

14.0 Northwest Minnehaha Creek

14.1 General Description of Drainage Area

Figure 14.1 depicts the Northwest Minnehaha Creek drainage basin and the individual subwatersheds within this area. The Northwest Minnehaha Creek drainage basin is located in the far northwest corner of Edina, east of the T.H. 169 North drainage area. This watershed is the smallest of the Minnehaha Creek watersheds and extends from T.H. 100 to areas west of the Interlachen Golf Course.

14.1.1 Drainage Patterns

The stormwater system within this drainage area is comprised of storm sewers, ponding basins, wetlands, drainage ditches, and overland flow paths. The Northwest Minnehaha Creek basin has been divided into several major watersheds based on the drainage patterns. These major watersheds are depicted in Figure 14.2. Each major watershed has been further delineated into numerous subwatersheds. The naming convention for each subwatershed is based on the major watershed it is located within. Table 14.1 lists each major watershed and the associated subwatershed naming convention.

Table 14.1 Major Watersheds within the Northwest Minnehaha Creek Drainage Basin

Major Watershed	Subwatershed Naming Convention	# of Subwatersheds	Drainage Area (acres)
T.H. 100	H100_##	15	104
Hopkins	HO_##	22	94
Interlachen	EI_##	37	345

14.1.1.1 T.H. 100

The land use of this watershed is primarily commercial and most of the runoff drains to a trunk stormsewer system along T.H. 100 that flows north to Minnehaha Creek. The storm sewer system analyzed in this watershed runs along Vernon Avenue, goes east to Eden Avenue and then to the T.H. 100 storm sewer system. The T.H. 100 storm sewer system was not analyzed as part of this study. The pipe system and ponds within the Grandview Square development were also incorporated in the hydraulic and water quality models.

14.1.1.2 Hopkins

The Hopkins watershed is located just south of the City of Hopkins and west of the Interlachen Country Club. This is a small watershed and consists of 94 acres of total land area. All of the water in this watershed is routed north by a lift station to a Hopkins storm sewer system. The land use is primarily low density residential with several ponds and wetlands.

14.1.1.3 Interlachen

The Interlachen watershed consists of the Interlachen Country Club and residential areas adjacent to the golf course. There are several ponds and wetlands that provide storage and treatment for runoff in this watershed. There are few storm sewer pipes and water conveyed by the storm sewer system drains north to Minnehaha Creek. Modeling of the storm sewer system includes proposed pipes connecting the ponds within the Interlachen Country Club. These pipes are shown on [Figure 14.3](#).

14.2 Stormwater System Analysis and Results

14.2.1 Hydrologic/Hydraulic Modeling Results

The 10-year and 100-year frequency event flood analyses were performed for the Northwest Minnehaha Creek drainage basin. For the Northwest Minnehaha Creek watersheds, the storm sewers were evaluated using a 10-year and a 100-year frequency storm event. The 10-year analysis was based on a ½-hour storm of 1.65 inches of rain and the 100-year analysis was based on a 24-hour storm event of 6 inches of rain. The storm sewers in [Table 14.2](#) present the watershed information and the results for the 10-year and 100-year hydrologic analyses for the Northwest Minnehaha Creek basin.

The results of the 10-year and the 100-year hydraulic analysis for the Northwest Minnehaha Creek drainage basin are summarized in [Table 14.3](#) and [Table 14.4](#). The column headings in [Table 14.3](#) are defined as follows:

Node/Subwatershed ID—XP-SWMM node identification label. Each XP-SWMM node represents a manhole, catchbasin, pond, or other junction within the stormwater system.

Downstream Conduit—References the pipe downstream of the node in the storm sewer system.

Flood Elevation—The maximum water elevation reached in the given pond/manhole for each referenced storm event (mean sea level). In some cases, an additional flood elevation has been given in parenthesis. This flood elevation reflects the 100-year flood elevation of Minnehaha Creek, as shown in the *National Flood Insurance Program Flood Insurance Study for the City of Edina, May 1980*.

Peak Outflow Rate—The peak discharge rate (cfs) from a given ponding basin for each referenced storm event. The peak outflow rates reflect the combined discharge from the pond through the outlet structure and any overflow.

NWL—The normal water level in the ponding basin (mean sea level). The normal water levels for the ponding basins were assumed to be at the outlet pipe invert or at the downstream control elevation.

Flood Bounce—The fluctuation of the water level within a given pond for each referenced storm event.

Volume Stored—The maximum volume (acre-ft) of water that was stored in the ponding basin during the storm event. The volume represents the live storage volume only.

Table 14.4 summarizes the conveyance system data used in the model and the model results for the storm sewer system within the Northwest Minnehaha Creek drainage basin. The peak flow through each conveyance system for the 10-year, and the 100-year frequency storm event is listed in the table. The values presented represent the peak flow rate through each pipe system only and does not reflect the combined total flow from an upstream node to the downstream node when overflow from a manhole/pond occurs.

Figure 14.3 graphically represents the results of the 10-year and the 100-year frequency hydraulic analyses. The figure depicts the Northwest Minnehaha Creek drainage basin boundary, subwatershed boundaries, the modeled storm sewer network, surcharge conditions for the XP-SWMM nodes (typically manholes), and the flood prone areas identified in the modeling analyses.

One of the objectives of the hydraulic analyses was to evaluate the level of service provided by the current storm sewer system. The level of service of the system was examined by determining the surcharge conditions of the manholes and catch basins within the storm sewer system during the 10-year and 100-year frequency storm events. An XP-SWMM node was considered surcharged if the hydraulic grade line at that node breached the ground surface (rim elevation). Surcharging is typically the result of limited downstream capacity and tailwater impacts. The XP-SWMM nodes depicted on Figure 14.3 were color coded based on the resulting surcharge conditions. The green nodes signify no surcharging occurred during the 100-year or 10-year frequency storm event, the yellow nodes indicate surcharging during the 100-year frequency event, and the red nodes identify that surcharging is likely to occur during both a 100-year and 10-year frequency storm event. Figure 14.3 illustrates that several XP-SWMM nodes within the Northwest Minnehaha Creek drainage basin are predicted to experience surcharged conditions during both the 10-year and 100-year frequency storm events. This indicates a probability greater than 10 percent *in any year* that the system will be overburdened and unable to meet the desired level of service at these locations. These manholes and catch basins are more likely to experience inundation during the smaller, more frequent storm events of various durations.

