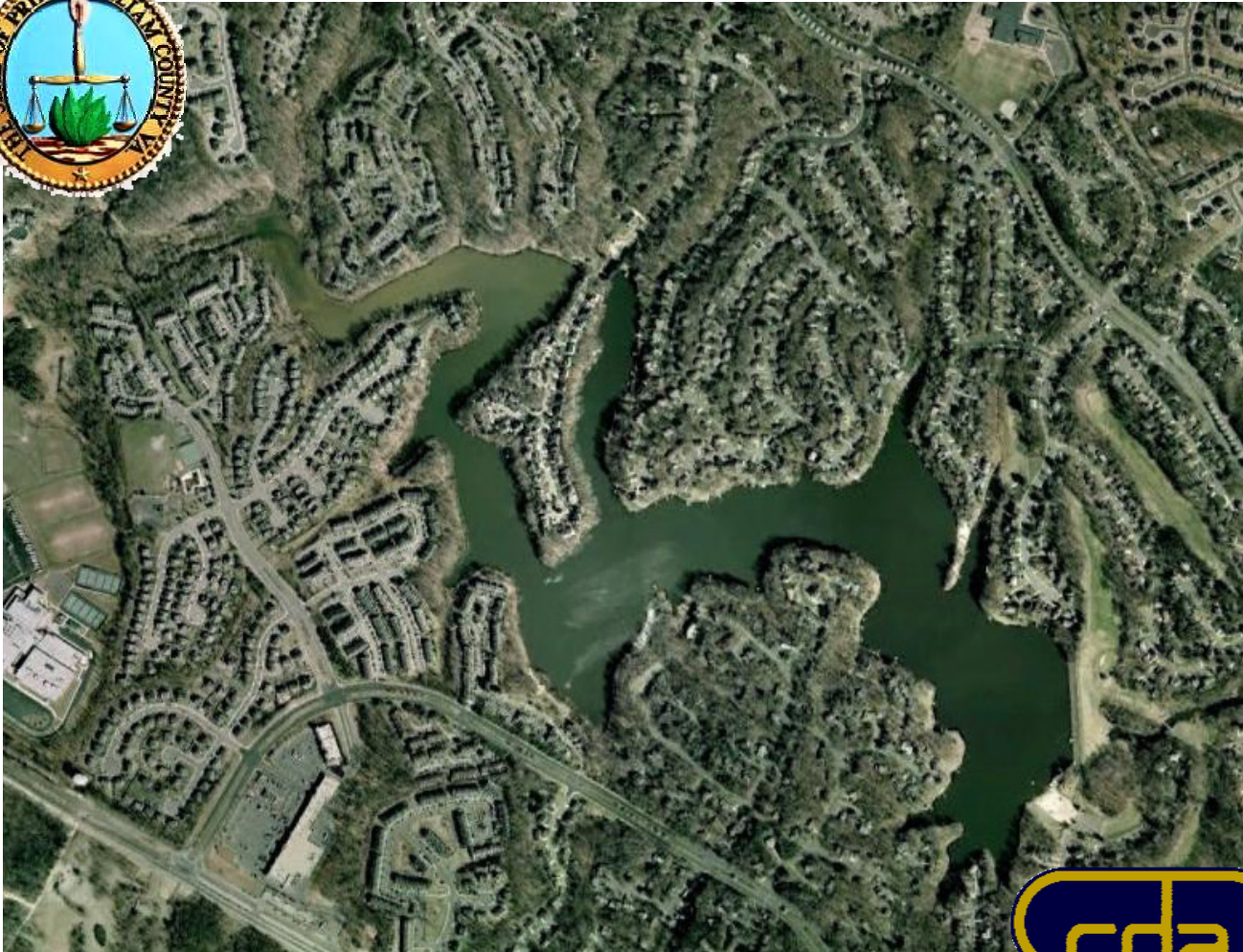


Lake Montclair Sediment Forebay

Final Report & Recommendations



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INTRODUCTION

Lake Montclair is an approximately 108-acre body of water with an upstream drainage area of approximately eleven square miles. Located within the Montclair subdivision in Dumfries, Va., Lake Montclair is bordered to the south by Dumfries Road (Route 234) and Waterway Drive, to the north and east by Waterway Drive, and to the west by Southlake Boulevard. Lake Montclair is fed by the main channel of Powells Creek, which flows into the northernmost portion of the lake.

