The Gilboa Dam and Schoharie Reservoir

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In 1926 the New York City Board of Water Supply began moving water from the Schoharie Reservoir, via the 18-mile-long Shandaken Tunnel beneath Balsam Mt. to the Esopus Creek and the Ashokan Reservoir(1). This landmark feat of civil engineering diverted much of the flow from what is now becoming the most productive tributary of the Mohawk River.

There have been both positive and negative consequences as a result of this human induced “stream piracy”. One great benefit resulting from the sequestering of flows up to 900 cfs from the 314 mi^2 catchment of the Schoharie Reservoir has been the great augmentation of the 257 mi^2 contribution of the Esopus Creek above the Ashokan Reservoir(2). The Schoharie Reservoir supplies on average 16% of the drinking water requirements of New York City(3). While the Schoharie Reservoir makes a substantial contribution to NY City’s drinking water needs, it is the smallest in both surface area and volume of the six West-of-Hudson-Reservoirs owned and operated by the New York City Department of Environmental Protection. Because of its small size relative to its catchment basin, the Schoharie Reservoir has the ability to fill rapidly. Two of the highest peaks of the Catskills, Hunter Mountain, el. 4,040’ and Westkill Mountain, 3,880’, and the “cloud raking” and rain making potential of the southeast slope of the Catskill Mts., both in close proximity to the Hudson River, lie within the upstream drainage basin of the Schoharie Reservoir(4).

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A major negative effect of the Gilboa Dam and the Schoharie Reservoir it impounds is that during the summer and early autumn months the Schoharie Creek is in effect forced to start itself all over again 35 miles from its headwaters, north of the Gilboa Dam. This effect of the Gilboa Dam is not confined to only the summer and autumn months as stream flow data demonstrates that it can take place any month of the year. All that is necessary for this severing of Schoharie Creek flow to take place, is to have the Reservoir elevation to be below crest level, 1130’ or “notch” level of 1124.5’ above sea level and to have the amount of water diverted from the Schoharie Creek drainage via the Shandaken Tunnel greater than the amount that is entering the Schoharie Reservoir.

For several months of each year, a very unusual set of circumstances occurs where the 886 mi^2 drainage basin of the entire Schoharie Creek at Burtonsville, NY, (USGS gauge #01351500) has less stream volume than the 232 mi^2 drainage basin of the Schoharie Creek at Prattsville, NY (USGS gauge # 0135000). The Gilboa Dam, when it is not spilling at elevation of 1124.5’ actually diminishes the Schoharie Creek’s effective catchment at Burtonsville, NY to 649 mi^2. Even at that figure, the Burtonsville catchment is more nearly triple that of 237 sq. mile water catchment basin of the Schoharie Creek at Prattsville, NY; such is the highly productive nature of the Schoharie Creek headwaters. The 314 mi^2 figure for the Schoharie Reservoir

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includes the drainage north of Prattsville, NY and south of USGS gauge station at Gilboa NY (USGS gauge #01350101).

There are very few rivers in the world that decrease in size and volume as they flow away from their source towards their destination. This unnatural condition is enhanced due to the direction of flow of the Schoharie Creek from S.E. to N.W., over its 85-mile course to the Mohawk River, at Fort Hunter, NY. During this flow, the Schoharie Creek is subjected to more or less daily strong solar influence, ie. east to west stream flow travels with the sun. Also, the Schoharie Creek drops precipitously in its first few miles from it's source at Acra, NY, quickly changing from a mountain brook to a frequently placid, valley stream[(5)]. The Schoharie Creek drainage predates the last ice age and is today a greatly "under fit" stream corridor[(6)].

The Schoharie Reservoir is small, relative to its catchment basin and both fills and spills rapidly in times of sudden snow melt or major storms, or a catastrophic combination of both factors. It is during the "major events" that one can witness the true magnitude of the Schoharie's mighty drainage. The tragic collapse of the bridge over the Schoharie Creek on the NYS Thruway, April 5, 1987 and the enormous snow melt induced flood of January 18 & 19, 1996 bears witness to the extreme flash flood potential of the Schoharie Creek.(7) With these factors in mind, what measures can be taken to remedy some of the negative impacts of the Schoharie Reservoir on those residing downstream of the Gilboa Dam?