Another objective of the hydraulic analysis was to evaluate the level of protection offered by the current stormwater system. Level of protection is defined as the capacity provided by a municipal drainage system (in terms of pipe capacity and overland overflow capacity) to prevent property damage and assure a reasonable degree of public safety following a rainstorm. A 100-year event is recommended as a standard for design of stormwater management basins. To evaluate the level of protection of the stormwater system within the Northwest Minnehaha Creek drainage area, the 100-year frequency flood elevations for the ponding basins and depressed areas were compared to the low elevations of structures surrounding each basin. The low elevations were initially determined

using 2-foot topographic information and aerial imagery in ArcView. Where 100-year frequency flood levels of the ponding areas appeared to potentially threaten structures, detailed low house elevations were obtained through field surveys.

14.2.2 Water Quality Modeling Results

The effectiveness of the stormwater system in removing stormwater pollutants such as phosphorus was analyzed using the P8 water quality model. The P8 model simulates the hydrology and phosphorus loads introduced from the watershed of each pond and the transport of phosphorus throughout the stormwater system. Since site-specific data on pollutant wash-off rates and sediment characteristics were not available, it was necessary to make assumptions based on national average values. Due to such assumptions and lack of in-lake water quality data for model calibration, the modeling results were analyzed based on the percent of phosphorus removal that occurred and not based on actual phosphorus concentrations.

Figure 14.4 depicts the results of the water quality modeling for the Northwest Minnehaha Creek drainage basin. The figure shows the fraction of total phosphorus removal for each water body as well as the cumulative total phosphorus removal in the watershed. The individual water bodies are colored various shades of blue, indicating the percent of the total annual mass of phosphorus entering the water body that is removed (through settling). It is important to note that the percent of phosphorus removal is based on total phosphorus, including phosphorus in the soluble form. Therefore, the removal rates in downstream ponds will likely decrease due to the large soluble fraction of incoming phosphorus that was un-settleable in upstream ponds. The watersheds are depicted in various shades of gray, indicating the cumulative total phosphorus removal achieved. The cumulative percent removal represents the percent of the total annual mass of phosphorus entering the watershed that is removed in the pond and all upstream ponds.

14.3 Implementation Considerations

The problem areas identified through the hydrologic and hydraulic XP-SWMM analyses and P8 water quality analysis were investigated to determine possible mitigation alternatives. These alternatives are discussed below.

14.3.1 Increased Storm Sewer Capacity Projects

The problems and potential corrective measures for areas within the Northwest Minnehaha Creek drainage basin are discussed below.

14.3.1.1 Interlachen Landlocked Area

The MCWD Plan identified a landlocked area located west of T.H. 100 and north of Vernon Avenue. This area, which encompasses subwatersheds EI_11, EI_12, EI_24, EI_13, and EI_19, currently drains to a wetland complex (EI_19) just south of Meadowbrook Golf Course. Two-foot topographic information for the area indicates that the natural overflow elevation between the landlocked wetland

complex and the Meadowbrook Golf Course is approximately 885 feet M.S.L. Based on the Federal Emergency Management Agency (FEMA) Flood Insurance Study for the City of Edina (FEMA, 1980), the 100-year flood level of Minnehaha Creek as it flows through the golf course is 892 feet M.S.L.

The maximum flood elevation that the City will allow in the wetland area (EI_19) is 888 feet M.S.L. To prevent the backflow of water from the Meadowbrook Golf Course to the wetland complex (EI_19), it is recommended that an embankment be constructed/raised between the wetland and the golf course to an elevation of at least 892 feet M.S.L. Upon raising the embankment, a pumped outlet will be required to keep the flood elevation below 888 feet M.S.L. The City should establish a management plan to address necessary pumping scenarios. Previous analyses for the area indicate a 1 cfs pumped outlet would be sufficient.

14.3.2 Construction/Upgrade of Water Quality Basins

Several ponds in this watershed are removing less than 60 percent of the average annual phosphorus load from storm water inflows. The light blue ponds in [Figure 14.4](#) are achieving less than 60 percent total phosphorus removal. However, the cumulative phosphorus removal was greater than 60 percent for all the watersheds. Additional analysis was performed to identify those ponds that were functioning properly and those ponds that were functioning poorly. In the P8 model, phosphorus particles are grouped into several fractions. The unsetttable, or dissolved fraction, is called P0. From the mass balance output of the P8 model, the percent total phosphorus removal for the other settleable phosphorus fractions was evaluated for the apparently non-performing ponds to determine if the ponds were removing greater than 60 percent of the settleable phosphorus fractions. From this analysis it was determined that these ponds were removing greater than 60 percent of the settleable phosphorus and that they were performing adequately. As a result, in this watershed no ponds were identified that require upgrades.

Table 14.2
Watershed Modeling Results for Subwatersheds in the Minnehaha Creek North East
Drainage Area

Watershed Information			100-Year Storm Results		10-Year Storm Results	
Watershed ID	Total Area (ac)	% Impervious Area	24-Hour Event		1/2-Hour Event	
			Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)	Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)
EI_1	10.2	41	45.8	3.66	37.8	0.97
EI_10	12.7	41	55.1	4.21	39.4	1.04
EI_11	1.5	20	5.7	0.41	2.9	0.09
EI_12	5.2	30	23.1	1.58	17.3	0.39
EI_13	8.1	28	36.2	2.42	27.1	0.60
EI_14	11.5	19	36.9	3.05	17.4	0.58
EI_15	13.4	31	57.7	4.08	39.5	0.97
EI_16	16.1	21	47.7	4.30	22.8	0.80
EI_17	3.0	23	12.8	0.84	8.1	0.20
EI_18	10.5	19	41.2	2.86	21.0	0.61
EI_19	16.2	52	72.0	6.26	54.9	1.62
EI_2	17.0	20	72.4	5.97	43.8	1.47
EI_20	23.5	20	82.5	6.63	40.8	1.39
EI_21	4.3	30	19.2	1.47	11.7	0.35
EI_22	2.3	20	9.5	0.65	5.0	0.14
EI_23	3.7	19	14.2	1.00	7.1	0.21
EI_24	22.5	26	93.4	6.73	56.4	1.57
EI_25	10.6	13	31.3	3.58	13.2	0.70
EI_26	5.2	3	20.0	1.34	7.4	0.29
EI_27	2.7	5	10.6	0.96	5.0	0.23
EI_28	5.9	32	19.0	1.33	15.6	0.42
EI_29	9.8	2	38.6	3.93	17.1	0.85
EI_3	20.6	20	49.4	7.11	21.4	1.22
EI_30	3.6	5	15.8	1.47	9.0	0.34
EI_31	6.0	22	26.9	2.53	19.9	0.62
EI_32	11.9	19	39.5	4.27	19.4	0.91
EI_33	9.0	2	29.5	2.86	9.9	0.58
EI_34	13.4	8	36.3	4.88	13.0	0.86
EI_35	5.9	20	19.5	1.94	9.7	0.42
EI_36	2.9	20	12.2	0.79	7.0	0.18
EI_37	1.5	20	6.7	0.30	4.8	0.10
EI_4	14.6	20	59.4	4.14	31.9	0.93
EI_5	7.4	20	32.3	2.04	19.7	0.48
EI_6	1.9	20	8.0	0.52	4.8	0.12
EI_7	7.8	20	27.8	2.10	13.7	0.42
EI_8	18.5	20	65.6	5.02	32.2	1.01
EI_9	3.8	20	17.2	1.07	21.5	0.30
HO_1	5.1	20	19.5	1.39	9.4	0.30
HO_10	1.6	20	5.8	0.42	2.9	0.09
HO_11	1.8	20	7.8	0.50	4.6	0.12
HO_12	2.0	20	8.2	0.56	4.4	0.12
HO_13	1.2	20	5.3	0.33	3.4	0.08
HO_14	2.2	20	8.8	0.60	4.6	0.13

