To: Chris Parker, AICP
From: Willand Pond Watershed Assessment Project Team
S.W. Cole Engineering, Inc. and Horsley Witten Group, Inc.

RE: Willand Pond Draft Report – Response to Public Comments

Date: May 22, 2009

Mr. Parker,

The Project Team of S.W. Cole Engineering, Inc. and Horsley Witten Group, Inc. delivered a draft Watershed Assessment Report for the Willand Pond Watershed to the City of Dover, City of Somersworth and State of New Hampshire Department of Environmental Services on April 17, 2009. On April 21, 2009 a public meeting was held to present the findings of the report. The draft report was posted on the City of Dover website and public comments on the draft report were accepted through May 5, 2009. We have summarized the comments relative to the report here, with our responses in italics. "Report amended" indicates that changes were made to the report to address the comment, while "Report not changed" indicates that the Project Team does not feel that modifications are necessary to the report to address that issue.

Comments from the City of Dover

1. I thought the Staples plaza stormwater design had a significant component of infiltration associated with the underground tunnel. I recall it being a gravel bottom structure designed so that a bobcat type front end loader could periodically go in and clean the bottom of the structure to preserve its infiltration capacity. The report makes it sound like a detention area only.

Report not changed. The plans and associated calculations for the Indian Brook Commons Shopping Center (prepared by VHB) were extensively reviewed. VHB describes the stormwater system at the site as extended detention, even though certain portions of the system will infiltrate through leaching chambers and crushed stone. VHB did not take that infiltration into account in their modeling nor in their pollutant removal estimates, and it is difficult to determine based on the available information how much water will actually infiltrate and how much phosphorous will be removed through the native soils. Thus, the Team determined that the existing facility should be evaluated as only an extended detention facility as a part of this assessment.

2. The 2003 Exit 10 Spaulding Turnpike Interchange Study Draft Environmental Impact Statement Volume II Figure 4.4-12A is a map showing wetlands in the Willand Pond

area. The title of the figure is "Potential Wetland Mitigation Site Site#1 Stackpole". It shows a continuous wetland from Willand Pond through the area where the Home Depot detention Pond is now. This map should be added to the historical references and Volume 1 of the document should be researched to determine what the recommendation for mitigation was at the time of the report in 2003.

Report amended. The 2003 Draft EIS Volumes I and II were reviewed. NHDOT's characterization of Willand Pond and the discharge area wetlands is consistent with the findings of this report. NHDOT identified the property adjacent to Stackpole Pond as a potential wetlands mitigation site to replace wetlands impacted by the proposed Exit 10 interchange, due to its location adjacent to existing wetlands, favorable soil types and the presence of a water supply as well as the fact that the "Stackpole" site had already been "highly disturbed" as the result of gravel extraction and land-filling activities. NHDOT designated the "Stackpole" site as having a high probability of success as a wetlands mitigation site. Figure 4.*4-12A referenced by the commenter is an aerial photo with GIS data overlay of hydric soil units provided by GRANIT (the New Hampshire GIS resource). The configuration of hydric soils on this Figure 4.4.-12A is similar to the National Wetlands Inventory (NWI) map included in Appendix B-6. Further inquiry has revealed that the 2004 wetland delineation figure shown on the same plan (map 2 of B-6) was an incomplete digitization by the City of Somersworth of wetland delineations by others, and so has been replaced in the report with the hydric soils overlay currently available from GRANIT.*

3. The references to the water elevations from the USGS maps as actual water level measurements at the time of map publication is misleading. I can see using the initial publication date of the 184 and 182 levels from USGS but subsequent publication of those levels seem more likely just reuse of existing data rather than measured levels.

Report not changed. We agree that the USGS water level elevations in 1918 and 1941 may be artifacts leftover from the 1916 map. According to our conversations with USGS mapping experts, water surface elevations are typically maximum high water elevations, as taken from spillways (on water bodies equipped with dams) or intake levels (on water bodes used as public water supplies). Regardless, data from 1916 and 1943 are presumed accurate, and are similar to the 1918 and 1941 elevations. Removal of these two data points would not significantly impact the overall message relayed by the graphs included in Appendix B-4; therefore the graphs were not changed.

4. With the suggested changes to the stormwater facilities, can you inquire as to why Target wasn't reviewed? Also at the boat launch location, did the review include the changes made as part of the sidewalk project the City completed in the fall of 2008.

Report not changed. The Target stormwater management facility was reviewed as a part of the stormwater retrofit assessment performed for the entire watershed, described in Section

4.0. It was also shown on our Watershed and Wetlands Map in Appendix B. In addition, we considered this existing stormwater facility in our estimate of phosphorus loading for the watershed for the 2008 conditions (see Section 3.4.1 and the associated Appendix C-2) as removing 45% of the phosphorous reaching the constructed wetland from the Target development. The phosphorous removal estimate is based on the rated pollutant removal efficiency from the New Hampshire Stormwater Manual – Volume I, Appendix E (2008). This is a recently constructed stormwater wetland system that, based on our review of the plans and on the findings of our field reconnaissance, the Team felt was functioning properly. A retrofit at this location would require significant investment (both in dollars and time) with little or no increase in nutrient removal; thus, the focus was on other sites where greater gains could be achieved.

