

CHARTER TOWNSHIP OF COMMERCE STORM WATER MASTER PLAN

Submitted to:
Michigan Hazard Mitigation Coordinating Council
4000 Collins Road
Lansing, MI 48909-8136

Attn: Mr. Matt Schnepf, Mitigation Officer

By: Giffels-Webster Engineers, Inc.
2871 Bond Street
Rochester Hills, MI 48309-3515
(248) 852-3100

GWE JOB #15886

Date: December 26, 2003

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I. INTRODUCTION:

A. General

Commerce Township is located in the Southwestern portion of Oakland County, Michigan. The landscape is defined by many lakes, streams and wooded open space. This landscape helped make Commerce Township one of the most desirable and fast growing Metro Detroit communities in the 1990's. This rapid development included new subdivisions and the rebuilding transformation of many one time summer cottages into large year round residences. Recently, all new developments, have, in general, been required to outlet a maximum of 0.2 cubic feet per second (c.f.s.) per acre if the site is located near a suitable drain to convey this runoff. Otherwise, the development is required to detain on site, two 100 year storm events on back to back days. Many of these developments occurred adjacent to the numerous bodies of water found throughout Commerce Township; hence discharging the allowable 0.2 c.f.s. per acre. Most of these sites fall within an area never studied by The Federal Emergency Management Agency (FEMA); as a result the 100 year floodplain was never officially established.

The overall drainage system is operating efficiently. The combination of the Huron River, the County Drains and the many lakes provide excellent conveyance of the surface water runoff generated by the Township. A few problem areas have become evident; each of these areas is discussed in detail later in this report.

B. Hazard Mitigation Grant Program

On September 10 and 11, 2000, portions of Wayne and Oakland County experienced significant rainfall on consecutive days. These storms prompted a Presidential Disaster Declaration. This Declaration made Federal Funds available under the Hazard Mitigation Grant Program (HMGP). These funds were eligible to states, local governments, private non-profit organizations, and Indian tribes and

tribal organizations. These funds were applied for by Commerce Township, who experienced significant public and private damage due to these storms. The funds are to be used for cost-effective hazard mitigation measures (actions intended to reduce or eliminate damages or other negative impacts caused by natural or technological hazards). The Township received funding to complete this Comprehensive Storm Water Master Plan. The Federal Funds will contribute 75% of the cost; Commerce Township will fund the remaining 25%. The Grant is organized in two phases. The first phase, which is completed, includes this Comprehensive Storm Water Master Plan for the entire Township. The Second Phase will fund the flood mitigation systems identified by this study and approved by the Emergency Management Division. The flood mitigation system funding would pay for the design and construction of physical improvements and purchasing easements and properties for storm water storage and conveyance.

C. Purpose and Approach

The purpose of this Storm Water Master Plan was to develop the necessary tools to effectively manage storm water runoff of existing and future developments in the Township. Of primary concern was the prevention of property damage caused by flooding.

The approach in developing this Storm Water Master Plan was as follows:

1. The first step was to analyze the existing drainage system to determine how well it currently functions. This step involved gathering various records, interviewing Township officials, and developing hydrological and hydraulic models of the existing drainage system. Two significant sets of maps were developed: Exhibit A is an Existing Drainage Issues map; Exhibit F is a series of maps that show the approximate 100 year floodplains associated with the FEMA established 100 year storm lake levels, the FEMA established river and drain 100 year floodplain, the MDEQ and developer established 100 year floodplains found in plats and condominium

documents, and the 100 year floodplain established through the modeling completed for this report.

2. The second step was to develop storm water management approaches that would be effective in controlling flooding and maintaining water quality in Commerce Township, specifically as is pertains to the problem areas.
3. The third step is to design and construct the portions of the mitigation plan that are most urgent. It also will include setting priorities for future projects and exploring methods for obtaining funding for these future projects.

II. EXISTING CONDITIONS:

A. Information Gathering

In order to evaluate the existing drainage system, it was first necessary to gather available information from various sources. The following is a listing of some of the sources of information:

- The MDEQ provided valuable information regarding the flood frequency discharges of many of the drains that receive significant storm water from the adjacent communities. These included a tributary to the Huron River at Cooley Lake Road, a tributary to the Huron River at Glengary Road, a tributary to the Huron River at Haggerty Highway, a tributary to the Huron River at South Commerce Road, and Hayes Creek at the Union Lake Dam. These flows were integral in developing the 100 year floodplain.
- The Oakland County Drain Commissioner's (OCDC) office had useful records of all the county drains established in Commerce Township. These records included flooding complaints, drain maintenance, and permitted drain modifications.
- Additional recorded flooding complaints were obtained from Township records and interviews with Township staff and residents. Exhibit A graphically shows the various flooding problem areas from information that was gathered from both the Township and the OCDC.
- Commerce Township Future Land Use Master Plan (Exhibit B).
- The Geographic Information System (GIS) (made available through the Oakland County Planning and Development Services) included a host of information that was valuable in developing this Storm Water Master Plan. This information included aerial photographs, current land use, wetlands,

soil types, topography and natural areas. The wetland inventory shown in Exhibit C is an example of the information available through the GIS.

- Culverts in the streams and areas not previously studied by FEMA were inspected and surveyed. Detailed information regarding size, culvert material, and slope (along with pictures) are included in the “Commerce Township Culvert Information 2003” supplemental report.
- Plans of existing developments in Commerce Township also provided needed information such as existing storm sewer systems, detention and retention basins, and drainage outlets.

B. Characteristics and Features of the Existing Drainage System

The existing drainage system consists of the following components:

- a. The Huron River, and its associated lakes, store and convey the majority of the surface water runoff generated from the Township.
- b. Legally established drains under the jurisdiction of the Oakland County Drain Commissioner (OCDC). These drains are both open ditch and enclosed storm sewer. These only account for a relatively small amount of the Township’s storm water conveyance system.
- c. The OCDC maintains most of the lake levels in the Township. This is accomplished by a network of Lake Level Control Structures. These structures also play a critical role in managing storm water run-off. The lakes controlled by these structures (operated by the OCDC) are Union Lake, Long Lake, Middle and Lower Straits Lake, Wolverine Lake, North and South Commerce Lake, and Fox Lake.
- d. Open ditches adjacent to major county roads, subdivisions, and other developments throughout the Township.

- e. Storm Sewers and detention or retention basins in more recent developments.

C. General Information on the Huron River in Commerce Township

A small network of legally established county drains helps capture and transport storm water runoff to the Huron River. The majority of the surface run-off that enters the Huron River comes from the lakes, which in turn, receive water from road side swales and non-point source runoff from individual homes and property. The vast majority of Commerce Township falls within the Huron River watershed. Less than half of one square mile flows into the Rouge River watershed. Commerce Township is located in the head waters of the Huron River. Commerce Township benefits greatly from the Huron River and the many lakes, but with the benefit comes responsibility. This responsibility includes keeping the river water quality high, maintaining the pristine and natural state found in the many parks, and to control the amount of surface runoff entering the river methods of accomplishing These goals will be discussed in detail later in this report.