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Drainage Area

Watershed Information			100-Year Storm Results		10-Year Storm Results	
			24-Hour Event		1/2-Hour Event	
Watershed ID	Total Area (ac)	% Impervious Area	Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)	Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)
HO_15	3.4	20	13.5	0.93	8.0	0.21
HO_16	2.7	44	12.2	0.92	12.2	0.24
HO_17	15.4	20	50.3	4.14	24.2	0.80
HO_18	2.0	20	7.5	0.55	3.7	0.11
HO_19	13.1	22	51.4	3.65	27.8	0.80
HO_2	1.1	16	4.7	0.28	2.9	0.07
HO_20	1.3	20	4.0	0.35	1.9	0.07
HO_21	0.7	20	3.1	0.19	2.6	0.05
HO_22	3.7	5	14.3	0.87	8.2	0.22
HO_3	6.5	20	16.7	1.70	7.7	0.30
HO_4	2.6	5	10.4	0.60	6.2	0.16
HO_5	8.3	20	30.0	2.26	14.7	0.46
HO_6	3.9	20	16.3	1.08	9.4	0.24
HO_7	1.5	21	6.4	0.42	3.6	0.09
HO_8	9.9	30	40.1	2.97	24.1	0.68
HO_9	3.5	20	9.5	0.92	4.4	0.16
H100_1	9.2	20	30.5	2.48	14.7	0.48
H100_10	5.48	25	18.7	1.54	9.6	0.31
H100_11	0.66	21	2.7	0.18	1.5	0.04
H100_12	2.42	20	9.1	0.66	4.5	0.14
H100_13	3.93	35	10.8	1.25	5.0	0.26
H100_14	4.49	50	20.4	1.65	17.6	0.43
H100_15	6.56	68	29.6	2.67	23.1	0.71
H100_2	3.64	30	13.1	1.08	7.1	0.23
H100_3	12.8	41	44.4	4.14	22.3	0.92
H100_4	9.93	46	42.3	3.40	28.1	0.82
H100_5	13.53	68	52.5	5.44	27.3	1.39
H100_6	4.22	20	17.2	1.16	9.1	0.25
H100_7	21.8	23	77.4	7.18	40.1	1.65
H100_8	0.71	20	3.2	0.20	2.2	0.05
H100_9	4.66	21	16.0	1.26	7.9	0.25

Table 14.3
Hydraulic Modeling Results for XP-SWMM Subwatersheds/Nodes in Minnehaha Creek North East Drainage Area

Subwatershed or Node	Downstream Conduit	100-Year Storm Results				10-Year Storm Results			
		24-Hour Event				1/2-Hour Event			
		Flood Elevation (ft) ²	Type of Storage ³	NWL (ft)	Flood Bounce (ft)	Node Name	Flood Elevation (ft)	NWL (ft)	Flood Bounce (ft)
1906	1275	924.2				1906	924.0		
1907	1276	917.4				1907	917.2		
1908	1277	905.4				1908	905.2		
1911	1279	906.9				1911	905.3		
1912	1281	897.5				1912	896.1		
1913	1282	894.1				1913	893.0		
2138	1700	892.6				2138	889.0		
2141	1701	889.7				2141	887.8		
2142	outfall	886.8				2142	886.1		
2155	1711	920.5				2155	920.3		
2156	1952	900.5				2156	900.2		
2159	1714	929.7				2159	929.5		
2160	1715	930.2				2160	930.0		
2161	1716	931.0				2161	930.9		
2162	1717	931.2				2162	931.0		
2163	1718	943.0				2163	943.0		
2173	1725	918.4				2173	918.0		
2174	1726	917.8				2174	917.2		
2175	1728	916.5				2175	914.7		
2177	1854	891.9				2177	890.4		
2183	1733	920.5				2183	917.1		
2186	1736	916.7				2186	914.9		
2187	1737	916.5				2187	914.5		
2188	1738	916.3				2188	914.3		
2189	1741	915.8				2189	913.5		
2191	1742	915.7				2191	913.3		
2198	1748	914.6				2198	912.9		
2200	outfall	919.0				2200	918.2		
2203	1750	924.1				2203	919.9		
2204	1751	924.1				2204	919.7		
2210	1754	924.1				2210	921.0		
2214	1758	931.2				2214	928.0		
2215	1759	928.7				2215	926.3		
2217	1761	924.8				2217	922.8		
2218	1762	924.8				2218	921.4		
2226	1768	888.7				2226	888.7		
2227	outfall	887.4				2227	887.4		
2229	outfall	886.3				2229	886.3		
2344	1855	891.9				2344	890.3		
2346	1857	891.3				2346	889.6		
2347	1858	891.2				2347	888.9		
2348	1859	888.9				2348	888.0		
2349	1860	888.6				2349	887.9		
2350	1861	888.3				2350	887.7		
2351	1862	887.7				2351	886.9		
2352	1863	887.2				2352	886.6		
2353	1864	885.4				2353	884.7		
2354	outfall	883.8				2354	883.4		
2356	1866	892.5 (892)				2356	891.1		
2357	1867	893.0 (892)				2357	891.9		
2358	1868	893.0				2358	892.1		
2421	PP6	900.5				2421	898.6		
2442	1947	922.6				2442	918.4		
2443	1948	921.7				2443	917.8		
2445	outfall	890.5				2445	889.5		
2456	PP8	897.1				2456	894.7		
2457	PP9	894.0				2457	890.6		