The review for WP-1, the boat launch location, included a review of the plans for the 2008 NH Route 108 modifications, as described in Section 4.2.1.

5. Does Appendix F conform w/ the DES decree? What about changes to reflect no nutrient loading?

Report amended. The following text was added to the introduction in Appendix F:
In order to achieve a "no net increase" in runoff and nutrient loading to Willand Pond per the 2007 DES policy, applicants would need to retrofit existing development to "off-set" increased loadings from their new development. We suggest adding a retrofit provision to existing stormwater management requirements for both cities.

Comments from the City of Somersworth

1. The report states "land-clearing, gravel extraction, road-building, and drainage diversion were conducted in the area throughout the 1960's". I believe some of these activities have occurred *since* the 1960's based on the aerial photos in the report.

Report amended. Review of historical aerials suggests that the most significant terrain alteration was initiated during the 1960s and was completed by the early 1970s; however, there was no intent suggest that terrain alteration north of the Pond has not occurred since the 1960s. The report has been revised to change this unintended emphasis.

2. The report states that the City of Somersworth constructed a sewer utility in 2000. I believe that it was constructed in the mid-1990s and was installed by Mr. Stackpole.

Report amended. Review of historical aerials and topographic maps indicates that the gravel road (and presumably subsurface sewer)were present in 1998. The report has been corrected.

3. The water line just north of the pond was approved on 3/1/1971. Construction likely occurred in the summer of 1971. The sewer line behind HD was approved on 7/23/93 and was most likely constructed in the mid-nineties, not the late nineties as we originally suspected.

Report amended. The dates in the report have been corrected.

4. Throughout the report – please change the date of the ("1969") large format aerial to the correct date (April 30, 1970) wherever it appears.

Report amended to reflect this change from 1969 to April 1970.

5. Incorporate the need to examine the downstream impacts of any proposed solution (see William Connor's letter dated 4/28/09).

Report amended. The following sentence has been modified as a part of the recommendations in Section 7.2, with the new section indicated in ***bold****:*

"Additional hydrogeologic analysis should be performed, including borings to identify any locations of bedrock, the composition of the soils in the proposed area, ***and possible hydrologic/hydraulic impacts that the proposed concept may have downstream from the outlet of Stackpole Pond.****"*

Comments from the Department of Environmental Services

DES Watershed Management Bureau:

1. Seems to me an adaptive management approach would be good, implementing the retrofit BMPs with beaver dam removal and some hydraulic improvements to the outlet.

Report not changed. Willand Pond itself has not been the subject of significant water quality testing/monitoring or evaluation. Other than the 2008 water quality sampling performed by UNH students, little water quality data exists for the Pond. However, based on our historical research, the Pond appears to be very sensitive to anthropogenic and natural impacts. Without a defined inlet or outlet, the Pond is presumed to have a very low flushing rate. Additional study into the morphometry, currents/flow dynamics and water chemistry of the Pond would be required to effectively assess or model the impact of the proposed retrofits and hydrologic reconnection. However, since the water quality and flooding problems can only be expected to grow worse with time, an adaptive management approach, where goals are specified, one or more remedial alternative are selected, anticipated outcomes are evaluated, and implementation is pursued, is the most reasonable course of action. The effectiveness of the recommended alternatives can be evaluated through water quality

monitoring data if a lake monitoring program is implemented (either community-based or publicly-funded). However, without baseline data, and given the flux of natural conditions in the Pond it will be difficult to empirically assess the effectiveness of the corrective action. Regardless, since a no action alternative is not a viable option an adaptive management approach appears most reasonable.

2. We really don't have a good way to estimate if the 31% P reduction from retrofit BMPs will eliminate cyanobacteria blooms, but it would certainly be a good start, and we can say with a straight face, I think, that these, in combination with pond level controls, will result in meeting water quality standards.

Report not changed. As noted above, since a baseline of water quality data does not exist, it will be difficult to empirically assess the effectiveness of the corrective action. Institution of a regular monitoring program will be necessary to evaluate whether water quality standards are achieved.

3. I think the alternative of pumping ground water in the aquifer around the pond would be a long-term winner, but it would need years to plan and implement. Meanwhile, the alternative 2 outlet modifications would substantially mitigate high water.

Report not changed. The recommended alternatives are expected to result in a measurable lowering of Willand Pond surface elevation, but an exact elevation cannot be predicted at this time. Changes in precipitation frequencies, and amounts due to global climate change are expected to make management of stormwater more challenging in the long term. The ongoing need for additional public water supplies and interest in reducing water storage in the watershed, combined with the favorable water natural groundwater chemistry in the watershed provide a unique set of circumstances that the community should be encouraged to explore.