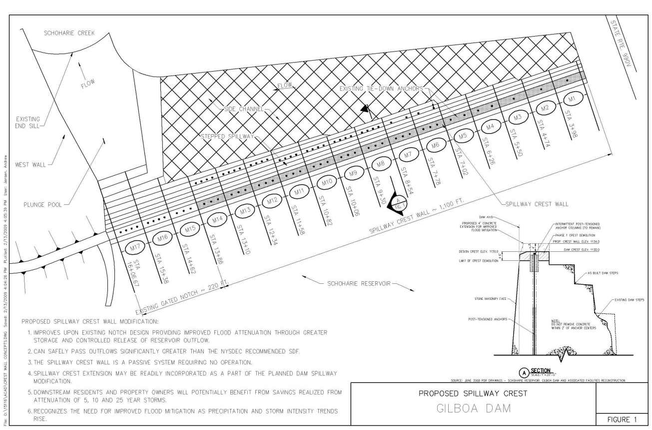
Several things can be done to improve the lot of those residing downstream of the Gilboa Dam, while having no detrimental impact on either the quantity or quality of water provided NYC by the Schoharie Reservoir:

1) At the present time, due to the unequal relationship between the size of the Schoharie Reservoir (1142 acres) and it's catchment 314 sq. mi., its ability to assist in flood mitigation is somewhat compromised. Upon completion of dam reconstruction work (2015), the new, sub-surface, low level outlet release works will provide a means for preemptively drawing down the water levels of the Schoharie Reservoir in anticipation of a flood. These works will have the capacity to reduce the volume of the Reservoir by 90% (21 billion gal.-2 billion gal.) in 14 days, assuming there is no refilling. This is a federally mandated guide line for the minimum rate of low level outlets. Had such a mechanism been in place, spring 1987, the Reservoir could have been lowered to accommodate the run-off from the 40" snow pack of that winter. Instead, the melt water filled the Reservoir, a major north east storm struck on Sat., April 4th, filling the Reservoir to its second highest elevation of record, 1135.69". This huge volume of water as measured at the Gilboa Dam caused the collapse of a portion of a bridge crossing the Schoharie Creek on the NYS Thruway, Sun., 4/5/87, and the loss of 10 lives[(8)]. The impact of this tragedy attracted attention world wide on issues of bridge safety and inspection regimes.

Ironically, there was little focus on what could have been done, 50 miles upstream of the thruway bridge at the Gilboa Dam, to prevent this disaster. It is possible that the bridge failure could have been averted had adequate release works been in place and in operation in a timely manner to create a void/storage in the Reservoir. The operation of low level release works are a proactive response to a perceived threat of future flooding posed by heavy snow pack. But, it takes time to draw a reservoir down and a low level outlet works is not a "quick response" flood mitigation tool.

2) A Crest Wall is another means of flood mitigation, involving attenuating the spill, thus reducing per second volume by the lengthening of spill time. It is passive, always in place and operational; it is economical; and most importantly, it works. This means of reducing the flood impact for areas north of the Gilboa Dam in portions of Schoharie, Montgomery, and Schenectady counties is the simple addition of a Crest Wall to the masonry spillway of the Dam. Until 2006, the 1324'

spillway of the Dam had no opening. Whenever the Reservoir filled to spillway crest elevation of 1130’, the waters spilled over and across the entire width. In response to the Gilboa Dam crisis of Oct. 2005 a 220’l x 5.5’d notch was cut in the western side of the spillway. This, in effect, lowered the Reservoir to elevation 1124.5’ and created a void/storage capacity of 2 billion gallons before the Dam could be “topped”. All the time the Reservoir would be filling to elevation 1130’, the notch would be spilling water up to a limit of 8600 cfs. During the time it takes to fill the Reservoir form 1124.5’-1130’ storms often pass through. The utility of the notch in attenuating discharge, and the four siphons, an emergency stop-gap measure put in place until a low level outlet is constructed, was demonstrated in the disastrous flooding late June, 2006. Based upon the success of the notch, it is proposed that an additional 4’ high crest wall be added to a portion of the existing 1324’ spillway at the Gilboa Dam. This addition would allow up to 20,000 cfs to spill before it “tops”; this attenuation time is assuming the Reservoir is at an elevation of 1124.5’. If the Reservoir were lower due to preemptive use of the low level outlet, attenuation would be lengthened. Preemptive releases pose less threat of causing Reservoir short fall due to increased rates or precipitation now occurring. Crest wall construction and low level outlet operation offers real potential relief in terms of life and property of those down stream of the Gilboa Dam.