D. Modeling the Existing Drainage System

An important aspect of analyzing the condition of the present Township drainage system is the determination of the approximate 100 year floodplain of each reach that was not previously modeled by FEMA or other agencies. These determinations were made using available photographic, topographic and soil maps, plans and records of county drains, as well as field surveys by Giffels-Webster Engineers, Inc. More specifically, the following procedure was used:

The storm water analysis was performed using computer software developed by the US Army Corps of Engineers, Hydrologic Engineering Center. Two programs were extensively utilized: the Hydrologic Modeling System (HEC-HMS) and the River Analysis System (HEC-RAS).

The Soil Conservation Services Unit Hydrograph Model (SCS UH Model) as described in the SCS Technical Report 55 (1986) was the primary model used when developing the run-off generated with the HEC-HMS software. The data for this method was found from the following sources: The United States Geological Survey's Soil Survey Map of Commerce Township, the Commerce Township Future Land Use Master Plan, aerial photographs and two foot contours developed by Oakland County, as well as surveyed measurements and photographs of all the unstudied culverts in the Township.

These resources were used to develop sub-basin areas, weighted curve numbers, initial loss, impervious percent, and UH lag time. The 100 year and 10 year storm events were modeled using the HEC-HMS Frequency-based Hypothetical Storm. These Hypothetical Storm events were developed from the Weather Bureau's TP-40 (Herschfield, 1961). This data was entered into the HEC-HMS model to derive the peak runoff for each sub-basin and reach. These HEC-HMS generated peak runoff values were then entered into the HEC-RAS computer model.

The physical geometry was modeled for each drain, using the HEC-RAS program developed by the US Army Corps of Engineers. The information entered into the HEC-RAS program was generated using the HEC-GeoRAS extension of ArcView GIS. The HEC-GeoRAS extension of ArcView GIS allows information to be exchanged between the HEC-RAS and the ArcView GIS programs. Data used in the ArcView GIS program included: the two foot contours from Oakland County, the drainage districts for each drain, and the existing stream locations. Field data was also gathered to obtain culvert information including: upstream and downstream inverts, culvert material type, sediment depth, and the general channel characteristics throughout the drains. The field information and the ArcView GIS information were used in the HEC-RAS program to generate a model of the existing channel and culvert conditions for each drain. The methods used in developing the HEC-RAS model are considered approximate methods. A large quantity of surveyed cross-sections of the streams would be required to more accurately establish the 100 year floodplain elevations.

The HEC-RAS and HEC-HMS models were developed as described above, and then an iterative process of testing the models against known data was completed. For instance, the initial models were tested to see how the peak runoffs for certain sub-basins as calculated by the HEC-HMS model compared to similar peak runoffs previously calculated by the Michigan Department of Environmental Quality. Similar testing was done to see how the 100 year floodplain elevations as calculated by the HEC-RAS model compared to established 100 year floodplain elevations as established on Subdivision Plats. The models were also tested to determine how sensitive the models were to certain input data. During this testing process, the models were de-bugged to eliminate errors, and modified to take natural detention areas into account.

E. 100 Year Floodplains

The results of the hydrologic and hydraulic modeling for a 100 year storm event for existing conditions have been shown graphically on aerial photos. These floodplain maps can be found in Exhibit F. The tabular output from the computer models is fairly massive in volume and is not considered to be of interest to most readers of this report. Digital copies of the models are being provided to Commerce Township for reference purposes.

Exhibit F contains the following information:

- The existing 100-year floodplain as established by FEMA through the Commerce Township Flood Insurance Study, dated September 16, 1980.
- A depiction of the approximate 100 year floodplain as determined in this study Storm Water Master Plan.
- A depiction of the 100 year floodplain in areas where it has been established by the MDEQ. The MDEQ has already made floodplain determinations on segments of the streams in Commerce Township. These floodplain

determinations were made in conjunction with the approval process of subdivisions plats and condominium documents.

- A local flood hazard area. Table R301.2 (1) of the Michigan Residential Building Code states that the local unit of government will establish the flood hazard areas in accordance with the adopted ordinance regulating construction in flood hazard locations. Exhibit F has been prepared such that Commerce Township can adopt a Flood Control Ordinance that references Exhibit F for a depiction of flood hazard areas. The flood hazard areas are somewhat larger than the approximate 100 year floodplains depicted in Exhibit F.

All areas within the local flood hazard areas are regulated by the Township through the Michigan Building code. In addition, the Michigan Department of Environmental Quality regulates flood hazard areas having a tributary area over two square miles. Through the regulatory process, the official 100 year floodplain will be established.

F. Summary of Findings

Based on a review of the existing conditions including available records and the storm water modeling, it has been concluded that the overall existing system generally functions quite well for present conditions. There are, however, some areas that have experienced significant flooding during the storm events of September, 2000. The items include Lower Mount Royal Subdivision, Golfview Lake Estates, Lower Straits Lake Drainage Course and the Wixom Road Parcel. These areas have been identified and are shown in Exhibit A. The drainage problem areas shown in Exhibit A are based on records, pictures, interviews, and on the storm water computer modeling. The following four sections are devoted to each of these problem areas.

G. Problem Area - Lower Mount Royal Storm Water Management Initiative

1. Introduction to Lower Mount Royal

Flooding has occurred in this portion of the Township for years. Lower Mount Royal's Polvadera Road is mentioned as a problem in the FEMA issued Flood Insurance Study in 1980. The type of the flooding can be best described as a nuisance. The flooding that some residents of Lower Mount Royal Subdivision have experienced involved water ponding on the streets, yards, and the a few garages. This flooding has in the past, and if nothing is done, will continue in the future to cause damage to both public and private property.

a. Location Description

Frank Salter's Mt. Royal Country Club was platted in 1927. This subdivision includes what is commonly referred to today as Lower Mount Royal Subdivision.

Lower Mount Royal is located in Section 10 of Commerce Township. The subdivision extends from the north shore of North Commerce Lake to Sleeth Road. It is bound on the east by South Commerce Road and on the west by The Commerce Lake Woods Subdivision.

Upper Mount Royal is bound on the south by Sleeth Road and consists of HalfPenny, Whitlow, Sundew, Halberd and Morella Streets.

Commerce Lake Woods is a new development that was completed in 2000. Commerce Lake Woods lies adjacent to the western boundary of Lower Mount Royal.

See Figure G.1 for a map showing the location of each subdivision and Huron Valley Hospital.

b. Storm Water Management History

Frank Salter's Mt. Royal Country Club was originally a summer cottage development with small lots, typically 50 ft. X 120 ft., gravel roads, and minimal open ditch type drainage. The cottages originally built in the development were typically much smaller than the permanent homes existing there today and many of the platted lots remained vacant until the 1960's. Storm water runoff was not a major concern in those earlier times because the amount of runoff was relatively small due to the limited impervious surface area. Also there was ample space between and around the cottages to allow runoff to find its way to the lake without causing property damage. Another factor is that year-round access to the cottages was not as big a concern as it is today.

Over the years, the character of Frank Salter's Mt. Royal Country Club (that part of which is located south of Sleeth Road, now known as Lower Mount Royal Subdivision) has changed dramatically. Small vacant lots were combined into larger building sites and large modern houses have been built with garages and paved driveways. Along with these changes, the amount of storm water runoff has increased substantially. Also, along the lake front, most of the small cottages have been replaced by very large houses with very little space between houses. There is inadequate space for surface water drainage from the higher parts of the subdivision to drain into the lake.

