COMMUNITY ASSISTANCE
PLANNING REPORT NO. 152

A STORMWATER DRAINAGE AND FLOOD CONTROL SYSTEM PLAN FOR THE MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

Part 2 of 2

APPENDICES

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Special acknowledgement is due Mr. Gary A. Gagnon, Group Manager, Planning and Engineering Support, Milwaukee Metropolitan Sewerage District, for his contribution to the preparation of this report.

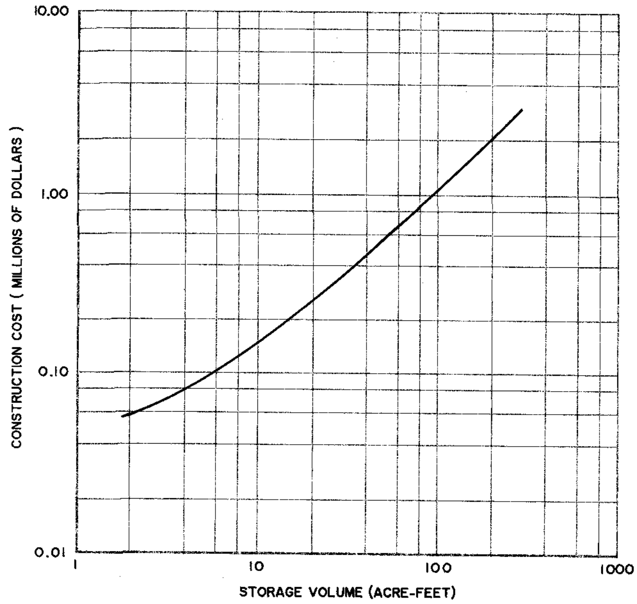
*The system planning was initiated in 1986 during Mr. Marchese's tenure as Executive Director of the Milwaukee Metropolitan Sewerage Commission. Mr. White succeeded Mr. Marchese in 1989 as the work of the Advisory Committee was in the final stages of completion.

Appendix A

COST DATA FOR DRAINAGE AND FLOOD CONTROL FACILITIES

Figure A-1

SURFACE STORAGE FACILITY COST CURVE[a]

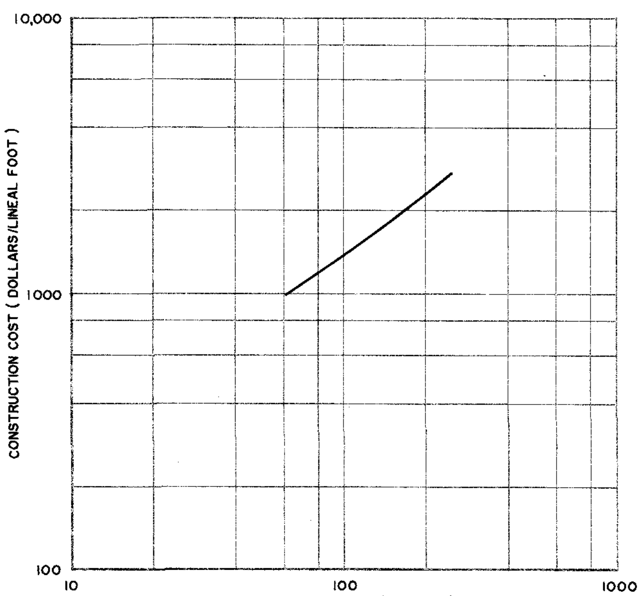


[a]*ENR CCI = 4520 (1986). Does not include land acquisition, engineering, administration, and contingencies. Operation and maintenance costs given in Table A-6.*

Source: SEWRPC.

Figure A-2

TUNNEL COST CURVE[a,b]



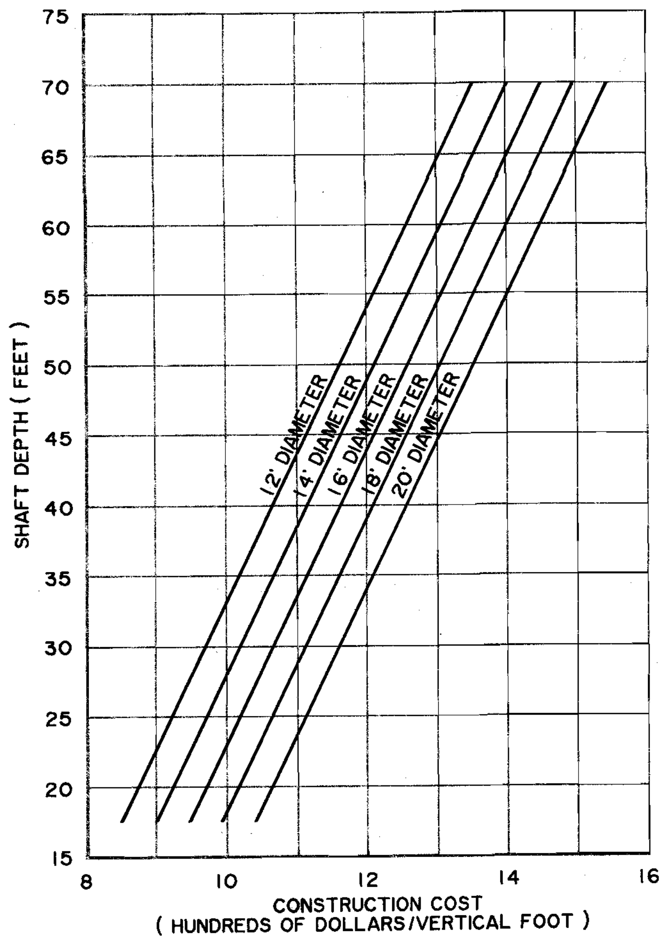
[a]*ENR CCI = 4520 (1986). Does not include engineering, administration, and contingencies. Annual operation and maintenance costs = $5,000 per mile.*

[b]*Curve should not be extrapolated below 60-inch tunnel diameter.*

Source: SEWRPC.

Figure A-3

TUNNEL SHAFT COST CURVE[a,b,c]



[a]*ENR CCI = 4520 (1986). Does not include engineering, administration, and contingencies.*

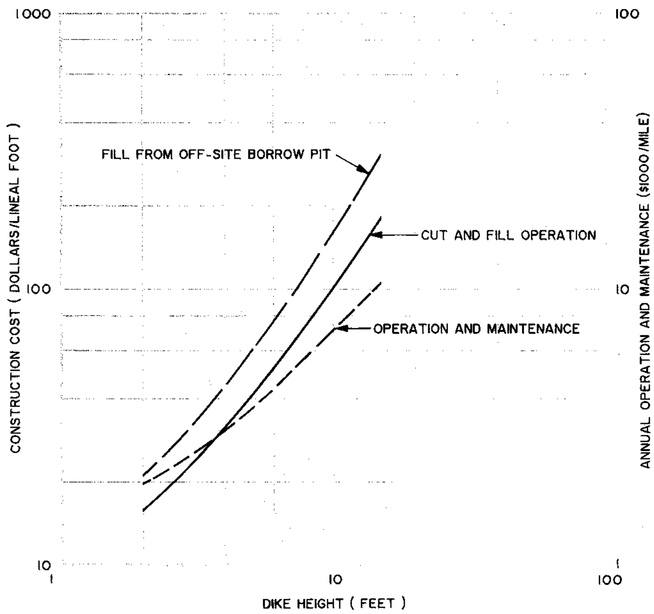
[b]*Does not include concrete structure at bottom of shaft.*

[c]*Does not include slurry wall or ground freezing costs.*

Source: SEWRPC.

Figure A-4

DIKE COST CURVES[a]

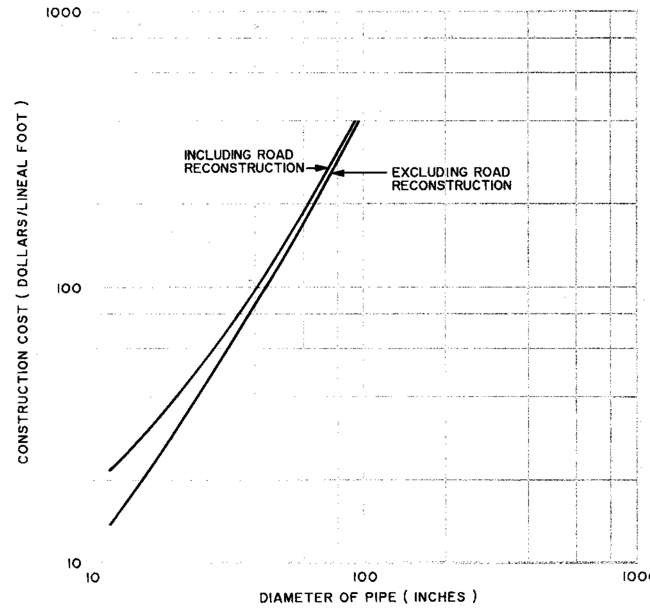


[a]ENR CCI = 4520 (1986). Does not include land acquisition, engineering, administration, and contingencies.

Source: SEWRPC.

Figure A-6

REINFORCED CONCRETE PIPE COST CURVES[a]

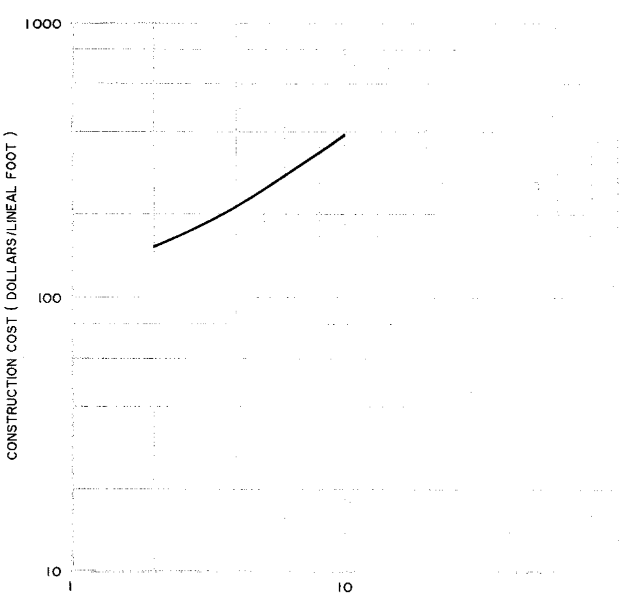


[a]ENR CCI = 4520 (1986). Does not include easements, engineering, administration, and contingencies.

Source: SEWRPC.

