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Alexander B. Grannis
Commissioner

To: **Larry Nashett – Regional Supervisor of Natural Resources (R5)**

From: **Eric Greppo, P.E. – Environmental Engineer I**

Re: **Duck Hole Pond Dam – Structural / Dam Safety Assessment**

Date: **October 3, 2008**

Cc: **Elizabeth Lowe – Regional Director (R5)**
Thomas Miller – Bureau Chief – Design and Construction
Don Tuxill – Section Chief – Design and Construction
Dominic Fontana – Dam Safety Environmental Engineer (R5)

Introduction ***(See 'Attachment A' Photos 1-13)***

On September 16th, 2008 at approximately 10:00am, several employees of DEC departed the Adirondack Regional Airport, in Saranac Lake, for an investigation of the condition of Duck Hole Dam. Along with me, the investigation crew included Larry Nashett, Betsy Lowe, and Rich Preall of Region 5.

The Dam, owned by NYS State (ID 184-4556), is located in the southeast corner of Franklin County. It is situated within the High Peaks Wilderness Complex (Western High Peaks – Zone B) and is subject to the regulations set forth in the *State of New York Adirondack Park State Land Master Plan (APSLMP)* (Rev. 2001) and the *High Peaks Wilderness Complex Unit Management Plan (UMP)* (March 1999). The dam, built in the late 1930's, is of timber crib construction. The Dam is 110 feet long, 14 feet high with a 62 foot wide spillway. A timber crib causeway/dike, approximately 200 feet long and constructed at the same time as the main dam, is located approximately 500 feet west of the Dam. Duck Hole Pond has a surface area of approximately 60 acres with a normal storage volume of 300 acre-feet.

Access to the dam was aided by a New York State helicopter. The Dam is very remote. Dirt roadway access (Preston Road) runs 7.6 miles southeast from Coreys Road (near Ampersand Lake) to Duck Hole Pond. The majority of the length of Preston Road runs through the High Peaks Wilderness Area to Duck Hole Pond and has most likely not had any motorized vehicle traffic in many years. Its condition should be further investigated for use as a potential site access. A hiking trail from the southeast at the terminus of Upper Works Rd (County Route 25) also leads to Duck Hole Pond (5.3 miles).

Refer to "Attachment A" to this memo for photos taken during the assessment. When "left" and "right" are used in reference to dam locations, they are based on looking downstream. For example, the left abutment would be that abutment at the observer's left hand side if she were standing on the dam looking downstream.

The trip was flown under sunny skies, with temperatures in the mid 50's (F) and calm winds. Upon approach, several circles were made about the pond noting the location of the manmade dike and main dam, approximate depth of the pond, and shoreline characteristics. Generally, the pond looked shallow (<10 feet) except for the primary flow channel. Though siltation within the pond has undoubtedly occurred since its construction in the late 1930's, the pond was most likely fairly shallow when created; the pond's shores were most likely marsh and wetland in their original condition.

Dam Observations ***(See 'Attachment A' Photos 14-35)***
A floating debris boom was located approximately 100 feet upstream of the Dam face. The condition of the boom appeared sound, though general maintenance was warranted as many logs and branches have collected along its length.

The Dam is of a timber crib type construction. The upstream face of the dam was silted entirely up to its crest such that none of the vertical wooden planks covering the timber cribbing could be seen below the waterline. The depth of sediment deposition receded gradually from the face of the dam heading upstream into the pond; the depth of water even 50 feet from the upstream dam face was only several feet deep based on visual observation. The downstream face of the dam, where a timber cribbing (with plank deck) splash pad once existed, is now a scoured plunge pool. Remnants of the splash pad are found on the downstream left side of the dam where a 15-20 foot long deteriorated section is still in partial operation. All of the stone which had filled the original splash pad cribbing (at least to the visible depth of 4-5 feet) has been washed downstream. Approximately 25 feet from the downstream face of the dam exists a large pile of 6" - 24" diameter stones in a pile dissimilar from the stream bed composition further downstream. It is assumed that the majority of these stones are remnants of the timber cribbing splash pad.

A survey of the Dam and its immediate vicinity was performed on March 28, 2007. The survey did not gather detailed data on the depth of the scoured pool on the downstream face of the Dam. Based on a DEC email dated December 14, 2005, the survey crew did "probe the scour pool and the base of the dam and reported that it is 6-12 feet deep. A ranger reported that there has been a deep scour hole at the base for many years." If further investigation is approved, it is recommended that a diver and camera inspection is conducted of the plunge pool and submerged downstream face of the Dam.