Table 14.3
Hydraulic Modeling Results for XP-SWMM Subwatersheds/Nodes in Minnehaha Creek North East Drainage Area

Subwatershed or Node	Downstream Conduit	100-Year Storm Results				10-Year Storm Results			
		24-Hour Event				1/2-Hour Event			
		Flood Elevation (ft) ²	Type of Storage ³	NWL (ft)	Flood Bounce (ft)	Node Name	Flood Elevation (ft)	NWL (ft)	Flood Bounce (ft)
EI_1	1869	891.6	P	887.0	4.6	EI_1	888.3	887.0	1.3
EI_10	landlocked	890.5	P	887.9	2.6	EI_10	888.5	887.9	0.6
EI_11	1771	917.6				EI_11	918.4		
EI_12	outfall	914.8	P	912.1	2.7	EI_12	912.8	912.1	0.7
EI_13	landlocked	899.3	P	888.0	11.3	EI_13	896.1	888.0	8.1
EI_14	1699	893.0 (892)	ST			EI_14	891.2		
EI_15	1278	909.9	ST			EI_15	909.7	904.5	5.2
EI_16	1280	903.4				EI_16	899.3		
EI_17	1274	928.4				EI_17	927.9		
EI_18	1697	893.9				Ei_18	892.2		
EI_19	landlocked	882.6	P	879.0	3.6	EI_19	880.6	879.0	1.6
EI_2	1720	895.8				EI_2	895.6		
EI_20	1769	888.5 (892)				EI_20	888.4		
EI_21	landlocked	888.3	P	884.6	3.7	EI_21	886.3	884.6	1.7
EI_22	drains to ditch	888.4 (892)				EI_22	888.3		
EI_23	1698	892.8 (892)				EI_23	890.7		
EI_24	landlocked	885.4	P	883.5	1.9	EI_24	884.9	883.5	1.4
EI_25	1865	892.7 (892)		889.0	3.7	EI_25	889.8	889.0	0.8
EI_26	overland flow	910.0	P	905.8	4.2	EI_26	908.0	905.8	2.2
EI_27	landlocked	905.3	P	901.8	3.5	EI_27	903.8	901.8	2.0
EI_28	overland flow	896.6	BYD	894.4	2.2	EI_28	895.9	894.4	1.5
EI_29	PP5	902.7		898.1	4.6	EI_29	899.4	898.1	1.3
EI_3	1727	893.1 (892)		886.6	6.5	EI_3	892.3	886.6	5.7
EI_30	PP2	906.0		902.8	3.2	EI_30	904.5	902.8	1.7
EI_31	PP7	899.3		896.3	3.0	EI_31	897.0	896.3	0.7
EI_32	PP3	907.5		906.6	0.9	EI_32	906.9	906.6	0.3
EI_33	pump	905.3	BYD	901.5	3.8	EI_33	902.5	901.5	1.0
EI_34	landlocked	892.7	P	887.1	5.5	EI_34	889.8	887.1	2.7
EI_35	landlocked	898.4	BYD	897.3	1.1	EI_35	897.9	897.3	0.6
EI_36	landlocked	953.0	BYD	949.2	3.8	EI_36	951.7	949.2	2.5
EI_37	landlocked	946.1	BYD	944.0	2.1	EI_37	945.3	944.0	1.3
EI_4	1766	893.1				EI_4	892.9		
EI_5	1856	891.9				EI_5	890.3		
EI_6	1767	893.1				EI_6	893.0		
EI_7	1719	946.5				EI_7	946.4		
EI_8	1713	929.5				EI_8	929.2		
EI_9	1712	923.7				EI_9	923.6		
HO_1	1722	918.8	P	913.2	5.6	HO_1	917.6	913.2	4.4
HO_10	1946	924.1				HO_10	919.2		
HO_11	1753	924.1				HO_11	920.5		
HO_12	1740	922.7				HO_12	916.7		
HO_13	Hopkins system	919.0				HO_13	918.2		
HO_14	1763	930.7	BYD	925.9	4.8	HO_14	930.6	925.9	4.7
HO_15	1724	919.5	ST			HO_15	919.3		
HO_16	1729	924.1	P	917.5	6.6	HO_16	919.7	917.5	2.2
HO_17	1755	924.5				HO_17	921.7		
HO_18	1752	924.2				HO_18	919.7		
HO_19	1747 (force main)	913.2	P	908.8	4.4	HO_19	909.5	908.8	0.7
HO_2	1744	917.0				HO_2	915.0		
HO_20	1760	928.0	ST			HO_20	924.5		
HO_21	landlocked	946.1	BYD	945.0	1.1	HO_21	946.0	945.0	1.0
HO_22	landlocked	932.7	BYD	930.1	2.6	HO_22	932.6	930.1	2.5
HO_3	1739	916.2				HO_3	914.1		

Table 14.3
Hydraulic Modeling Results for XP-SWMM Subwatersheds/Nodes in Minnehaha Creek North East Drainage Area

Subwatershed or Node	Downstream Conduit	100-Year Storm Results				10-Year Storm Results			
		24-Hour Event				1/2-Hour Event			
		Flood Elevation (ft) ²	Type of Storage ³	NWL (ft)	Flood Bounce (ft)	Node Name	Flood Elevation (ft)	NWL (ft)	Flood Bounce (ft)
HO_4	1843	916.9	BYD	912.9	4.0	HO_4	915.2	912.9	2.3
HO_5	1743	915.6				HO_5	915.6		
HO_6	1723	922.2				HO_6	922.0		
HO_7	1853	924.3	ST			HO_7	922.1		
HO_8	1745	915.6	P	912.0	3.6	HO_8	913.2	912.0	1.2
HO_9	1757	933.9				HO_9	929.3		
1885	1258	914.3				1885	913.8		
1886	1259	913.8				1886	913.3		
1889	1262	951.1				1889	949.0		
1891	1263	951.1				1891	948.4		
1892	1264	950.7				1892	947.5		
1893	1265	950.4				1893	947.3		
1894	1266	949.9				1894	947.0		
1895	1267	949.7				1895	946.8		
1896	1268	949.4				1896	946.6		
1897	1269	948.6				1897	946.1		
1898	1270	947.4				1898	945.1		
2268	outfall	906.8				2268	906.6		
2271	outfall	914.4				2271	911.2		
2274	outfall	916.0				2274	914.1		
2276	outfall	919.0				2276	918.8		
2278	outfall	911.9				2278	911.8		
2362	1872	931.7	P	928.6	3.1	2362	930.1	928.6	1.5
2364	1873	928.0				2364	927.7		
2365	1874	924.8				2365	924.4		
2366	1875	921.9				2366	921.3		
2367	1876	921.1				2367	920.7		
2368	1877	920.0				2368	919.4		
2370	1879	919.5	P	916.0	3.5	2370	918.1	916.0	2.1
2372	1880	918.6				2372	917.8		
2455	outfall	902.8				2455	901.7		
H100_1	1261	951.2				H100_1	950.8		
H100_10	(1)	911.4				H100_10	909.7		
H100_11	(1)	919.2				H100_11	918.9		
H100_12	(1)	916.3				H100_12	914.2		
H100_13	(1)	908.2				H100_13	906.0		
H100_14	1878	919.9				H100_14	918.6		
H100_15	outfall	908.0				H100_15	907.9		
H100_2	1260	951.3				H100_2	949.0		
H100_3	1256	939.8				H100_3	939.6		
H100_4	1871	932.7				H100_4	930.7		
H100_5	1257	916.7				H100_5	916.2		
H100_6	private sewer system	919.4	ST			H100_6	916.5		
H100_7	(1)	907.2	ST			H100_7	904.9		
H100_8	(1)	915.9				H100_8	915.9		
H100_9	(1)	914.9				H100_9	911.2		

