

The Harveys Lake Backflow Problem

"Provided to LHA by Richard Downer"

Frequently Asked Questions

1. What is the problem?

We need to go back to 1879 when William F. Hastie gave Abbie Jean Miller the right to “raise the lake 4 ½ feet above the lowest point on the top of a certain mud sill at the outlet.” Prior to that time Harveys Lake flowed unrestricted into South Peacham Brook.

By placing the dam behind the West Barnet Garage below the confluence of the outlet channel with the brook, Miller was able to increase the effective catchment area feeding the lake from 8.34 square miles to 20.48 square miles. This change in the natural flow pattern meant more water could be collected and stored to run the mills downstream on the Stevens River - a good idea in 1879.

2. What is the backflow?

Backflow is the water, sediment and debris that flows into Harveys Lake from South Peacham Brook that would otherwise flow on down the Stevens River.

3. Is this dam just to benefit a bunch of rich people who come here once in a while mostly during the summer?"

No. Harveys Lake is a valuable recreation resource for both the Town of Barnet and the region. It supports excellent swimming, boating and fishing. A State of Vermont Agency of Environmental Conservation report - “Harvey’s Lake Diagnostic Feasibility Study, 1980- 1983, Final Report” outlines the causes of water quality problems in the lake and gives specific recommendations for lake restoration. Modifying the existing dam is one of the recommended changes.

“Concern for water quality conditions in Harvey’s lake began in the mid 1970's when ice fisherman reported bright red algal scums emerging from holes bored in the ice.” If the water quality in the lake further declines, then it is true that the value of camps will slowly decline. But, the desirability of the public beach will be effected first. Already, the Campground is impacted by the narrowing channel, the delta forming in the lake and weeds growing on the delta.

4. Why don't the camp owners just pay for it themselves?

Harveys Lake belongs to the people of Vermont, not just the camp owners.

5. What's the problem with the channel being an inflow channel?

With the backflow from South Peacham Brook into Harveys Lake came sediment, debris and nutrients. The increase in sediment accelerated as farming in the basin switched from horses and small tractors to intensive utilization of the land - plowing close to the streams, more spreading of manure and fertilizers. By the early 1970's it was clear that the Lake was in trouble, suffering from an influx of nutrients which were causing extensive algae blooms. In 1977 the State of Vermont published a report on the Lake stating, "The annual phosphorous loading is considered critical. Unless this loading is lowered, Harveys Lake will show signs of increasing mesotrophy, or higher turbidity, more floating algae and a change from cold-water to a warm-water fishery." (Mesotrophy - conversion from a cold water fishery toward a warm water fishery. Turbidity - a cloud of fine sediment, suspended particles that make the water unclear.)

In 1983 the State published a second report detailing the sources of the nutrients and suggested ways to reduce their impact on the water quality of the Lake. The results showed that Jewett Brook contributed 40% of the phosphorous entering the Lake. But, because of little human impact, significant improvement would be difficult to achieve. The Arthur and Bruce Roy farms were found to contribute 27%. Backflow from South Peacham Brook contributed 19% of the phosphorus loading, while the remaining 14% was contributed by various small streams having relatively minor human impact.

To control phosphorous, the State recommended that:

- silica not be added,
- the swamp adjacent to the Francis Roy Campground access road be diverted away from the Lake and toward the Choate Farm,
- the small stream which runs parallel to Bruce Roy's driveway be diverted away from the Lake and into the swamp behind the Francis Roy Campground,
- that Arthur and Bruce Roy improve their manure management, and
- that a structure be built in the outlet channel to control backflow.

6. Where does this water go if not into the lake?

Down Stevens Brook, as it did before the first dam was constructed.

7. Where would be a better places to build the dam?

At the entrance to the channel, near the public beach, at the geologic control point for the lake, the sill left by the glaciers that set the original depth of the scoured out basin we now call Harveys Lake.

8. Can I go look at the dam?

Yes. The dam is located behind the West Barnet Garage. There is no labeled right-of-way, but if one parks in the garage lot and walks toward the brook the dam is immediately visible.

9. Is rapid draining of the lake of concern?

No. While a Civil Engineering student at the University of Vermont in 1973, William Mackay undertook a study of the existing dam and determined that with no additional input (rain) to the lake it took six hours to lower the lake just six inches after all the stoplogs (7) were removed. The bladder will be modulating every 15 minutes and one can assume that most of the time when a high flow comes down South Peacham Brook, rain has also fallen on the lake surface and in the lake watershed.

Thus, the time constant for the lake is greater than six hours, while the response time of the bladder will be only 15 minutes or less.

10. Where is the outlet of the lake?

At the inlet to the channel at the north end of the lake, to the right of the public beach.