Flow over the Dam spillway at the time of inspection was approximately one (1) inch. Over one (1) inch of rain had fallen in nearby Lake Placid (the closest weather station) over the course of the previous several days. The cascade of water over the dam cleared the downstream face of the dam such that the timbers were visible for inspection. Probing with a screwdriver yielded a sound condition assessment of the timber cribbing composing the face of the Dam. The timbers were very solid and the screwdriver only superficially penetrated them (<1/8") even with forceful stabs. One possible area of leakage/seepage was observed along the top right side of the central Dam pier (Photo 19). However, it was difficult to tell if this was water actually penetrating the dam, or just running over the face of the dam after passing over the spill crest. There were no "spouts" or "sprays" of leakage/seepage observed along the timbers; however, they were all very

moist, and dripping from the splashing of the water spilling over the dam from above. There were no signs of any missing timbers. The timbers were generally covered with a "slime like" algae.

Abutment Observations *(See 'Attachment A' Photos 36-51)*

The abutments were inspected and the following observations were made. The stone filling the abutment cribbing was one (1) to three (3) feet below the top of the cribbing and vertical wooden planking forming the cribbing fascia. This indicates settlement of the stone, or a potential displacement of fines below the abutment, allowing for this settlement. It could not be told whether the stone was originally placed to this "settled" elevation or if it actually settled akin to a sinkhole. Both abutments exhibited this characteristic. The timbers forming the abutment cribbing where in significantly worse shape than those in the Dam's main spillway. They were rotting significantly, with some of the top-most timbers missing, allowing for some of the interior stones to have spilled out the downstream slope adjacent to the cribbing. (This may partially account for some of the observed "settlement" of stones at the top of the abutment cribbing). The abutment timbers were not horizontally in place, further indicating settlement and/or displacement. The timbers, when probed with a screwdriver, yielded without any resistance. As such, they were providing little to no structural support.

There were no signs of water flowing around or though the abutments. The abutments appeared to tie into bedrock on both sides of the dam. It also did not appear that the normal high water levels in the pond fluctuate much. There were no indications that water ever flowed over or around the abutments. The pond bank vegetation also indicated that the pool elevation typically does not rise much above the level witnessed this day.

The cribbing composing the center pier of the Dam exhibited rotting timbers only at and above the lake pool elevation. Wooden planks running along the downstream face of the center pier were originally designed to be removed for drawdown of the pond. However, these boards are most likely completely inoperable due to their age and the quantity of siltation at the upstream face of the dam. A bridge over the dam was removed in 2002 after a 2000 Dam Safety inspection recommending such action.

As stated before, the upstream face of the dam was not observable due to the amount of siltation accumulated. Record plans show that there is timber sheeting "driven to refusal" along the upstream face of the dam.

Dike Observations *(See 'Attachment A' Photos 52-66)*

There is a dike about 500-600 feet to the west of the Dam. The dike is of timber crib construction and is approximately 200 feet long. The horizontal timbers composing its upstream lateral bracing were in very poor condition and had detached and fallen off in many spots. The vertical wooden fascia planks on the upstream face of the dike were in good condition. They showed little to no rot when probed with a screwdriver (even where the wood met the ground. Despite the missing horizontal timbers, the cribbing filler stone was still in place. The

downstream cribbing timbers were essentially completely rotted away allowing some of the cribbing stone to have displaced several feet downstream. The lake elevation was below the bottom of the visible wood composing the dike. There was no evidence that that the pool elevation rises to the planks regularly. There was no visible seepage or water flow was noted through the dike. Downstream of the dike was a bog-like wetland. When I walked across it, there was no sign of any concentrated flow path. However, an aerial photo taken from the helicopter shows a defined main channel within this bog. This pedestrian wooden plank walk across the dike was in significant disrepair. I would advise either removal or reconstruction of the walkway. It did not appear that this dike typically experiences water levels against the exposed wooden fascia boards, and certainly not flowing over them. I would also recommend removing woody vegetation from the dike.

Construction Limitations

Wilderness areas are very restrictive in terms of methods of disturbance and construction. Any reconstruction at Duck Hole Pond Dam would have to take the following into consideration.

