HILLSBOROUGH COUNTY
FLORIDA

# DELANEY CREEK AREA

## STORMWATER MANAGEMENT MASTER PLAN

**Prepared for the Hillsborough County Board of County Commissioners**

**By**

**Public Works Department Engineering Division**
**Stormwater Management Section**
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# DELANEY CREEK AREA WATERSHED MANAGEMENT PLAN

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# GLOSSARY AND ABBREVIATIONS

**Aquifer** – an underground source or "river" of water; generally confined by a clay or limestone layer which contains enough saturated, permeable material to conduct water

**Bloom** – generally refers to a sudden increase in algae or other micro-organisms due to favorable growth conditions, such as high level of nutrients or suitable temperature.

**CCMP** – Comprehensive Conservation and Management Plan for Tampa Bay by the National Estuary Program

**BMP** – Best Management Practice, a strategy for improving (typically) water quality

**Confining layer** – impervious or low permeability layers generally found above and below an aquifer, these are usually limestone or clay or a mixture of both

**CWA** – Clean Water Act (United States)

**DEP** – Department of Environmental Protection (Florida)

**DOM** – dissolved organic matter

**Ecosystem** – an inter-related group of plants and animals that are distinct

**DCA** – Delaney Creek Area, encompassing Delaney, Archie and North Archie Creeks, the study area

**EMC** – event mean concentration

**EPA** – Environmental Protection Agency of the United States

**EPC** – Environmental Protection Commission of Hillsborough County

**Exotic Species** – a plant or animal that does not historically occur in Hillsborough County and is generally introduced by man either on purpose or inadvertently; see also Nuisance Species

**FAC** – Florida Administrative Code

**Fragmentation** – the carving up of an ecosystem into smaller pieces or fragments that usually can not provide all the advantages of the original larger system

**FS** – Florida Statute

**GIS** – Geographical Information System

**Groundwater** – water, below the water table, that fills all the open areas of the underlying material

**Herbaceous** – a plant that contains no woody parts or a plant community that contains no woody trees or shrubs

**Hydric soil** – a soil that is saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile that favor the growth and regeneration of wetland (hydrophytic) vegetation.

**Hydrology** – the study of water in the natural environment

**Impervious** – a material, such as concrete or asphalt, that does not allow water (or air or roots) to naturally penetrate into the soil

**Karst (geology)** – an area underlain by limestone which has dissolved to some degree and forms depressions, sinkholes or small basins

**LDC** – Land Development Code for Hillsborough County

**Listed Species** – plant or animal species that are designated (listed) as endangered, threatened or species of special concern by the federal and/or state government and therefore receive special protection under the law

**Littoral Shelf** – the ledge, usually in a lake, where the water level is shallow enough to allow the growth of either emergent or submerged plants
**LOS** – Level of Service
**MFL** – Minimum Flows and Levels
**mg** – milligram or one-thousandth of a gram (1 x $10^{-4}$)
**mgd** – million gallons per day
**NEP** – National Estuary Program
**NGVD** – National Geodetic Vertical Datum; a standardized method of measuring elevation
**NPDES** – National Pollutant Discharge Elimination System
**Non-point source pollution** – diffuse pollution that enters is from multiple, rather than single,sources and cannot be easily trace, such as acid rain or runoff from paved roads
**Nuisance Species** – generally referring to plants; a plant that is native or naturally occurring in Hillsborough County but which is highly invasive or otherwise disruptive to natural communities
**Permeability** – the ability or rate at which water or other liquids can pass through a material, such as water passing through various layers of soil.
**Physiography** – the study and characterization, of the physical characteristics of an area of land such as topography, soil types, land use, etc.
**PLRM** – pollutant loading and removal model
**Point source discharge** – pollution originating from a specific area and usually discharged by an outfall pipe as from an industrial area or a stormwater drain from a roadside
**Receiving Body** – the downstream waterbody that gets water from another contributing waterbody, i.e. Tampa Bay is the receiving body for the Hillsborough River
**Stormwater Runoff** – water that begins as rain or irrigation that flows over land; as a general rule as the water picks up nutrients, sediments and other chemical during this overland flow.
**SCS** – United States Soil Conservation Service; now known as the Natural Resource Conservation Service (NRCS)
**SWFWMD** – Southwest Florida Water Management District
**TBEP** – Tampa Bay Estuary Program
**TBW** – Tampa Bay Water (formerly WCRWSA)
**TMDL** – Total Maximum Daily Load, the sum of allowable discharges that can enter a water body or water shed area; it includes point and non-point sources as well as a margin of safety.
**TSI** – Trophic State Index, a measure of water quality using total phosphorus concentration, chlorophyll concentration, nitrogen concentration and alternately Secchi Disk depth
**TSS** – Total suspended solids or the amount of particles in a unit of water
**Watershed** – the geographic region that contributes drainage to a waterbody, such as a river or lake
**WCRWSA** – West Coast Regional Water Supply Authority (now TBW)
***ug*** – microgram or one millionth of a gram (1 x $10^{-6}$)

# EXECUTIVE SUMMARY

The Delaney Creek Area (DCA) watershed drains approximately 33.7 square miles the eastern portion of Hillsborough County. The DCA watershed is generally bordered by Valrico Road on the east, Hillsborough Bay on the west, the CSX railway on the north and Riverview Drive on the south. The watershed is divided into four smaller units or subwatersheds within the project area. These are the Delaney Creek, Delaney Pop-off Canal, Archie Creek and North Archie Creek subwatersheds. The runoff of the entire watershed ultimately discharges into Tampa Bay through Hillsborough Bay. The watershed can be characterized as urban in the northern sections of Brandon, Clair Mel and Progress Village and somewhat rural in its southern and western portions. Land uses are varied. Of the total 21548.80 acres in the watershed, residential land uses constitute the largest portion at about 22.63% or 4876.142 acres. With almost the same total, are the combined natural systems areas with 22.62 % or 4874.516 acres. This total can be further broken down into upland forests - 2275.098 acres or 10.56 %, wetlands - 1446.748 acres or 6.71 % and open water - 1152.67 acres or 5.35 %. Next comes agriculture with 17.32 % or 3732.451 acres. Open land makes up 15.46 % or 3330.668 acres. Combined commercial, light industrial and institutional land uses equal 2437.371 acres or 11.31 %. Highways and utility corridors comprise 6.26 % or 1349.148 acres. Extractive/mining land uses occupies 803.308 acres or 3.73 %. And finally, recreational land uses comprise 145.158 acres or 0.67 %.

The study is broken up into two broad categories, flood control/water quantity and natural systems/water quality. One purpose of the flood control portion of the study is to develop a computer simulation model of the Delaney Creek Area watershed under current conditions. The objective of the plan is to determine level-of-service for existing stormwater infrastructure and to develop alternatives and recommendations for improving the conveyance system to eliminate the flooding situation.

## FLOOD CONTROL

Hillsborough County developed initial reports of Delaney Creek Stormwater Management Master Plan in 1986 and Archie Creek/Coastal Areas and Buckhorn Creek Watershed Stormwater Management Plan in 1988. The 1986 and 1988 SMMPs prepared by Ghioto, Singhoffen & Associates, Inc. for the SWFWMD Alafia Basin Board paved the way for the current study. In addition to the data collected during the preparation of the 1986 and the 1988 reports, drainage improvements completed by the County between 1986 and present have been revised as well as to take into consideration the entrance and exit headloss of the system.

The peak stages computed by the model were calibrated and verified with the USGS gage station for the Delaney Creek main channel and the downstream side of 78th Street of the North Archie and Archie Creek main channel. The development of the proposed watershed management plan also includes the future Falkenberg Road extension, the Cargill gypstack addition and associated channel diversion of North Archie Creek, and the Canterbury Lakes Regional Detention Facility improvements based on approved construction plans.

There are several target areas for the recommended improvements in this study based on model prediction, verification of field investigation and the two public meetings during the development of the watershed management plan:

## Delaney Creek Subwatershed

- Recommended improvements for the Delaney Creek main channel include the addition of a 8' x 12' concrete box culvert at U.S. Highway 41, channel cross section improvement from the Bay to Causeway Boulevard, and structural upgrades at Maydell Drive. These improvements will lower the water surface elevation between U.S. Highway 41 and Causeway Boulevard during the 25-year design storm event and will help in reducing the tailwater conditions for Clair Mel City which will enhance the County's completed projects.

- The Tributary "A" system recommended improvements include channel improvements throughout the whole length of the tributary and upgrading the entire drainage system at Maydell Drive.

- The Clair Mel City system recommendations include upgrading structures at Tidewater Trail and Robindale Road for Lateral "A" and Tidewater Trail and the two crossings of Rideout Road. In addition, regrading the channels for both Lateral "A" and Lateral "B" are proposed.

- The business area of Bay Plaza will have a structural upgrade at Palm River Road and an additional box culvert under Adamo Drive.

- The Heather Lakes subdivision will have a structural upgrade of a dual 38" x 60" ERCP at all driveway crossings of the ditch on the north and south side of Lumsden Avenue from Pauls Drive to Kings Avenue.

## Delaney Pop-off Canal Subwatershed

- The main channel will have a structural upgrade of a 6’ x 10’ concrete box culvert at Old U.S. Highway 41, a dual 72” RCP at 78$^{th}$ Street and the addition of a 5’ x 8’ concrete box culvert at Madison Avenue. Channel improvements are recommended with new cross sections approximately 1650 feet south and 1700 feet north of Madison Avenue. Also, cross section channel improvements downstream and upstream of 78$^{th}$ Street are recommended.

- The area of Sanson Park will benefit from the pond that is proposed pond to be constructed just south of Sanson Park. A new subdivision called Canterbury Lakes will have a 50 acre detention pond to collect its own and a portion of Sanson Park’s runoff to alleviate the flooding problems. Also, channel improvements are recommended behind the back lots of Libby Lane.

- The Fortuna Acres subdivision will have its entire conveyance system upgraded with a 3.5’ x 6’ concrete box culvert at Palm Drive and a 3’ x 3.5’ concrete box culvert at a driveway located west of 74$^{th}$ Street South. In addition, the channel will be improved with new cross sections between 74$^{th}$ Street and Palm Drive and from Palm Drive to the Fortuna Acres pond. The Fortuna Acres pond will have a 25 foot outfall weir installed that will discharge into the Delaney Pop-off Canal near Madison Avenue.

- Evergreen Estates will have a structural upgrade of a 4’ x 8’ concrete box culvert at U.S. Highway 41. Also, the channel will be improved with new cross sections approximately 600 feet upstream and 2700 feet downstream of the upgraded structure at U.S. Highway 41.

## North Archie Creek Subwatershed

- The Main channel will have a structural upgrade at U.S. Highway 41 by adding a 5’ x 10’ concrete box culvert.

- A dual 60” RCP system will be constructed under Endive Avenue to connect with Tributaries “B” and “A” at 78$^{th}$ Street.

- A bypass channel will be constructed from the outfall of Tributary “A” at the Main channel to meet with 78$^{th}$ Street near an office complex. The structures under this location of 78$^{th}$ Street will be upgraded to dual 60” RCPs.

## Archie Creek Subwatershed

- The structure under 78th Street just south of the TECO right-of-way will be upgraded to a 36" RCP. Also, 400 feet of the channel downstream of the upgraded structure will be improved.

- The structures under Mint Julip Drive in the Ashley Oaks subdivision will be upgraded to 36" RCPs and channel improvements will occur about 3375 feet downstream of Mint Julip Drive. In addition, the structure under Krycul Avenue will upgrade to a 42" RCP.

In conclusion, these proposed improvements should achieve the target 25-year/24-hour Level of Service B along the major conveyance systems of the Delaney Creek Area watershed.

# WATER QUALITY/NATURAL SYSTEMS

The water quality/natural systems portion of the plan evaluates the existing conditions for both criteria. Water quality information was gathered primarily from the Environmental Protection Commission's (EPC) sampling data that has been done on Delaney Creek since 1976. In the Florida Department of Environmental Protection's (FDEP) 1996 305b report, Delaney Creek was rated as having the worst water quality of any stream in the Tampa Bay watershed. This was no longer the case in the FDEP report two years later; however, it did not indicate where the stream presently stands. Review of EPC's data shows that there is a steady and slight improvement of the creek's water quality. This is probably directly attributable to the implementation of wetland protection and stormwater treatment practices instituted since 1984.

Another measure of water quality is the Trophic State Index (TSI). This system is used to directly compare one stream to another using the parameters of chlorophyll a, total phosphorus and total nitrogen. A TSI less than 45 indicates "good" water quality, between 45 and 60 is "fair" and greater than 60 is considered "poor". For years where the TSI could be calculated, it was in the poor range, up until 1996 and 1997 when the TSI was able to climb up into the "fair" range. This trend appears to be continuing on a trend of improving water quality.

Coliforms continue to be a problem in the watershed and this is not too surprising given the amount of dairies and septic tanks found within the basin. Water quality areas of concern are the protection of the watershed's lakes and streams through education and regulation. Low impact development measures should be explored as well. The County should continue in its efforts to "hold the line" on nitrogen loadings to the Bay.

Recommendations include:

- The removal of vegetation and excavated soils from the stormwater system when the County is doing its maintenance in the watershed's ditches and streams will remove a source of pollutant loading, especially nitrogen to the Bay.

- Any reshaping of channels should include the creation of gentler side slopes to facilitate mowing/vegetative removal and to decrease the possibility of erosion.

- Stormwater ponds built by the County should employ the SWFWMD's Conservation Method of stormwater treatment that employs a permanent pool and increased residence times.

- The STREAMWATERWATCH program should be used to assist in the development of specific event mean concentration values that can be used to verify the water quality computer modeling that was employed in this plan.

- Water flow information needs to be collected in conjunction with the EPC's data to further refine the estimation of pollutant loads. This should be done in partnership with EPC and the United States Geological Survey or the Southwest Florida Water Management District.

- Along with holding the line on nitrogen, the re-establishment of oligohaline habitat is a goal of the TBEP. At least one five acre project should be undertaken every five years to aid in this restoration.

- Adopt-A-Pond equipment should be for small-scale restoration projects, if available.

- A study should be undertaken to identify areas where coliform bacteria will be a high risk and develop a systematic plan to treat these "hot spots".

- Assimilative capacity studies should be conducted on the watershed's major lakes and this information should be used to develop lake management plans.

The evaluation of natural systems is the second portion of the environmental part of the plan. Some natural systems such as sand pine scrub have been completely eliminated from the watershed. This is due to the ease of development of this ecosystem for citrus and housing due to the lack of wetlands and the presence of a low water table. Overall, natural systems have declined to around 5949.42 acres or 27.61% of the watershed, if some of the rangeland land uses are included. The only "natural system" type that has increase in acreage is the open water category that has increased from 363.15 to 1152.67 acres, primarily through the creation of borrow pits/reservoirs. Listed species also fall into this section. Because most of the critical upland habitat such as sand pine scrub and sandhills have been eliminated in the watershed, most of the listed species are those that can utilize the remaining wetland areas such as the long-legged wading birds - herons, egrets, ibis, limpkin, spoonbill, wood stork and sandhill crane. Several estuarine species are also included - brown pelican, American Oystercatcher, black skimmer, least tern and West Indian manatee. The prominent reptiles include indigo snake, gopher turtle and American alligator. There is a possibility of thirteen listed plants in the watershed, three ferns, three orchids, two lilies, two bladderworts, an aster, a clubmoss and a cactus. The County's ELAP Program has bought one small parcel in the watershed, approximately 7 acres. Much of the mapped Significant and Essential Wildlife habitat is in the coastal or western portion of the basin. Areas of concern for natural systems are restoring upland habitat and preserving the remaining natural systems.

Recommendations include:

- Expanding existing programs such as the Pepper Busters and the Adopt-A-Pond program to assist in the removal of nuisance and exotic vegetation in the watershed.
- Initiate a control plan for the nutria that have been observed in the watershed. These highly destructive aquatic rodents should be controlled while their numbers are still relatively small.
- Undertake a project to restore ten acres of ecologically significant uplands every five years.
- Take advantage of less than optimal habitat for listed species in the watershed.
- Design a stormwater treatment/habitat restoration project for the Madison Avenue site that ELAPP presently has under its consideration.
- Develop a GIS based habitat tracking system to assist in the development of habitat corridors using ELAPP parcels and wetland mitigation bank or areas.
- The borrow pit in subbasin 290500 in the Archie Creek subwatershed has been shown to be an important stop-over area for shorebirds migrating through the watershed. The County should explore the possibility of acquiring the parcel and managing it for shorebirds and stormwater treatment.

# WATER QUALITY

Water supply is another aspect of the environmental plan. Recommendations include:

- Consideration of aquifer recharge potential when siting stormwater treatment facilities.

- The use of injection wells to slow or stop the saltwater intrusion into the freshwater aquifers. The use of potable, reclaimed and treated stormwater should be considered.

- The County's LAKEWATCH and STREAMWATERWATCH programs should encourage water conservation and reclaim water reuse.

# POLLUTANT LOADING AND REDUCTION MODEL

The environmental portion of this plan also employs a Pollutant Loading and Removal computer model (PLRM) to estimate the pollutant loading on the subbasin level and to determine the water quality treatment level of service (WQTLOS). The model predicts loadings for all the National Pollutant Discharge and Elimination System (NPDES) parameters - biological oxygen demand (BOD), total suspended solids (TSS), total Kjeldahl nitrogen (TKN), nitrates/nitrites ($NO_x$), total nitrogen (TN), total phosphorus (TP), total dissolved phosphorus (TDP), oil and grease, cadmium (Cd), copper (Cu), lead (Pb) and zinc (Zn).

The model first figures the load for all subbasins as if they were not receiving any stormwater treatment. Next the actual stormwater best management practices, if any, are determined for each subbasin. This information is entered into the model and net loads are calculated. Next the model calculates the loading for the watershed, assuming that all the subbasin are in the benchmark condition, untreated low to medium density residential land use. This result is compared to the net loads and a ratio is created. This ratio is then used to assign the WQTLOS. One lesson learned by using the model is the impact of impervious area on the watershed. It has been shown that when 10 to 15% of a watershed is covered by impervious structures, water quality begins to seriously degrade.

Recommendations include:

- The development of a method to track the amount of impervious surface in the watershed and explore the possibility of reducing some of the impervious area required to be built in the Land Development Code.

- Work with the Planning Commission and the SWFWMD to standardize their respective land use designations.
- The model should be continuously updated with "as-builts" submitted in electronic format by the developer.
- Expand the number of land use categories that the PLRM can analyze. This is especially important in the agricultural land use where there can be a wide range of loadings due to the type of activity.

## MAINTENANCE AND MONITORING PLANS

Finally, the plan includes a maintenance plan and a monitoring plan. The maintenance plan uses the Community Rating System as its basis. By concentrating on these issues, it is hoped that the County and its citizens will be able to benefit by lowering the flood insurance premiums for the County. The maintenance plan describes current maintenance program elements and gives an overall program assessment.

Recommendations include:

- The development of an inventory and mapping system to assist in the planning and scheduling of maintenance activities.
- Incorporation of the inspection and maintenance records into the inventory system.
- Increase the County's efforts to fully staff the budgeted and approved positions.
- Implementation of the use of the updated Hansen system and the concurrent revision of maintenance standards.
- Consideration of developing a leasing program for additional equipment that can be shared by the various maintenance units.
- Expand public education to inform the public about maintenance zones and schedules.
- Aggressively enforce the requirements of the County's NPDES permit regarding illicit discharges, which includes the development of an in-house training program for inspectors.

- Continue to monitor facilities not owned by the County and notify the owner as to needed maintenance (FDOT, railroads, etc.).

# INTRODUCTION

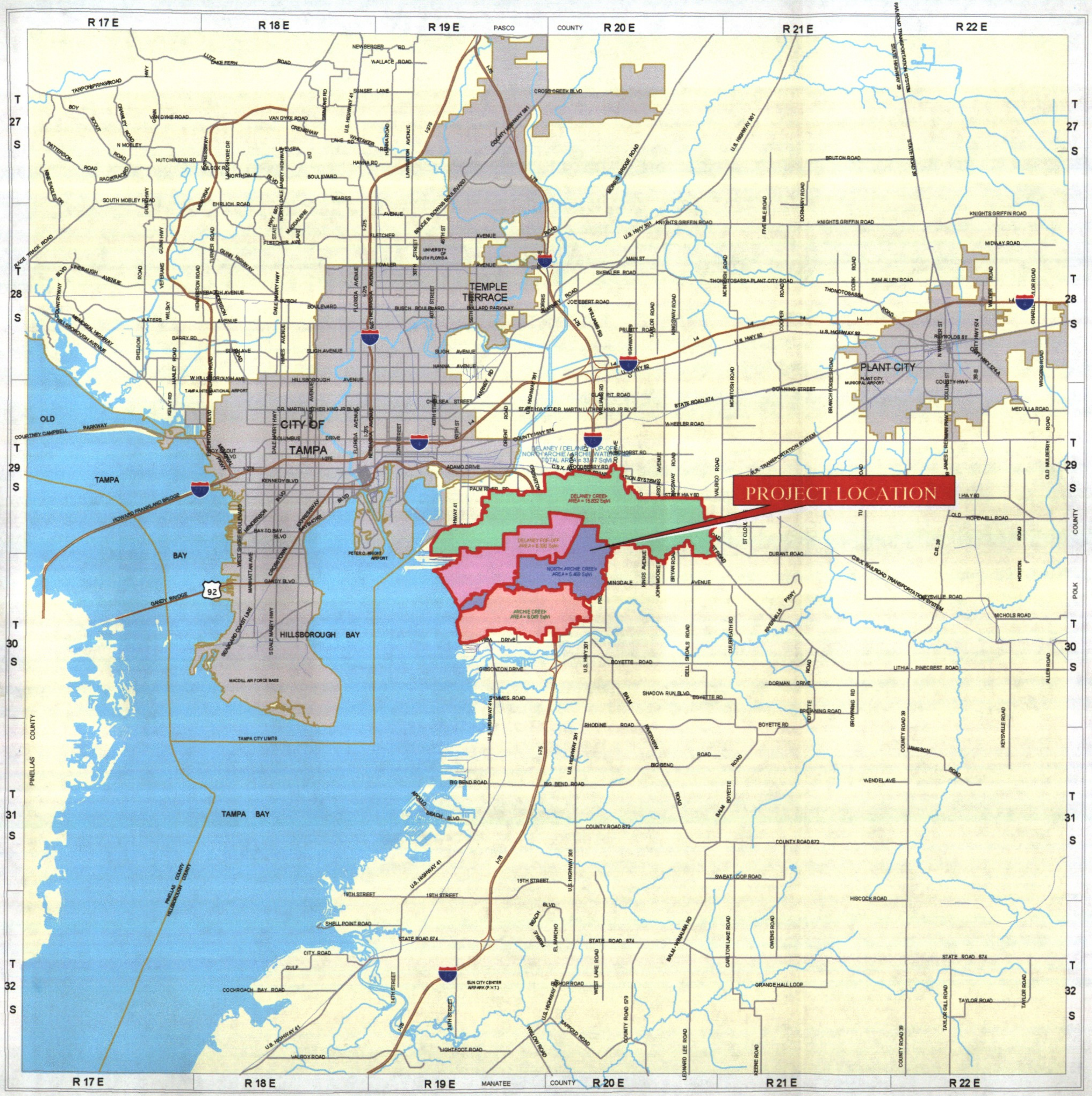
This report was prepared by the Stormwater Management Section of the Hillsborough County Public Works Department to provide a brief overview of existing flood control and environmental conditions within the Delaney Creek Area (DCA) watershed and to allow for informed decision-making when evaluating specific stormwater projects. Environmental issues associated with the proposed watershed management plan's flood control projects and general recommendations to address watershed areas of concern are also discussed.

## 1.1 OVERVIEW

The DCA watershed lies in the central portion of Hillsborough County. The DCA watershed has several conveyance outfalls and three boundaries within the project area. The watershed is separated into four subwatersheds. These subwatersheds are Delaney, Delaney Pop-off Canal, North Archie and Archie Creek.

The watershed is located in central Hillsborough County on the eastern shore of Hillsborough Bay, in an area in which a number of land and water management projects are currently being addressed by state, regional and local government agencies. The watershed can be characterized as a mix of urban and industrial / commercial land uses and contains approximately 33.7 square miles or about 21,500 acres (see Figure 1-1).

The watershed is generally bounded on the north by Palm River Road and the CSX railway, to the west by Hillsborough Bay, to the east by Valrico Road and to the south by an imaginary line approximately ½ to ¼ of a mile north of the Alafia River to the area of Buckhorn Springs and then east along the dividing line between Townships 29 and 30 in Range 20. Ultimately, water from this basin discharges into Hillsborough Bay of Tampa Bay via Delaney, Archie, and North Archie Creeks and the Delaney Creek Pop-off canal. Both Delaney and North Archie Creeks have been highly channelized to alleviate flooding in the upper reaches of the creeks, primarily in the Brandon and Progress Village areas. In 1996, the Florida Department of Environmental Protection described Delaney Creek as having the worst water quality of all tributaries emptying into Tampa Bay. However, the same study indicated that trends in the creek's water quality were improving.




# DELANEY CREEK AREA STORMWATER MANAGEMENT MASTER PLAN SEPTEMBER 2000

## LEGEND

- DELANEY CREEK AREA
- MAJOR ROAD
- RAIL ROAD
- MINOR ROAD
- CITY BOUNDARY
- WATER FEATURES

FIGURE 1-1
PROJECT LOCATION MAP

Hillsborough County
Florida

Department of Public Works
Engineering Division
Stormwater Management Section

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The Delaney Creek subwatershed originates at a point approximately 4,000 feet north of Paul's Drive/Causeway Boulevard (S.R. 676) intersection and flows west approximately 8 miles to eventually discharge into Hillsborough Bay. The subwatershed has interconnection points with the Delaney Pop-off Canal subwatershed.

The Delaney Creek Pop-off Canal subwatershed extends east to about U.S. Highway 301. The conveyance system consists of man-made ditches with no evidence of natural channel sections and generally flows south and west from U.S. Highway 301 to Hillsborough Bay. Major road crossings include U.S. Highway 301 at the eastern extremity, 78th Street near the middle, Madison Avenue (S.R. 676A) and U.S. Highway 41 at the western extremity. This subwatershed has interconnection points with Delaney Creek and North Archie Creek subwatersheds.

The North Archie Creek subwatershed extends east to Providence Avenue and north to the Lee Roy Selmon Expressway (formerly known as the Crosstown Expressway). This watershed is similar to the Delaney Creek Pop-off Canal subwatershed in that it is drained by a system of man-made ditches and flows in a south and west direction to Hillsborough Bay. Some improvements and extensions to the ditch system have been made in the eastern portions of the watershed as a result of the Interstate 75 and U.S. Highway 301 construction. A portion of North Archie Creek west of 78th Street has been relocated and expanded by Gardinier, Inc. (now known as Cargill Fertilizer, Inc.). This subwatershed has interconnections between the Delaney Pop-off Canal and Archie Creek subwatersheds.

The Archie Creek subwatershed generally lies east of Hillsborough Bay, north of Riverview Drive and west of U.S. Highway 301. It is divided approximately into thirds by 78th Street and Interstate 75. The watershed is drained by a system of man-made ditches from east to west into Hillsborough Bay. A notable feature of this watershed is Cargill Fertilizer, Inc.'s large agricultural-chemical complex located west of 78th Street and east of U. S. 41. Cargill Fertilizer, Inc. has a 326-acre gypsum field to the north of the creek and south of the 238-acre cooling ponds (waste water retention pond system) that will be expanded.

The climate in Hillsborough County can be characterized as subtropical. The average annual rainfall is approximately 52 inches. The wet season is approximately four months long during the summer, usually beginning in June and ending in September. The summer is generally hot and humid with daily high temperatures in the 90's. Afternoon thunderstorms of high intensity and short duration are common during the wet season. Winter temperatures range from typical lows in the 40's (°F) to highs in the 70's (°F).

In general, soils in the basin's western, coastal segment are designated as poorly drained soils according to the classification system developed by the United States Soil Conservation Service (SCS) for Hillsborough County. They are considered poorly drained in the watershed's central region. The better-drained soils occupy the higher, eastern portions of the watershed. The DCA watershed is contained within the Gulf Coast Lowlands portion of the Midpeninsular Zone, one of the three geomorphic divisions of Florida (White, 1970).

Existing land uses within the watershed boundaries are diverse and include several large commercial malls, office parks, light industries, a major port facility, major and minor roadways, residential subdivisions, a golf course and numerous types of agricultural activities. In addition, the DCA watershed contains commercial and residential sites. A few of these major urbanized locations are as follows: Evergreen Estates, Progress Village, Sanson Park, Pavilion, Waterford, Crescent Park, Lake St. Charles, Parkway Business Center, Cargill and Starlite subdivisions.

Twenty-six projects with County vesting or Development of Regional Impact (DRI) status lie wholly or partially within the watershed. It is expected that the majority of land use changes will center on the conversion of the remaining agricultural and open land areas into mixed urban residential and commercial land uses.

While there have been no long term water quality studies on any of the watershed's creek systems or any other waterbody in the basin, information for this report was gathered from a number of governmental agencies that do water quality sampling on some of these waterbodies. Currently, the Hillsborough County LAKEWATCH program has several volunteers on lakes throughout the watershed; however at the present time, no volunteers for the STREAMWATCH program exist.

Because some of the area was developed prior to the establishment of the majority of present day environmental laws, large blocks of the watershed lack stormwater treatment systems. Even though this development started early, large areas of natural systems can still be found within the watershed. The majority of these areas are around the watershed's lakes, streams and on the coast. Because of this location, the expected listed species will be primarily wading birds, which can still use the wetland areas. Areas of Significant or Essential Upland Habitat as defined by the Hillsborough County Land Development Code (LDC) exist in the southwestern portion of the watershed. The natural areas that do exist have had significant habitat loss due to at least three factors. They are direct degradation and fragmentation by development and the introduction of exotic and invasive plants and animals.

The engineering firm of Ghioto, Singhofen and Associates, Inc. developed the previous Stormwater Management Master Plan (SMMP) for the Archie Creek watershed, in 1986. The current model and report are based on survey information provided by the 1986 report along with later surveys (1996 and 1999 performed by Hillsborough County Survey Department). The subbasin delineation was based on the latest available Southwest Florida Water Management District (SWFWMD) aerials with contours and in conjunction with as-built or permitted construction plans.

Since the completion of the 1986 Archie Creek and Buckhorn Creek Stormwater Management Master Plan, the area has experienced a high volume of commercial and residential development. Some of these developments are the Falkenburg Road extension, the Lake St. Charles subdivision, the Parkway Business Center, Pavilion Commercial Center and various commercial developments along 78th Street.

# 1.2 PURPOSE AND SCOPE

The objective of this study is to develop an existing condition model for the DCA watershed, as well as develop a Stormwater Management Plan to the 1986 report. The plan shows the Level Of Service (LOS) analysis for the existing flood conditions as well as water quality treatment and evaluates potential improvements to improve these Levels Of Service.

## 1.2.1 FLOOD CONTROL LEVEL-OF-SERVICE

The scope of the project includes the establishment of the existing conditions for the DCA stormwater management infrastructure in terms of the computed water surface elevations and discharge rates. Hydrodynamic mathematical models are an important tool to accomplish the analysis of quantity and quality concerns that result from urban stormwater runoff and combined sewer overflows. The Delaney Creek Area Watershed study was prepared using one of these first models, the EPA Storm Water Management Model (SWMM) and its Extended Transport (EXTRAN) Block, as modified and used by Hillsborough County Stormwater Department to better accommodate the specific characteristics of this county.

In this model, six standard storm events with a 24-hour duration are used. The design storm events are as follows: 2.33 year (mean annual), 5-year, 10-year, 25-year, 50-year and 100-year storm event respectively.

The DCA major conveyance systems analysis is based on the computer model results (SWMM output files) which are graphically provided along with represented computed water surface profile. Various drainage improvements under construction or under the permitting process for construction during this study have been modeled as existing conditions and the results are reported herein.

Based on the results of the 25-year existing condition storm event, four Level of Service areas are examined for recommended improvements in the proposed condition. These improvements include structural upgrades and non-structural improvements. All of these efforts will accomplish the required Level of Service, which is Level B in the DCA area.

### 1.2.2 WATER QUALITY TREATMENT LEVEL-OF-SERVICE

To better assess the impact of stormwater runoff to the DCA systems, a pollutant-loading model is presented, to assist in the pinpointing of trouble spots both in the present and future condition.

## 1.3 REPORT ORGANIZATION

This report is organized into 19 chapters which addressing specific aspects of this study:

- Chapter 1 provides an introduction and an overview of the report along with a list of objectives.
- Chapter 2 provides an overview of the watershed including major environmental features related to stormwater management.
- Chapter 3 describes the basin’s major conveyance systems.
- Chapter 4 explains the Hydraulic/Hydrologic Model Methodology.
- Chapter 5 characterizes the Hydraulic/Hydrologic Model Calibration and Verification.
- Chapter 6 describes the existing conditions flood level of service along with analysis and designations.
- Chapter 7 discusses existing water quality conditions in the watershed.
- Chapter 8 summarizes existing conditions relating to natural systems.
- Chapter 9 discusses existing conditions affecting water supply, including ground and surface water use.
- Chapter 10 discusses the pollutant loading model and its use and results.
- Chapter 11 provides a summary of the existing conditions water quality level of service.

- Chapter 12 provides for a public meeting for input on the first draft of the watershed management plan.
- Chapter 13 discusses flood control and water quality alternatives.
- Chapter 14 provides for a second public meeting to address issues and concerns raised in the previous meeting.
- Chapter 15 lists the preferred alternatives including the proposed Levels of Service for flood control and water quality.
- Chapter 16 puts forth flood control and water quality recommendations.
- Chapter 17 discusses maintenance activities existing and proposed for the watershed.
- Chapter 18 is the proposed the maintenance plan
- Chapter 19 includes the list of recommended projects.

In addition, there are various tables, figures (consisting of illustrations, graphics, graphs, drawings, etc.), and appendices (support material, data, and information). At the end of the Table of Contents section, there is a glossary and list of abbreviations that may help the reader to understand some of the "terms of use" that are found throughout the text of this document.

# WATERSHED DESCRIPTION

## 2.1 OVERVIEW

The Delaney Creek Area watershed drains approximately 33.7 square miles or 21,600 acres in central Hillsborough County (Figure 2-1). The watershed is fairly evenly mixed between man-made land uses such as residential and commercial uses and natural systems. The watershed drains into Hillsborough Bay with four main outfalls: Delaney Creek, the Delaney Creek Pop-off Canal, Archie Creek and North Archie Creek. The eastern and northwestern portions of the watershed are primarily residential and include portions of the city of Brandon. The western and central portions of the basin contain more of the agricultural and natural areas. The watershed is generally bounded on the north by Palm River Road and the CSX railway, to the west by Hillsborough Bay, to the east by Valrico Road and to the south by an imaginary line approximately ½ to ¼ of a mile north of the Alafia River to the area of Buckhorn Springs and then east along the dividing line between Townships 29 and 30 in Range 20. Several large roads, including Interstate 75, U.S. Highways 41 and 301, State Road 60 (Brandon Boulevard) and Causeway Boulevard/Lumsden Avenue, bisect the watershed. The basin, shown in Figure 2-2, is composed of 615 smaller units or subbasins ranging in size from 0.195 to 439.068 acres. Topography varies from a high of over 90 feet National Geodetic Vertical Datum (NGVD) in the extreme southeastern and eastern portions of the watershed to a low of sea level along the coast and at the outfalls to Hillsborough Bay as depicted in Figure 2-3.

The major natural features of the watershed are Delaney, Archie and North Archie Creeks. All the watershed's drainage passes through these creeks and the Delaney Creek Pop-off Canal on its way to Hillsborough Bay. Delaney Creek is approximately 8 miles long, while North Archie Creek is approximately 5 miles long. Both streams have been highly channelized over the years, primarily as a method of flood control for the residential areas of Brandon and Clair Mel. In addition to the creeks, several large lakes occur in the watershed including: Gornto, Chapman, Tenmile, Clayton, Hendrics, Hickory Hammock and Kathy. Additionally, numerous smaller waterbodies such as Sand Pond and many borrow pits can be found. All these waterbodies are considered Class III waters with designated uses that include human recreation and the "propagation and maintenance of a healthy, well-balanced population of fish and wildlife" (Chapter 62-302.400, Florida Administrative Code).

Land uses within the watershed boundaries are diverse and include several large commercial malls, office parks, areas of light industry, major and minor roadways, residential subdivisions, a golf course, natural areas and agriculture.

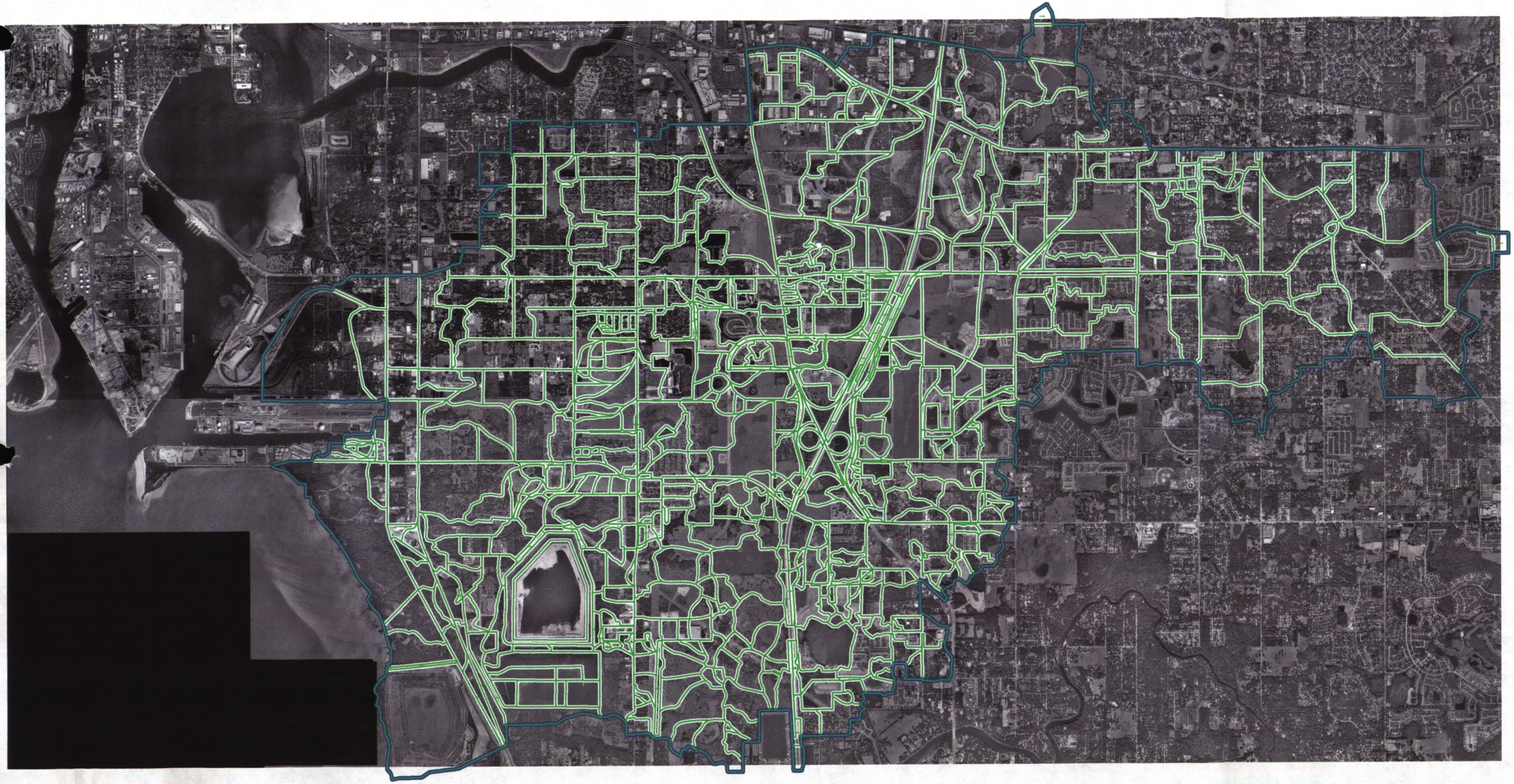

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FIGURE 2-1

**WATERSHED SUBBASIN MAP**

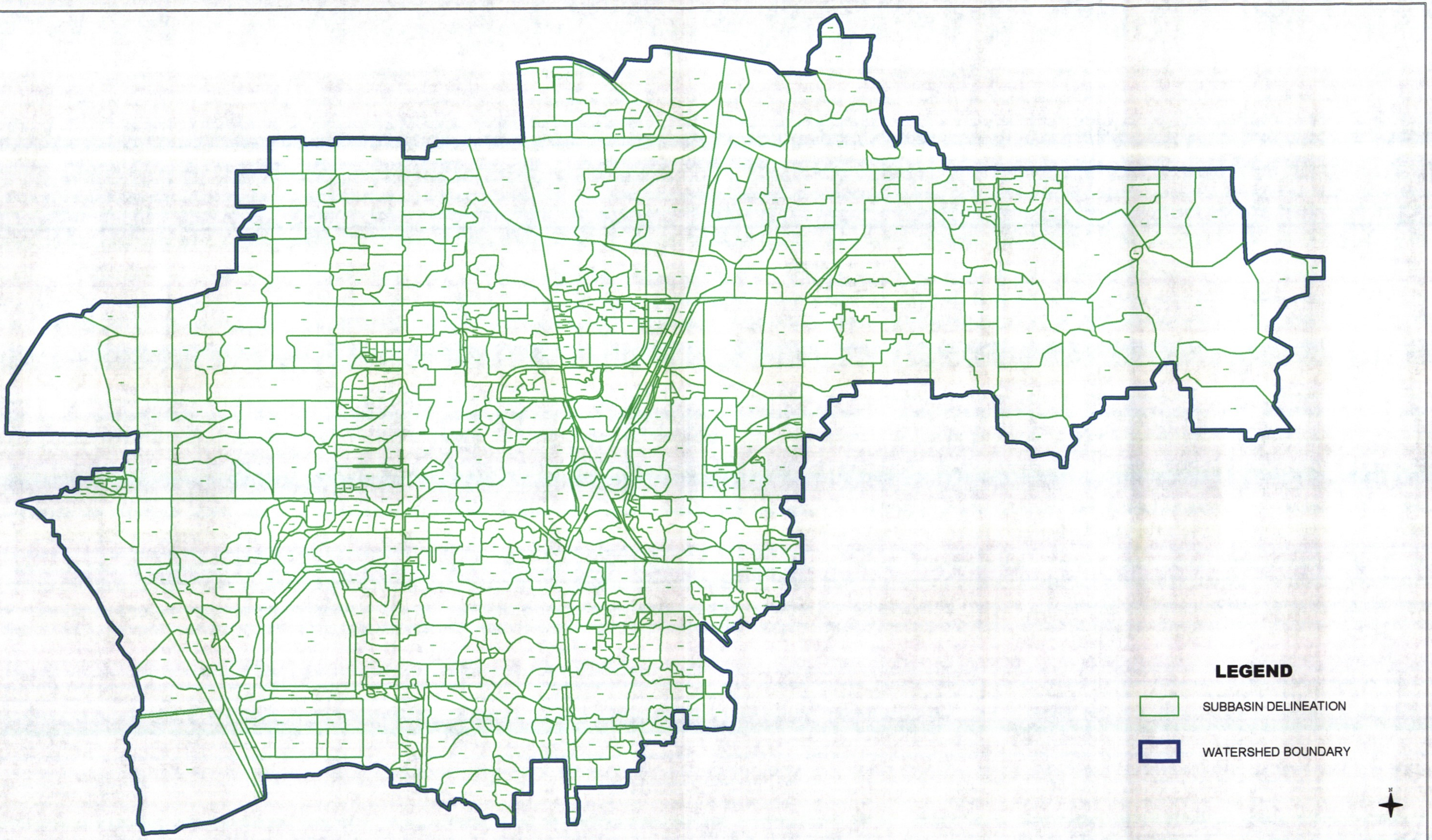


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FIGURE 2-2

**DELANEY CREEK AREA WATERSHED SUBBASIN MAP**

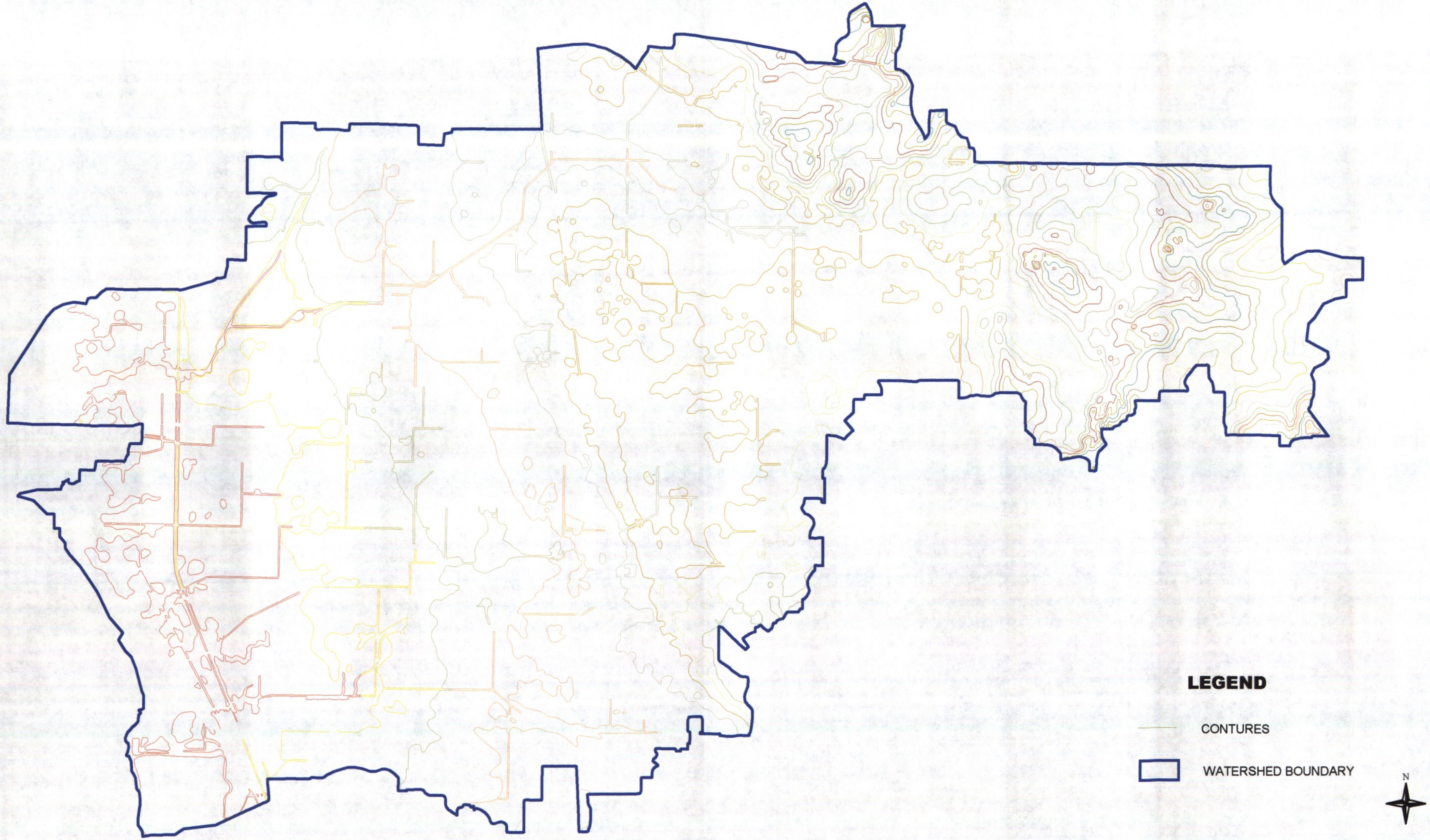


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FIGURE 2-3

**DELANEY CREEK AREA
WATERSHED TOPOGRAPHY
MAP**

# 2.2 CLIMATE

The climate of the Delaney Creek Area watershed, and for Hillsborough County as a whole, can be classified as humid subtropical. Annual average precipitation is around 52.4 inches. Approximately 60% of this total falls during the four-month rainy season that extends from June through September. This rainy season also coincides with the occurrence of most tropical storms and hurricanes. Additionally, the conditions are ripe for regular, convective afternoon and evening thunderstorms. These summer events, which can be very localized, are highly variable in both intensity and volume. The larger, normal summer storm events and those associated with tropical systems can cause flooding problems in areas where there are deficiencies in the existing stormwater or other drainage systems.

Winter rainfall is, for the most part, relatively light and generally associated with the weak cold fronts that descend from the northern part of the country and travel south through the region. However, some of the largest yearly rain events have occurred in the winter months. This is especially true in El NiZo years.

The annual mean temperature in Hillsborough County is about 72°F (Fahrenheit). The mean monthly temperature ranges from a low of approximately 60°F in January to a high of approximately 82°F in August. Typically, summer temperatures range from morning lows in the high 70's and low 80's to afternoon highs that can easily reach into the mid-90's, but rarely do they exceed 100°F. Summer humidity that ranges into the mid to upper 90's can further exacerbate the situation. Conversely, typical winter low temperatures generally range above freezing into the 40's, only occasionally dropping into the low 20's and teens. High temperatures generally reach into the upper 60's or low 70's for most of the season, especially between passages of the cold fronts.

According to the National Weather Service in Ruskin, humidity does not vary as seasonally as temperature and rainfall. The Service keeps daily records for 1 and 7 o'clock A.M. and 1 and 7 o'clock P.M. The 7 A.M. time period generally records the highest humidity with the annual average at 88% with the 1 P.M. time period recording the lowest at an average of 58%.

Evapotranspiration rates vary and limited data is available for analysis. Estimates of 39 inches per year have been reported. Viessman, et al. (1977) reports the figure to be closer to 48 inches per year. Lake evaporation data often quoted for use in Hillsborough County are those reported from Lake Alfred in Polk County, supplemented by scattered data available from the Lake Padgett weather station. Studies conducted by Tampa Bay Water estimate the lake evaporation rate to average approximately 56 inches per year.

# 2.3 SOILS

Soil distribution by type is shown in Figure 2-4. This information was developed based on Geographical Information Systems (GIS) coverages developed by SWFWMD. Much useful information, such as drainage classification, percent slope, water table depth, permeability, natural vegetation and potential uses for development and agriculture, can be ascertained by consulting the Soil Conservation Service's manual for Hillsborough County for each particular soil type.

These soil types can be arranged into four groups based on their runoff potential; these types are shown in Figure 2-5. The hydrologic groups are commonly used in watershed planning to estimate infiltration rates and moisture capacity. Soil properties that influence the minimum rate of infiltration obtained for bare soil after prolonged wetting are: depth to seasonally high water table, intake rate and permeability, and depth to a layer or layers that slow or impede water movement. The major soil hydrologic groups are:

- Group A (low runoff potential) soils have high infiltration rates and a high rate of water transmission even when thoroughly wetted. They have typical infiltration rates of 10 inches/hour when dry and 0.50 inches/hour when saturated. Soil types found in the Delaney Creek Area watershed that fall into this group include: Archbold fine sand (3), Candler fine sand (7), Candler-Urban land complex (9), Fort Meade loamy fine sand (18), Gainesville loamy fine sand (19), Kendrick fine sand (23), Lake fine sand (25) Orlando fine sand (35) and Tavares-Millhopper fine sands (53 & 54).

- Group B (moderate runoff potential) soils have moderate infiltration rates when thoroughly wetted and a moderate rate of water transmission. They have typical infiltration rates of 8 inches/hour when dry and 0.40 inches/hour when saturated.

- Group C (moderately high runoff potential) soils have low infiltration rates when thoroughly wetted and a low rate of water transmission. They have typical infiltration rates of 5 inches/hour when dry and 0.25 inches/hour when saturated. Soil types found in the Delaney Creek Area watershed that fall into this group include Pomello fine sand (41), St. Augustine-Urban land complex (45), Seffner fine sand (47), and Zolfo fine sand (61).

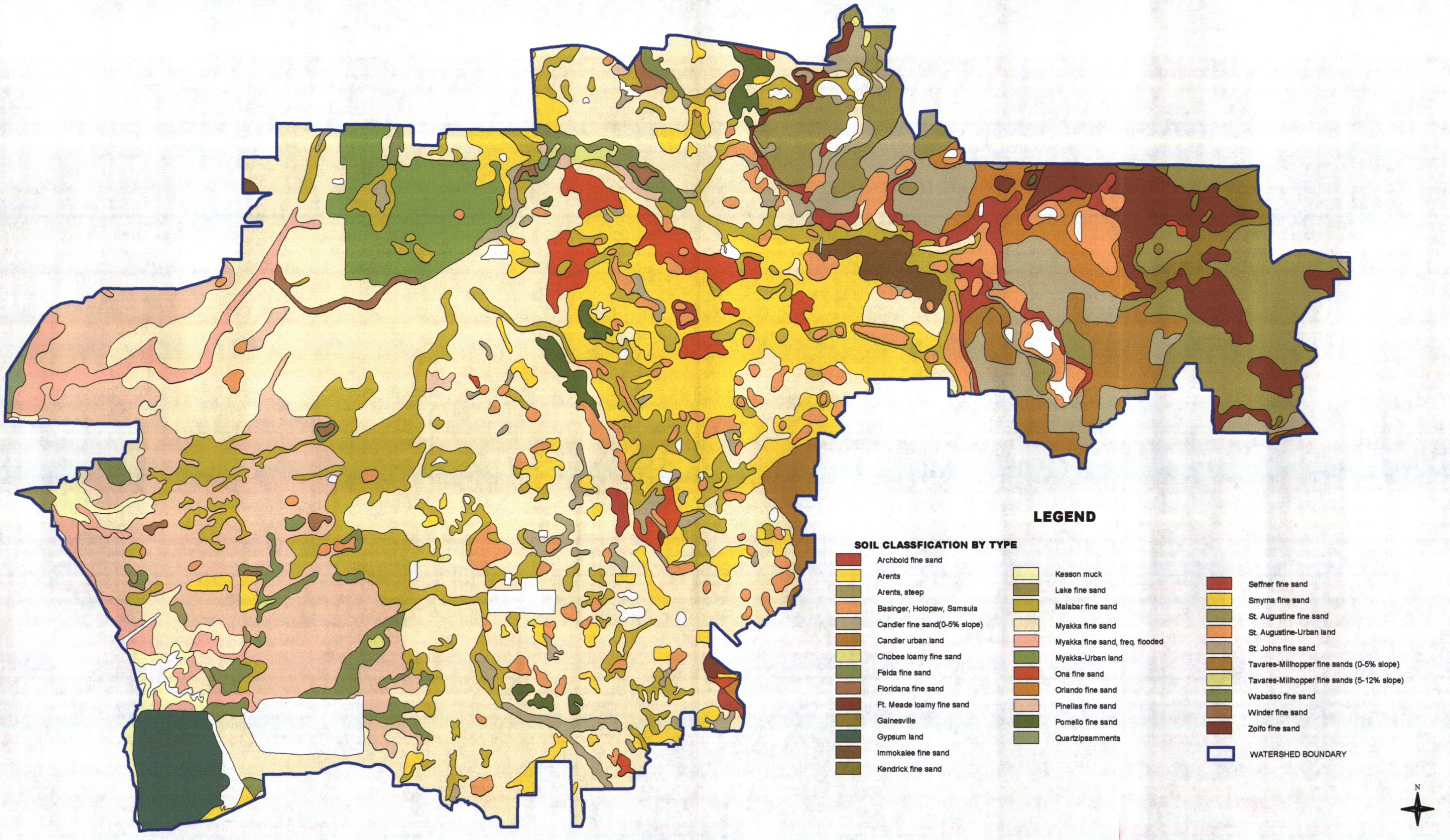


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FIGURE 2-4

**SOIL CLASSIFICATION BY TYPE MAP**

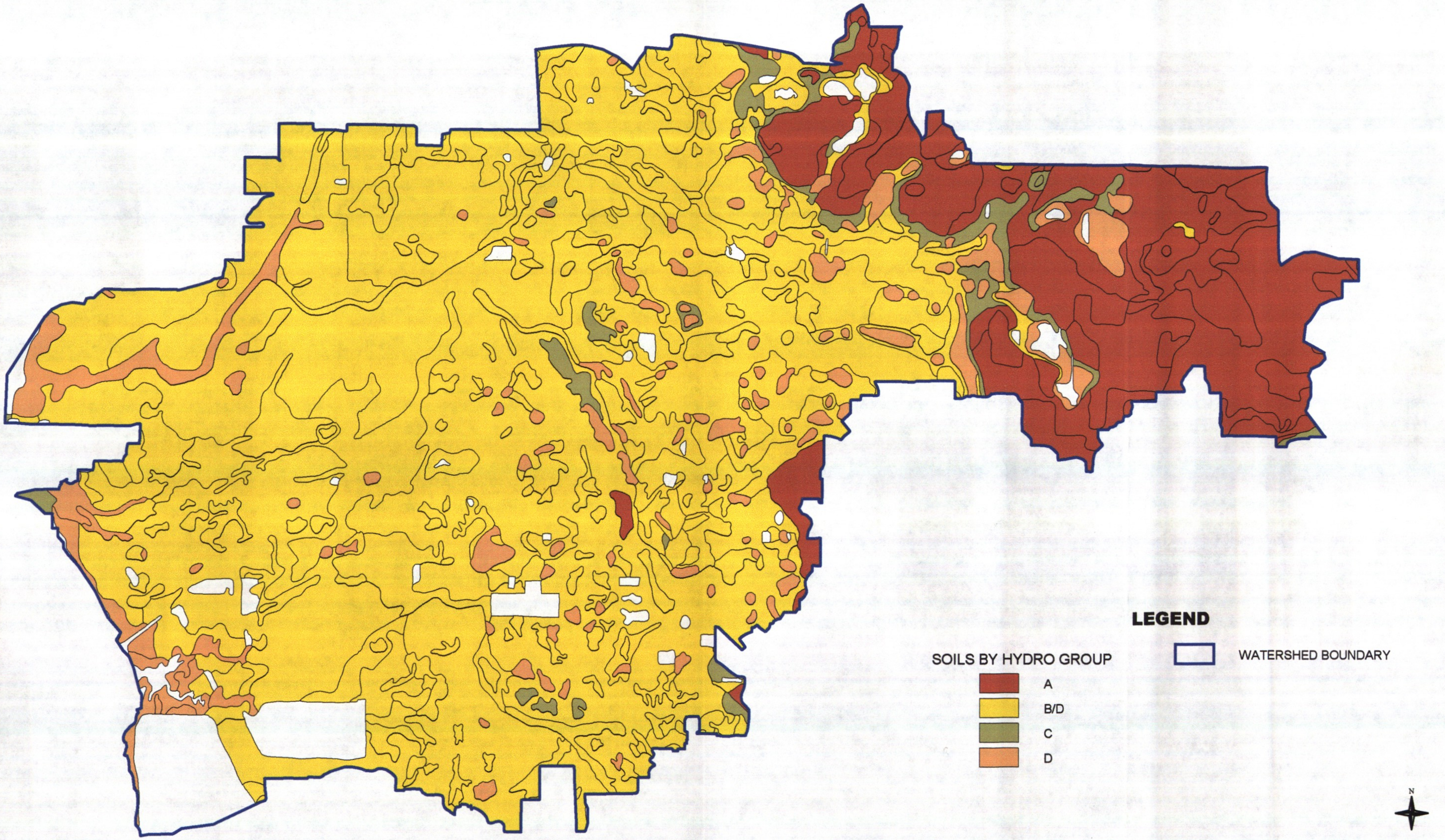


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FIGURE 2-5

**SOILS BY HYDRO GROUP**

- Group D (high runoff potential) soils have very slow infiltration rates when thoroughly wetted and a very low rate of water transmission. They have typical infiltration rates of 3 inches/hour when dry and 0.10 inches/hour when saturated. Soil types found in the Delaney Creek Area watershed that fall within this group include: Basinger, Holopaw and Samsula (5), Kesson muck (24) and Myakka fine sand (30).

Dual classifications (e.g. A/D or B/D) can be assigned to soils that exhibit substantially different hydrologic characteristics during the wet and dry seasons or if extensively and effectively drained such as by groundwater interception trenches or deep, artificial channels. During the wet season, these soils become saturated throughout much of the soil column due to elevated water table conditions. Infiltration is thus impeded and the soils exhibit Group D infiltration and runoff rates. During the dry season when the water levels recede, infiltration rates increase and runoff rates decline to Group A or Group B levels. Soil types that fall within the B/D classification found in the Delaney Creek Area watershed are: Chobee loamy fine sand (10), Felda fine sand (15), Floridana fine sand (17), Immokalee fine sand (21), Malabar fine sand (27), Myakka fine sand (29), Myakka-Urban land complex (32), Ona fine sand (33), Pinellas fine sand (38), St. Johns fine sand (46), Smyrna fine sand (52), Wabasso fine sand (57) and Winder fine sands (59 & 60).

Arents soils, both nearly level (4) and very steep (39), as well as Quartzipsamments, nearly level (43), are not assigned a hydrologic soils group due to the highly disturbed nature of these typically urban or mined soils.

Soils can also be classified as either hydric or non-hydric, which relates to whether the soils had wetland or upland origins, respectively. Those soils designated as hydric develop under anaerobic conditions in wetland areas and general contain a large amount of organics. They are poorly to very poorly drained or depressional in nature, and are associated with a high seasonal water table. In contrast, those soils that are non-hydric lack these characteristics and are associated with upland or transitional areas. Soil types with the hydric classification found within Delaney Creek Area watershed are Basinger, Holopaw and Samsula (5), Chobee loamy fine sand (10), Felda fine sand (15), Floridana fine sand (17), Kesson much (24), Malabar fine sand (27), Myakka fine sand (30), St. Johns fine sand (46) and Winder fine sand (60). All other types would be considered non-hydric.

## 2.4 PHYSIOGRAPHY AND HYDROLOGY

The Delaney Creek Area watershed lies within the Gulf Coastal Lowlands physiographic unit as defined by White. This unit is part of the Central or Mid-Peninsular physiographic zone, one of three in Florida. Land elevations in the watershed vary between a high of about 90 feet

NGVD in the eastern portions of the watershed to a low of sea level along the coast and at the three outfalls. These elevations are shown on Figure 2-3.

Surface flows are generally from the east to west or southwest toward Hillsborough Bay following the natural topography within the basin. Hydrologically, surface flows originate for the most part through stormwater runoff with very little influence from groundwater flows, with exception of the two major creek systems.

## 2.4.1 CONVEYANCE SYSTEMS

The watershed has four major outfalls, the three creeks and the Delaney Creek Pop-off canal, which discharge into Hillsborough Bay. In addition to these outfalls, each of the creek systems has major stormwater conveyance systems associated with them.

The Delaney Creek system is the largest of the three, with eight major conveyance systems. The westernmost of these is Tributary “A”, a ditched natural system that has its origins to the south of Palm River Road and to the east of Maydell Drive. This tributary drains an area of approximately 550 acres. A series of seven man-made “laterals” then drain into Delaney Creek. All but the final lateral enters the creek on the north side. They aid in routing flood/stormwater away from the residential areas of Clair Mel and west Brandon. The first three of these laterals, denoted “A”, “B” and “C”, are used to drain the Clair Mel area between 70$^{th}$ Street and Hobbs Road (90$^{th}$ Street). Excavated materials from these laterals may have been used as fill in the construction of the adjacent residential areas of Clair Mel. The next three, laterals “D”, “E” and “F”, drain mostly undeveloped lands between Interstate 75 and U.S. Highway 301. However, this area will be occupied by the Crosstown Center in the near future. The seventh and final lateral, designated as “G”, enters Delaney Creek from the south between Providence Road and Interstate 75.

The North Archie Creek system is similar to the one for Delaney Creek. It has seven major conveyance systems associated with it. The most downstream of these, Tributaries “B” and “C”, drain a large area west of the intersection of U.S. 301 and Interstate 75 and east of 78$^{th}$ Street. Draining the area west of Interstate 75 are Tributaries “E”, “F” and “G”. To the north, Tributaries “I” and “J” drain the area north of the intersection of U.S. Highway 301 and Interstate 75 between those two main roads.

Finally, the system for the Delaney Creek Pop-off Canal drains the area between the two creek systems. Like the North Archie Creek system, it is made up of seven major conveyance systems. Tributaries “A”, “E” and “F” drain that part of its watershed to the west of 78$^{th}$ Street. Of the portion of the watershed remaining to the east of 78$^{th}$ Street, Tributaries “B” and “C” drain the northern portion, with Tributaries "G" and "H" draining the southern section.

# 2.5 GEOLOGY AND HYDROGEOLOGY

The Delaney Creek Area watershed is underlain by a thick sequence of sedimentary strata divided into an upper zone of unconsolidated sediments and lower zone of consolidated carbonate rock.

At land surface, undifferentiated sediments including silt, sand, and clay, form surficial deposits that vary in thickness from less than 10 feet in coastal areas to over 100 feet in paleokarst depressional areas or in sand ridges. Typical thickness of the surficial deposits varies from 20 to 50 feet. In lower lying areas near lakes and streams, thin layers of organic material mix with the surficial deposits. Pleistocene-aged silts and clays form the base of the undifferentiated sediments.

Underlying the unconsolidated material is a series of Tertiary-aged limestones and dolomites that form the carbonate platform of peninsular Florida. The sequence of carbonate rocks includes, in descending order, the following formations: Tampa Member of the Hawthorn Group, Suwannee Limestone, Ocala Group, Avon Park, Oldsmar and Cedar Key Formations. A lithographic change from limestone and dolomite to a sequence of gypsiferous dolomite begins in the lower portion of the Avon Park Formation and continues into the Oldsmar and Cedar Key Formations. The top of this lithologic change marks the middle confining unit of the Floridan aquifer system. The middle confining unit is generally considered the base of the freshwater production zone of the Upper Floridan aquifer.

The Tampa Member of the Hawthorn Group is a tan-colored carbonate and sand mixture, which can contain variable amounts of clay. The Tampa Member can be fossiliferous and may also contain phosphate grains and chert. The Tampa Member ranges from 50 to 150 feet in thickness. The Suwannee Limestone consists of two rock types; the upper portion is tan-colored crystalline, limestone containing prominent gastropod and pelecypod molds and the lower portion is cream-colored limestone containing foraminifera and pellets of micrite in a finely crystalline limestone matrix. The Suwannee Limestone varies from 150 to 300 feet in thickness.

The Ocala Group contains a series of limestones that are generally soft, friable, porous and fossiliferous. This unit is late Eocene in age and ranges in thickness from 90 to 300 feet. The Avon Park Formation comprises brown, highly fossiliferous, and soft to well-indurated, chalky limestone and a gray to brown, very fine microcrystalline dolomite. The Avon Park Formation ranges from 300 to 500 feet in thickness.

The hydrogeologic flow system of the Tampa Bay region contains two distinct groundwater reservoirs: the unconfined surficial aquifer and the semi-confined Upper Floridan aquifer. The Upper Floridan aquifer is under water table conditions in areas where the clay confining layer is discontinuous or absent. A general hydrogeologic cross-section of the Tampa Bay region is shown in Figure 2-6.

## 2.5.1 SURFICIAL AQUIFER

The surficial aquifer is comprised primarily of unconsolidated deposits of fine-grained sand with an average thickness of 30 feet. Due to the karst geology of the region, thickness of the sand is highly variable. The depth of the water table ranges from near land surface to several tens of feet below land surface. Rainfall is the primary influence on water table elevation; with annual highs in most years occurring during the end of the wet season (September through October) and annual lows occurring near the end of the dry season (May through June). The direction of groundwater flow varies locally and is significantly influenced by the topography of the land surface. The hydraulic gradient (change of elevation per unit length) in the area typically ranges from a few feet per mile to about 10 feet per mile. The permeability of the surficial aquifer is generally low and water withdrawn from this aquifer is used most often for lawn irrigation and watering livestock. Surficial aquifer wells typically yield less than 20 gallons per minute.

## 2.5.2 SEMI-CONFINING ZONE

Below the surficial aquifer is a semi-confining unit comprised of clay, silt and sandy clay that has the ability to retard the movement of water between the overlying surficial aquifer and the underlying Upper Floridan aquifer. The confining materials are comprised of blue-green to gray, waxy, plastic, sandy clay and clay. The upper portion of the Arcadia Formation (Hawthorn Group) typically forms the semi-confining layer.

Leakage from the surficial aquifer into the Upper Floridan aquifer occurs by infiltration across the semi-confining layer or through fractures or secondary openings in the semi-confining unit caused by chemical dissolution of the underlying limestone. Due to the highly karstic nature of the geologic system, the clay semi-confining layer can be absent in one area but tens of feet

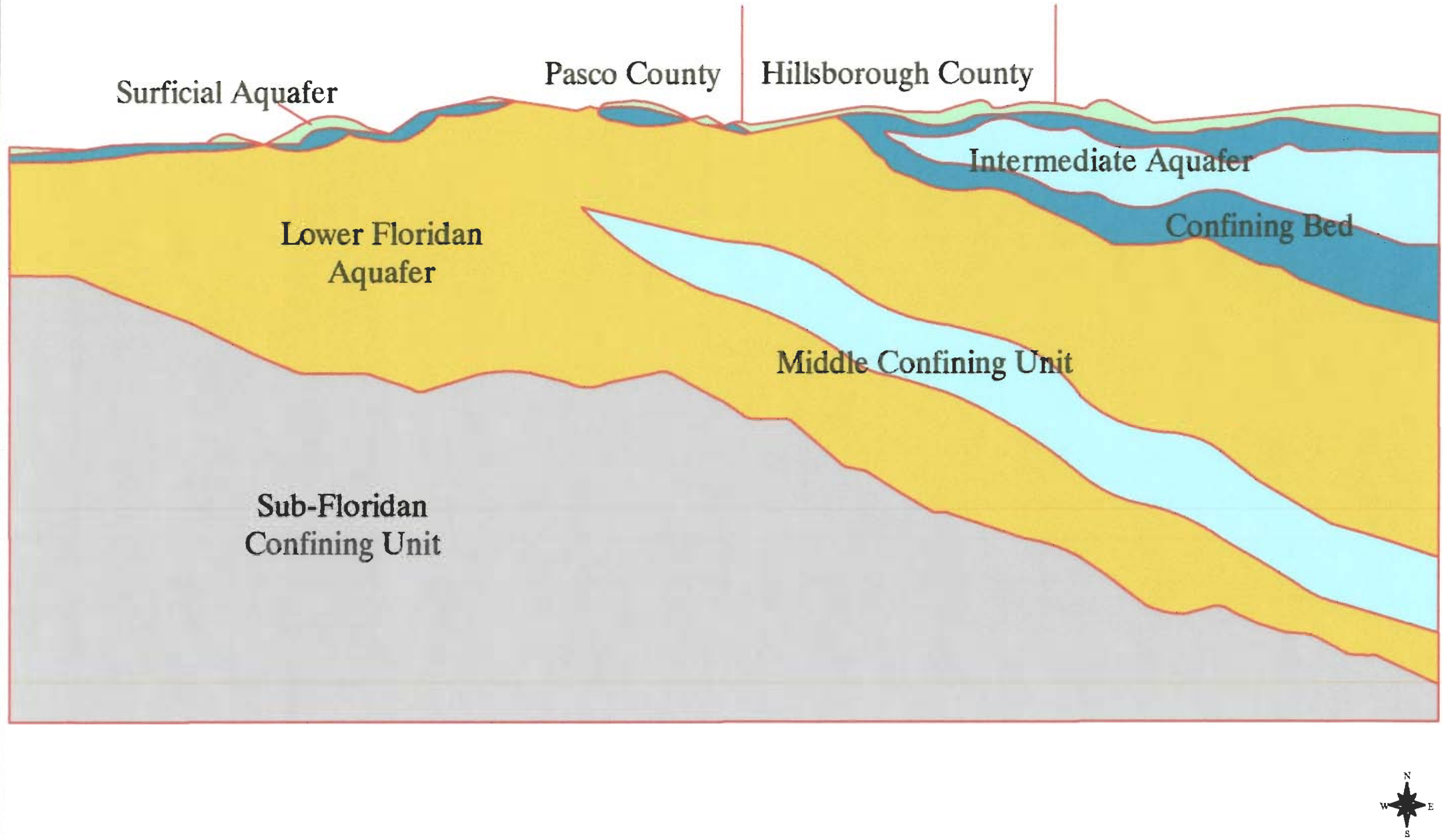


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FIGURE 2-6

**HYDROGEOLOGIC CROSS SECTION MAP**

thick just a short distance away. These localized karst features, in which the clay semi-confining layer is breached or missing, significantly increases hydraulic connection between the two aquifers (Hancock and Smith, 1996).

## 2.5.3 UPPER FLORIDAN AQUIFER

The Upper Floridan aquifer consists of a continuous series of carbonate units that include portions of the Tampa Member of the Hawthorn Group, Suwannee Limestone, Ocala Limestone, and the Avon Park Formation. Groundwater within the Upper Floridan aquifer is typically under artesian conditions within the project area.

Near the base of the Avon Park Formation lies the middle confining unit of the Floridan aquifer, an evaporite sequence of very low permeability that is composed of gypsiferous dolomite and dolomitic limestone.

The middle confining unit generally delineates the boundary between the freshwater Upper Floridan aquifer and the brine-saturated Lower Floridan aquifer. The evaporites function as a lower confining unit and retard vertical flow across the boundary. In general, the permeability of the Upper Floridan aquifer is moderate in the Tampa Member and Suwannee Limestone, low in the Ocala Limestone and very high in portions of the Avon Park Formation. The limestone and dolomite beds produce significant quantities of water due largely to numerous solution openings along bedding planes and fractures. The Ocala Limestone yields limited amounts of water and may be considered a semi-confining layer within the Upper Floridan aquifer. Overall, the Ocala Limestone tends to act as a semi-confining zone between the overlying Tampa/Suwannee Formations and the underlying Avon Park Formation. Transmissivity of the Avon Park Formation is very high due to the fractured nature of the dolomite zones.

Ground water flow in the Floridan aquifer originates as rainfall that percolates downward from the surficial aquifer. In areas where the Upper Floridan aquifer outcrops, this recharge can be direct. Recharge rates are generally higher in the northern portion of the County. However, recharge can be highly variable throughout the area, due to karst geology and induced leakage caused by ground-water withdrawals. The regional hydraulic gradient and direction of flow in the Upper Floridan aquifer is generally toward the south and west.

# 2.6 EXISTING AND FUTURE LAND USE

This information was gathered from two primary sources. The existing land use was determined by using 1995 Southwest Florida Water Management District and Hillsborough County Property Appraiser's information. The future land use information is from the Hillsborough County Planning Commission and reflects the predicted land use for the year 2015.

## 2.6.1 EXISTING LAND USE

The Delaney Creek Area watershed is diverse in terms of land uses, being made up of a combination of residential, agricultural, commercial and natural systems. The Southwest Florida Water Management District's 1995 Land Use/Land Cove Map is shown in Figure 2-7. Additional existing land use information provided by the County's Property Appraiser's Office is illustrated in Figure 2-8. Commercial, industrial, institutional and highway/utility land uses constitute approximately 3,900 acres in the watershed. These land uses are found primarily along the basin's major roads - U.S. Highways 41 and 301, State Road 60 and Causeway Boulevard. Residential land uses comprise just over 5,000 acres and include areas of low, medium and high density.

These uses are scattered throughout the basin, with the bulk of the medium density areas in the extreme eastern portion of the watershed. Many of the watershed's residential areas tend to be older subdivisions with little or no stormwater treatment being provided. The lots are typically between a quarter of an acre to an acre in size. Agricultural land uses encompass about the same area as the commercial land uses with 3,800 acres in the watershed. The majority of the agricultural uses, 3,500 or so acres, are made up of pasture and croplands found in the central portion of the watershed around U.S. Highway 301 and Interstate 75.

Other land uses in the agricultural category are feeding operations, specialty farms, tree crops, tropical fish farms and other open lands (rural). Undeveloped lands, including open land and water, and upland and wetland natural systems account for around 8,400 acres of the watershed. Again, these areas are scattered throughout the basin. Included in this grouping are both saltwater and freshwater forested and non-forested wetlands, forested uplands, waterbodies and open lands. The remainder of the watershed is made up of recreational land uses, about 150 acres, and mining or mining related activities, primarily the gypsum operations in the southwest portion of the watershed. The mining land use occupies approximately 800 acres of the watershed. As shown in Figure 2-9, there are numerous vested projects or Developments of Regional Impact (DRI) projects within the watershed. These occur primarily in the area of the

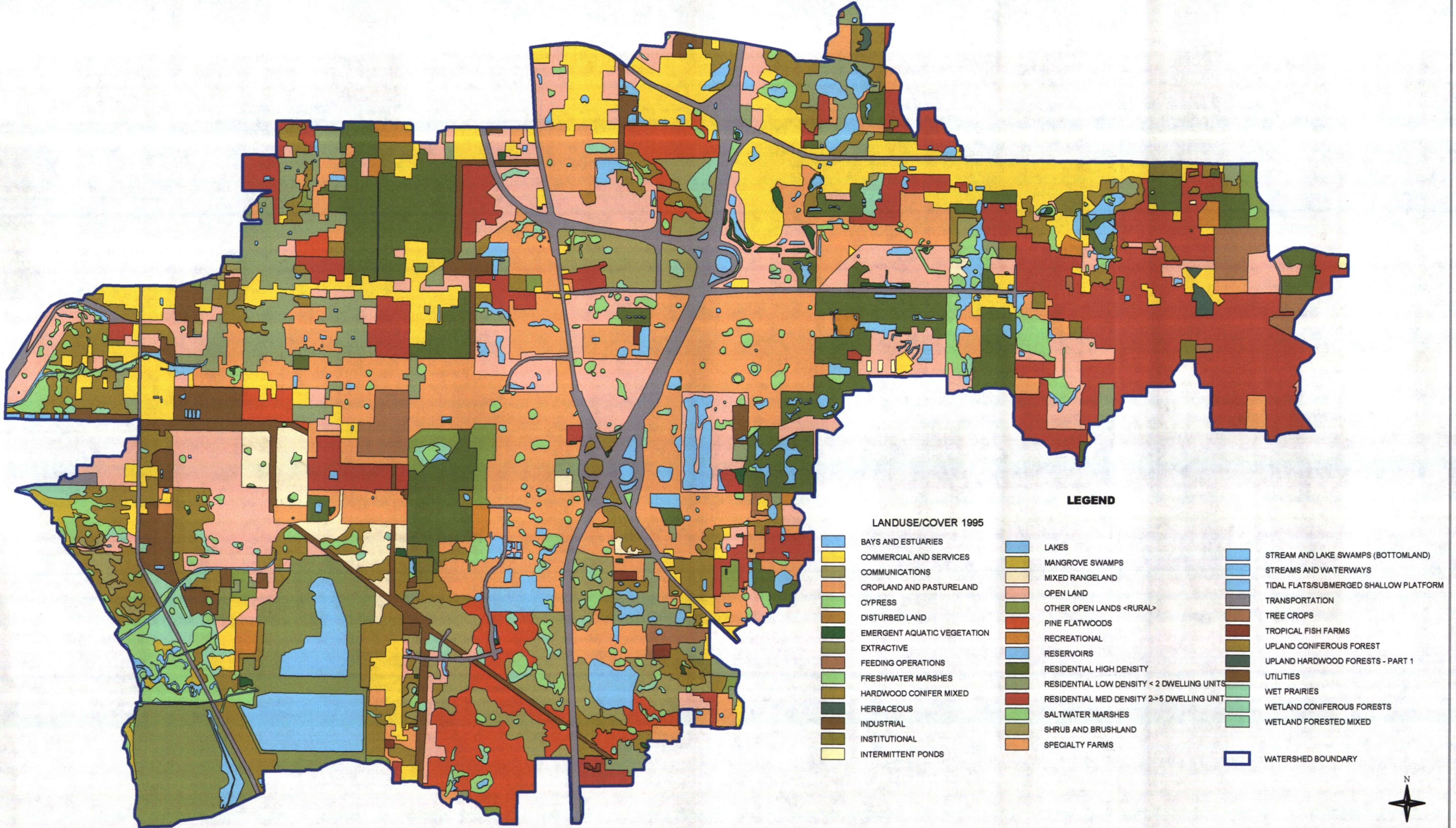


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FIGURE 2-7

**SWFWMD LANDUSE/COVER**

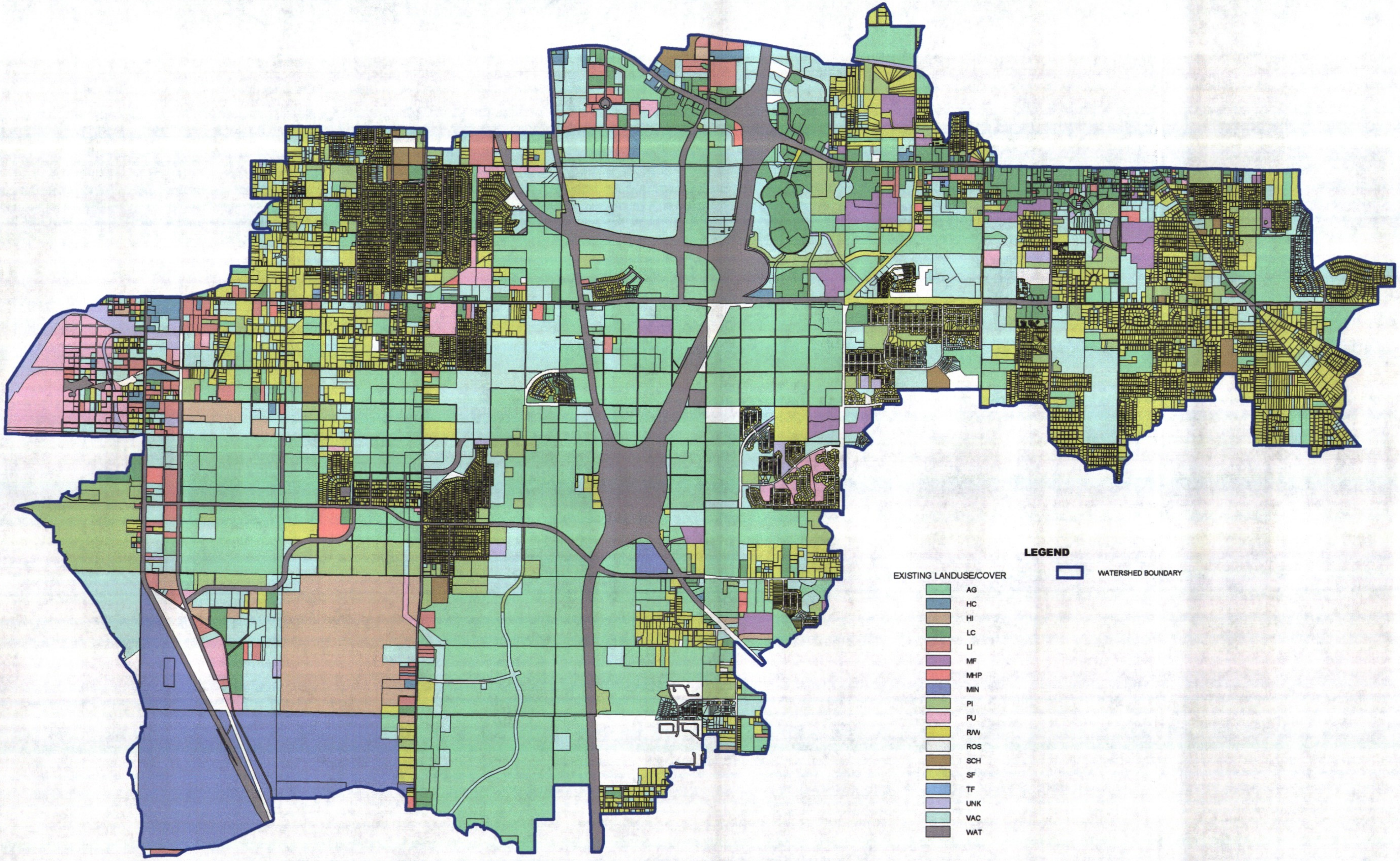


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FIGURE 2-8

**Hillsborough County**
**Existing Landuse/cover**

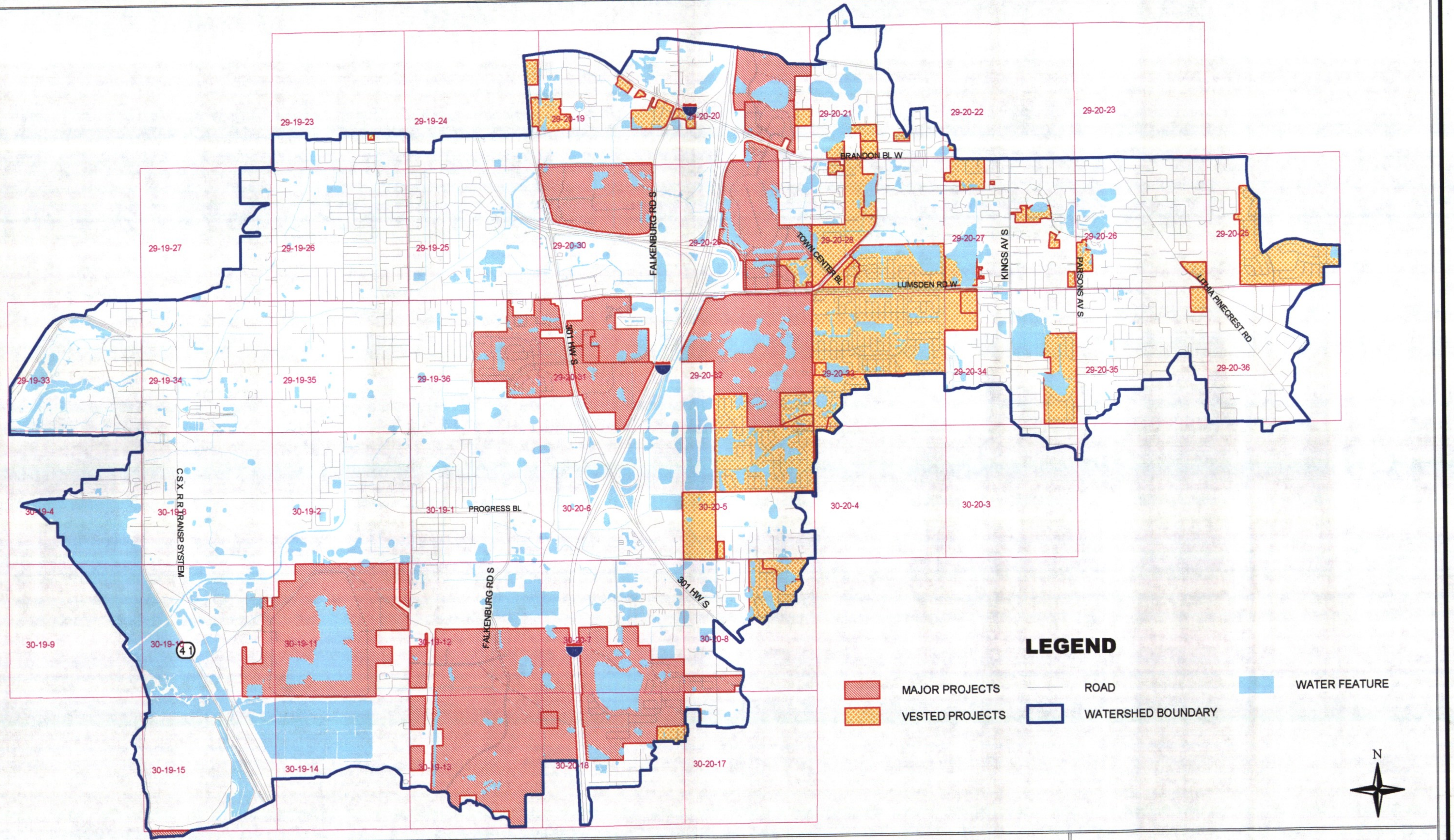


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FIGURE 2-9

**Major Project DRI's & Vested Project Map**

basin's major roads, Interstate 75 and U.S. Highway 301 in the central portion of the watershed and in the eastern portion of the area. Much of the Significant or Essential Upland Wildlife Habitats also can be found in the coastal area, with the remainder existing in the southwest quarter of the watershed area.

Table 2.1 indicates that of the 22,000+ acres in the watershed, 9,850+ acres or 44.6% of the watershed has been developed.

**Table 2.1**
**Existing Land Uses – Delaney Creek Area Watershed**
**(Based on 1995 Southwest Florida Water Management District Information)**

| Land Use Category | Total Acreage | Percent of Total |
|---|---|---|
| Low / Medium Density Residential | 3288.412 | 14.86 |
| High Density Residential | 1718.748 | 7.77 |
| Light Industrial | 307.728 | 1.39 |
| Agricultural | 3832.738 | 17.32 |
| Commercial | 1945.652 | 8.79 |
| Institutional | 249.481 | 1.13 |
| Highway / Utility | 1385.437 | 6.26 |
| Recreational | 149.058 | 0.67 |
| Open Land | 3420.160 | 15.46 |
| Extractive (Mining) / Disturbed | 824.892 | 3.73 |
| Upland Forested | 2336.228 | 10.56 |
| Wetland Forested | 400.923 | 1.81 |
| Wetland Non-Forested | 1084.698 | 4.90 |
| Water | 1183.641 | 5.35 |
| **TOTAL** | **22127.796** | **100.00** |

## 2.6.2 FUTURE LAND USES

Figure 2-10 shows the Planning Commission's projected land use for the year 2015. Due to the highly developed nature of the Delaney Creek Area watershed, not many changes in land use are predicted by Hillsborough County's Planning Commission projections for the year 2015. The majority of predicted changes will be associated with the agricultural and open land areas and will most likely change over to a mixed urban use of residential and light commercial land uses.

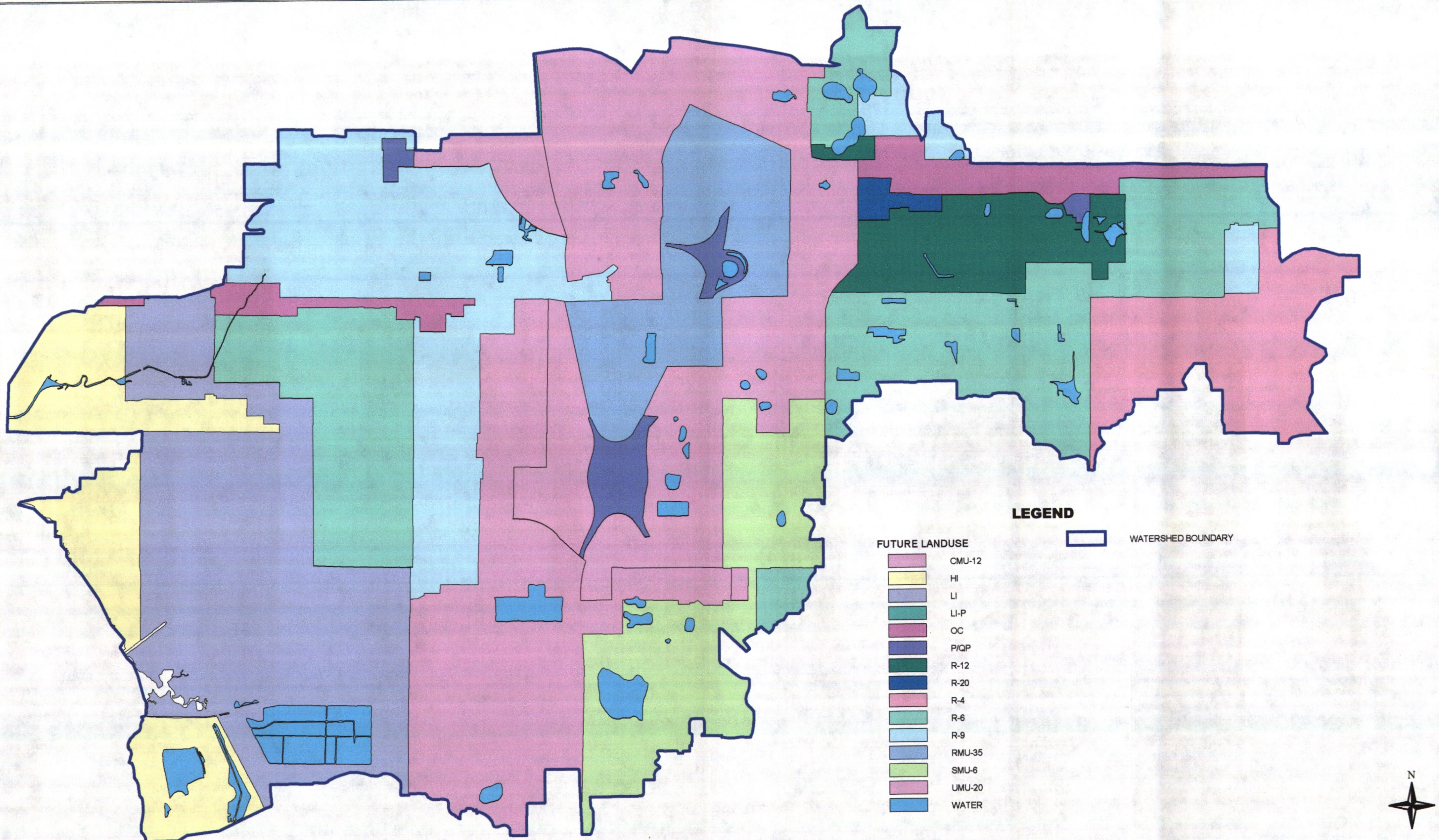


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FIGURE 2-10

**Hillsborough County**
**Feature Landuse/cover**

As can be seen from Future Land Uses Changes Table 2.2, several land uses that occurred in the existing land use table (Table 2.1) are not found in Table 2.2. In some cases, this is because that land use has been converted to another type. For example, it can be expected that at some point in the future that much of the agriculture use will be developed for residential, commercial or similar land use. Open land would fall under this category as well. However, other designations such as commercial and highway utilities are not shown. These land uses, designated by an asterisk (*), still exist in the watershed but due to the way the Planning Commission compiles their information, they are incorporated into another land use category.

**Table 2.2**
**Future Land Uses – Delaney Creek Area Watershed**
**(Based on Hillsborough County Property Appraiser's Office Information)**

| Land Use Category | Total Acreage | Percent of Total |
|---|---|---|
| Low / Medium Density Residential | 1110.444 | 5.153 |
| High Density Residential | 6493.959 | 30.136 |
| Light Industrial | 5126.011 | 23.788 |
| Agricultural | 0.0* | 0.0 |
| Commercial | 7900.27 | 36.66 |
| Institutional | 361.043 | 1.675 |
| Highway / Utility | 0.0* | 0.0 |
| Recreational | 0.0* | 0.0 |
| Open Land | 0.0* | 0.0 |
| Extractive (Mining) / Disturbed | 0.0* | 0.0 |
| Upland Forested | 35.10 | 0.163 |
| Wetland Forested | 0.0* | 0.0 |
| Wetland Non-Forested | 0.0* | 0.0 |
| Water | 521.406 | 2.42 |
| **TOTAL** | **21548.233** | **99.995** |

For example, the R-20 category includes commercial land uses, but for the purposes of Table 2.2, the R-20 designation has been included in the high-density residential category. There is no accurate way to remove the commercial land uses from this designation. Wetlands are treated in a similar manner. With present day wetland protection regulations, it is not likely that the nearly 1,500 acres of wetland will disappear. However, the Planning Commission does not treat wetlands as a land use; they are a form of land cover. Because of this, again they have been incorporated into another land use category. The acreage indicated in the table are only those natural areas that are under conservation easement or other type of preservation.

# MAJOR CONVEYANCE SYSTEMS

This chapter contains a general description of the major conveyance systems in the DCA watershed. The existing condition system performance for the major conveyance systems is contained in this chapter.

The description of major conveyance systems in the DCA watershed has been segmented into four subwatersheds (Delaney Creek, Delaney Pop-off, North Archie Creek and Archie Creek) as shown in Table 3.1.

**Table 3.1 Major Conveyance Systems**

| DELANEY CREEK | DELANEY POP-OFF | NORTH ARCHIE CREEK | ARCHIE CREEK |
|---|---|---|---|
| **Main channel Laterals** | **Main channel Tributaries** | **Main channel Tributaries** | **Main channel Tributaries** |
| Lateral A | Tributary A | Tributary A | Tributary A |
| Lateral A-1 | Tributary B | Tributary B | 78$^{th}$ Ditch |
| Lateral B | Tributary C | Tributary C | Tributary B |
| Lateral C | Tributary E | Unnamed Tributary | Tributary C |
| Lateral C-1 | Tributary F | Tributary D | Tributary D |
| Lateral D | Tributary G | Tributary E | Tributary F |
| Lateral E | Tributary H | Tributary F | Tributary G |
| Lateral E-1 | Tributary I | Tributary G | Isolated Basins |
| Lateral F | Aspen Cove Apartment | | |
| Hendrics Lake System | Evergreen Estates System | | |
| Brandon Town Center Mall System | | | |
| Gornto Lakes System | | | |
| Heather Lakes System | | | |
| Lumsden Road North Ditch | | | |
| Hickory Hammock System | | | |
| Isolated Basins System | | | |

# 3.1 DELANEY CREEK SUBWATERSHED

The Delaney Creek subwatershed originates at a point approximately 4000 feet north of Paul's Drive/Causeway Boulevard (State Road 676) intersection and flows west approximately 8.0 miles to eventually discharge out to Hillsborough Bay.

## 3.1.1 DELANEY CREEK MAIN CHANNEL SYSTEM (MODEL # 210XXX SERIES)

The Delaney Creek Main Channel System is considered with this study starting from south of Brandon Town Center Mall area, at the Hendrics Lake System confluence with Hickory Hammock System (jct. #210361) to the outfall location in Hillsborough Bay. The Delaney Creek Main Channel is a well defined channel which crosses Interstate 75, U.S. Highway 301, the Crosstown Expressway, 86$^{th}$ Street South, 78$^{th}$ Street South, Causeway Boulevard, 70$^{th}$ Street South, Maydell Drive, 37$^{th}$ Avenue South, the CSX Transportation System (twice) and U.S. Highway 41, ultimately discharging into Hillsborough Bay just north of Pendola Point Road/Port Sutton area.

## 3.1.2. LATERALS

The Delaney Creek main channel has various laterals that converge into the main channel. Most of the laterals are manmade and run north and south behind back lots of residential subdivisions. The laterals for the Delaney Creek subwatershed flow from north to south into the main channel. Several of the laterals are man-made ditches that were excavated originally for agricultural purposes but now serve as drainage ditches for various subdivisions as mentioned in the main channel system.

### 3.1.2.1 Lateral "A" (model # 211xxx series)

A natural tributary joins Delaney Creek approximately 3000 feet west of Maydell Drive. This tributary drains area North of Causeway Boulevard and flows in a north to south direction, crossing Causeway Boulevard, Maydell Drive, 20$^{th}$ Avenue South, 16$^{th}$ Avenue South and 12$^{th}$ Avenue South.

## 3.1.2.2 Lateral "A-1" (model # 2115xx series)

A manmade ditch system joins Delaney Creek approximately 1300 feet East of Maydell Drive. This tributary drains the area south of Causeway Boulevard and flows in a south to north direction, crossing 36th Avenue South, and 32nd Avenue before the confluence with Delaney Creek.

## 3.1.2.3 Lateral "B" (model # 212xxx series)

Lateral "B" is a large lateral ditch draining into Delaney Creek from the north at a 90° turn. Drainage from the western Clair Mel City area is collected between 78th Street and Causeway Boulevard in this lateral. The channel flows south and crosses Tidewater Trail, Robindale Road and 12th Avenue South to the confluence with Delaney Creek.

## 3.1.2.4 Lateral "C" (model # 213xxx series)

Lateral "C" is located less than 1000 feet upstream of the 78th Street crossing. The channel generally flows south and drains a portion of the Clair Mel City area. The channel flows south and crosses Tidewater Trail and Rideout Road twice before its confluence with Delaney Creek.

## 3.1.2.5 Lateral "C-1" (model # 2135xx series)

Lateral "C-1" is located approximately 800 feet west of Hobbs Road and drains the Green Ridge subdivision which is located to the north of Delaney Creek. Residential homes are located on the east side of the lateral along with a power transmission line easement. The channel flows south and crosses Tidewater Trail to the confluence with Delaney Creek.

## 3.1.2.6 Lateral "D" (model # 214xxx series)

Lateral "D" is located south of Adamo Drive and receives drainage from the Tampa Central Park commercial site. The channel is generally parallel to U.S. Highway 301 on the east and flows south crossing Palm River Road to the confluence with Delaney Creek.

### 3.1.2.7 Lateral "E" (model # 2150xx series)

Lateral "E" originates south of the CSX railroad located in the Interstate Park of Commerce. The channel generally flows south, crossing Adamo Drive and Palm River Road to the confluence with Delaney Creek.

### 3.1.2.8 Lateral "E-1" (model # 2155xx series)

Lateral "E-1" receives flow from an unnamed lake and adjacent developed area located north of State Road 60. Drainage from the unnamed lake flows through a swamp on the west side of Interstate 75 before entering Lateral "E-1". This agricultural channel has been excavated and spoil material has been placed adjacent to the channel. Falkenburg Road has been constructed recently to connect Causeway Boulevard (Lumsden Road) to Adamo Drive (State Road 60).

### 3.1.2.9 Lateral "F" (model # 216xxx series)

Lateral "F" originates south of the Crosstown Expressway and flows north through open pastures and meets with the main channel near Falkenburg Road. This agricultural channel has been excavated and spoil material has been placed adjacent to the channel.

### 3.1.2.10 Hendrics Lake System (model ID # 220xxx series)

The Hendrics Lake System begins east of Parsons Avenue between Brandon Boulevard (State Road 60) and Lumsden Road. A freshwater marsh is located north of Hendrics Lake and is connected to it through a small ditch. The marsh receives drainage from areas east of Bryan Road under extreme rainfall events. Hendrics Lake is connected to Clayton Lake with a concrete culvert crossing under Parsons Avenue. Clayton Lake then discharges into Doctor's Pond (Clayton Lake Addition) crossing Vonderburg Drive. From Doctor's Pond, the flow continues west crossing Kings Avenue to manmade ponds south of Oakfield Drive between Paul's Drive and Kings Avenue. From this location, the water's path changes towards the south on a natural channel ultimately reaching the Brandon Town Center area between Town Center Boulevard and Gornto Lake Road after crossing Paul's Drive, Lakewood Drive, Providence Road and Town Center Boulevard respectively.

## 3.1.2.11 Brandon Town Center Mall (model ID # 221xxx series)

The Brandon Town Center Mall system consists of two internal systems that are made up of interconnected ponds and pipes flowing south to join with the Delaney Creek main channel. One system meets with the main channel behind the car dealership property on the west. The second system runs southeast near the Gornto Lake Drive/Brandon Town Center Boulevard intersection on the east and joins with the main channel.

## 3.1.2.12 Gornto Lake System (model ID# 2215xx series)

The Gornto Lake system is part of the Hendrics Lakes main system and consists of Lake Gornto, Lake Chapman and Tenmile Lake. Tenmile Lake has a small swamp along a portion of its southern boundary. In addition, temperate and upland areas are located on the southeast side of Tenmile Lake. Improved pasture borders a major portion of both Gornto and Chapman Lakes. A weir outfall for Tenmile Lake exists at the south part of the lake. Flows over this weir are conveyed through a swale/ditch system to a 60-inch diameter culvert under State Road 60 and then into a lake located within the Old Times Square development. This lake serves as a detention pond and is controlled by an overflow structure. Under extreme storm events the drainage area located north of CSX Transportation System discharges to Lake Chapman via a concrete culvert crossing the railroad tracks and Camp Florida Road.

## 3.1.2.13 Heather Lakes System (model ID # 222xxx series)

Heather Lakes is a major tributary to the Hendrics Lake system. The confluence point is downstream of its Providence Road crossing. Heather Lakes is primarily a residential development located north and south of Lumsden Road between Paul’s Drive and Providence Road. The development consists of a series of interconnected lakes, storm sewers and culverts. The entire lake system crosses Lumsden Road at two locations. Both crossings by-pass the natural channels located on the north and south side of Lumsden Road (the south channel is named Lateral “G” in this study). Easterly, the location connects the two Heather Lakes directly via a concrete culvert. Westerly, Lumsden Road crossing is runs along Providence Road collecting the roadway drainage north of a controlled structure which discharges to Delaney Creek along the northeast side of the development. From North Heather Lakes, the flow path is along Providence Road heading north to the confluence downstream of Delaney Creek (Hendrics Lakes System) crossing Providence Road.

### 3.1.2.14 Lumsden Road North Ditch (model ID# 224xxx series)

The Lumsden North ditch consists of an area north of Lumsden Road at a gas station near the Lumsden Road/Kings Avenue intersection. The ditch flows west until it reaches Paul's Drive and then heads north into the Delaney Creek channel.

### 3.1.2.15 Hickory Hammock System (model ID# 230xxx series)

Lateral "G" flows east to west from Kings Avenue to the crossing under Lumsden Road for a distance of approximately 9500 feet. Providence Road crosses this lateral approximately 1300 feet east of the Lumsden Road crossing. Lateral "G" receives drainage from areas east of John Moore Road and Hickory Lake as well as areas to the south of Hickory Lake. The only outlet to this system is through a pair of 18-inch diameter culverts under Kings Avenue which ties into Lateral "G".

### 3.1.2.16 Isolated System (model ID# 270xxx series)

The isolated basins consist of the area east of Kingsway Road and the Hickory Hammock Lake system. These basins encompass various subdivisions and commercial sites like Brentwood Hills, the Nativity Catholic School and Salondino Park. The subbasins are not connected to the Delaney Creek main channel but to several systems like the Delaney Creek Pop-off Canal, Archie Creek and North Archie Creek.

## 3.2 DELANEY POP-OFF CANAL SUBWATERSHED

The Delaney Pop-off Canal subwatershed originates in the Tampa Triangle area and receives drainage from Evergreen Estates, Aspen Cove Apartments, Crescent Commercial Park, Madison Estates Mobile Home Park, Sanson Park, Waterford and the Pavilion subdivisions.

## 3.2.1 DELANEY POP-OFF MAIN CHANNEL SYSTEM

The Delaney Pop-off Main Channel System starts from U.S. Highway 301 near Tampa Triangle to the outfall location at Hillsborough Bay. The Delaney Pop-off Main Channel is a manmade canal that was constructed to alleviate the flooding problems of the Delaney Creek area located north of Delaney Pop-off Canal.

## 3.2.2 TRIBUTARIES

The tributaries of the Delaney Pop-off subwatershed consists mostly of man-made ditches along the back lots of residential areas like Fortuna Acres and Green Ridge Estates. The remaining tributaries on the east side of U.S. Highway 301 consist of the Interstate 75 drainage ditch and several ditch systems located in subdivisions of the Pavilion areas.

### 3.2.2.1 Tributary “A” System

Tributary “A” originates south of 36$^{th}$ Avenue and also collects flow from a small residential area north of 36$^{th}$ Avenue. The channel flows approximately 2500 feet south to the confluence with the Delaney Pop-off main channel.

### 3.2.2.2 Tributary “B” System

Tributary “B” originates in the Sanson Park subdivision located south of Causeway Boulevard and east of 78$^{th}$ Street. The channel generally flows east for approximately 2500 feet to eventually meet with the Delaney Pop-off channel and Tributary “C” from the west.

### 3.2.2.3 Tributary “C” System

Tributary “C” originates south of Causeway Boulevard near the Boulevard Villas subdivision which is located south of Causeway Boulevard and east of U.S. Highway 301. The channel flows south from this point along the U.S. Highway 301’s east roadside ditch and then west along Falkenburg Road to the confluence with the Delaney Pop-off main channel at South 86$^{th}$ Street (Wellborn Way). The portion of Tributary “C” along Falkenburg Road collects drainage from the Pavilion and Waterford subdivision.

### 3.2.2.4 Tributary "E" System

Tributary "E" originates to the west of 78th Street, south of Madison Avenue and north of an abandoned road (60th Avenue South). The channel generally flows west for approximately 2600 feet to eventually meet with the Delaney Pop-off channel at the Madison Estates Mobile Home Park.

### 3.2.2.5 Tributary "F" System

Tributary "F" flows west and collects drainage from a mobile home park to the east of Marc Drive located between the backyards of 50th and 51st Avenue lots.

### 3.2.2.6 Tributary "G" System

Tributary "G" is located just west of U.S. Highway 301 and south of the Waterford subdivision. The channel flows west for approximately 3000 feet before its confluence with the Delaney Pop-off canal.

### 3.2.2.7 Tributary "H" System

Tributary "H" originates in the Waterford subdivision and flows west approximately 2000 feet away from the Delaney Pop-off Canal. The channel collects drainage from the subdivision via treatment ponds located north of the channel.

### 3.2.2.8 Tributary "I" System

Tributary "I" originates west of U.S. Highway 301 and flows east along the Falkenburg Road ditch into Crescent Park. The channel's confluence with the Delaney Pop-off canal is approximately 3500 feet away from Interstate 75.

### 3.2.2.9 Aspen Cove Apartment System

The Aspen Cove System originates south of Causeway Boulevard and west of the Falkenburg Road/Crosstown Expressway exit. This system collects the drainage for the Aspen Cove Apartment complex through various treatment ponds and eventually discharges south into the Delaney Pop-off canal after going through Crescent Park's large treatment pond.

### 3.2.2.10 Evergreen Estates System

The Evergreen Estates System originates in the Evergreen Estates subdivision and collects drainage from the various treatment ponds before it crosses Causeway Boulevard near Falkenburg Road.

# 3.3 NORTH ARCHIE CREEK SUBWATERSHED

The North Archie Creek subwatershed is comprised of new subdivisions and commercial parks like Sterling Ranch, Brandon Lakes, Waterford, Parkway Business Center and Progress Village. The Interstate 75 and U.S. Highway 301 drainage systems make up a third of this subwatershed.

## 3.3.1 NORTH ARCHIE CREEK MAIN CHANNEL SYSTEM (MODEL # 260XXX SERIES)

The North Archie Creek Main Channel originates in the Providence Lakes subdivision and the area west of Providence Road. It flows for approximately 4600 feet and then turns south to meet with Tributary "F" at a borrow pit pond near Sherwood complex. At the Evergreen Estates Outfall, the channel crosses Interstate 75 and Tributary "D" from west to east. The channel continues to move west going under U.S. 301 Highway and Interstate 75 again on the north side of Madison Avenue. After passing through Interstate 75, North Archie Creek goes under Madison Avenue on west of Interstate 75 and then keeps heading west through the Progress Village subdivision. From here, the creek crosses 78$^{th}$ Street and flows on the north side of the Cargill gypstack before crossing Old U.S. Highway 23 and U.S. Highway 41 to its outfall into Hillsborough Bay.

## 3.3.2 TRIBUTARIES

The tributaries of the North Archie subwatershed consist mostly of man-made ditches along the back lots of residential areas such as Progress Village west of U.S. Highway 301. The remaining tributaries on the eastern side of U.S. Highway 301 consist of the Interstate 75 drainage ditch and several ditch systems located in subdivisions of the Bloomingdale Hills, Providence Oaks, Sterling Ranch and Brandon Lakes areas.

### 3.3.2.1 Tributary "A" (model # 261xxx series)

Tributary "A" originates north of Madison Avenue and west of the Falkenburg Road extension in a wetland located north of Fir Drive. The channel flows south to its confluence with the North Archie Main channel by way of interconnected stormwater pipes along the east side of 78$^{th}$ Street.

### 3.3.2.2 Tributary "B" (model # 262xxx series)

Tributary "B" originates south of Madison Avenue and west of the Falkenburg Road extension in the Parkway Business Center. The channel flows south and converges with the North Archie Main channel approximately 1600 feet away. This tributary is an open channel on top of a series of underground stormwater pipes. The outfall of the stormwater pipe is approximately 200 feet north of the 82$^{nd}$ Street double Conspan.

### 3.3.2.3 Tributary "C" (model # 265xxx series)

Tributary "C" originates south of Madison Avenue and west of the Falkenburg Road extension in the Parkway Business Center. The channel flows south to its confluence with the North Archie Main channel approximately 1600 feet away.

### 3.3.2.4 Unnamed tributary (model # 263xxx series)

This tributary originates north of Madison Avenue and west of Interstate 75 near the U.S. Highway 301 exit and the Crescent Park commercial site. The channel flows south and converges with the North Archie Main channel south of Foxworth Road which is approximately 2600 feet away.

### 3.3.2.5 Tributary "D" (model # 2705xx series)

Tributary "D" originates south of Lumsden Avenue in the proposed Florida Corporate Center. This tributary serves as Interstate 75's ditch. It flows south along the east side of Interstate 75 and west of Robert Tolle Road to its eventual confluence with the main channel near the west side of the borrow pit pond located in the Sherwood Apartment complex.

### 3.3.2.6 Tributary "E" (model # 272xxx series)

Tributary "E" originates approximately 1400 feet south of Bloomingdale Avenue located across from a mobile home park near the Bayou Crossing Apartment Complex. It serves as the ditch for the west side of Duncan Road which flows north collecting drainage from the Bayou Crossing Apartment complex on the east side of Duncan Road. This tributary eventually meets with the main channel near the west side of the borrow pit pond located in the Sherwood Apartment complex after it crosses a box culvert under Bloomingdale Avenue.

### 3.3.2.7 Tributary "F" (model # 273xxx series)

Tributary "F" originates in the Bloomingdale Hills subdivision, west of Providence Road. This tributary collects flow from two sub-tributaries that run north and parallel to each other for approximately 1150 feet. One of the sub-tributaries originates in the Bloomingdale Hills wetland which also collects drainage from the Providence Oaks subdivision. The other sub-tributary originates in the Bloomingdale Hills Park subdivision pond located south of Bloomingdale Avenue. Both sub-tributaries ultimately join the Bloomingdale Avenue Outfall channel flowing west to meet with Providence Lakes Outfall from the north at the borrow pit pond near Sherwood complex.

### 3.3.2.8 Tributary "G" (model # 27004x series)

Tributary "G" originates in the Sterling Ranch subdivision to the west of Providence Road. This tributary generally flows west and then turns south to meet with Tributary F" from the south at the borrow pit pond near Sherwood complex.

# 3.4 ARCHIE CREEK SUBWATERSHED

Half of the Archie Creek subwatershed consists of commercial areas like the Cargill complex and the Parkway Business Center. The other half is the Lake St. Charles, Starlite, Ashley Oaks, Suntree Estates and McMullen Farms subdivisions. Cargill occupies about a third of the subwatershed. The subwatershed generally starts at the Ashley Oaks subdivision and discharges out to the Bay near the north part of the Cargill facility.

## 3.4.1 ARCHIE CREEK MAIN CHANNEL SYSTEM (MODEL # 280XXX &290XXX SERIES)

The Archie Creek Main Channel System is considered in this study to start from east of Krycul Road near the Ashley Oaks subdivision, at the Lake St. Charles System confluence with Lateral "D" (jct. #290006) to the outfall location at Hillsborough Bay. The Archie Creek Main Channel is a well-defined channel which crosses Krycul Road, Bucks Ford Drive, Interstate 75, 78$^{th}$ Street, the Rinker Company entrance, Old U.S. Highway 23, the CSX Transportation System (twice) and U.S. Highway 41. It ultimately discharges into Hillsborough Bay just north of the Cargill area.

## 3.4.2 TRIBUTARIES

The tributaries are comprised mostly of man-made ditches that originate from wetland areas like Tributary "A" and "C". The other tributaries were originally excavated for agricultural use but now serve as drainage channels for areas like the Parkway Business Center, Starlite, Lake St. Charles and Ashley Oaks subdivisions.

### 3.4.2.1 Tributary "A" (model # 2801xx series)

A natural tributary joins Archie Creek approximately 650 feet east of the Rinker Company's entrance. This tributary drains the area north of Cargill's cooling ponds and west of 78$^{th}$ Street near Progress Boulevard as it flows in a north to south direction crossing 78$^{th}$ Street.

### 3.4.2.2 78th Street Ditch (model # 2803xx series)

A ditch system joins Archie Creek approximately 4000 feet south of Archie Creek. This tributary drains an area south of Eagle Palm Drive and east of 78th Street as it flows in a south to north direction through several residential and commercial (junkyard) driveways before the confluence with Archie Creek.

### 3.4.2.3 Tributary "B" (model # 2804xx series)

Lateral "B" is a large lateral ditch draining into Archie Creek from the north. Drainage from the Business Parkway area is collected east of 78th Street and west of Interstate 75 in this lateral. The channel flows south and crosses Falkenburg Road and Eagle Palm Drive to the confluence with Archie Creek near the Premier Beverage facility.

### 3.4.2.4 Tributary "C" (model # 2805xx series)

Lateral "C" is located approximately 1350 feet north of Riverview Drive near an eagle/gopher tortoise preserve and wetland area. The channel generally flows north and drains a portion of the Parkway Business area. The channel crosses only one dirt road that has limited access.

### 3.4.2.5 Tributary "D" (model # 2902xx and 2903xx series)

Lateral "D" is located approximately 350 feet south of Colonial Lake Drive immediately south of the Pond "AL" and drains Lake St. Charles located to the north of it. The channel flows south to the confluence with Archie Creek.

### 3.4.2.6 Tributary "F" (model # 290xxx, 2905xx and 2906xx series)

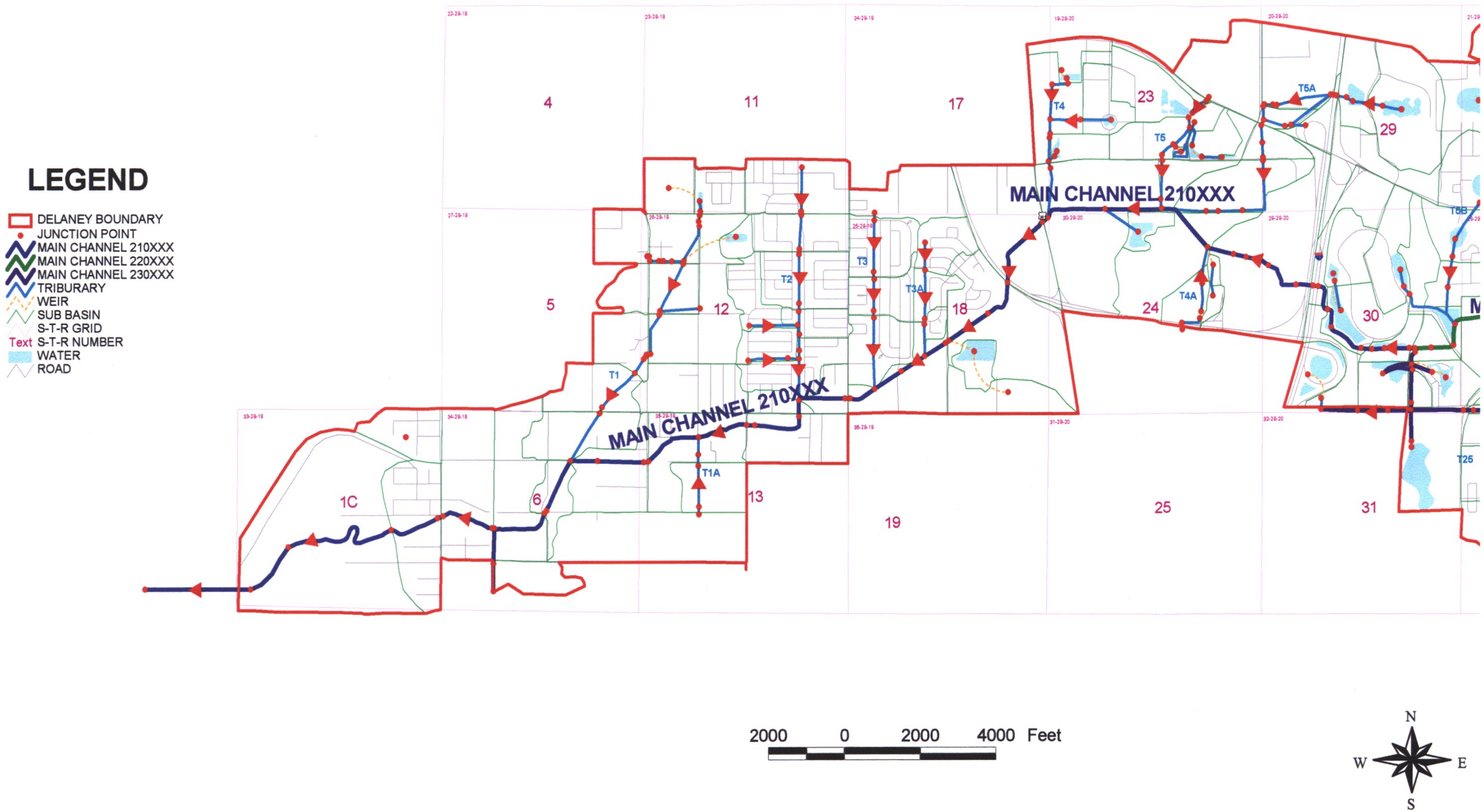
Lateral "F" originates at the intersection of Springbrook Drive and Brandon Circle and splits into two flow directions. The portion that receives drainage from the Starlite subdivision flows west while the portion collecting drainage of the fish hatchery flows south into the Lake St. Charles system. The channel flowing east to west crosses several wetlands located west of the bermed dirt road near the Starlite Subdivision.

## 3.4.2.7 Tributary “G” (model # 2901xx series)

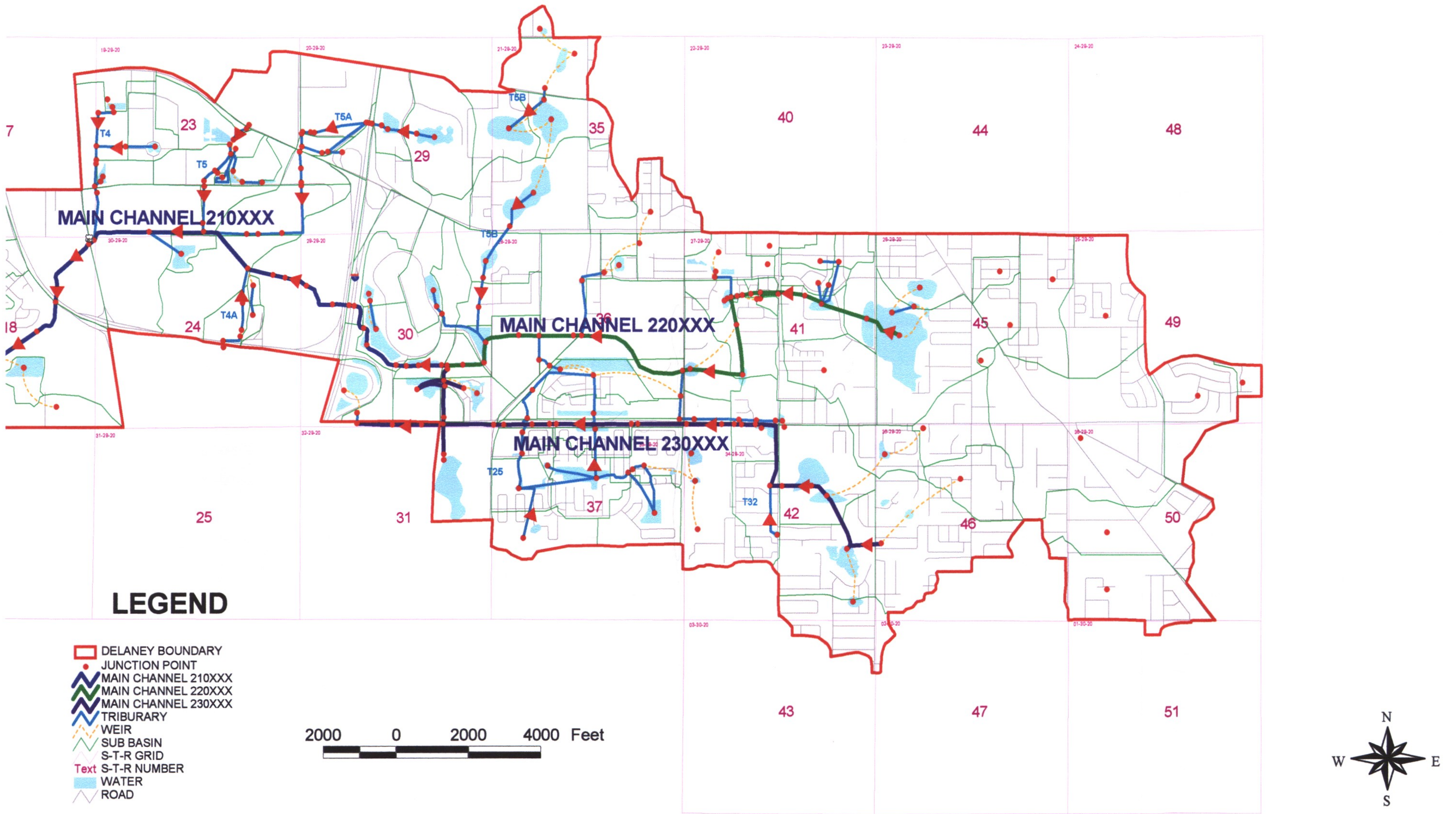
Lateral “G” originates south of the Menard Avenue located in the FDOT pond adjacent to Interstate 75. The channel generally flows north and parallel to Interstate 75 on the east side to connect with Archie Creek.

## 3.4.2.8 Isolated Basins (Cargill complex)

These isolated basins consist of the area east of U.S. Highway 41 on the Cargill complex and also west of U.S. Highway 41 and the Cargill gypstack which has its own drainage system. There is no connection to Archie Creek.




| | | |
|---|---|---|
| DEPARTMENT OF PUBLIC WORKS<br>ENGINEERING DIVISION<br>STORMWATER MANAGEMENT<br>SECTION | DELANEY CREEK AREA<br>STORMWATER MANAGEMENT<br>MASTER PLAN<br>SEPTEMBER 2000 | FIGURE 3-1a<br>DELANEY CREEK SUB-WATERSHED<br>EXISTING CONNECTIVITY DIAGRAM |

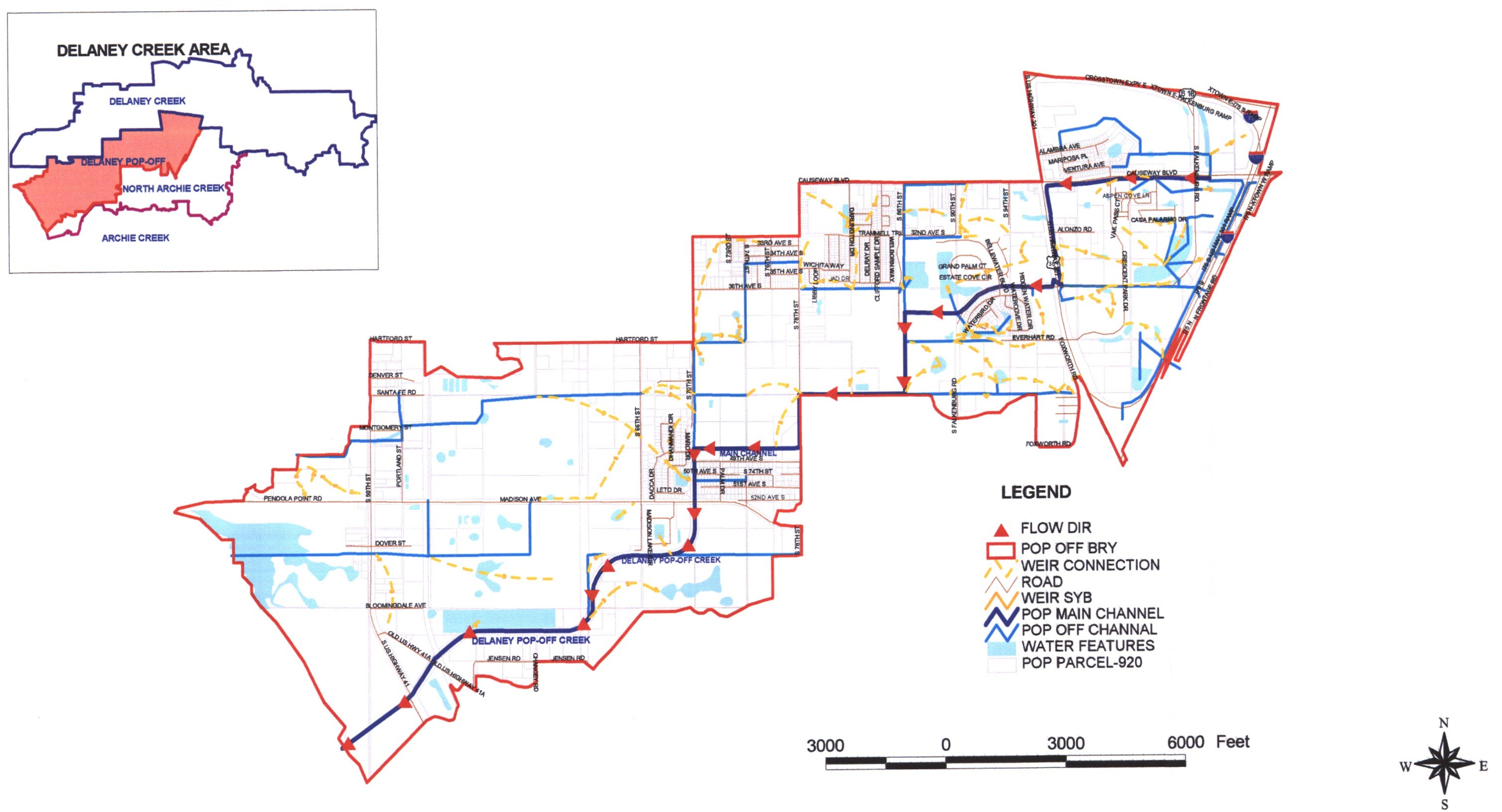



DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
STORMWATER MANAGEMENT
SECTION

DELANEY CREEK AREA
STORMWATER MANAGEMENT
MASTER PLAN
SEPTEMBER 2000

**FIGURE 3-1b**

DELANEY CREEK SUB-WATERSHED
EXISTING CONNECTIVITY DIAGRAM




DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
STORMWATER MANAGEMENT
SECTION

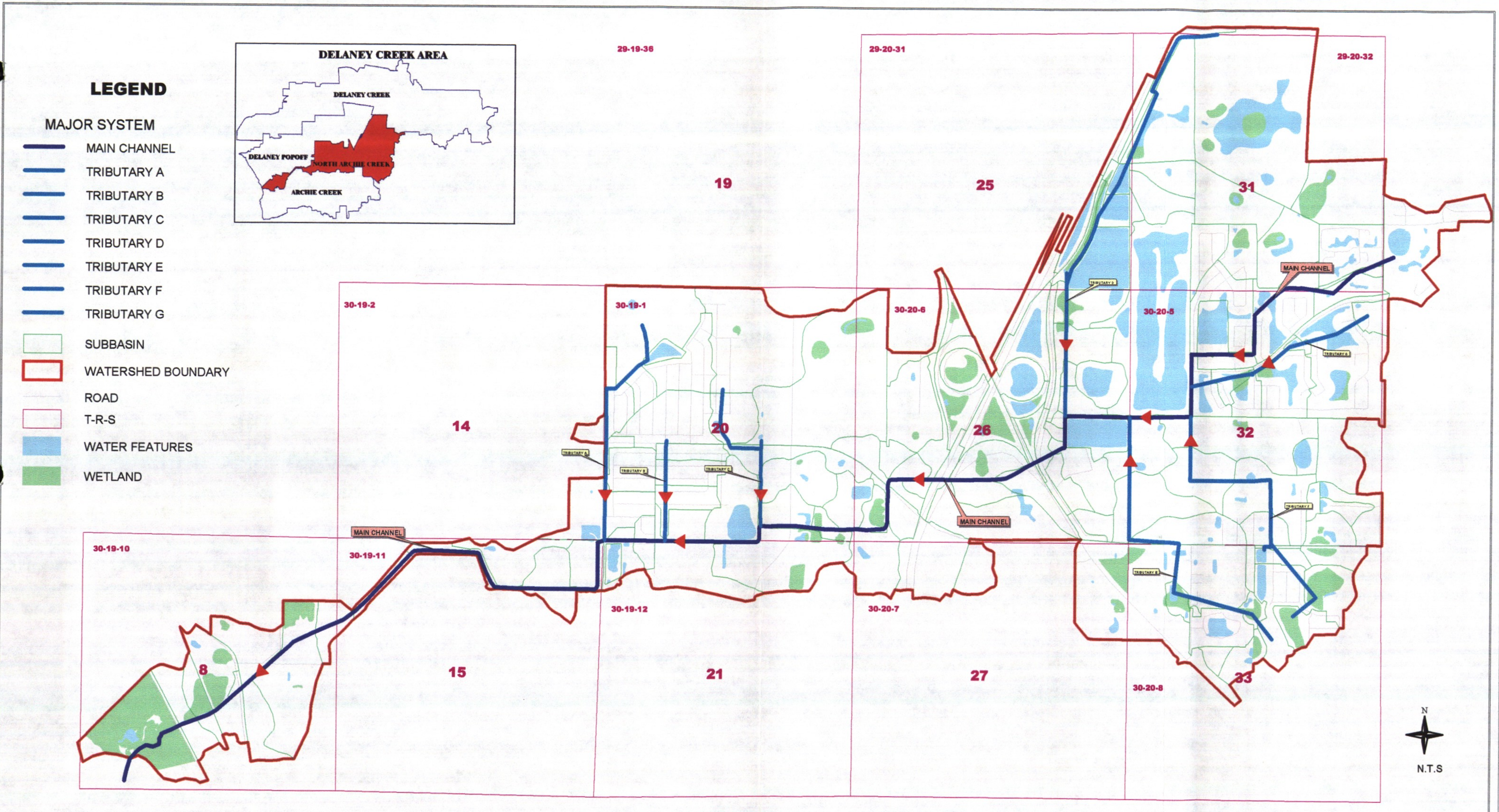
# DELANEY CREEK AREA

## STORMWATER MANAGEMENT MASTER PLAN

(SEPTEMBER 2000)

## FIGURE 3-2

DELANEY POPOFF SUB-WATERSHED
MAJOR CONVEYANCE SYSTEMS



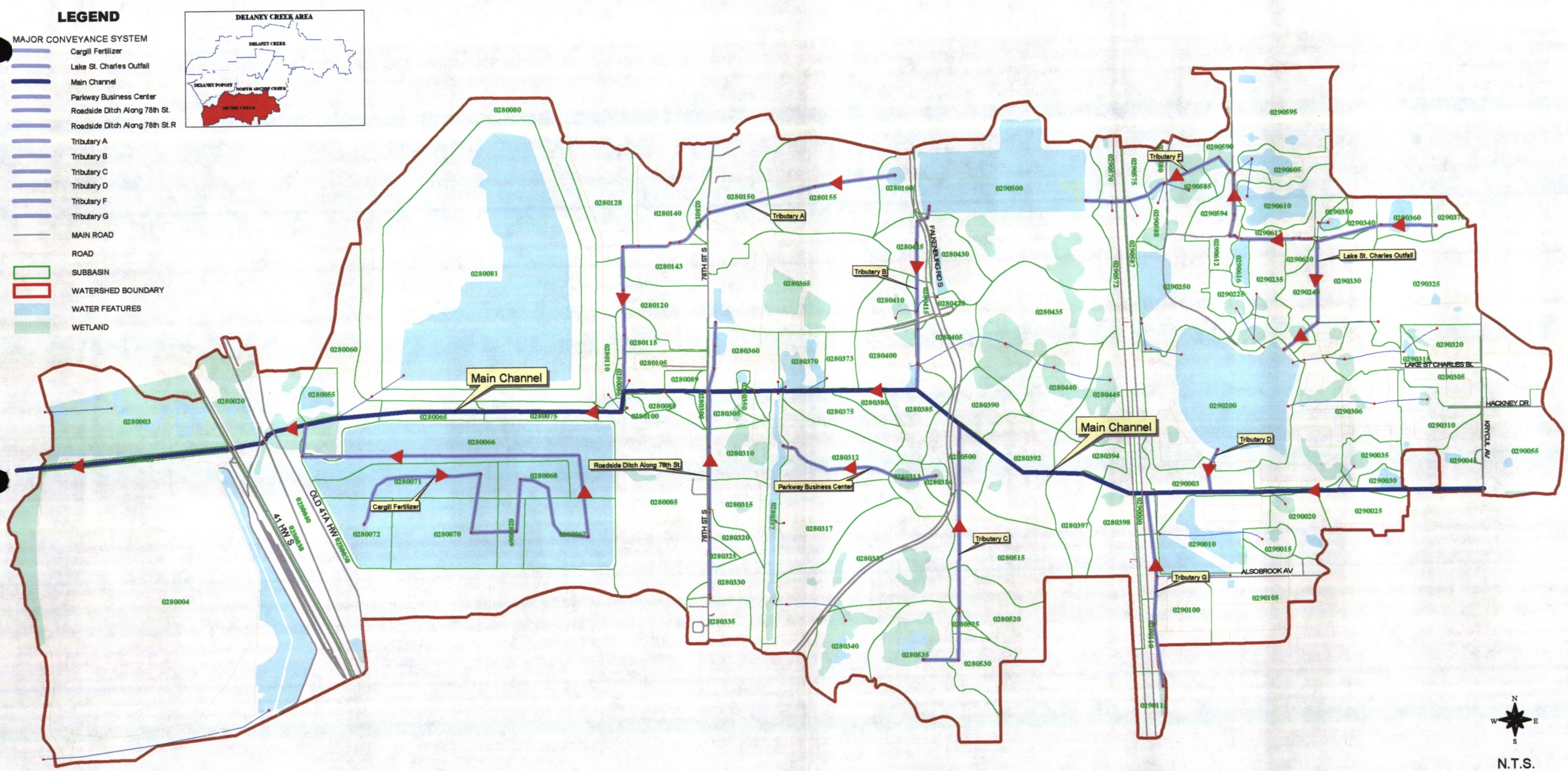

Hillsborough County
Florida

Department of Public Works
Engineering Division
Stormwater Management Section

NORTH ARCHIE CREEK AREA
STORMWATER MANAGEMENT
MASTER PLAN
( SEPT 2000 )

FIGURE 3-3

MAJOR CONVEYANCE SYSTEM MAP




Department of Public Works
Engineering Division
Stormwater Management Section

Hillsborough County
Florida

# ARCHIE CREEK AREA STORMWATER MANAGEMENT MASTER PLAN ( SEPT 2000 )

## FIGURE 3-4

Major Conveyance System MAP

# HYDRAULIC/HYDROLOGIC MODEL METHODOLOGY

Several computer software products and analysis techniques have been used to develop the current model for all the County watershed studies, including the Delaney Creek Area watershed (DCA). This chapter provides a general description of these methods and approaches.

## 4.1 GENERAL METHODOLOGY AND DATABASE DEVELOPMENT

The United States Department of Agriculture's Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service (SCS), Runoff Curve Number (CN) method has been used to generate runoff hydrographs from rainfall data and watershed parameters. This method estimates expected storm water runoff based on soil and land cover characteristics as well as watershed flow path and slope characteristics. Runoff hydrographs have been developed using the NRCS Dimensionless Unit Hydrograph method.

Inflow hydrographs have been generated at junctions. Discharges have been routed through the system using a modified version of the U. S. Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) version 4.31, Hillsborough County's version of SWMM. The EXTRAN block of SWMM provides a hydrodynamic channel routing model.

## 4.2 HYDROLOGY

In the Hillsborough County version of SWMM, the SCS-CN method, rather than the nonlinear reservoir method, was used to calculate the runoff hydrographs.

### 4.2.1 SCS-CN METHOD

The SCS-CN method is one of the most popular methods for computing the volume of surface runoff for a given rainfall event from small watersheds. Kent (1973) described and examined this method in detail. The SCS-CN method is based on the water balance equation and two fundamental hypotheses. The first hypothesis states that the ratio of the actual amount of direct runoff to the maximum potential runoff is equal to the ratio of the amount of actual infiltration to the amount of the potential maximum retention. The second hypothesis states that the amount of initial abstraction is some fraction of the potential maximum retention. Expressed mathematically, the water balance equation and the two hypotheses, respectively, are:

$$P = I_a + F + P_E \qquad (4\text{-}1)$$

$$\frac{P_E}{P - I_a} = \frac{F}{S} \qquad (4\text{-}2)$$

$$I_a = \lambda S \qquad (4\text{-}3)$$

where:

$P$ = total precipitation, inch;

$I_a$ = initial abstraction, inch;

$F$ = cumulative infiltration excluding $I_a$, inch;

$\lambda$ = non-dimensional parameter;

$P_E$ = direct runoff, inch; and

$S$ = potential maximum retention or infiltration, inch

The current version of the SCS-CN method assumes $\lambda$ equal to 0.2 for usual practical applications. As the initial abstraction component accounts for surface storage, interception, and infiltration before runoff begins, $\lambda$ can take any value ranging from 0 to 1. Combining (4-1) and (4-2), we can write an equation for $P_E$ as follows:

$$P_E = \frac{(P - I_a)^2}{P - I_a + S} \qquad (4\text{-}4)$$

If $\lambda$=0.2, then

$$P_E = \frac{(P - 0.2S)^2}{P + 0.8S} \qquad (4\text{-}5)$$

By studying the relationships of many different watersheds, the SCS further introduced a dimensionless number, *CN*, called curve number. The curve number and *S* are related by

$$S = \frac{1000}{CN} - 10 \qquad (4\text{-}6)$$

The curve number is a function of land use, cover, soil classification, hydrologic conditions, and antecedent runoff conditions. The variation in infiltration rates of different soils is incorporated in curve number selection through the classification of soils into four hydrologic soil groups: A, B, C, and D. These groups, representing soils having high, moderate, low, and very low infiltration rates :

Group A: soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission (greater than 0.30 in/h).

Group B: soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well drained to well drained soils with moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission (0.15-0.30 in/h).

Group C: soils have low infiltration rates when thoroughly wetted and consist mainly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/h).

Group D: soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/h).

Runoff curve numbers for urban areas, cultivated and other agricultural lands, and arid and semiarid rangelands are shown in Table 4.1

**Table 4.1a**
**Runoff Curve Numbers for Urban Areas***

| Cover type and hydrologic condition | Average impervious area percentage** | Curve numbers for hydrologic soil group | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| Fully developed urban areas (vegetation established) Open space (lawns, parks, golf courses, cemeteries, etc.)*** | | | | | |
| Poor condition (grass cover < 50%) | | 68 | 79 | 86 | 89 |
| Fair condition (grass cover 50% to 75%) | | 49 | 69 | 79 | 84 |
| Good condition (grass cover > 75%) | | 39 | 61 | 74 | 80 |
| Impervious areas: | | | | | |
| Paved parking lots, roofs, driveways, etc. (excluding Right-of-way) | | 98 | 98 | 98 | 98 |
| Streets and roads: | | | | | |
| Paved; curbs and storm sewers (excluding right-of-way) | | 98 | 98 | 98 | 98 |
| Paved; open ditches (including right-of-way) | | 83 | 89 | 92 | 93 |
| Gravel (including right-of-way) | | 76 | 85 | 89 | 91 |
| Dirt (including right-of-way) | | 72 | 82 | 87 | 89 |
| Western desert urban areas: | | | | | |
| Natural desert landscaping (pervious areas only) | | 63 | 77 | 85 | 88 |
| Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch, and basin borders) | | 96 | 96 | 96 | 96 |
| Urban districts: | | | | | |
| Commercial and business | 85 | 89 | 92 | 94 | 95 |
| Industrial | 72 | 81 | 88 | 91 | 93 |

**Table 4.1a -** cont'd.
**Runoff Curve Numbers for Urban Areas***

| **Cover type and hydrologic condition** | **Average impervious area percentage**** | **Curve numbers for hydrologic soil group** | | | |
|---|---|---|---|---|---|
| | | **A** | **B** | **C** | **D** |
| Residential districts by average lot size: | | | | | |
| 1/8 acre or less (town house) | 65 | 77 | 85 | 90 | 92 |
| 1/4 acre | 38 | 61 | 75 | 83 | 87 |
| 1/3 acre | 30 | 57 | 72 | 81 | 86 |
| 1/2 acre | 25 | 54 | 70 | 80 | 85 |
| 1 acre | 20 | 51 | 68 | 79 | 84 |
| 2 acre | 12 | 46 | 65 | 77 | 82 |
| Developing urban areas: | | | | | |
| Newly graded areas (pervious areas only, no vegetation) | | 77 | 86 | 91 | 94 |
| Idle lands (CNs are determined through the use of cover types similar to those for other agricultural lands.) | | | | | |

* Average runoff condition, and $I_a = 0.2S$.