11. What's wrong with the current dam?

The gate and stoplogs are difficult to open or close. The dam can not be operated to mitigate flood flows in South Peacham Brook.

12. Why is the dam there at all?

To store water to run the several mills downstream on the Stevens River - a good idea in 1879.

13. What's the history of the dam?

The first dam was built sometime after 1879. There has been a dam at the present location ever since.

14. What has been the impact of the dam on the lake?

The backflow from South Peacham Brook brings sediment, debris and nutrients into Harveys Lake. The increase in sediment accelerated as farming in the basin switched from horses and small tractors to intensive utilization of the land - plowing close to the streams, more spreading of manure and fertilizers. By the early 1970's it was clear that the Lake was in trouble, suffering from an influx of nutrients which were causing extensive algae blooms. In 1977 the State of Vermont published a report on the Lake stating, "The annual phosphorous loading is considered critical. Unless this loading is lowered, Harveys Lake will show signs of increasing mesotrophy," or higher turbidity, more floating algae and a change from cold-water to a warm-water fishery.

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15. What has been the impact of the dam in the channel?

The flood flows from South Peacham Brook enter the channel at nearly the same high velocities as are seen in the brook. Those high velocities carry sediment and floating debris into the lake. As the high velocity flows leave the channel and enter the broad lake they slow down and drop their sediment load. Thus, the delta of mud has grown in the lake at the entrance to the channel.

In the reverse cycle, when the lake begins to drain. The velocities are much lower. Thus, the delta and channel are not scoured out. With each cycle, over the past 30 years, the channel get progressively narrower, which increases the inflow velocity and accelerated the movement of sediment into the lake. But, because the channel is now narrower, the lake drains more slowly and less sediment is scoured from the delta.

16. What are the sizes of the contributing areas (watersheds) for Harveys Lake and South Peacham Brook?

The lake watershed is 8.34 square miles, South Peacham Brook watershed is 12.14 square miles.

17. Would the snow melt faster in the South Peacham Brook watershed or in the Harveys Lake watershed?

Spring thaw in South Peacham Brook watershed should be faster because there is more south-facing land which will heat up earlier and quicker.

18. Is the water level from the dam back into the lake always the same level?

No. At times when it has not rained for several days, the water levels at the dam and in the lake may appear to be nearly equal. For water to flow out of the lake the water level in the lake must be slightly higher than the water level at the dam.

If it rains hard on the lake, but not in South Peacham then for a time the water level in the lake will be higher than at the dam.

If it rains in South Peacham but not on the lake, then a short time later the runoff into South Peacham Brook will cause the water level near the Roy Mt. Road bridge to be higher than the level at the dam and in the lake.

Remember, water flows downhill or water will flow from the highest level toward a lower level.

19. What effect will this have on the beaver activity in the channel?

Probably none. Each year the yearlings are forced out of the colony. They often swim into the lake in search of a new home. Frequently during the summer they dine on the small ornamental trees in our front yards. Some of the beavers are attracted to the wetlands along the channel leading from the lake to the dam. The area is remote and has a good supply of food. Their dam building instincts drive them to start damming up the channel.

20. Will installation of the bladder dam dry up the wetlands between South Peacham Brook and the channel, behind the public beach?

No. Most of the time, a bladder dam will maintain the existing water levels in the lake, in the channel, in the wetlands and in South Peacham Brook. Only during a flood condition on South Peacham Brook will the dam deflate to allow the flood waters to pass without backing into the lake.

21. Will the silt in the channel go away after the new dam is constructed?

Maybe. It took many years to for the delta near the public beach to form and for silt to close in the channel. It will take many more years for the silt to slowly wash down the channel and over the dam. Under current Vermont law, the lake and the channel can not be dredged. The good news is, that if the bladder dam is installed, then most of the time the direction of flow will be out of the lake which should encourage some of the silt to move downstream.

22. Will the weeds stop growing in the lake?

Probably not. Reducing the inflow of nutrients into the lake should lessen the growth of weeds, but the degree of decline may not be noticeable. Lawn fertilizer, septage inflow and natural decay of vegetation all contribute nutrients to the lake.

23. Will the fish ladder be removed?

Maybe. Currently the fish ladder is inoperable. It is plugged with debris and some of the baffles have rotted away.

24. What about the pollution at the garage?

Some time ago a gasoline tank leaked at the garage. The material seeped into the soil mass and started to migrate toward South Peacham Brook.

25. If the pollutants do not go in the lake, where do they go?

To a treatment plant at the rear of the garage parking lot. To stop the migration and eventually remove the contaminants, the State has installed a vacuum "pump and treat"

system that slowly removes the gasoline vapors from the soil and collects them in charcoal filters. The filters are periodically removed and sent off for proper disposal.

