

**Preliminary Land Use Service (PLUS)
Comprehensive Plan Amendments and Municipal Ordinances**

Delaware State Planning Coordination
122 William Penn Street • Dover, DE 19901 • Phone: 302-739-3090 • Fax: 302-739-5661

Name of Municipality: City of Rehoboth Beach		PLUS 2012-10-01
Address: City Manager 229 Rehoboth Avenue Rehoboth Beach, DE 19971	Contact Person: Gregg Ferrese	
	Phone Number: (302) 227-4641	
	Fax Number: (302) 227-4643	
	E-mail Address: <u>information@cityofrehoboth.com</u>	

Date of Most Recently Certified Comprehensive Plan: _____ **Application Type:**
Comprehensive Plan Amendment: _____

Ordinance: _____

**Other: Report: “Rehoboth’s Lakes – Report with
Recommendations”**

Link to the proposed ordinance:

Comprehensive Plan Amendment or Municipal Ordinance prepared by: City of Rehoboth Beach Planning Commission	
Address: Chair, Planning Commission 306 Rehoboth Avenue Rehoboth Beach, DE 19971	Contact Person: Preston Littleton
	Phone Number: (302) 227-4504
	Fax Number: (302) 227-336
	E-mail Address: <u>Pal99h@hotmail.com</u> and <u>ann@cityofrehoboth.com</u>

Maps Prepared by: N/A	
Address:	Contact Person:
	Phone Number:
	Fax Number:
	E-mail Address:

Preliminary Land Use Service (PLUS) Comprehensive Plan Amendments and Municipal Ordinances

Delaware State Planning Coordination

122 William Penn Street • Dover, DE 19901 • Phone: 302-739-3090 • Fax: 302-739-5661

Please describe the submission:

The attached Report is in response to concerns raised by the community about the health and function of the various lakes within the City of Rehoboth Beach. The Report, written with the intent of being used to help educate the public about the lakes, outlines a series of recommendations and findings to improve these natural resources which include possible comprehensive plan amendments and zoning ordinances.

At the September 10, 2012 joint meeting of the Board of Commissioners and the Planning Commission to discuss the report and its implementation, the Mayor and City Commissioners endorsed the following recommendation:

“Because multiple State agencies, in addition to DNREC, may have valuable input or suggestions, or may have ongoing programs or funding sources that could be of assistance in implementing these various recommendations, a Preliminary Land Use Service (PLUS) review of this report should be sought through the Office of State Planning Coordination.”

REHOBOTH'S LAKES

REPORT WITH RECOMMENDATIONS

Planning Commission, City of Rehoboth Beach Delaware

August 1, 2012

INTRODUCTION: This report of Rehoboth's lakes was prepared by the Planning Commission in response to the March 16, 2012 resolution passed by the City's Board of Commissioners [exhibit #1]. Although this report is being submitted to the Mayor and Commissioners, as we believe will become evident in its reading, it is a report not only to the Board but also to the citizens of Rehoboth Beach and to citizens and government leaders of Dewey Beach, Sussex County, and the State.

The Board tasked the Planning Commission to seek public input, conduct research, and otherwise undertake necessary studies in order to develop proposed ordinances to amend the City's Code relative to establishing buffer areas around the City's lakes and for site plan review of future construction along the lakes. The Board stated that the interests of property owners to appropriately use their property should be balanced with the interests of other citizens.

The Planning Commission made special efforts to inform the public, all relevant City organizations, and the surrounding jurisdictions of this study. This included not only press releases, postings on the City's website, contact with organizations but also a special mailing to all property owners who bordered on Silver Lake and Lake Gerar in order to seek their input. Starting with its meeting of April 13, 2012, the Commission devoted a majority of all of its regular meetings to this task and on May 12th conducted a special workshop meeting devoted in its entirety to this task. Additionally, the Commission sought expert input from the State's Division of Natural Resources and other organizations with knowledge and expertise in this area. It likewise assembled a considerable volume of research papers and reports concerning waterbodies and their protection as well as ordinances implemented by other governmental bodies. Of particular note, the Planning Commission itself developed data and analyses to better understand the City lakes focusing primarily on Silver Lake.

STARTING PREMISE: Respectful of the Board's resolution, the Planning Commission stated that it should make no recommendations until it first understood what problems existed concerning the City's lakes, what could be done to address these problems and by whom, and in doing so what would be their relative benefit and cost.

I. UNDERSTANDING SILVER LAKE

A. Jurisdiction and Ownership

As detailed in exhibits #2 & 3, Silver Lake is approximately 42 acres in size and its current shoreline is approximately 9,929 feet in length. Of this shoreline, approximately 5,995 feet (60%) is within the City of Rehoboth Beach, 3,502 feet (35%) within Sussex County, and 427 feet (4%) within Dewey Beach. At the outset it should be noted that Lake Comegys, whose borders are within both Dewey Beach and Sussex County, communicates with Silver Lake so consideration must also be given to its dimensions and contributions to problems that might exist with regards to Silver Lake.

[Adding the approximately 3 acres of Lake Comegys and its 2,441 foot shoreline, approximately 49% of the combined shoreline is within the City of Rehoboth Beach, 38% within Sussex County, and 13% within Dewey Beach.]

Looking exclusively at the total shoreline length of those private properties within the City that directly abut Silver Lake [this excludes properties along the north side of Lake Drive but includes those within Country Club Estates, those within the Schoolvue subdivision and the adjacent Thoroughgood property, the Newbold Square development, and those within the Silver Lane area] only approximately 1,541 feet or 16% of the Silver Lake shoreline has private property in the City directly abutting the lake.

Regarding “public lands” within the City bordering on Silver Lake, the largest is the City’s “Tot-Lot” at approximately 1,000 feet. There are also two other small O-1 zoned property totaling approximately 125 feet, the school property, plus the right-of-ways for Stockley St. Ext., Scarborough St. Ext., and the bridge. These “public lands” total approximately 1,746 feet or 18% of the Silver Lake shoreline within the City.

Relative to zoning, it is important to note that with the exception of the above noted “public lands” all properties abutting on Silver Lake are zoned R-1. This zoning classification requires a 15 foot front setback [reducible to 10 feet with open porch construction], a minimum of 6 foot but combined 16 foot side lot setback, and a 10 foot rear yard setback. Auxiliary structures are allowed in the rear lot to within 4 feet of the rear and side lot property lines. Because of changes in the zoning laws that occurred over time and their interpretation, some structures such as the Newbold Square development, are built to the lake’s edge. Based on the orientation of a house, the current City Code allows a house to be built as close as 6 feet from the property line. It should be noted that those properties within the Schoolvue subdivision that border on the lake have, by covenant, a 25 foot rear set back.

Yet another important fact about Silver Lake is not only is its shoreline within multiple jurisdictions, but also no jurisdiction has yet claimed ownership of the lake itself. However the Commission was informed that there currently is ongoing discussion between the State and the City concerning such ownership. This lack of clear ownership complicates efforts regarding any restoration of the lake or, for that matter, what can occur on the lake and around its banks. This

also contributes to a problem cited by the public related to who has the ongoing responsibility to control the level of the lake.

Silver Lake is not fed by a flowing stream or river but, as discussed in the following section, primarily by stormwater drainage and groundwater ingress. To prevent flooding when there is heavy rain and high stormwater drainage, there is an outflow pipe to the ocean located in the southeast corner of the lake outside the City's limits. This outflow has "ledger boards" that regulate the water height as well as grates protecting the outflow pipe from debris. If a ledger board is added, the lake rises and if it is removed the level of the lake falls. If debris accumulates on the grate impeding outflow the lake also rises. There have been complaints that when the lake's level is high it results in seepage in the basement of some of the homes surrounding the lake. Conversely, when the lake's level is low it exposes an extensive mudflat at the far west end of the lake. There is some uncertainty as to who holds the right to control the level of the lake.

SUMMARY FACTS #1:

- *Silver Lake has multi-jurisdictional borders with only 60% [49% if Lake Comegys is included] of the shoreline being within the City of Rehoboth Beach.*
- *About 18% of the shoreline within the City is "public lands".*
- *Only 16% of Silver Lake's shoreline has private property within Rehoboth directly abutting the lake.*
- *All private property within the City surrounding Silver Lake is zoned R-1 residential.*
- *There is uncertainty about who is responsible for maintaining the Silver Lake outfall and the lake's level.*
- *The lack of clear jurisdictional ownership of Silver Lake complicates decisions about the lake.*

B. The Watershed of Silver Lake

As shown in exhibit #4, Silver Lake's watershed, excluding Lake Comegys, is 283 acres – the great majority of which is within the City of Rehoboth. Including Lake Comegys, the watershed totals 324 acres. Watershed can be explained as downslope with everything in this area flowing towards the lake.

Of great significance, however, is the impact of storm water drains and pipes flowing directly into Silver Lake. A 2006 study, see exhibit #5, found 21 discharge pipes emptying into Silver Lake, with 18 of them being within the City of Rehoboth Beach. The Planning Commission found more recent evidence, see exhibit #6, that there are 22 such pipes each identified with its respective storm drains within the City. Some of these drain pipes are quite large, see exhibit #7. These City drains are fed by over 150 in-street drains throughout south Rehoboth. It is also noted that Lake Comegys communicates with Silver Lake, historically conjoined, and it has at least one stormwater pipe that drains from the Route 1 area.

As described in detail in exhibit #8, the street perimeter of the private properties that front on these stormwater drains totals about 50,890 feet. In contrast, Silver Lake's total shoreline within the City is 5,995 feet or 12% of this stormwater drain frontage. All of the private property within this stormwater drainage field is 126 acres whereas all the private plus public property combined bordering the lake totals 14 acres or 11% of the drainage field [exhibit #9]. Of particular significance is the finding that the total area of the streets, i.e., impervious areas within this stormwater drainage field, is approximately an additional 2,223,200 square feet or 51 acres [exhibit #10]. By comparison, Silver Lake is 42 acres.

To better understand the potential impact on the health of Silver Lake by all those in the City living along the lake's shoreline including those on the north side of Lake Drive versus those living within City's stormwater drain field that empties into the lake, an analysis was made of what occurs with a one inch rainfall [exhibit #11]. (It is noted that the average annual rainfall in this area is 41-45 inches). This calculation was made using the DNREC estimate that approximately 22% of the rain runs off from a typical 50 x 100 foot lot with a house built on it – this translates into approximately 700 gallons of water. It was assumed 22% of the rain on those private lots along the lake went into the lake and 22% of the rain for those lots within the drain field went into the storm drains. Additionally, 100% of the rain that falls on the impervious streets and sidewalks flows into the stormwater drains. The results below are significant in that they show that less than 6% of the total runoff is from the private properties along the City's portion of Silver Lake:

- All lots along the lake 127,973 gal contains nitrates, phosphates, droppings
- Lots in storm drain field 751,312 gal contains nitrates, phosphates, etc.
- Streets in storm drain field 1,385,891 gal contains hydrocarbons, droppings
- Total going into lake 2,265,176 gallons
- % from lots along lake 5.7%

In comparison, 1,147,630 gallons of a one inch rainfall falls directly onto Silver Lake, and this contains only atmospheric contaminants. Therefore, about twice as much rainwater runoff that enters Silver Lake is from the land, and of this, only a small portion is from those lots along the shoreline.

