations at the bridge. These changed conditions could result in scour at the upstream, downstream, or riverbed adjacent to the bridge. Since the dam does not store a significant volume of water, however, flow conditions would be unchanged after dam removal. Neither water velocities nor flow volume would change appreciably after removal. Water velocity would be slightly lower at high flows after dam removal.

Bridge plans indicate that the bridge is founded on a stone mat located about 5 feet below the riverbed. Currently the toe of the dam is approximately the same elevation or slightly higher than the riverbed elevation beneath the bridge. Removal of the dam would occur only to the elevation of the current riverbed at the toe of the dam. The riverbed at the dam site would consist of either concrete or rock after dam removal. Since the dam is founded on rock, no scour would be expected at the dam site after removal. In fact, scour at the toe of the dam currently associated with high velocity due to flow over the spillway would be eliminated.

If the riverbed below the bridge were at a higher elevation than the riverbed elevation at the dam, scour could occur at the bridge. Because that is not the case, no scour is expected at the bridge.

14. Would dam removal cause a problem in the river downstream of the dam?

VNRC conducted a study of river stability above and below the Jackson Dam. Any dam removal project would have to ensure a stable river course post-dam removal. Providing for a stable river course will help protect areas downstream of the dam from receiving a heavy sediment burden after dam removal.

We anticipate that some level of earth moving work would coincide with dam removal. The earth moving work would include dredging material away from the river in the area just above the dam to create a flood way. The purpose of the flood way would be to protect the river banks from erosion during moderate storms like the annual spring melt. After the earth moving work, the river bank would be stabilized using bioengineering techniques.

On Alder Brook, we anticipate implementation of an instream structure to prevent any head cutting of the channel. Head cutting is a process that can occur when the level of a stream bed is lowered (such as through dam removal). This lowering of the stream bed can continue to migrate upstream resulting in erosion of sediment. Controlling a potential head cut in Alder Brook will be another important aspect of this project to protect downstream areas of the Lamoille River from a heavy sediment burden.

15. How will mud be stabilized during and after dam removal?

Mud will be stabilized in two ways. First, mud in Hardwick Lake will be stabilized naturally as the Lake soils drain and as natural vegetation grows in. Natural revegetation will occur within one growing season as was observed this past summer at Mackville Pond. A landscaping plan can also be developed for Hardwick Lake to enhance and select the desired types of plantings. Second, mud in steeper areas along the river banks will be stabilized using bioengineering techniques. Bioengineering involves using vegetation to stabilize banks rather than stone rip-rap.

16. What would be the impact on Pottersville Dam if Jackson Dam were removed?

Jackson Dam removal would not have any impact on the Pottersville Dam. Sediment will be controlled during Jackson Dam removal and banks will be stabilized as described above to prevent erosion and sediment transport.

17. Does the water level of Hardwick Lake have any connection to groundwater wells?

After dam removal, wells located near Hardwick Lake may see slightly lower water level elevations similar to those that occur when the impoundment is drawn down. We tested one landowner's well on Hardwick Lake and found that the well was about 4 to 5 feet lower when the lake was drained compared to the full pond. This lowering has virtually no impact on this landowner's water supply.

Lake and river water levels are directly connected to ground water. Essentially a river or lake is simply groundwater at an elevation above the ground surface. As lake levels rise and fall, so do adjacent ground water surface elevations.

As rain hits the earth, a portion of it will seep into the ground and flow beneath the surface rather than on the surface as a river or stream. Whether water flows from a lake into the ground or ground water flows into the lake will be determined by the local geography. The lake formed by impounding Alder Brook may cause some localized flow from the lake into the ground water. However, most of the adjacent topography around the lake is much higher than the lake elevation. In general, groundwater elevations adjacent to the lake will be higher than lake or creek elevations because water is coming from the higher elevations flowing through the ground to the lake or creek. See Figure 1 below.

