



Field Geology Services

Fluvial Geomorphology

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May 14, 2013

Michael Dixon
msdixon@roadrunner.com

Dear Mr. Dixon:

This letter shall serve as a report on the results of a qualitative geomorphic assessment I conducted for the Taylor Pond Association. The goal of the assessment was to better understand the causes for siltation at the Taylor Pond outlet and to provide management recommendations for controlling flooding and erosion between the outlet and the Hotel Road crossing approximately 950 ft downstream. This reconnaissance level effort consisted of a site visit on April 26, 2013 and a review of: 1) historical aerial photographs available through Google Earth; 2) historical topographic maps accessible online at <http://docs.unh.edu/nhtopos/nhtopos.htm>; and 3) previous letters, reports, and other documents related to the Taylor Pond outlet compiled by the Taylor Pond Association. The findings of the assessment are described below.

The channel of Taylor Brook at the outlet of Taylor Pond is approximately 10 ft wide and flows along the southern side (or right side of the valley looking downstream) of the 125 ft wide valley (Figure 1). Approximately, 450 ft downstream of the outlet the channel diverges into multiple poorly defined channels that spread across the entire valley. The channels flow through a wetland complex before reconverging just upstream of Hotel Road into a well defined single 25 ft wide channel. An historical topographic map from 1908 shows a single channel extending from the outlet to the Hotel Road crossing and beyond (Figure 2), but smaller channels that existed at the time may not have been shown. Historical aerial photographs extending back to 1997 on Google Earth demonstrate multiple channel threads have been present for at least the past 15 years between the outlet and the Hotel Road crossing.

Local residents have expressed concern about flooding and erosion in the outlet area. Previous letters and other documents regarding the outlet area demonstrate that these concerns have been expressed at various times over the past 30 years and likely longer. A riprap revetment was constructed along the southern edge of the valley just downstream of the outlet to address bank erosion (Figure 3). Other landowners have expressed concern regarding flooding and erosion along the northern edge of the floodplain downstream of where the brook diverges into multiple channels. While bare sloughing banks, typical of severe erosion, are not evident at

this location, recent sand deposition along the edge of the floodplain indicates at least minor flooding of neighboring lawns is possible.

Concerns about siltation in the channel, and its association with flooding and erosion, have been expressed since at least the 1980's as demonstrated by documents compiled by the Taylor Pond Association. Infilling of the channel would reduce the capacity of channel to convey flow and thus would increase the river stage for the same discharge. The reduced channel capacity due to siltation would encourage the development of a wetland complex with numerous diverging channels as seen downstream of the outlet. Siltation in the channel can also contribute to bank erosion as the diverging channels flow against the valley margins. Homes and other buildings above the floodplain level are not likely to be significantly impacted by increases in flood stage due to siltation as flood stage would not rise rapidly, even with significant increases in discharge, given the wide floodplain present. This is not to suggest a severe event would not be capable of causing severe flooding, but siltation in the channel is likely to have only a minor impact on conditions beyond the floodplain margins. Severe erosion beyond the floodplain margins is also unlikely as the diverging channels are unlikely to expand beyond the current width of the valley. Furthermore, the erosive power of the brook is diminished when the flow is split in multiple channels. The potential for erosion would be greatest if and where the flow is contained within a single channel and access to the adjacent floodplain is blocked.

Human alterations along Taylor Pond and Taylor Brook have also potentially increased flooding in the outlet area. A comparison of the 2012 aerial photograph (Figure 4) and 1908 topographic map (Figure 2) illustrates how the construction of homes and associated berms in the 1970's has blocked off a former wetland along the southern margins of the pond. Previously, the wetland area would have provided flood storage during periods of high flow, but now that flow more quickly reaches the outlet. Other development throughout the watershed has also been discussed in previous documents as a potential cause for increased flooding since previously forested areas have been converted into homes, roads, and other impervious surfaces that lead to greater runoff. The presence of the Stevens Mill Dam and the Hotel Road culvert may lead to flow impoundment and higher flood stages in the outlet area. Hydrologic and hydraulic modeling would be needed to determine how significantly these various factors alter flood stage for various rainfall events and discharges, but the impact of increased runoff due to development in the watershed is likely minimal given the still small percentage of development in the 14.9 mi² watershed.