3) Implement a continuous release of water from the Schoharie Reservoir north of the Gilboa Dam in times of non-spillage over the 1124.5’ elevation notch. This water need not come from the coldest part of the stratified column of water in the Schoharie Reservoir. The trout of the Esopus Creek have come to depend on that thermal layer. It has been estimated, by local professional fisheries biologists, that a flow between 50-75 cfs would greatly enhance the ability of the Schoharie Creek to reestablish itself below the Gilboa Dam, in times of non-spillage. This enhanced flow would provide waters for recreation in the Forever Wild section of the Schoharie Creek adjacent to Stryker Rd, from the 990V Bridge northward to Nickerson’s Camp Ground. Further downstream these waters will benefit Mine Kill State Park, the Blenheim-Gilboa Pumped Storage Project, owned and operated by the Power Authority State of New York (PASNY), anglers and other water sports. The Schoharie Creek is an important source of water for agricultural irrigation and increased flow will benefit farm business, while being returned through the soil and transpiration to both the water table and atmosphere.

4) In wintertime, continuous releases from the Schoharie Reservoir will help to create sufficient flow in the Schoharie Creek downstream of the Gilboa Dam to help prevent the formation of thick ice, which in times of spring run-off often leads to ice jams. The salutary effects of releases from Gilboa Dam in helping to prevent ice formation has been amply demonstrated by the functioning of the four siphons used as temporary draw down mechanisms, since 2006. In times of reservoir elevations of less than 1124.5’, the Schoharie Creek north of the Gilboa Dam has little current. This, coupled with low temperatures, is a sure recipe for thick ice formation in the slow moving eddies of the Schoharie Creek. With enhanced flow from

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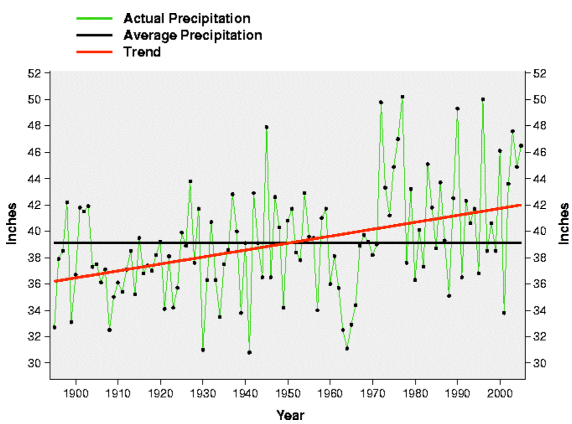
the siphons since 2006, pack ice has been incised by increased current in winter time, and the threat of ice jamming has thus been greatly reduced.

5) Whatever void is created by non-spillage release of water from the Schoharie Reservoir, via a continuous release regime will assist in the creation of a storage void to help accommodate "frozen assets," i.e. water from melting of snow pack in times of thawing. The NYCDEP has committed to a void draw down equivalent equal to 50% of the estimated water content in the Schoharie Watershed Snowpack.



It is a fair question to ask where the water will come from to provide for a continuous subsurface release in times of non-spillage. In 1970, the average precipitation total was 36"; it is now 42"[(9)]. As of January, 2009, 47.79" has fallen at Albany, NY[(10)]. This condition and trend is even more pronounced in the Schoharie Watershed. For whatever reason, it is beyond argument that the twenty-first century is a wetter time than when the Schoharie System, as the NYC Board of Water Supply called it, was designed. An additional source of 50-75 cfs Conservation Release Water is made available by the NYCDEP compliance with the State Pollution Discharge Elimination System (SPDES) Permit. Schoharie Reservoir Release Regulations (6NYCRR Part 670) states that from June through October each year, NYCDEP is to send through the Shandaken tunnel to the Esopus Creek, only enough water to create a maximum flow of 300 million gallons per day when combined with stream flow upstream of the Allaben Portal.