As will be discussed in more detail in the next section, contaminants, whatever their nature that run off of private property into these stormwater drains and everything on these streets, flows directly into Silver Lake.

There is historical documentation of Silver Lake's existence with springs apparently maintaining its level. For example, it is reported that in Colonial times it was a source of fresh water and, in the winter, ice for food preservation. However, there now seems to be uniform agreement that with the development of the City of Rehoboth Beach and surrounding areas, Silver Lake has become for all practical purposes a stormwater management system. Exhibits #12 and #13, the 1926 and current aerial views of the area around Silver Lake, reflect the transition from rural to urban. The lake's level is now maintained by these multiple stormwater drains and pipes emptying into it and by groundwater ingress/egress. Relative to the latter, DNREC scientists explain that the water levels in Silver Lake fluctuate with the local groundwater elevations.

When a storm event occurs, the water level will rise temporarily both as a result of shallow infiltration from the pervious surfaces and stormwater runoff from the impervious surfaces. After this temporary condition, the water elevations will stabilize back to the static water table elevation. If that elevation is higher than the elevation of the outlet structure, then there will be a surface discharge from the lake. While there may be some losses due to evaporation during extended dry periods, most of the drop in the water surface elevation of the lake during the summer months is due to the groundwater receding

The importance of trees is cited in the watershed protection literature. Trees are far superior to other vegetation in their capacity to absorb rainwater, utilize the nutrients in runoff, and filter contaminants. Noteworthy in Rehoboth is the relative lack of trees within the City's stormwater drainage field and the entire watershed that drains into Silver Lake. This is shown in exhibit #14. Citing the importance of trees in reducing stormwater runoff because it carries pollutants that span oxygen-robbing algae blooms in waterways, the State of Maryland recently announced plans to plant thousands of trees along its roads [exhibit #15].

SUMMARY FACTS #2:

- *A far larger portion of the lake's watershed is within the City as compared to the City's proportion of Silver Lake's shoreline.*
- *The street perimeter of the private properties in south Rehoboth served by stormwater drains is 8.5 times greater than the frontage of all properties within the City, be they private or public, which directly abut Silver Lake.*
- *The area of those lots within the City abutting Silver Lake is dwarfed by the 126 acres of private property in south Rehoboth served by stormwater drains.*
- *There is 51 acres of impervious streets that drain directly into Silver Lake.*
- *In terms of rainwater from the City entering Silver Lake, less than 6% is from all the private properties along the City's portion of the lake.*
- *There is a relative lack of trees in the Silver Lake watershed.*

C. The Water Quality of Silver Lake

The Planning Commission gave particular effort to obtain creditable information about the condition of Silver Lake. It is important to note that Silver Lake is not one of the waterbodies routinely monitored by the State. There is agreement that there have been changes that has accompanied the rapid in-fill and development of the City, and the County and Dewey Beach areas around the lake. As the City was developing, the utilization of Silver Lake as an unfiltered stormwater discharge area was in accord with the then accepted practices used throughout the country. While such practices would not be allowed now because of their environmental impact, what has been the result? The assistance of DNREC scientists was sought in assessing the health of Silver Lake, and it was concluded that its condition can now be termed "fair" and not dissimilar from other urbanized lakes within the State. The conclusion based on available data is that there has not been any significant worsening of the lake over the last 30 years.

When scientists look at a body of water like Silver Lake, they look for obvious urban contaminants like nitrogen products and phosphates, as well as other toxic chemicals and hydrocarbon runoff from streets. Particulate matter, especially suspended sediment, is also checked. Dissolved oxygen (DO) levels are studied as oxygen is important to aquatic life support. Biologic markers, such as the presence and type of fish and wildlife that inhabit the lake as well as aquatic plant life are examined. The science is complex and lake conditions change with changes in temperature, sunlight, and especially the volume and frequency of stormwater runoff.

Data shows that Silver Lake has high levels of microscopic algae, the growth of which is promoted by pollutants from runoff and bottom sediment. Algae increase dissolved oxygen when there is daylight and consume oxygen at night and cloudy days, especially in warm weather. A positive aspect of the lake's murky water is that little sunlight reaches the nutrient rich bottom. However, in the shallow western end of the lake sunlight is not as well filtered and filamentous algae can proliferate. Exhibit #16 is a July 28, 2012 picture showing mats of filamentous algae covering essentially the entire surface of the water west of the "turtle bridge". To date, Silver Lake has not been affected by the growth of Hydrilla, an even more serious invasive aquatic plant problem,

As the Planning Commission was preparing this report, a July 4, 2012 major fish kill occurred in Silver Lake. Prior to this event, there have been 8 other recorded fish kills in Silver Lake since 1982, the last in April 2008 [exhibit #17]. DNREC reports that six of these prior kills involved only gizzard shad - a species that is prone to kills for obscure reasons other than low DO, and three occurred from March into early April - a time of year when low DO is very rare. The July 4th event killed something in the range of 10,000 fish of multi species and followed an extended period of unusually high temperatures and very little rain. While DNREC is still investigating this event as this report was being written [exhibit #18], everything points to the usual problem that occurs with waterbodies like Silver Lake. The abundance of phosphates and nitrates, suspended sedimentation caused not only by runoff and erosion but also by lake wildlife that stir up the nutrient rich bottom, shallow waters throughout the lake [exhibit #19], lack of rain, and an extended period of sunny days and very warm temperatures all leads to excessive microscopic algae "bloom". The result is that dissolved oxygen falls to levels that are lethal to fish.

While these unwelcomed events are rare, now 9 documented fish kills in Silver Lake over the last 30 some years, they are not unexpected. Even with their occurrence, the expert scientific conclusion is that there has been no significant change in water quality in Silver Lake over this time period. Nonetheless, an obvious question presents – can they be prevented and, if so, at what cost? While there are no guarantees, experts think that they probably could, but at very high front-end and long-run operational and maintenance costs. Obvious steps include decreasing the lake's nutrient and sediment load from runoff and the installation of sufficient aeration systems to maintain DO at safe levels throughout the lake. Less obvious steps could include the possible elimination of species of fish that stir up bottom sedimentation, reducing non-migratory resident waterfowl populations, and dredging to not only remove sediment but also to significantly increase the depth of the lake.

One area that there has been recognized change is that there has been the loss of shoreline bank due to erosion and this contributes to both suspended and bottom sedimentation. Additionally, there has been significant sedimentation attributed to particulate matter originating throughout Silver Lake's large stormwater drainage field that is deposited into the lake. In this regard, significant shoaling has been occurring at the western end of the lake [exhibit #20] and to a lesser extent near King Charles Avenue where there are large discharge pipes. DNREC describes the sediment in Silver Lake as fine silt and clay particles that are easily re-suspended back into the water column by wave action, stormwater inflow, or even the actions of turtles, ducks, and fish.

Although the vast majority of the private properties surrounding Silver Lake are built out, as is most of the watershed feeding into the lake, redevelopment poses the risk of contributing significantly to further deterioration of the lake's water quality. If not carefully managed, the removal of existing structures and vegetation, re-grading of the land, and even repair of existing structures such as bulkheads and piers, pose risks of shoreline erosion and large scale runoff of sedimentation into the storm water system.

In its research the Planning Commission learned that it is common for laypeople to judge the health of a waterbody by its appearance. For example a murky colored lake, like Silver Lake's appearance, would be judged poor by many. (As previously discussed, the lake's murky water actually helps prevent filamentous algae blooms or invasive Hydrilla growth,) However, environmental scientists use other means to determine the lakes condition – and again the current health of Silver Lake has been judged to be "fair".

Because of its public health importance, the Planning Commission explored the possible adverse health effects for people who use Silver Lake for recreational purposes and come in contact with lake water. DNREC conducted a water sampling study of the City's lakes in 2005 and compared these results with prior studies [exhibit #21]. Relative to pathogens, the experts at DNREC advise that any untreated body of water hosts pathogens that have the potential to make people ill. While there is little scientific data about pathogens in Silver Lake, there is no evidence to indicate any unusual potential for sickness. The lake obviously supports abundant waterfowl and other wildlife with associated droppings. Likewise, accentuated by the stormwater drainage transfer, pet waste and any contaminants from business, homes, lawns, and streets that enter into the stormwater drain system get carried directly to the lake. Unlike other waterbodies, Silver Lake does not suffer from failed septic systems or sewerage discharge issues. Nonetheless, Silver Lake like other waterbodies is not chemically treated like a swimming pool, and indeed skin, intestinal, or other infections are possible from contact with or ingestion of untreated water. But again, there is no evidence that any unique pathologic problems exists in Silver Lake.

SUMMARY OF FACTS #3:

- *As the City and surrounding areas developed, Silver Lake was used as a stormwater retention pond.*
- *Consistent with then accepted building practices, and extensive system of storm drains and pipes were installed in south Rehoboth that discharged, without any treatment or control, into Silver Lake.*

- *The Lake condition deteriorated with development and the lake's current health is judged "fair".*
- *Redevelopment poses a risk of further damage to Silver Lake.*
- *Phosphates and nitrogen related chemicals plus particulate matter have contributed to Silver Lake's condition.*
- *Despite its murky appearance and several fish kills, there has been no significant change in the health of Silver Lake in the past 30 years.*
- *Relative to human health, Silver Lake presents no unique health problems that differentiate it from similar waterbodies.*

II. UNDERSTANDING LAKE GERAR

Lake Gerar's history differs significantly from that of Silver Lake. It is reported that up until the late 1920's it was basically a swamp that had shallow water when it rained. The then president of the DuPont Company entered into an agreement with the City regarding the lake. As part of an agreement to purchase a portion of the adjacent City land for development purposes, Mr. duPont agreed to dredge Lake Gerar and clean up its shoreline at his own expense.

Lake Gerar is 6.4 acres in size, far smaller than Silver Lake. Unlike Silver Lake, it lies totally within the City. A notable difference that has allowed recent successful restoration efforts is that the majority of its banks are O-1 zoned public lands and those areas on the western shore that are not under the City control are zoned R-1(S). This latter zoning classification requires a minimum lot size of 34,500 square feet in comparison to the typical 5,000 square foot lots in the R-1 residential district. Additionally, R-1(S) zoning requires a minimum of 50 foot rear yard depth in comparison to the 10 foot setback in the R-1 district.

While as shown in prior exhibit #5, five stormwater discharge pipes were identified in the 2006 study, however the Planning Commission received information that there may be as many as 11 such discharges – albeit receiving stormwater from a much smaller area than is the case with Silver Lake.