26. **What is a bladder?**

“Bladder” is short for “Bladder Dam” or “Inflatable Rubber Dam.” A bladder dam is a large thick, multi-ply rubber tube stretched across a stream to hold back the flow of water. The bladder is anchored on the bottom and ends. It is inflated by low pressure air. The bladder is deflated to let water pass down stream or inflated to prevent downstream flow. Instead of having manually operated gates or stoplogs that open and close, the whole dam (bladder) can be raised or lowered in just a few minutes by changing the air pressure inside.

27. **Have bladder dams been used elsewhere in Vermont?**

Yes. You can see a bladder dam at the exit of Joe’s Pond opposite Hastings Store in West Danville. Green Mountain power has installed bladder dams at most of its dams along the Winooski River.

28. **Would the lake level would drop each time the bladder was lowered?**

The answer is maybe. Whether the lake starts to lower is dependent on the response time of the bladder. As an example, if during the last 5 minutes of a 15-minute computer cycle, the brook level is actually lower than the lake level, then water would flow out of the lake until the computer redetermined the relative levels and started to re-inflate (maybe 5 more minutes). In this example, flow from the lake could last 10 minutes.

29. **How does a bladder work?**

A bladder dam is inflated by a small air compressor. Typical internal pressures are only 3 to 5 pounds per square inch. It collapses automatically when the air is released, and can be re-inflated while there is water flowing over it.

30. **Would the bladder remove all backflow?**

The answer depends on the response time of the bladder, ie, how fast it can deflate relative to how fast the water level rises in South Peacham Brook.

There will probably be two sensors. One at or near the Harvey Mt Road bridge and a second in the channel near the beach. When the computer determines that the water level in South Peacham Brook is higher than the water level in the lake, then the dam would start to deflate. The dam would deflate, for example, six inches rather slowly. Every 15 minutes the computer would retest the levels. If the lake level was still lower than the brook level then the bladder would deflate another six inches. The process would repeat until the water levels in South Peacham Brook were once again lower than

the lake level.

So would there be backflow. Maybe, sometimes, depending on how fast the bladder can deflate to compensate for the increased flow in South Peacham Brook.

31. What's in the bladder?

Air.

32. What's the bladder made of?

The tubes are constructed from layers of weather resistant rubber, synthetic rubber and nylon webbing. The outer layer is "Hypalon" rubber to guard against adverse atmospheric conditions. These sandwiches are 10 times more resistant to abrasion than iron and can resist puncture by a 22 caliber bullet.

33. Will the bladder definitely solve the problem?

Probably. Because the bladder can be easily and quickly inflated or deflated to any level and because the controlling computer can be reprogrammed to respond to any existing or new hydraulic conditions.

34. Will the lake be lowered for a long time to rebuild the dam?

No. Most likely the contractor will construct a temporary dam in the channel to hold the lake at its normal level while the existing dam is cut down (notched out) and the bladder is installed.

35. What happens when the water behind the dam freezes?

Nothing. The bladder dam will react to ice the same way the current concrete dam has. The ice in South Peacham Brook and the channel may freeze nearly solid as it has done for years. But, because of the constant flow near the crest of the dam, the water will probably not freeze at the crest. When the ice starts to break up, it will float down toward the bladder where it may hang up until the flow is great enough to carry it over the dam.

36. What if an ice jam forms at the dam?

The controller will sense a rising water level and lower the dam until the water level returns to normal. As the dam deflates, the velocity of flow will increase and undoubtedly carry some of the ice downstream. There will also be a manual over-ride which will allow an operator to lower and raise the dam to cause ice and debris to move downstream.

37. **What kind of sensors will be used to determine if water is backflowing into the lake?**

A direction sensor (like a wind direction vane) would be best, but would have problems with the ice in the winter or from passing debris. Depth of water sensors can be buried in perforated tubes below the ice line and out of the way of floating debris.

38. **How will the levels at the sensors be transmitted back to the computer that deflates/re-inflates the bladder?**

Several methods exist. The levels can be transmitted by cell phone, by regular telephone or by hard wires. All three methods are in common use for telemetering remote data as in the case of rain gauges or water level in remote tanks.

39. **What happens if the electricity goes out?**

Bladder dams are installed with “fail safe” mechanical controls as well as electronic controls to deflate the dam during excessive high water. The dam can be re-inflated by air stored in a large compressed air storage tank similar to those used in garages to operate the vehicle lifts. The controls will have backup battery power and maybe a small backup generator.