** The average percentage of impervious area shown was used to develop the composite CNs. Other assumptions are as follows: Impervious areas are directly connected to the drainage system; impervious areas have a CN of 98; and pervious areas are considered equivalent to open space in good hydrologic condition.

*** CNs shown are equivalent to those of pasture. Composite CNs may be computed for other combinations of open space cover type.

**Table 4.1b**
**Runoff Curve Numbers for Cultivated Agricultural Lands***

| Cover type | Treatment** | Hydrologic Condition*** | Curve numbers for hydrologic soil group | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| Fallow | Bare soil | | 77 | 86 | 91 | 94 |
| | Crop residue cover (CR) | Poor | 76 | 85 | 90 | 93 |
| | | Good | 74 | 83 | 88 | 90 |
| Row crops | Straight row (SR) | Poor | 72 | 81 | 88 | 91 |
| | | Good | 67 | 78 | 85 | 89 |
| | SR+CR | Poor | 71 | 80 | 87 | 90 |
| | | Good | 64 | 75 | 82 | 85 |
| | Contoured (C) | Poor | 70 | 79 | 84 | 88 |
| | | Good | 64 | 74 | 81 | 85 |
| | C+CR | Poor | 69 | 78 | 83 | 87 |
| | | Good | 64 | 74 | 81 | 85 |
| | Contoured and terraced (C&T) | Poor | 66 | 74 | 80 | 82 |
| | | Good | 62 | 71 | 78 | 81 |
| | C&T+CR | Poor | 65 | 73 | 79 | 81 |
| | | Good | 61 | 70 | 77 | 80 |
| Small grain | SR | Poor | 65 | 76 | 84 | 88 |
| | | Good | 63 | 75 | 83 | 87 |
| | SR+CR | Poor | 64 | 75 | 83 | 86 |
| | | Good | 60 | 72 | 80 | 84 |
| | C | Poor | 63 | 74 | 82 | 85 |
| | | Good | 61 | 73 | 81 | 84 |
| | C+CR | Poor | 62 | 73 | 81 | 84 |
| | | Good | 60 | 72 | 80 | 83 |
| | C&T | Poor | 61 | 72 | 79 | 82 |
| | | Good | 59 | 70 | 78 | 81 |
| | C&T+CR | Poor | 60 | 71 | 78 | 81 |
| | | Good | 58 | 69 | 77 | 80 |

**Table 4.1b -** cont'd**.**
**Runoff Curve Numbers for Cultivated Agricultural Lands***

| Cover type | Treatment** | Hydrologic Condition*** | Curve numbers for hydrologic soil group | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| Close-seeded or broadcast legumes or rotation meadow | SR | Poor | 66 | 77 | 85 | 89 |
| | | Good | 58 | 72 | 81 | 85 |
| | C | Poor | 64 | 75 | 83 | 85 |
| | | Good | 55 | 69 | 78 | 83 |
| | C&T | Poor | 63 | 73 | 80 | 83 |
| | | Good | 51 | 67 | 76 | 80 |

* Average runoff condition, and $I_a = 0.2S$.

** Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

*** Hydrologic condition is based on a combination of factors that affect infiltration and runoff, including:

(a) density and canopy of vegetative areas
(b) amount of year-round cover
(c) amount of grass or close-seeded legumes in rotations
(d) percentage of residue cover on the land surface (good $\geq$ 20%)
(e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.
Good: Factors encourage average and better-than-average infiltration and tend to decrease runoff.

**Table 4.1c**
**Runoff Curve Numbers for Other Agriculture Lands[1]**

| Cover type | Hydrologic condition | Curve numbers for hydrologic soil group | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| Pasture, grassland, or range-continuous forage for grazing[2] | Poor | 68 | 79 | 86 | 89 |
| | Fair | 49 | 69 | 79 | 84 |
| | Good | 39 | 61 | 74 | 80 |
| Meadow-continuous grass, protected from grazing and generally mowed for hay | | 30 | 58 | 71 | 78 |
| Brush—brush-weed-grass mixture with brush the major element[3] | Poor | 48 | 67 | 77 | 83 |
| | Fair | 35 | 56 | 70 | 77 |
| | Good | 30[4] | 48 | 65 | 73 |
| Woods—grass combination (orchard or tree farm)[5] | Poor | 57 | 73 | 82 | 86 |
| | Fair | 43 | 65 | 76 | 82 |
| | Good | 32 | 58 | 72 | 79 |
| Woods[6] | Poor | 45 | 66 | 77 | 83 |
| | Fair | 36 | 60 | 73 | 79 |
| | Good | 30[4] | 55 | 70 | 77 |
| Farmsteads—buildings, lanes, driveways, and surrounding lots | | 59 | 74 | 82 | 86 |

[1] Average runoff condition, and $I_a = 0.2S$.
[2] Poor: <50% ground cover or heavily grazed with no mulch.
Fair: 50% to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.
[3] Poor: <50% ground cover.
Fair: 50% to 75% ground cover.
Good: > 75% ground cover.
[4] Actual curve number is less than 30; use CN=30 for runoff computations.
[5] CNs shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CNs for woods and pasture.
[6] Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

**Table 4.1d**
**Runoff Curve Numbers for Arid and Semiarid Rangeland***

| Cover Type | Hydrologic condition** | Curve numbers for hydrologic soil group | | | |
|---|---|---|---|---|---|
| | | A*** | B | C | D |
| Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element | Poor | | 80 | 87 | 93 |
| | Fair | | 71 | 81 | 89 |
| | Good | | 62 | 74 | 85 |
| Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush. | Poor | | 66 | 74 | 79 |
| | Fair | | 48 | 57 | 63 |
| | Good | | 30 | 41 | 48 |
| Pinyon-juniper—pinyon, juniper, or both; grass understory. | Poor | | 75 | 85 | 89 |
| | Fair | | 58 | 73 | 80 |
| | Good | | 41 | 61 | 71 |
| Sagebrush with grass understory. | Poor | | 67 | 80 | 85 |
| | Fair | | 51 | 63 | 70 |
| | Good | | 35 | 47 | 55 |
| Desert shrub—major plants include saltbush, greasewood, creosote bush, blackbrush, bursage, paloverde, mesquite, and cactus. | Poor | 63 | 77 | 85 | 88 |
| | Fair | 55 | 72 | 81 | 86 |
| | Good | 49 | 68 | 79 | 84 |

*Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use the table for other agriculture lands.

** Poor: <30% ground cover (litter, grass, and brush overstory.
Fair: 30% to 70% ground cover.
Good: > 70% ground cover.

*** Curve numbers for group A have been developed for desert shrub only.

## 4.2.2 SCS DIMENSIONLESS HYDROGRAPH

The SCS dimensionless hydrograph is a synthetic unit hydrograph in which the discharge is expressed by the ratio of discharge $Q$ to peak discharge $Q_p$ and the time by the ratio of time t to the time of rise of the unit hydrograph, $T_p$. The unit peak discharge is calculated by

$$U_p = \frac{KA}{T_p} \qquad (4\text{-}7)$$

where:

$U_p$ = unit peak discharge, cfs/inch;

$A$ = drainage are, mile$^2$;

$K$ = hydrograph shape factor, ranges from 300 for flat swampy areas to 600 in steep terrain. SCS standard K value = 484.

$T_p$ = time to peak, in hours.

$$T_p = \frac{t_r}{2} + t_p \qquad (4\text{-}8)$$

where:

$t_r$ = storm duration, hours;

$t_p$ = drainage area lag, hours.

$$t_p = 0.6T_c \qquad (4\text{-}9)$$

where:

$T_c$ = time of concentration, hours.

Figure 4-1 below shows the definition of $U_p$, $T_p$, for a triangular unit hydrograph used in Hillsborough County version of SWMM.

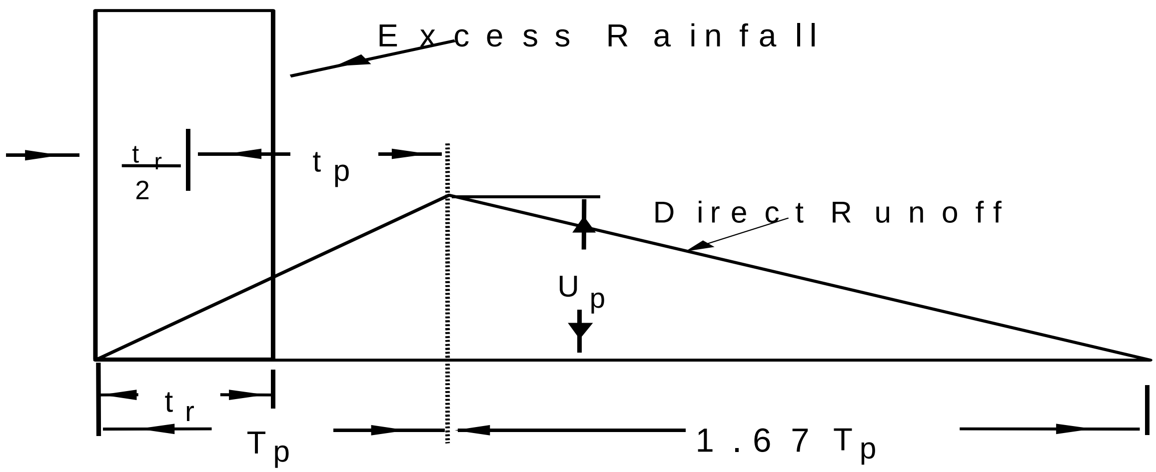



Figure 4-1 Definition of Unit Hydrograph

The peak discharge for a given rainfall is calculated by

$$Q_p = U_p P_E \qquad (4\text{-}10)$$

where:

$Q_p$= peak discharge, cfs. $P_E$ is calculated with Eq. (4-5).

## 4.2.3 MODEL IMPLEMENTATION

The convolution method is used to yield the direct runoff hydrograph. The convolution equation is:

$$Q_n = \sum_{m=1}^{n \le M} P_{Em} U_{n-m+1} \qquad (4\text{-}11)$$

where:

$P_{Em}$ = excess rainfall of *mth* pulse, inch;

$U_{n-m+1}$ = unit direct runoff at time *n*   *t* of *mth* rainfall pulse, interpolated from Fig. 4.1, cfs/inch;

.   *t*  = time step, minutes;

$Q_n$ = total runoff at time *n*   *t*, cfs;

M  = total pulses of excess rainfall.

## 4.2.4 RAINFALL DEPTH

Rainfall depths were estimated from isohyetal maps shown in the Southwest Florida Water Management District's (SWFWMD) Environmental Resource Permitting Information Manual.  The rainfall depths for the 24 hours duration storm event used in model simulation are as follows:

**Table 4.2**
**Design Storm Events**

| STORM EVENT PRECIPITATION | 24-HOUR DEPTH (inches) |
|---|---|
| Mean Annual | 4.50 |
| 5-year | 5.50 |
| 10-year | 7.00 |
| 25-year | 8.00 |
| 50-year | 10.0 |
| 100-year | 11.0 |

The design storm rainfall distribution used is the SCS 24-Hour Type II Florida-Modified, as required by both SWFWMD and Hillsborough County.

# 4.2.5 SOIL DATA, LAND USE, AND SCS-CN NUMBER DETERMINATION

## 4.2.5.1 Soil Data

SWFWMD Geographic Information System (GIS) soil coverage was used to obtain soil information for the DCA watershed. The SWFWMD coverage was developed from data in the SCS *Soil Survey of Hillsborough County, Florida*, 1989. Each soil polygon in the GIS coverage is associated with an attribute that designates its soil identification number. A database table was used to associate soil identification numbers with their corresponding Hydrologic Soil Group (HSG). Hydrologic soil groups in the DCA watershed consist of six designations A, B, C, D, B/D, A/D and Water. The HSG A soils have a high infiltration rate and low runoff potential. HSG B soils are moderately well drained and have a moderate infiltration rate. HSG C soils have slow infiltration rates and may contain a layer of fine texture soil, which impedes the downward movement of water. HSG D soils include poorly drained, very silty/clayey/organic soils or soils with high groundwater tables. Dual hydrologic classifications (B/D and A/D) includes soils which have a seasonal high water table but can be drained. The first hydrologic soil group designates the drained condition and the second hydrologic soil group designates the undrained condition of the soil. The hydrologic soil groups used in the analysis were shown in Figure 2-4. It is based on the SWFWMD GIS soil coverage.

## 4.2.5.2 Land Use

The SWFWMD GIS Land Use Coverage (1995) was used to represent the existing conditions land use. Each land use polygon in the GIS coverage is associated with an attribute that designates a classification from the Florida Land Use Classification Code System (FLUCCS) - also known as the Florida Land Use, Cover and Forms Classification System (FLUCFCS). There has been some development in the DCA watershed since 1995 that would is not represented in the SWFWMD coverage. As impervious area increases, runoff usually increases. However, SWFWMD has been regulating quantity of stormwater runoff since 1984. The objective of regulation has been to prevent peak runoff rates under the developed conditions from exceeding peak runoff rates associated with the predevelopment conditions. The Land Use/Land Cover data used in the analysis were shown in Figure 2-6. It is based on the SWFWMD GIS coverage for land use/land cover. The SWFWMD land use coverage is based on 1995 aerial infrared photography. SWFWMD uses the ARC/INFO GIS in Unix System, which is compatible to Hillsborough County's ARC/INFO GIS performed in Windows NT Workstation version GIS system.

### 4.2.5.3 Runoff Curve Numbers

Runoff curve number calculations were based on a GIS intersection of the SWFWMD land use coverage with the SWFWMD soil coverage and the County's subbasin map. The subbasin map was prepared in AutoCAD and exported in DXF format. It was then imported to the County GIS system for overlay with the soil and land use coverages. The resulting GIS polygons are associated with attributes of soil type and FLUCCS code. Each soil type was then associated with a hydrologic soil group (A, B, C, or D) as discussed in previous sections, and each FLUCCS code was associated with an SCS land use category. A CN value was then assigned to each polygon based on the specific hydrologic soil group and land cover classification. The average area weighted CN value was based on Table 4.1 then computed for each subbasin.

## 4.2.6 TIME-OF-CONCENTRATION

Time-of-concentration estimates were made by adding the travel times for each segment of the appropriate flow path. The methods used for calculating travel times are based on those shown in the Hillsborough County Stormwater Technical Manual, and are summarized as follows:

| | |
|---|---|
| Overland Flow: | Kinematic Wave Equation |
| Shallow Concentrated Paved: | SCS equations relating velocity to watercourse slope |
| Shallow Concentrated Unpaved: | SCS equations relating velocity to watercourse slope |
| Channel Flow: | Assumed velocity 2 ft/sec |
| Pipe Flow: | Assumed velocity 3 ft/sec |

The selection of Manning's coefficients for the calculation of overland flow travel time is based on Table 4.3.

**Table 4.3**
**Overland Flow Manning's n Values**

| Basin Type | Recommended value | Range of values |
|---|---|---|
| Concrete | 0.011 | 0.01 - 0.013 |
| Asphalt | 0.012 | 0.01 - 0.015 |
| Bare Sand | 0.010 | 0.010 - 0.016 |
| Graveled Surface | 0.012 | 0.012 - 0.030 |
| Bare Clay-loam (eroded) | 0.012 | 0.012 - 0.033 |
| Fallow (no residue) | 0.05 | 0.006 - 0.16 |
| Chisel Plow (<1/4 tons/acre residue) | 0.07 | 0.006 - 0.17 |
| Chisel Plow (1/4 - 1 tons/acre residue) | 0.18 | 0.07 - 0.34 |
| Chisel Plow (1 - 3 tons/acre residue) | 0.30 | 0.19 - 0.47 |
| Chisel Plow (>3 tons/acre residue) | 0.40 | 0.34 - 0.46 |
| Disk/Harrow (<1/4 tons/acre residue) | 0.08 | 0.008 - 0.41 |
| Disk/Harrow (1/4 -1 tons/acre residue) | 0.16 | 0.10 - 0.25 |
| Disk/Harrow (1 - 3 tons/acre residue) | 0.25 | 0.14 - 0.53 |
| Disk/Harrow (>3 tons/acre residue) | 0.30 | N/A |
| No Till (<1/4 tons/acre residue) | 0.04 | 0.03 - 0.07 |
| No Till (1/4 - 1 tons/acre residue) | 0.07 | 0.01 - 0.13 |
| No Till (1 - 3 tons/acre residue) | 0.30 | 0.16 - 0.47 |
| Plow (fall) | 0.06 | 0.02 - 0.10 |
| Coulter | 0.10 | 0.05 - 0.13 |
| Range (natural) | 0.13 | 0.01 - 0.32 |
| Range (clipped) | 0.08 | 0.02 - 0.24 |
| Grass (bluegrass sod) | 0.45 | 0.39 - 0.63 |
| Short grass prairie | 0.15 | 0.10 - 0.20 |
| Dense grass | 0.24 | 0.17 - 0.30 |
| Bermudagrass | 0.41 | 0.30 - 0.48 |
| Woods | 0.45 | N/A |

# 4.3 HYDRAULICS

## 4.3.1 MAJOR MODIFICATIONS

A modification of the U.S. EPA SWMM 4.31, Hillsborough County version of SWMM, was used to compute water surface elevations and discharges at links and nodes shown on the conduit/ junction schematic diagram. The SWMM EXTRAN block was used for hydraulic routing. The most significant modifications to EPA SWMM 4.31 included directly integrating the SCS method to generate runoff hydrographs, entrance and exit headloss coefficient, and conduit stretch factor.

The exit headloss coefficient is usually set to 1.0. The entrance headloss coefficient is selected based on Table 4.4.

Other minor changes included the increase of dimensions of a number of key parameters, enhancements of the inputs and the outputs and error trapping. Input enhancements included a provision for specifying reach numbers for orifices and weirs and another for using elevations rather than depths above invert for weir data. Several output enhancements have been provided including a provision for printing a summary file showing both computed peak discharge values and water surface elevations.

Elliptical and arch pipes are included in the current County version SWMM model. Natural channels are represented in EXTRAN as conduits with irregular cross section data. The cross section data is input as ground shots (elevations and stations across the channel) in a format similar to that of HEC-2 (U.S. Army Corps of Engineers) cross section data. EXTRAN uses the cross section data only to obtain the shape geometry. It uses invert elevations input on the conduit records to determine the channel slope. A natural channel is, thus, treated as a prismatic conduit with an irregular shape.

**Table 4.4**
**Culvert Entrance Loss Coefficients**

| Type of Structure and Design of Entrance | Coefficient $k_e$ |
|---|---|
| **Pipe, Concrete** | |
| Projecting from fill, socket end (groove-end) | 0.2 |
| Projecting from fill, square cut end | 0.5 |
| Straight headwall | |
| Socket end of pipe (groove-end) | 0.2 |
| Square-edge | 0.5 |
| Rounded (radius = 1/12D) (Indexes 250, 251, 252, 253, 255) | 0.2 |
| Mitered to conform to fill slope (Indexes 272, 273, 274) | 0.7 |
| End section conforming to fill slope' | 0.5 |

**Table 4.4** - cont'd.
**Culvert Entrance Loss Coefficients**

| Type of Structure and Design of Entrance | Coefficient $k_e$ |
|---|---|
| Beveled edges, 33.7° or 45° bevels | 0.2 |
| Side- or slope-tapered inlet | 0.2 |
| Straight sand-cement (Index 258) | 0.3 |
| U-type with grate (Index 260) | 0.7 |
| U-type (Index 261) | 0.5 |
| Winged concrete (Index 266) | 0.3 |
| U-type sand-cement (Index 268) | 0.5 |
| Flared end concrete (Index 270) | 0.5 |
| Side drain, mitered with grate (Index 273) | 1.0 |
| **Pipe or Pipe-Arch, Corrugated Metal** | |
| Straight endwall--rounded (Radius=1/12 D) (Index 250) | 0.2 |
| Projecting from fill (no headwall) | 0.9 |
| Headwall or headwall and wingwalls, square-edge | 0.5 |
| Mitered to conform to fill slope (Indexes 272, 273, 271) | 0.7 |
| End section conforming to fill slope, paved or unpaved* | 0.5 |
| Beveled edges, 33.7° or 45° bevels | 0.2 |
| Side- or slope-tapered inlet | 0.2 |
| **Box, Reinforced Concrete** | |
| Headwall parallel to embankment (no wingwalls) | |
| Square-edged on three edges | 0.5 |
| Rounded on three edges to radius of 1/12 barrel dimension, or beveled edges on three sides (Index 290) | 0.2 |
| Wingwalls at 30° to 75° to barrel | |
| Square-edged at crown | 0.4 |
| Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge | 0.2 |
| Wingwalls at 10° to 25° to barrel, square-edged at crown | 0.5 |
| Wingwalls parallel (extension of sides) | |
| Square edged at crown | 0.7 |
| Side- or slope-tapered inlet | 0.2 |

*End sections conforming to fill slope, made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests, they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections incorporating a closed taper in their design have a superior hydraulic performance.

Note: Entrance head loss, $H_e = K_e \frac{V^2}{2g}$

Reference : USDOT, FHWA, HEC-5 (1965).

## 4.3.2 BOUNDARY/INITIAL CONDITIONS

To solve the St. Vennant equations, both boundary and initial conditions are necessary. The boundary conditions are usually given water levels at downstream, steady and/or unsteady. The upstream boundary conditions, water inflows, are determined by hydrology subroutine. The propriety water levels and water discharges are used as initial conditions. In the studied area, four subwatershed systems make up the DCA watershed. These four subwatershed systems are the Delaney Creek, Delaney Creek Pop-off, North Archie Creek and Archie Creek. Boundary conditions will be discussed for each of the subwatersheds as follows.

The major channels of Delaney Creek, Delaney Creek Pop-off, North Archie Creek and Archie Creek have outflow points into Hillsborough Bay. For model purposes, the boundary conditions at Hillsborough Bay were set at a constant water surface elevation of 2.5 feet N.G.V.D. This elevation represents the mean high tide for the region of Hillsborough Bay. An initial water surface of 2.5 feet N.G.V.D. is also used for entire tidally influenced junctions in the DCA watersheds. The boundary condition used in the model does not include the storm surge effects within the Hillsborough Bay. The details of boundary and initial conditions are discussed in Chapter 5.

## 4.3.3 OVERFLOW WEIRS

At some roadway crossings, weirs were used to simulate the overtopping of the road. Broad crested weirs were also used to simulate overland flow connections. In some cases, overland flow weirs were used to convey overbank flow, which was modeled as re-entering the channel at a downstream junction point.

## 4.3.4 ROUGHNESS COEFFICIENTS

The roughness coefficients for the right, left, and center portion of channel sections were evaluated separately. In many cases, overbank areas were considered to be storage elements and not considered to have conveyance capability. Manning coefficients for channel sections were taken from several sources including but not limited to the HEC-2 water surface profile printouts obtained from FEMA. The values have been adjusted by Hillsborough County staff engineers on the basis of photographs, site visits, and general knowledge of the area. The roughness coefficients may be adjusted as more reliable field information becomes available or as refinements in model calibration occur. Higher roughness values sometimes result in smaller computed discharge values in downstream locations and larger computed water surface elevations in upstream locations. The roughness values are adjusted as part of the calibration efforts.

For some conduits, roughness coefficients were adjusted internally by providing the entrance and exit losses coefficient externally as discussed in Section 4.3.1.

## 4.3.5 NUMERICAL INSTABILITY

The EXTRAN model solves the St. Vennant equations that describes unsteady flow in channels based on three different numerical methods: the explicit finite difference method, the implicit finite difference method, and the iteration method. In this study, method three, the iteration method was used. The advantages of this method are: 1. Better stability; 2. Faster; and 3. Easier debugging. However, this method is still subject to numerical instability caused by accumulated round-off error. It is difficult to predict the conditions that cause numerical instability however. Big time step, short conduit lengths, steep bottom slopes for conduits and low storage at junctions are frequently associated with numerical instability. Achieving numerical stability requires numerous adjustments to the model input data. Such adjustments include the use of equivalent pipes with longer lengths, decreased time step, adjusting roughness and the addition of storage at the junctions.

The equivalent pipe formula used to calculate the adjustments is as follows:

$$n_e = n_p \, L_p^{1/2} \, / \, L_e^{1/2} \qquad (4.12)$$

where;

$n_e$ = Manning roughness of equivalent pipe

$L_e$ = Computed equivalent length

$n_p$ = Actual Manning roughness of the pipe

$L_p$ = Actual length of the pipe

# HYDROLOGY/HYDRAULIC MODEL CALIBRATION AND VERIFICATION

This chapter contains the data collection, hydrological/hydraulic model calibration and verification procedure used for the Delaney, Delaney Pop-off Canal, North Archie Creek, and Archie Creek subwatersheds existing conditions. The goal of the calibration effort is to develop a hydrological/ hydraulic model that reflects the observed conditions in these subwatersheds, which can be used to predict system performance for future events and to evaluate alternative projects in the watershed.

The calibration process includes simulating a measured event by first adjusting the hydrologic input parameters according to the measured rainfall depth and distribution and then comparing the computed water surface elevations and flows to the measured values collected at gage stations. The hydrodynamic model is then adjusted so that computed and measured values more closely match.

The model is considered well calibrated when the results of stage, flow, and volume are in reasonable range with the recorded data at the established gage stations. The model is then adjusted with specific parameters accordingly and verified with data from other storm events.

## 5.1 BOUNDARY CONDITIONS

The major outfalls within the study area all empty into Hillsborough Bay. The boundary conditions at the outflow points were set to be 2.5 feet NGVD.

## 5.2 DATA COLLECTION

As mentioned in Chapter 1, the Delaney, Delaney Pop-off, North Archie Creek, and Archie Creek subwatersheds are four developing areas. Many apartment and housing complexes, transportation and stormwater management projects were, are being, and will be developed. Because of this, rainfall/ runoff information older than 3 years is not reliable. Data collection for these four subwatersheds is a challenge.

The selected storm events used in this study for model calibration and verification are as follows:

- June 15, 1999 with a 3-hour duration
- August 4, 1999 with a 3-hour duration
- August 15, 1999 with a 3-hour duration
- September 26-28, 1999 with a 48-hour duration

Four gage stations (Table 5.1) are available in the studied area. All of these stations were set and are operated by USGS (Figure 5-1).

**Table 5.1**
**Gage Stations**

| Gage Number | Watershed | Junction ID | Datum (ft) | Rainfall | Stage | Discharge | Description |
|---|---|---|---|---|---|---|---|
| 02301750 | Delaney | 210210 | 10.72 | Yes | Yes | Yes | Near Tampa |
| 02301745 | Delaney Pop-off | 240155 | -2.07 | Yes | Yes | NA | 51st Street |
| 02301740 | North Archie | 260310 | 1.05 | NA | Yes | NA | Progress Boulevard |
| 02301738 | Archie | 280300 | -12.71 | Yes | Yes | NA | 78th Street |

Figure 5-1 shows the gage station locations. Figures 5-2 to 5-5 show the rainfall distribution for all four events. Table 5.2 lists all four event total rainfall.

**Table 5.2**
**Total Rainfall**

| Event | Duration (hours) | | | | Total Rainfall (inches) | | | |
|---|---|---|---|---|---|---|---|---|
| | Delaney | Pop-off | North Archie | Archie | Delaney | Pop-off | North Archie | Archie |
| June 15, 1999 | 2 | 1.5 | 2 | NA | 1.63 | 3.41 | 1.71 | NA |
| August 4, 1999 | 2.5 | 3 | 3 | NA | 2.94 | 2.01 | 1.85 | NA |
| August 15, 1999 | 2 | 2 | 2 | NA | 1.01 | 1.4 | 1.82 | NA |
| September 26-27, 1997 | 48 | NA | NA | NA | 12.77 | NA | NA | NA |

**Insert Figure 5-1**

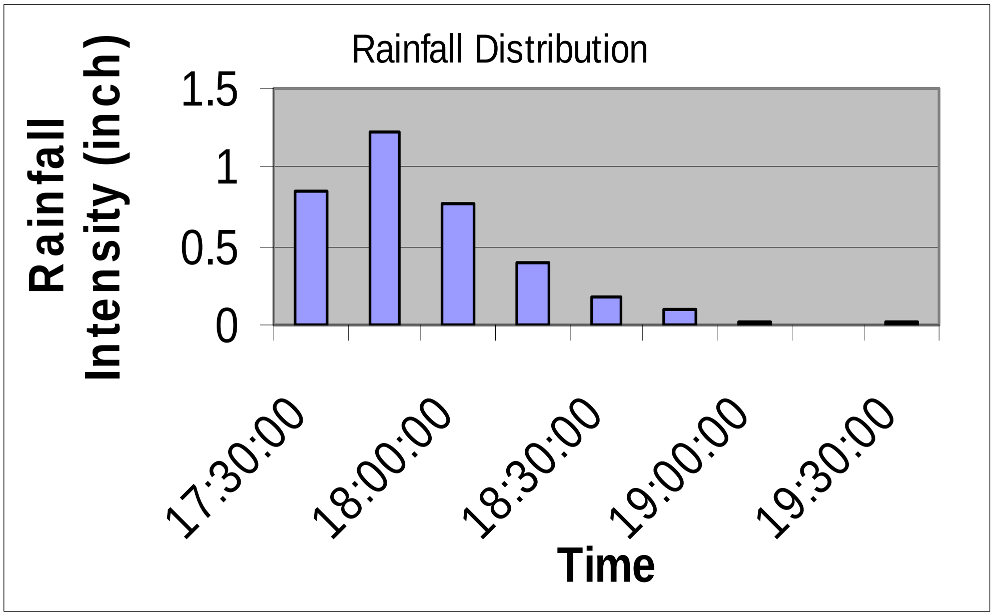



**Figure 5-2 Rainfall Distribution of June 15, 1999 Event**

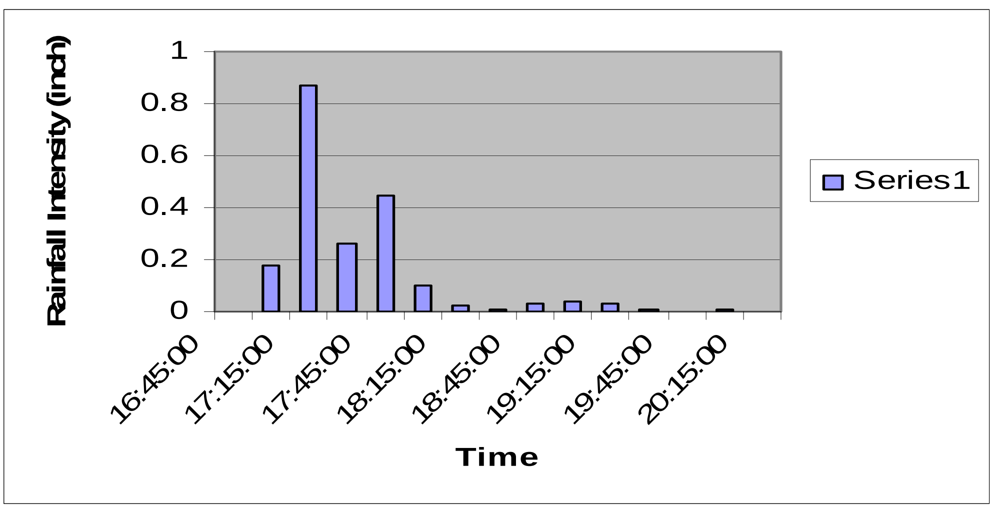



**Figure 5-3 Rainfall Distribution of August 4, 1999 Event**

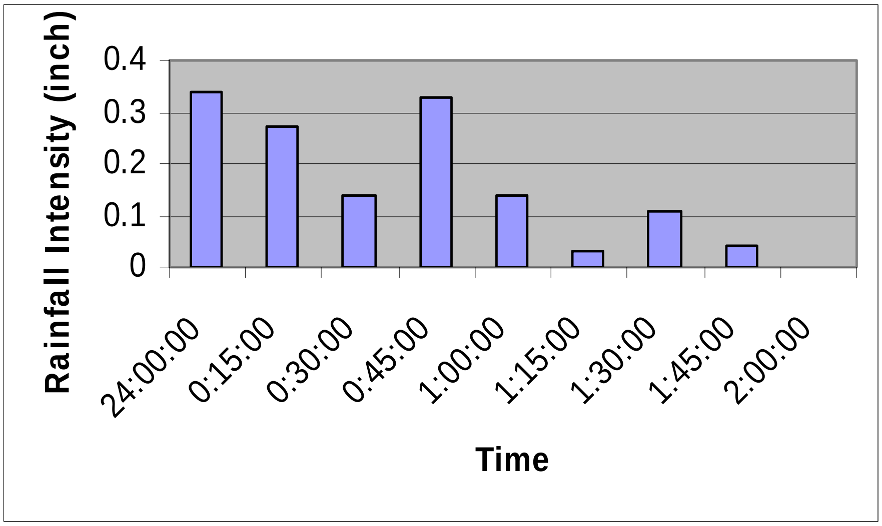



**Figure 5.4**
**Rainfall Distribution of August 14, 1999 Event**

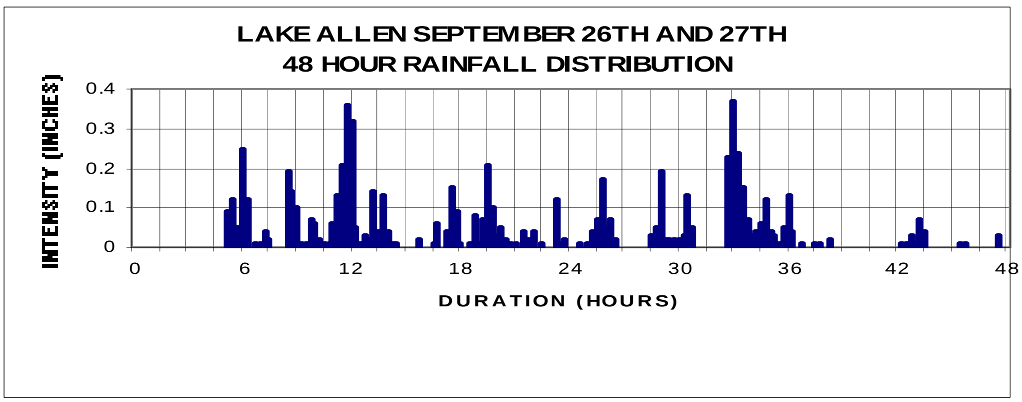



**Figure 5.5**
**Rainfall Distribution of September, 1997 Event**

# 5.3 EXISTING CONDITIONS MODEL CALIBRATION

In the Hillsborough County version of SWMM, most of the required input data simply describes the geometry and size of the hydraulic and hydrologic units of the subdivided study area. These data, such as the subbasin areas, channel widths, lengths and cross drain dimensions, are known quantities and are subject to very little interpretation. A few of the input requirements, however, are not derived from measurable qualities of the sub-catchments. These data are referred to as calibration parameters and include:

- The maximum and minimum infiltration rates for pervious areas
- The pervious and impervious depression storage volumes
- The channel and overland flow roughness coefficients

These parameters are first approximated with values derived from local data (e.g., aerial topographic photographs and soil surveys), but their final values are ultimately determined through model calibration.

After a fundamental hydrologic and hydraulic check, a calibration process is conducted to evaluate the general reliability of the model for producing reasonable results.

The August 4, 1999 rainfall event was selected for calibrating the existing conditions model due to the availability of recorded data.

The studied four subwatersheds cover an area of approximately 36 square miles. The total rainfall for the above storms, subject to study for calibration, was not uniformly distributed. Distribution ranges between 2.94 inches at the Delaney gage station in the northern part of the watershed and 1.85 inches at the North Archie Creek gage located south of the watershed (see Table 5.2). Table 5.2 also shows the differences of rainfall duration. For the daily record gages, the rainfall distribution of the closest hourly record gage is used, while keeping the total intensity of the rainfall in mind.

The objective of calibration is to better match the stages and discharges of the calculated hydrographs based on the recorded data. Adjustments to the infiltration rates increase or decrease flow rates during the time period of runoff. Similarly, adjustments to the total infiltration capacity affect the runoff volume, shift the time of the runoff, and alter the recession limb of the hydrograph. Based on a given set of calibration parameters, the model is adequately calibrated when the observed and calculated hydrograph agree with the 1999 storm. The model is then ready for further verification using different storm events.

Figures 5-6 to 5-9 show the comparisons of water levels between model results and observed ones at the four gage stations. Compared with other stations, Figure 5-9 shows that Archie Creek station had biggest difference of peak stage between model results and observed ones. The explanation for this is as follows. In this calibration, the rainfall depth of 2.01 inches was uniformly distributed in the studied subwatersheds. However, as shown in Table 5.2, the rainfall is non-uniform. For this special event, the southern part had significantly less rainfall than the northern part.

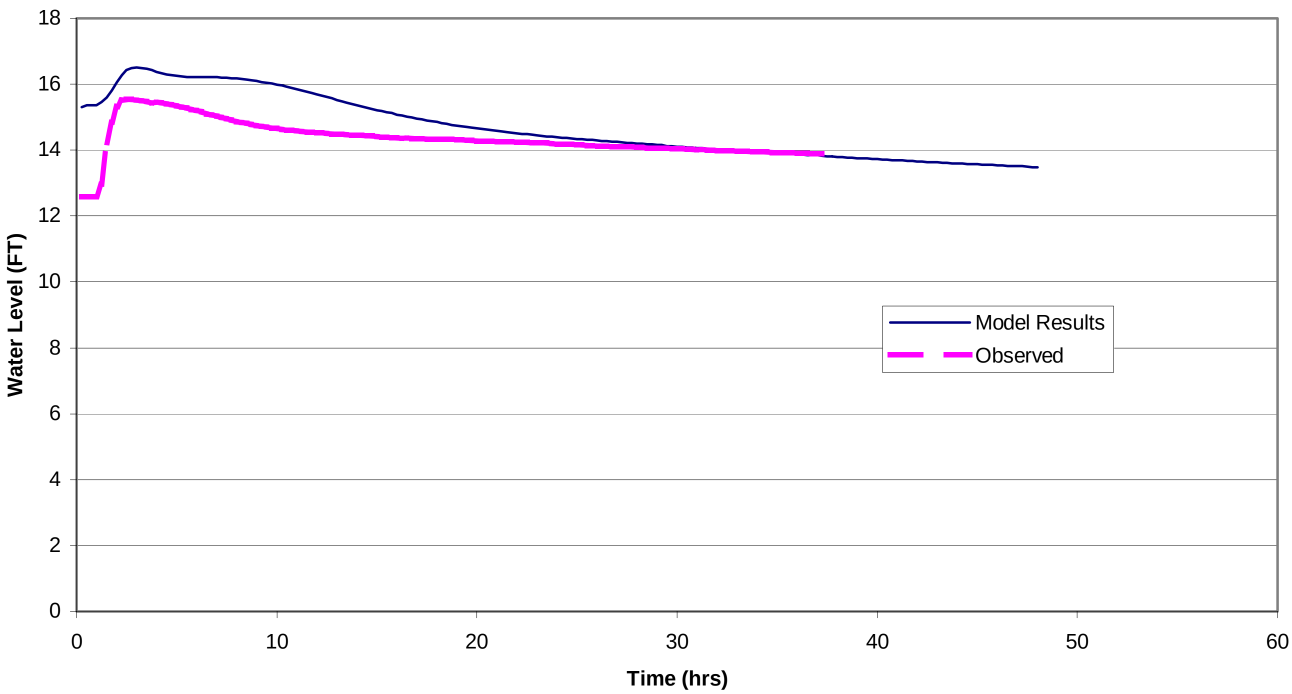



**Figure 5-6 Comparison of Water Levels in Delaney Creek (Darlington St., August 4, 1999 Event)**

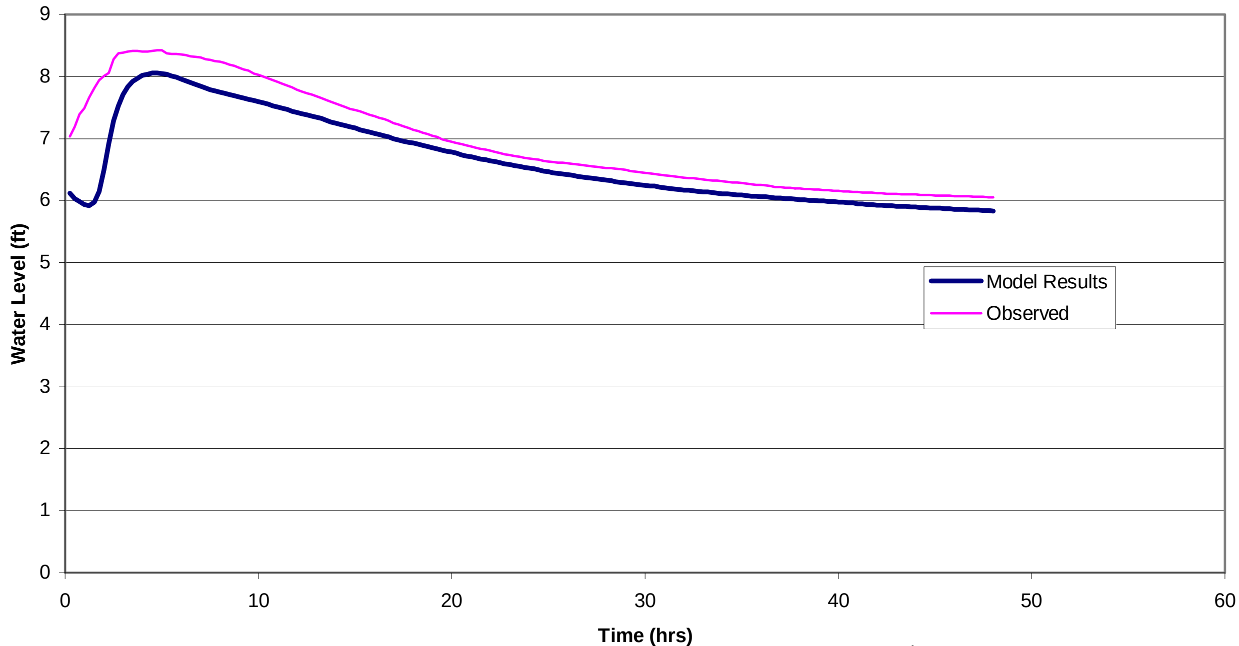



**Figure 5-7 Comparison of Water Level in Delaney Creek Pop-off (51st St., August 4, 1999 Event)**

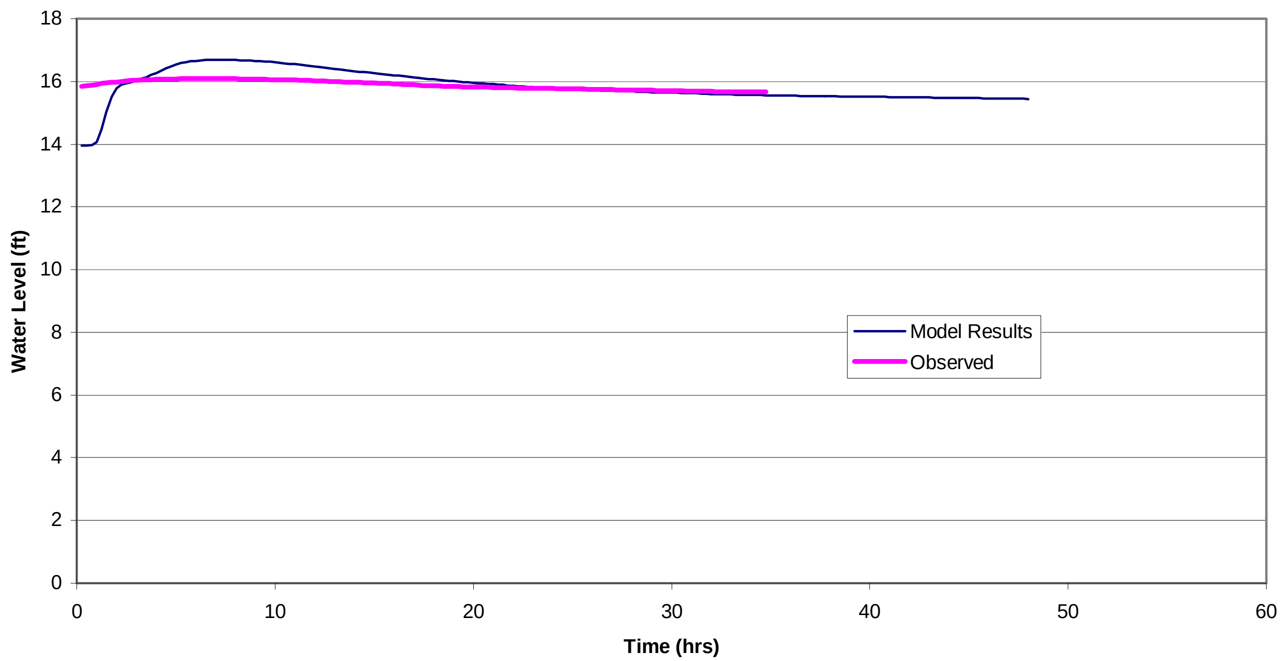



**Figure 5-8 Comparison of Water Levels in North Archie Creek (Progress Blvd, August 4, 1999 Event)**

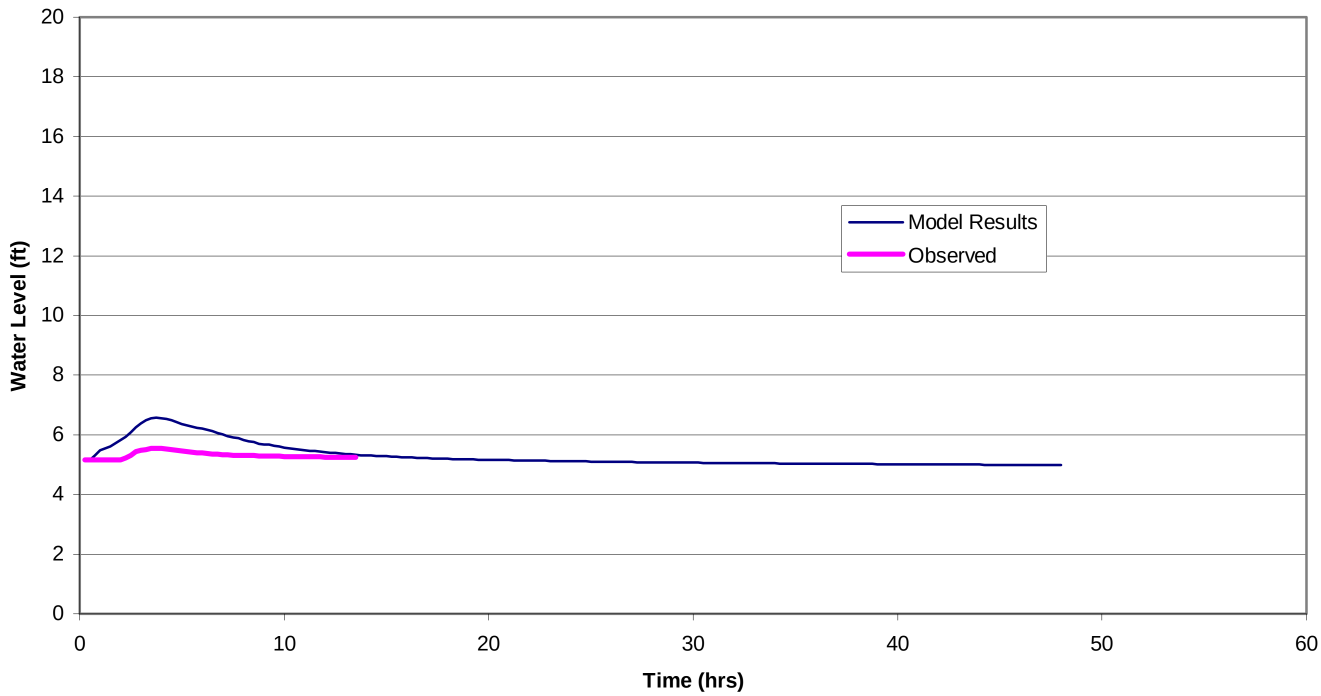



**Figure 5-9 Comparison of Water Levels in Archie Creek (78th St., August 4, 1999 Event)**

# 5.4 EXISTING CONDITIONS MODEL VERIFICATION

Model verification is an important step which ensures that adjustments made to the model during calibration are appropriate and to ensure that the model will produce reliable results.

The June 15, 1999, August 15, 1999, and September 26-27, 1997 rainfall events are selected as the verification events. These events are selected due to the availability of gage data and the magnitude of the storm. Total rainfall recorded data at USGS stations during the storm events are summarized in Table 5.2. The USGS streamflow gage recorded data collected prior to and following the September 1997 event are also considered in the verification process.

The verification event's hydrologic input file was developed using the same USGS source data for the appropriate storm events.

An important aspect of the hydrologic model that evolved during the calibration process was the establishment of antecedent soil moisture conditions. The numerous lakes and retention ponds are not the only storage elements that retain precipitation and runoff during storm events. The unsaturated portion of the soil profile acts as a storage reservoir for the water, which infiltrates the ground. In Florida, where the water table is usually very shallow, the available soil moisture holding capacity can vary over a wide range depending on the seasonal elevation of the water table. It is apparent in model calibration that the antecedent water table elevation (elevation at the beginning of the storm event) is an important factor, which determines the resultant magnitude of runoff.

Rainfalls in antecedent periods of 5 to 30 or more days prior to a storm are commonly used as indices of watershed wetness. An increase in an index means an increase in the runoff potential. Such indices are only rough approximations because they do not include the effects of evapotranspiration and infiltration on watershed wetness. Therefore, it is not worthwhile to attempt great accuracy in computing the index described below. The index of watershed wetness used with the runoff estimation method is Antecedent Moisture Condition (AMC). Two levels of AMC are used:

AMC-I Lowest runoff potential. The watershed soils are dry enough for satisfactory plowing or cultivation to take place.

AMC-II The average condition.

Using the traditional method the AMC can be estimated from 5-day antecedent rainfall by the use of the table below (Table 5.3), which gives the rainfall limits by season categories.

**Table 5.3**
**Antecedent Rainfall Estimation**

| Total 5-day Antecedent Rainfall | | |
|---|---|---|
| **AMC Group** | **Dormant Season** | **Growing Season** |
| AMC-I | Less than 0.50" | Less than 1.40" |
| AMC-II | 0.50" to 1.10" | 1.40" to 2.10" |
| AMC- III | Over 1.10” | Over 2.10” |

A comparison analysis between the rainfall daily average value uniformly distributed to the rainfall gage value recorded at USGS streamflow gages in the watershed for each particular storm event is necessary. As observed in Table 5-1 and Table 5-2, the June 1997 has a high rainfall precipitation volume generating the least stage at the gages. Also, the June 1999 storm that generates a high stage at the USGS gage has a low rainfall daily average. The above-mentioned analysis requires adopting a different Antecedent Moisture Condition for each storm event studied for calibration verification purposes.

AMC-I and AMC-II is used for the June 15, 1999 storm. A table of the curve number adjustments is provided below (Table 5.4). The CN Adjustment lookup table F.3 in Stormwater Management (Wanielista, Yousef, 1993).

Figures 5-10 to 5-16 show the verification results for all three events. Since the gage stations at Delaney Pop-off, North Archie Creek, and Archie Creek were set in 1999, there is no observation information available for these three gage stations for the 1997 event. The difference of the total volume of rainfall-runoff for the 1997 event at Delaney gage station is:

$$\varepsilon = \frac{\int_0^T Q_{model}(t)dt - \int_0^T Q_{observed}(t)dt}{\int_0^T Q_{observed}(t)dt} = \frac{45644 - 37940}{37940} = 17\% \qquad (5.1)$$

**Table 5.4 CN Adjustment Lookup Table**

| AMC 2 | AMC 1 | AMC 3 |
|---|---|---|
| 100 | 100 | 100 |
| 95 | 87 | 98 |
| 90 | 78 | 96 |
| 85 | 70 | 94 |
| 80 | 63 | 91 |
| 75 | 57 | 88 |
| 70 | 51 | 85 |
| 65 | 45 | 82 |
| 60 | 40 | 78 |
| 55 | 35 | 74 |
| 50 | 31 | 70 |
| 45 | 26 | 65 |
| 40 | 22 | 60 |
| 35 | 18 | 55 |
| 30 | 15 | 50 |

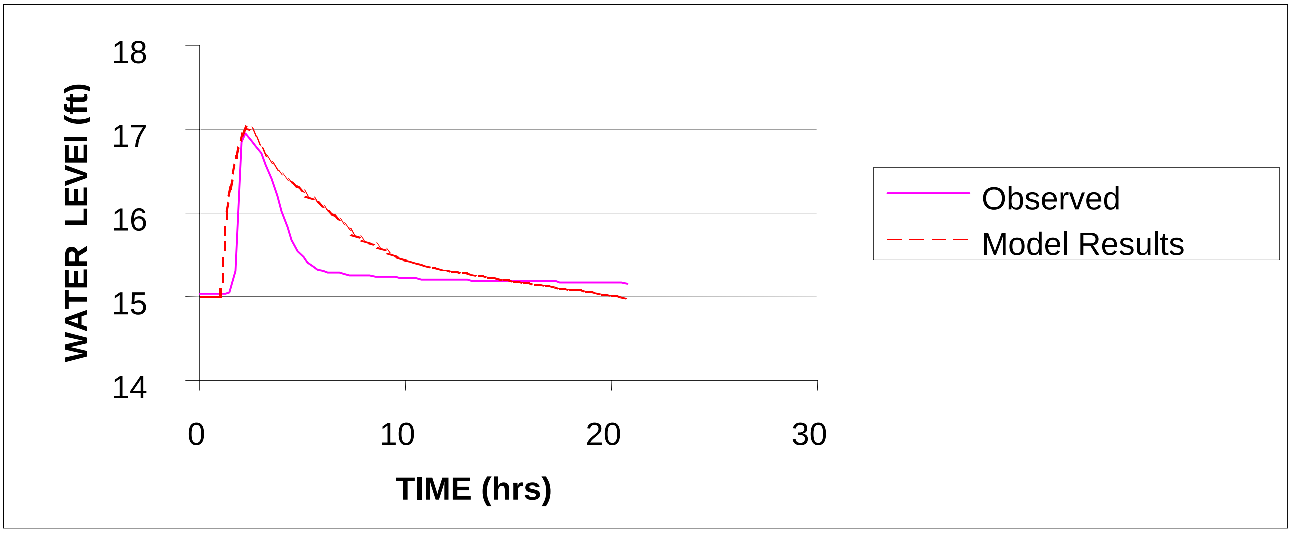



**Figure 5-10**
**Comparison of Water Levels at Progress Blvd. (North Archie Creek, June 15, 1999 Event)**

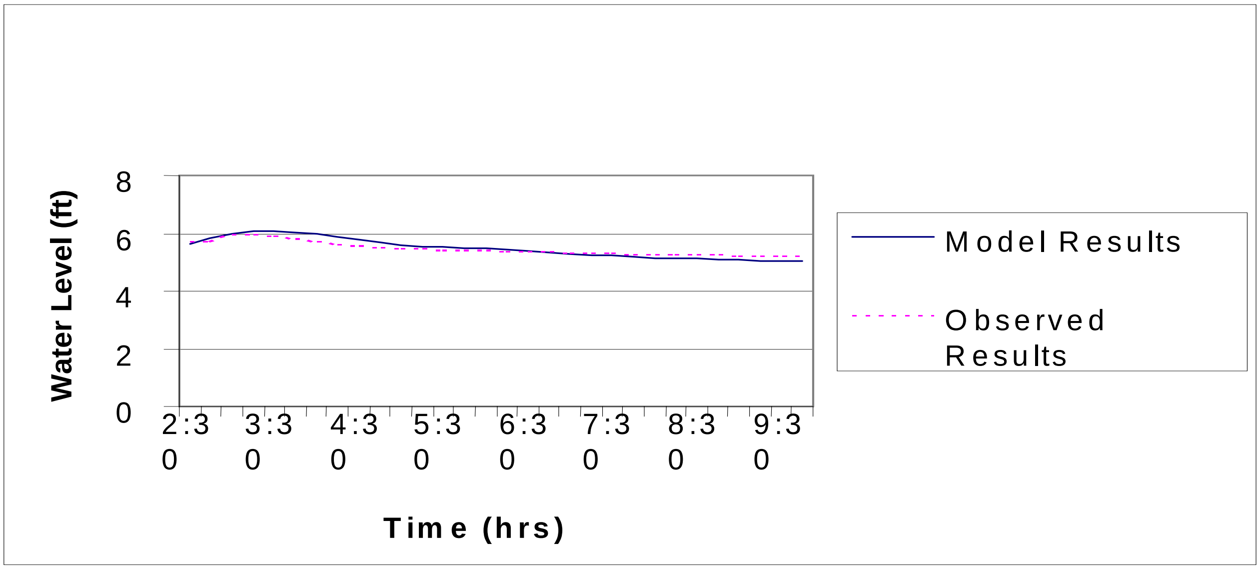



**Figure 5-11**
**Comparison of Water Levels at 78th St. (Archie Creek, June 15, 1999 Event)**

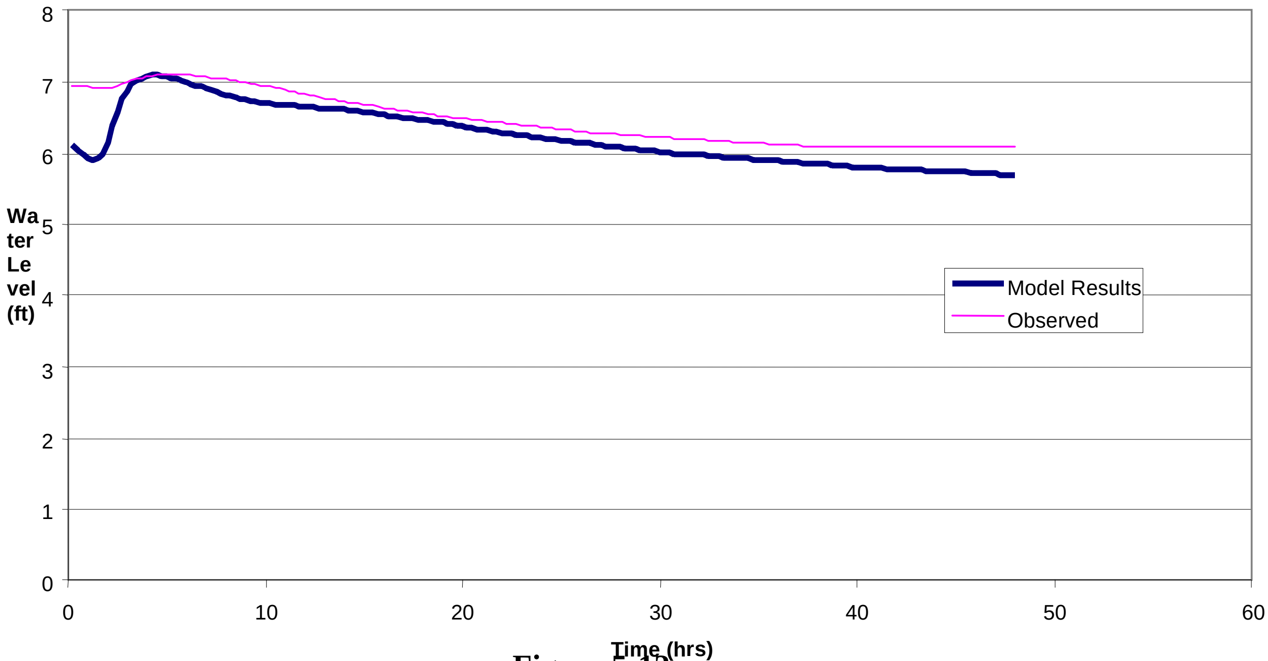



**Figure 5-12**
**Comparison of Water Levels in Delaney Creek Pop-off (51st St., August 15, 1999 Event)**

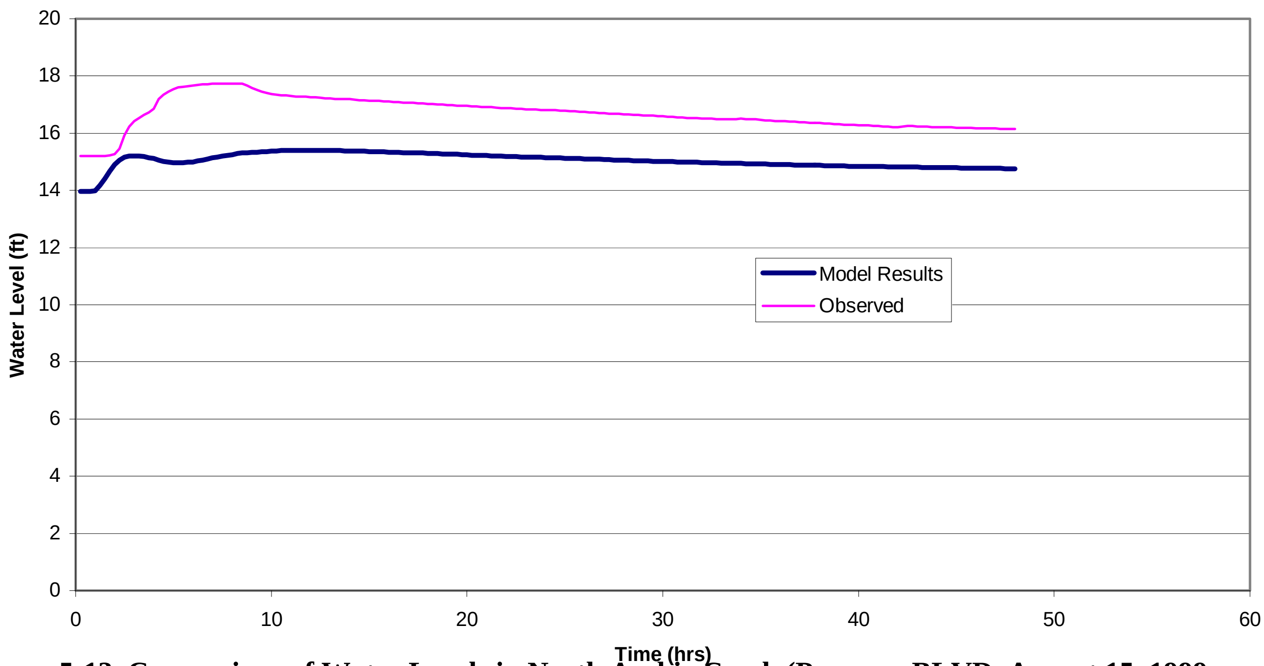



**Figure 5-13 Comparison of Water Levels in North Archie Creek (Progress BLVD, August 15, 1999 Event)**

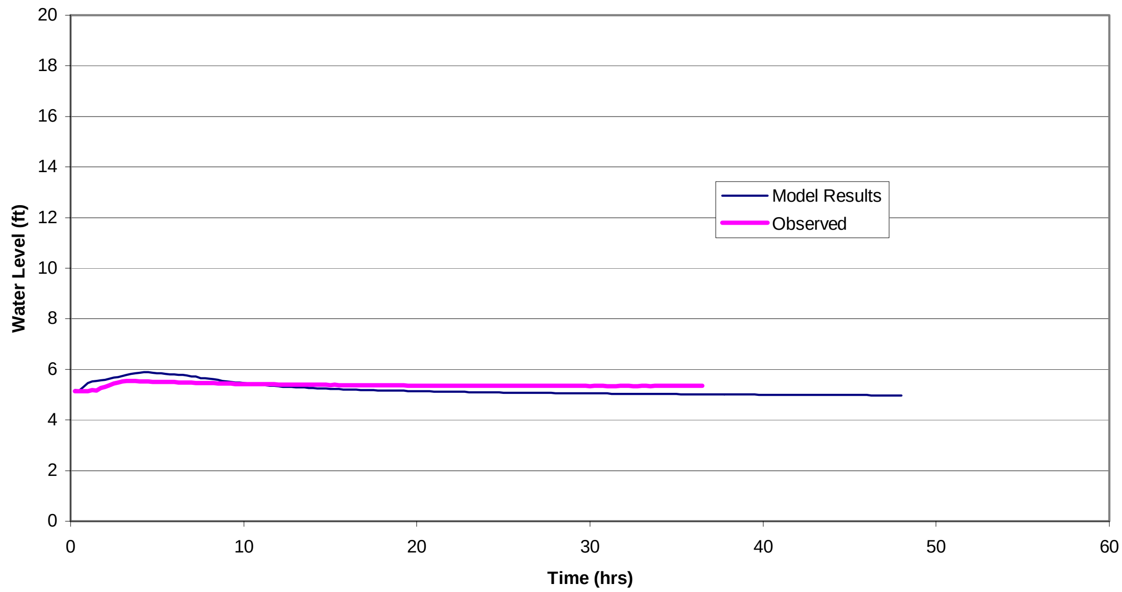



**Figure 5-14 Comparison of Water Levels in Archie Creek (78th St., August 14, 1999 Event)**

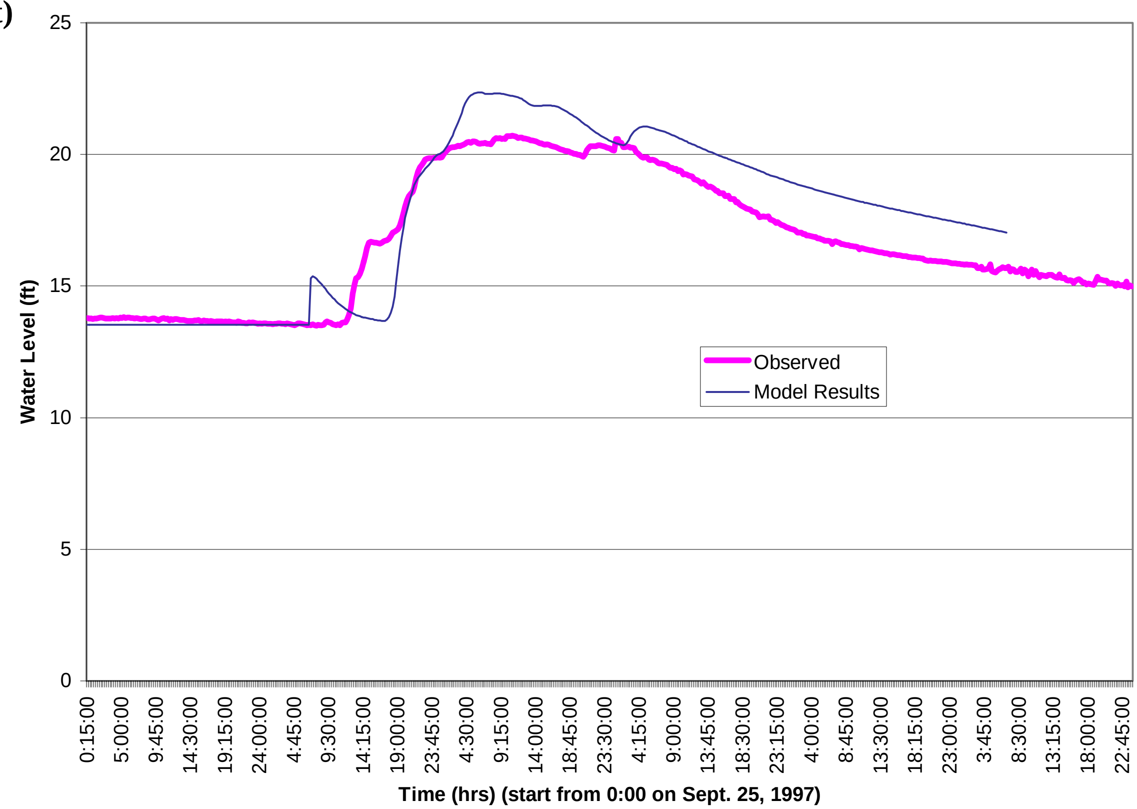



**Figure 5-15**
**Comparison of Water Levels in Delaney Creek (Darlington St., September 1997 Event)**

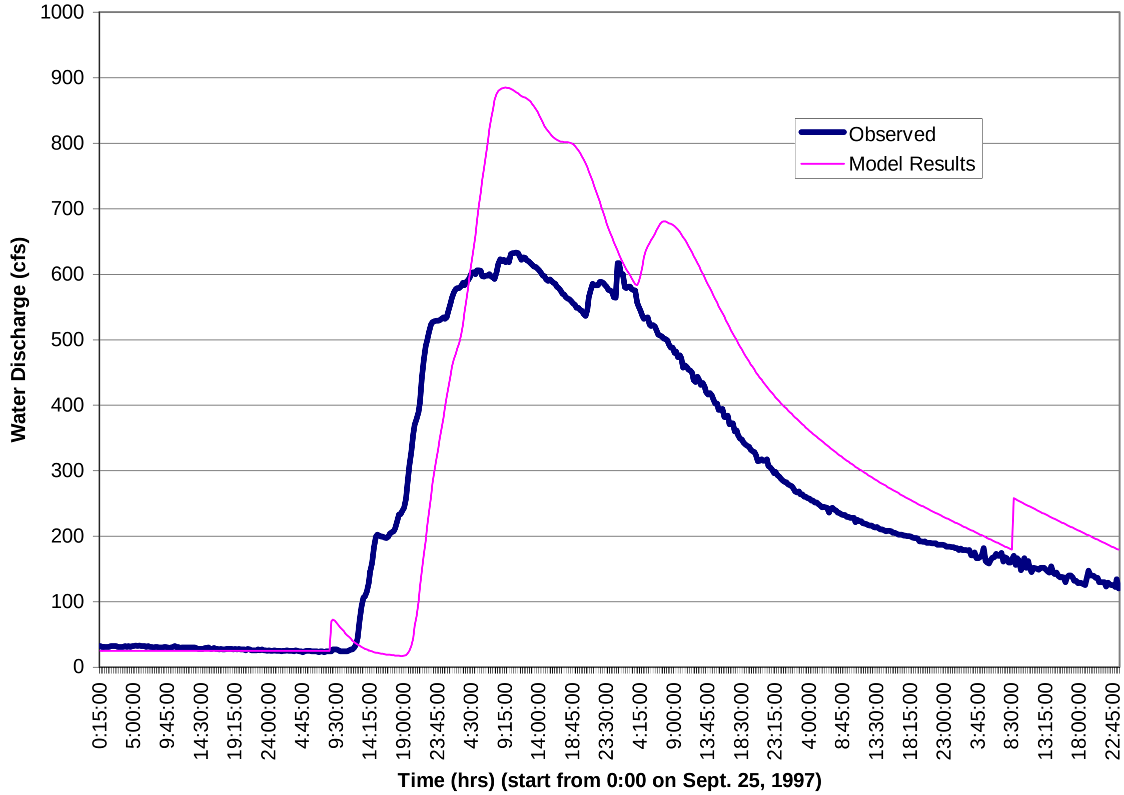



**Figure 5-16**
**Comparison of Water Discharges in Delaney Creek (Darlington St., September 1997 Event)**

# 5.5 SUMMARY

Based on the availability of field observation data, the August 4, 1999 event was selected for model calibration. The model was further verified with events of June 15, 1999, August 15, 1999, and September 1997, respectively.

In general, this model is well calibrated and verified. The model is capable of simulating major storm events in the Delaney, Delaney Pop-off, North Archie Creek, and Archie Creek subwatersheds.

# EXISTING CONDITIONS FLOOD LEVEL OF SERVICE

## 6.1 INTRODUCTION

Based on the Hillsborough County Stormwater Drainage manual and Southwest Florida Water Management District, a standard design storm is defined by duration, rainfall depth, and distribution, for a specific return period.

### 6.1.1 STANDARD DESIGN STORM EVENTS

There are six standard design storms used to analyze the flooding impact on the Delaney Creek, Delaney Creek Pop-off Canal, North Archie Creek and Archie Creek subwatersheds. The standard design storms used in this study are the 100-year, 50-year, 25-year, 10-year, 5-year and 2.33-year or mean annual event. The duration and distribution set by SWFWMD criteria, are 24 hours and SCS-type II Florida Modified respectively. Antecedent moisture conditions (AMC-II) are also set by the same SWFWMD criteria.

The total amount of rainfall for a particular frequency was determined based on SWFWMD's rainfall map, which may vary with the physical location of the watershed.

The total rainfall used for each standard design storm event is as follows in Table 6.1:

**Table 6.1**
**Standard Design Storm Rainfall Intensities**

| Design Storm | Rainfall Intensity |
|---|---|
| 100-yr/24-hr | 11.00 inches |
| 50-yr/24-hr | 10.00 inches |
| 25-yr/24-hr | 8.00 inches |
| 10-yr/24-hr | 7.00 inches |
| 5-yr/24-hr | 5.50 inches |
| 2.33-yr/24-hr | 4.50 inches |

Initial lake elevations used in the stormwater management model at the start of the design storm event was determined by the recorded data provided from SWFWMD.

### 6.1.2 EXISTING CONDITIONS MODEL SIMULATION RESULTS

The DCA stormwater management model results for the 2.33-yr, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr design storm events are listed in Tables 6.2, 6.3, 6.4 and 6.5. These tables present peak flood elevations in the main channel network for the various subwatersheds.

Each subbasin hydrograph is generated by the hydrologic model and routes (for Connectivity Map see Exhibit 5-1) through the hydrodynamic model, to calculate stages and discharges. These main channel profiles are presented in Exhibit 6-1 (a) through 6-1 (l). The following sections discuss the individual problems areas predicted by the EXTRAN model for each of the subwatersheds within the DCA.

The objective of next section is to present both the areas and major structures where the computer model indicated that insufficient channel capacity exists and flooding occurs along the DCA watershed channel alignments.

## 6.2 DELANEY CREEK SUBWATERSHED

The Delaney Creek subwatershed originates at a point approximately 4000 feet north of the intersection of Paul’s Drive and Causeway Boulevard (S.R. 676) and flows west approximately 8.0 miles to eventually discharge out to Hillsborough Bay. The Delaney Creek subwatershed is divided into 4 systems, which are listed below:

### 6.2.1 DELANEY CREEK SUBWATERSHED

- 6.2.1 Delaney Creek Main Channel (210000 to 220210)
- 6.2.2 Laterals
  - 6.2.2.1 Lateral “A” (210090 to 211160)
  - 6.2.2.2 Lateral “A-1” (210130 to 211530)
  - 6.2.2.3 Lateral “B” (210170 to 212130)
  - 6.2.2.4 Lateral “C” (210200 to 213060)

  - 6.2.2.5 Hendrics Lake System

## 6.2.1 DELANEY CREEK MAIN CHANNEL SYSTEM (210000 TO 220210)

The majority of the Delaney Creek Main Channel System lies west of U.S. Highway 301, north of Causeway Boulevard and east of U.S. Highway 41. The channel receives water from nine laterals that are located north of the system. The main channel crosses several subdivisions of the Green Ridge Estates, Orange River Estates, Delaney Creek Estates, Hali Acres and the Clair Mel City area. Clair Mel City has been known to have historic flooding.

## 6.2.2 LATERALS

The laterals for the Delaney Creek subwatershed flow from north to south into the main channel. Several of the laterals are man-made ditches that were excavated originally for agricultural purposes but serve as drainage ditches for of various subdivisions as mentioned in the main channel system.

### 6.2.2.1 Lateral "A" (210090 to 211160)

Lateral "A" originates in the Kingston Height subdivision pond approximately 300 feet north of 12$^{th}$ Street. The channel at this point flows south under 12$^{th}$ Street and parallel to 66$^{th}$ Street South to intersect with the tributary west of 66$^{th}$ Street South. This tributary starts at a pond located west of Windermere Way and flows west to join with the Kingston channel at 66$^{th}$ Street South. Lateral "A" continues to flow southwest through the Clair Mel City area and crosses 16$^{th}$ Avenue South, 20$^{th}$ Avenue South, Maydell Drive and Causeway Boulevard.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-1d.

The EXTRAN model predicts overtopping along the channel as follows:

Haven Oak Circle    Maydell Drive
20th Avenue    66th Street

## 6.2.2.2 Lateral "A-1" (210130 to 211530)

This lateral lies in Hali Acres subdivision approximately 200 feet south of Palm River Road. The channel generally flows south and crosses 12th Avenue South, Robindale Road, and Tidewater Trail. Lateral "A-1" joins with the main channel approximately 2300 feet south of Tidewater Trail.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-1e.

The EXTRAN model predicts overtopping along the channel as follows:

Tidewater Trail    Robindale Road
12th Avenue

## 6.2.2.3 Lateral "B" (210170 to 212130)

Lateral "B" originates 200 feet north of Rideout Road and runs parallel to the east side of 78th Street. The channel flows south and crosses Rideout Road, Ridein Road and Tidewater Trail to finally join with the main channel located 2000 feet south of Tidewater Trail.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-1f.

The EXTRAN model predicts overtopping along the channel as follows:

Rideout Road    Ridein Road
Tidewater Trail

### 6.2.2.4 Lateral "C" (210200 to 213060)

This lateral lies in the Delaney Creek Estates subdivision approximately 650 feet north of Ridein Road. The channel runs south crossing Ridein Road and Tidewater Trail and converge with Delaney main channel about 900 feet south of Tidewater Trail.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-1g.

The EXTRAN model predicts overtopping along the channel as follows:

Ridein Road Tidewater Trail

## 6.2.3 HENDRICS LAKE SYSTEM

The Heather/Tenmile/Hendrics Lakes System is located in the northern portion of the Delaney Creek Area watershed. The general system boundaries are Woodberry Road to the north and Lumsden Road to the south. Interstate 75 borders the system to the west and Mt. Carmel Road to the east. The system has a LOS C for the 10-year/24-hour storm event while the LOS of D is assigned for the 25-year/24-hour and 100-year/24-hour storm events. The Hillsborough County Modified EXTRAN model predicts that during the 10-year/24-hour storm event localized street and site flooding will occur in the main channel and various tributaries of the Heather/Tenmile/Hendrics Lake System.

### 6.2.3.1 Brandon Town Center Mall System (220010 to 222110)

The Brandon Town Center Mall system consists of two internal systems that are made up of interconnected ponds and pipes flowing south to join with the Delaney Creek main channel. One system meets with the main channel behind the car dealership property on the west. The second system runs southeast near the Gornto Lake Drive/Brandon Town Center Boulevard intersection on the east and joins with the main channel.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-1h.

The EXTRAN model predicts no overtopping along the channel.

### 6.2.3.2 Gornto Lake System (220000 to 221560)

The Gornto Lake system is part of the Hendrics Lakes main system and consists of Lake Gornto, Lake Chapman and Tenmile Lake. Tenmile Lake has a small swamp along a portion of its southern boundary. In addition, temperate and upland areas are located on the southeast side of Tenmile Lake. Areas of improved pasture border a major portion of Gornto and Chapman Lakes. A weir outfall for Tenmile Lakes exists at the south part of the lake. Flows over this weir are conveyed through a swale/ditch system to a 60-inch diameter culvert under State Road 60 and then into a lake located within the Old Times Square development. This lake serves as a detention pond and is controlled by an overflow structure. Under extreme storm events the drainage area located North of CSX Transportation System discharge to Lake Chapman via a concrete culvert crossing the railroad tracks and Camp Florida Rd.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-1i.

The EXTRAN model does not predict any overtopping along the channel.

### 6.2.3.3 Heather Lakes System (220000 to 222540)

The Heather Lakes system is located in the northeast portion of the Delaney Creek Area watershed. The general system boundaries are west of Pauls Drive, north of Providence Lake Boulevard, east of Providence Road and south of Burlwood Street at the north end of the Heather Lakes subdivision.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-1j.

The EXTRAN model predicts overtopping along the channel as follows:

Heather Lakes Road/Lumsden Road intersection on the south side.

## 6.2.4 HICKORY HAMMOCK LAKE SYSTEM

The Lumsden/Hickory Hammock Lake System is located in the eastern portion of the Delaney Creek Area watershed. The general system boundaries are Lumsden Road to the north and Ashbrook Drive to the south. Pauls Drive borders the system to the west and Mt. Carmel

Road to the east. The system has a LOS C for the 10-year/24-hour storm event, while a LOS of D is assigned for the 25-year/24-hour and 100-year/24-hour storm events. The Hillsborough County Modified EXTRAN model predicts that during the 10-year/24-hour storm event localized street and site flooding will occur in the main channel and various tributaries of the Lumsden/Hickory Hammock Lake System.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-1k.

The EXTRAN model predicts no overtopping along the channel.

### 6.2.5 ISOLATED BASINS

The isolated basins are the Brentwood Hills subdivision and older residential areas like Brandon Oak Grove, Brandon Spanish Oaks, Brandon Terrace Park, Childers, Van Sant, Sylvia Manor, Brandon Woodlands, Highland Manor and Dixon’s near Lithia Pinecrest Road. The historic flooding has occurred mostly at Dixon’s and Brandon Oak Grove subdivisions.

## 6.3 DELANEY POP-OFF CANAL SUBWATERSHED

The Delaney Creek Pop-off Canal subwatershed extends east to about U.S. Highway 301. The conveyance system consists of man-made ditches with no evidence of natural channel sections and generally flows south and west from U.S. Highway 301 to Hillsborough Bay. Major road crossings include U.S. Highway 301 at the eastern extremity, 78th Street near the middle and Madison Avenue (State Road 676A) and U.S. Highway 41 at the western extremity.

The Existing Level of Service and Flooding Concerns Areas discussed in the following paragraphs are based on the location on the watershed system, starting from the main channel to the tributary systems. A few locations within the watershed are not necessarily considered as flooding problem, but they influence significantly the water surface elevation where flooding has been recorded and predicted by the SWM computer model.

The Delaney Pop-off Canal subwatershed is divided into 3 systems, which are listed below:

6.3 Delaney Pop-off Canal Subwatershed
- 6.3.1 Delaney Pop-off Main Channel (240xxx series)
- 6.3.2 Tributaries
  - 6.3.2.1 Tributary “A” (243xxx series)
  - 6.3.2.2 Tributary “B” (247xxx series)
  - 6.3.2.3 Tributary “C” (244xx series)
  - 6.3.2.4 Tributary “E” (2420xx series)
  - 6.3.2.5 Tributary “F” (2425xx series)
  - 6.3.2.6 Tributary “G” (246xxx series)
  - 6.3.2.7 Tributary “H” (2465xx series)
  - 6.3.2.8 Tributary “I” (2478xx series)
  - 6.3.2.9 Evergreen Estates System (252xxx series)

## 6.3.1 DELANEY POP-OFF MAIN CHANNEL (240XXX SERIES)

There are no flooding problems along Pop-off main channel but several locations require improvements due to their tailwater influence to several flooding concerns locations. The results of SWM computer model simulation identify the existing Old U.S. Highway 41 crossdrain as a significant headloss along the main channel system. The water surface elevation across this location has a drop of 1.2 and 0.9 feet for 100-year and 25-year design storm event respectively.

Another location with a significant difference between upstream and downstream water surface elevations is identified at Madison Avenue. The elevation difference produced by the Madison Avenue crossdrain ranges between 0.51 and 2.0 feet for mean annual and 100-year design storm event respectively. The water Surface profile is depicted in Exhibit 6-2a.

The SWM computer model also predicts flooding at 78$^{th}$ Street South crossdrain. The water surface elevation across this pipe is as much as 0.68 for the mean annual design storm event. A few channel cross sections are found critical with regards to the upstream flooding problems. The 1999 survey information shows a significant reduction from upstream to downstream in cross section width, south of Madison Avenue crossing. The channel upstream of Madison Avenue has also a significant impact on the adjacent tributaries systems.

## 6.3.2 TRIBUTARIES

The tributaries of the Delaney Pop-off Canal subwatershed consists mostly of man-made ditches along the back lots of residential areas like Fortuna Acres, Green Ridge Estates. The remaining tributaries on the east side of U.S. Highway 301 consist of the Interstate 75 drainage ditch and several ditch systems located in subdivisions of the Pavilion areas.

### 6.3.2.1 Tributary "A" (243xxx Series)

The Tributary "A" System encompasses the subdivision located between 78$^{th}$ Street and 70$^{th}$ Street. A small residential area North of 36$^{th}$ Avenue is also served by the Tributary "A". This system flows into the Pop-off Canal approximately 2500 feet west of 78$^{th}$ Street. The water surface profile is depicted in Exhibit 6-2d. Several culvert crossings are overtopped for Tributary "A" in which they serve as driveway entrances and/or dirt road crossing between adjacent pastures. Although water surface elevations increase behind the culverts and cause substantial flooding of adjacent pasturelands, they pose no real problem to the developed areas. However, it is important that the conveyance over the road not be lost due to filling unless the culverts are upgraded.

There is no flooding history recorded along this system. Based on the computer model results this system has Level of Service A for the 25-year design storm event.

### 6.3.2.2 Tributary "B"/Sanson Park (247xxx Series)

The Tributary "B" System incorporates the Sanson Park subdivision. This channel runs west to east for approximately 2500 feet where confluence with other two tributary systems collecting the runoff from north and east. At this confluence location, the ditch direction changes due south for about 600 feet where joins the Delaney Pop-off main channel located 2500 feet south of Causeway Boulevard. Computer simulations indicate that the Sanson Park Subdivision will experience street flooding of about 8 inches for the 5-year storm event. Approximately 18 inches of flooding occurs for the 25-year storm event. It appears that several residential properties including buildings could be flooded on a 25-year storm event. The 100-year storm creates over 2 feet of water in this area. Problems in this area are directly related to high tailwater conditions in the Delaney Pop-off Canal.

Based on the computer model results that are supported by the recorded flooding complaints, this system has Level of Service between B and D for the mean-annual and the 25-year design storm event respectively. The water surface profile is depicted in Exhibit 6-2e.

## 6.3.2.3 Tributary "C" (244xxx Series)

The Tributary "C" System incorporates the northern part of the Pavilion subdivision and consists of the internal ponds and culverts. This system is divided into two (2) separate systems each with its own point of confluence with the main channel. The first is located on the west side of the Pavilion Subdivision in the main channel's man-made ditch, 600 feet west of Falkenburg Road. The second is located on the Pop-off Canal's main channel 30 feet west of Falkenburg Road at the point where the Pop-off Canal changes the conduit type from Falkenburg Road pipe system to man-made open channel.

There is no flooding history recorded along this system. Based on the computer model results this system has Level of Service A for the 25-year design storm event. The water surface profile is depicted in Exhibit 6-2f.

## 6.3.2.4 Tributary "E" (2420xx Series)

The Tributary "E" System originates southwest of 78$^{th}$ Street/Madison Avenue intersection in a pasture area. This channel runs east to west for approximately 3200 feet until it finally reaches its confluence with the Delaney Pop-off Canal south of the Madison Estates Mobile Home Park.

There is no flooding history recorded along this system. Based on the computer model results this system has Level of Service A for the 25-year design storm event. The water surface profile is depicted in Exhibit 6-2g.

## 6.3.2.5 Tributary "F" (2425xx Series)

The Tributary "F" System incorporates the neighborhood east and west of the Pop-off Canal main channel, north of Madison Avenue. This tributary channel runs east to west for approximately 1300 feet to ultimately discharge into Delaney Pop-off Canal, 500 feet north of Madison Avenue crossing. The area east of the main channel experienced flooding in the past due to the high tail water elevations in the main channel, as well as a conveyance system deficiency.

The mobile homes subdivision (2428xx Series) located west of main channel drains into an internal pond which apparently has no outfall.

Based on the computer model results, which are supported by the recorded flooding complaints, this system has Level of Service C for the mean annual design storm event and D for the 25-year design storm event. The water surface profile is depicted in Exhibit 6-2h.

## 6.3.2.6 Tributary "G" (246xxx Series)

The Tributary "G" System originates north of Bandit Boulevard near U.S. Highway 301. This tributary's channel generally runs east to west through pasture areas and crosses the new Falkenburg Road extension to finally connect with the Delaney Pop-off Canal.

There is no flooding history recorded along this system. Based on the computer model results this system has Level of Service A for the 25-year design storm event. The water surface profile is depicted in Exhibit 6-2i.

## 6.3.2.7 Tributary "H" (2465xx Series)

The Tributary "H" System incorporates the pasture area south of Falkenburg Road and south of the Pavilion Subdivision. Its channel generally runs east to west along future Everhart Road for about 1300 feet to finally enter the Delaney Pop-off main channel.

There is no flooding history recorded along this system. Based on the computer model results this system has Level of Service A for the 25-year design storm event. The water surface profile is depicted in Exhibit 6-2j.

## 6.3.2.8 Tributary "I" (2478xx Series)

The Tributary "I" System incorporates the Pavilion Subdivision south of Falkenburg Road and west of U.S. Highway 301. This system consists of the internal ponds and culverts which ultimately joins the Pop-off Canal's main channel 30 feet west of Falkenburg Road.

There is no flooding history recorded along this system. Based on the computer model results this system has Level of Service A for the 25-year design storm event. The water surface profile is depicted in Exhibit 6-2k.

## 6.3.2.9 Evergreen Estates System (252xxx Series)

The Evergreen Estates system is bordered by U.S. Highway 301 on the west, Falkenburg Road on the west, the Crosstown Expressway on the north and Causeway Boulevard on the south. This is an older subdivision with the roads cut to elevations of less than 28 feet. There are three possible outlets for these eastern subbasins of the Pop-off Canal watershed. One is located under U.S. Highway 301 and consists of two 36" culverts. These culverts also part of the U.S. Highway 301 drainage system.

The controlling invert elevation on the twin 36" culverts is 26.40 feet. Average ground elevation east of U.S. Highway 301 ranges from 28 to about 31 feet. Therefore, a large area would be flooded by the time these culverts are flowing full. The second controlling outlet to the Evergreen Estates area system consists of two 45"x68" culverts under a dirt driveway north of Causeway Boulevard. The controlling invert on these culverts is 23.40 feet. These pipes do not overtop until elevation 27.15. Water elevations do not increase significantly with flood frequency. There are two more sets of twin culverts, one upstream at Falkenburg Road crossing and the second downstream at Causeway Boulevard crossing. On both sets of twin culverts, the invert elevation is below 23.40 feet. The third outlet location is under the Crosstown Expressway. It consists of three 36" culverts at invert 25.85 feet that would sustain the flow to Delaney Creek Area Watershed. Similar with the U.S. Highway 301 crossdrain, a large area would be flooded by the time these culverts are flowing full.

Computer simulation indicates flooding for all the design storm events. The flooding concern at this location is identified as being directly related to high tail water conditions in the Delaney Pop-off Canal.

Based on the computer model results which are supported by the recorded flooding complaints this system has Level of Service C for the 10-year design storm event and D for the 100-year design storm event. The water Surface profile is depicted in Exhibit 6-2l

# 6.4 NORTH ARCHIE CREEK SUBWATERSHED

The North Archie Creek subwatershed extends east to Providence Avenue and as far north as the Crosstown Expressway. This subwatershed is similar to the Delaney Creek Pop-off Canal subwatershed in that it is drained by a system of man-made ditches and flows in a south and west direction to Hillsborough Bay. Some improvements and extensions to the ditch system have been made in the eastern portions of the watershed as a result of the Interstate 75 and U.S. Highway 301 construction. A portion of North Archie Creek west of 78th Street has been relocated and expanded by Gardinier, Inc.

The North Archie Creek subwatershed is divided into 3 systems, which are listed below:

6.4 North Archie Creek Subwatershed
- 6.4.1 North Archie Creek Main Channel (260xxx series)
- 6.4.2 Tributaries
  - 6.4.2.1 Tributary "A" (261xxx series)
  - 6.4.2.2 Tributary "B" (262xxx series)
  - 6.4.2.3 Tributary "C" (265xxx series)
  - 6.4.2.4 Unnamed tributary (263xxx series)
  - 6.4.2.5 Tributary "D" (2705xx series)
  - 6.4.2.6 Tributary "E" (272xxx series)
  - 6.4.2.7 Tributary "F" (273xxx series)
  - 6.4.2.8 Tributary "G" (27004x series)

## 6.4.1 NORTH ARCHIE CREEK MAIN CHANNEL SYSTEM

The North Archie Creek Main Channel originates from the Providence Lakes subdivision to the west of Providence Road. It flows for approximately 4600 feet and then turns south to meet with Tributary "F" from the south at a borrow pit pond near the Sherwood complex. At the Evergreen Estates outfall, the channel crosses Interstate 75 and Tributary "D" from west to east. The channel continues to move west under U.S. Highway 301 and Interstate 75 again on the north side of Madison Avenue. After passing through Interstate 75, North Archie Creek goes under Madison Avenue on west of Interstate 75 and continues heading west through Progress Village subdivision. From here, the creek crosses 78$^{th}$ Street and flows on the north side of the Cargill gypstack before crossing Old Highway 23 and U.S. Highway 41 to its outfall to Hillsborough Bay.

The water surface profile is depicted in Exhibit 6-3a.

## 6.4.2 TRIBUTARIES

The tributaries of the North Archie subwatershed consists mostly of man-made ditches along the back lots of residential areas like Progress Village west of U.S. Highway 301. The remaining tributaries on the east side of U.S. Highway 301 consist of the Interstate 75 drainage ditch and several ditch systems located in subdivisions of the Bloomingdale Hills, Providence Oaks, Sterling Ranch and Brandon Lakes areas.

### 6.4.2.1 Tributary "A"

Tributary "A" originates north of Madison Avenue and west of the Falkenburg Road extension in a wetland area located north of Fir Drive. The channel flows south to its confluence with the North Archie Main channel by way of interconnected stormwater pipes along the east side of 78$^{th}$ Street.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-3d.

The EXTRAN model predicts no overtopping along the channel.

### 6.4.2.2 Tributary "B"

Tributary "B" originates south of Madison Avenue and west of the Falkenburg Road extension in the Parkway Business Center. The channel flow south and confluence with North Archie Main channel approximately 1600 feet away. This tributary is an open channel on top of a series of underground stormwater pipes. The outfall of the stormwater pipe is approximately 200 ft north of 82$^{nd}$ Street double Conspan. Flooding has known to occur in the Progress Village neighborhood where this tributary flows through. This tributary is a shallow open channel behind the residential lots of 82$^{nd}$ Street and crosses Endive Avenue, Dahlia Avenue, Croton Avenue, Bahia Avenue and Allamanda Avenue.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-3e.

The EXTRAN model predicts overtopping along the channel as follows:

Endive Avenue near 82nd Street

## 6.4.2.3 Tributary “C”

Tributary “C” originates south of Madison Avenue and west of the Falkenburg Road extension in the Parkway Business Center. The channel flow is to the south until the confluence with the North Archie Main channel approximately 1600 feet away.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-3f.

The EXTRAN model predicts overtopping along the channel as follows:

Madison Avenue

## 6.4.2.4 Unnamed Tributary

This tributary originates north of Madison Avenue and west of Interstate 75 near the U.S. Highway 301 exit and the Crescent Park commercial site. The channel flows south to its confluence with North Archie Creek’s main channel south of Foxworth Road and approximately 2600 feet away.

The EXTRAN model predicts no overtopping along the channel.

## 6.4.2.5 Tributary “D”

Tributary “D” originates approximately south of Lumsden Avenue in the proposed Florida Corporate Center. This tributary serves as the Interstate 75 ditch. It flows south on the east side of Interstate 75 and to the west of Robert Tolle Road. It eventually joins with the main channel near the west side of the borrow pit pond located in the Sherwood Apartment complex. Historical flooding has been reported in the Sherwood Apartments near the borrow pit pond. However, this flooding problem is secondary flooding, the County does not maintain this area because it is managed privately.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-3g.

The EXTRAN model predicts overtopping along the channel as follows:

Robert Tolle Road

## 6.4.2.6 Tributary "E"

Tributary "E" is a ditch on the east side of Duncan Road and originates south of Bloomingdale Avenue. This tributary serves as drainage for the mobile home park on the west side of Duncan Road and the outfall for the Cross Bayou Apartment complex. It eventually connects with the main channel near the west side of the borrow pit pond located in the Sherwood Apartment complex. Historical flooding has been reported south of the Bloomingdale Avenue/Duncan Road intersection on the west side of Duncan Road. However, this flooding problem is secondary flooding in which the County does not maintain because it is managed privately. The water surface profile is depicted in Exhibit 6-3h.

## 6.4.2.7 Tributary "F"

Tributary "F" originates from the Bloomingdale Hills subdivision and west of Providence Road. This tributary collects flows from two sub-tributaries that run north and parallel to each other for approximately 1150 feet. One of the sub-tributary originates in the Bloomingdale Hills wetland which also collects the drainage of the Providence Oaks subdivision. The other sub-tributary originates in the Bloomingdale Hills Park subdivision pond located south of Bloomingdale Avenue. Both sub-tributaries ultimately join the Bloomingdale Avenue Outfall channel flowing west to meet with Providence Lakes Outfall from the north at the borrow pit pond near Sherwood complex.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-3i.

The EXTRAN model predicts no overtopping along the channel.

### 6.4.2.8 Tributary "G"

Tributary "G" originates from the Sterling Ranch subdivision and west of Providence Road. This tributary generally flows west for approximately feet and then turns south to meet with Tributary "F" from the south at the borrow pit pond near Sherwood complex.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-3j.

The EXTRAN model predicts no overtopping along the channel.

# 6.5 ARCHIE CREEK SUBWATERSHED

Half of the Archie Creek subwatershed consists of commercial areas like the Cargill complex and the Parkway Business Center. The other half is composed of the Lake St. Charles, Starlite, Ashley Oaks, Suntree Estates and McMullen Farms subdivisions. Cargill occupies about a third of the subwatershed. The subwatershed generally starts at the Ashley Oaks subdivision and discharges out to the Bay near the northern part of Cargill's facility.

The Archie Creek subwatershed is divided into 3 systems, which are listed below:

6.5 Archie Creek Subwatershed
- 6.5.1 Archie Creek Main Channel (280000 to 290055)
- 6.5.2 Tributaries
  - 6.5.2.1 Tributary "A" (280100 to 280150)
  - 6.5.2.2 78th Street Ditch (280300 to 280335)
  - 6.5.2.3 Tributary "B" (280400 to 280163)
  - 6.5.2.4 Tributary "C" (280500 to 280535)
  - 6.5.2.5 Tributary "D" (290000 to 290200)
  - 6.5.2.6 Tributary "F" (290570 to 290628)
  - 6.5.2.7 Tributary "G" (290100 to 290115)

## 6.5.1 ARCHIE CREEK MAIN CHANNEL SYSTEM (280000 TO 290055 SERIES)

The majority of the Archie Creek Main Channel System lies west of U.S. Highway 301, north of Causeway Boulevard and east of U.S. Highway 41. The channel receives water from seven laterals that are located north and south of the system. Most of these laterals flow from both the north and south directions into the main channel.

The main channel crosses a subdivision of the Ashley Oaks which has known to have historical flooding. In addition, the EXTRAN model predicts that flooding will occur in the Suntree Estates subdivision. The water surface profile is depicted in Exhibit 6-4a.

## 6.5.2 TRIBUTARIES

The tributaries comprise mostly of man-made ditches that originate from wetland areas like Tributary “A” and “C”. The other tributaries were originally excavated for agricultural uses but now they serve as drainage channels for areas like the Parkway Business Center and the Starlite, Lake St. Charles and Ashley Oaks subdivisions.

### 6.5.2.1 Tributary “A” (280100 to 280150)

Tributary “A” originates in the commercial site area approximately 300 feet west of 78$^{th}$ Street. The channel at this point flows west under 78$^{th}$ Street and south to intersect with a tributary running north to south. This tributary starts at the TECO easement through the Cargill property and flows south parallel to the back lots of several commercial sites to eventually meet with Archie Creek.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-4d.

The EXTRAN model predicts overtopping along the channel as follows:

78$^{th}$ Street near TSI or Trinity College of Florida

### 6.5.2.2 78$^{th}$ Street Ditch (280300 to 280335)

The 78$^{th}$ Street ditch originates near a junkyard approximately 1650 feet north of Riverview Drive on the east side of 78$^{th}$ Street. The channel generally flows north to meet with the outfall pipe on the north side of Archie Creek and the Business Parkway Center.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-4e.

The EXTRAN model predicts overtopping along the channel as follows:

All driveways of the junk yard east of 78$^{th}$ Street

### 6.5.2.3 Tributary “B” (280400 to 280163)

Tributary “B” originates in the Parkway Business Center area near a borrow pit pond located south of Progress Boulevard. The channel generally flows south west of Falkenburg Road. This tributary starts at a wetland west of Falkenburg Road near the borrow pit pond and flows south. Drainage from the borrow pit pond joins this tributary via the four 42” RCP under Falkenburg Road and continues heading south, crossing Eagle Palm Drive before it meets with Archie Creek.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-4f.

The EXTRAN model predicts overtopping along the channel as follows:

Dirt road along TECO easement

### 6.5.2.4 Tributary “C” (280500 to 280535)

Tributary “C” originates in the eagle/gopher tortoise preserve located 1400 feet north of Riverview Drive. The channel generally flows north through cattle pastures. This tributary does not cross any County maintained roads or subdivisions. No known historical flooding has been reported for this tributary since there are no residential developments.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-4g.

The EXTRAN model predicts no overtopping along the channel.

### 6.5.2.5 Tributary "D" (290000 to 290200)

Tributary "D" originates in an existing pond that has been altered to accommodate the flows from several units in the Lake St. Charles subdivision. This tributary is short and does not cross any County maintained structures. No known historical flooding has been reported for this tributary since Lake St. Charles is a recent development.

The EXTRAN model predicts no overtopping along the channel.

### 6.5.2.6 Tributary "F" (290570 to 290628)

Tributary "F" originates at the intersection of Springway Drive and Springbrook Drive where the flow is split in two directions. The well-defined channel flowing from east to west to the end of Springbrook Drive and turns north is recognized as Tributary "F". The other channel flows from the same point but heads south into the Lake St. Charles system. Flooding has been known to occur based on the residents living near Springbrook Drive.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-4h.

The EXTRAN model predicts overtopping along the channel as follows:

Bermed dirt road

### 6.5.2.7 Tributary "G" (290100 to 290115)

Tributary "G" originates at Alsobrook Avenue near Riverview Drive and flows west to meet with a ditch west of Interstate 75. The Interstate 75 ditch flows from south to north to its confluence with the Archie Creek main channel. Historic flooding occurs in an older residential area near of Alsobrook Avenue but not in the Archie Creek subwatershed.

A graphical representation of the water surface profile for all six standard storm events is provided in Exhibit 6-4i.

The EXTRAN model predicts overtopping along the channel as follows:

Alsobrook Avenue

# 6.6 FLOOD CONTROL LEVEL OF SERVICE DEFINITIONS

This chapter briefly describes the level of service (LOS) methodology used to analyze the Delaney Creek Area watershed and then discusses existing conditions LOS deficiencies within the study area. Figures 8 through 11 contain a graphical representation of the DCA level of service analysis for the 2.33-yr/24-hr, 5-yr/24-hr, 10-yr/24-hr, and 25-yr/24-hr storm events.

Discussion areas include the following topics below:

X Level of Service Methodology

X Level of Service Designations

The LOS designations are discussed for the DCA systems listed below:

Delaney Creek subwatershed

Delaney Pop-off Canal subwatershed

North Archie Creek subwatershed

Archie Creek subwatershed

# 6.7 LEVEL OF SERVICE ANALYSIS / METHODOLOGY

The Hillsborough County Comprehensive Plan, Stormwater Management Element contains definitions for level of service flood protection designations. According to these definitions, a storm return period and duration (i.e. 25-year/24-hour) and letter designation (i.e. B) are needed to define the level of flood protection (i.e. 25-year/24-hour level B). The flood level designations contained in the Comprehensive Plan are A, B, C and D, A being the highest level and D being the lowest. However, these criteria are somewhat subjective. Therefore, it is necessary to establish quantitative criteria by which to assign LOS designations. An allowable tolerance that is demographically representative for Hillsborough County before flooding can be classified was assigned to LOS designations A-D as shown in Table 6.6 below. This table contains the interpretation of the Comprehensive Plan definitions used in the LOS analysis herein.

**Table 6.6**
**Level of Service Definition Interpretations**

| Level | HC Comprehensive Plan Definitions | Master Plan Interpretations |
|---|---|---|
| A | No significant street flooding | No flooding |
| B | No major residential yard flooding | Street flooding is 3" or more above the crown |
| C | No significant structure flooding | Site flooding is 6" or more |
| D | No limitation on flooding | Structure flooding |

The LOS designations contained in the Comprehensive Plan contain the assumption that sites are higher than roads and structures are higher than sites. However, this is not always the case. The LOS analysis methodology used herein evaluates road, site and structure landmark elevations independently.

The Comprehensive Plan contains estimated adopted (existing conditions) and ultimate (proposed) LOS designations for several watersheds in Hillsborough County. According to the Comprehensive Plan, the 3-year/24-hour level B is the target LOS for the Delaney Creek Area. However, this is very conservative. In many areas of DCA, the 25-year/24-hour level B LOS can be achieved.

One goal of this report is to update the LOS designation for the DCA with the results of a formal LOS analysis for the watershed. The LOS analysis for adopted (or existing conditions) is contained in this chapter. The LOS analysis for the ultimate (or proposed) conditions is contained in Chapter 15.

### 6.7.1 ESTABLISHMENT OF LANDMARK ELEVATIONS

In order to evaluate the LOS for a watershed, landmark elevations must first be determined. These elevations refer to landmarks contained in the LOS definitions, including roads, sites and structures. Landmark elevations are established for every subbasin in the watershed. These landmarks then serve as a tool for determining the level of service for the subbasin, and on a broader scale, the system and the watershed. The landmark elevations established for LOS analysis are the critical or lowest landmark elevations in a subbasin. The critical landmark elevations are reflective of the worst case flooding that could occur in a subbasin. These are obtained from survey data and from topographic analysis. Every subbasin in the watershed is examined for the critical structure, site and road elevation. Tables 6.1, 6.2, 6.3 and 6.4 contain landmark elevations determined for each DCA subbasin within the unincorporated portion of Hillsborough County. These landmark elevations reflect the flood depth tolerance contained in Table 6.6.

### 6.7.2 COMPARISON OF COMPUTED RESULTS AND LANDMARK ELEVATIONS

Using flood protection LOS designation criteria contained in Table 6.6, the landmark elevations for each subbasin are compared to the computed results of the hydraulic model. In general, the computed result for the most downstream junction was used for comparison with landmark elevations. Tables 6.1, through 6.4 contain the difference between established landmark elevations and computed water surface elevations for the 2.33-yr/24-hr, 5-yr/24-hr, 10-yr/24-hr, and 25-yr/24-hr storm events.

## 6.8 LEVEL OF SERVICE DESIGNATIONS

LOS designations are assigned in three levels of detail: subbasin, system and watershed.

Within the watershed, the subbasins were aggregated into various systems (Delaney Creek Main Channel System, Delaney Pop-off Main Channel System, North Archie Creek Main Channel System, Archie Creek Main Channel System, Hendrics Lake System, Hickory Hammock Lake System, Isolated Basin System, etc.) according to general drainage patterns. For each return period storm event, the LOS designation is first determined for the subbasin. Then the LOS is determined for the individual systems based on the aggregated subbasins comprising the system. Finally, the LOS designation is determined for the overall watershed. The LOS of the DCA watershed is reflective of the worst case system and the LOS of the system is reflective of the worst case subbasin. Exhibits 6-6d, 6-7d, 6-8d and 6-9d contain a graphical representation of the DCA level of service analysis for the 25-yr/24-hr storm event.

It is important to be aware of the limits of the methodology used in the LOS analysis. Most landmark elevation information was taken from topographic maps, some of which are approximately 20 years old. In addition, the LOS analysis does not identify flood protection deficiencies for secondary systems contained in a subbasin, since only the major systems are contained in the hydraulic model. Conversely, since only the critical landmark elevations were identified in each subbasin, areas within a subbasin may contain a higher LOS than that assigned.

## 6.8.1 DELANEY CREEK SUBWATERSHED

Most flooding in this subwatershed is experienced in areas of older residential subdivisions like Progress Village. Historical flooding occurs in Clair Mel City and the Heather Lakes area.

### 6.8.1.1 Delaney Creek Main Channel System

The Delaney Creek Main Channel LOS System includes most of the eastern portion of the Delaney Creek Area Watershed. This system includes Delaney Creek's main channel and Laterals "A" through "F" conveyance systems. The system has a LOS D for the 25-yr/24-hour design storm event. The following areas are predicted to flood during the 25-year/24-hour storm event:

**Structure Flooding:**

SW of Raleigh Street
Just N of Hartford Street and E of 54th Street

**Site Flooding:**

Near Raleigh Street and 17th Street
Trenton Street just E of S 50th Street
Maydell Avenue N. of Causeway Blvd.
76th Street S. of 24th Avenue S.
Near Deauville Dr N of Reindeer Rd
Near Robindale Rd and Deauville Dr
Near Sherren Drive and 76th Street

**Road Flooding:**

| | |
|---|---|
| Raleigh Street (eastern most portion) | Trenton Street E of 50$^{th}$ Street |
| Maydell Drive N of Causeway Blvd. | 76$^{th}$ Street S of 24$^{th}$ Avenue S |
| Darlington Drive | Waikiki Way W of Darlington Drive |
| 24$^{th}$ Avenue S | 20$^{th}$ Avenue and Maydell Drive |
| 20$^{th}$ Avenue | Hartford Street |
| Wishing Well Way | Balfour Circle |
| Windermere Way | Deauville Drive |
| Robindale Road and Deauville Dr | Sherren Drive and 76$^{th}$ Street |
| Cadillac Circle | Clair Mel Circle |
| Eau Claire Circle | Palm River Road |

## 6.8.1.2 Hendrics Lake System

The Hendrics Lake LOS System is comprised of the following four conveyance systems: Brandon Town Center Mall System, Gornto Lake System, Heather Lakes System, and North Lumsden Avenue channel system. The Hendrics Lake System has a LOS B for the 25-year/24-hour design storm event. The model predicts that during the 25-year/24-hour storm event localized flooding will occur along Brandon Boulevard just east of Lakeside Drive.

## 6.8.1.3 Hickory Hammock Lake System

The Hickory Hammock Lake LOS System has a LOS C for the 25-year/24-hour design storm event. The following areas are predicted to flood:

**Site Flooding:**

| | |
|---|---|
| Near Bryan Road | Near Bell Shoals Road |

**Road Flooding:**

| | |
|---|---|
| John Moore Road | Kings Avenue |
| Parsons Avenue | Lumsden Avenue |
| Lithia Pinecrest Road | Kings Avenue |
| Bell Shoals Road | Bryan Road |

#### 6.8.1.4 Isolated Basin System

The Isolated Basin LOS System has a LOS C for the 25-year/24-hour design storm event. The following areas are predicted to flood:

**Site Flooding:**

Near Bell Shoals Rd.

**Road Flooding:**

Lithia Pinecrest Road Kings Avenue
Bell Shoals Road

### 6.8.2 DELANEY POP-OFF CANAL SUBWATERSHED

The Delaney Pop-off Canal subwatershed experiences most the flooding in areas of older residential subdivisions like Fortuna Acres, Madison Estates Mobile home park and a neighborhood north of 36th Avenue South. There are no flooding problems along the Pop-off main channel but several locations require improvements due to their tailwater influence to several flooding concerns locations.

#### 6.8.2.1 Delaney Pop-off Main Channel System

The Delaney Pop-off Main Channel LOS System includes most of the residential subdivisions west of 78th Street in the Delaney Pop-off subwatershed. This system includes the Delaney Pop-off main channel. The system has a LOS B for the 25-yr/24-hour design storm event. The following areas are predicted to flood during the 25-year/24-hour storm event:

**Road Flooding:**

78th Street

#### 6.8.2.2 Tributary "A" System

The Tributary "A" LOS System includes most of the residential subdivision west of 78th Street. The system has a LOS D for the 25-yr/24-hour design storm event. The following areas are predicted to flood during the 25-year/24-hour storm event:

**Structure Flooding:**

Most of the residential driveways of the residential homes

### 6.8.2.3 Tributary "B" / Sanson Park (247xxx Series)

The Tributary "B" LOS System includes most of the Sanson Park subdivision. The system has a LOS D for the 25-yr/24-hour design storm event. The following areas are predicted to flood during the 25-year/24-hour storm event:

**Structure Flooding:**

Residential homes in the Sanson Park subdivision

**Road Flooding:**

All the residential road of Sanson Park subdivision

**Site Flooding:**

Sanson Park subdivision

### 6.8.2.4 Tributary "F" (2425xx Series)

The Tributary "F" LOS System includes most of the older residential area located north of Madison Avenue and east of the Delaney Pop-off Main channel. The system has a LOS D for the 25-yr/24-hour design storm event. The following areas are predicted to flood during the 25-year/24-hour storm event:

**Structure Flooding:**

Residential homes in this subdivision

**Site Flooding:**

Subdivision east of Delaney Pop-off Main Channel

### 6.8.2.5 Evergreen Estates (2425xx Series)

The Evergreen Estates System includes most of the Evergreen Estates subdivision. Historic flooding has occurred due to tailwater conditions in the Delaney Pop-off main channel. The system has a LOS D for the 25-yr/24-hour design storm event. The following areas are predicted to flood during the 25-year/24-hour storm event:

**Structure Flooding:**

Residential homes in Evergreen Estates

**Site Flooding:**

Evergreen Estates Subdivision

## 6.8.3 NORTH ARCHIE CREEK SUBWATERSHED

The North Archie Creek subwatershed experiences most of its flooding in areas of older residential subdivisions like Progress Village. Historical flooding occurs in Progress Village, Sherwood Apartments and Duncan Road area near Bloomingdale Avenue.

### 6.8.3.1 North Archie Creek Main Channel System

The North Archie Creek Main Channel LOS System includes most of the eastern portion of the North Archie Creek subwatershed. This system includes the North Archie Creek main channel and Tributaries “A” through “G” conveyance systems. The system has a LOS C for the 25-yr/24-hour design storm event. The following areas are predicted to flood during the 25-year/24-hour storm event:

**Structure Flooding:**

East of 82$^{nd}$ Street near Endive Avenue

Hulett Drive near Kirtley of Sterling Ranch

Pepperson Drive of the Bloomingdale Hills Park

**Site flooding:**

Endive homes

**Road Flooding:**

| | |
|---|---|
| 82nd Street | Endive Avenue |
| Old U.S. Highway 23 | Bloomingdale Avenue |
| Pepperson Drive | Hulett Drive |

## 6.8.4 ARCHIE CREEK SUBWATERSHED

The Archie Creek subwatershed experiences most the flooding in areas of older residential subdivisions like the Starlite Subdivision. Historical flooding occurs in the outlying boundaries of the subwatershed as in the Krycul Avenue homes on the east side of the road.

### 6.8.4.1 Archie Creek Main Channel System

The Archie Creek Main Channel LOS System includes most of the eastern portion of the Archie Creek subwatershed. This system includes the Archie Creek main channel and Tributary "A" through "G" conveyance systems. This system also includes the area north of the Cargill gypsum stack and the TECO powerline easement west and east of 78th Street. The system has LOS varying from C to D for the 25-yr/24-hour design storm event. The following areas are predicted to flood during the 25-year/24- hour storm event:

**Structure Flooding:**

CSX bridge and CBC downstream of Old Hwy. 23 Rinker Entrance

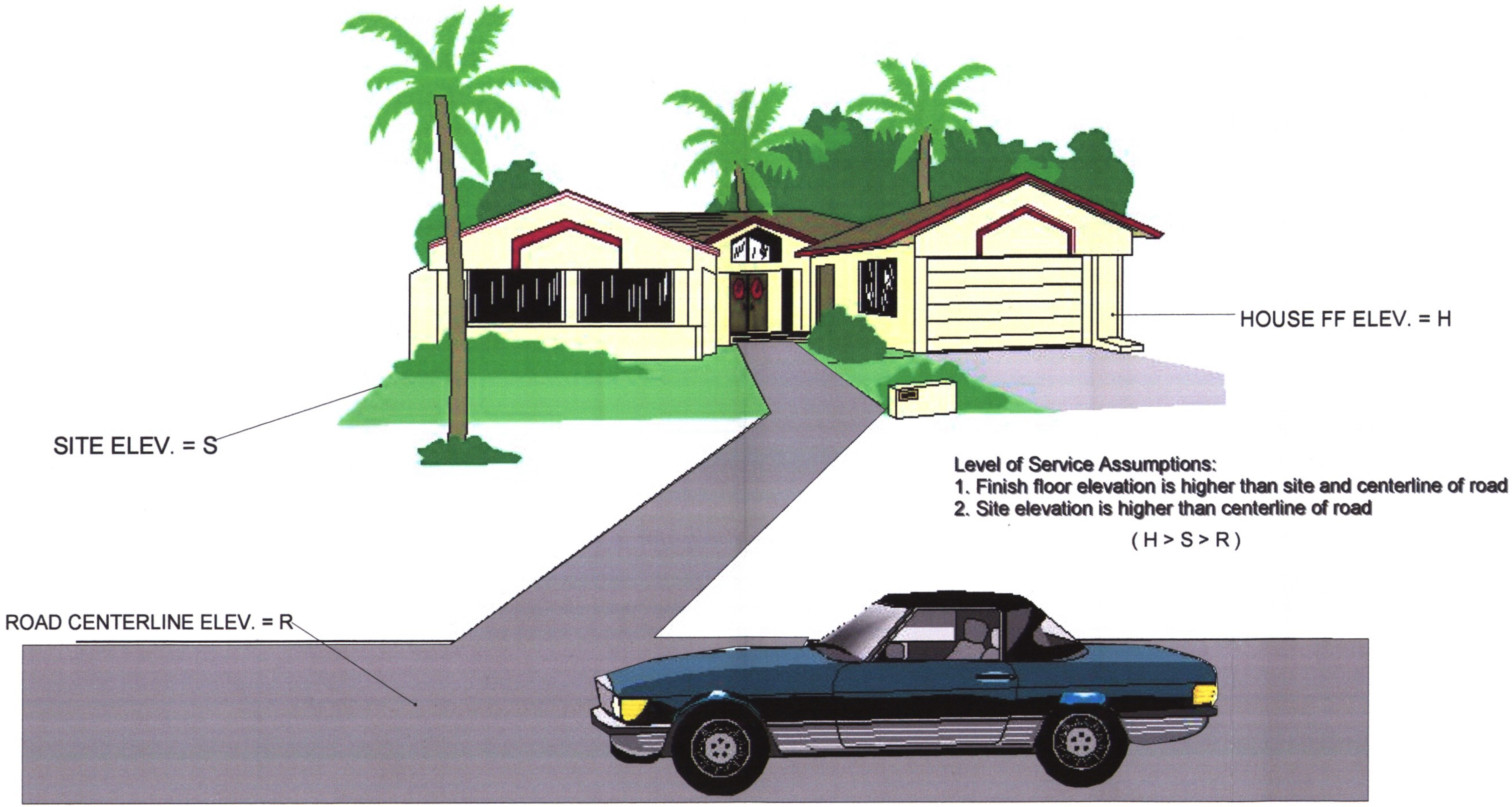
**Site Flooding:**

Back lots on the north side of Alsobrook Avenue

**Road Flooding:**

| | |
|---|---|
| Old U.S. Highway 23 | 78th Street |
| Mint Julip Circle of Ashley Oaks | Krycul Road |
| Kanakee Road | Freeport Road |

# Level of Service Model




**Level of Service Assumptions:**
1. Finish floor elevation is higher than site and centerline of road
2. Site elevation is higher than centerline of road

( H > S > R )

| | | |
|---|---|---|
| Hillsborough County Florida<br>Public Works Department<br>Engineering Division<br>Stormwater MANAGEMENT Section | EAST LAKE AREA<br>STORMWATER MANAGEMENT<br>MASTER PLAN<br>(SEPT 2000) | FIGURE 6-1<br>LEVEL OF SERVICE<br>DIAGRAM MAP |

# Delaney Creek Existing LOS

8/30/01

**Table 6.2**

| DELANEY CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 1C | 210010 | 5.25 | 5.30 | 5.60 | 4.51 | 5.09 | 5.89 | 6.40 | 7.33 | 7.78 | A | A | D | D | D | D |
| 1C | 210020 | 6.05 | 6.50 | 7.50 | 4.71 | 5.32 | 6.18 | 6.72 | 7.70 | 8.17 | A | A | B | C | D | D |
| 1C | 210025 | 6.45 | 6.70 | 7.50 | 4.49 | 5.23 | 6.10 | 6.78 | 8.22 | 9.00 | A | A | A | C | D | D |
| 6 | 210040 | 6.50 | 7.20 | 8.20 | 5.19 | 5.95 | 6.98 | 7.59 | 8.54 | 8.98 | A | A | B | C | D | D |
| 6 | 210060 | 10.55 | 10.50 | 11.00 | 6.54 | 7.39 | 8.49 | 9.14 | 10.07 | 10.46 | A | A | A | A | A | A |
| 6 | 210065 | 10.75 | 11.00 | 12.00 | 6.00 | 6.85 | 8.31 | 9.14 | 10.05 | 10.48 | A | A | A | A | A | A |
| 6 | 210080 | 10.70 | 12.00 | 12.00 | 7.51 | 8.36 | 9.48 | 10.13 | 11.11 | 11.51 | A | A | A | A | B | B |
| 6 | 210090 | 11.55 | 12.10 | 12.60 | 8.20 | 9.01 | 10.06 | 10.68 | 11.63 | 12.03 | A | A | A | A | B | B |
| 13/6 | 210100 | 11.25 | 11.80 | 12.30 | 8.87 | 9.68 | 10.73 | 11.38 | 12.39 | 12.83 | A | A | A | B | D | D |
| 13 | 210120 | 12.15 | 12.50 | 12.00 | 9.94 | 10.82 | 12.20 | 13.02 | 14.51 | 15.24 | A | A | D | D | D | D |
| 12 | 210125 | 11.95 | 12.50 | 13.00 | 12.54 | 12.73 | 12.96 | 13.10 | 13.34 | 13.45 | C | C | C | D | D | D |
| 13 | 210150 | 18.55 | 18.50 | 19.00 | 14.29 | 15.19 | 16.22 | 16.92 | 18.26 | 18.95 | A | A | A | A | A | C |
| 12 | 210170 | 18.05 | 18.80 | 19.30 | 15.71 | 16.67 | 17.88 | 18.57 | 19.80 | 20.36 | A | A | A | B | D | D |
| 12 | 210180 | 19.85 | 19.00 | 19.50 | 16.59 | 17.50 | 18.68 | 19.37 | 20.60 | 21.15 | A | A | A | C | D | D |
| 18 | 210190 | 19.25 | 21.40 | 20.90 | 16.73 | 17.70 | 19.08 | 19.90 | 21.29 | 21.79 | A | A | A | B | D | D |
| 18 | 210200 | 19.95 | 21.50 | 22.00 | 17.48 | 18.36 | 19.62 | 20.36 | 21.68 | 22.15 | A | A | A | B | C | D |
| 18 | 210210 | 22.65 | 24.50 | 25.00 | 18.71 | 19.60 | 20.82 | 21.56 | 22.70 | 23.12 | A | A | A | A | B | B |
| 18 | 210230 | 22.55 | 24.50 | 25.00 | 19.35 | 20.19 | 21.32 | 22.00 | 23.05 | 23.48 | A | A | A | A | B | B |
| 23 | 210260 | 27.45 | 25.50 | 25.70 | 23.88 | 24.49 | 25.31 | 25.81 | 26.63 | 26.98 | A | A | A | D | D | D |
| 23 | 210280 | 29.60 | 997.50 | 998.00 | 25.52 | 26.24 | 27.13 | 27.62 | 28.37 | 28.71 | A | A | A | A | A | A |
| 24 | 210290 | 27.85 | 28.00 | 29.70 | 25.95 | 26.67 | 27.55 | 28.03 | 28.78 | 29.11 | A | A | A | C | C | C |
| 24/29 | 210300 | 31.50 | 997.50 | 998.00 | 26.19 | 26.92 | 27.80 | 28.28 | 29.05 | 29.40 | A | A | A | A | A | A |
| 29 | 210332 | 35.50 | 37.50 | 39.00 | 29.42 | 30.36 | 31.71 | 32.62 | 34.47 | 35.43 | A | A | A | A | A | A |
| 29 | 210333 | 44.45 | 40.50 | 41.00 | 37.28 | 37.96 | 38.81 | 39.32 | 40.23 | 40.65 | A | A | A | A | A | C |
| 30 | 210335 | 997.25 | 997.50 | 998.00 | 26.86 | 27.55 | 28.31 | 28.69 | 29.35 | 29.65 | E | E | E | E | E | E |
| 30 | 210336 | 997.25 | 997.50 | 998.00 | 27.05 | 27.57 | 28.36 | 28.74 | 29.38 | 29.68 | E | E | E | E | E | E |
| 30 | 210350 | 997.25 | 997.50 | 998.00 | 27.09 | 27.93 | 28.93 | 29.38 | 30.16 | 30.52 | E | E | E | E | E | E |
| 30 | 210360 | 997.25 | 997.50 | 997.00 | 27.11 | 28.05 | 29.11 | 29.58 | 30.41 | 30.79 | E | E | E | E | E | E |
| 5 | 211010 | 13.05 | 12.50 | 13.00 | 8.20 | 9.01 | 10.07 | 10.70 | 11.65 | 12.05 | A | A | A | A | A | A |
| 12 | 211060 | 9.45 | 11.50 | 12.00 | 10.13 | 11.12 | 11.81 | 12.10 | 12.60 | 12.87 | B | B | C | D | D | D |
| 12 | 211080 | 12.75 | 13.50 | 14.00 | 10.66 | 11.65 | 12.62 | 13.13 | 13.92 | 14.16 | A | A | A | B | C | D |
| 12 | 211100 | 15.45 | 15.50 | 16.00 | 12.76 | 13.16 | 13.65 | 13.96 | 14.55 | 14.76 | A | A | A | A | A | A |
| 12 | 211110 | 997.25 | 22.20 | 22.70 | 19.34 | 19.44 | 19.58 | 19.67 | 19.82 | 19.89 | A | A | A | A | A | A |
| 5 | 211115 | 16.95 | 16.30 | 16.20 | 14.88 | 15.13 | 15.46 | 15.66 | 16.06 | 16.25 | A | A | A | A | A | D |
| 5 | 211030 | 13.25 | 13.60 | 15.20 | 8.73 | 9.78 | 10.77 | 11.24 | 12.01 | 12.41 | A | A | A | A | A | A |
| 11 | 211160 | 17.55 | 17.60 | 18.10 | 16.23 | 16.60 | 16.87 | 16.95 | 17.18 | 17.37 | A | A | A | A | A | A |
| 11 | 211165 | 17.55 | 18.60 | 19.10 | 17.24 | 17.32 | 17.44 | 17.51 | 17.64 | 17.71 | A | A | A | A | B | B |
| 5 | 211185 | 15.95 | 16.00 | 16.50 | 14.85 | 15.10 | 15.37 | 15.51 | 15.76 | 15.87 | A | A | A | A | A | A |
| 13 | 211510 | 15.75 | 15.50 | 16.00 | 11.89 | 12.46 | 14.02 | 14.45 | 15.22 | 15.86 | A | A | A | A | A | C |
| 13/6 | 211530 | 999.25 | 999.50 | 1000.00 | 13.49 | 14.43 | 15.51 | 15.98 | 16.75 | 17.09 | E | E | E | E | E | E |
| 12 | 212000 | 16.95 | 18.50 | 19.00 | 15.82 | 16.77 | 17.96 | 18.64 | 19.85 | 20.40 | A | A | B | C | D | D |
| 12 | 212030 | 17.95 | 20.50 | 21.00 | 16.02 | 17.04 | 18.39 | 19.19 | 20.45 | 20.84 | A | A | B | B | B | C |
| 12 | 212040 | 18.45 | 19.50 | 19.00 | 15.86 | 16.80 | 17.98 | 18.66 | 19.86 | 20.41 | A | A | A | B | D | D |

# Delaney Creek Existing LOS

8/30/01

**Table 6.2**

| DELANEY CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 12 | 212060 | 18.05 | 19.50 | 19.00 | 15.97 | 16.94 | 18.20 | 18.93 | 20.27 | 20.91 | A | A | B | B | D | D |
| 12 | 212080 | 17.35 | 18.50 | 19.00 | 16.52 | 17.92 | 18.86 | 19.33 | 20.13 | 20.53 | A | B | C | D | D | D |
| 12 | 212100 | 17.15 | 18.50 | 20.00 | 17.29 | 18.19 | 19.12 | 19.63 | 20.47 | 20.83 | B | B | C | C | D | D |
| 11 | 212130 | 18.85 | 20.50 | 21.00 | 17.77 | 18.98 | 20.39 | 20.86 | 21.53 | 21.83 | A | B | B | C | D | D |
| 18 | 213010 | 20.75 | 22.50 | 23.00 | 19.09 | 20.61 | 21.94 | 22.43 | 23.20 | 23.53 | A | A | B | B | D | D |
| 18 | 213040 | 21.45 | 23.50 | 24.00 | 20.24 | 21.15 | 22.23 | 22.74 | 23.57 | 23.93 | A | A | B | B | C | C |
| 17 | 213060 | 24.25 | 25.50 | 26.00 | 21.45 | 22.23 | 22.93 | 23.36 | 24.12 | 24.48 | A | A | A | A | A | B |
| 18 | 213510 | 24.05 | 25.50 | 26.00 | 18.97 | 19.60 | 20.83 | 21.58 | 22.72 | 23.48 | A | A | A | A | A | A |
| 18 | 213530 | 23.65 | 25.50 | 26.00 | 19.96 | 20.42 | 21.21 | 22.00 | 23.84 | 24.80 | A | A | A | A | B | B |
| 18 | 213800 | 997.25 | 997.50 | 998.00 | 24.45 | 24.73 | 25.08 | 25.29 | 25.66 | 25.83 | E | E | E | E | E | E |
| 18 | 213810 | 997.25 | 997.50 | 998.00 | 27.63 | 27.83 | 28.10 | 28.26 | 28.57 | 28.72 | E | E | E | E | E | E |
| 23 | 214012 | 27.45 | 997.50 | 998.00 | 27.10 | 27.56 | 28.13 | 28.46 | 29.07 | 29.32 | A | B | B | B | B | B |
| 17/23 | 214020 | 27.85 | 997.50 | 998.00 | 24.93 | 25.82 | 27.00 | 27.39 | 27.81 | 27.98 | A | A | A | A | A | B |
| 23 | 214040 | 997.25 | 997.50 | 998.00 | 29.29 | 30.09 | 31.05 | 31.56 | 32.46 | 32.89 | E | E | E | E | E | E |
| 23 | 214053 | 29.05 | 997.50 | 998.00 | 27.22 | 27.65 | 28.23 | 28.59 | 29.25 | 29.55 | A | A | A | A | B | B |
| 24 | 214500 | 997.25 | 997.50 | 998.00 | 25.35 | 25.51 | 25.74 | 25.88 | 26.59 | 27.38 | E | E | E | E | E | E |
| 23 | 215010 | 28.75 | 997.50 | 998.00 | 25.59 | 26.31 | 27.20 | 27.70 | 28.49 | 28.87 | A | A | A | A | A | B |
| 23 | 215023 | 30.25 | 29.40 | 29.90 | 25.27 | 26.21 | 27.18 | 27.73 | 28.62 | 29.22 | A | A | A | A | A | A |
| 23 | 215041 | 30.15 | 997.50 | 998.00 | 28.04 | 28.17 | 28.68 | 29.26 | 30.02 | 30.29 | A | A | A | A | A | B |
| 23 | 215042 | 31.15 | 997.50 | 998.00 | 28.04 | 28.21 | 28.91 | 29.53 | 30.09 | 30.37 | A | A | A | A | A | A |
| 23 | 215051 | 997.25 | 997.50 | 998.00 | 26.77 | 27.65 | 28.88 | 29.66 | 31.06 | 31.68 | E | E | E | E | E | E |
| 23 | 215060 | 32.15 | 30.50 | 31.00 | 26.32 | 26.88 | 27.85 | 28.44 | 29.37 | 29.77 | A | A | A | A | A | A |
| 23 | 215070 | 32.15 | 30.50 | 32.50 | 26.87 | 27.39 | 28.26 | 28.88 | 30.11 | 30.51 | A | A | A | A | A | C |
| 23/29 | 215500 | 31.15 | 29.30 | 30.50 | 25.53 | 26.25 | 27.14 | 27.63 | 28.38 | 28.72 | A | A | A | A | A | A |
| 23/29 | 215520 | 31.25 | 31.75 | 33.75 | 29.55 | 30.36 | 31.17 | 31.60 | 32.51 | 32.86 | A | A | A | B | C | C |
| 29 | 215530 | 31.65 | 32.75 | 33.75 | 30.05 | 31.05 | 32.17 | 32.74 | 33.61 | 33.99 | A | A | B | B | C | D |
| 29 | 215537 | 997.25 | 997.50 | 998.00 | 31.65 | 32.96 | 34.89 | 36.15 | 37.70 | 38.12 | E | E | E | E | E | E |
| 29 | 215538 | 32.25 | 32.50 | 40.00 | 29.98 | 30.70 | 31.52 | 32.04 | 33.12 | 33.67 | A | A | A | A | C | C |
| 29 | 215542 | 53.25 | 40.00 | 56.90 | 37.91 | 38.27 | 38.68 | 38.92 | 39.36 | 39.57 | A | A | A | A | A | A |
| 29 | 215550 | 52.25 | 40.30 | 56.90 | 37.93 | 38.31 | 38.80 | 39.15 | 40.03 | 40.50 | A | A | A | A | A | C |
| 24 | 216000 | 29.75 | 29.20 | 29.70 | 25.95 | 26.67 | 27.57 | 28.06 | 28.80 | 29.14 | A | A | A | A | A | A |
| 24 | 216500 | 997.25 | 997.50 | 998.00 | 25.91 | 26.50 | 27.03 | 27.56 | 28.29 | 28.57 | E | E | E | E | E | E |
| 24 | 216510 | 997.25 | 997.50 | 998.00 | 25.91 | 26.50 | 27.03 | 27.56 | 28.29 | 28.57 | E | E | E | E | E | E |
| 30 | 217000 | 997.25 | 997.50 | 998.00 | 26.97 | 27.76 | 28.67 | 29.11 | 29.83 | 30.16 | E | E | E | E | E | E |
| 30 | 217020 | 997.25 | 997.50 | 998.00 | 27.80 | 28.36 | 29.12 | 29.58 | 30.48 | 30.93 | E | E | E | E | E | E |
| 30 | 220000 | 999.25 | 999.50 | 1000.00 | 27.17 | 28.19 | 29.31 | 29.94 | 30.87 | 31.30 | E | E | E | E | E | E |
| 36 | 220010 | 32.05 | 997.50 | 998.00 | 28.79 | 29.07 | 29.65 | 30.12 | 30.95 | 31.36 | A | A | A | A | A | A |
| 36 | 220040 | 30.25 | 30.10 | 34.70 | 28.91 | 29.31 | 30.00 | 30.42 | 31.20 | 31.62 | A | A | A | C | C | C |

**Delaney Creek Existing LOS**

8/30/01

**Table 6.2**

| DELANEY CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 36 | 220050 | 30.45 | 30.70 | 31.40 | 28.92 | 29.42 | 30.06 | 30.46 | 31.22 | 31.64 | A | A | A | B | C | D |
| 41 | 220060 | 31.25 | 32.50 | 34.00 | 28.97 | 29.51 | 30.20 | 30.61 | 31.35 | 31.75 | A | A | A | A | B | B |
| 41 | 220070 | 33.90 | 33.50 | 34.00 | 30.91 | 31.32 | 31.90 | 32.24 | 32.84 | 33.11 | A | A | A | A | A | A |
| 41 | 220110 | 36.25 | 37.25 | 38.75 | 32.68 | 33.13 | 34.36 | 35.08 | 36.38 | 36.70 | A | A | A | A | B | B |
| 41 | 220130 | 36.50 | 37.25 | 38.75 | 32.76 | 33.23 | 34.47 | 35.21 | 36.82 | 37.29 | A | A | A | A | B | C |
| 41 | 220140 | 36.25 | 37.25 | 38.75 | 32.82 | 33.32 | 34.56 | 35.31 | 36.92 | 37.40 | A | A | A | A | B | C |
| 41 | 220170 | 44.25 | 37.50 | 38.00 | 33.90 | 34.42 | 35.20 | 35.90 | 36.85 | 37.34 | A | A | A | A | A | A |
| 41 | 220180 | 44.25 | 45.50 | 53.00 | 33.96 | 34.60 | 35.80 | 36.79 | 39.01 | 40.27 | A | A | A | A | A | A |
| 41 | 220190 | 44.25 | 38.50 | 45.00 | 34.98 | 35.90 | 37.03 | 37.98 | 39.21 | 39.63 | A | A | A | A | C | C |
| 41 | 220195 | 41.75 | 42.00 | 43.00 | 35.08 | 35.13 | 35.21 | 35.26 | 35.39 | 35.45 | A | A | A | A | A | A |
| 41 | 220200 | 39.25 | 40.25 | 41.00 | 35.29 | 36.27 | 37.09 | 37.63 | 38.64 | 39.19 | A | A | A | A | A | A |
| 45 | 220210 | 40.00 | 40.00 | 41.00 | 35.39 | 36.39 | 37.15 | 37.74 | 38.81 | 39.24 | A | A | A | A | A | A |
| 30 | 221000 | 31.05 | 30.00 | 41.00 | 27.32 | 28.21 | 29.32 | 29.95 | 30.88 | 31.31 | A | A | A | A | C | C |
| 30 | 221030 | 33.25 | 34.25 | 36.00 | 28.64 | 29.10 | 29.84 | 30.34 | 31.46 | 31.84 | A | A | A | A | A | A |
| 30/36 | 221500 | 35.25 | 35.50 | 36.00 | 34.19 | 34.53 | 35.04 | 35.35 | 35.90 | 36.10 | A | A | A | B | C | D |
| 30/36 | 221520 | 46.35 | 48.00 | 49.00 | 36.34 | 36.70 | 37.66 | 38.13 | 38.87 | 39.06 | A | A | A | A | A | A |
| 29/35 | 221540 | 43.25 | 41.50 | 43.00 | 37.08 | 37.38 | 37.94 | 38.41 | 39.37 | 39.77 | A | A | A | A | A | A |
| 35 | 221550 | 45.25 | 46.50 | 48.00 | 36.59 | 36.83 | 37.21 | 37.46 | 37.94 | 38.17 | A | A | A | A | A | A |
| 29/35 | 221560 | 51.25 | 41.50 | 43.00 | 36.67 | 36.95 | 37.40 | 37.72 | 38.36 | 38.68 | A | A | A | A | A | A |
| 35 | 221580 | 52.25 | 53.00 | 54.60 | 38.59 | 39.62 | 41.14 | 42.06 | 43.74 | 44.51 | A | A | A | A | A | A |
| 36 | 222000 | 32.05 | 32.50 | 33.50 | 28.55 | 28.98 | 29.74 | 30.25 | 31.01 | 31.41 | A | A | A | A | A | A |
| 36 | 222020 | 32.00 | 32.50 | 33.00 | 28.45 | 29.05 | 29.85 | 30.37 | 31.31 | 31.74 | A | A | A | A | A | A |
| 36 | 222030 | 31.05 | 30.50 | 31.90 | 28.45 | 29.05 | 29.86 | 30.37 | 31.32 | 31.76 | A | A | A | A | C | C |
| 37 | 222040 | 32.35 | 30.90 | 32.00 | 28.46 | 29.06 | 29.87 | 30.38 | 31.35 | 31.79 | A | A | A | A | C | C |
| 37 | 222050 | 32.25 | 32.40 | 33.00 | 28.47 | 29.10 | 29.92 | 30.43 | 31.47 | 31.91 | A | A | A | A | A | A |
| 37 | 222060 | 33.35 | 33.60 | 34.10 | 28.47 | 29.10 | 29.92 | 30.43 | 31.47 | 31.91 | A | A | A | A | A | A |
| 37 | 222080 | 32.35 | 32.50 | 33.10 | 28.49 | 29.15 | 29.98 | 30.49 | 31.51 | 31.94 | A | A | A | A | A | A |
| 42 | 222090 | 33.25 | 35.00 | 36.00 | 30.77 | 30.95 | 31.70 | 32.10 | 32.77 | 33.07 | A | A | A | A | A | A |
| 36 | 222500 | 31.65 | 31.90 | 35.00 | 28.83 | 29.63 | 31.14 | 31.87 | 33.24 | 33.88 | A | A | A | B | C | C |
| 37 | 222520 | 32.40 | 33.50 | 34.80 | 29.15 | 30.29 | 31.99 | 32.82 | 34.20 | 34.79 | A | A | A | B | C | C |
| 37 | 222530 | 32.35 | 33.50 | 34.80 | 29.14 | 30.27 | 31.97 | 32.81 | 34.19 | 34.78 | A | A | A | B | C | C |
| 37 | 222540 | 32.03 | 32.50 | 34.30 | 28.73 | 29.55 | 30.79 | 31.49 | 32.76 | 33.33 | A | A | A | A | C | C |
| 36 | 223000 | 31.50 | 32.00 | 33.00 | 30.01 | 30.15 | 30.40 | 30.57 | 31.10 | 31.52 | A | A | A | A | A | B |
| 36 | 223020 | 40.25 | 40.50 | 41.00 | 27.03 | 27.33 | 27.82 | 28.17 | 31.68 | 33.17 | A | A | A | A | A | A |
| 36 | 223030 | 34.75 | 31.00 | 35.00 | 33.50 | 33.98 | 34.30 | 34.46 | 34.73 | 34.85 | C | C | C | C | C | C |
| 35 | 223050 | 36.25 | 40.50 | 56.00 | 31.76 | 32.10 | 32.52 | 32.76 | 33.18 | 33.37 | A | A | A | A | A | A |
| 41 | 224010 | 29.25 | 35.50 | 37.00 | 29.45 | 29.99 | 30.96 | 31.55 | 32.52 | 32.92 | B | B | B | B | B | B |
| 41 | 224050 | 34.25 | 35.50 | 36.00 | 30.54 | 31.15 | 32.03 | 32.62 | 34.06 | 34.41 | A | A | A | A | A | B |