¹ Downstream conduit modeled as an orifice

² Flood elevations in parenthesis indicate a 100-year flood elevation based on the 100-year flood elevation of Minnehaha Creek, according to the Federal Emergency

³ ST=Street, BYD=Back Yard Depression, P=Pond

Table 14.4
Conduit Modeling Results for Subwatersheds in the Minnehaha Creek North East Drainage Areas

Conduit ID	Upstream Node	Downstream Node	Conduit Shape	Conduit Dimensions* (ft)	Roughness Coefficient	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Conduit Length (ft)	Slope	100Y Peak Flow Through Conduit (cfs)	10Y Peak Flow through Conduit (cfs)
1274	EL_17	1906	Circular	1.5	0.013	927	923.75	130	2.50	12.8	8.0
1275	1906	1907	Circular	2	0.013	923.25	919.25	200	2.00	12.8	8.0
1276	1907	1908	Circular	2	0.013	916.65	907.65	180	5.00	12.8	8.0
1277	1908	EL_16	Circular	2	0.013	904.65	896.65	200	4.00	12.8	8.0
1278	EL_15	1911	Circular	1.5	0.013	904.45	903.66	79	1.00	24.2	24.2
1279	1911	EL_16	Circular	2	0.013	903.66	897	402	1.66	24.4	24.3
1280	EL_16	1912	Circular	3	0.013	896.65	892	310	1.50	83.8	62.4
1281	1912	1913	Circular	3	0.013	892	888.22	252	1.50	68.8	62.6
1282	1913	EL_18	Circular	3	0.013	887.33	886.51	42	1.95	64.5	62.6
1697	EL_18	2138	Circular	3.5	0.013	886.51	884.9	322	0.50	84.8	80.6
1698	EL_23	2138	Circular	1	0.013	885.34	884.9	44	1.00	9.1	7.0
1699	EL_14	2138	Circular	2	0.013	886.5	885.1	330	0.42	23.2	17.3
1700	2138	2141	Circular	4.5	0.013	884.9	884.01	355	0.25	163.1	103.0
1701	2141	2142	Circular	4.5	0.013	884.01	883.1	385	0.24	157.0	102.9
1711	2155	2156	Circular	1.5	0.024	913.6	894.58	95	20.02	30.1	28.6
1712	EL_9	2155	Circular	1.75	0.024	916.32	913.9	30	8.43	29.3	29.4
1713	EL_8	EL_9	Circular	1.75	0.013	923.13	916.43	217	3.09	25.7	25.5
1714	2159	EL_8	Circular	1.5	0.013	925.64	923.33	43	5.44	9.9	11.1
1715	2160	2159	Circular	1.25	0.013	925.34	924.85	16	3.06	9.8	10.8
1716	2161	2160	Circular	1.25	0.013	925.78	925.72	36	0.17	9.8	10.6
1717	2162	2161	Circular	1.25	0.013	926.02	925.78	20	1.20	9.8	9.8
1718	2163	2162	Circular	1	0.013	937.77	926.52	264	4.26	7.7	7.7
1719	EL_7	2163	Circular	1	0.013	942.7	938.77	211	1.86	6.1	6.1
1720	EL_2	EL_1	Circular	1.25	0.013	889.33	887	237	0.98	11.0	10.5
1722	HO_1	HO_19	Circular	1	0.013	913.2	911.2	500	0.40	4.1	3.7
1723	HO_6	HO_15	Circular	1.5	0.013	917.98	916.66	441	0.30	8.4	8.7
1724	HO_15	2173	Circular	1.5	0.013	915.87	915.11	53	1.43	11.1	13.3
1725	2173	2174	Circular	1.5	0.013	915.11	914.24	60	1.45	10.8	12.0
1726	2174	2175	Circular	1.5	0.013	914.24	911.4	175	1.62	10.8	11.4
1727	EL_3	2177	Circular	1	0.013	887.83	887.52	285	0.11	4.4	4.2
1728	2175	HO_3	Circular	1.75	0.013	911.4	911.39	81	0.01	10.8	11.5
1729	HO_16	HO_10	Circular	2	0.013	917.07	917.54	24	-1.96	4.7	3.4
1733	2183	HO_4	Circular	1	0.013	916.02	912.91	191	1.63	4.7	3.7
1736	2186	2187	Circular	1.75	0.013	912.52	912.14	237	0.16	6.3	6.7
1737	2187	2188	Circular	2	0.013	912.14	911.75	245	0.16	6.0	6.6
1738	2188	HO_3	Circular	2	0.013	911.75	911.39	250	0.14	6.0	6.6
1739	HO_3	2189	Circular	3	0.013	911.39	910.72	393	0.17	26.9	24.1
1740	HO_12	2189	Circular	1	0.013	915.51	910.72	225	2.13	6.6	4.3
1741	2189	2191	Circular	3	0.013	910.72	910.58	99	0.14	34.4	27.9
1742	2191	HO_8	Circular	3	0.013	910.58	910.5	36	0.22	34.4	27.9
1743	HO_5	HO_8	Circular	1	0.013	912.12	912	30	0.40	7.4	7.3
1744	HO_2	HO_8	Circular	1	0.013	914.4	912	129	1.86	4.7	2.9
1745	HO_8	2198	Circular	1.5	0.013	912	911.75	128	0.20	7.4	3.8
1747 (force main)	HO_19	2200	Circular	0.66	NA	911	916.67	NA	NA	1.1	1.1
1748	2198	HO_19	Circular	1.5	0.013	911.75	911	371	0.20	7.3	3.8
1750	2203	2204	Circular	1.75	0.013	919.01	918.13	408	0.22	4.4	3.3
1751	2204	HO_16	Circular	1.75	0.013	917.63	917.5	59	0.22	4.4	3.2
1752	HO_18	HO_16	Circular	1	0.013	918.95	914.5	32	13.91	8.9	3.7
1753	HO_11	HO_16	Circular	3	0.013	917.85	917.4	15.6	2.88	69.3	38.1
1754	2210	HO_11	Circular	2.25	0.013	918.46	917.85	32	1.91	33.9	24.1