Figure A-5

FLOODWALL COST CURVE[a]

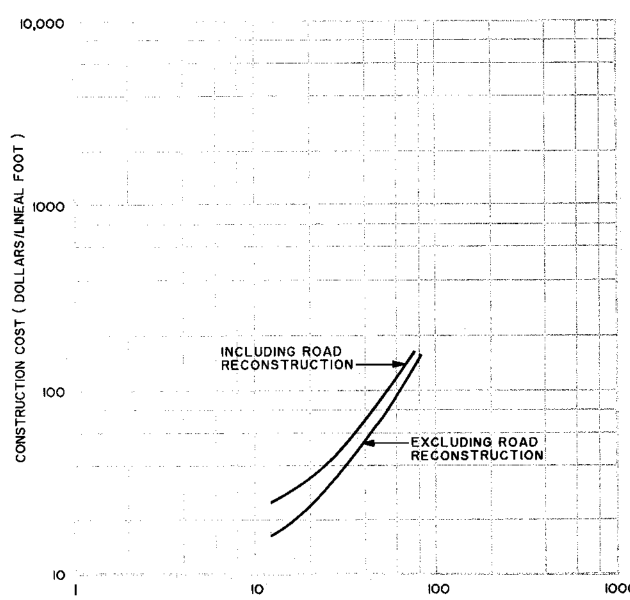


[a]ENR CCI = 4520 (1986). Does not include land acquisition, engineering, administration, and contingencies. Operation and maintenance costs = $3,000 per mile.

Source: SEWRPC.

Figure A-7

CORRUGATED METAL PIPE COST CURVES[a]

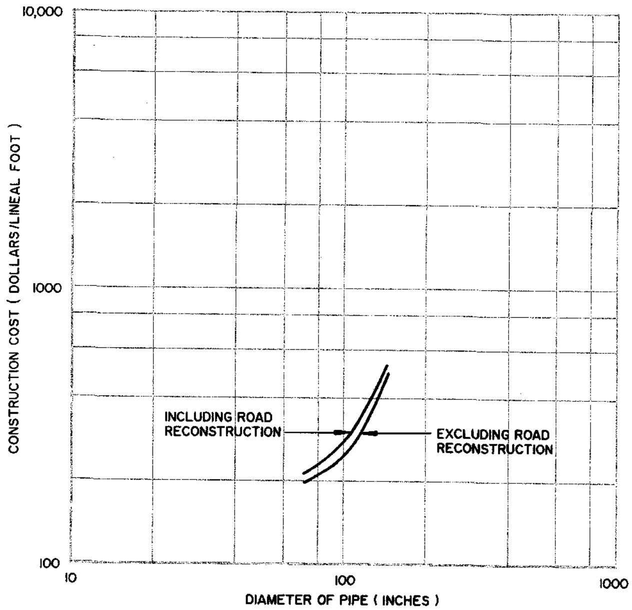


[a]ENR CCI = 4520 (1986). Does not include easements, engineering, administration, and contingencies.

Source: Dodge Guide and SEWRPC.

Figure A-8

STRUCTURAL PLATE PIPE COST CURVES[a]

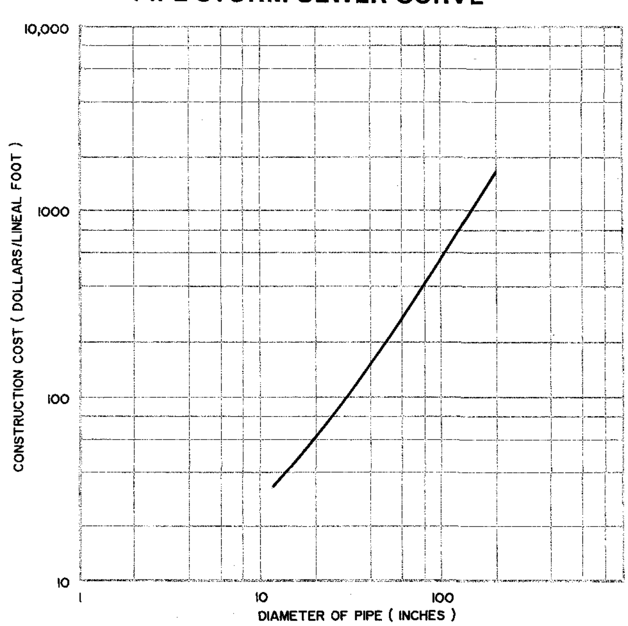


[a]*ENR CCI = 4520 (1986). Does not include easements, engineering, administration, and contingencies.*

Source: SEWRPC.

Figure A-9

REINFORCED CONCRETE PIPE STORM SEWER CURVE[a,b]



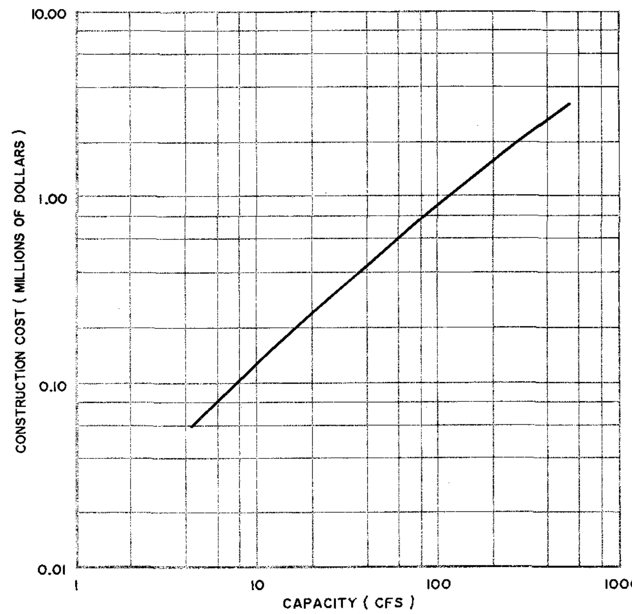
[a]*ENR CCI = 4520 (1986). Does not include easements, engineering, administration, and contingencies. Annual operation and maintenance costs = $1,000 per mile for diameter ≥ 36 inches and $2,000 per mile for diameter < 36 inches.*

[b]*This curve is applicable for pipe invert depths of up to 12 feet. For depths greater than 12 feet, site-specific cost adjustments should be made.*

Source: Stanley Consultants and SEWRPC.

Figure A-10

PUMPING STATION COST CURVE[a]



[a]*ENR CCI = 4520 (1986). Does not include land acquisition, engineering, administration, and contingencies. Annual operation and maintenance costs = $6,000 per station.*

Source: U. S. Army Corps of Engineers and SEWRPC.

Table A-1

UNIT COSTS FOR CHANNEL MODIFICATION COMPONENTS

Component	Unit Cost[a]
Clearing and Grubbing	$3,500 per acre
Excavation	$3 to $20 per cubic yard[b]
Concrete	$160 per cubic yard
Riprap	$40 per cubic yard
Gabions	$100 per cubic yard
Landscaping	$3,400 per acre

[a]*ENR CCI = 4520 (1986). Annual channel maintenance cost = $2,000 per mile.*

[b]*Cost dependent on haul distance to disposal site, disposal site tipping fees, and whether excavated material includes toxic substances requiring special disposal methods.*

Source: SEWRPC.

Table A-2

UNIT COSTS FOR STREET AND PEDESTRIAN BRIDGE REMOVAL AND REPLACEMENT

Type of Bridge	Unit Cost[a,b] ($ per square foot)
Street	60
Pedestrian	70

[a]*ENR CCI = 4520 (1986)*

[b]*Based on bridge deck area including street, curbs, sidewalks, and parapets.*

Source: SEWRPC.

Table A-3

UNIT COSTS FOR RAILWAY BRIDGE REMOVAL AND REPLACEMENT

Number of Tracks	Unit Cost ($ per lineal foot of span)
1	4,900
2	8,700
3	12,500

Source: SEWRPC.

Table A-4

UNIT COSTS FOR CONCRETE BOX CULVERTS

Culvert Size (feet)	Unit Cost[a,b] ($ per lineal foot)
8 x 6	400
8 x 8	460
10 x 6	490
10 x 8	580
10 x 10	660
12 x 6	640
12 x 8	670
12 x 10	820
12 x 12	900
16 x 6	600

[a]*ENR CCI = 4520 (1986)*

[b]*Add $30 per lineal foot of pipe to account for road reconstruction.*

Source: SEWRPC.

Table A-5

UNIT COSTS FOR CORRUGATED METAL PIPE ARCHES

	Unit Cost[a] ($ per lineal foot)	
Pipe Size, Span x Rise (inches)	Excluding Road Reconstruction	Including Road Reconstruction
36 x 22	70	80
43 x 27	100	110
50 x 31	110	120
58 x 36	130	140
65 x 40	180	200
72 x 44	190	210

[a]*ENR CCI = 4520 (1986)*

Source: Dodge Guide and SEWRPC.

Table A-6

UNIT COSTS FOR STRUCTURAL PLATE PIPE ARCHES

Pipe Size, Span x Rise (inches)	Unit Cost[a] ($ per lineal foot)	
	Excluding Road Reconstruction	Including Road Reconstruction
73 x 55	280	290
84 x 61	300	320
98 x 69	340	360
114 x 77	410	430
131 x 85	500	520
148 x 93	540	570
161 x 101	600	630
178 x 109	640	670
190 x 118	700	740
199 x 121	720	760

[a]ENR CCI = 4520 (1986)

Source: Dodge Guide and SEWRPC.

Table A-7

ANNUAL OPERATION AND MAINTENANCE COSTS FOR SURFACE STORAGE FACILITIES

Storage Volume (acre-feet)	Annual Operation and Maintenance as a Percent of Construction Cost[a]
Volume $\leq$ 5	6
5 $<$ Volume $\leq$ 20	4
Volume $>$ 20	3

[a]Includes periodic sediment removal.

Source: SEWRPC.

Table A-8

STRUCTURE FLOODPROOFING COSTS[a]

Structure Type	Cost per Structure
Single-Family Home	$4,600
Two-Family Residence	$6,800
Industrial/Commercial Building	Market Value x (0.07 + 0.05 x Height, in Feet, of Floodproofing Above First Floor)

[a]ENR CCI = 4520 (1986). Costs include administration and contingencies.

Source: SEWRPC.

Table A-9

SINGLE-FAMILY HOME ELEVATION COSTS[a]

Cost = $22,800 + $3,400 x Number of Feet Raised

[a]ENR CCI = 4520 (1986). Costs include administration and contingencies.

Source: SEWRPC.

Table A-10

SINGLE-FAMILY HOME REMOVAL[a]

Cost = $14,000 + Structure and Site Acquisition Cost

[a]ENR CCI = 4520 (1986).

Source: SEWRPC.