# Delaney Creek Existing LOS

8/30/01

**Table 6.2**

| DELANEY CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 41 | 225010 | 34.25 | 35.50 | 37.00 | 31.96 | 32.50 | 33.62 | 34.30 | 35.41 | 35.88 | A | A | A | B | B | C |
| 41 | 225017 | 37.25 | 39.50 | 40.00 | 36.97 | 38.14 | 39.07 | 39.54 | 40.30 | 40.62 | A | B | B | C | D | D |
| 41 | 225110 | 45.25 | 46.50 | 47.00 | 38.71 | 38.90 | 39.22 | 39.69 | 40.46 | 40.80 | A | A | A | A | A | A |
| 41 | 225120 | 38.25 | 40.50 | 41.00 | 38.90 | 39.09 | 39.35 | 39.80 | 40.58 | 40.93 | B | B | B | B | C | C |
| 41 | 225130 | 47.15 | 49.50 | 51.00 | 34.98 | 35.90 | 37.03 | 37.98 | 39.22 | 39.64 | A | A | A | A | A | A |
| 41 | 225140 | 44.25 | 44.80 | 46.00 | 34.98 | 35.90 | 37.03 | 37.98 | 39.22 | 39.63 | A | A | A | A | A | A |
| 41 | 225150 | 997.25 | 997.50 | 998.00 | 39.32 | 41.98 | 43.52 | 43.79 | 44.19 | 44.36 | E | E | E | E | E | E |
| 41 | 225160 | 997.25 | 997.50 | 998.00 | 43.92 | 44.06 | 44.26 | 44.38 | 44.62 | 44.71 | E | E | E | E | E | E |
| 45 | 226000 | 37.37 | 37.50 | 39.00 | 35.39 | 36.40 | 37.16 | 37.76 | 38.83 | 39.27 | A | A | A | C | C | D |
| 45 | 227000 | 50.25 | 45.50 | 56.00 | 43.19 | 43.48 | 43.96 | 44.29 | 44.93 | 45.24 | A | A | A | A | A | A |
| 45 | 227010 | 997.25 | 997.50 | 998.00 | 46.84 | 47.12 | 47.31 | 47.68 | 48.29 | 48.66 | E | E | E | E | E | E |
| 45 | 227020 | 997.25 | 997.50 | 998.00 | 45.35 | 46.17 | 46.40 | 46.72 | 47.35 | 47.70 | E | E | E | E | E | E |
| 45 | 227030 | 52.25 | 41.70 | 53.00 | 46.28 | 47.69 | 50.34 | 50.65 | 51.25 | 51.59 | C | C | C | C | C | C |
| 49 | 227040 | 59.05 | 60.50 | 61.00 | 57.41 | 57.94 | 58.32 | 58.48 | 58.96 | 59.22 | A | A | A | A | A | B |
| 45/46 | 227050 | 55.25 | 47.50 | 48.00 | 31.52 | 35.92 | 41.92 | 45.42 | 51.00 | 53.76 | A | A | A | A | D | D |
| 49 | 227060 | 89.05 | 79.20 | 95.00 | 72.52 | 73.36 | 74.75 | 75.75 | 77.81 | 78.86 | A | A | A | A | A | A |
| 49 | 227070 | 89.15 | 89.20 | 89.00 | 83.67 | 84.36 | 85.31 | 85.88 | 86.93 | 87.41 | A | A | A | A | A | A |
| 50 | 227080 | 73.85 | 74.10 | 74.60 | 69.90 | 70.34 | 70.72 | 71.06 | 71.75 | 72.09 | A | A | A | A | A | A |
| 50 | 227090 | 74.65 | 75.50 | 76.00 | 73.59 | 73.97 | 74.51 | 74.84 | 75.48 | 75.78 | A | A | A | B | B | C |
| 30 | 230005 | 30.25 | 997.50 | 998.00 | 28.80 | 29.26 | 29.82 | 30.21 | 30.99 | 31.40 | A | A | A | A | B | B |
| 30 | 230012 | 32.75 | 997.50 | 998.00 | 30.47 | 30.92 | 31.60 | 32.02 | 32.77 | 33.07 | A | A | A | A | B | B |
| 30 | 230030 | 30.25 | 30.90 | 31.40 | 28.77 | 29.23 | 29.81 | 30.19 | 30.91 | 31.28 | A | A | A | A | C | C |
| 31 | 230033 | 32.75 | 997.50 | 998.00 | 31.07 | 31.45 | 32.04 | 32.44 | 33.24 | 33.64 | A | A | A | A | B | B |
| 37 | 230090 | 32.35 | 31.80 | 32.50 | 29.66 | 30.06 | 30.65 | 31.01 | 31.73 | 32.06 | A | A | A | A | A | C |
| 42 | 230170 | 35.05 | 40.00 | 41.00 | 31.96 | 32.29 | 33.02 | 33.54 | 34.56 | 34.95 | A | A | A | A | A | A |
| 42 | 230180 | 41.25 | 41.50 | 42.00 | 32.23 | 33.19 | 34.45 | 34.91 | 35.39 | 35.64 | A | A | A | A | A | A |
| 46 | 230190 | 36.75 | 41.00 | 42.00 | 32.23 | 33.19 | 35.45 | 38.18 | 40.18 | 40.87 | A | A | A | B | B | B |
| 46 | 230200 | 48.25 | 48.50 | 49.50 | 46.80 | 47.54 | 48.46 | 49.01 | 50.00 | 50.43 | A | A | B | C | D | D |
| 42 | 231000 | 34.45 | 35.00 | 36.00 | 31.64 | 32.08 | 32.63 | 32.96 | 33.52 | 33.76 | A | A | A | A | A | A |

## Delaney Creek Existing LOS

8/30/01

**Table 6.2**

| DELANEY CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 42 | 232000 | 34.05 | 40.00 | 41.00 | 32.98 | 32.98 | 33.81 | 34.57 | 36.10 | 36.89 | A | A | A | B | B | B |
| 42/46 | 233000 | 43.91 | 44.50 | 46.00 | 41.05 | 41.92 | 42.93 | 43.48 | 44.32 | 44.61 | A | A | A | A | B | C |
| 45/46 | 233010 | 0.00 | 0.00 | 0.00 | 40.00 | 40.00 | 40.00 | 40.00 | 51.00 | 53.76 | D | D | D | D | D | D |
| 42 | 234000 | 0.00 | 0.00 | 0.00 | 31.00 | 31.00 | 31.00 | 31.00 | 31.00 | 31.00 | D | D | D | D | D | D |

## Delaney Pop-off Canal Existing LOS

8/30/01

**Table 6.3**

| DELANEY POP-OFF CANAL (EXISTING CONDITION) EXISTING LEVEL OF SERVICE Level of Service Analysis | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 2 | 200000 | 7.70 | 7.40 | 10.40 | 7.64 | 7.80 | 8.03 | 8.16 | 8.42 | 8.54 | C | C | C | C | D |
| 2 | 200010 | 7.70 | 7.40 | 10.40 | 7.55 | 7.70 | 7.90 | 8.03 | 8.27 | 8.38 | C | C | C | C | D |
| 2 | 200020 | 8.40 | 999.00 | 999.00 | 8.58 | 8.66 | 8.78 | 8.86 | 9.02 | 9.09 | B | B | B | B | D |
| 2 | 200025 | 8.55 | 8.60 | 10.70 | 8.71 | 8.79 | 8.91 | 8.99 | 9.14 | 9.22 | C | C | C | C | D |
| 2 | 200030 | 999.00 | 999.00 | 999.00 | 7.99 | 8.11 | 8.27 | 8.38 | 8.56 | 8.65 | E | E | E | E | E |
| 2 | 200040 | 999.00 | 999.00 | 999.00 | 6.60 | 6.65 | 6.70 | 6.73 | 6.78 | 6.80 | E | E | E | E | E |
| 2 | 200050 | 8.45 | 999.00 | 999.00 | 4.38 | 4.69 | 5.07 | 5.29 | 5.67 | 5.81 | A | A | A | A | D |
| 2 | 200065 | 999.00 | 999.00 | 999.00 | 3.65 | 4.03 | 4.50 | 4.96 | 5.69 | 6.01 | E | E | E | E | E |
| 2 | 200070 | 7.85 | 999.00 | 999.00 | 4.62 | 5.63 | 7.06 | 7.76 | 8.56 | 8.88 | A | A | A | A | D |
| 7 | 200090 | 8.55 | 5.90 | 6.40 | 4.86 | 6.02 | 7.64 | 8.39 | 9.27 | 9.62 | A | C | D | D | D |
| 6 | 200100 | 7.95 | 5.80 | 7.30 | 5.58 | 6.85 | 7.89 | 8.63 | 9.60 | 9.98 | A | C | D | D | D |
| 7 | 200110 | 9.45 | 999.00 | 999.00 | 6.01 | 7.08 | 8.74 | 9.74 | 10.92 | 11.48 | A | A | A | B | D |
| 7&6&2013 | 200120 | 8.55 | 8.80 | 9.30 | 6.65 | 7.50 | 8.95 | 9.93 | 11.17 | 11.76 | A | A | C | D | D |
| 6 | 200130 | 10.50 | 999.00 | 999.00 | 7.06 | 7.94 | 9.27 | 10.20 | 11.58 | 12.24 | A | A | A | A | D |
| 6&13 | 200140 | 10.20 | 10.80 | 11.30 | 9.39 | 9.84 | 10.27 | 10.48 | 11.77 | 12.41 | A | A | B | B | D |
| 14 | 200150 | 15.95 | 14.70 | 15.20 | 11.24 | 12.10 | 13.49 | 13.86 | 14.39 | 14.76 | A | A | A | A | D |
| 14 | 200335 | 10.25 | 12.70 | 13.40 | 9.40 | 9.90 | 10.40 | 10.66 | 12.12 | 12.80 | A | A | B | B | D |
| 7 | 200300 | 0.00 | 0.00 | 0.00 | 7.64 | 8.53 | 9.09 | 9.38 | 10.47 | 11.01 | D | D | D | D | D |
| 7 | 200310 | 9.05 | 9.30 | 9.80 | 8.53 | 9.13 | 10.21 | 10.86 | 12.33 | 13.02 | A | B | D | D | D |
| 7 | 200315 | 999.00 | 999.00 | 999.00 | 8.53 | 9.14 | 10.22 | 10.87 | 12.34 | 13.04 | E | E | E | E | E |
| 7 | 200320 | 9.65 | 999.00 | 999.00 | 8.55 | 9.17 | 10.26 | 10.95 | 12.47 | 13.20 | A | A | B | B | D |
| 7 | 200330 | 10.25 | 999.00 | 999.00 | 9.35 | 9.85 | 10.35 | 10.70 | 12.17 | 12.86 | A | A | B | B | D |
| | | | | | | | | | | | | | | | D |
| | | | | | | | | | | | | | | | D |
| 8 | 240040 | 9.05 | 999.00 | 999.00 | 3.90 | 4.42 | 5.08 | 5.41 | 6.01 | 6.34 | A | A | A | A | D |
| 8 | 240050 | 6.95 | 999.00 | 999.00 | 4.91 | 5.53 | 6.29 | 6.64 | 7.21 | 7.48 | A | A | A | A | D |
| 8 | 240060 | 6.95 | 7.70 | 8.40 | 5.14 | 5.95 | 7.09 | 7.58 | 8.32 | 8.65 | A | A | B | B | D |
| 8 | 240070 | 7.75 | 7.75 | 8.00 | 5.17 | 6.00 | 7.18 | 7.69 | 8.46 | 8.80 | A | A | A | A | D |
| 8 | 240080 | 8.55 | 9.30 | 9.80 | 5.28 | 6.10 | 7.26 | 7.76 | 8.52 | 8.86 | A | A | A | A | D |

# Delaney Pop-off Canal Existing LOS

8/30/01

**Table 6.3**

| DELANEY POP-OFF CANAL (EXISTING CONDITION) EXISTING LEVEL OF SERVICE Level of Service Analysis | | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 8 | 240085 | 999.00 | 999.00 | 999.00 | 5.36 | 5.49 | 5.70 | 6.03 | 7.00 | 7.46 | E | E | E | E | E |
| 8 | 240090 | 8.55 | 8.70 | 9.20 | 5.51 | 6.33 | 7.46 | 7.96 | 8.73 | 9.07 | A | A | A | A | D |
| 8 | 240100 | 8.35 | 8.35 | 8.70 | 5.75 | 6.57 | 7.66 | 8.16 | 8.93 | 9.28 | A | A | A | A | D |
| 14 | 240110 | 999.00 | 999.00 | 999.00 | 6.94 | 7.76 | 8.78 | 9.26 | 10.01 | 10.34 | E | E | E | E | E |
| 14 | 240120 | 14.55 | 14.80 | 15.30 | 7.66 | 8.56 | 9.67 | 10.17 | 10.86 | 11.17 | A | A | A | A | D |
| 14 | 240130 | 999.00 | 999.00 | 999.00 | 8.07 | 8.96 | 10.05 | 10.54 | 11.21 | 11.52 | E | E | E | E | E |
| 14 | 240135 | 12.75 | 13.00 | 13.60 | 10.19 | 10.33 | 10.51 | 10.62 | 11.24 | 11.55 | A | A | A | A | D |
| 14 | 240140 | 15.45 | 15.70 | 16.70 | 8.46 | 9.34 | 10.41 | 10.90 | 11.58 | 11.89 | A | A | A | A | D |
| 14 | 240150 | 13.75 | 14.00 | 14.50 | 8.68 | 9.24 | 11.21 | 11.90 | 13.19 | 13.74 | A | A | A | A | D |
| 14 | 240160 | 13.50 | 13.90 | 14.40 | 11.49 | 12.10 | 13.03 | 13.46 | 14.23 | 14.57 | A | A | A | A | D |
| 14 | 240170 | 999.00 | 999.00 | 999.00 | 12.53 | 13.17 | 14.03 | 14.46 | 15.03 | 15.30 | E | E | E | E | E |
| 14 | 240180 | 999.00 | 999.00 | 999.00 | 14.04 | 14.85 | 15.82 | 16.18 | 16.71 | 16.93 | E | E | E | E | E |
| 14 | 240190 | 999.00 | 999.00 | 999.00 | 14.85 | 15.74 | 16.75 | 17.06 | 17.57 | 17.77 | E | E | E | E | E |
| 14 | 240200 | 17.85 | 15.70 | 17.00 | 15.65 | 16.24 | 17.05 | 17.36 | 17.86 | 18.06 | A | C | D | D | D |
| 19 | 240210 | 18.45 | 17.70 | 19.00 | 15.99 | 16.87 | 18.32 | 18.61 | 18.97 | 19.12 | A | A | C | C | D |
| 19 | 240220 | 23.05 | 999.00 | 999.00 | 17.51 | 17.83 | 18.75 | 19.03 | 19.72 | 20.02 | A | A | A | A | D |
| 19 | 240230 | 999.00 | 999.00 | 999.00 | 17.45 | 18.18 | 19.22 | 19.43 | 19.68 | 19.79 | E | E | E | E | E |
| 19 | 240231 | 999.00 | 999.00 | 999.00 | 17.45 | 18.18 | 19.23 | 19.43 | 19.68 | 19.79 | E | E | E | E | E |
| 19 | 240235 | 999.00 | 999.00 | 999.00 | 20.27 | 20.33 | 20.46 | 20.53 | 20.67 | 20.73 | E | E | E | E | E |
| 25 | 246500 | 999.00 | 999.00 | 999.00 | 18.25 | 18.99 | 20.02 | 20.47 | 21.11 | 21.33 | E | E | E | E | E |
| 19 | 240255 | 999.00 | 999.00 | 999.00 | 19.11 | 19.62 | 20.36 | 20.71 | 21.28 | 21.52 | E | E | E | E | E |
| 25 | 244020 | 34.55 | 999.00 | 999.00 | 25.50 | 25.50 | 25.50 | 25.50 | 25.50 | 25.50 | A | A | A | A | D |
| 25 | 240380 | 32.65 | 999.00 | 999.00 | 27.19 | 27.42 | 27.69 | 27.82 | 28.07 | 28.61 | A | A | A | A | D |
| 25 | 240390 | 34.55 | 999.00 | 999.00 | 28.60 | 28.83 | 29.09 | 29.21 | 29.38 | 29.45 | A | A | A | A | D |
| 25 | 240400 | 999.00 | 999.00 | 999.00 | 28.82 | 29.28 | 29.90 | 30.26 | 30.82 | 31.09 | E | E | E | E | E |
| 25 | 240410 | 34.45 | 999.00 | 999.00 | 28.98 | 29.39 | 29.99 | 30.35 | 30.95 | 31.25 | A | A | A | A | D |
| 25 | 240420 | 34.45 | 999.00 | 999.00 | 29.96 | 30.17 | 30.45 | 30.66 | 31.26 | 31.61 | A | A | A | A | D |
| 25 | 240430 | 34.45 | 999.00 | 999.00 | 30.00 | 30.25 | 30.61 | 30.86 | 31.40 | 31.68 | A | A | A | A | D |
| 25 | 240440 | 34.45 | 34.70 | 35.20 | 29.98 | 30.24 | 30.61 | 30.85 | 31.40 | 31.68 | A | A | A | A | D |
| 25 | 240450 | 32.45 | 32.70 | 33.20 | 29.79 | 30.01 | 30.32 | 30.49 | 30.93 | 31.16 | A | A | A | A | D |
| 25 | 240460 | 999.00 | 999.00 | 999.00 | 29.52 | 29.71 | 29.95 | 30.19 | 30.67 | 30.80 | E | E | E | E | E |
| 14 | 241000 | 999.00 | 999.00 | 999.00 | 5.75 | 6.57 | 7.66 | 8.16 | 8.94 | 9.29 | E | E | E | E | E |
| 14 | 241010 | 12.55 | 12.80 | 13.30 | 5.75 | 6.57 | 7.66 | 8.16 | 8.94 | 9.29 | A | A | A | A | D |
| 14 | 241020 | 12.65 | 999.00 | 999.00 | 10.77 | 10.84 | 11.03 | 11.16 | 11.40 | 11.50 | A | A | A | A | D |
| 14 | 241030 | 13.15 | 999.00 | 999.00 | 11.58 | 11.64 | 11.72 | 11.77 | 11.86 | 11.90 | A | A | A | A | D |
| 14 | 241500 | 999.00 | 999.00 | 999.00 | 6.48 | 7.58 | 8.74 | 9.19 | 9.88 | 10.07 | E | E | E | E | E |
| 14 | 241510 | 999.00 | 999.00 | 999.00 | 11.43 | 11.56 | 11.75 | 11.88 | 12.11 | 12.22 | E | E | E | E | E |
| 14 | 241509 | 999.00 | 999.00 | 999.00 | 10.46 | 10.59 | 10.79 | 10.91 | 11.15 | 11.26 | E | E | E | E | E |
| 14 | 242000 | 999.00 | 999.00 | 999.00 | 8.08 | 8.97 | 10.06 | 10.54 | 11.21 | 11.53 | E | E | E | E | E |
| 14 | 242010 | 999.00 | 999.00 | 999.00 | 8.84 | 9.18 | 10.06 | 10.55 | 11.22 | 11.53 | E | E | E | E | E |
| 14 | 242020 | 999.00 | 999.00 | 999.00 | 10.66 | 10.91 | 11.22 | 11.40 | 11.72 | 11.87 | E | E | E | E | E |
| 13 | 242030 | 999.00 | 999.00 | 999.00 | 12.50 | 12.65 | 12.86 | 12.99 | 13.21 | 13.31 | E | E | E | E | E |
| 14 | 242500 | 14.45 | 14.70 | 15.20 | 11.51 | 12.13 | 13.05 | 13.48 | 14.25 | 14.59 | A | A | A | A | D |

## Delaney Pop-off Canal Existing LOS

8/30/01

**Table 6.3**

| DELANEY POP-OFF CANAL (EXISTING CONDITION) EXISTING LEVEL OF SERVICE Level of Service Analysis | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 14 | 242510 | 13.95 | 15.30 | 15.80 | 11.82 | 12.45 | 13.73 | 14.41 | 15.26 | 15.58 | A | A | A | B | D |
| 14 | 242520 | 13.50 | 14.40 | 14.90 | 12.64 | 13.09 | 13.99 | 14.52 | 15.34 | 15.66 | A | A | B | C | D |
| 14 | 242530 | 13.20 | 13.20 | 14.20 | 13.37 | 13.77 | 14.14 | 14.61 | 15.42 | 15.74 | C | C | C | D | D |
| 14 | 242800 | 11.55 | 13.80 | 14.30 | 11.59 | 12.61 | 13.29 | 13.49 | 14.26 | 14.58 | B | B | B | B | D |
| 14 | 243000 | 999.00 | 999.00 | 999.00 | 13.04 | 13.51 | 14.18 | 14.59 | 15.19 | 15.48 | E | E | E | E | E |
| 14 | 243005 | 15.75 | 14.70 | 15.20 | 13.25 | 13.35 | 13.51 | 13.66 | 14.31 | 14.66 | A | A | A | A | D |
| 14 | 243010 | 15.05 | 15.30 | 15.80 | 13.28 | 13.78 | 14.40 | 14.79 | 15.39 | 15.66 | A | A | A | A | D |
| 13 | 243020 | 15.75 | 999.00 | 999.00 | 14.29 | 14.77 | 15.37 | 15.84 | 16.43 | 16.69 | A | A | A | B | D |
| 14 | 243021 | 18.45 | 18.30 | 18.80 | 15.84 | 16.02 | 16.25 | 16.40 | 16.92 | 17.10 | A | A | A | A | D |
| 13 | 243030 | 16.85 | 16.70 | 17.20 | 14.29 | 14.72 | 15.51 | 15.98 | 16.69 | 17.00 | A | A | A | A | D |
| 13 | 243035 | 15.25 | 999.00 | 999.00 | 14.21 | 14.57 | 15.51 | 15.99 | 16.70 | 17.01 | A | A | B | B | D |
| 13 | 243040 | 999.00 | 999.00 | 999.00 | 14.89 | 15.21 | 15.87 | 16.19 | 16.81 | 17.10 | E | E | E | E | E |
| 13 | 243050 | 18.25 | 18.50 | 19.00 | 15.14 | 15.37 | 15.96 | 16.28 | 16.89 | 17.15 | A | A | A | A | D |
| 13 | 243060 | 18.25 | 18.50 | 19.00 | 15.68 | 16.01 | 16.40 | 16.61 | 17.09 | 17.39 | A | A | A | A | D |
| 13 | 243070 | 20.25 | 999.00 | 999.00 | 15.76 | 16.09 | 16.48 | 16.69 | 17.17 | 17.46 | A | A | A | A | D |
| 13 | 243080 | 18.65 | 999.50 | 100.00 | 15.95 | 16.36 | 16.91 | 17.21 | 17.89 | 18.21 | A | A | A | A | D |
| 13 | 243090 | 17.45 | 17.10 | 18.00 | 16.25 | 16.87 | 17.73 | 18.23 | 19.09 | 19.42 | A | A | C | D | D |
| 13 | 243100 | 19.45 | 20.00 | 20.50 | 16.32 | 16.89 | 17.73 | 18.23 | 19.11 | 19.44 | A | A | A | A | D |
| 13 | 243110 | 19.45 | 19.50 | 20.00 | 17.11 | 17.72 | 18.50 | 19.07 | 19.55 | 19.68 | A | A | A | A | D |
| 13 | 243120 | 18.45 | 18.70 | 19.20 | 17.37 | 18.03 | 18.86 | 19.37 | 19.94 | 20.16 | A | A | C | D | D |
| 13 | 243130 | 19.45 | 20.00 | 20.50 | 17.55 | 18.25 | 19.09 | 19.54 | 20.13 | 20.37 | A | A | A | B | D |
| 13 | 243135 | 18.95 | 17.90 | 19.40 | 17.90 | 17.98 | 18.10 | 18.17 | 18.30 | 18.36 | C | C | C | C | D |
| 13 | 243140 | 19.45 | 19.70 | 20.20 | 17.71 | 18.30 | 19.11 | 19.56 | 20.15 | 20.40 | A | A | A | B | D |
| 13 | 243150 | 20.45 | 18.70 | 21.20 | 17.81 | 18.40 | 19.19 | 19.62 | 20.22 | 20.48 | A | A | C | C | D |
| 13 | 243160 | 20.45 | 21.10 | 21.60 | 17.89 | 18.41 | 19.20 | 19.62 | 20.22 | 20.48 | A | A | A | A | D |
| 13 | 243500 | 999.00 | 999.00 | 999.00 | 15.00 | 15.48 | 15.97 | 16.29 | 16.86 | 17.06 | E | E | E | E | E |
| 13 | 243510 | 999.00 | 999.00 | 999.00 | 14.77 | 15.33 | 15.97 | 16.29 | 16.88 | 17.11 | E | E | E | E | E |
| 13 | 243520 | 999.00 | 999.00 | 999.00 | 14.77 | 15.34 | 15.97 | 16.29 | 16.88 | 17.12 | E | E | E | E | E |
| 19 | 244010 | 999.00 | 999.00 | 999.00 | 22.17 | 22.54 | 22.97 | 23.25 | 23.90 | 24.37 | E | E | E | E | E |
| 19 | 244510 | 999.00 | 999.00 | 999.00 | 19.05 | 19.62 | 20.39 | 20.76 | 21.35 | 21.60 | E | E | E | E | E |
| 19 | 246000 | 999.00 | 999.00 | 999.00 | 19.37 | 19.48 | 19.62 | 19.70 | 19.84 | 19.90 | E | E | E | E | E |
| 20&19 | 246010 | 999.00 | 999.00 | 999.00 | 21.81 | 22.10 | 22.50 | 22.71 | 23.04 | 23.16 | E | E | E | E | E |
| 20 | 246020 | 999.00 | 999.00 | 999.00 | 22.53 | 22.74 | 23.00 | 23.15 | 23.43 | 23.55 | E | E | E | E | E |
| 25&19 | 246035 | 31.65 | 999.00 | 999.00 | 22.59 | 22.80 | 23.04 | 23.17 | 23.41 | 23.51 | A | A | A | A | D |
| 25&26 | 246040 | 30.25 | 30.50 | 31.00 | 22.67 | 23.01 | 23.44 | 23.68 | 24.07 | 24.24 | A | A | A | A | D |
| 25 | 246050 | 31.95 | 999.00 | 999.00 | 22.67 | 23.02 | 23.45 | 23.69 | 24.09 | 24.25 | A | A | A | A | D |
| 25 | 246060 | 30.25 | 999.00 | 999.00 | 22.67 | 23.02 | 23.45 | 23.69 | 24.09 | 24.25 | A | A | A | A | D |
| 25 | 246070 | 35.00 | 999.00 | 999.00 | 34.39 | 34.42 | 34.46 | 34.49 | 34.54 | 34.56 | A | A | A | A | D |
| 19 | 246505 | 999.00 | 999.00 | 999.00 | 18.38 | 19.07 | 20.06 | 20.50 | 21.14 | 21.37 | E | E | E | E | E |
| 19 | 246510 | 999.00 | 999.00 | 999.00 | 18.40 | 19.07 | 20.06 | 20.50 | 21.14 | 21.37 | E | E | E | E | E |
| 25 | 246520 | 999.00 | 999.00 | 999.00 | 26.16 | 26.19 | 26.24 | 26.27 | 26.32 | 26.35 | E | E | E | E | E |

# Delaney Pop-off Canal Existing LOS

8/30/01

**Table 6.3**

| DELANEY POP-OFF CANAL (EXISTING CONDITION) EXISTING LEVEL OF SERVICE Level of Service Analysis | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 19 | 247000 | 999.00 | 21.70 | 22.20 | 19.20 | 19.70 | 20.37 | 20.72 | 21.23 | 21.42 | A | A | A | A | D |
| 19 | 247010 | 19.10 | 20.40 | 21.40 | 19.39 | 19.83 | 20.38 | 20.72 | 21.21 | 21.40 | B | B | B | C | D |
| 19 | 247020 | 19.10 | 20.00 | 21.40 | 19.40 | 19.83 | 20.31 | 20.54 | 20.88 | 21.02 | B | B | C | C | D |
| 19 | 247030 | 21.00 | 21.00 | 21.50 | 20.78 | 20.82 | 20.88 | 20.92 | 20.99 | 21.02 | A | A | A | A | D |
| 19 | 247040 | 22.65 | 22.90 | 23.40 | 22.35 | 22.59 | 22.89 | 23.06 | 23.37 | 23.51 | A | A | B | C | D |
| 19 | 247050 | 21.90 | 22.30 | 23.00 | 22.35 | 22.60 | 22.90 | 23.08 | 23.40 | 23.55 | C | C | C | D | D |
| 19 | 247060 | 21.45 | 22.00 | 23.00 | 21.44 | 21.71 | 22.16 | 22.41 | 22.82 | 23.01 | A | B | C | C | D |
| 19 | 247070 | 21.00 | 22.00 | 23.00 | 21.90 | 21.98 | 22.25 | 22.50 | 22.91 | 23.09 | B | B | C | C | D |
| 25 | 244030 | 32.65 | 999.00 | 999.00 | 25.87 | 25.94 | 26.04 | 26.10 | 26.21 | 26.26 | A | A | A | A | D |
| 19 | 247500 | 999.00 | 999.00 | 999.00 | 19.11 | 19.62 | 20.36 | 20.72 | 21.28 | 21.53 | E | E | E | E | E |
| 19 | 247510 | 23.25 | 22.80 | 23.30 | 19.12 | 19.63 | 20.36 | 20.72 | 21.31 | 21.59 | A | A | A | A | D |
| 19 | 247520 | 23.23 | 24.00 | 24.50 | 19.20 | 19.70 | 20.37 | 20.73 | 21.36 | 21.68 | A | A | A | A | D |
| 19 | 247530 | 999.00 | 999.00 | 999.00 | 19.22 | 19.72 | 20.38 | 20.73 | 21.40 | 21.76 | E | E | E | E | E |
| 19 | 247535 | 25.25 | 24.70 | 25.70 | 20.66 | 21.25 | 22.04 | 22.12 | 22.28 | 22.40 | A | A | A | A | D |
| 19 | 247540 | 24.95 | 24.70 | 26.20 | 20.25 | 20.59 | 21.03 | 21.30 | 21.80 | 22.04 | A | A | A | A | D |
| 19 | 247550 | 27.65 | 26.50 | 27.60 | 20.29 | 20.64 | 21.08 | 21.35 | 21.84 | 22.08 | A | A | A | A | D |
| 19 | 247801 | 26.15 | 26.00 | 29.00 | 22.91 | 23.11 | 23.53 | 23.79 | 24.18 | 24.35 | A | A | A | A | D |
| 19 | 247805 | 28.51 | 999.00 | 999.00 | 28.26 | 28.30 | 28.36 | 28.40 | 28.47 | 28.50 | A | A | A | A | D |
| 19 | 247810 | 26.75 | 27.40 | 29.00 | 25.54 | 25.78 | 26.08 | 26.28 | 26.60 | 26.74 | A | A | A | A | D |
| 19 | 247820 | 27.85 | 28.50 | 30.10 | 26.19 | 26.25 | 26.33 | 26.49 | 26.92 | 27.13 | A | A | A | A | D |
| 19 | 240355 | 34.45 | 999.00 | 999.00 | 22.64 | 22.96 | 23.53 | 24.14 | 26.34 | 27.26 | A | A | A | A | D |
| 19 | 248020 | 28.95 | 29.20 | 29.70 | 25.60 | 25.64 | 25.69 | 25.73 | 25.78 | 25.81 | A | A | A | A | D |
| 25 | 248040 | 30.55 | 31.70 | 33.20 | 28.17 | 28.80 | 29.77 | 30.43 | 31.04 | 31.16 | A | A | A | A | D |
| 25 | 249000 | 33.75 | 999.00 | 999.00 | 28.43 | 28.52 | 28.61 | 28.68 | 28.90 | 29.00 | A | A | A | A | D |
| 25 | 249030 | 999.00 | 999.00 | 999.00 | 28.18 | 28.36 | 28.60 | 28.75 | 29.03 | 29.18 | E | E | E | E | E |
| 25 | 249040 | 999.00 | 999.00 | 999.00 | 30.35 | 30.46 | 30.61 | 30.71 | 30.89 | 30.97 | E | E | E | E | E |
| 25 | 250000 | 999.00 | 999.00 | 999.00 | 26.26 | 26.67 | 27.79 | 28.38 | 29.20 | 29.51 | E | E | E | E | E |
| 25 | 250005 | 34.85 | 999.00 | 999.00 | 27.27 | 27.68 | 28.33 | 28.80 | 29.23 | 29.52 | A | A | A | A | D |
| 25 | 250010 | 32.55 | 999.00 | 999.00 | 26.27 | 26.68 | 27.79 | 28.38 | 29.20 | 29.51 | A | A | A | A | D |
| 25&31 | 250011 | 34.55 | 999.00 | 999.00 | 26.57 | 26.80 | 27.80 | 28.38 | 29.20 | 29.51 | A | A | A | A | D |
| 25 | 250030 | 33.65 | 999.00 | 999.00 | 26.79 | 27.56 | 28.37 | 28.73 | 29.41 | 29.68 | A | A | A | A | D |
| 24 | 250040 | 999.00 | 999.00 | 999.00 | 26.82 | 27.61 | 28.43 | 28.79 | 29.45 | 29.73 | E | E | E | E | E |
| 25 | 250050 | 31.85 | 999.00 | 999.00 | 28.50 | 28.80 | 29.08 | 29.21 | 29.63 | 30.00 | A | A | A | A | D |
| 25 | 250090 | 999.00 | 999.00 | 999.00 | 28.91 | 29.37 | 29.87 | 30.14 | 30.65 | 30.78 | E | E | E | E | E |
| 25 | 250110 | 31.50 | 31.20 | 34.00 | 30.34 | 30.51 | 30.76 | 30.92 | 31.24 | 31.39 | A | A | A | A | D |
| 25 | 250120 | 999.00 | 999.00 | 999.00 | 30.19 | 30.39 | 30.55 | 30.59 | 30.70 | 30.81 | E | E | E | E | E |
| 25 | 250330 | 30.40 | 999.00 | 999.00 | 28.17 | 28.33 | 28.55 | 28.69 | 28.95 | 29.13 | A | A | A | A | D |
| 25 | 250510 | 999.00 | 999.00 | 999.00 | 26.37 | 26.73 | 27.47 | 28.28 | 29.15 | 29.49 | E | E | E | E | E |
| 25 | 250520 | 999.00 | 999.00 | 999.00 | 26.45 | 26.84 | 27.47 | 28.29 | 29.21 | 29.57 | E | E | E | E | E |
| 25 | 250525 | 30.70 | 999.00 | 999.00 | 26.45 | 26.84 | 27.48 | 28.30 | 29.21 | 29.57 | A | A | A | A | D |
| 25 | 250527 | 32.55 | 999.00 | 999.00 | 29.27 | 29.30 | 29.33 | 29.36 | 29.41 | 29.44 | A | A | A | A | D |
| 25 | 250530 | 33.35 | 34.10 | 34.60 | 28.69 | 29.28 | 29.40 | 29.56 | 29.83 | 29.92 | A | A | A | A | D |
| 25 | 250550 | 999.00 | 999.00 | 999.00 | 29.56 | 29.63 | 29.70 | 29.74 | 29.82 | 29.85 | E | E | E | E | E |

# Delaney Pop-off Canal Existing LOS

8/30/01

**Table 6.3**

| DELANEY POP-OFF CANAL (EXISTING CONDITION) EXISTING LEVEL OF SERVICE Level of Service Analysis | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 25 | 250555 | 31.00 | 999.00 | 999.00 | 29.56 | 29.63 | 29.70 | 29.75 | 29.82 | 29.85 | A | A | A | A | D |
| 25 | 250557 | 30.50 | 999.00 | 999.00 | 29.31 | 29.34 | 29.40 | 29.44 | 29.52 | 29.56 | A | A | A | A | D |
| 25 | 250570 | 30.00 | 30.70 | 31.20 | 29.10 | 29.25 | 29.43 | 29.55 | 29.75 | 29.85 | A | A | A | A | D |
| 25 | 250580 | 30.00 | 30.70 | 31.20 | 29.10 | 29.26 | 29.46 | 29.59 | 29.82 | 29.93 | A | A | A | A | D |
| 25 | 250590 | 33.20 | 31.00 | 35.30 | 29.04 | 29.43 | 30.06 | 30.49 | 31.44 | 31.72 | A | A | A | A | D |
| 25 | 251000 | 33.95 | 999.00 | 999.00 | 28.01 | 28.22 | 28.48 | 28.59 | 29.20 | 29.51 | A | A | A | A | D |
| 26 | 251010 | 34.55 | 999.00 | 999.00 | 29.02 | 29.67 | 30.76 | 31.47 | 32.96 | 33.76 | A | A | A | A | D |
| 25 | 251011 | 32.50 | 999.00 | 999.00 | 32.19 | 32.24 | 32.31 | 32.35 | 32.43 | 32.47 | A | A | A | A | D |
| 25 | 251500 | 30.20 | 31.00 | 34.75 | 26.46 | 27.00 | 27.77 | 28.41 | 29.27 | 29.71 | A | A | A | A | D |
| 24 | 252000 | 31.55 | 999.00 | 999.00 | 26.82 | 27.63 | 28.45 | 28.82 | 29.44 | 29.72 | A | A | A | A | D |
| 24 | 252020 | 29.45 | 999.00 | 999.00 | 26.81 | 27.63 | 28.45 | 28.82 | 29.39 | 29.67 | A | A | A | A | D |
| 24&30 | 252025 | 31.00 | 999.00 | 999.00 | 29.24 | 29.33 | 29.51 | 29.63 | 29.87 | 29.99 | A | A | A | A | D |
| 24 | 252030 | 999.00 | 999.00 | 999.00 | 26.82 | 27.65 | 28.46 | 28.83 | 29.39 | 29.66 | E | E | E | E | E |
| 24 | 252040 | 999.00 | 999.00 | 999.00 | 27.15 | 27.89 | 28.58 | 28.92 | 29.41 | 29.67 | E | E | E | E | E |
| 24 | 252050 | 29.15 | 29.40 | 29.90 | 27.29 | 27.99 | 28.63 | 28.96 | 29.42 | 29.67 | A | A | A | A | D |
| 24 | 252060 | 31.15 | 30.50 | 31.00 | 27.42 | 28.15 | 28.88 | 29.13 | 29.49 | 29.68 | A | A | A | A | D |
| 24 | 252065 | 31.45 | 31.40 | 31.90 | 27.43 | 28.16 | 28.89 | 29.14 | 29.50 | 29.68 | A | A | A | A | D |
| 24 | 252080 | 28.35 | 28.60 | 29.40 | 27.44 | 28.16 | 28.90 | 29.15 | 29.50 | 29.68 | A | A | C | C | D |
| 24 | 252500 | 999.00 | 999.00 | 999.00 | 27.16 | 27.89 | 28.58 | 28.92 | 29.41 | 29.67 | E | E | E | E | E |
| 24 | 252510 | 28.35 | 28.60 | 30.50 | 27.16 | 27.89 | 28.58 | 28.93 | 29.41 | 29.67 | A | A | B | C | D |
| 25&31 | 253005 | 35.00 | 999.00 | 999.00 | 27.55 | 27.83 | 28.27 | 28.60 | 29.32 | 29.63 | A | A | A | A | D |
| 25&31 | 253015 | 35.00 | 999.00 | 999.00 | 29.91 | 30.69 | 31.29 | 31.54 | 31.93 | 32.10 | A | A | A | A | D |
| 31 | 253025 | 35.00 | 999.00 | 999.00 | 30.74 | 31.46 | 31.90 | 32.11 | 32.51 | 32.69 | A | A | A | A | D |
| 25 | 254010 | 31.50 | 999.00 | 999.00 | 29.16 | 29.27 | 29.37 | 29.45 | 29.68 | 29.91 | A | A | A | A | D |
| 25 | 254020 | 999.00 | 999.00 | 999.00 | 29.16 | 29.27 | 29.37 | 29.45 | 29.68 | 29.91 | E | E | E | E | E |
| 25 | 254030 | 31.50 | 999.00 | 999.00 | 29.16 | 29.27 | 29.37 | 29.45 | 29.68 | 29.91 | A | A | A | A | D |
| 25 | 254050 | 999.00 | 999.00 | 999.00 | 29.42 | 29.50 | 29.61 | 29.69 | 29.85 | 29.93 | E | E | E | E | E |

# North Archie Creek Existing LOS

8/30/01

**Table 6.4**

| NORTH CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| | 250000 | 999.25 | 999.50 | 999.00 | 26.26 | 26.67 | 27.79 | 28.38 | 29.20 | 29.51 | E | E | E | E | E | E |
| | 260000 | 6.05 | 6.50 | 7.00 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | A | A | A | A | A | A |
| | 260010 | 6.45 | 6.50 | 7.00 | 2.88 | 3.15 | 3.94 | 3.94 | 4.20 | 4.35 | A | A | A | A | A | A |
| 8 | 260020 | 6.75 | 7.20 | 8.20 | 2.94 | 3.26 | 4.16 | 4.16 | 4.46 | 4.63 | A | A | A | A | A | A |
| 8 | 260030 | 6.75 | 10.50 | 11.00 | 3.10 | 3.46 | 4.40 | 4.40 | 4.71 | 4.88 | A | A | A | A | A | A |
| 8 | 260040 | 9.45 | 999.50 | 1000.00 | 3.13 | 3.50 | 4.62 | 4.62 | 5.00 | 5.21 | A | A | A | A | A | A |
| 8 | 260050 | 999.25 | 999.50 | 999.00 | 3.57 | 4.00 | 5.13 | 5.14 | 5.51 | 5.72 | E | E | E | E | E | E |
| 8 | 260060 | 6.05 | 4.50 | 8.30 | 3.64 | 4.12 | 5.57 | 5.57 | 6.13 | 6.50 | A | A | C | C | C | C |
| 8 | 260065 | 6.05 | 999.50 | 1000.00 | 3.64 | 4.12 | 5.56 | 5.57 | 6.21 | 6.65 | A | A | A | A | B | B |
| 8 | 260070 | 6.45 | 999.50 | 999.00 | 4.19 | 4.90 | 6.67 | 6.68 | 7.04 | 7.35 | A | A | B | B | B | B |
| 8 | 260080 | 6.45 | 999.50 | 1000.00 | 4.43 | 5.23 | 7.49 | 7.50 | 7.76 | 7.99 | A | A | B | B | B | B |
| 8 | 260090 | 8.45 | 7.00 | 9.50 | 4.43 | 5.24 | 7.55 | 7.56 | 7.82 | 8.06 | A | A | C | C | C | C |
| 8 | 260100 | 999.25 | 999.50 | 1000.00 | 5.40 | 6.46 | 9.57 | 9.59 | 9.83 | 10.04 | E | E | E | E | E | E |
| 8,15 | 260110 | 17.35 | 17.60 | 18.10 | 6.25 | 7.29 | 10.33 | 10.35 | 10.58 | 10.83 | A | A | A | A | A | A |
| 15 | 260120 | 15.05 | 15.30 | 14.80 | 6.43 | 7.50 | 10.59 | 10.60 | 10.83 | 11.08 | A | A | A | A | A | A |
| 15 | 260130 | 12.55 | 12.80 | 13.30 | 6.60 | 7.69 | 10.76 | 10.77 | 10.98 | 11.24 | A | A | A | A | A | A |
| 15 | 260140 | 15.05 | 15.30 | 15.80 | 7.04 | 8.27 | 11.23 | 11.24 | 11.24 | 11.43 | A | A | A | A | A | A |
| 15 | 260145 | 17.75 | 18.00 | 18.50 | 6.83 | 7.96 | 11.00 | 11.00 | 11.23 | 11.49 | A | A | A | A | A | A |
| 15 | 260170 | 999.25 | 1000.00 | 999.50 | 7.79 | 8.47 | 11.04 | 11.19 | 11.49 | 11.75 | E | E | E | E | E | E |
| | 260180 | 6.25 | 999.50 | 1000.00 | 9.20 | 9.84 | 11.26 | 11.59 | 11.99 | 12.23 | B | B | B | B | B | B |
| 14 | 260190 | 13.45 | 999.50 | 1000.50 | 9.20 | 9.84 | 11.26 | 11.59 | 12.00 | 12.23 | A | A | A | A | A | A |
| 20 | 260200 | 999.25 | 999.50 | 17.00 | 9.26 | 9.92 | 11.30 | 11.66 | 12.09 | 12.33 | A | A | A | A | A | A |
| 21 | 260201 | 999.25 | 999.50 | 16.20 | 14.08 | 14.09 | 14.11 | 14.12 | 14.15 | 14.16 | A | A | A | A | A | A |
| 21 | 260202 | 999.25 | 999.50 | 1000.00 | 14.07 | 14.09 | 14.10 | 14.11 | 14.13 | 14.14 | E | E | E | E | E | E |
| 20,21 | 260210 | 999.25 | 999.50 | 17.00 | 11.23 | 12.21 | 13.23 | 13.75 | 14.48 | 14.84 | A | A | A | A | A | A |
| | 260220 | 999.25 | 999.50 | 1000.00 | 11.27 | 12.33 | 13.53 | 14.24 | 15.26 | 15.71 | E | E | E | E | E | E |
| 20,21 | 260230 | 14.25 | 999.50 | 16.00 | 11.59 | 12.70 | 13.92 | 14.61 | 15.68 | 16.13 | A | A | A | B | B | D |
| 20 | 260235 | 16.25 | 999.50 | 15.00 | 12.84 | 13.56 | 14.48 | 15.06 | 16.02 | 16.45 | A | A | A | D | D | D |
| 21 | 260240 | 18.75 | 999.50 | 1000.00 | 13.86 | 14.49 | 15.25 | 15.71 | 16.54 | 16.93 | A | A | A | A | A | A |
| 20 | 260250 | 19.25 | 999.50 | 1000.00 | 14.36 | 15.02 | 15.83 | 16.29 | 17.09 | 17.45 | A | A | A | A | A | A |
| | 260255 | 999.25 | 999.50 | 1000.00 | 14.37 | 15.03 | 15.84 | 16.31 | 17.11 | 17.48 | E | E | E | E | E | E |
| | 260260 | 999.25 | 999.50 | 1000.00 | 15.07 | 15.70 | 16.52 | 16.99 | 17.77 | 18.12 | E | E | E | E | E | E |
| 20 | 260270 | 999.25 | 999.50 | 1000.00 | 14.97 | 15.58 | 16.38 | 16.85 | 17.67 | 18.05 | E | E | E | E | E | E |
| 20,26 | 260275 | 999.25 | 999.50 | 999.50 | 14.97 | 15.58 | 16.38 | 16.85 | 17.67 | 18.05 | E | E | E | E | E | E |
| 26 | 260280 | 999.25 | 999.50 | 1000.00 | 17.18 | 17.63 | 18.20 | 18.52 | 19.02 | 19.22 | E | E | E | E | E | E |
| 26,27 | 260290 | 999.25 | 999.50 | 1000.00 | 17.27 | 17.79 | 18.51 | 18.94 | 19.70 | 20.02 | E | E | E | E | E | E |
| 26 | 260300 | 22.75 | 999.50 | 1000.00 | 19.47 | 20.10 | 20.65 | 20.89 | 21.29 | 21.48 | A | A | A | A | A | A |
| 26 | 260310 | 25.25 | 999.50 | 1000.00 | 19.50 | 20.17 | 20.80 | 21.10 | 21.64 | 21.88 | A | A | A | A | A | A |
| 20,26 | 260312 | 22.25 | 999.50 | 1000.00 | 21.37 | 21.40 | 21.43 | 21.45 | 21.64 | 21.89 | A | A | A | A | A | A |
| 26 | 260315 | 999.25 | 999.50 | 1000.00 | 20.57 | 21.32 | 22.18 | 22.66 | 23.41 | 23.77 | E | E | E | E | E | E |
| 26 | 260320 | 999.25 | 999.50 | 1000.00 | 21.15 | 21.95 | 22.91 | 23.45 | 24.39 | 24.79 | E | E | E | E | E | E |
| 26 | 260330 | 28.95 | 999.50 | 1000.00 | 21.17 | 22.00 | 23.02 | 23.61 | 24.66 | 25.12 | A | A | A | A | A | A |
| 26 | 260331 | 30.95 | 999.50 | 34.50 | 25.25 | 25.32 | 26.08 | 26.58 | 27.40 | 27.75 | A | A | A | A | A | A |

# North Archie Creek Existing LOS

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**Table 6.4**

| NORTH CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 26 | 260340 | 26.25 | 999.50 | 999.00 | 24.37 | 25.17 | 26.08 | 26.57 | 27.39 | 27.74 | A | A | A | B | B | B |
| 26 | 260350 | 34.25 | 999.50 | 1000.00 | 21.18 | 21.99 | 23.03 | 23.62 | 24.66 | 25.13 | A | A | A | A | A | A |
| 26 | 260360 | 35.45 | 999.50 | 35.00 | 25.06 | 25.84 | 26.80 | 27.32 | 28.17 | 28.52 | A | A | A | A | A | A |
| 26 | 260370 | 33.45 | 999.50 | 1000.00 | 25.07 | 25.85 | 26.83 | 27.35 | 28.22 | 28.56 | A | A | A | A | A | A |
| 26 | 260372 | 33.45 | 999.50 | 1000.00 | 30.09 | 30.11 | 30.13 | 30.15 | 30.18 | 30.19 | A | A | A | A | A | A |
| 26 | 260380 | 34.05 | 999.50 | 29.00 | 26.80 | 26.92 | 27.08 | 27.34 | 27.99 | 28.23 | A | A | A | A | A | A |
| 26 | 260390 | 30.45 | 999.50 | 33.20 | 25.13 | 25.91 | 26.88 | 27.40 | 28.27 | 28.60 | A | A | A | A | A | A |
| 26 | 260400 | 32.25 | 999.50 | 32.00 | 25.13 | 25.92 | 26.90 | 27.43 | 28.29 | 28.62 | A | A | A | A | A | A |
| 26 | 260410 | 999.25 | 999.50 | 33.30 | 27.27 | 27.35 | 27.46 | 27.54 | 27.92 | 28.11 | A | A | A | A | A | A |
| 20 | 261000 | 12.45 | 999.50 | 15.50 | 9.26 | 9.94 | 11.31 | 11.70 | 12.14 | 12.37 | A | A | A | A | A | A |
| 20 | 261010 | 12.55 | 999.50 | 15.60 | 9.41 | 10.07 | 11.33 | 11.95 | 13.18 | 13.56 | A | A | A | A | B | B |
| 20,21 | 261020 | 14.85 | 999.50 | 17.70 | 10.09 | 10.59 | 11.99 | 12.60 | 13.86 | 14.28 | A | A | A | A | A | A |
| 14 | 261021 | 15.55 | 999.50 | 1000.00 | 15.47 | 15.48 | 15.50 | 15.51 | 15.53 | 15.54 | A | A | A | A | A | A |
| | 261030 | 999.25 | 999.50 | 1000.00 | 11.86 | 12.22 | 12.75 | 13.63 | 14.59 | 14.90 | E | E | E | E | E | E |
| 20 | 261040 | 14.35 | 999.50 | 16.50 | 12.18 | 12.60 | 13.41 | 14.19 | 15.00 | 15.26 | A | A | A | A | B | B |
| 20 | 261050 | 14.45 | 999.50 | 17.50 | 12.23 | 12.63 | 13.42 | 14.19 | 14.94 | 15.18 | A | A | A | A | B | B |
| 20 | 261060 | 999.25 | 999.50 | 17.70 | 12.42 | 12.79 | 13.36 | 13.76 | 14.61 | 15.07 | A | A | A | A | A | A |
| 20 | 261061 | 17.85 | 999.50 | 1000.00 | 15.76 | 15.79 | 15.84 | 15.87 | 15.93 | 15.99 | A | A | A | A | A | A |
| 20 | 261062 | 15.15 | 999.50 | 17.20 | 15.47 | 15.50 | 15.54 | 15.57 | 15.61 | 15.64 | B | B | B | B | B | B |
| 20 | 262000 | 12.65 | 999.50 | 14.20 | 11.59 | 12.70 | 13.93 | 14.62 | 15.68 | 16.14 | A | B | B | D | D | D |
| 20 | 262010 | 13.55 | 999.50 | 16.50 | 11.59 | 12.70 | 13.94 | 14.63 | 15.69 | 16.15 | A | A | B | B | B | B |
| 20 | 262020 | 12.45 | 999.50 | 16.00 | 11.69 | 12.87 | 14.33 | 14.86 | 15.70 | 16.15 | A | B | B | B | B | D |
| 20 | 262030 | 14.45 | 999.50 | 16.40 | 11.89 | 13.16 | 14.73 | 15.27 | 15.75 | 16.16 | A | A | B | B | B | B |
| | 263000 | 999.25 | 999.50 | 1000.00 | 13.95 | 14.49 | 15.26 | 15.72 | 16.55 | 16.94 | E | E | E | E | E | E |
| 20 | 263010 | 19.25 | 999.50 | 1000.00 | 13.86 | 14.49 | 15.26 | 15.72 | 16.56 | 16.94 | A | A | A | A | A | A |
| 20 | 263020 | 18.05 | 999.50 | 1000.00 | 13.90 | 14.74 | 15.62 | 16.05 | 16.82 | 17.22 | A | A | A | A | A | A |
| 20,26 | 263030 | 20.05 | 999.50 | 1000.00 | 13.90 | 14.74 | 15.63 | 16.06 | 16.84 | 17.22 | A | A | A | A | A | A |
| | 263040 | 999.25 | 999.50 | 1000.00 | 13.90 | 14.84 | 16.02 | 16.62 | 17.70 | 18.22 | E | E | E | E | E | E |
| 20 | 263050 | 16.45 | 999.50 | 17.90 | 13.97 | 15.05 | 16.52 | 17.27 | 18.38 | 18.94 | A | A | B | B | D | D |
| 20 | 263060 | 16.05 | 999.50 | 18.00 | 14.69 | 15.90 | 17.08 | 17.73 | 18.82 | 19.39 | A | A | B | B | D | D |
| 26,27 | 264000 | 30.85 | 999.50 | 1000.00 | 19.48 | 20.14 | 20.97 | 21.15 | 21.46 | 21.60 | A | A | A | A | A | A |
| 27 | 264010 | 999.25 | 999.50 | 1000.00 | 23.70 | 23.76 | 23.84 | 23.89 | 23.98 | 24.03 | E | E | E | E | E | E |
| 26 | 265000 | 999.25 | 999.50 | 22.30 | 21.04 | 21.22 | 21.44 | 21.61 | 21.96 | 22.12 | A | A | A | A | A | A |
| 26 | 265001 | 999.25 | 999.50 | 24.00 | 20.51 | 20.71 | 21.04 | 21.32 | 21.77 | 21.97 | A | A | A | A | A | A |
| 26 | 265010 | 22.25 | 999.50 | 23.50 | 21.49 | 21.69 | 21.96 | 22.12 | 22.43 | 22.59 | A | A | A | A | B | B |
| 26 | 266000 | 28.45 | 999.50 | 1000.00 | 21.16 | 21.97 | 22.94 | 23.48 | 24.44 | 24.85 | A | A | A | A | A | A |
| 26 | 266010 | 31.25 | 999.50 | 1000.00 | 30.13 | 30.16 | 30.20 | 30.23 | 30.27 | 30.29 | A | A | A | A | A | A |
| 26 | 266020 | 30.25 | 999.50 | 1000.00 | 30.14 | 30.17 | 30.21 | 30.24 | 30.28 | 30.31 | A | A | A | A | B | B |
| 26 | 266030 | 34.45 | 999.50 | 1000.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | ## | ## | ## | ### | ### | ### |
| 26 | 267000 | 34.55 | 999.50 | 1000.00 | 26.84 | 26.97 | 27.15 | 27.33 | 27.83 | 28.06 | A | A | A | A | A | A |
| 26 | 267010 | 33.95 | 999.50 | 1000.00 | 26.86 | 26.99 | 27.18 | 27.36 | 27.81 | 28.02 | A | A | A | A | A | A |
| 26 | 267010 | 999.25 | 999.50 | 1000.00 | 26.86 | 26.99 | 27.18 | 27.36 | 27.81 | 28.02 | E | E | E | E | E | E |

## North Archie Creek Existing LOS

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**Table 6.4**

| NORTH CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 26 | 269000 | 34.45 | 999.50 | 1000.00 | 32.08 | 32.10 | 32.12 | 32.13 | 32.16 | 32.17 | A | A | A | A | A | A |
| 26 | 269010 | 34.25 | 999.50 | 35.50 | 32.43 | 32.75 | 33.27 | 33.62 | 34.07 | 34.14 | A | A | A | A | A | A |
| 26 | 270000 | 999.25 | 999.50 | 31.30 | 25.93 | 26.53 | 27.34 | 27.80 | 28.59 | 28.78 | A | A | A | A | A | A |
| 26 | 270010 | 28.85 | 999.50 | 32.20 | 26.59 | 27.07 | 27.87 | 28.42 | 29.12 | 29.38 | A | A | A | A | B | B |
| | 270020 | 999.25 | 999.50 | 1000.00 | 27.22 | 27.40 | 28.02 | 28.74 | 29.49 | 29.76 | E | E | E | E | E | E |
| 32 | 270030 | 999.25 | 999.50 | 35.00 | 29.04 | 29.32 | 29.74 | 29.94 | 30.39 | 30.66 | A | A | A | A | A | A |
| 22 | 270035 | 999.25 | 999.50 | 1000.00 | 29.08 | 29.33 | 29.73 | 29.88 | 30.39 | 30.66 | E | E | E | E | E | E |
| 32 | 270040 | 32.05 | 999.50 | 34.90 | 29.23 | 29.69 | 30.24 | 30.48 | 31.05 | 31.32 | A | A | A | A | A | A |
| 32 | 270041 | 32.05 | 999.50 | 34.90 | 29.26 | 29.72 | 30.34 | 30.75 | 31.53 | 31.89 | A | A | A | A | A | A |
| 32 | 270042 | 32.15 | 999.50 | 34.80 | 29.26 | 29.73 | 30.34 | 30.75 | 31.54 | 31.90 | A | A | A | A | A | A |
| 32 | 270043 | 33.15 | 999.50 | 35.70 | 29.32 | 29.53 | 29.99 | 30.27 | 30.90 | 31.22 | A | A | A | A | A | A |
| 32 | 270044 | 34.15 | 999.50 | 37.00 | 29.33 | 29.57 | 30.07 | 30.46 | 30.91 | 31.23 | A | A | A | A | A | A |
| 32 | 270045 | 34.15 | 999.50 | 36.30 | 29.24 | 29.51 | 29.94 | 30.27 | 30.91 | 31.23 | A | A | A | A | A | A |
| 32 | 270046 | 34.45 | 999.50 | 37.30 | 31.29 | 31.90 | 32.66 | 32.96 | 33.32 | 33.44 | A | A | A | A | A | A |
| | 270050 | 22.65 | 999.50 | 1000.00 | 29.31 | 29.79 | 30.35 | 30.60 | 31.20 | 31.52 | B | B | B | B | B | B |
| | 270055 | 999.25 | 999.50 | 1000.00 | 29.31 | 29.79 | 30.35 | 30.60 | 31.21 | 31.52 | E | E | E | E | E | E |
| 32 | 270060 | 34.95 | 999.50 | 35.80 | 30.54 | 31.25 | 31.90 | 32.28 | 33.05 | 33.43 | A | A | A | A | A | A |
| 31,32 | 270065 | 33.95 | 999.50 | 35.70 | 30.54 | 31.25 | 31.90 | 32.28 | 33.05 | 33.43 | A | A | A | A | A | A |
| 32 | 270070 | 33.25 | 999.50 | 32.00 | 29.35 | 29.84 | 30.42 | 30.70 | 31.29 | 31.61 | A | A | A | A | A | A |
| | 270080 | 999.25 | 999.50 | 1000.00 | 30.34 | 30.66 | 31.10 | 31.42 | 31.93 | 32.20 | E | E | E | E | E | E |
| 32 | 270090 | 999.25 | 999.50 | 1000.00 | 32.26 | 32.52 | 32.81 | 33.04 | 33.38 | 33.58 | E | E | E | E | E | E |
| | 270100 | 999.25 | 999.50 | 1000.00 | 32.27 | 32.53 | 32.83 | 33.07 | 33.45 | 33.68 | E | E | E | E | E | E |
| 31,32 | 270110 | 999.25 | 999.50 | 1000.00 | 32.30 | 32.57 | 32.91 | 33.08 | 33.75 | 34.04 | E | E | E | E | E | E |
| 31 | 270120 | 999.25 | 999.50 | 1000.00 | 32.83 | 33.09 | 33.45 | 33.70 | 34.29 | 34.64 | E | E | E | E | E | E |
| | 270125 | 35.85 | 999.50 | 38.40 | 31.77 | 31.87 | 32.01 | 32.30 | 33.06 | 33.45 | A | A | A | A | A | A |
| 31,32 | 270130 | 28.25 | 999.50 | 1000.00 | 34.07 | 34.36 | 34.72 | 34.96 | 35.46 | 35.70 | B | B | B | B | B | B |
| 31 | 270140 | 24.35 | 999.50 | 1000.00 | 34.21 | 34.67 | 35.44 | 35.93 | 36.81 | 37.22 | B | B | B | B | B | B |
| 31 | 270150 | 25.85 | 999.50 | 1000.00 | 35.52 | 35.96 | 36.63 | 37.08 | 37.94 | 38.35 | B | B | B | B | B | B |
| 37,38 | 270151 | 24.25 | 999.50 | 1000.00 | 35.52 | 35.97 | 36.64 | 37.08 | 37.94 | 38.36 | B | B | B | B | B | B |
| 26 | 270500 | 999.25 | 999.50 | 1000.00 | 25.93 | 26.53 | 27.36 | 27.82 | 28.59 | 28.78 | E | E | E | E | E | E |
| | 270505 | 999.25 | 999.50 | 1000.00 | 26.36 | 26.96 | 27.76 | 28.04 | 28.63 | 28.90 | E | E | E | E | E | E |
| 26 | 270510 | 999.25 | 999.50 | 1000.00 | 26.89 | 27.47 | 28.25 | 28.37 | 28.84 | 29.12 | E | E | E | E | E | E |
| 26 | 270515 | 999.25 | 999.50 | 1000.00 | 26.36 | 26.96 | 27.76 | 28.04 | 28.63 | 28.90 | E | E | E | E | E | E |
| 26 | 270520 | 31.95 | 999.50 | 1000.00 | 26.90 | 27.48 | 28.27 | 28.39 | 28.87 | 29.16 | A | A | A | A | A | A |
| 26 | 270521 | 33.75 | 999.50 | 1000.00 | 26.83 | 27.26 | 27.65 | 27.89 | 28.58 | 28.83 | A | A | A | A | A | A |
| 26 | 270525 | 36.25 | 999.50 | 1000.00 | 28.06 | 28.52 | 29.17 | 29.59 | 30.39 | 30.77 | A | A | A | A | A | A |
| 26 | 270530 | 31.85 | 999.50 | 1000.00 | 27.41 | 27.97 | 28.73 | 28.73 | 29.18 | 29.49 | A | A | A | A | A | A |
| | 270540 | 999.25 | 999.50 | 1000.00 | 27.42 | 27.98 | 28.75 | 28.75 | 29.20 | 29.50 | E | E | E | E | E | E |
| | 270570 | 999.25 | 999.50 | 1000.00 | 27.43 | 27.99 | 28.76 | 28.74 | 29.29 | 29.58 | E | E | E | E | E | E |
| 25 | 270580 | 30.05 | 999.50 | 1000.00 | 27.47 | 28.07 | 28.87 | 28.84 | 29.37 | 29.65 | A | A | A | A | A | A |
| 25 | 270585 | 999.25 | 999.50 | 1000.00 | 27.45 | 28.01 | 28.78 | 28.84 | 29.37 | 29.65 | E | E | E | E | E | E |
| 25 | 270590 | 999.25 | 999.50 | 1000.00 | 27.47 | 28.01 | 28.77 | 28.88 | 29.39 | 29.67 | E | E | E | E | E | E |
| 31 | 270592 | 999.25 | 999.50 | 1000.00 | 29.64 | 29.68 | 29.73 | 29.75 | 29.81 | 29.83 | E | E | E | E | E | E |

# North Archie Creek Existing LOS

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**Table 6.4**

| NORTH CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | Landmark Elevations | | | Water Surface Elevations | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 31 | 270594 | 999.25 | 999.50 | 1000.00 | 29.56 | 29.59 | 29.63 | 29.66 | 29.72 | 29.74 | E | E | E | E | E | E |
| 31 | 270596 | 999.25 | 999.50 | 1000.00 | 29.66 | 29.70 | 29.75 | 29.78 | 29.84 | 29.86 | E | E | E | E | E | E |
| 25,31 | 270610 | 999.25 | 999.50 | 1000.00 | 28.95 | 28.98 | 29.03 | 29.05 | 29.40 | 29.68 | E | E | E | E | E | E |
| 25,31 | 270620 | 999.25 | 999.50 | 1000.00 | 27.48 | 28.02 | 28.78 | 28.92 | 29.42 | 29.70 | E | E | E | E | E | E |
| 30,31 | 270630 | 32.65 | 999.50 | 1000.00 | 27.62 | 28.03 | 28.78 | 28.98 | 29.58 | 29.82 | A | A | A | A | A | A |
| 30,31 | 270640 | 999.25 | 999.50 | 1000.00 | 30.26 | 30.32 | 30.41 | 30.46 | 30.56 | 30.60 | E | E | E | E | E | E |
| 26,32 | 272000 | 36.75 | 999.50 | 34.50 | 26.56 | 27.08 | 27.88 | 28.43 | 29.13 | 29.39 | A | A | A | A | A | A |
| | 272010 | 999.25 | 999.50 | 1000.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | E | E | E | E | E | E |
| 32 | 272020 | 33.05 | 999.50 | 34.00 | 28.07 | 28.25 | 28.48 | 28.62 | 29.13 | 29.39 | A | A | A | A | A | A |
| 27,33 | 272030 | 33.95 | 999.50 | 38.00 | 28.27 | 28.27 | 28.48 | 28.62 | 29.13 | 29.40 | A | A | A | A | A | A |
| 27,33 | 272035 | 999.25 | 999.50 | 1000.00 | 33.00 | 33.00 | 33.00 | 33.00 | 33.00 | 33.00 | E | E | E | E | E | E |
| 33 | 272036 | 999.25 | 999.50 | 1000.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | E | E | E | E | E | E |
| 33 | 272040 | 999.25 | 999.50 | 1000.00 | 34.03 | 34.39 | 34.82 | 35.36 | 36.21 | 36.49 | E | E | E | E | E | E |
| 33 | 272050 | 39.15 | 999.50 | 44.70 | 36.16 | 36.19 | 36.23 | 36.26 | 36.31 | 36.53 | A | A | A | A | A | A |
| 33 | 272060 | 999.25 | 42.50 | 1000.00 | 38.06 | 38.07 | 38.08 | 38.09 | 38.11 | 38.12 | A | A | A | A | A | A |
| 33 | 272070 | 999.25 | 999.50 | 42.80 | 40.06 | 40.07 | 40.09 | 40.10 | 40.11 | 40.12 | A | A | A | A | A | A |
| 33 | 272080 | 41.75 | 999.50 | 43.40 | 40.05 | 40.06 | 40.10 | 40.19 | 40.34 | 40.40 | A | A | A | A | A | A |
| 32 | 273000 | 33.55 | 999.50 | 33.50 | 29.04 | 29.32 | 29.74 | 29.96 | 30.42 | 30.67 | A | A | A | A | A | A |
| 32 | 273010 | 36.55 | 999.50 | 37.00 | 32.21 | 32.52 | 32.93 | 33.18 | 33.61 | 33.81 | A | A | A | A | A | A |
| 32 | 273015 | 999.25 | 999.50 | 36.20 | 33.75 | 33.90 | 34.13 | 34.29 | 34.61 | 34.77 | A | A | A | A | A | A |
| 32 | 273020 | 999.25 | 999.50 | 36.00 | 34.24 | 34.56 | 34.91 | 35.09 | 35.40 | 35.55 | A | A | A | A | A | A |
| 32 | 273021 | 37.35 | 999.50 | 37.80 | 35.02 | 35.03 | 35.14 | 35.48 | 36.29 | 36.71 | A | A | A | A | A | A |
| 32 | 273025 | 37.25 | 999.50 | 40.20 | 34.45 | 34.75 | 35.10 | 35.28 | 35.61 | 35.76 | A | A | A | A | A | A |
| 32 | 273030 | 36.75 | 999.50 | 39.50 | 34.25 | 34.61 | 35.13 | 35.47 | 36.29 | 36.70 | A | A | A | A | A | A |
| 32 | 273040 | 37.55 | 999.50 | 39.50 | 34.25 | 34.61 | 35.13 | 35.48 | 36.29 | 36.71 | A | A | A | A | A | A |
| 32 | 273500 | 38.35 | 35.00 | 37.20 | 34.59 | 34.88 | 35.30 | 35.58 | 36.14 | 36.41 | A | A | C | C | C | C |
| 33 | 273510 | 38.35 | 40.00 | 1000.00 | 34.71 | 34.89 | 35.31 | 35.60 | 36.17 | 36.45 | A | A | A | A | A | A |
| 33 | 273520 | 40.25 | 43.50 | 40.00 | 34.72 | 34.89 | 35.31 | 35.60 | 36.17 | 36.45 | A | A | A | A | A | A |
| 33 | 273525 | 38.75 | 43.00 | 42.00 | 40.06 | 40.07 | 40.10 | 40.19 | 40.35 | 40.40 | B | B | B | B | B | B |
| 33 | 273530 | 40.25 | 36.90 | 41.80 | 39.62 | 40.04 | 40.11 | 40.21 | 40.39 | 40.45 | C | C | C | C | C | C |

# Archie Creek Existing LOS

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**Table 6.5**

| ARCHIE CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 9 | 280006 | 5.25 | 5.10 | 5.54 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | A | A | A | A | A | A |
| 9 | 280007 | 6.05 | 6.50 | 7.00 | 2.89 | 3.09 | 3.30 | 3.41 | 3.57 | 3.63 | A | A | A | A | A | A |
| 9 | 280008 | 6.45 | 6.50 | 7.00 | 3.10 | 3.34 | 3.60 | 3.72 | 3.89 | 3.95 | A | A | A | A | A | A |
| 9 | 280010 | 6.75 | 7.20 | 8.20 | 3.31 | 3.60 | 3.88 | 4.01 | 4.19 | 4.26 | A | A | A | A | A | A |
| 9 | 280015 | 6.75 | 10.50 | 11.00 | 3.39 | 3.70 | 4.02 | 4.17 | 4.42 | 4.50 | A | A | A | A | A | A |
| 9 | 280020 | 6.75 | 11.00 | 12.00 | 3.66 | 4.01 | 4.34 | 4.50 | 4.73 | 4.81 | A | A | A | A | A | A |
| 9 | 280030 | 10.10 | 11.00 | 11.64 | 3.75 | 4.12 | 4.53 | 4.72 | 4.97 | 5.06 | A | A | A | A | A | A |
| 9 | 280040 | 11.55 | 12.10 | 12.60 | 4.26 | 4.93 | 5.68 | 6.03 | 6.53 | 6.71 | A | A | A | A | A | A |
| 9 | 280050 | 11.25 | 11.80 | 12.30 | 4.39 | 5.17 | 6.05 | 6.47 | 7.09 | 7.31 | A | A | A | A | A | A |
| 8,9 | 280055 | 13.30 | 14.50 | 14.59 | 4.41 | 5.19 | 6.07 | 6.49 | 7.12 | 7.33 | A | A | A | A | A | A |
| 8,9 | 280060 | 11.95 | 12.50 | 13.00 | 4.43 | 5.21 | 6.10 | 6.52 | 7.15 | 7.37 | A | A | A | A | A | A |
| 8 | 280065 | 17.35 | 17.60 | 18.10 | 5.04 | 5.73 | 6.59 | 7.00 | 7.65 | 7.88 | A | A | A | A | A | A |
| 15 | 280066 | 7.45 | 7.70 | 8.20 | 1.40 | 1.49 | 1.63 | 1.72 | 1.90 | 1.99 | A | A | A | A | A | A |
| 16 | 280067 | 17.35 | 17.60 | 18.10 | 1.31 | 1.38 | 1.48 | 1.55 | 1.69 | 1.76 | A | A | A | A | A | A |
| 16 | 280068 | 15.05 | 15.30 | 14.80 | 1.28 | 1.34 | 1.44 | 1.50 | 1.62 | 1.69 | A | A | A | A | A | A |
| 16 | 280069 | 12.55 | 12.80 | 13.30 | 1.10 | 1.12 | 1.15 | 1.17 | 1.22 | 1.24 | A | A | A | A | A | A |
| 16 | 280070 | 15.05 | 15.30 | 15.80 | 2.59 | 2.94 | 3.47 | 3.82 | 4.52 | 4.87 | A | A | A | A | A | A |
| 16 | 280071 | 17.75 | 18.00 | 18.50 | 1.34 | 1.42 | 1.53 | 1.61 | 1.76 | 1.83 | A | A | A | A | A | A |
| 9,16 | 280075 | 16.85 | 1000.00 | 999.50 | 5.89 | 6.53 | 7.34 | 7.73 | 8.39 | 8.65 | A | A | A | A | A | A |
| 15 | 280080 | 6.25 | 999.50 | 1000.00 | 3.00 | 3.51 | 4.28 | 4.79 | 5.82 | 6.40 | A | A | A | A | A | B |
| 8,15 | 280085 | 13.75 | 14.00 | 1000.50 | 7.19 | 7.75 | 8.43 | 8.77 | 9.37 | 9.62 | A | A | A | A | A | A |
| 15,16 | 280086 | 8.55 | 999.50 | 1000.00 | 7.37 | 7.94 | 8.64 | 8.98 | 9.59 | 9.85 | A | A | B | B | B | B |
| 15 | 280088 | 9.45 | 10.60 | 9.80 | 7.85 | 8.45 | 9.16 | 9.52 | 10.16 | 10.44 | A | A | A | B | D | D |
| 15 | 280089 | 12.25 | 12.90 | 13.40 | 8.34 | 9.27 | 10.20 | 10.63 | 11.39 | 11.86 | A | A | A | A | A | A |
| 16 | 280100 | 10.85 | 11.10 | 1000.00 | 8.77 | 8.83 | 8.91 | 8.97 | 9.37 | 9.63 | A | A | A | A | A | A |
| 15 | 280105 | 9.85 | 11.30 | 29.60 | 7.37 | 7.95 | 8.64 | 8.98 | 9.59 | 9.86 | A | A | A | A | A | B |
| 15 | 280110 | 13.55 | 999.50 | 1000.00 | 9.10 | 9.10 | 9.10 | 9.15 | 9.38 | 9.63 | A | A | A | A | A | A |
| 15 | 280115 | 10.25 | 11.00 | 999.00 | 7.44 | 8.00 | 8.69 | 9.02 | 9.63 | 9.89 | A | A | A | A | A | A |
| 15 | 280120 | 13.05 | 12.50 | 13.00 | 7.77 | 8.28 | 8.88 | 9.19 | 9.77 | 10.03 | A | A | A | A | A | A |
| 15 | 280128 | 10.55 | 12.30 | 14.39 | 7.96 | 8.44 | 8.99 | 9.28 | 9.85 | 10.10 | A | A | A | A | A | A |
| 15 | 280140 | 999.25 | 999.50 | 1000.00 | 10.94 | 11.37 | 11.91 | 12.24 | 12.82 | 13.07 | E | E | E | E | E | E |
| 15 | 280143 | 999.25 | 999.50 | 1000.00 | 11.17 | 11.53 | 12.01 | 12.33 | 12.90 | 13.15 | E | E | E | E | E | E |
| 15 | 280145 | 13.45 | 999.50 | 1000.00 | 11.19 | 11.55 | 12.02 | 12.34 | 12.91 | 13.15 | A | A | A | A | A | A |
| 21 | 280150 | 12.25 | 13.30 | 999.50 | 12.24 | 12.78 | 13.36 | 13.63 | 14.02 | 14.19 | A | B | C | C | C | C |
| 21 | 280155 | 999.25 | 999.50 | 1000.00 | 15.35 | 15.49 | 15.68 | 15.80 | 16.01 | 16.11 | E | E | E | E | E | E |
| 21 | 280160 | 18.27 | 999.50 | 1000.00 | 15.83 | 16.02 | 16.27 | 16.42 | 16.69 | 16.81 | A | A | A | A | A | A |
| 15 | 280300 | 14.25 | 999.50 | 13.50 | 8.54 | 9.42 | 10.31 | 10.74 | 11.49 | 11.97 | A | A | A | A | A | A |
| 23 | 280305 | 12.25 | 999.50 | 14.00 | 8.62 | 9.48 | 10.38 | 10.82 | 11.65 | 12.19 | A | A | A | A | A | A |
| 22 | 280310 | 13.65 | 999.50 | 1000.00 | 10.22 | 10.30 | 10.47 | 10.85 | 11.66 | 12.20 | A | A | A | A | A | A |
| 22 | 280312 | 999.25 | 999.50 | 1000.00 | 17.71 | 17.87 | 18.08 | 18.21 | 18.45 | 18.57 | E | E | E | E | E | E |

**Archie Creek Existing LOS**

8/30/01

**Table 6.5**

| ARCHIE CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 22 | 280313 | 999.25 | 999.50 | 1000.00 | 18.00 | 18.00 | 18.16 | 18.29 | 18.53 | 18.65 | E | E | E | E | E | E |
| 22 | 280314 | 999.25 | 999.50 | 1000.00 | 18.50 | 18.50 | 18.50 | 18.50 | 18.56 | 18.68 | E | E | E | E | E | E |
| 22 | 280315 | 14.75 | 999.50 | 14.00 | 11.31 | 11.55 | 11.87 | 12.02 | 12.27 | 12.41 | A | A | A | A | A | A |
| 22 | 280317 | 999.25 | 999.50 | 999.00 | 17.56 | 17.69 | 17.85 | 17.96 | 18.15 | 18.25 | E | E | E | E | E | E |
| 22 | 280320 | 14.55 | 999.50 | 16.00 | 13.11 | 13.48 | 13.80 | 13.97 | 14.25 | 14.37 | A | A | A | A | A | A |
| 22 | 280325 | 14.85 | 999.50 | 1000.00 | 13.64 | 13.90 | 14.19 | 14.34 | 14.59 | 14.71 | A | A | A | A | A | A |
| 22 | 280330 | 15.25 | 999.50 | 1000.00 | 13.75 | 13.99 | 14.27 | 14.42 | 14.67 | 14.79 | A | A | A | A | A | A |
| 22 | 280333 | 999.25 | 999.50 | 1000.00 | 18.74 | 18.89 | 19.10 | 19.24 | 19.48 | 19.61 | E | E | E | E | E | E |
| 16,22 | 280335 | 15.65 | 18.10 | 1000.00 | 15.24 | 15.62 | 16.03 | 16.27 | 16.69 | 16.87 | A | A | B | B | B | B |
| 22 | 280340 | 999.25 | 999.50 | 22.00 | 18.90 | 19.08 | 19.36 | 19.54 | 19.70 | 19.76 | A | A | A | A | A | A |
| 21 | 280350 | 14.05 | 999.50 | 1000.00 | 10.90 | 11.28 | 11.88 | 12.21 | 13.15 | 13.58 | A | A | A | A | A | A |
| 22 | 280357 | 999.25 | 999.50 | 1000.00 | 9.84 | 10.91 | 12.24 | 13.10 | 14.63 | 15.20 | E | E | E | E | E | E |
| 21 | 280360 | 13.15 | 999.50 | 18.60 | 9.84 | 10.91 | 12.24 | 13.10 | 14.63 | 15.20 | A | A | A | A | B | B |
| 21 | 280365 | 12.55 | 999.50 | 15.50 | 10.07 | 10.36 | 10.77 | 11.83 | 13.14 | 13.49 | A | A | A | A | B | B |
| 21 | 280370 | 14.05 | 999.50 | 1000.00 | 10.90 | 11.62 | 12.56 | 13.10 | 14.61 | 15.18 | A | A | A | A | B | B |
| 21 | 280373 | 16.65 | 999.50 | 1000.00 | 20.50 | 20.50 | 20.50 | 20.50 | 20.51 | 20.56 | B | B | B | B | B | B |
| 21 | 280375 | 999.25 | 999.50 | 1000.00 | 12.14 | 12.56 | 13.18 | 13.62 | 14.71 | 15.28 | E | E | E | E | E | E |
| 21 | 280380 | 999.25 | 999.50 | 1000.00 | 14.90 | 15.40 | 15.96 | 16.26 | 16.80 | 17.05 | E | E | E | E | E | E |
| 21 | 280385 | 999.25 | 999.50 | 1000.00 | 15.57 | 16.09 | 16.70 | 17.02 | 17.60 | 17.86 | E | E | E | E | E | E |
| 22 | 280390 | 999.25 | 999.50 | 1000.00 | 16.22 | 16.74 | 17.34 | 17.66 | 18.23 | 18.48 | E | E | E | E | E | E |
| 22 | 280392 | 999.25 | 999.50 | 1000.00 | 16.44 | 16.98 | 17.60 | 17.92 | 18.49 | 18.72 | E | E | E | E | E | E |
| 22 | 280394 | 999.25 | 999.50 | 1000.00 | 16.83 | 17.35 | 17.96 | 18.29 | 18.85 | 19.08 | E | E | E | E | E | E |
| 22 | 280397 | 17.15 | 999.50 | 1000.00 | 17.10 | 17.66 | 18.32 | 18.67 | 19.30 | 19.55 | A | B | B | B | B | B |
| 22 | 280398 | 26.25 | 999.50 | 1000.00 | 17.40 | 17.91 | 18.52 | 18.86 | 19.46 | 19.69 | A | A | A | A | A | A |
| 21 | 280400 | 16.68 | 999.50 | 21.50 | 15.58 | 16.10 | 16.71 | 17.03 | 17.60 | 17.86 | A | A | B | B | B | B |
| 21 | 280405 | 999.25 | 999.50 | 1000.00 | 15.59 | 16.12 | 16.71 | 17.03 | 17.60 | 17.86 | E | E | E | E | E | E |
| 21 | 280410 | 999.25 | 999.50 | 1000.00 | 18.68 | 18.76 | 18.87 | 18.93 | 19.06 | 19.12 | E | E | E | E | E | E |
| 21 | 280415 | 21.55 | 999.50 | 1000.00 | 15.66 | 16.14 | 16.71 | 17.03 | 17.60 | 17.86 | A | A | A | A | A | A |
| 21 | 280420 | 22.25 | 999.50 | 1000.00 | 16.64 | 16.66 | 16.72 | 17.04 | 17.61 | 17.87 | A | A | A | A | A | A |
| 21 | 280425 | 21.25 | 999.50 | 1000.00 | 16.03 | 16.23 | 16.72 | 17.03 | 17.60 | 17.86 | A | A | A | A | A | A |
| 21 | 280430 | 21.25 | 999.50 | 1000.00 | 16.15 | 16.32 | 16.76 | 17.07 | 17.63 | 17.88 | A | A | A | A | A | A |
| 21 | 280435 | 999.25 | 999.50 | 1000.00 | 19.01 | 19.21 | 19.49 | 19.65 | 19.96 | 20.09 | E | E | E | E | E | E |
| 22,21 | 280440 | 999.25 | 999.50 | 1000.00 | 19.24 | 19.41 | 19.66 | 19.82 | 20.13 | 20.27 | E | E | E | E | E | E |
| 27 | 280445 | 28.85 | 999.50 | 1000.00 | 20.01 | 20.12 | 20.27 | 20.37 | 20.56 | 20.65 | A | A | A | A | A | A |
| 22 | 280500 | 999.25 | 999.50 | 1000.00 | 17.42 | 17.72 | 18.12 | 18.36 | 18.77 | 18.96 | E | E | E | E | E | E |
| 22 | 280515 | 999.25 | 999.50 | 1000.00 | 20.33 | 20.56 | 20.84 | 21.00 | 21.32 | 21.57 | E | E | E | E | E | E |
| 22 | 280520 | 999.25 | 999.50 | 1000.00 | 20.34 | 20.56 | 20.84 | 21.11 | 21.65 | 21.91 | E | E | E | E | E | E |
| 22 | 280525 | 999.25 | 999.50 | 1000.00 | 20.10 | 20.40 | 20.85 | 21.14 | 21.68 | 21.94 | E | E | E | E | E | E |
| 22 | 280530 | 999.25 | 999.50 | 1000.00 | 20.11 | 20.41 | 20.87 | 21.15 | 21.70 | 21.96 | E | E | E | E | E | E |
| 22 | 280535 | 999.25 | 999.50 | 1000.00 | 20.11 | 20.42 | 20.87 | 21.16 | 21.70 | 21.96 | E | E | E | E | E | E |

## Archie Creek Existing LOS

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**Table 6.5**

| ARCHIE CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 28 | 290000 | 28.25 | 999.50 | 1000.00 | 17.45 | 17.98 | 18.66 | 19.04 | 19.78 | 20.12 | A | A | A | A | A | A |
| 28 | 290003 | 23.95 | 999.50 | 1000.00 | 17.53 | 18.05 | 18.74 | 19.13 | 19.88 | 20.21 | A | A | A | A | A | A |
| 28 | 290010 | 22.65 | 999.50 | 1000.00 | 17.83 | 18.35 | 19.18 | 19.72 | 20.71 | 21.06 | A | A | A | A | A | A |
| 28 | 290015 | 999.25 | 22.50 | 24.00 | 23.40 | 23.40 | 23.40 | 23.40 | 23.40 | 23.41 | C | C | C | C | C | C |
| 28 | 290020 | 999.25 | 999.50 | 1000.00 | 23.60 | 23.60 | 23.61 | 23.67 | 23.78 | 23.84 | E | E | E | E | E | E |
| 28 | 290025 | 22.75 | 999.50 | 24.40 | 21.71 | 21.99 | 22.38 | 22.64 | 23.11 | 23.32 | A | A | A | A | B | B |
| 28 | 290030 | 999.25 | 999.50 | 1000.00 | 21.77 | 22.08 | 22.49 | 22.77 | 23.27 | 23.49 | E | E | E | E | E | E |
| 28 | 290035 | 26.05 | 999.50 | 25.00 | 26.00 | 26.00 | 26.00 | 26.02 | 26.13 | 26.18 | D | D | D | D | D | D |
| 34 | 290038 | 24.25 | 999.50 | 26.00 | 22.04 | 22.88 | 24.43 | 24.98 | 25.69 | 25.99 | A | A | B | B | B | B |
| 34 | 290045 | 24.65 | 999.50 | 28.00 | 24.29 | 24.77 | 25.38 | 25.75 | 26.39 | 26.69 | A | B | B | B | B | B |
| 34 | 290055 | 25.25 | 999.50 | 25.00 | 25.24 | 25.72 | 26.28 | 26.62 | 27.26 | 27.57 | D | D | D | D | D | D |
| 28 | 290100 | 22.85 | 999.50 | 23.00 | 19.87 | 20.14 | 20.47 | 20.67 | 21.01 | 21.16 | A | A | A | A | A | A |
| 28 | 290105 | 22.75 | 999.50 | 24.00 | 21.66 | 21.92 | 22.26 | 22.45 | 22.78 | 22.93 | A | A | A | A | B | B |
| 28 | 290110 | 28.25 | 999.50 | 1000.00 | 20.60 | 20.72 | 20.93 | 21.05 | 21.28 | 21.38 | A | A | A | A | A | A |
| 28 | 290115 | 28.25 | 999.50 | 1000.00 | 22.10 | 22.14 | 22.35 | 22.48 | 22.72 | 22.82 | A | A | A | A | A | A |
| 27,28 | 290200 | 23.75 | 999.50 | 24.00 | 21.40 | 21.72 | 22.19 | 22.49 | 23.04 | 23.31 | A | A | A | A | A | A |
| 27 | 290225 | 24.35 | 999.50 | 1000.00 | 24.09 | 24.18 | 24.29 | 24.35 | 24.45 | 24.50 | A | A | A | B | B | B |
| 27 | 290235 | 25.85 | 999.50 | 1000.00 | 24.91 | 25.01 | 25.14 | 25.22 | 25.36 | 25.43 | A | A | A | A | A | A |
| 27 | 290250 | 24.25 | 999.50 | 1000.00 | 22.43 | 22.57 | 22.77 | 22.90 | 23.16 | 23.36 | A | A | A | A | A | A |
| 28 | 290305 | 28.25 | 999.50 | 29.00 | 23.17 | 23.61 | 24.27 | 24.71 | 25.68 | 26.18 | A | A | A | A | A | A |
| 28 | 290306 | 24.25 | 999.50 | 25.00 | 23.53 | 23.89 | 24.39 | 24.70 | 25.28 | 25.56 | A | A | B | B | D | D |
| 34 | 290310 | 25.25 | 999.50 | 25.00 | 27.46 | 27.57 | 27.72 | 27.82 | 27.99 | 28.08 | D | D | D | D | D | D |
| 33 | 290315 | 999.25 | 999.50 | 1000.00 | 26.00 | 26.10 | 26.24 | 26.33 | 26.50 | 26.58 | E | E | E | E | E | E |
| 33 | 290320 | 39.25 | 999.50 | 37.00 | 27.00 | 27.02 | 27.14 | 27.21 | 27.35 | 27.42 | A | A | A | A | A | A |
| 33 | 290325 | 41.65 | 999.50 | 43.00 | 26.24 | 26.43 | 26.89 | 27.29 | 27.93 | 28.16 | A | A | A | A | A | A |
| 27 | 290330 | 999.25 | 999.50 | 32.00 | 24.65 | 25.73 | 26.87 | 27.28 | 27.91 | 28.15 | A | A | A | A | A | A |
| 27 | 290340 | 28.65 | 999.50 | 32.00 | 26.23 | 26.47 | 26.89 | 27.28 | 27.91 | 28.15 | A | A | A | A | A | A |
| 27 | 290350 | 999.25 | 999.50 | 33.00 | 27.99 | 28.15 | 28.40 | 28.57 | 28.89 | 29.05 | A | A | A | A | A | A |
| 27/33 | 290360 | 35.35 | 36.50 | 37.10 | 27.48 | 27.72 | 28.02 | 28.20 | 28.51 | 28.65 | A | A | A | A | A | A |
| 33 | 290370 | 37.65 | 37.50 | 39.00 | 27.64 | 27.88 | 28.19 | 28.37 | 28.68 | 28.81 | A | A | A | A | A | A |
| 21 | 290500 | 28.75 | 999.50 | 1000.00 | 16.45 | 16.66 | 17.02 | 17.26 | 17.73 | 17.95 | A | A | A | A | A | A |
| 27 | 290570 | 28.45 | 999.50 | 1000.00 | 20.04 | 20.42 | 20.86 | 21.10 | 21.48 | 21.63 | A | A | A | A | A | A |
| 27 | 290572 | 29.55 | 999.50 | 1000.00 | 25.50 | 25.50 | 25.54 | 25.60 | 25.71 | 25.77 | A | A | A | A | A | A |
| 27 | 290575 | 28.55 | 999.50 | 1000.00 | 20.12 | 20.52 | 21.05 | 21.38 | 21.88 | 22.12 | A | A | A | A | A | A |
| 27 | 290580 | 16.95 | 18.50 | 1000.00 | 21.21 | 21.38 | 21.60 | 21.73 | 22.01 | 22.24 | C | C | C | C | C | C |
| 27 | 290585 | 24.05 | 999.50 | 1000.00 | 22.34 | 22.51 | 22.73 | 22.86 | 23.10 | 23.22 | A | A | A | A | A | A |
| 27 | 290587 | 28.45 | 999.50 | 1000.00 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | A | A | A | A | A | A |
| 27 | 290588 | 25.25 | 999.50 | 1000.00 | 27.50 | 27.50 | 27.50 | 27.50 | 27.50 | 27.50 | B | B | B | B | B | B |
| 27 | 290590 | 26.05 | 999.50 | 1000.00 | 21.95 | 22.10 | 22.28 | 22.37 | 22.76 | 22.95 | A | A | A | A | A | A |
| 27 | 290594 | 26.55 | 999.50 | 1000.00 | 24.06 | 24.46 | 25.03 | 25.40 | 25.91 | 26.12 | A | A | A | A | A | A |
| 27 | 290595 | 29.45 | 999.50 | 31.00 | 24.08 | 24.46 | 25.03 | 25.40 | 25.91 | 26.12 | A | A | A | A | A | A |
| 27 | 290605 | 26.25 | 999.50 | 29.00 | 23.60 | 23.80 | 24.09 | 24.29 | 24.68 | 24.88 | A | A | A | A | A | A |
| 27 | 290610 | 26.25 | 999.50 | 29.20 | 23.60 | 23.80 | 24.09 | 24.29 | 24.68 | 24.87 | A | A | A | A | A | A |
| 27 | 290612 | 25.65 | 999.50 | 27.00 | 24.80 | 24.99 | 25.26 | 25.38 | 25.60 | 25.70 | A | A | A | A | A | B |

## Archie Creek Existing LOS

8/30/01

**Table 6.5**

| ARCHIE CREEK SUB-WATERSHED EXISTING LEVEL OF SERVICE | | Landmark Elevations | | | Water Surface Elevations | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 27 | 290616 | 999.25 | 999.50 | 30.00 | 24.98 | 25.18 | 25.50 | 25.72 | 26.08 | 26.22 | A | A | A | A | A | A |
| 27 | 290617 | 25.65 | 999.50 | 29.20 | 25.00 | 25.19 | 25.53 | 25.76 | 26.15 | 26.30 | A | A | A | B | B | B |
| 27 | 290620 | 999.25 | 999.50 | 29.00 | 25.20 | 25.41 | 25.90 | 26.17 | 26.57 | 26.73 | A | A | A | A | A | A |

# EXISTING WATER QUALITY CONDITIONS

## 7.1 OVERVIEW

As previously shown in Table 2.1 in Chapter 2, there is still a fair amount of wetland habitat left in the Delaney Creek Area watershed. Lakes and streams, excluding man-made reservoirs, contribute about 11.31% of the watershed's total wetland acreage and but constitute only 1.36% of its total acreage. The largest natural surface water feature in the watershed is Delaney Creek, which flows approximately 8 miles from its headwaters east of Pauls Drive on the south side of State Road 60 to its outfall into Hillsborough Bay. North Archie Creek in the southern portion of the watershed is similar in size and nature to Delaney Creek. In addition to these two creeks, there are several lakes, which total more than 10 acres. They are, in order of descending size in acres, Hickory Hammock, Kathy, Tenmile, Chapman, Gornto and Hendrics.

The federal Clean Water Act (CWA), as amended, provides the framework for water quality management throughout the United States. As overall goals, the CWA calls for the restoration and maintenance of "fishable and swimmable" waters for all citizens. Federal and state regulations developed to implement the act have therefore focused on providing water quality conditions necessary to support viable fish and wildlife populations and protect human health. Water quality standards that include: (1) designated uses; (2) numeric and narrative water quality criteria, and (3) an antidegradation policy, have been the primary tools used in the national management effort.

***Designated Uses***, such as potable water supply, shellfish harvesting, wildlife propagation and recreational contact, are identified at the state level (e.g. Ch. 62-302.400, Florida Administrative Code or
F.A.C.) through a formal rulemaking process, and are established for all waterbodies within the state's jurisdiction.

***Water quality criteria***, which describe the specific water quality conditions necessary to achieve designated uses, are also established by rulemaking at the state level (e.g. Ch. 62-302.530, F.A.C.). Criteria adopted by the state must be consistent with minimum federal standards set by the U.S. EPA. Presently, the EPA is working through DEP to establish TMDLs to be used on a statewide basis.

***Anti-degradation policy***, which is implemented by state and federal regulatory agencies through the permitting process, holds that all existing uses of a waterbody (including those that may exceed the designated uses) should be maintained. For example, regulatory agencies will seek to maintain the existing condition when that condition is higher than the minimum for a fishable and swimmable waterway unless important economic and social goals require otherwise.

All lakes and streams within the Delaney Creek Area watershed are considered to be Class III Florida waters. This designation allows uses for human recreation and the "propagation and maintenance of a healthy, well-balanced population of fish and wildlife" (Chapter 62-302.400 F.A.C.).

# 7.2 LAKES

Numerous lakes exist within the Delaney Creek Area watershed, with the majority of them located in the central portion of the watershed. Because their location is in the Brandon area, these lakes have undergone numerous man-induced changes through the years due to the progressively urban nature of the land uses that surround them. This has resulted in the accelerated eutrophication of many of these lakes.

## 7.2.1 DATA AND ASSESSMENT METHODS

Several of the lakes within the watershed have been monitored by the University of Florida's LAKEWATCH program that Hillsborough County participates in as the Lake Management Program (LaMP). Unfortunately, this monitoring has either not been carried out for an extended period or the sampling has been interrupted due to a change of LAKEWATCH volunteers on a particular lake. These lakes include Chapman, Tenmile and Hickory Hammock. Only two monitoring events on Tenmile Lake could be found. The condition of these waterbodies is a watershed area of concern.

Trained volunteers do monthly sampling for the LAKEWATCH program. These volunteers measure Secchi disk depth for water clarity and chlorophyll *a*, as well as general water chemistry. These samples are taken from three permanent sites on the lake. The samples are immediately frozen and shipped to a laboratory at the University of Florida for analysis. The lab provides measurements of total phosphorus, total nitrogen and chlorophyll *a* using FDEP approved methods. This sampling is to be carried out within a specified eleven-day period each month. Other information, such as bathymetry, lake stage and depth, vegetative and animal surveys and general water chemistry are also collected from a subset of lakes. These surveys are carried out by the Hillsborough County Lake Management Program (LaMP), which tries to sample between 30 and 50 lakes each year.

FDEP recommends the use of the Florida Trophic Site Index (TSI) to characterize water quality conditions in lakes and estuaries based on nutrient and chlorophyll concentrations (Hand et. al. 1990, 1996). The index approach was initially developed by Carlson (1977), who used three water quality indicators (total phosphorus concentration, chlorophyll concentration, and Secchi disk depth) to summarize trophic state conditions. Carlson's index was constructed so that a 10-unit change in index value represented a doubling or halving of chlorophyll concentration (an indicator of algal biomass). The Florida TSI developed by FDEP is based on the same rationale, but has been modified from Carlson's original formula. It includes the concentration of total nitrogen (TN) as an additional trophic state indicator and the indicator of Secchi depth has been dropped. The Secchi depth was dropped for calculation of TSI values (Hand et. al. 1996) because FDEP found that interpretation of Secchi depth data in many " (tannic) Florida waterbodies can be problematic due to reduction of water column transparency from naturally elevated concentrations of dissolved organic matter (DOM), algal cells or other sources of turbidity.

The components of the Trophic State Index are calculated as follows (Hand et. al. 1990):

$$TSI_{CHLa} = 16.8 + (14.4 \text{ x } \ln[\text{Chl } a])$$

$$TSI_{TP} = 18.6 + \ln([TP] \text{ x } 1000) - 18.4$$

$$TSI_{TN} = 56 + (19.8 \text{ x } \ln[TN])$$

$$TSI_{SECCHI} = 60 - (30 \text{ x } \ln[SD])$$

where:

[Chl *a*] = annual average chlorophyll a concentration in *u*g/l

[TP] = annual average total phosphorus concentration in mg/l

[TN] = annual average total nitrogen concentration in mg/l

[SD] = annual average Secchi disk depth in meters

ln = $\log_e$

An overall index value ($TSI_{avg}$) can be obtained by averaging the component values. FDEP recommends the following interpretation of calculated $TSI_{avg}$ values for lakes (Hand et. al. 1990, 1996):

FDEP Lake Water Quality

| $TSI_{avg}$ | Characterization |
|---|---|
| < 60 | "Good" |
| 60 - 69 | "Fair" |
| > 69 | "Poor" |

## 7.2.2 LAKE WATER QUALITY

LAKEWATCH and other information for the lakes in the Delaney Creek Area watershed is summarized in Table 7.1 below and includes surface area, mean depth, information on aquatic submerged vegetation, lake volume and annual average TSI, when available.

During the time of sampling, the annual average TSI has been rated as "good" for Tenmile Lake and Lake Gornto. Figure 7-1 shows the sampling locations for the lakes.

**Table 7.1**
**LAKEWATCH Data Summary**

| LAKE | LAKEWATCH DATA AVAILABLE | SURFACE AREA (acres) | MEAN DEPTH (ft) | AQUATIC SUBMERGED VEGETATION | | LAKE VOLUME | AQUATIC VEGETATION (% volume infestation) | ANNUAL AVERAGE TSI |
|---|---|---|---|---|---|---|---|---|
| | | | | Year | % cover | | | |
| **Kathy** | No Data | 22 | No Data | No Data | No Data | No Data | No Data | No Data |
| **Gornto** | No Data | 17 | No Data | No Data | No Data | No Data | No Data | 51 - good |
| **Chapman** | No Data | 17 | No Data | No Data | No Data | No Data | No Data | No Data |
| **Tenmile** | 9/24 & 12/15 1995 | 18 | No Data | No Data | No Data | No Data | No Data | 58 - good |
| **Sand Pond** | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| **Clayton** | No Data | 11 | No Data | No Data | No Data | No Data | No Data | No Data |
| **Hendrics** | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| **Hickory Hammock** | No Data | 26 | No Data | No Data | No Data | No Data | No Data | No Data |

# 7.3 STREAMS

Delaney Creek is the major nature water feature in the watershed and it can be divided into two stream segments. The upper segment can be classified as freshwater; while the lower, tidally influenced reaches can be categorized as estuarine. Stream water quality is impacted from both point and non-point sources all along its length. Even though Delaney Creek's water quality has been improving slightly for the last 10-15 years, it has still been rated as having the worst water quality in the Tampa Bay basin (FDEP 1996 - 305(b) Water Quality Assessment Report). In the creek's lower reaches, this has been due historically to the unregulated activities at the Nitram fertilizer plant and periodic spills from a battery-splitting operation. Sediments in the creek continue to retain large amounts of pollutants from these sources even though Nitram is now in compliance with state regulations and the battery plant has closed. Recently, soils at portions of the battery processing site have been removed and these areas have been capped with clean fill. Due to these impacts in water quality, Delaney Creek had been given a medium priority for setting TMDL's and the process was to start in 2005. The FDEP 1998 update to the 305(b) report still characterizes Delaney Creek's water quality as being among Tampa Bay's worst. The report now elevates the priority for setting TMDL's as high, with 2003 the new schedule date. Parameters of concern are dissolved oxygen, coliforms, lead concentration, nutrients, turbidity and biological oxygen demand. Water quality in the lower, estuarine reaches is important because this low salinity habitat serves as an important nursery area for many species of fish and shellfish found in Tampa Bay.

North Archie creek, like Delaney Creek, has both a freshwater and estuarine portion. Again, like Delaney Creek, many of the impacts to the creek have occurred in its lower reaches. Here, the creek has been re-routed around the Cargill, then Gardinier, gypsum stack. Some of these injuries will be mitigated for when the creek is re-routed a second time around Cargill's proposed new gypstack on the east side of U.S. Highway 41.

## 7.3.1. DATA AND ASSESSMENT METHODS

The Environmental Protection Commission of Hillsborough County has collected monthly water samples from various locations in the County since 1972 for estuarine systems and 1973 for freshwater habitats. These locations include creeks, rivers, Tampa Bay and Lake Thonotosassa and presently totals 92 locations. Twenty-eight parameters are tested including physical, chemical and biological factors. Physical measurements include parameters such as water and air temperature, pH, conductivity and turbidity. Chemical factors monitored are parameters like ions and metals. Biological measurements include BOD, chlorophyll and coliform counts. Two of these 92 sites occur in the Delaney Creek Area watershed (Figure 7-1). They are designated as site 133 and 138 and both are on Delaney Creek. Station 133 is within the tidally influenced portion of the stream where the creek passes under U.S. Highway 41. The second station, designated as 138, is upstream near the intersection of 36th Avenue and 54th Street in a freshwater portion of the creek. There has been no EPC sampling done on North Archie Creek. Annual averages for physical parameters from EPC's sampling information is reflected below in Table 7.2.

## Table 7.2
## Annual Averages for EPC Water Quality Sampling Sites on Delaney Creek
## (Physical Parameters - 1976 to 1983)

| Year | Station | Depth | | Color | Turbidity | Secchi | Water Temperature | | | Air Temp. | Conductivity | | | pH | | | Dissolved Oxygen | | | Salinity | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bot | Sample | | | Depth | Top | Mid | Bot | | Top | Mid | Bot | Top | Mid | Bot | Top | Mid | Bot | Top | Mid | Bot |
| | | Feet | | | NTU | inches | ºC | | | ºC | Umhos / cm | | | | | | mg / L | | | parts / thousand | | |
| 1976 | 133 | 1.9 | 0.9 | 68 | 7.0 | 20 | --- | 23.4 | --- | 24.5 | --- | 9827 | --- | --- | --- | --- | --- | 5.3 | --- | --- | 5.9 | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1977 | 133 | 1.6 | 0.8 | 55 | 4.0 | 17 | --- | 22.3 | --- | 19.9 | --- | --- | --- | --- | --- | --- | --- | 4.3 | --- | --- | 7.5 | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1978 | 133 | 1.8 | 0.9 | 53 | 4.0 | 19 | --- | 22.6 | --- | 22.9 | --- | --- | --- | --- | --- | --- | --- | 4.5 | --- | --- | 3.8 | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1979 | 133 | 1.8 | 0.9 | 75 | 8.0 | 17 | --- | 22.5 | --- | 25.2 | --- | --- | --- | --- | --- | --- | --- | 4.1 | --- | --- | 3.9 | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1980 | 133 | 1.6 | 0.8 | 44 | 3.0 | 18 | --- | 22.7 | --- | 23.1 | --- | --- | --- | --- | --- | --- | --- | 3.9 | --- | --- | 2.6 | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1981 | 133 | 1.7 | 0.8 | 69 | 3.0 | 19 | --- | 21.2 | --- | 21.6 | --- | --- | --- | --- | --- | --- | --- | 3.1 | --- | --- | 3.8 | --- |
| | 138 | 1.2 | 0.6 | 81 | 3.3 | 13 | --- | 21.9 | --- | 23.1 | --- | 2577 | --- | --- | --- | --- | --- | 3.0 | --- | --- | 1.5 | --- |
| 1982 | 133 | 1.6 | 0.8 | 75 | 5.0 | 16 | --- | 22.6 | --- | 22.9 | --- | --- | --- | --- | --- | --- | --- | 3.5 | --- | --- | 1.6 | --- |
| | 138 | 1.4 | 0.7 | 69 | 5.5 | 16 | --- | 21.8 | --- | 23.4 | --- | 689 | --- | --- | --- | --- | --- | 4.3 | --- | --- | 0.4 | --- |
| 1983 | 133 | 2.5 | 1.2 | 88 | 34.0 | 15 | --- | 21.8 | --- | 22.9 | --- | 5617 | --- | --- | 6.9 | --- | --- | 3.9 | --- | --- | 2.3 | --- |
| | 138 | 2.1 | 1.1 | 90 | 33.0 | 14.5 | --- | 20.9 | --- | 23.3 | --- | 542 | --- | --- | 7.2 | --- | --- | 5.3 | --- | --- | 0.3 | --- |

**Table 7.2** - cont'd.
**Annual Averages for EPC Water Quality Sampling Sites on Delaney Creek**
**(Physical Parameters - 1984 to 1991)**

| Year | Station | Depth | | Color | Turbidity | Secchi | Water Temperature | | | Air | Conductivity | | | pH | | | Dissolved Oxygen | | | Salinity | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bot | Sample | | | Depth | Top | Mid | Bot | Temp. | Top | Mid | Bot | Top | Mid | Bot | Top | Mid | Bot | Top | Mid | Bot |
| | | Feet | | | NTU | Inches | ºC | | | ºC | umhos / cm | | | | | | mg / L | | | Parts / thousand | | |
| 1984 | 133 | 1.6 | 0.8 | 71 | 28.0 | 12.0 | --- | 22.7 | --- | 23.5 | --- | 3049 | --- | --- | 7.0 | --- | --- | 3.8 | --- | --- | 2.8 | --- |
| | 138 | 1.6 | 0.8 | 83 | 37.5 | 13.5 | --- | 21.9 | --- | 23.8 | --- | 418 | --- | --- | 7.3 | --- | --- | 5.0 | --- | --- | 0.2 | --- |
| 1985 | 133 | 1.8 | 0.9 | 62 | 25.0 | 14.0 | --- | 22.7 | --- | 21.7 | --- | 6312 | --- | --- | 7.2 | --- | --- | 3.2 | --- | --- | 4.6 | --- |
| | 138 | 1.3 | 0.7 | 86 | 34.1 | 11.5 | --- | 20.9 | --- | 21.3 | --- | 520 | --- | --- | 7.5 | --- | --- | 4.4 | --- | --- | 0.2 | --- |
| 1986 | 133 | 1.5 | 0.8 | 57 | 11.0 | 16.0 | --- | 21.6 | --- | 22.5 | --- | 2842 | --- | --- | 7.3 | --- | --- | 4.6 | --- | --- | 1.3 | --- |
| | 138 | 1.4 | 0.7 | 71 | 15.9 | 16.5 | --- | 20.7 | --- | 23.1 | --- | 519 | --- | --- | 7.5 | --- | --- | 5.5 | --- | --- | 2.0 | --- |
| 1987 | 133 | 1.9 | 1.0 | 56 | 17.0 | 18.0 | --- | 22.5 | --- | 23.2 | --- | 1567 | --- | --- | 7.6 | --- | --- | 4.9 | --- | --- | 0.6 | --- |
| | 138 | 1.5 | 0.8 | 65 | 19.8 | 16.0 | --- | --- | --- | --- | --- | 702 | --- | --- | 7.7 | --- | --- | --- | --- | --- | --- | --- |
| 1988 | 133 | 2.2 | --- | 59 | 12.0 | 20.0 | --- | 21.6 | --- | 22.0 | --- | 6738 | --- | --- | 7.5 | --- | --- | 4.2 | --- | --- | 1.7 | --- |
| | 138 | 1.3 | --- | 65 | 12.0 | 16.0 | --- | 20.5 | --- | 22.0 | --- | 4823 | --- | --- | 7.6 | --- | --- | 4.6 | --- | --- | 3.5 | --- |
| 1989 | 133 | 1.9 | --- | 64 | 11.0 | 20.0 | --- | 23.5 | --- | 25.0 | --- | 6385 | --- | --- | 7.0 | --- | --- | 3.4 | --- | --- | 3.5 | --- |
| | 138 | 1.9 | --- | 72 | 14.0 | 20.0 | --- | 22.6 | --- | 25.0 | --- | 1028 | --- | --- | 7.2 | --- | --- | 4.4 | --- | --- | 0.3 | --- |
| 1990 | 133 | 2.2 | --- | 54 | 22.0 | 20.0 | 22.5 | 24.2 | --- | 25.0 | --- | 11087 | --- | --- | 7.1 | --- | --- | 3.0 | --- | --- | 5.2 | --- |
| | 138 | 1.8 | --- | 61 | 42.0 | 18.0 | 30.3 | 22.9 | --- | 25.0 | --- | 1536 | --- | --- | 7.0 | --- | --- | 4.5 | --- | --- | 0.3 | --- |
| 1991 | 133 | 1.8 | --- | 83 | 21.0 | 17.0 | --- | 23.3 | --- | 23.0 | 360 | 6018 | --- | --- | 7.1 | --- | --- | 3.6 | --- | --- | 3.2 | --- |
| | 138 | 1.5 | --- | 78 | 25.0 | 15.0 | --- | 22.5 | --- | 24.0 | 312 | 1119 | --- | --- | 7.2 | --- | --- | 4.0 | --- | --- | 0.3 | --- |

**Table 7.2** - cont'd.
**Annual Averages for EPC Water Quality Sampling Sites on Delaney Creek**
**(Physical Parameters - 1984 to 1991)**

| Year | Station | Depth | | Color | Turbidity | Secchi | Water Temperature | | | Air | Conductivity | | | pH | | | Dissolved Oxygen | | | Salinity | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bot | Sample | | | Depth | Top | Mid | Bot | Temp. | Top | Mid | Bot | Top | Mid | Bot | Top | Mid | Bot | Top | Mid | Bot |
| | | feet | | | NTU | inches | ºC | | | ºC | umhos / cm | | | | | | mg / L | | | parts / thousand | | |
| 1992 | 133 | 2.2 | 1.1 | 46.9 | 11.1 | 23 | --- | 23.3 | --- | 23.3 | --- | 12030 | --- | --- | 7.2 | --- | --- | 3.5 | --- | --- | 7.5 | --- |
| | 138 | 1.8 | 0.9 | 56.1 | 8.2 | 20 | --- | 22.4 | --- | 24.0 | --- | 1937 | --- | --- | 7.2 | --- | --- | 2.7 | --- | --- | 1.6 | --- |
| 1993 | 133 | 1.8 | 1.0 | 53.5 | 7.7 | 25 | --- | 23.0 | --- | 22.6 | --- | 9416 | --- | --- | 7.1 | --- | --- | 3.2 | --- | --- | 5.6 | --- |
| | 138 | 1.6 | 0.9 | 59.8 | 6.3 | 19 | --- | 21.7 | --- | 22.9 | --- | 1568 | --- | --- | 7.2 | --- | --- | 2.2 | --- | --- | 1.4 | --- |
| 1994 | 133 | 2.2 | 0.9 | 65.8 | 7.8 | 21 | 23.8 | 22.9 | 24 | 23.5 | 227 | 4802 | 231 | 6.8 | 7.1 | 6.8 | 3.9 | 3.5 | 4.1 | 1.0 | 2.9 | 1.0 |
| | 138 | 1.7 | 0.8 | 65.8 | 7.2 | 18 | 23.8 | 22.1 | 24 | 23.7 | 202 | 1645 | 206 | 6.8 | 7.2 | 6.8 | --- | 2.6 | 1.0 | 1.0 | 1.3 | 1.0 |
| 1995 | 133 | 1.9 | 0.9 | 62.1 | 7.0 | 20 | --- | 21.9 | --- | 21.7 | --- | 7746 | --- | --- | 7.0 | --- | --- | 3.5 | --- | --- | 4.9 | --- |
| | 138 | 1.3 | 0.7 | 71.2 | 12.8 | 14 | --- | 20.8 | --- | 21.7 | --- | 663 | --- | --- | 7.2 | --- | 0.2 | 1.8 | 2.7 | --- | 1.0 | --- |
| 1996 | 133 | 2.0 | 1.0 | 45.7 | 4.8 | 22 | --- | 21.2 | --- | 21.4 | --- | 5860 | --- | --- | 7.2 | --- | --- | 4.5 | --- | --- | 4.8 | --- |
| | 138 | 1.5 | 1.1 | 47.4 | 3.1 | 18 | --- | 20.3 | --- | 21.6 | --- | 774 | --- | --- | 7.3 | --- | --- | 5.7 | --- | --- | 1.3 | --- |
| 1997 | 133 | 1.8 | 0.9 | 49.6 | 3.6 | 21 | --- | 23.6 | --- | 23.7 | --- | 9635 | --- | --- | 7.1 | --- | --- | 3.3 | --- | --- | 8.4 | --- |
| | 138 | 1.7 | 0.8 | 52.2 | 3.3 | 20 | --- | 21.6 | --- | 24.0 | --- | 714 | --- | --- | 7.3 | --- | --- | 4.2 | --- | --- | 1.0 | --- |

## Table 7.2
## Annual Averages For EPC Water Quality Sampling Sites On Delaney Creek
## (Biological and Chemical Parameters - 1976 to 1986)

| Year | Station # | Chlorophyll | | | | BOD.5 | Coliform | | Phosphorus | | Nitrogen | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | a | b | c | Total | mg / L | Total | Fecal | Ortho | Total | Organic | Kjeldahl | $NH_3N$ | $NO_3$ / $NO_2$ | Total |
| | | *u*g / L | | | | | # / 100 ml | | mg / L | | mg / L | | | | |
| 1976 | 133 | 27.4 | 3.5 | 15.2 | 46.2 | 6.3 | 29975 | 5450 | 0.79 | 0.84 | --- | 27.51 | 11.00 | --- | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1977 | 133 | 19.7 | 2.4 | 9.5 | 31.7 | 4.6 | 49425 | 17850 | 1.56 | 1.67 | 34.69 | 58.69 | 47.26 | --- | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1978 | 133 | 23.4 | 4.8 | 10.6 | 38.9 | 4.3 | 25375 | 1825 | --- | 1.89 | 17.5 | 39.40 | 32.87 | --- | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1979 | 133 | 31.5 | 4.2 | 12.9 | 48.7 | 3.7 | 30550 | 15450 | --- | 1.61 | 12.53 | 39.64 | 27.58 | --- | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1980 | 133 | 23.9 | 3.9 | 10.7 | 39.5 | 4.6 | 13500 | 7325 | --- | 8.43 | 1.35 | 48.99 | 53.19 | --- | --- |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1981 | 133 | 22.8 | 3.2 | 9.3 | 35.4 | 3.3 | 20475 | 10175 | --- | 6.33 | 6.86 | 33.20 | 41.34 | --- | 66.65 |
| | 138 | 28.4 | 2.3 | 9.4 | 40.2 | 3.0 | 20375 | 18350 | 0.62 | 7.70 | 1.06 | 12.60 | 11.90 | --- | 6.49 |
| 1982 | 133 | 24.4 | 2.9 | 4.2 | 32.3 | 3.5 | 10250 | 4225 | --- | 0.68 | 4.66 | 31.68 | 39.89 | --- | 72.40 |
| | 138 | 4.8 | 1.3 | 3.2 | 9.4 | 2.4 | 4050 | 2275 | --- | 0.51 | 0.95 | 1.80 | 0.94 | --- | 2.97 |
| 1983 | 133 | 9.2 | 2.3 | 5.1 | 16.6 | 4.4 | 18925 | 10000 | --- | 0.92 | 2.39 | 21.98 | 21.29 | 29.670 | 68.45 |
| | 138 | 5.7 | 2.1 | 5.3 | 13.1 | 3.0 | 6050 | 3900 | --- | 0.69 | 0.88 | 1.53 | 0.60 | 0.730 | 2.25 |
| 1984 | 133 | 12.1 | 4.1 | 7.7 | 23.9 | 5.2 | 12925 | 5900 | --- | 4.03 | 6.12 | 17.01 | 12.03 | 11.730 | 28.74 |
| | 138 | 6.8 | 3.7 | 9.6 | 20.2 | 2.3 | 9750 | 6475 | --- | 0.75 | 1.31 | 1.56 | 0.25 | 0.470 | 2.03 |
| 1985 | 133 | 11.9 | 2.4 | 4.4 | 18.6 | 5.1 | 4225 | 1050 | --- | 1.31 | 1.89 | 11.76 | 10.68 | 7.650 | 19.42 |
| | 138 | 4.3 | 1.3 | 3.4 | 8.9 | 2.0 | 1850 | 675 | --- | 0.85 | 1.06 | 1.38 | 0.32 | 0.590 | 1.97 |
| 1986 | 133 | 10.6 | 1.8 | 2.6 | 14.9 | 3.9 | 4375 | 2175 | | 0.61 | 0.84 | 2.79 | 2.01 | 3.850 | 6.41 |
| | 138 | 3.2 | 0.9 | 2.5 | 6.6 | 1.7 | 2025 | 925 | | 0.76 | 0.73 | 0.90 | 0.17 | 0.360 | 10.50 |

## Table 7.2
## Annual Averages For EPC Water Quality Sampling Sites On Delaney Creek
## (Biological and Chemical Parameters - 1987 to 1997)

| Year | Station # | Chlorophyll | | | | BOD.5 | Coliform | | Phosphorus | | Nitrogen | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | a | b | c | Total | mg / L | Total | Fecal | Ortho | Total | Organic | Kjeldahl | $NH_3N$ | $NO_3$ / $NO_2$ | Total |
| | | *u*g / L | | | | | # / 100 ml | | mg / L | | mg / L | | | | |
| 1987 | 133 | 16.9 | 4.1 | 1.9 | 24.3 | 4.2 | 7125 | 4800 | --- | 0.60 | 13.61 | 22.09 | 8.56 | 5.430 | 27.52 |
| | 138 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1988 | 133 | 11.0 | 0.6 | 1.9 | 13.5 | 3.5 | 11292 | 6158 | --- | 0.89 | 1.82 | 2.72 | 0.94 | 1.450 | 4.17 |
| | 138 | 7.6 | 0.5 | 1.6 | 9.6 | 3.2 | 9533 | 9250 | --- | 0.89 | 1.26 | 2.14 | 0.89 | 0.800 | 2.94 |
| 1989 | 133 | 22.1 | 2.5 | 8.2 | 32.9 | 3.7 | 7608 | 4525 | --- | 0.74 | 1.18 | 1.98 | 0.80 | 1.550 | 3.53 |
| | 138 | 8.1 | 2.0 | 4.4 | 14.5 | 3.4 | 6492 | 5492 | --- | 0.67 | 0.92 | 1.37 | 0.45 | 0.660 | 2.03 |
| 1990 | 133 | 11.9 | 1.7 | 2.9 | 16.5 | 2.2 | 5750 | 2592 | 0.61 | 1.08 | 0.87 | 1.20 | 0.33 | 1.090 | 2.29 |
| | 138 | 5.7 | 2.6 | 3.5 | 11.7 | 1.9 | 2875 | 2175 | 0.64 | 1.90 | 0.87 | 1.25 | 0.38 | 0.930 | 2.18 |
| 1991 | 133 | 10.4 | 0.3 | 1.2 | 12.0 | 2.6 | 10083 | 7250 | 0.68 | 1.00 | 1.44 | 2.01 | 0.57 | 1.190 | 3.20 |
| | 138 | 3.3 | 0.5 | 0.9 | 4.7 | 2.8 | 3575 | 3042 | 0.72 | 1.01 | 1.15 | 1.63 | 0.48 | 0.657 | 2.25 |
| 1992 | 133 | 22.8 | 0.2 | 2.2 | 25.2 | 2.9 | 9467 | 6858 | 0.70 | 0.94 | 1.68 | 1.97 | 0.29 | 1.000 | 2.97 |
| | 138 | 2.1 | 0.3 | 0.4 | 2.8 | 2.7 | 3858 | 2858 | 0.75 | 0.84 | 1.28 | 1.49 | 0.21 | 0.894 | 2.38 |
| 1993 | 133 | 48.7 | 1.0 | 4.7 | 54.3 | 3.7 | 3808 | 1292 | 0.65 | 0.83 | 1.76 | 2.11 | 0.35 | 0.900 | 3.01 |
| | 138 | 9.2 | 0.2 | 1.2 | 10.6 | 2.9 | 3008 | 2050 | 0.79 | 0.95 | 1.06 | 1.93 | 0.87 | 0.518 | 2.45 |
| 1994 | 133 | 9.9 | 0.2 | 1.0 | 11.1 | 2.5 | 10417 | 5125 | 0.67 | 0.79 | 1.52 | 1.98 | 0.46 | 0.689 | 2.67 |
| | 138 | 1.7 | 0.2 | 0.1 | 2.2 | 2.8 | 4058 | 3070 | 0.60 | 0.73 | 0.98 | 1.38 | 0.40 | 0.508 | 1.89 |
| 1995 | 133 | 38.5 | 0.2 | 4.4 | 42.3 | 1.8 | 4000 | 1325 | 0.55 | 0.76 | 1.15 | 1.43 | 0.27 | 0.561 | 1.99 |
| | 138 | 3.9 | 0.1 | 0.1 | 4.7 | 2.9 | 3725 | 2502 | 1.48 | 1.99 | 0.84 | 7.48 | 6.71 | 0.379 | 1.44 |
| 1996 | 133 | 35.0 | 1.1 | 4.4 | 40.0 | 1.9 | 2617 | 1275 | 0.37 | 0.55 | 1.03 | 1.26 | 0.23 | 0.699 | 1.96 |
| | 138 | 1.4 | 0.2 | 0.4 | 3.1 | 1.2 | 2742 | 1337 | 0.29 | 0.39 | 0.78 | 0.88 | 0.11 | 0.434 | 1.32 |
| 1997 | 133 | 2.7 | 0.4 | 0.8 | 3.7 | 1.3 | 1533 | 725 | 0.49 | 0.55 | 1.09 | 1.41 | 0.32 | 1.144 | 2.56 |
| | 138 | 0.9 | 0.0 | 0.1 | 1.2 | 1.4 | 1525 | 758 | 0.46 | 0.51 | 0.85 | 0.99 | 0.14 | 0.592 | 1.58 |

In addition to the Environmental Protection Commission's sites, the United States Geological Service (USGS) maintains four gaging stations within the watershed (Figure 7-1). Two of the stations are on Delaney Creek and the other two are on Archie Creek. These stations record water flow information only; no water quality data is collected. See Table 7.3 below for the information available through the USGS.

**Table 7.3**
**USGS Streamflow Information for Delaney Creek Area Watershed**
**(1985 to present)**

| USGS Identification Number | Station Name | Location | Available Data | Drainage Area ($m^2$) | Mean Annual Discharge (cfs) | Period of Record |
|---|---|---|---|---|---|---|
| 02301745 | Delaney Creek Pop-off Canal | | Stage, Discharge | 16.1 | | |
| 02301750 | Delaney Creek near Tampa | Creek's left bank at south end of Darlington Street | Stage, Discharge | 16.1 | 7.94 | 1985 - 1997 |
| 02301738 | Archie Creek at 78th Street | | Stage, Discharge | | | |
| 02301740 | North Archie Creek at Progress Village | | Stage, Discharge | | | |

Just as lake water quality can be compared by using the TSI values, the water quality of a stream can be measured by the Water Quality Index or WQI. The WQI (Hand et. al. 1990, 1996) is a measure based on a combination of no more than six water quality indicator water clarity, dissolved oxygen, oxygen-demanding substances, bacteria, nutrients and biological diversity. These indicators can have multiple constituents, that is, more than one factor can be used to determine the indicator's value. Phosphorus and nitrogen both fall into the category of a nutrient indicator. Therefore, data availability will determine the constituents used for determining the Index. For each measured constituent, the raw data, in either a daily, weekly or monthly form, is converted into annual averages. These averages are then converted to percentiles using a database developed by FDEP. The information for this database is established by information on 2,000 Florida stream monitoring locations. These percentile values are then averaged to generate the WQI, which can range from a low of 10 (best quality) to over 90 (worst quality). This final averaging process ignores categories that have no available data. The WQI can be calculated from 1 or more of the six indicator categories; however, the more indicators used, the more reliable the determination will be (Hand et. al. 1990, 1996).

Hand et. al. (1996) provide the following summary of the WQI. The Florida Water Quality Index has several advantages over previous measures. First, since it is based on the percentile distribution of Florida stream data, it is tailored to Florida. Second, the index uses the most important measures of water quality in Florida: clarity, dissolved oxygen, oxygen-demanding substances, nutrients, bacteria, and biological diversity. Third, it is simple to understand and calculate and does not require a mainframe computer or any complex data transformations or averaging schemes. Finally, the index nicely identifies areas of good fair, and poor water quality that correspond to professional and public opinion." FDEP recommends the following interpretation of WQI values, based on an analysis of Florida stream data and the US EPA National Profiles Water-Quality Index (Hand et. al. 1996):

FDEP Stream Water Quality

| WQI | Characterization |
|---|---|
| < 45 | "Good" |
| 45 – 60 | "Fair" |
| > 60 | "Poor" |

The Florida Department of Environmental Protection's TSI can also be used as an indicator of estuarine water quality (Hand et. al. 1990). For estuaries, the Trophic State Indicator values are calculated using the same methodology as for lakes (see section 7.2.1), but these values are interpreted somewhat differently. Just as with lake TSI values, interpreting Secchi depth can be problematic with estuaries that have contributing waters from blackwater or tannic waterbodies. This can result in a reduction of the transparency of the water column due to naturally elevated concentrations of various factors such as dissolved organic matter, algal cells and other sources of turbidity. As a result, as with the lake calculations, Secchi depth has been dropped as an indicator in recent Florida Department of Environmental Protection's guidance for calculation of TSI average values (Hand et. al. 1990).

The Florida Department of Environmental Protection recommends the following interpretation of TSI values for estuaries (Hand et. al. 1990, 1996):

FDEP Estuary Water Quality

| $TSI_{avg}$ | Characterization |
|---|---|
| < 50 | "Good" |
| 50 - 59 | "Fair" |
| > 59 | "Poor" |

## 7.3.2 STREAM WATER QUALITY

As part of the Tampa Bay Estuarine Program's (TBEP) plan for the restoration of Tampa Bay, protection and restoration of low salinity or oligohaline habitat has been a prime issue. This habitat type along with mangroves and seagrasses serve as the primarily breeding and nursery area for many of the Bay's fin and shellfish. Water clarity, salinity regime, dissolved oxygen and bacteriological indicators are among the many important parameters for evaluating the health of the Bay.

### 7.3.2.1 Freshwater Streams

As previously stated, the water quality of Delaney Creek, the primary freshwater stream in the watershed, with the exception of fecal coliform levels, has been slowly increasing since 1985. This is due to several factors including the better stormwater treatment for new development in the watershed, bringing the Nitram site into compliance and the closing of the battery processing plant, public awareness in terms of fertilizer and pesticide use and very recently, the installation of an off-line treatment pond in the lower reaches of the creek by Hillsborough County. Annual WQI are shown in Figure 7.2.

### 7.3.2.2 Salinity Regimes

Oligohaline conditions exist when an estuary or stream's salinity averages 10 parts per thousand or less, mesohaline conditions occur when the averages are between 15 and 25 ppt while true saltwater typically contains salinity of 35 ppt. Mid-depth salinity for Delaney Creek for stations 133 and 138 are shown in Figure 7.3. These figures show that station 133 is meeting oligohaline conditions with an average value of 3.8 ppt. The average maximum value is just over the oligohaline threshold at 14.2 ppt while the average minimum salinity is well within freshwater conditions at 0.4 ppt. Station 138, which is well up the creek, shows freshwater conditions with an average salinity of 0.99 ppt, an average maximum of 4.1 ppt and an average minimum of 0.6 ppt.

### 7.3.2.3 Dissolved Oxygen

Dissolved oxygen content in water will vary with physical conditions such as the water's temperature or salinity and barometric pressure. Biological functions, primarily photosynthesis and respiration will also have an affect, as will decomposition and pollution. Photosynthesis is the major contributor of DO along with simple gas exchange or diffusion through the air-water surface interface. Respiration, decomposition and pollution have the opposite effect and use dissolved oxygen in the water. Depending on the salinity and temperature, 100% saturation for dissolved oxygen generally ranges between 7 and 8 mg/l. A value of 4 to 5 mg/l is generally accepted as being the minimum requirement for a healthy and diverse animal population, even though some organisms, such as certain larval insects, can survive in lower concentrations. Their presence is routinely used as an indicator of low DO content and/or water pollution. However, blackwater or spring-fed streams are naturally low in dissolved oxygen. A high DO can indicate an elevated level of photosynthesis, usually by algae and phytoplankton, and is a common characteristic of many hypereutrophic systems. Figure 7.4 gives the annual mean and average maximum and minimum values at mid-depth for EPC's sites 133 and 138. These figures show that the annual minimum averages fall below the acceptable 4 mg/l threshold for wildlife for all of the years sampled. The minimum value fell to 0 during 16 of the 36 sampling averages for site 138 during three years. This occurred three times in 1992, six times in 1993 and seven times in 1995. There were no such occurrences for the other site (133) on the creek's lower reaches. The average DO for site 133 averaged higher than 4.0 mg/l in only 9 of the 24 years or 37.5% of the time. This value was better for the upper reaches (Site 138) where the DO was above 4.0 mg/l 58.3% of the time or 7 of the 12 years.

## 7.3.2.4 Bacteriological Indicators

These indicators show the amount of coliform bacteria colonies in a given sample of water, usually 100 ml. This is measured in MPN's or most probable number. In general, coliform bacteria can be found either in the gut of various animals or in soils, but normally they are not naturally occurring in water. Fecal coliforms are found in the intestinal tracts of warm-blooded animals. As a general rule, coliform counts are higher in tributaries of the Bay than the Bay itself. This is due primarily to two factors - 1) dilution is not as great as it is in the Bay and 2) these areas are much closer to the source(s). The state sets a limit of less than 800 fecal coliforms colonies per 100 ml as a standard for water quality. Total counts include fecal coliforms as well as those coliforms found in non-warm-blooded animals and in the soil. While these bacteria may not be considered a health risk as fecal coliforms are, they are used as an indicator to test water further for fecal coliforms. The standard for total coliforms is 2,400 bacteria colonies per 100 ml. Figure 7.5 shows the measurements taken at the two EPC sites on Delaney Creek. As shown, it is a rare occasion when the creek meets either of the state's water quality standards for coliform bacteria. On a positive note, the trend is on a downward curve with the most encouraging data showing that both water quality standards were met in 1997, the year of the El NiZo rains, at both sites. The average values went up slightly for 1998, staying within the acceptable range for total coliforms but slightly exceeding the standard for fecals. Figure 7.6 depicts the number of months each year that the state's water quality standard was exceeded for both total and fecal coliforms. As can be seen from the graph, until around 1995, it was not uncommon for the water qualities standards, for both total and fecal coliforms, to be exceeded for well over six months out of the year. For both stations, in terms of total coliforms, the overall exceedence average was over 7 months out of a year. The average exceedence for fecals is right at 8 months out of a year. Dairies found within the creek's watershed have been one of the factors influencing coliform counts from the mid-70's through the mid-80's. These dairies were not required to treat the run-off from their farms and consequently coliform levels in the creek were high, routinely reaching into counts of tens or hundreds of thousand. Another related use was the conversion of manure into fertilizers. The largest single sampling event total was in June 1976 where the count reached almost 2.3 million. One of the highest counts in recent years and the highest for that year was in April 1995 as a result of a breech in a dairy's treatment pond. This pond emptied directly into Delaney Creek and resulted in counts of 20,000 (pers. comm. R. Boler - EPC). This was the largest count for any non-bay sample for the year of 1995.

## 7.3.2.5 Trophic State

Annual $TSI_{CHLa}$, $TSI_{TP}$, $TSI_{TN}$, and $TSI_{AVG}$ for the years 1981 through 1997 for EPC site 133 are shown in Figure 7.7. The TSI values could not be calculated for the years between 1976 and 1980 due to the lack of total nitrogen information for this time period. As can be seen from the graph, even though the TSI values are in the "poor" range, the general trend shows improving water conditions for TP and TN, both of which have dropped almost 40 and 70 points, respectively, and are approaching the "fair" range. CHL*a* values hovered inside the "fair" range between 1983 and 1992. Since then, the values have reached into the poor range but between 1996 and 1997, there was a dramatic drop of 40 points that moved the value into the "good" range. With the exception of 1987 when there was no data, Figure 7.7 shows the annual $TSI_{CHLa}$ $TSI_{TP}$, $TSI_{TN}$, and $TSI_{AVG}$ for EPC site 138 for the years 1981 through 1997. $TSI_{AVG}$ values for this period are considered "poor" for all years but 1996 and 1997 when the average value dropped into the "fair" range. Total nitrogen has mirrored the $TSI_{AVG}$ values and remained in the "poor" range at a lower value of around 75. With the exception of 1981, CHL*a* has remained within the "good" range. Total phosphorus has remained high and steady in the "poor" range at around 110.

The trends toward water quality improvement can be attributed to several factors. Certainly, the fact that various dairies have either closed or increased their treatment of stormwater run-off and the Nitram plant has come into compliance has resulted in a significant improvement. Stricter standards for stormwater run-off in general have also contributed to the improvement. Rainfall does not seem to enter into the equation as might be expected. The effect here seems to be more one of dilution or concentration. The values are generally lower in years of high rainfall while they are high in years of lower rainfall. It may be assumed that the high rainfall events are acting to flush nutrients and chlorophyll out of the creek and into the Bay where it is concentrated.

# 7.4 WATER QUALITY ISSUES / AREAS OF CONCERN

Management of natural lakes and streams has been identified as a specific area of concern for the Delaney Creek Area watershed. Proper management of these waterbodies includes the protection of lakes and streams exhibiting good water quality characteristics as well as restoration of waterbodies with degraded water quality.

## 7.4.1 LAKES

While it is hard to determine the overall water quality of the lakes in the Delaney Creek Area watershed due to the limited amount of data collected thus far, there can be no doubt that continued changes toward more intensive land uses within the watershed will have detrimental impacts on these natural waterbodies. These impacts result from practices such as mass grading and clearing of commercial and subdivision sites in conjunction with inadequate erosion control, especially during the summer rainy season, inadequately treated stormwater, septic system discharges, the removal of native vegetation from shorelines and the over-use of fertilizers and pesticides on residential lots.

Protection of lakes should be encouraged through regulation and education. Current regulations should be evaluated to see if they are meeting expectations. Alternatives for building on lakes such as lowering residential densities by increasing lot sizes, increasing setbacks, community access for boating and swimming and discouraging hardening of the shoreline by walls or ramps should be explored. Infrastructure, such as water and sewer, should be in place prior to development on lakes to prevent pollution through septic tanks and or the lowering of lake levels by either direct or indirect pumping. Education should emphasize the worth of native wetland vegetation in relation to lake health and explain the advantage of setbacks and buffers. Citizens and citizens groups should be encouraged to develop whole lake management plans as opposed to the separate, single residential lot approach that prevails today. It is clear some sort of incentive is needed to encourage single-family homeowners to be more sensitive to the conditions of their lakes. The LAKEWATCH program should continue to be expanded to increase the amount of data collected so trends in water quality and aquatic plant management can be assessed.

## 7.4.2 STREAMS

Stream water quality, especially in the lower or tidally influenced portion of the watershed discharging to Tampa Bay, is adversely impacted by both point and nonpoint source pollutant discharges. Delaney Creek discharges into Hillsborough Bay, which is one of the Bay's most polluted segments. The Tampa Bay Estuary Program has set various water quality and habitat management goals for the Bay. The TBEP is a partnership of federal, state and local governmental agencies working with various private groups, which have adopted several stormwater, related goals for each watershed.

- "Hold the line" on nitrogen loading to Tampa Bay and its major segments to 1992-94 average levels. This will serve as a baseline to measure improvements from. This measure should encourage the regrowth of an additional 12,350 acres of seagrasses and restore seagrass acreage to 1950's levels. Between 1950 and 1980 around 19,000 acres or about half the seagrasses in the Bay were lost.

- Toxic contaminants in the Bay that result from stormwater run-off are another concern. The TBEP seeks to protect the relatively clean areas of the Bay from further contamination and minimize the risk to humans and wildlife in those areas of the Bay that are already impacted.

- Another type of contamination is bacterial and results from sanitary sewer overflows and/or septic tank discharges that occur primarily in times of heavy rains. This impacts the use of the Bay for swimming and shellfish harvesting.

- Freshwater inflows for the Bay and its lower reaches are also critical to the health of the Bay. Stormwater detention and retention play an important part in this flow of water, where both timing and quantity are important. Presently, minimum flows and levels for most of the major waterbodies in the County are being developed by the Southwest Florida Water Management District. Related to this is the issue of impervious surfaces; it is a goal to reduce these surfaces and therefore reduce stormwater run-off.

Stormwater has been identified as a significant source of both nutrients and toxic pollutants in the Tampa Bay watershed (TBEP 1996). Almost half (45%) of the nitrogen loading into the Bay results from stormwater run-off as does approximately 60% of the metals chromium, lead, zinc and mercury. Discharge of microbial contaminants is one of the main concerns for the Delaney Creek Area watershed. As previously stated, fecal coliforms are hosted by warm-blooded animals and their presence in the watershed are a result of numerous sources:

- Leaky sanitary sewer lines or lift stations

- Deficient or failing septic systems

- Stormwater run-off from feedlots or dairies that has not been adequately treated.

- Intermittent surface water discharges from private wastewater treatment plants or other industries.

Another priority of the TBEP is the protection and restoration of oligohaline habitat in the Bay. These low salinity areas, in conjunction with mangroves and seagrass beds, are critical breeding and nursery habitat for many economically important fin and shell fish species. As previously shown in Figure 7.3, the lower reaches of the creek, at site 133, meet the 0 to 10 ppt criteria specified by the TBEP. The upper reaches, at site 138, also fall within this range, but would be better considered to be freshwater, rather than saltwater.

# EXISTING NATURAL SYSTEMS CONDITIONS

## 8.1 OVERVIEW

Even though this watershed contains the urban areas of Brandon, Clair Mel and East Tampa, there are a few large areas of natural systems still intact, especially in the western portions. The loss of natural systems and habitats to development commonly results in the degradation of water quality, an increase in run-off volumes and timing and a decrease in populations of aquatic and upland wildlife (Schuler, 1994). These decreases in wildlife are due to the variation in water levels and timing and by the sedimentation that usually accompanies increased flows. Another type of natural system alteration is the change in fire regime. Fire is an intricate part of maintaining system health and in some cases maintaining the system. Many of the upland systems, especially those in which pine trees are a major component, need fire for a couple of reasons. Some pinecones will not open until they are exposed to a certain heat level or are burned. In addition, pines are adapted to regular, light fires, which will eliminate most hardwoods such as oaks but does not affect the pines. In the same way, some wetland systems remain non-forested because regular fires will kill any encroaching trees or shrubs, while leaving the fire adapted herbaceous vegetation to resprout or reseed. Included in the goals of watershed management is the protection of these remaining natural areas and the restoration or creation of natural areas to levels that will be able to properly treat stormwater run-off. This in turn will increase the natural systems' water quality and biodiversity by providing more suitable wildlife habitat. Additionally, a decrease in run-off volume will increase stream channel stability and decrease stream bank erosion (Schueler, 1994).

## 8.2 HISTORIC HABITAT TYPES

This section uses information generated by the Southwest Florida Water Management District and attempts to reflect the possible land cover for the watershed prior to 1900. It was produced using data from historic aerial photographs and the 1988 Soils Conservation Service's *Soil Survey of Hillsborough County, Florida*. The information developed is not intended to be used for planning purposes, but is just an approximation of the most likely land cover types. It can accurately give coverage or acreage for general land cover types such as uplands or wetlands, but its reliability decreases when trying to determine if the wetland is a shallow grass pond or a freshwater marsh. The information can be used to determine the best area to try to restore the different natural systems types. It makes more sense to try to re-establish an area of sand pine scrub on a parcel on which it has historically occurred rather than trying to "force" it to grow on a parcel that did not support this community in the past and would be better suited for another type of ecosystem. The historic land coverage is shown in Figure 8-1.