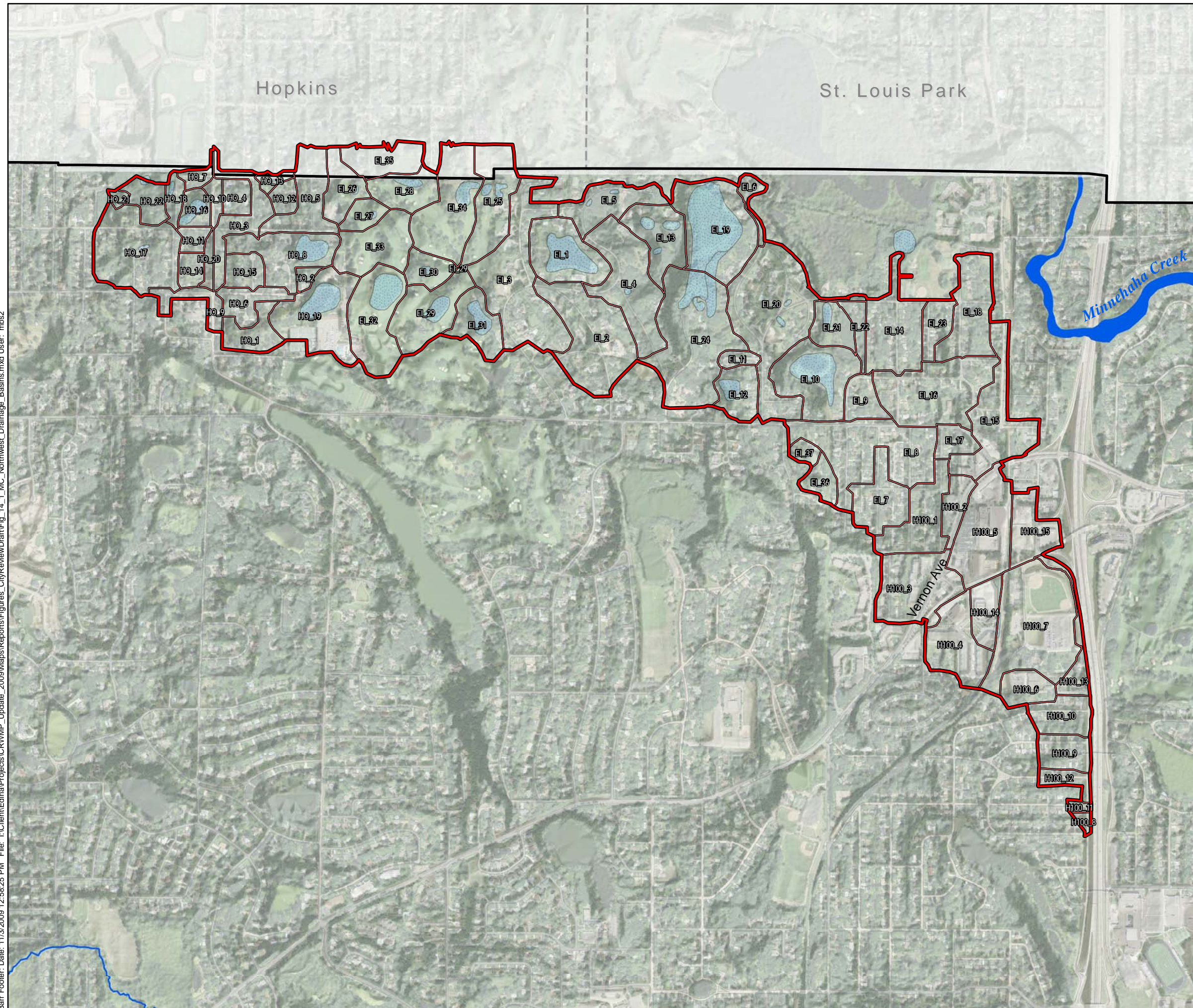
Table 14.4
Conduit Modeling Results for Subwatersheds in the Minnehaha Creek North East Drainage Areas