DES Watershed Assistance Section:

4. The report should at least determine a target elevation below which roads and trails will not be inundated.

Report not changed. As noted above, the recommended alternatives are expected to result in a measurable lowering of Willand Pond surface elevation, but an exact elevation cannot be predicted at this time. Recent data obtained by the City of Somersworth indicates that the former boardwalks were likely constructed at approximately 192 ft msl; a low spot on the gravel perimeter trail is approximately 190.8 ft msl, and the lowest spot on the boat launch "access road" is at 191.9 – 192.2 ft msl from edge to crown. The pond is estimated to have been below 190 ft msl at the time of the boardwalk's construction in 2001, which conforms with data from a City of Somersworth topographic survey at that period, see Appendix B-4. According to information from the City of Dover, data related to the design of the "boat

launch access road" indicates that the pond elevation was about 188 ft msl at the time of its design in 1995.

5. The report also needs a clearer examination of whether the proposed alternative 2 will work, hydrologically speaking. The wetland immediately southeast of the esker gravel road is marked at elevation 193.5' on the map on page 28, which is up-gradient of the current elevation of Willand Pond (192.4). Will the proposed beaver dam removal result in a low enough elevation to make the gradient work? It appears that the ground elevation of the wetland at 193.5' may be higher than the current Willand Pond elevation. Will subsurface flow be sufficient to lower the elevation of Willand Pond?

Report amended. With the exception of 200.12 (sewer manhole reference elevation) and 194.1 (esker road elevation) all elevations on Figure 5.1 reflect surface water elevation within wetlands, and the Home Depot detention pond, on the date of our field reconnaissance (October 2008). Ground elevations were not surveyed as part of our assessment. Figure 5.1, and Figures 5.2a and 5.2b provide conceptual step pool configuration/schematic. A detailed ground surface elevation survey will be required as part of the detailed engineering study phase recommended in our report. The survey data will be integral to developing a detailed step pool channel design.

6. The proposed BMPs are predicted to achieve a significant annual phosphorus load reduction (31%). The report needs to put this in the context of how much load reduction is needed to achieve water quality standards.

Report not changed. As noted above, since a baseline of water quality data does not exist, it will be difficult to empirically assess the effectiveness of the corrective action, short of the lack of algal bloom manifestation.. Institution of a regular monitoring program will be necessary to evaluate whether water quality standards are achieved.

DES Wetlands Bureau

7. How much wetland impact in sq. ft. (approximate) for each alternative?

Report not changed. Alternative 1: It is difficult to estimate the wetland impact associated with this alternative without a more in-depth analysis. However, it is assumed that this would entail a significant amount of work in and around the wetlands in the area. Alternative 2: There are negligible permanent wetland alterations associated with this alternative. The step pool itself would not be constructed in wetlands. It is anticipated that temporary wetland alterations will occur in the immediate area for the construction of the culverts for the Esker Road. Alternative 3: There would be no direct impacts to wetlands associated with the pumping alternative; however, depending on the amount of pumping, the extents of the wetlands would be expected to shrink, much like they have been expanding in recent

years as the water elevations in the Pond have risen. Alternative 4: There would be no direct impacts to wetlands associated with the no action alternative; however, if the water level in Willand Pond continues to rise, the levels in the surrounding wetlands would be expected to rise as well, which could greatly affect the vegetation and wildlife in these areas.

8. To assist with cyanobacteria reduction actions, it would be nice to know what the current flushing rate for the pond is. And also, what the proposed flushing rate would be if alternative 2 was implemented?

Report not changed. The flushing rate was last calculated by NHDES in 1988 and at the time was reported to be 0.30 times per year. The Pond is a kettle pond with no distinct inlet or outlet; therefore we believe the 1988 value is likely to be an over-estimate of the actual flushing rate of the pond. A study of the Pond's morphometry and prevailing currents would necessary to fully examine the flushing dynamics of the Pond. Furthermore, implementation of a water quality monitoring program will be necessary to evaluate the effectiveness of the stormwater retrofit and hydrologic connection recommendations. Since a significant dataset of water quality data does not exist as a baseline, it may be difficult to empirically assess the effectiveness of the remedial measures based solely on water quality data. Water temperature data may prove to be an important criteria to evaluate flushing/stagnation and pond currents. The proposed hydrologic connection will certainly improve the flushing rate somewhat, however it is difficult to estimate the magnitude of improvement.

DES Watershed Assistance Section

9. The table showing the points/ranking for the various retrofit scenarios should include a scoring for the estimated pollutant load reduction for phosphorous. The table currently shows TSS, which is not the pollutant of concern for this project.

Report amended. Table 4.3 Summary of Ranking for Proposed Retrofit Sites was revised to reflect scoring for the estimated pollutant load reduction for phosphorous instead of total suspended solids (the Table in the draft report contained an error in the labeling and not in the data presented).