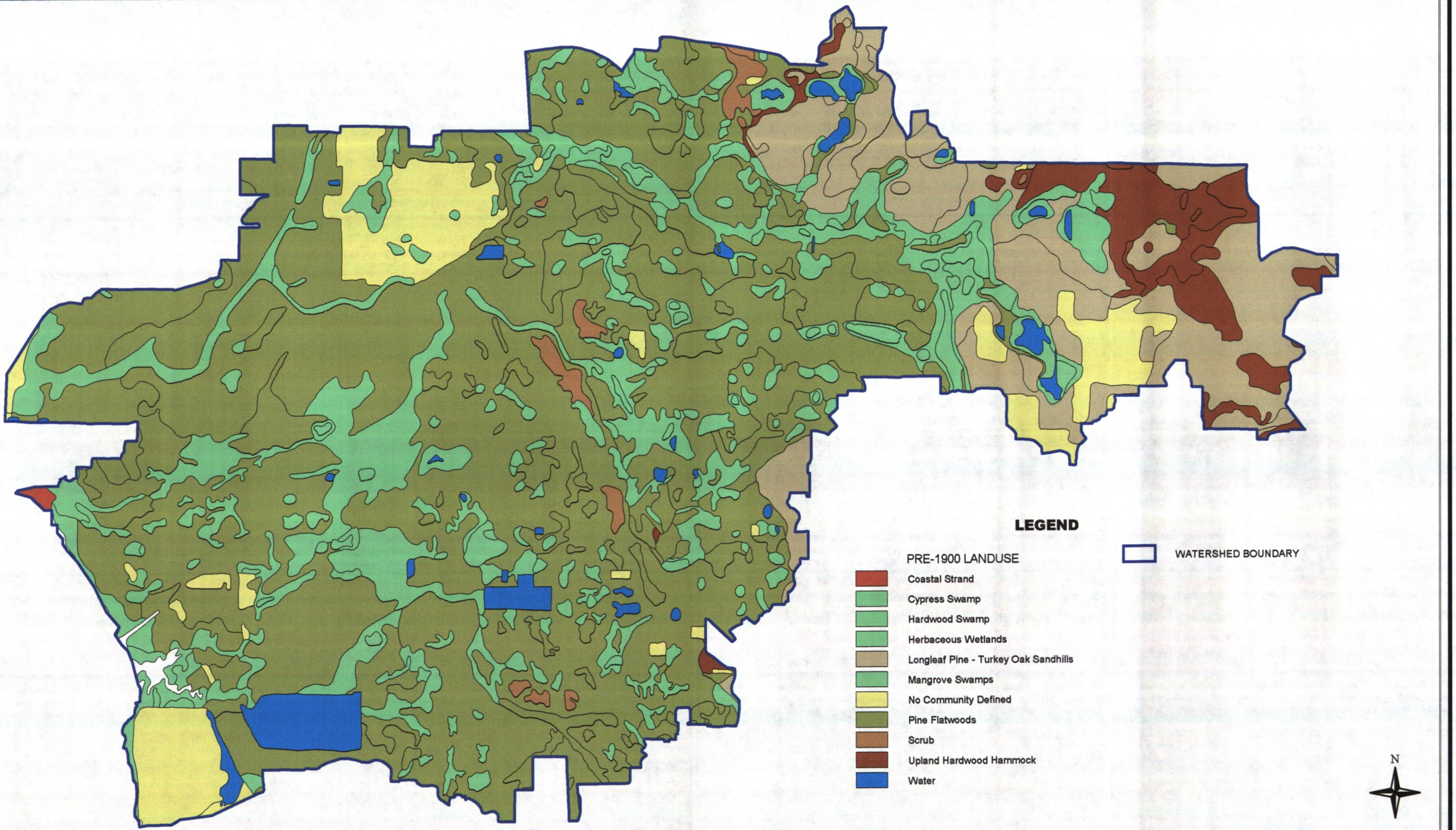
Table 8.1 summarizes the historic land use, its FLUCCS equivalent and the percent coverage of the watershed for that cover type.

**Table 8.1**
**Historic Land Cover Types**

| HISTORIC COVER TYPE | ACRES | % COVER | FLUCCS EQUIVALENT |
|---|---|---|---|
| South Florida Coastal Strand | 122.34 | 0.57 | Tidal Flats |
| Freshwater Marsh and Ponds | 647.21 | 3.00 | Cypress Swamp |
| Wetland Hardwood Hammocks | 289.64 | 1.34 | Stream & Lake Swamp (Bottomlands) |
| Slough | 1791.82 | 8.32 | Freshwater Marsh |
| Longleaf Pine-Turkey Oak Hills | 3500.90 | 16.25 | Longleaf Pine-Xeric Oak Forest |
| Mangrove Swamps | 607.97 | 2.82 | Mangrove Swamps |
| South Florida Flatwoods | 11084.94 | 51.44 | Pine Flatwoods |
| Sand Pine Scrub | 141.78 | 0.66 | Sand Pine |
| Upland Hardwood Hammocks | 1441.21 | 6.69 | Upland Hardwood Forest |
| Water | 363.15 | 1.69 | Water |
| No Community Defined | 1557.84 | 7.23 | No Community Defined |
| **UPLAND SUBTOTAL** | 16168.83 | 75.03 | |
| **WETLAND SUBTOTAL** | 3822.13 | 17.74 | |
| **UNDEFINED SUBTOTAL** | 1557.84 | 7.23 | |
| **GRAND TOTAL** | **21548.80** | **100.00** | |

## 8.2.1 HISTORIC UPLAND COMMUNITIES

Of the community types identified, uplands constituted about 16,168.83 acres or approximately 75% of the pre-1900 watershed. Generally, these are the first areas that are developed in most watersheds. Well-drained soils containing sandhills or sand pine scrub are prime real estate for the establishment of citrus groves, as well as other types of agriculture and residential areas. Pine flatwoods are also easily developed without too much alteration to soils or hydrology, as are the upland hardwood hammocks.




Hillsborough County
Florida

Department of Public Works
Engineering Division
Stormwater Management Section

**DELANEY CREEK AREA**
**STORMWATER MANAGEMENT**
**MASTER PLAN**
**SEPTEMBER 2000**

FIGURE 8-1

**PRE 1900 LAND USE**

## 8.2.1.1 Longleaf Pine-Turkey Oak Hills

This community type can be found throughout Florida, but is more common in central Florida and areas of the panhandle. The community size can vary widely and can include a few other habitat types, especially small isolated wetlands. This community type can be found in hilly areas with nearly level to strong slopes. The soils are moderately well to excessively drained, deep, somewhat acid in pH, and usually coarse textured. In the historic watershed they could have occurred on Candler fine sand (7), Candler-Urban complex (9), Gainesville loamy fine sand (19), Lake fine sand (25), Orlando fine sand (35) and Tavares-Millhopper fine sands (53 & 54).

There are two main vegetational types found within this community. The first type has a canopy dominated by scattered longleaf pine (*Pinus palustris*). These areas typically are the more mature, natural sites that have not been logged and/or their fire regime has no been altered. If the area has been logged or the fire regime is altered, the second community that results is typically dominated by turkey oak (*Quercus laevis*). In addition to these canopy species, bluejack oak (*Quercus incana*) is a commonly found tree in this habitat type. Various herbaceous and woody species can be found in the understory, which frequently contains numerous areas of bare ground. A shrub story is not commonly found in this community, but where it occurs, it could contain saw palmetto (*Serenoa repens*) and wax myrtle (*Myrica cerifera*). Ground cover can consist of numerous species in the aster family including asters (*Aster* species), blazing stars (*Liatris* species), elephant's foot (*Elephantopus* species) and golden-asters (*Chrysopsis* species), numerous plants from the bean family including butterfly peas (*Centrosema* and *Clitoria* species), partridge pea (*Cassia* species), beggarweed (*Desmodium* species) and indigoes (*Baptisia* species). Other plants that can also be found are bracken fern (*Pteridum aquilinum*), various milkweeds (*Asclepias* species) and various grasses that include dropseed (*Sporobolus* species), panic grasses (*Panicum* species) and indiangrass (*Sorghastrum nutans*).

Animals found in this community are usually adapted to conditions of high temperature and lack of water. Many are burrowing species or use the burrows of other animals, or have a nocturnal lifestyle so that they can avoid the heat of the day and conserve water. Frequently found mammals include fox squirrel (*Sciurus niger*), pocket gopher (*Geomys floridana*) and white-tailed deer (*Odecoileus virginianus*). Birds could include wild turkey (*Meleagris gallopavo*), northern bobwhite (*Colinus virginianus*) and eastern towhee (*Pipilo erthrophthalmus*). Commonly occurring reptiles would have included gopher turtle (*Gopherus polyphemus*), indigo snake (*Drymarchon corias*) and fence lizard (*Scleroporus undulatus*).

## 8.2.1.2 South Florida Flatwoods

This community type can be found throughout south and central Florida and, when combined with its northern counterpart, is probably the most common ecosystem in the state. Most areas of this type are very large in size and can include other habitat types, especially wetlands. Flatwoods can be found on nearly level land. The soils are poorly to somewhat poorly drained, deep, somewhat acid in pH, and usually coarse textured. In the historic watershed they could have occurred on Malabar fine sand (27), Myakka fine sand (29), Myakka-Urban land complex (32), Ona fine sand (33), Smyrna fine sand (52) and Wabasso fine sand (57).

Fire and water control the vegetation of this community. As with other pine-dominated ecosystems, this one is maintained by fire which precludes the establishment of hardwoods. On the other hand, due to the relatively high water table, especially during the summer, there are can be slight differences in vegetational types found. These vary with the wetness or dryness of the location. Generally, the wetter areas contain fewer trees and less saw palmetto. The canopy is dominated by slash pine (*Pinus elliottii*), with scattered live oak (*Quercus virginiana*). The shrub layer is usually dominated by saw palmetto with gallberry (*Ilex glabra*) and wax myrtle as minor components along with tarflower (*Befaria racemosa*) and blueberries (*Vaccinium* species) mixed in. Various herbaceous and woody species can be found in the groundcover, which is typically dominated by grasses such as bluestems (*Andropogon* and *Schizachyrium* species), switchgrasses and threeawn (*Aristida* species).

Due to the patchy nature of other included vegetative communities within the flatwoods ecosystem, there is a good diversity of animals that can be found. The ecotones or areas between the different systems provide good nesting sites and areas for food and cover. Typical animals include white-tailed deer, armadillo (*Dasypus novemcincutus*), eastern cottontail (*Sylvilagus floridanus*), and raccoon (*Procyon lotor*). Birds could include Bachman's sparrow (*Aimophila aestivalis*), wild turkey, pine warbler (*Dendroica pinus*), and red-bellied woodpecker (*Melanerpes carolinus*). Commonly occurring reptiles and amphibians would have included eastern diamondback rattlesnake (*Crotalus adamanteus*), black racer (*Coluber constrictor*) and pinewoods treefrog (*Hyla fumeralis*).

## 8.2.1.3 Sand Pine Scrub

This community type can be found throughout Florida, but occurs primarily in the central portion of the state or on the Panhandle's coast. Most areas of this type are usually small in size and can include other habitat types, especially wetlands. Scrub habitats can be found on nearly level to strongly sloping land. The soils are somewhat poorly to excessively drained, deep, somewhat acid in pH, and usually coarse textured. In the historic watershed they could have occurred on Archbold fine sand (3) or Pomello fine sand (41).

This is one of the most fire dependent of Florida's vegetative communities. Again, fire precludes the establishment of hardwoods. Due to the presence of a thick understory, fire is able to reach the crowns of the trees every 20 to 40 years. This results in stands of trees that are very close in age to each other, or even-aged. If the fire regime is altered or in areas of poorly drained soils, hardwoods can become dominant. The canopy is dominated by sand pine (*Pinus clausa*), with scattered oaks including bluejack, myrtle (*Quercus myrtifolia*), Chapman (*Q. chapmanii*), and sand live (*Q. geminata*). The shrub layer usually contains saw palmetto with gallberry and dwarf huckleberry (*Gaylussacia dumosa*) as minor components. As with the longleaf pine-turkey oak community, large unvegetated patches can be commonly found in this habitat. Where groundcover exists, it is dominated by various herbaceous and woody species such as bluestems, butterfly pea, switchgrasses, Curtiss' milkweed (*Asclepias curtissii*), Florida bonamia (*Bonamia grandiflora*) and threeawn grasses.

Again, like the similar longleaf pine-turkey oak community, animals found in this habitat must be adapted to dealing with high temperatures and lack of water. Typical animals include white-tailed deer, cotton rat (*Sigmodon hispidus*), and raccoon. Birds could include Bachman's sparrow, Florida scrub jay (*Aphelocoma coerulescens*), and red-headed woodpecker (*Melanerpes erythrocephalus*).

Commonly occurring reptiles and amphibians would have included gopher turtle, eastern diamondback rattlesnake, indigo snake, and scrub lizard (*Sceloporus woodi*) and gopher frog (*Rana areolata aesopus*).

## 8.2.1.4 Upland Hardwood Hammock

This community type is commonly found in north central Florida and less in the north or west portion of the state. Most areas of this community are usually smaller in size, generally less than a few hundred acres and can include other habitat types such as wetlands. This is considered the climax community type for Florida and most of the southeastern United States. Once attained, this community will be self-sustaining, provided it is not altered by humans or catastrophic natural occurrences such as hurricanes or wildfire.

This community occurs on rolling terrain with nearly level to strongly sloping land. The soils are typically deep, somewhat poorly to well drained and generally coarse textured. In the historic watershed, it could have occurred on the following soils: Fort Meade loamy fine sand (18), Gainesville loamy fine sand (19), Kendrick fine sand (23), Seffner fine sand (47), Tavares-

Millhopper fine sands (53 & 54) or Zolfo fine sand (61).

The canopy is dominated by oaks, primarily live and laurel (*Quercus laurifolia*), pignut hickory (*Carya glabra*), slash pine, southern magnolia (*Magnolia grandiflora*) and sweetgum (*Liquidambar styracaflua*). Because this is a climax community and typically has a dense canopy, the subcanopy layer can be quite sparse in large areas. Where vegetation does exist it could have contained American beautyberry (*Callicarpa americana*), waxmyrtle and coral bean (*Erythrina herbacea*). The groundcover is also sparse but could have contained asters, switchgrasses, various greenbriers (*Smilax* species), poison ivy (*Toxicodendron radicans*) and partridge berry (*Mitchellia repens*).

Due to the stability of this habitat, many animals can be found and many of them will be large mammals. Typical animals include white-tailed deer, cotton rat, gray squirrel, bobcat (*Lynx rufus*) and raccoon. Because of the food generated by the various trees and plants, this habitat type is very important for migratory songbirds and could include myrtle warbler (*Dendroica coronata*), summer tanager (*Piranga rubra*), Chuck-will’s-widow (*Caprimulgus carolinianus*) and various woodpeckers. Normally occurring reptiles and amphibians would have included eastern diamondback rattlesnake, indigo snake, southern ring-necked snake (*Diadophis punctatus*), and southern toad (*Bufo terrestris*).

## 8.2.2 HISTORIC WETLAND COMMUNITIES

Of the community types identified, wetlands constituted about 3,822.13 acres or approximately 17.74% of the pre-1900 watershed. As opposed to the uplands, these are usually the last areas that are developed in most watersheds. This is generally due to the cost of filling the wetlands and/or because of wetland protection regulations. Poorly drained muck soils are not good for much other than agriculture crops that need this type of rich soils. In this watershed, wetlands can be broadly divided into forested and non-forested areas or saltwater or freshwater wetlands.

### 8.2.2.1 South Florida Coastal Strand

This community type, as the name implies, is commonly found in coastal areas of southern Florida. They are usually fairly large in size unless interrupted by man’s alteration. However, these systems are generally very narrow.

This community occurs on rolling terrain with nearly level to strongly sloping land. The soils are typically deep, somewhat poorly to well drained and generally coarse textured. In the historic watershed, it could have occurred on either Kesson muck (24) or Myakka fine sand (30).

The canopy does not always occur and where is does it is very sparse and does not form a closed canopy. Trees that could occur include Sabal palm (*Sabal palmetto*) and Australian pine (*Causurina* species). Where a shrub layer could have existed, it could have contained seagrape (*Coccoloba uvifera*), waxmyrtle, and saw palmetto. The groundcover is probably the least sparse of the vegetational layers and could have contained railroad vine (*Ipomea pes-caprae*), beach sunflower (*Helianthus debilis*), bitter panicum (*Panicum amarum*), and seaoats (*Uniola paniculata*) and marshhay cordgrass (*Spartina patens*).

Many animals can be found, but they will have to be salt tolerant to an extent or a source of freshwater must exist in close proximity. Typical animals include cotton rat, gray squirrel and raccoon.

This habitat type is home to various birds such as shorebirds, gulls, terns, herons and egrets. Some of these areas are important stopover areas for the migratory types of these birds. Normally occurring reptiles and amphibians would have included eastern diamondback rattlesnake, indigo snake and green anole (*Anolis carolinensis*).

## 8.2.2.2 Freshwater Marsh And Pond

These ecological types are found throughout Florida and can vary greatly in size from several to several hundred acres. Most areas of this community are usually smaller in size, generally less than a few hundred acres. This type of habitat varies with the type of vegetation that dominates it. This can include trees such as cypress, shrubs like buttonbush and herbaceous species that include cattails, pickerelweed, soft rush and grasses.

This community is associated with nearly level land with somewhat poorly to very poorly drained and generally coarse textured soils or organic surfaces underlain with clay or sand. In the historic watershed, it could have occurred on the following soils: Basinger, Holopaw and Samsula soils (5), Chobee fine sand (10), Floridana fine sand (17), Immokalee fine sand (21), Saint Johns fine sand (46) or Winder fine sand (60).

As previously stated, this community type can exist in many different versions depending on the kinds of vegetation that dominates it. This can be the canopy, shrub or groundcover layer. If the canopy is main feature, it is usually dominated by pond cypress (*Taxodium ascendens*). If a shrub layer exists, it will generally be dominated by buttonbush (*Cephalanthus occidentalis*). The groundcover would consist of vegetation such as water horehound (*Lycopus rubellus*), pickerelweed (*Pontederia cordata*), maidencane (*Panicum hemitomon*) or dotted smartweed

(*Polygonum punctatum*). If the shrub layer is dominant, it usually consists of buttonbush. If the herbaceous layer is the major component, it is generally one of eight major types depending on the dominant species. This could be pickerelweed, sawgrass (*Cladium jamaicense*), arrowhead (*Sagittaria* species), fire flag (*Thalia geniculata*), cattails, spikerush (*Eleocharis* species) or maidencane.

Many animals can be found in these habitats and many of them will be large mammals. Typical animals include white-tailed deer, marsh rabbit (*Sylvilagus aquaticus*), bobcat, river otter (*Lutra canadensis*) and raccoon. The herbaceous habitats, in particular, will be important feeding areas for long-legged wading birds such as herons, egrets, ibis, wood stork (*Mycteria americana*), and roseate spoonbill (*Ajaia ajaja*). This is especially true for the last two species, since they feed by touch and therefore need shallow areas to hunt in. In terms of reptiles and amphibians, these areas are important as well. For many of the small treefrogs and salamanders, a relatively predator-, or at least fish-, free environment can be found in the ephemeral ponds that completely dry up at some point in the year, typically the winter.

## 8.2.2.3 Wetland Hardwood Hammock

This community type is commonly found scattered throughout Florida with the exception of the Central Florida Ridge. Some areas of this community can be smaller in size, but those areas associated with riverine floodplains can be quite large. Like its upland counterpart, this is considered a climax community type for Florida and most of the southeastern United States. Once attained, this community will be self-sustaining, provided it is left unaltered by humans or catastrophic natural occurrences such as hurricanes or wildfire.

This community occurs on level to nearly level land. The soils are typically deep, poorly to somewhat poorly and generally underlain with loamy subsoils. Surface soils are usually sandy in nature. In the historic watershed, it could have occurred on the following soils: Basinger, Holopaw and Samsula soils (5), Chobee fine sand (10), Felda fine sand (15), Floridana fine sand (17), Wabasso fine sand (57) or Winder fine sand (59).

Oaks, primarily live, laurel and water (*Quercus niger*), red maple (*Acer rubra*), slash pine, cabbage palm, sweetbay magnolia (*Magnolia virginiana*) and sweetgum dominate the canopy. Because this is a climax community and typically has a dense canopy, the subcanopy layer can be quite sparse in large areas. Where vegetation does exist it could have contained waxmyrtle, coral bean, saw palmetto, dwarf palmetto (*Sabal minor*) and sparkleberry (*Vaccinium arboretum*) along with saplings of the canopy species. Groundcover could also be sparse but could have contained asters, switchgrasses, various greenbriers, trumpet creeper (*Campsis radicans*) and numerous species of ferns (*Woodwardia, Osmunda, Blechnum* and *Thelypteris*).

Due to the stable habitat, many animals can be found and many of them will be large mammals. Typical animals include white-tailed deer, cotton rat, gray squirrel, bobcat, wild hog (*Sus scrofa*) and raccoon. Historically, this area would have been prime habitat for the Florida black bear (*Ursus americanus*) and the Florida panther (*Felix concolor*). Because the large variety of trees and plants that generate a large supply of food, this habitat type is very important for migratory songbirds and could include myrtle warbler, red-eyed vireo (*Vireo olivaceous*), scarlet tanager (*Piranga olivacea*) and various woodpeckers. Normally occurring reptiles and amphibians would have included eastern diamondback rattlesnake, indigo snake, various watersnakes (*Nerodia* species) and numerous frogs and toads.

## 8.2.2.4 Slough

This ecological type is found primarily in central and south Florida and can vary greatly in size. Sloughs are generally found within other large habitat types and serve as connecting ways between wetlands. Like the coastal strand, they are primarily long and narrow, linear systems. The connection can be either forested or non-forested.

This community is associated with nearly level land with somewhat poorly drained and generally coarse textured soils. In the historic watershed, sloughs could have occurred on the following soils: Felda fine sand (15), Malabar fine sand (27), Wabasso fine sand (57) or Winder fine sand (59).

As previously stated, this community type can be forested or non-forested. If forested, the edge of the slough is lined with cypress or slash pine depending on the community type it is occurring in or connecting. If a shrub layer exists, buttonbush, waxmyrtle or Saint Johnswort (*Hypericum* species), will generally dominate it. The groundcover would consist of vegetation such as pickerelweed, dwarf sundew (*Drosera brevifolia*), meadowbeauties (*Rhexia* species), milkworts (*Polygala* species) and yellow-eyed grass (*Xyris* species). However, grasses and sedges generally dominate with species such as maidencane, switchgrasses, threeawns, spikerushes, beakrushes (*Rhynchospora* species) and flatsedges (*Cyperus* species).

Many animals can be found in these habitats that are typical of the habitats the sloughs occur in. Typical animals include white-tailed deer, marsh rabbit, cotton rat, armadillo and raccoon. The herbaceous habitats, in particular, will be important feeding areas for long-legged wading birds such as herons, egrets, ibis, wood stork and roseate spoonbill. In terms of reptiles and amphibians, these areas are important as well. For many of the small treefrogs and salamanders, a relatively predator-, or at least fish-, free environment can be found in the sloughs that completely dry up at some point in the year, typically the winter.

## 8.2.2.5 Mangrove Swamp

This ecological type is found in coastal central and south Florida and reaches its northern limit in the Tampa Bay area on Florida's West Coast. Like sloughs and coastal strand, in this area they are primarily long and narrow, linear systems. In southern Florida, they can form extensive systems of islands and coastal fringing wetlands.

Mangrove swamps are associated with level land on very poorly drained and generally fine textured soils. In the historic watershed, these wetlands could have occurred on Kesson muck (24) or Myakka fine sand (30).

Mangrove swamp is a highly stratified community. Red mangrove (*Rhizophora mangle*) is normally the most waterward of the four typical "mangrove" species. Landward of the red mangrove band is a band of black mangrove (*Avicennia germinans*). Still landward of the black mangroves is the white mangrove (*Laguncularia racemosa*). Finally on the landward edge of the mangrove forest is the "mangrove", buttonwood (*Conocarpus erectus*). This final tree is not a true mangrove. Groundcover would consist of vegetation such as leatherfern (*Acrostichum aureum*), sea oxeye daisy (*Borrichia frutescens*) and sea purslane (*Sesuvium portulacastrum*).

Mammals found in this habitat are generally the same as those found in the coastal strand habitat. Birds would also be typical of the coastal strand, with shorebirds and long-legged waders along with gulls and terns. The mangrove watersnake (*Nerodia clarkii*) is a unique reptile that can be found only in this habitat. This habitat serves as an important breeding and/or nursery area in the life cycle of many marine animals, such as, shrimp, snook, redfish, crabs etc.

## 8.2.2.6 Open Water

This ecological type is found in throughout Florida and includes natural lakes, ponds and seasonal water features. The size of these communities can vary from a few hundred square feet to several hundred acres.

Because of the varied nature of the community, there is no typical landscape or soil type associated with open water. They commonly occur in almost all of the system types discussed in the previous sections.

Vegetation on the immediate edge of the system will vary with the type of community the open water is found in. In the open water itself numerous aquatic plants could be found including waterlilies (*Nymphea* species), pondweeds (*Potamogeton* species), various spikerushes, lemon bacopa (*Bacopa caroliniana*) and bladderworts (*Utricularia* species).

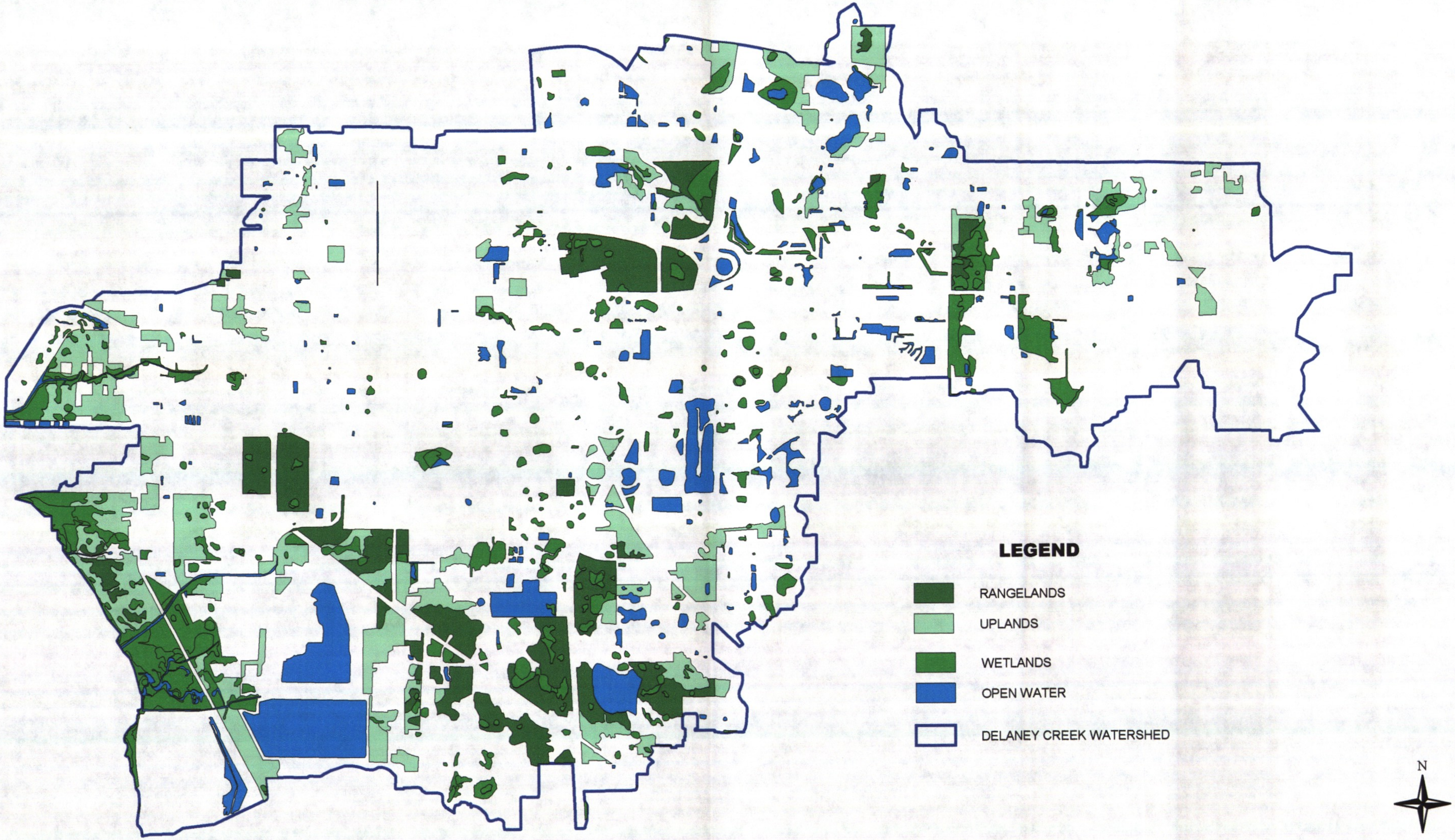
Mammals found in this habitat are generally the same as those found in adjacent habitats and use the open water as a source of drinking water or an area to breed. Birds would also be typical of the areas of open water with shorebirds and long-legged waders along with gulls and terns. Reptiles would include watersnakes, numerous species of turtles and the American alligator (*Alligator mississippiensis*). This habitat serves as an important area in the life cycle of many amphibians such as frogs, toads and salamanders.

# 8.3 EXISTING HABITAT TYPES

Degradation caused by the impacts to these natural systems affects the quality of life of all the citizens in, and in some cases, outside the watershed. These impacts may affect potable water supply, recreational resources and quite possibly the climate of the Tampa Bay area. It is therefore in the best interest of the community to preserve, enhance and restore natural systems within the watershed to historic or near historic levels. If natural systems are to be preserved, the first step has to be the identification and quantification of each system. Next, issues and areas of concern must be identified for each of the systems involved and from their possible solutions for improvements can then be explored.

This section identifies the remaining wetland and upland natural systems in the Delaney Creek Area watershed and describes the flora and fauna that can be expected to occur in each of the habitat types. Figure 8-2 depicts the natural systems that can be found in the watershed.

Approximately 27.61% or 5,949.42 acres of the watershed's 21,548.80 acres have not yet been developed. This acreage includes wetlands, uplands and open water. Of this total, 1,152.68 acres or 5.35% of the watershed is considered open water and consists of bays and estuaries, lakes, reservoirs, streams and waterways. As can be seen from Table 8.2 below, this is the only land cover that has increased in acreage from 363.15 to 1,152.67 acres.




Hillsborough County
Florida

Department of Public Works
Engineering Division
Stormwater Management Section

**DELANEY CREEK AREA**
**STORMWATER MANAGEMENT**
**MASTER PLAN**
**SEPTEMBER 2000**

FIGURE 8-2

**DELANEY CREEK AREA**
**EXISTING HABITAT**
**MAP**

**Table 8.2**
**Existing Natural Systems Land Cover Distribution in the Delaney Creek Area Watershed**

| FLUCCS CODE | LAND COVER TYPE | ACRES | % OF NATURAL SYSTEMS | % OF WATERSHED |
|---|---|---|---|---|
| **310** | Herbaceous | 7.001 | 0.117 | 0.032 |
| **320** | Shrub and Brushlands | 809.251 | 13.602 | 3.755 |
| **330** | Mixed Rangelands | 258.654 | 4.347 | 1.200 |
| **410** | Upland Coniferous Forests | 240.667 | 4.045 | 1.116 |
| **411** | Pine Flatwoods | 706.378 | 11.873 | 3.278 |
| **420** | Upland Hardwood Forests | 18.990 | 0.318 | 0.088 |
| **434** | Hardwood - Conifer Mixed | 1309.064 | 22.003 | 6.075 |
| ***Upland Subtotals*** | | ***3350.005*** | ***56.305*** | ***15.544*** |
| **510** | Streams and Waterways | 14.358 | 0.241 | 0.067 |
| **520** | Lakes | 92.903 | 1.562 | 0.431 |
| **530** | Reservoirs | 998.456 | 16.782 | 4.634 |
| **540** | Bays and Estuaries | 46.951 | 0.788 | 0.218 |
| ***Water Subtotals*** | | ***1152.668*** | ***19.373*** | ***5.350*** |
| **612** | Mangrove Swamps | 54.467 | 0.916 | 0.253 |
| **615** | Stream and Lake Swamps | 139.741 | 2.348 | 0.648 |
| **620** | Wetland Coniferous Forests | 3.385 | 0.056 | 0.016 |
| **621** | Cypress | 9.063 | 0.152 | 0.042 |
| **630** | Wetland Forested Mixed | 183.776 | 3.088 | 0.853 |
| **641** | Freshwater Marshes | 520.564 | 8.750 | 2.416 |
| **642** | Saltwater Marshes | 272.163 | 4.575 | 1.263 |
| **643** | Wet Prairies | 174.255 | 2.928 | 0.809 |
| **644** | Emergent Aquatic Vegetation | 69.140 | 1.162 | 0.321 |
| **651** | Tidal Flats | 10.926 | 0.184 | 0.051 |
| **653** | Intermittent Ponds | 9.267 | 0.155 | 0.043 |
| ***Wetland Subtotal*** | | ***1446.747*** | ***24.314*** | ***6.715*** |
| **TOTAL** | | **5949.420** | **99.992 %** | **27.609** |

This 217.41% increase is due to the creation of all the borrow pits/reservoirs in the watershed. Open water represents 19.37% of the natural systems area. Forested and non-forested wetland acreage comprises 24.31% of the natural systems area and 6.72% of the total watershed area. Wetlands have undergone a 58.17% decrease from a historic high of 3,458.98 acres to a low of 1,446.75 acres. Finally, uplands total 3,350.01 acres, which translates to 15.54% of the watershed area and 56.31% of the natural systems. Uplands had the largest percent decrease for the natural systems with a 79.28% reduction of total upland area, falling

from a historic total of 16,168.83 acres. This information is summarized and further broken down in Table 8.2.

Of these losses, residential land uses have contributed the most with 22.63% or 4,876.14 acres converted from natural systems. Combined commercial, institutional, light industrial and highway/utility land uses destroyed 17.57% of the original watershed area or 3,786.56 acres. Close behind is agricultural land uses, which transformed 17.32% of the watershed area or 3,732.45 acres. Open land use, undeveloped land in the urban landscape, accounts for approximately 2,255.76 acres or 10.47% of the watershed's losses. Mining and areas disturbed by mining activities, either directly or indirectly, affects 803.31 acres or 3.73% of the watershed. Finally, 0.67% of the watershed or 145.16 acres have been changed to recreational land uses.

## 8.3.1 EXISTING UPLAND HABITAT

The descriptions of the following habitat types are based on information found in the Florida Land Use, Cover and Forms Classification system, generally referred to as FLUCCS codes. Information from the Florida Chapter of the Soil and Water Conservation Society's publication, *26 Ecological Communities of Florida* is also used. Upland natural systems presently cover approximately 15.54 % of the watershed's total area, which equates to about 3,350.01 acres. This acreage is divided into non-forested systems, primarily rangelands and forested systems, both coniferous and hardwoods or a mixture of both.

### 8.3.1.1 Rangelands

Rangeland is defined as land on which the vegetation is dominated by a combination of grasses, sedges, forbs and shrubs. The land is commonly used for agricultural purposes, primarily for the grazing of livestock. In general, little is done to alter or "improve" the land; management practices usually include brush control, regulation of grazing intensity and rotation of field use. These practices are designed to increase the grass production on the land.

#### 8.3.1.1.1 Herbaceous Rangelands

This rangeland type is found in the extreme north-central portion of the watershed and only occupies an area of 7.00 acres. This translates to 0.12% of the natural systems area and 0.03% of the total watershed area. Historically, this area occurred in an area of longleaf pine – turkey oak habitat. Herbaceous rangelands are generally dominated by prairie grasses and can be found the uplands adjacent to wetland habitats. In wetter areas, tree and shrub establishment is retarded and grasses, sedges, rushes and forbs will dominate. In drier areas, shrubs and more upland type grasses can be found including wiregrass and saw palmetto.

## 8.3.1.1.2 Shrub and Brushland Rangelands

This rangeland type is found mostly in three large areas around the watershed. The first area is along the coast in the southwest portion of the watershed. The second is in the south-central portion of the basin. A third area can be found east of Interstate 75 around the Crosstown Expressway. Several other smaller areas also exist, scattered throughout. Combined, these areas contain about 809.25 acres. This totals 13.60% of the natural systems area and 3.76% of the total watershed area. As the name implies, shrub and brushlands are generally dominated by shrubby vegetation depending on whether the area is coastal or inland in nature. Historically, this area occurred primarily in areas of pine flatwoods habitat and is many times the result of the removal of the canopy from this type of system. Because of this, the dominant plant species is generally saw palmetto. The species composition of the vegetation is largely fire-dependent. When fire is suppressed, the system will, through natural succession, become forested again. If the burns occur on a regular cycle of four to five years, the saw palmetto can become the dominant species and form a dense monoculture. If the system burns on a more frequent basis than this, the grasses and other herbaceous vegetation will become the dominant species. In coastal areas, the vegetation can include sea grape (*Coccoloba uvifera*), sea oats (*Uniola paniculata*) and railroad vine. Inland area vegetation will include saw palmetto, wax myrtle and gallberry with a groundcover of grasses and sedges. Other vegetation that can be expected to be found are ruderal or pioneering species such as wax myrtle, saltbush or groundsel tree (*Baccharis* species), gallberry, Brazilian pepper (*Schinus terebinthifolius*), air potato (*Dioscorea bulbifera*), sweet white clover (*Melilotus indica*), Caesar’s weed (*Urena lobata*), ragweed (*Ambrosia artemisiifolia*), bluestem grasses, smutgrass (*Sporobolus indicus*), bahia grass (*Paspalum notatum*), grape vine (*Vitis* species), morning glories (*Ipomea* species), sandspurs (*Cenchrus* species), dog fennel (*Eupatorium* species), blackberries (*Rubus* species) and Spanish needles (*Bidens alba*).

Mammals expected to be found in this habitat include opossum, nine-banded armadillo, raccoon and hispid cotton rat.

Birds that could be anticipated to be found are year round or resident species such as northern cardinal (*Cardinalis cardinalis*), northern mockingbird (*Mimus polyglottos*), mourning dove, eastern towhee, common yellowthroat (*Geothlypis trichas*), white-eyed vireo, turkey vulture (*Cathartes aura*), Carolina wren (*Thryothorus ludovicianus*), loggerhead shrike (*Lanius ludovicianus*) and red-tailed hawk (*Buteo jamaicensis*). Other species such as palm warbler (*Dendroica palmarum*), yellow-rumped or “Myrtle” warbler and gray catbird (*Dumetella* *carolinensis*) could be expected in spring and fall during their migration or as overwintering species.

#### 8.3.1.1.3 Mixed Rangeland

This plant community occupies 258.65 acres within the watershed area, comprising approximately 4.35% of the natural areas and 1.2% of the total watershed. The majority of the acreage is in the west central portion of the basin. These areas are in historic pine flatwoods habitat. This community is found where there is a mixture of grassland and shrub and brushland plant species, but none of them dominate. If more than one-third of the area is composed of either of the two community types, the area is classified as Mixed Rangeland. Plants and animals will be similar to those found in the either of the two community types and will vary with habitat quality.

### 8.3.1.2 Upland Forests

These plant communities are characterized by being non-wetland in nature and supporting forested systems with greater than 10% canopy closure. Upland forests can be further subdivided into xeric or dry and mesic or moderately moist habitats. If 66% or more of the total canopy can be attributed to one particular species or group of species, it can be given its own category type, i.e. sand pine or xeric oak. The upland forest category can include tree plantations for commercial use as well as many recreational areas. Within the Delaney Creek Area watershed, upland forests cover just over 2,275 acres. This translates to 38.24% of the natural systems area or 10.56% of the total watershed area. This acreage is divided between coniferous forest, pine flatwoods, hardwood forest and hardwood mixed conifer classifications. As demonstrated in Table 8.3, pine flatwoods historically covered around 11,084 acres in the watershed; this is almost ten times the amount the coverage for the next largest category. Pine flatwoods covered over 51 % of the historic watershed. This coverage was reduced by almost 94%, to the 706.38 acres that exist today. The bulk of this acreage is in the western two-thirds of the watershed. As Table 8.3 demonstrates, almost 80% of the original upland habitats have been lost to development in the watershed.

**Table 8.3**
**Land Cover Changes in the Delaney Creek Area Watershed**

| AGGREGATE TYPE | LAND COVER TYPE | HISTORIC ACRES | EXISTING ACRES | % CHANGE |
|---|---|---|---|---|
| **RANGELANDS** | Herbaceous | --- | 7.001 | --- |
| | Shrub and Brushlands | --- | 809.251 | --- |
| | Mixed Rangelands | --- | 258.654 | --- |
| **UPLANDS (16168.83 ACRES)** | Upland Coniferous Forest | --- | 240.667 | --- |
| | Pine Flatwoods | 11084.94 | 706.378 | - 93.63 |
| | Upland Hardwood Forest | 1441.21 | 18.99 | - 98.68 |
| | Sand Pine Scrub | 141.78 | 0.000 | - 100.00 |
| | Hardwood-Conifer Mixed | 3500.90 | 1309.064 | - 62.61 |
| | **Subtotal** | **16168.83** | **3350.005** | **- 79.28** |
| **WETLANDS (3458.98 ACRES)** | Mangrove Swamps | 607.97 | 54.467 | - 91.04 |
| | Stream and Lake Swamps | --- | 139.741 | --- |
| | Wetland Coniferous Forest | --- | 3.385 | --- |
| | Cypress | --- | 9.063 | --- |
| | Wetland Mixed Forest | --- | 183.776 | --- |
| | Freshwater Marshes | --- | 520.564 | --- |
| | Saltwater Marshes | --- | 272.163 | --- |
| | Wet Prairies | --- | 174.255 | --- |
| | Emergent Aquatic Vegetation | --- | 69.140 | --- |
| | Tidal Flats | 122.34 | 10.926 | - 91.07 |
| | Intermittent Ponds | --- | 9.267 | --- |
| | **Subtotal** | **3458.98** | **1446.747** | **- 58.17** |
| **OPEN WATER (363.15 ACRES)** | Streams and Waterways | | 14.358 | --- |
| | Lakes | 363.15 | 92.903 | - 74.42 |
| | Reservoirs | --- | 998.456 | --- |
| | Bays and Estuaries | --- | 46.951 | --- |
| | **Subtotal** | **363.15** | **1152.668** | **+ 217.41** |
| **UNDEFINED (1557.84 ACRES)** | Undefined Community | **1557.84** | 2255.762 | + 48.69 |
| **21548.80 acres** | **TOTAL** | **21548.80 *** | **5949.42 **** | **- 72.39** |

* Total of all **bolded** subtotals
** Does not included undefined lands (open land); only a total of uplands, wetlands and water.

### 8.3.1.2.1 Upland Coniferous Forest

In this land cover type, if the natural forest stand has a canopy that is composed of at least 66% coniferous trees, it will qualify as upland coniferous forest. This does not include pine tree farms, which are not natural communities and have their own category of tree plantation. As with the shrub and brushland community, this natural system type, especially its groundcover and shrub layers, is fire dependent.

While the slash and longleaf pines that dominate these systems are fairly fire resistant, if they do not burn on a regular basis of every 1 to 8 years, hardwoods such as the various oaks, can take hold and begin to dominate and change the system's species composition. Slash pine, which is the less fire resistant of the two, inhabits the moister upland areas. It has been found that the cones of slash pine open better when subjected to heat such as that given off by a fire. Because of this, slash pine is sometimes considered fire dependent rather than resistant. The drier areas are occupied by longleaf pine due to its higher resistance to fire. With the advent of modern agricultural methods that favor the creation of monocultures that are easily managed when compared to mixed natural systems, slash pine has become the dominant species in coniferous systems due to its ease of cultivation. A little over 240 acres of forest fall into this land use designation within the Delaney Creek Area watershed. This constitutes about 4.05% of the natural systems area and 1.12% of the watershed's total acreage. This acreage is scattered throughout the watershed.

Vegetation that can be expected to make up the canopy of upland coniferous forests include longleaf and slash pines, with to a minor extent, various oaks, loblolly bay, sweet gum and hickories (*Carya* species). While subcanopies generally are absent in this system type, if present, they would mainly be made up of saplings of the canopy species. The shrub layer could contain saw palmetto, saltbush, wax myrtle, gallberry and various shrubs in the blueberry family (*Lyonia* and *Vaccinium* species). Groundcover species could include bluestem grasses, sandspurs, dog fennel, blackberries, pineland goldenrod (*Solidago fistulosus*), blueberries (*Vaccinium darrowii* and *V. myrsinites*), pennyroyal (*Piloblephis rigida*), deertongue (*Carphephorus corymbosus*), narrow-leaf sabatia (*Sabatia brevifolia*), wiregrass and candyweed (*Polygala lutea*).

Expected mammals would include opossum, nine-banded armadillo, raccoon, gray squirrel, hispid cotton rat, and evening bat (*Nycticeius humeralis*).

Resident birds would include northern cardinal, northern mockingbird, mourning dove, eastern towhee, common yellowthroat, white-eyed vireo, red-tailed hawk, turkey vulture, downy woodpecker (*Picoides pubescens*), red-bellied woodpecker (*Melanerpes carolinus*), great horned owl (*Bubo virginianus*), pine warbler, great crested flycatcher (*Myiarchus crinitus*) and northern bobwhite (*Colinus virginianus*). Other species such as palm and “Myrtle” warblers, thrushes (*Catharus* species), Carolina chickadee (*Parus carolinensis*), tufted titmouse (*Parus bicolor*) and gray catbird could be expected in spring and fall during their migration or as overwintering species.

### 8.3.1.2.2 Sand Pine Scrub

This vegetative community, described in the historic section above, has been eliminated from the watershed. With its well-drained soils, sand pine areas are one of the first areas to be developed for citrus production. In coastal areas, scrub is especially vulnerable to residential development, as are inland areas.

### 8.3.1.2.3 Pine Flatwoods

As previously discussed, this community was once the dominant type in the watershed covering just a little more than half its area. Presently, flatwoods occupy 706.38 acres, which translates into 11.87% of the natural systems or 3.28% of the total basin’s area. As with some of the upland coniferous forest, this is a fire dependent community. This community was discussed in the historic section above and the present day systems will have the same plant and animal species composition as those discussed there.

### 8.3.1.2.4 Upland Hardwood Forest

This type of upland forest is dominated by, as the name implies, has a canopy made up of at least 66% hardwoods. Hardwoods include, but are not limited to oaks, maple, hickories and magnolias. Hardwood plantations, which have a category of their own, are not included in this group - only natural systems qualify. Only 18.99 acres of this ecosystem can be found in the eastern portion of the watershed. This is less than 1% of both the natural systems and total watershed area. Historically, approximately 1,440 acres of this habitat existed; therefore, the loss to the watershed has been over 98%. As with the pine flatwoods habitat, the present day systems should be composed of the same flora and fauna that was found in the historic habitat.

### 8.3.1.2.4 Hardwood-Conifer Mixed Forest

This community type is not dominated by the required 66% of either hardwoods or conifers. A total of 1309.06 acres of this ecosystem occurs in the watershed. This amounts to around 22% of the natural systems area and just over 6% of the entire watershed. The larger areas of hardwood conifer mixed forest can be found in the western third of the basin; however, the acreage is scattered throughout the watershed. Most of this type occurs in area of pine flatwoods and probably included the historic areas of longleaf pine-turkey oak habitat in the watershed. Assuming this is true, there has been a 62% loss of this habitat type in the basin.

The plants and animals found in this ecosystem would be expected to be a combination of those that would be found in both coniferous and hardwood systems.

## 8.3.1.3 Open Water

This is another type of non-vegetated "wetland". Most of the open water portions of lakes, swamps, etc. would not qualify under the state's definition of a wetland. These areas fall under the category of Waters of the State and would receive protection under those regulations.

This land use category is generally defined as those areas that are predominately or persistently cover with water and if linear in nature must be at least one-eighth of a mile (660 feet) wide or, if extended, cover at least 40 acres. FLUCCS codes do routinely classify waterbodies that are ten acres or less. Open water occupies 1152.67 acres in the Delaney Creek Area watershed. This amounts to 19.37% of the natural systems or 5.35% of the total basin area. This habitat type has had a net increase in the watershed from a historic low of 363.15 acres to the present day total of 1,152.67 acres. This represents an increase of over 217%. The bulk of this increase is in the reservoir category with an increase of about a thousand acres.

### 8.3.1.3.1 Streams and Waterways

This category includes the natural systems of rivers, creeks, canals and other linear waterbodies that do not have their course interrupted by control structures. If control structures exist, the waterbody is included in the reservoir land use category. In the watershed, this system type occupies 14.36 acres, which is less than 1% of both the watershed and natural systems totals. This land cover type applies to only the non-tidal portions of the creeks in the watershed; the tidal portions of the creeks fall into the Bays and Estuaries FLUCCS codes.

Vegetation that would be expected in this habitat would include red maple, Coastal Plains willow, wax myrtle, Brazilian pepper, primrose willow, cattails, umbrella pennywort, paragrass, spreading dayflower, various flat sedges and softrush.

Faunal usage would be expected similar to those species common to freshwater marshes and lakes. In addition, they would include species from the habitat type that the stream runs through, as this would be the most likely source of drinking water for those animals.

## 8.3.1.3.2 Lakes

This habitat type is characterized as large, non-flowing, natural areas of permanent water. As discussed in the previous section, the FLUCCS system separates the vegetated portion of a lake into a separate wetland category depending on the species composition. As discussed in the previous chapter, there are several smaller lakes contained in the watershed. These range in size from the 26-acre Hickory Hammock Lake to the 11-acre Lake Clayton. These lakes serve as important areas for the wildlife of the watershed. Within the watershed lakes occupy 92.90 acres, which translates into 1.56% of the natural systems area and 0.43% of the total watershed area. According to the historical data, there has been a 74.42% reduction in the areal coverage of lakes from the pre-1900 figure of 363.15. This loss has undoubtedly occurred in the smaller lakes of the watershed.

Trees that can be expected to be found include pond cypress, Coastal Plains willow, laurel oak, red maple, live oak, sweet gum and slash pine. Shrubs include primrose willow, Mexican seedbox (*Ludwigia octovalvis*), wax myrtle and saltbush. Herbaceous vegetation includes cattails, umbrella pennywort, sacred lotus (*Nelumbo nucifera*), spatterdock, fragrant waterlily (*Nymphaea odorata*), pickerelweed and duck potato.

Faunal species will be similar to those species found in freshwater marshes and to some extent, the forested wetland systems.

## 8.3.1.3.3. Reservoirs

As stated in the introduction to this section, reservoirs have increased dramatically in the watershed. Much of this land use is in residential areas, where the waterbody was created as an amenity. They may also have been used as a source of fill for house pads, road construction and other similar uses. They now occupy 998.46 acres in the watershed, and they cover about 16.782% of the natural systems area and 4.63% of the total watershed area. Many of these areas serve to treat stormwater, either by design or accident.

Floral and faunal components will be similar to those found in lakes and freshwater marshes.

### 8.3.1.3.4 Bays and Estuaries

These areas are defined as those inlets or arms of the sea that extend into the land and are included within the landmass of the State of Florida. Embayments less than one nautical mile are classed as Streams and Canals. They can be future subdivided by the waterbody (ocean) into which they empty directly into. The creeks in this watershed all outfall indirectly into the Gulf of Mexico. Like the mangrove forest and saltmarshes, these are important areas for breeding and nurseries of many finfish and shellfish. For this and other reasons, the Tampa Bay Estuary Program has also targeted the oligohaline sections of these streams as important areas to be restored to promote the health of the Bay. Included in the 46.95 acres of this habitat are the tidally influenced portions of the watershed's creeks.

## 8.3.1.4 Wetlands

Wetlands are those areas, typically associated with topographic lows and a water table at or near the soils surface, where there is sufficient hydrologic regime to support, in most cases, aquatic or hydrophytic flora. However, unvegetated wetlands can exist in the form of alluvial or tidal flats. Wetland areas with permanent pools of open water are considered water by FLUCCS and are not included in this category.

The definition of a wetland for the State of Florida as found in 373.019 (17) Florida Statutes reads "… *those areas that are inundated or saturated by surface water or ground water at a frequency and a duration sufficient to support, and under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soils. Soils present in wetlands generally are classified as hydric or alluvial, or possess characteristics that are associated with reducing soil conditions. The prevalent vegetation in wetlands generally consists of facultative or obligate hydrophytic macrophytes that are typically adapted to areas having soil conditions described above. These species due to morphological, physiological, or reproductive adaptation, have the ability to grow, reproduce or persist in aquatic environments or anaerobic soil conditions. Florida wetlands generally include swamps, marshes, bayheads, bogs, cypress domes and strands, sloughs, wet prairies, riverine swamps and marshes, hydric seepage slopes, tidal marshes, mangrove swamps and other similar areas. Florida wetlands generally do not include longleaf or slash pine flatwoods with an understory dominated by saw palmetto.*" As can be seen from Table 8.3, almost 60% of the watershed's wetlands have been developed since 1900, from a high of 3,458.98 acres down to the present-day total of 1,446.75.

### 8.3.1.4.1 Forested Wetlands

All the forested wetland areas combined total 390.43 acres. In terms of percent cover of the natural systems, this equates to 6.56% and 1.81% of the watershed. These areas serve as carbon sinks, storing $CO_2$ in the form of cellulose – the structural tissue of plants. Many of the forested wetlands in the watershed have been logged in the earlier part of this century. Cypress was especially sought due to its natural resistance to rot and insect attack. These areas are especially important to migrating birds that use these types of wetlands as a stopover point for food, water and temporary shelter.

### 8.3.1.4.2 Mangrove Forest

This coastal ecosystem is found on the western edge of the watershed adjacent to Tampa Bay. Historically mangroves covered around 607 acres of the watershed. In today's basin this has been reduced by over 91% to only 54.47 acres. Mangrove forests are formed by three or four different species that are grouped together more because of habitat or ecological preference than by a genuine evolutionary link. These species usually grow in specific zones, depending primarily on the way the seeds are distributed. The red mangrove has a seed that germinates while still attached to the tree and forms a long cigar-shaped seedling about a foot long. It drops into the water and embeds itself or begins to float perpendicular to the seafloor until it contacts suitable substrate where it attaches and begins growing. This is the mangrove that forms the outer or seaward edge of the mangroves and is typically seen growing on aerial roots that look like stilts. These roots trap debris and begin to form small islands that are suitable for the next species, black mangrove, to grow on. The black mangrove is the most common species of the "mangroves" found in Florida. It has a round, flat seed about an inch and a half to two inches in diameter. The seed will beach itself and sprout at the water's edge, generally just behind the red mangroves. This mangrove can be identified by its distinctive pneumatophores, or breathing roots, that can be found coming up through the soil from underneath the trees. Behind both these species, the white mangroves grow. This species has no special root adaptations like the previous two trees, only special salt excreting gland found in the leaves. It will rarely produce pneumatophores like the black mangrove. Finally in the most landward zone, the buttonwood occurs. This tree is in the same family as the white mangrove and does not always occur in mangrove forests. It is a common misconception that mangroves are saltwater plants. Actually, they can and will grow in freshwater; however, they do not compete as well in that environment as they do in saltwater. These trees are just better adapted to living in a salt environment than most other woody plants. The red mangrove is highly efficient in preventing salt from entering its roots. The black and white mangroves, on the other hand, are very proficient at removing salt that has entered their tissues. The plants and animals found in the historic watershed would, for the most part, be expected to be found in the present-day areas.

### 8.3.1.4.3 Stream and Lake Swamps

This community type is also referred to as bottomland and is generally restricted to flowing wetland systems. Because of this, it is commonly impacted as a result of flood control projects. These projects typically result in the channelization of the stream portions which are then routinely maintained. The side slopes are usually well maintained as well to allow easy access for equipment and this leads to the depauperization of these areas. Canopy species are primarily hardwoods with a minor coniferous component, usually cypress. This land use category occupies just over 139.74 acres in the basin which means that it covers just a little over 2% of the natural systems area and less than 1% of the total watershed area.

Hardwoods that would be expected in the canopy would be red maple, sweet gum, laurel and water oaks, sweetbay, Coastal Plains willow (*Salix caroliniana*), tupelo or black gum (*Nyssa biflora*) and green ash (*Fraxinus caroliniana*). Conifers in the canopy would include bald cypress and slash pine. The subcanopy's expected species would include primrose willow, buttonbush, wax myrtle, St. Johnsworts, fetterbush (*Lyonia lucida*) and elderberry (*Sambucus canadensis*). Groundcover species would include cinnamon fern (*Osmunda cinnamonea*), climbing aster (*Aster carolinianus*), Virginia chain fern (*Woodwardia virginica*), bog hemp (*Boehmeria cylindrica*), wild taro (*Colocassia esculentum*), swamp lily (*Crinum americanum*), water hoarhound and horned beakrush (*Rhynchospora inundata*).

### 8.3.1.4.4 Wetland Coniferous Forest

This wetland community is dominated by at least 66 % coniferous tree species and is of natural origin. Again, coniferous tree plantations would have a separate classification. They are frequently found in the interiors of other wetland types such as riverine systems, bogs or sloughs. Slash pine is frequently found on the upland side of this type of system. Along with all the other wetland communities, wetland coniferous forests are a very important component of the natural stormwater management system in both treating and storing run-off. In the Delaney Creek Area watershed, this land cover type occupies only 3.39 acres or 0.06% of the natural systems and 0.02% of the total watershed area.

In addition to the coniferous species, the canopy could contain numerous hardwoods. In riverine systems, Carolina ash, red maple, American elm, swamp tupelo and sweetbay would be expected. The subcanopy would include saplings of these species in addition to dahoon holly

(*Ilex cassine*), hornbeam or musclewood (*Carpinus caroliniana*) and red bay (*Persea palustris*). The shrub layer could include buttonbush, wax myrtle, highbush blueberry (*Vaccinium corymbosum*) and various St. Johnsworts. Understory vegetation typically includes water hoarhound, cinnamon fern, royal fern (*Osmunda regalis*), Virginia chain fern, netted chain fern (*Woodwardia areolata*), swamp fern (*Blechnum serrulatum*), swamp milkweed (*Asclepias perrenis*), bog hemp, warty sedge (*Carex verrucosa*), shiny chasmanthium (*Chasmanthium nitidum*) and stiff marsh bedstraw (*Galium tinctorium*).

With the exception of the Florida black bear and Florida panther, the faunal species would be similar to those described in the historic wetland hardwood hammock described above.

## 8.3.1.4.5 Cypress Forests

This forested system can be dominated by either of the two species of cypress, pond or bald. Pond cypress is generally found in the isolated cypress “dome” systems, which are generally found within pine flatwoods or wet prairies. In the case of cypress domes, cypress is usually the only tree species found. Bald cypress can be found primarily in the riverine systems and is found in association of other hardwoods. At this time there is some debate as to whether these two trees are independent species or whether they are two subspecies. This habitat covers only about 9.06 acres, which translates to 0.15% of the natural systems area and 0.04% of the total watershed area. The three small areas of cypress in the watershed can be found to the north of the intersection of U.S. Highway 301 and Interstate 75.

Floral and faunal species would be expected to be similar to those for wetland coniferous forests.

## 8.3.1.4.6 Wetland Forested Mixed

As with the upland mixed forests, in this community, the canopy does not attain the required 66 % coverage by either conifers or hardwoods. Due to this mixture of conifers and hardwoods, this is an especially rich environment in terms of food; shelter and nesting for the many animals that are its inhabitants. This habitat is frequently found in floodplains of rivers and streams. In the Delaney Creek Area watershed, this community can be found scattered throughout the watershed on 183.78 acres or 3.09% of the natural systems and 0.85% of the total watershed area.

Plant and animal species would be expected to a mixture of those found in the wetland coniferous forests and wetland hardwood hammocks.

### 8.3.1.4.7 Non-Forested Wetlands

Non-forested wetlands combined total 1036.12 acres, which equates to 17.42% of the natural systems and 4.81% of the total watershed. While the forested wetland areas can be important for migratory birds, these non-forested wetlands, particularly the ephemeral isolated systems, can be very important in the breeding cycle of many amphibians. This is due to the fact that they dry out during the winter effectively eliminating fish from the system. In this predator-reduced environment the larvae have a better chance of survival.

### 8.3.1.4.8 Freshwater Marshes

This community type constitutes the largest amount of wetland acreage in the watershed at 520.56 acres. In terms of percent coverage, this equates to 8.75% of the natural systems area and 2.42% of the total watershed area. These marshes can be further categorized depending on the dominant vegetative type. The determination is similar to forested areas; if 66% or more of an individual plant species dominates the area, the marsh can be characterized as that type of marsh. For example if it contains 66% or more cattails, it will be designated as a cattail marsh. As stated in the historic section for this community, there are eight major types that can be found. It is doubtful however that bulrush or common reed marshes exist in this watershed.

The same flora and fauna found in the historic systems could be expected to be found in today's freshwater marshes.

### 8.3.1.4.9 Saltwater Marshes

This habitat covers 272.16 acres of the watershed adjacent to Tampa Bay. This translates to 4.58% of the natural systems area and 1.26% of the watershed's total area. Like the freshwater marshes, saltwater marshes, along with mangrove forests, serve as important breeding areas for numerous types of marine animals - finfish and shellfish in particular. Both salt marsh and mangrove systems serve an important role in buffering the shoreline against wave action; this is particularly important for tropical storms and hurricanes. As with freshwater marshes, these marshes can be further broken down by the species that achieve at least 66% dominance. The primary dominants are cordgrass and needlerush (*Juncus roemarianus*), but it can also include grasses in the genus (*Sporobolus*, *Distichlis* or *Paspalum*); saltwort (*Batis maritima*); fringerush (*Fimbristylis* species); or seaside or sea oxeye daisy (*Borrichia frutescens*).

As with the mangrove forest, this ecosystem has vegetation that occurs in a zonated pattern due to the changing water levels and salinities. In addition to those species mentioned above, other common plants common in the marsh include sea blite (*Suaeda linearis*), sea purslane (*Sesuvium portulacastrum*), railroad vine and various spurges (*Chamaesyce* species).

Mammals expected to be found in this ecosystem would include raccoon and marsh rabbit. Birds would include various shorebirds, gulls, terns, brown pelican (*Pelecanus occidentalis*), herons, egrets, ibis, roseate spoonbill and double-crested cormorant (*Phalacocorax auritus*). Reptiles could include saltmarsh watersnake, diamondback terrapin (*Malaclemys terrapin*) and the eastern diamondback rattlesnake.

## 8.3.1.4.10 Wet Prairie

This predominately grassy habitat occupies 174.26 acres throughout the watershed generally in the areas of historic pine flatwoods. Natural systems coverage amounts to 2.93%; while, total watershed area coverage comes to 0.81%. The main feature that separates this type from freshwater marsh is the relatively drier conditions and shorter vegetation.

There are few if any trees associated with wet prairies and those would be found along the fringe with the exception of the odd tupelo in areas of longer standing water. Shrubs would be limited to buttonbush, St. Johnsworts, *Ludwigias* and wax myrtle. Herbaceous vegetation would include meadowbeauties, various grasses and sedges, marsh pinks (*Sabatia* species), yellow-eyed grasses (*Xyris* species) and sundews.

Animals would be similar to those found in freshwater marshes.

## 8.3.1.4.11 Emergent Aquatic Vegetation

This wetland habitat is characterized by having vegetation that is either floating on or partially or completely above the water's surface. In the watershed, this community covers 69.14 acres or 1.16% of the natural systems and 0.32% of the total watershed area. The majority of this acreage can be found in the north-central portion of the watershed in areas of historic cypress and pine flatwoods ecosystems.

Vegetation is typically herbaceous and could be expected to include species such as southern cattails (*Typha latifolia*), spatterdock (*Nuphar luteum*), various waterlilies (*Nymphea* species), bulrushes (*Scirpus* species) and duckweeds (*Lemna* species).

Animal species would be similar to those found in open water systems. Mammals could include armadillo, raccoon, white-tailed deer, marsh rabbit and hispid cotton rat. Birds would consist of long-legged wading birds, common moorhen (*Gallinula chloropus*), wintering American coot (*Fulica americana*) and pied-billed grebe (*Podilymbus podiceps*). Reptiles and amphibians would include various watersnakes, treefrogs, toads, aquatic turtles (*Chelydra, Chrysemys, Deirochelys, Kinosternon* and *Trionyx* species) and true frogs (*Rana* species).

### 8.3.1.4.12 Non-Vegetated Wetlands

This grouping of wetlands lack vegetation but occur on hydric soils. Vegetation is usually absent for one of a number of reasons. Most commonly, the action of wind and water cause continual erosion that prevents the establishment of vegetation. In other cases the soil itself may not allow for the growth of plants due to build up of toxins in the soil such as hydrogen sulfide or high salt content. The soils' pH is also a contributing factor. They can be either saltwater or freshwater in nature. These types of wetlands can be found on 20.19 acres in the watershed. This equates to 0.34% of the natural systems area and 0.09% of the total watershed area.

### 8.3.1.4.13 Tidal Flats

These are essentially the unvegetated portions of marine shorelines that experience repeated cycles of inundation and exposure due to tidal rhythms. These tidal forces are also responsible for the continual deposition and erosion of sediments. This habitat occupies 10.93 acres in the watershed. This is less than 1% of both the natural and total watershed areas. Due to the lack of vegetation, very few if any higher animals will inhabit these communities. Life is generally limited to algae and bacteria that can adapt to the harsh living conditions and the few lower animals, primarily gastropods and crustaceans, that are adapted to feed on them. These animals could in turn be prey for transient birds or mammals.

### 8.3.1.4.14 Intermittent Ponds

These are the freshwater unvegetated wetlands. The lack of vegetation here is due to the harsh water regime. The ponds are full during the rainy season and empty during the dry season. In the Delaney Creek Area watershed, this habitat contains 9.27 acres and is found.

As previously stated, these temporary habitats are prime breeding areas for many amphibians, especially the various treefrogs (*Hyla* species). In addition to these species, the flora and fauna of these systems would be similar to those for freshwater marshes and open water.

# 8.4 LISTED SPECIES WITHIN THE WATERSHED

Listed species are those flora and fauna protected by federal and state regulations that prohibit certain activities that might harm these species or their habitats. In 1973, the federal government in order to protect these plants and animals passed the Endangered Species Act. The United States Fish and Wildlife Service (USFWS) is responsible for federal enforcement and administers protection for plants under 50 CFR 23 and for animals under 50 CFR 17. Listed plants and animals are divided into two categories at the federal level, endangered and threatened.

> **Federally listed endangered species** are defined as "any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary (of the Interior or Commerce) to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man."

> **Federally listed threatened species** are those plants and animals "which are likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

The State of Florida has similar protections that are administered by Florida Fish and Wildlife Conservation Commission for animals and by the Florida Department of Agriculture and Consumer Services (ACS) for plants. Animals are placed into three categories - endangered, threatened and species of special concern and are protected by Rules 39-27.003, 39-27.004 and 39-27.005 respectively.

> **State listed endangered animals** are those "fish and wildlife naturally occurring in Florida, whose prospects of survival are in jeopardy due to modification or loss of habitat; overutilization for commercial, sporting, scientific, or educational purposes; disease; predation; inadequacy of regulatory mechanisms; or other natural or manmade factors affecting its continued existence."

> **State listed threatened animals** are defined as "fish and wildlife naturally occurring in Florida which may not be in immediate danger of extinction, but which exists in such small populations as to become endangered if it is subjected

to increased stress as a result of further modification of its environment."

**State listed species of special concern** are those "faunal species that warrant special protection, recognition or consideration because it has an inherent significant vulnerability to habitat modification, environmental alteration, human disturbance, or substantial human exploitation which, in the foreseeable future, may result in its becoming a threatened species; may already meet certain criteria for designation as a threatened species but for which conclusive data are limited or lacking; may occupy such an unusually vital and essential ecological niche that should it decline significantly in numbers or distribution other species would be adversely affected to a significant degree; or has not sufficiently recovered from past population depletion."

Plants are similarly divided into endangered, threatened and commercially exploited and fall under Chapter 5B-40.

**State listed endangered plants** include those species "native to the state that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue, and includes all species determined to be endangered or threatened pursuant to the federal Endangered Species Act of 1973, as amended, Pub. L. No. 93-205 (87 Stat. 884)."

**State listed threatened plants** refer to "species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in such number as to cause them to be endangered."

**State listed commercially exploited plants** encompass those "species native to the state which are subject to being removed in significant numbers from native habitats in the state and sold or transported for sale."

A list of the flora and fauna that could potentially be found or has been observed in the Delaney Creek Area watershed is summarized in Tables 8.4a-d. The tables also summarize the habitat types in which those species were, or could be expected to be, found. Habitat loss and fragmentation from development has been the main factor in driving these plants and animals toward extinction, with the introduction of exotic and nuisance species and commercial exploitation playing a lesser role. Species listed in **bold type** were observed during one or more of the field visits to the watershed and the column bearing the bold "**X**" is the habitat type in which those species were observed. The following key is to be used with these tables.

**STATUS[1] - FL** = Florida Fish & Wildlife Conservation Commission; **FED** = United States Fish and Wildlife Service; **E** = Endangered; **T** = Threatened; **T / SA** = Threatened / Similarity of Appearance; **SSC** = Species of Special Concern and **CE** = Commercially Exploited

**HABITAT PREFERENCE[2] - HR -** Herbaceous Rangeland; **SB -** Shrub and Brushlands; **MR -** Mixed Rangelands; **UC -** Upland Coniferous Forests; **PF -** Pine Flatwoods; **UH -** Upland Hardwood Forest; **HC -** Hardwood / Coniferous Mixed Forests; **SW -** Streams and Waterways; **LR -** Lakes and Reservoirs; **BE -** Bays and Estuaries; **MS -** Mangrove Swamp; **SL -** Stream and Lake Swamps; **WC -** Wetland Coniferous Forest; **CF -** Cypress Forests; **WM -** Wetland Forested Mixed; **FM -** Freshwater Marshes; **SM -** Saltwater Marshes; **WP -** Wet Prairies; **EV -** Emergent Aquatic Vegetation; **TF -** Tidal Flats and **IP -** Intermittent Ponds

**Table 8.4a**
**Listed Fauna Potentially Found and/or Observed in the Delaney Creek Area Watershed - Upland and Open Water Habitats**

| | | STATUS[1] | | HABITAT PREFERENCE[2] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **FL** | **FED** | **HR** | **SB** | **MR** | **UC** | **PF** | **UH** | **HC** | **SW** | **LR** | **BE** |
| **Fishes** | | | | | | | | | | | | | |
| Common Snook | *Centropomus undecimalis* | SSC | --- | | | | | | | | | | X |
| Mangrove Rivulus | *Rivulus marmoratus* | SSC | --- | | | | | | | | | | |
| **Reptiles and Amphibians** | | | | | | | | | | | | | |
| American Alligator | *Alligator mississippiensis* | SSC | T/SA | | | | | | | | X | X | X |
| Eastern Indigo Snake | *Drymarchon corias* | T | T | | | X | | X | | | X | | |
| Gopher Turtle | *Gopherus polyphemus* | SSC | --- | | | | X | X | | | | | |
| Gopher Frog | *Rana capito* | SSC | --- | | | | X | X | | | | | |
| Suwannee Cooter | *Pseudemys concinna* | SSC | --- | | | | | | | | X | X | |
| **Birds** | | | | | | | | | | | | | |
| **Roseate Spoonbill** | *Ajaia ajaja* | SSC | --- | | | | | | | | X | X | **X** |
| Limpkin | *Aramus guarauna* | SSC | --- | | | | | | | | X | X | |
| **Little Blue Heron** | *Egretta caerulea* | SSC | --- | | | | | | | | **X** | **X** | **X** |
| Reddish Egret | *Egretta rufescens* | SSC | --- | | | | | | | | | | X |
| **Snowy Egret** | *Egretta thula* | SSC | --- | | | | | | | | **X** | **X** | **X** |
| **Tricolored Heron** | *Egretta tricolor* | SSC | --- | | | | | | | | **X** | **X** | **X** |
| **White Ibis** | *Eudocimus albus* | SSC | --- | **X** | | **X** | | **X** | | | **X** | **X** | **X** |
| Peregrine Falcon | *Falco peregrinus* | E | --- | X | | | | | | | | X | X |
| Southeastern Kestrel | *Falco sparverius paulus* | T | --- | X | X | X | | X | | | | | |
| **Sandhill Crane** | *Grus canadensis* | T | --- | X | X | X | | | | | X | X | X |
| Bald Eagle | *Haliaeetus leucocephalus* | T | T | | | | | | | | | X | X |
| American Oystercatcher | *Haematopus palliatus* | SSC | --- | | | | | | | | | | X |
| **Wood Stork** | *Mycteria americana* | E | E | | | | | | | | | | |
| **Brown Pelican** | *Pelecanus occidentalis* | SSC | --- | | | | | | | | X | X | **X** |
| Black Skimmer | *Rynchops niger* | SSC | --- | | | | | | | | | | X |
| Least Tern | *Sterna anatillarum* | T | --- | | | | | | | | | X | X |
| **Mammals** | | | | | | | | | | | | | |
| Sherman' Fox Squirrel | *Sciurus niger shermani* | SSC | --- | | | | | X | X | X | | | |
| West Indian Manatee | *Trichechus manatus* | E | E | | | | | | | | X | | X |

**Table 8.4b**
**Listed Fauna Potentially Found and/or Observed in the Delaney Creek Area Watershed - Wetland Habitats**

| | | STATUS[1] | | HABITAT PREFERENCE[2] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **FL** | **FED** | **MS** | **SL** | **WC** | **CF** | **WM** | **FM** | **SM** | **WP** | **EV** | **TF** | **IP** |
| **Fishes** | | | | | | | | | | | | | | |
| Common Snook | *Centropomus undecimalis* | SSC | --- | X | | | | | | X | | | X | |
| Mangrove Rivulus | *Rivulus marmoratus* | SSC | --- | X | | | | | | | | | | |
| **Reptiles and Amphibians** | | | | | | | | | | | | | | |
| American Alligator | *Alligator mississippiensis* | SSC | T/SA | | X | | | | X | | | X | | |
| Eastern Indigo Snake | *Drymarchon corias* | T | T | | | | | | | | | | | |
| Gopher Turtle | *Gopherus polyphemus* | SSC | | | | | | | | | | | | |
| Gopher Frog | *Rana capito* | SSC | --- | | | | X | | X | | | | | X |
| Suwannee Cooter | *Pseudemys concinna* | SSC | --- | | X | | | | X | | | X | | |
| **Birds** | | | | | | | | | | | | | | |
| **Roseate Spoonbill** | *Ajaia ajaja* | SSC | --- | | | | | | | | | | | |
| Limpkin | *Aramus guarauna* | SSC | --- | | X | | | | X | | | X | | X |
| **Little Blue Heron** | *Egretta caerulea* | SSC | --- | **X** | **X** | | **X** | | **X** | | | **X** | | **X** |
| Reddish Egret | *Egretta rufescens* | SSC | --- | X | | | | | | X | | | | |
| **Snowy Egret** | *Egretta thula* | SSC | --- | **X** | **X** | | **X** | | **X** | | | **X** | | **X** |
| **Tricolored Heron** | *Egretta tricolor* | SSC | --- | **X** | **X** | | | | **X** | **X** | | **X** | | **X** |
| **White Ibis** | *Eudocimus albus* | SSC | --- | **X** | **X** | X | **X** | X | **X** | **X** | **X** | **X** | **X** | **X** |
| Peregrine Falcon | *Falco peregrinus* | E | --- | | | | | | X | X | | | | |
| Southeastern Kestrel | *Falco sparverius paulus* | T | --- | | | | | | | | | | | |
| **Sandhill Crane** | *Grus canadensis* | T | --- | | X | | | | | X | X | | | X |
| Bald Eagle | *Haliaeetus leucocephalus* | T | T | | X | | | | | X | X | X | | |
| American Oystercatcher | *Haematopus palliatus* | SSC | --- | X | | | | | | X | | | | |
| **Wood Stork** | *Mycteria americana* | E | E | **X** | **X** | | | | **X** | **X** | X | X | | X |
| **Brown Pelican** | *Pelecanus occidentalis* | SSC | --- | **X** | | | | | | **X** | | | | |
| Black Skimmer | *Rynchops niger* | SSC | --- | | | | | | | X | | | X | |
| Least Tern | *Sterna anatillarum* | T | --- | | | | | | | X | | | X | |
| **Mammals** | | | | | | | | | | | | | | |
| Sherman's Fox Squirrel | *Sciurus niger shermani* | SSC | --- | | | | | | | | | | | |
| West Indian Manatee | *Trichechus manatus* | E | E | X | | | | | | X | | | | |

**Table 8.4c**
**Listed Flora Potentially Found and/or Observed in the Delaney Creek Area Watershed - Upland and Open Water Habitats**

| | | STATUS[1] | | HABITAT PREFERENCE[2] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **FL** | **FED** | **HR** | **SB** | **MR** | **UC** | **PF** | **UH** | **HC** | **SW** | **LR** | **BE** |
| Giant Leather Fern | *Acrostichum aureum* | CE | --- | | | | | | | | X | | X |
| Nuttall's Rayless Goldenrod | *Bigelowia nuttalli* | E | --- | | | | | X | | | | | |
| Bearded Grass Pink | *Calopogon barbatus* | T | --- | | | | | X | | | | | |
| Butterfly Orchid | *Encyclia tampensis* | CE | --- | | | | | | | | | | |
| Greenfly Orchid | *Epidendrum conopseum* | CE | --- | | | | | | | | | | |
| Catesby's or Pine Lily | *Lilium catesbaei* | T | --- | | | | X | X | | | | | |
| Nodding Clubmoss | *Lycopodium cernuum* | CE | --- | | | | | X | | | | | |
| Shell Mound Prickly Pear | *Opuntia stricta* | T | --- | | | | | | | | | | X |
| **Cinnamon Fern** | *Osmunda cinnamomea* | CE | --- | | | | | **X** | | | **X** | **X** | |
| **Royal Fern** | *Osmunda regalis* | CE | --- | | | | | | | | **X** | X | |
| Blue-flowered Bladderwort | *Pinguicula caerulea* | T | --- | | | | X | X | | | | | |
| Yellow-flowered Bladderwort | *Pinguicula lutea* | T | --- | | | | X | X | | | | | |
| Rain Lily | *Zephyranthes atamasco* | T | --- | | | | | X | | | | | |

Some of these species are not always limited to those habitats listed in these tables. As more and more suitable habitat is altered or destroyed, many species will utilize less than ideal habitat as a substitute. For instance, sandhill cranes use large, grassy open areas to forage in. This includes pastureland and other open spaces that are not included in the tables above. In recent years, the best place to see sandhill cranes in the Brandon area has been in the vicinity of Brandon High School, just to the north of the watershed at Kings Avenue and Victoria Street. "Florida" kestrels, the listed subspecies of the Southeastern kestrel, are notorious for hanging out around Little League baseball fields and golf courses. They need habitats where the grass stays low enough for them to easily find their primary prey - grasshoppers. Golf courses and ball fields are a good substitute for the grasslands they once used. Rain lilies also need open grassy areas for suitable habitat and because of this, this species is most commonly found in residential yards and other similar areas. Finally, roadside ditches function much like streams and lakeshores in terms of feeding habitat for many of the long-legged wading birds like herons, egrets, ibis and storks. This is especially true for wood storks. They feed primarily by touch and prefer their food items to be concentrated in areas of low water. Roadside ditches with their alternating water regimes of flow and no flow, depending on storm events, mimics the seasonal drawdowns of the ponds and streams this species depends on as a source of food.

**Table 8.4d**
**Listed Flora Potentially Found and/or Observed in the Delaney Creek Area Watershed - Wetland Habitats**

| | | STATUS[1] | | HABITAT PREFERENCE[2] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **FL** | **FED** | **MS** | **SL** | **WC** | **CF** | **WM** | **FM** | **SM** | **WP** | **EV** | **TF** | **IP** |
| Giant Leather Fern | *Acrostichum aureum* | CE | --- | | | | | | | | | X | | X |
| Nuttall's Rayless Goldenrod | *Bigelowia nuttalli* | E | --- | | | | | | X | | X | | | |
| Bearded Grass Pink | *Calopogon barbatus* | T | --- | | | | | | | | X | | | X |
| Butterfly Orchid | *Encyclia tampensis* | CE | --- | | | X | X | X | | | | | | |
| Greenfly Orchid | *Epidendrum conopseum* | CE | --- | | | X | X | X | | | | | | |
| Catesby's or Pine Lily | *Lilium catesbaei* | T | --- | | | | | | | | X | | | |
| Nodding Clubmoss | *Lycopodium cernuum* | CE | --- | | | | | | | | X | | | X |
| Shell Mound Prickly Pear | *Opuntia stricta* | T | --- | X | | | | | | X | | | X | |
| **Cinnamon Fern** | *Osmunda cinnamomea* | CE | --- | | **X** | **X** | **X** | X | **X** | | X | | | |
| **Royal Fern** | *Osmunda regalis* | CE | --- | | X | X | X | X | X | | | | | |
| Blue-flowered Bladderwort | *Pinguicula caerulea* | T | --- | | | | | | | | | | | |
| Yellow-flowered Bladderwort | *Pinguicula lutea* | T | --- | | | | | | | | | | | |
| Rain Lily | *Zephyranthes atamasco* | T | --- | | | | | | | | | | | |

# 8.5 PROTECTED LANDS WITHIN THE WATERSHED

There are numerous mechanisms for preserving land in the watershed. On the state level, Florida Forever/Preservation 2000 is the most recent initiative on buying and preserving vital habit. These programs were preceded in 1979 by the establishment of the Conservation and Recreational Lands (CARL) program and in 1981 by the development of both the Save Our Coast (SOC) and Save Our Rivers (SOR) programs. On the County level, the Environmental Lands Acquisition and Protection Program (ELAPP) serves a similar function in land preservation to that of the state.

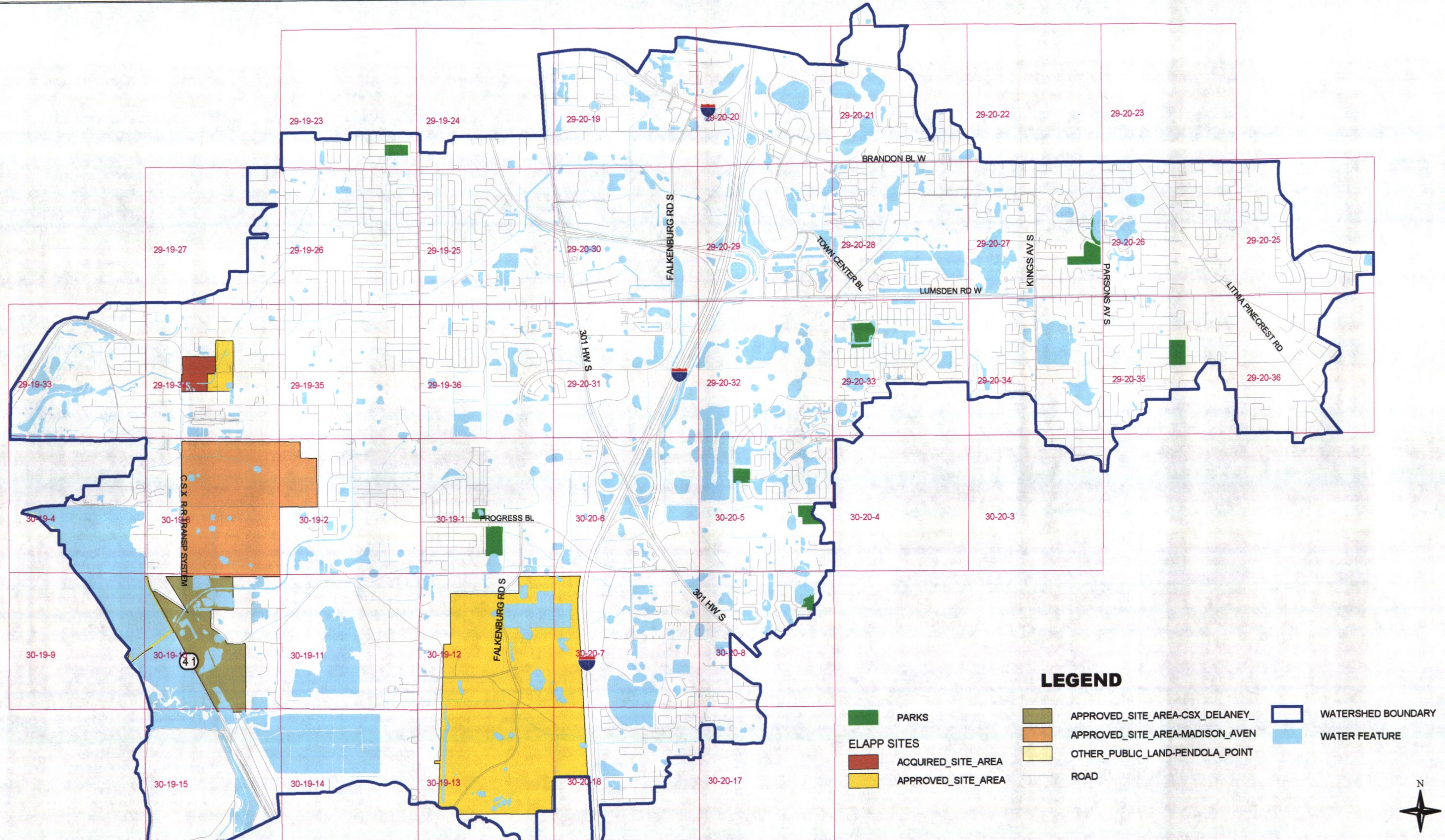
Other mechanisms protect certain habitat types. Since 1984, Florida has protected its valuable wetlands through State law. This has been done most recently when the State rewrote its wetland regulations that went into effect in July 1994. Both the Department of Environmental Regulation and the state's Water Management District use these regulations to protect wetlands. Hillsborough County is one of the few counties in the state that has additional wetland protection through local government. This is accomplished through the Rules of Hillsborough County, Chapter 1-11, the Wetland Rule. In addition to wetland protection, the County has provisions written in the Land Development Code to protect vital upland habitat, as well. This is carried out under the Upland Habitat Ordinance that divides environmentally sensitive uplands into two categories. The first is termed Significant Wildlife Habitat and has the potential for use by listed species. The second is Essential Wildlife Habitat, which are habitats on which listed species have been observed.

## 8.5.1 ELAPP SITES

Only the ELAP program has purchased habitat in the watershed. This program was established in 1987 and its primary purpose is to acquire, preserve and manage environmentally sensitive lands. Public use is permitted on select parcels. The program is under the County's Parks and Recreation Department with an advisory board composed of concerned private citizens and County staff. Both the acquired and proposed sites are shown on Figure 8-3. The only acquired parcel is known as the Delaney Creek Restoration site and is located on the south side of Delaney Creek, north of Hartford Street and east of CSX railroad. The parcel is the site of a restoration project carried out by the Hillsborough County Stormwater Section, which includes a large off line area of marsh used to treat water that flows through the creek and into Tampa Bay. ELAPP presently has four other sites under consideration in the watershed. The largest of these is the Madison Avenue tract south of the creek, north of Madison Avenue and east of the railroad that parallels U. S. Highway 41. Adjacent and immediately to the south is the CSX/Delaney Creek parcel. Adjacent and immediately east of the Delaney Creek Restoration parcel is another parcel of almost equal size. Finally, the Pendola Point parcel is located between the coast and U.S. Highway 41 and south of Pendola Point Road.

## 8.5.2 SIGNIFICANT AND ESSENTIAL WILDLIFE HABITAT

The areas of Significant and Essential Wildlife habitat, shown in Figure 8-4, as mapped by the County are all in the southwest corner of the watershed. Parcels to the west of U.S. Highway 41 are primarily saltwater to brackish systems while those on the eastern side of the road are brackish to saltwater marsh systems. These areas include corridors that are proposed for the County's proposed system of greenways/trails that would link these now isolated systems.



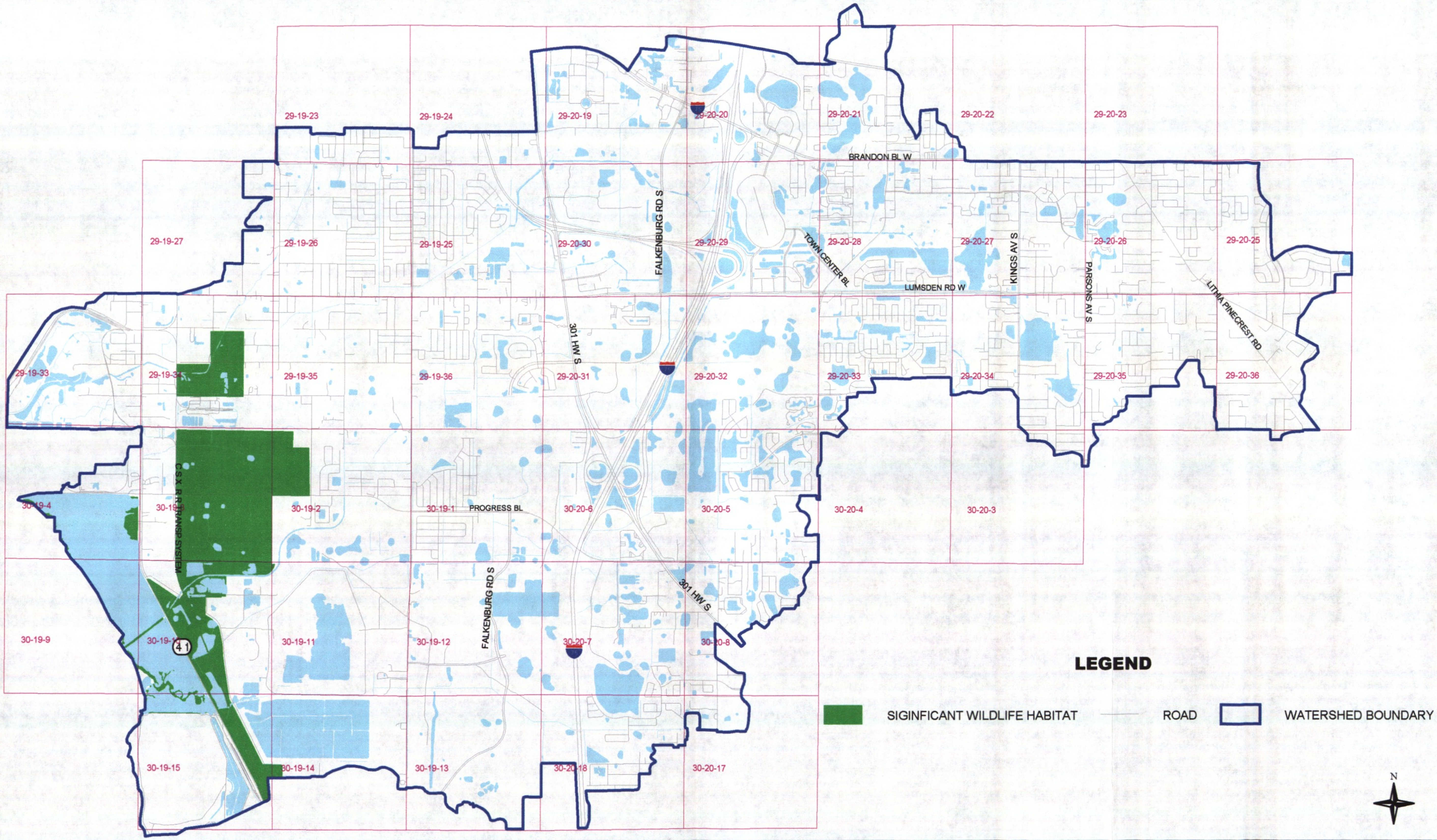

Hillsborough County Florida

Department of Public Works
Engineering Division
Stormwater Management Section

**DELANEY CREEK AREA**
**STORMWATER MANAGEMENT**
**MASTER PLAN**
**SEPTEMBER 2000**

FIGURE 8-3

**ELAPP SITES AND PARKS MAP**




Hillsborough County Florida

Department of Public Works
Engineering Division
Stormwater Management Section

**DELANEY CREEK AREA**
**STORMWATER MANAGEMENT**
**MASTER PLAN**
**SEPTEMBER 2000**

FIGURE 8-4

**SIGNIFICANT WILDLIFE HABITAT MAP**

# 8.6 NATURAL SYSTEMS ISSUES/AREAS OF CONCERN

This section discusses the major issues of concern for the natural systems in the watershed and describes specific problems with respect to these issues. These issues have been identified as habitat loss through fragmentation and degradation, the introduction of exotic species, the loss of buffers against water quality impacts, and the alteration of flow into wetland systems. These issues are described in more detailed in the following paragraphs.

## 8.6.1 LOSS OF HABITAT AS A RESULT OF FRAGMENTATION AND DEGRADATION

Two of the main reasons for habitat loss within the Delaney Creek Area watershed are fragmentation and degradation of the existing habitats. Fragmentation is the slicing up of large pieces of habitat or entire ecosystems into smaller "islands" which themselves are frequently subject to further fragmentation. Generally, these islands contain wetlands that were to cost prohibitive to fill prior to wetland protection rules and regulations or were not allowed to be impacted by regulatory agencies. The same may be true for some green spaces that are now required as part of present day zoning requirements. As the spaces between these "islands" are filled with development, the lack of greenways or corridors prevents most wildlife from recolonizing one area from another until the habitat's value is near zero. Another aspect of this process is what has come to be termed the "edge effect". In this scenario, the edges in and around the habitat increases, which makes less large areas of deep habitat that is required for the breeding success of some wildlife, especially certain species of songbirds. If these species do not feel they are inside a large enough area of suitable habitat, they will move on to a more appropriate area. Additionally, this increase in edge also allows greater access by predators. In some cases, it has been demonstrated that the decline in population of some deep woods dwelling songbirds, such as vireos and warblers, is the result of parasitism by the brown-headed cowbird. Cowbirds are normally found in grasslands and other similar open habitats, but with an increase in edges, it is not difficult for them to penetrate into breeding habitat of these songbirds that were previously too deep in the forest for the cowbirds to reach. This "edge effect" can be a two-sided sword however as some species such as wild turkey, northern bobwhite and white-tailed deer seem to benefit from it.

Degradation of the remaining habitat can occur in various ways. As stated above, many of the natural systems in the watershed are dependent on a regime of fire to maintain the status quo of the systems. If coniferous habitats are not subjected to frequent light fires, hardwoods will gain a foothold and the system will, through natural succession, become a hardwood system. In the same way, if fire is suppressed in a wet prairie or freshwater marsh, trees and shrubs will become established and the area will transition into a forested system. In areas of development it is increasingly difficult to burn and maintain these fire dependent habitats. Another type of degradation is through alteration of the hydrologic regime of a system, especially wetlands. As run-off is captured by treatment systems, the frequency and duration of water being delivered into the system is altered and this can lead to changes in the vegetative composition of wetland plant species, which in turn affects the wildlife usage of the system. The removal of vegetation can impact a system both directly or indirectly. The direct impact can be the outright removal of habitat. More subtle impacts occur when trees or floating vegetation are removed from a lake or stream, which can result in a rise in water temperature. The same effect has been observed in the soils of terrestrial habitats. The removal of groundcover can result in increased erosion and sedimentation and a lessening of the stormwater treatment ability of the system. Other types of degradation can result from the inappropriate recreation use of an area. Wetlands can be favorite spots for off road "mud-boggers". Illegal dumping or discharges can also lead to degradation, both direct and indirect.

## 8.6.2. INTRODUCTION OF EXOTIC SPECIES

With the advent of relatively easy access to virtually any part of the planet, the problem of invasion by exotic plant and animal species has become a serious issue for the Delaney Creek Area watershed and the state of Florida. Given Florida's mild climate and abundant rain, close to one-third of the state's flora are exotic plants. Some of these were introduced intentionally; punktree (*Melaleuca quinquenervia*) was brought in to assist in the draining of wetland because it has a high rate of transpiration. Brazilian pepper was first introduced as an ornamental because of its bright red berries, which are prevalent in the winter (the austral summer) especially during the Christmas season. Australian pines and congongrass (*Imperata cylindrica*) were brought in for agricultural purposes, as a windbreak and groundcover, respectively. Others, such as water hyacinth (*Eichhornia crassipes*), hydrilla (*Hydrilla verticillata*) and primrose willow (*Ludwigia peruviana*) cost the state and private homeowners millions of dollars annually to control in lakes, streams and wetlands. Vines, such as air potato (*Dioscorea bulbifera*) and skunk vine (*Paederia foetida*) are quickly overgrowing forested systems and out competing native vines such as grapes and catbriers that are relied on by wildlife for winter forage. It has been estimated that at least 40,000 acres in Florida have been overgrown by the Japanese and Old World climbing ferns (*Lygodium japonicum* and *L. microphyllum*), respectively. Most of this acreage is in South Florida and the floodplain of the Apalachicola River. But the extremes of these two sites demonstrate just how adaptable this species is. The Exotic Pest Plant Council of Florida, established in 1993, has compiled a listing of most of the exotic species found in the state and has ranked them in three different categories based on their propensity to become invasive or nuisance and the amount of damage that can or has been done.

Plants are not the only aliens in our environment. Feral animals, cats, pigs and dogs, decimate plant and wildlife populations. This is especially true of the feral hogs which can destroy large areas of wetland vegetation while rooting for food. Nutria (*Myocastor coypus*) a large South American rodent, was originally farmed in Louisiana and escaped from captivity during flooding that resulted from hurricanes in the 1940's. It has since made its way to Florida and is destroying wetland habitats with its voracious appetite and vigorous burrowing. This mammal has been observed in numerous sites in or just outside the watershed. The large ponds at the interchange between Interstate 75 and U.S. Highway 301 are areas where these animals can frequently be seen. Two amphibians, the cane or giant toad (*Bufo marinus*) and the Cuban treefrog (*Osteopilus septentrionalis*), affect our domestic and wild animals in various ways. The cane toad eats virtually anything that will fit into its mouth from insects to small mammals to birds. In addition, the cane toad is also very toxic because it possesses rather large parotoid glands which hold a milky poison which can easily kill any small animal that tries to eat it. The Cuban treefrog predates directly on our native treefrogs and competes with them for breeding space. Introduced birds like the European starling (*Sturnella vulgaris*), house sparrow (*Passer domesticus*) and rock dove (*Columba livia*) compete directly with native species that occupy the same ecological niche. The starling and sparrow have been attributed to the decline of the eastern bluebird (*Sialia sialis*) by out competing the bluebird for suitable nesting habitat.

Controlling these exotic species in an urban environment can be difficult. Vacant lands can become refugia for these species; a place to re-invade from once the eradication process is over. In addition, many of these species, especially the plants, are pioneer species, which specialize in colonizing areas that have been cleared of vegetation. So clearing an area may just encourage the same or different species to re-establish themselves in the same area. Another example of the “edge effect” is shown with some plants like primrose willow which are very good at colonizing cleared edges of wetlands and from there penetrating toward the interior. Other species can be resistant to many or all herbicides and therefore require vast amounts of labor-intensive removal. Clearly this is one of the major problems to the natural systems in the watershed.

## 8.6.3 THE LOSS OF BUFFERS AGAINST WATER QUALITY IMPACTS

The presence of buffers is of extreme importance along the edges of wetland systems. These buffers provide a variety of functions. In terms of water quality, several direct and indirect results can be observed. The vegetation in these buffers helps to maintain water quality by slowing down velocities allowing particulates to settle out of the water column. This increased residence time also allows the plants to remove more nutrients and other pollutant from the water column. Erosion and sedimentation is lessened by the vegetation ability to stabilize wetland banks and bottoms. If large areas of buffer exist, such as a floodplain, the volume of water stored can prevent damage to roads and other structures. These areas also moderate the velocity and flow of water thus minimizing scouring in flowing systems. In coastal areas buffering against wave action, especially during hurricanes or tropical storms, can again save large amounts of money. These savings are two-fold. The first is the direct savings by the prevention of flooding while the second is indirect in that costly seawalls or rip-rap will not be needed.

Another indirect benefit is to wildlife. These vegetated areas can serve as important greenway corridors that will allow for the flow of plants and animals between otherwise isolated areas of habitat. The larger the corridor is, the larger the type of animal will be that can utilize it. This relates to the edge effect that has already been discussed in this chapter. It has been hypothesized that some greenways are used as reference points for migrating animals (Primack, 1993).

## 8.6.4 THE ALTERATION OF FLOWS TO WETLAND SYSTEMS

With the advent of modern stormwater treatment techniques, one of the drawbacks is the change in water regime for many wetland systems. This can be through the reduction of historic flows or by increasing them. Most stormwater systems are built to retain water for the treatment process, usually done by vegetation. Now, water that historically flowed directly into a wetland is held back. This water may or may not reach the wetland. Some of the water is lost through transpiration of the vegetation or directly via evaporation. Still more is lost through percolation into the ground. This amount can be small in the case of a traditional detention pond or large in the case of an infiltration or retention pond where virtually all the water will go into the ground. The timing of the delivery of water is also related to this. Many streams rely on periodic flushing of built up sediments by large storm events. This is prevented when a stormwater system now moderates the flow of water by releasing it more gradually than it would under unaltered conditions. These reduced flows can also change the salinity regime in a tidally influenced stream by allowing the saltwater “plug” to move upstream. This is one of the main concerns of the Tampa Bay Estuary Program, that this phenomenon is causing the loss of oligohaline, or low salinity habitats. Conversely, an increase in the impervious surfaces in a basin can increase the historic flows into a wetland, even if it goes through a stormwater system and water is lost as described above. This is due to the sheer magnitude of run-off that creates “new” water that now reaches the wetland but which would not have been generated if the area was in its natural state. An increase in water in wetlands is not always a good thing. Cypress trees depend on a “dry” season for their seeds to germinate. While they will remain viable for a period of time in water, they must have dry land to be able to root and grow. Many amphibians depend on the timing of rainpool development for their successful breeding. Too much water can result in a permanent pond that may be used by fish; too little water and the pond may dry up before the larvae will be able to fully develop.

# WATER SUPPLY

## 9.1 OVERVIEW

Water is supplied to the Tampa Bay area through both ground and surface water. Of the two, groundwater provides the main supply for Hillsborough County including the Delaney Creek Area (DCA) watershed. Within Hillsborough County, groundwater supplies at least three-quarters of the water used, with only the City of Tampa currently relying on surface water for part of its public water supply. For the rest of the County, water is supplied from groundwater through both private and public wells. The public groundwater supply is managed by Tampa Bay Water (TBW). This entity was formed in 1998 from its predecessor, the West Coast Regional Water Supply Authority (WCRWSA). Between the years of 1960 and 1993, public supply water use in the Tampa Bay area has increased by over 400 percent, from 60 million gallons per day (mgd) to over 251 mgd. Within Hillsborough County alone, water demand for all uses in 1995 was approximately 252 mgd. Water use has begun to stabilize due to the practices of water conservation and reuse, however demand projections from the Southwest Florida Water Management District (SWFWMD) estimate that total water use within Hillsborough County will increase to over 321 mgd in the year 2020. Providing an adequate water supply for our ever-increasing population while trying to protect the environment has become one of the greatest challenges facing our region.

Watershed management issues that are related to water supply and that are being considered in this report include:

a) ground and surface water use

b) aquifer recharge

c) impacts due to water withdrawals

d) minimum flows and levels, and

e) water conservation.

Following is a discussion of these issues.

# 9.2 GROUNDWATER USE

The Delaney Creek Area watershed lies within what is known as the Southern Groundwater Basin (SGWB). The SGWB is located from approximately Central Pasco County down to the northern end of Lee County and from the coastline over to approximately U.S. Highway 27 in Highlands and Polk Counties. This is an area in which the boundaries act as a barrier to groundwater flow (i.e. groundwater does not flow to or from adjacent basins). Groundwater within the SGWB accumulates from recharge due to rainfall. The groundwater system in this area is composed of three aquifers, the shallow surficial, intermediate, and deeper Floridan. The surficial aquifer is made up of sand and variable amounts of organic matter and clay, and is used mostly for some domestic and irrigation purposes. The intermediate aquifer between the Floridan and surficial consists of sand, clay, phosphatic sand and clay, and limestone, but it thins and disappears to the north into northern Hillsborough County and is not a significant supply source in this watershed. The primary water source is the Floridan aquifer, which consists of thick layers of limestone that can produce large quantities of water for public, agricultural, and industrial use.

Water use is divided into permitted uses and non-permitted uses. Water Use Permits (WUP's) are issued by the SWFWMD for significant uses that meet one of the following thresholds:

1. Total withdrawal capacity from any source or combination of sources is greater than or equal to 1,000,000 gallons per day (gpd).

2. Annual average withdrawal from any source or combined sources is greater than or equal to 100,000 gpd.

3. Withdrawal is from a well having an outside diameter of six inches or more at the surface.

4. Withdrawal is from a surface water body and the outside diameter of the withdrawal pipe or the sum of the outside diameters of the withdrawal pipes is four inches or greater.

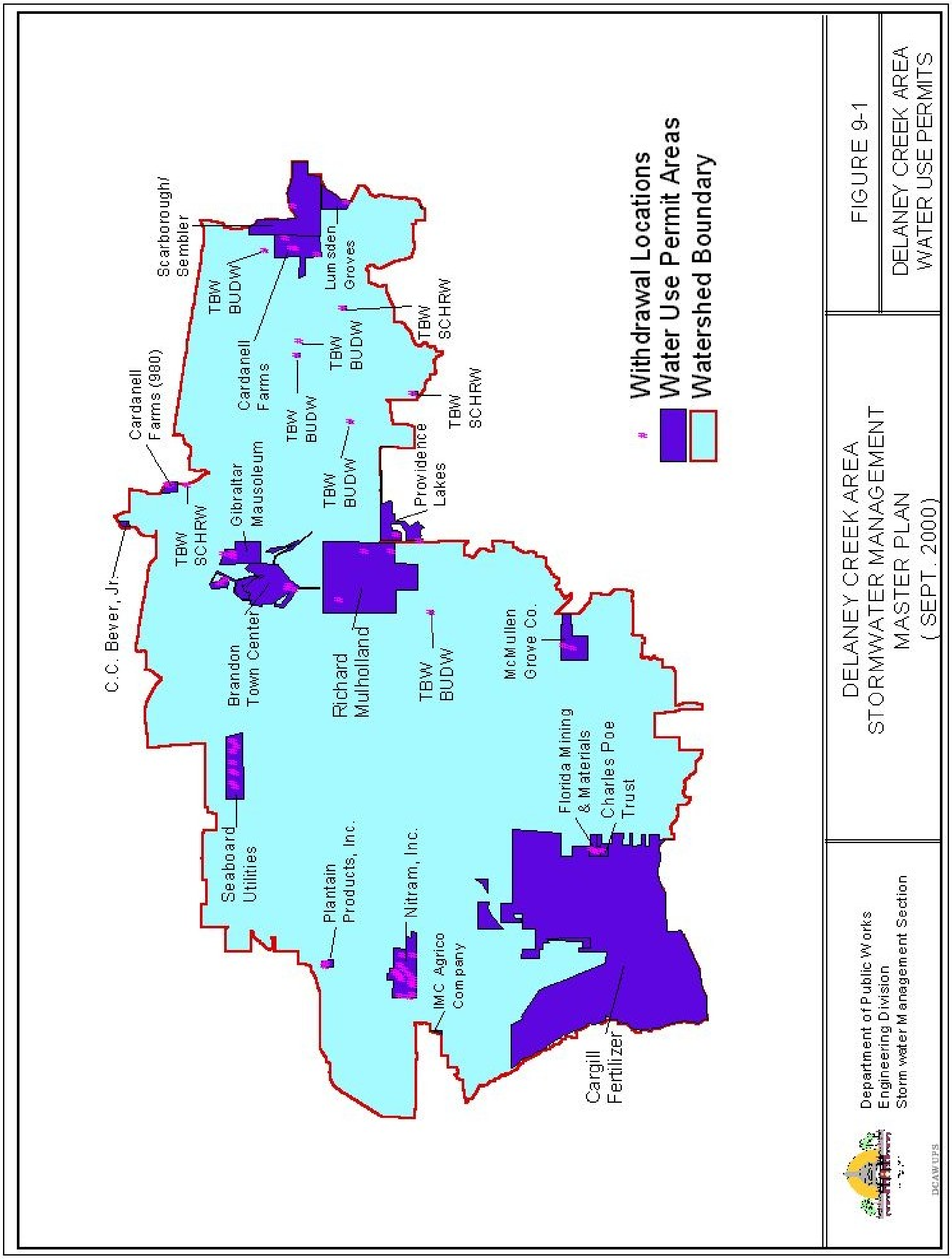
The following table summarizes WUP's issued within the DCA watershed.

**Table 9.1**
**Water Use Permits For The Delaney Creek Area Watershed**
**(Based On SWFWMD Permit Data)**

| Permit Number | Permittee | Predominant Use | Average Use (gpd) | Peak Mo. Use (gpd) | Expiration Date |
|---|---|---|---|---|---|
| 000980 | Cardanell Farms | Agriculture | 300 | 400 | April 5, 2015 |
| 008452 | C.C. Bever Jr. | Agriculture | 4100 | 17000 | December 19, 2005 |
| 010400 | Cardanell Farms | Agriculture | 93300 | 413000 | October 22, 2014 |
| 006390 | Richard Mulholland | Agriculture | 64000 | 70000 | August 25, 2008 |
| 000538 | Lumsden Grove, Inc. | Agriculture | 75000 | 281400 | January 24, 2015 |
| 001035 | McMullen Grove Co. | Agriculture | 79000 | 303000 | October 20, 2017 |
| 008166 | Plantain Products Co. | Indust./Comm. | 8000 | 12000 | November 18, 2001 |
| 001930 | Nitram, Inc. | Indust./Comm. | 346000 | 432000 | November 9, 2004 |
| 003050 | IMC Agrico Co. | Indust./Comm. | 4000000 | 4500000 | August 28, 2000 |
| 008493 | Fla. Mining & Mater. | Indust./Comm. | 70000 | 90000 | July 6, 2002 |
| 001532 | Cargill Fertilizer, Inc. | Indust./Comm. | | | (in renewal process) |
| 008406 | Charles Poe Irr. Trust | Indust./Comm. | 10000 | 17000 | November 30, 2013 |
| 002840 | Seaboard Utilities | Public | 396000 | 594000 | November 26, 2013 |
| 004352 | TBW (S.C.H.R.W.) | Public | *24100000 | *33000000 | November 20, 2006 |
| 011732 | TBW (B.U.D.W.) | Public | *6000000 | *9240000 | December 31, 2010 |
| 010550 | Brandon Town Ctr. | Recreational | 73000 | 185000 | March 5, 2002 |
| 010182 | Gibraltar Mausoleum | Recreational | 78000 | 156000 | December 11, 2013 |
| 003383 | Scarborough/Sembler | Recreational | 41000 | | October 14, 2009 |
| 008381 | Providence Lakes | Recreational | 39000 | 103500 | April 18, 2006 |

* Only a portion of the amount permitted is withdrawn from points within the watershed.

Based on the SWFWMD permit data, there are 19 water use permits within the DCA watershed, all of which are for groundwater withdrawals. Six are for agricultural use, six for industrial/commercial, four for recreational, and three for public supply use. Although the amount permitted for public supply appears to be by far the largest amount, in actuality, there are only a few wells that are part of the Tampa Bay Water (TBW) permits that are located within the watershed. The total average amount permitted for public supply that is located within the watershed is 2,646,000 gallons per day (gpd). Average amounts also permitted include, 315,700 gpd for agriculture, 4,434,000 gpd for industrial/commercial, and 231,000 gpd for recreational use for a total average amount permitted within the DCA watershed of 7,817,500 gpd. Figure 9-1 shows the locations of the water use permits.


Withdrawal Locations
Water Use Permit Areas
Watershed Boundary
Scarborough/ Sembler
TBW BUDW
Lumsden Groves
TBW SCHRW
Cardanell Farms (980)
Cardanell Farms
Gibraltar Mausoleum
Providence Lakes
C.C. Bever, Jr.
Brandon Town Center
Richard Mulholland
McMullen Grove Co.
Seaboard Utilities
Plantain Products, Inc.
Nitram, Inc.
IMC Agrico Company
Florida Mining & Materials
Charles Poe Trust
Cargill Fertilizer
Department of Public Works
Engineering Division
Stormwater Management Section
DCAWUPS
DELANEY CREEK AREA
STORMWATER MANAGEMENT
MASTER PLAN
( SEPT. 2000)
FIGURE 9-1
DELANEY CREEK AREA
WATER USE PERMITS

# 9.3 SURFACE WATER USE

Based on available permit data, it does not appear that there are any permitted surface water withdrawals from any of the streams or water bodies within the Delaney Creek Area watershed. In fact, within the Tampa Bay area, the use of surface water for public water supply has been limited mainly to the use of the Hillsborough River as the main supply for the City of Tampa. Recently though, due to the recognition of adverse environmental impacts from groundwater pumping, and subsequent requirements to reduce the amount of pumping from wellfields, alternative supply sources including new surface water supplies are now part of Tampa Bay Water's Master Water Plan. However, none of the proposed surface water supply sources are located within the Delaney Creek Area watershed. Given the relatively small scale of the streams and water bodies within the DCA watershed, it is unlikely that any significant public surface water supply development would occur in this watershed.

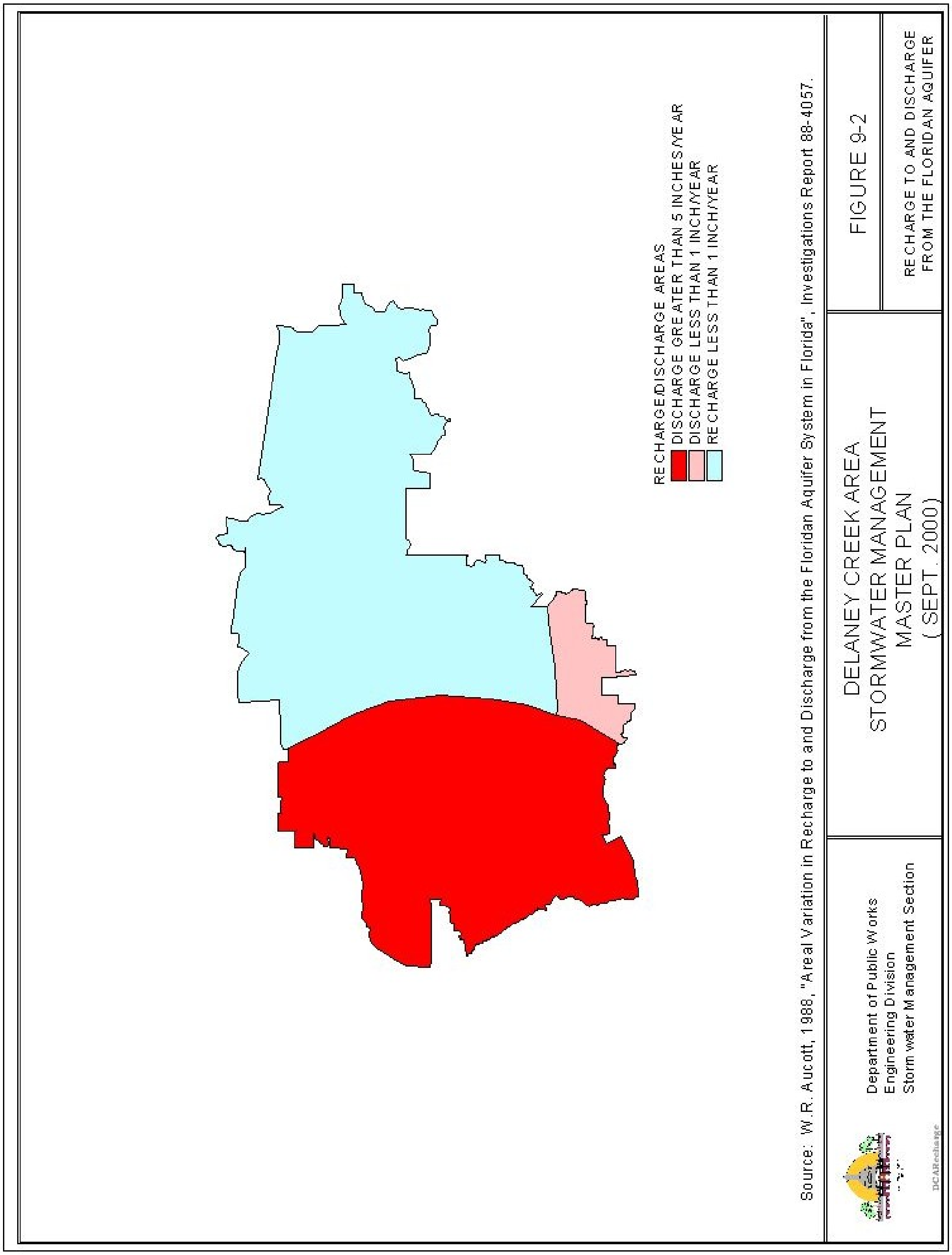
# 9.4 WATER SUPPLY ISSUES / AREAS OF CONCERN

As stated above, watershed management issues related to water supply include impacts due to withdrawals, aquifer recharge, minimum flows and levels, and water reuse and conservation. These items are discussed in the following paragraphs.

## 9.4.1. AQUIFER RECHARGE

Aquifer recharge refers to the replenishment of groundwater in an aquifer through infiltration of rainwater or from flow from an adjacent aquifer. Recharge to the aquifer typically occurs in areas that are topographically higher than surrounding areas, and where the hydraulic gradient causes flow into the aquifer. Recharge for the surficial aquifer is directly related to rainfall. This means annual high water levels in the surficial aquifer generally occur in September-October with the end of the rainy season and conversely annual lows follow the end of the dry season in April-May.

Recharge to the Upper Floridan aquifer occurs in the upper or eastern half of the watershed, and is considered to be relatively low based on a study by Aucott (1988) that discusses general variations in recharge to and discharge from the Floridan aquifer system. The lower or western half of the watershed is considered to be a discharge zone for the Floridan aquifer that is to be expected due to the low surface elevation and proximity to the coast. Figure 9-2 shows these general variations in recharge/discharge in the DCA watershed.


RECHARGE/DISCHARGE AREAS
DISCHARGE GREATER THAN 5 INCHES/YEAR
DISCHARGE LESS THAN 1 INCH/YEAR
RECHARGE LESS THAN 1 INCH/YEAR
Source: W.R. Aucott, 1988, "Areal Variation in Recharge to and Discharge from the Floridan Aquifer System in Florida", Investigations Report 88-4057.
Department of Public Works
Engineering Division
Storm water Management Section
DELANEY CREEK AREA
STORMWATER MANAGEMENT
MASTER PLAN
( SEPT. 2000)
FIGURE 9-2
RECHARGE TO AND DISCHARGE
FROM THE FLORIDAN AQUIFER

Several factors influence the amount of recharge in both aquifers. One of the most obvious is the amount of impervious area found in the watershed. This will prevent or reduce the amount of water that is able to penetrate into the soil and from there into one or both aquifers. Closely related to impervious area, is the treatment of stormwater run-off from these areas. In older developed areas the run-off from impervious areas is not captured and treated by stormwater systems, but is directed toward the Bay in as quick and direct a manner as possible. This effectively removes the stormwater from being able to infiltrate into the ground and contribute to recharging the aquifer. If the water is captured by a stormwater system, it may be transported from an area of relatively high recharge potential to one of low potential. Consideration of these factors should be given when locating and designing future stormwater projects.

## 9.4.2. IMPACTS DUE TO WATER WITHDRAWALS

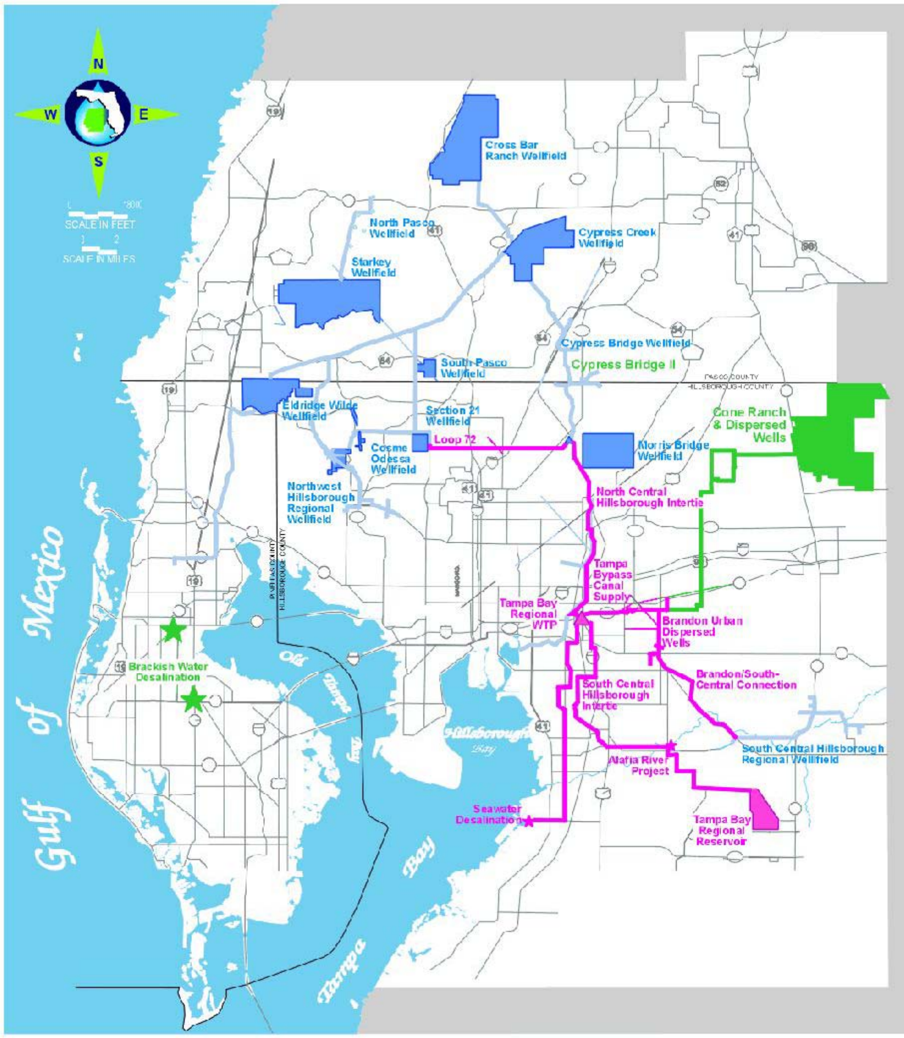
Withdrawal of water due to groundwater or surface water pumping can have adverse impacts on the environment and on other water users. Because groundwater is the main source of water in our region, impacts from water withdrawals are most commonly related to groundwater pumping. During the mid to late 1980's, declining hydrologic conditions were observed in the eastern Tampa Bay area including the DCA watershed. In response to this, the SWFWMD designated the area as the Eastern Tampa Bay Water Use Caution Area (ETB WUCA) in 1989, and implemented specific water use permitting rules for this area to better manage future withdrawals. A water resource assessment of the area was also conducted by the District, which showed that the groundwater resources of the ETB WUCA are interdependent with the adjacent Highlands Ridge WUCA (HR WUCA). This led to the establishment of the Southern Water Use Caution Area (SWUCA) in 1992 which encompasses the ETB and HR WUCAs as well as all the areas in between. The SWUCA covers southern Hillsborough County as well as all of Manatee, Hardee, DeSoto, and Sarasota Counties, and parts of Polk, Highlands, and Charlotte Counties.

One common type of impact due to groundwater withdrawal is the dewatering of wetlands and declining lake levels due to the lowering of the water table. This has occurred in the northwest area of Hillsborough County from years of significant pumping at several public supply wellfields that has negatively impacted wetlands and several lakes in the area. These environmental impacts sparked several years of disputes between the WCRWSA, its member governments, and the SWFWMD. In 1998 in order to try and resolve the impacts to the water resources, the WCRWSA was reorganized into what is now Tampa Bay Water, and all parties approved the Northern Tampa Bay New Water Supply and Ground-Water Withdrawal Reduction Agreement known as the "Partnership Agreement". The key objectives of the agreement are the development of new water supply sources other than groundwater, a phased reduction in existing pumping, the end of litigation, and financial assistance from the SWFWMD in the development of new water supplies. Also as part of the reorganization and agreement, the member governments sold all their active well fields to TBW. This ownership allows TBW to manage the total water supply in a more environmentally sensitive way. The idea is to rotate pumping, allowing one or more of the wellfields to "rest" and letting the groundwater in the area to recover. If it is found that one or more wellfields are adversely affecting wetlands or groundwater, they can be taken off-line. Those wellfields that were "resting" can be put back on-line and allow the water table to recover in the areas of impact. In order to make this concept work, TBW has established a loop system to link all existing water supplies and will link future projects into the loop as well. Also, TBW is required to reduce groundwater pumping from 11 wellfields in the northern Tampa Bay region from approximately 158 million gallons per day (mgd) down to 121 mgd by the end of 2002, and down to 90 mgd by the end of 2007. In conjunction with these reductions, alternative water supply sources are to be developed to provide 85 mgd of new water supply by the end of 2007. Figure 9-3 illustrates Tampa Bay Water's Master Water Plan projects within Hillsborough County.

Of the new water supply sources proposed, only one of the projects is located within the DCA watershed. That is the Brandon Urban Dispersed Wellfield. This project consists of several wells located in the Brandon area that in total will be able to provide an annual average daily amount of 6,000,000 gpd. Four of these wells are located within the DCA watershed (see Figure 9-1).

Another impact due to groundwater withdrawals is known as saltwater intrusion. Underlying the fresh groundwater in the Floridan aquifer there is saltwater. The transition zone where the groundwater changes from freshwater to saltwater is referred to as the saltwater interface. The farther inland you go from the coast, the deeper the saltwater interface occurs (usually several hundred to over one thousand feet deep). When fresh groundwater is pumped out of the Floridan aquifer, the deeper salt water can move in to take its place causing the saltwater interface to slowly move upward and farther inland. This saltwater intrusion has been occurring in the Tampa Bay area for several decades. The movement of the saltwater is a slow process, usually on the order of one foot per year or less, although in some areas it is occurring at a faster rate.

In southern Hillsborough County along the east coast of Tampa Bay, saltwater intrusion is becoming an increasing problem. Unless all groundwater pumping in the area is completely stopped, the saltwater will continue to slowly move inward and upward within the aquifer. However, doing away with groundwater withdrawals is not realistic, but there are possibilities for controlling the problem. By injecting freshwater (potable, reclaimed, or possibly treated stormwater) into the aquifer, the movement of the saltwater interface can be slowed and possibly stopped.




Source of Data: Tampa Bay Water

| | | |
|---|---|---|
| | DELANEY CREEK AREA STORMWATER MANAGEMENT MASTER PLAN TEAM (September 2000) | *Public Works Department Engineering Division Stormwater Management Section*<br>Figure 9-3 Tampa Bay Water Existing & Proposed Regional Water Use Facilities Map |

## 9.4.3. MINIMUM FLOWS AND LEVELS

In 1996, the Florida Legislature directed the state's five water management districts to set schedules to "establish minimum flows and levels for watercourses in their respective districts." The SWFWMD was subsequently required to set the flows and levels for surface waters and aquifers in Hillsborough, Pasco and Pinellas Counties, "below which significant harm to the water resources or ecology of the state or region" would occur. Subsequently, a committee composed of District staff, local government representatives and interested citizens, was formed to define "significant harm". This Technical Advisory Committee was further broken down into subcommittees to reach a consensus on the methodologies for setting the minimum flows and levels (MFLs) for aquifers, lakes and wetlands. The term significant harm now equates to "significant change".

The SWFWMD adopted an MFL rule in November 1998, but due to challenges by various parties, the rule did not go into effect until early 2000. This rule established minimum levels for several lakes in the northern Tampa Bay region, including northwest Hillsborough County, and also established a minimum flow for the Hillsborough River. A priority list and schedule for establishing future MFLs within the SWFWMD is being developed that includes establishing a minimum level for the Floridan aquifer within the Southern Water Use Caution Area, however none of the proposed lakes or streams on the list are located within the DCA watershed.

## 9.4.4 WATER CONSERVATION

Over the past thirty years, our region has experienced increasing growth and development as more and more people have moved into the area. Along with the ever-increasing growth, of course, comes a greater demand on services including the need for more water. Because of the recognition of environmental degradation due to increasing water use, the need for water conservation has become more and more important. Hillsborough County has a variety of water conservation programs currently in place. These include an increasing use of reclaimed water, a low-flow toilet rebate program, lawn watering restrictions, and a public outreach and education program to promote awareness of the importance of water conservation. An increasing awareness of the need for water conservation on the part of the general public and private industry, and the implementation of the above programs has helped to decrease the per capita daily water use in Hillsborough County from approximately 146 gallons per day in 1989 to about 103 gallons per day in 1996.

One area where there is potential for increased conservation efforts in the DCA watershed is the use of reclaimed water. Currently there are no reclaimed water sites in the DCA watershed, and there are not any sites proposed in the near future. In the future, as the South-Central Hillsborough County Reclaimed Water Plan is updated, sites within this area should be considered for inclusion in the plan. Additionally, the County should continue to promote water conservation efforts, and provide information to the public on the importance of conserving what is arguably our most important resource.

# POLLUTANT LOADING AND REMOVAL MODEL

## 10.1 OVERVIEW

Development in Hillsborough County has been proceeding steadily throughout the last decade. This is especially true in the northwest and north central portions of the County, as well as the Brandon area. In 1998 the County contracted Parsons Engineering Sciences, Inc. to assist in the development of a qualitative pollutant loading and removal model (PLRM) to be used as a tool in the County's watershed management plans, in order to better evaluate the water quality impacts that may result from this development and to assist in the establishment of a water quality treatment level of service (WQTLOS). The model's purpose is to qualitatively assess the amount of pollutant loading and use that information to determine a water quality treatment level of service for a given area; these areas can be an entire watershed, subwatershed, subbasin or even a catchment area.

Two versions of the model were considered prior to its development, both a GIS based and spreadsheet based program. It was decided to base the model on spreadsheets, which can be worked from the Excel© spreadsheet program. The spreadsheet concept was chosen due to its ease of use and because it does not need special equipment or software. Sensitivity analysis is also easier to perform with spreadsheets. To allow use in the Excel© program, the model was written in VisualBasic© code and includes various input or editing screens to facilitate its use. Since land uses will certainly change in the future, the model was made so that new data can be incorporated into the model as it becomes available.

## 10.2 MODEL INPUT DATA

There are three main components of the PLRM. Gross pollutant loads can be determined in the first component. This is most easily accomplished with a GIS program such as ArcView©. Next, an initial input file is created by forming an intersection of soil and land use data in conjunction with the subbasin delineations. This information is combined with run-off coefficients, rainfall amounts and event mean concentration (EMC) information to develop an annual average pollutant load for each subbasin. By applying best management practices information to these same areas, a net loading, the second component, can be calculated. Finally, as part of the third component, the water quality treatment level of service can be determined by comparing the net load versus a benchmark standard, in this case low or medium density residential land use without stormwater treatment. This WQTLOS can be determined on a watershed, subwatershed or subbasin level. The operation of the model is shown in the flowchart Figure 10-1.

## 10.2.1 LAND USE

The PLRM uses SWFWMD's 1995 land use coverage, which is based on the Florida Land Use and Cover Classification System (FLUCCS) codes. The land use is a general indicator of the amount of impervious surface area to be found within a given parcel of land and this can be used to gage the amount of run-off that might be generated for each rainfall event using predetermined run-off coefficients that the model has incorporated in one of its look-up tables.

For the purposes of this model, land use categories were aggregated to correspond with those in Hillsborough County's NPDES permit. These aggregated land use categories are:

- Low/Medium Density residential
- High Density Residential
- Light Industrial
- Agricultural
- Commercial
- Institutional
- Highway/Utility
- Recreational
- Open Land
- Extractive (mining)/Disturbed
- Upland Forest
- Wetland Forest
- Wetland Non-Forested

See Table 2.1 for a summary of the existing aggregated land uses in the Delaney Creek Area watershed.

## 10.2.2 SOIL CHARACTERISTICS

Here, soils are divided into their hydrologic soils group. As previously discussed in Chapter 2, there are four main hydrologic soil groups based on their infiltration rates and soil moisture capacities. These groups are:

- Group A - low run-off potential
- Group B - moderately low run-off potential

**Insert Figure 10-1, PLRM flowchart**

- Group C - moderately high run-off potential
- Group D - high run-off potential

In addition, the infiltration rate of some soils changes, depending on the time of year and soil saturation. In this case a dual designation can be assigned such as A/D or B/D. In this dual designation, the first letter indicates the infiltration rate during the dry season. Here, a soil may act like an A or B class soil with higher infiltration rates. The second letter indicates the infiltration rate during the wet season where the soil will have a slower infiltration rate and, therefore in these two examples, act more like a D class soil.

## 10.2.3 RUN-OFF COEFFICIENT

Run-off volume calculations are based on the application of run-off coefficients to the intersection of each soil and land use type. The values assigned to the run-off coefficients were based on those obtained from NPDES permit studies conducted in Hillsborough County. Most of the coefficients, listed by land use, can be found in the FDOT drainage manual. Run-off coefficients used by the PLRM are summarized in Table 10.1 below.

**Table 10.1**
**Run-off Coefficients for Pollutant Loading and Removal Model**

| Land Use | Hydrologic Soil Group | Run-off Coefficient |
|---|---|---|
| Low/Medium Density Residential | A | 0.267 |
| | B/D | 0.322 |
| | C | 0.379 |
| | D | 0.430 |
| High Density Residential | A | 0.500 |
| | B/D | 0.566 |
| | C | 0.634 |
| | D | 0.700 |

**Table 10.1** - cont'd.
**Run-off Coefficients for Pollutant Loading and Removal Model**

| Land Use | Hydrologic Soil Group | Run-off Coefficient |
|---|---|---|
| Light Industrial Or Highway/Utility | A | 0.500 |
| | B/D | 0.599 |
| | C | 0.701 |
| | D | 0.800 |
| Agricultural | A | 0.150 |
| | B/D | 0.233 |
| | C | 0.318 |
| | D | 0.400 |
| Commercial Or Institutional | A | 0.450 |
| | B/D | 0.549 |
| | C | 0.651 |
| | D | 0.750 |
| Recreational Or Open Land | A | 0.100 |
| | B/D | 0.166 |
| | C | 0.234 |
| | D | 0.300 |
| Extractive (mining)/Disturbed Or Upland Forested | A | 0.050 |
| | B/D | 0.050 |
| | C | 0.050 |
| | D | 0.050 |
| Wetland forested Or Wetland Non-Forested | A | 0.200 |
| | B/D | 0.200 |
| | C | 0.200 |
| | D | 0.200 |

## 10.2.4 SUBBASIN DELINEATIONS

The Delaney Creek Area watershed was broken down into four subwatersheds, each in turn made up of a number of smaller subbasins in order to be better able to compare the hydrologic, hydraulic and water quality characteristics. These subbasins range in size between less than one acre to over 439 acres, depending on the land use and configuration of any stormwater system. These subbasins can also be aggregated into larger areas (subwatersheds or watersheds) for a broader view.

## 10.2.5 EVENT MEAN CONCENTRATIONS

The event mean concentration or EMC specifies the average concentration of a given pollutant measured in run-off during storm events for a given land use and is calculated by flow weighting each pollutant sample measured. For the purposes of the PLRM, the pollutants chosen are those which are monitored for the County's NPDES permit. These constituents and their related EMC's are found in Table 10.2. By multiplying a particular EMC by the annual run-off volume, an annual average pollutant load can be determined. These EMC values were derived from various sources. Many of the values are reported in the County's NPDES permit. All other values were compiled from other, appropriate Florida studies. With the exception of nitrogen for residential land uses and nitrogen and phosphorus for agricultural land uses, the EMC's used are similar to or lower than EMC's for other parts of Florida and the nation. Copper in the County was higher than other parts of Florida but lower than national measurements. Total nitrogen and total phosphorus measurements were found to be much higher than residential land uses - 74 and 586%, respectively. The total nitrogen EMC is similar to other agricultural locations in Florida; however, the total phosphorus data was 6 times the Florida norm.

**Table 10.2**
**Event Mean Concentration (EMC) Values by Land Use** (Source - Parsons Engineering Sciences)

| Land Use | NPDES Conventional Water Quality Parameters (mg/l) | | | | | | | | | | | | | | | | NPDES Metals (mg/l) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $BOD_5$ | | TSS | | TKN | | $NO_3$+$NO_2$ | | TN | | TP | | TDP | | Oil/Grease | | Cd | | Cu | | Pb | | Zn | |
| Low/Med Density Residential | 1.0 | e | 19 | | 1.082 | | 0.281 | | 1.363 | g | 0.401 | | 0.282 | | 1.08 | | 0.001 | e | 0.013 | | 0.008 | | 0.022 | |
| High Density Residential | 2.6 | | 29 | | 1.368 | | 0.679 | | 2.047 | g | 1.337 | | 0.552 | | 1.073 | | 0.001 | e | 0.047 | | 0.006 | | 0.058 | |
| Light Industrial | 2.87 | | 18.2 | | 2.088 | | 0.187 | | 2.275 | g | 0.332 | | 0.187 | | 3.663 | | 0.001 | e | 0.024 | | 0.006 | | 0.096 | |
| Agriculture | 18.3 | | 12.7 | | 2.167 | | 0.803 | | 2.970 | g | 2.349 | | 1.223 | | 0.5 | e | 0.013 | | 0.041 | | 0.003 | e | 0.017 | |
| Commercial – Office | 2.62 | | 36.5 | | 2.207 | | 0.171 | | 2.378 | g | 0.305 | | 0.182 | | 0.793 | | 0.001 | e | 0.014 | | 0.003 | e | 0.036 | |
| Commercial – Retail | 2.72 | | 9.33 | | 1.083 | | 0.603 | | 1.686 | g | 0.253 | | 0.132 | | 0.5 | e | 0.001 | e | 0.021 | | 0.005 | | 0.015 | |
| Commercial – Combined | 2.67 | | 22.92 | | 1.65 | | 0.39 | | 2.032 | g | 0.28 | | 0.16 | | 0.65 | | 0.001 | | 0.02 | | 0.004 | | 0.03 | |
| Institutional | 2.67 | f | 22.92 | f | 1.65 | f | 0.39 | f | 2.032 | g | 0.28 | f | 0.16 | f | 0.65 | f | 0.001 | f | 0.02 | f | 0.004 | f | 0.03 | f |
| Highway / Utility | 24 | a | 261 | a | 2.99 | a | 1.140 | a | 4.130 | g | 0.120 | a | 0.300 | d | 0.4 | d | 0.040 | a | 0.103 | a | 0.960 | a | 0.410 | a |
| Recreational | 3.8 | b | 11.1 | b | 2.09 | b | 0.508 | b | 2.598 | g | 0.050 | b | 0.13 | c | 0.9 | d | 0.007 | b | 0.041 | b | 0.006 | b | 0.004 | b |
| Open Land | 3.8 | f | 11.1 | f | 2.09 | f | 0.03 | c | 2.598 | g | 0.19 | c | 0.13 | f | 0.9 | f | 0.0003 | c | 0.001 | c | 0.001 | c | 0.006 | |
| Extractive (Mining) / Disturbed | 28.94 | c | 13.2 | c | 3.50 | c | 0.03 | c | 3.530 | g | 0.19 | c | 0.13 | c | 0.9 | d | 0.0003 | c | 0.001 | c | 0.001 | c | 0.006 | c |
| Upland Forested | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h |
| Wetland Forest | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h |
| Wetland Non-forested | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h | 0 | h |

All EMC values without footnotes were obtained from samples collected for the Hillsborough Co. NPDES Permit Application (1993)
For parameters not detected in all samples, EMC's were calculated using in half the reporting limit for nondetects.
For pollutants not reported by Hillsborough County (1993), additional sources were used as noted:

a. Average values used by Hillsborough County (1994) (from Smith and Lord (1990), provided in Wanielista and Yousef (1993)
b. Literature value reported as EMC in Hillsborough County (1994)
c. Calculated value from Sarasota County stormwater sample
d. Orange County, 1993
e. Surrogate based on ½ DL for values reported as BDL
f. EMC's for open land use were assumed to be less than or equal to EMC's for recreational land use
g. Total nitrogen (TN) estimated as the sum of NH3 + organic N (TKN) + oxidized N (NO2+NO3)
h. EMC's for upland forest, wetland forest and non-forested wetland were assumed to be zero for benchmark comparison

EMC's reported as representative of agricultural land use were used for all subcategories of agricultural land use (e.g. pastures, crops and groves)

# 10.2.6 BEST MANAGEMENT PRACTICES (BMP) INFORMATION

The final input data needed centers on the BMPs existing within the watershed's subbasins. The type of BMP and its percent coverage for each land use within each subbasin is determined using current aerial photography, such as the colored orthophoto quads or blue line aerials; specific site data or permits and/or actual field inspections. The BMP types and their removal efficiencies are shown in Table 10.3. This information is needed in calculating the net pollutant loading. The BMP file must be in a specific format, which can be generated by the model.

**Table 10.3**
**Estimated BMP Removal Efficiencies**
(Source - Parsons Engineering Sciences)

| BMP Type | $BOD_5$ | TSS | TKN | $NO_3$ + $NO_2$ | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wet Detention | 60% | 85% | 30% | 80% | 30% | 65% | 80% | 35% | 75% | 65% | 75% | 85% |
| Percolation | 80% | 80% | 80% | 80% | 80% | 80% | 80% | 80% | 80% | 80% | 80% | 80% |
| Infiltration Trench | | 75% | | | | 60% | | | | | | |
| Grass Swale | | 60% | 10% | 15% | 10% | 20% | | | | | | |

Harper, H. H. 1995. "Pollutant removal efficiencies for typical stormwater management systems in Florida"

Kadlec, R. H and R. L. Knight, 1996. "Treatment Wetlands" CTC Press, Inc. Boca Raton, Florida

USEPA, 1993 "Guidance specifying management measures for sources of nonpoint pollution in coastal waters"

Parsons Engineering Science, 1999

# 10.3 DETERMINATION OF GROSS AND NET POLLUTANT LOADS

This model uses the EPA Simple Method to determine non-point pollutant loads. This is done according to the formula - LI = (0.277)(P)(CF)(RVI)(CI)(AI); where

$L_I$ = the annual pollutant load per basin in pounds per year

P = the annual average precipitation in inches per year

CF = the correction factor for storms not producing run-off; assumed to be 0.9

$R_{VI}$ = the weighted average runoff coefficient based on impervious area

$C_I$ = the event mean concentration of pollutant in milligrams per liter; and

$A_I$ = the catchment area contributing to the outfall in acres

The first step in the process of determining the gross pollutant load is the creation of an input data file. This is in the form of a GIS export file that contains the intersection of subbasin, soil and land use coverage. The resulting file lists areas referred to as elements, in acres, for every combination of land use and hydrologic soils group in each subbasin. The data input file is added to the model and the model's run-off coefficient, rainfall and EMC data can then be applied to this file. The gross pollutant loads are determined on the watershed, basin and subbasin level. In the determination of the net pollutant load, the model is run a second time using the same data as in the gross load determination, but here the BMP coverage file is applied. Appendices 10A through 10D, summarize the net pollutant loads for each of the basin's four subwatersheds.

# 10.4 DETERMINATION OF WATER QUALITY TREATMENT LEVEL OF SERVICE

The WQTLOS has been developed to aid in the comparison of existing or proposed water quality standards to pollutant loading goals. The low to medium single family residential land use, without stormwater treatment has been selected as the benchmark for this comparison. The model calculates the net pollutant load for each pollutant based on land use and BMP practices.

It also calculates the gross load for each pollutant assuming 100% of the subbasin is in low to medium single-family residential land use. Next, the ratio of net to gross load is determined. The LOS is then determined for each subbasin based on the criteria listed below. This LOS is designated by the letters A through F with A being the highest and F the lowest LOS.

**LOS A, net load equivalent to 20% or less of untreated single family residential.** This level generally applies to undisturbed natural systems or areas with stormwater treatment facilities that can remove pollutants down to the level of undisturbed natural systems. Areas where typical land uses (residential) exhibit stormwater treatment levels above the minimum required per 62-40.432(5) F.A.C. (Water Policy) would also receive LOS A.

**LOS B, net load equivalent to between 20% and 40% of untreated single family residential.** This level applies to those areas built to present day SWFWMD standards of 80% removal and assumes that the facility has been properly designed and maintained.

**LOS C, net load equivalent to between 40% and 70% of untreated single family residential.** This level would apply to areas which were built to present day standards but the facility was poorly designed or maintained. It would also apply to properly designed and maintained systems built prior to present day standards.

**LOS D, net load equivalent to between 70% and 100% of untreated single family residential.** This level would apply to those subbasins with minimal treatment.

