II. BACKGROUND, HISTORY AND PHYSICAL ENVIRONMENT

The City has a variety of lakes, wetlands and waterways that provide aesthetic, environmental and recreational value to the community. The City has an area of approximately 15,400 acres or about 24 square miles of land. Water bodies, including lakes, ponds, wetlands, streams and rivers, constitute approximately 3,975 acres, about 26 percent of the City. Portions of four major watersheds exist with in the City (See Figure 2A). Table 2 provides the approximate surface areas of the City that are encompassed by the four watersheds units. These data are not intended to represent the exact areas within the watershed legal boundaries or hydrologic boundaries. Instead the areas are presented to illustrate the relative area of each within the City.

Table 2. Approximate Watershed Surface Areas

Watershed Area	Area (acres[1])	Percentage of City (%)
Carver County Watershed	300	1.9
Lower Minnesota River Watershed	1,300	8.4
Minnehaha Creek Watershed	2,900	18.8
Riley Purgatory Bluff Creek Watershed	10,900	70.9

1. Areas are approximate and rounded to the nearest 100 acres.

There are 12 lakes, approximately 356 wetlands, 171 storm water ponds, and 4 creeks located wholly or partially within the City. One of these creeks, Bluff Creek, runs the entire length of the City and there are numerous bluffs and wooded areas along the creek. Chanhassen also has a number of public open spaces located throughout the community, including the Minnesota Landscape Arboretum, Lake Minnewashta Regional Park, and Lake Ann Park. Section IV presents more detailed information on the water bodies within the City.

The largest type of land use in the City is low-density residential. There are numerous areas of commercial and industrial land use, the largest contiguous area being the downtown area of Chanhassen, along West 78th Street. The City has experienced increased growth throughout the 1990s and into the 2000s and is considered a developing community, as discussed in the City's Comprehensive Plan. Prior to the more recent development activity, the City mostly consisted of agricultural land use. Overall, the low-density residential development will remain the largest land use, with some higher density residential areas, employment centers and shopping areas.

A. Soils and Geology

The topography of this area is gently to steeply rolling. Many depressions of various sizes are present in the overall topography. The numerous lakes and wetlands found in the City fill these depressional areas. The natural drainage in the City is fairly complicated since there is no prevailing direction for surface flow.

1. Soil Associations

The major soil associations present in the City is the Hayden-Lester-Peat. The Hayden and Lester series are deep, well-drained soils. Peat soils are associated with wet depressions and drainageways. Pockets of other soil types exist including poorly drained Cordova, Webster, and Glencoe soils and the moderately well drained LeSueur and Terril loamy soils. The Minnesota River Valley possesses two associations, the Alluvial land-Chaska-Oshawa association, and to the west the Salida-Hayden association. The latter association is characterized by coarse to medium-textured soils on steep slopes and bluffs overlooking the river. The former association is characterized by alluvial soils that are typically fine-grained silts and are very poorly drained.

The central portion of the City, with its more gentle topography, is covered with larger amounts of Lester soils than any other type. Lester soils are generally well drained and have a moderately thick, organic-rich top soil. The rest of the watershed not included in the Lower Minnesota Watershed or central region contains predominantly Hayden soils. The Hayden soils are similar to the loamy Lester soils but contain less organic matter and a thinner mantle of top soil. All the non-alluvial soils in the City have formed over glacial till. The most recent glacial coverage of Carver County was the Mankato substage of the Wisconsin continental glacier. The calcareous, clay loamy material and limestone rock fragments carried by the last ice sheet advance are the parent material for most of the soils in the City.

The soils associated with the Minnesota River Valley originated predominantly from glacial outwash. This material, deposited by the escaping melt waters of glaciers, is often well sorted and can range from gravel to fine clays depending on the location. The cutting action of the river exposes different layers deposited by earlier advances of the ice sheets. The diverse mixture of parent materials exposed and transported by the river's erosional processes is often deposited by the river's waters in well sorted layers. The layering is dependent on the size of the material and the river's flow, which will vary in time and space. The result is a complex network of layers that are difficult to predict and must be checked at individual sites in the field.