Comments from Dover Residents

1. I feel that the best solution to the problem is to reinstate pumping of water from Willand Pond. With all due respect to those residents who have lived in this area the longest, I feel it was fairly evident from the information presented on Tuesday night that looking for a solution to the water level by creating an outlet stream from the Pond to the northeast is not going to cause the types of reductions in water level that will create dry basements in the neighborhoods and restore Willand Pond to a useful recreation area. I feel that many residents think an outlet stream is the solution - I feel they are in error - information provided by the engineer counter their argument that an outlet stream ever existed.

Spending money on such an outlet stream will only take away from solutions that will have the greatest impact on the overall water level in the Pond - pumping water from the Pond.

Report not changed. The recommended alternatives are expected to result in a measurable lowering of Willand Pond surface elevation, but an exact elevation cannot be predicted at this time. Changes in precipitation frequencies, and amounts due to global climate change are expected to make management of stormwater more challenging in the long term. The ongoing need for additional public water supplies and interest in reducing water storage in the watershed, combined with the favorable water natural groundwater chemistry in the watershed provide a unique set of circumstances that the community should be encouraged to explore.

2. I also feel that correcting the phosphorus levels in the Pond is as equally important as correcting the water level. It would be very short-sighted (and selfish) to just address the water levels. A pond that has a low water level but cannot be used for recreation or wildlife is just as unacceptable as a high level pond.

Report not changed. As noted above, due to the nature of the Pond as a kettle pond, without a defined inlet or outlet the natural flushing rate is not high; the suggested hydrologic connection is expected to increase the flushing rate somewhat; however will not overcome the natural stagnant tendencies of the Pond. If loading is not decreased, nutrients are expected to accumulate in the Pond, resulting in the potential increase of algae population and the increased frequency of cyanobacteria blooms. Reduction of nutrient loading through stormwater retrofits such as those recommended will be necessary to improve water quality in the Pond. Community education, awareness and implementation of a water quality monitoring program will also be important to ensuring the health of the Pond.

3. I would like to make one final observation. I noticed that the engineer kind of hinted that the level of Willand Pond is not guaranteed to be the primary contributor to the water table level in the surrounding neighborhoods. I have wondered about this for some time. I have wondered how Willand Pond was formed in the first place; I suspect it is isolated from the surrounding water table - it was proposed at one time that it is entirely fed form an underground spring - it's base is likely mostly clay and that water does not flow from or to the Pond to the surrounding water table. I feel the (increased impervious surface) in the neighborhoods from recent development in the area is the bigger culprit in the raising of the overall water table in the surrounding neighborhood. I wouldn't be surprised at all if the water level in people's basements doesn't appreciably diminish if the water level in Willand Pond decreases. Some people will be sorely disappointed.

Report not changed. Although addressed in the text of the report (Section 2.3) this is a vital topic which bears re-iterating. Willand Pond is a kettle pond formed in the wide kame plain

which underlies much of Somersworth and extends into Dover and Rollinsford. The kame plain is a highly permeable ice-contact deposit of sand, gravel and boulders. The Willand Pond watershed lies at the southern end of the kame terrace; and Willand Pond itself lies in the southern end of the (Middle) Salmon Falls watershed. Watershed divides roughly coincide with Route 108 and Route 9, see Appendix B-2. As its name suggests, a watershed divide marks the location where groundwater moves in opposite directions. Groundwater within the Willand Pond watershed moves toward the Pond and then northward toward Peters Marsh Brook; groundwater west of the divide moves south and westward toward the Cocheco River, and groundwater east of the divide moves south and eastward toward Rollins Brook (USGS , 1992). Residents who live in the Strafford Road/Wellington Avenue, Cranbrook/Maplewood Avenue and so-called "Indian Village" (Apache Street) areas of Dover, west of Willand Pond, were impacted by flooded basements in spring 2007. The presence of the groundwater divide along Route 108 indicates that the groundwater discharging to Willand Pond is not the cause of water in basements on the other side of the divide. The water level at Willand Pond was surveyed in July 2007 by the City of Somersworth. To assess conditions in residents' homes, the water level in the basement sump of a Strafford Road residence was also surveyed at that time and found to be 2 feet higher than the surface water in the pond, confirming the presence of the groundwater divide and the conclusion that surface water level in Willand Pond is not the cause for flooded basements. Rather than being isolated from the groundwater table, since Willand Pond is a kettle pond, the surface water levels in the pond are reflective of groundwater levels in the aquifer. Although homeowners west of Route 108 are in a different watershed, the geologic deposit underlying these homes is similar to that of Willand Pond, and groundwater levels beneath these homes can be expected to respond similarly to those in the Willand Pond. The Pond's circumstances are compounded by the lack of an organized discharge zone. Regardless, the groundwater levels in these neighborhoods is not expected to be significantly effected by establishing a hydrologic outlet to Willand Pond.

4. I think the step ponds are a good ecological start. I don't think the 3 feet it will lower the pond is enough, but it is a start. I have a foot plus of water in the sump hole in my basement. Combined with pumping water from the pond, it may lower the levels enough to dry out our basements and get rid of the mold and dampness.

Report not changed. See response to Comments from Dover Residents #1 and #3, above.