**LOS F, net load equivalent to or greater than 100% of untreated single family residential.** This level would apply to those subbasins having no or inadequate stormwater treatment of an area producing larger pollutant loads per unit area than typical residential land uses.

# 10.5 ADDITIONAL FEATURES AND UTILITIES

## 10.5.1 FEATURES

The model can be programmed two different ways. The first way is through a series of dialog boxes that guide the user through the steps in setting up and executing a pollutant-loading scenario. The second way is by directly inputting the required information into the Manager sheet of the model. This second option is also a good way to check the input information prior to running the model.

The model contains various look-up tables including literature references for the BMP information, both general and single family residential run-off coefficients, general and single family residential event mean concentrations and examples of pollutant loading, LOS and Manager sheets.

Also included are a user's manual and a very brief help section that explains how to execute a scenario and gives formatting hints.

A report option allows easy access to output files for executed scenarios and level of service.

## 10.5.2 UTILITIES

The model has the capability to create a template for inputting BMP coverage information. This is important because the subbasin ID numbers and land use spellings must be identical in the input and BMP files in order for the model to produce the correct loadings. If the numbers and spellings are not identical, the model will treat them as different categories and the resulting information will not be an accurate accounting of the pollutant loads.

Land uses can be reaggregated according to FLUCCS codes to have the required land use categories. After reaggregation, all identically numbered subbasins must be regrouped together, if they were separated from each other during the reaggregation process.

## 10.5.3 ADDING DATA

Data can be added to the EMC, run-off coefficient, land use aggregation and watershed listings; however, new worksheets must be formatted exactly like the existing sheet.

~~Table 10.4a~~ Ap 10A

## Summary of Net Pollutant Loads for the Delaney Creek Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 210010 | Delaney Creek | 10267.046 | 44883.64 | 1694.97 | 529.451 | 2245.98 | 82.986 | 162.538 | 435.4901 | 15.479 | 41.404 | 109.653 | 66.611 |
| 210020 | Delaney Creek | 2262.7311 | 13586.31 | 644.08 | 176.047 | 823.856 | 103.56 | 80.2528 | 271.6237 | 2.93099 | 11.708 | 20.445 | 18.282 |
| 210025 | Delaney Creek | 1641.5132 | 9110.782 | 418.554 | 114.936 | 536.284 | 53.321 | 42.0633 | 132.8687 | 2.13514 | 8.0986 | 14.8154 | 12.483 |
| 210040 | Delaney Creek | 1952.6837 | 11514.28 | 959.013 | 179.399 | 1168.04 | 121.06 | 75.7633 | 619.5994 | 1.55942 | 10.509 | 9.84681 | 19.908 |
| 210060 | Delaney Creek | 2198.767 | 13654.18 | 810.625 | 152.354 | 962.979 | 183.26 | 116.04 | 918.221 | 1.87673 | 10.351 | 28.2145 | 33.853 |
| 210065 | Delaney Creek | 273.62763 | 652.6395 | 347.119 | 9.10816 | 378.546 | 27.564 | 8.91203 | 562.6177 | 0.05967 | 1.9904 | 0.3261 | 3.4046 |
| 210080 | Delaney Creek | 253.70848 | 2302.924 | 151.827 | 40.5823 | 192.409 | 59.605 | 40.1152 | 131.8297 | 0.19879 | 1.7161 | 0.9223 | 2.6255 |
| 210090 | Delaney Creek | 489.58237 | 4469.577 | 337.829 | 74.6777 | 412.507 | 67.519 | 43.4285 | 244.3851 | 0.21921 | 3.4268 | 1.14613 | 6.655 |
| 210100 | Delaney Creek | 1174.3424 | 4033.392 | 311.505 | 93.1781 | 404.683 | 193.48 | 112.606 | 208.4218 | 0.86822 | 4.5109 | 1.46833 | 4.7786 |
| 210120 | Delaney Creek | 1656.1063 | 4570.947 | 426.696 | 120.176 | 554.147 | 252.39 | 144.972 | 255.4427 | 1.18337 | 5.6217 | 1.63896 | 5.3616 |
| 210125 | Delaney Creek | 461.05912 | 6117.554 | 381.083 | 95.1721 | 476.255 | 109.79 | 73.5725 | 286.5523 | 0.30283 | 4.3535 | 2.04313 | 6.9829 |
| 210150 | Delaney Creek | 355.00463 | 4094.17 | 340.193 | 70.075 | 425.566 | 84.415 | 58.465 | 256.4867 | 0.22992 | 2.9572 | 1.60918 | 4.5804 |
| 210170 | Delaney Creek | 299.73512 | 2713.676 | 180.079 | 49.8261 | 229.905 | 53.617 | 26.0515 | 82.63053 | 0.11311 | 2.5877 | 0.49562 | 3.5549 |
| 210180 | Delaney Creek | 351.88715 | 3139.05 | 195.146 | 70.3808 | 265.835 | 105.82 | 47.0516 | 115.6876 | 0.12849 | 4.0801 | 0.60677 | 5.2345 |
| 210190 | Delaney Creek | 3829.8945 | 18343.71 | 661.519 | 205.464 | 876.927 | 69.876 | 80.4688 | 216.2136 | 5.88042 | 17.156 | 41.9362 | 27.219 |
| 210200 | Delaney Creek | 1062.2377 | 9277.505 | 518.1 | 204.409 | 722.509 | 353.11 | 153.015 | 320.4076 | 0.46058 | 12.928 | 1.83164 | 16.1 |
| 210210 | Delaney Creek | 922.86661 | 4647.698 | 144.693 | 49.7719 | 196.53 | 27.159 | 24.6296 | 59.44895 | 1.49047 | 4.5256 | 10.7498 | 7.125 |
| 210230 | Delaney Creek | 5517.1113 | 14215.46 | 862.168 | 243.981 | 1163.05 | 388.44 | 216.992 | 253.7493 | 6.04128 | 17.758 | 30.8915 | 21.007 |
| 210240 | Delaney Creek | 6560.3959 | 27202.58 | 1123.99 | 332.292 | 1478.7 | 91.791 | 119.585 | 357.1118 | 9.57542 | 25.916 | 66.3315 | 41.755 |
| 210260 | Delaney Creek | 9329.7874 | 20003.89 | 1317.37 | 442.135 | 1769.02 | 778.01 | 444.407 | 327.9833 | 9.32161 | 27.603 | 37.8308 | 28.818 |
| 210280 | Delaney Creek | 1000.7549 | 10707.64 | 130.518 | 48.659 | 179.177 | 7.9972 | 13.8578 | 19.56991 | 1.63845 | 4.2924 | 38.9866 | 16.771 |
| 210290 | Delaney Creek | 1078.7681 | 5415.884 | 320.167 | 81.4781 | 405.207 | 16.279 | 28.5155 | 131.005 | 0.92545 | 2.2042 | 17.621 | 7.8671 |
| 210300 | Delaney Creek | 8406.1625 | 35945.04 | 1152.81 | 384.174 | 1555.81 | 39.007 | 115.736 | 245.5373 | 13.3399 | 34.218 | 95.271 | 55.015 |
| 210332 | Delaney Creek | 3727.3867 | 16017.35 | 575.589 | 156.81 | 769.29 | 28.761 | 49.5432 | 124.6216 | 5.96838 | 16.169 | 42.8325 | 24.889 |
| 210333 | Delaney Creek | 2105.7473 | 8881.503 | 581.116 | 68.8636 | 780.171 | 29.157 | 25.1337 | 133.8156 | 2.07227 | 8.1344 | 48.4669 | 13.4 |
| 210335 | Delaney Creek | 944.00458 | 3701.187 | 264.373 | 25.7745 | 354.584 | 7.3104 | 7.10648 | 52.2178 | 0.9212 | 3.4689 | 21.801 | 5.7197 |
| 210336 | Delaney Creek | 1748.3406 | 7129.494 | 381.306 | 41.5666 | 526.657 | 7.6525 | 10.9382 | 47.4339 | 1.82088 | 6.564 | 43.6987 | 11.198 |
| 210350 | Delaney Creek | 47.976176 | 54.03205 | 46.258 | 3.21078 | 57.4957 | 0.608 | 0.82922 | 18.47214 | 0.00794 | 0.0149 | 0.00843 | 0.0305 |
| 210360 | Delaney Creek | 56.857442 | 105.0403 | 54.1473 | 4.6832 | 70.5385 | 6.727 | 2.20588 | 25.84035 | 0.0104 | 0.229 | 0.02705 | 0.1413 |
| 211010 | Delaney Creek | 423.53377 | 4244.414 | 337.793 | 68.3368 | 409.398 | 77.448 | 52.535 | 328.4918 | 0.2271 | 3.3454 | 1.43242 | 7.6125 |
| 211030 | Delaney Creek | 172.38261 | 3113.146 | 188.33 | 46.2695 | 237.114 | 67.127 | 46.4491 | 186.6432 | 0.16568 | 2.1754 | 1.32446 | 3.6034 |
| 211060 | Delaney Creek | 1873.8807 | 5064.39 | 431.523 | 140.152 | 572.507 | 304.05 | 167.431 | 258.0719 | 1.32658 | 6.9155 | 1.66141 | 6.6206 |
| 211080 | Delaney Creek | 322.03929 | 1709.933 | 119 | 33.3503 | 152.35 | 58.985 | 35.7925 | 86.72686 | 0.23766 | 1.585 | 0.61807 | 1.9956 |
| 211100 | Delaney Creek | 281.73263 | 2053.062 | 131.138 | 36.4234 | 167.561 | 63.829 | 40.662 | 114.5146 | 0.22953 | 1.723 | 0.8364 | 2.3998 |
| 211110 | Delaney Creek | 130.18927 | 125.2823 | 48.3632 | 4.77359 | 65.0708 | 18.606 | 5.51907 | 22.86998 | 0.0556 | 0.4496 | 0.05539 | 0.1787 |
| 211116 | Delaney Creek | 128.49097 | 2190.194 | 156.189 | 33.1346 | 196.752 | 50.465 | 33.2526 | 153.0452 | 0.12056 | 1.636 | 0.96448 | 2.536 |

~~Table 10.4a~~ App. 10A

## Summary of Net Pollutant Loads for the Delaney Creek Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 211160 | Delaney Creek | 61.254431 | 387.9827 | 99.9659 | 8.44283 | 129.516 | 23.124 | 8.06301 | 89.6436 | 0.03195 | 0.7699 | 0.24768 | 0.5072 |
| 211165 | Delaney Creek | 96.169505 | 1438.687 | 91.2001 | 23.4639 | 114.664 | 29.192 | 21.1322 | 83.4889 | 0.07836 | 0.9424 | 0.5824 | 1.6223 |
| 211185 | Delaney Creek | 118.39591 | 256.6737 | 80.016 | 6.49842 | 102.76 | 21.147 | 7.49595 | 61.53823 | 0.05852 | 0.5419 | 0.17181 | 0.3012 |
| 211510 | Delaney Creek | 1712.6945 | 1940.23 | 253.242 | 84.9895 | 340.889 | 232 | 123.284 | 100.2908 | 1.22714 | 4.3195 | 0.57274 | 2.4556 |
| 211530 | Delaney Creek | 4054.2033 | 6854.903 | 786.748 | 232.325 | 1052.8 | 579.72 | 290.679 | 329.0854 | 2.67538 | 12.726 | 1.76548 | 9.6935 |
| 212000 | Delaney Creek | 856.32978 | 7565.056 | 450.4 | 203.135 | 656.869 | 373.96 | 168.262 | 346.0862 | 0.33368 | 14.247 | 1.51118 | 14.373 |
| 212030 | Delaney Creek | 447.11397 | 2757.671 | 204.162 | 97.0578 | 304.706 | 185.95 | 88.77 | 168.5283 | 0.18625 | 7.4041 | 0.51001 | 5.4895 |
| 212040 | Delaney Creek | 431.64597 | 3860.747 | 219.765 | 107.004 | 328.624 | 206.8 | 91.4309 | 177.9047 | 0.166 | 7.787 | 0.76563 | 7.711 |
| 212060 | Delaney Creek | 629.07693 | 6255.461 | 306.109 | 145.733 | 451.842 | 287.7 | 122.216 | 238.8173 | 0.28213 | 9.8945 | 1.37157 | 12.164 |
| 212080 | Delaney Creek | 1215.6332 | 10874.31 | 618.503 | 301.753 | 925.494 | 583.86 | 258.088 | 501.6825 | 0.46755 | 21.975 | 2.15728 | 21.749 |
| 212100 | Delaney Creek | 803.50999 | 5816.764 | 430.631 | 155.93 | 589.116 | 239.14 | 108.646 | 265.0999 | 0.3787 | 10.047 | 1.125 | 10.465 |
| 212130 | Delaney Creek | 1103.5375 | 8208.341 | 592.785 | 205.832 | 822.006 | 360.72 | 155.357 | 360.6155 | 0.69893 | 14.387 | 1.89665 | 15.022 |
| 213010 | Delaney Creek | 696.3617 | 6547.968 | 353.008 | 172.814 | 528.087 | 335.08 | 145.737 | 283.2092 | 0.28134 | 12.443 | 1.43218 | 13.076 |
| 213040 | Delaney Creek | 1088.6017 | 7886.162 | 492.441 | 230.94 | 731.506 | 423.77 | 203.021 | 396.5749 | 0.57683 | 17.719 | 6.14469 | 15.026 |
| 213060 | Delaney Creek | 1488.8614 | 13892.2 | 578.424 | 151.535 | 740.841 | 111.95 | 67.1978 | 239.3309 | 1.50413 | 8.3649 | 30.6552 | 19.777 |
| 213510 | Delaney Creek | 1426.5835 | 6939.126 | 222.957 | 76.1185 | 302.644 | 39.929 | 38.4791 | 93.88208 | 2.30376 | 7.0017 | 16.5005 | 10.665 |
| 213530 | Delaney Creek | 1772.4142 | 8859.067 | 297.327 | 95.8157 | 397.593 | 47.129 | 50.8485 | 141.6049 | 2.88074 | 8.5552 | 20.6291 | 13.271 |
| 213800 | Delaney Creek | 314.87787 | 1306.573 | 81.966 | 8.40574 | 111.386 | 4.1823 | 3.05187 | 22.27388 | 0.32441 | 1.2422 | 7.70143 | 2.029 |
| 213810 | Delaney Creek | 2046.9285 | 6691.668 | 337.504 | 109.338 | 449.114 | 156.9 | 96.1908 | 125.372 | 2.35363 | 7.5605 | 12.1994 | 9.5482 |
| 214012 | Delaney Creek | 129.93296 | 404.3304 | 139.4 | 9.38421 | 172.244 | 11.357 | 3.74068 | 51.35769 | 0.02997 | 0.7091 | 0.11661 | 0.4458 |
| 214020 | Delaney Creek | 1431.6561 | 6605.987 | 408.325 | 110.04 | 520.494 | 29.069 | 34.4854 | 143.0804 | 1.65731 | 5.2578 | 11.1465 | 8.5797 |
| 214040 | Delaney Creek | 245.5907 | 787.277 | 264.745 | 17.7989 | 327.041 | 22.333 | 7.20389 | 97.19168 | 0.0574 | 1.4 | 0.22878 | 0.875 |
| 214053 | Delaney Creek | 889.23716 | 4109.457 | 206.784 | 52.3344 | 267.183 | 16.115 | 17.2123 | 62.5342 | 1.22631 | 3.8057 | 8.59114 | 5.8607 |
| 214500 | Delaney Creek | 11.461538 | 9.019927 | 7.83484 | 0.57605 | 9.85103 | 0.5586 | 0.26509 | 2.970059 | 0.00307 | 0.01 | 0.00155 | 0.0058 |
| 215010 | Delaney Creek | 2606.2427 | 12759.08 | 486.538 | 145.649 | 637.448 | 45.945 | 49.6667 | 131.8212 | 3.83435 | 11.811 | 27.1209 | 18.544 |
| 215013 | Delaney Creek | 62.094934 | 253.1956 | 13.5734 | 1.47676 | 18.742 | 0.2752 | 0.38905 | 1.696896 | 0.06465 | 0.2333 | 1.55138 | 0.3977 |
| 215023 | Delaney Creek | 91.362612 | 312.9987 | 79.7064 | 5.55683 | 99.1554 | 6.4501 | 2.18017 | 28.08632 | 0.03909 | 0.4808 | 0.61268 | 0.3892 |
| 215041 | Delaney Creek | 233.11386 | 846.8862 | 169.161 | 14.1669 | 210.352 | 13.876 | 5.41693 | 59.98335 | 0.17658 | 1.2145 | 1.16051 | 1.1121 |
| 215042 | Delaney Creek | 246.26541 | 1008.202 | 81.5614 | 11.7365 | 103.868 | 5.8675 | 4.02246 | 25.26482 | 0.3305 | 1.1376 | 2.33776 | 1.5014 |
| 215051 | Delaney Creek | 1202.1538 | 5567.318 | 384.004 | 70.6221 | 488.895 | 31.918 | 24.7121 | 124.4534 | 1.5337 | 5.4538 | 10.7001 | 7.8747 |
| 215060 | Delaney Creek | 900.0463 | 3870.774 | 129.73 | 37.2887 | 174.523 | 5.8774 | 11.7059 | 26.46661 | 1.45623 | 3.8804 | 10.4608 | 6.0374 |
| 215070 | Delaney Creek | 2177.1684 | 19337.1 | 817.469 | 187.363 | 1008.71 | 105.93 | 74.7046 | 496.4466 | 2.18939 | 11.143 | 44.7815 | 31.867 |
| 215500 | Delaney Creek | 166.37774 | 678.1014 | 49.2421 | 8.58384 | 62.9823 | 3.105 | 2.76654 | 15.29247 | 0.22383 | 0.7093 | 1.57393 | 0.9933 |
| 215520 | Delaney Creek | 608.20788 | 2532.272 | 165.25 | 27.7831 | 212.44 | 11.216 | 9.30112 | 48.20447 | 0.86986 | 2.7555 | 6.18774 | 3.8298 |
| 215530 | Delaney Creek | 788.88278 | 3366.084 | 144.544 | 33.7159 | 190.515 | 8.2318 | 10.8427 | 35.14846 | 1.23169 | 3.4696 | 8.82466 | 5.2021 |
| 215537 | Delaney Creek | 1562.7889 | 6373.248 | 340.721 | 37.1162 | 470.627 | 6.8372 | 9.76743 | 42.32553 | 1.62791 | 5.8686 | 39.0697 | 10.012 |

~~Table 10.4a~~ App 10A

## Summary of Net Pollutant Loads for the Delaney Creek Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 215538 | Delaney Creek | 1254.4194 | 11724.2 | 396.261 | 65.9216 | 504.923 | 29.417 | 20.9794 | 141.6519 | 1.72016 | 5.8259 | 40.019 | 18.654 |
| 215542 | Delaney Creek | 532.66883 | 1807.939 | 224.15 | 18.8751 | 290.212 | 5.4485 | 5.18452 | 65.15098 | 0.43305 | 1.6488 | 9.83617 | 2.6718 |
| 215550 | Delaney Creek | 258.21357 | 823.5415 | 280.762 | 18.9553 | 347.105 | 23.817 | 7.94044 | 108.0455 | 0.06137 | 1.4414 | 0.25062 | 0.9104 |
| 216000 | Delaney Creek | 872.86023 | 3612.385 | 154.424 | 47.2932 | 203.483 | 4.6742 | 13.7148 | 42.98464 | 1.2735 | 3.2257 | 8.95844 | 5.2859 |
| 216500 | Delaney Creek | 7.7546843 | 8.49444 | 7.46388 | 0.51834 | 9.27807 | 0.0893 | 0.13265 | 2.984533 | 0.00128 | 0.0018 | 0.00128 | 0.0046 |
| 216510 | Delaney Creek | 323.94368 | 1366.525 | 47.4607 | 13.4259 | 63.8137 | 1.3942 | 4.10962 | 10.22192 | 0.52023 | 1.3371 | 3.7323 | 2.1319 |
| 217000 | Delaney Creek | 263.08651 | 746.6429 | 278.312 | 18.8088 | 344.143 | 20.284 | 7.15666 | 103.617 | 0.05832 | 1.249 | 0.20992 | 0.8012 |
| 217020 | Delaney Creek | 254.85193 | 739.6317 | 270.496 | 18.2637 | 334.419 | 20.265 | 7.02745 | 100.4581 | 0.05703 | 1.2523 | 0.2093 | 0.7992 |
| 220000 | Delaney Creek | 45.107541 | 36.98686 | 31.0162 | 2.3051 | 39.0841 | 2.3521 | 1.07557 | 11.89591 | 0.01203 | 0.0452 | 0.00665 | 0.0259 |
| 220010 | Delaney Creek | 2701.5243 | 770.5845 | 292.45 | 101.674 | 400.104 | 276.93 | 180.488 | 76.68982 | 1.91547 | 6.0601 | 0.11408 | 1.022 |
| 220040 | Delaney Creek | 4373.0859 | 3260.848 | 648.208 | 204.101 | 867.696 | 533.28 | 305.188 | 234.2407 | 3.07797 | 10.768 | 0.69699 | 4.1052 |
| 220050 | Delaney Creek | 3608.7262 | 15424.71 | 549.137 | 192.565 | 751.432 | 78.884 | 80.2182 | 165.7317 | 5.53236 | 16.787 | 39.1823 | 23.913 |
| 220060 | Delaney Creek | 190.63274 | 587.7079 | 108.337 | 25.0055 | 138.162 | 9.8823 | 7.86003 | 50.48895 | 0.05264 | 0.3175 | 0.07208 | 0.4313 |
| 220070 | Delaney Creek | 239.7064 | 3303.462 | 244.021 | 52.6877 | 305.809 | 69.518 | 47.8469 | 200.4777 | 0.18024 | 2.3882 | 1.34231 | 3.7663 |
| 220075 | Delaney Creek | 1304.7858 | 6538.864 | 312.151 | 97.1229 | 423.677 | 91.257 | 50.3914 | 127.2946 | 1.76064 | 7.5 | 12.4163 | 10.663 |
| 220110 | Delaney Creek | 29.20063 | 126.6179 | 28.5319 | 3.80922 | 41.8641 | 12.854 | 3.13039 | 21.26145 | 0.00765 | 0.4512 | 0.04776 | 0.2424 |
| 220130 | Delaney Creek | 20.16083 | 86.72346 | 19.3559 | 2.64062 | 28.5981 | 8.9907 | 2.16854 | 14.40373 | 0.00516 | 0.3153 | 0.03198 | 0.1686 |
| 220140 | Delaney Creek | 36.702534 | 156.7811 | 34.8742 | 4.80352 | 51.6865 | 16.404 | 3.93479 | 25.81719 | 0.00925 | 0.5756 | 0.05689 | 0.3069 |
| 220170 | Delaney Creek | 14.431219 | 274.1932 | 15.6146 | 4.05517 | 19.6698 | 5.7869 | 4.0696 | 15.58572 | 0.01443 | 0.1876 | 0.11545 | 0.3175 |
| 220180 | Delaney Creek | 261.86977 | 2303.488 | 122.985 | 34.314 | 157.583 | 37.24 | 23.7523 | 81.85338 | 0.28433 | 1.9598 | 1.98975 | 3.0124 |
| 220190 | Delaney Creek | 296.78002 | 2432.745 | 184.359 | 43.7364 | 228.096 | 30.197 | 18.391 | 78.79075 | 0.11232 | 1.7764 | 0.45369 | 2.6552 |
| 220195 | Delaney Creek | 435.14106 | 4627.054 | 304.174 | 78.319 | 382.493 | 98.642 | 67.0483 | 242.1941 | 0.39121 | 3.8683 | 1.74751 | 5.2067 |
| 220200 | Delaney Creek | 203.90915 | 962.7726 | 193.44 | 19.4197 | 239.698 | 21.324 | 8.41325 | 73.10596 | 0.05825 | 1.2873 | 0.22674 | 1.1215 |
| 220210 | Delaney Creek | 653.41621 | 6563.89 | 625.208 | 120.618 | 827.433 | 207.53 | 102.8 | 481.2212 | 0.36334 | 7.2586 | 2.55457 | 8.1342 |
| 221000 | Delaney Creek | 1383.5628 | 2633.693 | 266.101 | 81.4432 | 347.602 | 168.87 | 89.2774 | 82.20177 | 0.93585 | 3.9895 | 0.74979 | 3.1459 |
| 221030 | Delaney Creek | 412.2139 | 1363.166 | 370.484 | 27.4696 | 458.896 | 32.725 | 11.5851 | 134.1708 | 0.19328 | 2.2255 | 1.07072 | 1.6444 |
| 221500 | Delaney Creek | 732.73707 | 1082.72 | 220.783 | 46.875 | 316.014 | 136.86 | 53.443 | 120.2699 | 0.43839 | 3.5663 | 0.29719 | 1.7824 |
| 221520 | Delaney Creek | 909.58131 | 1914.893 | 352.947 | 48.248 | 447.32 | 90.171 | 43.6969 | 119.2674 | 0.67226 | 3.3388 | 2.197 | 2.5792 |
| 221540 | Delaney Creek | 2904.5009 | 15420.47 | 865.552 | 222.112 | 1158.59 | 270.94 | 148.658 | 477.5988 | 3.54117 | 16.464 | 23.0116 | 21.568 |
| 221550 | Delaney Creek | 498.30164 | 2023.271 | 144.105 | 45.4253 | 189.53 | 94.098 | 53.5232 | 105.236 | 0.36952 | 2.3193 | 0.73663 | 2.6029 |
| 221560 | Delaney Creek | 197.97826 | 2445.051 | 144.913 | 38.5786 | 183.492 | 59.782 | 40.3553 | 138.1098 | 0.17715 | 1.7999 | 1.01831 | 2.8401 |
| 221580 | Delaney Creek | 1199.6907 | 1432.011 | 182.788 | 62.1856 | 244.974 | 158.59 | 85.5061 | 69.6258 | 0.84764 | 2.9443 | 0.39716 | 1.7486 |
| 221590 | Delaney Creek | 76.915987 | 720.2222 | 44.2091 | 12.0128 | 56.2218 | 19.805 | 12.9784 | 40.44801 | 0.06519 | 0.5643 | 0.29695 | 0.839 |
| 222000 | Delaney Creek | 515.04493 | 382.1795 | 69.4952 | 23.0206 | 93.9446 | 65.571 | 34.0551 | 17.43135 | 0.36116 | 1.1772 | 0.07694 | 0.5008 |
| 222020 | Delaney Creek | 169.02354 | 292.287 | 161.237 | 13.5097 | 208.521 | 17.161 | 5.98147 | 74.96853 | 0.03043 | 0.5798 | 0.07215 | 0.3698 |
| 222030 | Delaney Creek | 332.43187 | 1115.435 | 161.089 | 20.4573 | 214.512 | 23.892 | 9.1936 | 74.01536 | 0.33544 | 1.5882 | 2.30002 | 1.7282 |

Table ~~10.4~~a App 10A

## Summary of Net Pollutant Loads for the Delaney Creek Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 222040 | Delaney Creek | 184.31828 | 770.9467 | 169.715 | 24.0677 | 253.952 | 82.934 | 19.5661 | 123.6084 | 0.04431 | 2.9154 | 0.26584 | 1.5419 |
| 222050 | Delaney Creek | 287.4366 | 922.2305 | 268.47 | 31.7458 | 379.58 | 89.531 | 22.4281 | 166.8149 | 0.06265 | 3.1359 | 0.29901 | 1.699 |
| 222060 | Delaney Creek | 30.615079 | 93.21318 | 28.6604 | 3.27837 | 40.1347 | 8.8275 | 2.24499 | 17.30646 | 0.01764 | 0.4123 | 0.03902 | 0.1662 |
| 222080 | Delaney Creek | 243.76109 | 476.4652 | 240.693 | 18.2722 | 304.646 | 18.934 | 7.20373 | 101.7991 | 0.04632 | 0.7931 | 0.12021 | 0.5269 |
| 222090 | Delaney Creek | 959.04758 | 1883.371 | 355.392 | 45.2177 | 492.042 | 127.31 | 37.0825 | 159.067 | 0.6418 | 4.484 | 2.93186 | 3.0718 |
| 222500 | Delaney Creek | 125.43342 | 445.5331 | 40.4623 | 5.90665 | 51.8338 | 0.8744 | 1.73924 | 13.61713 | 0.16242 | 0.4171 | 1.13801 | 0.6658 |
| 222505 | Delaney Creek | 96.207382 | 344.1116 | 32.0651 | 8.42153 | 40.5965 | 0.9991 | 2.33118 | 12.31274 | 0.09087 | 0.2144 | 0.56822 | 0.3941 |
| 222520 | Delaney Creek | 191.34031 | 715.5988 | 158.262 | 22.9063 | 235.973 | 77.964 | 19.2436 | 113.2864 | 0.05844 | 2.7085 | 0.24572 | 1.4172 |
| 222530 | Delaney Creek | 471.83545 | 731.5273 | 229.305 | 27.9158 | 327.01 | 99.322 | 25.961 | 125.5175 | 0.20376 | 3.222 | 0.27309 | 1.3487 |
| 222540 | Delaney Creek | 361.29375 | 837.9456 | 237.916 | 29.0977 | 339.758 | 95.555 | 24.4239 | 146.6272 | 0.11446 | 3.0646 | 0.2919 | 1.554 |
| 223000 | Delaney Creek | 807.10886 | 4595.025 | 429.106 | 93.1601 | 558.632 | 140.1 | 68.2608 | 238.9912 | 0.42631 | 5.0879 | 1.2445 | 5.5 |
| 223010 | Delaney Creek | 183.74891 | 1826.464 | 124.386 | 29.8942 | 154.28 | 26.288 | 16.1381 | 64.72481 | 0.08378 | 1.3588 | 0.43063 | 2.053 |
| 223020 | Delaney Creek | 11.338967 | 67.04911 | 18.095 | 1.35581 | 22.8403 | 3.501 | 1.38344 | 16.47581 | 0.00672 | 0.1101 | 0.04686 | 0.0777 |
| 223030 | Delaney Creek | 524.71927 | 4647.208 | 294.499 | 72.4827 | 367.245 | 61.773 | 39.3025 | 152.8519 | 0.37865 | 3.5694 | 2.3412 | 5.4447 |
| 223050 | Delaney Creek | 1801.5731 | 10728.82 | 449.207 | 129.976 | 582.559 | 84.857 | 68.4551 | 218.8763 | 2.58716 | 9.473 | 18.4198 | 14.962 |
| 224010 | Delaney Creek | 810.11252 | 3492.929 | 100.352 | 34.7365 | 136.961 | 3.4395 | 10.5983 | 18.28772 | 1.31968 | 3.3892 | 9.46623 | 5.4216 |
| 224050 | Delaney Creek | 407.64446 | 2899.092 | 124.293 | 35.7304 | 160.772 | 33.292 | 26.1577 | 89.20522 | 0.60885 | 2.4165 | 4.40047 | 3.9194 |
| 225010 | Delaney Creek | 109.40322 | 381.6302 | 106.485 | 10.6352 | 139.527 | 20.929 | 5.84541 | 50.84281 | 0.02633 | 0.8933 | 0.11214 | 0.5261 |
| 225017 | Delaney Creek | 231.12535 | 794.8344 | 226.469 | 16.4429 | 281.406 | 21.454 | 7.15003 | 88.34635 | 0.09379 | 1.3548 | 0.52919 | 0.9546 |
| 225110 | Delaney Creek | 114.25604 | 1012.206 | 69.3404 | 17.9756 | 87.3159 | 16.904 | 8.57973 | 29.87756 | 0.04294 | 0.8887 | 0.18105 | 1.2462 |
| 225120 | Delaney Creek | 382.14515 | 2924.032 | 193.019 | 46.5904 | 239.81 | 31.47 | 18.5737 | 73.93693 | 0.25222 | 2.3149 | 1.45889 | 3.422 |
| 225130 | Delaney Creek | 289.93855 | 2489.766 | 178.733 | 42.0484 | 220.781 | 30.314 | 17.0584 | 70.62397 | 0.10865 | 1.9014 | 0.43461 | 2.7706 |
| 225140 | Delaney Creek | 138.88646 | 1157.682 | 85.2066 | 20.0721 | 105.279 | 13.957 | 8.01936 | 33.78872 | 0.05136 | 0.872 | 0.20056 | 1.278 |
| 225150 | Delaney Creek | 254.80787 | 2188.092 | 157.077 | 36.9536 | 194.03 | 26.641 | 14.9915 | 62.06675 | 0.09549 | 1.671 | 0.38195 | 2.4349 |
| 225160 | Delaney Creek | 320.46798 | 2751.929 | 197.553 | 46.476 | 244.029 | 33.506 | 18.8546 | 78.0604 | 0.12009 | 2.1016 | 0.48037 | 3.0624 |
| 226000 | Delaney Creek | 983.43249 | 9139.632 | 627.443 | 155.664 | 783.107 | 138.77 | 77.48 | 293.567 | 0.40332 | 7.3564 | 1.8697 | 10.693 |
| 227000 | Delaney Creek | 14.60923 | 65.55297 | 8.79206 | 2.16264 | 10.9547 | 0.7441 | 0.85237 | 4.659805 | 0.00489 | 0.022 | 0.01485 | 0.0521 |
| 227010 | Delaney Creek | 283.40147 | 3508.347 | 187.942 | 69.1594 | 257.102 | 117.37 | 56.4233 | 149.0682 | 0.14625 | 4.2094 | 0.96104 | 5.6366 |
| 227020 | Delaney Creek | 324.63406 | 3599.505 | 171.933 | 83.6607 | 255.594 | 162.91 | 67.4632 | 132.6304 | 0.12504 | 5.7543 | 0.74385 | 7.1179 |
| 227030 | Delaney Creek | 477.58878 | 6550.172 | 393.14 | 111.129 | 504.269 | 152.48 | 93.2596 | 327.7868 | 0.38402 | 5.8314 | 2.31809 | 8.285 |
| 227040 | Delaney Creek | 3349.2368 | 8992.257 | 665.93 | 271.93 | 938.109 | 620.31 | 299.39 | 338.6493 | 2.35392 | 16.612 | 3.18292 | 15.657 |
| 227050 | Delaney Creek | 2666.3037 | 12276.6 | 1164.23 | 259.747 | 1478.76 | 394.16 | 231.921 | 759.2145 | 1.88799 | 11.932 | 5.99454 | 14.112 |
| 227060 | Delaney Creek | 1314.9303 | 4589.932 | 298.906 | 107.067 | 406.537 | 204.06 | 108.057 | 170.537 | 1.11681 | 6.1977 | 3.85488 | 6.9924 |
| 227070 | Delaney Creek | 9.0921424 | 144.931 | 8.1437 | 2.43589 | 10.5796 | 3.7648 | 2.26901 | 7.692579 | 0.00715 | 0.1256 | 0.05435 | 0.1915 |
| 227080 | Delaney Creek | 577.68432 | 8386.267 | 491.549 | 129.32 | 620.869 | 191.7 | 131.893 | 475.5603 | 0.53221 | 5.9587 | 3.5006 | 9.7111 |
| 227090 | Delaney Creek | 1143.3736 | 7788.049 | 504.951 | 140.754 | 645.705 | 248.57 | 156.941 | 429.4838 | 0.91519 | 6.6674 | 3.12681 | 9.1055 |

~~Table 10.4a~~ App 10A

## Summary of Net Pollutant Loads for the Delaney Creek Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 230005 | Delaney Creek | 504.22569 | 1906.968 | 144.303 | 39.0607 | 184.085 | 3.8525 | 10.6544 | 52.5351 | 0.55906 | 1.3565 | 3.69821 | 2.3924 |
| 230012 | Delaney Creek | 1121.4229 | 2672.05 | 238.138 | 59.984 | 340.9 | 135.53 | 58.497 | 111.3655 | 1.103 | 5.0281 | 4.93347 | 4.2977 |
| 230030 | Delaney Creek | 295.86411 | 1198.271 | 60.3659 | 17.74 | 78.6611 | 1.7522 | 5.04653 | 18.60402 | 0.40595 | 1.0196 | 2.82151 | 1.6954 |
| 230033 | Delaney Creek | 4612.2316 | 4133.494 | 535.973 | 196.328 | 737.794 | 507.68 | 293.953 | 138.1051 | 3.62114 | 11.763 | 4.9648 | 6.2194 |
| 230090 | Delaney Creek | 326.33773 | 1353.783 | 297.194 | 42.6397 | 443.469 | 142.96 | 34.004 | 215.0036 | 0.07865 | 5.0239 | 0.46022 | 2.6698 |
| 230170 | Delaney Creek | 1455.5703 | 2670.031 | 335.9 | 82.0023 | 438.88 | 183.62 | 99.3404 | 141.819 | 1.08133 | 4.3333 | 1.91423 | 3.4954 |
| 230180 | Delaney Creek | 975.32176 | 4267.841 | 418.024 | 113.452 | 531.476 | 128.26 | 86.0776 | 259.0725 | 0.56163 | 3.2686 | 1.3235 | 4.5133 |
| 230190 | Delaney Creek | 634.2309 | 10555.25 | 636.55 | 164.447 | 800.998 | 218.18 | 155.699 | 606.0427 | 0.56545 | 7.0639 | 4.35173 | 12.056 |
| 230200 | Delaney Creek | 242.15919 | 4575.265 | 260.865 | 67.7103 | 328.575 | 96.372 | 67.7368 | 259.4627 | 0.24061 | 3.1321 | 1.92119 | 5.2967 |
| 231000 | Delaney Creek | 702.62373 | 4135.568 | 238.382 | 69.6274 | 325.496 | 99.361 | 45.0188 | 114.8862 | 0.81843 | 5.5408 | 5.74455 | 7.1939 |
| 232000 | Delaney Creek | 953.72385 | 10641.63 | 502.129 | 249.071 | 751.199 | 490.33 | 202.51 | 393.9675 | 0.36716 | 17.236 | 2.20404 | 21.274 |
| 233000 | Delaney Creek | 176.96432 | 3053.168 | 177.429 | 45.6929 | 223.122 | 62.545 | 43.5518 | 166.9336 | 0.15965 | 2.1101 | 1.22821 | 3.525 |
| 233010 | Delaney Creek | 313.80251 | 4802.203 | 296.298 | 73.0003 | 371.526 | 94.526 | 64.6822 | 252.8924 | 0.24638 | 3.3925 | 1.82043 | 5.5227 |
| 234000 | Delaney Creek | 383.53483 | 4569.317 | 288.197 | 82.3014 | 370.499 | 115.41 | 72.916 | 251.3865 | 0.27288 | 3.7107 | 1.6957 | 5.7191 |

~~Table 10.4b~~ App 10B

## Summary of Net Pollutant Loads for the Delaney Pop-off Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200000 | Delaney Popoff | 1848.225 | 8000.539 | 219.256 | 77.1844 | 300.765 | 7.64438 | 23.69899 | 36.84981 | 3.041834 | 7.821341 | 21.8564 | 12.48525 |
| 200010 | Delaney Popoff | 529.9067 | 2210.122 | 88.5182 | 27.5966 | 117.2155 | 2.72829 | 8.066778 | 23.46527 | 0.789897 | 2.006437 | 5.578817 | 3.271808 |
| 200020 | Delaney Popoff | 33.45105 | 213.5099 | 19.7561 | 4.70365 | 24.45977 | 2.30796 | 1.647611 | 8.06037 | 0.011083 | 0.137448 | 0.034059 | 0.21584 |
| 200025 | Delaney Popoff | 204.8182 | 1595.892 | 80.544 | 20.4542 | 101.1051 | 11.1956 | 7.552962 | 29.37557 | 0.191562 | 1.055666 | 2.496 | 2.067617 |
| 200030 | Delaney Popoff | 42.48225 | 124.0929 | 23.3652 | 5.67921 | 29.04445 | 0.55898 | 1.45334 | 10.06159 | 0.01118 | 0.01118 | 0.01118 | 0.067077 |
| 200040 | Delaney Popoff | 14.41169 | 42.09731 | 7.92643 | 1.92662 | 9.853047 | 0.18963 | 0.493032 | 3.413296 | 0.003793 | 0.003793 | 0.003793 | 0.022755 |
| 200050 | Delaney Popoff | 29.02886 | 84.79483 | 15.9659 | 3.8807 | 19.84657 | 0.38196 | 0.993093 | 6.875257 | 0.007639 | 0.007639 | 0.007639 | 0.045835 |
| 200065 | Delaney Popoff | 65.8126 | 205.7179 | 36.355 | 8.82508 | 45.18005 | 1.08332 | 2.310047 | 15.60323 | 0.017584 | 0.03229 | 0.020258 | 0.122886 |
| 200070 | Delaney Popoff | 226.0164 | 890.673 | 57.8292 | 16.0418 | 74.2324 | 1.79034 | 4.484981 | 20.04105 | 0.27331 | 0.686972 | 1.848343 | 1.174772 |
| 200090 | Delaney Popoff | 3177.167 | 14065.28 | 624.667 | 142.302 | 787.4213 | 43.0341 | 49.69723 | 431.2587 | 4.860906 | 14.42164 | 34.75586 | 22.9996 |
| 200100 | Delaney Popoff | 1166.009 | 8254.115 | 616.365 | 119.494 | 736.9452 | 97.8587 | 57.69584 | 504.0479 | 0.775443 | 7.5165 | 4.670003 | 16.69311 |
| 200110 | Delaney Popoff | 1220.043 | 5270.383 | 151.743 | 52.1258 | 206.6884 | 5.48844 | 16.05784 | 30.69269 | 1.987458 | 5.12764 | 14.2591 | 8.259364 |
| 200120 | Delaney Popoff | 4515.533 | 45280.23 | 767.207 | 255.946 | 1023.153 | 26.5028 | 66.88819 | 181.1814 | 6.850735 | 17.44132 | 161.506 | 69.68225 |
| 200130 | Delaney Popoff | 1212.165 | 6076.208 | 417.215 | 59.258 | 479.8322 | 53.7723 | 37.73662 | 589.898 | 1.437132 | 6.975567 | 10.0905 | 19.61286 |
| 200140 | Delaney Popoff | 1347.259 | 6431.218 | 284.698 | 70.4862 | 372.0112 | 32.9376 | 30.71349 | 100.3376 | 2.032305 | 6.273209 | 14.46336 | 9.518902 |
| 200150 | Delaney Popoff | 675.2908 | 2384.911 | 224.502 | 61.1754 | 285.6773 | 84.1581 | 50.77682 | 113.5228 | 0.40894 | 2.237977 | 0.615322 | 2.571707 |
| 200261 | Delaney Popoff | 1850.944 | 7509.328 | 374.25 | 110.257 | 487.9992 | 10.9175 | 31.40911 | 114.669 | 2.550643 | 6.411926 | 17.74364 | 10.65024 |
| 200280 | Delaney Popoff | 830.5554 | 4501.084 | 200.398 | 55.7994 | 257.6636 | 24.5097 | 20.18993 | 62.16764 | 1.10874 | 4.031141 | 7.726347 | 6.235026 |
| 200300 | Delaney Popoff | 1791.871 | 7831.351 | 777.089 | 101.353 | 885.3488 | 160.508 | 90.79022 | 1106.72 | 1.377258 | 10.11183 | 7.0847 | 29.30356 |
| 200305 | Delaney Popoff | 189.0787 | 777.2632 | 117.324 | 8.11241 | 130.7101 | 11.143 | 5.658789 | 180.0534 | 0.173789 | 1.157828 | 1.205237 | 2.681661 |
| 200310 | Delaney Popoff | 1006.854 | 3478.163 | 399.333 | 99.6272 | 499.7871 | 13.5155 | 27.89928 | 179.5808 | 0.761116 | 1.852146 | 4.384125 | 4.038309 |
| 200315 | Delaney Popoff | 433.7413 | 2306.871 | 182.939 | 46.7167 | 229.656 | 4.64057 | 12.00011 | 73.94274 | 0.297636 | 0.640825 | 5.309289 | 2.71188 |
| 200320 | Delaney Popoff | 597.9121 | 1746.128 | 329.391 | 79.856 | 409.3077 | 7.93293 | 20.45367 | 142.9808 | 0.157311 | 0.162606 | 0.158042 | 0.952248 |
| 200330 | Delaney Popoff | 637.1851 | 2470.078 | 163.888 | 45.4256 | 210.3252 | 4.48214 | 12.5483 | 57.10278 | 0.765669 | 1.884095 | 5.168361 | 3.244802 |
| 200335 | Delaney Popoff | 2157.885 | 14354.6 | 481.593 | 145.446 | 627.0396 | 97.5598 | 76.06405 | 171.4369 | 2.408254 | 6.575066 | 44.90522 | 20.89332 |
| 240040 | Delaney Popoff | 428.0944 | 1880.988 | 53.8026 | 17.518 | 72.31494 | 2.76539 | 5.847675 | 19.01191 | 0.701061 | 1.875621 | 5.042056 | 3.176272 |
| 240050 | Delaney Popoff | 246.7295 | 1053.884 | 39.0808 | 9.88504 | 50.32928 | 1.94285 | 3.281544 | 24.34131 | 0.396969 | 1.088629 | 2.854539 | 1.742132 |
| 240060 | Delaney Popoff | 114.0905 | 271.3127 | 145.257 | 3.71688 | 158.2657 | 11.5482 | 3.716885 | 236.6234 | 0.024845 | 0.834808 | 0.13665 | 1.4311 |
| 240070 | Delaney Popoff | 84.32833 | 200.5369 | 107.364 | 2.74728 | 116.9798 | 8.53567 | 2.747282 | 174.8968 | 0.018364 | 0.617037 | 0.101003 | 1.057777 |
| 240080 | Delaney Popoff | 267.1427 | 753.9605 | 83.3834 | 12.8204 | 96.20374 | 22.1571 | 12.53202 | 86.08449 | 0.096916 | 0.859589 | 0.194141 | 2.232556 |
| 240085 | Delaney Popoff | 274.0347 | 800.4698 | 150.719 | 36.6341 | 187.3532 | 3.60572 | 9.374872 | 64.90296 | 0.072114 | 0.072114 | 0.072114 | 0.432686 |
| 240090 | Delaney Popoff | 570.9571 | 1222.426 | 152.612 | 29.6365 | 182.2481 | 72.2535 | 38.8358 | 179.9963 | 0.357886 | 2.092119 | 0.345614 | 4.74107 |
| 240100 | Delaney Popoff | 254.9609 | 1223.284 | 145.948 | 23.0261 | 168.9737 | 19.9185 | 14.46432 | 170.3962 | 0.078443 | 1.091714 | 0.344114 | 3.933598 |
| 240110 | Delaney Popoff | 14.78793 | 44.30807 | 5.9169 | 1.5186 | 7.435498 | 0.63572 | 0.606826 | 2.409509 | 0.007379 | 0.016617 | 0.052529 | 0.039974 |
| 240120 | Delaney Popoff | 553.9575 | 615.7605 | 88.5447 | 27.2824 | 123.2253 | 74.3853 | 36.49049 | 32.78773 | 0.406933 | 1.607171 | 0.45471 | 0.890433 |
| 240130 | Delaney Popoff | 229.0174 | 278.9321 | 51.1144 | 14.5712 | 67.60134 | 26.1358 | 14.0784 | 19.39552 | 0.139946 | 0.504412 | 0.044604 | 0.285435 |

~~Table 10.4b~~ App 10B

## Summary of Net Pollutant Loads for the Delaney Pop-off Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 240135 | Delaney Popoff | 189.018 | 393.4895 | 82.711 | 14.8128 | 122.0687 | 48.4427 | 15.58888 | 53.53387 | 0.098936 | 1.444318 | 0.123996 | 0.73473 |
| 240140 | Delaney Popoff | 830.4088 | 647.8005 | 105.33 | 37.9912 | 143.3209 | 106.131 | 55.73257 | 27.63828 | 0.586078 | 1.868713 | 0.135623 | 0.834048 |
| 240150 | Delaney Popoff | 33.74671 | 641.1875 | 36.5139 | 9.48283 | 45.99677 | 13.5324 | 9.516573 | 36.44645 | 0.033747 | 0.438707 | 0.269974 | 0.742428 |
| 240160 | Delaney Popoff | 8.871009 | 168.5492 | 9.59843 | 2.49275 | 12.09119 | 3.55727 | 2.501625 | 9.58069 | 0.008871 | 0.115323 | 0.070968 | 0.195162 |
| 240170 | Delaney Popoff | 1266.916 | 879.9769 | 150.23 | 55.6033 | 205.8738 | 162.648 | 84.67744 | 34.8169 | 0.899985 | 2.839513 | 0.173644 | 1.177772 |
| 240180 | Delaney Popoff | 89.63455 | 62.2054 | 10.6141 | 3.93314 | 14.54725 | 11.5055 | 5.990331 | 2.449031 | 0.063675 | 0.200821 | 0.012245 | 0.083267 |
| 240190 | Delaney Popoff | 111.0321 | 77.05505 | 13.1479 | 4.87206 | 18.01996 | 14.2522 | 7.42034 | 3.033663 | 0.078875 | 0.24876 | 0.015168 | 0.103145 |
| 240200 | Delaney Popoff | 782.629 | 543.136 | 92.6752 | 34.3416 | 127.0168 | 100.459 | 52.30356 | 21.38331 | 0.555966 | 1.753431 | 0.106917 | 0.727032 |
| 240210 | Delaney Popoff | 1444.67 | 1264.52 | 191.984 | 65.9443 | 259.4799 | 175.571 | 103.0879 | 71.46635 | 1.035071 | 3.563712 | 0.368732 | 1.588322 |
| 240220 | Delaney Popoff | 3900.578 | 2170.981 | 446.646 | 162.684 | 612.1542 | 467.636 | 260.678 | 106.5732 | 2.770903 | 8.739001 | 0.409774 | 2.906038 |
| 240230 | Delaney Popoff | 623.4538 | 347.0015 | 71.3902 | 26.0028 | 97.84443 | 74.7452 | 41.66579 | 17.03426 | 0.442891 | 1.396809 | 0.065497 | 0.46449 |
| 240231 | Delaney Popoff | 248.6765 | 151.8693 | 28.8582 | 10.5845 | 39.5518 | 30.6435 | 16.6192 | 6.79444 | 0.176655 | 0.557144 | 0.029216 | 0.20329 |
| 240235 | Delaney Popoff | 435.3918 | 302.1571 | 51.557 | 19.1049 | 70.66194 | 55.8872 | 29.09749 | 11.89595 | 0.309295 | 0.975468 | 0.05948 | 0.404462 |
| 240355 | Delaney Popoff | 1477.249 | 6336.495 | 189.4 | 69.0382 | 258.438 | 122.958 | 69.83954 | 40.34414 | 1.531124 | 4.316331 | 20.77325 | 9.724406 |
| 240380 | Delaney Popoff | 136.2147 | 1096.458 | 24.7941 | 8.00031 | 32.79439 | 3.69244 | 3.368246 | 6.64047 | 0.178581 | 0.461612 | 3.780683 | 1.662306 |
| 240390 | Delaney Popoff | 271.7777 | 872.1797 | 60.6221 | 17.5237 | 78.4914 | 8.95055 | 8.037143 | 20.12562 | 0.301824 | 0.772946 | 1.772319 | 1.155996 |
| 240400 | Delaney Popoff | 57.62442 | 245.3629 | 8.08625 | 2.67289 | 10.88719 | 0.26449 | 0.800881 | 1.777559 | 0.090832 | 0.232354 | 0.647933 | 0.374266 |
| 240410 | Delaney Popoff | 96.47204 | 361.3023 | 28.6976 | 7.70534 | 36.53504 | 0.75985 | 2.09245 | 10.59874 | 0.103474 | 0.249522 | 0.67839 | 0.444663 |
| 240420 | Delaney Popoff | 78.77612 | 305.5912 | 20.1968 | 5.6022 | 25.92443 | 0.55278 | 1.548146 | 7.027063 | 0.094869 | 0.233531 | 0.640712 | 0.401938 |
| 240430 | Delaney Popoff | 76.22513 | 295.6418 | 19.5591 | 5.42428 | 25.10471 | 0.53522 | 1.498825 | 6.807743 | 0.091744 | 0.225817 | 0.619525 | 0.388726 |
| 240440 | Delaney Popoff | 98.46778 | 390.8284 | 22.9863 | 6.39442 | 29.68409 | 0.69276 | 1.800516 | 7.569749 | 0.127039 | 0.32023 | 0.872249 | 0.535608 |
| 240450 | Delaney Popoff | 141.989 | 611.8901 | 20.8507 | 5.89672 | 27.99711 | 1.01414 | 1.861145 | 4.300254 | 0.229343 | 0.616747 | 1.647444 | 0.953683 |
| 240460 | Delaney Popoff | 263.7204 | 1118.205 | 39.0102 | 12.5024 | 52.2541 | 1.31311 | 3.736562 | 9.045709 | 0.41078 | 1.054289 | 2.925015 | 1.69635 |
| 241000 | Delaney Popoff | 824.4408 | 4375.127 | 124.456 | 42.6027 | 167.0588 | 54.7172 | 33.62141 | 30.622 | 0.905456 | 2.475022 | 14.51317 | 6.635725 |
| 241010 | Delaney Popoff | 388.056 | 269.8283 | 46.0529 | 17.0488 | 63.10171 | 49.7841 | 25.92637 | 10.6517 | 0.275563 | 0.868952 | 0.053043 | 0.360641 |
| 241020 | Delaney Popoff | 117.6542 | 255.0937 | 48.2991 | 11.8337 | 62.08547 | 9.13342 | 5.86335 | 21.41672 | 0.050129 | 0.209349 | 0.032553 | 0.198309 |
| 241030 | Delaney Popoff | 118.425 | 151.8726 | 28.6264 | 7.61617 | 37.81234 | 14.0292 | 7.417353 | 12.28645 | 0.072439 | 0.279761 | 0.029597 | 0.159386 |
| 241500 | Delaney Popoff | 622.8768 | 5865.279 | 89.0799 | 28.8869 | 117.9669 | 3.45186 | 7.863424 | 17.40238 | 0.891471 | 2.280517 | 21.17596 | 9.097046 |
| 241509 | Delaney Popoff | 611.1337 | 4458.288 | 174.117 | 48.7965 | 222.9136 | 9.20237 | 14.52816 | 61.37403 | 0.661551 | 1.622038 | 13.89562 | 6.303184 |
| 241510 | Delaney Popoff | 682.5408 | 6074.614 | 141.083 | 42.6716 | 183.7549 | 5.1228 | 11.47094 | 40.84099 | 0.90867 | 2.285777 | 20.90876 | 9.132193 |
| 242000 | Delaney Popoff | 587.8263 | 409.795 | 69.9661 | 25.8683 | 95.83444 | 75.3581 | 39.25769 | 16.23488 | 0.41721 | 1.315345 | 0.080409 | 0.546608 |
| 242010 | Delaney Popoff | 550.5846 | 382.0997 | 65.1976 | 24.1595 | 89.35717 | 70.6734 | 36.7959 | 15.04329 | 0.391126 | 1.23355 | 0.075216 | 0.511472 |
| 242020 | Delaney Popoff | 598.3518 | 415.2496 | 70.854 | 26.2555 | 97.10955 | 76.8048 | 39.98821 | 16.34841 | 0.425059 | 1.34057 | 0.081742 | 0.555846 |
| 242030 | Delaney Popoff | 341.9377 | 316.2111 | 43.5667 | 16.6433 | 60.20996 | 46.8024 | 23.94939 | 12.24982 | 0.240449 | 0.885562 | 0.063092 | 0.47893 |
| 242500 | Delaney Popoff | 9.604553 | 182.4865 | 10.3921 | 2.69888 | 13.09101 | 3.85143 | 2.708484 | 10.37292 | 0.009605 | 0.124859 | 0.076836 | 0.2113 |
| 242510 | Delaney Popoff | 8.0814 | 153.5466 | 8.74408 | 2.27087 | 11.01495 | 3.24064 | 2.278955 | 8.727912 | 0.008081 | 0.105058 | 0.064651 | 0.177791 |

App 10B

~~Table 10.4b~~

## Summary of Net Pollutant Loads for the Delaney Pop-off Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 242520 | Delaney Popoff | 849.9076 | 3367.732 | 154.94 | 49.7133 | 205.8578 | 67.6673 | 44.34721 | 80.71208 | 1.064003 | 3.495308 | 6.080453 | 4.774332 |
| 242530 | Delaney Popoff | 1126.641 | 3343.212 | 220.452 | 70.3853 | 291.4083 | 139.771 | 82.00518 | 124.961 | 1.056884 | 4.006148 | 3.728899 | 4.402625 |
| 242800 | Delaney Popoff | 57.08239 | 406.712 | 108.085 | 8.02008 | 136.1558 | 20.0288 | 8.048616 | 100.1796 | 0.035676 | 0.649312 | 0.285412 | 0.47093 |
| 243000 | Delaney Popoff | 290.9191 | 567.8387 | 57.8873 | 17.4245 | 75.36515 | 35.5886 | 19.06485 | 18.26067 | 0.190688 | 0.857508 | 0.102397 | 0.667742 |
| 243005 | Delaney Popoff | 114.1768 | 243.0491 | 27.7235 | 7.63602 | 35.96382 | 15.1179 | 8.365078 | 13.83887 | 0.076233 | 0.332651 | 0.068493 | 0.27587 |
| 243010 | Delaney Popoff | 624.2221 | 1120.033 | 117.641 | 36.1585 | 153.8579 | 77.3325 | 41.01006 | 36.17875 | 0.413756 | 1.780324 | 0.203185 | 1.327814 |
| 243020 | Delaney Popoff | 755.7843 | 559.7133 | 92.2586 | 33.5681 | 125.9089 | 95.8979 | 50.45805 | 22.0419 | 0.534735 | 1.721079 | 0.108436 | 0.736743 |
| 243021 | Delaney Popoff | 2033.426 | 1469.524 | 247.148 | 89.7257 | 337.3163 | 255.804 | 136.0355 | 60.12885 | 1.439758 | 4.634529 | 0.288796 | 1.933413 |
| 243030 | Delaney Popoff | 585.9192 | 1781.867 | 141.771 | 43.5238 | 185.2952 | 95.6911 | 55.32201 | 95.09151 | 0.437984 | 2.121031 | 0.670784 | 2.127266 |
| 243035 | Delaney Popoff | 321.2312 | 222.9309 | 38.0387 | 14.0956 | 52.13424 | 41.2334 | 21.46807 | 8.776808 | 0.228197 | 0.719698 | 0.043884 | 0.298411 |
| 243040 | Delaney Popoff | 138.5074 | 90.35529 | 16.2374 | 5.98651 | 22.25428 | 17.4233 | 9.256535 | 3.784356 | 0.098393 | 0.310317 | 0.017597 | 0.120948 |
| 243050 | Delaney Popoff | 878.1285 | 591.1292 | 103.464 | 38.2431 | 141.8034 | 111.59 | 58.68585 | 23.99258 | 0.623807 | 1.967392 | 0.115764 | 0.791275 |
| 243060 | Delaney Popoff | 931.2514 | 681.7206 | 112.608 | 41.267 | 153.9766 | 119.16 | 62.87984 | 28.59345 | 0.662411 | 2.118601 | 0.146308 | 0.902268 |
| 243070 | Delaney Popoff | 672.02 | 452.3833 | 79.1796 | 29.2669 | 108.5202 | 85.3983 | 44.9115 | 18.3612 | 0.477391 | 1.505619 | 0.088593 | 0.605552 |
| 243080 | Delaney Popoff | 82.69661 | 100.8587 | 12.0806 | 4.19176 | 16.27236 | 11.2624 | 6.03759 | 4.759082 | 0.059434 | 0.210825 | 0.029969 | 0.126856 |
| 243090 | Delaney Popoff | 56.45137 | 1072.576 | 61.0804 | 15.8628 | 76.94322 | 22.637 | 15.91929 | 60.96748 | 0.056451 | 0.733868 | 0.451611 | 1.24193 |
| 243100 | Delaney Popoff | 6.590613 | 125.2217 | 7.13104 | 1.85196 | 8.983006 | 2.64284 | 1.858553 | 7.117862 | 0.006591 | 0.085678 | 0.052725 | 0.144993 |
| 243110 | Delaney Popoff | 6.200907 | 117.8172 | 6.70938 | 1.74245 | 8.451836 | 2.48656 | 1.748656 | 6.696979 | 0.006201 | 0.080612 | 0.049607 | 0.13642 |
| 243120 | Delaney Popoff | 11.90531 | 226.2008 | 12.8815 | 3.34539 | 16.22693 | 4.77403 | 3.357297 | 12.85773 | 0.011905 | 0.154769 | 0.095242 | 0.261917 |
| 243130 | Delaney Popoff | 13.57656 | 257.9547 | 14.6898 | 3.81501 | 18.50485 | 5.4442 | 3.828591 | 14.66269 | 0.013577 | 0.176495 | 0.108612 | 0.298684 |
| 243135 | Delaney Popoff | 50.20973 | 951.4741 | 54.2741 | 14.0822 | 68.36686 | 20.0777 | 14.1199 | 54.1032 | 0.050092 | 0.651043 | 0.400501 | 1.10152 |
| 243140 | Delaney Popoff | 20.45217 | 388.5912 | 22.1292 | 5.74706 | 27.87631 | 8.20132 | 5.767512 | 22.08834 | 0.020452 | 0.265878 | 0.163617 | 0.449948 |
| 243150 | Delaney Popoff | 20.89547 | 397.0139 | 22.6089 | 5.87163 | 28.48053 | 8.37908 | 5.892523 | 22.56711 | 0.020895 | 0.271641 | 0.167164 | 0.4597 |
| 243160 | Delaney Popoff | 18.08449 | 343.6052 | 19.5674 | 5.08174 | 24.64915 | 7.25188 | 5.099825 | 19.53124 | 0.018084 | 0.235098 | 0.144676 | 0.397859 |
| 243500 | Delaney Popoff | 278.5157 | 158.7713 | 40.0478 | 10.4753 | 54.88781 | 34.4737 | 15.95432 | 8.968596 | 0.176654 | 0.601711 | 0.033972 | 0.212529 |
| 243510 | Delaney Popoff | 242.0727 | 167.9958 | 28.6651 | 10.6221 | 39.28721 | 31.0726 | 16.17786 | 6.614008 | 0.171964 | 0.542349 | 0.03307 | 0.224876 |
| 243520 | Delaney Popoff | 366.4764 | 254.3306 | 43.3964 | 16.0809 | 59.47732 | 47.0412 | 24.49184 | 10.01302 | 0.260338 | 0.821067 | 0.050065 | 0.340443 |
| 244010 | Delaney Popoff | 1120.103 | 919.9768 | 209.689 | 53.6298 | 278.9962 | 125.4 | 61.4011 | 60.5674 | 0.66602 | 2.192763 | 0.153526 | 0.952395 |
| 244020 | Delaney Popoff | 1418.127 | 4334.306 | 172.248 | 61.7685 | 235.1709 | 123.557 | 75.32291 | 39.14136 | 1.329866 | 3.849039 | 13.95107 | 6.631248 |
| 244030 | Delaney Popoff | 418.3135 | 1542.36 | 50.2933 | 18.8007 | 69.09397 | 38.5242 | 21.27459 | 10.11889 | 0.414766 | 1.189464 | 4.959525 | 2.375253 |
| 244510 | Delaney Popoff | 189.2412 | 542.9361 | 120.58 | 20.9671 | 150.0726 | 2.33947 | 5.378468 | 50.02133 | 0.059603 | 0.090824 | 0.462704 | 0.411427 |
| 246000 | Delaney Popoff | 766.4859 | 468.1009 | 88.9484 | 32.6242 | 121.909 | 94.4512 | 51.22471 | 20.94224 | 0.544498 | 1.717263 | 0.090052 | 0.626592 |
| 246010 | Delaney Popoff | 335.8973 | 186.9535 | 38.4628 | 14.0095 | 52.7155 | 40.2703 | 22.44822 | 9.177522 | 0.238616 | 0.752557 | 0.035288 | 0.250253 |
| 246020 | Delaney Popoff | 387.6502 | 236.742 | 44.9856 | 16.4997 | 61.65545 | 47.7687 | 25.9069 | 10.59154 | 0.27538 | 0.868506 | 0.045544 | 0.316899 |
| 246035 | Delaney Popoff | 2498.63 | 1315.522 | 281.072 | 101.411 | 385.2579 | 285.718 | 165.555 | 67.98812 | 1.800153 | 5.652012 | 0.535378 | 1.787532 |
| 246040 | Delaney Popoff | 1048.349 | 1455.929 | 153.609 | 52.8014 | 206.7402 | 134.674 | 74.27555 | 61.89956 | 0.801403 | 2.7957 | 0.974104 | 1.888767 |

Table 10.4b App 12B

## Summary of Net Pollutant Loads for the Delaney Pop-off Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 246050 | Delaney Popoff | 817.3203 | 2798.863 | 92.6867 | 33.5817 | 127.7685 | 28.1863 | 21.33168 | 15.802 | 1.16656 | 3.088018 | 7.378828 | 4.365679 |
| 246060 | Delaney Popoff | 108.4917 | 211.8278 | 12.799 | 4.62402 | 17.54233 | 9.04462 | 5.312473 | 2.954928 | 0.112679 | 0.32317 | 0.456783 | 0.319805 |
| 246070 | Delaney Popoff | 422.0807 | 1836.051 | 47.3258 | 17.0415 | 65.36975 | 1.68832 | 5.276009 | 7.034679 | 0.703468 | 1.81143 | 5.064969 | 2.884218 |
| 246500 | Delaney Popoff | 1140.074 | 674.1427 | 137.841 | 49.0904 | 187.7446 | 134.895 | 75.64549 | 34.65869 | 0.802398 | 2.521148 | 0.122418 | 0.863353 |
| 246505 | Delaney Popoff | 1037.327 | 736.4074 | 125.069 | 45.9835 | 171.052 | 132.496 | 69.12993 | 29.41965 | 0.735058 | 2.314858 | 0.161966 | 0.974939 |
| 246510 | Delaney Popoff | 55.42094 | 155.7718 | 20.918 | 5.42888 | 26.34692 | 2.76352 | 2.389354 | 8.425121 | 0.028595 | 0.067257 | 0.181584 | 0.141879 |
| 246520 | Delaney Popoff | 111.4724 | 410.1981 | 14.7586 | 5.29047 | 20.04903 | 9.99755 | 5.6082 | 3.365474 | 0.108381 | 0.309155 | 1.29134 | 0.622577 |
| 247000 | Delaney Popoff | 464.1476 | 5011.248 | 79.1283 | 33.3796 | 112.5079 | 29.9946 | 16.69009 | 28.82899 | 0.700661 | 2.714026 | 16.36307 | 8.125549 |
| 247010 | Delaney Popoff | 773.0477 | 8525.628 | 402.968 | 199.873 | 602.8407 | 393.953 | 162.7773 | 315.4635 | 0.300342 | 13.82773 | 1.763859 | 17.04701 |
| 247020 | Delaney Popoff | 890.4261 | 4122.627 | 276.182 | 99.1761 | 375.4763 | 187.245 | 90.68018 | 153.7522 | 0.532881 | 5.790523 | 0.91796 | 6.496155 |
| 247030 | Delaney Popoff | 29.46177 | 152.9988 | 27.7342 | 3.51843 | 35.26532 | 5.79253 | 2.20663 | 11.78521 | 0.008002 | 0.259458 | 0.037645 | 0.242758 |
| 247040 | Delaney Popoff | 415.6343 | 3377.63 | 210.43 | 30.5528 | 263.779 | 20.7778 | 10.96437 | 72.44004 | 0.411056 | 2.143789 | 8.687256 | 4.81121 |
| 247050 | Delaney Popoff | 135.6097 | 1143.828 | 83.3542 | 19.6254 | 102.9796 | 13.8448 | 7.888656 | 33.00755 | 0.050411 | 0.866351 | 0.198764 | 1.26676 |
| 247060 | Delaney Popoff | 246.2133 | 2422.206 | 152.116 | 56.5952 | 216.1154 | 109.345 | 44.80351 | 100.9213 | 0.088555 | 3.946852 | 0.512198 | 4.727731 |
| 247070 | Delaney Popoff | 407.5506 | 2874.194 | 140.614 | 53.5485 | 198.7663 | 85.2666 | 37.58694 | 81.25655 | 0.424367 | 3.973541 | 2.945886 | 5.172857 |
| 247500 | Delaney Popoff | 342.8631 | 3728.205 | 42.7381 | 16.2907 | 59.02877 | 1.71476 | 4.286966 | 5.726326 | 0.571362 | 1.471236 | 13.71237 | 5.856404 |
| 247510 | Delaney Popoff | 111.7049 | 1185.174 | 29.1246 | 8.84142 | 37.96606 | 5.93388 | 5.053665 | 16.50295 | 0.160439 | 0.534385 | 3.519645 | 1.740469 |
| 247520 | Delaney Popoff | 192.9715 | 2240.86 | 40.8086 | 13.2555 | 54.06409 | 7.90014 | 7.131985 | 21.8387 | 0.309944 | 0.980681 | 7.158432 | 3.382703 |
| 247530 | Delaney Popoff | 247.6667 | 2719.745 | 33.9623 | 12.522 | 46.4843 | 2.52351 | 3.970466 | 7.578705 | 0.410614 | 1.091165 | 9.802818 | 4.24693 |
| 247535 | Delaney Popoff | 36.41654 | 673.6421 | 38.4409 | 9.99637 | 48.43726 | 14.3309 | 10.05469 | 38.27913 | 0.036127 | 0.462675 | 0.283483 | 0.780132 |
| 247540 | Delaney Popoff | 161.8341 | 1305.896 | 35.0928 | 10.8718 | 46.16807 | 6.84704 | 6.08859 | 18.94816 | 0.254072 | 0.829566 | 3.434553 | 1.920753 |
| 247550 | Delaney Popoff | 74.82041 | 845.3688 | 50.7133 | 13.5595 | 64.27284 | 21.2697 | 14.21852 | 47.41633 | 0.065211 | 0.633641 | 0.348875 | 0.982304 |
| 247801 | Delaney Popoff | 65.26216 | 159.2723 | 42.8223 | 7.3762 | 53.25202 | 0.81611 | 1.890588 | 17.85636 | 0.017301 | 0.022109 | 0.031499 | 0.092251 |
| 247805 | Delaney Popoff | 1614.88 | 6973.106 | 186.522 | 66.383 | 256.6887 | 7.72949 | 20.95902 | 29.72646 | 2.665277 | 6.861809 | 19.12357 | 10.91534 |
| 247810 | Delaney Popoff | 76.51171 | 200.254 | 47.2111 | 9.37643 | 58.68833 | 1.00103 | 2.406705 | 19.95489 | 0.018952 | 0.019978 | 0.018878 | 0.108317 |
| 247820 | Delaney Popoff | 49.99314 | 129.7809 | 30.9803 | 5.85031 | 38.53575 | 0.62609 | 1.500668 | 12.98772 | 0.014445 | 0.019404 | 0.031331 | 0.077476 |
| 248020 | Delaney Popoff | 232.5172 | 295.6187 | 34.6004 | 11.9418 | 46.54224 | 31.8456 | 17.1173 | 14.07315 | 0.1673 | 0.59985 | 0.089434 | 0.370532 |
| 248040 | Delaney Popoff | 2293.262 | 3400.171 | 281.659 | 101.815 | 384.5115 | 240.261 | 129.9251 | 65.24524 | 2.040633 | 6.151659 | 5.54447 | 4.943643 |
| 249000 | Delaney Popoff | 587.8818 | 2552.829 | 67.2821 | 24.0268 | 92.69767 | 2.38009 | 7.416243 | 10.48481 | 0.975425 | 2.510427 | 7.017972 | 4.000803 |
| 249030 | Delaney Popoff | 85.55962 | 282.0508 | 37.2132 | 9.34012 | 46.60668 | 0.91989 | 2.438928 | 15.31397 | 0.05407 | 0.113088 | 0.286392 | 0.253227 |
| 249040 | Delaney Popoff | 246.939 | 818.0855 | 106.165 | 26.6933 | 133.0191 | 2.62906 | 6.977751 | 43.57602 | 0.160025 | 0.337781 | 0.859764 | 0.745713 |
| 250000 | Delaney Popoff | 836.6625 | 3057.251 | 233.481 | 62.9981 | 298.1268 | 6.17084 | 17.56181 | 85.98422 | 0.935219 | 2.272577 | 6.187683 | 3.936001 |
| 250005 | Delaney Popoff | 1183.822 | 5149.627 | 132.736 | 47.7968 | 183.3445 | 4.73529 | 14.79778 | 19.73037 | 1.973037 | 5.080571 | 14.20587 | 8.089453 |
| 250010 | Delaney Popoff | 181.7116 | 182.9716 | 23.7591 | 8.33731 | 32.16922 | 20.4758 | 11.18616 | 6.054802 | 0.139897 | 0.424281 | 0.190889 | 0.246177 |
| 250011 | Delaney Popoff | 762.4148 | 3316.505 | 85.4858 | 30.7825 | 118.079 | 3.04966 | 9.530185 | 12.70691 | 1.270691 | 3.27203 | 9.148978 | 5.209835 |
| 250030 | Delaney Popoff | 966.4265 | 3313.435 | 109.893 | 39.8732 | 151.4827 | 34.1571 | 25.31401 | 18.7026 | 1.377782 | 3.647948 | 8.70747 | 5.165746 |

~~Table 10.4b~~ App 12B

## Summary of Net Pollutant Loads for the Delaney Pop-off Subwatershed

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 250040 | Delaney Popoff | 573.0918 | 2492.949 | 64.2579 | 23.1386 | 88.75759 | 2.29237 | 7.163647 | 9.55153 | 0.955153 | 2.459519 | 6.877101 | 3.916127 |
| 250050 | Delaney Popoff | 456.566 | 1949.288 | 57.124 | 19.7082 | 77.87311 | 2.5455 | 6.259974 | 10.62785 | 0.737446 | 1.895308 | 5.263773 | 3.020765 |
| 250090 | Delaney Popoff | 834.3302 | 3581.999 | 108.055 | 36.7772 | 146.735 | 3.6407 | 11.14834 | 21.19935 | 1.344056 | 3.447213 | 9.623151 | 5.527192 |
| 250110 | Delaney Popoff | 85.19352 | 403.8647 | 38.5657 | 9.70943 | 48.27517 | 0.96198 | 2.491411 | 15.88654 | 0.049772 | 0.100929 | 0.796828 | 0.436672 |
| 250120 | Delaney Popoff | 105.2597 | 307.4692 | 57.8929 | 14.0716 | 71.96442 | 1.385 | 3.600991 | 24.92994 | 0.0277 | 0.0277 | 0.0277 | 0.1662 |
| 250330 | Delaney Popoff | 223.8648 | 431.2728 | 35.4245 | 11.461 | 47.08368 | 17.7875 | 10.72857 | 10.09229 | 0.210792 | 0.589927 | 0.797318 | 0.593737 |
| 250510 | Delaney Popoff | 0.543741 | 0.141506 | 0.11268 | 0.01193 | 0.154431 | 0.06107 | 0.018169 | 0.024141 | 0.000241 | 0.001066 | 4.64E-05 | 0.000189 |
| 250520 | Delaney Popoff | 1542.729 | 909.8449 | 228.189 | 58.8692 | 313.4631 | 193.125 | 88.68649 | 54.6751 | 0.974989 | 3.428707 | 0.198009 | 1.233848 |
| 250525 | Delaney Popoff | 239.1818 | 166.5843 | 32.1273 | 10.4243 | 43.72215 | 29.8495 | 15.12723 | 7.826281 | 0.162247 | 0.521148 | 0.032142 | 0.212675 |
| 250527 | Delaney Popoff | 561.8935 | 331.4557 | 64.8734 | 23.7312 | 88.91273 | 68.5188 | 37.55168 | 15.35228 | 0.399159 | 1.258887 | 0.063328 | 0.443681 |
| 250530 | Delaney Popoff | 611.9384 | 363.3095 | 90.4902 | 23.6069 | 123.5906 | 75.0628 | 34.91192 | 20.9645 | 0.385851 | 1.310371 | 0.07551 | 0.471976 |
| 250550 | Delaney Popoff | 86.54184 | 60.05909 | 10.2479 | 3.79744 | 14.04531 | 11.1086 | 5.783643 | 2.364531 | 0.061478 | 0.193892 | 0.011823 | 0.080394 |
| 250555 | Delaney Popoff | 53.5663 | 37.17443 | 6.34307 | 2.35048 | 8.693547 | 6.87581 | 3.579868 | 1.46356 | 0.038053 | 0.120012 | 0.007318 | 0.049761 |
| 250557 | Delaney Popoff | 455.5892 | 253.5715 | 52.1684 | 19.0016 | 71.49988 | 54.6201 | 30.4473 | 12.44779 | 0.323643 | 1.020719 | 0.047862 | 0.339426 |
| 250570 | Delaney Popoff | 67.1807 | 254.1436 | 55.5229 | 8.17304 | 82.70212 | 27.1194 | 6.714749 | 39.70406 | 0.019476 | 0.937082 | 0.085448 | 0.496658 |
| 250580 | Delaney Popoff | 48.71164 | 201.8618 | 44.2985 | 6.36526 | 66.07783 | 21.2656 | 5.063495 | 32.01947 | 0.011744 | 0.74726 | 0.068496 | 0.397357 |
| 250590 | Delaney Popoff | 56.11195 | 251.4036 | 30.6081 | 8.85602 | 39.46416 | 6.06369 | 3.812426 | 15.1586 | 0.016057 | 0.20409 | 0.036496 | 0.308902 |
| 251000 | Delaney Popoff | 2165.073 | 9127.23 | 326.203 | 105.117 | 436.0702 | 10.3913 | 31.22685 | 78.30775 | 3.339302 | 8.519219 | 23.72832 | 13.77794 |
| 251010 | Delaney Popoff | 2022.831 | 8799.313 | 226.81 | 81.6718 | 313.2859 | 8.09132 | 25.28538 | 33.71384 | 3.371384 | 8.681315 | 24.27397 | 13.82268 |
| 251011 | Delaney Popoff | 37.6834 | 124.7538 | 16.2279 | 4.07917 | 20.33145 | 0.40176 | 1.066152 | 6.663305 | 0.024334 | 0.051299 | 0.130481 | 0.113475 |
| 251500 | Delaney Popoff | 323.7467 | 1014.652 | 142.398 | 35.4757 | 178.2235 | 3.47761 | 9.374232 | 59.42313 | 0.19518 | 0.400885 | 1.000417 | 0.899684 |
| 252000 | Delaney Popoff | 542.6786 | 2307.085 | 76.217 | 25.171 | 102.6048 | 2.48953 | 7.550325 | 16.8215 | 0.854891 | 2.186704 | 6.097259 | 3.52104 |
| 252020 | Delaney Popoff | 970.1758 | 3877.222 | 169.848 | 51.5641 | 223.8604 | 5.04768 | 15.35791 | 48.93357 | 1.408106 | 3.564195 | 9.881862 | 5.777149 |
| 252025 | Delaney Popoff | 3808.009 | 16314.34 | 483.874 | 165.594 | 658.4183 | 16.3724 | 50.51284 | 93.00595 | 6.158384 | 15.80223 | 44.11529 | 25.28468 |
| 252030 | Delaney Popoff | 1782.314 | 7509.826 | 269.631 | 86.7658 | 360.3025 | 8.57697 | 25.76104 | 65.0188 | 2.745418 | 7.002973 | 19.50384 | 11.32881 |
| 252040 | Delaney Popoff | 121.4649 | 333.5171 | 66.1377 | 15.9944 | 82.21322 | 1.56626 | 4.155379 | 28.76801 | 0.031964 | 0.031964 | 0.029727 | 0.18028 |
| 252050 | Delaney Popoff | 517.7808 | 1908.854 | 186.008 | 48.3528 | 235.0961 | 8.39744 | 15.58691 | 80.66491 | 0.478446 | 1.248216 | 2.948632 | 2.153135 |
| 252060 | Delaney Popoff | 1976.794 | 8188.034 | 382.571 | 110.763 | 500.8559 | 14.1758 | 32.98212 | 114.0992 | 2.822307 | 7.283131 | 19.79634 | 11.85499 |
| 252065 | Delaney Popoff | 440.3299 | 1434.706 | 62.4978 | 19.2803 | 84.23732 | 20.1626 | 13.82986 | 16.2618 | 0.591809 | 1.665185 | 3.579602 | 2.206952 |
| 252080 | Delaney Popoff | 54.60363 | 413.6156 | 41.5057 | 9.75461 | 52.32558 | 11.5206 | 10.17805 | 40.09069 | 0.055876 | 0.518818 | 0.546343 | 0.520368 |
| 252500 | Delaney Popoff | 167.6622 | 905.7568 | 69.4774 | 17.7415 | 87.31854 | 2.27749 | 5.003453 | 29.35494 | 0.120841 | 0.282952 | 2.181347 | 1.100003 |
| 252510 | Delaney Popoff | 293.9732 | 1393.194 | 71.5602 | 20.6834 | 93.38074 | 13.8304 | 14.58067 | 49.29128 | 0.449318 | 1.566175 | 3.028246 | 2.033629 |
| 253005 | Delaney Popoff | 757.4851 | 3295.06 | 84.933 | 30.5835 | 117.3155 | 3.02994 | 9.468564 | 12.62475 | 1.262475 | 3.250874 | 9.089821 | 5.176148 |
| 253015 | Delaney Popoff | 2041.47 | 8880.395 | 228.9 | 82.4244 | 316.1727 | 8.16588 | 25.51838 | 34.0245 | 3.40245 | 8.76131 | 24.49764 | 13.95005 |
| 253025 | Delaney Popoff | 2033.258 | 8844.671 | 227.979 | 82.0928 | 314.9008 | 8.13303 | 25.41572 | 33.88763 | 3.388763 | 8.726064 | 24.39909 | 13.89393 |
| 254010 | Delaney Popoff | 76.12393 | 208.4193 | 25.152 | 6.6552 | 31.85374 | 2.99254 | 2.793157 | 9.765169 | 0.055976 | 0.136268 | 0.247761 | 0.210967 |

~~Table 10.4b~~ App 10B

**Summary of Net Pollutant Loads for the Delaney Pop-off Subwatershed**

| Subbasin ID | Subwatershed | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 254020 | Delaney Popoff | 3.820367 | 4.603177 | 0.83065 | 0.24634 | 1.076992 | 0.38942 | 0.226728 | 0.288013 | 0.002322 | 0.006826 | 0.000633 | 0.004119 |
| 254030 | Delaney Popoff | 112.0107 | 164.8944 | 13.1138 | 4.83145 | 18.00189 | 11.413 | 6.190489 | 2.806367 | 0.102369 | 0.299855 | 0.298128 | 0.244815 |
| 254050 | Delaney Popoff | 694.3139 | 536.5209 | 82.2505 | 30.4858 | 112.7363 | 88.4601 | 46.10964 | 18.9131 | 0.498364 | 1.566582 | 0.308928 | 0.731744 |

~~Table 10.4c~~ App 10C

## Summary of the Net Pollutant Loads for the North Archie Creek Subwatershed

| Subbasin ID | Basin ID | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 260000 | North Archie Creek | 547.5351 | 2381.778 | 61.3924 | 22.10673 | 84.79951 | 2.190141 | 6.844189 | 9.12559 | 0.91256 | 2.34984 | 6.57042 | 3.74149 |
| 260040 | North Archie Creek | 637.8623 | 2774.701 | 71.5203 | 25.75369 | 98.78892 | 2.551449 | 7.973279 | 10.631 | 1.0631 | 2.73749 | 7.65435 | 4.358726 |
| 260050 | North Archie Creek | 2.645158 | 21.74089 | 1.67877 | 0.348987 | 2.027755 | 0.281383 | 0.158368 | 1.09206 | 0.00098 | 0.01813 | 0.00415 | 0.035636 |
| 260060 | North Archie Creek | 77.31148 | 332.8251 | 79.1273 | 5.29951 | 88.47212 | 7.625586 | 3.104298 | 109.271 | 0.02033 | 0.52508 | 0.09667 | 0.859903 |
| 260065 | North Archie Creek | 94.67832 | 297.5132 | 97.7342 | 6.974581 | 120.6854 | 8.134615 | 2.751608 | 35.9832 | 0.02873 | 0.55274 | 0.08951 | 0.320853 |
| 260080 | North Archie Creek | 1.721905 | 5.029776 | 0.94705 | 0.230192 | 1.177239 | 0.022657 | 0.058907 | 0.40782 | 0.00045 | 0.00045 | 0.00045 | 0.002719 |
| 260090 | North Archie Creek | 369.2776 | 1627.62 | 171.704 | 23.7258 | 195.4299 | 24.09242 | 14.41565 | 187.709 | 0.08556 | 1.57909 | 0.37075 | 4.970313 |
| 260100 | North Archie Creek | 771.1017 | 2398.297 | 291.465 | 68.00196 | 364.571 | 62.19977 | 38.89304 | 112.652 | 0.65411 | 3.99544 | 0.62913 | 2.263536 |
| 260110 | North Archie Creek | 138.7545 | 217.4612 | 42.8091 | 7.951993 | 50.76107 | 1.514784 | 2.473079 | 18.6417 | 0.01864 | 0.03414 | 0.02168 | 0.17251 |
| 260120 | North Archie Creek | 21.13645 | 10.03268 | 2.62447 | 0.043006 | 2.66748 | 0.142715 | 0.102572 | 0.69004 | 0.00077 | 0.00077 | 0.00077 | 0.0046 |
| 260130 | North Archie Creek | 19.49428 | 8.891654 | 2.35764 | 0.020208 | 2.377844 | 0.13068 | 0.090264 | 0.60625 | 0.00067 | 0.00067 | 0.00067 | 0.004042 |
| 260140 | North Archie Creek | 18.43236 | 101.0366 | 2.2616 | 0.432191 | 2.693791 | 0.108417 | 0.155313 | 0.44492 | 0.01515 | 0.03848 | 0.35595 | 0.153858 |
| 260145 | North Archie Creek | 860.9477 | 8565.034 | 143.46 | 47.70138 | 191.1613 | 5.019374 | 12.52065 | 33.2728 | 1.29652 | 3.30261 | 30.5917 | 13.19238 |
| 260160 | North Archie Creek | 821.8105 | 8359.302 | 132.805 | 45.15911 | 177.9637 | 4.693948 | 11.81843 | 29.4553 | 1.26789 | 3.23514 | 29.9959 | 12.91579 |
| 260170 | North Archie Creek | 676.7781 | 7357.773 | 84.5432 | 32.16397 | 116.7392 | 3.398713 | 8.466928 | 11.3812 | 1.1275 | 2.90404 | 27.0582 | 11.55743 |
| 260190 | North Archie Creek | 753.0323 | 3215.921 | 122.367 | 39.44629 | 163.3893 | 8.048364 | 12.8098 | 32.9363 | 1.13188 | 3.02278 | 8.00316 | 4.844791 |
| 260200 | North Archie Creek | 16.60997 | 53.48755 | 17.9187 | 1.204433 | 22.13417 | 1.519546 | 0.48862 | 6.57458 | 0.00389 | 0.09531 | 0.01556 | 0.059521 |
| 260201 | North Archie Creek | 171.2484 | 1588.4 | 55.481 | 9.029378 | 70.99749 | 3.95107 | 2.74599 | 16.4222 | 0.23415 | 0.78671 | 5.45206 | 2.442402 |
| 260202 | North Archie Creek | 0.92268 | 2.971223 | 0.99538 | 0.066906 | 1.229549 | 0.08441 | 0.027143 | 0.36522 | 0.00022 | 0.00529 | 0.00086 | 0.003306 |
| 260210 | North Archie Creek | 89.4581 | 717.0977 | 66.6218 | 16.68791 | 89.72374 | 31.04468 | 12.5217 | 36.3218 | 0.02909 | 1.18057 | 0.15794 | 1.333113 |
| 260230 | North Archie Creek | 1616.47 | 3135.075 | 236.36 | 92.34565 | 329.6693 | 232.396 | 116.531 | 82.1718 | 1.20772 | 5.36436 | 4.32288 | 5.149119 |
| 260235 | North Archie Creek | 330.162 | 1055.001 | 104.105 | 32.22188 | 142.9462 | 67.63168 | 31.36045 | 53.0252 | 0.22678 | 2.25124 | 0.2469 | 1.941035 |
| 260240 | North Archie Creek | 2086.302 | 3903.434 | 282.905 | 81.24548 | 387.7022 | 171.6751 | 87.28871 | 58.6938 | 2.05515 | 6.0068 | 8.72421 | 5.925447 |
| 260250 | North Archie Creek | 625.1565 | 2268.674 | 83.9794 | 24.04859 | 115.1202 | 14.19218 | 10.24021 | 15.2491 | 0.89914 | 2.40004 | 6.12536 | 3.532116 |
| 260270 | North Archie Creek | 89.54993 | 47.41678 | 21.6633 | 2.977324 | 29.05537 | 9.159302 | 2.999544 | 5.71981 | 0.03812 | 0.16017 | 0.00926 | 0.042347 |
| 260275 | North Archie Creek | 261.1379 | 67.96008 | 54.1148 | 5.729338 | 74.16745 | 29.32986 | 8.726002 | 11.5942 | 0.11594 | 0.51193 | 0.0223 | 0.09097 |
| 260280 | North Archie Creek | 64.99043 | 16.91349 | 13.4678 | 1.425883 | 18.45835 | 7.299437 | 2.171675 | 2.8855 | 0.02886 | 0.12741 | 0.00555 | 0.02264 |
| 260290 | North Archie Creek | 1038.868 | 720.9627 | 123.018 | 45.58528 | 168.6031 | 133.3497 | 69.42814 | 28.3844 | 0.73799 | 2.32752 | 0.14192 | 0.965068 |
| 260300 | North Archie Creek | 554.6266 | 880.8991 | 64.8229 | 23.86142 | 89.00652 | 54.32079 | 29.69524 | 13.7081 | 0.52373 | 1.52089 | 1.68522 | 1.316246 |
| 260310 | North Archie Creek | 251.4273 | 423.2636 | 29.3448 | 10.79409 | 40.30051 | 23.81116 | 13.10607 | 6.14452 | 0.24368 | 0.70288 | 0.8416 | 0.635333 |
| 260312 | North Archie Creek | 575.4561 | 574.7653 | 67.841 | 25.08274 | 93.0377 | 67.89945 | 35.85145 | 15.2116 | 0.45467 | 1.38769 | 0.64779 | 0.817852 |
| 260315 | North Archie Creek | 468.3337 | 541.7313 | 55.085 | 20.34263 | 75.56843 | 52.74405 | 28.07854 | 12.1644 | 0.38938 | 1.17086 | 0.76719 | 0.78505 |
| 260320 | North Archie Creek | 787.0379 | 2748.038 | 94.3302 | 33.68376 | 129.3855 | 30.55603 | 22.28697 | 20.5562 | 1.11277 | 3.00108 | 6.99739 | 4.24505 |
| 260330 | North Archie Creek | 1417.001 | 6163.956 | 158.881 | 57.21143 | 219.4581 | 5.668005 | 17.71252 | 23.6167 | 2.36167 | 6.0813 | 17.004 | 9.682843 |
| 260331 | North Archie Creek | 1711.989 | 3526.352 | 220.01 | 77.37918 | 298.8369 | 138.2851 | 79.68867 | 50.531 | 1.77738 | 4.98959 | 7.47383 | 5.222398 |
| 260340 | North Archie Creek | 1183.362 | 2474.853 | 137.283 | 50.34045 | 188.6977 | 95.64882 | 54.51107 | 27.5127 | 1.27317 | 3.57902 | 5.52747 | 3.769843 |

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Table 10.4c

## Summary of the Net Pollutant Loads for the North Archie Creek Subwatershed

| Subbasin ID | Basin ID | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 260350 | North Archie Creek | 1848.918 | 8042.793 | 207.31 | 74.65006 | 286.3512 | 7.395672 | 23.11147 | 30.8153 | 3.08153 | 7.93494 | 22.187 | 12.63427 |
| 260360 | North Archie Creek | 1266.889 | 5510.969 | 142.05 | 51.15066 | 196.2095 | 5.067557 | 15.83612 | 21.1148 | 2.11148 | 5.43707 | 15.2027 | 8.657077 |
| 260370 | North Archie Creek | 570.7035 | 1892.033 | 111.659 | 15.10617 | 154.0999 | 13.75908 | 10.50667 | 15.4839 | 0.55653 | 1.96959 | 11.4084 | 2.964772 |
| 260372 | North Archie Creek | 576.2843 | 578.7666 | 61.9877 | 21.81059 | 85.08123 | 49.02899 | 32.92625 | 14.6497 | 0.50772 | 1.50207 | 1.25344 | 0.878643 |
| 260380 | North Archie Creek | 263.6438 | 1075.172 | 57.4798 | 6.261541 | 79.39524 | 1.153442 | 1.647774 | 7.14035 | 0.27463 | 0.99004 | 6.5911 | 1.688968 |
| 260390 | North Archie Creek | 727.7628 | 523.7146 | 129.117 | 29.96733 | 179.139 | 98.76692 | 43.14562 | 44.4344 | 0.45194 | 1.93508 | 0.13631 | 0.76467 |
| 260400 | North Archie Creek | 78.23083 | 362.6286 | 13.5467 | 2.540553 | 18.60959 | 5.326184 | 1.939699 | 2.57915 | 0.07416 | 0.22853 | 1.29371 | 0.566866 |
| 260410 | North Archie Creek | 64.02052 | 71.39365 | 23.2233 | 2.92049 | 33.44503 | 11.90177 | 3.154236 | 11.5806 | 0.02558 | 0.31886 | 0.0244 | 0.134169 |
| 261000 | North Archie Creek | 234.7635 | 2404.622 | 138.421 | 56.22354 | 199.532 | 109.3252 | 44.91129 | 96.4303 | 0.08624 | 3.91115 | 0.5048 | 4.732219 |
| 261010 | North Archie Creek | 323.3535 | 3606.635 | 170.134 | 84.44501 | 254.5787 | 166.2783 | 68.65043 | 133.445 | 0.12437 | 5.84524 | 0.7462 | 7.21327 |
| 261020 | North Archie Creek | 68.10735 | 759.6589 | 35.8349 | 17.7865 | 53.62144 | 35.0229 | 14.45971 | 28.1074 | 0.0262 | 1.23117 | 0.15717 | 1.519318 |
| 261021 | North Archie Creek | 376.1575 | 889.3171 | 45.3298 | 16.90075 | 62.60889 | 30.16722 | 17.1227 | 10.271 | 0.41811 | 1.23899 | 1.95066 | 1.383758 |
| 261040 | North Archie Creek | 361.9504 | 2479.577 | 129.813 | 62.1206 | 191.9341 | 128.5255 | 55.16825 | 92.1219 | 0.18802 | 4.17882 | 0.5134 | 4.885074 |
| 261050 | North Archie Creek | 128.1454 | 1150.496 | 65.4191 | 27.83125 | 97.59902 | 58.11168 | 23.1514 | 49.3569 | 0.05269 | 2.00269 | 0.24547 | 2.293369 |
| 261060 | North Archie Creek | 13.39911 | 30.81037 | 7.74711 | 1.050728 | 11.42466 | 3.856864 | 0.954424 | 4.95712 | 0.00453 | 0.12279 | 0.0106 | 0.060513 |
| 261061 | North Archie Creek | 1443.472 | 890.1799 | 210.513 | 55.72598 | 289.0168 | 181.3074 | 83.6696 | 49.3141 | 0.91371 | 3.2264 | 0.19043 | 1.238699 |
| 261062 | North Archie Creek | 404.0087 | 3796.376 | 213.995 | 91.31428 | 319.577 | 189.8476 | 75.38036 | 162.831 | 0.1607 | 6.58634 | 0.81013 | 7.57614 |
| 262000 | North Archie Creek | 284.168 | 2818.494 | 135.831 | 66.91903 | 202.7499 | 133.1767 | 55.44829 | 104.339 | 0.12023 | 4.60535 | 0.5829 | 5.621582 |
| 262010 | North Archie Creek | 261.7985 | 2920.06 | 137.746 | 68.36968 | 206.116 | 134.6248 | 55.58183 | 108.042 | 0.10069 | 4.73251 | 0.60415 | 5.84012 |
| 262020 | North Archie Creek | 179.0001 | 1992.704 | 94.3133 | 46.576 | 140.8893 | 91.44501 | 37.77756 | 73.6237 | 0.06885 | 3.21892 | 0.41189 | 3.974262 |
| 262030 | North Archie Creek | 629.3353 | 6919.299 | 334.653 | 159.8193 | 494.472 | 307.6283 | 127.6206 | 253.119 | 0.24167 | 10.9267 | 1.42074 | 13.54114 |
| 263010 | North Archie Creek | 1486.408 | 1985.339 | 177.377 | 64.94333 | 242.9298 | 158.0807 | 85.16697 | 39.3229 | 1.30919 | 3.9157 | 3.2581 | 2.897198 |
| 263020 | North Archie Creek | 1013.157 | 2676.628 | 139.247 | 48.15222 | 188.5738 | 65.51066 | 40.19446 | 34.3656 | 1.24248 | 3.77069 | 6.0834 | 3.99369 |
| 263030 | North Archie Creek | 6425.316 | 4866.944 | 724.361 | 261.0467 | 993.041 | 691.6568 | 404.8199 | 171.636 | 4.99944 | 15.3538 | 5.93507 | 6.961284 |
| 263050 | North Archie Creek | 666.6295 | 1084.242 | 127.394 | 42.14681 | 174.9971 | 102.0648 | 52.93912 | 52.9154 | 0.4404 | 2.61165 | 0.22511 | 1.908087 |
| 263060 | North Archie Creek | 3322.506 | 4992.605 | 504.769 | 204.7091 | 712.7755 | 510.1008 | 268.1174 | 212.825 | 2.25708 | 12.4593 | 0.99775 | 9.019409 |
| 264000 | North Archie Creek | 2027.268 | 19185.68 | 305.398 | 106.1226 | 411.8352 | 31.04871 | 37.46461 | 64.6928 | 3.03044 | 7.81868 | 69.0397 | 29.77708 |
| 264010 | North Archie Creek | 73.32083 | 182.0479 | 39.3183 | 9.434269 | 48.87509 | 0.91651 | 2.508344 | 17.3655 | 0.01929 | 0.01929 | 0.01592 | 0.098404 |
| 265000 | North Archie Creek | 554.2916 | 897.7004 | 141.988 | 32.21086 | 185.6868 | 70.03784 | 35.86085 | 68.5469 | 0.33683 | 1.39976 | 0.28802 | 0.988772 |
| 265001 | North Archie Creek | 349.1561 | 96.9242 | 37.2109 | 13.02276 | 50.99968 | 35.85432 | 23.33431 | 9.53978 | 0.24803 | 0.78226 | 0.01431 | 0.129741 |
| 265010 | North Archie Creek | 935.4034 | 4319.068 | 124.445 | 42.64035 | 169.2314 | 13.14271 | 17.7251 | 37.0329 | 1.53421 | 4.16391 | 11.0037 | 6.625279 |
| 266000 | North Archie Creek | 1161.343 | 4736.103 | 253.197 | 27.5819 | 349.7337 | 5.080877 | 7.258396 | 31.453 | 1.20973 | 4.36109 | 29.0336 | 7.439856 |
| 266010 | North Archie Creek | 213.3519 | 2320.202 | 26.5801 | 10.13422 | 36.71431 | 1.06676 | 2.666899 | 3.55587 | 0.35559 | 0.91564 | 8.53408 | 3.644762 |
| 266020 | North Archie Creek | 905.2321 | 3937.76 | 101.499 | 36.54875 | 140.1978 | 3.620929 | 11.3154 | 15.0872 | 1.50872 | 3.88495 | 10.8628 | 6.185753 |
| 266030 | North Archie Creek | 809.3256 | 3300.531 | 176.45 | 19.22148 | 243.725 | 3.540799 | 5.058285 | 21.9192 | 0.84305 | 3.03919 | 20.2331 | 5.184742 |
| 267000 | North Archie Creek | 261.21 | 1065.247 | 56.9492 | 6.203737 | 78.66229 | 1.142794 | 1.632562 | 7.07444 | 0.27209 | 0.9809 | 6.53025 | 1.673376 |

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~~Table 10.4c~~

## Summary of the Net Pollutant Loads for the North Archie Creek Subwatershed

| Subbasin ID | Basin ID | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 267010 | North Archie Creek | 603.2329 | 2460.059 | 131.517 | 14.32678 | 181.6611 | 2.639144 | 3.770206 | 16.3376 | 0.62837 | 2.26527 | 15.0808 | 3.864461 |
| 269000 | North Archie Creek | 474.8209 | 2065.471 | 53.2393 | 19.17089 | 73.53789 | 1.899284 | 5.935261 | 7.91368 | 0.79137 | 2.03777 | 5.69785 | 3.24461 |
| 269010 | North Archie Creek | 370.5502 | 629.5949 | 52.7635 | 16.20926 | 70.98849 | 35.37982 | 19.23071 | 12.75 | 0.34942 | 1.05969 | 1.1861 | 0.931631 |
| 270000 | North Archie Creek | 62.30111 | 16.21361 | 12.9105 | 1.36688 | 17.69454 | 6.997385 | 2.08181 | 2.7661 | 0.02766 | 0.12213 | 0.00532 | 0.021703 |
| 270010 | North Archie Creek | 1052.342 | 1685.471 | 162.683 | 66.11786 | 228.801 | 169.8293 | 83.45902 | 64.2606 | 0.71693 | 3.79048 | 0.34133 | 2.919961 |
| 270030 | North Archie Creek | 2251.809 | 1791.461 | 306.146 | 102.3678 | 414.3827 | 290.6064 | 151.0989 | 84.3257 | 1.58433 | 5.25729 | 0.39274 | 2.362354 |
| 270035 | North Archie Creek | 396.289 | 193.5492 | 163.891 | 13.55583 | 211.336 | 33.59615 | 11.47632 | 54.4554 | 0.14569 | 0.58957 | 0.0424 | 0.16444 |
| 270040 | North Archie Creek | 27.7355 | 83.63976 | 34.9188 | 2.504507 | 43.68455 | 3.316846 | 1.568763 | 22.7766 | 0.00863 | 0.10483 | 0.04727 | 0.084063 |
| 270041 | North Archie Creek | 11.47634 | 48.74597 | 15.996 | 1.240913 | 20.33924 | 2.492593 | 0.971013 | 12.1274 | 0.00445 | 0.08162 | 0.02943 | 0.057461 |
| 270042 | North Archie Creek | 39.24275 | 175.6849 | 39.9501 | 5.163132 | 58.02111 | 17.26861 | 4.302492 | 30.5719 | 0.01094 | 0.60328 | 0.07056 | 0.327828 |
| 270043 | North Archie Creek | 160.0615 | 668.5516 | 147.209 | 20.8744 | 220.2698 | 71.93937 | 16.97378 | 107.192 | 0.03852 | 2.52843 | 0.23053 | 1.337062 |
| 270044 | North Archie Creek | 13.9372 | 58.29504 | 12.8329 | 1.819877 | 19.20252 | 6.271072 | 1.479488 | 9.34664 | 0.00335 | 0.22045 | 0.0201 | 0.11659 |
| 270045 | North Archie Creek | 347.6506 | 1413.896 | 322.7 | 44.46194 | 478.3169 | 149.6675 | 35.64309 | 231.065 | 0.08321 | 5.25676 | 0.48951 | 2.79173 |
| 270046 | North Archie Creek | 53.18022 | 209.0385 | 49.1478 | 6.667519 | 72.48413 | 22.02585 | 5.25884 | 34.4239 | 0.01245 | 0.77352 | 0.07116 | 0.411139 |
| 270060 | North Archie Creek | 44.62096 | 58.5302 | 44.1263 | 3.079896 | 54.9059 | 1.011716 | 0.942925 | 19.0986 | 0.00824 | 0.0276 | 0.02089 | 0.039204 |
| 270065 | North Archie Creek | 762.6882 | 3034.469 | 209.642 | 20.82184 | 282.5186 | 7.065527 | 6.50513 | 50.7457 | 0.75899 | 2.81469 | 17.9806 | 4.69702 |
| 270070 | North Archie Creek | 23.0688 | 42.13745 | 22.5603 | 1.860854 | 29.07327 | 2.36264 | 0.852252 | 10.9086 | 0.00439 | 0.07933 | 0.01213 | 0.051786 |
| 270090 | North Archie Creek | 155.2981 | 593.3017 | 132.762 | 18.71959 | 198.2805 | 65.03124 | 15.44201 | 95.1687 | 0.04026 | 2.25753 | 0.20454 | 1.184091 |
| 270110 | North Archie Creek | 90.68574 | 267.4524 | 22.5189 | 2.430992 | 31.02741 | 4.608577 | 1.649253 | 5.91491 | 0.07593 | 0.32239 | 1.51162 | 0.419136 |
| 270120 | North Archie Creek | 311.7047 | 216.3197 | 36.9106 | 13.67753 | 50.58814 | 40.01062 | 20.83141 | 8.51652 | 0.22143 | 0.69835 | 0.04258 | 0.289562 |
| 270125 | North Archie Creek | 2044.108 | 729.0166 | 224.082 | 79.56644 | 308.1003 | 216.0205 | 138.7702 | 61.5751 | 1.44726 | 4.81497 | 0.11745 | 1.085449 |
| 270130 | North Archie Creek | 53.72046 | 64.13396 | 45.4275 | 3.592745 | 57.20056 | 2.639842 | 1.519367 | 18.8239 | 0.01303 | 0.06857 | 0.01204 | 0.05497 |
| 270140 | North Archie Creek | 214.5783 | 776.74 | 169.801 | 25.01762 | 253.5645 | 85.41679 | 21.41699 | 121.631 | 0.06785 | 2.92403 | 0.26429 | 1.537589 |
| 270150 | North Archie Creek | 22.8561 | 72.93154 | 19.8883 | 2.463702 | 28.51122 | 7.483745 | 1.849543 | 12.7273 | 0.00551 | 0.25843 | 0.02409 | 0.137674 |
| 270151 | North Archie Creek | 352.8417 | 1380.319 | 297.077 | 46.34952 | 432.1251 | 123.0065 | 31.68941 | 203.961 | 0.08759 | 4.30557 | 0.42158 | 2.399555 |
| 270500 | North Archie Creek | 427.2045 | 118.5901 | 45.5288 | 15.93379 | 62.39987 | 43.869 | 28.55033 | 11.6723 | 0.30348 | 0.95712 | 0.01751 | 0.158743 |
| 270510 | North Archie Creek | 154.641 | 42.92766 | 16.4807 | 5.767771 | 22.58773 | 15.87986 | 10.33475 | 4.22516 | 0.10985 | 0.34646 | 0.00634 | 0.057462 |
| 270515 | North Archie Creek | 203.2596 | 52.89747 | 42.1208 | 4.459493 | 57.72905 | 22.82922 | 6.79198 | 9.0245 | 0.09025 | 0.39847 | 0.01735 | 0.070808 |
| 270520 | North Archie Creek | 1230.729 | 1304.742 | 135.352 | 48.22992 | 185.7606 | 112.1649 | 70.81857 | 31.3844 | 1.0755 | 3.18898 | 2.59116 | 1.959127 |
| 270521 | North Archie Creek | 1288.062 | 5600.109 | 144.429 | 52.00833 | 199.4946 | 5.252927 | 16.14476 | 21.4763 | 2.146 | 5.52627 | 15.4471 | 8.796976 |
| 270525 | North Archie Creek | 1075.965 | 4387.92 | 234.583 | 25.55417 | 324.0224 | 4.707347 | 6.724781 | 29.1407 | 1.1208 | 4.04047 | 26.8991 | 6.892901 |
| 270530 | North Archie Creek | 1015.595 | 759.436 | 114.225 | 41.20747 | 156.6349 | 109.6471 | 64.13192 | 27.0158 | 0.7873 | 2.4166 | 0.91029 | 1.086132 |
| 270570 | North Archie Creek | 1305.038 | 905.9112 | 154.581 | 57.27403 | 211.8549 | 167.5037 | 87.21314 | 35.6783 | 0.92703 | 2.92365 | 0.1783 | 1.212397 |
| 270580 | North Archie Creek | 331.1981 | 781.0235 | 38.2706 | 14.00452 | 52.63317 | 23.76434 | 13.94335 | 7.44268 | 0.37945 | 1.05127 | 1.83376 | 1.197806 |
| 270585 | North Archie Creek | 60.41712 | 15.72331 | 12.52 | 1.325545 | 17.15945 | 6.785783 | 2.018856 | 2.68245 | 0.02682 | 0.11844 | 0.00516 | 0.021047 |
| 270590 | North Archie Creek | 243.4508 | 168.9522 | 28.8283 | 10.68257 | 39.51087 | 31.2495 | 16.26996 | 6.65166 | 0.17294 | 0.54544 | 0.03326 | 0.226156 |

App 10C

## Table 10.4c
## Summary of the Net Pollutant Loads for the North Archie Creek Subwatershed

| Subbasin ID | Basin ID | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 270592 | North Archie Creek | 832.6226 | 577.831 | 98.5953 | 36.5353 | 135.1306 | 106.876 | 55.64467 | 22.7493 | 0.59148 | 1.86544 | 0.11375 | 0.773475 |
| 270594 | North Archie Creek | 55.81126 | 15.31262 | 12.2782 | 1.266859 | 16.7122 | 6.173366 | 1.849561 | 2.79919 | 0.02452 | 0.10778 | 0.00484 | 0.019672 |
| 270596 | North Archie Creek | 695.9967 | 483.0141 | 82.4167 | 30.54018 | 112.9568 | 89.33859 | 46.51388 | 19.0163 | 0.49442 | 1.55934 | 0.09508 | 0.646554 |
| 270610 | North Archie Creek | 2512.465 | 1868.041 | 297.3 | 110.1272 | 407.5082 | 318.2696 | 166.0606 | 68.284 | 1.81735 | 5.69883 | 0.74696 | 2.534916 |
| 270620 | North Archie Creek | 311.1651 | 360.9959 | 36.5971 | 13.51481 | 50.20618 | 35.0074 | 18.63981 | 8.07902 | 0.25899 | 0.77853 | 0.51318 | 0.523314 |
| 270630 | North Archie Creek | 531.2661 | 2065.466 | 59.9907 | 21.68525 | 82.77817 | 10.47725 | 10.28972 | 9.57008 | 0.82122 | 2.14225 | 5.57844 | 3.233775 |
| 270640 | North Archie Creek | 7606.849 | 3452.155 | 813.076 | 285.0422 | 1114.758 | 750.4217 | 490.7612 | 204.384 | 5.71371 | 17.7075 | 4.19252 | 4.948507 |
| 272000 | North Archie Creek | 1366.741 | 1274.971 | 172.31 | 63.52383 | 235.9133 | 175.6777 | 91.6586 | 46.2213 | 0.99828 | 3.33411 | 0.6398 | 1.786627 |
| 272020 | North Archie Creek | 292.4089 | 446.499 | 88.1235 | 16.26476 | 113.0417 | 35.02173 | 17.90614 | 37.4107 | 0.18934 | 0.81625 | 0.3738 | 0.536141 |
| 272030 | North Archie Creek | 3464.739 | 11880.46 | 661.859 | 163.6344 | 876.2571 | 201.6609 | 122.1778 | 231.017 | 4.30382 | 13.4306 | 25.8215 | 17.56642 |
| 272035 | North Archie Creek | 47.09647 | 685.3095 | 41.5166 | 10.49904 | 52.01564 | 13.04758 | 8.881203 | 34.2474 | 0.03493 | 0.48292 | 0.24778 | 0.786137 |
| 272036 | North Archie Creek | 19.55345 | 189.1722 | 13.0044 | 3.113398 | 16.11777 | 2.649704 | 1.606111 | 6.4708 | 0.0086 | 0.14139 | 0.04258 | 0.212262 |
| 272040 | North Archie Creek | 1.975511 | 10.1469 | 2.92095 | 0.209157 | 3.653 | 0.432184 | 0.166284 | 2.09955 | 0.00084 | 0.0168 | 0.00579 | 0.011603 |
| 272050 | North Archie Creek | 932.1413 | 817.1991 | 120.831 | 43.08836 | 163.9198 | 119.6399 | 62.48184 | 30.9804 | 0.65657 | 2.1827 | 0.16396 | 1.05369 |
| 272060 | North Archie Creek | 143.4815 | 528.2478 | 44.0382 | 11.78904 | 55.82726 | 17.12442 | 9.154699 | 15.6651 | 0.0837 | 0.55594 | 0.09359 | 0.60181 |
| 272070 | North Archie Creek | 178.5991 | 108.7579 | 49.9998 | 5.786952 | 66.19794 | 18.645 | 5.937094 | 13.8252 | 0.07498 | 0.36779 | 0.02603 | 0.109925 |
| 272080 | North Archie Creek | 133.151 | 146.0977 | 24.1923 | 7.70183 | 31.89417 | 15.36429 | 8.479453 | 8.0487 | 0.08634 | 0.27718 | 0.02455 | 0.157449 |
| 273000 | North Archie Creek | 1030.734 | 652.4977 | 134.949 | 43.77238 | 180.8721 | 105.0874 | 68.25193 | 39.0077 | 0.71425 | 2.46845 | 0.10427 | 0.771974 |
| 273010 | North Archie Creek | 670.7428 | 464.0222 | 128.984 | 32.64708 | 168.9279 | 67.66363 | 44.10634 | 60.5749 | 0.4478 | 1.53831 | 0.12567 | 0.457234 |
| 273015 | North Archie Creek | 7.381423 | 7.069532 | 2.86222 | 0.25061 | 3.739353 | 0.949841 | 0.303663 | 1.42921 | 0.00328 | 0.0214 | 0.00372 | 0.008417 |
| 273020 | North Archie Creek | 6.812977 | 48.54246 | 12.9004 | 0.957223 | 16.25065 | 2.390503 | 0.96063 | 11.9568 | 0.00426 | 0.0775 | 0.03406 | 0.056207 |
| 273021 | North Archie Creek | 168.3541 | 360.385 | 60.6775 | 16.06911 | 76.74663 | 12.22608 | 8.88709 | 25.6555 | 0.11361 | 0.46186 | 0.07923 | 0.264242 |
| 273025 | North Archie Creek | 19.28807 | 137.4275 | 36.522 | 2.709973 | 46.00686 | 6.7677 | 2.719617 | 33.8506 | 0.01206 | 0.2194 | 0.09644 | 0.159127 |
| 273030 | North Archie Creek | 127.5385 | 189.6805 | 42.3076 | 7.111232 | 54.75689 | 19.73781 | 9.645944 | 29.8409 | 0.08914 | 0.42631 | 0.09192 | 0.233422 |
| 273040 | North Archie Creek | 7.970958 | 56.79307 | 15.093 | 1.11992 | 19.01273 | 2.79681 | 1.123905 | 13.989 | 0.00498 | 0.09067 | 0.03985 | 0.06576 |
| 273500 | North Archie Creek | 428.004 | 644.6264 | 68.9243 | 23.31444 | 92.23872 | 60.20371 | 32.69804 | 31.5998 | 0.30936 | 1.16692 | 0.20689 | 0.801267 |
| 273510 | North Archie Creek | 21.59074 | 144.6129 | 8.16031 | 3.32487 | 11.48518 | 6.66673 | 3.158984 | 6.19874 | 0.01319 | 0.20729 | 0.0388 | 0.249011 |
| 273520 | North Archie Creek | 210.8604 | 203.3102 | 38.3172 | 10.61618 | 54.0577 | 32.01229 | 14.73552 | 16.7149 | 0.14276 | 0.68102 | 0.05216 | 0.312052 |
| 273525 | North Archie Creek | 7.039826 | 37.47121 | 10.2133 | 0.769971 | 12.90821 | 2.02919 | 0.793776 | 9.19333 | 0.00407 | 0.06268 | 0.02612 | 0.043475 |
| 273530 | North Archie Creek | 201.3645 | 672.8296 | 140.318 | 24.77853 | 197.932 | 48.78979 | 14.8285 | 88.2736 | 0.06032 | 1.65141 | 0.1731 | 0.986509 |
| 273800 | North Archie Creek | 133.6518 | 50.08437 | 31.4551 | 3.196585 | 42.64311 | 15.54295 | 4.70583 | 9.74705 | 0.05974 | 0.28299 | 0.02237 | 0.064172 |
| 273810 | North Archie Creek | 169.3791 | 289.3408 | 79.7159 | 10.50895 | 116.4972 | 40.13545 | 10.20801 | 46.6766 | 0.06247 | 1.19849 | 0.09931 | 0.560289 |
| 273820 | North Archie Creek | 64.88186 | 258.4802 | 59.9156 | 8.205751 | 88.63572 | 27.36165 | 6.51536 | 42.3173 | 0.01528 | 0.96112 | 0.08824 | 0.51028 |
| 274000 | North Archie Creek | 1305.596 | 5550.734 | 161.284 | 52.7658 | 220.69 | 7.419571 | 16.79269 | 27.9503 | 2.12941 | 5.49597 | 15.2563 | 8.701041 |
| 274010 | North Archie Creek | 61.24257 | 55.38173 | 48.3622 | 3.464361 | 60.48749 | 2.117654 | 1.276125 | 18.7993 | 0.01399 | 0.03835 | 0.00896 | 0.032846 |
| 274025 | North Archie Creek | 1545.839 | 879.6925 | 177.56 | 64.7787 | 243.3557 | 186.5195 | 103.3094 | 42.2361 | 1.09814 | 3.46336 | 0.16683 | 1.177541 |

~~Table 10.4c~~ App 10C

**Summary of the Net Pollutant Loads for the North Archie Creek Subwatershed**

| Subbasin ID | Basin ID | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 274030 | North Archie Creek | 591.0638 | 153.8219 | 122.484 | 12.96787 | 167.8718 | 66.38567 | 19.75057 | 26.2426 | 0.26243 | 1.15871 | 0.05047 | 0.205903 |
| 276000 | North Archie Creek | 751.9611 | 2694.612 | 85.3054 | 30.913 | 117.6298 | 22.61497 | 17.96546 | 14.2127 | 1.1025 | 2.90376 | 7.15311 | 4.207497 |
| 276010 | North Archie Creek | 7369.461 | 32057.15 | 826.301 | 297.542 | 1141.345 | 29.47784 | 92.11826 | 122.824 | 12.2824 | 31.6273 | 88.4335 | 50.35798 |
| 276500 | North Archie Creek | 623.7197 | 2543.607 | 135.984 | 14.81334 | 187.8306 | 2.728774 | 3.898248 | 16.8924 | 0.64971 | 2.3422 | 15.593 | 3.995704 |
| 276510 | North Archie Creek | 560.0465 | 2229.108 | 121.947 | 13.27511 | 168.4097 | 4.00041 | 3.890429 | 15.4166 | 0.5748 | 2.07731 | 13.6433 | 3.500796 |
| 276530 | North Archie Creek | 656.2916 | 2854.869 | 73.5867 | 26.49777 | 101.6432 | 2.625167 | 8.203645 | 10.9382 | 1.09382 | 2.81658 | 7.8755 | 4.484659 |

App 10D

Table ~~10.4d~~

## Summary of the Net Pollutant Loads for the Archie Creek Subwatershed

| Subbasin ID | Basin ID | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 280003 | Archie Creek | 307.4017 | 3033.424 | 38.18887 | 13.22104 | 51.40991 | 1.587624 | 3.608693 | 5.552174 | 0.463842 | 1.192777 | 11.1086 | 4.75002 |
| 280004 | Archie Creek | 2432.496 | 5967.448 | 283.1885 | 51.59952 | 337.751 | 12.93342 | 21.08126 | 57.64244 | 2.120251 | 5.395159 | 15.01195 | 8.770821 |
| 280010 | Archie Creek | 75.90912 | 51.04088 | 9.620479 | 0.181643 | 10.07125 | 0.498304 | 0.358821 | 2.342483 | 0.007188 | 0.019488 | 0.115784 | 0.043836 |
| 280020 | Archie Creek | 560.9637 | 6096.958 | 70.6442 | 26.79596 | 97.44016 | 2.958128 | 7.083401 | 9.69884 | 0.93295 | 2.410959 | 22.37926 | 9.571538 |
| 280030 | Archie Creek | 923.4935 | 10042.99 | 115.0519 | 43.86594 | 158.9178 | 4.617467 | 11.54367 | 15.39156 | 1.539156 | 3.963326 | 36.93974 | 15.77635 |
| 280040 | Archie Creek | 23.25632 | 74.8902 | 25.08868 | 1.686378 | 30.991 | 2.127581 | 0.684138 | 9.205356 | 0.005447 | 0.13345 | 0.021788 | 0.083338 |
| 280050 | Archie Creek | 166.2461 | 77.00728 | 20.2961 | 0.236242 | 20.53234 | 1.132676 | 0.790486 | 5.260748 | 0.006609 | 0.010721 | 0.006439 | 0.035018 |
| 280055 | Archie Creek | 17.72782 | 8.085946 | 2.144001 | 0.018377 | 2.162378 | 0.118839 | 0.082085 | 0.551315 | 0.000613 | 0.000613 | 0.000613 | 0.003675 |
| 280060 | Archie Creek | 65.22371 | 53.25187 | 11.97908 | 1.33236 | 13.31144 | 0.498769 | 0.58404 | 3.990069 | 0.019488 | 0.104798 | 0.016979 | 0.021582 |
| 280065 | Archie Creek | 35.4713 | 16.17903 | 4.289895 | 0.036771 | 4.326665 | 0.237783 | 0.164242 | 1.103116 | 0.001226 | 0.001226 | 0.001226 | 0.007354 |
| 280066 | Archie Creek | 23.12653 | 10.54838 | 2.79692 | 0.023974 | 2.820894 | 0.155029 | 0.107082 | 0.719208 | 0.000799 | 0.000799 | 0.000799 | 0.004795 |
| 280067 | Archie Creek | 6.459074 | 2.946088 | 0.78116 | 0.006696 | 0.787855 | 0.043299 | 0.029907 | 0.20087 | 0.000223 | 0.000223 | 0.000223 | 0.001339 |
| 280068 | Archie Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 280069 | Archie Creek | 0.593673 | 0.270784 | 0.071799 | 0.000615 | 0.072414 | 0.00398 | 0.002749 | 0.018463 | 2.05E-05 | 2.05E-05 | 2.05E-05 | 0.000123 |
| 280070 | Archie Creek | 1.97121 | 0.899101 | 0.238398 | 0.002043 | 0.240441 | 0.013214 | 0.009127 | 0.061302 | 6.81E-05 | 6.81E-05 | 6.81E-05 | 0.000409 |
| 280071 | Archie Creek | 0.897893 | 0.409543 | 0.108591 | 0.000931 | 0.109522 | 0.006019 | 0.004157 | 0.027923 | 3.1E-05 | 3.1E-05 | 3.1E-05 | 0.000186 |
| 280072 | Archie Creek | 4.240101 | 1.933978 | 0.512797 | 0.004395 | 0.517193 | 0.028424 | 0.019633 | 0.131862 | 0.000147 | 0.000147 | 0.000147 | 0.000879 |
| 280075 | Archie Creek | 39.57489 | 18.05075 | 4.786183 | 0.041024 | 4.827207 | 0.265291 | 0.183242 | 1.230733 | 0.001367 | 0.001367 | 0.001367 | 0.008205 |
| 280080 | Archie Creek | 295.9906 | 135.0061 | 35.79707 | 0.306832 | 36.1039 | 1.98418 | 1.370516 | 9.204961 | 0.010228 | 0.010228 | 0.010228 | 0.061366 |
| 280081 | Archie Creek | 380.2699 | 173.4472 | 45.98979 | 0.394198 | 46.38399 | 2.549148 | 1.760752 | 11.82595 | 0.01314 | 0.01314 | 0.01314 | 0.07884 |
| 280085 | Archie Creek | 1549.027 | 3448.996 | 333.4479 | 97.67112 | 431.119 | 189.6067 | 100.0938 | 107.8094 | 0.987509 | 4.731753 | 0.622445 | 4.025776 |
| 280086 | Archie Creek | 45.22361 | 232.4828 | 18.04377 | 4.561315 | 22.60509 | 5.19838 | 2.818603 | 6.745339 | 0.023575 | 0.21132 | 0.040887 | 0.261803 |
| 280088 | Archie Creek | 48.176 | 409.7539 | 29.4493 | 6.936199 | 36.38549 | 5.048847 | 2.838409 | 11.62677 | 0.018221 | 0.31378 | 0.071534 | 0.456056 |
| 280089 | Archie Creek | 123.5348 | 1060.821 | 76.15318 | 17.91567 | 94.06885 | 12.91595 | 7.268115 | 30.09092 | 0.046294 | 0.81014 | 0.185175 | 1.18049 |
| 280100 | Archie Creek | 10.65572 | 91.50304 | 6.568732 | 1.545349 | 8.114082 | 1.114089 | 0.626925 | 2.595548 | 0.003993 | 0.06988 | 0.015973 | 0.101825 |
| 280105 | Archie Creek | 83.79326 | 269.8317 | 90.3953 | 6.076071 | 111.6615 | 7.665741 | 2.46497 | 33.16719 | 0.019626 | 0.480826 | 0.078502 | 0.300271 |
| 280110 | Archie Creek | 12.63536 | 5.763189 | 1.528118 | 0.013098 | 1.541216 | 0.084701 | 0.058505 | 0.392945 | 0.000437 | 0.000437 | 0.000437 | 0.00262 |
| 280115 | Archie Creek | 68.70887 | 590.0183 | 42.35566 | 9.964524 | 52.32019 | 7.183727 | 4.042455 | 16.73628 | 0.025748 | 0.450592 | 0.102992 | 0.656577 |
| 280120 | Archie Creek | 234.524 | 1962.7 | 141.4729 | 33.1118 | 174.5847 | 23.90221 | 13.45773 | 55.79841 | 0.085753 | 1.49679 | 0.342305 | 2.182107 |
| 280128 | Archie Creek | 181.402 | 974.4871 | 22.25058 | 4.164821 | 26.4154 | 1.070229 | 1.513506 | 4.406149 | 0.14596 | 0.370632 | 3.426889 | 1.482018 |
| 280140 | Archie Creek | 1022.011 | 10582.85 | 152.547 | 53.38875 | 205.9358 | 5.629253 | 14.03175 | 30.22069 | 1.610637 | 4.123233 | 38.29132 | 16.44275 |
| 280143 | Archie Creek | 6.118106 | 42.07345 | 3.639916 | 0.417186 | 4.057102 | 0.518415 | 0.318812 | 5.727479 | 0.00362 | 0.041665 | 0.055236 | 0.166868 |
| 280145 | Archie Creek | 367.4597 | 3999.965 | 46.23192 | 17.56471 | 63.79663 | 2.024485 | 4.720637 | 6.626959 | 0.612118 | 1.581131 | 14.68326 | 6.279761 |
| 280150 | Archie Creek | 2278.566 | 23946.96 | 417.1924 | 126.562 | 543.7544 | 37.27206 | 42.99674 | 198.0865 | 3.490106 | 10.29866 | 81.96767 | 39.0589 |
| 280155 | Archie Creek | 717.0008 | 835.2528 | 150.3397 | 45.07777 | 195.4175 | 74.56792 | 42.97181 | 51.35707 | 0.441538 | 1.306605 | 0.117138 | 0.764616 |
| 280160 | Archie Creek | 232.0278 | 590.0811 | 41.80949 | 8.109313 | 57.26459 | 13.90718 | 7.859635 | 7.28616 | 0.203731 | 0.698036 | 3.108348 | 0.896215 |

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~~Table 10.4d~~

## Summary of the Net Pollutant Loads for the Archie Creek Subwatershed

| Subbasin ID | Basin ID | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 280300 | Archie Creek | 52.44853 | 450.3872 | 32.33196 | 7.606364 | 39.93833 | 5.483658 | 3.085786 | 12.77555 | 0.019655 | 0.343957 | 0.078619 | 0.501195 |
| 280305 | Archie Creek | 81.18932 | 718.0914 | 19.94757 | 5.842652 | 25.79022 | 0.842335 | 1.575056 | 6.366071 | 0.103786 | 0.274367 | 2.349595 | 1.057225 |
| 280310 | Archie Creek | 765.5917 | 8042.082 | 112.4221 | 39.80742 | 152.2295 | 4.61012 | 10.5469 | 21.44035 | 1.221433 | 3.159268 | 29.06942 | 12.5103 |
| 280312 | Archie Creek | 84.01804 | 245.4211 | 46.20992 | 11.23188 | 57.44181 | 1.1055 | 2.874301 | 19.89901 | 0.02211 | 0.02211 | 0.02211 | 0.13266 |
| 280313 | Archie Creek | 12.18036 | 13.34231 | 11.7236 | 0.814161 | 14.57316 | 0.140234 | 0.208348 | 4.687837 | 0.002003 | 0.002805 | 0.002003 | 0.007212 |
| 280314 | Archie Creek | 25.41178 | 74.22913 | 13.97648 | 3.397153 | 17.37363 | 0.334365 | 0.86935 | 6.018578 | 0.006687 | 0.006687 | 0.006687 | 0.040124 |
| 280315 | Archie Creek | 1549.621 | 15338.19 | 202.314 | 75.1131 | 277.4271 | 26.82731 | 27.90338 | 32.12197 | 2.419684 | 6.377916 | 55.53265 | 23.99266 |
| 280317 | Archie Creek | 69.72408 | 203.6677 | 38.34824 | 9.321009 | 47.66925 | 0.917422 | 2.385297 | 16.5136 | 0.018348 | 0.018348 | 0.018348 | 0.110091 |
| 280320 | Archie Creek | 327.2877 | 1953.889 | 50.46052 | 17.10028 | 67.56081 | 22.64042 | 13.39548 | 11.98661 | 0.371417 | 1.140099 | 6.167372 | 2.959692 |
| 280325 | Archie Creek | 99.8556 | 73.66465 | 12.09991 | 4.437588 | 16.5375 | 12.80436 | 6.668987 | 2.847914 | 0.07075 | 0.226108 | 0.014395 | 0.097534 |
| 280330 | Archie Creek | 1320.96 | 14029.07 | 167.7626 | 63.41674 | 231.1794 | 12.16721 | 19.23072 | 25.69421 | 2.1644 | 5.625163 | 51.29903 | 22.00458 |
| 280333 | Archie Creek | 17.77626 | 90.36346 | 7.62085 | 1.939176 | 9.560025 | 0.215027 | 0.508048 | 3.096796 | 0.011613 | 0.024711 | 0.198711 | 0.103666 |
| 280335 | Archie Creek | 187.9294 | 1860.831 | 115.0768 | 27.94654 | 143.0234 | 23.4062 | 14.45448 | 57.45172 | 0.108223 | 1.312047 | 1.173294 | 2.186409 |
| 280340 | Archie Creek | 284.7339 | 294.4624 | 38.81534 | 13.7487 | 52.56405 | 37.99121 | 20.16744 | 13.34951 | 0.203802 | 0.694859 | 0.080505 | 0.375997 |
| 280350 | Archie Creek | 268.3906 | 2872.84 | 35.89238 | 13.24598 | 49.13836 | 1.389038 | 3.480189 | 5.743965 | 0.439217 | 1.128592 | 10.50628 | 4.49552 |
| 280357 | Archie Creek | 457.4439 | 4049.1 | 106.4957 | 31.75786 | 138.2536 | 3.236555 | 8.244506 | 33.24592 | 0.59908 | 1.494398 | 13.67357 | 6.010417 |
| 280360 | Archie Creek | 1687.147 | 7255.323 | 219.9403 | 74.66731 | 298.4487 | 7.646743 | 22.67525 | 43.51512 | 2.714207 | 6.977133 | 19.42956 | 11.18444 |
| 280365 | Archie Creek | 3974.948 | 16929.65 | 616.7012 | 192.043 | 817.3021 | 24.2119 | 59.22968 | 195.7827 | 6.10753 | 15.9479 | 43.41658 | 26.68998 |
| 280370 | Archie Creek | 302.6165 | 1214.024 | 60.6753 | 13.05053 | 79.62534 | 1.446756 | 3.927542 | 16.62361 | 0.457117 | 1.170997 | 3.259169 | 1.871592 |
| 280373 | Archie Creek | 247.2437 | 990.2111 | 53.86046 | 15.55241 | 69.85831 | 1.535641 | 4.386522 | 17.26376 | 0.328292 | 0.820612 | 2.266311 | 1.375846 |
| 280375 | Archie Creek | 83.1468 | 242.8762 | 45.73074 | 11.11541 | 56.84616 | 1.094037 | 2.844496 | 19.69266 | 0.021881 | 0.021881 | 0.021881 | 0.131284 |
| 280380 | Archie Creek | 34.09083 | 99.5811 | 18.74996 | 4.557405 | 23.30736 | 0.448564 | 1.166265 | 8.074143 | 0.008971 | 0.008971 | 0.008971 | 0.053828 |
| 280385 | Archie Creek | 104.1184 | 679.3209 | 37.19829 | 9.853692 | 47.05199 | 0.985172 | 2.537863 | 14.27399 | 0.093603 | 0.217423 | 1.901777 | 0.895736 |
| 280390 | Archie Creek | 618.0024 | 6395.056 | 94.41396 | 32.88443 | 127.2984 | 3.424085 | 8.614094 | 19.31641 | 0.972529 | 2.48729 | 23.09284 | 9.922624 |
| 280392 | Archie Creek | 802.7397 | 7460.01 | 167.9224 | 51.88876 | 219.8112 | 5.316042 | 13.50016 | 48.52826 | 1.113841 | 2.801972 | 25.76592 | 11.23832 |
| 280394 | Archie Creek | 411.575 | 1748.286 | 59.03788 | 19.36415 | 79.30961 | 1.915887 | 5.783795 | 13.34104 | 0.644642 | 1.647753 | 4.593394 | 2.657752 |
| 280397 | Archie Creek | 163.5199 | 1451.872 | 37.82973 | 11.30395 | 49.13368 | 1.152376 | 2.934936 | 11.7607 | 0.214937 | 0.536454 | 4.91011 | 2.15721 |
| 280398 | Archie Creek | 1864.521 | 8020.368 | 236.7304 | 81.17662 | 322.1852 | 8.036808 | 24.67849 | 44.98908 | 3.018843 | 7.747328 | 21.63256 | 12.40885 |
| 280400 | Archie Creek | 762.18 | 3258.132 | 103.0336 | 34.518 | 139.2665 | 3.416274 | 10.39861 | 21.53978 | 1.21397 | 3.109338 | 8.6751 | 4.997344 |
| 280405 | Archie Creek | 700.4567 | 7464.685 | 95.43677 | 34.92715 | 130.3639 | 3.658983 | 9.172731 | 15.90348 | 1.140469 | 2.928746 | 27.25499 | 11.66832 |
| 280410 | Archie Creek | 305.378 | 1266.532 | 53.19699 | 16.36918 | 70.18863 | 1.617976 | 4.757117 | 14.62147 | 0.448203 | 1.136178 | 3.156424 | 1.859277 |
| 280415 | Archie Creek | 406.4822 | 1768.198 | 45.57682 | 16.41172 | 62.95393 | 1.625929 | 5.081028 | 6.774704 | 0.67747 | 1.744486 | 4.877787 | 2.777628 |
| 280420 | Archie Creek | 191.6066 | 833.4889 | 21.48389 | 7.736118 | 29.67508 | 0.766427 | 2.395083 | 3.193444 | 0.319344 | 0.822312 | 2.29928 | 1.309312 |
| 280425 | Archie Creek | 424.5428 | 1816.693 | 56.81579 | 19.10436 | 76.87846 | 1.890875 | 5.763626 | 11.70873 | 0.678038 | 1.737227 | 4.847543 | 2.790478 |
| 280430 | Archie Creek | 190.8462 | 778.2948 | 41.60845 | 4.532598 | 57.47255 | 0.834952 | 1.192789 | 5.168752 | 0.198798 | 0.716667 | 4.771156 | 1.222609 |
| 280435 | Archie Creek | 86.94457 | 95.23862 | 83.68415 | 5.811558 | 104.0246 | 1.001007 | 1.48721 | 33.46222 | 0.0143 | 0.02002 | 0.0143 | 0.05148 |

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~~Table 10.4d.~~

## Summary of the Net Pollutant Loads for the Archie Creek Subwatershed

| Subbasin ID | Basin ID | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 280440 | Archie Creek | 59.02236 | 64.65278 | 56.80902 | 3.945179 | 70.61714 | 0.679534 | 1.009593 | 22.71584 | 0.009708 | 0.013591 | 0.009708 | 0.034947 |
| 280445 | Archie Creek | 692.801 | 2822.201 | 135.1925 | 40.2297 | 176.7533 | 4.103896 | 11.56803 | 40.47322 | 0.969348 | 2.442067 | 6.759825 | 4.037916 |
| 280500 | Archie Creek | 63.17105 | 184.526 | 34.74408 | 8.444972 | 43.18905 | 0.831198 | 2.161115 | 14.96156 | 0.016624 | 0.016624 | 0.016624 | 0.099744 |
| 280515 | Archie Creek | 126.8852 | 370.6385 | 69.78689 | 16.96255 | 86.74944 | 1.669543 | 4.340811 | 30.05177 | 0.033391 | 0.033391 | 0.033391 | 0.200345 |
| 280520 | Archie Creek | 1.635306 | 4.776813 | 0.899418 | 0.218615 | 1.118033 | 0.021517 | 0.055945 | 0.387309 | 0.00043 | 0.00043 | 0.00043 | 0.002582 |
| 280525 | Archie Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 280530 | Archie Creek | 0.003111 | 0.010019 | 0.003356 | 0.000226 | 0.004146 | 0.000285 | 9.15E-05 | 0.001232 | 7.29E-07 | 1.79E-05 | 2.91E-06 | 1.11E-05 |
| 280535 | Archie Creek | 87.8716 | 30.80431 | 20.15879 | 2.064956 | 27.38613 | 10.14514 | 3.06063 | 5.878965 | 0.039223 | 0.183146 | 0.013184 | 0.039746 |
| 290000 | Archie Creek | 1468.759 | 6373.192 | 169.5601 | 60.34009 | 233.362 | 5.977004 | 18.60122 | 26.93083 | 2.432305 | 6.25857 | 17.49443 | 9.978017 |
| 290003 | Archie Creek | 102.1038 | 905.7518 | 23.6649 | 7.067146 | 30.73205 | 0.720393 | 1.834833 | 7.366066 | 0.134066 | 0.334556 | 3.061863 | 1.3454 |
| 290010 | Archie Creek | 786.3681 | 8585.263 | 101.917 | 38.31551 | 140.2326 | 5.565069 | 10.9411 | 17.49166 | 1.307864 | 3.410746 | 31.32274 | 13.45407 |
| 290015 | Archie Creek | 16.10403 | 305.9765 | 17.42456 | 4.525232 | 21.94979 | 6.457715 | 4.541336 | 17.39235 | 0.016104 | 0.209352 | 0.128832 | 0.354289 |
| 290020 | Archie Creek | 1.463447 | 27.80549 | 1.58345 | 0.411229 | 1.994678 | 0.586842 | 0.412692 | 1.580523 | 0.001463 | 0.019025 | 0.011708 | 0.032196 |
| 290025 | Archie Creek | 709.7523 | 497.2118 | 85.13307 | 31.27408 | 116.5308 | 91.05906 | 47.4243 | 20.22488 | 0.503686 | 1.59125 | 0.098808 | 0.662606 |
| 290030 | Archie Creek | 32.99624 | 28.10819 | 5.345089 | 1.526131 | 7.155734 | 4.415657 | 2.265236 | 2.300965 | 0.023371 | 0.081325 | 0.008447 | 0.036582 |
| 290035 | Archie Creek | 39.44346 | 116.2003 | 22.00833 | 5.274564 | 27.3651 | 0.59803 | 1.374374 | 9.697173 | 0.010465 | 0.01298 | 0.011488 | 0.06384 |
| 290045 | Archie Creek | 412.0324 | 364.0378 | 66.13263 | 20.54946 | 88.14883 | 51.1675 | 27.09561 | 23.29247 | 0.282055 | 0.915786 | 0.079508 | 0.428287 |
| 290055 | Archie Creek | 1185.276 | 2525.054 | 239.8983 | 73.88416 | 313.7859 | 159.9332 | 86.76825 | 101.0314 | 0.813855 | 3.615241 | 0.660438 | 3.006348 |
| 290100 | Archie Creek | 921.7892 | 4477.015 | 168.5614 | 53.66306 | 223.9284 | 47.18642 | 36.89846 | 87.37112 | 1.360108 | 4.250584 | 9.158779 | 6.490087 |
| 290105 | Archie Creek | 191.9383 | 2845.646 | 164.3009 | 41.10527 | 207.6492 | 56.89944 | 39.85665 | 158.4385 | 0.22286 | 2.051825 | 1.716499 | 3.384397 |
| 290110 | Archie Creek | 944.9753 | 4131.252 | 109.1242 | 38.88762 | 150.2439 | 4.500656 | 12.35397 | 18.34305 | 1.569045 | 4.056997 | 11.29298 | 6.465875 |
| 290115 | Archie Creek | 1203.41 | 5241.352 | 139.8479 | 49.67815 | 192.3611 | 5.393514 | 15.56674 | 23.25751 | 1.99302 | 5.141738 | 14.33702 | 8.198261 |
| 290200 | Archie Creek | 135.4396 | 112.6494 | 98.06559 | 7.133077 | 123.0314 | 5.869586 | 3.014137 | 37.56816 | 0.034228 | 0.105166 | 0.018894 | 0.069772 |
| 290225 | Archie Creek | 136.8606 | 35.61742 | 28.36119 | 3.002708 | 38.87067 | 15.37158 | 4.57324 | 6.076463 | 0.060765 | 0.268299 | 0.011686 | 0.047677 |
| 290235 | Archie Creek | 295.1787 | 81.31381 | 63.56242 | 6.625253 | 86.75081 | 33.00508 | 9.865022 | 14.53588 | 0.130468 | 0.578088 | 0.027205 | 0.106321 |
| 290240 | Archie Creek | 300.4053 | 112.1242 | 69.67462 | 7.331992 | 94.31926 | 33.33668 | 10.26519 | 17.61235 | 0.131904 | 0.590795 | 0.037756 | 0.137991 |
| 290250 | Archie Creek | 1699.705 | 1187.095 | 217.0809 | 75.01276 | 295.2236 | 215.9866 | 112.6609 | 53.13693 | 1.197216 | 3.770431 | 0.232722 | 1.572651 |
| 290305 | Archie Creek | 314.6166 | 1275.593 | 116.1398 | 31.97251 | 148.1123 | 44.96928 | 28.94452 | 74.91809 | 0.20393 | 1.084447 | 0.432319 | 1.367878 |
| 290306 | Archie Creek | 318.0208 | 869.6462 | 163.4178 | 40.12276 | 203.5406 | 7.252477 | 11.74837 | 69.74096 | 0.0956 | 0.136347 | 0.08032 | 0.484828 |
| 290310 | Archie Creek | 116.6532 | 511.2224 | 69.79963 | 17.15656 | 86.9562 | 5.646892 | 6.617882 | 36.56772 | 0.03851 | 0.165737 | 0.112726 | 0.400697 |
| 290315 | Archie Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 290320 | Archie Creek | 151.3032 | 1303.378 | 93.81042 | 21.99702 | 115.8979 | 16.00783 | 9.035382 | 37.48876 | 0.057044 | 0.995949 | 0.23082 | 1.450932 |
| 290325 | Archie Creek | 1356.144 | 2881.566 | 273.8922 | 84.49347 | 358.3856 | 183.8562 | 99.81062 | 116.4969 | 0.931797 | 4.135338 | 0.744474 | 3.431304 |
| 290330 | Archie Creek | 457.2899 | 202.2089 | 98.65815 | 11.18705 | 134.6814 | 52.63506 | 16.38232 | 24.90346 | 0.205487 | 0.945304 | 0.074134 | 0.255333 |
| 290340 | Archie Creek | 35.03481 | 665.6615 | 37.90767 | 9.844783 | 47.75245 | 14.04896 | 9.879818 | 37.8376 | 0.035035 | 0.455453 | 0.280279 | 0.770766 |
| 290350 | Archie Creek | 2.689615 | 19.16351 | 5.092787 | 0.377891 | 6.415405 | 0.943719 | 0.379236 | 4.720275 | 0.001681 | 0.030594 | 0.013448 | 0.022189 |

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~~Table 10.4d~~

## Summary of the Net Pollutant Loads for the Archie Creek Subwatershed

| Subbasin ID | Basin ID | BOD5 | TSS | TKN | NO3 +NO2 | TN | TP | TDP | Oil and Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 290360 | Archie Creek | 18.81874 | 102.7344 | 29.04353 | 2.09839 | 36.38789 | 4.562445 | 1.774686 | 22.24572 | 0.008722 | 0.168905 | 0.061903 | 0.117848 |
| 290370 | Archie Creek | 19.5534 | 189.1711 | 13.00432 | 3.113383 | 16.1177 | 2.64968 | 1.606094 | 6.470738 | 0.008604 | 0.141385 | 0.042584 | 0.21226 |
| 290500 | Archie Creek | 498.9958 | 636.9908 | 152.2396 | 13.9903 | 201.2057 | 36.8476 | 12.41301 | 41.528 | 0.27511 | 1.08299 | 3.013884 | 0.91042 |
| 290570 | Archie Creek | 1034.213 | 3782.192 | 117.1942 | 42.44336 | 161.6283 | 28.51353 | 23.57733 | 19.32558 | 1.536242 | 4.036425 | 10.08515 | 5.909774 |
| 290572 | Archie Creek | 1751.251 | 7400.503 | 210.4833 | 73.81859 | 288.2742 | 13.15551 | 25.13693 | 36.64273 | 2.829359 | 7.29189 | 20.08523 | 11.52267 |
| 290575 | Archie Creek | 419.8852 | 1771.349 | 63.97984 | 20.55423 | 85.43963 | 2.032999 | 6.086504 | 15.49597 | 0.645639 | 1.646523 | 4.585627 | 2.666417 |
| 290580 | Archie Creek | 25.84001 | 75.48002 | 14.212 | 3.454401 | 17.66641 | 0.34 | 0.884 | 6.120002 | 0.0068 | 0.0068 | 0.0068 | 0.0408 |
| 290585 | Archie Creek | 70.6103 | 56.76209 | 24.67778 | 3.542234 | 31.45022 | 6.804883 | 3.757721 | 8.840729 | 0.039608 | 0.119341 | 0.010185 | 0.059083 |
| 290587 | Archie Creek | 898.8092 | 3458.035 | 116.1618 | 39.80652 | 157.761 | 17.63963 | 17.96487 | 23.54274 | 1.345303 | 3.495674 | 9.081551 | 5.313398 |
| 290588 | Archie Creek | 25.87878 | 75.56627 | 14.22809 | 3.458495 | 17.68659 | 0.341908 | 0.885722 | 6.126644 | 0.006816 | 0.006834 | 0.006809 | 0.040853 |
| 290590 | Archie Creek | 50.47425 | 125.3091 | 23.47247 | 5.855284 | 29.32775 | 1.808829 | 2.050875 | 9.87257 | 0.017726 | 0.03293 | 0.012025 | 0.073238 |
| 290594 | Archie Creek | 133.726 | 92.80437 | 15.8352 | 5.867867 | 21.70307 | 17.16515 | 8.936988 | 3.653715 | 0.094997 | 0.299605 | 0.018269 | 0.124226 |
| 290595 | Archie Creek | 722.5209 | 1316.162 | 156.6528 | 22.5214 | 211.1465 | 58.22686 | 20.76893 | 55.07942 | 0.625041 | 2.147748 | 3.086578 | 1.987334 |
| 290605 | Archie Creek | 8.990566 | 64.05778 | 17.02364 | 1.263175 | 21.44475 | 3.154565 | 1.26767 | 15.77844 | 0.005619 | 0.102268 | 0.044953 | 0.074172 |
| 290610 | Archie Creek | 18.15851 | 129.3793 | 34.38313 | 2.55127 | 43.31257 | 6.371366 | 2.560349 | 31.86818 | 0.011349 | 0.206553 | 0.090793 | 0.149808 |
| 290612 | Archie Creek | 256.2266 | 279.5232 | 35.69464 | 12.56056 | 48.2552 | 34.40415 | 18.31922 | 12.8492 | 0.183628 | 0.633838 | 0.078691 | 0.355091 |
| 290616 | Archie Creek | 24.00982 | 7.359794 | 5.248468 | 0.545967 | 7.159351 | 2.735297 | 0.819712 | 1.342939 | 0.010689 | 0.048593 | 0.002846 | 0.009643 |
| 290617 | Archie Creek | 8.402486 | 58.8816 | 15.66788 | 1.163518 | 19.74019 | 2.913953 | 1.169296 | 14.50064 | 0.005226 | 0.094226 | 0.041306 | 0.068185 |
| 290620 | Archie Creek | 171.9695 | 175.5599 | 23.32283 | 8.274142 | 31.59698 | 22.91135 | 12.15357 | 7.93123 | 0.123053 | 0.418328 | 0.04764 | 0.224459 |

# WATER QUALITY TREATMENT LEVEL OF SERVICE

## 11.1 OVERVIEW

The determination of a water quality treatment level of service (WQTLOS) is one of the latest tools to be applied to watershed management. Designating levels of service has been done routinely for years in such different areas as traffic volume or flood control, of which, water quality has sometimes been a component. Assigning levels of service allows for the comparison of existing or proposed conditions against a standard. In this case the standard will be the low to medium density residential land use without stormwater treatment. One of the difficulties in trying to establish a WQLOS is that numerous parameters are measured. For the County's purposes, twelve different water quality elements from its NPDES can be chosen from. They are:

- BOD - biological oxygen demand
- TSS - total suspended solids
- TKN - total Kjeldahl nitrogen
- $NO_3 + NO_2$ - nitrates and nitrites
- TN - total nitrogen
- TP - total phosphorus
- TDP - total dissolved phosphorus
- Oil and Grease
- Cd - cadmium
- Cu - copper
- Pb - lead
- Zn - zinc

In determining the overall LOS for a particular basin, it is problematic to try to average parameters or to focus on just one or two parameters. A basin could have good water quality in terms of most or all but one of these parameters, but may have dangerous levels of one parameter such as lead, so care must be taken when choosing parameter(s).