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Appendix B

HYDROLOGIC-HYDRAULIC SUMMARY FOR STRUCTURES IN THE KINNICKINNIC RIVER WATERSHED

Table B-1

HYDROLOGIC-HYDRAULIC SUMMARY—KINNICKINNIC RIVER YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
S. Chase Avenue	100	2.40	1S	50	No	4,350	587.1	582.8	4.3	--	--	6,200	589.2	584.1	5.1	0.0	--	7,000	589.9	584.9	5.0	0.2	--
IH 94	105	2.57	1I	--	--	4,350	--	--	--	--	--	6,200	--	--	--	--	--	7,000	--	--	--	--	--
S. 6th Street	120	2.81	1S	50	Yes	3,750	591.1	591.1	0.0	--	--	5,300	592.2	592.2	0.0	--	--	6,000	592.6	592.6	0.0	--	--
S. 9th Place	140	3.08	1S	10	Yes	3,750	598.8	598.8	0.0	--	--	5,300	600.2	400.2	0.0	--	--	6,000	600.7	600.7	0.0	--	--
S. 13th Street	160	3.32	1S	50	Yes	3,750	602.1	602.1	0.0	--	--	5,300	603.4	603.4	0.0	--	--	6,000	603.9	603.9	0.0	--	--
S. 16th Street	180	3.58	1S	50	Yes	3,550	609.6	609.6	0.0	--	--	5,000	610.9	610.9	0.0	--	--	5,700	611.4	611.4	0.0	--	--
Pedestrian Bridge	185	3.65	1S	--	--	3,550	613.1	611.4	1.7	--	--	5,000	616.6	614.4	2.2	--	--	5,700	616.4	616.4	0.0	--	--
W. Cleveland Avenue	190	3.79	1S	50	Yes	3,550	617.5	614.4	3.1	--	--	5,000	619.4	616.2	3.2	--	--	5,700	620.4	616.6	3.8	--	--
Chicago & North Western Railway	200	3.94	1S	100	Yes	3,550	617.7	617.7	0.0	--	--	5,000	620.5	619.6	0.9	--	--	5,700	621.7	620.6	1.1	-	--
Railroad Spur	205	3.96	1S	100	Yes	3,550	619.7	617.7	2.0	--	--	5,000	622.7	620.5	2.2	--	--	5,700	624.2	621.7	2.5	--	--
Drop Structure	210	3.96	3S	--	--	3,550	619.8	619.8	0.0	--	--	5,000	622.7	622.7	0.0	--	--	5,700	624.2	624.2	0.0	--	--
S. 20th Street	215	4.32	1S	10	Yes	3,550	628.0	624.6	3.4	--	--	5,000	630.8	626.0	4.8	--	--	5,700	632.9	626.7	6.2	--	--
Chicago & North Western Railway Spur	220	4.44	1S	100	Yes	3,550	628.6	628.0	0.6	--	--	5,000	631.7	630.9	0.8	--	--	5,700	633.8	633.1	0.7	--	--
S. 27th Street	225	4.91	1S	50	Yes	3,550	629.8	629.4	0.4	--	--	5,000	632.4	632.1	0.3	--	--	5,700	634.2	633.9	0.3	--	--
S. 29th Street	230	5.03	1S	10	Yes	3,550	630.4	630.1	0.3	--	--	5,000	632.8	632.6	0.2	--	--	5,700	634.5	634.3	0.2	--	--
Drop Structure	232	5.12	3S	--	--	3,550	630.7	630.7	0.0	--	--	5,000	633.0	633.0	0.0	--	--	5,700	634.6	634.6	0.0	--	--
Kinnickinnic River Parkway	235	5.14	1S	10	Yes	3,550	632.8	630.4	2.4	--	--	5,000	634.3	632.7	1.6	--	--	5,700	635.5	634.4	1.1	--	--
Pedestrian Bridge	240	5.21	1S	--	--	1,600	633.0	632.8	0.2	--	--	2,250	634.5	634.4	0.1	--	--	2,550	635.7	635.6	0.1	--	--
S. 35th Street	245	5.45	1S	50	Yes	1,600	633.7	633.5	0.2	--	--	2,250	635.0	634.8	0.2	--	--	2,550	636.0	635.9	0.1	--	--
W. Forest Home Avenue	250	5.71	1S	50	Yes	1,600	636.5	634.8	1.7	--	--	2,250	637.9	635.8	2.1	--	--	2,550	638.4	636.6	1.8	--	--
Jackson Park Drive	255	5.87	1S	10	Yes	1,600	637.3	636.6	0.7	--	--	2,250	638.7	638.0	0.7	--	--	2,550	639.2	638.5	0.7	--	--
Jackson Park Tunnel Outlet Structure	260	6.01	4S	--	--	1,600	--	637.4	--	--	--	2,250	--	6.38.8	--	--	--	2,550	--	639.4	--	--	--
Jackson Park Tunnel Inlet Structure	265	6.14	4S	--	--	1,600	637.6	--	--	--	--	2,250	639.0	--	--	--	--	2,550	641.4	--	--	--	--
Drop Structure	270	6.27	3S	--	--	1,600	644.4	638.6	--	--	--	2,250	644.6	640.0	--	--	--	2,550	644.6	641.9	--	--	--
Park Pedestrian Bridge	275	6.44	1I	--	--	1,600	--	--	--	--	--	2,250	--	--	--	--	--	2,550	--	--	--	--	--
S. 43rd Street	280	6.51	1S	50	No	790	649.3	647.5	1.8	0.0	--	1,100	649.9	648.0	1.9	0.2	--	1,200	650.1	648.2	1.9	0.3	--
Park Pedestrian Bridge	285	7.16	1I	--	--	790	--	--	--	--	--	1,100	--	--	--	--	--	1,200	--	--	--	--	--
S. 60th Street Outfall	290	8.05	4I	--	--	790	--	--	--	--	--	1,100	--	--	--	--	--	1,200	--	--	--	--	--

[a] *Measured in miles above confluence with the Milwaukee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table B-2

HYDROLOGIC-HYDRAULIC SUMMARY—LYONS PARK CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Drop Structure	300	0.04	3S	--	--	670	686.7	686.4	0.0	--	--	980	687.5	687.4	0.0	--	--	1,150	687.9	687.8	0.0	--	--
Parking Lot Tunnel Outlet	303	0.06	4S	--	--	670	--	686.7	--	--	--	980	--	687.5	--	--	--	1,150	--	687.9	--	--	--
W. Cleveland Avenue Tunnel Inlet	305	0.12	4S	10	Yes	670	692.3	--	--	-5.6	-9.1	980	693.1	--	--	-4.0	-7.5	1,150	695.0	--	--	-4.0	-5.6
Drop Structure	310	0.12	3S	--	--	670	692.3	--	--	--	--	980	693.1	--	--	--	--	1,150	695.0	--	--	--	--
Pedestrian Bridge	315	0.20	1I	--	--	670	--	--	--	--	--	980	--	--	--	--	--	1,150	--	--	--	--	--
Drop Structure	320	0.27	3S	--	--	670	696.2	695.8	--	--	--	980	697.2	696.8	--	--	--	1,150	697.6	697.3	--	--	--
Drop Structure	325	0.31	3S	--	--	670	698.7	697.0	--	--	--	980	699.8	697.9	--	--	--	1,150	700.2	688.3	--	--	--
W. Stack Drive	330	0.36	1S	10	Yes	670	701.9	699.8	1.5	-3.1	05.3	980	704.8	700.9	1.6	-1.6	-3.8	1,150	704.9	701.4	2.7	-1.5	-3.3
Drop Structure	335	0.37	3S	--	--	670	703.1	701.9	--	--	--	980	703.9	704.8	--	--	--	1,150	704.9	704.9	--	--	--
Drop Structure	340	0.42	3S	--	--	670	705.3	704.0	--	--	--	980	706.2	704.8	--	--	--	1,150	706.6	705.1	--	--	--
Drop Structure	345	0.50	3S	--	--	670	709.2	707.0	--	--	--	980	710.2	707.8	--	--	--	1,150	710.5	708.2	--	--	--
W. Bennett Avenue Tunnel Outlet	350	0.54	4S	10	Yes	670	--	709.9	--	-5.5	-6.1	980	--	710.8	--	-4.6	-5.2	1,150	--	711.2	--	-4.1	-4.7
Oklahoma Avenue	--	0.61	N/A	--	--	670	--	--	--	--	--	980	--	--	--	--	--	1,150	--	--	--	--	--
W. Lakefield Drive Extension Tunnel Inlet	355	0.70	4S	--	--	670	720.5	--	--	--	--	980	721.2	--	--	--	--	1,150	724.3	--	--	--	--
Drop Structure	360	0.70	3S	--	--	670	720.5	--	--	--	--	980	721.2	--	--	--	--	1,150	724.3	--	--	--	--
Drop Structure	365	0.80	3S	--	--	670	722.3	722.4	--	--	--	980	723.1	723.2	--	--	--	1,150	724.4	724.4	--	--	--
S. 57th Street Culvert	370	0.84	1S	10	Yes	670	725.9	722.9	0.8	-4.0	-5.2	980	728.1	723.7	1.4	-2.6	-3.8	1,150	727.5	724.0	0.2	-2.1	-3.3
Pedestrian Bridge	375	0.89	1I	--	--	670	--	--	--	--	--	980	--	--	--	--	--	1,150	--	--	--	--	--
Pedestrian Bridge	380	0.97	1I	--	--	670	--	--	--	--	--	980	--	--	--	--	--	1,150	--	--	--	--	--
Pedestrian Bridge	385	1.07	1I	--	--	670	--	--	--	--	--	980	--	--	--	--	--	1,150	--	--	--	--	--
S. 55th Street Culvert	390	1.17	1S	10	Yes	670	738.8	733.8	0.0	-2.0	-2.0	980	739.0	734.6	0.0	-1.2	-1.2	1,150	739.1	734.8	0.0	-1.0	-1.0
W. Forest Home Avenue Culvert Outlet	395	1.31	4I	--	--	475	--	N/A	--	--	--	640	--	--	--	--	--	710	--	--	--	--	--

NOTE: N/A indicates data not available.

[a] *Measured in miles above confluence with the Kinnickinnic River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table B-3