Citizen concern in recent years regarding the amount of sediment entering the lake led Prince William County's Environmental Services Division to begin exploring design alternatives to lessen the sediment load and water quality in Lake Montclair. As a privately owned lake, the maintenance and sediment removal from Lake Montclair falls upon the Montclair Property Owners Association (MPOA). The MPOA turned to Prince William County (PWC) to investigate options to reduce the sediment deposition which would improve the overall water quality of the lake. Prince William County's ultimate goal of this study is to determine the most feasible methods of reducing the sediment entering Lake Montclair and, thereby, improving the water quality.

SCOPE OF WORK AND METHODOLOGY

SCOPE OF WORK

Prince William County tasked Whitman, Requardt & Associates, LLP (WR&A) to create a feasibility study regarding the potential sediment control measures for this Lake Montclair. WR&A produced a report entitled *Lake Montclair Sedimentation Control Feasibility Study*. This report, dated July 2008, presented three (3) possible design alternatives to address, and reduce, the amount of sediment deposited in Lake Montclair. RDA based the first three design alternatives evaluated with this report upon the findings from the WR&A study, which recommends, "...Construction of an In-Lake Sediment Forebay to intercept a portion of the natural bed load and the watershed generated sediment..." and the "...assessment and repair of sources of locally generated sediment." Unfortunately, the South Lakes Cove (SLC) Homeowners Association has expressed stringent opposition to a paved maintenance access road through its property which has effectively ended any potential hope of constructing a forebay on the southern shore of Powell's Creek.

Prince William County tasked Rinker Design Associates, P.C. (RDA) to review WR&A's report and generate a basic design for the proposed forebays along with other potential alternatives which would also meet the County's goal. RDA was requested to gather topographical survey data and develop design alternatives for a sediment forebay near the confluence of Powells Creek and Lake Montclair. The overall scope of work, as outlined in RDA's proposal to PWC, included obtaining boundary and topographic survey information, collecting Prince William County GIS Data, evaluating possible design alternatives and locations for the proposed sediment forebay, providing materials to Prince William County for dissemination among the local residents and

community organizations, and the preparation of a final report and recommendations for feasible options for the construction of a sediment forebay to benefit Lake Montclair. This report includes the methodology that led to the possible design alternatives, summaries of the design alternatives investigated, and recommendations for the most appropriate course of action to alleviate the sedimentation occurring within Lake Montclair.

METHODOLOGY

On July 29, 2009, Ned Greene (a MPOA Board Member) led representatives from RDA and PWC on a boat tour of Lake Montclair to provide a first-hand account of sediment issues facing Lake Montclair. RDA used this tour, as well as the information gained from listening to Mr. Greene, to become familiar with the sedimentation issues challenging the integrity of Lake Montclair. Drawing upon the knowledge gained from the boat tour with Mr. Greene and the recommendations included within the WR&A study, RDA performed a field-run topographic survey from the confluence of Powells Creek and Lake Montclair to the west for approximately 1,300 linear feet, until reaching the existing stormwater management pond and access road located on the Forest Park High School site. RDA also collected and incorporated PWC GIS data into the base drawing to supplement the field-run survey efforts and provide a base map along Powells Creek until reaching Spriggs Road. Utilizing the topographic information available, and using the WR&A study as a basis for design, RDA developed numerous options for addressing Lake Montclair's sedimentation issues. Summarized in detail in the following section, RDA developed these design alternatives in an attempt to improve the overall water quality of Lake Montclair, while limiting the impacts to the surrounding residents and ecosystem.

DESIGN ALTERNATIVES

RDA developed design alternatives to lessen the sediment deposition occurring within Lake Montclair in Dumfries, Va. The following section provides a general description of each design alternative, as well as a discussion pertaining to the positive and negative aspects of each alternative.

OPTION 1 – IN-LAKE OPTION

The In-Lake Option (Option 1) was the preferred solution proposed by the WR&A study. It was the determination of that report that this is the design that is the most effective in preventing sediment from entering Lake Montclair. Option 1 proposes the construction of a 2,370 cubic yard (total volume) sediment forebay at the confluence of Powells Creek and Lake Montclair. A flow diverting structure would direct flow into the forebay prior to entering Lake Montclair. A paved road located along the bank of Powells Creek would allow for maintenance access and removal of accumulated sediment deposits. Additional advantages of this design option include the proposed volumes for both the sediment loading and the total volume exceed the required values determined as part of the WR&A feasibility study, and that the Department of Environmental Quality (DEQ) and Army Corps of Engineers (ACOE) reviewed and accepted the concept.