A notable difference within Lake Gerar's watershed and stormwater drain system is that these areas are very heavily treed with a large number of mature trees on private property, in the City's right-of-ways, and all of the large Central Park that is proximate to the lake.

Because of these significant differences and the fact that a successful restoration program, which included aeration and the installation of several stormwater sceptors, had already been implemented for Lake Gerar, the Planning Commission concentrated most of its efforts on Silver Lake and the contribution of Lake Comegys.

SUMMARY OF FACTS #4

- *Lake Gerar differs significantly from Silver Lake in terms of its history, size, shoreline zoning, watershed tree coverage, and successful restoration efforts.*

III. RESEARCH AND LITERATURE ON SHORELINE BUFFERS AND ORDINANCES

The Planning Commission assembled a significant volume of information and profited by presentations from and discussions with experts in the field of shoreline buffers and waterbody restoration.

A majority of the resource material obtained deals with flowing and lengthy rivers and streams and their banks. Others describe and discuss buffers in tidal waters. There is extensive discussion of the science, design, and effective regulations for buffers in these situations. However, very little of the resource materials deal with self-contained lakes and that which does applies primarily to lakes in rural or undeveloped wilderness areas. The problems associated with a self-contained urban lake that is used primarily as a stormwater retention pond is not directly addressed.

Nonetheless some important facts were learned. For example, for the filtration of contaminants such as phosphates and nitrogen products, buffer zones of 100 feet or more from the shoreline are recommended. There is research that shows the effectiveness of such buffers. However the literature suggests that minimum width for an effective filtration buffer is 35 feet and, provided that such buffers are treed, they may absorb up to 20 percent of the contaminants. Research demonstrates the importance of trees and vegetation in the watershed and their absorptive properties.

Natural lake shore buffers have other benefits beyond filtering contaminants. They provide a means of bank stabilization and erosion control, habitat for wildlife, and a deterrent to nuisance geese. Concerning the latter, some owners along Silver Lake complain about the "invasion" of resident geese and their droppings. It is noted that the City itself maintains a 10 foot managed no-mow zone along the lake [exhibit # 22].

While the majority of the literature discusses the use and importance of buffers for pollutant and contaminant control, there is also discussion of buffers for esthetics and protection of lake views for adjacent neighbors and the public. Public comments received by the Commission addresses these latter issues. The literature cites that lakes and other waterbodies, and the use and view thereof, contribute to the public welfare and enjoyment. More clearly stated, not only should immediate property owners have the right to enjoy the use and view of the waterbody, but their doing so must not unduly hinder the reasonable use and views of their neighbors and the public.

Examples of regulations and/or model ordinances for both types of buffers are presented in the literature reviewed by the Commission. However, most do not address the unique issues of an

already built-out shoreline of a lake in a highly urbanized setting. In her April 13th presentation to the public and Commission, Jennifer Volk, a scientist from DNREC's Watershed Assessment Section, discussed the issues relative to Rehoboth's lakes and explained why natural buffers on Silver Lake would have limited effect on water quality but would have esthetic value and help control nuisance geese [exhibit #23].

SUMMARY OF FACTS #5:

- *Two types of buffers are discussed and recommended in the literature.*
- *The literature concerning buffers for effective contaminant control state that buffers should be wide and treed.*
- *The literature regarding buffers for the protection of views, uses, and enjoyment of a waterbody do not address already built-out shorelines of lakes in urban settings.*

IV. SUMMARY OF FINDINGS

Based on both its research and input from the public, the Planning Commission finds that efforts should be focused on Silver Lake and, since it communicates with Silver Lake, Lake Comegys, because that is where, absent proper management, there is greatest potential for significant worsening of conditions, including through redevelopment. For Silver Lake there are unique complexities because its borders are within three jurisdictions and there has yet to be any clear determination of the ownership of the lake itself. While little more than half of Silver Lake's shoreline is within the City of Rehoboth Beach, none of Lake Comegys is within Rehoboth.

Silver Lake and Lake Gerar are considered visual treasures to not only Rehoboth but also to the State. They contribute significantly to the character, feel, and charm of the City. While some long for a return to what is believed to be their pristine history, that is not the history of Lake Gerar. However, Silver Lake indeed was detrimentally transformed over the past century as a result of the then standard infrastructure development that accompanied urbanization into what is today a stormwater management "lake".

Without question, what occurs along these lakes' shorelines does impact the lakes. However, because the City and surrounding areas are essentially totally built-out, and their stormwater drain fields feed into Silver Lake, the contribution of chemical contaminants to the lake by shoreline owners is minor in comparison to what is contributed by all of those within the total watershed. The primary exceptions are shoreline stabilization and construction site silt control, without which there will be continued sedimentation. Bank stabilization and erosion control, however, is an issue that can only be addressed by the lakeshore owners, be they private or public.

While people may lament Silver Lake's murky appearance and assume the worse – there is no creditable evidence that there has been a significant change in its condition over the past three

decades. Additionally, in terms of human health concerns, its status does not differ from other waterbodies that support abundant waterfowl and wildlife.

This said, in terms of contaminants and sedimentation, the Planning Commission does not accept that a rating of “fair” is a target to be maintained for the future. Restoration and improvements are possible, but there is no quick or inexpensive fixes. It is abundantly clear that effective solutions are not the responsibility of any one entity but rather is a responsibility shared by everyone residing within the lake’s watershed, and multiple governmental agencies – not just the City of Rehoboth Beach – but also of its surrounding jurisdictions and the State.

Based on its study and analysis, the Planning Commission presents specific recommendations and suggestions on how to accomplish this.

A separate issue is how to best ensure the continued visual beauty of the lake for not only lake-front property owners but also for the public. While the Planning Commission was diligent in explaining to the public that its Board-given assignment would not remedy expressed concerns about a new house under construction on Silver Lake, the generic issues related to view, setback, and what is appropriate along the lake’s immediate shoreline was part of its assignment. Of note, more citizens expressed their concerns about these vista, esthetics, and building issues than about condition of the lake itself.

Based on its study and analysis, the Planning Commission presents specific recommendations and suggestions on how to address public concern about what may be termed “visual environmental pollution”.

V. SPECIFIC RECOMMENDATIONS, SUGGESTIONS, AND ACKNOWLEDGEMENTS*

1. PUBLIC EDUCATION AND ACTION:

One of the most important tasks is to educate the public residing in the watershed and stormwater systems of Lake Gerar, Silver Lake, and Lake Comegys and explain that what they do on their property or allow to runoff of their property directly affects the condition of these lakes. The Planning Commission recommends that there be renewed public-private initiatives to accomplish this. The fact that there is an extensive existing stormwater management system throughout the City that discharges runoff from private property into the City’s lakes makes this effort of paramount importance. Companion

* Wherever “lake’s water edge” is cited in these recommendation, such edge will be defined as follows: the ordinary high water mark of Silver Lake shall be defined as elevation 6.0 feet above North American Vertical Datum of 1988 (NAVD 88) and the ordinary high water mark of Lake Gerar shall be defined as elevation 5.0 feet above NAVD 88. **CODE CHANGE REQUIRED**

and coordinated efforts are needed in the County's and Dewey Beach's watershed area as well.

In making this recommendation, the Commission wants to acknowledge the significant and positive efforts of the volunteer organization, SOLA-3, which has been committed to this effort as well as the involvement of other volunteer organizations. Likewise, the City itself has undertaken positive initiatives, for example the installation of informational "medallions" on stormwater grates, making public information available, and the recent installation of the rain garden demonstration at City Hall. There are also other organizations within the State, such as the Delaware Livable Lawns' program funded by DelDOT who stand ready to assist.

The Planning Commission recommends that a joint public-private "task force" be created to design a long-term plan – capitalizing on what has already been achieved. For example, the informative signage now in place at Lake Gerar or informing lakeside property owners of means of controlling geese, and associated geese droppings, using natural growth barriers that have proven effective at Lake Gerar. The main elements of such a plan are that it should be comprehensive and continuous. While one-time events/activities may be part of the plan – this must be a long-term effort.

With some embarrassment, the Planning Commission itself acknowledges that despite these ongoing efforts of SOLA-3, the City, and others – it was not until it undertook this current assigned task that members of the Commission began to comprehend the magnitude of the problem, the complexity of solutions, and, most importantly, the need to not only educate the citizenry but also for citizens to take positive action.

2. REDUCTION OF CONTAMINANTS ENTERING THE STORMWATER SYSTEM:

- Efforts to ensure the proper use of fertilizers and insecticides are important and it is thought that the primary problem results from inappropriate action by private property owners. Recognizing that it is nearly impossible to monitor such behavior, emphasis must be given to a continuous public education program. The compliance of commercial applicators and lawn service companies, for whom the City has contact information via their business licenses, should also be monitored.
- Special attention needs to be given to preventing construction site silt and other debris from entering storm drains. Notwithstanding any current Code provision, the City must ensure that all reasonable steps are taken, that may include silt-screening or graveled construction site access-ways, to accomplish this. [Silt-screening is not currently required by the City for most residential construction on a typical 5,000 square foot lot.] The storage of construction materials on streets and public right-of-ways should be prohibited. Monitoring by the City is required to ensure that dirt and other contaminants do not enter the street and then storm drains. Enforcement actions should be taken – including stop-work orders, mandating remedial action, and penalties imposed. Preventing contaminant leakage from construction site dumpsters must also be monitored and enforced. An overall review and discussion of sediment/contaminant control should be part of the building permitting process. CODE CHANGE REQUIRED