HYDROLOGIC-HYDRAULIC SUMMARY—WILSON PARK CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Outlet Control Sill	400	0.00	2S	- -	- -	1,970	632.1	632.1	0.0	- -	- -	2,730	633.5	633.5	0.0	- -	- -	3,070	634.8	634.8	0.0	- -	- -
W. Oklahoma Avenue Tunnel Outlet	404	0.05	4S	- -	- -	1,970	- -	634.1	- -	- -	- -	2,730	- -	635.0	- -	- -	- -	3,070	- -	635.3	- -	- -	- -
W. Euclid Avenue Tunnel Inlet	406	0.32	4S	- -	- -	1,970	638.7	- -	- -	- -	- -	2,730	639.9	- -	- -	- -	- -	3,070	640.6	- -	- -	- -	- -
W. Lakefield Drive	412	0.49	1S	10	Yes	1,970	641.4	641.1	0.3	- -	- -	2,730	643.5	642.6	0.9	- -	- -	3,070	644.4	643.2	1.2	- -	- -
W. Morgan Avenue Tunnel Outlet	416	0.68	4S	- -	- -	1,670	- -	643.1	- -	- -	- -	2,310	- -	644.7	- -	- -	- -	2,600	- -	645.4	- -	- -	- -
S. 27th Street Tunnel Inlet	418	0.87	4S	- -	- -	1,670	646.1	- -	- -	- -	- -	2,310	648.1	- -	- -	- -	- -	2,600	649.7	- -	- -	- -	- -
Howard Avenue	420	1.30	1S	50	Yes	1,670	646.5	646.5	0.0	- -	- -	2,310	648.6	648.6	0.2	- -	- -	2,600	650.2	649.8	0.4	- -	- -
S. 20th Street[f]	428	1.70	1S	10	Yes	1,670	652.8	648.8	4.0	- -	- -	2,310	654.1	650.1	4.0	- -	- -	2,600	654.7	651.0	3.7	- -	- -
Pedestrian Bridge	432	1.83	1I	- -	- -	1,670	- -	- -	- -	- -	- -	2,310	- -	- -	- -	- -	- -	2,600	- -	- -	- -	- -	- -
S. 13th Street	436	2.42	1S	50	Yes	1,250	658.1	656.5	1.6	- -	- -	1,690	660.1	657.4	2.7	- -	- -	1,880	660.8	657.7	3.1	0.6	0.6
IH 94	438	2.50	1I	100	- -	1,250	- -	- -	- -	- -	- -	1,690	- -	- -	- -	- -	- -	1,880	- -	- -	- -	- -	- -
Soo Line Railroad	440	2.57	1S	100	Yes	1,250	659.5	658.2	1.3	- -	- -	1,690	662.6	660.3	2.3	- -	- -	1,880	663.6	660.8	2.8	- -	- -
S. 6th Street	444	3.03	1S	10	Yes	1,250	659.9	659.8	0.1	- -	- -	1,690	663.7	662.7	1.0	0.6	0.0	1,880	664.3	663.7	0.6	1.2	0.6
S. 5th Street	448	3.18	1S	10	Yes	1,250	660.7	660.1	0.6	- -	- -	1,690	664.2	663.8	0.4	1.3	1.3	1,880	664.7	664.4	0.3	1.8	1.8
Layton Avenue Tunnel Outlet	452	3.51	4S	- -	- -	520	- -	661.0	- -	- -	- -	660	- -	664.3	- -	- -	- -	710	- -	664.8	- -	- -	- -
Howell Avenue Tunnel Inlet	454	3.65	4S	- -	- -	520	661.3	- -	- -	- -	- -	660	664.5	- -	- -	- -	- -	710	665.1	- -	- -	- -	- -
Airport Tunnel Outlet	455	3.86	4S	- -	- -	520	- -	661.5	- -	- -	- -	660	- -	664.7	- -	- -	- -	710	- -	665.3	- -	- -	- -
Airport Tunnel Inlet	456	4.76	4S	- -	- -	400	662.4	- -	- -	- -	- -	550	665.2	- -	- -	- -	- -	620	665.8	- -	- -	- -	- -
Airport Service Road	457	4.96	1S	- -	- -	400	664.0	663.8	0.2	- -	- -	550	665.5	665.5	0.0	- -	- -	620	666.1	666.0	0.1	- -	- -
Drop Structure	457A	5.28	3S	- -	- -	400	665.4	664.8	0.6	- -	- -	550	666.0	666.0	0.0	- -	- -	620	666.5	666.5	0.0	- -	- -
Chicago & North Western Railway	458	5.34	1S	100	Yes	400	670.0	668.2	1.8	- -	- -	550	671.2	668.8	2.4	- -	- -	620	671.4	669.8	1.6	- -	- -
Utility Lane	460	5.36	1S	- -	- -	400	670.7	670.0	0.7	0.4	- -	550	671.3	671.2	0.1	1.0	- -	620	671.5	671.4	0.1	1.2	- -
Pennsylvania Avenue	464	5.54	1S	50	No	350	673.1	671.8	1.3	0.5	- -	450	673.4	672.3	1.1	1.8	- -	510	673.5	672.6	0.9	1.9	0.0
Frontage Road	468	5.98	1S	- -	- -	350	677.4	677.2	0.2	3.1	- -	450	677.9	677.7	0.2	3.6	0.1	510	678.1	677.9	0.2	3.8	0.3
Nicholson Road	472	5.99	1S	10	No	350	677.4	677.4	0.0	3.2	- -	450	677.9	677.9	0.0	3.7	0.3	510	678.2	678.1	0.1	4.0	0.6
Whitnall Avenue	476	6.12	1S	50	No	350	682.3	681.0	1.3	0.5	0.5	450	682.4	681.5	0.9	0.6	0.6	510	682.5	681.6	0.9	0.7	0.7

[a] *Measured in miles above confluence with the Kinnickinnic River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *There is a drop of about 5.4 feet in the streambed at the downstream side of the S. 20th Street bridge.*

Source: SEWRPC

Table B-4

HYDROLOGIC-HYDRAULIC SUMMARY—WILSON PARK CREEK YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITION

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Outlet Control Sill	400	0.00	2S	--	--	2,150	632.1	632.1	0.0	--	--	2,820	633.5	633.5	0.0	--	--	3,090	634.8	634.8	0.0	--	--
W. Oklahoma Avenue Tunnel Outlet	404	0.05	4S	--	--	2,150	--	634.4	--	--	--	2,820	--	635.1	--	--	--	3,090	--	635.3	--	--	--
W. Euclid Avenue Tunnel Inlet	406	0.32	4S	--	--	2,150	639.0	--	--	--	--	2,820	640.1	--	--	--	--	3,090	640.6	--	--	--	--
W. Lakefield Drive	412	0.49	1S	10	Yes	2,150	642.0	641.6	0.4	--	--	2,820	643.8	642.8	1.0	--	--	3,090	644.8	643.3	1.5	--	--
W. Morgan Avenue Tunnel Outlet	416	0.68	4S	--	--	1,920	--	643.4	--	--	--	2,570	--	644.7	--	--	--	2,840	--	645.5	--	--	--
S. 27th Street Tunnel Inlet	418	0.87	4S	--	--	1,920	645.8	--	--	--	--	2,570	648.9	--	--	--	--	2,840	650.5	--	--	--	--
Howard Avenue	420	1.30	1S	50	Yes	1,920	646.5	646.4	0.1	--	--	2,570	649.4	649.1	0.3	--	--	2,840	651.1	650.6	0.5	--	--
S. 20th Street	428	1.70	1S	10	Yes	1,920	650.3	649.2	1.1	--	--	2,570	652.0	650.6	1.4	--	--	2,840	653.2	651.8	1.4	--	--
Pedestrian Bridge	432	1.83	1I	--	--	1,920	--	--	--	--	--	2,570	--	--	--	--	--	2,840	--	--	--	--	--
S. 13th Street	436	2.42	1S	50	Yes	1,590	653.6	653.6	0.0	--	--	2,120	655.4	654.8	0.6	--	--	2,340	656.3	655.4	0.9	--	--
IH 94	438	2.50	1I	100	--	1,590	--	--	--	--	--	2,120	--	--	--	--	--	2,340	--	--	--	--	--
Soo Line Railroad	440	2.57	1S	100	Yes	1,590	654.7	654.3	0.4	--	--	2,120	657.2	655.9	1.3	--	--	2,340	658.2	656.6	1.6	--	--
S. 6th Street	444	3.03	1S	10	Yes	1,590	657.1	657.1	0.0	--	--	2,120	658.6	658.6	0.0	--	--	2,340	659.4	659.4	0.0	--	--
S. 5th Street	448	3.18	1S	10	Yes	1,590	660.2	659.2	1.0	--	--	2,120	661.6	660.1	1.5	--	--	2,340	662.1	660.5	1.6	--	--
Layton Avenue Tunnel Outlet	452	3.51	4S	--	--	580	--	660.9	--	--	--	750	--	662.2	--	--	--	830	--	662.7	--	--	--
Howell Avenue Tunnel Inlet	454	3.65	4S	--	--	580	661.3	--	--	--	--	750	662.6	--	--	--	--	830	663.2	--	--	--	--
Airport Tunnel Outlet	455	3.86	4S	--	--	580	--	661.5	--	--	--	750	--	662.9	--	--	--	830	--	665.3	--	--	--
Airport Tunnel Inlet	456	4.76	4S	--	--	400	662.5	--	--	--	--	550	663.8	--	--	--	--	620	664.4	--	--	--	--
Airport Service Road	457	4.96	1S	--	--	400	663.8	663.8	0.0	--	--	550	664.6	664.5	0.1	--	--	620	665.0	665.0	0.0	--	--
Drop Structure[f]	457A	5.28	3S	--	--	400	--	--	--	--	--	550	--	--	--	--	--	620	--	--	--	--	--
Chicago & North Western Railway	458	5.34	1S	100	Yes	400	665.2	664.9	0.3	--	--	550	666.0	665.6	0.4	--	--	620	666.3	666.0	0.3	--	--
Utility Lane	460	5.36	1S	--	--	400	665.3	665.2	0.1	--	--	550	666.1	666.0	0.1	--	--	620	666.4	666.3	0.1	--	--
Pennsylvania Avenue	464	5.54	1S	50	Yes	350	666.4	666.2	0.2	--	--	450	667.2	667.0	0.2	--	--	510	667.5	667.3	0.2	--	--
Frontage Road	468	5.98	1S	--	--	350	--	--	--	--	--	450	--	--	--	--	--	510	--	--	--	--	--
Nicholson Road	472	5.99	1S	10	Yes	350	674.2	--	--	--	--	450	675.2	--	--	--	--	510	675.8	--	--	--	--
Whitnall Avenue	476	6.12	1S	50	No	350	682.3	680.6	0.7	0.5	0.5	450	682.4	680.9	0.5	0.6	0.6	510	682.5	681.2	0.3	0.7	0.7

[a]Measured in miles above confluence with the Kinnickinnic River.

[b]Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.

[c]A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.

[d]The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.

[e]Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.

[f]Drop structure removed under recommended channel conditions.

Source: SEWRPC.

Table B-5

HYDROLOGIC-HYDRAULIC SUMMARY—S. 43RD STREET DITCH
YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Chicago & North Western Railway Tunnel Outlet	800	0.00	4S	--	--	520	--	638.6	--	--	--	630	--	640.0	--	--	--	670	--	641.9	--	--	--
Chicago & North Western Railway Tunnel Inlet	800	0.10	4S	--	--	520	639.5	--	--	--	--	630	641.7	--	--	--	--	670	643.8	--	--	--	--
W. Lincoln Avenue Tunnel Inlet	802	0.21	4S	--	--	490	--	639.5	--	--	--	600	--	641.8	--	--	--	640	--	643.8	--	--	--
S. 43rd Street Tunnel Inlet	802	0.66	4S	--	--	440	641.0	--	--	--	--	510	643.4	--	--	--	--	540	645.6	--	--	--	--
Drop Structure	803	0.66	3S	--	--	440	643.8	641.0	--	--	--	510	644.4	643.4	--	--	--	540	645.8	645.6	--	--	--
W. Electric Avenue	806	0.95	1S	10	Yes	330	650.1	649.8	0.3	--	--	380	650.8	650.4	0.4	--	--	400	651.1	650.7	0.4	--	--

[a]*Measured in miles above confluence with the Kinnickinnic River.*

[b]*Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table B-6

HYDROLOGIC-HYDRAULIC SUMMARY—VILLA MANN CREEK
YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
S. 20th Street	600	0.07	1S	50	Yes	360	654.0	654.0	0.0	--	--	530	655.1	655.1	0.0	--	--	600	655.6	655.6	0.0	--	--
Drop Structure	600A	0.09	3S	--	--	360	654.0	654.0	0.0	--	--	530	655.1	655.1	0.0	--	--	600	655.6	655.6	0.0	--	--
Drop Structure	601	0.18	3S	--	--	360	657.8	655.6	2.2	--	--	530	658.4	656.0	2.4	--	--	600	658.6	656.3	2.3	--	--
W. Plainfield Avenue	602	0.24	1S	10	Yes	360	658.9	658.1	0.8	--	--	530	659.6	658.7	0.9	--	--	600	659.9	659.0	0.9	--	--
W. Bolivar Avenue	604	0.40	1S	10	Yes	360	665.5	664.8	0.7	--	--	530	666.1	665.6	0.5	--	--	600	666.3	665.8	0.5	--	--
IH 894 Outlet	606A	0.76	4I	--	--	360	--	683.3	--	--	--	530	--	683.9	--	--	--	600	--	684.2	--	--	--