These factors were apparent in the 1980's when the residents expressed their desire to improve the roads throughout Lower Mount Royal. The residents were most desirous of having good, year-round access, as well as a more aesthetic appearance to their properties. A plan was presented to the residents that included adequate drainage improvements that would safely collect and convey runoff from heavy rains and snowmelt to the lake.

When confronted with the cost of constructing this type of drainage improvement, the residents opted to petition the Township for constructing paved streets with a minimal amount of drainage improvements. These drainage improvements included a limited amount of open ditch, several new culverts, and several leaching basins at street intersections.

Another key factor in this decision was the Township's inability to obtain easements between lakefront lots for the purpose of installing storm water outlets to the lake. For the above reasons, the streets were paved in 1988 without fully addressing the drainage situation.

Since the roads were paved in 1988, there has been a significant amount of additional new house construction that has further exacerbated the drainage problems. Flooding problems have continually increased in frequency and intensity. In September of 2000, this area experienced a particularly severe rain storm that caused widespread damage throughout Oakland County, resulting in a Presidential Disaster Declaration. The federal government made local governments eligible for financial assistance under the Hazard Mitigation Grant Program. Commerce Township applied for and received a grant to develop solutions to the Lower Mount Royal flooding problems, along with an analysis and recommendation of other known flooding problems within Commerce Township. The

grant also covered the cost of a Storm Water Master Plan that would help present additional flooding problems from occurring in the future. The Township engaged Giffels-Webster Engineers, Inc. to assist it in accomplishing those tasks.

2. Storm Water Runoff Analysis

a. Hydraulic Analysis

An analysis was performed wherein the subdivision was divided into several natural drainage tributary areas. The runoff from each of these tributary areas during a 100 Year Storm was calculated, including runoff from offsite areas. These offsite areas included the right-of-way of Sleeth Road, Upper Mount Royal and some runoff from the hospital site.

b. Residential Survey

In an effort to better understand the frequency and extent of the flooding, a survey was developed and distributed to the 325 residences in Lower Mount Royal Subdivision. All 325 residences were located south of Sleeth Road. Upper Mount Royal was not surveyed because they do not have flooding problems; however, Upper Mount Royal does contribute a significant amount of storm water discharge to Lower Mount Royal, adding to their flooding dilemma. Of the 325 surveys sent with addressed, stamped envelopes, 142 were returned. Of the returned surveys, 41 households reported having flooding on their property; the remaining 101 indicated they had not experienced flooding on their property. None of the respondents indicated that flood water had entered their home or caused serious damage as result of the 100 year storm of 2000.

It is probably reasonable to assume that most of those who did not respond do not feel that they have a flooding problem on their property. It should be noted; however, that the runoff from all lots in Upper and Lower Mount Royal contribute to the flooding problems that periodically occur. It is the lower lying lots that are impacted the most by the lack of an adequate drainage system.

Based on the hydraulic analysis and survey responses, we have identified four main drainage problem areas. These are shown on Figure G-2 and are described below.

i. Vandalia Outlot and Sherbrooke Intersection

All of the storm water runoff that flows southerly on Vandalia, including the off-site runoff, discharges into an outlot at the south end of Vandalia. This outlot was originally platted as an extension of Vandalia from Ridgemont to Sherbrooke. All of this runoff, plus additional runoff from Ridgemont, flows onto Sherbrooke where the water ponds until it flows around several houses on the south side of Sherbrooke.

ii. Sundew and the Sundew-Polvadera Intersection

In 1988, the residents on Sundew opted out of the paving project and Sundew remained a gravel road. During this paving project, measures were taken to help alleviate the drainage problem, specifically at the northeast and northwest corners of Sundew and Polvadera. Leaching basins were installed. These basins have become ineffective and now cause water to accumulate at these corners. Erosion of the gravel

roadway and driveways is evidence that the road-side swales and culverts are undersized and should be improved.

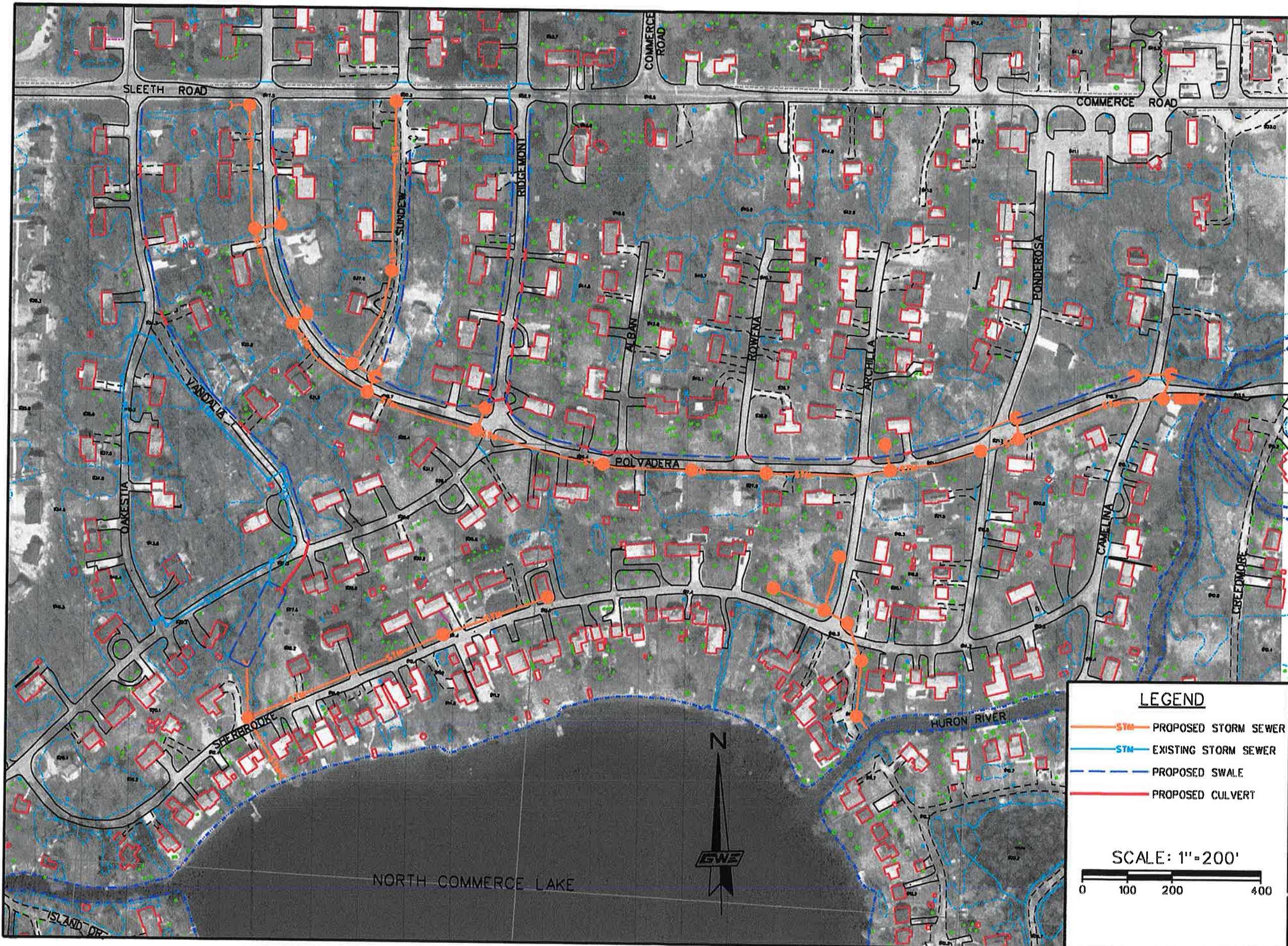
iii. Polvadera and the Intersections of Achilla-Sherbrooke and Ponderosa-Sherbrooke

Most of the large volume of runoff from the north side of Sleeth Road flows into Polvadera. The volume of runoff greatly exceeds the capacity of the open ditches and culverts on Polvadera. In moderately heavy rains, water flows onto and across private properties and even into some garages. There is excessive erosion damage to both private property and road right-of-way.