- Since water, either rain or runoff from yard watering systems, is the main way silt and other contaminants are washed into the stormwater drains, efforts to reduce such runoff is warranted. Again, as part of the building permitting process, the means of keeping rain water on-property should be addressed and required. Additionally, the installation of any lawn watering system in the public right-of-way by private property owners should be prohibited. **CODE CHANGE REQUIRED**
 - Where street curbing is not in place, and unless there are unique site specific reasons to the contrary, private property owners should be prohibited from installing impervious paving in the public right-of-way. The City should continue its efforts to encourage the use of pervious alternatives for driveway construction.
 - The City is commended for its street sweeping efforts and to the extent possible and on an as-need basis such efforts should be increased in order to remove dirt and debris from the streets before they enter the stormwater system.
 - The City should implement a convenient, in-City, means for residents to dispose of environmentally hazardous waste, e.g., paints, solvents, engine oil, pesticides, herbicides, etc.
3. IMPROVEMENTS TO CITY'S STORMWATER SYSTEM:
- Accurate location and elevation data on the City's entire stormwater management system should be entered into the City comprehensive computer based mapping system and kept up to date.
 - The City is to be commended for the recent installation of the two new stormwater sceptors on large drain pipes entering the western end of Silver Lake in addition to two at Lake Gerar. The City should commit to a long-term goal of upgrading the system to further prevent silt, debris, and oils from being discharged into the lakes. It is suggested that priority be given to the large pipe entering off of King Charles Ave as there is visible silting at that site. Further, the planned excavation of City streets associated with the construction of the ocean outfall wastewater system may present opportunities to also do upgrades to the stormwater system in the area of construction. Other proposed utility work in the City may provide similar opportunities.
4. INCREASE THE URBAN FOREST WITHIN THE CITY:
- The City is to be commended for its recent efforts to add trees in public areas. However, because of the demonstrated importance of trees to contaminant control such efforts need to be expanded, with particular attention given to the Silver Lake watershed. Not only should trees on public land be maintained and increased, but every effort needs to be made to maintain and increase trees on private land as well. In all instances, appropriate trees for our sea-side area and climate should be used.
5. LAKE BANK STABILIZATION:
- The City is to be commended for implementing a managed 10 foot no-mow zone on public property abutting the City's lakes and, in some areas, for the installation of engineered environmental "bio-log" buffers.
 - Lake bank stabilization of all property within the City should be required using the most appropriate environmental means. Not dissimilar to the existing legal requirements for sidewalks, all property owners who own property to the lake's water edge should be

required, if not already in place, to install bank stabilization. Because of the different topographies, proposed means of stabilization should be approved by the City, in consultation with DNREC, on a parcel-by-parcel basis. Preference should be given to stabilization measures that are most consistent with other public objectives, including the provision of habitat for fauna and flora, and visual appeal. Therefore, stabilization should be done through the use of indigenous vegetation, supplemented as necessary by “bio logs” and the like. Use of boulders (“rip rap”) would be a second-best solution, where conditions do not permit a more natural solution. New bulkheads have been prohibited for many years, and it is proposed that when existing bulkheads reach the end of useful life, they should, where possible, be replaced by the preferred stabilization measures. Where current stabilization is deemed inadequate, affected property owners should be required to complete such stabilization within two years of notification or be required to maintain a ten foot, managed, no-mow zone extending from the lake’s edge. The City’s Code will be amended to accomplish this. **CODE CHANGE REQUIRED**

6. ADDITIONAL MEANS TO IMPROVE SILVER LAKE:

With heightened public concern and interest prompted by the July 2012 major fish kill in Silver Lake, but tempered by the recognition that there have been only 8 other documented fish kills in Silver Lake in the past 3 decades, an analysis of what additional means, beyond the recommendations cited above, could be taken to address the problem of low dissolved oxygen. An obvious example would be aerators similar to those that have been installed in Lake Gerar. However, beyond being many times bigger, Silver Lake has unique problems caused by a multi-jurisdictional shoreline and an outstanding question about the ownership of the lake itself. Only with the best scientific estimate of what additional means could be taken to improve Silver Lake and their probability of success coupled with not only an estimate of their initial, operational, and maintenance costs but also an assessment of the distributed responsibilities of the various jurisdictions involved can rational decisions be made. The City should petition the State to undertake such an analysis.

7. PROTECTION OF LAKE VIEWS AND CHARACTER:

- The City Code will be amended to establish a “No-Build Buffer” for all properties within the City that border on Silver Lake or Lake Gerar. This no-build area will extend inland 10 feet as measured from the lake’s water edge and must be maintained as a natural area as currently defined by the City Code, e.g., auxiliary structures will be prohibited in the “No-Build Buffer”. **CODE CHANGE REQUIRED**
- The City Code will be amended to prohibit the installation of any yard watering system on private property within 10 feet of the lake’s water edge.
- The City Code will be amended to require site plan review for any residential structure that is built or substantially renovated whose foundation is within 25 feet inland of the lake’s water edge. **CODE CHANGE REQUIRED**

8. STATE-DNREC:

- The City will petition the State/DNREC to include Silver Lake in their periodic routine monitoring system. This is essential in order to be able to determine the success of the

proposed restoration activities and, at the minimum, to ensure that there is no deterioration from the lake's current condition that would prompt more intensive interventions.

- The City will petition and collaborate with DNREC to accomplish the expeditious dredging and restoration of the currently silted-in western end of Silver Lake.
- The City will petition the State to make a determination on the ownership of Silver Lake and the requirements associated with the State assuming such legal ownership.
- The City will petition the State to assume responsibility for maintaining the Silver Lake outfall drain system and to maintain an established lake level.

9. OFFICE OF STATE PLANNING:

- Because multiple State agencies, in addition to DNREC, may have valuable input or suggestions, or may have ongoing programs or funding sources that could be of assistance in implementing these various recommendations, a Preliminary Land Use Service (PLUS) review of this report should be sought through the Office of State Planning Coordination.
- Because the ultimate success of maintaining and restoring Silver Lake [and Lake Comegys because of its communication with Silver Lake] requires coordinated efforts of the City, Dewey Beach, Sussex County, and the State, the City will petition the Office of State Planning Coordination to take the lead in facilitating such coordination.

EXHIBITS

REHOBOTH LAKES REPORT

1. Commissioners' March 16, 2012 resolution regarding the City's lakes
2. PC Table #1 – Silver Lake perimeter measurements by jurisdiction
3. PC Table #2 – Silver Lake percent perimeter by jurisdiction
4. Map: Silver Lake and Lake Comegys watershed
5. 2006 study: Discharge point locations
6. City's stormwater drains and pipes
7. Picture: City's large stormwater discharge pipe – NW corner of Silver Lake
8. PC Table #3 – Private property in Silver Lake drainage zone [acreage]
9. PC Table #3a – Property adjacent to Silver Lake [acreage]
10. PC Table #4 – Street Area [impervious] in Silver Lake's drainage zone [acreage]
11. PC Table #5 – Analysis of gallons of rainwater discharge with one inch rainfall
12. 1926 aerial picture of Silver Lake and Lake Comegys drainage area
13. Current aerial picture of Silver Lake and Lake Comegys drainage area
14. Map: City's tree canopy
15. Maryland tree planting program to filter highway runoff
16. Picture: Filamentous algae bloom, July 2012
17. DNREC's documented fish kills in Silver Lake: 1982-2008
18. DNREC's report of July 4, 2012 fish kill in Silver Lake
19. Map: Silver Lake water depth readings
20. Picture: Shoaling/mud-flats, western end of Silver Lake
21. DNREC's water sampling report of City's lakes in 2005 [11 pages]
22. Picture: City's no-mow protected natural area
23. Concluding slides from DNREC's April 13, 2012 presentation re Silver Lake

NOTICE

THE COMMISSIONERS OF THE CITY OF REHOBOTH BEACH
ON MARCH 16, 2012, ADOPTED RESOLUTION NO. 0312-01
WHICH READS AS FOLLOWS.

**RESOLUTION BY THE COMMISSIONERS OF THE CITY OF REHOBOTH
BEACH REGARDING THE CITY'S LAKES**

Purpose: The purpose of this resolution is to develop ordinances and regulations which will protect the environmental health, beauty, and enjoyment of Rehoboth Beach's lakes for all citizens.

Background: Because the City's Comprehensive Development Plans of 2004 and 2010 specifically call for ordinances which would create a buffer zone around Silver Lake, and other measures to ensure the health of the City's lakes, the Rehoboth Beach City Commissioners resolve that the Planning Commission develop proposed ordinances to provide for such a buffer zone, setbacks or other measures to protect the City's lakes.

Charge to the Planning Commission:

- 1 The Planning Commission will be expected to consider and make recommendations concerning the most effective means of protecting the City's unique lakes, with particular focus on Silver Lake.
- 2 The Planning Commission will establish a method of obtaining appropriate involvement from the citizens of the City of Rehoboth Beach and the general public during the process of researching and drafting the ordinances and regulations. The interests of property owners to appropriately use their property should be balanced with the interests of other citizens to enjoy the beauty of the lakes.
- 3 The Planning Commission is charged to conduct research, examine, and recommend to the City Commissioners one or more ordinances and/or regulations to protect the City's lakes, including, but not limited to, regulating residential development around them.
- 4 In its research, the Planning Commission shall review the effectiveness of existing and established buffer zones and other protective measures from the region and around the country to determine what ordinances and regulations, policies or powers create effective protection of lakes and how such elements may be best incorporated into the ordinances and regulations of the city of Rehoboth Beach.

5. The Planning Commission is encouraged to contact administrators or Commissioners from other communities and to use additional resources as needed to gain knowledge of the inherent impacts and benefits of such ordinances and regulations.

6. Such ordinances may incorporate the following

- Determination of the environmental and aesthetic impact of structures and their relationship to the character of the surrounding area.
- Amendment to Site Plan Review, as provided for in Section 236.30 of the Code of the City of Rehoboth Beach, which would provide for such review for any structures built on property bordering lakes or the buffer zones around them.
- Regulations setting out a buffer zone or setback around Silver Lake, prohibiting or restricting construction or setting standards or guidelines for location of and exterior features of structures.
- The effect of structures and buffer zones around the lakes on the health, safety and general welfare of the city.

7. The Planning Commission shall make recommendations regarding, and shall demonstrate the significant benefits of, any proposed ordinances or regulations, including the following

- the proper powers of city commissions or other regulatory bodies to effectively implement any new ordinances or regulations.
- the resources required for effective enforcement of any recommended ordinances or regulations, as well as effective communication to, and education of, the citizens of Rehoboth Beach regarding such ordinances and regulations.
- further steps to be taken in concert with DNREC and other State agencies, Sussex County and Dewey Beach to protect the health and enjoyment of Silver Lake.

Timeline:

The Planning Commission shall make a written report of their findings and recommendations to the City Commissioners within 90 days of the passage of this resolution. Monthly reports on progress of the Planning Commission shall be made to the City Commissioners by the Planning Commission Chairman or his designee at each regular meeting of the Mayor and Commissioners.