[a]*Measured in miles above confluence with Wilson Park Creek.*

[b]*Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC

Table B-7

HYDROLOGIC-HYDRAULIC SUMMARY—VILLA MANN CREEK TRIBUTARY YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics / 10-Year Recurrence Interval Flood

Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	10-Year: Instantaneous Peak Discharge (cfs)	10-Year: Upstream Stage[d] (feet above NGVD)	10-Year: Downstream Stage[d] (feet above NGVD)	10-Year: Backwater[e] (feet)	10-Year: Depth at Low Point in Bridge Approach Road (feet)	10-Year: Depth on Road at Centerline of Bridge (feet)
S. 27th Street Tunnel Outlet	607	0.00	4S	- -	- -	180	- -	682.3	- -	- -	- -
S. 27th Street Tunnel Inlet	607	0.27	4S	- -	- -	160	686.9	- -	- -	- -	- -
IH 894	607A	0.50	1S	100	Yes	160	695.9	693.8	2.1	- -	- -
W. Colony Drive	607B	0.65	1S	10	Yes	130	712.7	709.0	3.7	- -	- -

50-Year Recurrence Interval Flood

Name	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
S. 27th Street Tunnel Outlet	270	- -	683.3	- -	- -	- -
S. 27th Street Tunnel Inlet	240	688.0	- -	- -	- -	- -
IH 894	240	697.1	694.2	2.9	- -	- -
W. Colony Drive	200	713.8	709.4	4.4	- -	- -

100-Year Recurrence Interval Flood

Name	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
S. 27th Street Tunnel Outlet	320	- -	683.7	- -	- -	- -
S. 27th Street Tunnel Inlet	290	690.2	- -	- -	- -	- -
IH 894	290	697.8	694.4	3.4	- -	- -
W. Colony Drive	230	714.2	709.6	4.6	- -	- -

[a] *Measured in miles above confluence with Villa Mann Creek.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Appendix C

HYDROLOGIC-HYDRAULIC SUMMARY FOR STRUCTURES IN THE MILWAUKEE RIVER WATERSHED

Table C-1

HYDROLOGIC-HYDRAULIC SUMMARY—INDIAN CREEK
YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Bradley Road	3100	0.13	1S	10	Yes	910	644.2	642.9	1.3	- -	- -	1,560	647.0	645.1	1.9	1.0	0.7	1,890	647.4	646.0	1.4	1.4	1.1
Private Drive	3105	0.21	1S	- -	- -	910	645.1	644.4	0.7	0.9	0.1	1,560	647.4	647.1	0.3	3.2	2.4	1,890	647.8	647.5	0.3	3.6	2.8
N. River Road	3110	0.41	1S	10	Yes	790	647.6	647.5	0.1	- -	- -	1,300	648.5	648.2	0.3	- -	- -	1,520	648.9	648.6	0.3	- -	- -
Footbridge	3112	0.66	1S	- -	- -	790	651.0	650.8	0.2	0.4	- -	1,300	652.8	652.3	0.5	2.2	1.2	1,520	653.2	652.7	0.5	2.6	1.6
Private Drive	3115	0.68	1I	- -	- -	790	- -	- -	- -	- -	- -	1,300	- -	- -	- -	- -	- -	1,520	- -	- -	- -	- -	- -
Private Drive	3120	0.84	1S	- -	- -	790	654.2	653.4	0.8	1.3	1.3	1,300	655.2	654.6	0.6	2.3	2.3	1,520	655.6	655.1	0.5	2.7	2.7
Private Drive	3125	1.05	1S	- -	- -	790	655.3	654.6	0.7	0.4	- -	1,300	656.3	655.6	0.7	1.4	0.4	1,520	656.7	656.0	0.7	1.8	0.8
N. Pheasant Lane Tunnel Outlet	3130	1.36	4S	- -	- -	810	- -	757.7	- -	- -	- -	1,370	- -	758.9	- -	- -	- -	1,610	- -	659.3	- -	- -	- -
IH 43 Tunnel Inlet	3135	1.38	4S	- -	- -	810	657.9	- -	- -	- -	- -	1,370	659.6	- -	- -	- -	- -	1,610	660.2	- -	- -	- -	- -
N. Port Washington Road/CTH W	3140	1.57	1S	50	Yes	780	659.8	658.3	1.5	- -	- -	1,310	663.6	659.9	3.7	- -	- -	1,540	665.4	660.5	4.9	0.3	0.3
Footbridge	3145	1.76	1I	- -	- -	780	- -	- -	- -	- -	- -	1,310	- -	- -	- -	- -	- -	1,540	- -	- -	- -	- -	- -
E. Dean Road	3150	1.91	1S	10	No	700	660.3	660.0	0.3	0.9	- -	1,160	663.7	663.7	0.0	4.3	2.1	1,350	665.5	665.4	0.1	6.1	3.9

[a]*Measured in miles above confluence with the Milwaukee River.*

[b]*Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table C-2

HYDROLOGIC-HYDRAULIC SUMMARY—INDIAN CREEK
YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Bradley Road	3100	0.13	1S	10	Yes	930	644.4	643.0	1.4	- -	- -	1,640	647.1	645.3	1.8	1.1	0.8	2,040	647.5	646.3	1.2	1.5	1.2
Private Drive	3105	0.21	1S	- -	- -	930	645.2	644.6	0.6	1.0	0.2	1,640	647.5	647.2	0.3	3.3	2.5	2,040	648.0	647.7	0.3	3.8	3.0
N. River Road	3110	0.41	1S	10	Yes	820	647.6	647.6	0.0	- -	- -	1,420	648.8	648.3	0.5	- -	- -	1,700	649.1	648.7	0.4	- -	- -
Footbridge	3112	0.66	1S	- -	- -	820	652.3	650.8	1.5	1.7	0.7	1,420	653.3	652.2	1.1	2.7	1.7	1,700	653.8	653.1	0.7	3.2	2.2
Private Drive	3115	0.68	1I	- -	- -	820	- -	- -	- -	- -	- -	1,420	- -	- -	- -	- -	- -	1,700	- -	- -	- -	- -	- -
Private Drive	3120	0.84	1S	- -	- -	820	654.3	653.5	0.8	1.4	1.4	1,420	655.5	654.9	0.6	2.6	2.6	1,700	656.0	655.4	0.6	3.1	3.1
Private Drive	3125	1.05	1S	- -	- -	820	655.4	654.7	0.7	0.5	- -	1,420	656.5	655.8	0.7	1.6	0.6	1,700	657.0	656.3	0.7	2.1	1.1
N. Pheasant Lane Tunnel Outlet	3130	1.36	4S	- -	- -	860	- -	657.8	- -	- -	- -	1,530	- -	659.2	- -	- -	- -	1,890	- -	659.6	- -	- -	- -
IH 43 Tunnel Inlet	3135	1.38	4S	- -	- -	860	658.0	- -	- -	- -	- -	1,530	660.0	- -	- -	- -	- -	1,890	660.9	- -	- -	- -	- -
N. Port Washington Road/CTH W	3140	1.57	1S	50	Yes	830	658.8	658.4	0.4	- -	- -	1,460	660.8	660.2	0.6	- -	- -	1,810	661.8	661.0	0.8	- -	- -
Footbridge	3145	1.76	1I	- -	- -	830	- -	- -	- -	- -	- -	1,460	- -	- -	- -	- -	- -	1,810	- -	- -	- -	- -	- -
E. Dean Road	3150	1.91	1S	10	No	700	659.6	659.4	0.2	0.2	- -	1,160	661.8	661.2	0.6	2.4	0.2	1,350	662.5	662.2	0.3	3.1	0.9