Efforts to manage siltation at the Taylor Pond outlet have likely been ongoing since the early 20th century. The 1908 historical topographic map shows the Taylor Brook channel between the outlet and Hotel Road in a nearly straight alignment flowing along the southern edge of the valley. Although other side channels may have been present at this time, as described above, the straight alignment along the valley margins are indicative of an artificially straightened channel. The straightening was likely undertaken to increase flow velocity and thereby reduce flooding and siltation of the channel. However, by containing flow in a single channel, the erosive force of the stream would be increased and may be contributing to present-day erosion problems being managed at the outlet (Figure 3).

Documents compiled by the Taylor Pond Association allude to proposals in the 1980's to dredge the channel, indicating that efforts to manage siltation at the outlet continued throughout much of the 20th century. The need for dredging in the 1980's as expressed in the compiled documents also indicates that channel straightening and removal of silt are not sustainable management approaches. The Stevens Mill Dam and the narrowing of the channel at the Hotel Road crossing have been identified as potential causes for siltation and increased flooding as described above. While detailed surveying and hydraulic modeling would be needed to determine how these structures impact flow, the natural setting is also an important factor promoting siltation in the channel. The channel is relatively narrow compared to the valley through which it flows and can be characterized as an underfit stream. Underfit streams are streams that flow through a large valley that was carved by much larger discharges that no longer occur under the current hydrologic regime. In the case of Taylor Brook, the larger discharges forming the valley were likely associated with glacial meltwaters at the end of the last ice age. Given the low slope and wide valley carved by these higher discharges, the current stream is unable to effectively transport sediment through the reach, leading to a sluggish meandering channel or a multi-thread channel flowing through a wetland. As such, channel straightening, dredging, and other management efforts that attempt to increase the stream's capacity to transport sediment are ultimately unable to overcome the natural tendency for siltation in the area, a condition that is likely to persist into the future.

Future management of Taylor Brook in the outlet area must be conducted with this understanding of a natural tendency towards siltation. Great expense could be incurred removing the Stevens Mill Dam and enlargening the Hotel Road crossing with little increase in flow velocity or reduction in siltation. If the channel is to be dredged, straightened, and confined to a single channel, such efforts must be undertaken with the realization that such management efforts will need to be periodically repeated as the channel once again fills with silt and multiple channel threads develop. Since the erosion resulting from siltation in the channel is unlikely to severely impact homes and other infrastructure immediately adjacent to the floodplain margins, vegetative solutions are the most sustainable management approach for the erosion problems. Plantings along the banks of those channels that flow along the margins of the floodplain will serve to absorb the channel's erosive energy without unduly transferring erosive forces downstream as can occur when using rock riprap.

Please let me know if you have any additional questions related to the assessment reported above or regarding the recommendations made. In general, I do not see siltation in the channel as resulting in significant flooding and erosion to properties near the outlet area.

Sincerely,

A handwritten signature in black ink, appearing to read "John Field". The signature is stylized and cursive.

John Field, PhD



Figure 1. Aerial photograph from Google Earth of the Taylor Pond outlet area.

