Keoka Lake Association

Dam Repair Proposal

08-26-2004

Some news: My son, Kilton, is currently a Life Scout and has just turned 17. His last remaining hurdle on his path to Eagle Scout is to plan and manage a Leadership Service Project that is of significant benefit to a community. He is very interested in repairing the KLA dam as his project. As our troop Advancement Chairman and KLA Dam Committee Chairman, I have given his proposal my blessing, as has his Scoutmaster. He is currently writing up a formal project plan to be submitted to the Casco Bay District Eagle Board for review. Assuming that approval is forthcoming, Kilton will be managing the labor aspects of the project, while I will continue to be responsible for the engineering.

The upside of this for the KLA is that the labor to sandbag the temporary barrier dam, remove the old gate, pressure wash and repair the concrete, install the new gates, and then remove the temporary dam, will all be volunteered. Kilton expects the team to be primarily staffed by the Scouts, with assistance from his other friends and any interested KLA members. Our project costs will therefore be limited to the gate mechanism and shipping, fastening hardware, epoxy, and some sustenance for the workers. This will be important, as you'll see, based on the pricing of the gate hardware I've received so far.

I have submitted a Permit by Rule Notification Form to the DEP, which includes a location map and pictures of the current situation. The cost for this permitting process is $55, which Steve provided a check to cover. I additionally discovered that the DEP requires that any new concrete cure for at least a week before letting the lake water come in contact with it. Based on this knowledge, we plan to use 3M Scotch-Weld Urethane Adhesive instead, since it fully hardens within an hour as an epoxy chemical reaction occurs.

After having examined the various options available, I have three alternative recommendations for repairing the gate in the KLA dam sluiceway. So that everyone is on the same page, here is a little background on nomenclature:

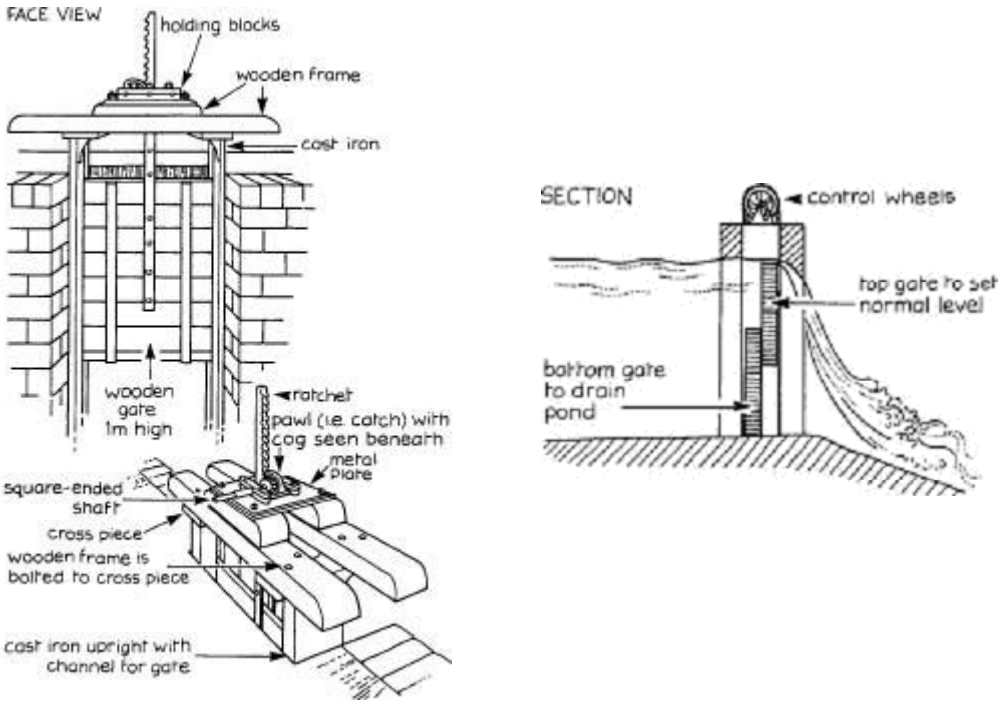
We have a low-head concrete-faced granite dam with two level-controlling mechanisms. The first is the static SPILLWAY that is the 12' wide opening on the left when facing the dam from the lake. It regulates the maximum level of the lake by allowing excessive levels of water to spill over its WEIR (top lip) as necessary, which is about 29" below the top of the dam. The lake level this year has been regulated at approximately the spillway level.