[a]*Measured in miles above confluence with the Milwaukee River.*

[b]*Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table C-3

HYDROLOGIC-HYDRAULIC SUMMARY—LINCOLN CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
N. Green Bay Avenue/STH 57	238	0.43	1S	50	Yes	5,410	622.3	622.2	0.1	--	--	7,370	623.8	623.4	0.4	--	--	7,970	624.2	623.7	0.5	--	--
W. Villard Avenue	239	0.81	1S	50	Yes	4,740	624.0	623.9	0.1	--	--	6,120	625.7	625.3	0.4	--	--	6,510	626.1	625.7	0.4	--	--
Pedestrian Bridge	239A	0.93	1I	--	--	4,740	--	--	--	--	--	6,120	--	--	--	--	--	6,510	--	--	--	--	--
N. Teutonia Avenue	240	1.30	1S	50	No	4740	628.1	626.1	2.0	--	--	6,120	631.0	627.6	3.4	2.3	--	6,510	631.3	628.0	3.3	2.6	--
W. Cameron Avenue	241	1.53	1S	10	Yes	4,580	628.8	628.8	0.0	--	--	5,840	631.4	631.4	0.0	--	--	6,160	631.6	631.6	0.0	--	--
Soo Line Railroad	242	1.65	1S	100	Yes	4,580	629.9	629.3	0.6	--	--	5,840	632.0	631.6	0.4	--	--	6.160	632.3	631.9	0.4	--	--
W. Hampton Avenue	243	1.73	1S	50	Yes	4,580	630.6	630.2	0.4	--	--	5,840	632.7	632.2	0.5	--	--	6,160	633.0	632.6	0.4	--	--
N. 32nd Street[f]	244	1.90	1S	10	Yes	4,580	637.2	631.3	5.9	--	--	5,840	639.5	633.2	6.3	--	--	6,160	639.8	633.6	6.2	0.3	--
Soo Line Railroad	245	2.01	1S	100	Yes	4,580	640.5	637.6	2.9	--	--	5,840	641.8	639.8	2.0	--	--	6,160	642.2	640.1	2.1	--	--
W. Glendale Avenue	246	2.20	1S	10	Yes	4,580	643.6	641.4	2.2	--	--	5,840	645.7	642.8	2.9	1.0	0.8	6,160	646.0	643.2	2.8	1.3	1.1
N. 35th Street	248	2.52	1S	50	No	3,730	645.5	644.4	1.1	--	--	4,530	649.2	646.4	2.8	0.2	--	4,600	649.4	646.7	2.7	0.4	--
N. 37th Street	249	2.64	1S	10	Yes	3,730	646.4	645.6	0.8	--	--	4,530	650.8	649.3	1.5	--	--	4,600	651.1	649.5	1.6	--	--
Pedestrian Bridge	249A	2.82	1I	--	--	3,880	--	--	--	--	--	4,960	--	--	--	--	--	5,240	--	--	--	--	--
N. Sherman Boulevard	250	3.03	1S	50	No	3,870	650.0	647.6	2.4	0.3	--	4,790	651.7	651.4	0.3	2.0	0.7	5,060	652.0	651.8	0.2	2.3	1.0
Pedestrian Bridge	251	3.48	1I	--	--	4,020	--	--	--	--	--	6,290	--	--	--	--	--	7,340	--	--	--	--	--
N. 51st Street	252	3.59	1S	10	Yes	4,020	652.6	652.0	0.6	--	--	6,290	654.3	653.8	0.5	--	--	7,340	654.9	654.3	0.6	0.1	--
Pedestrian Bridge	253	3.80	1I	--	--	4,020	--	--	--	--	--	6,290	--	--	--	--	--	7,340	--	--	--	--	--
N. 60th Street	254	4.24	1S	50	Yes	3,190	656.2	656.1	0.1	--	--	5,000	658.8	658.0	0.8	--	--	5,860	660.0	658.6	1.4	--	--
W. Hampton Avenue/ CTH EE	255	4.41	1S	50	Yes	3,190	658.2	658.2	0.0	--	--	5,000	660.2	660.2	0.0	--	--	5,860	661.1	661.1	0.0	--	--
Pedestrian Bridge	256	4.56	1I	--	--	2,490	--	--	--	--	--	3,910	--	--	--	--	--	4,590	--	--	--	--	--
W. Villard Avenue	257	4.92	1S	50	Yes	1,130	661.6	661.3	0.3	--	--	1,820	664.0	663.5	0.5	--	--	2,160	665.1	664.3	0.8	--	--
N. 60th Street and W. Custer Avenue	258	5.37	1S	50	No	1,130	663.6	662.4	1.2	--	--	1,820	667.8	664.7	3.1	0.4	0.4	2,160	668.3	665.8	2.5	0.9	0.9
Pedestrian Bridge	259	5.51	1I	--	--	1,130	--	--	--	--	--	1,820	--	--	--	--	--	2,160	--	--	--	--	--
W. Silver Spring Drive/CTH E	260	5.65	1S	50	Yes	530	665.9	665.2	0.7	--	--	770	668.5	668.3	0.2	--	--	840	669.0	668.8	0.2	--	--
Steel Drop Spillway	261	5.79	2S	--	--	530	673.4	668.4	5.0	--	--	770	674.9	669.3	5.6	--	--	840	675.4	669.7	5.7	--	--
Private Drive	263	6.06	1S	--	--	500	679.0	677.0	2.0	0.1	0.1	720	680.7	678.0	2.7	1.8	1.8	780	681.0	678.2	2.8	2.1	2.1
Wisconsin & Southern Railroad	265	6.28	1S	100	Yes	440	681.9	680.9	1.0	--	--	640	683.4	682.0	1.4	--	--	690	683.8	682.3	1.5	--	--
Private Drive	266	6.29	1S	--	--	440	683.1	681.9	1.2	0.7	--	640	683.8	683.4	0.4	1.4	0.4	690	684.0	683.8	0.2	1.6	0.6
Pedestrian Bridge	268	6.67	1I	--	--	460	--	--	--	--	--	640	--	--	--	--	--	700	--	--	--	--	--
Chicago & North Western Railway	269	6.73	1S	100	Yes	460	688.3	684.8	3.5	--	--	640	690.2	685.4	4.8	--	--	700	690.8	685.6	5.2	--	--
W. Woolworth Avenue	270	6.82	1S	10	No	660	688.3	688.3	0.0	2.6	2.2	1,110	690.2	690.2	0.0	4.5	4.1	1,330	690.8	690.8	--	5.1	4.7
N. 51st Street	271	6.86	1S	10	No	660	688.3	688.3	0.0	1.8	1.8	1,110	690.2	690.2	0.0	3.7	3.7	1,330	690.8	690.8	--	4.3	4.3
W. Mill Road/ CTH S	272	6.90	1S	50	No	660	689.2	688.3	0.9	--	--	1,110	690.3	690.2	0.1	0.2	0.2	1,330	690.9	690.8	0.1	0.8	0.8
N. Green Tree Road	273	7.40	1S	10	Yes	260	691.6	690.7	0.9	--	--	380	692.7	691.8	0.9	0.1	--	400	692.7	692.3	0.4	0.1	--
W. Good Hope Road/ CTH PP	274	7.92	1S	50	Yes	210	--	692.7	--	--	--	290	--	693.6	--	--	--	310	--	693.9	--	--	--
Chicago & North Western Railway and Concrete Drop Spillway	275	7.97	1, 3S	100	Yes	210	694.6	--	--	--	--	290	695.8	--	--	--	--	310	696.3	--	--	--	--
Chicago & North Western Railway	277	8.49	1S	100	Yes	210	711.7	707.9	3.8	--	--	290	713.4	708.4	5.0	--	--	310	713.8	708.5	5.3	--	--
N. 60th Street	278	8.55	1S	50	Yes	210	713.1	711.7	1.4	--	--	290	715.0	713.4	1.6	--	--	310	715.7	713.8	1.9	--	--

[a] *Measured in miles above confluence with the Milwaukee River.*

[b] *aStructure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *This structure was replaced in 1984 by the City of Milwaukee in accordance with the recommended flood control plan. The stages listed in this table do not reflect the new bridge.*

Source: SEWRPC.

Table C-4

HYDROLOGIC-HYDRAULIC SUMMARY—LINCOLN CREEK
YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
N. Green Bay Avenue/STH 57	238	0.43	1S	50	Yes	7,600	622.4	622.3	0.1	--	--	12,460	624.7	624.6	0.1	--	--	14,000	625.3	625.2	0.1	--	--
W. Villard Avenue	239	0.81	1S	50	Yes	6,950	623.3	623.2	0.1	--	--	11,030	625.9	625.8	0.1	--	--	12,650	626.6	626.5	0.1	--	--
Pedestrian Bridge	239A	0.93	1I	--	--	6,950	--	--	--	--	--	11,030	--	--	--	--	--	12,650	--	--	--	--	--
N. Teutonia Avenue	240	1.30	1S	50	Yes	6,950	627.7	623.9	3.8	--	--	11,030	630.2	626.7	3.5	--	--	12,650	630.8	627.5	3.3	--	--
W. Cameron Avenue	241	1.53	1S	10	Yes	6,700	629.5	629.4	0.1	--	--	10,650	632.3	631.8	0.5	--	--	12,200	633.6	632.5	1.1	--	--
Soo Line Railroad	242	1.65	1S	100	Yes	6,700	631.5	630.5	1.0	--	--	10,650	634.4	633.3	1.1	--	--	12,200	635.5	634.4	1.1	--	--
W. Hampton Avenue	243	1.73	1S	50	Yes	6,700	632.6	631.8	0.8	--	--	10,650	637.0	634.9	2.1	--	--	12,200	638.2	636.0	2.2	--	--
N. 32nd Street[f]	244	1.90	1S	10	Yes	6,700	--	633.2	--	--	--	10,650	--	637.5	--	--	--	12,200	--	638.5	--	--	--
Soo Line Railroad	245	2.01	1S	100	Yes	6,610	633.3	--	--	--	--	10,540	637.5	--	--	--	--	12,080	638.5	--	--	--	--
W. Glendale Avenue	246	2.20	1S	10	Yes	6,610	634.5	634.1	0.4	--	--	10,540	638.9	638.6	0.3	--	--	12,080	640.2	640.0	0.2	--	--
N. 35th Street	248	2.52	1S	50	Yes	5,350	637.8	637.0	0.8	--	--	8,540	641.2	640.4	0.8	--	--	9,790	642.3	641.5	0.8	--	--
N. 37th Street	249	2.64	1S	10	Yes	5,350	638.5	638.4	0.1	--	--	8,540	641.8	641.8	0.0	--	--	9,790	642.9	642.9	0.0	--	--
Pedestrian Bridge	249A	2.82	1I	--	--	5,350	--	--	--	--	--	8,540	--	--	--	--	--	9,790	--	--	--	--	--
N. Sherman Boulevard	250	3.03	1S	50	Yes	5,140	642.3	642.2	0.1	--	--	8,540	645.2	644.9	0.3	--	--	9,430	646.3	645.9	0.4	--	--
Pedestrian Bridge	251	3.48	1I	--	--	4,030	--	--	--	--	--	6,310	--	--	--	--	--	7,350	--	--	--	--	--
N. 51st Street	252	3.59	1S	10	Yes	4,030	646.3	645.2	1.1	--	--	6,310	648.0	647.3	0.7	--	--	7,350	648.8	648.1	0.7	--	--
Pedestrian Bridge	253	3.80	1I	--	--	4,030	--	--	--	--	--	6,310	--	--	--	--	--	7,350	--	--	--	--	--
N. 60th Street	254	4.24	1S	50	Yes	3,200	654.8	654.2	0.6	--	--	5,030	656.7	655.9	0.8	--	--	5,860	657.4	656.6	0.8	--	--
W. Hampton Avenue/ CTH EE	255	4.41	1S	50	Yes	3,200	656.4	655.4	1.0	--	--	5,030	658.5	657.2	1.3	--	--	5,860	659.4	657.9	1.5	--	--
Pedestrian Bridge	256	4.56	1I	--	--	2,500	--	--	--	--	--	3,930	--	--	--	--	--	4,600	--	--	--	--	--
W. Villard Avenue	257	4.92	1S	50	Yes	1,140	661.6	661.3	0.3	--	--	1,840	664.0	663.5	0.5	--	--	2,170	665.1	664.3	0.8	--	--
N. 60th Street and W. Custer Avenue	258	5.37	1S	50	No	1,140	663.7	662.4	1.3	--	--	1,840	667.9	664.7	3.2	0.7	0.7	2,170	668.3	665.8	2.5	1.1	1.1
Pedestrian Bridge	259	5.51	1I	--	--	1,140	--	--	--	--	--	1,840	--	--	--	--	--	2,170	--	--	--	--	--
W. Silver Spring Drive/CTH E	260	5.65	1S	50	Yes	620	666.2	665.2	1.0	--	--	980	668.7	668.4	0.3	--	--	1,110	669.2	668.8	0.4	--	--
Steel Drop Spillway	261	5.79	2S	--	--	620	674.1	668.7	5.4	--	--	980	675.5	669.8	5.7	--	--	1,110	675.6	670.2	5.4	--	--
Private Drive	263	6.06	1S	--	--	590	678.9	676.2	2.7	--	--	930	681.2	677.3	3.9	--	--	1,050	681.6	677.6	4.0	--	--
Wisconsin & Southern Railroad	265	6.28	1S	100	Yes	530	682.2	680.5	1.7	--	--	850	684.8	682.2	2.6	--	--	950	685.7	682.6	3.1	--	--
Private Drive	266	6.29	1S	--	--	530	683.5	682.2	1.3	--	--	850	684.9	684.8	0.1	--	--	950	685.8	685.7	0.1	--	--
Pedestrian Bridge	268	6.67	1I	--	--	610	--	--	--	--	--	980	--	--	--	--	--	1,120	--	--	--	--	--
Chicago & North Western Railway	269	6.73	1S	100	Yes	610	684.6	684.6	0.0	--	--	980	685.9	685.7	0.2	--	--	1,120	686.5	686.3	0.7	--	--
W. Woolworth Avenue	270	6.82	1S	10	Yes	610	685.0	684.9	0.1	--	--	980	686.6	686.4	0.2	--	--	1,120	687.2	687.0	0.2	--	--
N. 51st Street	271	6.86	1S	10	Yes	610	685.2	685.0	0.2	--	--	980	686.8	686.6	0.2	--	--	1,120	687.3	687.2	0.1	--	--
W. Mill Road/CTH S	272	6.90	1S	50	Yes	610	686.3	685.2	1.1	--	--	980	687.8	686.8	0.4	--	--	1,120	687.9	687.3	0.6	--	--
N. Green Tree Road	273	7.40	1S	10	Yes	560	688.0	687.1	0.9	--	--	850	689.6	688.6	1.0	--	--	965	690.4	689.4	1.0	--	--
W. Good Hope Road/ CTH PP	274	7.92	1S	50	Yes	210	--	689.8	--	--	--	290	--	691.3	--	--	--	310	--	692.0	--	--	--
Chicago & North Western Railway and Concrete Drop Spillway	275	7.97	1, 3S	100	Yes	210	689.9	--	--	--	--	290	691.5	--	--	--	--	310	692.3	--	--	--	--
Chicago & North Western Railway	277	8.49	1S	100	Yes	210	711.7	704.3	7.4	--	--	290	713.4	704.8	8.6	--	--	310	713.8	705.0	8.8	--	--
N. 60th Street	278	8.55	1S	50	Yes	210	713.1	711.7	1.4	--	--	290	715.0	713.4	1.6	--	--	310	715.7	713.8	1.9	--	--

[a]Measured in miles above confluence with the Milwaukee River.