NYCDEP is also obligated to send enough water through the Tunnel to maintain a minimum flow of 160 million gallons per day in the Esopus Creek. Thus, the Shandaken Tunnel discharge under most conditions prevailing from the months of May-October is limited to less than 50% of its carrying or design capacity. The excess water that can not be discharged under normal operating circumstances can and should be used to meet the Conservation Release Requirements of the Schoharie Creek north of the Gilboa Dam.

In the eight decades since the completion of the Gilboa Dam/Schoharie Reservoir system, methods of weather prognostication have greatly improved. Though the engineering, the thought and design as manifested at Gilboa are superb, it is hoped that the twenty-first century is a more enlightened age in terms of a more reasonable approach concerning matters such as the conservation release being advocated in this paper. The citizens living downstream of the Gilboa Dam are asking not for the release of the coldest water, rather just any water at all. The sight of crayfish, Dobson Fly larvae, and May Fly larvae fortunate enough to be mobile (*Isonychia bicolor*, etc.) all scurrying for cover when the Schoharie Creek at North Blenheim, NY, drops 2 feet in a matter of minutes, is heart breaking. Such precipitous drops occur when the so-called recreational releases take place via the Shandaken Tunnel starting each spring around Memorial Day. These releases of up to 900 cfs at Allaben and downstream on the Esopus Creek are intended to benefit tubers, kayakers and tourism along Rt. 28 in the Esopus Valley. The citizens of the Schoharie valley aren't asking for an end to recreational releases of Schoharie Reservoir water into the Esopus, rather, they are asking for a continuous release of reasonable quantities of life sustaining water into the Schoharie Creek north (downstream) of the Gilboa Dam. NYCDEP refers to water that leaves the Schoharie System northward over the dam or through the notch or siphons as "waste water". For those of Native American ancestry, this term is especially galling. It is not “waste water” that the Schoharie Creek north of the Gilboa Dam needs, but the vital life giving force of water released at a reasonable and sustainable rate of flow. Surely, with the sophisticated technology of today and a more enlightened attitude on the part of the NYCDEP, the time for Conservation Releases is at hand.

Footnotes

1. Merriman, Thaddes, Board of Water Supply Annual Report, 1923, p. 93. plate 6.
2. Galusha, Diane, “Liquid Assets”, p. 265.
3. Galusha, Diane, “Liquid Assets”, p. 264.
4. Evers, Alf, “The Catskills”, front piece.
5. Austin, Francis M., “Catskill Rivers”, p. 210.
6. Fluhr and Terenzio, Engineering Geology of NYC Water Supply System, p. 34.
7. Daily Gazette-April, 1, 2007, p. 1.
8. Daily Gazette-April, 1, 2007, p. 10.
9. Precipitation graph-National Weather Service.
10. Daily Gazette-Jan. 1, 2007, 2008. & 2009, Annual Weather summaries.

References

1. Board of Water Supply, City of New York-Annual Reports 1917-1927, Thaddes Merriman, Chief Engineer.
2. Evers, Alf, “The Catskills”, Doubleday, Garden City, NY, 1972.
3. Francis, Austin, M., “Catskill Rivers”, Nick Lyons, 1983, NY, NY.
4. Galusha, Diane, “Liquid Assets, A History of the New York City’s Water Supply”, Purple Mountain Press, Fleischmanns, NY, 1999.
5. National Weather Service, Albany, NY, 2005. courtesy, Dr. Robert Titus.
6. New York State Geological Survey, “Engineering” Geology of New York City Water Supply System”, Thomas W. Fluhr, p.e. and Vincent G. Terenzio, p.e., Oct. 1984.
7. “The Daily Gazette”, Schenectady, NY, Annual Weather Summaries-2006, 2007, 2008.