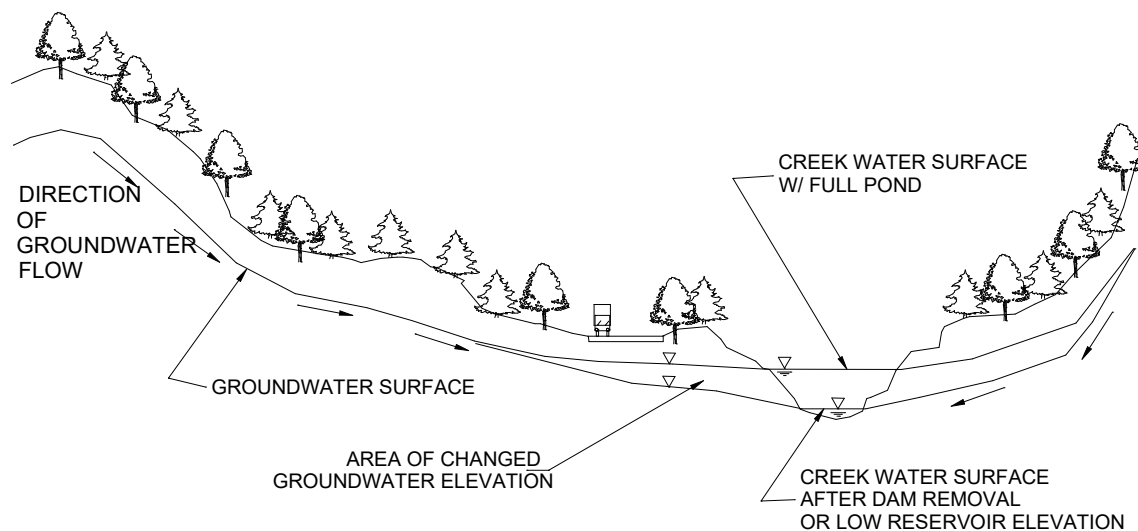


Figure 1 Section through Alder Creek

18. Someone commented that most of the silt came down the river in 1963 and 1973.

Much sediment is transported in a river during high flood events. However, sediment has been building up behind Jackson Dam and in Hardwick Lake since the dam was first constructed around 1914.

19. Does organic silt have any commercial value?

The silt and sand that has accumulated behind the dam likely has some value. Dredging this material and transporting it, however, are expensive. Some earth moving work would be required as part of a dam removal project (see Question #14). It is possible that these dredged materials could be used by the Town of Hardwick or others for road building, road sanding or fill material.

20. If the Jackson Dam were not removed, what would it cost to dredge Hardwick Lake in order to improve it as a recreational resource?

Dredging Hardwick Lake would be prohibitively expensive and would only be a temporary solution because the dam causes continuous sediment build-up in the Lake. Dredging costs vary dramatically depending on volume of material to be dredged, access, material deposition location relative to the removal site, grain size of the material, method used for dredging, availability of water for slurry transport of spoils, and other site specific conditions. Generally, the cost of dredging small quantities of material can range from as much as \$15 to \$7 per cubic yard. Much of the cost is associated with mobilizing and demobilizing equipment for small projects. Dredging even a few feet of sediment from the entire Lake would range in the millions of dollars.

21. Will dam removal and the subsequent draining of Hardwick Lake decrease the value of properties on the lake?

VNRC contacted six realtors familiar with the Hardwick market to give their general views about this question. Realtors were told that Hardwick was considering the removal of Jackson Dam and that removal would result in draining Hardwick Lake. Realtors were also told that Hardwick Lake would revert to a combination of wet ponds, seasonally wet meadows and forest. Realtors were asked to give their general opinion regarding whether property values on Hardwick Lake would decrease as a result of dam removal.

There was general consensus among all the realtors that Hardwick Lake is not considered water front property in the same sense as many of the recreational ponds and lakes in the area because Hardwick Lake is shallow and mucky. There was also general consensus that draining the Lake probably would not effect values because these properties are not considered true water front

properties. Realtors also noted that the new green space replaced by the lake consisting of wet meadow and drier forest land is a plus to property values especially if these lands will be protected over the long term as town forest or in conservation easement. Realtors agreed that any aesthetic value provided by Hardwick Lake would be replaced if a natural area were created in its place with no net loss to any property owners. One of the realtors thought that individual properties would have to be appraised on a case by case basis to know for sure the impact of draining the lake on property values. VNRC spoke with the realtors below.

Brent Miller Realty, Jan Miller, 888-3390

Anne Batten, 472-6066

Marble Realty Inc., Marcia Marble, 888-3418

Sanville Realty, Ron Sanville, 472-6425

Manosh H.A. Corp., Nancy Demers, 888-1102

Peter D. Watson Agency Inc., Brenda Minard, 472-3338

22. How will the decision regarding Jackson Dam removal be made? Will rate payers of the Hardwick Electric Department have any input?

Many townspeople in Hardwick have expressed an interest in a town vote to decide whether Jackson Dam should be removed. It is likely that the Hardwick Select Board with input from HED will decide whether a vote will take place.

If a town vote were conducted, rate payers outside of Hardwick would not have any input into the decision. A few rate payers have commented that they would like input because a decision to keep the dam in place would cost rate payers in the future.