Based on the responses to the resident survey, examination of available topographic maps and field observations, we have developed a proposed plan to alleviate potential flooding problems in Lower Mount Royal Subdivision. The proposed plan is shown graphically on Figure G-3 and is described below.

iiii. Northern Vandalia

There are several houses in this area that appear to be impacted by a large amount of runoff from areas to the north and west, including the Sleeth Road right-of-way, hospital frontage property and part of Commerce Lake Woods. Also, it has been reported that runoff from Halfpenny Court and other areas on the north side of Sleeth Road sheet flow southerly across Sleeth Road and then southerly in Vandalia.



PRINCIPAL:	LDC
PROJ. MNGR:	CB
DESIGN:	MWM
DRAWN:	RAS
IND. REVIEW:	
SECTION:	10
T-2-N, R-9-E	

GWE
Giffels-Webster Engineers, Inc.
 ENGINEERS LAND SURVEYORS PLANNERS LANDSCAPE ARCHITECTS
 2871 BOND STREET ROCHESTER HILLS, MI 48309
 (248) 852-3100

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LEGEND

- STW — PROPOSED STORM SEWER
- STW — EXISTING STORM SEWER
- PROPOSED SWALE
- PROPOSED CULVERT

SCALE: 1" = 200'

SHEET TITLE:
 Lower Mount Royal Proposed Plan
 COMMERC TWP., OAKLAND COUNTY, MICHIGAN

FIGURE G.3

DATE:	8/23/03
SCALE:	1" = 200'
SHEET:	1 of 1
JOB:	15886

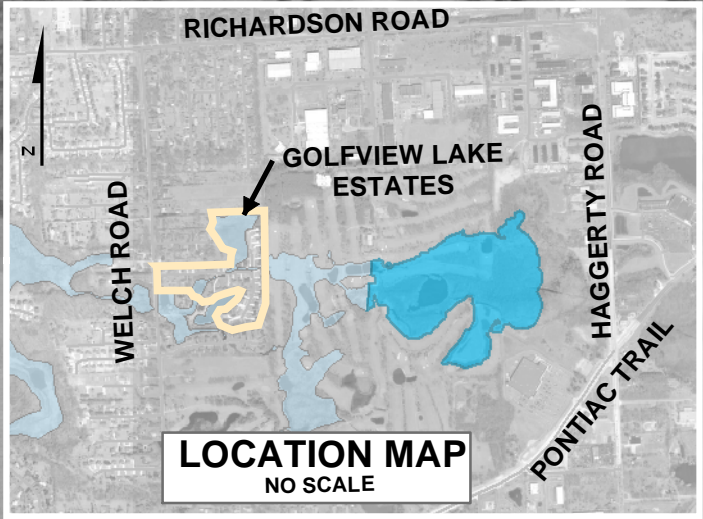
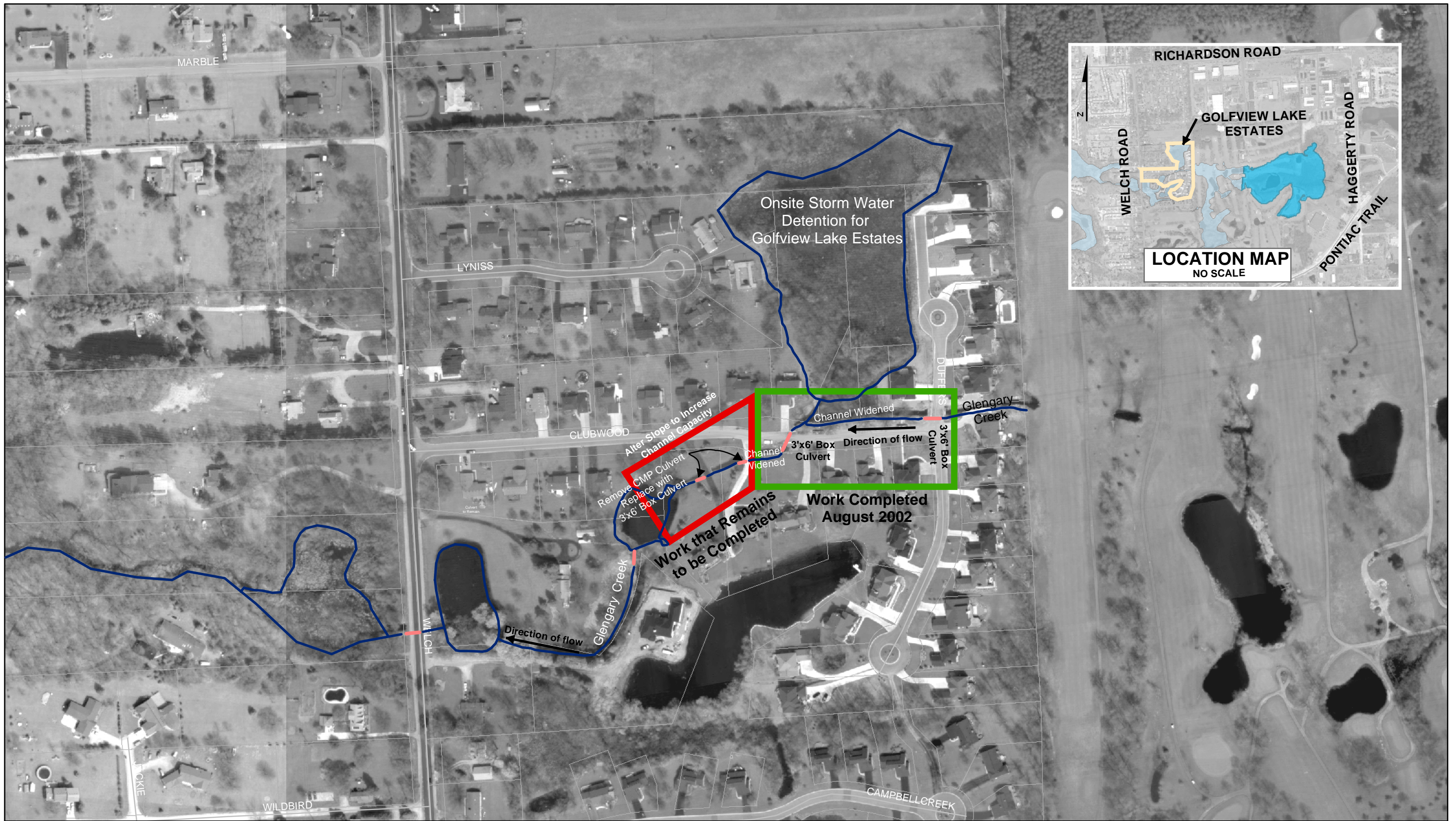
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It is apparent that the existing storm sewer and drainage system does not have sufficient capacity for the amount of runoff flowing down Vandalia from Sleeth Road. The resulting flooding problems might be tolerable if they occurred very infrequently, during very extreme conditions but not as frequently as the residents have reported them to be occurring.