40. **What happens if the phones go out?**

Water level may not be transmitted to the computer. Bladder dams are installed with “fail safe” mechanical controls as well as electronic controls to deflate the dam during excessive high water. In the worst case, if the bladder remains deflated for several hours, then water may start to drain from the lake. It takes six hours without rain to drain the lake six inches. With rain falling on the lake or in the watershed it would take even longer.

41. **Could the lake drain while the bladder dam is deflated to allow a flood to pass?**

No. Because the time constant for a flood flow to reach its peak is very short, there is a greater likelihood that there will be occasional backflow to the lake rather than uncontrolled draining of the lake. Reducing the computer cycle time and the bladder deflation time might cure this problem, if we encounter it at all.

42. **What happens when debris comes down the brook?**

Debris may momentarily hang up on the bladder dam, but it will eventually pass over the dam much the same as debris now passes downstream with high water. A manual override will allow the operator to deflate the dam to cause debris to pass downstream.

43. **What happens when someone vandalizes the dam?**

The bladder dam might deflate. The bladder is thick enough to resist a 22 caliber bullet. The bladder can be patched much like an automobile tire. The air pressure inside is about the same as in an ATV vehicle tire.

44. **Who is responsible if someone falls off or goes over the dam?**

The foolish, risk-taking individual. The Town will undoubtedly put up a fence and post signs warning of the possible danger. Maybe the Town of Barnet could be sued.

45. **Who is responsible if something goes wrong with the construction?**

The contractor.

46. **How long is the warranty on the dam?**

Most manufactures guaranteed their bladder dams for at least 25 years of service.

47. **How would the dam affect boats (a) on the lake (b) in the channel?**

48. **How would this affect swimming at the public beach (depth of water)?**

49. **Who will maintain the dam?**

The dam is owned by the Town of Barnet and as such the Town is ultimately responsible for its operation and maintenance.

50. **Who will operate the dam?**

The dam will be deflated or inflated automatically by a computer housed near the dam. The Town may delegate someone to check the controls. In the past, George Copenrath, who lives near the dam, has been appointed to that position.

51. **Who decides the level of the Harveys Lake?**

The water level in Harveys Lake is set by a Vermont Water Resources Board decree. The current water level is the historical level maintained by the old dam, which was reconstructed in 1972.

52. **Why can't the water level be lowered for the entire winter like it was in the 1930's, 40's and 50's?**

We have since learned that lowering the water for extensive periods of time disrupts the spawning cycle of fish. The fish like to lay their eggs in the Fall in the gravel deposits along the shorelines.

53. Will the lake be lowered to allow annual shoreline maintenance?

In recent years the lake has been lowered from September 15 to October 15 each year. Hopefully this will continue as it will become a much easier process for the operator to merely press a button.

54. How low can the lake be lowered?

This will be determined by the fully deflated elevation of the bladder. The engineering study and plans will determine the minimum elevation.

55. Will the new bladder dam work the same way as the current concrete dam.

Essentially. It may take several days to calibrate the bladder inflation/deflation system to the proper height. But, the advantage of the bladder is that it can be adjusted until the height is just right to pass the normal flows while maintaining the lake at its historical level. Once the operating protocols are determined they can be locked into the computer.

56. Who owns the power dam downstream?

The Stevens Falls Dam at Barnet is owned by Timothy Buzzell, Methodist Hill Road, Lebanon, NH 03766.

The Stevens Falls Dam is located under the Church Street bridge just upstream of the Barnet War Memorial. The power station is located off Route 5 just behind the Barnet Village Store.

57. Does that dam provide power around here?

The Stevens Falls Dam delivers its power into the local grid where it is sold on the open market.

58. What will be the effect on people downstream?

Because Harveys Lake will no longer be used as a storage reservoir, the flow in the Stevens River will revert to its historical cycles. The flows in the river below West Barnet will have higher peaks of shorter duration than are currently experienced.

59. What happens to the farm below the dam?

Some of the Choate Farm fields which are in the mapped flood plain will experience higher peak flows of shorter duration followed by lower dry-weather flows.

60. What will be the effect on the power dam?

The power dam will get the same volume of water, but in a shorter periods of time. This means that power generation will become more erratic with higher peaks and lower valleys.

1. **Why should we could care if he's upset?**
2. **Won't there be flooding if the lake does not absorb the water?**
3. **How will this affect the level of the lake?**
4. **Who pays for these gizmos?**
5. **What is the maintenance costs?**
6. **How much does this cost?**
7. **What can go wrong.**
8. **Why are the fish dying?**
9. **What are the environmental implications?**
10. **Could the new dam design cause more erosion?**
11. **What does the dam do to fish? (Like, is the dam good or bad for fish? Is it good or bad for fishermen?)**
12. **Will the salmon return?**