#1

#2

Table 1

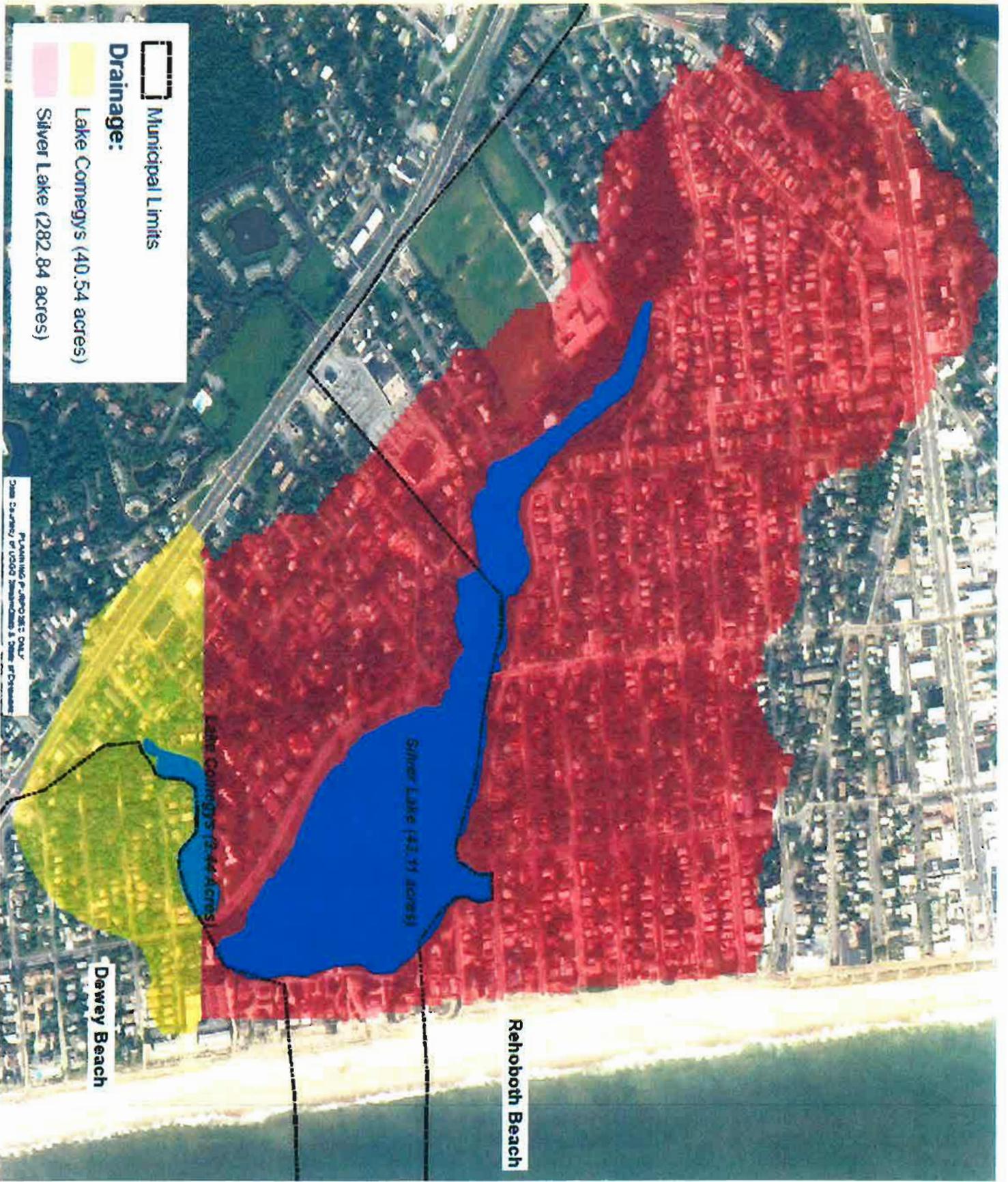
Measurement Position	Map Meas. [cm]	Scaled Distance [Ft]	Comments	% Total Perimeter (Silver Lake & Comegy)	% Jurisdiction on Silver Lake
1-2	23.9	1159.9	RB - Lake Drive ->King Charles	9.4	19.3
2-3	7.0	339.7	Rehoboth	2.7	5.7
3-3a	7.9	383.4	Rehoboth	3.1	6.4
3a-3b	18.2	883.2	County	7.1	14.7
3b-4	8.8	427.1	Dewey	3.5	7.1
4-5	41.0	1989.7	County	16.1	33.2
6-6a	13.0	630.9	County	5.1	10.5
6a-7	15.5	752.2	Rehoboth	6.1	12.5
7-7a	8.7	422.2	Newbold Apts	3.4	7.0
7a-8	9.7	470.7	School	3.8	7.9
8-9	4.5	218.4	RB-Thorogood + Stokley St. Easment	1.8	3.6
9-10	4.9	237.8	Country Club Est. (Zellers, etc)	1.9	4.0
10-11	9.0	436.8	Park--> Footbridge	3.5	7.3
11-12	12.6	611.5	Footbridge --> End of Scarborough	4.9	10.2
12-13	19.9	965.7	Along Lake Drive-> Bridge	7.8	16.1

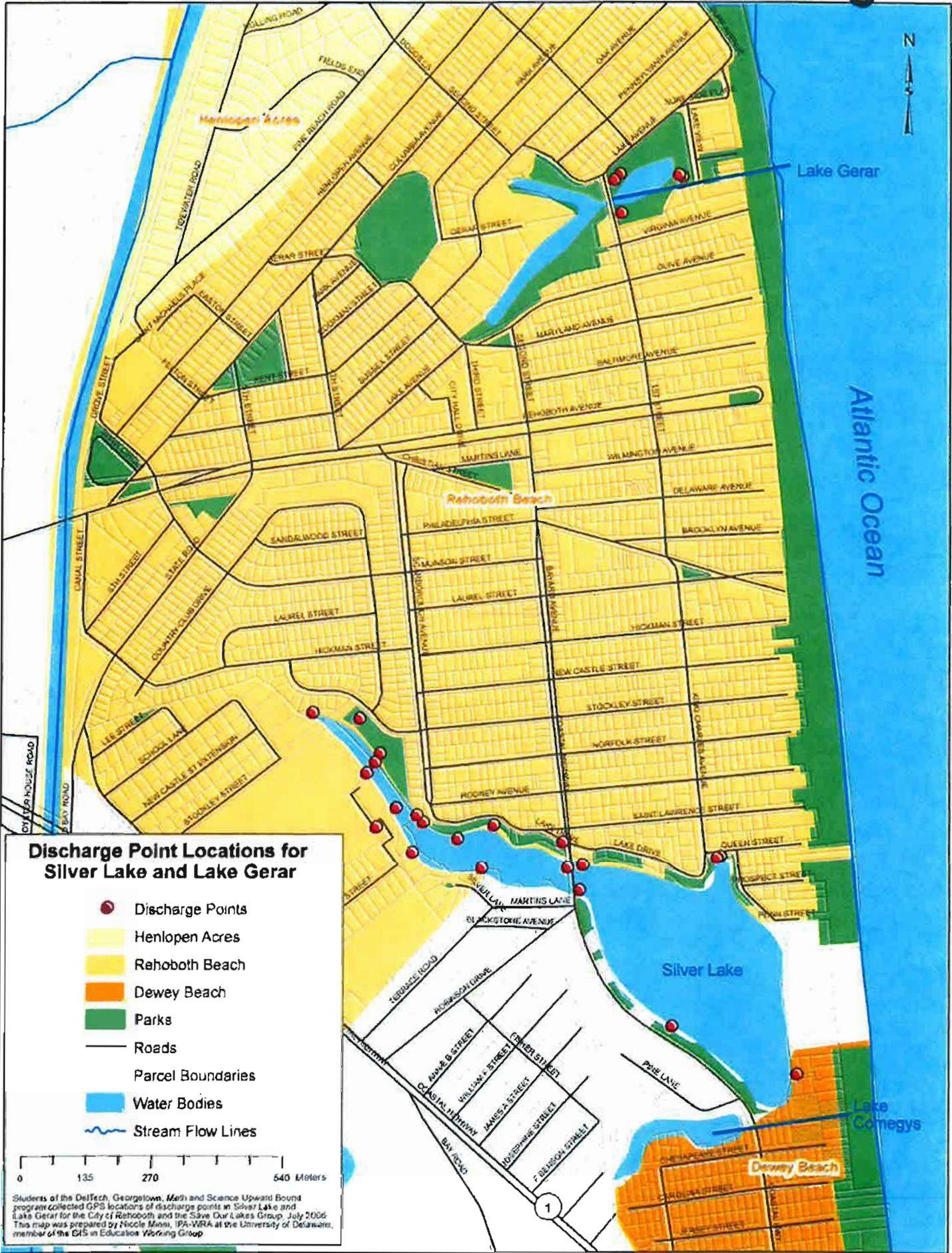
Table 2

9929.2	Silver Lake Perimeter				Silver Lake Area	1840872 Ft ²	42.26 Acres
2441.1	Lake Comegys Perimeter				Lake Comegy Area	127758 Ft ²	2.93 Acres
12370.3	Total Lake(s) Perimeter				Total Area	1968630 Ft ²	45.19 Acres
		% of Total	% of Silver Lake				
	Lake Gerar Perimeter				Lake Gerar Area	279976	6.43 Acres
5995.0	Rehoboth Perimeter (SL)	48.5	60.4				
3501.7	County Perimeter (SL)	28.3	35.3				
427.1	Dewey Perimeter (SL)	3.5	4.3				
1227.8	Lake Comegy Perimeter (Dewey)	9.9	12.4				
1213.3	Lake Comegy Perimeter (County)	9.8	12.2				
2050.0	Typical 2nd & 3rd Block Perimeter	16.6	20.6		Typical 2nd & 3rd Block Area	165000 Ft ²	3.79 Acres
1440.0	Typical 1st Block Perimeter	11.6	14.5		Typical 1st Block Area	128000 Ft ²	2.94 Acres
300.0	Typical 50x100 Ft Lot Perimeter	2.4	3.0		Typical 50x100 Ft Lot Area	5000 Ft ²	0.115 Acre