There are a number of drawbacks to Option 1. Due to its location, this option requires the longest access road (approximately 1,871 linear feet). The access road requires an excessive amount of grading for construction, would have a significant longitudinal slope in places (10% - 15%), and must cross two drainage ways and an existing gas line, requiring culverts and utility protection. These factors result in an access road with significant construction costs, especially when compared to the construction costs of the sediment forebay itself. Furthermore, this design alternative, will result in disturbance to approximately 0.40 acres of existing wetlands. While the nature of this disturbance will likely be relatively minor, mitigation measures will most likely be required to offset impacts to the existing forested wetlands.

The most significant drawback associated with Option 1 is the South Lakes Cove(SLC) Homeowners Association's stringent opposition to a paved access road through its property. This paved road would provide the only point of access for maintenance operations to the sediment forebay. At a meeting at RDA's office on August 12, 2009, Mr. Guillermo Garcia, a representative from the South Lakes Cove HOA, stated that the HOA felt that unruly teenage activity would increase if PWC constructed the paved access road within this area between the school and lake. Furthermore, Mr. Garcia expressed concerns regarding an increase in noise resulting from dredging operations associated with the forebay. As a result, the SLC HOA denied access rights across their property and ultimately rejected Option 1.

OPTION 2 – PARALLEL TO POWELLS CREEK OPTION

Option 2 proposes a sediment forebay along the southern side of Powells Creek. Sited approximately four hundred linear feet upstream of the confluence of Powells Creek and Lake Montclair, Option 2 results in an approximately 1,907 cubic yard facility parallel to Powells Creek and approximately 1,443 linear feet of paved roadway surface. The decreased length of the access road results in a lower associated construction cost and maintenance efforts when compared to Option 1. Additional advantages to Option 2 include fewer construction impacts to Lake Montclair, and reduced wetland disturbance when compared to Option 1 (0.26 acres of wetland impact associated with Option 2 versus 0.40 acres under Option 1).

Despite these advantages, however, there are a number of negative aspects associated with Option 2. First, due to its location, any sediment entering Powells Creek downstream of the Option 2 facility will enter Lake Montclair. Additionally, due to the site constraints and existing topographic features in the area, the total volume provided (1,907 cubic yards) is less than the WR&A required volume for the entire project of 2,300 cubic yards. Due to the site constraints and topographical features for the entire project area, the proposed grading for the facility results in a facility that is smaller than the required volume. Similarly to Option 1, Option 2 includes the excessive grading and longitudinal slopes associated with the access road, the fact that the access road will need to cross an existing gas line, and the likely mitigation measures associated with the 0.26 acres of wetland disturbance previously mentioned and it would require disturbance of SLC HOA property.

OPTION 3 – PARALLEL TO GAS EASEMENT OPTION

Option 3 proposes an approximately 2,124 cubic yard sediment forebay at the confluence of Powells Creek and an unnamed tributary flowing from the Forest Park High School stormwater management pond and approximately 530 linear feet of paved roadway surface. Located approximately 800 feet upstream of the confluence of Powells Creek and Lake Montclair, Option 3 is adjacent to the existing Virginia Gas easement in the vicinity and parallel to Powells Creek. Based upon the findings in the WR&A study, the sediment volume provided through this design exceeds the assumed sediment loading from Powells Creek. This design also provides a sediment forebay that will effectively control the sediment loading from the school's outfall. Additional advantages to this design alternative include a relatively small amount of access road to construct (and maintain) and the elimination of any required gas line crossing. Finally, this option results in only 0.04 acres of impact to the existing wetlands, which likely will not require mitigation.

Despite these advantages, Option 3 contains fundamental flaws. First, due to the final elevations required to construct the forebay and achieve the required volumes, Powells Creek will not actually flow into the forebay. The difference between the existing and proposed grades will result in a forebay elevation higher than that of Powells Creek's water surface elevation. This eliminates any effectiveness of the facility removing sediment from Powells Creek and, therefore, does not achieve the overall goal of the project. Additional disadvantages to this design alternative include those previously mentioned for Options 1 and 2: the access road will require significant grading operations, while still having steep longitudinal slopes; the location's constraints (dimensions, existing grades, etc.) prevent the required storage volume from being achieved through the design; there is a significant cost of constructing and maintaining the access road when compared to the overall cost of the forebay facility; and, as previously mentioned, the project's overall goal is not achievable as the final elevations preclude flow from Powells Creek from entering the forebay facility and it would require disturbance of SLC HOA property.

OPTION 4 – WETLAND OPTION

Option 4 provides for sediment removal and improved water quality through constructed wetlands and approximately 760 linear feet of paved roadway surface. This design alternative improves the overall quality of the watershed in an environmentally friendly manner by employing an innovative Best Management Practice (BMP). Design Option 4 allows for sediment removal, while limiting impact to the surrounding ecosystem. As an acceptable mitigation effort, the constructed wetlands will offset any impact to existing wetlands due to construction activities.