Conduit ID	Upstream Node	Downstream Node	Conduit Shape	Conduit Dimensions* (ft)	Roughness Coefficient	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Conduit Length (ft)	Slope	100Y Peak Flow Through Conduit (cfs)	10Y Peak Flow through Conduit (cfs)
1755	HO_17	2210	Circular	2.25	0.013	918.86	918.46	96	0.42	33.9	24.1
1757	HO_9	2214	Circular	1.5	0.013	928.32	927.01	329	0.40	9.5	4.6
1758	2214	2215	Circular	1.5	0.013	926.8	925.8	278	0.36	9.4	4.4
1759	2215	HO_20	Circular	1.5	0.013	925.8	923.75	60	3.42	9.4	4.4
1760	HO_20	2217	Circular	1.5	0.013	923.75	920.2	175	2.03	12.7	6.2
1761	2217	2218	Circular	1.5	0.013	920.2	918.46	100	1.74	11.7	10.4
1762	2218	HO_11	Circular	1.5	0.010	918.46	917.85	100	0.61	14.6	10.4
1763	HO_14	2217	Circular	0.5	0.015	925.9	921.3	239	1.92	1.0	1.0
1766	EL_4	EL_1	Circular	1	0.013	887.62	887	176	0.35	5.7	5.5
1767	EL_6	2226	Circular	1	0.024	889.1	887.7	138	1.01	3.5	3.5
1768	2226	2227	Circular	1	0.013	887.4	886.6	85	0.94	3.5	3.5
1769	EL_20	2229	Circular	1	0.013	885.5	885.34	31	0.52	6.6	6.4
1771	EL_11	EL_12	Circular	1	0.013	916.52	912.1	138	3.20	5.6	3.4
1843	HO_4	2186	Circular	1.75	0.013	912.91	912.52	110	0.35	6.7	7.3
1853	HO_7	2203	Circular	1	0.013	919.66	919.34	158	0.20	5.1	3.6
1854	2177	2344	Circular	2	0.010	886.29	885.99	193	0.16	8.1	5.2
1855	2344	EL_5	Circular	2	0.013	885.99	885.87	152	0.08	8.1	5.2
1856	EL_5	2346	Circular	2	0.013	885.87	885.87	100	0.00	21.2	17.5
1857	2346	2347	Circular	2	0.013	885.87	885.79	91	0.09	20.1	17.8
1858	2347	2348	Circular	2	0.013	885.79	885.76	112	0.03	29.1	17.7
1859	2348	2349	Circular	3	0.013	885.76	885.74	98	0.02	29.1	17.2
1860	2349	2350	Circular	3	0.013	885.74	885.79	91	-0.05	29.1	17.2
1861	2350	2351	Circular	3	0.013	885.79	886	131	-0.16	29.1	17.1
1862	2351	2352	Circular	3	0.013	885	884.77	123	0.19	29.1	17.1
1863	2352	2353	Circular	3	0.013	884.77	884.77	73	0.00	29.1	17.1
1864	2353	2354	Circular	3	0.013	883	882.07	281	0.33	29.1	17.1
1865	EL_25	2356	Circular	1.5	0.010	889	886.2	39	7.18	-18.0	-11.2
1866	2356	2357	Circular	2	0.010	884.4	883.91	163	0.30	-18.0	-11.2
1867	2357	2358	Circular	2	0.010	883.91	883.6	225	0.14	-12.6	-11.2
1868	2358	EL_3	Circular	2	0.010	887	886.62	225	0.17	-14.2	-12.2
1869	EL_1	2177	Circular	1	0.013	887	886.29	247	0.29	-4.1	-2.2
1946	HO_10	2442	Circular	1	0.013	917.54	917.4	94	0.15	4.7	3.4
1947	2442	2443	Circular	1	0.013	917.4	917.12	54	0.52	4.7	3.4
1948	2443	2183	Circular	1	0.013	917.12	916.02	71	1.55	4.7	3.5
1952	2156	2445	Circular	2	0.013	894.58	888.52	174	3.48	52.9	42.1
PP2	EL_30	2421	Circular	1	0.013	902.8	902.5	411	0.07	2.7	1.7
PP3	EL_32	EL_29	Circular	1.25	0.013	906.6	898.1	264	3.22	8.5	1.7
PP5	EL_29	2421	Circular	1.25	0.013	898.1	898	150	0.07	6.0	2.5
PP6	2421	EL_31	Circular	1.25	0.013	898	896.3	50	3.40	8.5	4.0
PP7	EL_31	2456	Circular	1.25	0.013	896.3	894	230	1.00	6.4	3.5
PP8	2456	2457	Circular	1.25	0.013	894	890	350	1.14	6.1	3.5
PP9	2457	EL_1	Circular	1.25	0.013	890	887	250	1.20	6.1	3.5
1256	H100_3	H100_5	Circular	1.75	0.013	934	911.6	440	5.09	35.7	35.7
1257	H100_5	1885	Circular	2.5	0.013	909.35	908.74	130	0.47	57.4	57.0
1258	1885	1886	Circular	3.58	0.013	908.74	908.43	77	0.40	64.8	61.2
1259	1886	H100_15	Circular	3	0.013	908.3	906.9	285	0.49	64.8	61.2
1260	H100_2	1889	Circular	2	0.013	945.38	944.6	146	0.53	13.1	7.1
1261	H100_1	1889	Circular	1.25	0.013	946.18	944.6	78	2.03	11.1	11.5
1262	1889	1891	Circular	2	0.013	944.6	944.39	112	0.29	16.8	16.9
1263	1891	1892	Circular	2	0.013	944.39	944.11	99	0.28	23.0	20.7

Table 14.4
Conduit Modeling Results for Subwatersheds in the Minnehaha Creek North East Drainage Areas

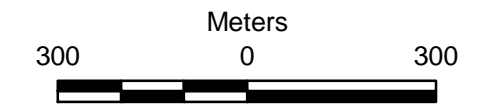
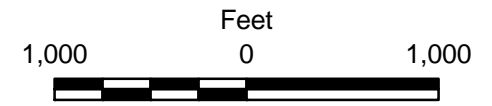
Conduit ID	Upstream Node	Downstream Node	Conduit Shape	Conduit Dimensions* (ft)	Roughness Coefficient	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Conduit Length (ft)	Slope	100Y Peak Flow Through Conduit (cfs)	10Y Peak Flow through Conduit (cfs)
1264	1892	1893	Circular	2.5	0.013	944.11	943.81	48	0.63	25.4	20.7
1265	1893	1894	Circular	2.5	0.013	943.81	943.69	124	0.10	22.7	20.6
1266	1894	1895	Circular	2.5	0.013	943.69	943.6	46	0.20	22.6	20.5
1267	1895	1896	Circular	2.5	0.013	943.6	943.31	81	0.36	22.5	20.3
1268	1896	1897	Circular	2.5	0.013	943.31	943.08	135	0.17	22.6	20.0
1269	1897	1898	Circular	2	0.013	943.08	942.5	32	1.81	22.5	19.5
1270	1898	H100_3	Circular	1.75	0.013	942.5	934	365	2.33	22.5	19.1
1871	H100_4	2362	Circular	3	0.013	928.8	927.5	186	0.70	42.3	28.3
1872	2362	2364	Circular	2	0.013	929	927.3	186	0.91	18.7	7.9
1873	2364	2365	Circular	2	0.013	927.3	923.8	24	14.58	18.7	7.9
1874	2365	2366	Circular	1.75	0.013	923.8	920.5	92	3.59	18.7	7.9
1875	2366	2367	Circular	2.5	0.013	920.5	920	55	0.92	18.7	7.9
1876	2367	2368	Circular	2.5	0.013	920	918.7	88	1.48	18.7	7.9
1877	2368	H100_14	Circular	2.5	0.013	918.7	917.4	80	1.63	18.7	7.9
1878	H100_14	2370	Circular	2.5	0.013	917.4	917	19	2.16	38.3	17.6
1879	2370	2372	Circular	2	0.013	916	917.1	25	-4.49	-27.5	-10.5
1880	2372	H100_5	Circular	2	0.013	917.1	911.2	35	16.86	27.5	13.4