[b]Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.

[c]A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.

[d]The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.

[e]Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.

[f]This structure was replaced in 1984 by the City of Milwaukee in accordance with the recommended flood control plan. The stages listed in this table reflect the new bridge.

Source: SEWRPC.

Table C-5

HYDROLOGIC-HYDRAULIC SUMMARY—BEAVER CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
YMCA Pedestrian Bridge	3000	0.10	1S	- -	- -	640	648.7[f]	648.7[f]	0.0	0.4	- -	1,040	650.4[f]	650.4[f]	0.0	2.1	- -	1,180	651.0[f]	651.0[f]	0.0	2.7	- -
N. Green Bay Road Tunnel Outlet/STH 57	3005	0.18	4S	- -	- -	620	- -	648.7[f]	- -	- -	- -	1,010	- -	650.4[f]	- -	- -	- -	1,140	- -	651.0[f]	- -	- -	- -
N. Green Bay Road Tunnel Inlet/STH 57	3005	0.33	4S	- -	- -	620	648.7[f]	- -	- -	- -	- -	1,010	651.3	- -	- -	- -	- -	1,140	652.2	- -	- -	- -	- -
Utility Road	3010	0.67	1S	- -	- -	620	649.8	649.7	0.1	- -	- -	1,010	652.0	651.7	0.3	- -	- -	1,130	652.8	652.3	0.5	- -	- -
Wisconsin Central Railroad	3015	0.69	1S	100	Yes	620	649.8	649.8	0.0	- -	- -	1,010	652.1	652.0	0.1	- -	- -	1,130	652.8	652.8	0.0	- -	- -
N. 51st Street	3020	0.92	1S	10	Yes	590	650.7	650.4	0.3	- -	- -	1,090	652.7	652.3	0.4	- -	- -	1,370	653.6	653.1	0.5	- -	- -
N. 60th Street	3025	1.50	1S	50	Yes	410	654.0	653.6	0.4	- -	- -	770	656.2	655.2	1.0	- -	- -	970	657.2	655.9	1.3	- -	- -
W. Brown Deer Road/ STH 100[g]	3030	1.76	1S	50	Yes	260	660.4	655.8	4.6	- -	- -	460	661.3	657.0	4.3	- -	- -	580	661.8	657.8	4.0	- -	- -
N. 64th Street	3035	1.93	1S	10	Yes	230	667.4	665.5	1.9	- -	- -	400	670.5	666.5	4.0	1.4	1.4	500	670.8	667.0	3.8	1.7	1.7
N. 66th Street	3040	2.06	1S	10	Yes	230	673.1	671.6	1.5	- -	- -	400	674.7	672.1	2.6	0.6	- -	500	675.0	672.3	2.7	0.9	- -
W. Brown Deer Road/ STH 100	3045	2.20	1S	50	- -	230	- -[h]	674.0	- -	- -	- -	400	- -[h]	675.0	- -	- -	- -	500	- -[h]	675.3	- -	- -	- -

[a] *Measured in miles above confluence with the Milwaukee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *The flood stage indicated represents the water surface elevation on the Milwaukee River.*

[g] *There is a drop of about 2.7 feet in the streambed at the downstream side of the W. Brown Deer Road bridge.*

[h] *No flood stages were determined upstream of this structure.*

Source: SEWRPC.

Table C-6

HYDROLOGIC-HYDRAULIC SUMMARY—BEAVER CREEK
YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
YMCA Pedestrian Bridge	3000	0.10	1S	- -	- -	640	648.7[f]	648.7[f]	0.0	0.4	- -	1,040	650.4[f]	650.4[f]	0.0	2.1	- -	1,180	651.0[f]	651.0[f]	0.0	2.7	- -
N. Green Bay Road Tunnel Outlet/STH 57	3005	0.18	4S	- -	- -	620	- -	648.7[f]	- -	- -	- -	1,010	- -	650.4[f]	- -	- -	- -	1,140	- -	651.0[f]	- -	- -	- -
N. Green Bay Road Tunnel Inlet/STH 57	3005	0.33	4S	- -	- -	620	648.7[f]	- -	- -	- -	- -	1,010	651.3	- -	- -	- -	- -	1,140	652.2	- -	- -	- -	- -
Utility Road	3010	0.67	1S	- -	- -	620	649.8	649.7	0.1	- -	- -	1,010	652.0	651.7	0.3	- -	- -	1,130	653.8	652.3	0.5	- -	- -
Wisconsin Central Railroad	3015	0.69	1S	100	Yes	620	649.8	649.8	0.0	- -	- -	1,010	652.1	652.0	0.1	- -	- -	1,130	652.8	652.8	0.0	- -	- -
N. 51st Street	3020	0.92	1S	10	Yes	590	650.7	650.4	0.3	- -	- -	1,090	652.7	652.3	0.4	- -	- -	1,370	653.6	653.1	0.5	- -	- -
N. 60th Street	3025	1.50	1S	50	Yes	410	654.0	653.6	0.4	- -	- -	770	656.2	655.2	1.0	- -	- -	970	657.2	655.9	1.3	- -	- -
W. Brown Deer Road/ STH 100[g]	3030	1.76	1S	50	Yes	260	660.4	655.8	4.6	- -	- -	460	661.3	657.0	4.3	- -	- -	580	661.8	657.8	4.0	- -	- -
N. 64th Street	3035	1.93	1S	10	Yes	230	665.8	665.5	0.3	- -	- -	400	666.9	666.5	0.4	- -	- -	500	667.4	667.0	0.4	- -	- -
N. 66th Street	3040	2.06	1S	10	Yes	230	668.7	668.6	0.1	- -	- -	400	669.7	669.5	0.2	- -	- -	500	670.1	669.8	0.3	- -	- -
W. Brown Deer Road/ STH 100	3045	2.20	1S	50	- -	230	- -[h]	672.4	- -	- -	- -	400	- -[h]	673.5	- -	- -	- -	500	- -[h]	674.0	- -	- -	- -

[a] *Measured in miles above confluence with the Milwaukee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *The flood stage indicated represents the water surface elevation on the Milwaukee River.*

[g] *There is a drop of about 2.7 feet in the streambed at the downstream side of the W. Brown Deer Road bridge.*

[h] *No flood stages were determined upstream of this structure.*

Source: SEWRPC.

Table C-7

HYDROLOGIC-HYDRAULIC SUMMARY—BROWN DEER PARK CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
N. Range Line Road	3515	0.19	1S	50	No	360	657.4	655.8	1.6	- -	- -	520	658.5	656.3	2.2	0.6	- -	580	658.6	656.5	2.1	0.7	- -
Private Drive	3520	0.285	1S	- -	- -	360	662.8	660.3	2.5	1.1	- -	560	663.3	660.7	2.6	1.6	- -	650	663.5	660.9	2.6	1.8	- -
Private Dam	3522	0.467	2I	- -	- -	330	- -	- -	- -	- -	- -	520	- -	- -	- -	- -	- -	610	- -	- -	- -	- -	- -
N. Green Bay Road/ STH 57	3525	0.746	1S	50	Yes	340	677.0	676.0	1.0	- -	- -	550	677.9	676.6	1.3	- -	- -	650	679.2	676.8	2.4	- -	- -
W. Bradley Road	3530	0.78	1S	10	No	340	679.3	678.1	1.2	0.5	0.5	550	680.3	679.7	0.6	1.5	1.5	650	681.1	680.9	0.2	2.3	2.3
Brown Deer Park Drive (north)	3540	0.88	1S	- -	- -	340	680.8	680.0	0.8	0.5	0.5	550	681.2	681.0	0.2	0.9	0.9	650	681.7	681.7	0.0	1.4	1.4
Brown Deer Park Drive (south)	3550	1.45	1S	- -	- -	500	684.8	683.7	1.1	1.9	1.9	780	685.0	684.4	0.6	2.1	2.1	910	685.2	684.6	0.6	2.3	2.3
Brown Deer Park Golf Course Dam (south)	3595	1.86	2I	- -	- -	560	- -	- -	- -	- -	- -	840	- -	- -	- -	- -	- -	990	- -	- -	- -	- -	- -
W. Good Hope Road[f]	3600	1.94	1S	50	Yes	580	687.2	686.3	0.9	- -	- -	900	689.6	686.9	2.7	0.0	- -	1,060	689.8	687.2	2.6	0.2	0.0

[a] *Measured in miles above confluence with the Milwaukee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *There is a drop in the streambed of about 3.5 feet at the downstream side of the W. Good Hope Road bridge.*

Source: SEWRPC.