3. The Proposed Plan

The proposed plan consists of a combination of new storm sewers, vegetated swales and sediment removal facilities. The intent of the plan is to collect the runoff that flows from the north and west Lower Mount Royal Subdivision at Sleeth Road and Vandalia, and Polvadera and Sundew. The new storm sewers would convey the runoff from moderately intense storms safely through Lower Mount Royal and discharge into Commerce Lake and the Huron River. An important feature of the plan is that the storm water would pass through sedimentation basins and/or grit removal chambers prior to discharge into the lake or river, thus improving water quality. Grass swales will be constructed to direct water to storm sewer catch basins and inlets.

These storm sewers would be designed to convey the runoff from a theoretical 10 Year Storm, which is a storm with a 10% chance of occurring in any given year. More intense rainfalls, such as a 100 Year Storm with a 1% chance of occurring in a given year, may generate runoff that exceeds the capacity of the storm sewers. At such times, storm water would travel through the roadside swales and in the roads, until it flowed into the lake or river. This is particularly true for Vandalia Avenue and Polvadera Avenue because so much runoff from outside Lower Mount Royal enters these two streets at Sleeth Road.



Commerce Township Storm Water Master Plan:
 Figure H.1
 Golfview Lakes Estates (1" = 200')

a. Estimated Cost

We have estimated the cost of constructing this plan at roughly \$1,800,000 in 2003 dollars. The project is quite expensive because it is a retrofit situation where the road right-of-way already is occupied by all other utilities, which increases the cost of the storm sewer installation. The estimate includes about \$500,000 for removing and replacing existing pavement and landscape restoration.

b. Suggested Method of Financing

If this project is undertaken, it would probably be financed through the sale of special assessment bonds. The Special Assessment District would encompass all properties whose storm water runoff contributes to the present drainage problems. It appears that this would include the Road Commission for Oakland County, the Huron Valley Hospital, most of the lots in Lower Mount Royal, lots on Sundew, Whitlow, and Halfpenny in Upper Mount Royal. It may also include some lots on the east side of Commerce Woods Drive. The assessment to each entity would generally be based on the amount of runoff from each.

Based on topographic maps and site visits, it appears that approximately one third of the estimated cost (or \$600,000) could be assessed to the Road Commission and hospital combined with the balance assessed to the homeowners benefiting. This would amount to roughly \$3,000 per residence or vacant building site.

4. Conclusions and Recommendations

The Hazard Mitigation Grant has given this community a unique opportunity to address these problems in a proactive manner, identifying potentially expensive flooding problems. The construction of the aforementioned solutions is the best way to help protect these residents from the effects flooding can inflict on a neighborhood. Innovative funding sources should be explored to make these improvements come to fruition, Commerce Township should continue to promote and encourage these improvements to be built. Ultimately, it will be the residents of Lower and Upper Mount Royal who make this project become a reality.

H. Problem Area - Golfview Lake Estates Flood Mitigation Efforts

1. Introduction to Golfview Lake Estates

Golfview Lake Estates No.1 and Golfview Lake Estates Phase 2 were built in 1996 and 1999, respectively. Golfview Lake Estates III was finished in 2002. The road infrastructure, culverts and grading for these developments altered the existing 100 year floodplain. During the storm events of September, 2000, much of the road and yards of these developments experienced significant flooding. The most serious damage occurred when approximately 8 inches of flood waters entered homes adjacent to the golf course via walkout basements. This flooding helped prompt the Township to apply for matching funds with the Hazard Mitigation Grant Program.

a. Location Description

The Golfview Lake Estates developments are located in Section 24 of Commerce Township on the east side of Welch Road approximately half way between Pontiac Trail and Oakley Park

Road, see Figure H.1. These developments included 40 single family residential homes on 80' by 150' lots on Clubwood Drive and Duffers Lane. Single lots on Clubwood Drive were also developed on this land. Directly adjacent to these developments to the east are two golf courses, The Links at Pinewood and El Dorado Country Club. This is a dynamic portion of the Township and it has recently been announced that The Commerce Township Downtown Development Authority (DDA) has purchased the El Dorado Country Club and other properties with the intention of building a road and infrastructure for a commercial center and other developments in the area.

b. Storm Water Management History

The low lying areas of the golf courses retain significant storm water that is generated from the surrounding tributary area. As part of this study, the MDEQ provided flows from neighboring municipalities. The MDEQ provided us with a value of 250 cubic feet per second (c.f.s.) of peak run off from West Bloomfield via the culvert under Haggerty Road. This is in direct contrast to FEMA, Flood Insurance Study of 1980. This Study identified 32 c.f.s. of peak discharge through this culvert. Our analysis showed that the flow under Haggerty was more similar to the FEMA established 32 c.f.s. The FEMA study also described the discharge at Welch Road being 265 c.f.s. The storm events of September 2000 gave the unique opportunity to witness and document a 100 year storm through this area. Using the computer modeled geomerty it was found that 265 c.f.s. could not flow through the culvert under Welch Road, it would have to crest the Road. During the storm events of 2000 the flood water did not crest the road. It is then assumed that the 100 year flow at Welch Road is significantly less than the 265

c.f.s. as found by the FEMA report. Upon review and further analysis of the Golf Courses detention characteristics it was found that this FEMA flow did not adequately account for storage.

From the Welch Road culvert the water continues through the Glengary Creek, which outlets into South Commerce Lake and then ultimately into the Huron River. The potential development will use, just as the golf courses have, the low lying area to serve as storm water detention.

Golfview Lake Estates utilizes a large wetland, which runs parallel with the northern stretch of Duffers Lane, as on site storm water detention. During the brief history of these developments, there has been some problems involving this storm water management system. Neighbors to the north of Golfview Lake Estates on Lyniss Drive have experienced flooding from the ill constructed wetland outlet. Upon review, it was determined that the outlet of this wetland had been partially filled; the result was that the wetland could not drain to its static level in between storm events as designed, limiting its effectiveness as a detention facility.

2. Storm Water Runoff Analysis

a. Hydraulic Analysis

In 2001 and in 2003, two separate analyses were conducted. In 2001, a detailed model was developed. This model included dividing the tributary area of Carus Lake and Campbell Creek in to sub-basins and analyzing them with run-off calculations and computer modeling. These models were used to determine the amount of storage the golf courses provided in the event of a 100

year storm. This was, in turn, used to determine the peak flow rate from the golf course into Campbell Creek.

This area was remodeled using updated methods, newly developed software and the latest GIS themes. This model supported our original assessment and added more detail to the 100 year flood plain.