2. Hydrologic Soil Groups and Infiltration Capacities

Soils in the City vary widely. Some areas have well drained soils, and other areas, near the numerous wetlands, are usually poorly drained. Figure 3 illustrates soil types relative to their hydrologic soil group (HSG). The HSG is an indicator of the relative infiltration rate of the soil. HSG "A" soils have relative high natural infiltration rates and HSG "D" soils generally have very low natural infiltration rates as described below. Infiltration capacities of soils can affect the amount of direct runoff resulting from a rainfall event. Generally, the higher the infiltration rate a soil is given, the lower the runoff potential. Conversely, soils with low infiltration rates produce relatively high runoff volumes and peak discharge rates. Four general hydrologic soil groups for soils based on texture and slope have been established by the Natural Resource Conservation Service (NRCS). The groups as shown in Figure 3 are:

- Group A – Low runoff potential, high infiltration rate
- Group B – Moderate infiltration rate
- Group C – Slow infiltration rate
- Group D – High runoff potential, very slow infiltration rate

Soils within Chanhassen are predominately Group B soils, with large areas of Group C and D soils, and a very small area of Group A soils. As part of the hydrologic assessment of this planning project, the hydrologic grouping was evaluated along with future 2020 land use data to estimate runoff characteristics that will occur over a given area for a particular rainfall amount. These modeling efforts and results are discussed more in Section III of this Plan.

Soil characteristics are essential for completing hydrologic analyses and are also important when developing erosion control plans. Special attention to erosion control measures and establishment of interim cover during construction must be considered in areas of steep slopes, in areas with highly erodible soil, and in areas with prolonged exposure of disturbed land. The erosion control handbook published by the Board of Water and Soil Resources (BWSR) and the MPCA Storm Water Manual (2005) include recommended best management practices for erosion protection.

B. Vegetation

The original vegetation in Chanhassen was a mosaic of plant communities adapted to the climatic, topographic, geologic, and biologic conditions of the region at that time. According to the 1994 Plan, four major communities originally occurred within Chanhassen's City limits: oak openings and barrens; Big Woods; wet prairies, marshes and sloughs; and river-bottom forest. The oak openings and barrens mainly consisted of individual oak trees and islands of oaks scattered amongst prairie grasses. These oak openings and barrens probably occupied a transition zone between Big Woods and prairie communities. The Big Woods community was dominated by red and white oak, sugar maple, and basswood trees, with numerous shrubs and herbaceous species. Low pockets of wet prairies, marshes and sloughs were scattered within the big woods region, and consisted of cattail in wetter sites, and willows, red osier dogwood, and sedges dominating the seasonally flooded sites. The community at the southern limit of the City was the Minnesota River and associated river bottom forest. This community was strongly influenced by seasonal flooding.

Agricultural use in Chanhassen began around the mid-1800's, with approximately 70 percent of this area cleared for agricultural use since the late 1800's. Wetlands were first drained for cultivation and grading, and the draining was followed by filling of wetlands for development purposes. These activities have significantly altered the quality and quantity of wetlands in the City over the last century and a half.

The plant species composition has also been altered with the changes to the wetlands due to associated land use changes. The scattered prairies, marshes and sloughs of pre-settlement wetlands included many of the same species that still exist in wetlands, such as cattails, bulrushes, iris, and willows. However, the mix and dominance of these species in most cases was quite different than is encountered today. While the major species may be similar, the specific interrelationship of the plant community was likely quite different.

Today most plant communities are characterized by the dominance of a single species within the entire wetland or wetland zone, while other species are just scattered individuals. The largest difference is the composition of grasses. Canada bluejoint and big bluestem were the prominent grasses throughout this area in pre-settlement times. Today, there are some high quality wetlands with bluejoint grass present, but none with big bluestem prominent. Reed canary grass, which is an exotic subspecies, is the dominant grass in most wetlands, and has displaced all other plant species in many Chanhassen wetlands.

C. Precipitation

Climate within the Minneapolis-St. Paul metropolitan area is a humid continental climate with moderate precipitation, wide daily temperature variations, warm humid summers and cold winters. The total average annual precipitation is 29 inches. The average annual snowfall is approximately 50 inches, equivalent to roughly 5 inches of water. Rainfall data for a variety of return frequencies and storm duration for the Minneapolis-St. Paul metropolitan area is shown in Table 3. The 100-Year, 24-hour storm event is the event used to design most flood control structures and detention basins. This data is consistent with the Minnesota Hydrology Guide.