- Duck Hole Dam is a conforming structure within the High Peaks Wilderness Complex and may be replaced if warranted (APSLMP, Page 21-22).
- Any construction at the Dam would have to be without "motor vehicles" which are defined as "devices for transporting people, supplies or material." This essentially includes all motorized apparatus that moves including trucks, bulldozers, and excavators. "Motorized equipment", however, is permitted during "off peak seasons" i.e. chain saws, generators, rock drills (UMP, Page 97). The off peak season is defined from October 16 through May 24 (Chapter 8410 of DEC Policies and Procedures Manual, 1974). Helicopters are permitted for access to the Dam during this off peak season. A limited construction season would generally lead to increased project costs.
- Access via roadway would have to be further investigated. Preston Road runs almost eight (8) miles, through mostly Wilderness Area, to the site. Its condition should be confirmed as a potential access route.
- In the reconstruction of a dam "natural materials will be used wherever possible." Natural materials are defined as: "construction components drawn from the immediate project site or materials brought into the construction site that conform in size, shape and physical characteristics to those naturally present in the vicinity of the project site. Such materials include stone, logs, and sawn and treated timber. Natural materials may be fastened or anchored by use of bolts, nails, spikes or similar means." (APSLMP, Page 21-22).
- The UMP states that dam "design considerations will require structure walls to be camouflaged and arranged with rock to make natural cascade of rapids" (UMP, Page 161).

Historical Comparison

Comparing the condition of the Dam to photos taken in late February 2004 does not show any visible changes in the spillway, abutment or splash pad conditions.

Dam Safety conducted an inspection of the Dam (but not the nearby dike) on May 17, 2000. The findings of this inspection were nearly identical those observations made within this memo. Comparing the photos within the 2000 inspection yields no visible changes in the spillway or abutments or splash pad conditions, Based on the inspection report, the condition of the dam does not appear to have deteriorated much over the last eight (8) years.

An inspection by C.T. Male Associates on July 31, 1980 shows some changes in the Dam's condition compared to today. The left abutment cribbing, particularly on the downstream side, appeared to be fully in tact based on a photograph. The splash pad was still in place from the left abutment to the center pier (about 15 feet more than what is in place today).

Based on photographs, the pond elevation and flow over the dam during each of the historical inspections appears nearly identical.

Summary of Findings/Recommendations

- A SCUBA dive investigation of the scour hole on the downstream side of the Dam should be conducted by a licensed engineer, to determine the depth of the scour. It would be critical to know whether the scour has penetrated to depths below the bottom of the cribbing to determine the abutment stability. If a scour hole ultimately permitted the passage of water and sediment beneath the dam, it could ultimately undermine the dam triggering a breach. Depending on the dive findings, the scour hole could be filled with a large stone fill in combination with the reconstruction of the splash pad as a remediation measure.
- A hydrologic and hydraulic assessment of the dam and its capacity should be conducted. This would also help to determine whether the Dam meets current Dam Safety criteria.
- A portion of timber sheeting on the upstream face of the dam should be revealed to evaluate its condition below the water line.
- If a decision is made to preserve the Dam, its abutments should be repaired. Though it did not appear that flows have passed over the abutments, if they ever did, a breach of the dam could be triggered.
- Sediment has deposited to the crest of the dam. If the dam were to breach, either naturally or intentionally, the released sediment load could be of concern to the downstream waterways.
- The overall dike condition was poor. However, there is little evidence that the pool elevation normally reaches the elevation of the exposed timber planks. Failure of the planking on the upstream face of the dike would have little to no impact on Duck Hole Pond as the planking is above the normal pool elevation.
- The timber cribbing composing the primary span of the dam spillway was in good condition with no signs of rot or displacement.
- The wooden walkway across the dike is a safety hazard. The planking should be removed or replaced.
- Significant access restrictions exist due to the remote location of the Dam and the classification restrictions associated with the High Peaks Wilderness Area.
- Most likely, if the Dam does fail, it will be a gradual deterioration of the structure rather than a catastrophic breach and release of the impoundment.

- Once a more comprehensive structural inspection can be performed, results will be used in an environmental assessment and cost benefit analysis to determine if the dam should be intentionally breached, or repaired.

Attachments:

Attachment A – 2008 Inspection Photos
Attachment B – 2004 Inspection Photos
Attachment C – 2000 Inspection Photos
Attachment D – 1980 Inspection Photos
Attachment E – 2007 Survey Mapping
Attachment F – Original Design Plans