NA-Not Applicable



-  City of Edina Boundary
-  Roads/Highways
-  Lake/Wetland
-  Creek/Stream
-  Minnehaha Creek - Northwest Drainage Basin
-  Subwatershed

Imagery Source: Aerials Express, 2008

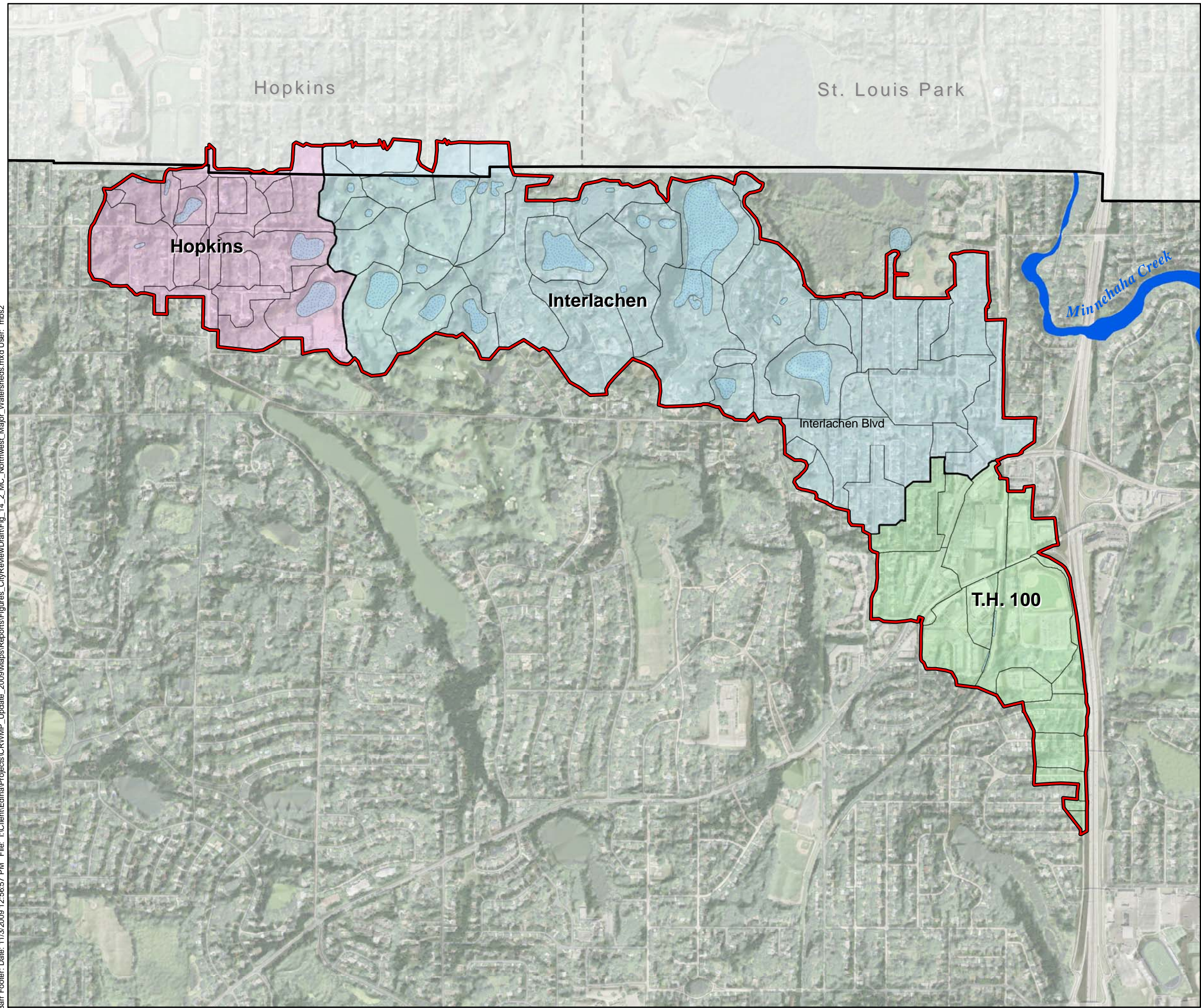









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Figure 14.1

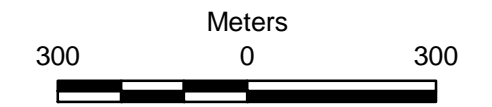
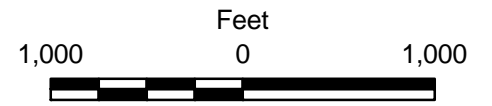
NORTHWEST MINNEHAHA CREEK
 DRAINAGE BASIN
 Comprehensive Water Resource
 Management Plan
 City of Edina, Minnesota

Barr Footer: Date: 11/3/2009 12:56:57 PM File: I:\Client\Edina\Projects\CRWMP_Update_2009\Maps\Repons\Figures_CityReview\Draft\Fig_14_2_MC_Northwest_Major_Watersheds.mxd User: mbs2



-  City of Edina Boundary
-  Roads/Highways
-  Creek/Stream
-  Lake/Wetland
-  Minnehaha Creek - Northwest Drainage Basin
-  Major Watershed
-  Subwatershed

Imagery Source: Aerials Express, 2008



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Figure 14.2

NORTHWEST MINNEHAHA CREEK
 MAJOR WATERSHEDS
 Comprehensive Water Resource
 Management Plan
 City of Edina, Minnesota







Hopkins

St. Louis Park





Percent TP Removal in Water Body*

This number represents the percent of the total annual mass of phosphorus entering the water body that is removed.



-  0 - 25% (Poor/No Removal)
-  25 - 40% (Moderate Removal)
-  40 - 60% (Good Removal)
-  60 - 100% (Excellent Removal)

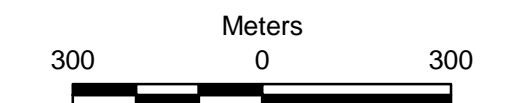
Cumulative TP Removal in Watershed*

This number represents the percent of the total annual mass of phosphorus entering the watershed and upstream watersheds that is removed in the pond and all upstream ponds.

-  0 - 25% (Poor/No Removal)
-  25 - 40% (Moderate Removal)
-  40 - 60% (Good Removal)
-  60 - 100% (Excellent Removal)

*Data based on results of P8 modeling.

-  Area Draining Directly to Minnehaha Creek
-  Flow Direction



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Figure 14.4

NORTHWEST MINNEHAHA CREEK
 WATER QUALITY
 MODELING RESULTS
 Comprehensive Water Resource
 Management Plan
 City of Edina, Minnesota

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Imagery Source: Aerials Express, 2008