For the purposes of this study, two parameters were chosen – total nitrogen (TN) and total suspended solids (TSS). Total nitrogen was chosen for several reasons. This is the one of the most difficult constituent to remove from stormwater, with an average removal rate of about 30% using a typical wet detention pond built and maintained to present day standards and assuming a 3 day residence time (Harper, 1995). Wet detention at this level of treatment will also remove at least 60% of the remaining ten pollutants with the exception of oil and grease and Kjeldahl nitrogen, which have approximately 35% and 30% removal rates, respectively. Another reason for choosing nitrogen is that it is also the target of the Tampa Bay Estuary Program's plan to improve the water quality of Tampa Bay and restore seagrasses to historic levels. Governments within the Tampa Bay watershed have already agreed to "hold the line" on this pollutant. Ideally, as many compounds as possible should be removed on the subbasin level prior to reaching the Bay, rather than letting them impact the Bay and then trying to remove them. One of the ways of doing this is by increased residence times, which at the same time should increase the removal rates of the other pollutants accordingly. Particulates such as TSS and the various metals will have longer to settle out of the water column and the other pollutants will have a longer residence time to be acted on by biological or chemical means. It has been found that some pollutants such as metals and pathogens adhere to the TSS particles and would be removed with them. This is the reason for choosing TSS as the second WQTLOS parameter. Pathogens are not normally considered in LOS determinations and increased residence times would be one way to increase their removal, as well.

# 11.2 WATER QUALITY TREATMENT LEVEL OF SERVICE DEFINITIONS

The WQTLOS is determined by using the Pollutant Loading and Removal Model to compare a particular subbasin's existing net pollutant load against the non-treated pollutant load of the same subbasin, assuming that its land use coverage is 100% single family low to medium density. This is done by calculating the ratio of net load to the gross load and then applying the criteria listed below.

**LOS A, net load equivalent to 20% or less of untreated single family residential.** This level generally applies to undisturbed natural systems or areas with stormwater treatment facilities going above and beyond present day treatment standards by removing pollutants down to the level of undisturbed natural systems. Areas of low to medium density land uses with stormwater treatment levels above the minimum required per 62-40.432(5) F.A.C. (Water Policy) would also receive LOS A.

**LOS B, net load equivalent to between 20% and 40% of untreated single family residential.** This level applies to those areas built to present day SWFWMD standards of 80% removal and assumes that the facility has been properly designed and maintained.

**LOS C, net load equivalent to between 40% and 70% of untreated single family residential.** This level would apply to areas which were built to present day standards but the facility was poorly designed or maintained. It could also apply to properly designed and maintained systems built prior to present day standards.

**LOS D, net load equivalent to between 70% and 100% of untreated single family residential.** This level would apply to those subbasins with minimal treatment.

**LOS F, net load equivalent to or greater than 100% of untreated single family residential.** This level would apply to those subbasins with no treatment or inadequate treatment of an area producing large pollutant loads per unit area when compared to the low to medium density residential land use standard.

# 11.3 RESULTS

The water quality treatment level of service for each of the Delaney Creek Area's subwatersheds by subbasins is summarized in Exhibit 11-A. This information shows that the majority of the subbasins, in the majority of the parameters used, are at level of service D and F. The only exceptions to this pattern are those subbasins that remain in natural systems or have low to medium single-family residential land uses with adequate stormwater treatment.

## 11.3.1 ARCHIE CREEK SUBWATERSHED

Of the 127 subbasins in this subwatershed, only 11 basins attained level of service A across the board for each parameter. These are subbasins 280068, 280069, 280070, 280071, 280143, 280333, 280520, 280525, 280530, 290020 and 290315. The first four subbasins, 280068 to 280071, consist of the cooling ponds for the new Gardinier gypsum stack and are waterbodies. Subbasin 280143 is 100% mixed hardwood and coniferous forest. Subbasin 280333 is a combination of natural systems primarily pine flatwoods with wet prairie, freshwater marshes and open lands. Subbasins 280520, 525 & 530 are made up entirely of pine flatwoods. Subbasin 290020 is a blend of mixed hardwood and coniferous forest, pine flatwoods, freshwater marsh, emergent aquatic vegetation and a very small sliver of low/medium density residential land uses. Subbasin 290315 is similar in make up to the previous subbasin, but lacks the pine flatwoods and residential land uses. These 11 along with 11 more were the only subbasins to achieve level of service C or above for all parameters. As with the all LOS A subbasins, the majority of these LOS C or better subbasins were made up primarily of natural systems land use/land cover. No subbasins scored LOS F on all parameters in the subwatershed.

For the subwatershed, 37 basins or an average of 29.2 % had a LOS A for one or more of the pollutants. For LOS B, this dropped to 12 subbasins or 9.5 %. The average came up slightly for LOS C to 14.3 % or 18 subbasins. For LOS D, this dropped again to 9 subbasins or an average of 6.9 %. Finally and most unfortunately, LOS F averaged 40% or 51 subbasins.

When looking at the parameters of TSS and TN, the LOS is somewhat better. For TSS, 72 subbasins or 56.69 % scored an LOS C or better. For TN, this amounted to 57 subbasins or 44.88 %. The upper portion of Table 11.1a below summarizes how many subbasins met a particular treatment level of service for a given parameter. The lower portion gives same information as a percentage of the total amount of subbasins. As can be seen from the table, Biological Oxygen Demand (BOD) treatment level of service is the worst with 98 subbasins scoring LOS F. This corresponds to over 77 % of the subbasins. On the other end of the scale is Total Phosphorus (TP) where 66 subbasins achieved LOS A. This is approximately 52 % of the subwatershed's subbasins.

**Table 11.1a**
**Treatment Level of Service Summary for Each Parameter by Subbasin for the Archie Creek Subwatershed**

| | BOD | TSS | TKN | $NO_3$ $+NO_2$ | TN | TP | TDP | Oil & Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # LOSA | 11 | 43 | 18 | 28 | 19 | 66 | 46 | 48 | 25 | 42 | 52 | 47 |
| # LOS B | 3 | 11 | 13 | 7 | 13 | 11 | 13 | 39 | 13 | 7 | 11 | 4 |
| # LOS C | 8 | 18 | 27 | 22 | 25 | 15 | 23 | 29 | 10 | 13 | 9 | 19 |
| # LOS D | 7 | 7 | 13 | 10 | 13 | 7 | 18 | 6 | 5 | 3 | 8 | 9 |
| # LOS F | 98 | 48 | 56 | 60 | 57 | 28 | 27 | 5 | 74 | 62 | 47 | 48 |
| TOTAL | 127 | 127 | 127 | 127 | 127 | 127 | 127 | 127 | 127 | 127 | 127 | 127 |
| % LOS A | 8.661 | 33.86 | 14.17 | 22.05 | 15 | 52 | 36.22 | 37.795 | 19.7 | 33.1 | 40.9 | 37 |
| % LOS B | 2.362 | 8.661 | 10.24 | 5.512 | 10.2 | 8.66 | 10.24 | 30.709 | 10.2 | 5.51 | 8.66 | 3.15 |
| % LOS C | 6.299 | 14.17 | 21.26 | 17.32 | 19.7 | 11.8 | 18.11 | 22.835 | 7.87 | 10.2 | 7.09 | 15 |
| % LOS D | 5.512 | 5.512 | 10.24 | 7.874 | 10.2 | 5.51 | 14.17 | 4.724 | 3.94 | 2.36 | 6.3 | 7.09 |
| % LOS F | 77.17 | 37.80 | 44.09 | 47.24 | 44.9 | 22 | 21.26 | 3.937 | 58.3 | 48.8 | 37 | 37.8 |
| TOTAL | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

## 11.3.2 DELANEY CREEK SUBWATERSHED

Unfortunately but not entirely unexpectedly, of the 158 subbasins in this subwatershed, none level of service A or even LOS B across the board for each parameter. Only one subbasin scored LOS C across the board. This is due to the poor showing for the BOD parameter. No subbasins scored LOS A or B for this pollutant. The BOD scores also limited the number of subbasins that contain level of service C or above for all parameters to 2. Again, these LOS C or better subbasins were made up primarily of natural systems land use/land cover. Twenty-three subbasins scored LOS F on all parameters in the subwatershed.

For the subwatershed, 4 basins or an average of 2.7% had a LOS A for one or more of the pollutants. For LOS B, this remained the same, at 4 subbasins or 2.7%. The average came up slightly for LOS C to 8.8% for 14 subbasins. For LOS D, this rose to 26 subbasins or 16.2%. Finally and most unfortunately, LOS F occurred in 110 subbasins or 69.3%.

When looking at the parameters of TSS and TN, the LOS is not very good. For TSS, only 23 subbasins or 14.56% scored a LOS C or better. For TN, this amounted to only 8 subbasins or 4.43%. The upper portion of Table 11.1b below summarizes how many subbasins met a particular treatment level of service for a given parameter. The lower portion gives same information as a percentage of the total amount of subbasins. As with the Archie Creek subwatershed, Biological Oxygen Demand (BOD) treatment level of service is the worst with 149 subbasins scoring LOS F followed closely behind Cd with 133, $NO_3$ + $NO_2$ with 132, TN with 128, TKN with 127 and Cu with 126 subbasins. This corresponds to over 94% of the subbasins. Again TP is at the other end of the scale where 16 subbasins achieved LOS A. This is approximately 10 % of the subwatershed's subbasins.

**Table 11.1b**
**Treatment Level of Service Summary for Each Parameter by Subbasin for the Delaney Creek Subwatershed**

| | BOD | TSS | TKN | $NO_3$ $+NO_2$ | TN | TP | TDP | Oil & Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# LOSA** | 0 | 3 | 1 | 1 | 1 | 16 | 5 | 4 | 1 | 5 | 9 | 5 |
| **# LOS B** | 0 | 5 | 1 | 1 | 1 | 7 | 9 | 16 | 3 | 2 | 7 | 2 |
| **# LOS C** | 2 | 15 | 7 | 5 | 6 | 17 | 21 | 44 | 7 | 8 | 20 | 16 |
| **# LOS D** | 7 | 24 | 22 | 19 | 22 | 28 | 43 | 54 | 14 | 17 | 38 | 20 |
| **# LOS F** | 149 | 111 | 127 | 132 | 128 | 90 | 80 | 40 | 133 | 126 | 84 | 115 |
| **TOTAL** | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 |
| **% LOS A** | 0 | 1.899 | 0.633 | 0.633 | 0.63 | 10.1 | 3.165 | 2.5316 | 0.63 | 3.16 | 5.7 | 3.16 |
| **% LOS B** | 0 | 3.165 | 0.633 | 0.633 | 0.63 | 4.43 | 5.696 | 10.127 | 1.9 | 1.27 | 4.43 | 1.27 |
| **% LOS C** | 1.266 | 9.494 | 4.43 | 3.165 | 3.8 | 10.8 | 13.29 | 27.848 | 4.43 | 5.06 | 12.7 | 10.1 |
| **% LOS D** | 4.43 | 15.19 | 13.92 | 12.03 | 13.9 | 17.7 | 27.22 | 34.177 | 8.86 | 10.8 | 24.1 | 12.7 |
| **% LOS F** | 94.3 | 70.25 | 80.38 | 83.54 | 81 | 57 | 50.63 | 25.316 | 84.2 | 79.7 | 53.2 | 72.8 |
| **TOTAL** | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

## 11.3.3 DELANEY POP-OFF CANAL SUBWATERSHED

As with the Delaney Creek subwatershed, of the 183 subbasins in the Delaney Pop-off Canal subwatershed, none achieved an across the board LOS A or B. Only three subbasins rated level of service C or above for all parameters. Again these LOS C or better subbasins were made up primarily of natural systems land use/land cover. There were five subbasins that scored LOS F on all parameters within the subwatershed.

For the subwatershed, 12 basins or 6.6% had a LOS A for one or more of the pollutants. For LOS B, this raised slightly to 18 subbasins or 9.8%. The average came up slightly more for

LOS C to 12.5% or 23 subbasins. LOS D remained around the same with 18 subbasins or 12.9%. Finally and most unfortunately, LOS F averaged 58.1% or 106 subbasins.

When looking at the parameters of TSS and TN, the LOS is somewhat better. Just fewer than 50% of the subbasins made LOS C or better for a total of 85 subbasins. For TN, this amounted to only 14 subbasins or 7.65 %. The upper portion of Table 11.1c below summarizes how many subbasins met a particular treatment level of service for a given parameter. The lower portion gives same information as a percentage of the total amount of subbasins. As can be seen from the table, Biological Oxygen Demand (BOD) treatment level of service is again the worst, with 166 of the 183 total subbasins scoring LOS F. This corresponds to over 90 % of the subbasins. On the other end of the scale is Total Phosphorus (TP) where 44 subbasins achieved LOS A. This is around 24 % of the subwatershed's subbasins.

**Table 11.1c**
**Treatment Level of Service Summary for Each Parameter by Subbasin for the Delaney Pop-off Canal Subwatershed**

| | BOD | TSS | TKN | $NO_3$ $+NO_2$ | TN | TP | TDP | Oil & Grease | Cd | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# LOSA** | 0 | 7 | 1 | 3 | 1 | 44 | 14 | 6 | 2 | 16 | 34 | 16 |
| **# LOS B** | 2 | 37 | 2 | 4 | 2 | 17 | 26 | 58 | 5 | 11 | 34 | 17 |
| **# LOS C** | 1 | 41 | 10 | 14 | 11 | 21 | 21 | 78 | 16 | 7 | 9 | 47 |
| **# LOS D** | 14 | 24 | 30 | 31 | 29 | 19 | 27 | 27 | 16 | 20 | 22 | 26 |
| **# LOS F** | 166 | 74 | 140 | 131 | 140 | 82 | 95 | 14 | 144 | 129 | 84 | 77 |
| **TOTAL** | 183 | 183 | 183 | 183 | 183 | 183 | 183 | 183 | 183 | 183 | 183 | 183 |
| **% LOS A** | 0 | 3.825 | 0.546 | 1.639 | 0.55 | 24 | 7.65 | 3.2787 | 1.09 | 8.74 | 18.6 | 8.74 |
| **% LOS B** | 1.093 | 20.22 | 1.093 | 2.186 | 1.09 | 9.29 | 14.21 | 31.694 | 2.73 | 6.01 | 18.6 | 9.29 |
| **% LOS C** | 0.546 | 22.4 | 5.464 | 7.65 | 6.01 | 11.5 | 11.48 | 42.623 | 8.74 | 3.83 | 4.92 | 25.7 |
| **% LOS D** | 7.65 | 13.11 | 16.39 | 16.94 | 15.8 | 10.4 | 14.75 | 14.754 | 8.74 | 10.9 | 12 | 14.2 |
| **% LOS F** | 90.71 | 40.44 | 76.5 | 71.58 | 76.5 | 44.8 | 51.91 | 7.6503 | 78.7 | 70.5 | 45.9 | 42.1 |
| **TOTAL** | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

## 11.3.4 NORTH ARCHIE CREEK SUBWATERSHED

As with the Archie Creek subwatershed, only three of the 150 subbasins in the North Archie Creek subwatershed achieved an across the board LOS A. Only five subbasins rated level of service C or above for all parameters. Again these LOS C or better subbasins were made up primarily of natural systems land use/land cover. There were fifteen subbasins that scored LOS F on all parameters within the subwatershed.

For the subwatershed, 10 subbasins or an average of 6.6 % had a LOS A for one or more of the pollutants. For LOS B, this raised slightly to 11 subbasins or 7.4 %. The average came up slightly more for LOS C to 12 subbasins or 10.4 %. LOS D remained around the same with 12 subbasins or 7.8 %. Again, unfortunately, LOS F averaged 58.1 % over 102 subbasins.

When looking at the parameters of TSS and TN, the LOS is not encouraging. Just over 35% of the subbasins made LOS C or better for a total of 53 subbasins. For TN, this amounted to only 16 subbasins or 10.67 %. The upper portion of Table 11.1d below summarizes how many subbasins met a particular treatment level of service for a given parameter. The lower portion gives same information as a percentage of the total amount of subbasins. As can be seen from the table, Biological Oxygen Demand (BOD) treatment level of service is again the worst, with 141 of the 150 total subbasins scoring LOS F. This corresponds to 94 % of the subbasins. On the other end of the scale is lead, and not Total Phosphorus (TP), where 23 subbasins achieved LOS A. This is about 15 % of the subwatershed's subbasins for this parameter.

**Table 11.1d**
**Treatment Level of Service Summary for Each Parameter by Subbasin**
**for the North Archie Creek Subwatershed**

| | **BOD** | **TSS** | **TKN** | **$NO_3$ +$NO_2$** | **TN** | **TP** | **TDP** | **Oil & Grease** | **Cd** | **Cu** | **Pb** | **Zn** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# LOSA** | 3 | 10 | 5 | 7 | 5 | 15 | 9 | 13 | 6 | 11 | 23 | 13 |
| **# LOS B** | 1 | 14 | 1 | 2 | 1 | 15 | 8 | 55 | 3 | 2 | 25 | 6 |
| **# LOS C** | 1 | 29 | 9 | 6 | 10 | 16 | 12 | 44 | 7 | 7 | 15 | 31 |
| **# LOS D** | 4 | 16 | 18 | 13 | 14 | 9 | 14 | 13 | 8 | 8 | 14 | 11 |
| **# LOS F** | 141 | 81 | 117 | 122 | 120 | 95 | 107 | 25 | 126 | 122 | 73 | 89 |
| **TOTAL** | 150 | 150 | 150 | 150 | 150 | 150 | 1506 | 150 | 150 | 150 | 150 | 150 |
| **% LOS A** | 2 | 6.667 | 3.333 | 4.667 | 3.33 | 10 | 6 | 8.6667 | 4 | 7.33 | 15.3 | 8.67 |
| **% LOS B** | 0.667 | 9.333 | 0.667 | 1.333 | 0.67 | 10 | 5.333 | 36.667 | 2 | 1.33 | 16.7 | 4 |
| **% LOS C** | 0.667 | 19.33 | 6 | 4 | 6.67 | 10.7 | 8 | 29.333 | 4.67 | 4.67 | 10 | 20.7 |
| **% LOS D** | 2.667 | 10.67 | 12 | 8.667 | 9.33 | 6 | 9.333 | 8.6667 | 5.33 | 5.33 | 9.33 | 7.33 |
| **% LOS F** | 94 | 54 | 78 | 81.33 | 80 | 63.3 | 71.33 | 16.667 | 84 | 81.3 | 48.7 | 59.3 |
| **TOTAL** | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Again, it should be remembered that the subbasin LOS is determined by comparing each subbasin against the untreated low to medium density single family residential "benchmark". Because of this, it will be almost impossible for any basin with non-residential land uses to achieve a high LOS without the incorporation of extra or extraordinary stormwater treatment system(s). Even most of the residential areas in the watershed do not have treatment facilities because they were developed prior to the establishment of any standards for water quality.

# Study Objectives

### Flood Control

We will be constructing computerized hydrologic and hydraulic models of the watershed to simulate historic flooding conditions and predict the response of the watershed statistical rainfall events.

The model will be compared to historical storm events and citizen input to verify the simulation of existing conditions. The model will then be used to develop alternatives where flood control improvements are needed. Recommendations of improvement projects will be made based on these alternatives and additional public input.

### Water Quality

Water quality can affect our drinking water supply, recreational interests, and the health of the local aquatic ecosystems.

We will evaluate existing and historical trends of water quality for all water bodies within the watershed.
A pollutant loading model will be developed to determine gross pollutant loads contributed to the creek by individual basins during rainfall events.

These endeavors will help to focus efforts by Hillsborough County and other governmental agencies to improve water quality through various best management practices.

### Natural Systems

Over time, nearly 45% of the natural habitats within the watershed have been lost or fragmented by development and the invasion of exotic vegetation.

The objective of this portion of the project will be to inventory existing natural systems and compare them with historical conditions. This comparison will help to identify strategic preservation and restoration areas within the watershed. We will also be designing new projects that can be used to protect, preserve, and restore natural ecosystems with in the Delaney Creek Area Watershed.

Hillsborough County
Stormwater Management Section
Engineer
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Tampa, FL 33601
Phone: (813) 272-5912 ext.3628
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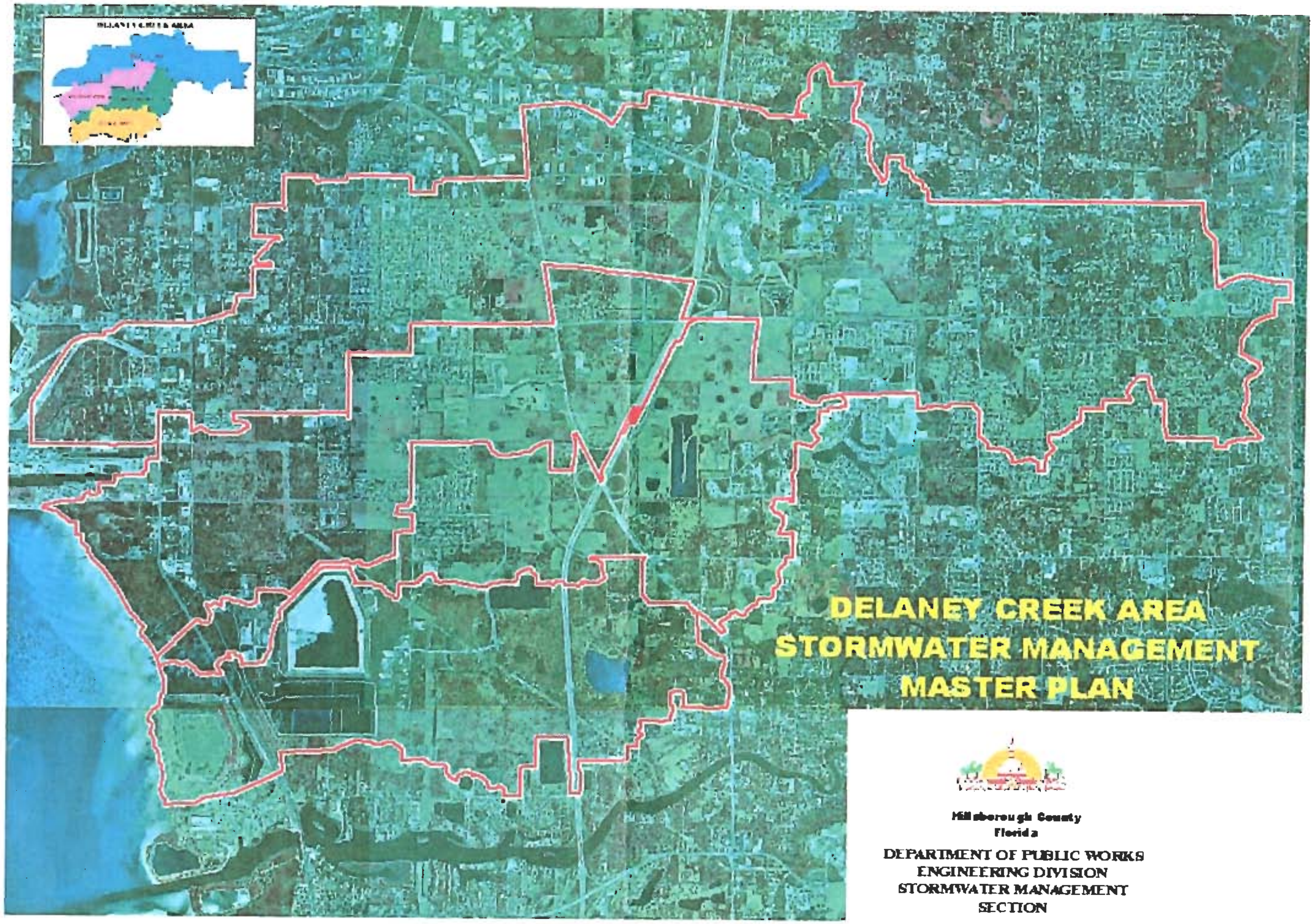
# Delaney Creek Area Watershed Management Plan

# Four Sub-watersheds of the Delaney Creek Area Watershed Management Plan




The Delaney Creek Area Watershed encompass approximately 33.7 square miles. The watershed is generally bounded by Palm River Road to the north, Lithia Pinecrest Road to the east, Tampa Bay to the west and Riverview Drive to the south. Over 30 tributaries contribute to the flow of the creek and ultimately drain to Tampa Bay.

An additional public meeting will be held after the County incorporate the public's comments from the November 15, 2000 meeting.

# COMMENT FORM

***For your comments regarding the Delaney Creek Area Watershed Management Plan***

Name: ______________________________

Address: ______________________________

City, State, Zip: ______________________________

Phone: ______________________________

E-mail: ______________________________

*Please deposit in Comment Box tonight or mail by **December 1, 2000** to:*

**Attn: Kimloan T. Nguyen**
**Hillsborough County**
**Stormwater Section**
**Public Works**
**P.O. Box # 1110**
**Tampa, FL 33601**

1. Describe the nature of flooding (e.g. yard, roadway, home, etc.) ______________________________

2. Average depth of flooding (e.g. 6" in yard, road is impassable, 2" in garage, etc.) ______________________________

3. How often does it occur? (e.g. every summer, once every five years, only saw it during El Nino, etc.) ______________________________

4. What is your opinion of the cause? (e.g. blocked drainage pipe, collapsed culvert, backed up downstream, etc.) ______________________________

5. Please provide any additional comments regarding flooding: ______________________________

***Any photos of the flooding or any other types of documentation you could make available to us would be appreciated.***

6. Enter any additional comments/concerns regarding environmental / water quality / natural systems: ______________________________

**THANK YOU - YOUR COMMENTS ARE APPRECIATED!**

Place: McLane Middle School

# DELANEY CREEK AREA WATERSHED MANAGEMENT PLAN

**PLEASE PRINT**

| | NAME | ADDRESS | TELEPHONE NUMBER |
|---|---|---|---|
| 1 | Theresa L Bishop | 2021 S. 86th | 623-1316 |
| 2 | Mary L. Owns | 2021 S. 86th | 623-1316 |
| 3 | Michelle Juncal | 2021 S. 86th | 623-1314 |
| 4 | JOHN KRAWCZYK / Prudy | 3021 S. 70th | 621-5770 |
| 5 | JOHN WARREN | H.C. ROAD MAIN. PWD | 744-5752 x127 |
| 6 | BARBARA BAIN | 712 LOMA LINDA CT | 654-7133 |
| 7 | JOHN SOEDER | 1347 Big Pine DR. | 662-9416 |
| 8 | Nona Boblitt | 1703 Green ridge Rd | 621-1930 |
| 9 | MERRITT McCLAMMA | 2314 GREEN LAWN ST | 689-4793 |
| 10 | C.L. Miller | P.O. Box 1636, Lutz FL 33549 | 949-3889 |
| 11 | Mike Taylor | 2407 COLLEGE HILL DR BRANDON | 681-6763 |
| 12 | D. Reynolds | 197 Hidden LK Brandon | 689-9139 |
| 13 | J C [illegible] SWFWMD | 14937 Lake Forest Dr Lutz | 977 5691 |
| 14 | David ARNOLD | 1814 Medford LN. BRANDON | 813 654-2444 |
| 15 | Diane Arnold | 1814 Medford LN. BRANDON | 813 654-2444 |
| 16 | | | |
| 17 | | | |

# ALTERNATIVES ANALYSIS

The objective of this chapter is to describe the alternatives that can provide an upgrade to the existing Level of Service of the areas that historically experienced flooding deficiencies.

## 13.1 FLOOD CONTROL ALTERNATIVES

As discussed previously in the existing conditions chapter (section 5), upon successful completion of the development and calibration of the detailed hydrologic and hydraulic model of the Delaney Creek basin's primary drainage system, the next step was to identify any locations with potential flooding concerns. Computer model results of the design standard storms simulations were analyzed with respect to the County's adopted flooding level of service criteria (LOS) to identify locations within the watershed where the LOS criteria is not being met.

As a primary level of analysis, known flooding concerns in the study area were evaluated based on a review of historical flood complaint information that was compiled from the recorded available data. The staff of the Hillsborough County Stormwater Section developed this system as a means of recording and monitoring response activities to residential flooding-related complaints that are received. The nature and extent of these flood concerns was quite varied, but could be aggregated into three general classifications.

Minor drainage problems are considered as those, which are not associated with the main drainage system, but with the minor drainage system, such as roadside ditches, street drains and lot lines swales. Generally, these complaints are associated with complaints requiring completion of vegetative control activities, as well as ditch and culvert cleaning.

Maintenance problems are those requiring repairs or prevention of eroded natural and/or manmade channel banks, culvert failure, impaired drainage, or where there is a risk to public works such as roadways.

Flooding problems are considered as complaints of property and street flooding associated with the primary drainage system of Delaney Creek. Focus was directed to this later category since the others generally indicated a resolution of the problem.

Based on existing condition model results Hillsborough County staff identified a set of flooding deficiencies that were to be addressed within the Delaney Creek Area Watershed Management Plan. Also, maintenance needs, which were identified from field observations of the primary drainage system, were incorporated into this report as a means of accomplishing the overall flood control objectives. Therefore the alternatives presented below should be considered preliminary.

At the present time Hillsborough County is in a land acquisition process for implementing the Delaney Creek Stormwater Management Improvements Phase I project between Hobbs Street and CSX transportation system's bridge located between U.S. Highway 41 and 54$^{th}$ Street South. Delaney Creek channel cross sections proposed by the before mentioned project were incorporated into the computer model together with a proposed Maydell Drive bridge upgrade project – also under design development stage at this time. In addition, the Sanson Park flooding problem will be alleviated through the Canterbury Lakes Regional Stormwater Detention Facility Project that is currently under review for the Delaney Pop-off Canal area.

The computer model results for the 25 and 100-year design storm events were compared with the existing condition results. As can be observed on the water surface comparison profile (Exhibit 13-1a) of these results, the stage decreases by almost 2 feet between the Hobbs Street (beginning channel improvements) and approximately 700 feet of channel alignment of the Lateral "A" confluence with the main channel. At the Lateral "A's" confluence with Delaney Creek, the existing 25-year storm event elevation is surpassed by the model results with the present proposed improvements by as much as 0.4 feet, to reach a maximum difference of 1.10 feet at the U.S. Highway 41 crossing location.

Based on the analysis described above, the Delaney Creek subwatershed alternatives are proposed to resolve the flooding deficiencies. Alternative 1 for the Delaney Creek subwatershed is mainly based on resolving the flooding deficiencies in the Clair Mel City area – East of 86$^{th}$ Street South and the area located along Lateral "E-1". The Clair Mel City area flooding control approach based on alternative 1 is intended to decrease the water surface elevation in the Delaney Creek Main Channel and the adjacent Laterals ("A"; "B"; "C" and "C-1" respectively) with respect to the tail-water conditions on the Delaney Creek main channel.

Alternative 2 is also intended to resolve flooding concerns within the Clair Mel City area. This alternative is designed to provide more storage through the construction of detention ponds at hydraulically critical locations where potential land availability can be an option.

# 13.1.1 DELANEY CREEK SUBWATERSHED

The Delaney Creek subwatershed originates at a point approximately 4,000 feet north of the Paul's Drive/Causeway Boulevard (S.R. 676) intersection and flows west approximately 8.0 miles through several residential and commercial areas to its eventual discharge into Hillsborough Bay.

## 13.1.1.1 Delaney Creek Main Channel System (model # 210xxx series)

The Delaney Creek Main Channel System incorporates the Clair Mel City area located between 54th Street South and the Crosstown Expressway in the east/west direction and Palm River Road and Causeway Boulevard in the north/south direction. This area includes Laterals "A" (211xxx model series), "B" (212xxx model series), "C" (2130xx model series) and "C-1" (2135xx model series). As identified in the Existing Condition chapter of this report, the area around Clair Mel City provides a low level of flood protection based on computer model results as well as the numerous resident complaints for street and yard flooding.

### 13.1.1.1.1 Alternative 1

This alternative includes channel cross section improvements between McKay Bay and the Causeway Boulevard crossing. The proposed cross sections with this alternative are approximately 3.50 miles (18,640 feet) in length. The new cross sections were designed to preserve the existing/or proposed (by the Delaney Creek Stormwater Management Improvements Phase I project) top of bank locations. In places this will be accomplished by reshaping the bank slopes to a 2 (horizontal) to 1 (vertical) on both sides of the creek. The channel cross section increases the channel capacity to match the upstream cross sections proposed by the Delaney Creek improvement project, which was permitted in 1993.

**U.S. 41 Bridge Upgrade –** Based on model simulations, the water surface elevation continues to exceed the U.S. Highway 41 overtopping elevation of 7.95 feet (NGVD) for the 50-year storm event or higher. This is in spite of all the channel improvements proposed with the 1993 Delaney Creek channel improvements project. In order to correct this flooding concern, the addition of an 8' x 12' concrete box culvert to the existing 3' x 8.25' x 12' concrete box culverts is proposed at this location. The effectiveness of this improvement in relieving the flooding conditions upstream of this location and in providing the required 50-year design storm LOS for the U.S. Highway 1 structure is shown in the Alternative 1 profile plots of figure 13-2a and in the flooding comparison table 13.3.

**Maydell Drive Bridge Upgrade –** The existing 9 x 17.5 foot concrete box culvert will be replaced with a 12 x 32 foot Conspan. This upgrade has been included in the model as part of 1993 channel improvements project. The Maydell Drive bridge upgrade is in the design development stage at this time.

**70th Street South Bridge Upgrade –** The channel improvement upstream of this location resulted in an increase in flow rate and consequently of the head loss at 70th Street bridge structure. The computer model results reflected the necessity to decrease the water surface elevation upstream of this location in order to provide the adequate tailwater conditions for Laterals "B", "C" and "C-1" within the Clair Mel City area. There are flooding complaint records for a nearby location which can be attributed to the undersize structure – cross section of 70th Street South Bridge. The existing concrete bridge pile is proposed to be replaced with a 12 x 32 foot Conspan structure (same size and shape as Maydell Drive structure). Based on the model simulations, the water surface elevation decreases by 2.8 feet for a 25-year storm event and 3.3 feet for 100-year storm event with the proposed improvement. The effectiveness of this improvement in stage reduction and relieving the flooding conditions upstream of this location is shown in the Alternative 1 profile plots of Figure 13-2a and in the flooding comparison Table 13.3.

## 3.1.1.1.2 Alternative 2

**U.S. Highway 41 Bridge Improvements** - In order to provide the same water surface elevation between the existing condition and those proposed by the 1993 Delaney Creek Phase I project, the addition of an 8 x 24 foot Conspan to the existing three concrete box culverts is proposed at this location. This improvement will provide a 60-foot span culvert, which practically, will be difficult to construct.

The effectiveness of this improvement in relieving the flooding conditions upstream of this location and providing a 50-year design storm LOS for the U.S. Highway 41 structure is shown in the Alternative 1 profile plots of figure 13-2 and in the flooding comparison table 13.3.

Three ponds were added at various areas along the Delaney Creek Main Channel (210xx model series) system. Their locations are as follows:

**<u>Pond 1 (model junction # 210060)</u>**

This irregular shaped pond is located south of Causeway Boulevard, west of 54th Street, parallel to the Delaney Creek Main Channel and upstream of the CSX Bridge. The proposed pond provides approximately 178 acre-foot volume at a depth of 12 feet.

**<u>Pond 2 (model junction # 210080)</u>**

This irregular shaped pond is located south of Causeway Boulevard, east of 54th Street and parallel to Lateral "A" on the north side of 36th Avenue. The proposed pond provides approximately 57 acre-foot volume at a depth of 10 feet.

**<u>Pond 3 (model junction # 210090)</u>**

This irregular shaped pond is located north of Causeway Boulevard and west of Maydell Drive at the confluence of Delaney Creek's Main Channel with Lateral "A". The proposed pond provides approximately 157 acre-foot volume at a depth of 10 feet.

## 13.1.1.2 Laterals

The laterals for the Delaney Creek subwatershed flow from north to south into the main channel. Several of the laterals are man-made ditches that were excavated originally for agricultural purposes but serve as drainage ditches for the various subdivisions mentioned in the main channel system.

### 13.1.1.2.1 Lateral "A" (model # 211xxx series)

**Alternative 1**

Channel cross section improvements are proposed between the confluence with Delaney Creek and 20th Avenue South. The proposed cross section for this approximately 0.90 miles (4,800 feet) of natural channel alignment has been designed to preserve the existing top of banks location and reshape the bank slopes to a 3 (horizontal) to 1 (vertical) on both sides.

The existing 48-inch CMP and two 48 inch CMPs between Haven Oak Circle and the private driveway east of Maydell Drive crossing will be replaced with 5 x 16 foot concrete box culvert. The existing conditions model results reflect an overtopping water surface elevation at these locations, which is confirmed by the recorded flood complaints of this area.

**Alternative 2**

Two ponds were added at various areas along the Lateral “A” (211xx model series) system. Their locations are as follows:

**Pond 4 (model junction # 211030)**

This rectangular shaped pond is located north of Causeway Boulevard, south of 20th Street, west of Maydell Drive and parallel to Lateral “A” on its west side. The proposed pond provides approximately 52 acre-foot volume at a depth of 7 feet.

**Pond 5 (model junction # 211060)**

This rectangular shaped pond is located north of Causeway Boulevard, south of 20th Street, east of Maydell Drive and parallel to Lateral “A” on its east side and upstream of the Maydell Drive crossing. The proposed pond provides approximately 96 acre-foot volume at a depth of 5 feet.

## 13.1.1.2.2 Lateral “A-1” (model # 2115xx series)

This system will be analyzed together with Delaney Pop-off, Archie Creek and North Archie Creek systems due to its interconnection with the Delaney Creek subwatershed system and the above-mentioned subwatersheds.

## 13.1.1.2.3 Lateral “B” (model # 212xxx series)

**Alternative 1**

This alternative includes channel cross section improvements between the confluence with Delaney Creek and Robindale Road. The proposed cross section for this approximately 0.7 miles (3,780 feet) of natural channel alignment has been designed to increase the Lateral “B” main channel width and reshape the bank slopes to a 2 (horizontal) to 1 (vertical) on both sides. All this work should be performed within the existing 80-foot drainage right-of-way. There is also proposed a 1,260 foot channel cross section improvement on the ditch along Balfour Circle where a flood complaint was recorded and the model results predicted flooding for all the design storm events. The remaining 0.6 miles (3,288 feet) of natural channels within the Lateral “B” system shall be cleaned of nuisance vegetation and debris. Based on the model simulation, the culverts under Tidewater Trail and Robindale Road are undersized resulting in a road overtopping for all of the design storm events except the 2.33-year design storm event. The construction of a neighborhood drainage system that will provide adequate flood relief to the Clair Mel City residents in the vicinity of Lateral "B" will require the complete rehabilitation of the conveyance system, along the main channel that serves this subdivision. In addition to the natural channel cleaning and cross section improvements mentioned at the beginning of this sub-section, the culvert replacement at Tidewater Trail and Robindale Road is part of the Lateral "B" flood control improvements.

The proposed culvert replacements are as follows:

> Tidewater Trail location - the existing twin 36 x 60 inch ERCPs will be replaced with 5 x 12 foot concrete box culvert.
>
> Robindale Road location - the existing twin 30 x 54 inch ERCPs will be replaced with 4 x 12 foot concrete box culvert.
>
> Balfour Circle location - the existing 48 inch CMP will be replaced with 4 x 6 foot concrete box culvert.

The effectiveness of this improvement in stage reduction and relieving the flooding conditions within the Lateral "B" drainage system is shown in the Alternative 1 profile plots of figure 13-2a and in the flooding comparison table 13.3.

**Alternative 2**

As for Lateral "B" (model junction # 212120), one 600-foot square pond was proposed for the system located south of Palm River Road, north of 12$^{th}$ Street on an existing school stadium. The proposed pond provides approximately 39 acre-foot volume at a depth of 5 feet.

## 13.1.1.2.4 Lateral "C" (model # 213xxx series)

**Alternative 1**

Channel cross section improvements between the confluence with Delaney Creek and Rideout Road are explored. The proposed cross section for this approximately 0.85 mile (4,480 feet) of natural channel alignment has been designed, increasing the Lateral "C" main channel width and reshaping the bank slopes to a 2 (horizontal) to 1 (vertical) on both sides. All this work should be performed within the existing 80-foot drainage right-of-way.

Based on the model simulation the culverts under Tidewater Trail, Ridein Road and Rideout Road are undersized. The result is road overtopping for the 10-year design storm event or greater at Tidewater Trail, for the 5-year design storm event or greater at Ridein Road and Rideout Road crossing respectively.

The construction of a neighborhood drainage system to provide flood relief to the Clair Mel City residents in the vicinity of Lateral "C" will require the complete rehabilitation of the conveyance system along the main channel that serves this subdivision. In addition to the natural channel cross section improvements mentioned at the beginning of this sub-section, the culvert replacement at Tidewater Trail, Ridein Road and Rideout Road is part of the Lateral "C" flood control improvements.

The proposed culvert replacements are as follows:

> Tidewater Trail location - the existing twin 36" x 54" ERCPs will be replaced with a 5' x 14' concrete box culvert.
>
> Ridein Road location - the existing twin 30" x 54" ERCPs will be replaced with 4' x 12' concrete box culvert.
>
> Rideout Road location - the existing 34" x 53" ERCP will be replaced with 4' x 8' concrete box culvert.

The effectiveness of this improvement in stage reduction and relieving the flooding conditions within the Lateral "C" drainage system is shown in the Alternative 1 profile plots of figure 13-2a and in the flooding comparison Table13.4.

**Alternative 2**

As for Lateral "C" (model junction # 213060), one 600-foot square pond was proposed for the system located south of Palm River Road and north of Rideout Road. The proposed pond provides approximately 96 acre-foot volume at a depth of 5 feet. The improvements on the Laterals "B" and "C" can work independently from one another. Alternative 2 assumes that the Delaney Creek main channel improvements proposed in the 1993 project are to be accomplished together with the Maydell Drive structure upgrade.

### 13.1.1.2.5 Lateral "C-1" (model # 2135xx series)

No flooding problems are identified from the model simulations nor were any complaints recorded within this drainage system.

### 13.1.1.2.6 Lateral "D" (model # 214xxx series)

The flooding concern at this location was identified from model simulations. The computed water surface exceeds the Palm River Road crossing overtopping elevation of 26.92 by 0.3, 0.7 and 0.9 for the 25, 50 and 100-year design storms respectively. Despite model results, no flooding complaints have been recorded at this time; therefore, no improvement is proposed for this location.

### 13.1.1.2.7 Lateral "E" (model # 215xxx series)

No flooding problems were identified during the model simulations nor were any complaints recorded within this drainage system.

### 13.1.1.2.8 Lateral "E-1" (model # 2155xx series)

**Alternative 1**

A flooding concern area, which was identified by both the model and complaint records, is along the Lateral "E-1" system between the Palm River Road crossing and Frank Adamo Drive (State Road 60). It was determined based on model results and field observations that the Palm River Road culvert is undersized, an existing 6' x 5' concrete box culvert, compared to the four 48" x 72" ERCP (four 4' x 6' elliptical reinforced concrete pipes). The model predicted a 1.40 foot head loss for a 25-year design storm event at this location. Also, flooding complaints were recorded at a location upstream of the Palm River Road crossing.

The area north (upstream) of Adamo Drive crossing has experienced flooding concerns based on complaint records. The model simulation indicates a 0.67 foot head loss for 25-year design storm event at this location.

The proposed culvert replacements are as follows:

> Palm River Road location - the existing 6’ x 5’ concrete box culvert will be replaced with 6’ x 16’ concrete box culvert.
>
> Frank Adamo Drive (State Road 60) location, one additional 4’ x 6’ concrete box culvert to the existing twin 4’ x 6’ concrete box culverts.

The effectiveness of this improvement in stage reduction and relieving the flooding conditions within the Lateral “E-1” drainage system is shown in the Alternative 1 profile plots of figure 13-2a and in the flooding comparison table 13.3.

**Alternative 2**

No 2$^{nd}$ alternative is being proposed for this system.

## 13.1.1.3 Hendrics Lake System (model # 220xxx series)

No flooding problems are identified from the model simulations. Although flooding complaints were recorded within this drainage system, they appear to be a local drainage problem, which cannot be resolved with improvements in the major channels.

## 13.1.1.4 Hickory Hammock Lake System (model # 230xxx series)

There were no flooding problems identified from the model simulations. Although flooding complaints were recorded within some of the subbasins, they appear to be a local drainage problem. These flooding concerns cannot be resolved due to a lack of outfall for these subbasins.

## 13.1.1.5 Closed Basin System (model # 227xxx series)

No flooding problems are identified from the model simulations. Although flooding complaints were recorded within this drainage system, they appear to be a local drainage problem, which cannot be resolved with improvements in the major channels.

## 13.1.2 DELANEY POP-OFF CANAL SUBWATERSHED

The Delaney Creek Pop-off Canal subwatershed extends east to about U.S. Highway 301. The conveyance system consists of man-made ditches with no evidence of natural channel sections and generally flows south and west from U.S. Highway 301 to Hillsborough Bay. Major road crossings include U.S. Highway 301 at the eastern extremity, 78th Street near the middle and Madison Avenue (State Road 676A) and U.S. Highway 41 at its western extremity.

### 13.1.2.1 Delaney Pop-off Main Channel System (model # 210xxx series)

Although road overtopping is not prolific along the Pop-off Canal's main channel, there are several locations where improvements are necessary due to the water surface elevation impact on the major tributary systems.

**Alternative 1**

The results of SWMM computer simulation identifies the existing Old U.S. Highway 41 crossdrain as a significant headloss along the main channel system. The water surface elevation across this location has a drop of 1.2 and 0.9 feet for the 100-year and 25-year design storm events respectively. The existing 60" corroded metal pipe is proposed to be replaced with an 8' x 12' concrete box culvert. The water surface elevation decreases by 0.80 feet for the 25-year design storm event with this upgrade. The proposed level of service of the adjacent subbasins will be upgraded from B to A for the 25-year design storm event.

Another location that shows a significant difference between upstream and downstream water surface elevations is identified at Madison Avenue. The elevation difference produced by the Madison Avenue crossdrain ranges between 0.51 and 2.0 feet for mean annual and 100-year design storm event respectively. The large losses are attributable to the size and depth of the channel south of Madison Avenue. With the flow increase caused by the upstream improvements described later on this chapter, the Madison Avenue crossdrain requires an increase in capacity. Therefore an additional 5' x 8' concrete box culvert is proposed at this location. The improvement will lower the water surface elevation as much as 2.23 feet for the 25-year design storm event. The main purpose of this additional pipe is to improve the level of service on Tributary "F" located 600 feet upstream of Madison Avenue. The channel cross section is also proposed to be improved upstream of Madison Avenue for 4,000 linear feet of ditch alignment. The 1999 survey information shows a significant reduction from upstream to downstream in cross section width to the south of the Madison Avenue crossing. The channel cross section is proposed to be improved by matching the cross section characteristics upstream of the reduction. This improvement is also part of the Tributary "F" alternative solutions and will lower the water surface elevation upstream of Madison Avenue. The 78th Street South crossdrain is also one of the main channel locations with significant headloss predicted by the computer model results. The water surface elevation difference across these pipes is as much as 0.68 for the mean annual design storm event. The existing twin 4.58' x 7' arch metal pipes are proposed to be replaced with double 72" reinforced concrete pipes. This crossdrain upgrade is part of Capital Improvement Project (CIP) #47025, which was in the permitting stage during the earlier phases of this study and which have been included in the proposed conditions model. Same CIP is also proposing improvements in the main channel cross section upstream and downstream of 78th Street, which were also incorporated in the proposed condition model input. The main channel cross section improvement east of 78th Street, which includes the south top of bank restoration will help to alleviate offsite inflows to Progress Village from the Delaney Creek Pop-off Canal.

**Alternative 2**

Upgrade the existing double 5' x 6' CBC with the addition of a 5' x 8' CBC under Madison near Madison Estates Mobile Home Park.

**Alternative 3**

Upgrade the existing double 55" x 81" arched pipes to a double 72" RCPs under 78th Street along the main channel and located north of 49th Avenue South.

**Alternative 4**

Install a 25 foot weir structure on the Fortuna Acres subdivision pond located west of the Delaney Pop-off main channel and north of the Madison Avenue crossing.

## 13.1.2.2 Tributaries

The tributaries of the Delaney Pop-off subwatershed consists mostly of man-made ditches along the back lots of residential areas like Fortuna Acres and Green Ridge Estates. The remaining tributaries on the east side of U.S. Highway 301 consist of the Interstate 75 drainage ditch and several ditch systems located in the Pavilion areas.

### 13.1.2.2.1 Tributary “B” (model # 241xxx series)

The Tributary “B” System incorporates the Sanson Park subdivision. This channel runs west to east for approximately 2,400 feet until its confluence with the Delaney Pop-off Canal. The Sanson Park flooding concern described in the Existing Condition chapter will be alleviated by diverting the flow through the Canterbury Lakes Regional Stormwater Detention Facility Project that is currently under review by the governmental regulatory agencies.

The crossdrain upgrade and, channel improvement upstream and downstream of 78th Street described under the main channel alternatives are also part of the Sanson Park solutions. A series of ponds - model junction # 240220 and 242225 - will be constructed south of Sanson Park and Tributary “B” in the Canterbury Lakes Regional Stormwater Detention facility. This irregular shaped pond will serve as drainage for the Canterbury Lakes subdivision and also alleviate the flooding problems in the Sanson Park subdivision. The water surface elevation drops as much as 2.1 feet for the 25-year design storm event and 2.30 for the 100-year design storm event. The proposed Level of Service for the Sanson Park subdivision is also improved from “C” to “A” for 25 and 100-year design storm events.

### 13.1.2.2.2 Tributary “F” (model # 241xxx series)

The Tributary “F” System incorporates the neighborhood east of Fortuna Acres subdivision. This channel runs east to west for approximately 1,300 feet until it reaches its confluence with the Delaney Pop-off Canal.

As identified in the Existing Condition chapter of this report, this area is predicted to provide a low level of flood protection based on the computer model results as well as the numerous resident complaints for street and yard flooding.

**Alternative 1**

This alternative proposes channel and crossdrain improvements located east of the main channel and north of Madison Avenue. The channel cross section improvement on Tributary “F” begins to the west of 78th Street at the eastern end and ends at the confluence with the Pop-off Canal main channel 600 feet north of Madison Avenue. The improved ditch is approximately 1,240 feet length. The new cross sections were designed to reshape the bank slopes to 2 (horizontal) to 1 (vertical) on both sides.

Culvert are proposed to be improved as follows:

Replace the existing double 14” RCP with 3’ x 3.5’ concrete box culvert at the private driveway located on the west right-of-way of 74$^{th}$ Street south.

Replace the existing Palm Drive double 29” x 45” ERCP with 3.5’ x 6’ concrete box culvert.

The above listed alternative together with main channel improvements upstream and downstream of Madison Avenue would bring the level of service on this system from “D” to “A” for a 25-year design storm event.

As previously discussed, the mobile home park located west of the Pop-off main channel (2438xx Series) and immediately north of Madison Avenue appears to have frequent street flooding. The park drains into an apparently land locked man-made pond. Based on computer simulation, flooding is created because of the lack of an outfall. Water surface elevation in the Pop-off Canal does not back up into this subdivision. Therefore, an outfall to the pond would alleviate this concern. It is recommended that a positive outfall be established for this pond if one does not exists. It is also recommended that prior to connecting to Pop-off main channel, some form of water quality treatment BMP be implemented. In the proposed condition model simulation, it was assumed that a half an inch treatment volume takes place in a pond’s underdrain filtration system. Therefore the proposed 25-foot outfall weir was set at elevation 10.36’, which represents the water quality elevation in the mobile home park’s pond. With the construction of the proposed outfall structure the Level of Service will be improved from “B” to “A” and from “D” to “B” for 25 and 100-year design storm events respectively.

**Alternative 2**

This alternative involves the upgrade of the existing double 14” RCP to a 3’ x 3.5’ CBC under 74$^{th}$ Street South in a residential area located east of Fortuna Acres subdivision.

**Alternative 3**

Upgrading the existing double 29” x 45” ERCP to a 3.5’ x 6’CBC under Palm Drive in the residential area east of Fortuna Acres subdivision.

## 13.1.2.3 Evergreen Estates System (model # 2520xx series)

The Evergreen Estates System incorporates the Evergreen Estates subdivision located between Falkenburg Road and U.S. Highway 301 and north of Causeway Boulevard. As identified in the Existing Condition chapter of this report, this area provides a low level of flood protection based on computer model results as well as the numerous resident complaints for street and yard flooding.

In order to alleviate the flooding concerns in this residential area, a flow diversion to Delaney Creek's main channel is proposed as a solution. The flow will be directed via the U.S. Highway 301 improved crossdrain to an existing man-made channel which will ultimately discharge into Delaney Creek's main channel 1,270 feet downstream of Crosstown Expressway concrete pile bridge (junction #210240).

**Alternative 1**

This alternative involves the upgrade of the U.S. Highway 301 existing crossdrain from a 36" RCP to a 4' x 8' concrete box culvert. In addition, the culvert's invert will be lowered from 26.4' to 24.0' feet.

Remove the existing berm located west of U.S. Highway 301 and lower the existing ditch invert to match with the proposed crossdrain.

Channel cross section improvements should take place on both sides of U.S. Highway 301. The east side begins within Evergreen Estates (junction #252070) near the cul-de-sac of Ventura Avenue. The west side of U.S. Highway 301 is maintained along the connector ditch to the confluence point with Delaney Creek. The proposed cross section is proposed for approximately 600 feet of ditch alignment on its east side and 2,700 feet on the west side of U.S. Highway 301. The channel cross section increases the channel capacity to deliver the flow to the west and then north to Delaney Creek without creating an adverse impact on private property downstream of U.S. Highway 301. This alternative will improve the Level of Service within Evergreen Estates subdivision from "C" to "A" and from "D" to "C" for the 25-year and 100-year design storm event respectively.

**Alternative 2**

Channel cross section improvements to begin at east of U.S. Highway 301 (252072) to Evergreen Estates (252070) near the cul-de-sac of Ventura Avenue are investigated. The proposed cross sections with this alternative are approximately 0.23 miles (1,240 feet) length.

The new cross sections were designed to preserve the existing /or proposed top of banks location and to reshape the bank slopes to 2 (horizontal) to 1 (vertical) on both sides. The channel cross section increases the channel capacity to match the downstream cross sections of the Delaney Pop-off channel. As shown in Figures 13-4a, this alternative can significantly lower the water level in the main channel. This alternative, therefore, can solve many of the problems. This alternative has little effect on downstream conditions.

**Alternative 3**

Channel cross section improvements are modeled to begin to the west of U.S. Highway 301 at its confluence with Delaney Creek near Green Ridge Road in the Green Ridge Estates subdivision. The proposed cross sections with this alternative are approximately 0.23 miles (1,240 feet) length. The new cross sections were designed to preserve the existing /or proposed top of banks location and to reshape the bank slopes to 2 (horizontal) to 1 (vertical).

**Alternative 4**

The option of removing the berm located west of U.S. Highway 301 near Alambra Avenue that extends to the Green Ridge Estate near Delaney Creek is explored. The berm removal associated with this alternative is approximately 0.23 miles (1,240 feet) length.

## 13.1.3 NORTH ARCHIE CREEK SUBWATERSHED

The North Archie Creek subwatershed extends as far east as Providence Avenue and as far north as the Crosstown Expressway. This subwatershed is similar to the Delaney Creek Pop-off Canal subwatershed in that it is drained by a system of man-made ditches and flows in a south and west direction to Hillsborough Bay. Some improvements and extensions to the ditch system have been made in the eastern portions of the subwatershed as a result of Interstate 75 and U.S. Highway 301 construction. A portion of North Archie Creek west of 78th Street has been relocated and expanded by Gardinier, Inc.

### 13.1.3.1 North Archie Main Channel System (model # 210xxx series)

**Progress Village**

Progress Village has had a long history of frequent and long duration flooding. Historical observations indicate that numerous roads in the Progress Village area will flood during the 10-
year and 25-year events. Some of the lower roadways will experience as much as 12 inches of

flooding with the 25-year events and may persist for several days. The problems experienced in Progress Village are mainly caused by the higher water level in the main channel. Although the computer model results do not show flooding problems in this area, alternative analysis is still performed. This is because, without detailed survey information, the designed channel cross section data were used in the computer modeling. However, based on field observation, the channels downstream of 82nd street are filled with vegetation and silt.

### 82nd Street Road Crossing

The 82nd Street road crossing is located at the south end of Progress Village along North Archie Creek. This crossing has been identified as a separate problem from Progress Village because of its close proximity to an elementary school. The residents reported that the road and adjacent sidewalk become inundated during summer storms. This is the only access to the school and poses a significant safety hazard. Substantial vortexing occurs at the upstream end of the existing culverts.

### Alternatives

Table 13.7 below, lists the possible alternatives.

**Table 13.7**
**Alternative Analysis for Progress Village and 82nd Street**

| Alternative Number | Method(s) | Comments | Recommend (?) |
|---|---|---|---|
| 1 | Clean and snag channels downstream of 82nd street. | Can totally solve the problem. | Yes |
| 2 | Construct a bypass channel start from the confluence of North Archie Creek and sub-tributary “B”, end at turn point west of 78th Street total length is about 1,500'. | Can totally solve the problems of both 82nd Street and Progress Village. | No. |

Since the problems both in Progress Village and at the 82nd Street road crossing are caused by the higher water level in the main channel, the key point to solve all these problems is how to lower the water level.

Although adopting a pond will significantly lower the water level and can totally solve the problems, the soil type in this area is not suitable for a pond.

**Alternative 1**

Clear and snag the channels downstream of 78th Street (Figure 13-2).

**Alternative 2**

Construct a bypass channel starting at the confluence of North Archie Creek and subsystem B and ending at the turning point west of 78th Street. The total length of the bypass channel is about 1,500 feet; the cross section area is about 210 feet$^2$ (Figure 13-3).

Both alternatives need to include the upgrade of the culvert at Old U.S. Highway 41 as a component. Upgrade the existing 2-5' x 13' culvert to three 6.5' x 13' culverts.

Considering the construction and land acquisition cost, alternative 1 is recommended.

## 13.1.4 ARCHIE CREEK SUBWATERSHED

Half of the Archie Creek subwatershed consists of commercial areas like the Cargill complex and the Parkway Business Center. The other half contains areas like the Lake St. Charles, Starlite, Ashley Oaks, Suntree Estates and McMullen Farms subdivisions. Cargill occupies about a third of the subwatershed. The subwatershed generally starts at the Ashley Oaks subdivision and discharges out into the Bay near the north part of the Cargill facility.

### 13.1.4.1 Archie Creek Main Channel System (model # 280xxx series)

The Archie Creek Main Channel System incorporates the Cargill complex, Parkway Business Center, Lake St. Charles subdivision and the Ashley Oaks subdivision. This area includes Tributary "A" (210xxx model series), 78th Street Ditch (283xxx model series), "B" (284xxx model series), and "C" (285xx model series). As identified in the Existing Condition chapter of this report, the Ashley Oaks area near Krycul Avenue provides a low level of flood protection based on computer model results as well as the resident complaints for street and yard flooding.

**Alternative 1**

Channel cross section improvements are proposed between Bucks Ford Drive in the Lake St. Charles subdivision and Mint Julip Circle in the Ashley Oaks subdivision. The proposed cross section with this alternative is approximately 0.25 miles (1,125 feet) length. The new cross sections were designed to preserve the existing /or proposed top of banks location and to reshape the bank slopes to a 2 (horizontal) to 1 (vertical) on both sides. The channel cross section increases the channel capacity to match the downstream cross sections of Archie Creek. As shown in Figures 13-9a and 13-9b, this alternative can significantly lower the water level in the main channel. This alternative, therefore, can solve the problems. This alternative has little effect on downstream channel flooding.

**Alternative 2**

This alternative investigates upgrading the existing 26” x 34” ERCP to a double 36” RCP at Mint Julip Circle located on the west side of the Ashley Oaks treatment pond. As shown in Figures 13-9a and 13-9b, this alternative can significantly lower the water level in the main channel. This alternative has little effect on the downstream channel.

**Alternative 3**

Upgrade the existing 26” x 36” ERCP to a double 36” RCP at Mint Julip Circle located on the east side of the Ashley Oaks treatment pond and west of the Ashley Oaks entrance. As shown in Figures 13-9a and 13-9b, this alternative can significantly lower the water level in the main channel. This alternative has little effect on the downstream channel.

**Alternative 4**

Upgrade the existing 15” x 24” ERCP to a 42” RCP under Krycul Avenue located north of the Ashley Oaks entrance. As shown in Figures 13-9a and 13-9b, this alternative can significantly lower the water level in the main channel. This alternative has little effect on the downstream channel.

## 13.1.4.2 Tributaries

The tributaries are comprised mostly of man-made ditches that originate from wetland areas like Tributary "A" and "C". The other tributaries were originally excavated for agricultural uses but now serve as drainage channels for areas like the Parkway Business Center, Starlite, Lake St. Charles and Ashley Oaks subdivisions.

### 13.1.4.2.1 Tributary "A" (model # 281xxx series)

The Tributary "A" System incorporates the Rinker complex, Parkway Business Center and the Trinity College of Florida. As identified in the Existing Condition chapter of this report, 78th Street provides a low level of flood protection based on computer model results as well as the street flooding.

**Alternative 1**

The existing 24" x 48" ECMP will be replaced by a 36" RCP under 78th Street located north of Eagle Palm Drive of the Parkway Business Center entrance. As shown in Figures 13-9a and 13-9b, this alternative can significantly lower the water level in the tributary. This alternative has little effect on downstream channel.

**Alternative 2**

Channel cross section improvements between west of 78th Street and north of the undeveloped South Tampa commercial site are part of this alternative. The proposed cross section with this alternative is approximately 0.08 miles (400 feet) length. The new cross sections are preserving the existing /or proposed top of banks location and reshaping the bank slopes to a 2 (horizontal) to 1 (vertical) on both sides. As shown in Figures 13-9a and 13-9b, this alternative can significantly lower the water level in the tributary. This alternative has little effect on the downstream channel.

### 13.1.4.2.2 78th Street Ditch (model # 283xxx series)

**Alternative 1**

A pond was added at various points along the 78th Street Ditch system. The locations are as follows:

**<u>Pond 1 (model junction # 280335)</u>**

This one-acre, rectangular shaped pond is located south of Eagle Palm Drive and north of Riverview Drive. As shown in Figures 13-9a and 13-9b, this alternative can significantly lower the water level in the ditch. This alternative has little effect on downstream channel.

# 13.2 WATER QUALITY OVERVIEW

This portion of the chapter will review the proposed flood control and water quality projects and one or more alternatives for each of those projects. These projects are meant to provide the citizens of Hillsborough County with a reasonable level of service for both flood control and water quality. The alternatives are explored to see which, if any, of them can provide this expected level of service, generally at a reasonable cost. Therefore, each project should be designed to serve multiple functions in terms of flood control and increasing water quality and, if possible, wildlife habitat. Components used for the environmental portion of this review are broken down into three broad categories. The first component looked at is water quality, which can be further subdivided into the categories of pollutant loading, pathogen loading and erosion and sedimentation. The second factor is natural systems. Aspects of this component include habitat loss, minimum flows and levels (water regime), aquatic ecosystems, and exotic vegetation. Finally, water supply is looked at in terms of stressed lakes or wetlands, potable water quality, surface water yield and groundwater discharge.

## 13.2.1 STRUCTURAL ALTERNATIVES

Structural stormwater best management practices are those systems that can be constructed. The best example of a structural stormwater BMP is a stormwater pond. Since much of the watershed was developed during the period prior to the requirement for stormwater treatment, retrofitting or use of existing areas must be focused on. The alternative(s) used must be carefully matched to the physical constraints of the area or site or with the type of pollutant(s) desired for removal.

### 13.2.1.1 Regional Stormwater Facilities

Stormwater treatment usually occurs on the parcel of land that generates the runoff. Regional stormwater facilities, in contrast, treat stormwater that has been gathered from usually more than one subbasin and transported it to the facility, generally through a series of pipes and/or ditches. These areas can contain detention or retention ponds or more advanced systems such as alum treatment facilities. It is recommended that regional facilities be designed to allow for multiple uses such as open/green space, corridors, recreation, groundwater recharge, reuse, etc. These facilities should incorporate into their design enough land to have sufficient slope to have planted littoral shelves if wet detention is used. This slope should be a minimum of 4 to 1 with 6:1 to 10:1 preferred.

## 13.2.1.2 Use of Existing Conditions

Wherever possible, the natural contours of the land should be used to convey stormwater. This will reduce erosion and sedimentation and in most parts of the County where slopes are gentle, the reduced velocities will allow for filtration and infiltration. Different examples of this technique are discussed below.

### 13.2.1.2.1 Wetlands

Existing wetlands can be used to attenuate stormwater as long as hydroperiods are not drastically altered. However, care must be taken to bleed off excess water as soon as possible, especially for herbaceous wetlands that are usually much more sensitive to prolonged inundation. Sediment sumps are usually required to prevent excess sedimentation. This will lessen the need for maintenance dredging. This option is especially desirable when the storage of stormwater will lead to the rehydration of a dewatered wetland. Wetlands are analogous to vegetated wet detention ponds, but can usually be more aesthetically pleasing and harbor more habitat area for wildlife.

### 13.2.1.2.2 Grassed Swales and Overland Flow

These BMP types use existing vegetation to slow velocities. This will allow particulates, such as sediments and metals, to drop out of the water column and increase residence time to allow for better nutrient uptake. In general they are situated above the water table to allow for some percolation as well. Grass swales can be made more efficient with the use of check dams to further slow velocities. Overland flow must take physical and biological aspects into account. The type of vegetation used must be able to stand limited inundation and the dry periods between use. Soils must likewise be suited to prevent erosion. Slope will also come into play with respect to soil erosion. A disadvantage of both of these BMPs is that they have the potential to use up large, linear parcels of land.

## 13.2.1.3 Buffers

Vegetative strips are the most commonly used buffers. Their placement in sensitive areas, such as between roadways and stormwater ponds, can greatly reduce the amount of sediment that enters the system. These buffers serve multiple purposes such as stabilization, capture of sediment, some filtering capacity, wildlife habitat and aesthetics. As with stormwater ponds, swales should be designed to have 4:1 or gentler slopes to allow for adequate plant coverage and to reduce erosion and sedimentation.

## 13.2.1.4 Pervious Concrete and Tuft Block

The use of pervious pavement or materials such as turf block on the edges of impervious areas can also perform some of the same function as buffers. They are especially important when looking at groundwater recharge, since water is allowed to penetrate the soil rather than being discharged to a receiving waterbody. Pervious concrete has regular maintenance requirements such as sweeping, vacuuming or pressure washing to prevent clogging. Materials such as turf block and other similar systems provide infiltration through the interstitial areas in the gridwork. This type of BMP does not clog as readily as pervious concrete. Both BMPs have similar characteristics. Percolation can be enhanced by placing a layer of gravel underneath them, as well as by placing them in well-drained soils situated above the high water table. These BMPs have the disadvantage in that neither is good to use in areas used by heavy equipment.

## 13.2.1.5 Chemical Treatment

The most common of these types of treatments is with the use of alum; however types of iron (ferric) compounds as well as polyacrylics can also be used. In these types of systems, flocculation is the method to remove the pollutants. When the coagulant is introduced into the system, it forms a precipitate that binds with it many different chemicals, suspended particles and even microbial pathogens. This treatment can occur either on or off line. It has been found to be one of the most effective methods of pollutant removal with efficiencies at or above 90% for most pollutants. Drawbacks of this type of treatment are toxicity and its effects on flora and fauna and that it does not readily remove dissolved constituents contained in stormwater.

## 13.2.1.6 Solid/Liquid Separation Structures

This type of technology is used primarily to remove gross pollutants such as litter, debris and coarse sediments by passing the flow through a series of baffles and chambers designed to settle out the target materials. Litter is defined as human created materials such as paper, cloth, metals, etc.. Debris is naturally occurring, organic materials such as leaves, branches and yard waste. Coarse sediments are inorganic particles such as sand and other soils. These types of systems have proven to be very effective in this regard, provided they are adequately maintained. However, as with alum treatment, removal efficiencies for pollutants other than gross pollutants typically runs less than 30 %. To offset this drawback, some systems add or rely upon a series of filters and/or activated charcoal to remove dissolved pollutants. All of these structures can reduce the flows in the stormwater system and large storms that exceed the design capacities can bypass the treatment and even resuspend previously captured materials.

## 13.2.1.7 Detention and Retention Ponds

These two BMP types are the most common stormwater treatment options in use. Detention ponds, as the name implies, are used to temporarily store or detain water until it can percolate into the ground. Like many of the previous BMPs, soils should be porous and the water table low. Vegetation should be able to survive constantly changing conditions from periods of inundation to drought. Fine sediments can reduce percolation rates and sedimentation rates can be high. Retention ponds hold or retain water and generally have some permanent pool. Created stormwater wetlands serve the same functions. Because they are commonly planted or have vegetated littoral shelves, they can provide some wildlife habitat. These types of BMP can be either in-line or off-line systems. Both require regular maintenance, but this can be reduced with the installation of a sediment sump. Multi-use facilities, similar to those discussed with the regional treatment facilities can be designed, usually on a smaller scale. Also as with regional facilities, this type should be designed to maximize slopes that can be planted with native vegetation for treatment.

## 13.2.1.8 Filtration Systems

These areas are similar to retention ponds in that water is allowed to percolate into the ground, and from there into the groundwater. They most commonly are in the form of a pond, trench or pipe. All use gravel or sand as the filtration/percolation medium, sometimes underlain with some type of filter mat. Sediment sumps or some other type of BMP are helpful in reducing sedimentation that leads to clogging. Clogging is a major concern and routine maintenance is required. As with the other types of percolation BMPs, the water table must be low and soils must be porous.

## 13.2.2 NON-STRUCTURAL ALTERNATIVES

As the alternative to structural BMPs, non-structural alternatives do not require construction. They generally center on source reduction by various means.

### 13.2.2.1 Maintenance

This aspect is almost as important as the construction of the BMP. In facilities which contain underdrain filtration systems, it has been observed that regular maintenance must be perform on an almost monthly basis or the system may actually become an exporter of pollutants, such as nitrogen, pathogens and/or phosphorus (Harper, et. al. 1999). Vegetation in stormwater ponds has maximum treatment when the plants are in the growing stage and this levels off after they have matured. Also, some plants such as cattails can add large amounts of organics and muck as they decompose in the pond.

### 13.2.2.2 Education

Another important type of source control is education. This will inform the public as to the results of their actions and are especially important in reducing gross pollutants. Various programs exist in this arena, water quality monitoring programs, clean up programs, festivals and Earth Day events, xeriscaping and gardening programs and school programs.

### 13.2.2.3 Preventative or Source Reduction Measures

These measures can be as varied as street sweeping, litter control laws, facilities inspections, proper use of chemicals and the elimination of illicit discharges. Street sweeping serves a dual purpose in that it removes pollutants prior to their introduction into the system. Maintenance is reduced by the prevention of clogging of the system. To be effective, sweeping must be done on a regular basis, preferably between major storm events. Litter control laws and facilities inspections can be used to decrease or eliminate the source inputs. Other measures can be used to reduce the amount of run-off generated by impervious surfaces. While they are "constructed" BMP's, again the idea is to reduce the run-off and therefore the pollutant load. Included in this category are cisterns, rooftop holding areas and rainbarrels. In agricultural areas, the reuse of water through a system of tailwater recovery ponds will help in reducing loads by recycling nutrients and other chemicals. For specific pollutants such as pathogens, frequent inspection of septic systems can prevent illicit discharges. Removing the septic tanks and placing the land use on sanitary sewers or small “package plants” can further reduce these discharges, again as long as the system is regularly inspected and maintained. In those areas where cattle are a contributing factor, simply fencing the area to prevent their direct entry into the affected waterbody(s) can greatly reduce the loading. Providing separate “watering holes” can work in the same way. Treatment ponds can be used here as well. Programs can be taken advantage of such as the one in which repetitively flooded structures can be removed using Federal Emergency Management Agency’s (FEMA) incentives. Simply removing the structures and associated septic systems, if any, can go a long way to reducing loading. If a stormwater treatment system is constructed in addition to structure removal, the reduction can be further increased.

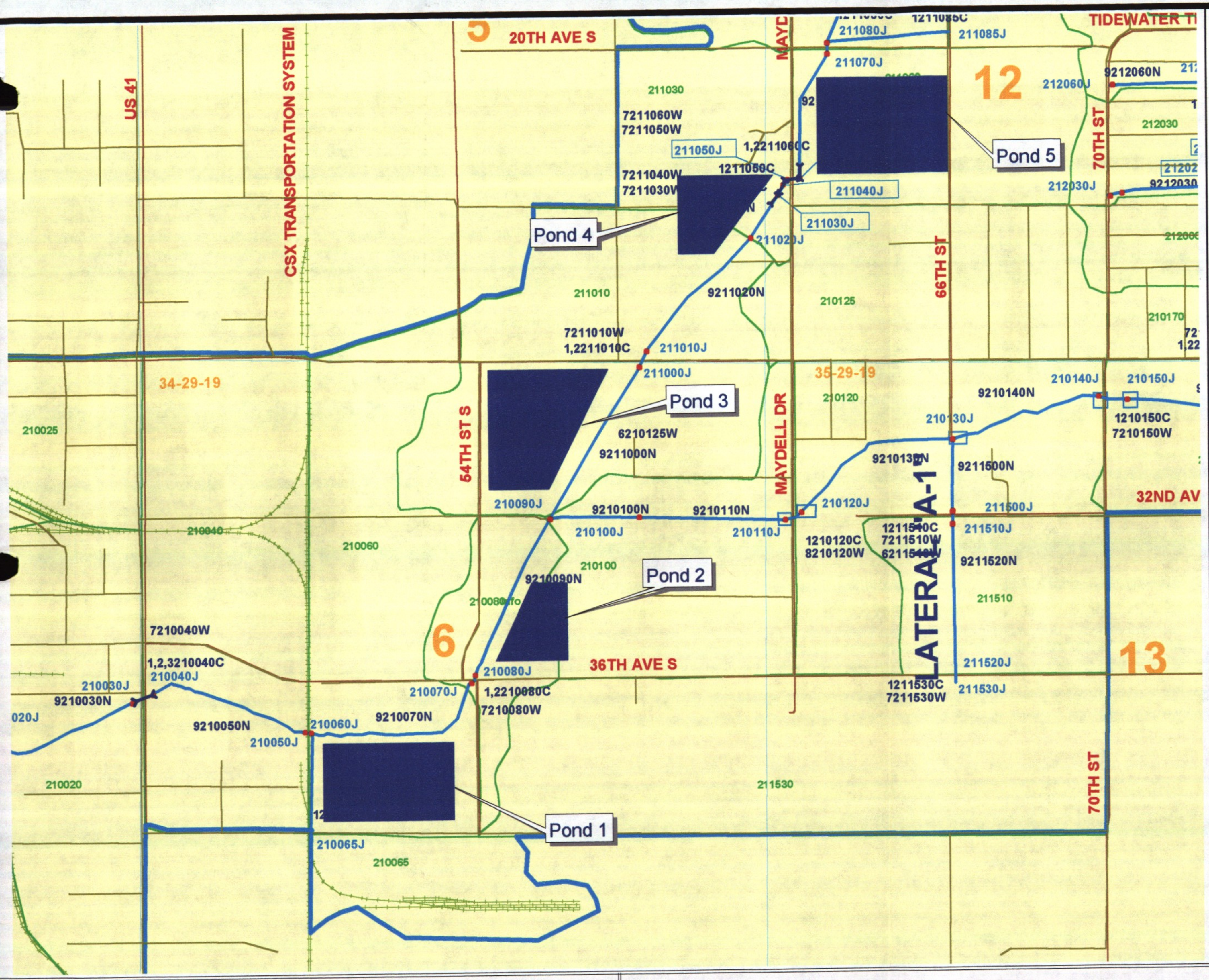
## 13.2.2.4 Planted Vegetation

Re-establishment of vegetation in both uplands and wetlands is another alternative method. This alternative is similar to preserving existing vegetative buffers and serves all the same purposes including reduction in velocity, direct nutrient removal, soil stabilization and erosion prevention, capture of sediment and the creation of wildlife habitat. This can be done in upland areas to create a buffer or in wetlands and waterbodies to provide treatment.

## 13.2.2.5 Habitat Preservation

The simple act of preserving natural areas both uplands and wetlands, like many of the other options in this chapter, can serve a dual purpose. The first is that the preservation will provide treatment of stormwater run-off and prevent erosion/sedimentation in the case of both uplands and wetlands. Of course wetlands will provide a greater role in treatment. The second is a form of source reduction by preventing the land from going into a more intensive land use that could increase pollutant loads.

Many of these alternatives must be applied on a case by case basis and many will be recommended in the following chapters.




- Pipe
- Junction Point
- Stormwater Network Flow Segments
- Proposed Pond
- Street
- Study Area Basin Boundary
- Main Road
- Sub- Basin
- SectionGrid
- Junct-new
- Text Basin-ID
- Text SB-Number
- Text Sec-town-range
- Rail Roads
- Text Lake-Name
- Text Reach
- Reach_Txt
- Text Road Name
- Junct-new_txt
- Text Junct-new_txt
- Surface Water Storage Features

1. PROPOSED POND 1, AREA 16.40 Ac.
2. PROPOSED POND 2, AREA 6.20 Ac.
3. PROPOSED POND 3, AREA 17.20 Ac.
4. PROPOSED POND 4, AREA 8.20 Ac.
5. PROPOSED POND 5, AREA 20.20 Ac.

500 0 500 1000 Feet

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# DELANEY CREEK AREA

STORMWATER MANAGEMENT
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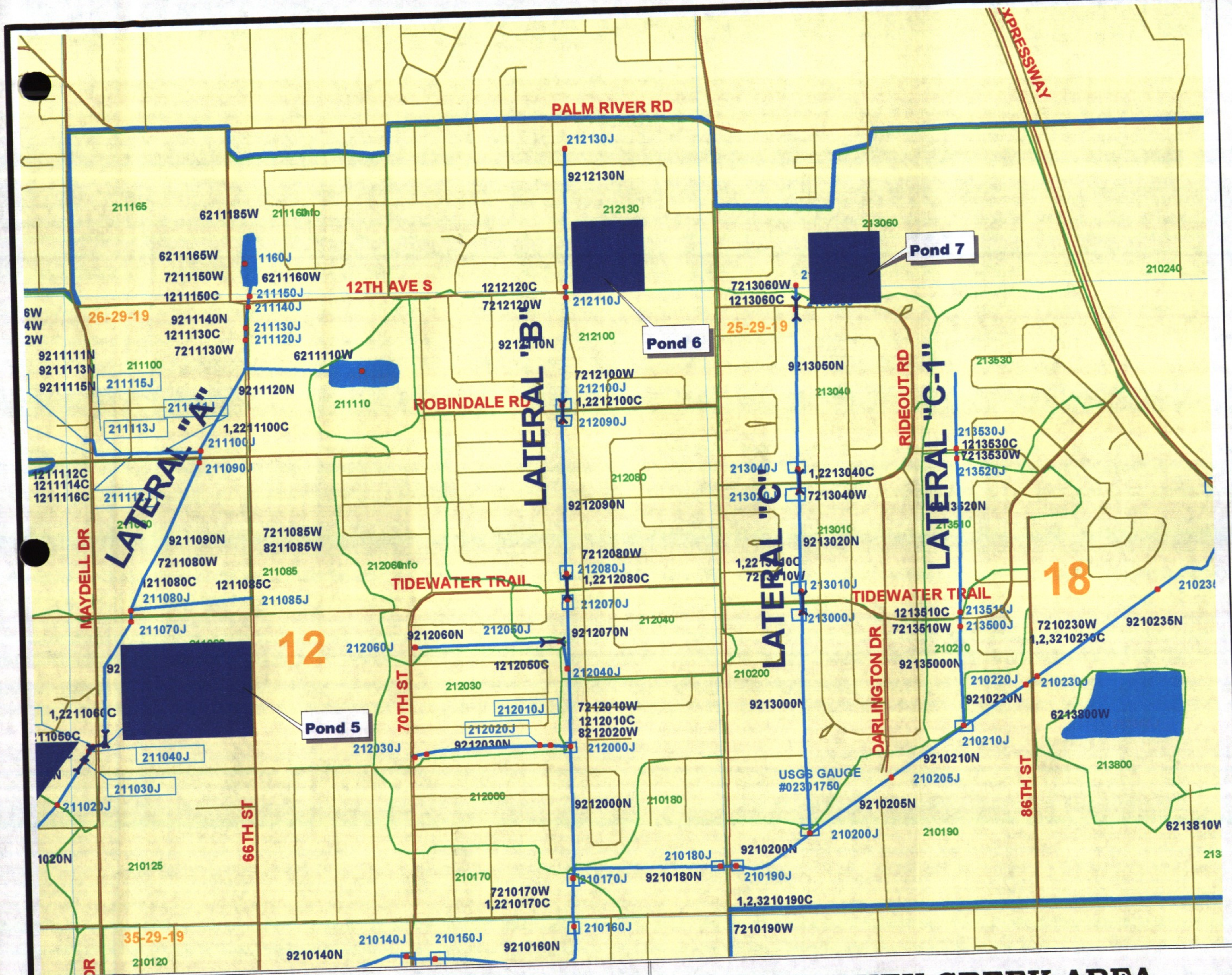
## FIGURE 13-1a2

DELANEY CREEK SUB-WATERSHED
LOCATION OF ALTERNATIVE 2 IMPROVEMENTS




Pipe
Junction Point
Stormwater Network Flow Segments
Proposed Pond
Street
Study Area Basin Boundary
Main Road
Sub- Basin
SectionGrid
Junct-new
Text Basin-ID
Text SB-Number
Text Sec-town-range
Rail Roads
Text Lake-Name
Text Reach
Reach_Txt
Text Road Name
Junct-new_txt
Text Junct-new_txt
Surface Water Storage Features

5. PROPOSED POND 5, AREA 20.20 Ac.
6. PROPOSED POND 6, AREA 8.30 Ac.
7. PROPOSED POND 7, AREA 8.30 Ac.

500 0 500 1000 Feet

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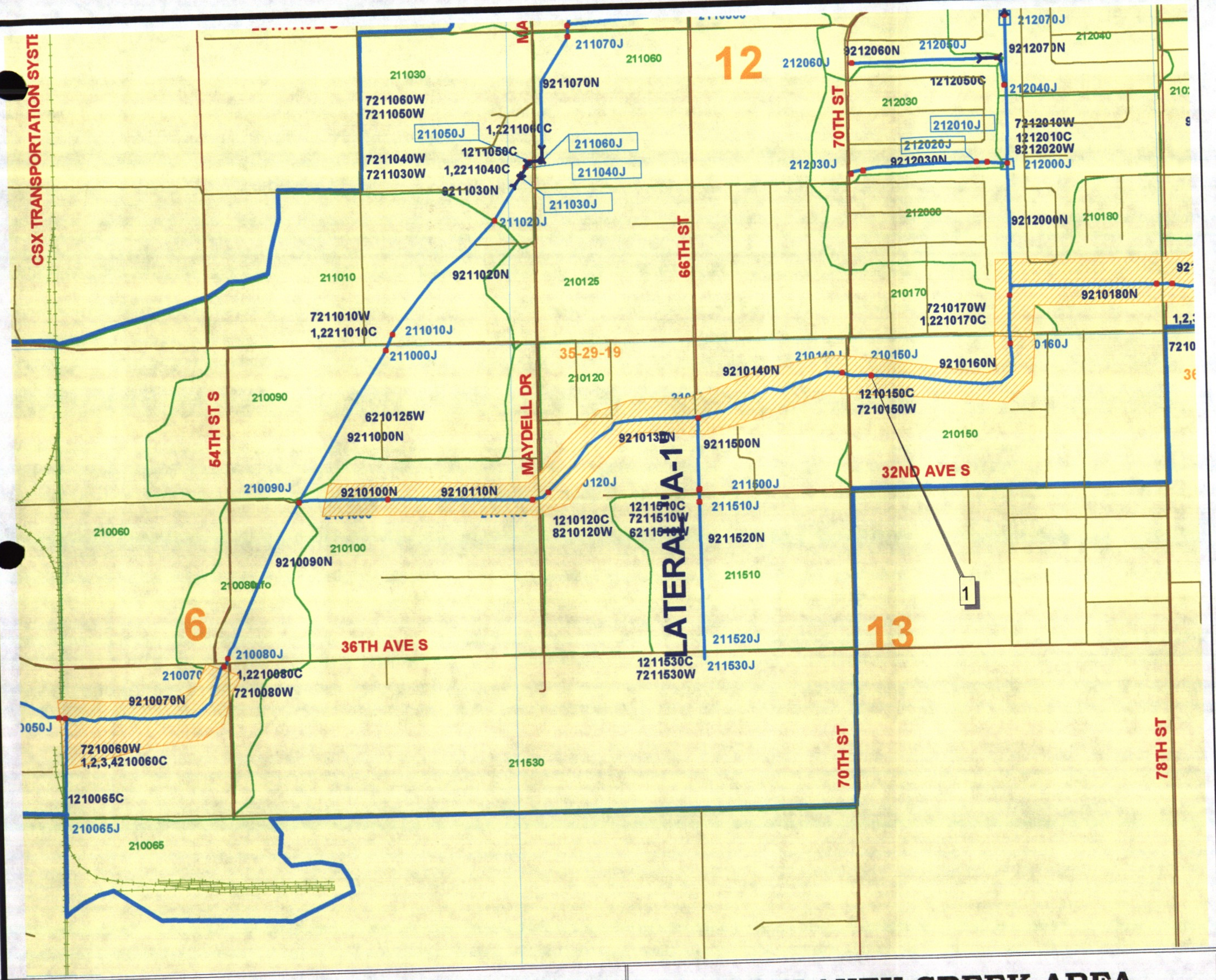
## FIGURE 13-1b2

DELANEY CREEK SUB-WATERSHED
LOCATION OF ALTERNATIVE 2 IMPROVEMENTS




- Pipe
- Junction Point
- Stormwater Network Flow Segments
- ALTERNATIVE1 AREA
- Street
- Study Area Basin Boundary
- Main Road
- Sub- Basin
- SectionGrid
- Junct-new
- Text Basin-ID
- Text SB-Number
- Text Sec-town-range
- Rail Roads
- Text Lake-Name
- Text Reach
- Reach_Txt
- Text Road Name
- Junct-new_txt
- Text Junct-new_txt
- Surface Water Storage Features

1. MAYDELL DR. REPLACE EXIST BRIDGE W / 12'x32' CONSPAN

500 0 500 1000 Feet

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# DELANEY CREEK AREA

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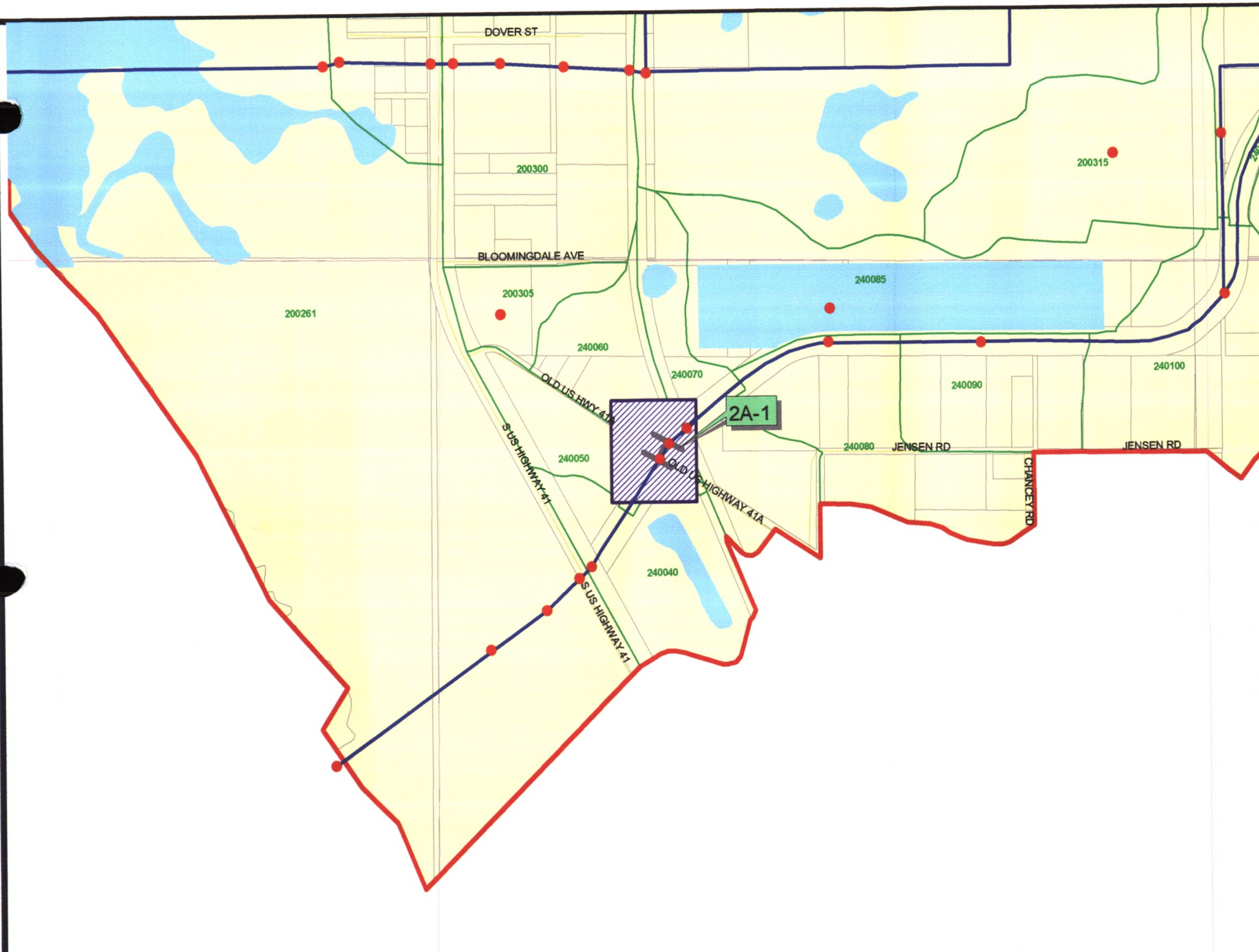
## FIGURE 13-1a3

DELANEY CREEK SUB-WATERSHED
INPROVEMENTS PHASE 1 -1993




**ALTERNATIVE FEATURES**

OLD US HIGHWAY 41A

***2A-1 REPLASE EXISTING 60" CMP WITH 6' X 10' CONCRETE BOX CULVERT***

## LEGEND

- JUNCTION
- POPOFF CHANNEL
- ALTER PIPE
- ALTERNATIVE LOCATION
- BOUNDARY
- NEW POND
- Text SUB BASIN ID
- SUB BASIN
- SEC-T-R GRID
- ROAD
- WATER STORAGE
- PARCEL

400 0 400 800 Feet

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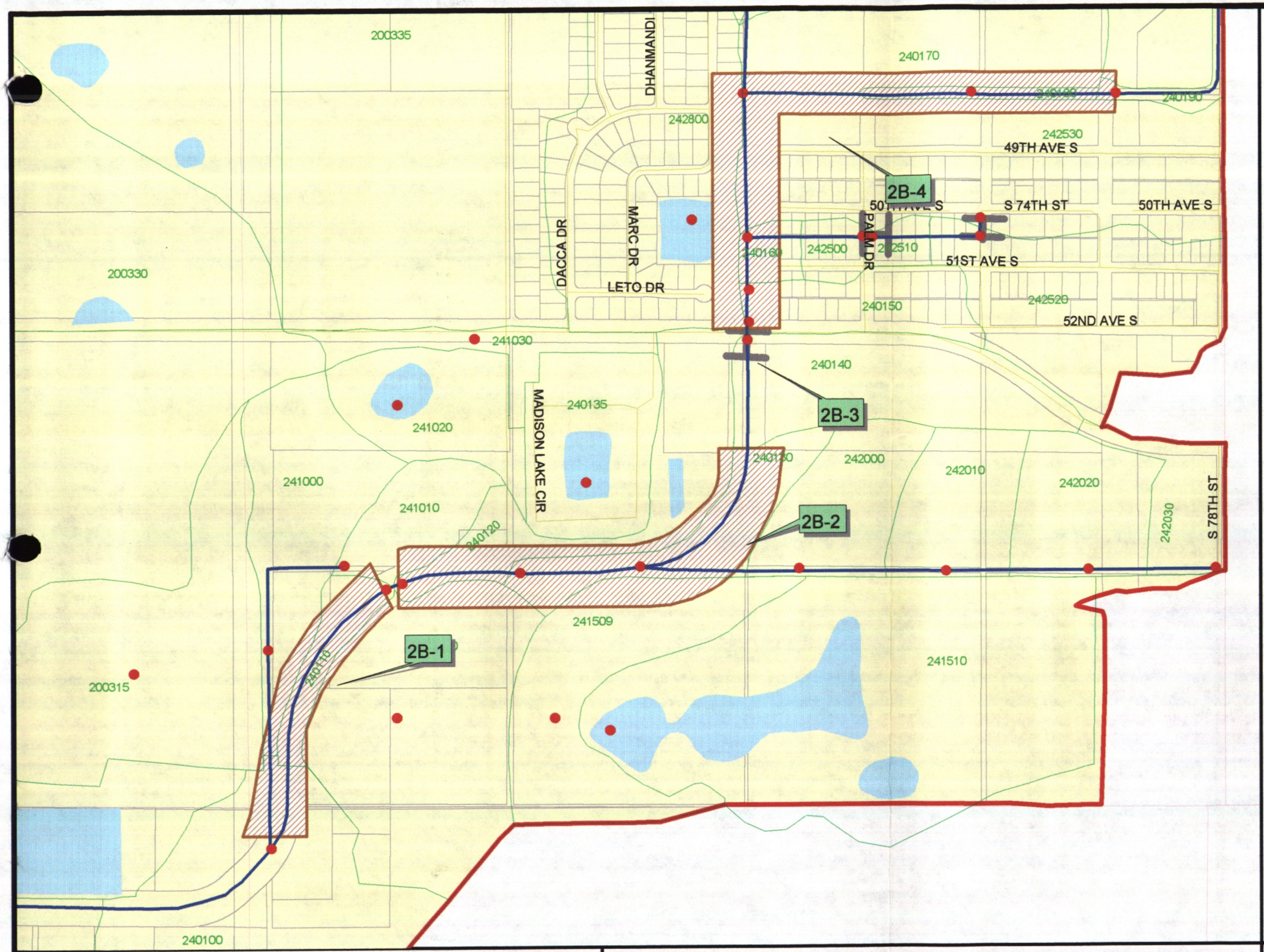
**FIGURE 13-2A**

DELANEY POPOFF SUB-WATERSHED
OLD US HIGHWAY 41A
DETENTION FACILITY




**ALTERNATIVE FEATURES**

MADISON AVENUE

***2B-1 PROPOSED 1650 LF OF CHANNEL CROSS-SECTION IMPROVEMENT***
***2B-2 PROPOSED 1700 LF OF CHANNEL CROSS-SECTION IMPROVEMENT***
***2B-3 PROPOSED ADDITIONAL ONE 5' x 8' BOX CULVERT TO EXISTING 2-5' x 6' BOX CULVERT***
***2B-4 PROPOSED 4010 LF OF CHANNEL CROSS-SECTION IMPROVEMENT***

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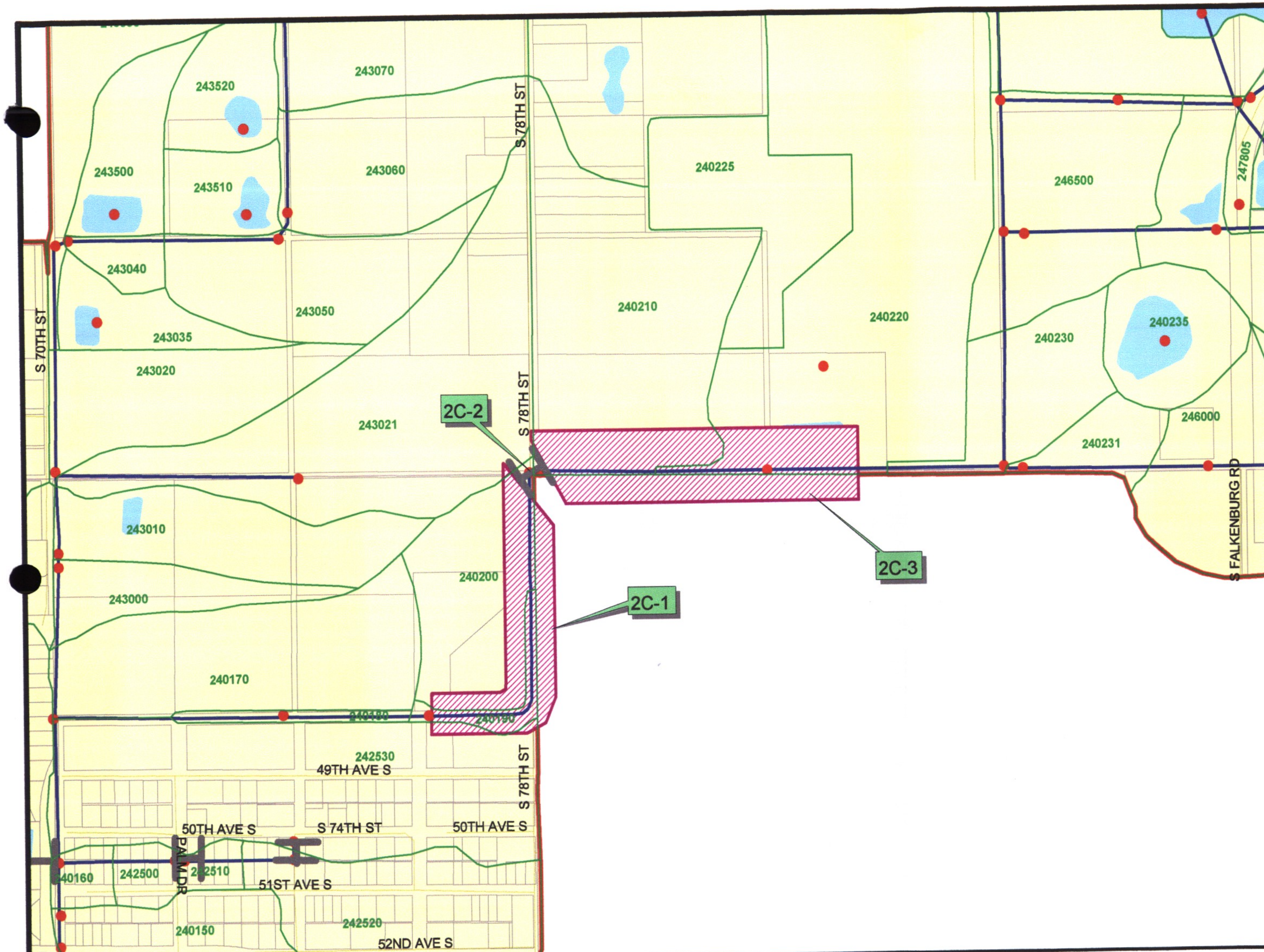
**FIGURE 13-2B**

DelaneyPopoff SUB-WATERSHED
MADISON AVENUE
ALTERNATIVE IMPROVEMENTS




**ALTERNATIVE FEATURES**

DELANEY POP-OFF AT 78TH ST

*2C-1 PROPOSED 1300 LF OF CHANNEL CROOSS-SECTION IMPROVEMENT*
*2C-2 REPLACE EXISTING 2x55"x84" CMP ARCH PIPE WITH 2x72" RCP*
*2C-3 PROPOSED 1460 LF OF CHANNEL CROSS-SECTION IMPROVEMENT*

LEGEND

- Text Basin-10-3.dwg
- Basin-10-3.dwg
- ALTER PIPE
- JUNCTION
- POPOFF CHANNEL
- ROAD
- ALTERNATIVE LOCATION
- BOUNDARY
- SEC-T-R GRID
- WATER STORAGE
- PARCEL

400 0 400 Feet

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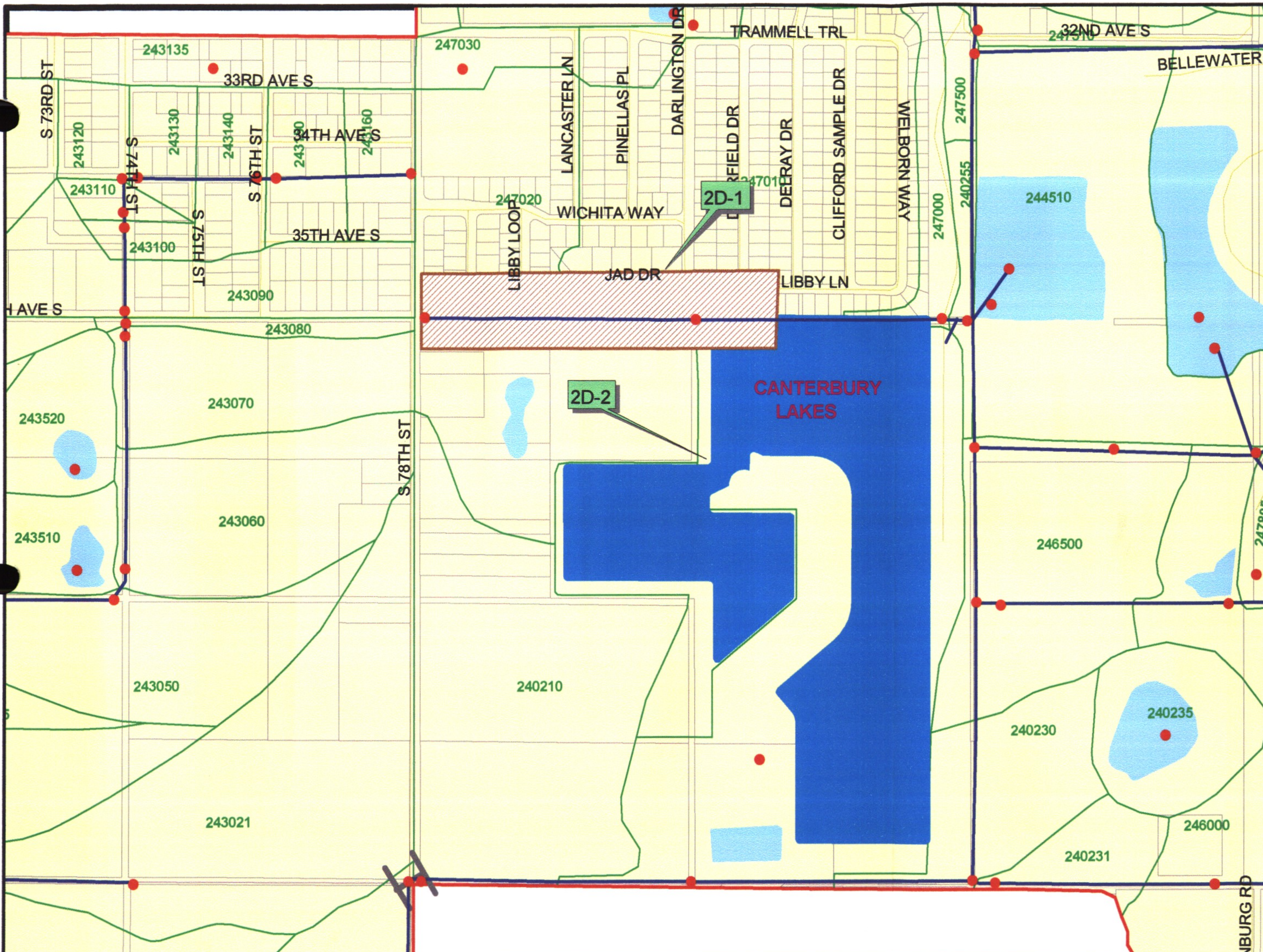
**FIGURE 13-2C**

**DELANEY POPOFF SUB-WATERSHED**
**DELANEY POP-OFF AT 78TH ST**
**ALTERNATIVE IMPROVEMENTS**




# ALTERNATIVE FEATURES

## CANTERBURY LAKES REGIONAL DETENTION FACILITY

***2D-1 PROPOSED 1400 LF OF CHANNEL CROSS-SECTION IMPROVEMENT***
***2D-2 CONSTRUCT CANTERBURY LAKES APPROXIMATELY 50 ACRES***

## LEGEND

- DELANEY JUCTION
- JUNCTION
- POPOFF CHANNEL
- ROAD
- ALTERNATIVE FEATURES
- BOUNDARY
- DELANEY WATER
- Text DELANEY BASIN ID
- DELANEY BASIN
- DELANEY CHANNEL
- NEW POND
- Text SUB BASIN ID
- SUB BASIN
- SEC-T-R GRID
- WATER STORAGE
- PARCEL
- ALTER PIPE

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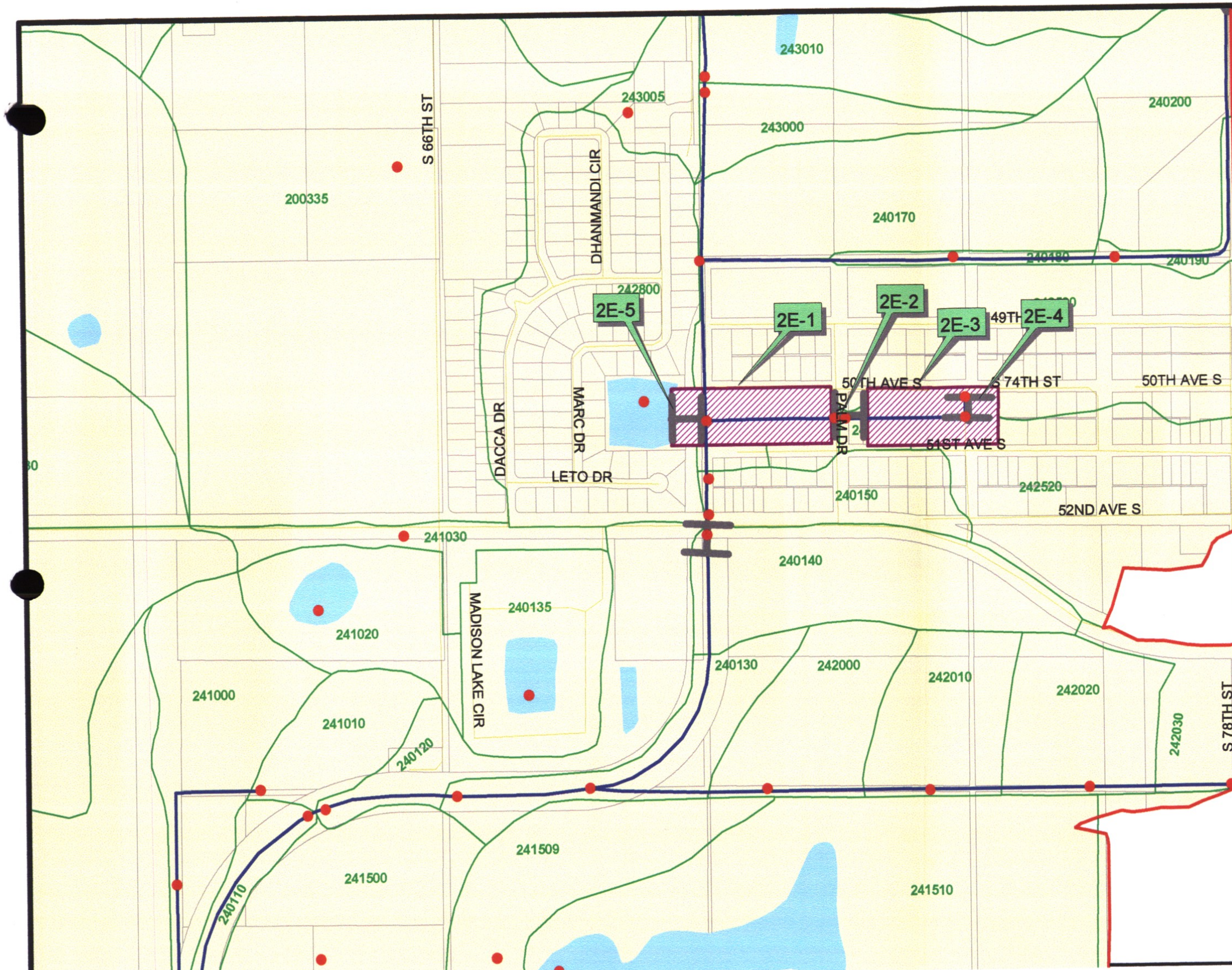
## FIGURE 13-2D

DELANEY POPOFF SUB-WATERSHED
CANTERBURY LAKES REGIONAL
DETENTION FACILITY




## ALTERNATIVE FEATURES

### FORTUNA ACRES

**2E-1** PROPOSED 600 LF OF CHANNEL CROSS-SECTION IMPROVEMENT

**2E-2** REPLACE EXISTING 2x29"x45" ERCP WITH ONE 3.5'x6' CBC UNDER PALM DRIVE IN THE RESIDENTIAL AREA EAST OF FORTUNA ACRES SUBDIVISION SUBDIVISION

**2E-3** PROPOSED 640 LF OF CHANNEL CROSS-SECTION IMPROVEMENT

**2E-4** REPLACE EXISTING DOUBLE 14" RCP TO A 3'x3.5' CBC UNDER THE FORTUNA ACCESS DRIVEWAY ON THE WEST RIGHT-OF-WAY OF 74TH STREET SOUTH

**2E-5** PROPOSED 25' OUTFALL WEIR

## LEGEND

- DELANEY JUCTION
- JUNCTION
- POPOFF CHANNEL
- ROAD
- ALTERNATIVE FEATURES
- BOUNDARY
- DELANEY WATER
- DELANEY BASIN ID
- DELANEY BASIN
- DELANEY CHANNEL
- NEW POND
- SUB BASIN ID
- SUB BASIN
- SEC-T-R GRID
- WATER STORAGE
- PARCEL
- ALTER PIPE

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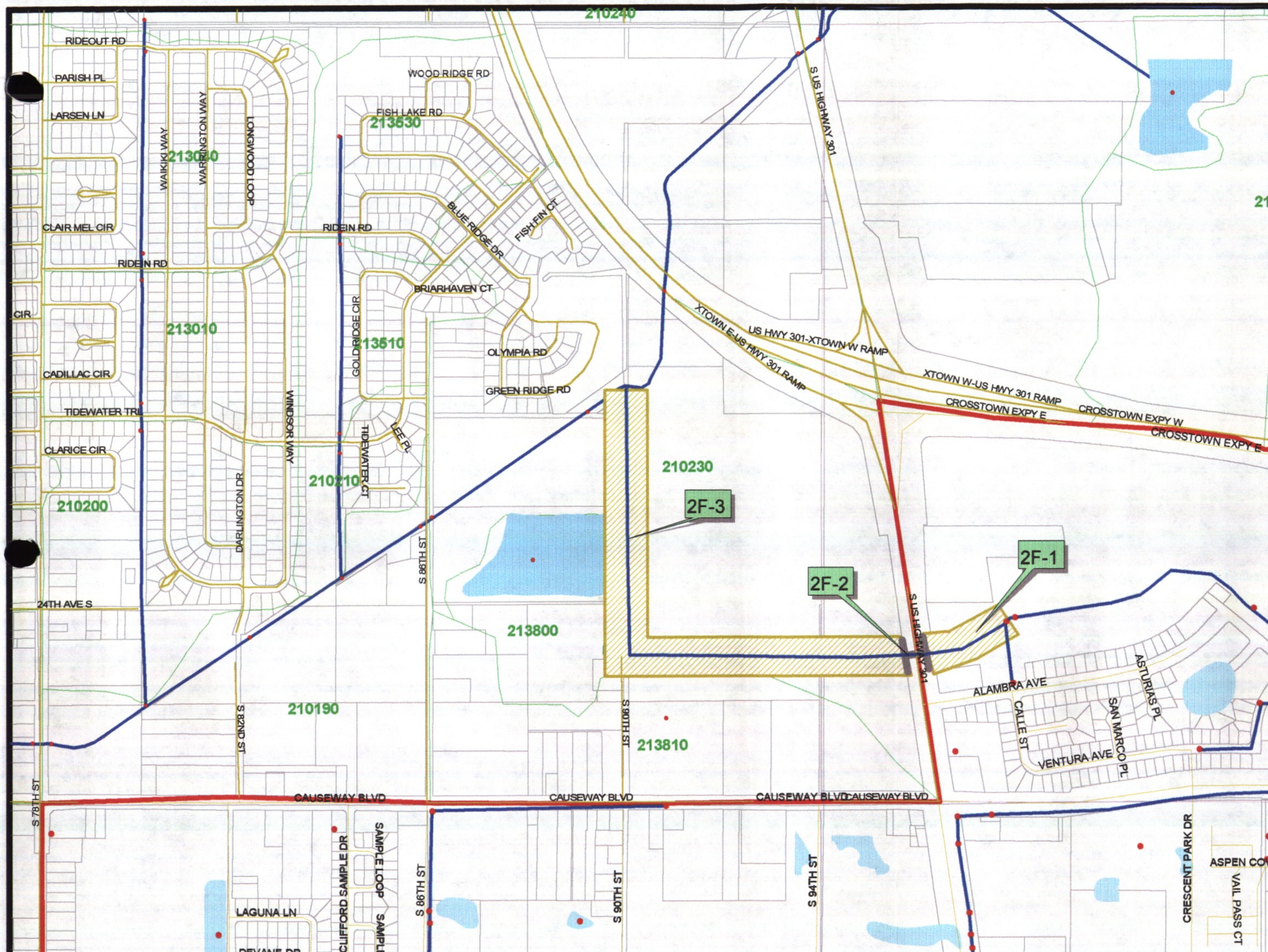
FIGURE 13-2E

DELANEY POPOFF SUB-WATERSHED
FORTUNA ACRES
ALTERNATIVE IMPROVEMENTS




**ALTERNATIVE FEATURES**

EVERGREEN ESTATES

*2F-1 PROPOSED 600 LF OF CHANNEL CROSS-SECTION IMPROVEMENT*

*2F-2 REPLACE EXISTING 36" RCP WITH ONE 4' x 8 CONCRETE BOX CULVERT*

*2F-3 PROPOSED 2700 LF OF CHANNEL CROSS-SECTION IMPROVEMENT*

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# DELANEY CREEK AREA

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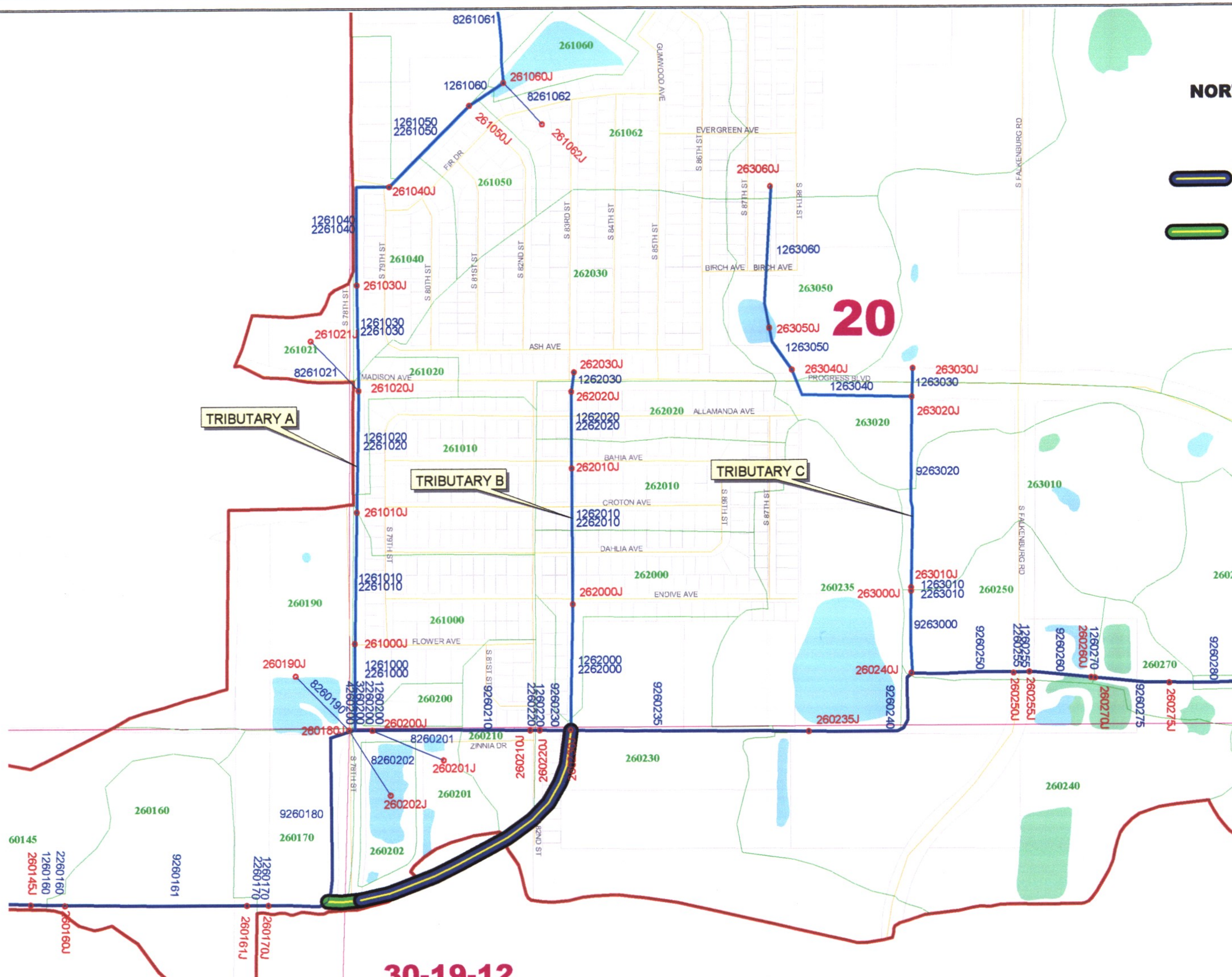
## FIGURE 13-2F

DelaneyPopoff SUB-WATERSHED
EVERGREEN ESTATES
ALTERNATIVE IMPROVEMENTS




## NORTH ARCHIE CREEK IMPROVEMENT 1

1.1 Construct a bypass channel from conlfuence of Tributary B to divert flow to 78th street and through a proposed.

1.2 Two 60" RCP at 78th Street.

**LEGEND**

- SUBBASIN
- ROAD
- WATERSHED BOUNDARY
- T-R-S
- WATER FEATURES
- WETLAND
- PARCEL

Hillsborough County Florida

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**DELANEY CREEK AREA STORMWATER MANAGEMENT MASTER PLAN SEPTEMBER 2000**

# FIGURE 13-3 A1

**NORTH ARCHIE CREEK SUB-WATERSHED IMPROVEMENT 1 MAP**

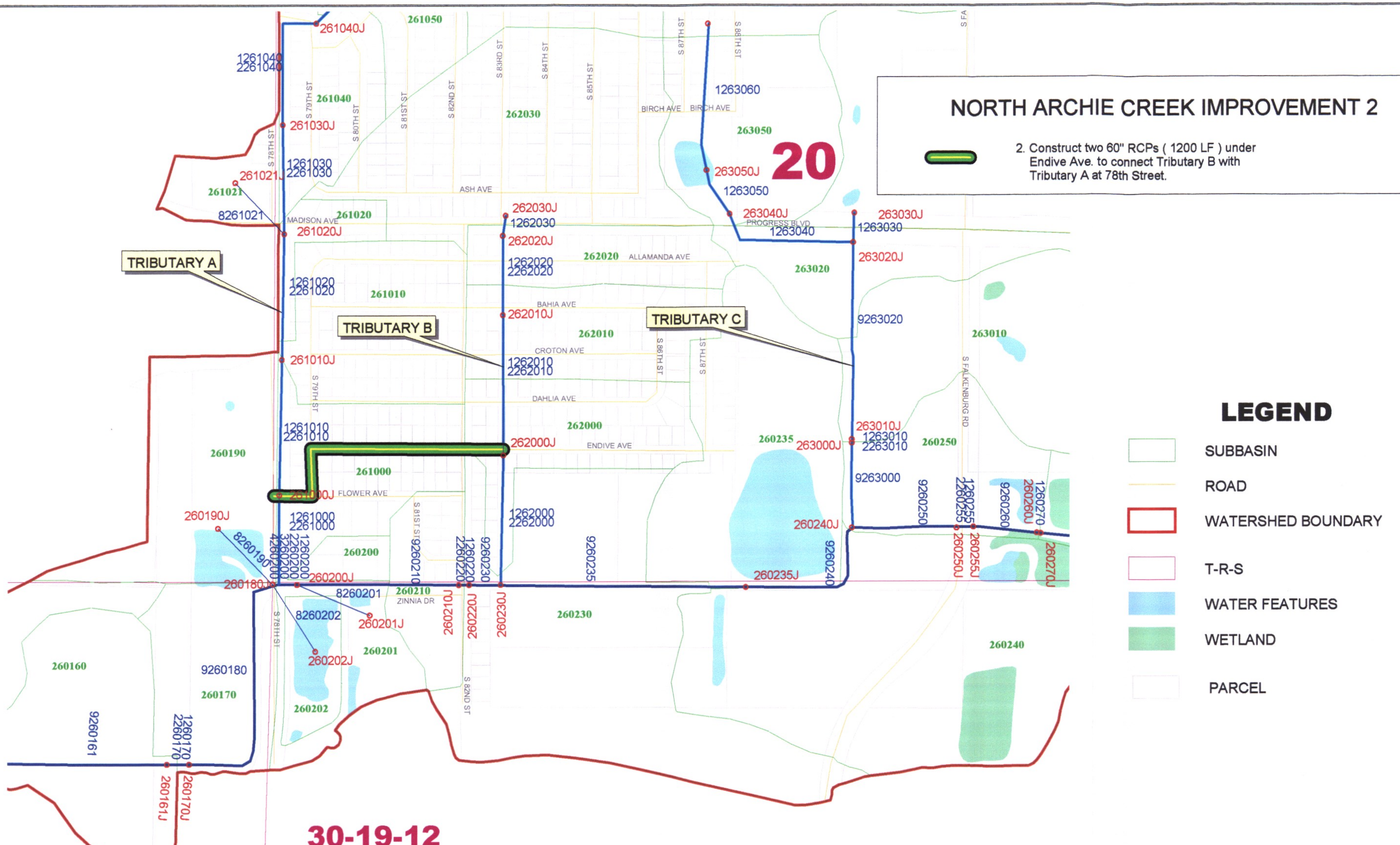


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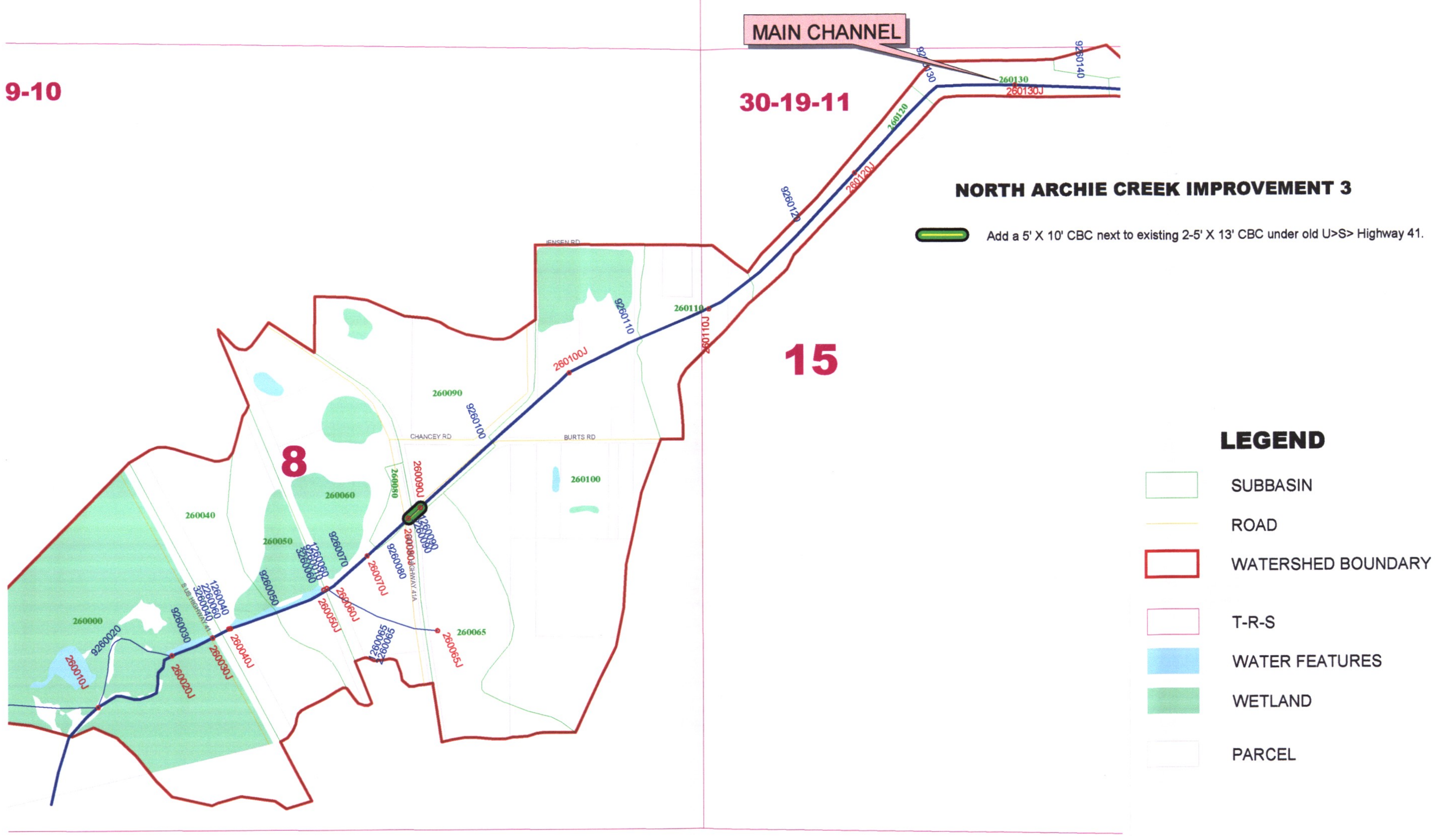
FIGURE 13-3 A2

**NORTH ARCHIE CREEK SUB-WATERSHED IMPROVEMENT 2 MAP**

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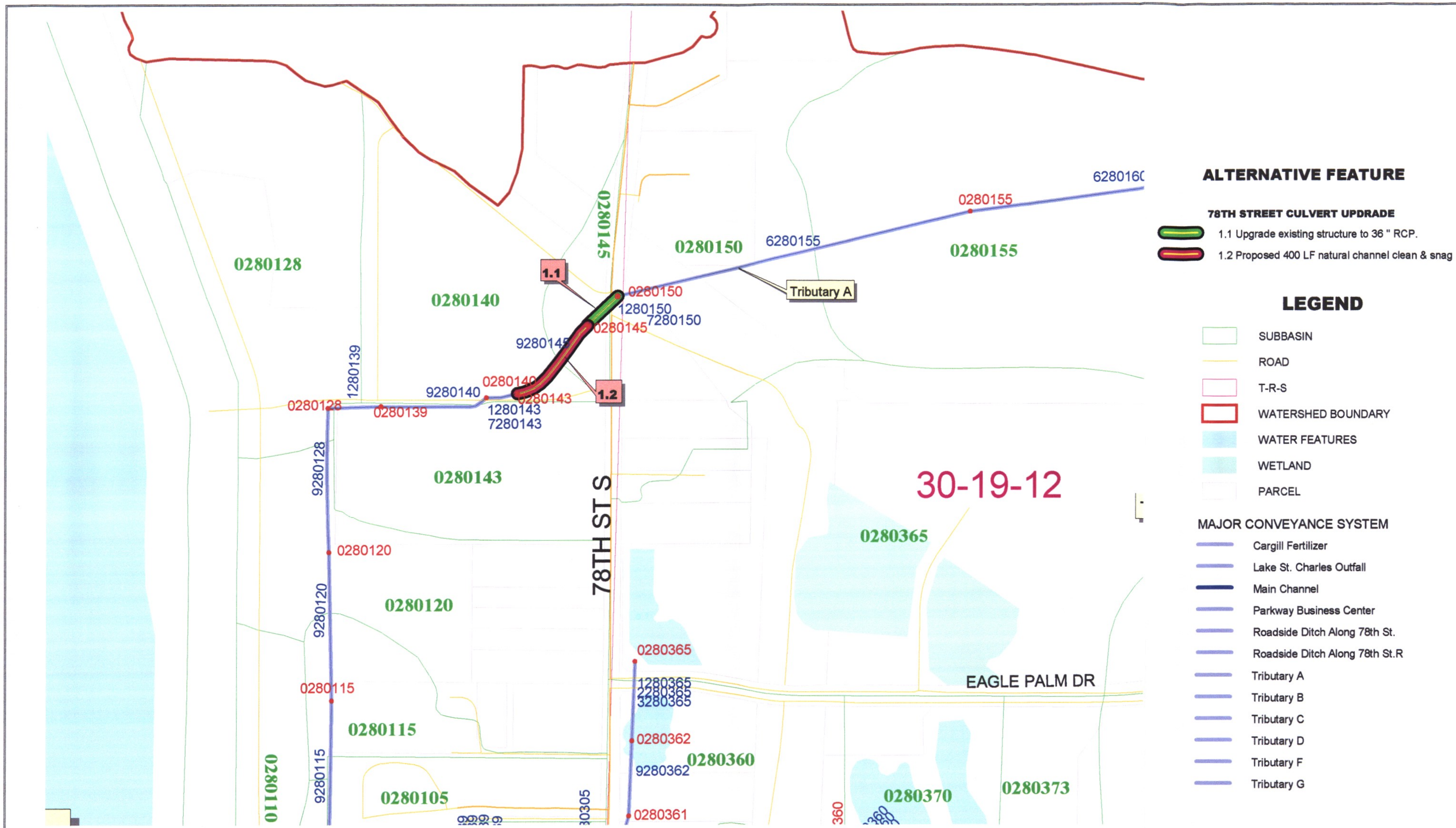
# DELANEY CREEK AREA STORMWATER MANAGEMENT MASTER PLAN SEPTEMBER 2000

FIGURE 13-3 B

NORTH ARCHIE CREEK SUB-WATERSHED IMPROVEMENT 3 MAP

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**STORMWATER MANAGEMENT**
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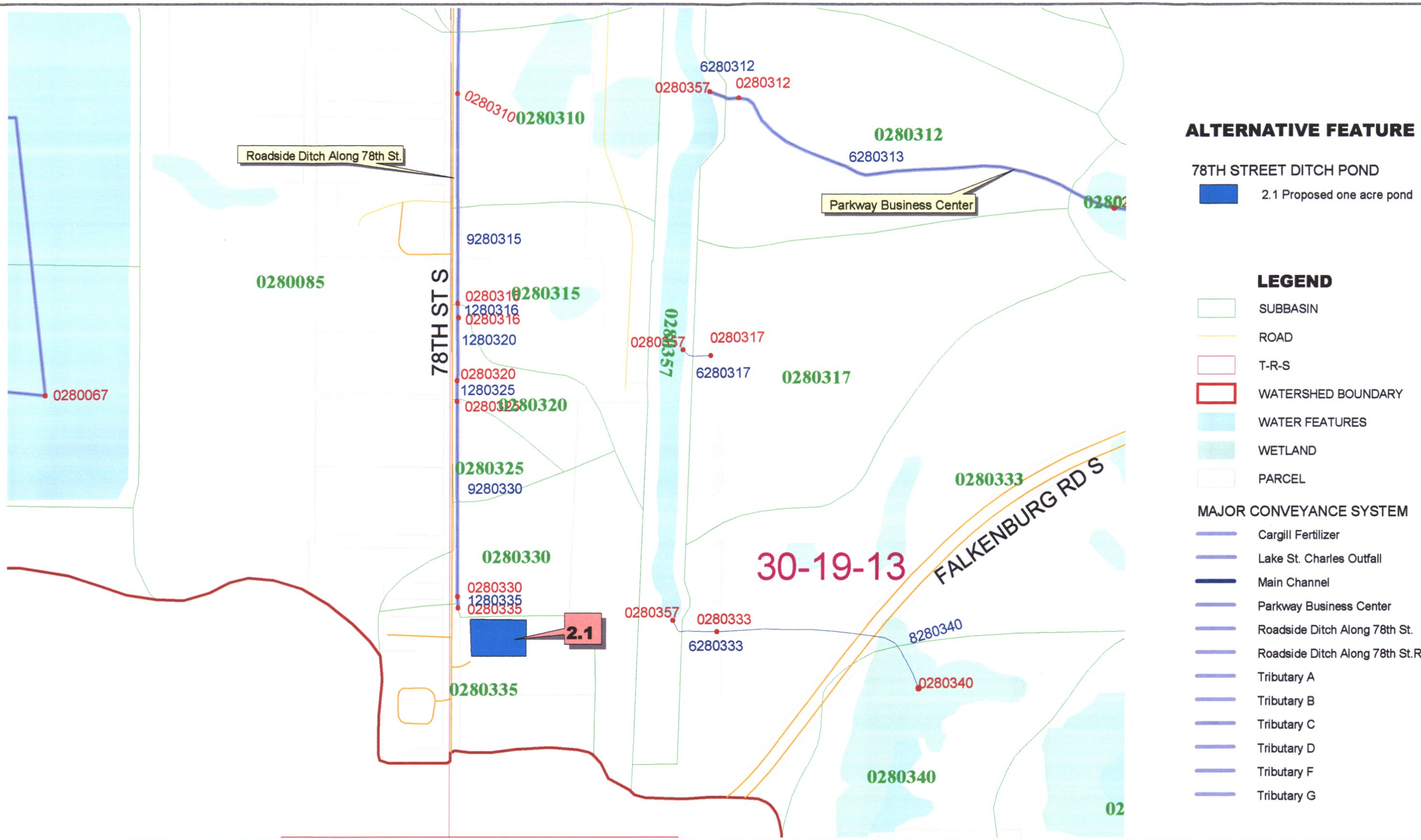
**SEPTEMBER 2000**

# FIGURE 13-4 A

**ARCHIE CREEK SUB-WATERSHED ALTERNATIVES 78TH STREET IMPROVEMENT MAP**

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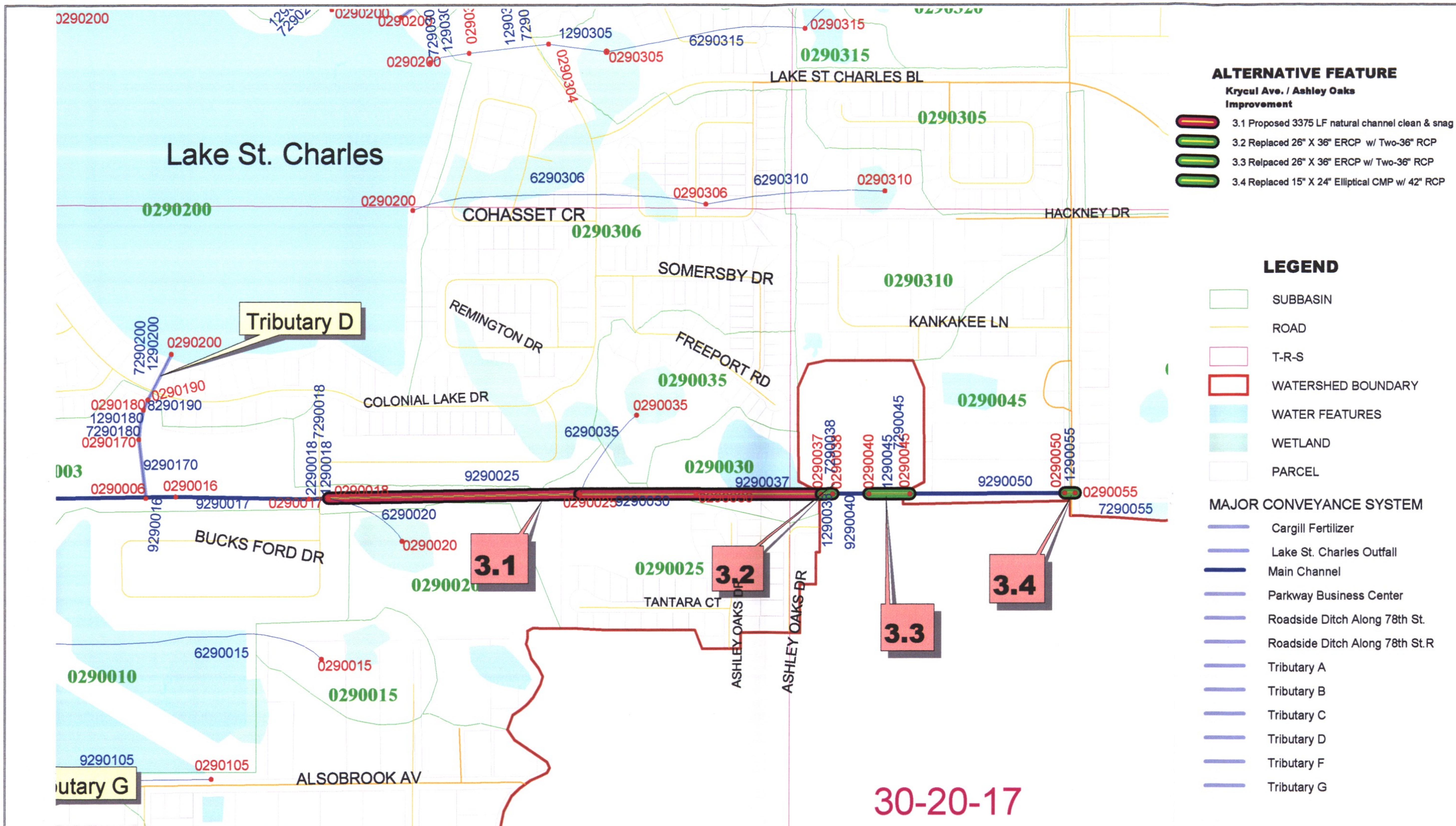
**DELANEY CREEK AREA STORMWATER MANAGEMENT MASTER PLAN SEPTEMBER 2000**

FIGURE 13-4 B

**ARCHIE CREEK SUB-WATERSHED ALTERNATIVES 78TH STREET IMPROVEMENT MAP**

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**DELANEY CREEK AREA STORMWATER MANAGEMENT MASTER PLAN SEPTEMBER 2000**

FIGURE 13-4 C

**ARCHIE CREEK SUB-WATERSHED PROBLEM C C-Krgcul Ave.AshleyOaks IMPROVEMENT MAP**

Place: DOWDELL MIDDLE SCHOOL

# DELANEY CREEK AREA WATERSHED MEETING

**PLEASE PRINT**

| | NAME | ADDRESS | TELEPHONE NUMBER |
|---|---|---|---|
| 1 | ~~[illegible]~~ | | |
| 2 | Vincent Evelyn Forbes | 5609 - S. 70th St. | 626-3025 |
| 3 | Esther Hoover | 6802 Causeway Blvd Tampa | 626-3209 |
| 4 | Joseph Weiner | 2208 Maydell Dr Tampa | 621-1542 |
| 5 | Estalee Eckert | 5902 24th Ave S - Tampa | 626 6941 |
| 6 | Charles Eckert | 5902 24th Ave. S. TPA | 626-6941 |
| 7 | Nicko Honey Gibson | 2057 Balfour Cir TPA 33619 | 626-5368 |
| 8 | Michael Halikoytakis | 7202 32nd Ave So 33619 | 626-5096 |
| 9 | Gary Anzulewicz | 8251 Causeway Blvd Tpa 33619 | 626-3333 |
| 10 | Alan De Guzman | 1410 N. 21st St. TPA 33605 | 272-7104 |
| 11 | Dan Ross | P. O. Box 2968 TPA 33601 | 626-2181 |
| 12 | Charles Ingram | 604 Southwood Cove Brandon 33511 | 681-9084 |
| 13 | Rick Paul | 1020 S. 82nd St | 626-2051 |
| 14 | Mike Kelley | 430 Columbia | 251-9156 |
| 15 | Charles B Courtney | Star Dairy | 626-6254 |
| 16 | [illegible] | | 664 1666 |
| 17 | William Courtney | | 623-1138 |
| 18 | Maggie Staros | H.C. | 2-5912 |

| | NAME | ADDRESS | TELEPHONE NUMBER |
|---|---|---|---|
| 19 | Theresa Bishop | 2021 S. 86th St | |
| 20 | Michelle Juncal | 2021 S. 86th St | |
| 21 | Frank & Linda Reichart | 7504 Lavender Ln. | |
| 22 | Erwin & LaVera Leiss | 3407 Delaney Creek Lane | |
| 23 | Jean Corwin | 5211 36th Av So | |
| 24 | Susan Green Tribune | 505 W. Robertson, Brandon | 657-4579 |
| 25 | Jose Suarez | 1516 S 70 | 626125 |
| 26 | Glen Cross | 8925 Eagle Watch Dr Riverview | 672-0608 |
| 27 | C. Lynn Miller | P.O. Box 1636 Lutz, FL 33548 | (813) 949-3889 |
| 28 | Mary Broon | 6008-24th Ave. S | 621-2178 |
| 29 | MR + MRS. W. L. Wood | 3813 So. 70th St. | 626-1044 |
| 30 | Mr & Mrs Frank Suarez | 7216 Causeway Blvd Tpa | 621-1341 |
| 31 | Nancy Spencer, | 2612 S. 69th St. Tampa | 626-5563 |
| 32 | Christine Moore | 3813-58th St Tampa | 621-3235 |
| 33 | Pat Kronech | 311 River Bay Dr. Tampa 33619 | 623-3092 |
| 34 | Patricia LaFrance | 8913- Tidewater Tr. | |
| 35 | Ron Bergsten | Seffner, FL | |
| 36 | Florence Benninger | 8508 Blue Ridge Dr Tpa | |

37 Dawn Turner 8005 Deerwood Cr. (883) 664-0929

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# DELANEY CREEK AREA WATERSHED MEETING

## COMMENT SHEET

DATE: JANUARY 23, 2001

NAME: R T Paul

ADDRESS: 1020 S. 82nd St.