3. The Proposed Plan

Analysis completed in 2001 and the current results indicate that the culverts under Duffers Lane and Clubwood Drive were undersized. It was also determined that a wetland adjacent to the creek that served as Golfview's storm water detention basin, was ineffective. Further, the creek had insufficient area to transport the required flow due to fill from the adjoining lots. The developer was required to upsize the culverts the 30" by 40" elliptical culverts to 3' by 6' box culverts, to regrade and widen the exit of the detention wetland and widen and regrade the creek through Golfview Lake Estates. This work was completed in August 2002 (see Exhibit H.1).

Our analysis also indicated that two culverts placed in the Glengary Creek by individual homeowners, would need to be removed and replaced with 3' by 6' box culverts like the ones immediately upstream at Clubwood Drive and Duffer Lane. These culverts were not placed by the developer so it is unreasonable to require that he replace these culverts. It became evident when the Township applied for the Hazard Mitigation Grant Program that matching funds could be used to rectify this flooding problem. Exhibit H.1 also shows the portion of Glengary Creek that has been improved and the portions still requiring work. A portion of the second phase of the grant would go toward making these improvements.

a. Estimated Cost

The estimated cost of removing two driveway culverts and replacing them with 90 total linear feet of 3' X 6' reinforced concrete box culvert is \$101,000.00 in 2003 dollars. This cost includes replacement of the concrete and asphalt drives, along with fencing and landscape restoration. This cost also includes re-grading 500 feet of the creek.

b. Suggested Method of Financing

75% of the funding for the construction of these improvements could come from Phase II of the Township Hazard Mitigation Grant with the remaining 25% coming from the Township or the Commerce Township DDA. Another possible source of money for this project could include the residents whose culverts will be replaced.

4. Conclusions and Recommendations

After these improvements are completed, the system will be capable of handling a 100 year storm event. As mentioned previously, the large area east of Golfview Lake Estates is in a state of transition. It will be absolutely critical to design the system in a manner that will not overwhelm the measures taken recently to mitigate flooding in this area. This development could go a long way in improving water quality by designing the system in a way that slows the velocity of storm water and promotes on-site infiltration. The use of alternative building methods including, bio-swales, green roof systems and native landscapes, would help in improving surface water quality, improving the overall site aesthetic, and save money in construction and operating costs.

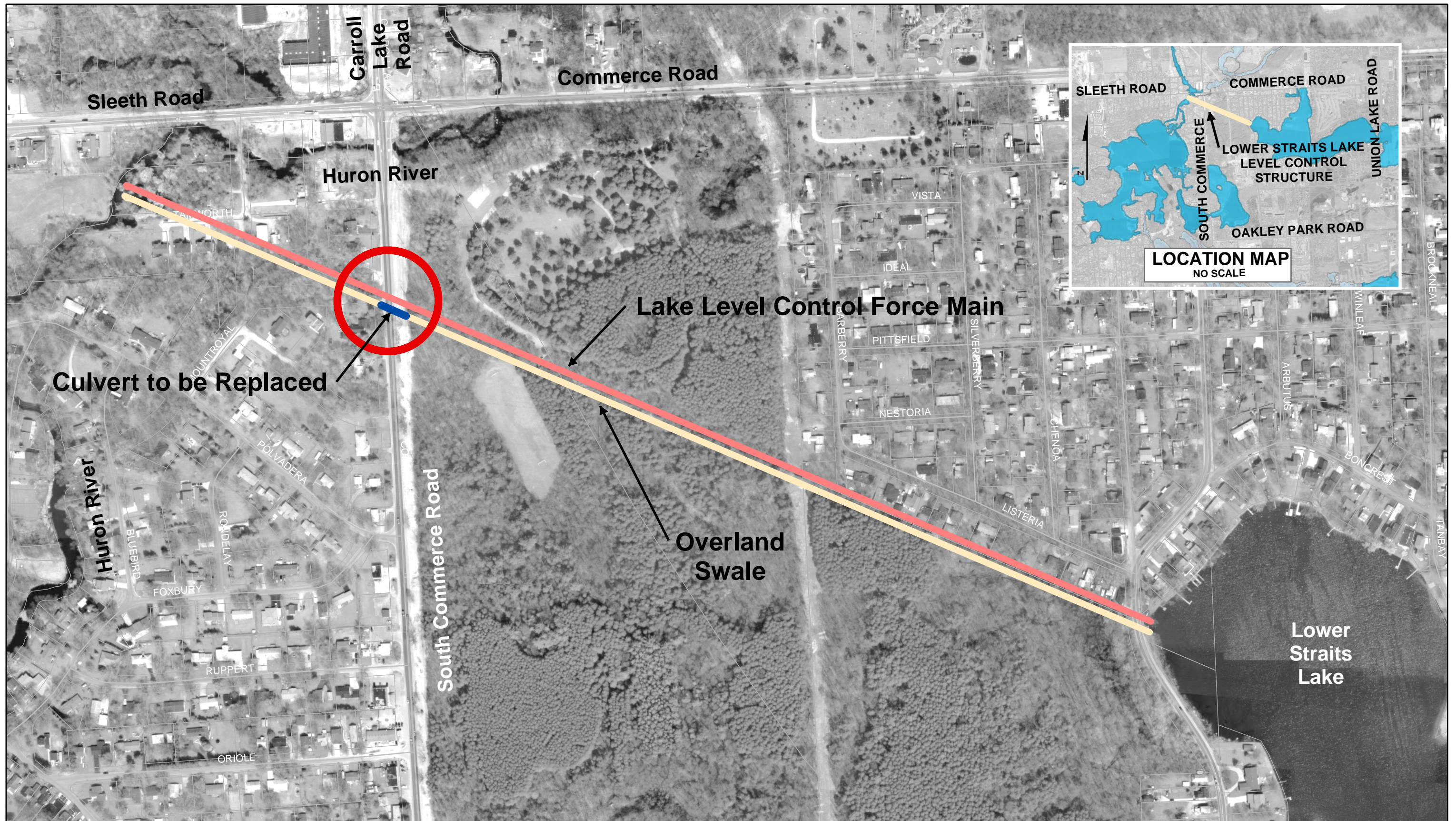
I. Problem Area - Lower Straits Lake Drainage Course

1. Introduction

Lower and Middle Straits Lake have their lake levels controlled by an overflow swale and a pump station. To maintain the desired water surface elevation during dry times of the year, the pump station is required to run, pumping water from the Huron River up into Lower Straits Lake. This forcemain is operated and maintained by the Oakland County Drain Commissioner (OCDC). When the lake level rises above the desired elevation, water spills over a control structure and flows via an overland swale into the Huron River. This overland swale runs adjacent and parallel to the force main. The swale is not operated or maintained by the OCDC. One objective of this master plan is to have the OCDC take control of this overland swale and to legally establish it as a County Drain. Associated with this overland swale is a culvert that runs under South Commerce Road. This culvert is in disrepair. It is an old stone culvert that has been modified with a corrugated metal pipe running through the downstream half of the culvert. Debris often gets lodged inside, dramatically restricting its flow and requiring maintenance personal to enter the culvert and physically remove the debris.

a. Location Description

Lower Straits Lake is located in Sections 11, 12, 13, and 14 of Commerce Township. Middle Straits Lake occupies the land directly east of Lower Straits Lake in the Township of West Bloomfield (see Exhibit I.1). The lake level control overflow structure is located at the intersection of Newton Road and Lower Straits Lake. The pump station is located on the Huron River near



Commerce Township Storm Water Master Plan:
Figure I.1
Lower Straits Lake Level Control (1" = 300')

the southwest corner of Sleeth and South Commerce Road. The forcemain and overland swale run between these two points.