Table 3. Rainfall Data for the Minneapolis-St. Paul Metropolitan Area

Return Frequency	24-hr	12-hr	6-hr	3-hr	2-hr	1-hr	30-min	15-min
1-Year	2.3	2.0	1.7	1.5	1.4	1.2	0.9	0.6
2-Year	2.8	2.4	2.1	1.7	1.7	1.4	1.1	0.7
5-Year	3.6	3.1	2.7	2.3	2.2	1.8	1.4	1.0
10-Year	4.2	3.7	3.1	2.6	2.5	2.1	1.7	1.3
25-Year	4.6	4.2	3.5	3.0	2.8	2.3	1.9	1.4
50-Year	5.3	4.6	4.0	3.4	3.1	2.7	2.1	1.5
100-Year	6.0	5.0	4.4	3.8	3.5	2.9	2.4	1.7
500-Year	7.4							

Several rainfall parameters are considered in using the NRCS hydrologic design methodology. Storm duration, rainfall depths, time distribution (how the total rainfall depth is distributed over the duration of the rainfall event), and recurrence interval (how probable it is that the rainfall event will recur in a given year) are important factors.

The 24-hour, NRCS Type II rainfall distribution with average soil moisture conditions (AMC-2) is used for overall subwatershed planning within the City of Chanhassen. This is consistent with the Minnesota Hydrology Guide's distribution recommendation for hydrologic analysis of urban areas. See Appendix B for more detail on Type II storm distributions.

The return period is related to the probability of a given event being equaled or exceeded. The probability that the "100-year event" will be exceeded in a given year is 1 percent. Conventional wisdom holds that if a 100-year event occurs in one year, then it cannot occur for another 100 years. This belief is false because it implies that rainfall occurs deterministically rather than randomly. Because rainfall occurs randomly, there is a finite possibility that the 100-year event could occur in two consecutive years or more frequently than one occurrence in any given year.

More information on the NRCS design method or rainfall events is available at http://www.nrcs.usda.gov, or on the State Climatology website at http://climate.umn.edu.

D. Land Use

The City of Chanhassen is considered to be a developing community, as discussed in the Comprehensive Plan. The predominant land uses include single-family residential, parks, open space and natural areas. Single-family residential will continue to be the predominant housing type in the City, although housing types have slowly been shifting from this type of housing, and becoming more diversified. Industrial development has been growing in the City in recent years, and according to the City's 2020 Land Use Plan it will make up approximately 9% of the City's area. Commercial land use will constitute approximately 1% of the City's 2020 land use. Most of the commercial development has taken place in the City's downtown district, along West 78th Street. Figure 4 illustrates the existing land use, and Figure 5 illustrates the 2020 Land Use Plan for the City. For more information on land use within the City of Chanhassen refer to the City's 2020 Comprehensive Plan.

The City has created and maintained numerous park and open space areas throughout the City. In addition, many outlots or natural areas are incorporated into new developments. While many of these outlots are marginal lands for development, most contain wetlands or are used for storm water detention, both of which can provide important wildlife habitat as well as aesthetic benefits for the City.

Future land use projections help to identify areas that may be available for water resource enhancements and also help to prioritize improvements. Significant changes in land use can increase runoff rates and volumes due to the additional impervious surface, and degrade or improve water quality depending on the type of change. As areas develop or redevelop at a higher density, storm water runoff generally increases. Numerous studies have been completed on the effect development can have on water quality. Without getting into great detail, the general conclusions are that as the percentage of impervious cover increases, the greater the risk to water quality. Generally speaking, water quality can be negatively impacted when the impervious level in the watershed reaches as little as 10-15 percent of the total contributing area.

1. Impervious Surfaces and Water Quality

Treatment facilities like NURP ponds can help offset the impacts, but reducing the level of impervious cover (or effective impervious) in the first place is gaining more support in Minnesota and nationally every year. What has been termed low-impact development (LID), low impact design, conservation site design as well as many others, is basically a process that strives to create a site design that will have little to no adverse impacts on the surrounding water resources.

While LID concepts can extend beyond water quality and water resource issues, the focus of this discussion is on the concepts that could result in developments better managing their storm water runoff by mimicking the existing site hydrology. A number of different site layout and physical practices are combined to accomplish this goal. For example, some the practices include narrow streets (less impervious surface), rural road sections with adjacent grassed swales and without curb and gutter, rain water gardens, bio-retention areas, infiltration basins and many others. Chanhassen has some forms of these practices already established throughout the City.