Although Option 4 unobtrusively blends in with the surrounding ecosystem, its inherent design qualities make it difficult to quantify its sediment removing capacity. Therefore, it is difficult to ascertain with any certainty the sediment loading controlled by the facility. This, in turn, makes it difficult to predict its effectiveness in improving the water quality of Lake Montclair. Additional disadvantages associated with Option 4 include the excessive access road grading and longitudinal slopes (as discussed with other options as well), construction costs, maintenance costs in reestablishing existing and constructed wetlands, required utility crossings (one existing culvert and the existing gas line) and it would require disturbance of SLC HOA property.

OPTION 5 – NORTHERN SIDE OF POWELLS CREEK OPTION

Option 5 proposes the construction of a sediment forebay along the northern side of Powells Creek. While developed only qualitatively, this design option proposes an in-stream forebay parallel to Powells Creek (similar in nature to Option 2). RDA developed this option as a response to the lack of support from the South Lakes Cove HOA. Benefits associated with a sediment forebay constructed along the northern side of Powells Creek include sediment removal from Powells Creek and subsequently Lake Montclair, an improvement in the water quality of Lake Montclair, and a facility located outside of South Lakes Cove HOA's property. Drawbacks associated with Option 5 include the necessity of a paved access road (which, in turn, increases cost and maintenance), as well as potentially needing approval and/or easements from two HOAs; including a portion of the access road that would be located on the SLC HOA property north of Powells Creek. Furthermore, since Option 5 qualifies as an "In-Stream" option, and not an "In-Lake" option, it is very possible that the DEQ and the ACOE will reject this design alternative.

OPTION 6 – FOREBAY CREATED BY EXISTING SANITARY SEWER OPTION

An existing sanitary sewer crosses beneath Lake Montclair in the western portion of the lake below the confluence with Powells Creek. This sanitary line is covered by a stone embankment which extends to a few feet below the water surface. Because of the over excavation by the MPOA above the sanitary sewer with the previous dredging efforts, this crossing creates a "natural" forebay in the lake just below the confluence with Powells Creek. Option 6 proposes the use of the "natural" forebay to allow sediment to settle out of Powells Creek prior to entering the main body of Lake Montclair. Routine dredging operations will be necessary under Option 6 in order to ensure the forebay functions properly. Positive factors associated with Option 6 include the following: the project uses an existing, natural forebay and, thereby, reduces construction costs; the forebay qualifies as an "In-Lake" facility and, therefore, is likely to gain approval from the DEQ and the ACOE; and, finally, the design meets PWC's overall project goal by both reducing the sedimentation within Lake Montclair.

As with the other design alternatives, disadvantages and drawbacks exist for Option 6. The first drawback is the cost to dredge the lake. By comparison to the previous Options, Option 6 will not decrease the cost of dredging operations. Furthermore, since this option will most likely require the use of a barge with a crane to perform the dredging, it is possible that the overall cost of the dredging operations *will increase*. Lastly, Option 6 involves PWC taking over the maintenance efforts, and their associated costs, of a privately owned facility. In doing so, it will set a precedent and will likely lead to owners of similar private facilities requesting PWC to take over the maintenance of their facilities. This could potentially result in tremendous costs and increased maintenance responsibilities for PWC.

OPTION 7 – SOURCE CONTROL OPTION

Option 7 proposes to limit sedimentation from entering Powells Creek and ultimately Lake Montclair at the source of the sedimentation. These measures would be required from Spriggs Road to the headwaters of the Powells Creek, but could be implemented to the confluence of Powells Creek and Lake Montclair. Enhanced Erosion Control and Buffer Enlargement above what is currently required by Prince William County as well as spot repairs and stream restorations are all methods that could be implemented in order to protect the creek. If more stringent protection of the creek is implemented at the design review and construction inspection stages, it certainly has the potential to significantly reduce the levels of sediment that enter the Lake. An increased burden must also be placed on the Developers and County Inspectors to ensure that the measures shown on the plan are adhered to and properly maintained. If erosion measures are not properly installed or maintained and a major failure occurs, then the creek and lake will be unprotected.

OPTION 8 – “HANDS OFF” OPTION

The final option involves a “hands off” approach. Lake Montclair is a privately owned and operated facility; therefore, the financial burdens associated with its maintenance operations are not the responsibility of PWC. While this course of action may result in outcry from the MPOA, the maintenance efforts (and their associated costs) of Lake Montclair lie solely with the owner and are not the obligation of Prince William County.