5. Nowhere in this report is it clear what the target maximum water elevation for Willand Pond should be**.** This high water problem must be remediated to levels that existed just 8 years ago or whatever was considered normal previously. The SW Cole Report, the closest thing I can find is on page 1 where it states that the current elevation of Willand Pond is 192.4 feet. Anyone who lives on the pond, or near it, knows that as of this month (April 2008) the pond is 30" above the previous max EVER. So if we do the math, it can

be said that the Willand Pond maximum elevation should be 189' give or take 6". Why doesn't the report clearly state a target maximum water elevation level?

<u>Report not changed.</u> The Project Team evaluated options for re-establishing the hydrologic/ hydraulic connection of Willand Pond to Peters Marsh Brook.

During the course of our investigations, we evaluated historical aerial photographs, surveys, engineering plans and other data, and performed a field reconnaissance of the outlet from Willand Pond to the Peters Marsh Brook stream channel north of the existing culverts within the Commercial Drive right-of-way.

The recommended alternative has been developed within the constraints of existing terrain, existing environmental resource limits, physical limitations, permitting realities, and economic limitations. The elevations proposed for the natural channel-based connection between the existing wetland complex and Stackpole Pond sets the inverts at the lowest elevation feasible, within this location, and proposes a subsurface gravel trench to facilitate movement of groundwater flow below the channel by gravity towards Stackpole Pond.

The suggestion that Willand Pond must be lowered to a specific elevation based on anecdotal data of what it may or may not have been at a time before the outlet hydrology was compromised does not recognize current physical, economic, permitting, and environmental constraints. It is our professional opinion that construction of an outlet pipe or channel draining from Willand Pond to the north, with an upstream elevation of 189 and an outlet north of Commercial Drive at an elevation lower than 188 (a distance of nearly 3000 ft), is not feasible considering physical or economic constraints, nor is it appropriate from an environmental perspective to impact the natural wetlands that exist in this area—realistically, such an approach would not be permitted by NHDES. The approach proposed by the Project Team applies the well-established and appropriate concept of "adaptive management," where goals are specified, alternatives are considered, one or more approaches are defined, anticipated outcomes are estimated, and implementation is pursued. If goals are achieved or partially achieved, then results can be measured; if estimated objectives are not fully achieved, other options and/or strategies can be pursued.

The project Team compiled pond elevation data from several sources including historical surveys and engineering plans. Based upon this data, and data from interviews with local officials familiar with flooding issues at the Pond, the highest recorded elevation was measured in May 2007 (193.1 ft msl), following near-record-breaking precipitation in April 2007 (10.26 inches; normal precipitation for April is 4.09 inches) atop a sustained high water level from the record-breaking precipitation in 2006 (61.91 inches). Therefore, the statement that the pond is "30" above the previous max EVER" is inaccurate. In April 2009 the water level at Willand Pond was measured at 192.69 ft msl; this is 0.41 ft or 4.92 inches <u>below</u> the previous measured maximum surface water elevation.

6. Also, on Page 30 of the report, 192' is listed as the wetland water surface for Willand Pond. Is this the current level, or the solution level? 189' needs to be the solution level; this has to be clarified.

Report not changed. The surface water elevation of Willand Pond was approximately 192 ft msl at the time of our field reconnaissance in October 2008. Figures 5.2a and 5.2b are conceptual *diagrams of the recommended alternative. As described in our response to Comment #5 above, it is inappropriate to establish a "target maximum pond elevation" at this juncture.*

7. Figure 5.2 on page 30 is inaccurate (incorrect water level), and not clear. I just want a clear solution that will lower Willand Pond to 189'.

Report not changed. The project Team agrees that the communities must continue to collaborate in order to mitigate the water quality and flooding issues at Willand Pond. Again, it is inappropriate, however, to establish a "target pond elevation" at this juncture. See response to Comment #5 above.

8. We need) an agreement from the City of Somersworth that they concur with the SW Cole report and the intent to bring Willand Pond back down to 189' through the hydrologic connection recommended in the SW Cole report.

Report not changed. See response to Comment #5 above.

9. The 380' overall length of the Hydrologic Connection (5.2.2, on page 27) is not sufficient. Nor is the recommended Hydrologic Connection *deep* enough. The five 12" culverts under the Esker Roadway would have to be at a depth of 5' below the existing level of the Esker Roadway. (194 - 5 = 189) It states right in the report that the low point of the Esker Roadway is at 194'. This is 5 ' above the target pond maximum elevation of 189'. And the Step-pools would have to be 5' to 6' deep going down from there. This is not stated in the report. I'd really like to see an elevation that clarifies the 5.2.2. solution. An elevation that goes from Stackpole Pond at 188.5 feet elevation, up to the necessary elevation at 189 feet on the other side of the Esker Roadway. The 380' long 'Step Pool' and 12" culverts at the Esker Roadway is about 150' too short and about 4' not deep enough.

Report not changed. See response to Comment #5 above.