#4

Silver Lake's Watershed





#6

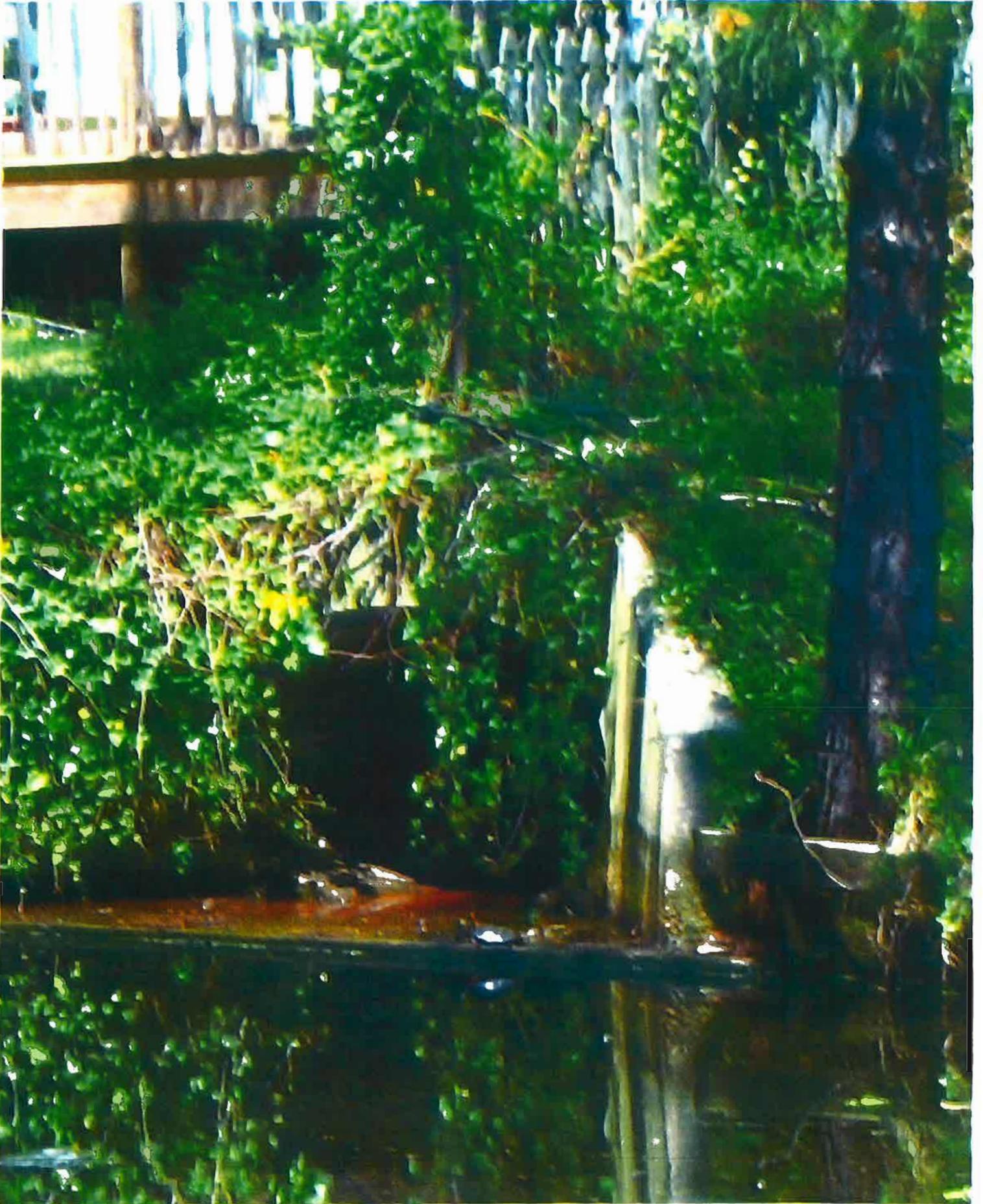
CITY OF REHOBOTH BEACH STORM DRAINAGE SYSTEM & DEPICTION OF 4 WATERSHED AREAS

BOUNDARIES APPROXIMATED



MAP 2004 - NOT CURRENT

#7



#8

Table 3 - Private Property In Drainage Zone

Block No. (RB Zoning Map)	Scaled Perimeter Distance [ft]	% of Total Lake(s) Perimeter	Scaled Block Area [Pi]	Block Area [Ft^2]	Block Area [Acres]
2		0.0		0	0.00
3		0.0	8409	76152	1.75
4		0.0	37508	339672	7.80
5	1600.0	12.9	12533	113499	2.61
6	2470.0	20.0	22256	201550	4.63
7	3900.0	31.5	37998	344110	7.90
8	2100.0	17.0	18568	168152	3.86
9	1670.0	13.5	13879	123877	2.84
10		0.0		0	0.00
11	1290.0	10.4	9995	90515	2.08
12	1450.0	11.7	11608	105122	2.41
13	510.0	4.1	5190	47001	1.08
14	2090.0	16.9	11844	107259	2.46
15	2050.0	16.6	18220	165000	3.79
18	2050.0	16.6	18220	165000	3.79
17	2050.0	16.6	18220	165000	3.79
18	2050.0	16.6	18220	165000	3.79
19	2260.0	18.3	24398	220930	5.07
20		0.0	18139	164267	3.77
21		0.0	18256	165326	3.80
22		0.0	24708	223738	5.14
23	2200.0	17.8	18059	163542	3.75
24	2050.0	16.6	18220	165000	3.79
25	2050.0	16.6	18220	165000	3.79
26	2050.0	16.6	18220	165000	3.79
27	2050.0	16.6	18220	165000	3.79
28	2050.0	16.6	18220	165000	3.79
29	2260.0	18.3	25080	227124	5.21
30		0.0	25959	235085	5.40
31		0.0	9002	81522	1.87
32		0.0	6761	61228	1.41
33	1440.0	11.6	13502	122274	2.81
34	1440.0	11.6	13502	122274	2.81
35	1440.0	11.6	13502	122274	2.81
36	1440.0	11.6	13502	122274	2.81
37	1440.0	11.6	13502	122274	2.81
38	1440.0	11.6	13502	122274	2.81
		0.0			
		0.0			
		0.0		0	0.00
Total	50890.0			5478319	125.76

9

Table 3a - Property Adjacent To Lake

Description	Scaled Area [Pi]	Area [Ft^2]	Area [Acres]
Lots #23-#27/Blk4 (Zellers, etc.)	24706	223738	5.14
Lot #9/Blk 13 (End of Scarborough)	847	7870	0.18
Thorogood & Adjacent Lot	5644	51112	1.17
Scarborough St. Ext. (North)	1926	17442	0.40
Scarborough St. Ext. (South)	3033	27467	0.63
6 Silver Lane	786	7118	0.16
7, 8 & 9 Silver Lane	2232	20213	0.46
O1 Park-Tot Lot	11182	101264	2.32
Lake Drive (West of bridge)	6385	57823	1.33
Lake Drive (East of bridge)	8218	56310	1.29
County Land Between Lake & Road		0	0.00
Houses In County - East of Silver Lane	16635	72994	1.68
Buffer Along Road Past Carpenter Prop.		0	0.00
Condos in Dewey Beach		0	0.00
School		0	0.00
Newbold Square	5907	53494	1.23
		0	0.00
		0	0.00
		0	0.00
Total		696845	15.99

#10

Street Area In Silver Lake Drainage Zone

Table 4

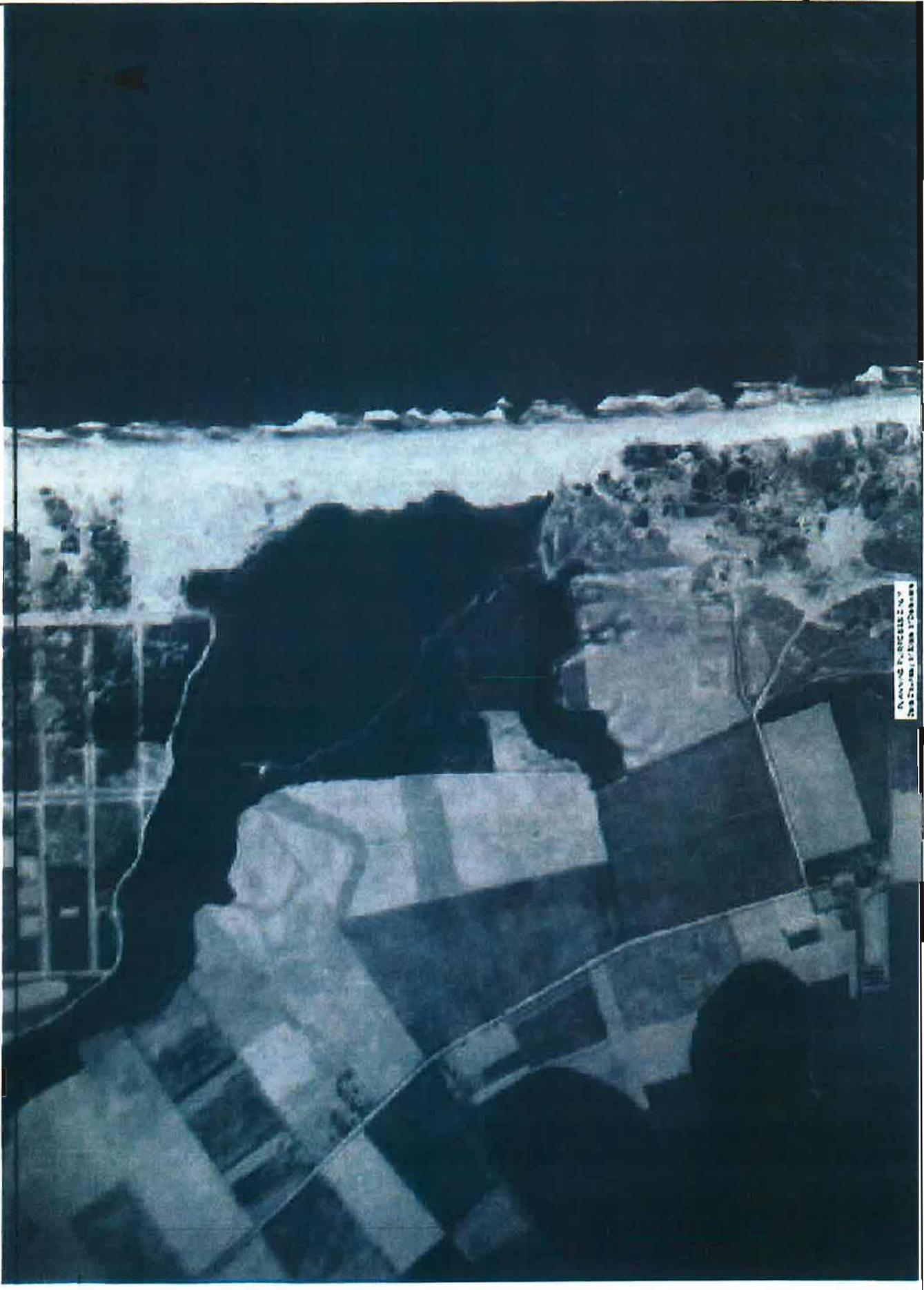
Street	Scaled Distance Map Meas. [cm]	Distance [Ft]	Street Width* [Ft]	Street Area [Ft^2]	Street Area [Acres]
King Charles	19.5	1950	88	171600	3.94
Bayard	23.8	2380	88	209440	4.81
Scarborough	22.9	2290	88	201520	4.63
Lake Drive	29.1	2910	40	116400	2.67
St. Lawrence	14.9	1490	58	86420	1.98
Rodney	23	2300	58	133400	3.06
Norfolk	23	2300	58	133400	3.06
Stokley	34.3	3430	58	198940	4.57
New Castle	23	2300	58	133400	3.06
Hickman	36.1	3610	58	209380	4.81
Laurel	27.5	2750	58	159500	3.66
Munson	21.1	2110	58	122380	2.81
Philadelphia	8.9	890	58	51620	1.18
Country Club Drive	30.1	3010	58	174580	4.01
Sandalwood	7.3	730	58	42340	0.97
Scarborough Ext.	9.6	960	58	55680	1.28
Stokley Ext.	4	400	58	23200	0.53
New Castle Ext.	0	0	58	0	0.00
School Lane	0	0	58	0	0.00
					0.00
					0.00
					0.00
					0.00
Total Street Area				2223200	51.04