CONCLUSIONS AND RECOMMENDATIONS

Increased dredging efforts, visible sediment accumulation, and growing community concern regarding the quality of Lake Montclair led Prince William County to investigate methods and alternatives to reduce the degradation of the lake. Drawing upon a previous feasibility study prepared by Whitman, Requardt & Associates (WR&A) dated July 2008, Rinker Design Associates, P.C. (RDA) developed a number of preliminary design alternatives to curb the amount of sedimentation occurring within Lake Montclair. These design alternatives, described in the previous section, include an in-lake sediment forebay, a sediment forebay located adjacent to Powells Creek, a sediment forebay located at the confluence of Powells Creek and an unnamed tributary, the installation of constructed wetlands, a sediment forebay located on the northern side of Powells Creek, the utilization of an existing “forebay” created by an existing sanitary sewer crossing, source control and a “hands off” approach to the situation. Based upon available information and preliminary engineering efforts, Option 1 (in-lake sediment forebay) is the most effective design alternative to combat sedimentation occurring within Lake Montclair. At this time, however, it is RDA’s recommendation that it is in the best interest of Prince William County to postpone making improvements or constructing any sediment controlling facilities. A number of possibilities causing a skewing of data and water conditions exist that may account for the increase in sedimentation within Lake Montclair, while misrepresenting the actual water quality.

As presented in the WR&A report, dredging reports from 1991 to 2007 show increases between the volumes of material dredged from Lake Montclair. The largest of these increases occurs between 2001 and 2007, which coincides with the increased concern from local residents. As stated in the WR&A report, dredging reports prior to 2007 based their findings upon limited information. The first report published following a full bathymetric survey of the lake occurred in 2007. In addition, the Montclair Property Owners Association (MPOA) expanded dredging efforts within the lake in 2007 and over excavated the area above the sanitary sewer crossing for increased sediment deposition.. An increase in the area and depth of dredging alone accounts for the increase in exported material.

In addition to misrepresentation of the sediment levels through inaccurate or partial dredging reports, a number of external factors may account for the increased sedimentation in Lake Montclair between 2001 and 2007. Multiple, large scale construction projects occurred within the upstream drainage shed of Lake Montclair. Intense construction activities associated with the widening of Spriggs Road, as well as large-scale home construction within the Lake Terrapin subdivision, are possible factors that account for the increased sediment loading within Powells Creek. Had inadequate, improper, or poorly maintained erosion and sediment (E&S) control measures been characteristics of these projects, an unusually high amount of sediment flowing into Powells Creek and Lake Montclair would result. This may potentially account for the local residents noticing discoloration of the water from the sediment-laden runoff. Due to the proximity of the construction activity to the waters of Powells Creek and Lake Montclair, the E&S controls would be the only barrier preventing the sediment-laden runoff from entering Lake Montclair’s watershed. As construction intensity slows, it is possible the amount of sediment

loading within the waters will also diminish. This can be seen in the clarity of water within Powells Creek and the lack of sediment depositions recently witnessed in the stream above Lake Montclair.

Additional factors causing increased sedimentation within Lake Montclair over recent years may include the breach of the nearby, upstream, Lake Terrapin Dam and the increased deterioration of outfall structures and streams from the local storm sewer system (outside of the Powells Creek watershed). The Lake Terrapin Dam Breach represents an isolated incident that has the potential to account for a large amount of sedimentation, while the deterioration of old storm sewer outfalls from the neighborhoods surrounding Lake Montclair represent a gradual change to the state of the lake.

Considering the factors described above, as well as the feasibility and effectiveness of each of the preliminary design options, it is RDA's recommendation that PWC and the MPOA defer any action until a later date. Instead, RDA recommends that PWC institute a monitoring program to track the changes in sedimentation in the lake over the next few years. A bathymetric survey of "existing forebay" as well as the installation of multiple sediment monitoring stations within this forebay would provide a base condition that could be studied over the next few years. This will provide data to more accurately determine the water quality and amount of sediment accumulation within Lake Montclair. In deferring construction and, instead, closely monitoring the situation, PWC and the MPOA will be able to sufficiently determine whether or not additional measures are needed to correct sediment levels within the lake. Should the sediment loading from Powells Creek continue to be a detrimental issue, corrective action may then be taken. This will allow for a prudent course of action and eliminate the possibility of expending copious amounts of time, effort, and financial resources on a temporary issue that would otherwise naturally correct itself.

It is also our opinion that Prince William County may need to increase the buffer requirement and the stringency of Erosion and Sediment Control policies for projects adjacent to streams/waterbodies.