Because a reduction in the impervious cover is one of the most effective LID practices, more and more projects in Minnesota and throughout the nation are using pervious pavements; pavements that are designed to let the rainfall pass through them into the underlying soils instead of directly running off. These pavements come in many forms such as:

- Paver blocks, with gaps between the blocks that allow rainfall to be infiltrated or filtered.
- Porous asphalt and concrete which are similar to their impervious counterparts except that larger pores are created to allow the rainfall to pass through the surface.
- Structurally reinforced turf, in which a geo-engineered grid or underlayment is placed below a typical turf grass area. The geo-grid allows heavier traffic to use the are without significantly compacting the soils, thus maintaining the pervious nature of the grassed surface.

There are volumes of information available on the internet on pervious pavement options and many more products than are summarized above. The main point in discussing these systems in this Plan is to raise the awareness of these alternative pavements and to encourage developers and City decision makers to challenge designers to take a real look at the applicability to their projects. These systems are not without concerns, especially in colder climates with extensive freeze-thaw cycles and heavy applications of sand, and the systems tend to be more expensive to install and maintain compared to conventional pavements. The challenge in determining their cost-effectiveness overall is to also consider the cost savings that may be realized in offsetting some of the other storm water BMP costs (e.g., land acquisition for a NURP pond). Therefore, like any storm water BMP, selection of porous pavement for a project site needs to be considered from many perspectives, but is an option that will likely continue to gain momentum.

2. TH 212 – Anticipated Impacts on Water Resources

The Minnesota Department of Transportation (MnDOT) is currently constructing the new alignment of Highway 212 through the City of Chanhassen. The purpose of the project is to increase capacity, decrease congestion, and improve traffic safety. The project includes construction of a 4-lane highway and includes construction of several bridges, interchanges, and overpasses throughout the project alignment. Impacts to water resources include wetland impacts and mitigation projects, and construction of storm water ponds to treat the storm water runoff from the roadway project.

E. Public Utilities

Public utilities within the City include sanitary sewer, water supply system and storm sewer. The City currently operates 9 wells, 4 storage tanks, and 30 lift stations, and the system consists of over 122 miles of water main and over 110 miles of sanitary sewer trunk lines. The City is in the process of constructing a Water Treatment Plant, which will provide mineral treatment to water. Sanitary sewer and municipal water is available to approximately two-thirds of the City.

Currently there are approximately 350 individual sewage treatment systems (ISTS) within the City limits.

Chanhassen's drainage system includes storm sewer, open channels, storm water ponds, wetlands, creeks and lakes. A significant portion of the City's drainage system consists of storm sewer. Construction of new storm sewer and improvement of existing storm sewer throughout the City is primarily controlled by new development and street maintenance or reconstruction activities. The storm water system is discussed in more detail in Section III of this Plan.

As part of this project, the City's existing storm sewer system database has been updated. The update results in a GIS-based version of much of the storm sewer system based on a field inventory of the existing storm water infrastructure. The inventory includes survey-grade GPS location and elevation data for the vast majority of storm water infrastructure located on City-owned and privately-owned land in Chanhassen. Ultimately, these files will form the foundation for complying with the inspection, maintenance and reporting requirements for the National Pollutant Discharge Elimination System (NPDES) Phase II storm water permit program discussed in Section III of this Plan. These data will also serve to improve the City's abilities and efficiencies in reviewing development projects.

F. Water-Based Recreation Areas

As mentioned previously, the City has 12 lakes (7 recreational development lakes, 5 natural environment lakes), 4 creeks, and 356 wetlands. These diverse water features provide aesthetic, environmental and recreational value to the community. Several parks located on or near these recreational waters provide boat ramps, fishing access and/or swimming beaches, along with trails and picnic areas. Table 4 summarizes the water-based recreational facilities at these locations. Figure 6 shows the locations of the DNR protected waters in Chanhassen. Section V of this Plan includes a summary of the inventoried wetlands throughout the City based on the Minnesota Routine Assessment Method, version 3.0. Wetlands provide habitat for several wildlife species and thus provide aesthetic and recreational value.

Table 4. Summary of Water-Based Recreational Facilities

Lake	Park or Area	Boat Ramp	Fishing Access	Swimming Beach	Trails or Picnic Areas
Ann	Lake Ann Park	●	●	●	●
Christmas		●			
Lotus	Carver Beach Park		●	●	●
	North Lotus Lake Park				●
	South Lotus Lake Park	●	●		●
Lucy					
Minnewashta	Roundhouse Park		●	●	●
	Lake Minnewashta Regional Park	●	●	●	●
Riley	Riley Lake Park (Eden Prairie)	●	●	●	●
St. Joe		●			
Susan	Lake Susan Park	●	●	●	●

G. Unique Features and Scenic Areas

The following paragraphs summarize three unique water and natural resource features within Chanhassen. Additional information on each of these and other resources is provided in Section IV.