10. 'Step Pools' will not work. The beavers would just love a series of step pools. Step pools in this wooded and rarely visited area will become a quarterly maintenance issue.

Report not changed. The proposed naturalized step-pool channel has been conceptually designed to provide a hydrologic/hydraulic connection between the wetland system north of

Willand Pond and Stackpole Pond. Step pools are proposed to be modest in size and are not expected to be sufficient in depth or area to attract beaver, though this cannot be ruled out completely. Assuming the connection results in a lowering of groundwater in the immediate vicinity of the wetland complex, and a flowing channel is established, the potential for beavers and beaver dams exists. Assuming the recommendation to pursue this option is carried to the next level with detailed assessments and an engineering design, a beaver assessment and management plan would need to be an integral component to this option, and has been identified in the report.

11. The best solution is to bury a large pipe that is 400' long that runs from Stackpole Pond up at a very mild grade to a location in the Willand Pond Swamp another 100' beyond the Esker Roadway ending in a well engineered solution, perhaps long concrete slotted control gate that would discourage beavers and natural clogging. There are many designs of this functionality that have been proven to work in areas similar to Willand Pond Swamp. This control gate needs to be at height of 189'. The area around this control gate needs to be cleared of trees.

Report not changed. The commenter's suggestion is one that would have significant impact to the wetlands and is not likely to be permitted by NHDES. See response to Comment #5 above.

12. There are several references to 2006 being the year that the water came up. Please note pages 1 and 3 of the report which state that the Mothers Day flood of 2006 is when the sustained flooding began. This is not simply NOT true. The water started to come up steadily as early as 2003. This is during normal years of precipitation! The foot path bridges were floating in the fall of 2005.

Report not changed. A summary of documented Willand Pond surface elevations since 1916 is included in Appendix B-4. The table and accompanying graphs in Appendix B-4 illustrate that surface water elevations in Willand Pond have risen consistently since circa 1970. The graphs illustrate a comparison of Willand Pond surface water elevation and historical precipitation data and Pond elevation against impervious surface (% of watershed). The 1970 timeframe coincides with the end of the watershed's use as a water supply (the City of Dover stopped pumping the Willand well circa 1966) and significant terrain alteration of the wetlands/discharge area as described in Section 2.2 and Appendix E. Rainfall in May 2006 exceeded 14 inches; normal rainfall for May is 3.4 inches. According to local officials, although water levels in the pond had been observed to be rising, surface water elevations above 192 ft msl have been sustained since May 2006.

13. There should be 5 WP's listed in section 4.0 of the Stormwater Management Assessment as BMP's. With WP-5 (the Target Detention Pond) being the big boy as it is acknowledged in Section 3.4.1 paragraph 3 on page 18.

Report not changed. The Target stormwater management facility was reviewed as a part of the stormwater retrofit assessment performed in Section 4.0. This is a recently constructed stormwater wetland system that, based on our review of the plans and on the findings of our field reconnaissance, the Team felt was functioning properly. A retrofit at this location would require significant investment (both in dollars and time) with little or no increase in nutrient removal; thus, we turned our focus to other sites where greater gains could be achieved.

14. WP-4 would be the detention pond behind the dollar store. This is also very large area and should have been in the report. At what parking lot drain or street drain does this drainage area start?

Report not changed. The stormwater management facility behind the DollarTree/Seacoast Bingo was reviewed as a part of the stormwater retrofit assessment performed in Section 4.0, and discussed in Section 3.4.1. The drainage area to the stormwater facility, which consists of two infiltration basins/swales on both the north and south sides of the back parking lot, does not extend to a street drain – the street drainage network in front of this parcel drains to a separate watershed (see the watershed map in Appendix B). The majority of the drainage area to the infiltration basins is comprised of overflow, gravel parking. The infiltration basins have no formal outlet and, based on the findings of our field reconnaissance, the Team felt they were functioning properly. Infiltration systems provide an estimated 65% reduction in phosphorus. A retrofit at this location would require significant investment (both in dollars and time) with little or no increase in nutrient removal; thus, we turned our focus to on other sites where greater gains could be achieved.

15. The 1999 Survey by Sewell Surveyors of Maine was not used as any reference. Mention of it was made. But the survey was not actually used visually at all. Although it was actually made in 1976, the area behind Home Depot had not changed much between 1976 and 1999 and this was the last known survey of the area before the installation of the sewer line by the City of Somersworth without a Wetlands permit. Why wasn't this survey used as a reference by SW Cole?

Report not changed. The so-called "1999 Survey" referenced by the commenter, was described in section 2.2 of our report and is included in Section 8.0, References.. This topographic map was prepared by J.W. Sewall Company from 1976 aerial photography using ground-controlled photogrammetric methods. The plan was used at the base plan for a 1979 Master Plan study of Willand Pond as a community recreation site, and as the base plan for a 1989-1990 proposed golf course development prepared by McEnearney Survey Associates, Inc. A portion of the plan is included as Appendix B-2G. Relevant data from the plan was clearly visible on the April 1970 large-format aerial photograph included as Appendix B-3.