TELEPHONE: 626-2051 (623-6826 work)

COMMENTS: General: It is very disturbing to attend a public meeting where the project objectives are never clearly explained and the initial (overview) presenter has neglected to bring the proper materials. The public's confusion only increases. Mine did. The full breadth of this project was not explained.

Specific questions: (1) If drainage will be improved by speeding stormwater downstream, won't that cause increasing TN and TSS discharges to Tampa Bay?

(2) How aggressively will the county pursue acquisition of open lands to construct wetlands projects that hold back water to reduce residential flooding, improve water quality, and provide wildlife habitat values?

(3) Will the results of this study be used to reduce future development and associated flooding?

Your comments are valuable to us. If you have any unanswered questions, please include them on this form. Please leave this form with the public information representative or mail it to:

HILLSBOROUGH COUNTY COMMUNICATIONS DEPARTMENT
COMMUNITY RELATIONS
601 EAST KENNEDY BLVD., 22ND FLOOR
P.O. BOX 1110
TAMPA, FL 33601
ATTENTION: STEVE VALDEZ, COMMUNITY RELATIONS MANAGER
(813) 272-5275 (fax: 276-2915)
www.hillsboroughcounty.org

(4) When does this project go before the BOCC for approval?

# Meeting to air Delaney Creek plans

County planners are hoping for better turnout at a second meeting to discuss flooding issues around Delaney Creek.

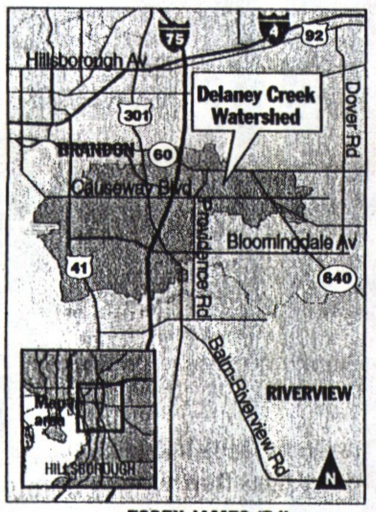
By SUSAN M. GREEN
of The Tampa Tribune

A $10 million project to widen and clean a 3-mile stretch of Delaney Creek anchors a Hillsborough County list of proposed drainage improvements in a 34-square-mile area.

The area includes much of Brandon, as well as Clair-Mel City, Progress Village and parts of Palm River and Riverview.

Staff members from the county's Public Works Department will present their recommendations at a public meeting at 6:30 p.m. Tuesday in the cafeteria of Dowdell Middle School, 1208 Wishing Well Way, Clair-Mel City.

County engineers and scientists are drafting a $1 million watershed management study for the Delaney Creek area, which includes some of the neighborhoods hardest hit by flooding during the El Nino downpours of 1997-98.




ESSEX JAMES/Tribune map

The meeting Tuesday may be residents' last chance to comment on the proposals in draft form. Although the target area is one of the most heavily populated in the county, only 14 people turned out for the first public meeting on the watershed plan in November.

"It seems with the dry weather and all that, people just were not all that interested," said Kelly Holland, an environmental scientist with the county's Public Works Department who has been working on the plan.

Other watershed plans have featured three public meetings, but county officials are considering limiting this one to two, he said.

Delaney Creek starts roughly at Pauls Drive and flows about 10 miles west to McKay Bay. The creek was relocated years ago to accommodate Brandon TownCenter mall, but that part of the waterway appears to be functioning well, Holland said.

County officials are targeting a stretch between 86th Street and the CSX railroad just east of U.S. 41 for major improvements, said Horatio Droc, a water resources engineer working on the project.

The creek is about 30 feet to 40 feet wide in that area. The county wants to widen it to 50 feet to 70 feet, Droc said.

"It's a very, very big project," he said. "We've been trying to accomplish this one for many years."

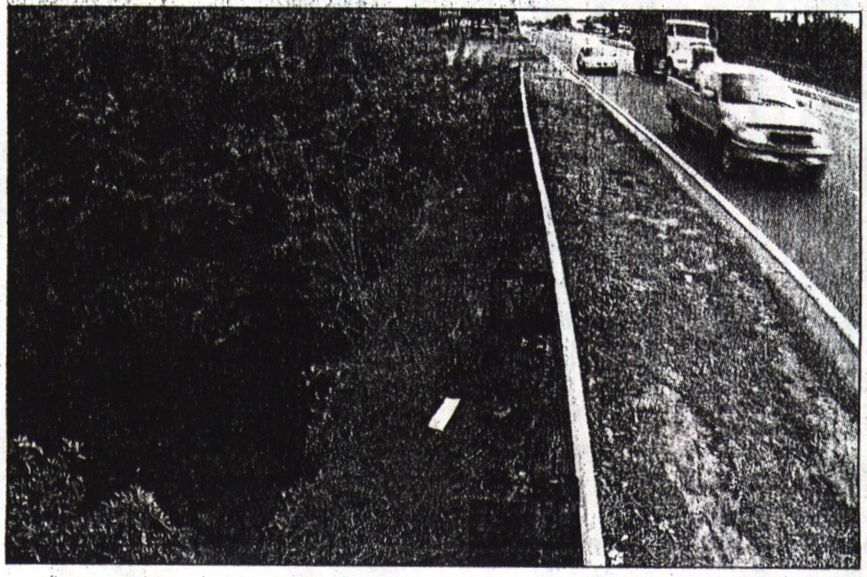
The estimated cost includes land acquisition and construction costs, he said.

Other flood control projects already being developed include diverting runoff from Delaney Pop-off in the Evergreen Estates area to Delaney Creek. That area is roughly bounded by U.S. 301 to the east, Interstate 75 to the west, Lee Roy Selmon Expressway to the north and Causeway Boulevard to the south.

In the Progress Village area, a project to improve flow in Delaney Pop-off near 78th Street is in the permitting stages, Droc said.

See CREEK, Page 3 ▶

DAVE GEIGER/Tribune photos



**Delaney Creek, seen east, above, and south, at left, of U.S. 41, is being targeted for major drainage improvements. A public meeting at 6:30 p.m. Tuesday in Clair-Mel City offers residents a chance to comment on the proposals while they are still in draft form. Only 14 people turned out for the first public meeting on the watershed plan in November.**

## CREEK / Area includes flooding sites

◀ From Page 1

Other projects that county staff members are expected to propose include building a large retention pond in the Lake St. Charles area of Riverview, Holland said.

The watershed is slated for big changes with the proposed extension of a series of roads from the Selmon expressway to Pauls Drive.

But those projects should be subject to built-in stormwater runoff controls as part of the regulatory process and thus won't figure heavily into the county's management plan, Holland said.

County officials recently began considering water pollution and habitat preservation along with flooding problems as part of their management efforts.

Delaney Creek has been the focus of cleanup efforts over the past few years. But, Holland said, "It's still one of the most polluted creeks that runs into Tampa Bay."

For information about the meeting, call Steve Valdez with the county's Communications Department, (813) 272-5275.

▶ **Susan M. Green covers the Brandon environment and can be reached at (813) 657-4529 or *sgreen@tampatrib.com***

2nd PUBLIC MEETING ON JANUARY 23, 2001

# Creek proposal meets skeptics, legal hurdles

**CLAIR-MEL CITY** – Officials say drainage will be "dramatically better" with a wider Delaney Creek.

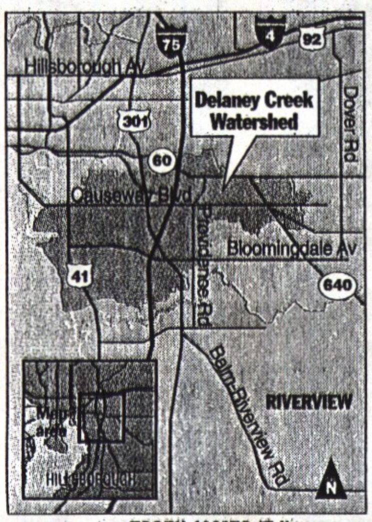
**By SUSAN M. GREEN**
**of The Tampa Tribune**

A $10 million plan to widen part of Delaney Creek has run into legal snarls, and several people who live near the creek quizzed county officials this week about how the project might affect their property.

Jean Corwin, whose 36th Avenue home is near the creek, was among about 40 people who turned out for a public meeting Tuesday on the project at Dowdell Middle School. She said her home is protected from flooding by an 11-foot-high embankment.

"What that means for me is I don't have to pay flood insurance," said Corwin, who moved to her home in 1989. "If you take that big hump off, will I have to pay?"

County scientists and engineers at the meeting couldn't answer specific questions about flood insurance. Generally, however, the plan to widen a 3-mile section of Delaney Creek between 86th Street and the CSX railroad crossing just east of U.S. 41 should make drainage "dramatically better" for much of the watershed, said Horatio Droc, an engineer working on the project.



ESSEX JAMES/Tribune map

The creek widening is one of several projects proposed as part of a stormwater management plan for the 34-square-mile Delaney Creek watershed. The area includes some communities that were hard hit by flooding during the El Nino deluges of 1997-98.

Maps at the meeting showed plans to replace a number of box culverts; create a 50-acre retention pond at Canterbury Lakes near Progress Village, a project already under construction; and replace the Maydell Drive bridge with a taller structure. Droc said county staff also is recommending replacement of the 70th Street bridge.

But the Delaney Creek widening project dominated a question-and-answer session between residents and representatives of the county's Public Works Department. Droc said the creek now spans about 35 to 55 feet and will be widened to as much as 80 feet in some areas.

Officials said they hope to get started on the project in 2002. But Kelly Holland, a Public Works wetlands scientist, said 48 parcels needed for the widening are tied up in eminent domain litigation. Droc said it's hard to predict how long it might take for the cases to wind through court.

Some criticized county maintenance of the creek. Droc said routine maintenance will become easier if the county gets the easements it is seeking.

Corwin said after the meeting that she was approached about selling an easement, but she wants the county to buy her property outright. She said she fears the easement would become an overgrown haven for snakes. "They're more apt to maintain it if they buy it," she said.

Others suggested widening only a portion of the creek would create a bottleneck at U.S. 41, backing water up onto some people's property. County officials acknowledged that the project stops just short of an old battery plant blamed for contaminating the creek with lead, and construction there could be a problem.

But Droc said aerial photographs indicate the creek naturally is wide enough west of the railroad to keep water from stalling. Officials noted that the county built a large sump just east of the tracks to collect water about two years ago.

**▶ Susan M. Green covers the Brandon area environment and can be reached at (813) 657-4529 or *sgreen@tampatrib.com***

# PROPOSED LEVEL OF SERVICE

## 15.1 INTRODUCTION

This chapter discusses the improved level of service (LOS) for the Delaney Creek Area watershed based on the alternative analysis and recommendations as described in Chapter 13. Exhibits 15-1-1d, 15-1-2d, 15-1-3d, and 15-1-4d contain graphical representations of the DCA proposed LOS analysis for the 25-year/24-hour storm event.

Discussion areas include the following topics below:

- The DCA LOS goals
- Level of Service Designation for the individual system

The proposed conditions LOS designations are discussed for each subwatershed of the DCA system as listed below:

Delaney Creek
Delaney Pop-off Canal
North Archie Creek
Archie Creek

## 15.2 LEVEL OF SERVICE GOALS FOR THE DELANEY CREEK AREA WATERSHED

As defined in the Stormwater Management Element of Hillsborough County Comprehensive plan, one of the goals of this report is to achieve an ultimate LOS for the Delaney Creek Area watershed (i.e., 25-yr/24-hour/level B). Although this is the ultimate goal for DCA Watershed Management Plan, certain limitations have to be taken into consideration. For instance, not all subdivisions and facilities discharging into the major conveyance systems have adequate stormwater management systems. Also, as mentioned in the Stormwater Management Element, both physical and environmental constraints affect proposed channel alterations. This limits the recommendations and thus limits the LOS achieved with the implementation of the proposed conditions.

Unlike the Level of Service for flooding, the water quality treatment level of service

(WQTLOS) is not currently defined in any governmental law or rule, nor is it addressed in the Hillsborough County Comprehensive Plan. In this watershed, the single family low to medium density residential land use without any type of stormwater treatment is being employed as the standard for comparison. It was felt that this is the best compromise to use for the following reasons. Natural systems were initially investigated for use as the benchmark; however, the resulting LOS would have been skewed downward because these systems, in general, provide treatment rather than creating pollutant loads. If a more intensive land use, such as commercial or industrial, were used, the results would have been shifted towards a higher LOS due to the large amount of pollutant loading generated by these land uses. This is due primarily to the amount of impervious surfaces that generate large amounts of run-off.

## 15.2.1 DELANEY CREEK SUBWATERSHED

With the preferred alternatives for the Delaney Creek LOS Main System, the ultimate LOS is B with the exception of an isolated area just north of Hartford Street and east of $54^{th}$ Street for the main channel system. Table 15.1 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-1d.

### 15.2.1.1 Delaney Creek Main System

Using preferred alternative one for the Delaney Creek Main System, the ultimate LOS (i.e., 10yr/24-hr/level B) is satisfied. However during the 25-yr/24-hr storm event, the Hendrics Lake System shows some areas where localized street and site flooding exists. Table 15.1 shows these deficiencies and contains the difference between established landmark elevations and computed water surface elevations for the 2.33-yr/24-hr, 5-yr/24-hr, 10-yr/24-hr, and 25-yr/24-hr storm events.

The proposed improvements to the channel, bridges and culvert will not significantly change the WQTLOS for the creek system. However, to insure that the water quality will not be affected during or after construction the following is recommended:

Channel sideslopes be constructed at a 4:1 or gentler slope, this will allow for ease in stabilization with sodding or seeding methods.

Erosion control methods such as silt screens and floating turbidity barriers be employed during construction and until all exposed soils are stabilized.

All excavated soils should be removed from the site and stockpiled for use by the County at a later date. Traditionally, this spoil material is piled on the banks of the creek where it erodes back into the channel with each and every storm event.

The option of placing solid / liquid separation structures as a part of this project should be explored.

### 15.2.1.1.2 Hendrics Lake System

A preferred alternative was not examined since flooding problems were not identified from the model simulations. Although flooding complaints were recorded within this drainage system, most of them are localized flooding problems, which can be resolved with improvements of the main channel.

### 15.2.1.1.3 Tenmile Lake System

A preferred alternative was not examined since no flooding problems were identified from the model simulations. Although flooding complaints were recorded within this drainage system, most of them are localized flooding problems, which can be resolved with improvements of the main channel.

### 15.2.1.1.4 Lateral "E" System

A preferred alternative was not examined since flooding problems were not identified from the model simulations nor were any complaints recorded within this drainage system.

### 15.2.1.1.5 Lateral "D" System

The flooding concern at this location was identified from model simulations. The computed water surface exceeds the Palm River Road crossing overtopping elevation of 26.92 by 0.3, 0.7 and 0.9 feet for the 25, 50 and 100-year design storms respectively. Despite model results, no flooding complaints have been recorded at this time; therefore, no improvements are proposed for this location.

### 15.2.1.1.6 Lateral "C" System

With the preferred alternative 1, the water surface elevations decrease as much as one half of a foot in the Lateral "C" System. The proposed conditions qualify for a 25-yr/24-hr LOS Level A, an upgrade from the 25-yr/24-hr existing conditions LOS Level B, thus satisfying the ultimate LOS.

The proposed improvements will not appreciably change the WQTLOS. The placement of solid/liquid separation devices should be investigated with the proposed culvert replacements. Silt screens and turbidity barriers should be employed during the proposed channel improvement and until all areas of exposed soils are stabilized by sodding or seeding. It is recommended that sideslopes be 4:1 or gentler to allow for future maintenance and ease of stabilization.

### 15.2.1.1.7 Lateral "B" System

Employing the preferred alternative 1, the water surface elevations decrease as much as one half of a foot in the Lateral "B" system. The proposed conditions qualify for a 25-yr/24-hr LOS Level A, an upgrade from the 25-yr/24-hr existing conditions LOS Level B, thus satisfying the ultimate LOS.

Again, the proposed improvements will not appreciably change the WQTLOS. Silt screens and turbidity barriers should be employed during the proposed channel improvement and until all areas of exposed soils are stabilized by sodding or seeding. It is recommended that sideslopes be 4:1 or gentler to allow for future maintenance and ease of stabilization. The placement of solid/liquid separation devices should be investigated with the proposed culvert replacements.

### 15.2.1.1.8 Lateral "A" System

With the preferred alternative 1, the water surface elevations decrease as much as one half of a foot in the Tributary "A" system. The proposed conditions qualify for a 25-yr/24-hr LOS Level A, an upgrade from the 25-yr/24-hr existing conditions LOS Level B, thus satisfying the ultimate LOS.

The proposed alternatives will not substantially change the WQTLOS for this area. It is recommended that solid/liquid separation devices be employed to raise the water quality somewhat. In addition during construction and channel improvement, turbidity barriers and silt screens should be kept in place until all areas of exposed soils have been stabilized by seeding or sodding. The sideslopes that result from the channelization should be maximized within the easement or right-of-way area.

## 15.2.2 DELANEY POP-OFF CANAL SYSTEM

With the proposed recommendations for the Delaney Pop-off Main Channel LOS System, the ultimate LOS is B with the exception of an isolated area of the industrial area of Pendola Point Road. Table 15.2 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-2d.

### 15.2.2.1 Main Channel (240xxx Series)

Although road overtopping is not prolific along the Pop-off Canal's main channel, there are several locations where improvements are necessary due to the water surface elevation impact on the major tributary systems.

#### 15.2.2.1.1 Alternative 1

The results of the SWMM computer simulation identify the existing Old U.S. Highway 41 crossdrain as a significant source of headloss along the main channel system. The water surface elevation across this location has a drop of 1.2 and 0.9 feet for 100-year and 25-year design storm event respectively. The existing 60 inch corroded metal pipe is proposed to be replaced with an 8' x 12' concrete box culvert. The water surface elevation decreases by 0.80 feet for the 25-year design storm event with this upgrade. The proposed level of service of the adjacent subbasins will be upgraded from B to A for the 25-year design storm event.

Another location with a significant difference between upstream and downstream water surface elevations is identified at Madison Avenue. The elevation difference produced by the Madison Avenue crossdrain ranges between 0.51 and 2.0 feet for mean annual and 100-year design storm events respectively. The large losses are attributable to the size and depth of the channel south of Madison Avenue. With the flow increase by the upstream improvements described later in this chapter, the Madison Avenue crossdrain requires an increase in capacity. Therefore, an additional 5' x 8' concrete box culvert is proposed at this location. The improvement will lower the water surface elevation as much as 2.23 feet for the 25-year design storm event. The main purpose of this additional pipe is to improve the level of service on Tributary "F" located 600 feet upstream of Madison Avenue. The channel cross section is also proposed to be improved upstream of Madison Avenue for 4000 linear foot of ditch alignment.

The 1999 survey information shows a significant reduction from upstream to downstream in the cross section width to the south of Madison Avenue crossing. The channel cross section is proposed to be improved by matching the cross section characteristics upstream of the reduction. This improvement is also part of the Tributary "F" alternative solutions and will lower the water surface elevation upstream of Madison Avenue.

The 78$^{th}$ Street South crossdrain is also one of the main channel locations with significant headloss predicted by the computer model. The water surface elevation difference across these pipes is as much as 0.68 feet for the mean annual design storm event. The existing twin 4.58' x 7' arch metal pipes are proposed to be replaced with double 72" reinforced concrete pipes.

This crossdrain upgrade is part of Capital Improvement Project (CIP) #47025, which was in the permitting stage during the earlier phases of this study and has been included in the proposed conditions model. This same CIP project also proposes improvements in the main channel cross section upstream and downstream of 78$^{th}$ Street which were also incorporated in the proposed condition model input.

The main channel cross section improvement east of 78$^{th}$ Street, which includes the south top of bank restoration will help to alleviate offsite inflows into Progress Village from the Delaney Creek Pop-off Canal.

These improvements will not substantially change the water quality treatment level of service for this area. However, the option of placing solid/liquid separation structures as a part of this project should be explored. Water quality could be temporarily impacted during the channel widening process with the disturbance to the soils during the construction. Turbidity barriers and silt screens should be used until the sideslopes can be stabilized by sodding or seeding. If possible, the excavated soils should be removed from the project area to be stockpiled and reused in other County projects.

## 15.2.2.2 Tributaries

The tributaries of the Delaney Pop-off Canal subwatershed consist mostly of man-made ditches along the back lots of residential areas like Fortuna Acres and Green Ridge Estates. The remaining tributaries on the east side of U.S. Highway 301 consist of the Interstate 75 drainage ditch and several ditch systems located in subdivisions of the Pavilion areas.

### 15.2.2.2.1 Tributary "B" (model # 247xxx series)

The Tributary "B" System incorporates the Sanson Park subdivision. This channel runs west to east for approximately 2400 feet to its confluence with the Delaney Pop-off Canal.

The Sanson Park flooding concern described in the Existing Condition chapter will be alleviated by diverting the flow through the Canterbury Lakes Regional Stormwater Detention Facility Project that is currently under review by the governmental regulatory agencies.

The crossdrain upgrade and channel improvements both upstream and downstream of 78$^{th}$ Street described under main channel alternatives are also part of Sanson Park solutions. A series of ponds - model junctions # 240220 and 242225 - will be constructed south of Sanson Park and Tributary "B" in the Canterbury Lakes Regional Stormwater Detention facility. This irregularly shaped pond will serve as drainage for the Canterbury Lakes subdivision and will alleviate the flooding problems in the Sanson Park subdivision. The water surface elevation drops as much as 2.1 feet for the 25-year design storm event and 2.30 feet for the 100-year design storm event.

The proposed Level of Service for the Sanson Park subdivision is improved from C to A for the 25 and 100-year design storm events.

## WATER QUALITY TREATMENT LEVEL OF SERVICE

### Total Suspended Solids

The Sanson Park Regional Treatment Facility project will significantly increase the water quality treatment level of service (WQTLOS) for the parameter of total suspended solids (TSS) in the subbasins where treatment will occur. All but five of the twenty subbasins treated by this facility had some improvement in their treatment level of service. Three subbasins improved one level, seven subbasins improved by two levels and five subbasins improved by three levels. There were only two WQTLOS A scores in the pre-treatment condition. This improves to seven subbasins in the post-treatment condition. WQTLOS B rose from one to five subbasins. These were all new subbasins, the only pre-treatment subbasin B went to an A in the treated condition. The results were the same for WQTLOS C subbasins; all the subbasins with C in the untreated condition rose to A or B in the treated condition. All of the four C subbasins in the treated condition were previously scored F. Again, the same is true for the only D subbasins. In the untreated condition, there was one D score; this subbasin was elevated to an A in the treated condition. Similarly, there was one D score in the treated condition and this subbasin was an F previously. Where there were twelve WQTLOS F in the pre-treatment condition, this falls to only three F scores after treatment.

This project highlights the role of the Highway/Utility land use in the determination of the treatment level of service for the parameter of total suspended solids. For the treated condition WQTLOS F subbasins, the common denominator is that over 30 % of these subbasins are in the Highway/Utility land use. This is further reinforced by the fact that the only D scoring subbasin is over 18 % Highway/Utility land use. This is not too surprising, when the Highway/Utility event mean concentration value for TSS used by the Pollutant Loading and Removal Model is almost ten times the value of the next highest category which is High Density Residential, 261 mg/l and 29 mg/l respectively. So even with 85 % of the load removed, the Highway / Utility land use generates as much, or more than, the untreated single family residential benchmark. The treated C subbasins are between 10 % to 15 % Highway/Utility. Only two of the treated A subbasins contained this land use and they were both less than 0.2 %. For comparison, subbasin 247010 is over 99 % High Density Residential, with the second highest EMC value for TSS, and in the treated condition it rose from an F to a C.

**<u>Total Nitrogen</u>**

Unfortunately, this constituent, which is targeted for reduction by the Tampa Bay Estuary Program (TBEP), is not as easy to remove as TSS. Generally, treatment of stormwater by conventional methods wet detention ponds such as the regional treatment facility only removes around 30 % of this pollutant. Of the 20 subbasins treated by the facility, only five had changes in their level of service. Two of these were F subbasins that were raised to D and the other three were D subbasins that went to C LOS. It is highly likely that they were already on the threshold of moving up and that the 30 % reduction kicked them up into the next level. Here, agriculture seems to be the force driving down the WQTLOS; the EMC for agriculture is twice that of the next land use which is again High Density Residential, 2.349 mg/l and 1.337 mg/l respectively.

## 15.2.2.2.2 Tributary “F” (model # 2425xx series)

The Tributary “F” system incorporates the neighborhood east of Fortuna Acres subdivision. This channel runs east to west for approximately 1300 feet until the confluence with the Delaney Pop-off Canal.

As identified in the Existing Condition chapter of this report, this area provides a low level of flood protection based on computer model results as well as the numerous resident complaints for street and yard flooding.

**<u>Alternative 1</u>**

This alternative proposed the channel and crossdrain improvements located east of the main channel and north of Madison Avenue.

The channel cross section improvement on the tributary “F” begins to the west of 78th

Street at its eastern end and terminates at the confluence with the Pop-off Canal main channel 600 feet north of Madison Avenue. The improved ditch is approximately 1240 feet in length. The new cross sections were designed to shape the bank slopes to a 2 (horizontal) to 1 (vertical) on both sides. The culvert are proposed to be improved as follows:

- Replace the existing double 14” RCP with 3’ x 3.5’ concrete box culvert at the private driveway located on the west right-of-way of 74$^{th}$ Street South.

- Replace the existing Palm Drive double 29” x 45” ERCP with 3.5’ x 6’concrete box culvert.

The above listed alternatives in conjunction with the main channel improvements upstream and downstream of Madison Avenue would bring the level of service on this system from D to A for a 25-year design storm event.

As previously discussed, the mobile home park located west of the Pop-off main channel (2438xx Series) and immediately north of Madison Avenue appears to experience frequent street flooding. The park drains into an apparently land locked man-made pond. Based on computer simulation, flooding occurrs because of the lack of an outfall. Water surface elevation in the Pop-off Canal does not back up into this subdivision. Therefore, an outfall to the pond would alleviate this concern. It is recommended that a positive outfall be established for this pond if one does not exists. It is also recommended that prior to connecting to Pop-off main channel, some form of water treatment procedure be implemented. In the proposed condition model simulation, it was assumed that a half-inch treatment volume takes place in a pond’s underdrain filtration system. Therefore, the proposed 25-foot outfall weir was set at the elevation 10.36 NGVD, which represents the water quality elevation in the mobile home park pond.

With the construction of the proposed outfall structure the Level of Service will be improved from B to A and from D to B for the 25 and 100-year design storm events respectively.

These improvements will not greatly alter the water quality treatment level of service. As with many of the previous projects, the option of installing some sort of solid/liquid separation technology with the new culverts should be explored. During construction, turbidity barriers and silt screens should be deployed until all exposed sediments are stabilized by seeding or sodding. The possibility of removing all excavated materials for later reuse should be explored.

## 15.2.2.2.3 Evergreen Estates System (model # 2520xx series)

The Evergreen Estates System incorporates the Evergreen Estates subdivision located between Falkenburg Road and U.S. Highway 301 and north of Causeway Boulevard. As identified in the Existing Condition chapter of this report, this area provides a low level of flood protection based on computer model results as well as the numerous resident complaints for street and yard flooding.

In order to alleviate the flooding concerns in this residential area, a flow diversion to Delaney Creek's main channel is the proposed solution. The flow will be directed via the U.S. Highway 301 improved crossdrain to an existing man-made channel which will ultimately discharge into Delaney Creek's main channel 1270 feet downstream of the Crosstown Expressway's concrete pile bridge (junction #210240)

This alternative consists of :

- Upgrading the U.S. Highway 301 existing crossdrain from 36" RCP to 4' x 8' concrete box culvert and lowering the invert from 26.4 to 24.0 feet.

- Removing the existing berm located west of U.S. Highway 301 and lowering the existing ditch invert to match with the proposed crossdrain.

- Channel cross section improvements to take place on both sides of U.S. Highway 301. On the east side, beginning within Evergreen Estates (junction #252070) near the cul-de-sac of Ventura Avenue.

- On the west side of U.S. Highway 301, the proposal is to maintain along the connector ditch to the confluence point with Delaney Creek. The improved cross section is proposed for approximately 600 feet of ditch alignment on the east and 2700 feet on the west of U.S. Highway 301. The channel cross section increases the channel capacity to provide the flow toward the west and then north to Delaney Creek without creating an adverse impact on the private property downstream of U.S. Highway 301.

This alternative will improve the Level of Service within Evergreen Estates Subdivision from C to A and from D to C for the 25-year and 100-year design storm events respectively.

With the proposed recommendations for the Delaney Pop-off Main Channel LOS System, the ultimate LOS is B with the exception of an isolated area of the industrial area of Pendola Point Road. Table 15.2 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-2d.

To insure that water quality will not be affected during or after construction, the following is recommended. The channel sideslopes should be constructed at a 4:1 or gentler slope to allow for ease in stabilization with sodding or seeding methods and to aid in preventing sedimentation. Erosion control methods such as silt screens and floating turbidity barriers should be employed during construction and until all exposed soils are stabilized. All excavated soils should be removed from the site and stockpiled for use by the County at a later date. The option of placing solid/liquid separation structures as a part of this project should be explored.

## 15.2.3 NORTH ARCHIE CREEK SYSTEM

With the proposed recommendations for the North Archie Creek Main Channel LOS System, the ultimate LOS is B with the exception of an isolated area for the main channel system. Table 15.3 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-3d.

### 15.2.3.1 North Archie Creek Main Channel

With the proposed recommendations for the North Archie Creek Main Channel LOS System, the ultimate LOS is satisfied for the 10-year/24-hour storm event. Table 15.3 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-3d.

To insure that water quality will not be affected during or after the construction of the by-pass canal, the following is recommended. The channel sideslopes should be constructed at a 4:1 or gentler slope to allow for ease in stabilization with sodding or seeding methods. This will also aid in preventing future erosion and sedimentation. Available erosion control methods such as haybales, silt screens and floating turbidity barriers should be employed during construction. Their use should continue until all exposed soils are stabilized. All excavated soils should be removed from the site and stockpiled for reuse by the County. The option of placing solid/liquid separation structures as a part of this project should be explored.

## 15.2.3.2 Tributary "A"

The proposed LOS of B is achieved for this tributary based on the proposed recommendation. Table 15.3 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-3d.

## 15.2.3.3 Tributary "B"

With the proposed recommendations for Tributary "B", the ultimate LOS (i.e., 25-year/24-hour B) is achieved for this system. However, lowering the water level for Tributary "B" does not solve the road overtopping at 82nd Street crossing of the main channel. Table 15.3 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-3d. However, the 25-year/24-hour proposed conditions LOS of A is attained.

## 15.2.3.4 Tributary "C"

With the proposed recommendations, the water surface elevations decrease as much as half a foot in Tributary "C". Table 15.1 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-3d.

## 15.2.3.5 Unnamed Tributary

This tributary has no historical flooding and the ultimate LOS is attained in the existing LOS so no recommendations were proposed. Table 15.3 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-3d.

### 15.2.3.6 Tributary "D"

With the proposed recommendations, the water surface elevations decrease as much as half a foot in Tributary "D". Table 15.3 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-3d.

### 15.2.3.7 Tributary "F"

With the proposed recommendations, the water surface elevations decrease as much as half a foot in Tributary "F". Table 15.3 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-3d. However, the 25-year/24-hour proposed conditions LOS is still the same as the existing LOS but there is no historical flooding for this area.

### 15.2.3.8 Tributary "G"

With the proposed recommendations, the water surface elevations decrease as much as half a foot in Tributary "G". Table 15.3 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-3d. However, the 25-year/24-hour proposed conditions LOS is still the same as the existing LOS but there are no historical flooding events for this area.

## 15.2.4 ARCHIE CREEK SYSTEM

With the proposed recommendations for the Archie Creek Main Channel LOS System, the ultimate LOS is satisfied with the exception of an isolated areas of the Cargill complex and the Bay. Table 15.4 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-4d.

### 15.2.4.1 Archie Creek Main Channel (I-75 to Krycul)

With the proposed recommendations for the Archie Creek Main Channel LOS System, the ultimate LOS is satisfied for the 10-year/24-hour storm event. Table 15.3 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-4d.

The proposed improvements will not affect the water quality treatment level of service. To insure water quality will not be affected during or after construction, the following is recommended. The channel sideslopes should be constructed at a 4:1 or gentler slope, this will allow for ease in stabilization with sodding or seeding methods and aid in preventing sedimentation. Erosion control methods such as silt screens and floating turbidity barriers should be employed during construction and until all exposed soils are stabilized. All excavated soils should be removed from the site and stockpiled for later reuse by the County.

## 15.2.4.2 Tributary “A”

With the proposed recommendations, the water surface elevations decrease as much as one half foot in Tributary “A”. Table 15.4 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-4d. However, the 25-year/24-hour proposed conditions LOS is still the same as the existing LOS but there has been no historical flooding for this area.

The proposed alternative will not significantly alter the water quality treatment level of service. It is recommended that the option of incorporating solid/liquid separation devices as part of the project be explored.

## 15.2.4.3 78th Street Ditch

With the proposed recommendations, the water surface elevations decrease as much as half a foot in 78th Street Ditch. Table 15.4 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-4d. However, there are secondary site and yard flooding complaints on the west side of the ditch.

## 15.2.4.4 Tributary "B"

With the proposed recommendations, the proposed LOS has been attained for this tributary. This area is the Parkway Business Center in which several areas of this ditch have been upgraded by the developer. Table 15.4 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-4d.

## 15.2.4.5 Tributary "C"

With the proposed recommendations, the proposed LOS has been attained for this tributary. This area is the undeveloped area of the Parkway Business Center in which natural wetlands and open land are not resided by residents so historical complaints have not been recorded. There is secondary flooding of a dirt road crossing for cattle. Table 15.4 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-4d.

## 15.2.4.6 Tributary "D"

With the proposed recommendations, the proposed LOS has been attained for this tributary. This area is the Lake St. Charles subdivision in which this tributary has been upgraded by the developer. Table 15.4 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS.

## 15.2.4.7 Tributary "F"

With the proposed recommendations, the proposed LOS has been attained for this tributary. This area is the Starlite subdivision in which this tributary has been upgraded by the County. The portion of this tributary that flows south has experienced storage upgrade by a developer of the McMullen Farms subdivision. Table 15.4 shows the landmark elevations, water surface elevations, and flood level designations for the proposed LOS. Detailed locations where flooding is predicted to occur for the 25-year/24-hour storm event is shown in Exhibit 15-1-4d.

# Delaney Creek Proposed LOS

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**Table 15.1**

| DELANEY CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | Landmark Elevations | | | Water Surface Elevations | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 1C | 210010 | 5.25 | 5.30 | 6.60 | 3.41 | 3.93 | 4.65 | 5.11 | 6.02 | 6.43 | A | A | A | A | C | C |
| 1C | 210020 | 6.05 | 6.50 | 7.50 | 3.84 | 4.50 | 5.39 | 5.92 | 6.91 | 7.36 | A | A | A | A | C | C |
| 1C | 210025 | 6.45 | 6.70 | 7.50 | 4.49 | 4.85 | 5.41 | 5.82 | 6.73 | 7.37 | A | A | A | A | C | C |
| 6 | 210040 | 6.50 | 7.20 | 8.20 | 4.28 | 5.08 | 6.18 | 6.86 | 8.12 | 8.66 | A | A | A | B | C | D |
| 6 | 210060 | 10.55 | 10.50 | 11.00 | 4.66 | 5.51 | 6.70 | 7.39 | 8.78 | 9.38 | A | A | A | A | A | A |
| 6 | 210065 | 10.75 | 11.00 | 12.00 | 5.77 | 6.19 | 7.90 | 8.87 | 9.86 | 10.21 | A | A | A | A | A | A |
| 6 | 210080 | 10.70 | 12.00 | 13.00 | 6.50 | 6.60 | 7.75 | 8.42 | 9.72 | 10.30 | A | A | A | A | A | A |
| 6 | 210090 | 11.55 | 12.10 | 12.60 | 7.20 | 7.56 | 8.70 | 9.36 | 10.59 | 11.14 | A | A | A | A | A | A |
| 13/6 | 210100 | 11.25 | 11.80 | 12.30 | 7.70 | 7.88 | 9.02 | 9.69 | 10.93 | 11.48 | A | A | A | A | A | B |
| 13 | 210120 | 12.15 | 12.50 | 13.00 | 8.50 | 8.57 | 9.80 | 10.52 | 11.83 | 12.42 | A | A | A | A | A | B |
| 12 | 210125 | 11.95 | 12.50 | 13.00 | 12.54 | 12.73 | 12.96 | 13.10 | 13.34 | 13.45 | C | C | C | D | D | D |
| 13 | 210150 | 18.55 | 18.50 | 19.00 | 11.33 | 12.14 | 13.20 | 13.83 | 14.90 | 15.36 | A | A | A | A | A | A |
| 12 | 210170 | 18.05 | 18.80 | 19.30 | 12.98 | 13.70 | 14.62 | 15.17 | 16.10 | 16.48 | A | A | A | A | A | A |
| 12 | 210180 | 19.85 | 19.00 | 19.50 | 15.06 | 15.85 | 16.67 | 17.14 | 17.90 | 18.20 | A | A | A | A | A | A |
| 18 | 210190 | 19.25 | 21.40 | 21.90 | 15.37 | 16.24 | 17.48 | 18.15 | 19.41 | 20.09 | A | A | A | A | B | B |
| 18 | 210200 | 19.95 | 21.50 | 22.00 | 15.42 | 16.29 | 17.53 | 18.19 | 19.45 | 20.12 | A | A | A | A | A | B |
| 18 | 210210 | 22.65 | 24.50 | 25.00 | 16.73 | 17.36 | 18.44 | 19.04 | 20.17 | 20.75 | A | A | A | A | A | A |
| 18 | 210230 | 22.55 | 24.50 | 25.00 | 17.50 | 18.12 | 18.97 | 19.53 | 20.65 | 21.20 | A | A | A | A | A | A |
| 23 | 210260 | 27.45 | 25.50 | 26.70 | 23.87 | 24.48 | 25.28 | 25.76 | 26.56 | 26.90 | A | A | A | C | C | D |
| 23 | 210280 | 29.60 | 997.50 | 998.00 | 25.47 | 26.17 | 27.05 | 27.53 | 28.30 | 28.65 | A | A | A | A | A | A |
| 24 | 210290 | 27.85 | 28.00 | 29.70 | 25.89 | 26.60 | 27.45 | 27.93 | 28.70 | 29.05 | A | A | A | B | C | C |
| 24/29 | 210300 | 31.50 | 997.50 | 998.00 | 26.14 | 26.86 | 27.72 | 28.20 | 28.99 | 29.35 | A | A | A | A | A | A |
| 29 | 210332 | 35.50 | 37.50 | 39.00 | 29.43 | 30.36 | 31.71 | 32.62 | 34.47 | 35.42 | A | A | A | A | A | A |
| 29 | 210333 | 44.45 | 40.50 | 41.00 | 37.00 | 37.72 | 38.60 | 39.13 | 40.06 | 40.48 | A | A | A | A | A | A |
| 30 | 210335 | 997.25 | 997.50 | 998.00 | 26.81 | 27.49 | 28.23 | 28.60 | 29.29 | 29.60 | E | E | E | E | E | E |
| 30 | 210336 | 997.25 | 997.50 | 998.00 | 27.05 | 27.51 | 28.29 | 28.66 | 29.32 | 29.63 | E | E | E | E | E | E |
| 30 | 210350 | 997.25 | 997.50 | 998.00 | 27.04 | 27.86 | 28.83 | 29.28 | 30.05 | 30.43 | E | E | E | E | E | E |
| 30 | 210360 | 997.25 | 997.50 | 998.00 | 27.06 | 27.98 | 29.01 | 29.48 | 30.29 | 30.68 | E | E | E | E | E | E |
| 5 | 211010 | 13.05 | 12.50 | 13.00 | 6.70 | 7.58 | 8.72 | 9.38 | 10.62 | 11.17 | A | A | A | A | A | A |
| 12 | 211060 | 9.45 | 11.50 | 12.00 | 8.68 | 9.60 | 10.49 | 10.87 | 11.56 | 11.87 | A | B | B | B | C | C |
| 12 | 211080 | 12.75 | 13.50 | 14.00 | 10.38 | 11.08 | 11.95 | 12.54 | 13.50 | 13.89 | A | A | A | A | C | C |
| 12 | 211100 | 15.45 | 15.50 | 16.00 | 12.76 | 13.16 | 13.65 | 13.96 | 14.55 | 14.76 | A | A | A | A | A | A |
| 12 | 211110 | 997.25 | 22.20 | 22.70 | 19.34 | 19.44 | 19.58 | 19.67 | 19.82 | 19.89 | A | A | A | A | A | A |
| 5 | 211115 | 16.95 | 16.30 | 17.20 | 14.88 | 15.13 | 15.46 | 15.66 | 16.06 | 16.25 | A | A | A | A | A | A |
| 5 | 211030 | 13.25 | 13.60 | 15.20 | 6.93 | 7.78 | 8.90 | 9.55 | 10.76 | 11.30 | A | A | A | A | A | A |
| 11 | 211160 | 17.55 | 17.60 | 18.10 | 16.23 | 16.60 | 16.87 | 16.95 | 17.18 | 17.37 | A | A | A | A | A | A |
| 11 | 211165 | 17.55 | 18.60 | 19.10 | 17.24 | 17.32 | 17.44 | 17.51 | 17.64 | 17.71 | A | A | A | A | B | B |
| 5 | 211185 | 15.95 | 16.00 | 16.50 | 14.85 | 15.10 | 15.37 | 15.51 | 15.76 | 15.87 | A | A | A | A | A | A |
| 13 | 211510 | 15.75 | 15.50 | 16.00 | 11.98 | 12.58 | 13.48 | 14.04 | 14.55 | 14.81 | A | A | A | A | A | A |
| 13/6 | 211530 | 999.25 | 999.50 | 1000.00 | 13.36 | 14.22 | 15.33 | 15.83 | 16.62 | 16.96 | E | E | E | E | E | E |
| 12 | 212000 | 16.95 | 18.50 | 19.00 | 13.53 | 14.20 | 15.07 | 15.60 | 16.50 | 16.88 | A | A | A | A | A | A |
| 12 | 212030 | 17.95 | 20.50 | 21.00 | 13.91 | 14.68 | 15.76 | 16.44 | 17.72 | 18.31 | A | A | A | A | A | B |

# Delaney Creek Proposed LOS

8/30/01

**Table 15.1**

| DELANEY CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | **2.33-yr** | **5-yr** | **10-yr** | **25-yr** | **50-YR** | **100-yr** | **2.33-yr** | **5-yr** | **10-yr** | **25-yr** | **50-yr** | **100-yr** |
| 12 | 212040 | 18.45 | 19.50 | 20.00 | 13.72 | 14.38 | 15.23 | 15.75 | 16.64 | 17.03 | A | A | A | A | A | A |
| 12 | 212060 | 18.05 | 19.50 | 20.00 | 13.94 | 14.54 | 15.38 | 15.91 | 16.84 | 17.25 | A | A | A | A | A | A |
| 12 | 212080 | 17.35 | 18.50 | 19.00 | 14.28 | 14.95 | 15.97 | 16.56 | 17.95 | 18.43 | A | A | A | A | B | B |
| 12 | 212100 | 17.15 | 18.50 | 20.00 | 14.57 | 15.29 | 16.47 | 17.16 | 18.39 | 18.84 | A | A | A | B | B | C |
| 11 | 212130 | 18.85 | 20.50 | 21.00 | 15.15 | 15.79 | 16.88 | 17.56 | 18.84 | 19.36 | A | A | A | A | A | B |
| 18 | 213010 | 20.75 | 22.50 | 23.00 | 17.11 | 17.79 | 18.78 | 19.44 | 20.76 | 21.36 | A | A | A | A | B | B |
| 18 | 213040 | 21.45 | 23.50 | 24.00 | 17.55 | 18.33 | 19.46 | 20.24 | 21.41 | 21.92 | A | A | A | A | A | B |
| 17 | 213060 | 24.25 | 25.50 | 26.00 | 17.90 | 18.71 | 19.96 | 20.81 | 22.11 | 22.59 | A | A | A | A | A | A |
| 18 | 213510 | 24.05 | 25.50 | 26.00 | 18.92 | 19.44 | 20.26 | 20.79 | 21.97 | 22.65 | A | A | A | A | A | A |
| 18 | 213530 | 23.65 | 25.50 | 26.00 | 20.39 | 20.87 | 21.74 | 22.30 | 23.72 | 24.56 | A | A | A | A | B | B |
| 18 | 213800 | 997.25 | 997.50 | 998.00 | 24.45 | 24.73 | 25.08 | 25.29 | 25.66 | 25.83 | E | E | E | E | E | E |
| 18 | 213810 | 997.25 | 997.50 | 998.00 | 27.63 | 27.83 | 28.10 | 28.26 | 28.57 | 28.72 | E | E | E | E | E | E |
| 23 | 214012 | 27.45 | 997.50 | 998.00 | 27.10 | 27.56 | 28.13 | 28.46 | 29.07 | 29.32 | A | B | B | B | B | B |
| 17/23 | 214020 | 27.85 | 997.50 | 998.00 | 24.93 | 25.83 | 27.01 | 27.39 | 27.82 | 27.99 | A | A | A | A | A | B |
| 23 | 214040 | 997.25 | 997.50 | 998.00 | 29.29 | 30.09 | 31.05 | 31.56 | 32.46 | 32.89 | E | E | E | E | E | E |
| 23 | 214053 | 29.05 | 997.50 | 998.00 | 27.22 | 27.65 | 28.23 | 28.59 | 29.25 | 29.55 | A | A | A | A | B | B |
| 24 | 214500 | 997.25 | 997.50 | 998.00 | 25.35 | 25.51 | 25.74 | 25.88 | 26.43 | 27.17 | E | E | E | E | E | E |
| 23 | 215010 | 28.75 | 997.50 | 998.00 | 25.53 | 26.23 | 27.13 | 27.63 | 28.43 | 28.82 | A | A | A | A | A | B |
| 23 | 215023 | 30.25 | 29.40 | 29.90 | 25.18 | 26.12 | 27.10 | 27.64 | 28.58 | 29.21 | A | A | A | A | A | A |
| 23 | 215041 | 30.15 | 997.50 | 998.00 | 28.04 | 28.17 | 28.67 | 29.25 | 30.01 | 30.28 | A | A | A | A | A | B |
| 23 | 215042 | 31.15 | 997.50 | 998.00 | 28.04 | 28.21 | 28.91 | 29.52 | 30.09 | 30.36 | A | A | A | A | A | A |
| 23 | 215051 | 997.25 | 997.50 | 998.00 | 27.15 | 28.14 | 29.00 | 29.76 | 31.15 | 31.76 | E | E | E | E | E | E |
| 23 | 215060 | 32.15 | 30.50 | 31.00 | 26.33 | 26.82 | 27.84 | 28.43 | 29.37 | 29.77 | A | A | A | A | A | A |
| 23 | 215070 | 32.15 | 30.50 | 32.50 | 26.87 | 27.39 | 28.26 | 28.88 | 30.11 | 30.52 | A | A | A | A | A | C |
| 23/29 | 215500 | 31.15 | 29.30 | 30.50 | 25.47 | 26.18 | 27.06 | 27.54 | 28.31 | 28.66 | A | A | A | A | A | A |
| 23/29 | 215520 | 31.25 | 31.75 | 33.75 | 29.08 | 29.70 | 30.41 | 30.79 | 31.41 | 31.72 | A | A | A | A | B | B |
| 29 | 215530 | 31.65 | 32.75 | 33.75 | 29.51 | 30.31 | 31.34 | 31.91 | 32.88 | 33.30 | A | A | A | B | C | C |
| 29 | 215537 | 997.25 | 997.50 | 998.00 | 31.53 | 32.77 | 34.64 | 35.90 | 37.61 | 38.05 | E | E | E | E | E | E |
| 29 | 215538 | 32.25 | 32.50 | 40.00 | 29.69 | 30.70 | 31.52 | 31.73 | 32.32 | 32.82 | A | A | A | A | B | C |
| 29 | 215542 | 53.25 | 40.00 | 56.90 | 37.91 | 38.27 | 38.68 | 38.92 | 39.36 | 39.57 | A | A | A | A | A | A |
| 29 | 215550 | 52.25 | 40.30 | 56.90 | 37.93 | 38.31 | 38.80 | 39.15 | 40.03 | 40.50 | A | A | A | A | A | C |
| 24 | 216000 | 29.75 | 29.20 | 29.70 | 25.89 | 26.60 | 27.46 | 27.94 | 28.72 | 29.06 | A | A | A | A | A | A |
| 24 | 216500 | 997.25 | 997.50 | 998.00 | 25.86 | 26.44 | 26.99 | 27.32 | 28.09 | 28.42 | E | E | E | E | E | E |
| 24 | 216510 | 997.25 | 997.50 | 998.00 | 25.86 | 26.44 | 26.99 | 27.32 | 28.09 | 28.42 | E | E | E | E | E | E |
| 30 | 217000 | 997.25 | 997.50 | 998.00 | 26.92 | 27.69 | 28.57 | 29.02 | 29.74 | 30.08 | E | E | E | E | E | E |
| 30 | 217020 | 997.25 | 997.50 | 998.00 | 27.80 | 28.36 | 29.12 | 29.58 | 30.48 | 30.93 | E | E | E | E | E | E |
| 30 | 220000 | 997.25 | 997.50 | 998.00 | 27.13 | 28.12 | 29.22 | 29.86 | 30.79 | 31.23 | E | E | E | E | E | E |

# Delaney Creek Proposed LOS

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**Table 15.1**

| DELANEY CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 36 | 220010 | 32.05 | 997.50 | 998.00 | 28.79 | 29.07 | 29.61 | 30.07 | 30.89 | 31.30 | A | A | A | A | A | A |
| 36 | 220040 | 30.25 | 30.10 | 34.70 | 28.91 | 29.31 | 29.98 | 30.40 | 31.17 | 31.59 | A | A | A | C | C | C |
| 36 | 220050 | 30.45 | 30.70 | 31.40 | 28.93 | 29.42 | 30.05 | 30.44 | 31.19 | 31.61 | A | A | A | A | C | D |
| 41 | 220060 | 31.25 | 32.50 | 34.00 | 28.97 | 29.51 | 30.20 | 30.60 | 31.33 | 31.73 | A | A | A | A | B | B |
| 41 | 220070 | 33.90 | 33.50 | 34.00 | 30.91 | 31.32 | 31.91 | 32.24 | 32.84 | 33.11 | A | A | A | A | A | A |
| 41 | 220110 | 36.25 | 37.25 | 38.75 | 32.72 | 33.18 | 34.39 | 35.12 | 36.40 | 36.72 | A | A | A | A | B | B |
| 41 | 220130 | 36.50 | 37.25 | 38.75 | 32.81 | 33.30 | 34.53 | 35.27 | 36.86 | 37.32 | A | A | A | A | B | C |
| 41 | 220140 | 36.25 | 37.25 | 38.75 | 32.89 | 33.39 | 34.63 | 35.38 | 36.97 | 37.44 | A | A | A | A | B | C |
| 41 | 220170 | 44.25 | 37.50 | 38.00 | 33.90 | 34.42 | 35.20 | 35.91 | 36.89 | 37.36 | A | A | A | A | A | A |
| 41 | 220180 | 44.25 | 45.50 | 53.00 | 33.96 | 34.60 | 35.80 | 36.79 | 39.01 | 40.28 | A | A | A | A | A | A |
| 41 | 220190 | 44.25 | 38.50 | 45.00 | 35.16 | 36.13 | 37.29 | 38.24 | 39.37 | 39.81 | A | A | A | A | C | C |
| 41 | 220195 | 41.75 | 42.00 | 43.00 | 41.35 | 41.71 | 42.25 | 42.60 | 43.28 | 43.60 | A | A | C | C | D | D |
| 41 | 220200 | 39.25 | 40.25 | 41.00 | 35.55 | 36.51 | 37.33 | 37.91 | 39.06 | 39.53 | A | A | A | A | A | B |
| 45 | 220210 | 40.00 | 40.00 | 41.00 | 35.63 | 36.56 | 37.36 | 38.00 | 39.08 | 39.56 | A | A | A | A | A | A |
| 30 | 221000 | 31.05 | 30.00 | 41.00 | 27.32 | 28.13 | 29.23 | 29.87 | 30.81 | 31.25 | A | A | A | A | C | C |
| 30 | 221030 | 33.25 | 34.25 | 36.00 | 28.64 | 29.10 | 29.84 | 30.34 | 31.45 | 31.83 | A | A | A | A | A | A |
| 30/36 | 221500 | 35.25 | 35.50 | 36.00 | 34.19 | 34.53 | 35.04 | 35.35 | 35.90 | 36.10 | A | A | A | B | C | D |
| 30/36 | 221520 | 46.35 | 48.00 | 49.00 | 36.34 | 36.70 | 37.66 | 38.13 | 38.87 | 39.06 | A | A | A | A | A | A |
| 29/35 | 221540 | 43.25 | 41.50 | 43.00 | 37.08 | 37.38 | 37.94 | 38.41 | 39.37 | 39.77 | A | A | A | A | A | A |
| 35 | 221550 | 45.25 | 46.50 | 48.00 | 36.59 | 36.83 | 37.21 | 37.46 | 37.94 | 38.17 | A | A | A | A | A | A |
| 29/35 | 221560 | 51.25 | 41.50 | 43.00 | 36.67 | 36.95 | 37.40 | 37.72 | 38.36 | 38.68 | A | A | A | A | A | A |
| 35 | 221580 | 52.25 | 53.00 | 54.60 | 38.59 | 39.62 | 41.14 | 42.06 | 43.74 | 44.51 | A | A | A | A | A | A |
| 36 | 222000 | 32.05 | 32.50 | 33.50 | 28.55 | 28.98 | 29.73 | 30.23 | 30.95 | 31.35 | A | A | A | A | A | A |
| 36 | 222020 | 32.00 | 32.50 | 33.00 | 28.45 | 29.05 | 29.84 | 30.35 | 31.28 | 31.72 | A | A | A | A | A | A |
| 36 | 222030 | 31.05 | 30.50 | 31.90 | 28.45 | 29.05 | 29.85 | 30.36 | 31.29 | 31.73 | A | A | A | A | C | C |
| 37 | 222040 | 32.35 | 30.90 | 32.00 | 28.46 | 29.06 | 29.86 | 30.37 | 31.33 | 31.78 | A | A | A | A | C | C |
| 37 | 222050 | 32.25 | 32.40 | 33.00 | 28.47 | 29.10 | 29.91 | 30.42 | 31.45 | 31.90 | A | A | A | A | A | A |
| 37 | 222060 | 33.35 | 33.60 | 34.10 | 28.47 | 29.10 | 29.91 | 30.42 | 31.46 | 31.90 | A | A | A | A | A | A |
| 37 | 222080 | 32.35 | 32.50 | 33.10 | 28.49 | 29.15 | 29.98 | 30.48 | 31.50 | 31.93 | A | A | A | A | A | A |
| 42 | 222090 | 33.25 | 35.00 | 36.00 | 30.77 | 30.95 | 31.70 | 32.10 | 32.77 | 33.07 | A | A | A | A | A | A |
| 36 | 222500 | 31.65 | 31.90 | 35.00 | 28.77 | 29.56 | 31.08 | 31.80 | 33.16 | 33.79 | A | A | A | B | C | C |
| 37 | 222520 | 32.40 | 33.50 | 34.80 | 29.14 | 30.27 | 31.97 | 32.79 | 34.18 | 34.77 | A | A | A | B | C | C |
| 37 | 222530 | 32.35 | 33.50 | 34.80 | 29.13 | 30.26 | 31.95 | 32.79 | 34.17 | 34.76 | A | A | A | B | C | C |
| 37 | 222540 | 32.03 | 32.50 | 34.30 | 28.71 | 29.54 | 30.78 | 31.47 | 32.74 | 33.31 | A | A | A | A | C | C |
| 36 | 223000 | 31.50 | 32.00 | 33.00 | 30.01 | 30.15 | 30.40 | 30.57 | 31.05 | 31.47 | A | A | A | A | A | A |
| 36 | 223020 | 40.25 | 40.50 | 41.00 | 27.03 | 27.33 | 27.82 | 28.17 | 31.68 | 33.17 | A | A | A | A | A | A |
| 36 | 223030 | 34.75 | 31.00 | 35.00 | 33.50 | 33.98 | 34.30 | 34.46 | 34.73 | 34.85 | C | C | C | C | C | C |

**Delaney Creek Proposed LOS**

8/30/01

**Table 15.1**

| DELANEY CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 35 | 223050 | 36.25 | 40.50 | 56.00 | 31.76 | 32.10 | 32.52 | 32.76 | 33.18 | 33.37 | A | A | A | A | A | A |
| 41 | 224010 | 29.25 | 35.50 | 37.00 | 29.45 | 29.99 | 30.96 | 31.55 | 32.52 | 32.92 | B | B | B | B | B | B |
| 41 | 224050 | 34.25 | 35.50 | 36.00 | 30.54 | 31.15 | 32.03 | 32.62 | 34.06 | 34.41 | A | A | A | A | A | B |
| 41 | 225010 | 34.25 | 35.50 | 37.00 | 31.99 | 32.51 | 33.63 | 34.30 | 35.41 | 35.88 | A | A | A | B | B | C |
| 41 | 225017 | 37.25 | 39.50 | 40.00 | 36.97 | 38.14 | 39.07 | 39.54 | 40.30 | 40.62 | A | B | B | C | D | D |
| 41 | 225110 | 45.25 | 46.50 | 47.00 | 38.71 | 38.90 | 39.22 | 39.69 | 40.46 | 40.80 | A | A | A | A | A | A |
| 41 | 225120 | 38.25 | 40.50 | 41.00 | 38.90 | 39.09 | 39.35 | 39.80 | 40.58 | 40.93 | B | B | B | B | C | C |
| 41 | 225130 | 47.15 | 49.50 | 51.00 | 35.16 | 36.13 | 37.29 | 38.25 | 39.38 | 39.82 | A | A | A | A | A | A |
| 41 | 225140 | 44.25 | 44.80 | 46.00 | 35.16 | 36.13 | 37.29 | 38.24 | 39.37 | 39.81 | A | A | A | A | A | A |
| 41 | 225150 | 997.25 | 997.50 | 998.00 | 39.32 | 41.98 | 43.52 | 43.77 | 44.19 | 44.37 | E | E | E | E | E | E |
| 41 | 225160 | 997.25 | 997.50 | 998.00 | 43.92 | 44.06 | 44.26 | 44.38 | 44.62 | 44.71 | E | E | E | E | E | E |
| 45 | 226000 | 37.37 | 37.50 | 39.00 | 35.64 | 36.57 | 37.37 | 38.01 | 39.10 | 39.59 | A | A | B | C | D | D |
| 45 | 227000 | 50.25 | 45.50 | 56.00 | 43.19 | 43.48 | 43.96 | 44.29 | 44.93 | 45.24 | A | A | A | A | A | A |
| 45 | 227010 | 997.25 | 997.50 | 998.00 | 46.84 | 47.12 | 47.31 | 47.68 | 48.29 | 48.66 | E | E | E | E | E | E |
| 45 | 227020 | 997.25 | 997.50 | 998.00 | 45.35 | 46.17 | 46.40 | 46.72 | 47.35 | 47.70 | E | E | E | E | E | E |
| 45 | 227030 | 52.25 | 41.70 | 53.00 | 46.28 | 47.69 | 50.34 | 50.65 | 51.25 | 51.59 | C | C | C | C | C | C |
| 49 | 227040 | 59.05 | 60.50 | 61.00 | 57.41 | 57.94 | 58.32 | 58.48 | 58.96 | 59.22 | A | A | A | A | A | B |
| 45/46 | 227050 | 55.25 | 47.50 | 48.00 | 31.52 | 35.92 | 41.92 | 45.42 | 51.00 | 53.76 | A | A | A | A | D | D |
| 49 | 227060 | 89.05 | 79.20 | 95.00 | 72.52 | 73.36 | 74.75 | 75.75 | 77.81 | 78.86 | A | A | A | A | A | A |
| 49 | 227070 | 89.15 | 89.20 | 89.00 | 81.80 | 82.18 | 82.78 | 83.19 | 84.03 | 84.45 | A | A | A | A | A | A |
| 50 | 227080 | 73.85 | 74.10 | 74.60 | 69.90 | 70.34 | 70.72 | 71.06 | 71.75 | 72.09 | A | A | A | A | A | A |
| 50 | 227090 | 74.65 | 75.50 | 76.00 | 73.59 | 73.97 | 74.51 | 74.84 | 75.48 | 75.78 | A | A | A | B | B | C |
| 30 | 230005 | 30.25 | 997.50 | 998.00 | 28.55 | 29.00 | 29.61 | 30.01 | 30.82 | 31.23 | A | A | A | A | B | B |
| 30 | 230012 | 32.75 | 997.50 | 998.00 | 31.06 | 31.86 | 32.87 | 33.45 | 34.48 | 34.97 | A | A | B | B | B | B |
| 30 | 230030 | 30.25 | 30.90 | 31.40 | 28.54 | 28.98 | 29.60 | 30.00 | 30.73 | 31.11 | A | A | A | A | B | C |
| 31 | 230033 | 32.75 | 997.50 | 998.00 | 31.07 | 31.45 | 32.04 | 32.44 | 33.24 | 33.64 | A | A | A | A | B | B |
| 37 | 230090 | 32.35 | 31.80 | 32.50 | 29.66 | 30.06 | 30.65 | 31.01 | 31.72 | 32.05 | A | A | A | A | A | C |

## Delaney Creek Proposed LOS

8/30/01

**Table 15.1**

| DELANEY CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 42 | 230170 | 35.05 | 40.00 | 41.00 | 31.96 | 32.29 | 33.02 | 33.54 | 34.56 | 34.95 | A | A | A | A | A | A |
| 42 | 230180 | 41.25 | 41.50 | 42.00 | 32.23 | 33.19 | 34.45 | 34.91 | 35.39 | 35.64 | A | A | A | A | A | A |
| 46 | 230190 | 36.75 | 41.00 | 42.00 | 32.23 | 33.19 | 35.45 | 38.18 | 40.18 | 40.87 | A | A | A | B | B | B |
| 46 | 230200 | 48.25 | 48.50 | 49.50 | 46.80 | 47.54 | 48.46 | 49.01 | 50.00 | 50.43 | A | A | B | C | D | D |
| 42 | 231000 | 34.45 | 35.00 | 36.00 | 31.64 | 32.08 | 32.63 | 32.96 | 33.51 | 33.76 | A | A | A | A | A | A |
| 42 | 232000 | 34.05 | 40.00 | 41.00 | 32.98 | 32.98 | 33.81 | 34.57 | 36.10 | 36.89 | A | A | A | B | B | B |
| 42/46 | 233000 | 43.91 | 44.50 | 46.00 | 41.05 | 41.92 | 42.93 | 43.48 | 44.32 | 44.61 | A | A | A | A | B | C |
| 45/46 | 233010 | 37.05 | 44.00 | 45.00 | 40.00 | 40.00 | 40.00 | 40.00 | 51.00 | 53.76 | B | B | B | B | D | D |
| 42 | 234000 | 44.75 | 36.90 | 45.50 | 31.00 | 31.00 | 31.00 | 31.00 | 31.00 | 31.00 | A | A | A | A | A | A |

# Delaney Pop-off Canal Proposed LOS

8/30/01

**Table 15.2**

| DELANEY POP-OFF CANAL SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 2 | 200000 | 7.70 | 7.40 | 10.40 | 7.64 | 8.28 | 9.28 | 9.95 | 11.32 | 12.01 | C | C | C | C | D |
| 2 | 200010 | 7.70 | 7.40 | 10.40 | 7.57 | 8.28 | 9.28 | 9.95 | 11.32 | 12.01 | C | C | C | C | D |
| 2 | 200020 | 8.40 | 999.00 | 999.00 | 8.58 | 8.66 | 9.28 | 9.95 | 11.32 | 12.01 | B | B | B | B | B |
| 2 | 200025 | 8.55 | 8.60 | 10.70 | 8.71 | 8.79 | 9.28 | 9.95 | 11.32 | 12.01 | C | C | C | C | D |
| 2 | 200030 | 999.00 | 999.00 | 999.00 | 7.99 | 8.28 | 9.28 | 9.95 | 11.32 | 12.01 | E | E | E | E | E |
| 2 | 200040 | 999.00 | 999.00 | 999.00 | 7.57 | 8.28 | 9.28 | 9.95 | 11.32 | 12.01 | E | E | E | E | E |
| 2 | 200050 | 8.45 | 999.00 | 999.00 | 7.57 | 8.28 | 9.28 | 9.95 | 11.32 | 12.01 | A | A | B | B | B |
| 2 | 200065 | 999.00 | 999.00 | 999.00 | 3.61 | 3.94 | 4.41 | 4.83 | 5.61 | 5.92 | E | E | E | E | E |
| 2 | 200070 | 7.85 | 999.00 | 999.00 | 4.51 | 5.35 | 6.79 | 7.59 | 8.48 | 8.79 | A | A | A | A | B |
| 7 | 200090 | 8.55 | 5.90 | 6.40 | 4.74 | 5.71 | 7.34 | 8.20 | 9.18 | 9.52 | A | A | D | D | D |
| 6 | 200100 | 7.95 | 5.80 | 7.30 | 5.54 | 6.70 | 7.76 | 8.46 | 9.51 | 9.89 | A | C | D | D | D |
| 7 | 200110 | 9.45 | 999.00 | 999.00 | 5.85 | 6.76 | 8.43 | 9.54 | 10.73 | 11.21 | A | A | A | B | B |
| 7&6&2013 | 200120 | 8.55 | 8.80 | 9.30 | 6.58 | 7.34 | 8.69 | 9.75 | 10.97 | 11.48 | A | A | B | D | D |
| 6 | 200130 | 10.50 | 999.00 | 999.00 | 7.03 | 7.85 | 9.09 | 10.04 | 11.34 | 11.90 | A | A | A | A | B |
| 6&13 | 200140 | 10.20 | 10.80 | 11.30 | 9.39 | 9.85 | 10.27 | 10.48 | 11.52 | 12.06 | A | A | B | B | D |
| 14 | 200150 | 15.95 | 14.70 | 15.20 | 11.24 | 12.10 | 13.49 | 13.86 | 14.17 | 14.42 | A | A | A | A | A |
| 14 | 200335 | 10.25 | 12.70 | 13.40 | 9.40 | 9.90 | 10.40 | 10.65 | 11.82 | 12.38 | A | A | B | B | B |
| 7 | 200300 | 0.00 | 0.00 | 0.00 | 7.78 | 8.56 | 9.10 | 9.38 | 10.46 | 10.98 | D | D | D | D | D |
| 7 | 200310 | 9.05 | 9.30 | 9.80 | 8.54 | 9.14 | 10.21 | 10.85 | 12.16 | 12.78 | A | B | D | D | D |
| 7 | 200315 | 999.00 | 999.00 | 999.00 | 8.54 | 9.15 | 10.23 | 10.86 | 12.18 | 12.80 | E | E | E | E | E |
| 7 | 200320 | 9.65 | 999.00 | 999.00 | 8.55 | 9.18 | 10.27 | 10.94 | 12.32 | 12.97 | A | A | B | B | B |
| 7 | 200330 | 10.25 | 999.00 | 999.00 | 9.35 | 9.85 | 10.35 | 10.66 | 11.89 | 12.47 | A | A | B | B | B |
| | | | | | | | | | | | | | | | |
| 8 | 240040 | 9.05 | 999.00 | 999.00 | 3.91 | 4.53 | 5.36 | 5.84 | 6.72 | 7.09 | A | A | A | A | A |
| 8 | 240050 | 6.95 | 999.00 | 999.00 | 4.27 | 4.93 | 5.79 | 6.25 | 7.06 | 7.41 | A | A | A | A | B |
| 8 | 240060 | 6.95 | 7.70 | 8.40 | 4.36 | 5.08 | 6.13 | 6.72 | 7.72 | 8.13 | A | A | A | A | C |
| 8 | 240070 | 7.75 | 7.75 | 8.00 | 4.50 | 5.14 | 6.25 | 6.88 | 7.94 | 8.36 | A | A | A | A | D |
| 8 | 240080 | 8.55 | 9.30 | 9.80 | 4.72 | 5.34 | 6.42 | 7.03 | 8.06 | 8.47 | A | A | A | A | A |

**Delaney Pop-off Canal Proposed LOS**

8/30/01

**Table 15.2**

| DELANEY POP-OFF CANAL SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 8 | 240085 | 999.00 | 999.00 | 999.00 | 5.36 | 5.49 | 5.69 | 5.83 | 6.50 | 7.03 | E | E | E | E | E |
| 8 | 240090 | 8.55 | 8.70 | 9.20 | 5.20 | 5.74 | 6.81 | 7.40 | 8.40 | 8.82 | A | A | A | A | C |
| 8 | 240100 | 8.35 | 8.35 | 8.70 | 5.40 | 6.11 | 7.18 | 7.75 | 8.73 | 9.14 | A | A | A | A | D |
| 14 | 240110 | 999.00 | 999.00 | 999.00 | 5.88 | 6.75 | 7.86 | 8.44 | 9.43 | 9.86 | E | E | E | E | E |
| 14 | 240120 | 14.55 | 14.80 | 15.30 | 6.37 | 7.32 | 8.63 | 9.34 | 10.41 | 10.83 | A | A | A | A | A |
| 14 | 240130 | 999.00 | 999.00 | 999.00 | 6.66 | 7.61 | 8.91 | 9.60 | 10.66 | 11.09 | E | E | E | E | E |
| 14 | 240135 | 12.75 | 13.00 | 13.60 | 10.19 | 10.33 | 10.51 | 10.62 | 10.81 | 11.11 | A | A | A | A | A |
| 14 | 240140 | 15.45 | 15.70 | 16.70 | 7.49 | 8.40 | 9.64 | 10.30 | 11.35 | 11.78 | A | A | A | A | A |
| 14 | 240150 | 13.75 | 14.00 | 14.50 | 7.62 | 8.14 | 8.83 | 10.79 | 12.27 | 12.90 | A | A | A | A | A |
| 14 | 240160 | 13.50 | 13.90 | 14.40 | 8.69 | 9.19 | 9.85 | 11.16 | 12.52 | 13.12 | A | A | A | A | A |
| 14 | 240170 | 999.00 | 999.00 | 999.00 | 9.60 | 10.12 | 10.87 | 11.76 | 12.95 | 13.48 | E | E | E | E | E |
| 14 | 240180 | 999.00 | 999.00 | 999.00 | 10.85 | 11.48 | 12.27 | 12.83 | 13.77 | 14.18 | E | E | E | E | E |
| 14 | 240190 | 999.00 | 999.00 | 999.00 | 11.99 | 12.66 | 13.48 | 13.95 | 14.74 | 15.06 | E | E | E | E | E |
| 14 | 240200 | 17.85 | 15.70 | 17.00 | 13.58 | 14.20 | 14.94 | 15.27 | 15.76 | 15.93 | A | A | A | A | C |
| 19 | 240210 | 18.45 | 17.70 | 19.00 | 13.80 | 14.52 | 15.52 | 16.07 | 17.00 | 17.29 | A | A | A | A | A |
| 19 | 240220 | 23.05 | 999.00 | 999.00 | 16.51 | 16.83 | 17.34 | 17.73 | 18.53 | 18.87 | A | A | A | A | A |
| 19 | 240230 | 999.00 | 999.00 | 999.00 | 16.38 | 17.16 | 18.11 | 18.63 | 19.34 | 19.49 | E | E | E | E | E |
| 19 | 240231 | 999.00 | 999.00 | 999.00 | 16.38 | 17.17 | 18.11 | 18.63 | 19.34 | 19.49 | E | E | E | E | E |
| 19 | 240235 | 999.00 | 999.00 | 999.00 | 20.27 | 20.33 | 20.46 | 20.53 | 20.67 | 20.73 | E | E | E | E | E |
| 25 | 246500 | 999.00 | 999.00 | 999.00 | 17.84 | 18.32 | 19.44 | 20.09 | 20.96 | 21.24 | E | E | E | E | E |
| 19 | 240255 | 999.00 | 999.00 | 999.00 | 17.95 | 18.85 | 19.88 | 20.49 | 21.42 | 21.72 | E | E | E | E | E |
| 25 | 244020 | 34.55 | 999.00 | 999.00 | 25.50 | 25.50 | 25.50 | 25.50 | 25.50 | 25.50 | A | A | A | A | A |
| 25 | 240380 | 32.65 | 999.00 | 999.00 | 27.19 | 27.42 | 27.69 | 27.82 | 28.07 | 28.58 | A | A | A | A | A |
| 25 | 240390 | 34.55 | 999.00 | 999.00 | 28.60 | 28.83 | 29.09 | 29.21 | 29.38 | 29.45 | A | A | A | A | A |
| 25 | 240400 | 999.00 | 999.00 | 999.00 | 28.82 | 29.28 | 29.90 | 30.26 | 30.82 | 31.09 | E | E | E | E | E |
| 25 | 240410 | 34.45 | 999.00 | 999.00 | 28.98 | 29.39 | 29.99 | 30.35 | 30.95 | 31.25 | A | A | A | A | A |
| 25 | 240420 | 34.45 | 999.00 | 999.00 | 29.96 | 30.17 | 30.45 | 30.66 | 31.26 | 31.60 | A | A | A | A | A |
| 25 | 240430 | 34.45 | 999.00 | 999.00 | 30.00 | 30.25 | 30.61 | 30.86 | 31.40 | 31.68 | A | A | A | A | A |
| 25 | 240440 | 34.45 | 34.70 | 35.20 | 29.98 | 30.24 | 30.61 | 30.85 | 31.39 | 31.68 | A | A | A | A | A |
| 25 | 240450 | 32.45 | 32.70 | 33.20 | 29.79 | 30.01 | 30.32 | 30.49 | 30.89 | 31.10 | A | A | A | A | A |
| 25 | 240460 | 999.00 | 999.00 | 999.00 | 29.52 | 29.71 | 29.93 | 30.10 | 30.55 | 30.75 | E | E | E | E | E |
| 14 | 241000 | 999.00 | 999.00 | 999.00 | 5.41 | 6.11 | 7.18 | 7.75 | 8.73 | 9.14 | E | E | E | E | E |
| 14 | 241010 | 12.55 | 12.80 | 13.30 | 5.45 | 6.11 | 7.18 | 7.75 | 8.73 | 9.14 | A | A | A | A | A |
| 14 | 241020 | 12.65 | 999.00 | 999.00 | 10.77 | 10.84 | 11.03 | 11.16 | 11.40 | 11.50 | A | A | A | A | A |
| 14 | 241030 | 13.15 | 999.00 | 999.00 | 11.58 | 11.64 | 11.72 | 11.77 | 11.86 | 11.90 | A | A | A | A | A |
| 14 | 241500 | 999.00 | 999.00 | 999.00 | 6.48 | 7.58 | 8.74 | 9.19 | 9.88 | 10.07 | E | E | E | E | E |
| 14 | 241510 | 999.00 | 999.00 | 999.00 | 11.43 | 11.56 | 11.75 | 11.88 | 12.11 | 12.22 | E | E | E | E | E |
| 14 | 241509 | 999.00 | 999.00 | 999.00 | 10.46 | 10.59 | 10.79 | 10.91 | 11.15 | 11.26 | E | E | E | E | E |
| 14 | 242000 | 999.00 | 999.00 | 999.00 | 8.01 | 8.35 | 8.92 | 9.61 | 10.67 | 11.09 | E | E | E | E | E |
| 14 | 242010 | 999.00 | 999.00 | 999.00 | 8.84 | 9.18 | 9.62 | 9.88 | 10.67 | 11.10 | E | E | E | E | E |
| 14 | 242020 | 999.00 | 999.00 | 999.00 | 10.66 | 10.91 | 11.22 | 11.40 | 11.72 | 11.87 | E | E | E | E | E |
| 13 | 242030 | 999.00 | 999.00 | 999.00 | 12.50 | 12.65 | 12.86 | 12.99 | 13.21 | 13.31 | E | E | E | E | E |
| 14 | 242500 | 14.45 | 14.70 | 15.20 | 10.29 | 10.51 | 10.79 | 11.22 | 12.54 | 13.13 | A | A | A | A | A |

## Delaney Pop-off Canal Proposed LOS

8/30/01

**Table 15.2**

| DELANEY POP-OFF CANAL SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 14 | 242510 | 13.95 | 15.30 | 15.80 | 10.84 | 11.15 | 11.56 | 11.81 | 12.88 | 13.61 | A | A | A | A | A |
| 14 | 242520 | 13.50 | 14.40 | 14.90 | 11.60 | 11.89 | 12.27 | 12.49 | 13.14 | 13.73 | A | A | A | A | B |
| 14 | 242530 | 13.20 | 13.20 | 14.20 | 11.76 | 12.15 | 12.69 | 13.02 | 13.83 | 14.11 | A | A | A | A | C |
| 14 | 242800 | 11.55 | 13.80 | 14.30 | 10.74 | 10.89 | 11.09 | 11.25 | 12.48 | 13.11 | A | A | A | A | B |
| 14 | 243000 | 999.00 | 999.00 | 999.00 | 12.44 | 12.62 | 12.82 | 12.96 | 13.21 | 13.66 | E | E | E | E | E |
| 14 | 243005 | 15.75 | 14.70 | 15.20 | 13.25 | 13.35 | 13.51 | 13.66 | 13.95 | 14.08 | A | A | A | A | A |
| 14 | 243010 | 15.05 | 15.30 | 15.80 | 12.90 | 13.14 | 13.50 | 13.67 | 13.97 | 14.53 | A | A | A | A | A |
| 13 | 243020 | 15.75 | 999.00 | 999.00 | 14.18 | 14.69 | 15.20 | 15.66 | 16.25 | 16.53 | A | A | A | A | B |
| 14 | 243021 | 18.45 | 18.30 | 18.80 | 15.84 | 16.02 | 16.25 | 16.39 | 16.62 | 16.72 | A | A | A | A | A |
| 13 | 243030 | 16.85 | 16.70 | 17.20 | 14.19 | 14.68 | 15.32 | 15.79 | 16.45 | 16.76 | A | A | A | A | C |
| 13 | 243035 | 15.25 | 999.00 | 999.00 | 14.21 | 14.56 | 15.32 | 15.79 | 16.46 | 16.76 | A | A | B | B | B |
| 13 | 243040 | 999.00 | 999.00 | 999.00 | 14.97 | 15.27 | 15.82 | 16.13 | 16.71 | 16.95 | E | E | E | E | E |
| 13 | 243050 | 18.25 | 18.50 | 19.00 | 15.06 | 15.33 | 15.86 | 16.17 | 16.75 | 16.98 | A | A | A | A | A |
| 13 | 243060 | 18.25 | 18.50 | 19.00 | 15.64 | 15.98 | 16.38 | 16.59 | 17.06 | 17.34 | A | A | A | A | A |
| 13 | 243070 | 20.25 | 999.00 | 999.00 | 15.66 | 16.01 | 16.40 | 16.62 | 17.08 | 17.37 | A | A | A | A | A |
| 13 | 243080 | 18.65 | 999.50 | 100.00 | 15.89 | 16.28 | 16.84 | 17.15 | 17.83 | 18.17 | A | A | A | A | A |
| 13 | 243090 | 17.45 | 17.10 | 18.00 | 16.21 | 16.81 | 17.67 | 18.18 | 19.07 | 19.40 | A | A | C | D | D |
| 13 | 243100 | 19.45 | 20.00 | 20.50 | 16.24 | 16.82 | 17.67 | 18.18 | 19.07 | 19.41 | A | A | A | A | A |
| 13 | 243110 | 19.45 | 19.50 | 20.00 | 17.08 | 17.69 | 18.46 | 19.04 | 19.54 | 19.67 | A | A | A | A | C |
| 13 | 243120 | 18.45 | 18.70 | 19.20 | 17.35 | 18.01 | 18.83 | 19.35 | 19.93 | 20.15 | A | A | C | D | D |
| 13 | 243130 | 19.45 | 20.00 | 20.50 | 17.56 | 18.23 | 19.07 | 19.52 | 20.11 | 20.36 | A | A | A | B | C |
| 13 | 243135 | 18.95 | 17.90 | 19.40 | 17.90 | 17.98 | 18.10 | 18.17 | 18.30 | 18.36 | C | C | C | C | C |
| 13 | 243140 | 19.45 | 19.70 | 20.20 | 17.61 | 18.25 | 19.07 | 19.52 | 20.12 | 20.37 | A | A | A | B | D |
| 13 | 243150 | 20.45 | 18.70 | 21.20 | 17.71 | 18.34 | 19.16 | 19.59 | 20.19 | 20.45 | A | A | C | C | C |
| 13 | 243160 | 20.45 | 21.10 | 21.60 | 17.74 | 18.35 | 19.16 | 19.59 | 20.19 | 20.45 | A | A | A | A | B |
| 13 | 243500 | 999.00 | 999.00 | 999.00 | 15.00 | 15.48 | 15.87 | 16.18 | 16.75 | 16.93 | E | E | E | E | E |
| 13 | 243510 | 999.00 | 999.00 | 999.00 | 14.66 | 15.21 | 15.87 | 16.18 | 16.75 | 16.96 | E | E | E | E | E |
| 13 | 243520 | 999.00 | 999.00 | 999.00 | 14.66 | 15.22 | 15.87 | 16.18 | 16.76 | 16.97 | E | E | E | E | E |
| 19 | 244010 | 999.00 | 999.00 | 999.00 | 22.17 | 22.54 | 22.97 | 23.25 | 23.90 | 24.39 | E | E | E | E | E |
| 19 | 244510 | 999.00 | 999.00 | 999.00 | 18.86 | 19.05 | 19.92 | 20.53 | 21.47 | 21.77 | E | E | E | E | E |
| 19 | 246000 | 999.00 | 999.00 | 999.00 | 19.37 | 19.48 | 19.62 | 19.70 | 19.84 | 19.90 | E | E | E | E | E |
| 20&19 | 246010 | 999.00 | 999.00 | 999.00 | 21.81 | 22.10 | 22.50 | 22.71 | 23.04 | 23.16 | E | E | E | E | E |
| 20 | 246020 | 999.00 | 999.00 | 999.00 | 22.53 | 22.74 | 23.00 | 23.15 | 23.43 | 23.55 | E | E | E | E | E |
| 25&19 | 246035 | 31.65 | 999.00 | 999.00 | 22.59 | 22.80 | 23.04 | 23.17 | 23.41 | 23.51 | A | A | A | A | A |
| 25&26 | 246040 | 30.25 | 30.50 | 31.00 | 22.67 | 23.01 | 23.44 | 23.68 | 24.07 | 24.24 | A | A | A | A | A |
| 25 | 246050 | 31.95 | 999.00 | 999.00 | 22.67 | 23.02 | 23.45 | 23.69 | 24.09 | 24.25 | A | A | A | A | A |
| 25 | 246060 | 30.25 | 999.00 | 999.00 | 22.67 | 23.02 | 23.45 | 23.69 | 24.09 | 24.25 | A | A | A | A | A |
| 25 | 246070 | 35.00 | 999.00 | 999.00 | 34.39 | 34.42 | 34.46 | 34.49 | 34.54 | 34.56 | A | A | A | A | A |
| 19 | 246505 | 999.00 | 999.00 | 999.00 | 18.38 | 18.77 | 19.57 | 20.15 | 20.98 | 21.26 | E | E | E | E | E |
| 19 | 246510 | 999.00 | 999.00 | 999.00 | 18.40 | 18.77 | 19.57 | 20.15 | 20.98 | 21.26 | E | E | E | E | E |
| 25 | 246520 | 999.00 | 999.00 | 999.00 | 26.16 | 26.19 | 26.24 | 26.27 | 26.32 | 26.35 | E | E | E | E | E |

# Delaney Pop-off Canal Proposed LOS

8/30/01

**Table 15.2**

| DELANEY POP-OFF CANAL SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | **2.33-yr** | **5-yr** | **10-yr** | **25-yr** | **50-YR** | **100-yr** | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 19 | 247000 | 999.00 | 21.70 | 22.20 | 17.95 | 18.85 | 19.88 | 20.49 | 21.42 | 21.72 | A | A | A | A | C |
| 19 | 247010 | 19.10 | 20.40 | 21.40 | 17.42 | 17.75 | 18.24 | 18.52 | 18.90 | 19.05 | A | A | A | A | A |
| 19 | 247020 | 19.10 | 20.00 | 21.40 | 17.88 | 18.21 | 18.61 | 18.84 | 19.18 | 19.33 | A | A | A | A | B |
| 19 | 247030 | 21.00 | 21.00 | 21.50 | 20.78 | 20.82 | 20.88 | 20.92 | 20.99 | 21.02 | A | A | A | A | C |
| 19 | 247040 | 22.65 | 22.90 | 23.40 | 22.05 | 22.42 | 22.76 | 22.94 | 23.24 | 23.37 | A | A | B | C | C |
| 19 | 247050 | 21.90 | 22.30 | 23.00 | 22.06 | 22.42 | 22.77 | 22.95 | 23.26 | 23.40 | B | C | C | C | D |
| 19 | 247060 | 21.45 | 22.00 | 23.00 | 20.94 | 21.13 | 21.53 | 21.80 | 22.26 | 22.46 | A | A | B | B | C |
| 19 | 247070 | 21.00 | 22.00 | 23.00 | 21.90 | 21.98 | 22.09 | 22.16 | 22.40 | 22.60 | B | B | C | C | C |
| 25 | 244030 | 32.65 | 999.00 | 999.00 | 25.87 | 25.94 | 26.04 | 26.10 | 26.21 | 26.26 | A | A | A | A | A |
| 19 | 247500 | 999.00 | 999.00 | 999.00 | 17.96 | 18.86 | 19.88 | 20.49 | 21.42 | 21.73 | E | E | E | E | E |
| 19 | 247510 | 23.25 | 22.80 | 23.30 | 17.98 | 18.87 | 19.89 | 20.50 | 21.44 | 21.75 | A | A | A | A | A |
| 19 | 247520 | 23.23 | 24.00 | 24.50 | 19.14 | 19.49 | 19.96 | 20.51 | 21.45 | 21.77 | A | A | A | A | A |
| 19 | 247530 | 999.00 | 999.00 | 999.00 | 19.19 | 19.56 | 20.04 | 20.52 | 21.46 | 21.80 | E | E | E | E | E |
| 19 | 247535 | 25.25 | 24.70 | 25.70 | 20.66 | 21.25 | 22.04 | 22.12 | 22.28 | 22.40 | A | A | A | A | A |
| 19 | 247540 | 24.95 | 24.70 | 26.20 | 20.25 | 20.59 | 21.03 | 21.29 | 21.75 | 21.98 | A | A | A | A | A |
| 19 | 247550 | 27.65 | 26.50 | 27.60 | 20.30 | 20.64 | 21.08 | 21.34 | 21.80 | 22.02 | A | A | A | A | A |
| 19 | 247801 | 26.15 | 26.00 | 29.00 | 22.91 | 23.11 | 23.53 | 23.79 | 24.18 | 24.33 | A | A | A | A | A |
| 19 | 247805 | 28.51 | 999.00 | 999.00 | 28.26 | 28.30 | 28.36 | 28.40 | 28.47 | 28.50 | A | A | A | A | A |
| 19 | 247810 | 26.75 | 27.40 | 29.00 | 25.54 | 25.78 | 26.08 | 26.28 | 26.60 | 26.74 | A | A | A | A | A |
| 19 | 247820 | 27.85 | 28.50 | 30.10 | 26.19 | 26.25 | 26.33 | 26.49 | 26.92 | 27.13 | A | A | A | A | A |
| 19 | 240355 | 34.45 | 999.00 | 999.00 | 22.64 | 22.96 | 23.51 | 24.10 | 25.99 | 26.99 | A | A | A | A | A |
| 19 | 248020 | 28.95 | 29.20 | 29.70 | 25.60 | 25.64 | 25.69 | 25.73 | 25.78 | 25.81 | A | A | A | A | A |
| 25 | 248040 | 30.55 | 31.70 | 33.20 | 28.17 | 28.80 | 29.77 | 30.43 | 31.04 | 31.16 | A | A | A | A | B |
| 25 | 249000 | 33.75 | 999.00 | 999.00 | 28.43 | 28.52 | 28.61 | 28.68 | 28.90 | 29.00 | A | A | A | A | A |
| 25 | 249030 | 999.00 | 999.00 | 999.00 | 28.18 | 28.36 | 28.60 | 28.75 | 29.03 | 29.18 | E | E | E | E | E |
| 25 | 249040 | 999.00 | 999.00 | 999.00 | 30.35 | 30.46 | 30.61 | 30.71 | 30.89 | 30.97 | E | E | E | E | E |
| 25 | 250000 | 999.00 | 999.00 | 999.00 | 26.16 | 26.54 | 27.08 | 28.38 | 29.16 | 29.45 | E | E | E | E | E |
| 25 | 250005 | 34.85 | 999.00 | 999.00 | 27.27 | 27.68 | 28.33 | 28.80 | 29.23 | 29.45 | A | A | A | A | A |
| 25 | 250010 | 32.55 | 999.00 | 999.00 | 26.16 | 26.55 | 27.09 | 28.38 | 29.16 | 29.45 | A | A | A | A | A |
| 25&31 | 250011 | 34.55 | 999.00 | 999.00 | 26.57 | 26.80 | 27.13 | 28.39 | 29.16 | 29.45 | A | A | A | A | A |
| 25 | 250030 | 33.65 | 999.00 | 999.00 | 26.45 | 27.15 | 27.97 | 28.51 | 29.30 | 29.52 | A | A | A | A | A |
| 24 | 250040 | 999.00 | 999.00 | 999.00 | 26.46 | 27.21 | 28.03 | 28.53 | 29.31 | 29.53 | E | E | E | E | E |
| 25 | 250050 | 31.85 | 999.00 | 999.00 | 28.50 | 28.78 | 29.05 | 29.16 | 29.48 | 29.73 | A | A | A | A | A |
| 25 | 250090 | 999.00 | 999.00 | 999.00 | 28.91 | 29.34 | 29.79 | 30.02 | 30.53 | 30.73 | E | E | E | E | E |
| 25 | 250110 | 31.50 | 31.20 | 34.00 | 30.34 | 30.52 | 30.83 | 31.04 | 31.49 | 31.65 | A | A | A | A | C |
| 25 | 250120 | 999.00 | 999.00 | 999.00 | 30.19 | 30.39 | 30.55 | 30.59 | 30.69 | 30.76 | E | E | E | E | E |
| 25 | 250330 | 30.40 | 999.00 | 999.00 | 28.17 | 28.33 | 28.55 | 28.69 | 28.95 | 29.11 | A | A | A | A | A |
| 25 | 250510 | 999.00 | 999.00 | 999.00 | 26.32 | 26.64 | 27.17 | 28.23 | 29.12 | 29.44 | E | E | E | E | E |
| 25 | 250520 | 999.00 | 999.00 | 999.00 | 26.41 | 26.77 | 27.37 | 28.23 | 29.17 | 29.52 | E | E | E | E | E |
| 25 | 250525 | 30.70 | 999.00 | 999.00 | 26.41 | 26.77 | 27.37 | 28.24 | 29.17 | 29.52 | A | A | A | A | A |
| 25 | 250527 | 32.55 | 999.00 | 999.00 | 29.27 | 29.30 | 29.33 | 29.36 | 29.41 | 29.44 | A | A | A | A | A |
| 25 | 250530 | 33.35 | 34.10 | 34.60 | 28.69 | 29.28 | 29.40 | 29.56 | 29.83 | 29.92 | A | A | A | A | A |
| 25 | 250550 | 999.00 | 999.00 | 999.00 | 29.56 | 29.63 | 29.70 | 29.74 | 29.82 | 29.85 | E | E | E | E | E |

## Delaney Pop-off Canal Proposed LOS

8/30/01

**Table 15.2**

| DELANEY POP-OFF CANAL SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 100-yr |
| 25 | 250555 | 31.00 | 999.00 | 999.00 | 29.56 | 29.63 | 29.70 | 29.75 | 29.82 | 29.85 | A | A | A | A | A |
| 25 | 250557 | 30.50 | 999.00 | 999.00 | 29.31 | 29.34 | 29.40 | 29.44 | 29.52 | 29.56 | A | A | A | A | A |
| 25 | 250570 | 30.00 | 30.70 | 31.20 | 29.10 | 29.25 | 29.43 | 29.55 | 29.75 | 29.85 | A | A | A | A | |
| 25 | 250580 | 30.00 | 30.70 | 31.20 | 29.10 | 29.26 | 29.46 | 29.59 | 29.82 | 29.93 | A | A | A | A | |
| 25 | 250590 | 33.20 | 31.00 | 35.30 | 29.04 | 29.43 | 30.06 | 30.49 | 31.44 | 31.72 | A | A | A | A | |
| 25 | 251000 | 33.95 | 999.00 | 999.00 | 28.01 | 28.22 | 28.48 | 28.59 | 29.16 | 29.45 | A | A | A | A | |
| 26 | 251010 | 34.55 | 999.00 | 999.00 | 29.02 | 29.67 | 30.76 | 31.47 | 32.96 | 33.76 | A | A | A | A | |
| 25 | 251011 | 32.50 | 999.00 | 999.00 | 32.19 | 32.24 | 32.31 | 32.35 | 32.43 | 32.47 | A | A | A | A | |
| 25 | 251500 | 30.20 | 31.00 | 34.75 | 26.35 | 26.90 | 27.68 | 28.41 | 29.22 | 29.65 | A | A | A | A | |
| 24 | 252000 | 31.55 | 999.00 | 999.00 | 26.48 | 27.26 | 28.07 | 28.55 | 29.30 | 29.51 | A | A | A | A | |
| 24 | 252020 | 29.45 | 999.00 | 999.00 | 26.52 | 27.24 | 28.10 | 28.50 | 29.29 | 29.50 | A | A | A | A | |
| 24&30 | 252025 | 31.00 | 999.00 | 999.00 | 29.24 | 29.33 | 29.51 | 29.63 | 29.87 | 29.99 | A | A | A | A | |
| 24 | 252030 | 999.00 | 999.00 | 999.00 | 26.53 | 27.25 | 28.10 | 28.48 | 29.08 | 29.30 | E | E | E | E | |
| 24 | 252040 | 999.00 | 999.00 | 999.00 | 26.72 | 27.36 | 28.19 | 28.54 | 29.10 | 29.31 | E | E | E | E | |
| 24 | 252050 | 29.15 | 29.40 | 29.90 | 26.84 | 27.44 | 28.21 | 28.56 | 29.10 | 29.30 | A | A | A | A | |
| 24 | 252060 | 31.15 | 30.50 | 31.00 | 26.98 | 27.52 | 28.24 | 28.57 | 29.07 | 29.25 | A | A | A | A | |
| 24 | 252065 | 31.45 | 31.40 | 31.90 | 27.00 | 27.54 | 28.26 | 28.59 | 29.08 | 29.26 | A | A | A | A | |
| 24 | 252080 | 28.35 | 28.60 | 29.40 | 26.86 | 27.33 | 27.96 | 28.27 | 28.72 | 28.86 | A | A | A | A | |
| 24 | 252500 | 999.00 | 999.00 | 999.00 | 26.76 | 27.39 | 28.20 | 28.56 | 29.11 | 29.31 | E | E | E | E | |
| 24 | 252510 | 28.35 | 28.60 | 30.50 | 26.78 | 27.41 | 28.21 | 28.56 | 29.11 | 29.31 | A | A | A | B | |
| 25&31 | 253005 | 35.00 | 999.00 | 999.00 | 27.55 | 27.83 | 28.27 | 28.57 | 29.27 | 29.50 | A | A | A | A | |
| 25&31 | 253015 | 35.00 | 999.00 | 999.00 | 29.91 | 30.69 | 31.29 | 31.54 | 31.93 | 32.10 | A | A | A | A | |
| 31 | 253025 | 35.00 | 999.00 | 999.00 | 30.74 | 31.46 | 31.90 | 32.11 | 32.51 | 32.69 | A | A | A | A | |
| 25 | 254010 | 31.50 | 999.00 | 999.00 | 29.16 | 29.27 | 29.37 | 29.44 | 29.66 | 29.79 | A | A | A | A | |
| 25 | 254020 | 999.00 | 999.00 | 999.00 | 29.16 | 29.27 | 29.37 | 29.44 | 29.66 | 29.79 | E | E | E | E | |
| 25 | 254030 | 31.50 | 999.00 | 999.00 | 29.16 | 29.27 | 29.37 | 29.44 | 29.66 | 29.79 | A | A | A | A | |
| 25 | 254050 | 999.00 | 999.00 | 999.00 | 29.42 | 29.50 | 29.61 | 29.69 | 29.85 | 29.93 | E | E | E | E | |

# North Archie Creek Proposed LOS

8/30/01

**Table 15.3**

| NORTH ARCHIE CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| | 250000 | 999.25 | 999.50 | 1000.00 | 26.16 | 26.54 | 27.08 | 28.38 | 29.16 | 29.45 | E | E | E | E | E | E |
| | 260000 | 6.05 | 6.50 | 7.00 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | A | A | A | A | A | A |
| | 260010 | 6.45 | 6.50 | 7.00 | 2.87 | 3.14 | 3.94 | 3.94 | 4.21 | 4.35 | A | A | A | A | A | A |
| 8 | 260020 | 6.75 | 7.20 | 8.20 | 2.94 | 3.25 | 4.16 | 4.16 | 4.47 | 4.63 | A | A | A | A | A | A |
| 8 | 260030 | 6.75 | 10.50 | 11.00 | 3.09 | 3.44 | 4.40 | 4.41 | 4.72 | 4.89 | A | A | A | A | A | A |
| 8 | 260040 | 9.45 | 999.50 | 1000.00 | 3.12 | 3.48 | 4.62 | 4.62 | 5.01 | 5.22 | A | A | A | A | A | A |
| 8 | 260050 | 999.25 | 999.50 | 1000.00 | 3.56 | 3.98 | 5.13 | 5.14 | 5.52 | 5.73 | E | E | E | E | E | E |
| 8 | 260060 | 6.05 | 4.50 | 8.30 | 3.63 | 4.09 | 5.57 | 5.58 | 6.14 | 6.51 | A | A | C | C | C | C |
| 8 | 260065 | 6.05 | 999.50 | 1000.00 | 3.63 | 4.09 | 5.56 | 5.57 | 6.24 | 6.67 | A | A | A | A | B | B |
| 8 | 260070 | 6.45 | 999.50 | 1000.00 | 4.17 | 4.87 | 6.67 | 6.69 | 7.04 | 7.34 | A | A | B | B | B | B |
| 8 | 260080 | 6.45 | 999.50 | 1000.00 | 4.41 | 5.19 | 7.49 | 7.51 | 7.74 | 7.98 | A | A | B | B | B | B |
| 8 | 260090 | 8.45 | 7.00 | 9.50 | 4.41 | 5.19 | 7.50 | 7.52 | 7.76 | 8.00 | A | A | C | C | C | C |
| 8 | 260100 | 999.25 | 999.50 | 1000.00 | 5.37 | 6.40 | 9.53 | 9.58 | 9.79 | 9.98 | E | E | E | E | E | E |
| 8,15 | 260110 | 17.35 | 17.60 | 18.10 | 6.22 | 7.24 | 10.30 | 10.34 | 10.54 | 10.77 | A | A | A | A | A | A |
| 15 | 260120 | 15.05 | 15.30 | 15.80 | 6.41 | 7.45 | 10.57 | 10.60 | 10.78 | 11.01 | A | A | A | A | A | A |
| 15 | 260130 | 12.55 | 12.80 | 13.30 | 6.57 | 7.63 | 10.74 | 10.77 | 10.94 | 11.17 | A | A | A | A | A | A |
| 15 | 260140 | 15.05 | 15.30 | 15.80 | 7.00 | 8.21 | 11.17 | 11.15 | 11.15 | 11.37 | A | A | A | A | A | A |
| 15 | 260145 | 17.75 | 18.00 | 18.50 | 6.78 | 7.86 | 10.97 | 10.97 | 11.14 | 11.39 | A | A | A | A | A | A |
| 15 | 260170 | 999.25 | 1000.00 | 1000.50 | 7.27 | 8.12 | 10.97 | 11.02 | 11.22 | 11.46 | E | E | E | E | E | E |
| | 260180 | 6.25 | 999.50 | 1000.00 | 9.00 | 9.60 | 11.11 | 11.36 | 11.68 | 11.90 | B | B | B | B | B | B |
| 14 | 260190 | 13.45 | 999.50 | 1000.50 | 9.00 | 9.60 | 11.11 | 11.36 | 11.68 | 11.90 | A | A | A | A | A | A |
| 20 | 260200 | 999.25 | 999.50 | 17.00 | 9.07 | 9.70 | 11.15 | 11.44 | 11.79 | 12.01 | A | A | A | A | A | A |
| 21 | 260201 | 999.25 | 999.50 | 16.20 | 14.08 | 14.09 | 14.11 | 14.12 | 14.15 | 14.16 | A | A | A | A | A | A |
| 21 | 260202 | 999.25 | 999.50 | 1000.00 | 14.07 | 14.09 | 14.10 | 14.11 | 14.13 | 14.14 | E | E | E | E | E | E |
| 20,21 | 260210 | 999.25 | 999.50 | 17.00 | 11.23 | 12.20 | 13.22 | 13.69 | 14.39 | 14.73 | A | A | A | A | A | A |
| | 260220 | 999.25 | 999.50 | 1000.00 | 11.27 | 12.33 | 13.52 | 14.17 | 15.15 | 15.58 | E | E | E | E | E | E |
| 20,21 | 260230 | 14.25 | 999.50 | 16.00 | 11.59 | 12.69 | 13.91 | 14.55 | 15.57 | 16.01 | A | A | A | B | B | D |
| 20 | 260235 | 16.25 | 999.50 | 16.00 | 12.84 | 13.55 | 14.48 | 15.01 | 15.92 | 16.33 | A | A | A | A | A | D |
| 21 | 260240 | 18.75 | 999.50 | 1000.00 | 13.85 | 14.49 | 15.24 | 15.67 | 16.46 | 16.83 | A | A | A | A | A | A |
| 20 | 260250 | 19.25 | 999.50 | 1000.00 | 14.35 | 15.01 | 15.82 | 16.26 | 17.04 | 17.40 | A | A | A | A | A | A |
| | 260255 | 999.25 | 999.50 | 1000.00 | 14.36 | 15.03 | 15.84 | 16.28 | 17.07 | 17.42 | E | E | E | E | E | E |
| | 260260 | 999.25 | 999.50 | 1000.00 | 15.07 | 15.70 | 16.52 | 16.97 | 17.75 | 18.09 | E | E | E | E | E | E |
| 20 | 260270 | 999.25 | 999.50 | 1000.00 | 14.96 | 15.57 | 16.38 | 16.82 | 17.64 | 18.01 | E | E | E | E | E | E |
| 20,26 | 260275 | 999.25 | 999.50 | 1000.50 | 14.96 | 15.57 | 16.38 | 16.82 | 17.64 | 18.01 | E | E | E | E | E | E |
| 26 | 260280 | 999.25 | 999.50 | 1000.00 | 17.18 | 17.63 | 18.19 | 18.51 | 19.02 | 19.22 | E | E | E | E | E | E |
| 26,27 | 260290 | 999.25 | 999.50 | 1000.00 | 17.27 | 17.78 | 18.50 | 18.93 | 19.69 | 20.02 | E | E | E | E | E | E |
| 26 | 260300 | 22.75 | 999.50 | 1000.00 | 19.47 | 20.09 | 20.65 | 20.88 | 21.29 | 21.48 | A | A | A | A | A | A |
| 26 | 260310 | 25.25 | 999.50 | 1000.00 | 19.50 | 20.17 | 20.80 | 21.10 | 21.64 | 21.88 | A | A | A | A | A | A |
| 20,26 | 260312 | 22.25 | 999.50 | 1000.00 | 21.37 | 21.40 | 21.43 | 21.45 | 21.64 | 21.88 | A | A | A | A | A | A |
| 26 | 260315 | 999.25 | 999.50 | 1000.00 | 20.56 | 21.31 | 22.17 | 22.64 | 23.40 | 23.76 | E | E | E | E | E | E |
| 26 | 260320 | 999.25 | 999.50 | 1000.00 | 21.14 | 21.94 | 22.89 | 23.42 | 24.38 | 24.78 | E | E | E | E | E | E |
| 26 | 260330 | 28.95 | 999.50 | 1000.00 | 21.16 | 21.99 | 23.00 | 23.58 | 24.65 | 25.10 | A | A | A | A | A | A |

# North Archie Creek Proposed LOS

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**Table 15.3**

| NORTH ARCHIE CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 26 | 260331 | 30.95 | 999.50 | 35.50 | 25.25 | 25.32 | 26.07 | 26.56 | 27.38 | 27.74 | A | A | A | A | A | A |
| 26 | 260340 | 26.25 | 999.50 | 1000.00 | 24.37 | 25.16 | 26.06 | 26.56 | 27.37 | 27.73 | A | A | A | B | B | B |
| 26 | 260350 | 34.25 | 999.50 | 1000.00 | 21.17 | 21.97 | 23.01 | 23.59 | 24.65 | 25.11 | A | A | A | A | A | A |
| 26 | 260360 | 35.45 | 999.50 | 35.00 | 25.05 | 25.83 | 26.79 | 27.30 | 28.15 | 28.51 | A | A | A | A | A | A |
| 26 | 260370 | 33.45 | 999.50 | 1000.00 | 25.06 | 25.84 | 26.81 | 27.33 | 28.20 | 28.55 | A | A | A | A | A | A |
| 26 | 260372 | 33.45 | 999.50 | 1000.00 | 30.09 | 30.11 | 30.13 | 30.15 | 30.18 | 30.19 | A | A | A | A | A | A |
| 26 | 260380 | 34.05 | 999.50 | 29.00 | 26.80 | 26.92 | 27.08 | 27.32 | 27.99 | 28.22 | A | A | A | A | A | A |
| 26 | 260390 | 30.45 | 999.50 | 33.20 | 25.12 | 25.90 | 26.87 | 27.38 | 28.25 | 28.59 | A | A | A | A | A | A |
| 26 | 260400 | 32.25 | 999.50 | 32.00 | 25.12 | 25.90 | 26.88 | 27.41 | 28.27 | 28.61 | A | A | A | A | A | A |
| 26 | 260410 | 999.25 | 999.50 | 33.30 | 27.27 | 27.35 | 27.46 | 27.54 | 27.91 | 28.11 | A | A | A | A | A | A |
| 20 | 261000 | 12.45 | 999.50 | 15.50 | 9.08 | 9.72 | 11.17 | 11.48 | 11.84 | 12.14 | A | A | A | A | A | A |
| 20 | 261010 | 12.55 | 999.50 | 15.60 | 9.34 | 9.98 | 11.20 | 11.76 | 13.11 | 13.50 | A | A | A | A | B | B |
| 20,21 | 261020 | 14.85 | 999.50 | 17.70 | 10.08 | 10.54 | 11.89 | 12.46 | 13.80 | 14.24 | A | A | A | A | A | A |
| 14 | 261021 | 15.55 | 999.50 | 1000.00 | 15.47 | 15.48 | 15.50 | 15.51 | 15.53 | 15.54 | A | A | A | A | A | A |
| | 261030 | 999.25 | 999.50 | 1000.00 | 11.86 | 12.22 | 12.75 | 13.56 | 14.55 | 14.88 | E | E | E | E | E | E |
| 20 | 261040 | 14.35 | 999.50 | 16.50 | 12.18 | 12.60 | 13.41 | 14.17 | 14.98 | 15.25 | A | A | A | A | B | B |
| 20 | 261050 | 14.45 | 999.50 | 17.50 | 12.23 | 12.63 | 13.42 | 14.16 | 14.92 | 15.17 | A | A | A | A | B | B |
| 20 | 261060 | 999.25 | 999.50 | 17.70 | 12.42 | 12.79 | 13.36 | 13.76 | 14.59 | 15.02 | A | A | A | A | A | A |
| 20 | 261061 | 17.85 | 999.50 | 1000.00 | 15.76 | 15.79 | 15.84 | 15.87 | 15.93 | 15.96 | A | A | A | A | A | A |
| 20 | 261062 | 15.15 | 999.50 | 17.20 | 15.47 | 15.50 | 15.54 | 15.57 | 15.61 | 15.64 | B | B | B | B | B | B |
| 20 | 262000 | 12.65 | 999.50 | 14.20 | 11.59 | 12.69 | 13.92 | 14.56 | 15.57 | 16.01 | A | B | B | D | D | D |
| 20 | 262010 | 13.55 | 999.50 | 16.50 | 11.59 | 12.70 | 13.93 | 14.57 | 15.58 | 16.02 | A | A | B | B | B | B |
| 20 | 262020 | 12.45 | 999.50 | 16.00 | 11.69 | 12.87 | 14.32 | 14.86 | 15.59 | 16.03 | A | B | B | B | B | D |
| 20 | 262030 | 14.45 | 999.50 | 16.40 | 11.89 | 13.16 | 14.72 | 15.27 | 15.75 | 16.04 | A | A | B | B | B | B |
| | 263000 | 999.25 | 999.50 | 1000.00 | 13.89 | 14.49 | 15.25 | 15.68 | 16.47 | 16.83 | E | E | E | E | E | E |
| 20 | 263010 | 19.25 | 999.50 | 1000.00 | 13.85 | 14.49 | 15.25 | 15.68 | 16.47 | 16.84 | A | A | A | A | A | A |
| 20 | 263020 | 18.05 | 999.50 | 1000.00 | 13.90 | 14.74 | 15.62 | 16.01 | 16.71 | 17.07 | A | A | A | A | A | A |
| 20,26 | 263030 | 20.05 | 999.50 | 1000.00 | 13.90 | 14.74 | 15.63 | 16.03 | 16.74 | 17.09 | A | A | A | A | A | A |
| | 263040 | 999.25 | 999.50 | 1000.00 | 13.89 | 14.84 | 16.02 | 16.48 | 17.28 | 17.70 | E | E | E | E | E | E |
| 20 | 263050 | 16.45 | 999.50 | 17.90 | 13.98 | 15.05 | 16.52 | 17.05 | 17.78 | 18.22 | A | A | B | B | B | D |
| 20 | 263060 | 16.05 | 999.50 | 18.00 | 14.69 | 15.90 | 17.08 | 17.49 | 18.14 | 18.59 | A | A | B | B | D | D |
| 26,27 | 264000 | 30.85 | 999.50 | 1000.00 | 19.48 | 20.14 | 20.97 | 21.15 | 21.46 | 21.60 | A | A | A | A | A | A |
| 27 | 264010 | 999.25 | 999.50 | 1000.00 | 23.70 | 23.76 | 23.84 | 23.89 | 23.98 | 24.03 | E | E | E | E | E | E |
| 26 | 265000 | 999.25 | 999.50 | 22.30 | 21.04 | 21.22 | 21.44 | 21.61 | 21.96 | 22.12 | A | A | A | A | A | A |
| 26 | 265001 | 999.25 | 999.50 | 24.00 | 20.51 | 20.71 | 21.03 | 21.32 | 21.77 | 21.97 | A | A | A | A | A | A |
| 26 | 265010 | 22.25 | 999.50 | 23.50 | 21.49 | 21.69 | 21.96 | 22.12 | 22.43 | 22.59 | A | A | A | A | B | B |
| 26 | 266000 | 28.45 | 999.50 | 1000.00 | 21.15 | 21.96 | 22.92 | 23.45 | 24.43 | 24.84 | A | A | A | A | A | A |
| 26 | 266010 | 31.25 | 999.50 | 1000.00 | 30.13 | 30.16 | 30.20 | 30.23 | 30.27 | 30.29 | A | A | A | A | A | A |
| 26 | 266020 | 30.25 | 999.50 | 1000.00 | 30.14 | 30.17 | 30.21 | 30.24 | 30.28 | 30.31 | A | A | A | A | B | B |
| 26 | 266030 | 34.45 | 999.50 | 1000.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | ## | ## | ## | ### | ### | ### |
| 26 | 267000 | 34.55 | 999.50 | 1000.00 | 26.84 | 26.97 | 27.15 | 27.32 | 27.83 | 28.05 | A | A | A | A | A | A |

# North Archie Creek Proposed LOS

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**Table 15.3**

| NORTH ARCHIE CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 26 | 267010 | 33.95 | 999.50 | 1000.00 | 26.86 | 26.99 | 27.18 | 27.35 | 27.80 | 28.02 | A | A | A | A | A | A |
| 26 | 267010 | 999.25 | 999.50 | 1000.00 | 26.86 | 26.99 | 27.18 | 27.35 | 27.80 | 28.02 | E | E | E | E | E | E |
| 26 | 269000 | 34.45 | 999.50 | 1000.00 | 32.08 | 32.10 | 32.12 | 32.13 | 32.16 | 32.17 | A | A | A | A | A | A |
| 26 | 269010 | 34.25 | 999.50 | 35.50 | 32.43 | 32.75 | 33.27 | 33.62 | 34.07 | 34.14 | A | A | A | A | A | A |
| 26 | 270000 | 999.25 | 999.50 | 31.30 | 25.87 | 26.46 | 27.26 | 27.73 | 28.57 | 28.78 | A | A | A | A | A | A |
| 26 | 270010 | 28.85 | 999.50 | 32.20 | 26.58 | 27.06 | 27.86 | 28.34 | 29.11 | 29.37 | A | A | A | A | B | B |
| | 270020 | 999.25 | 999.50 | 1000.00 | 27.22 | 27.40 | 28.01 | 28.56 | 29.48 | 29.75 | E | E | E | E | E | E |
| 32 | 270030 | 999.25 | 999.50 | 35.00 | 29.04 | 29.32 | 29.74 | 29.97 | 30.39 | 30.66 | A | A | A | A | A | A |
| 22 | 270035 | 999.25 | 999.50 | 1000.00 | 29.08 | 29.33 | 29.73 | 29.97 | 30.39 | 30.66 | E | E | E | E | E | E |
| 32 | 270040 | 32.05 | 999.50 | 34.90 | 29.23 | 29.69 | 30.24 | 30.51 | 31.05 | 31.32 | A | A | A | A | A | A |
| 32 | 270041 | 32.05 | 999.50 | 34.90 | 29.26 | 29.72 | 30.34 | 30.80 | 31.53 | 31.89 | A | A | A | A | A | A |
| 32 | 270042 | 32.15 | 999.50 | 34.80 | 29.26 | 29.73 | 30.34 | 30.81 | 31.54 | 31.90 | A | A | A | A | A | A |
| 32 | 270043 | 33.15 | 999.50 | 35.70 | 29.32 | 29.53 | 29.99 | 30.32 | 30.90 | 31.22 | A | A | A | A | A | A |
| 32 | 270044 | 34.15 | 999.50 | 37.00 | 29.33 | 29.57 | 30.07 | 30.52 | 30.91 | 31.22 | A | A | A | A | A | A |
| 32 | 270045 | 34.15 | 999.50 | 36.30 | 29.24 | 29.51 | 29.94 | 30.33 | 30.91 | 31.23 | A | A | A | A | A | A |
| 32 | 270046 | 34.45 | 999.50 | 37.30 | 31.29 | 31.90 | 32.66 | 32.96 | 33.32 | 33.44 | A | A | A | A | A | A |
| | 270050 | 22.65 | 999.50 | 1000.00 | 29.31 | 29.79 | 30.35 | 30.63 | 31.20 | 31.52 | B | B | B | B | B | B |
| | 270055 | 999.25 | 999.50 | 1000.00 | 29.31 | 29.79 | 30.35 | 30.63 | 31.21 | 31.52 | E | E | E | E | E | E |
| 32 | 270060 | 34.95 | 999.50 | 35.80 | 30.54 | 31.25 | 31.90 | 32.28 | 33.05 | 33.43 | A | A | A | A | A | A |
| 31,32 | 270065 | 33.95 | 999.50 | 35.70 | 30.54 | 31.25 | 31.90 | 32.29 | 33.05 | 33.43 | A | A | A | A | A | A |
| 32 | 270070 | 33.25 | 999.50 | 32.00 | 29.35 | 29.84 | 30.42 | 30.72 | 31.29 | 31.61 | A | A | A | A | A | A |
| | 270080 | 999.25 | 999.50 | 1000.00 | 30.34 | 30.66 | 31.10 | 31.42 | 31.93 | 32.20 | E | E | E | E | E | E |
| 32 | 270090 | 999.25 | 999.50 | 1000.00 | 32.26 | 32.52 | 32.81 | 33.04 | 33.38 | 33.58 | E | E | E | E | E | E |
| | 270100 | 999.25 | 999.50 | 1000.00 | 32.27 | 32.53 | 32.83 | 33.07 | 33.45 | 33.68 | E | E | E | E | E | E |
| 31,32 | 270110 | 999.25 | 999.50 | 1000.00 | 32.30 | 32.57 | 32.91 | 33.08 | 33.75 | 34.04 | E | E | E | E | E | E |
| 31 | 270120 | 999.25 | 999.50 | 1000.00 | 32.83 | 33.09 | 33.45 | 33.70 | 34.29 | 34.64 | E | E | E | E | E | E |
| | 270125 | 35.85 | 999.50 | 38.40 | 31.77 | 31.87 | 32.01 | 32.30 | 33.06 | 33.45 | A | A | A | A | A | A |
| 31,32 | 270130 | 28.25 | 999.50 | 1000.00 | 34.07 | 34.36 | 34.72 | 34.96 | 35.46 | 35.70 | B | B | B | B | B | B |
| 31 | 270140 | 24.35 | 999.50 | 1000.00 | 34.21 | 34.67 | 35.44 | 35.93 | 36.81 | 37.22 | B | B | B | B | B | B |
| 31 | 270150 | 25.85 | 999.50 | 1000.00 | 35.52 | 35.96 | 36.63 | 37.08 | 37.94 | 38.35 | B | B | B | B | B | B |
| 37,38 | 270151 | 24.25 | 999.50 | 1000.00 | 35.52 | 35.97 | 36.64 | 37.08 | 37.94 | 38.36 | B | B | B | B | B | B |
| 26 | 270500 | 999.25 | 999.50 | 1000.00 | 25.87 | 26.46 | 27.28 | 27.74 | 28.58 | 28.77 | E | E | E | E | E | E |
| | 270505 | 999.25 | 999.50 | 1000.00 | 26.28 | 26.86 | 27.67 | 27.94 | 28.61 | 28.87 | E | E | E | E | E | E |
| 26 | 270510 | 999.25 | 999.50 | 1000.00 | 26.80 | 27.36 | 28.14 | 28.33 | 28.80 | 29.08 | E | E | E | E | E | E |
| 26 | 270515 | 999.25 | 999.50 | 1000.00 | 26.28 | 26.86 | 27.67 | 27.94 | 28.61 | 28.87 | E | E | E | E | E | E |
| 26 | 270520 | 31.95 | 999.50 | 1000.00 | 26.81 | 27.38 | 28.16 | 28.35 | 28.82 | 29.11 | A | A | A | A | A | A |
| 26 | 270521 | 33.75 | 999.50 | 1000.00 | 26.79 | 27.18 | 27.94 | 27.88 | 28.58 | 28.80 | A | A | A | A | A | A |
| 26 | 270525 | 36.25 | 999.50 | 1000.00 | 28.06 | 28.52 | 29.17 | 29.59 | 30.39 | 30.77 | A | A | A | A | A | A |
| 26 | 270530 | 31.85 | 999.50 | 1000.00 | 27.32 | 27.85 | 28.61 | 28.73 | 29.14 | 29.43 | A | A | A | A | A | A |
| | 270540 | 999.25 | 999.50 | 1000.00 | 27.33 | 27.87 | 28.63 | 28.75 | 29.15 | 29.44 | E | E | E | E | E | E |
| | 270570 | 999.25 | 999.50 | 1000.00 | 27.34 | 27.88 | 28.64 | 28.76 | 29.24 | 29.52 | E | E | E | E | E | E |
| 25 | 270580 | 30.05 | 999.50 | 1000.00 | 27.37 | 27.95 | 28.76 | 28.82 | 29.31 | 29.60 | A | A | A | A | A | A |

# North Archie Creek Proposed LOS

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**Table 15.3**

| NORTH ARCHIE CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 25 | 270585 | 999.25 | 999.50 | 1000.00 | 27.36 | 27.90 | 28.67 | 28.82 | 29.32 | 29.60 | E | E | E | E | E | E |
| 25 | 270590 | 999.25 | 999.50 | 1000.00 | 27.38 | 27.90 | 28.66 | 28.86 | 29.34 | 29.63 | E | E | E | E | E | E |
| 31 | 270592 | 999.25 | 999.50 | 1000.00 | 29.64 | 29.68 | 29.73 | 29.75 | 29.81 | 29.83 | E | E | E | E | E | E |
| 31 | 270594 | 999.25 | 999.50 | 1000.00 | 29.56 | 29.59 | 29.63 | 29.66 | 29.72 | 29.74 | E | E | E | E | E | E |
| 31 | 270596 | 999.25 | 999.50 | 1000.00 | 29.66 | 29.70 | 29.75 | 29.78 | 29.84 | 29.86 | E | E | E | E | E | E |
| 25,31 | 270610 | 999.25 | 999.50 | 1000.00 | 28.95 | 28.98 | 29.03 | 29.05 | 29.35 | 29.63 | E | E | E | E | E | E |
| 25,31 | 270620 | 999.25 | 999.50 | 1000.00 | 27.39 | 27.91 | 28.66 | 28.88 | 29.37 | 29.65 | E | E | E | E | E | E |
| 30,31 | 270630 | 32.65 | 999.50 | 1000.00 | 27.57 | 27.98 | 28.67 | 28.93 | 29.55 | 29.80 | A | A | A | A | A | A |
| 30,31 | 270640 | 999.25 | 999.50 | 1000.00 | 30.26 | 30.32 | 30.41 | 30.46 | 30.56 | 30.60 | E | E | E | E | E | E |
| 26,32 | 272000 | 36.75 | 999.50 | 34.50 | 26.55 | 27.07 | 27.87 | 28.35 | 29.11 | 29.38 | A | A | A | A | A | A |
| | 272010 | 999.25 | 999.50 | 1000.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | E | E | E | E | E | E |
| 32 | 272020 | 33.05 | 999.50 | 34.00 | 28.07 | 28.25 | 28.48 | 28.62 | 29.11 | 29.39 | A | A | A | A | A | A |
| 27,33 | 272030 | 33.95 | 999.50 | 38.00 | 28.27 | 28.27 | 28.48 | 28.62 | 29.12 | 29.40 | A | A | A | A | A | A |
| 27,33 | 272035 | 999.25 | 999.50 | 1000.00 | 33.00 | 33.00 | 33.00 | 33.00 | 33.00 | 33.00 | E | E | E | E | E | E |
| 33 | 272036 | 999.25 | 999.50 | 1000.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | E | E | E | E | E | E |
| 33 | 272040 | 999.25 | 999.50 | 1000.00 | 34.03 | 34.39 | 34.82 | 35.36 | 36.21 | 36.49 | E | E | E | E | E | E |
| 33 | 272050 | 39.15 | 999.50 | 44.70 | 36.16 | 36.19 | 36.23 | 36.26 | 36.31 | 36.53 | A | A | A | A | A | A |
| 33 | 272060 | 999.25 | 42.50 | 1000.00 | 38.06 | 38.07 | 38.08 | 38.09 | 38.11 | 38.12 | A | A | A | A | A | A |
| 33 | 272070 | 999.25 | 999.50 | 42.80 | 40.06 | 40.07 | 40.09 | 40.10 | 40.11 | 40.12 | A | A | A | A | A | A |
| 33 | 272080 | 41.75 | 999.50 | 43.40 | 40.05 | 40.06 | 40.10 | 40.19 | 40.34 | 40.40 | A | A | A | A | A | A |
| 32 | 273000 | 33.55 | 999.50 | 33.50 | 29.04 | 29.32 | 29.74 | 29.98 | 30.42 | 30.67 | A | A | A | A | A | A |
| 32 | 273010 | 36.55 | 999.50 | 37.00 | 32.21 | 32.52 | 32.93 | 33.18 | 33.61 | 33.81 | A | A | A | A | A | A |
| 32 | 273015 | 999.25 | 999.50 | 36.20 | 33.75 | 33.90 | 34.13 | 34.29 | 34.61 | 34.77 | A | A | A | A | A | A |
| 32 | 273020 | 999.25 | 999.50 | 36.00 | 34.24 | 34.56 | 34.91 | 35.09 | 35.40 | 35.55 | A | A | A | A | A | A |
| 32 | 273021 | 37.35 | 999.50 | 37.80 | 35.02 | 35.03 | 35.14 | 35.48 | 36.29 | 36.71 | A | A | A | A | A | A |
| 32 | 273025 | 37.25 | 999.50 | 40.20 | 34.45 | 34.75 | 35.10 | 35.28 | 35.61 | 35.76 | A | A | A | A | A | A |
| 32 | 273030 | 36.75 | 999.50 | 39.50 | 34.25 | 34.61 | 35.13 | 35.47 | 36.29 | 36.70 | A | A | A | A | A | A |

# Archie Creek Proposed LOS

8/30/01

**Table 15.4**

| ARCHIE CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 9 | 280006 | 5.25 | 5.10 | 6.54 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | A | A | A | A | A | A |
| 9 | 280007 | 6.05 | 6.50 | 7.00 | 2.89 | 3.09 | 3.30 | 3.41 | 3.57 | 3.62 | A | A | A | A | A | A |
| 9 | 280008 | 6.45 | 6.50 | 7.00 | 3.10 | 3.34 | 3.60 | 3.72 | 3.89 | 3.95 | A | A | A | A | A | A |
| 9 | 280010 | 6.75 | 7.20 | 8.20 | 3.31 | 3.60 | 3.88 | 4.01 | 4.19 | 4.26 | A | A | A | A | A | A |
| 9 | 280015 | 6.75 | 10.50 | 11.00 | 3.39 | 3.70 | 4.02 | 4.18 | 4.41 | 4.50 | A | A | A | A | A | A |
| 9 | 280020 | 6.75 | 11.00 | 12.00 | 3.66 | 4.01 | 4.34 | 4.50 | 4.73 | 4.81 | A | A | A | A | A | A |
| 9 | 280030 | 10.10 | 11.00 | 12.64 | 3.75 | 4.12 | 4.53 | 4.72 | 4.97 | 5.06 | A | A | A | A | A | A |
| 9 | 280040 | 11.55 | 12.10 | 12.60 | 4.25 | 4.93 | 5.68 | 6.04 | 6.53 | 6.71 | A | A | A | A | A | A |
| 9 | 280050 | 11.25 | 11.80 | 12.30 | 4.38 | 5.17 | 6.06 | 6.47 | 7.09 | 7.31 | A | A | A | A | A | A |
| 8,9 | 280055 | 13.30 | 14.50 | 15.59 | 4.40 | 5.19 | 6.08 | 6.49 | 7.12 | 7.33 | A | A | A | A | A | A |
| 8,9 | 280060 | 11.95 | 12.50 | 13.00 | 4.43 | 5.22 | 6.11 | 6.52 | 7.15 | 7.37 | A | A | A | A | A | A |
| 8 | 280065 | 17.35 | 17.60 | 18.10 | 5.04 | 5.74 | 6.60 | 7.01 | 7.65 | 7.89 | A | A | A | A | A | A |
| 15 | 280066 | 7.45 | 7.70 | 8.20 | 1.40 | 1.49 | 1.63 | 1.72 | 1.90 | 1.99 | A | A | A | A | A | A |
| 16 | 280067 | 17.35 | 17.60 | 18.10 | 1.31 | 1.38 | 1.48 | 1.55 | 1.69 | 1.76 | A | A | A | A | A | A |
| 16 | 280068 | 15.05 | 15.30 | 15.80 | 1.28 | 1.34 | 1.44 | 1.50 | 1.62 | 1.69 | A | A | A | A | A | A |
| 16 | 280069 | 12.55 | 12.80 | 13.30 | 1.10 | 1.12 | 1.15 | 1.17 | 1.22 | 1.24 | A | A | A | A | A | A |
| 16 | 280070 | 15.05 | 15.30 | 15.80 | 2.59 | 2.94 | 3.47 | 3.82 | 4.52 | 4.87 | A | A | A | A | A | A |
| 16 | 280071 | 17.75 | 18.00 | 18.50 | 1.34 | 1.42 | 1.53 | 1.61 | 1.76 | 1.83 | A | A | A | A | A | A |
| 9,16 | 280075 | 16.85 | 1000.00 | 1000.50 | 5.87 | 6.53 | 7.35 | 7.74 | 8.40 | 8.65 | A | A | A | A | A | A |
| 15 | 280080 | 6.25 | 999.50 | 1000.00 | 3.00 | 3.51 | 4.28 | 4.79 | 5.82 | 6.41 | A | A | A | A | A | B |
| 8,15 | 280085 | 13.75 | 14.00 | 1000.50 | 7.16 | 7.74 | 8.44 | 8.77 | 9.37 | 9.63 | A | A | A | A | A | A |
| 15,16 | 280086 | 8.55 | 999.50 | 1000.00 | 7.34 | 7.93 | 8.65 | 8.99 | 9.60 | 9.86 | A | A | B | B | B | B |
| 15 | 280088 | 9.45 | 10.60 | 9.80 | 7.82 | 8.43 | 9.17 | 9.52 | 10.16 | 10.45 | A | A | A | B | D | D |
| 15 | 280089 | 12.25 | 12.90 | 13.40 | 8.30 | 9.22 | 10.19 | 10.63 | 11.39 | 11.90 | A | A | A | A | A | A |
| 16 | 280100 | 10.85 | 11.10 | 1000.00 | 8.77 | 8.83 | 8.91 | 8.97 | 9.38 | 9.63 | A | A | A | A | A | A |
| 15 | 280105 | 9.85 | 11.30 | 29.60 | 7.35 | 7.94 | 8.65 | 8.99 | 9.60 | 9.86 | A | A | A | A | A | B |
| 15 | 280110 | 13.55 | 999.50 | 1000.00 | 9.10 | 9.10 | 9.10 | 9.15 | 9.38 | 9.63 | A | A | A | A | A | A |
| 15 | 280115 | 10.25 | 11.00 | 1000.00 | 7.41 | 8.00 | 8.70 | 9.03 | 9.64 | 9.90 | A | A | A | A | A | A |
| 15 | 280120 | 13.05 | 12.50 | 13.00 | 7.75 | 8.29 | 8.91 | 9.22 | 9.79 | 10.05 | A | A | A | A | A | A |
| 15 | 280128 | 10.55 | 12.30 | 14.39 | 7.94 | 8.46 | 9.03 | 9.32 | 9.88 | 10.13 | A | A | A | A | A | A |
| 15 | 280140 | 999.25 | 999.50 | 1000.00 | 10.89 | 11.38 | 11.93 | 12.25 | 12.81 | 13.05 | E | E | E | E | E | E |
| 15 | 280143 | 999.25 | 999.50 | 1000.00 | 11.14 | 11.57 | 12.04 | 12.35 | 12.90 | 13.13 | E | E | E | E | E | E |
| 15 | 280145 | 13.45 | 999.50 | 1000.00 | 11.16 | 11.59 | 12.05 | 12.36 | 12.90 | 13.13 | A | A | A | A | A | A |
| 21 | 280150 | 12.25 | 13.30 | 1000.50 | 11.71 | 12.46 | 13.14 | 13.45 | 13.90 | 14.08 | A | B | B | C | C | C |
| 21 | 280155 | 999.25 | 999.50 | 1000.00 | 15.35 | 15.49 | 15.68 | 15.80 | 16.01 | 16.11 | E | E | E | E | E | E |
| 21 | 280160 | 18.27 | 999.50 | 1000.00 | 15.83 | 16.02 | 16.27 | 16.42 | 16.69 | 16.81 | A | A | A | A | A | A |
| 15 | 280300 | 14.25 | 999.50 | 13.50 | 8.50 | 9.37 | 10.31 | 10.74 | 11.49 | 12.01 | A | A | A | A | A | A |
| 23 | 280305 | 12.25 | 999.50 | 14.00 | 8.58 | 9.43 | 10.38 | 10.82 | 11.65 | 12.24 | A | A | A | A | A | A |
| 22 | 280310 | 13.65 | 999.50 | 1000.00 | 10.11 | 10.19 | 10.42 | 10.85 | 11.66 | 12.24 | A | A | A | A | A | A |

# Archie Creek Proposed LOS

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**Table 15.4**

| ARCHIE CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 22 | 280312 | 999.25 | 999.50 | 1000.00 | 17.71 | 17.87 | 18.08 | 18.21 | 18.45 | 18.57 | E | E | E | E | E | E |
| 22 | 280313 | 999.25 | 999.50 | 1000.00 | 18.00 | 18.00 | 18.16 | 18.29 | 18.53 | 18.65 | E | E | E | E | E | E |
| 22 | 280314 | 999.25 | 999.50 | 1000.00 | 18.50 | 18.50 | 18.50 | 18.50 | 18.56 | 18.68 | E | E | E | E | E | E |
| 22 | 280315 | 14.75 | 999.50 | 15.00 | 11.18 | 11.40 | 11.71 | 11.88 | 12.18 | 12.34 | A | A | A | A | A | A |
| 22 | 280317 | 999.25 | 999.50 | 1000.00 | 17.56 | 17.69 | 17.85 | 17.96 | 18.15 | 18.25 | E | E | E | E | E | E |
| 22 | 280320 | 14.55 | 999.50 | 16.00 | 12.68 | 13.18 | 13.61 | 13.79 | 14.12 | 14.26 | A | A | A | A | A | A |
| 22 | 280325 | 14.85 | 999.50 | 1000.00 | 13.33 | 13.68 | 14.02 | 14.18 | 14.47 | 14.60 | A | A | A | A | A | A |
| 22 | 280330 | 15.25 | 999.50 | 1000.00 | 13.46 | 13.77 | 14.11 | 14.27 | 14.56 | 14.68 | A | A | A | A | A | A |
| 22 | 280333 | 999.25 | 999.50 | 1000.00 | 18.74 | 18.89 | 19.10 | 19.24 | 19.48 | 19.61 | E | E | E | E | E | E |
| 16,22 | 280335 | 15.65 | 18.10 | 1000.00 | 13.64 | 14.08 | 14.77 | 15.21 | 15.83 | 16.08 | A | A | A | A | B | B |
| 22 | 280340 | 999.25 | 999.50 | 22.00 | 18.90 | 19.08 | 19.36 | 19.54 | 19.70 | 19.76 | A | A | A | A | A | A |
| 21 | 280350 | 14.05 | 999.50 | 1000.00 | 10.93 | 11.36 | 11.94 | 12.21 | 13.16 | 13.60 | A | A | A | A | A | A |
| 22 | 280357 | 999.25 | 999.50 | 1000.00 | 9.82 | 10.89 | 12.24 | 13.12 | 14.65 | 15.23 | E | E | E | E | E | E |
| 21 | 280360 | 13.15 | 999.50 | 18.60 | 9.82 | 10.89 | 12.24 | 13.12 | 14.65 | 15.23 | A | A | A | A | B | B |
| 21 | 280365 | 12.55 | 999.50 | 15.50 | 10.07 | 10.36 | 10.77 | 11.80 | 13.13 | 13.48 | A | A | A | A | B | B |
| 21 | 280370 | 14.05 | 999.50 | 1000.00 | 11.03 | 11.73 | 12.66 | 13.14 | 14.63 | 15.20 | A | A | A | A | B | B |
| 21 | 280373 | 16.65 | 999.50 | 1000.00 | 20.50 | 20.50 | 20.50 | 20.50 | 20.51 | 20.56 | B | B | B | B | B | B |
| 21 | 280375 | 999.25 | 999.50 | 1000.00 | 12.18 | 12.61 | 13.26 | 13.69 | 14.73 | 15.31 | E | E | E | E | E | E |
| 21 | 280380 | 999.25 | 999.50 | 1000.00 | 14.96 | 15.47 | 16.02 | 16.31 | 16.82 | 17.06 | E | E | E | E | E | E |
| 21 | 280385 | 999.25 | 999.50 | 1000.00 | 15.63 | 16.17 | 16.76 | 17.08 | 17.62 | 17.87 | E | E | E | E | E | E |
| 22 | 280390 | 999.25 | 999.50 | 1000.00 | 16.30 | 16.84 | 17.42 | 17.73 | 18.26 | 18.50 | E | E | E | E | E | E |
| 22 | 280392 | 999.25 | 999.50 | 1000.00 | 16.54 | 17.10 | 17.70 | 18.02 | 18.52 | 18.74 | E | E | E | E | E | E |
| 22 | 280394 | 999.25 | 999.50 | 1000.00 | 16.95 | 17.50 | 18.08 | 18.40 | 18.90 | 19.10 | E | E | E | E | E | E |
| 22 | 280397 | 17.15 | 999.50 | 1000.00 | 17.27 | 17.84 | 18.47 | 18.81 | 19.36 | 19.57 | B | B | B | B | B | B |
| 22 | 280398 | 26.25 | 999.50 | 1000.00 | 17.56 | 18.09 | 18.68 | 19.00 | 19.51 | 19.71 | A | A | A | A | A | A |
| 21 | 280400 | 16.68 | 999.50 | 21.50 | 15.64 | 16.18 | 16.77 | 17.08 | 17.63 | 17.88 | A | A | B | B | B | B |
| 21 | 280405 | 999.25 | 999.50 | 1000.00 | 15.65 | 16.19 | 16.77 | 17.09 | 17.63 | 17.88 | E | E | E | E | E | E |
| 21 | 280410 | 999.25 | 999.50 | 1000.00 | 18.68 | 18.76 | 18.87 | 18.93 | 19.06 | 19.12 | E | E | E | E | E | E |
| 21 | 280415 | 21.55 | 999.50 | 1000.00 | 15.70 | 16.20 | 16.77 | 17.09 | 17.63 | 17.88 | A | A | A | A | A | A |
| 21 | 280420 | 22.25 | 999.50 | 1000.00 | 16.64 | 16.66 | 16.78 | 17.09 | 17.63 | 17.88 | A | A | A | A | A | A |
| 21 | 280425 | 21.25 | 999.50 | 1000.00 | 16.03 | 16.26 | 16.77 | 17.08 | 17.62 | 17.88 | A | A | A | A | A | A |
| 21 | 280430 | 21.25 | 999.50 | 1000.00 | 16.15 | 16.33 | 16.79 | 17.09 | 17.64 | 17.89 | A | A | A | A | A | A |
| 21 | 280435 | 999.25 | 999.50 | 1000.00 | 19.01 | 19.21 | 19.49 | 19.65 | 19.96 | 20.09 | E | E | E | E | E | E |
| 22,21 | 280440 | 999.25 | 999.50 | 1000.00 | 19.24 | 19.41 | 19.66 | 19.82 | 20.13 | 20.27 | E | E | E | E | E | E |
| 27 | 280445 | 28.85 | 999.50 | 1000.00 | 20.01 | 20.12 | 20.27 | 20.37 | 20.56 | 20.65 | A | A | A | A | A | A |
| 22 | 280500 | 999.25 | 999.50 | 1000.00 | 17.42 | 17.72 | 18.12 | 18.36 | 18.77 | 18.96 | E | E | E | E | E | E |
| 22 | 280515 | 999.25 | 999.50 | 1000.00 | 20.33 | 20.56 | 20.84 | 21.00 | 21.32 | 21.57 | E | E | E | E | E | E |
| 22 | 280520 | 999.25 | 999.50 | 1000.00 | 20.34 | 20.56 | 20.84 | 21.11 | 21.65 | 21.91 | E | E | E | E | E | E |