Street Width*: Includes Street Width & Sidewalk

Table 5 - Estimated Rainfall Runoff

Description	Area [Ft ²]	Area [Acres]	Rainfall Volume Gal/1" Rainfall	Comments
Silver Lake & Lake Comegys	1968630	45.19	1227198	contains atmospheric contaminants
Streets/sidewalks - Silver Lake Drainage Zone	2223200	51.04	1385891	contaminants: hydrocarbons & droppings
Private Property - Silver Lake Drainage Zone	5478319	125.76	751312	contaminants: nitrates & phosphates
<u>Private Property Adjacent To Lake</u>				
Lots #23-#27/Bika (Zellers, etc.)	223738	5.14	30684	
Lot #9/Bik 13 (End of Scarborough)	7670	0.18	1052	
Thorogood & Adjacent Lot	51112	1.17	7010	
Scarborough St. Ext. (North)	17442	0.40	2392	
Scarborough St. Ext. (South)	27467	0.63	3767	
6 Silver Lane	7118	0.16	976	
7, 8 & 9 Silver Lane	20213	0.46	2772	
O1 Park-Tot Lot	101264	2.32	13888	
Lake Drive (West of bridge)	57823	1.33	7930	
Lake Drive (East of bridge)	56310	1.29	7723	
County Land Between Lake & Road	n/a			
Houses in County - East of Silver Lane	72994	1.68	10011	
Buffer Along Road Past Carpenter Prop.	n/a			
Condos in Dewey Beach	n/a			
School	n/a			
Newbold Square	53494	1.23	7336	
Lake Gerar	279976	6.42	174530	

1926: Lake Comegys & Silver Lake



U.S. GEOLOGICAL SURVEY
AERIAL PHOTOGRAPHY
1926

Bing Maps Aerial: Lake Comegys & Silver Lake (current)



14



Community Name: Rehoboth Beach

UTC: 32.75%

Total Area: 1050.72 Acres

Urban Tree Canopy (UTC): 209.02 Acres

Map is for information only and is not intended as a survey



MARYLAND: SHA planting trees to filter highway runoff

7:47 AM, Jun 7, 2012 |

Written by
ASSOCIATED PRESS

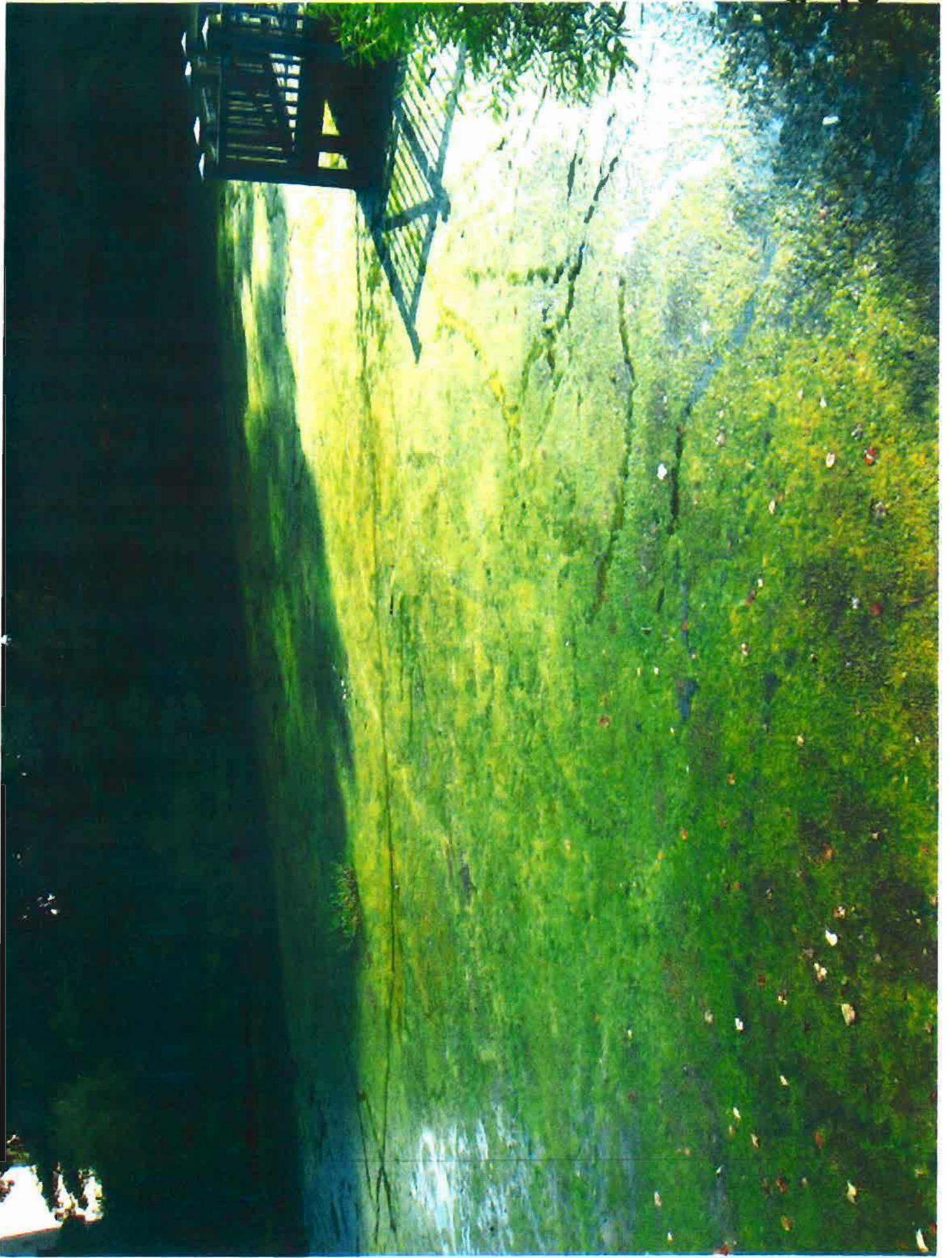
ANNAPOLIS — Maryland highway officials are planting thousands of trees statewide to help filter stormwater that runs off roads and pollutes waterways.

The State Highway Administration is planting nearly 120,000 trees on 480 acres along interchanges and grassy areas where they won't hinder visibility. The trees are being planted in the counties of Anne Arundel, Baltimore, Carroll, Charles, Frederick, Harford, Howard, Montgomery and Prince George's.

Reducing stormwater runoff is a key goal in Chesapeake Bay restoration efforts because rain carries pollutants that spawn oxygen-robbing algae blooms in waterways.

Trees help slow and absorb the runoff, keeping it from reaching the bay. They also prevent erosion of soil and stream banks, which also clouds bay water. And trees absorb carbon dioxide, a greenhouse gas blamed for climate change.

16



Silver Lake Rehoboth fish kills

Silver Lake (Rehoboth) Fish Kills - Information provided by DNREC 6/8/12

Date	No. Dead	Species	Probable Cause
3/26/82	1,000	gizzard shad	Unknown
6/20/83	30,018	gizzard shad, white perch, a few others	low D.O.
3/9/87	200	gizzard shad	Unknown
4/5/88	30	gizzard shad	Unknown
5/1/93	2,000	gizzard shad	Unknown
8/25/97	1,000	gizzard shad	Unknown
7/10/06	578	gizzard shad	Unknown
4/26/08	6,300	white perch, gizzard shad, bluegill, largemouth bass	low D.O.

17

NEWS FROM THE DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

For more information, contact Joanna Wilson, DNREC Public Affairs, 302-739-9902.

First reported fish kill of summer fits familiar pattern of high heat and low dissolved oxygen

REHOBOTH BEACH (July 5, 2012) – On July 4, DNREC responded to reports of a fish kill in Rehoboth Beach's Silver Lake that initially involved an estimated 1,500 gizzard shad 2 to 4 inches long along with 800 white perch the same size, plus a few bluegills and a largemouth bass. Today, DNREC scientists continued to investigate the cause of the fish kill, which had broadened overnight to include both juvenile and adult fish of those same species – with approximately 5,000 to 6,000 dead gizzard shad of all sizes and 600 adult white perch, plus adult blue gills and largemouth bass observed today.

Surface water testing on both days by fisheries biologists indicated that dissolved oxygen levels in the water have been low enough this week in Silver Lake, a freshwater impoundment, to be lethal for fish. These conditions repeat a familiar pattern for fish kill occurrence – high temperatures and an excessive microscopic algae bloom result in low oxygen levels in shallow water.

"As long as these conditions persist, there's a chance of more fish kills in Delaware," said John Clark, DNREC Fisheries Section administrator. "Aggravating this summertime problem, increased temperatures lead to warmer water, which holds less dissolved oxygen. So seeing more fish kills this year as the heat continues would come as no surprise.

"We can't predict when fish kills will occur, but we know what usually contributes to them, and a low oxygen level is at the top of the list," Clark said. "Bright sunny days encourage also algae growth. Like other aquatic plants, algae contribute to the oxygen supply by day, and then consume oxygen at night. Plus, algae can die, drop to the bottom and decompose, which consumes even more oxygen from the water."

DNREC Division of Fish and Wildlife biologists routinely monitor the status of fish and other aquatic species, while environmental laboratory scientists from DNREC's Division of Water keep an ongoing record of water quality in waterways throughout the state.

Anyone observing an unusual number of dead or dying fish in Delaware ponds, rivers or other waterways are encouraged to report their observations, including an estimate of how many fish are involved, and, if known, the species of fish. Depending on the situation, DNREC staff – including fisheries biologists, Fish and Wildlife Enforcement, and environmental scientists – will respond to investigate a fish kill. To help determine the cause of the event, responders will estimate the number of dead fish, note the species, location and other conditions, and also take water samples.

To report a suspected fish kill, please call the Fisheries Section at 302-739-9914 from 8 a.m. to 4:30 p.m. Monday through Friday, and DNREC's citizen complaint hotline at 1-800-662-8802 after hours and on weekends.

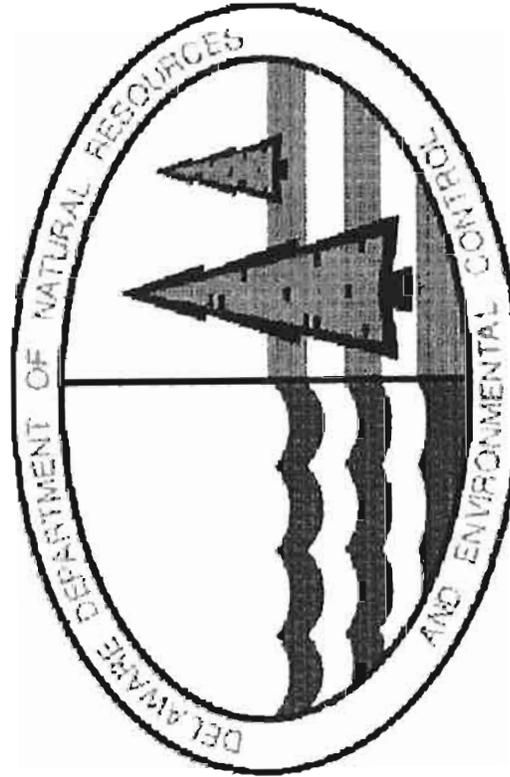


**Summary of Water Sampling Results
from Lakes in the Rehoboth Beach /
Dewey Beach Area: Summer of 2005**

May, 2008

To the City of Rehoboth Beach

**By the State of Delaware
Department of Natural Resources and
Environmental Control (DNREC)
Division of Water Resources (DWR)
Environmental Laboratory Section (ELS)
89 Kings Highway
Dover, DE 19901**



21A

Introduction

Three natural freshwater interdunal swale lakes occur within the Rehoboth Beach / Dewey Beach area including Lake Gerar, Silver Lake, and Comegys Lake. Though none have been sampled consistently, some sporadic sampling has been done of Lake Gerar and Silver Lake by the State. The only known sampling of Comegys Lake occurred in the summers of 2005 and 2007. Silver Lake and Lake Gerar are known to have annual and very dense blooms of algae. The algae blooms have been of the phytoplankton (microscopic) type and the filamentous type. The phytoplankton algae give the water a rich green color and sometimes form a paint-like scum on the surface. The filamentous algae float in greenish colored mats on the water surface and resemble tangled thread or hair.