16. Did (Mr.) Stackpole ever have to comply with DES or discuss the impact of his projects on the wetlands?

    Report not changed. According to the City of Somersworth, Mr. Stackpole installed the sewer line from the Stackpole Pond area to the area south of the Home Depot detention pond in the mid-1990s; that project did not require a wetlands permit. Furthermore, the Home Depot and Target projects did not require wetlands permits. However, Mr. Stackpole obtained a wetlands permit for the water utility/Commercial Drive project in June 2003. No wetlands permit would have been required for any work prior to 1970.

17. I would like to see the Pond itself addressed, whether it requires pumping stations or other engineering. To address the Home Depot-Stackpole Project area first will mean a huge "wait and see" for the dying Willand which in my estimation does not have a lot of time to spare. How sad if we let it come to pass.

Report not changed. On the contrary, the recommended hydrologic connection alternative can be implemented on a fast track and completed within the 2009 construction season, resulting in lower surface water levels in a manner of months. The hydrologic connection is intended to provide a long-term solution which will control the Pond elevation and contribute to the long-term management of the Pond level. Changes in precipitation frequencies, and amounts due to global climate change are expected to make management of stormwater more challenging in the long term – making such an engineering solution even more useful. Nevertheless, if the community decides a lower Pond elevation is preferred than that which can be achieved through engineering applications, groundwater removal from the aquifer could assist in controlling Pond elevations. As noted above, the ongoing need for additional public water supplies and interest in reducing water storage in the watershed, combined with the favorable water natural groundwater chemistry in the watershed provide a unique set of circumstances that the community should be encouraged to explore. Nevertheless, hydrogeologic studies, permitting of large groundwater withdrawals and construction and connection of a new water supply well is a time consuming process which may require 2 or more years to implement.

18. Target is said to be in the Willand Pond watershed yet no investigation of its contribution to the problem has been made to date.

Report not changed. See responses for Comment #4 from the City of Dover and Comment #13 from Dover Residents

19. I know from my work for the City of Dover as City Engineering and Public Works director while active, the "Willand Well" pumped ALL its water to Lowell Ave. pump station where it was treated before being pumped to the Garrison Hill water tank. While this well was being used or pumped, as I recall the level of Willand Pond was considerably lower, say 10 to maybe 18 feet (lower) than its present level. This should of no surprise as the well

was de-watering and/or lowering the ground water table. This same effect happened at Barbadoes Pond and its water level was down from the present level by about 6-8 feet. Then the City was told to stop pumping so much water, wells were rotated in and out of service and the level came back up.

With all this said here is my recommendation for Willand Pond:

a) The City is always looking for more water and the water quality now at Willand Pond may be suspect, however that probably can be corrected with treatment.
b) The area around Willand is probably a great aquifer, so redevelop it!
c) Work out a mutual contract with the City of Somersworth, drill a new well in the same area; construct a small treatment plant there; connect the impure by-product water to Dover's sewer system; connect to Dover's water system; put a use time on the well so it draws down to a predetermined elevation; when the NORTH end pressure drops below a certain pressure, have this pump go on line to raise the pressure and volume and then you won't have to construct a new water tower!

There will have to be engineering done, but as a quick look this can work. The cost spent to divert the water should be used to create a use for the water, as this is possible and both Cities need the resource.

Report not changed. See responses for Comment #2 from the DES and Comment #17 from Dover Residents.

Comments from Somersworth residents

1. I am aware that privately owned shoreline properties are located in areas WP-2 and WP-3 based on the charts provided in the draft report. I wonder if that may be a problem for the City of Somersworth or the property owners in addressing any mitigation considerations.

Report not changed. Typically, with retrofit projects such as WP-2 and WP-3, the City would approach the private owners and negotiate a drainage easement on the properties in question.

2. Are stimulus funds available (to fund the remedial effort)? Can a State/Federal grant request be prepared and proceed on a fast-track?

Report not changed. Stimulus funds may be available for projects such as this one, and we concur with the commenter that a grant request should be prepared if possible.

3. Would the removal of the two beaver dams also have to require our State Fish and Game professionals to relocate the beaver population (from the site) to prevent re-establishment of their habitat and future blockage?

Report not changed. Assuming the recommendation to pursue the proposed naturalized step-pool channel is carried to the next level with detailed assessments and an engineering design, a beaver assessment and management plan would need to be an integral component to this option, and has been identified in the report. The beaver assessment and management plan would identify the necessary parties to be notified and to carry out the relocation process.