The second controlling mechanism is the SLUICEWAY. Our sluiceway is 34.75" wide at the dam face and its INVERT (bottom sill) is 75" below the top of the dam. This is the minimum lake level that we can drain to without pumping, a total range below the spillway of about 46". Within the sluiceway is the GATE mechanism. When it was functional, our sluice gate (a set of planks held together by a simple metal rack) could be lifted in its 2.25" square slots to provide a FLUSH (an opening at the bottom), and planks could be manually removed at the top to adjust the height of the weir for overflow. Most dams having this type of mechanism use two gates side by side, the upstream one

controlling the flush and the downstream one controlling the weir (see diagrams below). In any case, plank sluice gate mechanisms have the following issues:

- They leak and erode unless constructed as double sets of boards with packing.
- They may be very hard to move under pressure or in a strong current.
- They can be easily vandalized and the boards taken.
- They do not allow fine, stable adjustments of the water level.

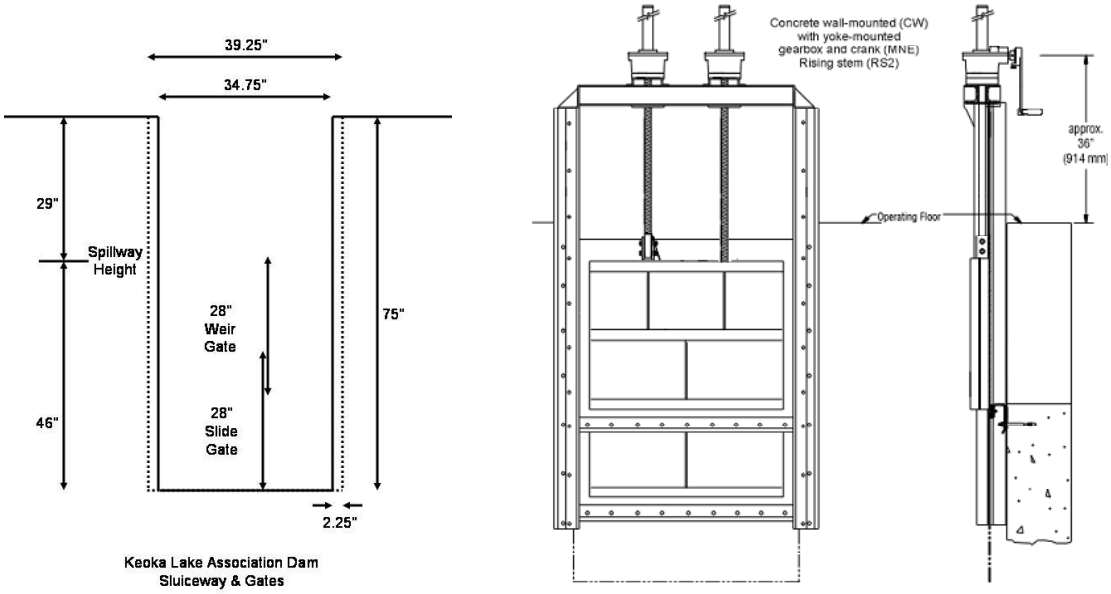
Typical Plank Sluice Gate Mechanism



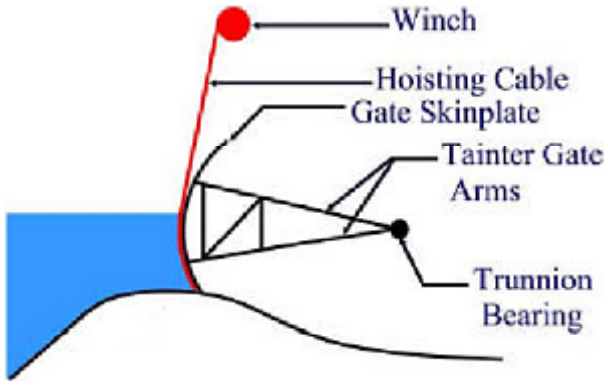
Our current situation is that the single plank gate is virtually immobile due to the significant erosion of the bottom half of the slots in the concrete wall. On Sunday, August 22nd, I sawed about 6" off the top of the wooden gate to start lowering the lake to more traditional summer levels.

The original project plan was to repair the concrete on the upstream dam face to either side of the sluiceway and then replace our crude plank sluice gate with a set of surface mount sluice and weir gates, of similar construction to what is shown below. While this would solve the structural and basic control issues, it would still require monitoring and adjustment in order to comply with our current Water Control Plan (see document attached).

Option "A" - Dual Slide/Weir Gate cost including shipping: $12,250 (best price from four vendors received so far; the high end of the range was $15,000. Still have four more quotations yet to come in.)