1. Assumption Creek

Assumption Creek is a designated Trout Stream within the City of Chanhassen. The City recognizes how important it is to protect this unique and special resource and the standards of this Plan support that goal. In addition, the NPDES Construction Storm Water Permit and the City's MS4 Permit have provisions that require additional measures to be implemented by development projects in the watershed.

2. Seminary Fen

The Seminary Fen is a calcareous fen located in the southern portion of Chanhassen. There are approximately 112 acres of calcareous seepage fen in this area with rare and threatened plant species. Preserving and protecting this resource is at the top of the City's wetland protection and preservation policies. The Seminary Fen is also listed in Minnesota Rules, Chapter 7050 as an Outstanding Resource Value Water. As such, the NPDES Construction Storm Water Permit and the City's MS4 Permit have provisions that require additional measures to be implemented by development projects in the watershed.

3. Bluff Creek

Bluff Creek runs southeast of Lake Minnewashta and discharges into Rice Lake and the Minnesota River. The City completed a management plan for the Bluff Creek Corridor in order to develop guidelines and goals on how to preserve and protect the Bluff Creek Watershed before development occurs. The watershed is currently in a state of transition due to the City's rapid growth and development, and the Bluff Creek Watershed Natural Resources Management Plan identifies significant natural features along the Bluff Creek Corridor.

In 1998, the City adopted Article XXXI, Chapter 20 of its City code entitled "Bluff Creek Overlay District." This article serves to implement the regulatory recommendations set forth in the management plan, including primary corridor preservation and grading and structural setbacks from the primary corridor. These regulations are the foundation for the preservation of Bluff Creek as a water resource, a continuous habitat corridor and a vital component of the City's urban forestry resources.

In order to further realize the natural resources recommendations in the plan, the City petitioned the Riley-Purgatory-Bluff Creek Watershed District to undertake a basic water management project in 1997. The City's main goal is for Bluff Creek to be de-listed as an impaired water. The City will continue to work with the RBPCWD to manage Bluff Creek.

H. Pollutant Sources

The City of Chanhassen does not have any landfills, dumps, hazardous sites, or feedlots within its boundaries. Information on pollutant sources is available from the MPCA (651.296.6300). This detailed information has not been included here as it is subject to frequent change and may be obtained by calling the MPCA or by visiting the MPCA's website (www.pca.state.mn.us) which has information on various pollutant sources and related regulatory programs. The MPCA will identify leaking underground storage tank (LUST) sites and maintain a list of registered above and underground storage tanks (ASTs and USTs) within the City. The MPCA also has information on permitted wastewater discharges and hazardous waste sites. Carver County has information on abandoned wells within the City of Chanhassen.

Some additional pollutant source information may also be available from Carver and Hennepin Counties. Counties maintain maps and databases that display MPCA-reported LUSTs, MPCA-reported spills, MPCA-registered ASTs and USTs.

I. Groundwater Resource Data

According to the RPBCWD Water Management Plan, the groundwater system is comprised of the glacial drift water table and the underlying bedrock aquifers which are partially in artesian condition, meaning water in the bedrock is maintained under pressure by confining upper layers. In many places, the Jordan Formation is a source of water to Riley, Purgatory and Bluff Creeks.

J. Fish and Wildlife Habitat

As Identified in Section II (Background, History, and Physical Environment) Part G (Unique Features and Scenic Areas) The City of Chanhassen has adopted a Bluff Creek Natural Resources Management Plan to address the specific concerns of development along the creek corridor and bluff areas. There is also a Bluff Creek Overlay District, which would protect critical wildlife corridors and habitat. Section 5 (Wetlands), Part D (Functions and Values Assessment) of the SWMP also includes a brief description of the critical resource areas that would be identified as outstanding fish and wildlife habitat. These sources include Seminary fen, Raguet Wildlife Management Area, Minnesota Valley Wildlife Refuge, and Assumption Creek. This section also discusses the results of the County Biological Survey completed for Carver, Hennepin, and Scott Counties, and the concentration of critical habitat, both upland and wetland, along the Minnesota River bluffs, and the occurrence of the least darter in Lake Minnewashta. The MCWD has identified wetlands along the eastern side of Lake Minnewashta as exceptional or high aesthetic value and exceptional or high wildlife habitat.