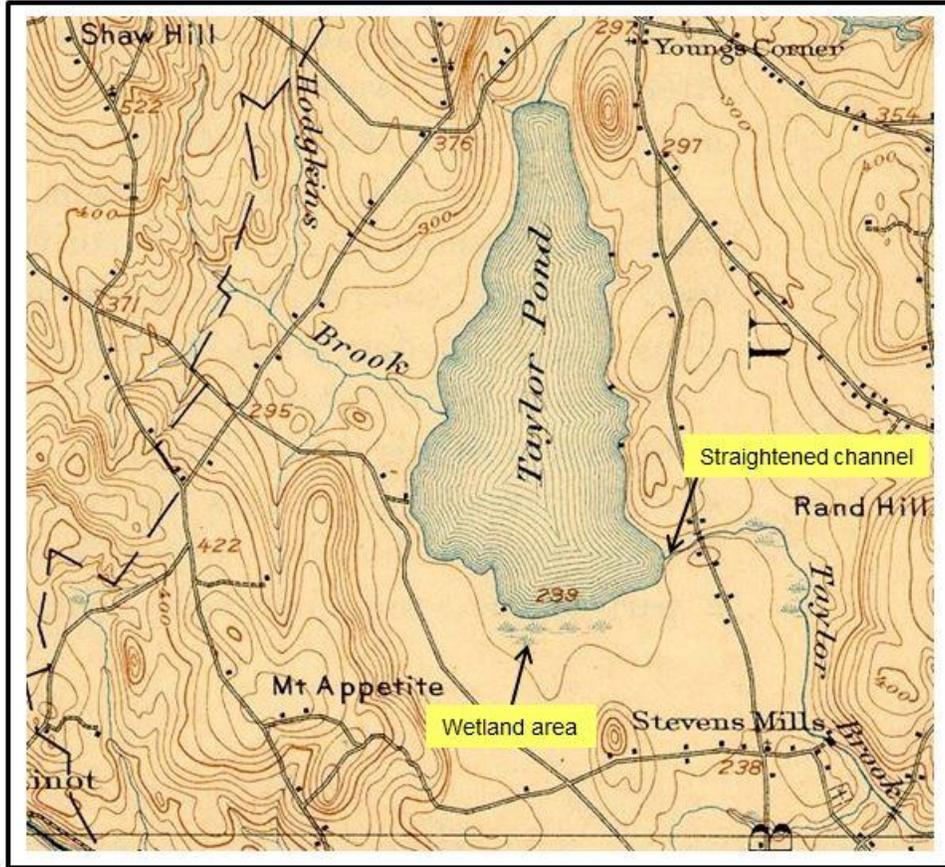


Figure 2. Topographic map of Taylor Pond from 1908 showing wetland at southern margin of pond and straightened channel at outlet.



Figure 3. Riprap revetment constructed to manage bank erosion just downstream of the Taylor Pond outlet.

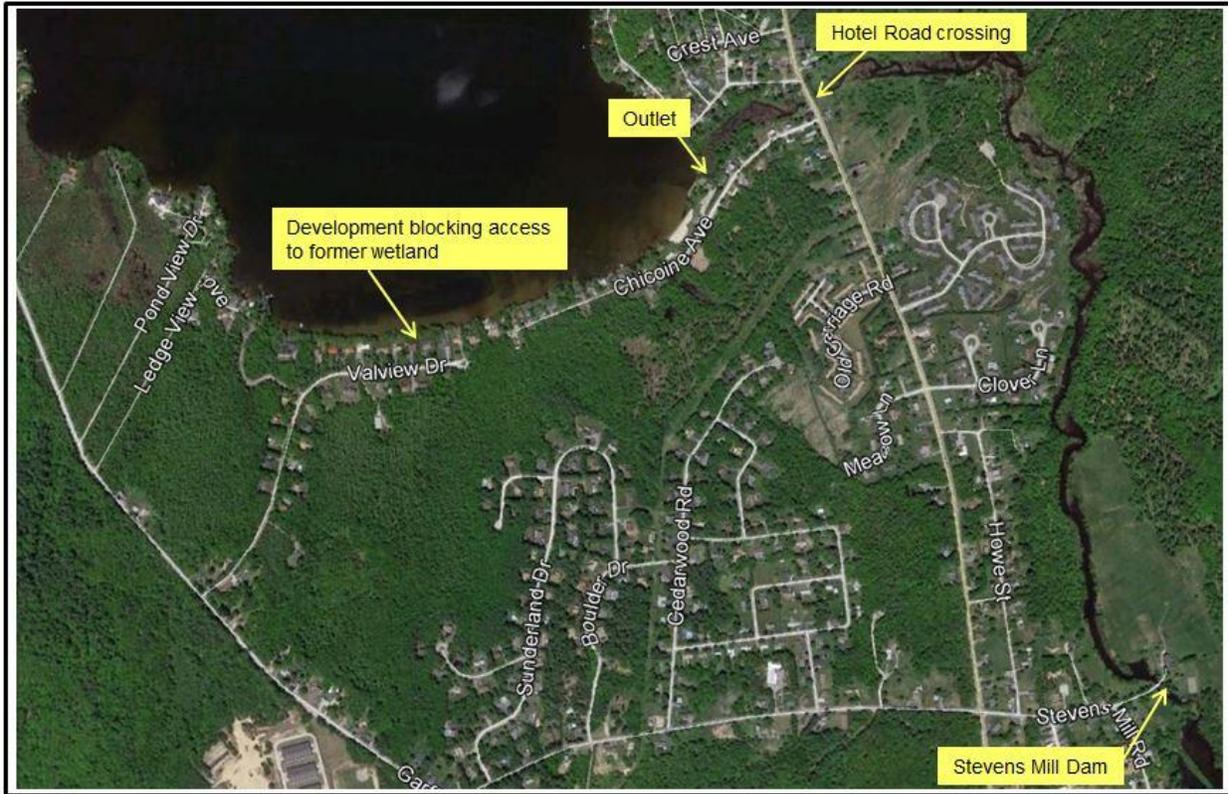


Figure 4. Aerial photograph from 2012 showing development blocking former wetland area.