Environmental sampling of these lakes by the State has primarily been a response to the concerns expressed by citizens regarding environmental health, aesthetic quality, and/or risk to human health. The present study was implemented by the DNREC, Environmental Laboratory Section (ELS) in agreement with the Save Our Lakes Alliance (3) and the City of Rehoboth Beach. This report summarizes the data for selected water quality indicators of eutrophic (nutrient-enriched) condition that were sampled during the late summer to early fall of 2007.

Methods

One site was sampled in each lake (Figure 1a-c). Sampling occurred on July 27, August 16 and September 20, 2007. The water quality indicator variables sampled were the same as in 2005 and included:

- ⇒ Total phosphorus - a primary nutrient indicator in freshwater lakes.
- ⇒ Chlorophyll a - an indirect measurement of algal density in ambient surface waters.
- ⇒ Total suspended solids - an indicator of the amount of particulate matter suspended in ambient surface water.
- ⇒ Secchi depth - a measure of water clarity (transparency) in ambient surface water.
- ⇒ pH - an indicator in freshwater of the magnitude of photosynthetic activity and thus algal density.
- ⇒ Microcystin - hepato-toxin produced by the microscopic blue-green algae *Microcystis* and *Anabaena*, both of which have been observed in Lake Gerar, Silver Lake, many other Delaware lakes, and globally. (See note at end of discussion)

#21.8

Samples were collected by lowering a bucket into the water. The filled bucket represented a composite of the upper 1-1.5 ft. (0.3-0.45m) of the water column. Samples of water were tested for total phosphorus, chlorophyll a, total suspended solids, and microcystin at the DNREC, ELS laboratory in Dover. Water clarity was determined onsite by lowering a Secchi disk into the water until it disappeared from view. Distance from the surface to the point of disappearance is regarded as water clarity. The pH and water temperature were measured onsite using a meter. The microcystin level was determined on a plate reader using Abraxis ELISA methodology.

Results

All three lakes had a typical summer appearance during all three sampling events – low water clarity and greenish in color. The data for each variable and sampling event are presented in Table 1.

Water Temperature (°C)	30.5	29.1	23.0	30.6	29.4
Microcystin (ug/L)	< 0.1	< 0.1	< 0.1	NS	NS

NS – not sampled
 mg/L – milligrams per liter (parts per million - ppm)
 ug/L – micrograms per liter (parts per billion - ppb)
 m - meters
 SU – Standard Units (pH range of 1-14)
 °C – Centigrade
 UR – unvalid result (< 0.2 mg/L)
 * Secchi disk visible on bottom

Discussion

The 2007 results indicate highly eutrophic conditions in all three lakes. All of the results are within the ranges exhibited by lakes/ponds in Delaware that have high density of microscopic algae (phytoplankton), a condition which causes low water clarity.

The Silver Lake and Lake Gerar visual appearances and water quality data are consistent with past data and observations (Ritter 1981, Tyler 1998). As during 2005 Lake Gerar did not have floating mats of filamentous algae at the time of

later 2007 sampling event. Filamentous algae was observed at Silver Lake. Historically a nuisance there and its control was the intent of efforts to improve the quality of the lake during the mid-1990's (Tyler 1998). On September 20, Lake Gerar and Silver Lake had thin scums of microscopic blue-green algae.

Table 1: Results for water quality indicator variables sampled in three freshwater lakes in the Rehoboth Beach / Dewey Beach area during 2007.

	Silver Lake			Lake Gerar			Comegys Lake		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Total Phosphorus (mg/L)	0.332	0.518	0.205	0.572	0.568	0.346	0.177	0.149	0.120
Chlorophyll-a (ug/L)	221	286	249	36	25	177	70	47	146
Total Susp. Solids (mg/L)	UR	73	29	63	51	31	41	27	34
Secchi Depth (clarity) (m)	0.2	0.20	0.3	0.2	0.3	0.20	0.2*	0.05	0.2
pH (SU)	10.5	9.9	8.9	9.8	9.4	9.5	9.2	9.5	9.5

#21.0

(Clarity) (m)						
pH (SU)	9.8	10.5	9.3	9.9	9.6	8.9

Note on Microcystin

An emerging issue over the past two decades pertaining to low-energy freshwater systems (lakes, tidal freshwater) is the effects of toxins produced by some genera and species of microscopic blue-green algae (Cyanobacteria) upon aquatic life, and terrestrial life (mammals, birds, etc.) that are exposed to water in which such blooms occur. Numerous incidents involving the deaths of livestock, pets, and birds have been reported from North America and the world (Chorus and Bartram). While research and the consideration of protective criteria are ongoing, the World Health Organization recommends that the microcystin concentration in finished drinking water (which the Rehoboth area lakes obviously are not) not exceed 1 part per billion. The ecological effects of microcystin concentrations that are within the range observed in Silver Lake this August (0.5 – 3.0ppb) are unclear. Nonetheless, should there ever be a warm season event in which an unusually large number of the resident waterfowl or other animals die on Silver Lake for no apparent reason then microcystin should be considered as a possible cause. Although the microcystin results from Lake Gerar and Comegys Lake were negative this year

21.D

A 1979 vs. 2007 comparison of summer water quality data from Silver Lake (Table 2) suggests that the condition of the lake has been stable over at least the past quarter-century. However, note the large discrepancy between years with regard to the chlorophyll-a data. The 1979 chlorophyll-a data does not make sense. Taken in context with the other variables including total phosphorus, secchi depth and pH, all of which strongly suggest high algal density, the 1979 chlorophyll-a results should have been much higher. Moreover, the author of the 1979 study (Ritter 1981) stated that the main aquatic plant problem was microscopic blue-green algae of the genera *Anabaena* and *Microcystis*. The July 2007 pH reading is extremely high and was associated with a bloom of the blue-green genera *Snowella*.

Table 2: Comparison of Silver Lake (Rehoboth) summer water quality data, 1979 vs. 2005.

	July		August		September	
	1979	2007	1979	2005	1979	2005
Total Phosphorus (mg/L)	0.25	0.33	0.36	0.32	0.39	0.21
Chlorophyll-a (ug/L)	5.8	221	12.4	286	0.14	249
Secchi Depth	0.10	0.2	0.08	0.2	0.15	0.3

the number of samples was small and the possibility of toxic events there should not be arbitrarily ruled out. Microcystin testing was first initiated in Delaware in 2002 by the ELS laboratory as a pilot project on a select number of lakes known to have blooms of microscopic blue-green algae. Presently, the ELS laboratory is continuing to explore testing this relatively new environmental variable (State of Delaware 2004).

In conclusion, the water quality sampling results from the three lakes during 2005 were as expected and consistent with past findings (Silver Lake and Lake Gerar). It is recommended that this level of sampling continue in the future on all three lakes. The total cost of sampling Silver Lake and Lake Gerar to the City of Rehoboth Beach was \$408.00. The cost of sampling Lake Comegys was absorbed by the ELS laboratory. In particular, continuation of microcystin testing is suggested for these lakes. Silver Lake in particular, because it has a long history of extremely heavy blue-green algae blooms, has a large population of resident waterfowl, and may be used by domestic animals.

Acknowledgement

This study was a coordinated effort between Save Our Lakes Alliance (3), the City of Rehoboth Beach and the State of Delaware. Funding was provided by the City of Rehoboth Beach and the State of Delaware. The collection of water samples, testing, and production of this report was conducted

by the State of Delaware. The principal investigator was Robin M. Tyler, Ph.D. of the Department of Natural Resources and Environmental Control, Division of Water Resources, Environmental Laboratory Section.

References

- Chorus I. and J. Bartram. 1999. Toxic cyanobacteria in water: A guide to their public health consequences, monitoring, and management. Published on Behalf of the World Health Organization. E & FN Spon. ISBN 0-419-23930-8. 407pp.
- Ritter W. 1981. Survey and classification of Delaware's public lakes. Division of Fish and Wildlife, Delaware Department of Natural Resources and Environmental Control. 89 Kings Highway, Dover DE 19901
- State of Delaware. 2002. Microcystin Pilot Study 2002. Division of Water Resources, Environmental Laboratory Section. Delaware Department of Natural Resources and Environmental Control 89 Kings Highway, Dover, DE 19901
- State of Delaware. 2004. Microcystin Project 2003. Division of Water Resources, Environmental Laboratory Section, Delaware Department of Natural Resources and

Environmental Control 89 Kings Highway,
Dover, DE 19901

Tyler R.M. 1998. A test of Nurture Biostimulation
Technology to control nuisance algae in
Delaware lakes. Division of Water
Resources, Environmental Laboratory Section,
Delaware Department of Natural Resources
and Environmental Control. 89 Kings
Highway, Dover, DE 19901

21. F

Rehoboth Beach's Silver Lake and the Potential Impacts of a New Buffer Ordinance

Jennifer Volk
DNREC, Watershed Assessment
Section
April 13, 2012

Summary

- Buffers on Silver Lake will provide some benefits to water quality, but those effects will likely be limited.
 - Jurisdictional boundaries and existing structures and roads will likely result in a patchy and narrow buffer
 - Natural character of lake (shallow, enriched sediments, sediment disturbing fish) will likely limit the impacts of buffers
 - Hardened shoreline and storm drains limit the impacts of the buffer

Suggestions

- Aesthetic, wildlife, and nuisance geese benefits will outweigh the water quality benefits of buffers at this location
- Education/outreach to lake-side land owners to encourage:
 - Maintaining existing lake-side vegetation
 - Planting native grasses, shrubs, and trees where they do not currently exist
- Further investigate need for ordinance

Other Tools...

- Reduce runoff
 - Keep water on pervious (yard) areas
 - Disconnect downspouts
 - Don't water the sidewalk or street
 - Wash cars on yards
 - Reduce impervious surfaces (pavement)
- Reduce pollutant inputs
 - Use fertilizer sparingly and appropriately
 - Follow recommended rates
 - Don't fertilize before rain events
 - Use native plants that require fewer nutrients