2. The Proposed Plan

Two issues need to be addressed in order to insure flooding won't result from Lower Straits Lake overtopping the lake level control structure and flowing down the swale into the Huron River. They involve the OCDC operating and maintaining the overland swale and modifying the South Commerce Road culvert to handle the resulting flow.

The process for legally establishing a County Drain is straight forward and is currently in the process of being completed.

The culvert under South Commerce Road has been a long known problem. Plans to remove the old dilapidated culvert and replace it with a new properly sized culvert have been incorporated into a large sanitary forcemain project slated to be completed in 2004.

a. Estimated Cost

The estimated cost for the removal and replacement of the culvert under South Commerce Road is \$77,000.00 in 2003 dollars. This cost includes upsizing the culvert to a 70 ft long 4' X 8' reinforced concrete box culvert. This cost also includes removal and replacement of South Commerce Road, traffic control, landscape restoration, and re-grading the channel invert.

b. Suggested Method of Financing

The fees associated with the establishment of the County Drain will allow the OCDC to develop and perform a maintenance schedule on the overland swale and culvert. This yearly fee will be assessed to the same parties who pay for the operation and maintenance of the lake level control pump station and forcemain. These people include the residents and businesses that enjoy the benefit of the constant lake level of Lower and Middle Straits Lake.

A portion of the financing of this culvert work could come from Phase 2 of the Hazard Mitigation Grant, with the remainder being paid by Commerce Township through the Newton Road Sanitary Forcemain project.

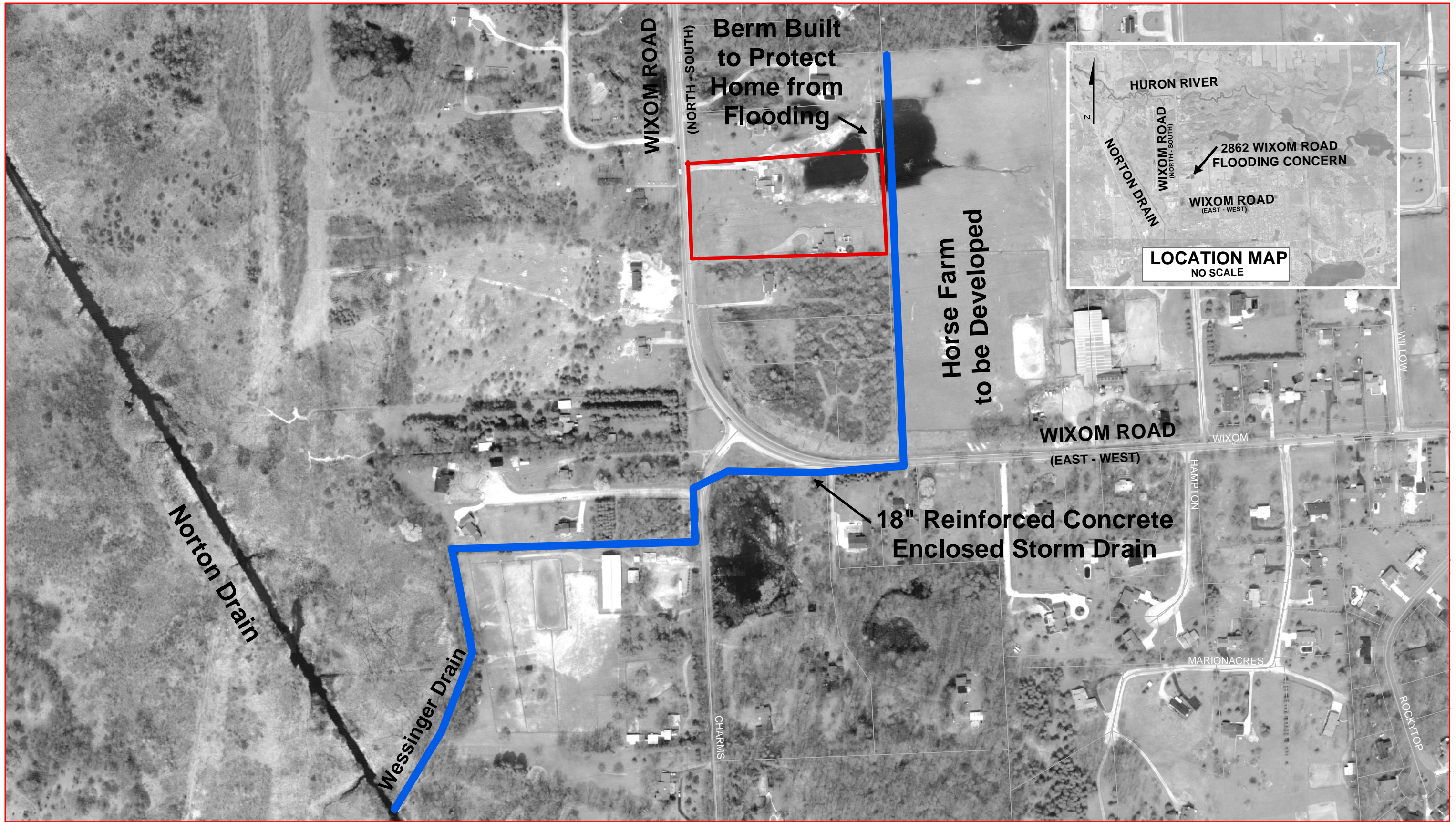
J. Problem Area - Wixom Road Parcel

1. Introduction

On Wixom Road, an individual house was built on a single lot with a walk out basement. This home was situated on the lot adjacent to a wetland. This home was built with a basement floor elevation that was too low, causing the basement to flood during significant storm events.

a. Location Description

This parcel is located at 2862 Wixom Road, in Section 19 at the western boundary of Commerce Township (See Exhibit J.1). It is located midway between Collendale and Wixom Road (east-west), on the east side of Wixom Road (north-south).



Commerce Township Storm Water Master Plan:
 Figure J.1
 Wixom Road Parcel (1" = 300')

b. Storm Water Management History

The 1.0 acre wetland is located directly behind the house. Historically, 50 acres of tributary area drained to this low lying wetland. In an effort to correct this problem, the homeowners have built a berm along their eastern property line. This has helped alleviate this homes flooding problem, but could cause problems for their eastern neighbors. The property directly to the east is a horse farm that has recently been purchased and is in the process of being developed.

2. The Proposed Plan

Located in the direct vicinity of this problem area are the upstream terminus of the Wessinger and Webb Drains. Both of these are legally established County Drains; however they have fallen into dire disrepair and require significant work to bring these drains back into functioning order. The Webb Drain flows to the north, basically traveling parallel to Wixom Road (north-south) and discharging in to the Huron River.