4. (The report) did not address and offer solutions to all issues. Peters Marsh Brook and Tates Brook areas have increased in size and are steadily encroaching on new land mass. These conditions are similar to those of Willand Pond. The report envisions sending Willand Pond waters in a northerly direction to Somersworth's natural drainage areas, including Peters Marsh and Tates Brooks, on to the Salmon Falls River. Currently the water levels in these drainage areas are at historic highs and not draining as successfully as they did just a few years ago. I believe the (suggested alternative) would be a 'high impact' solution if the natural watershed cannot handle the additional water from Willand Pond. The brooks and inter-connecting culverts leading to the Salmon Falls River have not been identified as deemed capable of handling additional volumes of water. A long-term program of value-added system maintenance is needed to assure the *whole* water drainage system is working and healthy. It needs to be in place for all parties involved. Otherwise, why would the City of Somersworth want to receive the volumes of Dover's troubled waters, when they have their own problems to deal with? The total scope of discharging the waters from Willand Pond and the watershed areas on to the Salmon Falls River (must be addressed in the next phase). Dover and Somersworth want the same thing – roads, land and basements which are not flooded.

Report amended. We agree with the commenter, and the following sentence has been modified as a part of the recommendations in Section 7.2, with the new section indicated in ***bold****:*

"Additional hydrogeologic analysis should be performed, including borings to identify any locations of bedrock, the composition of the soils in the proposed area, ***and possible hydrologic/hydraulic impacts that the proposed concept may have downstream from the outlet of Stackpole Pond.****"*

5. It is a formidable document based on lot of historical data and analytical conclusions. Much of the hydrology is above my comprehension, and I hope that it will have a review by qualified hydrologists.

<u>Report not changed.</u> The report has been reviewed by professional staff of the City of Dover Environmental Services/Engineering Department, Planning Department and the City of Somersworth Planning staff as well as technical staff of the Department of Environmental Services, see their comments, above.

6. How do you explain lack of large numbers of dying trees (usual consequence of severe flooding) in the wetlands overall. If the Willand Pond water level rose 9 ft as some claim, should it not have risen also in the wetlands, if the flow from the Willand Pond is causing the wetlands? The root collars of the trees seem to show only a foot or so variation from low to high. Could it be that dry periods before 2005 had lowered the general water table in the wetlands that later were replaced by the heavy rains.

<u>Report not changed.</u> According to historical Pond elevation data compiled for this assessment, a steady rise in surface water elevation was documented from 1967 (183 ft msl) to 2007. A significant rise from 183 ft msl to 189 ft msl occurred in the 9 years following shut-down of the Willand public water supply well (1967 to 1976), see Appendix B. From 1976 to 2002 Pond levels appeared to change very little. Due to the shape of the pond (bathymetry), with steep sides, changes in the pond elevation from 1967 to 2002 were largely contained within the principal pond basin, as seen in the presence of an non-vegetated perimeter of the pond at low levels, see Appendix B-6. Topography suggests that actual flooding of the wetlands likely did not occur until pond elevations exceeded 190 ft, first measured in 2002. The Team's working hydrologic conceptual model is as follows: during this period of increasing surface water elevations, the increased hydraulic head in the Pond is expected to have increased discharge to the wetlands. Because of the broad shallow topography of the wetland area, wetlands likely adapted to the increased water by expanding laterally. However the expansion of the wetlands was limited by topography and, with outlets blocked, the water levels would have started to rise, flooding the wetlands. Not until the storage capacity of the wetlands soils was exceeded would surface water in the wetlands increase to the point of visibility on root collars.

Additionally, the wetlands are dominated by red maple, which is highly tolerant to rising water levels. The Team's wetland scientist did note dying pines (which prefer well-drained soils) along interior portions of the wetland area, which suggested drier soils in the past. These dying pines are likely not visible to the casual observer on the perimeter of the wetlands.

7. In addition to the surface drainages mentioned, I think the impact of the sea gull deposits should be assessed. Anecdotal reports state that more than 100 sea gulls on northeastern corner of the lake. I have seen a large number of sea gulls on the lake in the past. I have seen reports that claim that waterfowl can produce up to a pound (of waste) per day per bird. If that is true, then the gull population may be an important contributor to nutrient loading.

<u>Report not changed.</u> Waterfowl Management is addressed in Section 6.2 Public Education and Outreach, of the report. The section focuses on geese and ducks but many of the management suggestions are appropriate to gulls. Recent success with gull management has been achieved at Lake Auburn in Maine.

8. The former race track area seems to be pretty impervious. Much of the area is sparsely grass covered (if any), and trees are not able to invade the site. There is little soil, but mostly hard packed gravelly surface. Some of it may be underlain by large boulders. What about the denudation and impermeability surface during the hey-day of the general recreation area? The development of the area at the time may not have been bituminous surface, but the compacted gravel parking lots and road surfaces provided good rapid surface flow causing pollution of the lake. Was this area modeled as pervious or impervious surface?

<u>Report not changed.</u> The former race track area has been modeled as pervious surface, but as scrub/shrub land cover rather than forest. Research has shown that areas such as this over time function more like pervious areas than impervious due to the many pathways formed by vegetation and associated root systems. In addition, this area is considered "disconnected," which means that runoff from this area does not flow directly into the Pond or into a stormwater system that outfalls to the Pond. Runoff from the race track area would flow overland towards the wetlands, being filtered along the way. Finally, the use in this area is very low if any, which means that little phosphorus would be expected in the runoff.