In discussions with engineering firms specializing in water control equipment, I learned quite a bit about alternative gate mechanisms. A TAINTER gate utilizes a pivoting mechanism to control the water flow:



I've located a firm that has created a modern version of this mechanism that has many advantages over most other gate designs:

The Waterman Type "C" gate automatically maintains a *constant* water level on the *upstream* side of the gate section. It operates...

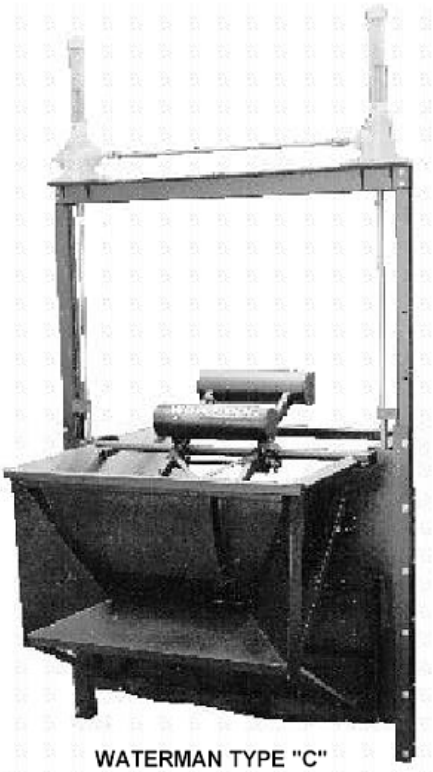
- without any outside power or motor
- free of any manual intervention
- irrespective of the volume of incoming flow
- independently of the downstream level

The gate is directly actuated by the water level it controls. Hoists, cables, floats, float wells, and other structural complications have been completely eliminated. Instead, the upstream side of the radial face plate is simply provided with a specially designed buoyant compartment. The supporting frame rotates about a horizontal shaft and includes ballast containers for easy and accurate balancing of the gate. Frictionless, non-stick operation is guaranteed by the tapered shape of the leaf and matching sluice.

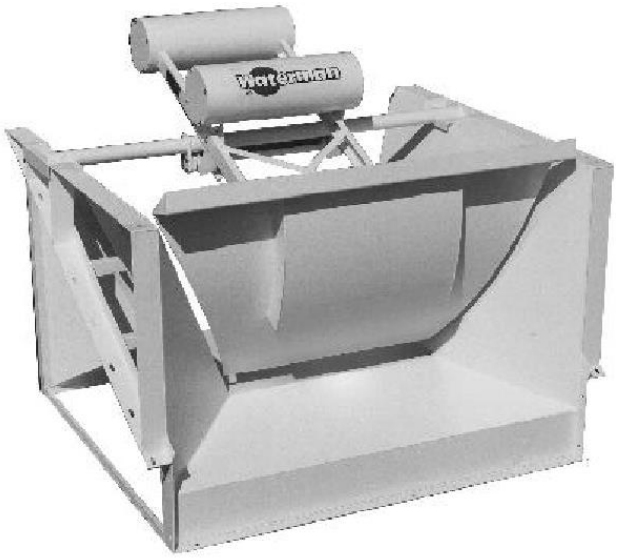
On recreational lakes, the Waterman Type "C" gate can maintain a pleasantly constant water level in all seasons. No operating costs and no maintenance costs are required, except for occasional inspection/lubrication and touchup painting of the gates. An optional, adjustable prefab sluice way can allow the operator to easily adjust the "set" level of the gate.

Option "B" - Cost: It would be about $8,500 for a fixed height Type "C" gate, set to regulate the lake at approximately 6" to 8" below the current spillway height, plus an additional $2,000 for a manual stop gate mounted below the Type "C" gate to allow for periodic flushing, for a total of about $10,500 (still awaiting firm bid). There would be no provision for allowing the lake to "fill up" to the spillway level and stay there in the off season.

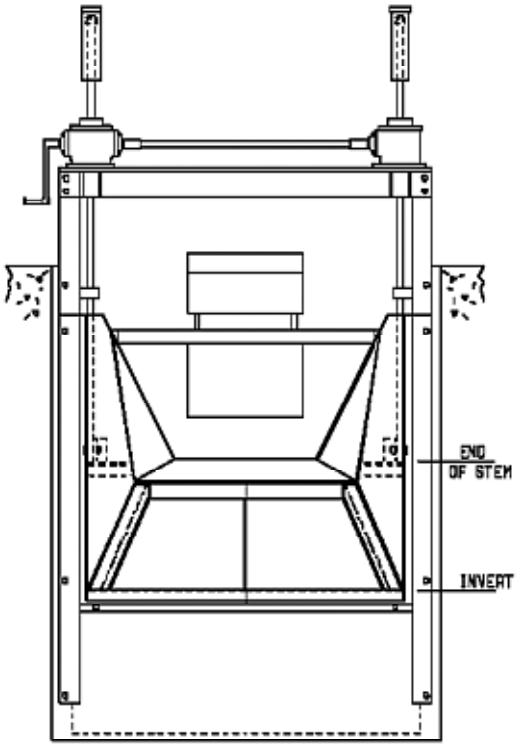
Option "C" - Cost: It would be about $12,000 (still awaiting firm bid) for a fully adjustable Type "C" gate, which could regulate the lake anywhere from the current spillway height downwards 1.5', to allow for different seasonal levels and periodic flushing.