The Wessinger Drain is an enclosed 12" clay storm pipe. It flows in a southwesterly direction into Milford Township, discharging into the Norton Creek. This drain has been out of service for many years and it would require new storm pipe to be installed, possibly on its original alignment. This Drain seems to be the best choice to service this problem area. The Drain itself is quite short and could be put back into service with less cost than that for the Webb Drain.

a. Estimated Cost

The estimated cost of rebuilding Wessinger drain would be roughly \$325,000.00 in 2003 dollars. This would include 3,500 linear feet of 18” reinforced concrete storm pipe, bore and jacking under Wixom and Charms Roads, and all associated structures and catch basins. In this plan, the original clay pipe would be abandoned, making way for the larger diameter concrete pipe. This drain also travels through an existing well-developed street requiring extensive landscape and asphalt restoration.

b. Suggested Method of Financing

The cost for improvement to the Wessinger Drain could come from three sources: the HGMP, Commerce Township, and those parcels that benefit from the improvement and drain maintenance. The new owners of the horse farm have expressed interest to the Township of extending the Wessinger Drain north to the problem wetland. This could then serve as a storm outlet to the horse farm’s detention system in their future development. This could also control the wetlands high water elevation, protecting the residence at 2862 Wixom Road from future flooding problems.

III. The Commerce Township Storm Water Management Strategy

A. Introduction

In the past two decades, Commerce Township has experienced extensive growth. This growth has altered the hydraulic and hydrologic features of the Township. The Township chose to protect the lakes, streams, rivers, and ground water by requiring

new developments to provide on-site detention, or on-site retention, depending on its proximity to an outlet. These on-site facilities perform many important functions, including settling out sediment and particulates, promoting infiltration, and dramatically lowering the peak flow. If these facilities are designed properly, they can also provide much needed open space, wildlife habitat, and aesthetic landscape.

B. Control Storm Water Runoff with on-Site Detention/Retention Basins

Restricting the discharge of the increased runoff from new developments is an important element of the Township's current Engineering Design Standards (Exhibit L).

The primary method for restricting runoff discharge from developed sites is by means of detention or retention basins. The Engineering Design Standards establish criteria to be used in calculating allowable rates of discharge and in determining the necessity for detention or retention basins. The use of on-site storm water management basins to control runoff is a strategy that has been successfully used throughout the Township and Country for years.

Detention basins temporarily hold storm water during and after heavy rainstorms releasing the water at a slow rate so as to not overtax downstream water courses and drainage facilities. Detention basins may contain permanent bodies of water with sufficient freeboard to allow for storage above normal water levels, thus providing an attractive water amenity. Detention basins may also be dry and well drained when they are not required for storing excess rainstorm runoff. These dry basins may be used for play areas, athletic fields, or they may provide attractive open space.

Because retention basins have no direct outlet, they depend on percolation through pervious sub-soils to dissipate excess storm water. This type of basin may be normally dry, consist of low lying wetland areas, or open water.

Either type of facility, when properly designed and situated, can greatly enhance the value of any development. These basins also provide significant treatment of storm water: the basins provide a place for phosphorous laden sediment to settle out, and they provide areas where water can percolate to ground water.

A significant advantage of on-site storm water management basins is that each development is responsible for its own basin, thus the Township is usually not responsible for any costs.

Maintenance of storm water management basins, both through the construction phase of the development and then over the life of the facility, are an important concern. The Township's Engineering Design Standards require that the developer be responsible for maintenance until the development is at least 95% complete. At that point, maintenance is turned over to a homeowner's association. Appropriate documentation of the means of financing maintenance costs and a cash bond are included in the requirements.

To ensure the storm water management basins are being maintained and that the basins are functioning properly, an ongoing, regular Township inspection routine should be established. This will require that necessary staff be assigned this responsibility. The Phase II General Storm Water Permit will require such an inspection routine.

An alternate approach for providing inspection and maintenance of the storm water management basins is the establishment of a Chapter 18 Drain for each new development. If a Chapter 18 Drain is established, the Oakland County Drain Commissioner would assume responsibility for inspecting and maintaining the

storm system, including the storm water management basins. The cost for inspection and maintenance would then be assessed to either the homeowner's association or to the individual benefited properties.

C. Strategies for Maintaining and Improving Storm Water Quality

An important storm water management consideration for Commerce Township is water quality. Commerce Township is regulated by Phase II of the Clean Water Act. The Township is currently in the process of applying for coverage under the State of Michigan's General Storm Water Permit. This permit will require that the Township monitor storm water outfalls within the Township and develop regulations to maintain and/or improve storm water quality. This section provides a general discussion of storm water quality issues, and approaches the Township might take in addressing these issues.

On-site detention and retention facilities can provide a high level of storm water treatment. These facilities provide a place for sediment and other pollutants to settle out. Sediment is known to carry heavy loads of phosphorous, and phosphorous is a major water quality issue for the Huron River Watershed. Phosphorous causes algae and other plants to grow within the lakes that the Huron River flows through.

From a water quality perspective, soil erosion is a significant concern. Commerce Township and the Michigan Department of Environmental Quality provide the regulatory authority to control soil erosion and sedimentation. The Township also provides additional regulation of soil erosion and sedimentation control through its Engineering Design Standards: all new developments are required to show erosion and sedimentation controls on engineering plans. The regulatory authorities, along with the civil engineering profession, have developed "Best Management Practices" or BMP's for controlling soil erosion and sedimentation. These BMP's must be incorporated into the engineering plans. It is important for the Township to

diligently inspect and enforce each site's soil erosion and sedimentation control. The permit holder should be informed when adequate soil erosion and sedimentation measures are not in place and be given a strict timeline to correct these measures.

The Township is required to develop Storm Water Pollution Prevention Initiatives (SWPPI) as part of the Phase II regulations. SWPPI provides a list of items the Township has agreed to do in its effort to maintain and improve storm water quality.

IV. CONCLUSION AND RECOMMENDATIONS

Commerce Township is approaching the point at which the majority of its developable land has been built on. The Township took great strides to maintain the vast amount of parks and nature preserves that its citizens enjoy. The Township needs to remain committed to maintaining the water quality of its many bodies of water, including the Huron River. It is of vital importance that the Township develop an inspection system to evaluate its vast amount of on-site storm water management systems. Not only is this required by the Phase II Storm Water Regulations, but helps protect the lives and property of those living downstream.

As result of the analysis of each problem area and the subsequent cost estimates a pattern of priority emerged. It is preliminarily suggested that the projects be completed in the following order (if funds are available): Golfview Lake Estates, Lower Straits Lake / South Commerce Road Culvert, Lower Mount Royal, and Wixom Road. This is subject to change and is only a suggested starting point, the Township leadership will have an important say in when these project are completed.

The Township, through its own funds, those from the Hazard Mitigation Grant Program, and those from other sources, can take a proactive approach in mitigating its flood hazards. Innovative funding will be required to make the necessary improvements to

protect the many potentially threatened homes and property of Lower Mount Royal Subdivision. Further effort will be required to resolve the problems of Golfview Lake Estates, Lower Straits Lake Level Control, and the Wixom Road parcel flooding. Through cooperation, innovation, and diligence, these problems will be resolved, and the citizens of Commerce Township will reap the benefits.