# Archie Creek Proposed LOS

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**Table 15.4**

| ARCHIE CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 22 | 280525 | 999.25 | 999.50 | 1000.00 | 20.10 | 20.40 | 20.85 | 21.14 | 21.68 | 21.94 | E | E | E | E | E | E |
| 22 | 280530 | 999.25 | 999.50 | 1000.00 | 20.11 | 20.41 | 20.87 | 21.15 | 21.70 | 21.96 | E | E | E | E | E | E |
| 22 | 280535 | 999.25 | 999.50 | 1000.00 | 20.11 | 20.42 | 20.87 | 21.16 | 21.70 | 21.96 | E | E | E | E | E | E |
| 28 | 290000 | 28.25 | 999.50 | 1000.00 | 17.62 | 18.18 | 18.86 | 19.22 | 19.86 | 20.16 | A | A | A | A | A | A |
| 28 | 290003 | 23.95 | 999.50 | 1000.00 | 17.75 | 18.31 | 18.97 | 19.33 | 19.96 | 20.25 | A | A | A | A | A | A |
| 28 | 290010 | 22.65 | 999.50 | 1000.00 | 17.94 | 18.47 | 19.29 | 19.81 | 20.75 | 21.08 | A | A | A | A | A | A |
| 28 | 290015 | 999.25 | 22.50 | 24.00 | 23.40 | 23.40 | 23.40 | 23.40 | 23.40 | 23.41 | C | C | C | C | C | C |
| 28 | 290020 | 999.25 | 999.50 | 1000.00 | 23.60 | 23.60 | 23.61 | 23.67 | 23.78 | 23.84 | E | E | E | E | E | E |
| 28 | 290025 | 22.75 | 999.50 | 24.40 | 20.31 | 20.67 | 21.12 | 21.38 | 21.96 | 22.24 | A | A | A | A | A | A |
| 28 | 290030 | 999.25 | 999.50 | 1000.00 | 20.78 | 21.09 | 21.45 | 21.66 | 22.15 | 22.40 | E | E | E | E | E | E |
| 28 | 290035 | 26.05 | 999.50 | 25.00 | 26.00 | 26.00 | 26.00 | 26.02 | 26.13 | 26.18 | D | D | D | D | D | D |
| 34 | 290038 | 24.25 | 999.50 | 26.00 | 22.20 | 22.54 | 22.93 | 23.17 | 23.74 | 24.07 | A | A | A | A | A | A |
| 34 | 290045 | 24.65 | 999.50 | 28.00 | 22.80 | 23.27 | 23.91 | 24.22 | 24.95 | 25.27 | A | A | A | A | B | B |
| 34 | 290055 | 25.25 | 999.50 | 25.00 | 23.48 | 23.95 | 24.61 | 25.05 | 25.79 | 26.14 | A | A | A | D | D | D |
| 28 | 290100 | 22.85 | 999.50 | 23.00 | 19.87 | 20.14 | 20.47 | 20.67 | 21.01 | 21.16 | A | A | A | A | A | A |
| 28 | 290105 | 22.75 | 999.50 | 24.00 | 21.66 | 21.92 | 22.26 | 22.45 | 22.78 | 22.93 | A | A | A | A | B | B |
| 28 | 290110 | 28.25 | 999.50 | 1000.00 | 20.60 | 20.72 | 20.93 | 21.05 | 21.28 | 21.38 | A | A | A | A | A | A |
| 28 | 290115 | 28.25 | 999.50 | 1000.00 | 22.10 | 22.14 | 22.35 | 22.48 | 22.72 | 22.82 | A | A | A | A | A | A |
| 27,28 | 290200 | 23.75 | 999.50 | 24.00 | 21.40 | 21.72 | 22.19 | 22.49 | 23.04 | 23.31 | A | A | A | A | A | A |
| 27 | 290225 | 24.35 | 999.50 | 1000.00 | 24.09 | 24.18 | 24.29 | 24.35 | 24.45 | 24.50 | A | A | A | B | B | B |
| 27 | 290235 | 25.85 | 999.50 | 1000.00 | 24.91 | 25.01 | 25.14 | 25.22 | 25.36 | 25.43 | A | A | A | A | A | A |
| 27 | 290250 | 24.25 | 999.50 | 1000.00 | 22.43 | 22.57 | 22.77 | 22.90 | 23.16 | 23.36 | A | A | A | A | A | A |
| 28 | 290305 | 28.25 | 999.50 | 29.00 | 23.17 | 23.61 | 24.27 | 24.71 | 25.68 | 26.18 | A | A | A | A | A | A |
| 28 | 290306 | 24.25 | 999.50 | 25.00 | 23.53 | 23.89 | 24.39 | 24.70 | 25.28 | 25.56 | A | A | B | B | D | D |
| 34 | 290310 | 25.25 | 999.50 | 25.00 | 27.46 | 27.57 | 27.72 | 27.82 | 27.99 | 28.08 | D | D | D | D | D | D |
| 33 | 290315 | 999.25 | 999.50 | 1000.00 | 26.00 | 26.10 | 26.24 | 26.33 | 26.50 | 26.58 | E | E | E | E | E | E |
| 33 | 290320 | 39.25 | 999.50 | 37.00 | 27.00 | 27.02 | 27.14 | 27.21 | 27.35 | 27.42 | A | A | A | A | A | A |
| 33 | 290325 | 41.65 | 999.50 | 43.00 | 26.24 | 26.43 | 26.89 | 27.29 | 27.93 | 28.16 | A | A | A | A | A | A |
| 27 | 290330 | 999.25 | 999.50 | 32.00 | 24.65 | 25.73 | 26.87 | 27.28 | 27.91 | 28.15 | A | A | A | A | A | A |
| 27 | 290340 | 28.65 | 999.50 | 32.00 | 26.23 | 26.47 | 26.89 | 27.28 | 27.91 | 28.15 | A | A | A | A | A | A |
| 27 | 290350 | 999.25 | 999.50 | 33.00 | 27.99 | 28.15 | 28.40 | 28.57 | 28.89 | 29.05 | A | A | A | A | A | A |
| 27/33 | 290360 | 35.35 | 36.50 | 37.10 | 27.48 | 27.72 | 28.02 | 28.20 | 28.51 | 28.65 | A | A | A | A | A | A |
| 33 | 290370 | 37.65 | 37.50 | 39.00 | 27.64 | 27.88 | 28.19 | 28.37 | 28.68 | 28.81 | A | A | A | A | A | A |
| 21 | 290500 | 28.75 | 999.50 | 1000.00 | 16.45 | 16.66 | 17.03 | 17.27 | 17.73 | 17.96 | A | A | A | A | A | A |
| 27 | 290570 | 28.45 | 999.50 | 1000.00 | 20.04 | 20.42 | 20.86 | 21.10 | 21.48 | 21.63 | A | A | A | A | A | A |
| 27 | 290572 | 29.55 | 999.50 | 1000.00 | 25.50 | 25.50 | 25.54 | 25.60 | 25.71 | 25.77 | A | A | A | A | A | A |
| 27 | 290575 | 28.55 | 999.50 | 1000.00 | 20.12 | 20.52 | 21.05 | 21.38 | 21.88 | 22.12 | A | A | A | A | A | A |
| 27 | 290580 | 16.95 | 18.50 | 1000.00 | 21.21 | 21.38 | 21.60 | 21.73 | 22.01 | 22.24 | C | C | C | C | C | C |
| 27 | 290585 | 24.05 | 999.50 | 1000.00 | 22.34 | 22.51 | 22.73 | 22.86 | 23.10 | 23.22 | A | A | A | A | A | A |
| 27 | 290587 | 28.45 | 999.50 | 1000.00 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | A | A | A | A | A | A |
| 27 | 290588 | 25.25 | 999.50 | 1000.00 | 27.50 | 27.50 | 27.50 | 27.50 | 27.50 | 27.50 | B | B | B | B | B | B |
| 27 | 290590 | 26.05 | 999.50 | 1000.00 | 21.95 | 22.10 | 22.28 | 22.37 | 22.76 | 22.95 | A | A | A | A | A | A |

**Archie Creek Proposed LOS**

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**Table 15.4**

| ARCHIE CREEK SUB-WATERSHED PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| Story Board | Subbasin | Road | Site | Struct | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-YR | 100-yr | 2.33-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 27 | 290594 | 26.55 | 999.50 | 1000.00 | 24.06 | 24.46 | 25.03 | 25.40 | 25.91 | 26.12 | A | A | A | A | A | A |
| 27 | 290595 | 29.45 | 999.50 | 31.00 | 24.08 | 24.46 | 25.03 | 25.40 | 25.91 | 26.12 | A | A | A | A | A | A |
| 27 | 290605 | 26.25 | 999.50 | 29.00 | 23.60 | 23.80 | 24.09 | 24.29 | 24.68 | 24.88 | A | A | A | A | A | A |
| 27 | 290610 | 26.25 | 999.50 | 29.20 | 23.60 | 23.80 | 24.09 | 24.29 | 24.68 | 24.87 | A | A | A | A | A | A |
| 27 | 290612 | 25.65 | 999.50 | 27.00 | 24.80 | 24.99 | 25.26 | 25.38 | 25.60 | 25.70 | A | A | A | A | A | B |
| 27 | 290616 | 999.25 | 999.50 | 30.00 | 24.98 | 25.18 | 25.50 | 25.72 | 26.08 | 26.22 | A | A | A | A | A | A |
| 27 | 290617 | 25.65 | 999.50 | 29.20 | 25.00 | 25.19 | 25.53 | 25.76 | 26.15 | 26.30 | A | A | A | B | B | B |
| 27 | 290620 | 999.25 | 999.50 | 29.00 | 25.20 | 25.41 | 25.90 | 26.17 | 26.57 | 26.73 | A | A | A | A | A | A |

**Delaney Creek Sub-watershed**

**Existing vs Proposed LOS**

8/30/01

**Table 15.1a**

| DELANEY CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 1C | 210010 | 5.25 | 5.30 | 6.60 | 5.89 | 4.65 | 6.40 | 5.11 | 7.78 | 6.43 | | C | A | C | A | D | C |
| 1C | 210020 | 6.05 | 6.50 | 7.50 | 6.18 | 5.39 | 6.72 | 5.92 | 8.17 | 7.36 | | B | A | C | A | D | C |
| 1C | 210025 | 6.45 | 6.70 | 7.50 | 6.10 | 5.41 | 6.78 | 5.82 | 9.00 | 7.37 | | A | A | C | A | D | C |
| 6 | 210040 | 6.50 | 7.20 | 8.20 | 6.98 | 6.18 | 7.59 | 6.86 | 8.98 | 8.66 | | B | A | C | B | D | D |
| 6 | 210060 | 10.55 | 10.50 | 11.00 | 8.49 | 6.70 | 9.14 | 7.39 | 10.46 | 9.38 | | A | A | A | A | A | A |
| 6 | 210065 | 10.75 | 11.00 | 12.00 | 8.31 | 7.90 | 9.14 | 8.87 | 10.48 | 10.21 | | A | A | A | A | A | A |
| 6 | 210080 | 10.70 | 12.00 | 13.00 | 9.48 | 7.75 | 10.13 | 8.42 | 11.51 | 10.30 | | A | A | A | A | B | A |
| 6 | 210090 | 11.55 | 12.10 | 12.60 | 10.06 | 8.70 | 10.68 | 9.36 | 12.03 | 11.14 | | A | A | A | A | B | A |
| 13/6 | 210100 | 11.25 | 11.80 | 12.30 | 10.73 | 9.02 | 11.38 | 9.69 | 12.83 | 11.48 | | A | A | B | A | D | B |
| 13 | 210120 | 12.15 | 12.50 | 13.00 | 12.20 | 9.80 | 13.02 | 10.52 | 15.24 | 12.42 | | B | A | D | A | D | B |
| 12 | 210125 | 11.95 | 12.50 | 13.00 | 12.96 | 12.96 | 13.10 | 13.10 | 13.45 | 13.45 | | C | C | D | D | D | D |
| 13 | 210150 | 18.55 | 18.50 | 19.00 | 16.22 | 13.20 | 16.92 | 13.83 | 18.95 | 15.36 | | A | A | A | A | C | A |
| 12 | 210170 | 18.05 | 18.80 | 19.30 | 17.88 | 14.62 | 18.57 | 15.17 | 20.36 | 16.48 | | A | A | B | A | D | A |
| 12 | 210180 | 19.85 | 19.00 | 19.50 | 18.68 | 16.67 | 19.37 | 17.14 | 21.15 | 18.20 | | A | A | C | A | D | A |
| 18 | 210190 | 19.25 | 21.40 | 21.90 | 19.08 | 17.48 | 19.90 | 18.15 | 21.79 | 20.09 | | A | A | B | A | C | B |
| 18 | 210200 | 19.95 | 21.50 | 22.00 | 19.62 | 17.53 | 20.36 | 18.19 | 22.15 | 20.12 | | A | A | B | A | D | B |
| 18 | 210210 | 22.65 | 24.50 | 25.00 | 20.82 | 18.44 | 21.56 | 19.04 | 23.12 | 20.75 | | A | A | A | A | B | A |
| 18 | 210230 | 22.55 | 24.50 | 25.00 | 21.32 | 18.97 | 22.00 | 19.53 | 23.48 | 21.20 | | A | A | A | A | B | A |
| 23 | 210260 | 27.45 | 25.50 | 26.70 | 25.31 | 25.28 | 25.81 | 25.76 | 26.98 | 26.90 | | A | A | C | C | D | D |
| 23 | 210280 | 29.60 | 997.50 | 998.00 | 27.13 | 27.05 | 27.62 | 27.53 | 28.71 | 28.65 | | A | A | A | A | A | A |
| 24 | 210290 | 27.85 | 28.00 | 29.70 | 27.55 | 27.45 | 28.03 | 27.93 | 29.11 | 29.05 | | A | A | C | B | C | C |
| 24/29 | 210300 | 31.50 | 997.50 | 998.00 | 27.80 | 27.72 | 28.28 | 28.20 | 29.40 | 29.35 | | A | A | A | A | A | A |
| 29 | 210332 | 35.50 | 37.50 | 39.00 | 31.71 | 31.71 | 32.62 | 32.62 | 35.43 | 35.42 | | A | A | A | A | A | A |
| 29 | 210333 | 44.45 | 40.50 | 41.00 | 38.81 | 38.60 | 39.32 | 39.13 | 40.65 | 40.48 | | A | A | A | A | C | A |
| 30 | 210335 | 997.25 | 997.50 | 998.00 | 28.31 | 28.23 | 28.69 | 28.60 | 29.65 | 29.60 | | E | E | E | E | E | E |
| 30 | 210336 | 997.25 | 997.50 | 998.00 | 28.36 | 28.29 | 28.74 | 28.66 | 29.68 | 29.63 | | E | E | E | E | E | E |
| 30 | 210350 | 997.25 | 997.50 | 998.00 | 28.93 | 28.83 | 29.38 | 29.28 | 30.52 | 30.43 | | E | E | E | E | E | E |
| 30 | 210360 | 997.25 | 997.50 | 998.00 | 29.11 | 29.01 | 29.58 | 29.48 | 30.79 | 30.68 | | E | E | E | E | E | E |
| 5 | 211010 | 13.05 | 12.50 | 13.00 | 10.07 | 8.72 | 10.70 | 9.38 | 12.05 | 11.17 | | A | A | A | A | A | A |

**Delaney Creek Sub-watershed**

**Existing vs Proposed LOS**

8/30/01

**Table 15.1a**

| DELANEY CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 12 | 211060 | 9.45 | 11.50 | 12.00 | 11.81 | 10.49 | 12.10 | 10.87 | 12.87 | 11.87 | C | B | D | B | D | C |
| 12 | 211080 | 12.75 | 13.50 | 14.00 | 12.62 | 11.95 | 13.13 | 12.54 | 14.16 | 13.89 | A | A | B | A | D | C |
| 12 | 211100 | 15.45 | 15.50 | 16.00 | 13.65 | 13.65 | 13.96 | 13.96 | 14.76 | 14.76 | A | A | A | A | A | A |
| 12 | 211110 | 997.25 | 22.20 | 22.70 | 19.58 | 19.58 | 19.67 | 19.67 | 19.89 | 19.89 | A | A | A | A | A | A |
| 5 | 211115 | 16.95 | 16.30 | 17.20 | 15.46 | 15.46 | 15.66 | 15.66 | 16.25 | 16.25 | A | A | A | A | A | A |
| 5 | 211030 | 13.25 | 13.60 | 15.20 | 10.77 | 8.90 | 11.24 | 9.65 | 12.41 | 11.30 | A | A | A | A | A | A |
| 11 | 211160 | 17.55 | 17.60 | 18.10 | 16.87 | 16.87 | 16.95 | 16.95 | 17.37 | 17.37 | A | A | A | A | A | A |
| 11 | 211165 | 17.55 | 18.60 | 19.10 | 17.44 | 17.44 | 17.51 | 17.51 | 17.71 | 17.71 | A | A | A | A | B | B |
| 5 | 211185 | 15.95 | 16.00 | 16.50 | 15.37 | 15.37 | 15.51 | 15.51 | 15.87 | 15.87 | A | A | A | A | A | A |
| 13 | 211510 | 15.75 | 15.50 | 16.00 | 14.02 | 13.48 | 14.45 | 14.04 | 15.86 | 14.81 | A | A | A | A | C | A |
| 13/6 | 211530 | 999.25 | 999.50 | 1000.00 | 15.51 | 15.33 | 15.98 | 15.83 | 17.09 | 16.96 | E | E | E | E | E | E |
| 12 | 212000 | 16.95 | 18.50 | 19.00 | 17.96 | 15.07 | 18.64 | 15.60 | 20.40 | 16.88 | B | A | C | A | D | A |
| 12 | 212030 | 17.95 | 20.50 | 21.00 | 18.39 | 15.76 | 19.19 | 16.44 | 20.84 | 18.31 | B | A | B | A | C | B |
| 12 | 212040 | 18.45 | 19.50 | 20.00 | 17.98 | 15.23 | 18.66 | 15.75 | 20.41 | 17.03 | A | A | B | A | D | A |
| 12 | 212060 | 18.05 | 19.50 | 20.00 | 18.20 | 15.38 | 18.93 | 15.91 | 20.91 | 17.25 | B | A | B | A | D | A |
| 12 | 212080 | 17.35 | 18.50 | 19.00 | 18.86 | 15.97 | 19.33 | 16.56 | 20.53 | 18.43 | C | A | D | A | D | B |
| 12 | 212100 | 17.15 | 18.50 | 20.00 | 19.12 | 16.47 | 19.63 | 17.16 | 20.83 | 18.84 | C | A | C | B | D | C |
| 11 | 212130 | 18.85 | 20.50 | 21.00 | 20.39 | 16.88 | 20.86 | 17.56 | 21.83 | 19.36 | B | A | C | A | D | B |
| 18 | 213010 | 20.75 | 22.50 | 23.00 | 21.94 | 18.78 | 22.43 | 19.44 | 23.53 | 21.36 | B | A | B | A | D | B |
| 18 | 213040 | 21.45 | 23.50 | 24.00 | 22.23 | 19.46 | 22.74 | 20.24 | 23.93 | 21.92 | B | A | B | A | C | B |
| 17 | 213060 | 24.25 | 25.50 | 26.00 | 22.93 | 19.96 | 23.36 | 20.81 | 24.48 | 22.59 | A | A | A | A | B | A |
| 18 | 213510 | 24.05 | 25.50 | 26.00 | 20.83 | 20.26 | 21.58 | 20.79 | 23.48 | 22.65 | A | A | A | A | A | A |
| 18 | 213530 | 23.65 | 25.50 | 26.00 | 21.21 | 21.74 | 22.00 | 22.80 | 24.80 | 24.56 | A | A | A | A | B | B |
| 18 | 213800 | 997.25 | 997.50 | 998.00 | 25.08 | 25.08 | 25.29 | 25.29 | 25.83 | 25.83 | E | E | E | E | E | E |
| 18 | 213810 | 997.25 | 997.50 | 998.00 | 28.10 | 28.10 | 28.26 | 28.26 | 28.72 | 28.72 | E | E | E | E | E | E |
| 23 | 214012 | 27.45 | 997.50 | 998.00 | 28.13 | 28.13 | 28.46 | 28.46 | 29.32 | 29.32 | B | B | B | B | B | B |
| 17/23 | 214020 | 27.85 | 997.50 | 998.00 | 27.00 | 27.01 | 27.39 | 27.39 | 27.98 | 27.99 | A | A | A | A | B | B |
| 23 | 214040 | 997.25 | 997.50 | 998.00 | 31.05 | 31.05 | 31.56 | 31.56 | 32.89 | 32.89 | E | E | E | E | E | E |
| 23 | 214053 | 29.05 | 997.50 | 998.00 | 28.23 | 28.23 | 28.59 | 28.59 | 29.55 | 29.55 | A | A | A | A | B | B |
| 24 | 214500 | 997.25 | 997.50 | 998.00 | 25.74 | 25.74 | 25.88 | 25.88 | 27.38 | 27.17 | E | E | E | E | E | E |
| 23 | 215010 | 28.75 | 997.50 | 998.00 | 27.20 | 27.13 | 27.70 | 27.63 | 28.87 | 28.82 | A | A | A | A | B | B |
| 23 | 215023 | 30.25 | 29.40 | 29.90 | 27.18 | 27.10 | 27.73 | 27.64 | 29.22 | 29.21 | A | A | A | A | A | A |
| 23 | 215041 | 30.15 | 997.50 | 998.00 | 28.68 | 28.67 | 29.26 | 29.25 | 30.29 | 30.28 | A | A | A | A | B | B |
| 23 | 215042 | 31.15 | 997.50 | 998.00 | 28.91 | 28.91 | 29.53 | 29.52 | 30.37 | 30.36 | A | A | A | A | A | A |
| 23 | 215051 | 997.25 | 997.50 | 998.00 | 28.88 | 29.00 | 29.66 | 29.76 | 31.68 | 31.76 | E | E | E | E | E | E |
| 23 | 215060 | 32.15 | 30.50 | 31.00 | 27.85 | 27.84 | 28.44 | 28.43 | 29.77 | 29.77 | A | A | A | A | A | A |
| 23 | 215070 | 32.15 | 30.50 | 32.50 | 28.26 | 28.26 | 28.88 | 28.88 | 30.51 | 30.52 | A | A | A | A | C | C |
| 23/29 | 215500 | 31.15 | 29.30 | 30.50 | 27.14 | 27.06 | 27.63 | 27.54 | 28.72 | 28.66 | A | A | A | A | A | A |
| 23/29 | 215520 | 31.25 | 31.75 | 33.75 | 31.17 | 30.41 | 31.60 | 30.79 | 32.86 | 31.72 | A | A | B | A | C | B |
| 29 | 215530 | 31.65 | 32.75 | 33.75 | 32.17 | 31.34 | 32.74 | 31.91 | 33.99 | 33.30 | B | A | B | B | D | C |
| 29 | 215537 | 997.25 | 997.50 | 998.00 | 34.89 | 34.64 | 36.15 | 35.90 | 38.12 | 38.05 | E | E | E | E | E | E |
| 29 | 215538 | 32.25 | 32.50 | 40.00 | 31.52 | 31.52 | 32.04 | 31.73 | 33.67 | 32.82 | A | A | A | A | C | C |
| 29 | 215542 | 53.25 | 40.00 | 56.90 | 38.68 | 38.68 | 38.92 | 38.92 | 39.57 | 39.57 | A | A | A | A | A | A |

# Delaney Creek Sub-watershed
## Existing vs Proposed LOS
8/30/01
**Table 15.1a**

| DELANEY CREEK SUB-WATERSHED<br>EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 29 | 215550 | 52.25 | 40.30 | 56.90 | 38.80 | 38.80 | 39.15 | 39.15 | 40.50 | 40.50 | | A | A | A | A | C | C |
| 24 | 216000 | 29.75 | 29.20 | 29.70 | 27.57 | 27.46 | 28.06 | 27.94 | 29.14 | 29.06 | | A | A | A | A | A | A |
| 24 | 216500 | 997.25 | 997.50 | 998.00 | 27.03 | 26.99 | 27.56 | 27.32 | 28.57 | 28.42 | | E | E | E | E | E | E |
| 24 | 216510 | 997.25 | 997.50 | 998.00 | 27.03 | 26.99 | 27.56 | 27.32 | 28.57 | 28.42 | | E | E | E | E | E | E |
| 30 | 217000 | 997.25 | 997.50 | 998.00 | 28.67 | 28.57 | 29.11 | 29.02 | 30.16 | 30.08 | | E | E | E | E | E | E |
| 30 | 217020 | 997.25 | 997.50 | 998.00 | 29.12 | 29.12 | 29.58 | 29.58 | 30.93 | 30.93 | | E | E | E | E | E | E |
| 30 | 220000 | 997.25 | 997.50 | 998.00 | 29.31 | 29.22 | 29.94 | 29.86 | 31.30 | 31.23 | | E | E | E | E | E | E |
| 36 | 220010 | 32.05 | 997.50 | 998.00 | 29.65 | 29.61 | 30.12 | 30.07 | 31.36 | 31.30 | | A | A | A | A | A | A |
| 36 | 220040 | 30.25 | 30.10 | 34.70 | 30.00 | 29.98 | 30.42 | 30.40 | 31.62 | 31.59 | | A | A | C | C | C | C |
| 36 | 220050 | 30.45 | 30.70 | 31.40 | 30.06 | 30.05 | 30.46 | 30.44 | 31.64 | 31.61 | | A | A | B | A | D | D |
| 41 | 220060 | 31.25 | 32.50 | 34.00 | 30.20 | 30.20 | 30.61 | 30.60 | 31.75 | 31.73 | | A | A | A | A | B | B |
| 41 | 220070 | 33.90 | 33.50 | 34.00 | 31.90 | 31.91 | 32.24 | 32.24 | 33.11 | 33.11 | | A | A | A | A | A | A |
| 41 | 220110 | 36.25 | 37.25 | 38.75 | 34.36 | 34.39 | 35.08 | 35.12 | 36.70 | 36.72 | | A | A | A | A | B | B |
| 41 | 220130 | 36.50 | 37.25 | 38.75 | 34.47 | 34.53 | 35.21 | 35.27 | 37.29 | 37.32 | | A | A | A | A | C | C |
| 41 | 220140 | 36.25 | 37.25 | 38.75 | 34.56 | 34.63 | 35.31 | 35.38 | 37.40 | 37.44 | | A | A | A | A | C | C |
| 41 | 220170 | 44.25 | 37.50 | 38.00 | 35.20 | 35.20 | 35.90 | 35.91 | 37.34 | 37.36 | | A | A | A | A | A | A |
| 41 | 220180 | 44.25 | 45.50 | 53.00 | 35.80 | 35.80 | 36.79 | 36.79 | 40.27 | 40.28 | | A | A | A | A | A | A |
| 41 | 220190 | 44.25 | 38.50 | 45.00 | 37.03 | 37.29 | 37.98 | 38.24 | 39.63 | 39.81 | | A | A | A | A | C | C |
| 41 | 220195 | 41.75 | 42.00 | 43.00 | 35.21 | 42.25 | 35.26 | 42.60 | 35.45 | 43.60 | | A | C | A | C | A | D |
| 41 | 220200 | 39.25 | 40.25 | 41.00 | 37.09 | 37.33 | 37.88 | 37.91 | 39.19 | 39.53 | | A | A | A | A | A | B |
| 45 | 220210 | 40.00 | 40.00 | 41.00 | 37.15 | 37.36 | 37.74 | 38.00 | 39.24 | 39.56 | | A | A | A | A | A | A |
| 30 | 221000 | 31.05 | 30.00 | 41.00 | 29.32 | 29.23 | 29.96 | 29.87 | 31.31 | 31.25 | | A | A | A | A | C | C |
| 30 | 221030 | 33.25 | 34.25 | 36.00 | 29.84 | 29.84 | 30.34 | 30.34 | 31.84 | 31.83 | | A | A | A | A | A | A |
| 30/36 | 221500 | 35.25 | 35.50 | 36.00 | 35.04 | 35.04 | 35.35 | 35.35 | 36.10 | 36.10 | | A | A | B | B | D | D |
| 30/36 | 221520 | 46.35 | 48.00 | 49.00 | 37.66 | 37.66 | 38.13 | 38.13 | 39.06 | 39.06 | | A | A | A | A | A | A |
| 29/35 | 221540 | 43.25 | 41.50 | 43.00 | 37.94 | 37.94 | 38.41 | 38.41 | 39.77 | 39.77 | | A | A | A | A | A | A |
| 35 | 221550 | 45.25 | 46.50 | 48.00 | 37.21 | 37.21 | 37.46 | 37.46 | 38.17 | 38.17 | | A | A | A | A | A | A |
| 29/35 | 221560 | 51.25 | 41.50 | 43.00 | 37.40 | 37.40 | 37.72 | 37.72 | 38.68 | 38.68 | | A | A | A | A | A | A |
| 35 | 221580 | 52.25 | 53.00 | 54.60 | 41.14 | 41.14 | 42.06 | 42.06 | 44.51 | 44.51 | | A | A | A | A | A | A |
| 36 | 222000 | 32.05 | 32.50 | 33.50 | 29.74 | 29.73 | 30.25 | 30.23 | 31.41 | 31.35 | | A | A | A | A | A | A |
| 36 | 222020 | 32.00 | 32.50 | 33.00 | 29.85 | 29.84 | 30.37 | 30.35 | 31.74 | 31.72 | | A | A | A | A | A | A |
| 36 | 222030 | 31.05 | 30.50 | 31.90 | 29.86 | 29.85 | 30.37 | 30.36 | 31.76 | 31.73 | | A | A | A | A | C | C |
| 37 | 222040 | 32.35 | 30.90 | 32.00 | 29.87 | 29.86 | 30.38 | 30.37 | 31.79 | 31.78 | | A | A | A | A | C | C |
| 37 | 222050 | 32.25 | 32.40 | 33.00 | 29.92 | 29.91 | 30.43 | 30.42 | 31.91 | 31.90 | | A | A | A | A | A | A |
| 37 | 222060 | 33.35 | 33.60 | 34.10 | 29.92 | 29.91 | 30.43 | 30.42 | 31.91 | 31.90 | | A | A | A | A | A | A |
| 37 | 222080 | 32.35 | 32.50 | 33.10 | 29.98 | 29.98 | 30.49 | 30.48 | 31.94 | 31.93 | | A | A | A | A | A | A |
| 42 | 222090 | 33.25 | 35.00 | 36.00 | 31.70 | 31.70 | 32.10 | 32.10 | 33.07 | 33.07 | | A | A | A | A | A | A |
| 36 | 222500 | 31.65 | 31.90 | 35.00 | 31.14 | 31.08 | 31.87 | 31.80 | 33.88 | 33.79 | | A | A | B | B | C | C |
| 37 | 222520 | 32.40 | 33.50 | 34.80 | 31.99 | 31.97 | 32.82 | 32.79 | 34.79 | 34.77 | | A | A | B | B | C | C |
| 37 | 222530 | 32.35 | 33.50 | 34.80 | 31.97 | 31.95 | 32.81 | 32.79 | 34.78 | 34.76 | | A | A | B | B | C | C |
| 37 | 222540 | 32.03 | 32.50 | 34.30 | 30.79 | 30.78 | 31.49 | 31.47 | 33.33 | 33.31 | | A | A | A | A | C | C |

**Delaney Creek Sub-watershed**

**Existing vs Proposed LOS**

8/30/01

**Table 15.1a**

| DELANEY CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 36 | 223000 | 31.50 | 32.00 | 33.00 | 30.40 | 30.40 | 30.57 | 30.57 | 31.52 | 31.47 | | A | A | A | A | B | A |
| 36 | 223020 | 40.25 | 40.50 | 41.00 | 27.82 | 27.82 | 28.17 | 28.17 | 33.17 | 33.17 | | A | A | A | A | A | A |
| 36 | 223030 | 34.75 | 31.00 | 35.00 | 34.30 | 34.30 | 34.46 | 34.46 | 34.85 | 34.85 | | C | C | C | C | C | C |
| 35 | 223050 | 36.25 | 40.50 | 56.00 | 32.52 | 32.52 | 32.76 | 32.76 | 33.37 | 33.37 | | A | A | A | A | A | A |
| 41 | 224010 | 29.25 | 35.50 | 37.00 | 30.96 | 30.96 | 31.55 | 31.55 | 32.92 | 32.92 | | B | B | B | B | B | B |
| 41 | 224050 | 34.25 | 35.50 | 36.00 | 32.03 | 32.03 | 32.62 | 32.62 | 34.41 | 34.41 | | A | A | A | A | B | B |
| 41 | 225010 | 34.25 | 35.50 | 37.00 | 33.62 | 33.63 | 34.30 | 34.30 | 35.88 | 35.88 | | A | A | B | B | C | C |
| 41 | 225017 | 37.25 | 39.50 | 40.00 | 39.07 | 39.07 | 39.54 | 39.54 | 40.62 | 40.62 | | B | B | C | C | D | D |
| 41 | 225110 | 45.25 | 46.50 | 47.00 | 39.22 | 39.22 | 39.69 | 39.69 | 40.80 | 40.80 | | A | A | A | A | A | A |
| 41 | 225120 | 38.25 | 40.50 | 41.00 | 39.35 | 39.35 | 39.80 | 39.80 | 40.93 | 40.93 | | B | B | B | B | C | C |
| 41 | 225130 | 47.15 | 49.50 | 51.00 | 37.03 | 37.29 | 37.98 | 38.25 | 39.64 | 39.82 | | A | A | A | A | A | A |
| 41 | 225140 | 44.25 | 44.80 | 46.00 | 37.03 | 37.29 | 37.98 | 38.24 | 39.63 | 39.81 | | A | A | A | A | A | A |
| 41 | 225150 | 997.25 | 997.50 | 998.00 | 43.52 | 43.52 | 43.79 | 43.77 | 44.36 | 44.37 | | E | E | E | E | E | E |
| 41 | 225160 | 997.25 | 997.50 | 998.00 | 44.26 | 44.26 | 44.38 | 44.38 | 44.71 | 44.71 | | E | E | E | E | E | E |
| 45 | 226000 | 37.37 | 37.50 | 39.00 | 37.16 | 37.37 | 37.76 | 38.01 | 39.27 | 39.59 | | A | B | C | C | D | D |
| 45 | 227000 | 50.25 | 45.50 | 56.00 | 43.96 | 43.96 | 44.29 | 44.29 | 45.24 | 45.24 | | A | A | A | A | A | A |
| 45 | 227010 | 997.25 | 997.50 | 998.00 | 47.31 | 47.31 | 47.68 | 47.68 | 48.66 | 48.66 | | E | E | E | E | E | E |
| 45 | 227020 | 997.25 | 997.50 | 998.00 | 46.40 | 46.40 | 46.72 | 46.72 | 47.70 | 47.70 | | E | E | E | E | E | E |
| 45 | 227030 | 52.25 | 41.70 | 53.00 | 50.34 | 50.34 | 50.65 | 50.65 | 51.59 | 51.59 | | C | C | C | C | C | C |
| 49 | 227040 | 59.05 | 60.50 | 61.00 | 58.32 | 58.32 | 58.48 | 58.48 | 59.22 | 59.22 | | A | A | A | A | B | B |
| 45/46 | 227050 | 55.25 | 47.50 | 48.00 | 41.92 | 41.92 | 45.42 | 45.42 | 53.76 | 53.76 | | A | A | A | A | D | D |
| 49 | 227060 | 89.05 | 79.20 | 95.00 | 74.75 | 74.75 | 75.75 | 75.75 | 78.86 | 78.86 | | A | A | A | A | A | A |
| 49 | 227070 | 89.15 | 89.20 | 89.00 | 85.31 | 82.78 | 85.88 | 83.19 | 87.41 | 84.45 | | A | A | A | A | A | A |
| 50 | 227080 | 73.85 | 74.10 | 74.60 | 70.72 | 70.72 | 71.06 | 71.06 | 72.09 | 72.09 | | A | A | A | A | A | A |
| 50 | 227090 | 74.65 | 75.50 | 76.00 | 74.51 | 74.51 | 74.84 | 74.84 | 75.78 | 75.78 | | A | A | B | B | C | C |
| 30 | 230005 | 30.25 | 997.50 | 998.00 | 29.82 | 29.61 | 30.21 | 30.01 | 31.40 | 31.23 | | A | A | A | A | B | B |
| 30 | 230012 | 32.75 | 997.50 | 998.00 | 31.60 | 32.87 | 32.02 | 33.45 | 33.07 | 34.97 | | A | B | A | B | B | B |
| 30 | 230030 | 30.25 | 30.90 | 31.40 | 29.81 | 29.60 | 30.19 | 30.00 | 31.28 | 31.11 | | A | A | A | A | C | C |
| 31 | 230033 | 32.75 | 997.50 | 998.00 | 32.04 | 32.04 | 32.44 | 32.44 | 33.64 | 33.64 | | A | A | A | A | B | B |
| 37 | 230090 | 32.35 | 31.80 | 32.50 | 30.65 | 30.65 | 31.01 | 31.01 | 32.06 | 32.05 | | A | A | A | A | C | C |
| 42 | 230170 | 35.05 | 40.00 | 41.00 | 33.02 | 33.02 | 33.54 | 33.54 | 34.95 | 34.95 | | A | A | A | A | A | A |
| 42 | 230180 | 41.25 | 41.50 | 42.00 | 34.45 | 34.45 | 34.91 | 34.91 | 35.64 | 35.64 | | A | A | A | A | A | A |
| 46 | 230190 | 36.75 | 41.00 | 42.00 | 35.45 | 35.45 | 38.18 | 38.18 | 40.87 | 40.87 | | A | A | B | B | B | B |
| 46 | 230200 | 48.25 | 48.50 | 49.50 | 48.46 | 48.46 | 49.01 | 49.01 | 50.43 | 50.43 | | B | B | C | C | D | D |
| 42 | 231000 | 34.45 | 35.00 | 36.00 | 32.63 | 32.63 | 32.96 | 32.96 | 33.76 | 33.76 | | A | A | A | A | A | A |
| 42 | 232000 | 34.05 | 40.00 | 41.00 | 33.81 | 33.81 | 34.57 | 34.57 | 36.89 | 36.89 | | A | A | B | B | B | B |
| 42/46 | 233000 | 43.91 | 44.50 | 46.00 | 42.93 | 42.93 | 43.48 | 43.48 | 44.61 | 44.61 | | A | A | A | A | C | C |
| 45/46 | 233010 | 37.05 | 44.00 | 45.00 | 40.00 | 40.00 | 40.00 | 40.00 | 53.76 | 53.76 | | B | B | B | B | D | D |
| 42 | 234000 | 44.75 | 36.90 | 45.50 | 31.00 | 31.00 | 31.00 | 31.00 | 31.00 | 31.00 | | A | A | A | A | A | A |
| #N/A | 250525 | #N/A | #N/A | #N/A | 27.48 | 27.37 | 28.30 | 28.24 | 29.57 | 29.52 | | ## | ## | ## | ### | ### | ### |
| #N/A | 250527 | #N/A | #N/A | #N/A | 29.33 | 29.33 | 29.36 | 29.36 | 29.44 | 29.44 | | ## | ## | ## | ### | ### | ### |
| #N/A | 250530 | #N/A | #N/A | #N/A | 29.40 | 29.40 | 29.56 | 29.56 | 29.92 | 29.92 | | ## | ## | ## | ### | ### | ### |
| #N/A | 250550 | #N/A | #N/A | #N/A | 29.70 | 29.70 | 29.74 | 29.74 | 29.85 | 29.85 | | ## | ## | ## | ### | ### | ### |

**Delaney Creek Sub-watershed**

**Existing vs Proposed LOS**

8/30/01

**Table 15.1a**

| DELANEY CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| #N/A | 250555 | #N/A | #N/A | #N/A | 29.70 | 29.70 | 29.75 | 29.75 | 29.85 | 29.85 | ## | ## | ## | ### | ### | ### |
| #N/A | 250557 | #N/A | #N/A | #N/A | 29.40 | 29.40 | 29.44 | 29.44 | 29.56 | 29.56 | ## | ## | ## | ### | ### | ### |
| #N/A | 250570 | #N/A | #N/A | #N/A | 29.43 | 29.43 | 29.55 | 29.55 | 29.85 | 29.85 | ## | ## | ## | ### | ### | ### |
| #N/A | 250580 | #N/A | #N/A | #N/A | 29.46 | 29.46 | 29.59 | 29.59 | 29.93 | 29.93 | ## | ## | ## | ### | ### | ### |
| #N/A | 250590 | #N/A | #N/A | #N/A | 30.06 | 30.06 | 30.49 | 30.49 | 31.72 | 31.72 | ## | ## | ## | ### | ### | ### |
| #N/A | 251000 | #N/A | #N/A | #N/A | 28.48 | 28.48 | 28.59 | 28.59 | 29.51 | 29.45 | ## | ## | ## | ### | ### | ### |
| #N/A | 251010 | #N/A | #N/A | #N/A | 30.76 | 30.76 | 31.47 | 31.47 | 33.76 | 33.76 | ## | ## | ## | ### | ### | ### |
| #N/A | 251011 | #N/A | #N/A | #N/A | 32.31 | 32.31 | 32.35 | 32.35 | 32.47 | 32.47 | ## | ## | ## | ### | ### | ### |
| #N/A | 251500 | #N/A | #N/A | #N/A | 27.77 | 27.68 | 28.41 | 28.41 | 29.71 | 29.65 | ## | ## | ## | ### | ### | ### |
| #N/A | 252000 | #N/A | #N/A | #N/A | 28.45 | 28.07 | 28.82 | 28.55 | 29.72 | 29.51 | ## | ## | ## | ### | ### | ### |
| #N/A | 252020 | #N/A | #N/A | #N/A | 28.45 | 28.10 | 28.82 | 28.50 | 29.67 | 29.50 | ## | ## | ## | ### | ### | ### |
| #N/A | 252025 | #N/A | #N/A | #N/A | 29.51 | 29.51 | 29.63 | 29.63 | 29.99 | 29.99 | ## | ## | ## | ### | ### | ### |
| #N/A | 252030 | #N/A | #N/A | #N/A | 28.46 | 28.10 | 28.83 | 28.48 | 29.66 | 29.30 | ## | ## | ## | ### | ### | ### |
| #N/A | 252040 | #N/A | #N/A | #N/A | 28.58 | 28.19 | 28.92 | 28.54 | 29.67 | 29.31 | ## | ## | ## | ### | ### | ### |
| #N/A | 252050 | #N/A | #N/A | #N/A | 28.63 | 28.21 | 28.96 | 28.56 | 29.67 | 29.30 | ## | ## | ## | ### | ### | ### |
| #N/A | 252060 | #N/A | #N/A | #N/A | 28.88 | 28.24 | 29.13 | 28.57 | 29.68 | 29.25 | ## | ## | ## | ### | ### | ### |
| #N/A | 252065 | #N/A | #N/A | #N/A | 28.89 | 28.26 | 29.14 | 28.59 | 29.68 | 29.26 | ## | ## | ## | ### | ### | ### |
| #N/A | 252080 | #N/A | #N/A | #N/A | 28.90 | 27.96 | 29.15 | 28.27 | 29.68 | 28.86 | ## | ## | ## | ### | ### | ### |
| #N/A | 252500 | #N/A | #N/A | #N/A | 28.58 | 28.20 | 28.92 | 28.56 | 29.67 | 29.31 | ## | ## | ## | ### | ### | ### |
| #N/A | 252510 | #N/A | #N/A | #N/A | 28.58 | 28.21 | 28.93 | 28.56 | 29.67 | 29.31 | ## | ## | ## | ### | ### | ### |
| #N/A | 253005 | #N/A | #N/A | #N/A | 28.27 | 28.27 | 28.60 | 28.57 | 29.63 | 29.50 | ## | ## | ## | ### | ### | ### |
| #N/A | 253015 | #N/A | #N/A | #N/A | 31.29 | 31.29 | 31.54 | 31.54 | 32.10 | 32.10 | ## | ## | ## | ### | ### | ### |
| #N/A | 253025 | #N/A | #N/A | #N/A | 31.90 | 31.90 | 32.11 | 32.11 | 32.69 | 32.69 | ## | ## | ## | ### | ### | ### |
| #N/A | 254010 | #N/A | #N/A | #N/A | 29.37 | 29.37 | 29.45 | 29.44 | 29.91 | 29.79 | ## | ## | ## | ### | ### | ### |
| #N/A | 254020 | #N/A | #N/A | #N/A | 29.37 | 29.37 | 29.45 | 29.44 | 29.91 | 29.79 | ## | ## | ## | ### | ### | ### |
| #N/A | 254030 | #N/A | #N/A | #N/A | 29.37 | 29.37 | 29.45 | 29.44 | 29.91 | 29.79 | ## | ## | ## | ### | ### | ### |
| #N/A | 254050 | #N/A | #N/A | #N/A | 29.61 | 29.61 | 29.69 | 29.69 | 29.93 | 29.93 | ## | ## | ## | ### | ### | ### |

# Delaney Pop-off Canal
## Existing vs Proposed LOS
8/30/01

**Table 15.2a**

| DELANEY POPOFF CANAL SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 2 | 200000 | 7.70 | 7.40 | 10.40 | 8.03 | 9.28 | 8.16 | 9.95 | 8.54 | 12.01 | C | C | C | C | C | D |
| 2 | 200010 | 7.70 | 7.40 | 10.40 | 7.90 | 9.28 | 8.03 | 9.95 | 8.38 | 12.01 | C | C | C | C | C | D |
| 2 | 200020 | 8.40 | 999.00 | 999.00 | 8.78 | 9.28 | 8.86 | 9.95 | 9.09 | 12.01 | B | B | B | B | B | B |
| 2 | 200025 | 8.55 | 8.60 | 10.70 | 8.91 | 9.28 | 8.99 | 9.95 | 9.22 | 12.01 | C | C | C | C | C | D |
| 2 | 200030 | 999.00 | 999.00 | 999.00 | 8.27 | 9.28 | 8.38 | 9.95 | 8.65 | 12.01 | E | E | E | E | E | E |
| 2 | 200040 | 999.00 | 999.00 | 999.00 | 6.70 | 9.28 | 6.73 | 9.95 | 6.80 | 12.01 | E | E | E | E | E | E |
| 2 | 200050 | 8.45 | 999.00 | 999.00 | 5.07 | 9.28 | 5.29 | 9.95 | 5.81 | 12.01 | A | B | A | B | A | B |
| 2 | 200065 | 999.00 | 999.00 | 999.00 | 4.50 | 4.41 | 4.96 | 4.83 | 6.01 | 5.92 | E | E | E | E | E | E |
| 2 | 200070 | 7.85 | 999.00 | 999.00 | 7.06 | 6.79 | 7.76 | 7.59 | 8.88 | 8.79 | A | A | A | A | B | B |
| 7 | 200090 | 8.55 | 5.90 | 6.40 | 7.64 | 7.34 | 8.39 | 8.20 | 9.62 | 9.52 | D | D | D | D | D | D |
| 6 | 200100 | 7.95 | 5.80 | 7.30 | 7.89 | 7.76 | 8.63 | 8.46 | 9.98 | 9.89 | D | D | D | D | D | D |
| 7 | 200110 | 9.45 | 999.00 | 999.00 | 8.74 | 8.43 | 9.74 | 9.54 | 11.48 | 11.21 | A | A | B | B | B | B |
| 7&6&2013 | 200120 | 8.55 | 8.80 | 9.30 | 8.95 | 8.69 | 9.93 | 9.75 | 11.76 | 11.48 | C | B | D | D | D | D |
| 6 | 200130 | 10.50 | 999.00 | 999.00 | 9.27 | 9.09 | 10.20 | 10.04 | 12.24 | 11.90 | A | A | A | A | B | B |
| 6&13 | 200140 | 10.20 | 10.80 | 11.30 | 10.27 | 10.27 | 10.48 | 10.48 | 12.41 | 12.06 | B | B | B | B | D | D |
| 14 | 200150 | 15.95 | 14.70 | 15.20 | 13.49 | 13.49 | 13.86 | 13.86 | 14.76 | 14.42 | A | A | A | A | C | A |
| 14 | 200335 | 10.25 | 12.70 | 13.40 | 10.40 | 10.40 | 10.65 | 10.65 | 12.80 | 12.38 | B | B | B | B | C | B |
| 7 | 200300 | 0.00 | 0.00 | 0.00 | 9.09 | 9.10 | 9.38 | 9.38 | 11.01 | 10.98 | D | D | D | D | D | D |
| 7 | 200310 | 9.05 | 9.30 | 9.80 | 10.21 | 10.21 | 10.86 | 10.85 | 13.02 | 12.78 | D | D | D | D | D | D |
| 7 | 200315 | 999.00 | 999.00 | 999.00 | 10.22 | 10.23 | 10.87 | 10.86 | 13.04 | 12.80 | E | E | E | E | E | E |
| 7 | 200320 | 9.65 | 999.00 | 999.00 | 10.26 | 10.27 | 10.95 | 10.94 | 13.20 | 12.97 | B | B | B | B | B | B |
| 7 | 200330 | 10.25 | 999.00 | 999.00 | 10.35 | 10.35 | 10.70 | 10.66 | 12.86 | 12.47 | B | B | B | B | B | B |
| | | | | | | | | | | | | | | | D | D |
| | | | | | | | | | | | | | | | D | D |
| 8 | 240040 | 9.05 | 999.00 | 999.00 | 5.08 | 5.36 | 5.41 | 5.84 | 6.34 | 7.09 | A | A | A | A | A | A |
| 8 | 240050 | 6.95 | 999.00 | 999.00 | 6.29 | 5.79 | 6.64 | 6.25 | 7.48 | 7.41 | A | A | A | A | B | B |
| 8 | 240060 | 6.95 | 7.70 | 8.40 | 7.09 | 6.13 | 7.58 | 6.72 | 8.65 | 8.13 | B | A | B | A | D | C |
| 8 | 240070 | 7.75 | 7.75 | 8.00 | 7.18 | 6.25 | 7.69 | 6.88 | 8.80 | 8.36 | A | A | A | A | D | D |
| 8 | 240080 | 8.55 | 9.30 | 9.80 | 7.26 | 6.42 | 7.78 | 7.03 | 8.86 | 8.47 | A | A | A | A | B | A |
| 8 | 240085 | 999.00 | 999.00 | 999.00 | 5.70 | 5.69 | 6.03 | 5.83 | 7.46 | 7.03 | E | E | E | E | E | E |

# Delaney Pop-off Canal

## Existing vs Proposed LOS

8/30/01

**Table 15.2a**

| DELANEY POPOFF CANAL SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 8 | 240090 | 8.55 | 8.70 | 9.20 | 7.46 | 6.81 | 7.96 | 7.40 | 9.07 | 8.82 | | A | A | A | A | C | C |
| 8 | 240100 | 8.35 | 8.35 | 8.70 | 7.66 | 7.18 | 8.16 | 7.75 | 9.28 | 9.14 | | A | A | A | A | D | D |
| 14 | 240110 | 999.00 | 999.00 | 999.00 | 8.78 | 7.86 | 9.26 | 8.44 | 10.34 | 9.86 | | E | E | E | E | E | E |
| 14 | 240120 | 14.55 | 14.80 | 15.30 | 9.67 | 8.63 | 10.17 | 9.34 | 11.17 | 10.83 | | A | A | A | A | A | A |
| 14 | 240130 | 999.00 | 999.00 | 999.00 | 10.05 | 8.91 | 10.54 | 9.60 | 11.52 | 11.09 | | E | E | E | E | E | E |
| 14 | 240135 | 12.75 | 13.00 | 13.60 | 10.51 | 10.51 | 10.62 | 10.62 | 11.55 | 11.11 | | A | A | A | A | A | A |
| 14 | 240140 | 15.45 | 15.70 | 16.70 | 10.41 | 9.64 | 10.90 | 10.30 | 11.89 | 11.78 | | A | A | A | A | A | A |
| 14 | 240150 | 13.75 | 14.00 | 14.50 | 11.21 | 8.83 | 11.90 | 10.79 | 13.74 | 12.90 | | A | A | A | A | A | A |
| 14 | 240160 | 13.50 | 13.90 | 14.40 | 13.03 | 9.85 | 13.46 | 11.16 | 14.57 | 13.12 | | A | A | A | A | D | A |
| 14 | 240170 | 999.00 | 999.00 | 999.00 | 14.03 | 10.87 | 14.46 | 11.76 | 15.30 | 13.48 | | E | E | E | E | E | E |
| 14 | 240180 | 999.00 | 999.00 | 999.00 | 15.82 | 12.27 | 16.18 | 12.83 | 16.93 | 14.18 | | E | E | E | E | E | E |
| 14 | 240190 | 999.00 | 999.00 | 999.00 | 16.75 | 13.48 | 17.06 | 13.95 | 17.77 | 15.06 | | E | E | E | E | E | E |
| 14 | 240200 | 17.85 | 15.70 | 17.00 | 17.05 | 14.94 | 17.36 | 15.27 | 18.06 | 15.93 | | D | A | D | A | D | C |
| 19 | 240210 | 18.45 | 17.70 | 19.00 | 18.32 | 15.52 | 18.61 | 16.07 | 19.12 | 17.29 | | C | A | C | A | D | A |
| 19 | 240220 | 23.05 | 999.00 | 999.00 | 18.75 | 17.34 | 19.03 | 17.73 | 20.02 | 18.87 | | A | A | A | A | A | A |
| 19 | 240230 | 999.00 | 999.00 | 999.00 | 19.22 | 18.11 | 19.43 | 18.63 | 19.79 | 19.49 | | E | E | E | E | E | E |
| 19 | 240231 | 999.00 | 999.00 | 999.00 | 19.23 | 18.11 | 19.43 | 18.63 | 19.79 | 19.49 | | E | E | E | E | E | E |
| 19 | 240235 | 999.00 | 999.00 | 999.00 | 20.46 | 20.46 | 20.53 | 20.53 | 20.73 | 20.73 | | E | E | E | E | E | E |
| 25 | 246500 | 999.00 | 999.00 | 999.00 | 20.02 | 19.44 | 20.47 | 20.09 | 21.33 | 21.24 | | E | E | E | E | E | E |
| 19 | 240255 | 999.00 | 999.00 | 999.00 | 20.36 | 19.88 | 20.71 | 20.49 | 21.52 | 21.72 | | E | E | E | E | E | E |
| 25 | 244020 | 34.55 | 999.00 | 999.00 | 25.50 | 25.50 | 25.50 | 25.50 | 25.50 | 25.50 | | A | A | A | A | A | A |
| 25 | 240380 | 32.65 | 999.00 | 999.00 | 27.69 | 27.69 | 27.82 | 27.82 | 28.61 | 28.58 | | A | A | A | A | A | A |
| 25 | 240390 | 34.55 | 999.00 | 999.00 | 29.09 | 29.09 | 29.21 | 29.21 | 29.45 | 29.45 | | A | A | A | A | A | A |
| 25 | 240400 | 999.00 | 999.00 | 999.00 | 29.90 | 29.90 | 30.26 | 30.26 | 31.09 | 31.09 | | E | E | E | E | E | E |
| 25 | 240410 | 34.45 | 999.00 | 999.00 | 29.99 | 29.99 | 30.35 | 30.35 | 31.25 | 31.25 | | A | A | A | A | A | A |
| 25 | 240420 | 34.45 | 999.00 | 999.00 | 30.45 | 30.45 | 30.66 | 30.66 | 31.61 | 31.60 | | A | A | A | A | A | A |
| 25 | 240430 | 34.45 | 999.00 | 999.00 | 30.61 | 30.61 | 30.86 | 30.86 | 31.68 | 31.68 | | A | A | A | A | A | A |
| 25 | 240440 | 34.45 | 34.70 | 35.20 | 30.61 | 30.61 | 30.85 | 30.85 | 31.68 | 31.68 | | A | A | A | A | A | A |
| 25 | 240450 | 32.45 | 32.70 | 33.20 | 30.32 | 30.32 | 30.49 | 30.49 | 31.16 | 31.10 | | A | A | A | A | A | A |
| 25 | 240460 | 999.00 | 999.00 | 999.00 | 29.95 | 29.93 | 30.19 | 30.10 | 30.80 | 30.75 | | E | E | E | E | E | E |
| 14 | 241000 | 999.00 | 999.00 | 999.00 | 7.66 | 7.18 | 8.16 | 7.75 | 9.29 | 9.14 | | E | E | E | E | E | E |
| 14 | 241010 | 12.55 | 12.80 | 13.30 | 7.66 | 7.18 | 8.16 | 7.75 | 9.29 | 9.14 | | A | A | A | A | A | A |
| 14 | 241020 | 12.65 | 999.00 | 999.00 | 11.03 | 11.03 | 11.16 | 11.16 | 11.50 | 11.50 | | A | A | A | A | A | A |
| 14 | 241030 | 13.15 | 999.00 | 999.00 | 11.72 | 11.72 | 11.77 | 11.77 | 11.90 | 11.90 | | A | A | A | A | A | A |
| 14 | 241500 | 999.00 | 999.00 | 999.00 | 8.74 | 8.74 | 9.19 | 9.19 | 10.07 | 10.07 | | E | E | E | E | E | E |
| 14 | 241510 | 999.00 | 999.00 | 999.00 | 11.75 | 11.75 | 11.88 | 11.88 | 12.22 | 12.22 | | E | E | E | E | E | E |
| 14 | 241509 | 999.00 | 999.00 | 999.00 | 10.79 | 10.79 | 10.91 | 10.91 | 11.26 | 11.26 | | E | E | E | E | E | E |
| 14 | 242000 | 999.00 | 999.00 | 999.00 | 10.06 | 8.92 | 10.54 | 9.61 | 11.53 | 11.09 | | E | E | E | E | E | E |
| 14 | 242010 | 999.00 | 999.00 | 999.00 | 10.06 | 9.62 | 10.55 | 9.88 | 11.53 | 11.10 | | E | E | E | E | E | E |
| 14 | 242020 | 999.00 | 999.00 | 999.00 | 11.22 | 11.22 | 11.40 | 11.40 | 11.87 | 11.87 | | E | E | E | E | E | E |
| 13 | 242030 | 999.00 | 999.00 | 999.00 | 12.86 | 12.86 | 12.99 | 12.99 | 13.31 | 13.31 | | E | E | E | E | E | E |
| 14 | 242500 | 14.45 | 14.70 | 15.20 | 13.05 | 10.79 | 13.48 | 11.22 | 14.59 | 13.13 | | A | A | A | A | B | A |
| 14 | 242510 | 13.95 | 15.30 | 15.80 | 13.73 | 11.56 | 14.41 | 11.81 | 15.58 | 13.61 | | A | A | B | A | C | A |

# Delaney Pop-off Canal

## Existing vs Proposed LOS

8/30/01

**Table 15.2a**

| DELANEY POPOFF CANAL SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 14 | 242520 | 13.50 | 14.40 | 14.90 | 13.99 | 12.27 | 14.52 | 12.49 | 15.66 | 13.73 | B | A | C | A | D | B |
| 14 | 242530 | 13.20 | 13.20 | 14.20 | 14.14 | 12.69 | 14.61 | 13.02 | 15.74 | 14.11 | C | A | D | A | D | C |
| 14 | 242800 | 11.55 | 13.80 | 14.30 | 13.29 | 11.09 | 13.49 | 11.25 | 14.58 | 13.11 | B | A | B | A | D | B |
| 14 | 243000 | 999.00 | 999.00 | 999.00 | 14.18 | 12.82 | 14.59 | 12.96 | 15.48 | 13.66 | E | E | E | E | E | E |
| 14 | 243005 | 15.75 | 14.70 | 15.20 | 13.51 | 13.51 | 13.66 | 13.66 | 14.66 | 14.08 | A | A | A | A | A | A |
| 14 | 243010 | 15.05 | 15.30 | 15.80 | 14.40 | 13.50 | 14.79 | 13.67 | 15.66 | 14.53 | A | A | A | A | C | A |
| 13 | 243020 | 15.75 | 999.00 | 999.00 | 15.37 | 15.20 | 15.84 | 15.66 | 16.69 | 16.53 | A | A | B | A | B | B |
| 14 | 243021 | 18.45 | 18.30 | 18.80 | 16.25 | 16.25 | 16.40 | 16.39 | 17.10 | 16.72 | A | A | A | A | A | A |
| 13 | 243030 | 16.85 | 16.70 | 17.20 | 15.51 | 15.32 | 15.98 | 15.79 | 17.00 | 16.76 | A | A | A | A | C | C |
| 13 | 243035 | 15.25 | 999.00 | 999.00 | 15.51 | 15.32 | 15.99 | 15.79 | 17.01 | 16.76 | B | B | B | B | B | B |
| 13 | 243040 | 999.00 | 999.00 | 999.00 | 15.87 | 15.82 | 16.19 | 16.13 | 17.10 | 16.95 | E | E | E | E | E | E |
| 13 | 243050 | 18.25 | 18.50 | 19.00 | 15.96 | 15.86 | 16.28 | 16.17 | 17.15 | 16.98 | A | A | A | A | A | A |
| 13 | 243060 | 18.25 | 18.50 | 19.00 | 16.40 | 16.38 | 16.61 | 16.59 | 17.39 | 17.34 | A | A | A | A | A | A |
| 13 | 243070 | 20.25 | 999.00 | 999.00 | 16.48 | 16.40 | 16.69 | 16.62 | 17.46 | 17.37 | A | A | A | A | A | A |
| 13 | 243080 | 18.65 | 999.50 | 100.00 | 16.91 | 16.84 | 17.21 | 17.15 | 18.21 | 18.17 | A | A | A | A | A | A |
| 13 | 243090 | 17.45 | 17.10 | 18.00 | 17.73 | 17.67 | 18.23 | 18.18 | 19.42 | 19.40 | C | C | D | D | D | D |
| 13 | 243100 | 19.45 | 20.00 | 20.50 | 17.73 | 17.67 | 18.23 | 18.18 | 19.44 | 19.41 | A | A | A | A | A | A |
| 13 | 243110 | 19.45 | 19.50 | 20.00 | 18.50 | 18.46 | 19.07 | 19.04 | 19.68 | 19.67 | A | A | A | A | C | C |
| 13 | 243120 | 18.45 | 18.70 | 19.20 | 18.86 | 18.83 | 19.37 | 19.35 | 20.16 | 20.15 | C | C | D | D | D | D |
| 13 | 243130 | 19.45 | 20.00 | 20.50 | 19.09 | 19.07 | 19.54 | 19.52 | 20.37 | 20.36 | A | A | B | B | C | C |
| 13 | 243135 | 18.95 | 17.90 | 19.40 | 18.10 | 18.10 | 18.17 | 18.17 | 18.36 | 18.36 | C | C | C | C | C | C |
| 13 | 243140 | 19.45 | 19.70 | 20.20 | 19.11 | 19.07 | 19.56 | 19.52 | 20.40 | 20.37 | A | A | B | B | D | D |
| 13 | 243150 | 20.45 | 18.70 | 21.20 | 19.19 | 19.16 | 19.62 | 19.59 | 20.48 | 20.45 | C | C | C | C | C | C |
| 13 | 243160 | 20.45 | 21.10 | 21.60 | 19.20 | 19.16 | 19.62 | 19.59 | 20.48 | 20.45 | A | A | A | A | B | B |
| 13 | 243500 | 999.00 | 999.00 | 999.00 | 15.97 | 15.87 | 16.29 | 16.18 | 17.06 | 16.93 | E | E | E | E | E | E |
| 13 | 243510 | 999.00 | 999.00 | 999.00 | 15.97 | 15.87 | 16.29 | 16.18 | 17.11 | 16.96 | E | E | E | E | E | E |
| 13 | 243520 | 999.00 | 999.00 | 999.00 | 15.97 | 15.87 | 16.29 | 16.18 | 17.12 | 16.97 | E | E | E | E | E | E |
| 19 | 244010 | 999.00 | 999.00 | 999.00 | 22.97 | 22.97 | 23.25 | 23.25 | 24.37 | 24.39 | E | E | E | E | E | E |
| 19 | 244510 | 999.00 | 999.00 | 999.00 | 20.39 | 19.92 | 20.76 | 20.53 | 21.60 | 21.77 | E | E | E | E | E | E |
| 19 | 246000 | 999.00 | 999.00 | 999.00 | 19.62 | 19.62 | 19.70 | 19.70 | 19.90 | 19.90 | E | E | E | E | E | E |
| 20&19 | 246010 | 999.00 | 999.00 | 999.00 | 22.50 | 22.50 | 22.71 | 22.71 | 23.16 | 23.16 | E | E | E | E | E | E |
| 20 | 246020 | 999.00 | 999.00 | 999.00 | 23.00 | 23.00 | 23.15 | 23.15 | 23.55 | 23.55 | E | E | E | E | E | E |
| 25&19 | 246035 | 31.65 | 999.00 | 999.00 | 23.04 | 23.04 | 23.17 | 23.17 | 23.51 | 23.51 | A | A | A | A | A | A |
| 25&26 | 246040 | 30.25 | 30.50 | 31.00 | 23.44 | 23.44 | 23.68 | 23.68 | 24.24 | 24.24 | A | A | A | A | A | A |
| 25 | 246050 | 31.95 | 999.00 | 999.00 | 23.45 | 23.45 | 23.69 | 23.69 | 24.25 | 24.25 | A | A | A | A | A | A |
| 25 | 246060 | 30.25 | 999.00 | 999.00 | 23.45 | 23.45 | 23.69 | 23.69 | 24.25 | 24.25 | A | A | A | A | A | A |
| 25 | 246070 | 35.00 | 999.00 | 999.00 | 34.46 | 34.46 | 34.49 | 34.49 | 34.56 | 34.56 | A | A | A | A | A | A |
| 19 | 246505 | 999.00 | 999.00 | 999.00 | 20.06 | 19.57 | 20.50 | 20.15 | 21.37 | 21.26 | E | E | E | E | E | E |
| 19 | 246510 | 999.00 | 999.00 | 999.00 | 20.06 | 19.57 | 20.50 | 20.15 | 21.37 | 21.26 | E | E | E | E | E | E |
| 25 | 246520 | 999.00 | 999.00 | 999.00 | 26.24 | 26.24 | 26.27 | 26.27 | 26.35 | 26.35 | E | E | E | E | E | E |
| 19 | 247000 | 999.00 | 21.70 | 22.20 | 20.37 | 19.88 | 20.72 | 20.49 | 21.42 | 21.72 | A | A | A | A | A | C |

# Delaney Pop-off Canal
## Existing vs Proposed LOS
8/30/01

**Table 15.2a**

| DELANEY POPOFF CANAL SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 19 | 247010 | 19.10 | 20.40 | 21.30 | 20.38 | 18.24 | 20.72 | 18.52 | 21.40 | 19.05 | B | A | C | A | D | A |
| 19 | 247020 | 19.10 | 20.00 | 21.40 | 20.31 | 18.61 | 20.54 | 18.84 | 21.02 | 19.33 | C | A | C | A | C | B |
| 19 | 247030 | 21.00 | 21.00 | 21.50 | 20.88 | 20.88 | 20.92 | 20.92 | 21.02 | 21.02 | A | A | A | A | C | C |
| 19 | 247040 | 22.65 | 22.90 | 23.40 | 22.89 | 22.76 | 23.06 | 22.94 | 23.51 | 23.37 | B | B | C | C | D | C |
| 19 | 247050 | 21.90 | 22.30 | 23.00 | 22.90 | 22.77 | 23.08 | 22.95 | 23.55 | 23.40 | C | C | D | C | D | D |
| 19 | 247060 | 21.45 | 22.00 | 23.00 | 22.16 | 21.53 | 22.41 | 21.80 | 23.01 | 22.46 | C | B | C | B | D | C |
| 19 | 247070 | 21.00 | 22.00 | 23.00 | 22.25 | 22.09 | 22.50 | 22.16 | 23.09 | 22.60 | C | C | C | C | D | C |
| 25 | 244030 | 32.65 | 999.00 | 999.00 | 26.04 | 26.04 | 26.10 | 26.10 | 26.26 | 26.26 | A | A | A | A | A | A |
| 19 | 247500 | 999.00 | 999.00 | 999.00 | 20.36 | 19.88 | 20.72 | 20.49 | 21.53 | 21.73 | E | E | E | E | E | E |
| 19 | 247510 | 23.25 | 22.80 | 23.30 | 20.36 | 19.89 | 20.72 | 20.50 | 21.59 | 21.75 | A | A | A | A | A | A |
| 19 | 247520 | 23.23 | 24.00 | 24.50 | 20.37 | 19.96 | 20.73 | 20.51 | 21.68 | 21.77 | A | A | A | A | A | A |
| 19 | 247530 | 999.00 | 999.00 | 999.00 | 20.38 | 20.04 | 20.73 | 20.52 | 21.76 | 21.80 | E | E | E | E | E | E |
| 19 | 247535 | 25.25 | 24.70 | 25.70 | 22.04 | 22.04 | 22.12 | 22.12 | 22.40 | 22.40 | A | A | A | A | A | A |
| 19 | 247540 | 24.95 | 24.70 | 26.20 | 21.03 | 21.03 | 21.30 | 21.29 | 22.04 | 21.98 | A | A | A | A | A | A |
| 19 | 247550 | 27.65 | 26.50 | 27.60 | 21.08 | 21.08 | 21.35 | 21.34 | 22.08 | 22.02 | A | A | A | A | A | A |
| 19 | 247801 | 26.15 | 26.00 | 29.00 | 23.53 | 23.53 | 23.79 | 23.79 | 24.35 | 24.33 | A | A | A | A | A | A |
| 19 | 247805 | 28.51 | 999.00 | 999.00 | 28.36 | 28.36 | 28.40 | 28.40 | 28.50 | 28.50 | A | A | A | A | A | A |
| 19 | 247810 | 26.75 | 27.40 | 29.00 | 26.08 | 26.08 | 26.28 | 26.28 | 26.74 | 26.74 | A | A | A | A | A | A |
| 19 | 247820 | 27.85 | 28.50 | 30.10 | 26.33 | 26.33 | 26.49 | 26.49 | 27.13 | 27.13 | A | A | A | A | A | A |
| 19 | 240355 | 34.45 | 999.00 | 999.00 | 23.53 | 23.51 | 24.14 | 24.10 | 27.26 | 26.99 | A | A | A | A | A | A |
| 19 | 248020 | 28.95 | 29.20 | 29.70 | 25.69 | 25.69 | 25.73 | 25.73 | 25.81 | 25.81 | A | A | A | A | A | A |
| 25 | 248040 | 30.55 | 31.70 | 33.20 | 29.77 | 29.77 | 30.43 | 30.43 | 31.16 | 31.16 | A | A | A | A | B | B |
| 25 | 249000 | 33.75 | 999.00 | 999.00 | 28.61 | 28.61 | 28.68 | 28.68 | 29.00 | 29.00 | A | A | A | A | A | A |
| 25 | 249030 | 999.00 | 999.00 | 999.00 | 28.60 | 28.60 | 28.75 | 28.75 | 29.18 | 29.18 | E | E | E | E | E | E |
| 25 | 249040 | 999.00 | 999.00 | 999.00 | 30.61 | 30.61 | 30.71 | 30.71 | 30.97 | 30.97 | E | E | E | E | E | E |
| 25 | 250000 | 999.00 | 999.00 | 999.00 | 27.79 | 27.08 | 28.38 | 28.38 | 29.51 | 29.45 | E | E | E | E | E | E |
| 25 | 250005 | 34.85 | 999.00 | 999.00 | 28.33 | 28.33 | 28.80 | 28.80 | 29.52 | 29.45 | A | A | A | A | A | A |
| 25 | 250010 | 32.55 | 999.00 | 999.00 | 27.79 | 27.09 | 28.38 | 28.38 | 29.51 | 29.45 | A | A | A | A | A | A |
| 25&31 | 250011 | 34.55 | 999.00 | 999.00 | 27.80 | 27.13 | 28.38 | 28.39 | 29.51 | 29.45 | A | A | A | A | A | A |
| 25 | 250030 | 33.65 | 999.00 | 999.00 | 28.37 | 27.97 | 28.73 | 28.51 | 29.68 | 29.52 | A | A | A | A | A | A |
| 24 | 250040 | 999.00 | 999.00 | 999.00 | 28.43 | 28.03 | 28.79 | 28.53 | 29.73 | 29.53 | E | E | E | E | E | E |
| 25 | 250050 | 31.85 | 999.00 | 999.00 | 29.08 | 29.05 | 29.21 | 29.16 | 30.00 | 29.73 | A | A | A | A | A | A |
| 25 | 250090 | 999.00 | 999.00 | 999.00 | 29.87 | 29.79 | 30.14 | 30.02 | 30.78 | 30.73 | E | E | E | E | E | E |
| 25 | 250110 | 31.50 | 31.20 | 34.00 | 30.76 | 30.83 | 30.92 | 31.04 | 31.39 | 31.65 | A | A | A | A | C | C |
| 25 | 250120 | 999.00 | 999.00 | 999.00 | 30.55 | 30.55 | 30.59 | 30.59 | 30.81 | 30.76 | E | E | E | E | E | E |
| 25 | 250330 | 30.40 | 999.00 | 999.00 | 28.55 | 28.55 | 28.69 | 28.69 | 29.13 | 29.11 | A | A | A | A | A | A |
| 25 | 250510 | 999.00 | 999.00 | 999.00 | 27.47 | 27.17 | 28.28 | 28.23 | 29.49 | 29.44 | E | E | E | E | E | E |
| 25 | 250520 | 999.00 | 999.00 | 999.00 | 27.47 | 27.37 | 28.29 | 28.23 | 29.57 | 29.52 | E | E | E | E | E | E |
| 25 | 250525 | 30.70 | 999.00 | 999.00 | 27.48 | 27.37 | 28.30 | 28.24 | 29.57 | 29.52 | A | A | A | A | A | A |
| 25 | 250527 | 32.55 | 999.00 | 999.00 | 29.33 | 29.33 | 29.36 | 29.36 | 29.44 | 29.44 | A | A | A | A | A | A |
| 25 | 250530 | 33.35 | 34.10 | 34.60 | 29.40 | 29.40 | 29.56 | 29.56 | 29.92 | 29.92 | A | A | A | A | A | A |
| 25 | 250550 | 999.00 | 999.00 | 999.00 | 29.70 | 29.70 | 29.74 | 29.74 | 29.85 | 29.85 | E | E | E | E | E | E |
| 25 | 250555 | 31.00 | 999.00 | 999.00 | 29.70 | 29.70 | 29.75 | 29.75 | 29.85 | 29.85 | A | A | A | A | A | A |

## Delaney Pop-off Canal
## Existing vs Proposed LOS

8/30/01

**Table 15.2a**

| DELANEY POPOFF CANAL SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 25 | 250557 | 30.50 | 999.00 | 999.00 | 29.40 | 29.40 | 29.44 | 29.44 | 29.56 | 29.56 | | A | A | A | A | A | A |
| 25 | 250570 | 30.00 | 30.70 | 31.20 | 29.43 | 29.43 | 29.55 | 29.55 | 29.85 | 29.85 | | A | A | A | A | A | A |
| 25 | 250580 | 30.00 | 30.70 | 31.20 | 29.46 | 29.46 | 29.59 | 29.59 | 29.93 | 29.93 | | A | A | A | A | A | A |
| 25 | 250590 | 33.20 | 31.00 | 35.30 | 30.06 | 30.06 | 30.49 | 30.49 | 31.72 | 31.72 | | A | A | A | A | C | C |
| 25 | 251000 | 33.95 | 999.00 | 999.00 | 28.48 | 28.48 | 28.59 | 28.59 | 29.51 | 29.45 | | A | A | A | A | A | A |
| 26 | 251010 | 34.55 | 999.00 | 999.00 | 30.76 | 30.76 | 31.47 | 31.47 | 33.76 | 33.76 | | A | A | A | A | A | A |
| 25 | 251011 | 32.50 | 999.00 | 999.00 | 32.31 | 32.31 | 32.35 | 32.35 | 32.47 | 32.47 | | A | A | A | A | A | A |
| 25 | 251500 | 30.20 | 31.00 | 34.75 | 27.77 | 27.68 | 28.41 | 28.41 | 29.71 | 29.65 | | A | A | A | A | A | A |
| 24 | 252000 | 31.55 | 999.00 | 999.00 | 28.45 | 28.07 | 28.82 | 28.55 | 29.72 | 29.51 | | A | A | A | A | A | A |
| 24 | 252020 | 29.45 | 999.00 | 999.00 | 28.45 | 28.10 | 28.82 | 28.50 | 29.67 | 29.50 | | A | A | A | A | B | B |
| 24&30 | 252025 | 31.00 | 999.00 | 999.00 | 29.51 | 29.51 | 29.63 | 29.63 | 29.99 | 29.99 | | A | A | A | A | A | A |
| 24 | 252030 | 999.00 | 999.00 | 999.00 | 28.46 | 28.10 | 28.83 | 28.48 | 29.66 | 29.30 | | E | E | E | E | E | E |
| 24 | 252040 | 999.00 | 999.00 | 999.00 | 28.58 | 28.19 | 28.92 | 28.54 | 29.67 | 29.31 | | E | E | E | E | E | E |
| 24 | 252050 | 29.15 | 29.40 | 29.90 | 28.63 | 28.21 | 28.96 | 28.56 | 29.67 | 29.30 | | A | A | A | A | C | B |
| 24 | 252060 | 31.15 | 30.50 | 31.00 | 28.88 | 28.24 | 29.13 | 28.57 | 29.68 | 29.25 | | A | A | A | A | A | A |
| 24 | 252065 | 31.45 | 31.40 | 31.90 | 28.89 | 28.26 | 29.14 | 28.59 | 29.68 | 29.26 | | A | A | A | A | A | A |
| 24 | 252080 | 28.35 | 28.60 | 29.40 | 28.90 | 27.96 | 29.15 | 28.27 | 29.68 | 28.86 | | C | A | C | A | D | C |
| 24 | 252500 | 999.00 | 999.00 | 999.00 | 28.58 | 28.20 | 28.92 | 28.56 | 29.67 | 29.31 | | E | E | E | E | E | E |
| 24 | 252510 | 28.35 | 28.60 | 30.50 | 28.58 | 28.21 | 28.93 | 28.56 | 29.67 | 29.31 | | B | A | C | B | C | C |
| 25&31 | 253005 | 35.00 | 999.00 | 999.00 | 28.27 | 28.27 | 28.60 | 28.57 | 29.63 | 29.50 | | A | A | A | A | A | A |
| 25&31 | 253015 | 35.00 | 999.00 | 999.00 | 31.29 | 31.29 | 31.54 | 31.54 | 32.10 | 32.10 | | A | A | A | A | A | A |
| 31 | 253025 | 35.00 | 999.00 | 999.00 | 31.90 | 31.90 | 32.11 | 32.11 | 32.69 | 32.69 | | A | A | A | A | A | A |
| 25 | 254010 | 31.50 | 999.00 | 999.00 | 29.37 | 29.37 | 29.45 | 29.44 | 29.91 | 29.79 | | A | A | A | A | A | A |
| 25 | 254020 | 999.00 | 999.00 | 999.00 | 29.37 | 29.37 | 29.45 | 29.44 | 29.91 | 29.79 | | E | E | E | E | E | E |
| 25 | 254030 | 31.50 | 999.00 | 999.00 | 29.37 | 29.37 | 29.45 | 29.44 | 29.91 | 29.79 | | A | A | A | A | A | A |
| 25 | 254050 | 999.00 | 999.00 | 999.00 | 29.61 | 29.61 | 29.69 | 29.69 | 29.93 | 29.93 | | E | E | E | E | E | E |

# North Arhie Creek Sub-watershed

## Existing vs Proposed LOS

8/30/01

**Table 15.3a**

| NORTH ARCHIE CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 0 | 250000 | 999.25 | 999.50 | 1000.00 | 27.79 | 27.08 | 28.38 | 28.38 | 29.51 | 29.45 | E | E | E | E | E | E |
| 0 | 260000 | 6.05 | 6.50 | 7.00 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | A | A | A | A | A | A |
| 0 | 260010 | 6.45 | 6.50 | 7.00 | 3.94 | 3.94 | 3.94 | 3.94 | 4.35 | 4.35 | A | A | A | A | A | A |
| 0 | 260020 | 6.75 | 7.20 | 8.20 | 4.16 | 4.16 | 4.16 | 4.16 | 4.63 | 4.63 | A | A | A | A | A | A |
| 0 | 260030 | 6.75 | 10.50 | 11.00 | 4.40 | 4.40 | 4.40 | 4.41 | 4.88 | 4.89 | A | A | A | A | A | A |
| 0 | 260040 | 9.45 | 999.50 | 1000.00 | 4.62 | 4.62 | 4.62 | 4.62 | 5.21 | 5.22 | A | A | A | A | A | A |
| 0 | 260050 | 999.25 | 999.50 | 1000.00 | 5.13 | 5.13 | 5.14 | 5.14 | 5.72 | 5.73 | E | E | E | E | E | E |
| 0 | 260060 | 6.05 | 4.50 | 8.30 | 5.57 | 5.57 | 5.57 | 5.58 | 6.50 | 6.51 | C | C | C | C | C | C |
| 0 | 260065 | 6.05 | 999.50 | 1000.00 | 5.56 | 5.56 | 5.57 | 5.57 | 6.65 | 6.67 | A | A | A | A | B | B |
| 0 | 260070 | 6.45 | 999.50 | 1000.00 | 6.67 | 6.67 | 6.68 | 6.69 | 7.35 | 7.34 | B | B | B | B | B | B |
| 0 | 260080 | 6.45 | 999.50 | 1000.00 | 7.49 | 7.49 | 7.50 | 7.51 | 7.99 | 7.98 | B | B | B | B | B | B |
| 0 | 260090 | 8.45 | 7.00 | 9.50 | 7.55 | 7.50 | 7.56 | 7.52 | 8.06 | 8.00 | C | C | C | C | C | C |
| 0 | 260100 | 999.25 | 999.50 | 1000.00 | 9.57 | 9.53 | 9.59 | 9.58 | 10.04 | 9.98 | E | E | E | E | E | E |
| 0 | 260110 | 17.35 | 17.60 | 18.10 | 10.33 | 10.30 | 10.35 | 10.34 | 10.83 | 10.77 | A | A | A | A | A | A |
| 0 | 260120 | 15.05 | 15.30 | 15.80 | 10.59 | 10.57 | 10.60 | 10.60 | 11.08 | 11.01 | A | A | A | A | A | A |
| 0 | 260130 | 12.55 | 12.80 | 13.30 | 10.76 | 10.74 | 10.77 | 10.77 | 11.24 | 11.17 | A | A | A | A | A | A |
| 0 | 260140 | 15.05 | 15.30 | 15.80 | 11.23 | 11.17 | 11.24 | 11.15 | 11.43 | 11.37 | A | A | A | A | A | A |
| 0 | 260145 | 0.25 | 0.50 | 1.00 | 11.00 | 10.97 | 11.00 | 10.97 | 11.49 | 11.39 | D | D | D | D | D | D |
| 0 | 260170 | 999.25 | 1000.00 | 1000.50 | 11.04 | 10.97 | 11.19 | 11.02 | 11.75 | 11.46 | E | E | E | E | E | E |
| 0 | 260180 | 6.25 | 999.50 | 1000.00 | 11.26 | 11.11 | 11.59 | 11.36 | 12.23 | 11.90 | B | B | B | B | B | B |
| 0 | 260190 | 13.45 | 999.50 | 1000.50 | 11.26 | 11.11 | 11.59 | 11.36 | 12.23 | 11.90 | A | A | A | A | A | A |
| 0 | 260200 | 999.25 | 999.50 | 17.00 | 11.30 | 11.15 | 11.66 | 11.44 | 12.33 | 12.01 | A | A | A | A | A | A |
| | 260201 | 999.25 | 999.50 | 16.20 | 14.11 | 14.11 | 14.12 | 14.12 | 14.16 | 14.16 | A | A | A | A | A | A |
| | 260202 | 999.25 | 999.50 | 1000.00 | 14.10 | 14.10 | 14.11 | 14.11 | 14.14 | 14.14 | E | E | E | E | E | E |
| 0 | 260210 | 999.25 | 999.50 | 17.00 | 13.23 | 13.22 | 13.75 | 13.69 | 14.84 | 14.73 | A | A | A | A | A | A |
| 0 | 260220 | 999.25 | 999.50 | 1000.00 | 13.53 | 13.52 | 14.24 | 14.17 | 15.71 | 15.58 | E | E | E | E | E | E |
| 0 | 260230 | 14.25 | 999.50 | 16.00 | 13.92 | 13.91 | 14.61 | 14.55 | 16.13 | 16.01 | A | A | B | B | D | D |
| 0 | 260235 | 16.25 | 999.50 | 16.00 | 14.48 | 14.48 | 15.06 | 15.01 | 16.45 | 16.33 | A | A | A | A | D | D |
| 0 | 260240 | 18.75 | 999.50 | 1000.00 | 15.25 | 15.24 | 15.71 | 15.67 | 16.93 | 16.83 | A | A | A | A | A | A |
| 0 | 260250 | 19.25 | 999.50 | 1000.00 | 15.83 | 15.82 | 16.29 | 16.26 | 17.45 | 17.40 | A | A | A | A | A | A |
| 0 | 260255 | 999.25 | 999.50 | 1000.00 | 15.84 | 15.84 | 16.31 | 16.28 | 17.48 | 17.42 | E | E | E | E | E | E |
| 0 | 260260 | 999.25 | 999.50 | 1000.00 | 16.52 | 16.52 | 16.99 | 16.97 | 18.12 | 18.09 | E | E | E | E | E | E |
| 0 | 260270 | 999.25 | 999.50 | 1000.00 | 16.38 | 16.38 | 16.85 | 16.82 | 18.05 | 18.01 | E | E | E | E | E | E |
| 0 | 260275 | 999.25 | 999.50 | 1000.50 | 16.38 | 16.38 | 16.85 | 16.82 | 18.05 | 18.01 | E | E | E | E | E | E |
| 0 | 260280 | 999.25 | 999.50 | 1000.00 | 18.20 | 18.19 | 18.52 | 18.51 | 19.22 | 19.22 | E | E | E | E | E | E |
| 0 | 260290 | 999.25 | 999.50 | 1000.00 | 18.51 | 18.50 | 18.94 | 18.93 | 20.02 | 20.02 | E | E | E | E | E | E |
| 0 | 260300 | 22.75 | 999.50 | 1000.00 | 20.65 | 20.65 | 20.89 | 20.88 | 21.48 | 21.48 | A | A | A | A | A | A |
| 0 | 260310 | 25.25 | 999.50 | 1000.00 | 20.80 | 20.80 | 21.10 | 21.10 | 21.88 | 21.88 | A | A | A | A | A | A |
| 0 | 260312 | 22.25 | 999.50 | 1000.00 | 21.43 | 21.43 | 21.45 | 21.45 | 21.89 | 21.88 | A | A | A | A | A | A |
| 0 | 260315 | 999.25 | 999.50 | 1000.00 | 22.18 | 22.17 | 22.66 | 22.64 | 23.77 | 23.76 | E | E | E | E | E | E |
| 0 | 260320 | 999.25 | 999.50 | 1000.00 | 22.91 | 22.89 | 23.45 | 23.42 | 24.79 | 24.78 | E | E | E | E | E | E |
| 0 | 260330 | 28.95 | 999.50 | 1000.00 | 23.02 | 23.00 | 23.61 | 23.58 | 25.12 | 25.10 | A | A | A | A | A | A |

# North Arhie Creek Sub-watershed

## Existing vs Proposed LOS

8/30/01

**Table 15.3a**

| NORTH ARCHIE CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 0 | 260331 | 30.95 | 999.50 | 35.50 | 26.08 | 26.07 | 26.58 | 26.56 | 27.75 | 27.74 | A | A | A | A | A | A |
| 0 | 260340 | 26.25 | 999.50 | 1000.00 | 26.08 | 26.06 | 26.57 | 26.56 | 27.74 | 27.73 | A | A | B | B | B | B |
| 0 | 260350 | 34.25 | 999.50 | 1000.00 | 23.03 | 23.01 | 23.62 | 23.59 | 25.13 | 25.11 | A | A | A | A | A | A |
| 0 | 260360 | 35.45 | 999.50 | 35.00 | 26.80 | 26.79 | 27.32 | 27.30 | 28.52 | 28.51 | A | A | A | A | A | A |
| 0 | 260370 | 33.45 | 999.50 | 1000.00 | 26.83 | 26.81 | 27.35 | 27.33 | 28.56 | 28.55 | A | A | A | A | A | A |
| 0 | 260372 | 33.45 | 999.50 | 1000.00 | 30.13 | 30.13 | 30.15 | 30.15 | 30.19 | 30.19 | A | A | A | A | A | A |
| 0 | 260380 | 34.05 | 999.50 | 29.00 | 27.08 | 27.08 | 27.34 | 27.32 | 28.23 | 28.22 | A | A | A | A | A | A |
| 0 | 260390 | 30.45 | 999.50 | 33.20 | 26.88 | 26.87 | 27.40 | 27.38 | 28.60 | 28.59 | A | A | A | A | A | A |
| 0 | 260400 | 32.25 | 999.50 | 32.00 | 26.90 | 26.88 | 27.43 | 27.41 | 28.62 | 28.61 | A | A | A | A | A | A |
| 0 | 260410 | 999.25 | 999.50 | 33.30 | 27.46 | 27.46 | 27.54 | 27.54 | 28.11 | 28.11 | A | A | A | A | A | A |
| 0 | 261000 | 12.45 | 999.50 | 15.50 | 11.31 | 11.17 | 11.70 | 11.48 | 12.37 | 12.14 | A | A | A | A | A | A |
| 0 | 261010 | 12.55 | 999.50 | 15.60 | 11.33 | 11.20 | 11.95 | 11.76 | 13.56 | 13.50 | A | A | A | A | B | B |
| 0 | 261020 | 14.85 | 999.50 | 17.70 | 11.99 | 11.89 | 12.60 | 12.46 | 14.28 | 14.24 | A | A | A | A | A | A |
| 0 | 261021 | 15.55 | 999.50 | 1000.00 | 15.50 | 15.50 | 15.51 | 15.51 | 15.54 | 15.54 | A | A | A | A | A | A |
| 0 | 261030 | 999.25 | 999.50 | 1000.00 | 12.75 | 12.75 | 13.63 | 13.56 | 14.90 | 14.88 | E | E | E | E | E | E |
| 0 | 261040 | 14.35 | 999.50 | 16.50 | 13.41 | 13.41 | 14.19 | 14.17 | 15.26 | 15.25 | A | A | A | A | B | B |
| 0 | 261050 | 14.45 | 999.50 | 17.50 | 13.42 | 13.42 | 14.19 | 14.16 | 15.18 | 15.17 | A | A | A | A | B | B |
| 0 | 261060 | 999.25 | 999.50 | 17.70 | 13.36 | 13.36 | 13.76 | 13.76 | 15.07 | 15.02 | A | A | A | A | A | A |
| 0 | 261061 | 17.85 | 999.50 | 1000.00 | 15.84 | 15.84 | 15.87 | 15.87 | 15.99 | 15.96 | A | A | A | A | A | A |
| 0 | 261062 | 15.15 | 999.50 | 17.20 | 15.54 | 15.54 | 15.57 | 15.57 | 15.64 | 15.64 | B | B | B | B | B | B |
| 0 | 262000 | 12.65 | 999.50 | 14.20 | 13.93 | 13.92 | 14.62 | 14.56 | 16.14 | 16.01 | B | B | D | D | D | D |
| 0 | 262010 | 13.55 | 999.50 | 16.50 | 13.94 | 13.93 | 14.63 | 14.57 | 16.15 | 16.02 | B | B | B | B | B | B |
| 0 | 262020 | 12.45 | 999.50 | 16.00 | 14.33 | 14.32 | 14.86 | 14.86 | 16.15 | 16.03 | B | B | B | B | D | D |
| 0 | 262030 | 14.45 | 999.50 | 16.40 | 14.73 | 14.72 | 15.27 | 15.27 | 16.16 | 16.04 | B | B | B | B | B | B |
| 0 | 263000 | 999.25 | 999.50 | 1000.00 | 15.26 | 15.25 | 15.72 | 15.68 | 16.94 | 16.83 | E | E | E | E | E | E |
| 0 | 263010 | 19.25 | 999.50 | 1000.00 | 15.26 | 15.25 | 15.72 | 15.68 | 16.94 | 16.84 | A | A | A | A | A | A |
| 0 | 263020 | 18.05 | 999.50 | 1000.00 | 15.62 | 15.62 | 16.05 | 16.01 | 17.22 | 17.07 | A | A | A | A | A | A |
| 0 | 263030 | 20.05 | 999.50 | 1000.00 | 15.63 | 15.63 | 16.06 | 16.03 | 17.22 | 17.09 | A | A | A | A | A | A |
| 0 | 263040 | 999.25 | 999.50 | 1000.00 | 16.02 | 16.02 | 16.62 | 16.48 | 18.22 | 17.70 | E | E | E | E | E | E |
| 0 | 263050 | 16.45 | 999.50 | 17.90 | 16.52 | 16.52 | 17.27 | 17.05 | 18.94 | 18.22 | B | B | B | B | D | D |
| 0 | 263060 | 16.05 | 999.50 | 18.00 | 17.08 | 17.08 | 17.73 | 17.49 | 19.39 | 18.59 | B | B | B | B | D | D |
| 0 | 264000 | 30.85 | 999.50 | 1000.00 | 20.97 | 20.97 | 21.15 | 21.15 | 21.60 | 21.60 | A | A | A | A | A | A |
| 0 | 264010 | 999.25 | 999.50 | 1000.00 | 23.84 | 23.84 | 23.89 | 23.89 | 24.03 | 24.03 | E | E | E | E | E | E |
| 0 | 265000 | 999.25 | 999.50 | 22.30 | 21.44 | 21.44 | 21.61 | 21.61 | 22.12 | 22.12 | A | A | A | A | A | A |
| 0 | 265001 | 999.25 | 999.50 | 24.00 | 21.04 | 21.03 | 21.32 | 21.32 | 21.97 | 21.97 | A | A | A | A | A | A |
| 0 | 265010 | 22.25 | 999.50 | 23.50 | 21.96 | 21.96 | 22.12 | 22.12 | 22.59 | 22.59 | A | A | A | A | B | B |
| 0 | 266000 | 28.45 | 999.50 | 1000.00 | 22.94 | 22.92 | 23.48 | 23.45 | 24.85 | 24.84 | A | A | A | A | A | A |
| 0 | 266010 | 31.25 | 999.50 | 1000.00 | 30.20 | 30.20 | 30.23 | 30.23 | 30.29 | 30.29 | A | A | A | A | A | A |
| 0 | 266020 | 30.25 | 999.50 | 1000.00 | 30.21 | 30.21 | 30.24 | 30.24 | 30.31 | 30.31 | A | A | A | A | B | B |
| 0 | 266030 | 34.45 | 999.50 | 1000.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | ## | ## | ## | #### | #### | #### |
| 0 | 267000 | 34.55 | 999.50 | 1000.00 | 27.15 | 27.15 | 27.33 | 27.32 | 28.06 | 28.05 | A | A | A | A | A | A |

# North Arhie Creek Sub-watershed

## Existing vs Proposed LOS

8/30/01

**Table 15.3a**

| NORTH ARCHIE CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 0 | 267010 | 33.95 | 999.50 | 1000.00 | 27.18 | 27.18 | 27.36 | 27.35 | 28.02 | 28.02 | A | A | A | A | A | A |
| 0 | 267010 | 33.95 | 999.50 | 1000.00 | 27.18 | 27.18 | 27.36 | 27.35 | 28.02 | 28.02 | A | A | A | A | A | A |
| 0 | 269000 | 34.45 | 999.50 | 1000.00 | 32.12 | 32.12 | 32.13 | 32.13 | 32.17 | 32.17 | A | A | A | A | A | A |
| 0 | 269010 | 34.25 | 999.50 | 35.50 | 33.27 | 33.27 | 33.62 | 33.62 | 34.14 | 34.14 | A | A | A | A | A | A |
| 0 | 270000 | 999.25 | 999.50 | 31.30 | 27.34 | 27.26 | 27.80 | 27.73 | 28.78 | 28.78 | A | A | A | A | A | A |
| 0 | 270010 | 28.85 | 999.50 | 32.20 | 27.87 | 27.86 | 28.42 | 28.34 | 29.38 | 29.37 | A | A | A | A | B | B |
| 0 | 270020 | 999.25 | 999.50 | 1000.00 | 28.02 | 28.01 | 28.74 | 28.56 | 29.76 | 29.75 | E | E | E | E | E | E |
| 0 | 270030 | 999.25 | 999.50 | 35.00 | 29.74 | 29.74 | 29.94 | 29.97 | 30.66 | 30.66 | A | A | A | A | A | A |
| 0 | 270035 | 999.25 | 999.50 | 1000.00 | 29.73 | 29.73 | 29.88 | 29.97 | 30.66 | 30.66 | E | E | E | E | E | E |
| 0 | 270040 | 32.05 | 999.50 | 34.90 | 30.24 | 30.24 | 30.48 | 30.51 | 31.32 | 31.32 | A | A | A | A | A | A |
| 0 | 270041 | 32.05 | 999.50 | 34.90 | 30.34 | 30.34 | 30.75 | 30.80 | 31.89 | 31.89 | A | A | A | A | A | A |
| 0 | 270042 | 32.15 | 999.50 | 34.80 | 30.34 | 30.34 | 30.75 | 30.81 | 31.90 | 31.90 | A | A | A | A | A | A |
| 0 | 270043 | 33.15 | 999.50 | 35.70 | 29.99 | 29.99 | 30.27 | 30.32 | 31.22 | 31.22 | A | A | A | A | A | A |
| 0 | 270044 | 34.15 | 999.50 | 37.00 | 30.07 | 30.07 | 30.46 | 30.52 | 31.23 | 31.22 | A | A | A | A | A | A |
| 0 | 270045 | 34.15 | 999.50 | 36.30 | 29.94 | 29.94 | 30.27 | 30.33 | 31.23 | 31.23 | A | A | A | A | A | A |
| 0 | 270046 | 34.45 | 999.50 | 37.30 | 32.66 | 32.66 | 32.96 | 32.96 | 33.44 | 33.44 | A | A | A | A | A | A |
| 0 | 270050 | 22.65 | 999.50 | 1000.00 | 30.35 | 30.35 | 30.60 | 30.63 | 31.52 | 31.52 | B | B | B | B | B | B |
| 0 | 270055 | 999.25 | 999.50 | 1000.00 | 30.35 | 30.35 | 30.60 | 30.63 | 31.52 | 31.52 | E | E | E | E | E | E |
| 0 | 270060 | 34.95 | 999.50 | 35.80 | 31.90 | 31.90 | 32.28 | 32.28 | 33.43 | 33.43 | A | A | A | A | A | A |
| 0 | 270065 | 33.95 | 999.50 | 35.70 | 31.90 | 31.90 | 32.28 | 32.29 | 33.43 | 33.43 | A | A | A | A | A | A |
| 0 | 270070 | 33.25 | 999.50 | 32.00 | 30.42 | 30.42 | 30.70 | 30.72 | 31.61 | 31.61 | A | A | A | A | A | A |
| 0 | 270080 | 999.25 | 999.50 | 1000.00 | 31.10 | 31.10 | 31.42 | 31.42 | 32.20 | 32.20 | E | E | E | E | E | E |
| 0 | 270090 | 999.25 | 999.50 | 1000.00 | 32.81 | 32.81 | 33.04 | 33.04 | 33.58 | 33.58 | E | E | E | E | E | E |
| 0 | 270100 | 999.25 | 999.50 | 1000.00 | 32.83 | 32.83 | 33.07 | 33.07 | 33.68 | 33.68 | E | E | E | E | E | E |
| 0 | 270110 | 999.25 | 999.50 | 1000.00 | 32.91 | 32.91 | 33.08 | 33.08 | 34.04 | 34.04 | E | E | E | E | E | E |
| 0 | 270120 | 999.25 | 999.50 | 1000.00 | 33.45 | 33.45 | 33.70 | 33.70 | 34.64 | 34.64 | E | E | E | E | E | E |
| 0 | 270125 | 35.85 | 999.50 | 38.40 | 32.01 | 32.01 | 32.30 | 32.30 | 33.45 | 33.45 | A | A | A | A | A | A |
| 0 | 270130 | 28.25 | 999.50 | 1000.00 | 34.72 | 34.72 | 34.96 | 34.96 | 35.70 | 35.70 | B | B | B | B | B | B |
| 0 | 270140 | 24.35 | 999.50 | 1000.00 | 35.44 | 35.44 | 35.93 | 35.93 | 37.22 | 37.22 | B | B | B | B | B | B |
| 0 | 270150 | 25.85 | 999.50 | 1000.00 | 36.63 | 36.63 | 37.08 | 37.08 | 38.35 | 38.35 | B | B | B | B | B | B |
| 0 | 270151 | 24.25 | 999.50 | 1000.00 | 36.64 | 36.64 | 37.08 | 37.08 | 38.36 | 38.36 | B | B | B | B | B | B |
| 0 | 270500 | 999.25 | 999.50 | 1000.00 | 27.36 | 27.28 | 27.82 | 27.74 | 28.78 | 28.77 | E | E | E | E | E | E |
| 0 | 270505 | 999.25 | 999.50 | 1000.00 | 27.76 | 27.67 | 28.04 | 27.94 | 28.90 | 28.87 | E | E | E | E | E | E |
| 0 | 270510 | 999.25 | 999.50 | 1000.00 | 28.25 | 28.14 | 28.37 | 28.33 | 29.12 | 29.08 | E | E | E | E | E | E |
| 0 | 270515 | 999.25 | 999.50 | 1000.00 | 27.76 | 27.67 | 28.04 | 27.94 | 28.90 | 28.87 | E | E | E | E | E | E |
| 0 | 270520 | 31.95 | 999.50 | 1000.00 | 28.27 | 28.16 | 28.39 | 28.35 | 29.16 | 29.11 | A | A | A | A | A | A |
| 0 | 270521 | 33.75 | 999.50 | 1000.00 | 27.65 | 27.94 | 27.89 | 27.88 | 28.83 | 28.80 | A | A | A | A | A | A |
| 0 | 270525 | 36.25 | 999.50 | 1000.00 | 29.17 | 29.17 | 29.59 | 29.59 | 30.77 | 30.77 | A | A | A | A | A | A |
| 0 | 270530 | 31.85 | 999.50 | 1000.00 | 28.73 | 28.61 | 28.73 | 28.73 | 29.49 | 29.43 | A | A | A | A | A | A |
| 0 | 270540 | 999.25 | 999.50 | 1000.00 | 28.75 | 28.63 | 28.75 | 28.75 | 29.50 | 29.44 | E | E | E | E | E | E |
| 0 | 270570 | 999.25 | 999.50 | 1000.00 | 28.76 | 28.64 | 28.74 | 28.76 | 29.58 | 29.52 | E | E | E | E | E | E |
| 0 | 270580 | 30.05 | 999.50 | 1000.00 | 28.87 | 28.76 | 28.84 | 28.82 | 29.65 | 29.60 | A | A | A | A | A | A |

## North Arhie Creek Sub-watershed
## Existing vs Proposed LOS
8/30/01
**Table 15.3a**

| NORTH ARCHIE CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 0 | 270585 | 999.25 | 999.50 | 1000.00 | 28.78 | 28.67 | 28.84 | 28.82 | 29.65 | 29.60 | E | E | E | E | E | E |
| 0 | 270590 | 999.25 | 999.50 | 1000.00 | 28.77 | 28.66 | 28.88 | 28.86 | 29.67 | 29.63 | E | E | E | E | E | E |
| 0 | 270592 | 999.25 | 999.50 | 1000.00 | 29.73 | 29.73 | 29.75 | 29.75 | 29.83 | 29.83 | E | E | E | E | E | E |
| 0 | 270594 | 999.25 | 999.50 | 1000.00 | 29.63 | 29.63 | 29.66 | 29.66 | 29.74 | 29.74 | E | E | E | E | E | E |
| 0 | 270596 | 999.25 | 999.50 | 1000.00 | 29.75 | 29.75 | 29.78 | 29.78 | 29.86 | 29.86 | E | E | E | E | E | E |
| 0 | 270610 | 999.25 | 999.50 | 1000.00 | 29.03 | 29.03 | 29.05 | 29.05 | 29.68 | 29.63 | E | E | E | E | E | E |
| 0 | 270620 | 999.25 | 999.50 | 1000.00 | 28.78 | 28.66 | 28.92 | 28.88 | 29.70 | 29.65 | E | E | E | E | E | E |
| 0 | 270630 | 32.65 | 999.50 | 1000.00 | 28.78 | 28.67 | 28.98 | 28.93 | 29.82 | 29.80 | A | A | A | A | A | A |
| 0 | 270640 | 999.25 | 999.50 | 1000.00 | 30.41 | 30.41 | 30.46 | 30.46 | 30.60 | 30.60 | E | E | E | E | E | E |
| 0 | 272000 | 36.75 | 999.50 | 34.50 | 27.88 | 27.87 | 28.43 | 28.35 | 29.39 | 29.38 | A | A | A | A | A | A |
| 0 | 272010 | 999.25 | 999.50 | 1000.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | E | E | E | E | E | E |
| 0 | 272020 | 33.05 | 999.50 | 34.00 | 28.48 | 28.48 | 28.62 | 28.62 | 29.39 | 29.39 | A | A | A | A | A | A |
| 0 | 272030 | 33.95 | 999.50 | 38.00 | 28.48 | 28.48 | 28.62 | 28.62 | 29.40 | 29.40 | A | A | A | A | A | A |
| 0 | 272035 | 999.25 | 999.50 | 1000.00 | 33.00 | 33.00 | 33.00 | 33.00 | 33.00 | 33.00 | E | E | E | E | E | E |
| 0 | 272036 | 999.25 | 999.50 | 1000.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | E | E | E | E | E | E |
| 0 | 272040 | 999.25 | 999.50 | 1000.00 | 34.82 | 34.82 | 35.36 | 35.36 | 36.49 | 36.49 | E | E | E | E | E | E |
| 0 | 272050 | 39.15 | 999.50 | 44.70 | 36.23 | 36.23 | 36.26 | 36.26 | 36.53 | 36.53 | A | A | A | A | A | A |
| 0 | 272060 | 999.25 | 42.50 | 1000.00 | 38.08 | 38.08 | 38.09 | 38.09 | 38.12 | 38.12 | A | A | A | A | A | A |
| 0 | 272070 | 999.25 | 999.50 | 42.80 | 40.09 | 40.09 | 40.10 | 40.10 | 40.12 | 40.12 | A | A | A | A | A | A |
| 0 | 272080 | 41.75 | 999.50 | 43.40 | 40.10 | 40.10 | 40.19 | 40.19 | 40.40 | 40.40 | A | A | A | A | A | A |
| 0 | 273000 | 33.55 | 999.50 | 33.50 | 29.74 | 29.74 | 29.96 | 29.98 | 30.67 | 30.67 | A | A | A | A | A | A |
| 0 | 273010 | 36.55 | 999.50 | 37.00 | 32.93 | 32.93 | 33.18 | 33.18 | 33.81 | 33.81 | A | A | A | A | A | A |
| 0 | 273015 | 999.25 | 999.50 | 36.20 | 34.13 | 34.13 | 34.29 | 34.29 | 34.77 | 34.77 | A | A | A | A | A | A |
| 0 | 273020 | 999.25 | 999.50 | 36.00 | 34.91 | 34.91 | 35.09 | 35.09 | 35.55 | 35.55 | A | A | A | A | A | A |
| 0 | 273021 | 37.35 | 999.50 | 37.80 | 35.14 | 35.14 | 35.48 | 35.48 | 36.71 | 36.71 | A | A | A | A | A | A |
| 0 | 273025 | 37.25 | 999.50 | 40.20 | 35.10 | 35.10 | 35.28 | 35.28 | 35.76 | 35.76 | A | A | A | A | A | A |
| 0 | 273030 | 36.75 | 999.50 | 39.50 | 35.13 | 35.13 | 35.47 | 35.47 | 36.70 | 36.70 | A | A | A | A | A | A |
| 0 | 273040 | 37.30 | 999.00 | 38.50 | 35.13 | 35.13 | 35.48 | 35.48 | 36.71 | 36.71 | A | A | A | A | A | A |
| 0 | 273500 | 38.10 | 34.50 | 36.20 | 35.30 | 35.30 | 35.58 | 35.58 | 36.41 | 36.41 | C | C | C | C | D | D |
| 0 | 273510 | 38.10 | 39.50 | 999.00 | 35.31 | 35.31 | 35.60 | 35.60 | 36.45 | 36.45 | A | A | A | A | A | A |
| 0 | 273520 | 40.00 | 43.00 | 39.00 | 35.31 | 35.31 | 35.60 | 35.60 | 36.45 | 36.45 | A | A | A | A | A | A |
| 0 | 273525 | 38.50 | 42.50 | 41.00 | 40.10 | 40.10 | 40.19 | 40.19 | 40.40 | 40.40 | B | B | B | B | B | B |
| 0 | 273530 | 40.00 | 36.40 | 40.80 | 40.11 | 40.11 | 40.21 | 40.21 | 40.45 | 40.45 | C | C | C | C | C | C |
| 0 | 273800 | 38.80 | 999.00 | 41.00 | 35.10 | 35.10 | 35.28 | 35.28 | 35.76 | 35.76 | A | A | A | A | A | A |
| 0 | 273810 | 42.00 | 999.00 | 42.00 | 35.33 | 35.33 | 35.62 | 35.62 | 36.48 | 36.48 | A | A | A | A | A | A |
| 0 | 273820 | 43.00 | 999.00 | 32.80 | 40.19 | 40.19 | 40.21 | 40.21 | 40.26 | 40.26 | D | D | D | D | D | D |
| 0 | 274000 | 33.00 | 999.00 | 31.40 | 31.91 | 31.91 | 32.29 | 32.29 | 33.44 | 33.44 | D | D | D | D | D | D |
| 0 | 274010 | 32.00 | 999.00 | 999.00 | 31.91 | 31.91 | 32.29 | 32.29 | 33.44 | 33.44 | A | A | B | B | B | B |
| 0 | 274025 | 999.00 | 999.00 | 999.00 | 31.94 | 31.94 | 32.29 | 32.29 | 33.44 | 33.44 | E | E | E | E | E | E |
| 0 | 274030 | 32.50 | 999.00 | 999.00 | 31.99 | 31.99 | 32.30 | 32.30 | 33.44 | 33.44 | A | A | A | A | B | B |
| 0 | 276000 | 32.20 | 999.00 | 999.00 | 28.75 | 28.63 | 28.75 | 28.75 | 29.50 | 29.44 | A | A | A | A | A | A |
| 0 | 276010 | 999.00 | 999.00 | 999.00 | 31.94 | 31.94 | 32.12 | 32.12 | 32.61 | 32.61 | E | E | E | E | E | E |
| 0 | 276500 | 999.00 | 999.00 | 999.00 | 28.76 | 28.64 | 28.75 | 28.76 | 29.58 | 29.52 | E | E | E | E | E | E |

**North Arhie Creek Sub-watershed**

**Existing vs Proposed LOS**

8/30/01

**Table 15.3a**

| NORTH ARCHIE CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 0 | 276510 | 999.00 | 999.00 | 999.00 | 28.77 | 28.66 | 28.88 | 28.86 | 29.68 | 29.63 | E | E | E | E | E | E |
| 0 | 276530 | 999.00 | 999.00 | 999.00 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | E | E | E | E | E | E |
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# Archie Creek Sub-watershed
## Existing vs Proposed LOS
8/30/01
**Table 15.4a**

| ARCHIE CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 9 | 280006 | 5.25 | 5.10 | 6.54 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | A | A | A | A | A | A |
| 9 | 280007 | 6.05 | 6.50 | 7.00 | 3.30 | 3.30 | 3.41 | 3.41 | 3.63 | 3.62 | A | A | A | A | A | A |
| 9 | 280008 | 6.45 | 6.50 | 7.00 | 3.60 | 3.60 | 3.72 | 3.72 | 3.95 | 3.95 | A | A | A | A | A | A |
| 9 | 280010 | 6.75 | 7.20 | 8.20 | 3.88 | 3.88 | 4.01 | 4.01 | 4.26 | 4.26 | A | A | A | A | A | A |
| 9 | 280015 | 6.75 | 10.50 | 11.00 | 4.02 | 4.02 | 4.17 | 4.18 | 4.50 | 4.50 | A | A | A | A | A | A |
| 9 | 280020 | 6.75 | 11.00 | 12.00 | 4.34 | 4.34 | 4.50 | 4.50 | 4.81 | 4.81 | A | A | A | A | A | A |
| 9 | 280030 | 10.10 | 11.00 | 12.64 | 4.53 | 4.53 | 4.72 | 4.72 | 5.06 | 5.06 | A | A | A | A | A | A |
| 9 | 280040 | 11.55 | 12.10 | 12.60 | 5.68 | 5.68 | 6.03 | 6.04 | 6.71 | 6.71 | A | A | A | A | A | A |
| 9 | 280050 | 11.25 | 11.80 | 12.30 | 6.05 | 6.06 | 6.47 | 6.47 | 7.31 | 7.31 | A | A | A | A | A | A |
| 8,9 | 280055 | 13.30 | 14.50 | 15.59 | 6.07 | 6.08 | 6.49 | 6.49 | 7.33 | 7.33 | A | A | A | A | A | A |
| 8,9 | 280060 | 11.95 | 12.50 | 13.00 | 6.10 | 6.11 | 6.52 | 6.52 | 7.37 | 7.37 | A | A | A | A | A | A |
| 8 | 280065 | 17.35 | 17.60 | 18.10 | 6.59 | 6.60 | 7.00 | 7.01 | 7.88 | 7.89 | A | A | A | A | A | A |
| 15 | 280066 | 7.45 | 7.70 | 8.20 | 1.63 | 1.63 | 1.72 | 1.72 | 1.99 | 1.99 | A | A | A | A | A | A |
| 16 | 280067 | 17.35 | 17.60 | 18.10 | 1.48 | 1.48 | 1.55 | 1.55 | 1.76 | 1.76 | A | A | A | A | A | A |
| 16 | 280068 | 15.05 | 15.30 | 15.80 | 1.44 | 1.44 | 1.50 | 1.50 | 1.69 | 1.69 | A | A | A | A | A | A |
| 16 | 280069 | 12.55 | 12.80 | 13.30 | 1.15 | 1.15 | 1.17 | 1.17 | 1.24 | 1.24 | A | A | A | A | A | A |
| 16 | 280070 | 15.05 | 15.30 | 15.80 | 3.47 | 3.47 | 3.82 | 3.82 | 4.87 | 4.87 | A | A | A | A | A | A |
| 16 | 280071 | 17.75 | 18.00 | 18.50 | 1.53 | 1.53 | 1.61 | 1.61 | 1.83 | 1.83 | A | A | A | A | A | A |
| 9,16 | 280075 | 16.85 | 1000.00 | 1000.50 | 7.34 | 7.35 | 7.73 | 7.74 | 8.65 | 8.65 | A | A | A | A | A | A |
| 15 | 280080 | 6.25 | 999.50 | 1000.00 | 4.28 | 4.28 | 4.79 | 4.79 | 6.40 | 6.41 | A | A | A | A | B | B |
| 8,15 | 280085 | 13.75 | 14.00 | 1000.50 | 8.43 | 8.44 | 8.77 | 8.77 | 9.62 | 9.63 | A | A | A | A | A | A |
| 15,16 | 280086 | 8.55 | 999.50 | 1000.00 | 8.64 | 8.65 | 8.98 | 8.99 | 9.85 | 9.86 | B | B | B | B | B | B |
| 15 | 280088 | 9.45 | 10.60 | 9.80 | 9.16 | 9.17 | 9.52 | 9.52 | 10.44 | 10.45 | A | A | B | B | D | D |
| 15 | 280089 | 12.25 | 12.90 | 13.40 | 10.20 | 10.19 | 10.63 | 10.68 | 11.86 | 11.90 | A | A | A | A | A | A |
| 16 | 280100 | 10.85 | 11.10 | 1000.00 | 8.91 | 8.91 | 8.97 | 8.97 | 9.63 | 9.63 | A | A | A | A | A | A |
| 15 | 280105 | 9.85 | 11.30 | 29.60 | 8.64 | 8.65 | 8.98 | 8.99 | 9.86 | 9.86 | A | A | A | A | B | B |
| 15 | 280110 | 13.55 | 999.50 | 1000.00 | 9.10 | 9.10 | 9.15 | 9.15 | 9.63 | 9.63 | A | A | A | A | A | A |
| 15 | 280115 | 10.25 | 11.00 | 1000.00 | 8.69 | 8.70 | 9.02 | 9.03 | 9.89 | 9.90 | A | A | A | A | A | A |
| 15 | 280120 | 13.05 | 12.50 | 13.00 | 8.88 | 8.91 | 9.19 | 9.22 | 10.03 | 10.05 | A | A | A | A | A | A |
| 15 | 280128 | 10.55 | 12.30 | 14.39 | 8.99 | 9.03 | 9.28 | 9.32 | 10.10 | 10.13 | A | A | A | A | A | A |
| 15 | 280140 | 999.25 | 999.50 | 1000.00 | 11.91 | 11.93 | 12.24 | 12.25 | 13.07 | 13.05 | E | E | E | E | E | E |
| 15 | 280143 | 999.25 | 999.50 | 1000.00 | 12.01 | 12.04 | 12.33 | 12.35 | 13.15 | 13.13 | E | E | E | E | E | E |
| 15 | 280145 | 13.45 | 999.50 | 1000.00 | 12.02 | 12.05 | 12.34 | 12.36 | 13.15 | 13.13 | A | A | A | A | A | A |
| 21 | 280150 | 12.25 | 13.30 | 1000.50 | 13.36 | 13.14 | 13.63 | 13.45 | 14.19 | 14.08 | C | B | C | C | C | C |
| 21 | 280155 | 999.25 | 999.50 | 1000.00 | 15.68 | 15.68 | 15.80 | 15.80 | 16.11 | 16.11 | E | E | E | E | E | E |
| 21 | 280160 | 18.27 | 999.50 | 1000.00 | 16.27 | 16.27 | 16.42 | 16.42 | 16.81 | 16.81 | A | A | A | A | A | A |
| 15 | 280300 | 14.25 | 999.50 | 13.50 | 10.31 | 10.31 | 10.74 | 10.74 | 11.97 | 12.01 | A | A | A | A | A | A |
| 23 | 280305 | 12.25 | 999.50 | 14.00 | 10.38 | 10.38 | 10.82 | 10.82 | 12.19 | 12.24 | A | A | A | A | A | A |
| 22 | 280310 | 13.65 | 999.50 | 1000.00 | 10.47 | 10.42 | 10.85 | 10.85 | 12.20 | 12.24 | A | A | A | A | A | A |

# Archie Creek Sub-watershed

## Existing vs Proposed LOS

8/30/01

**Table 15.4a**

| ARCHIE CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 22 | 280312 | 999.25 | 999.50 | 1000.00 | 18.08 | 18.08 | 18.21 | 18.21 | 18.57 | 18.57 | | E | E | E | E | E | E |
| 22 | 280313 | 999.25 | 999.50 | 1000.00 | 18.16 | 18.16 | 18.29 | 18.29 | 18.65 | 18.65 | | E | E | E | E | E | E |
| 22 | 280314 | 999.25 | 999.50 | 1000.00 | 18.50 | 18.50 | 18.50 | 18.50 | 18.68 | 18.68 | | E | E | E | E | E | E |
| 22 | 280315 | 14.75 | 999.50 | 15.00 | 11.87 | 11.71 | 12.02 | 11.88 | 12.41 | 12.34 | | A | A | A | A | A | A |
| 22 | 280317 | 999.25 | 999.50 | 1000.00 | 17.85 | 17.85 | 17.96 | 17.96 | 18.25 | 18.25 | | E | E | E | E | E | E |
| 22 | 280320 | 14.55 | 999.50 | 16.00 | 13.80 | 13.61 | 13.97 | 13.79 | 14.37 | 14.26 | | A | A | A | A | A | A |
| 22 | 280325 | 14.85 | 999.50 | 1000.00 | 14.19 | 14.02 | 14.34 | 14.18 | 14.71 | 14.60 | | A | A | A | A | A | A |
| 22 | 280330 | 15.25 | 999.50 | 1000.00 | 14.27 | 14.11 | 14.42 | 14.27 | 14.79 | 14.68 | | A | A | A | A | A | A |
| 22 | 280333 | 999.25 | 999.50 | 1000.00 | 19.10 | 19.10 | 19.24 | 19.24 | 19.61 | 19.61 | | E | E | E | E | E | E |
| 16,22 | 280335 | 15.65 | 18.10 | 1000.00 | 16.03 | 14.77 | 16.27 | 15.21 | 16.87 | 16.08 | | B | A | B | A | B | B |
| 22 | 280340 | 999.25 | 999.50 | 22.00 | 19.36 | 19.36 | 19.54 | 19.54 | 19.76 | 19.76 | | A | A | A | A | A | A |
| 21 | 280350 | 14.05 | 999.50 | 1000.00 | 11.88 | 11.94 | 12.21 | 12.21 | 13.58 | 13.60 | | A | A | A | A | A | A |
| 22 | 280357 | 999.25 | 999.50 | 1000.00 | 12.24 | 12.24 | 13.10 | 13.12 | 15.20 | 15.23 | | E | E | E | E | E | E |
| 21 | 280360 | 13.15 | 999.50 | 18.60 | 12.24 | 12.24 | 13.10 | 13.12 | 15.20 | 15.23 | | A | A | A | A | B | B |
| 21 | 280365 | 12.55 | 999.50 | 15.50 | 10.77 | 10.77 | 11.83 | 11.80 | 13.49 | 13.48 | | A | A | A | A | B | B |
| 21 | 280370 | 14.05 | 999.50 | 1000.00 | 12.56 | 12.66 | 13.10 | 13.14 | 15.18 | 15.20 | | A | A | A | A | B | B |
| 21 | 280373 | 16.65 | 999.50 | 1000.00 | 20.50 | 20.50 | 20.50 | 20.50 | 20.56 | 20.56 | | B | B | B | B | B | B |
| 21 | 280375 | 999.25 | 999.50 | 1000.00 | 13.18 | 13.26 | 13.62 | 13.69 | 15.28 | 15.31 | | E | E | E | E | E | E |
| 21 | 280380 | 999.25 | 999.50 | 1000.00 | 15.96 | 16.02 | 16.26 | 16.31 | 17.05 | 17.06 | | E | E | E | E | E | E |
| 21 | 280385 | 999.25 | 999.50 | 1000.00 | 16.70 | 16.76 | 17.02 | 17.08 | 17.86 | 17.87 | | E | E | E | E | E | E |
| 22 | 280390 | 999.25 | 999.50 | 1000.00 | 17.34 | 17.42 | 17.66 | 17.73 | 18.48 | 18.50 | | E | E | E | E | E | E |
| 22 | 280392 | 999.25 | 999.50 | 1000.00 | 17.60 | 17.70 | 17.92 | 18.02 | 18.72 | 18.74 | | E | E | E | E | E | E |
| 22 | 280394 | 999.25 | 999.50 | 1000.00 | 17.96 | 18.08 | 18.29 | 18.40 | 19.08 | 19.10 | | E | E | E | E | E | E |
| 22 | 280397 | 17.15 | 999.50 | 1000.00 | 18.32 | 18.47 | 18.67 | 18.81 | 19.55 | 19.57 | | B | B | B | B | B | B |
| 22 | 280398 | 26.25 | 999.50 | 1000.00 | 18.52 | 18.68 | 18.86 | 19.00 | 19.69 | 19.71 | | A | A | A | A | A | A |
| 21 | 280400 | 16.68 | 999.50 | 21.50 | 16.71 | 16.77 | 17.03 | 17.08 | 17.86 | 17.88 | | B | B | B | B | B | B |
| 21 | 280405 | 999.25 | 999.50 | 1000.00 | 16.71 | 16.77 | 17.03 | 17.09 | 17.86 | 17.88 | | E | E | E | E | E | E |
| 21 | 280410 | 999.25 | 999.50 | 1000.00 | 18.87 | 18.87 | 18.93 | 18.93 | 19.12 | 19.12 | | E | E | E | E | E | E |
| 21 | 280415 | 21.55 | 999.50 | 1000.00 | 16.71 | 16.77 | 17.03 | 17.09 | 17.86 | 17.88 | | A | A | A | A | A | A |
| 21 | 280420 | 22.25 | 999.50 | 1000.00 | 16.72 | 16.78 | 17.04 | 17.09 | 17.87 | 17.88 | | A | A | A | A | A | A |
| 21 | 280425 | 21.25 | 999.50 | 1000.00 | 16.72 | 16.77 | 17.03 | 17.08 | 17.86 | 17.88 | | A | A | A | A | A | A |
| 21 | 280430 | 21.25 | 999.50 | 1000.00 | 16.76 | 16.79 | 17.07 | 17.09 | 17.88 | 17.89 | | A | A | A | A | A | A |
| 21 | 280435 | 999.25 | 999.50 | 1000.00 | 19.49 | 19.49 | 19.65 | 19.65 | 20.09 | 20.09 | | E | E | E | E | E | E |
| 22,21 | 280440 | 999.25 | 999.50 | 1000.00 | 19.66 | 19.66 | 19.82 | 19.82 | 20.27 | 20.27 | | E | E | E | E | E | E |
| 27 | 280445 | 28.85 | 999.50 | 1000.00 | 20.27 | 20.27 | 20.37 | 20.37 | 20.65 | 20.65 | | A | A | A | A | A | A |
| 22 | 280500 | 999.25 | 999.50 | 1000.00 | 18.12 | 18.12 | 18.36 | 18.36 | 18.96 | 18.96 | | E | E | E | E | E | E |
| 22 | 280515 | 999.25 | 999.50 | 1000.00 | 20.84 | 20.84 | 21.00 | 21.00 | 21.57 | 21.57 | | E | E | E | E | E | E |
| 22 | 280520 | 999.25 | 999.50 | 1000.00 | 20.84 | 20.84 | 21.11 | 21.11 | 21.91 | 21.91 | | E | E | E | E | E | E |
| 22 | 280525 | 999.25 | 999.50 | 1000.00 | 20.85 | 20.85 | 21.14 | 21.14 | 21.94 | 21.94 | | E | E | E | E | E | E |

# Archie Creek Sub-watershed

## Existing vs Proposed LOS

8/30/01

**Table 15.4a**

| ARCHIE CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 22 | 280530 | 999.25 | 999.50 | 1000.00 | 20.87 | 20.87 | 21.15 | 21.15 | 21.96 | 21.96 | E | E | E | E | E | E |
| 22 | 280535 | 999.25 | 999.50 | 1000.00 | 20.87 | 20.87 | 21.16 | 21.16 | 21.96 | 21.96 | E | E | E | E | E | E |
| 28 | 290000 | 28.25 | 999.50 | 1000.00 | 18.66 | 18.86 | 19.04 | 19.22 | 20.12 | 20.16 | A | A | A | A | A | A |
| 28 | 290003 | 23.95 | 999.50 | 1000.00 | 18.74 | 18.97 | 19.13 | 19.33 | 20.21 | 20.25 | A | A | A | A | A | A |
| 28 | 290010 | 22.65 | 999.50 | 1000.00 | 19.18 | 19.29 | 19.72 | 19.81 | 21.06 | 21.08 | A | A | A | A | A | A |
| 28 | 290015 | 999.25 | 22.50 | 24.00 | 23.40 | 23.40 | 23.40 | 23.40 | 23.41 | 23.41 | C | C | C | C | C | C |
| 28 | 290020 | 999.25 | 999.50 | 1000.00 | 23.61 | 23.61 | 23.67 | 23.67 | 23.84 | 23.84 | E | E | E | E | E | E |
| 28 | 290025 | 22.75 | 999.50 | 24.40 | 22.38 | 21.12 | 22.64 | 21.38 | 23.32 | 22.24 | A | A | A | A | B | A |
| 28 | 290030 | 999.25 | 999.50 | 1000.00 | 22.49 | 21.45 | 22.77 | 21.66 | 23.49 | 22.40 | E | E | E | E | E | E |
| 28 | 290035 | 26.05 | 999.50 | 25.00 | 26.00 | 26.00 | 26.02 | 26.02 | 26.18 | 26.18 | D | D | D | D | D | D |
| 34 | 290038 | 24.25 | 999.50 | 26.00 | 24.43 | 22.93 | 24.98 | 23.17 | 25.99 | 24.07 | B | A | B | A | B | A |
| 34 | 290045 | 24.65 | 999.50 | 28.00 | 25.38 | 23.91 | 25.75 | 24.22 | 26.69 | 25.27 | B | A | B | A | B | B |
| 34 | 290055 | 25.25 | 999.50 | 25.00 | 26.28 | 24.61 | 26.62 | 25.05 | 27.57 | 26.14 | D | A | D | D | D | D |
| 28 | 290100 | 22.85 | 999.50 | 23.00 | 20.47 | 20.47 | 20.67 | 20.67 | 21.16 | 21.16 | A | A | A | A | A | A |
| 28 | 290105 | 22.75 | 999.50 | 24.00 | 22.26 | 22.26 | 22.45 | 22.45 | 22.93 | 22.93 | A | A | A | A | B | B |
| 28 | 290110 | 28.25 | 999.50 | 1000.00 | 20.93 | 20.93 | 21.05 | 21.05 | 21.38 | 21.38 | A | A | A | A | A | A |
| 28 | 290115 | 28.25 | 999.50 | 1000.00 | 22.35 | 22.35 | 22.48 | 22.48 | 22.82 | 22.82 | A | A | A | A | A | A |
| 27,28 | 290200 | 23.75 | 999.50 | 24.00 | 22.19 | 22.19 | 22.49 | 22.49 | 23.31 | 23.31 | A | A | A | A | A | A |
| 27 | 290225 | 24.35 | 999.50 | 1000.00 | 24.29 | 24.29 | 24.35 | 24.35 | 24.50 | 24.50 | A | A | B | B | B | B |
| 27 | 290235 | 25.85 | 999.50 | 1000.00 | 25.14 | 25.14 | 25.22 | 25.22 | 25.43 | 25.43 | A | A | A | A | A | A |
| 27 | 290250 | 24.25 | 999.50 | 1000.00 | 22.77 | 22.77 | 22.90 | 22.90 | 23.36 | 23.36 | A | A | A | A | A | A |
| 28 | 290305 | 28.25 | 999.50 | 29.00 | 24.27 | 24.27 | 24.71 | 24.71 | 26.18 | 26.18 | A | A | A | A | A | A |
| 28 | 290306 | 24.25 | 999.50 | 25.00 | 24.39 | 24.39 | 24.70 | 24.70 | 25.56 | 25.56 | B | B | B | B | D | D |
| 34 | 290310 | 25.25 | 999.50 | 25.00 | 27.72 | 27.72 | 27.82 | 27.82 | 28.08 | 28.08 | D | D | D | D | D | D |
| 33 | 290315 | 999.25 | 999.50 | 1000.00 | 26.24 | 26.24 | 26.33 | 26.33 | 26.58 | 26.58 | E | E | E | E | E | E |
| 33 | 290320 | 39.25 | 999.50 | 37.00 | 27.14 | 27.14 | 27.21 | 27.21 | 27.42 | 27.42 | A | A | A | A | A | A |
| 33 | 290325 | 41.65 | 999.50 | 43.00 | 26.89 | 26.89 | 27.29 | 27.29 | 28.16 | 28.16 | A | A | A | A | A | A |
| 27 | 290330 | 999.25 | 999.50 | 32.00 | 26.87 | 26.87 | 27.28 | 27.28 | 28.15 | 28.15 | A | A | A | A | A | A |
| 27 | 290340 | 28.65 | 999.50 | 32.00 | 26.89 | 26.89 | 27.28 | 27.28 | 28.15 | 28.15 | A | A | A | A | A | A |
| 27 | 290350 | 999.25 | 999.50 | 33.00 | 28.40 | 28.40 | 28.57 | 28.57 | 29.05 | 29.05 | A | A | A | A | A | A |
| 27/33 | 290360 | 35.35 | 36.50 | 37.10 | 28.02 | 28.02 | 28.20 | 28.20 | 28.65 | 28.65 | A | A | A | A | A | A |
| 33 | 290370 | 37.65 | 37.50 | 39.00 | 28.19 | 28.19 | 28.37 | 28.37 | 28.81 | 28.81 | A | A | A | A | A | A |
| 21 | 290500 | 28.75 | 999.50 | 1000.00 | 17.02 | 17.03 | 17.26 | 17.27 | 17.95 | 17.96 | A | A | A | A | A | A |
| 27 | 290570 | 28.45 | 999.50 | 1000.00 | 20.86 | 20.86 | 21.10 | 21.10 | 21.63 | 21.63 | A | A | A | A | A | A |
| 27 | 290572 | 29.55 | 999.50 | 1000.00 | 25.54 | 25.54 | 25.60 | 25.60 | 25.77 | 25.77 | A | A | A | A | A | A |
| 27 | 290575 | 28.55 | 999.50 | 1000.00 | 21.05 | 21.05 | 21.38 | 21.38 | 22.12 | 22.12 | A | A | A | A | A | A |
| 27 | 290580 | 16.95 | 18.50 | 1000.00 | 21.60 | 21.60 | 21.73 | 21.73 | 22.24 | 22.24 | C | C | C | C | C | C |
| 27 | 290585 | 24.05 | 999.50 | 1000.00 | 22.73 | 22.73 | 22.86 | 22.86 | 23.22 | 23.22 | A | A | A | A | A | A |
| 27 | 290587 | 28.45 | 999.50 | 1000.00 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | A | A | A | A | A | A |
| 27 | 290588 | 25.25 | 999.50 | 1000.00 | 27.50 | 27.50 | 27.50 | 27.50 | 27.50 | 27.50 | B | B | B | B | B | B |
| 27 | 290590 | 26.05 | 999.50 | 1000.00 | 22.28 | 22.28 | 22.37 | 22.37 | 22.95 | 22.95 | A | A | A | A | A | A |
| 27 | 290594 | 26.55 | 999.50 | 1000.00 | 25.03 | 25.03 | 25.40 | 25.40 | 26.12 | 26.12 | A | A | A | A | A | A |

# Archie Creek Sub-watershed

## Existing vs Proposed LOS

8/30/01

**Table 15.4a**

| ARCHIE CREEK SUB-WATERSHED EXISTING vs PROPOSED LEVEL OF SERVICE ANALYSIS | | | | | | | | | | | | Flood Level Designations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Landmark Elevations | | | Water Surface Elevations | | | | | | | | | | | | |
| | | | | | 10-yr | | 25-yr | | 100-yr | | | 10-yr | | 25-yr | | 100-yr | |
| Story Board | Subbasin | Road | Site | Struct | EXIST | PROP | EXIST | PROP | EXIST | PROP | | EXIST | PROP | EXIST | PROP | EXIST | PROP |
| 27 | 290595 | 29.45 | 999.50 | 31.00 | 25.03 | 25.03 | 25.40 | 25.40 | 26.12 | 26.12 | | A | A | A | A | A | A |
| 27 | 290605 | 26.25 | 999.50 | 29.00 | 24.09 | 24.09 | 24.29 | 24.29 | 24.88 | 24.88 | | A | A | A | A | A | A |
| 27 | 290610 | 26.25 | 999.50 | 29.20 | 24.09 | 24.09 | 24.29 | 24.29 | 24.87 | 24.87 | | A | A | A | A | A | A |
| 27 | 290612 | 25.65 | 999.50 | 27.00 | 25.26 | 25.26 | 25.38 | 25.38 | 25.70 | 25.70 | | A | A | A | A | B | B |
| 27 | 290616 | 999.25 | 999.50 | 30.00 | 25.50 | 25.50 | 25.72 | 25.72 | 26.22 | 26.22 | | A | A | A | A | A | A |
| 27 | 290617 | 25.65 | 999.50 | 29.20 | 25.53 | 25.53 | 25.76 | 25.76 | 26.30 | 26.30 | | A | A | B | B | B | B |
| 27 | 290620 | 999.25 | 999.50 | 29.00 | 25.90 | 25.90 | 26.17 | 26.17 | 26.73 | 26.73 | | A | A | A | A | A | A |
| 45 | 226000 | 37.37 | 37.50 | 39.00 | 37.16 | 37.37 | 37.76 | 38.01 | 39.27 | 39.59 | | A | B | C | C | D | D |
| 45 | 227000 | 50.25 | 45.50 | 56.00 | 43.96 | 43.96 | 44.29 | 44.29 | 45.24 | 45.24 | | A | A | A | A | A | A |
| 45 | 227010 | 997.25 | 997.50 | 998.00 | 47.31 | 47.31 | 47.68 | 47.68 | 48.66 | 48.66 | | E | E | E | E | E | E |
| 45 | 227020 | 997.25 | 997.50 | 998.00 | 46.40 | 46.40 | 46.72 | 46.72 | 47.70 | 47.70 | | E | E | E | E | E | E |
| 45 | 227030 | 52.25 | 41.70 | 53.00 | 50.34 | 50.34 | 50.65 | 50.65 | 51.59 | 51.59 | | C | C | C | C | C | C |
| 49 | 227040 | 59.05 | 60.50 | 61.00 | 58.32 | 58.32 | 58.48 | 58.48 | 59.22 | 59.22 | | A | A | A | A | B | B |
| 45/46 | 227050 | 55.25 | 47.50 | 48.00 | 41.92 | 41.92 | 45.42 | 45.42 | 53.76 | 53.76 | | A | A | A | A | D | D |
| 49 | 227060 | 89.05 | 79.20 | 95.00 | 74.75 | 74.75 | 75.75 | 75.75 | 78.86 | 78.86 | | A | A | A | A | A | A |
| 49 | 227070 | 89.15 | 89.20 | 89.00 | 85.31 | 82.78 | 85.88 | 83.19 | 87.41 | 84.45 | | A | A | A | A | A | A |
| 50 | 227080 | 73.85 | 74.10 | 74.60 | 70.72 | 70.72 | 71.06 | 71.06 | 72.09 | 72.09 | | A | A | A | A | A | A |
| 50 | 227090 | 74.65 | 75.50 | 76.00 | 74.51 | 74.51 | 74.84 | 74.84 | 75.78 | 75.78 | | A | A | B | B | C | C |
| 30 | 230005 | 30.25 | 997.50 | 998.00 | 29.82 | 29.61 | 30.21 | 30.01 | 31.40 | 31.23 | | A | A | A | A | B | B |
| 30 | 230012 | 32.75 | 997.50 | 998.00 | 31.60 | 32.87 | 32.02 | 33.45 | 33.07 | 34.97 | | A | B | A | B | B | B |
| 30 | 230030 | 30.25 | 30.90 | 31.40 | 29.81 | 29.60 | 30.19 | 30.00 | 31.28 | 31.11 | | A | A | A | A | C | C |
| 31 | 230033 | 32.75 | 997.50 | 998.00 | 32.04 | 32.04 | 32.44 | 32.44 | 33.64 | 33.64 | | A | A | A | A | B | B |
| 37 | 230090 | 32.35 | 31.80 | 32.50 | 30.65 | 30.65 | 31.01 | 31.01 | 32.06 | 32.05 | | A | A | A | A | C | C |
| 42 | 230170 | 35.05 | 40.00 | 41.00 | 33.02 | 33.02 | 33.54 | 33.54 | 34.95 | 34.95 | | A | A | A | A | A | A |
| 42 | 230180 | 41.25 | 41.50 | 42.00 | 34.45 | 34.45 | 34.91 | 34.91 | 35.64 | 35.64 | | A | A | A | A | A | A |
| 46 | 230190 | 36.75 | 41.00 | 42.00 | 35.45 | 35.45 | 38.18 | 38.18 | 40.87 | 40.87 | | A | A | B | B | B | B |
| 46 | 230200 | 48.25 | 48.50 | 49.50 | 48.46 | 48.46 | 49.01 | 49.01 | 50.43 | 50.43 | | B | B | C | C | D | D |
| 42 | 231000 | 34.45 | 35.00 | 36.00 | 32.63 | 32.63 | 32.96 | 32.96 | 33.76 | 33.76 | | A | A | A | A | A | A |
| 42 | 232000 | 34.05 | 40.00 | 41.00 | 33.81 | 33.81 | 34.57 | 34.57 | 36.89 | 36.89 | | A | A | B | B | B | B |
| 42/46 | 233000 | 43.91 | 44.50 | 46.00 | 42.93 | 42.93 | 43.48 | 43.48 | 44.61 | 44.61 | | A | A | A | A | C | C |
| 45/46 | 233010 | 37.05 | 44.00 | 45.00 | 40.00 | 40.00 | 40.00 | 40.00 | 53.76 | 53.76 | | B | B | B | B | D | D |
| 42 | 234000 | 44.75 | 36.90 | 45.50 | 31.00 | 31.00 | 31.00 | 31.00 | 31.00 | 31.00 | | A | A | A | A | A | A |

# RECOMMENDED PROJECTS

## 16.1 OVERVIEW

Flooding problem areas and their recommended solutions have been identified and described in this chapter. Figure 16-1 shows the locations of all recommended projects. Proposed project information includes planning level structures and non-structures scenario solutions associated with costs and benefits analysis. Planning level costs are the cost of the improvement based on non-detailed quantity estimates. All estimates are based primarily on SWFMWD contour maps, aerial maps, and limited survey data. Unit costs utilized in developing planning level costs were taken from the Construction Contract History, FDOT State Estimates Office, Engineering Support Services, July 1995 through June 1996. The criteria used to evaluate the technical feasibility of each of the proposed projects is contained in Chapter 13, Alternatives Analysis.

Recommended projects will be presented and discussed in the sequences of the major conveyance systems as described in the previous chapters. These projects are:

Delaney Creek Main Channel

1. Upgrade the U.S. Highway 41 Bridge
2. Channel Improvements
3. Upgrade the Maydell Drive Bridge
4. Upgrade the 70$^{th}$ Street South Bridge

Lateral “A”

1. Upgrade the culvert between Haven Oak Circle and private driveway

Lateral “B”

1. Upgrade the culvert at Robindale Road
2. Channel improvements
3. Upgrade the culvert at Balfour Circle