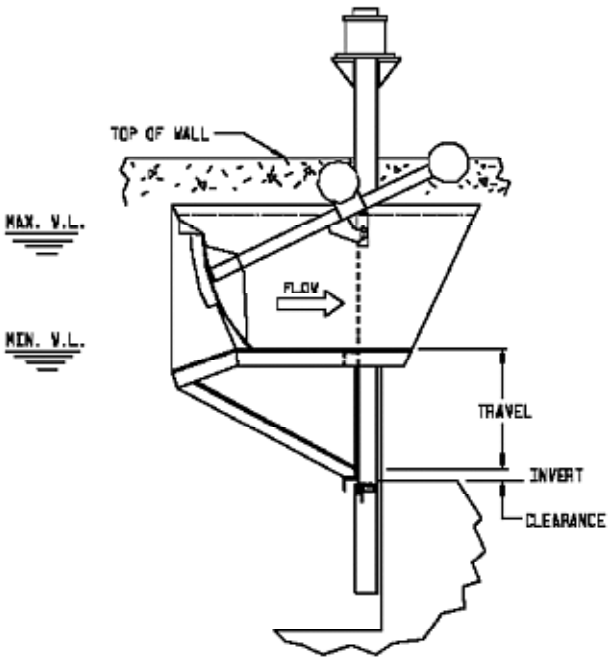


WATERMAN TYPE "C"
AUTOMATIC LEVEL CONTROL GATE
MOUNTED IN A PATENTED WATERMAN
ADJUSTABLE SLIDING WEIR SLUICEWAY



WATERMAN TYPE C AUTOMATIC LEVEL CONTROL GATE
MOUNTED IN A WATERMAN PREFABRICATED CONTROL STRUCTURE





Regardless of which way we go with the gate mechanism, we will also be mounting a Staff Gage measuring plate (see picture at right) on the dam next to the sluiceway to facilitate measuring the water level and setting the weir height accurately going forward. In any of the three options, additional costs for all the other materials will likely run less than $500.

In summary, these are the “best fit” permanent engineering solutions I could find to meet what I perceive to be our long-term needs. (I personally prefer Option C the most, followed by Option A.) Additional minor consideration: We may want to add a fish ladder at some point to allow trout and other small native fish to migrate from the brook back up into the lake. Options B or C would allow for this at moderate expense, while it would be quite easy with Option A at minimal expense.

If we are unwilling to spend these higher amounts at this time, I can also re-examine less expensive, stop-log fixes that will not offer the control advantages of these solutions, but will at least get the structure stable. These solutions would come in at $8,000 or less, but would have the disadvantages of the current gate system when it was actually usable. Please let me know ASAP which direction you think we should pursue.

Keoka Lake Association
Waterford, ME

Keoka Lake Dam – Water Control Plan

Adopted 06-23-2000, Updated 07-28-2001

I. General Objectives

The authorized purposes of the Keoka Lake Dam are to maintain proper water levels to support fire protection, provide flood control, encourage fish and wildlife populations and insure water quality and recreation benefits. The operational objective of the Keoka Lake Dam will be to maximize the benefits of these authorized purposes. This water control management plan has been developed for the Keoka Lake Dam to conform with the objectives and specific provisions of its authorizing authorities.

II. Standing Instructions to the Project Operator

A. Check the gate several times in the late Fall and flush out leaves and other debris.

B. In the Spring immediately following ice-out, open the gate and flush out debris.

C. Set the bottom gate level at 1 to 2 inches in order to maintain a minimum flow.

D. Adjust top and bottom gate levels as necessary based on weather conditions to maintain summer water levels approximately 6" to 12" below the level of the spillway. The maximum fluctuation of water height throughout the year should not exceed 36".

III. Flood Control

Under flood conditions, the water management objective of the Keoka Lake Dam is to pass all inflow through the dam while minimizing flooding downstream.

IV. Dam Committee Contact Information

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