Table C-8

HYDROLOGIC-HYDRAULIC SUMMARY—SOUTH BRANCH CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Private Drive	3300	0.11	1S	- -	- -	1,050	650.8	647.5[f]	3.3	0.8	0.5	1,570	651.4	649.4[f]	2.0	1.4	1.1	1,690	651.6	650.2[f]	1.4	1.6	1.3
Green Bay Court	3305	0.16	1S	10	No	1,050	654.2	650.9	3.3	1.7	0.6	1,570	654.4	651.5	2.9	1.9	0.8	1,690	654.5	651.7	2.8	2.0	0.9
N. Green Bay Road/ STH 57	3310	0.23	1S	50	Yes	1,050	654.3	654.2	0.1	- -	- -	1,570	654.8	654.4	0.4	- -	- -	1,690	654.9	654.5	0.4	- -	- -
N. Teutonia Avenue	3315	0.35	1S	50	Yes	1,130	654.9	654.3	0.6	- -	- -	1,500	655.8	654.8	1.0	- -	- -	1,580	656.1	654.9	1.2	- -	- -
W. Dean Road	3320	0.47	1S	10	Yes	870	658.4	655.3	3.1	- -	- -	1,170	660.0	656.2	3.8	0.1	- -	1,240	660.4	656.4	4.0	0.5	- -
N. 47th Street	3325	0.75	1S	10	No	870	674.1	662.6	11.5	0.7	0.7	1,120	674.5	663.2	11.3	1.1	1.1	1,170	674.6	663.3	11.3	1.2	1.2
N. 51st Street	3330	1.01	1S	10	No	770	676.3	674.2	2.1	0.9	0.9	970	676.7	674.6	2.1	1.3	1.3	1,010	676.7	674.7	2.0	1.3	1.3
N. 54th Street	3335	1.17	1S	10	No	740	677.6	676.3	1.3	1.7	1.2	850	677.7	676.7	1.0	1.8	1.3	860	677.7	676.7	1.0	1.8	1.3
N. 55th Street	3340	1.34	1S	10	No	720	681.0	677.5	3.5	2.9	2.9	810	681.2	677.7	3.5	3.1	3.1	820	681.2	677.7	3.5	3.1	3.1
W. Bradley Road Outfall	3350	1.53	4I	- -	- -	720	- -	682.8	- -	- -	- -	810	- -	683.1	- -	- -	- -	820	- -	683.2	- -	- -	- -

[a] *Measured in miles above confluence with the Milwaukee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *The flood stage indicated represents the water surface elevation on the Milwaukee River.*

Source: SEWRPC.

Table C-9

HYDROLOGIC-HYDRAULIC SUMMARY—SOUTH BRANCH CREEK YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Private Drive	3300	0.11	1S	--	--	1,020	650.7	647.5[f]	3.2	0.7	0.4	1,520	651.4	649.4[f]	2.0	1.4	1.1	1,640	651.5	650.2[f]	1.3	1.5	1.2
Green Bay Court	3305	0.16	1S	10	No	1,020	654.0	650.8	3.2	1.5	0.4	1,520	654.3	651.5	2.8	1.8	0.7	1,640	654.5	651.6	2.9	2.0	0.9
N. Green Bay Road/ STH 57	3310	0.23	1S	50	Yes	1,020	654.2	654.0	0.2	--	--	1,520	654.6	654.3	0.3	--	--	1,640	654.8	654.5	0.3	--	--
N. Teutonia Avenue	3315	0.35	1S	50	Yes	1,100	654.7	654.2	0.5	--	--	1,450	655.7	654.6	1.1	--	--	1,530	656.0	654.8	1.2	--	--
W. Dean Road	3320	0.47	1S	10	Yes	840	658.2	655.1	3.1	--	--	1,120	659.8	656.1	3.7	--	--	1,190	660.1	656.3	3.8	0.2	--
N. 47th Street	3325	0.75	1S	10	Yes	840	666.2	662.5	3.7	--	--	1,070	667.4	663.1	4.3	--	--	1,120	667.7	663.2	4.5	--	--
N. 51st Street	3330	1.01	1S	10	Yes	740	669.7	668.2	1.5	--	--	930	671.0	668.9	2.1	--	--	960	671.2	669.1	2.1	--	--
N. 54th Street	3335	1.17	1S	10	Yes	740	673.4	672.2	1.2	--	--	850	674.0	672.7	1.3	--	--	860	674.1	672.8	1.3	--	--
N. 55th Street	3340	1.34	1S	10	Yes	720	676.2	675.3	0.9	--	--	810	676.5	675.7	0.8	--	--	820	676.6	675.8	0.8	--	--
W. Bradley Road Outfall	3350	1.53	4I	--	--	720	--	682.5	--	--	--	810	--	682.8	--	--	--	820	--	682.9	--	--	--

[a] *Measured in miles above confluence with the Milwaukee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *The flood stage indicated represents the water surface elevation on the Milwaukee River.*

Source: SEWRPC.

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Appendix D

HYDROLOGIC-HYDRAULIC SUMMARY FOR STRUCTURES IN THE OAK CREEK WATERSHED

Table D-1

HYDROLOGIC-HYDRAULIC SUMMARY—LOWER OAK CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Pedestrian Bridge	100	0.14	1I	--	--	1,910	--	--	--	--	--	2,540	--	--	--	--	--	2,810	--	--	--	--	--
1st Oak Creek Parkway Bridge	105	0.35	1S	10	Yes	1,910	587.7	586.6	1.1	--	--	2,540	589.3	587.6	1.7	--	--	2,810	589.9	588.0	1.9	--	--
2nd Oak Creek Parkway Bridge	110	0.88	1S	10	Yes	1,910	601.3	599.6	1.7	--	--	2,540	602.9	600.4	2.5	--	--	2,810	603.9	600.7	3.2	--	--
Mill Road	115	0.94	1S	50	Yes	1,910	604.0	603.3	0.7	--	--	2,540	605.3	603.9	1.4	--	--	2,810	605.7	604.4	1.3	--	--
Oak Creek Parkway Dam	120	0.95	2S	--	--	1,910	617.6	604.0	13.6	--	--	2,540	618.3	605.3	13.0	--	--	2,810	618.5	605.7	12.8	--	--
3rd Oak Creek Parkway Bridge	125	1.18	1S	10	Yes	1,910	617.9	617.6	0.3	--	--	2,540	618.9	618.3	0.6	--	--	2,810	619.2	618.5	0.7	--	--
4th Oak Creek Parkway Bridge	130	1.32	1S	10	Yes	1,910	620.3	618.6	1.7	--	--	2,540	622.0	619.3	2.7	--	--	2,810	622.7	619.5	3.2	--	--
Chicago Avenue/ STH 32	135	1.61	1S	50	Yes	1,890	626.1	623.5	2.6	--	--	2,510	627.5	624.5	3.0	--	--	2,770	628.0	624.9	3.1	--	--
5th Oak Creek Parkway Bridge	140	2.14	1S	10	Yes	1,890	633.1	632.5	0.6	--	--	2,510	634.2	633.5	0.7	--	--	2,770	634.7	633.9	0.8	--	--
Pedestrian Bridge	145	2.24	1I	--	--	1,890	--	--	--	--	--	2,510	--	--	--	--	--	2,770	--	--	--	--	--
Chicago & North Western Railway	150	2.35	1S	100	Yes	1,890	638.3	637.4	0.9	--	--	2,510	639.6	638.5	1.1	--	--	2,770	640.0	638.9	1.1	--	--
15th Avenue	155	2.84	1S	50	Yes	1,840	642.7	641.6	1.1	--	--	2,440	644.0	642.4	1.6	--	--	2,700	644.6	642.7	1.9	--	--
Pedestrian Bridge	160	3.18	1I	--	--	1,840	--	--	--	--	--	2,440	--	--	--	--	--	2,700	--	--	--	--	--
Pine Street	165	3.37	1S	10	Yes	1,840	647.6	647.0	0.6	--	--	2,440	648.6	648.0	0.6	--	--	2,700	448.9	648.3	0.6	--	--
E. Rawson and 16th Avenues	170 & 175	3.65	1S	50	Yes	1,840	650.4	649.7	0.7	--	--	2,440	652.3	650.7	1.6	--	--	2,700	653.1	651.1	2.0	--	--
15th Avenue	180	3.76	1S	50	Yes	1,840	650.8	650.6	0.2	--	--	2,440	653.0	652.5	0.5	--	--	2,700	654.0	653.3	0.7	1.0	--
Pedestrian Bridge	185	3.89	1I	--	--	1,840	--	--	--	--	--	2,440	--	--	--	--	--	2,700	--	--	--	--	--
Milwaukee Avenue	190	4.01	1S	50	Yes	1,840	651.4	651.2	0.2	--	--	2,440	653.6	653.2	0.4	--	--	2,700	654.8	654.2	0.6	0.3	--
15th Avenue	195	4.06	1S	50	Yes	1,840	651.6	651.4	0.2	--	--	2,440	653.7	653.6	0.1	--	--	2,700	655.2	654.8	0.4	1.0	--
Pedestrian Bridge	200	4.18	1I	--	--	1,840	--	--	--	--	--	2,440	--	--	--	--	--	2,700	--	--	--	--	--
S. Pennsylvania Avenue[f]	205	4.71	1S	50	Yes	1,840	653.8	652.7	1.1	--	--	2,440	654.7	654.6	0.1	--	--	2,700	655.9	655.8	0.1	--	--

[a] *Measured in miles above mouth at Lake Michigan.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *There is a drop of about 4.0 feet in the streambed at the downstream side of the S. Pennsylvania Avenue bridge.*

Source: SEWRPC.

Table D-2

HYDROLOGIC-HYDRAULIC SUMMARY—MIDDLE OAK CREEK
YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Chicago & North Western Railway	210	5.25	1S	100	Yes	1,500	661.4	661.1	0.3	- -	- -	2,030	662.5	662.1	0.4	- -	- -	2,270	662.9	662.4	0.5	- -	- -
E. Drexel Avenue	215	5.56	1S	50	Yes	1,500	662.1	662.0	0.1	- -	- -	2,030	663.6	663.0	0.6	- -	- -	2,270	664.1	663.4	0.7	- -	- -
Chicago & North Western Railway	220	6.06	1S	100	Yes	1,500	663.3	663.0	0.3	- -	- -	2,030	664.6	664.2	0.4	- -	- - -	2,270	665.8	664.8	1.0	- -	- -
E. Forest Hill Avenue	225	6.25	1S	10	No	1,500	663.5	663.4	0.1	1.8	0.7	2,030	664.8	664.8	0.0	3.1	2.0	2,270	665.9	665.9	0.0	4.2	3.1
E. Puetz Road	230	6.88	1S	50	No	1,500	664.3	663.9	0.4	- -	- -	2,030	665.6	665.0	0.6	0.6	- -	2,270	666.2	666.0	0.2	1.2	- -
Chicago & North Western Railway	235	7.34	1S	100	Yes	2,080	665.5	665.0	0.5	- -	- -	2,870	666.6	665.8	0.8	- -	- -	3,220	667.2	666.4	0.8	- -	- -
S. Nicholson Road	240	7.44	1S	50	No	2,080	666.7	666.0	0.7	1.5	- -	2,870	667.6	667.0	0.6	2.4	- -	3,220	668.0	667.6	0.4	2.8	- -
S. Shepard Avenue	250	8.41	1S	10	No	2,080	671.0	670.4	0.6	0.4	- -	2,870	671.6	670.9	0.7	1.0	- -	3,220	671.8	671.1	0.7	1.2	- -
S. Howell Avenue/ Northbound STH 38	255	9.22	1S	50	Yes	2,080	677.6	677.2	0.4	- -	- -	2,870	678.5	677.9	0.6	- -	- -	3,220	678.9	678.2	0.7	0.2	- -
S. Howell Avenue/ Southbound STH 38	256	9.24	1S	50	Yes	2,080	677.6	677.6	0.0	- -	- -	2,870	678.7	678.5	0.2	- -	- -	3,220	679.2	678.9	0.3	0.5	- -

[a] *Measured in miles above mouth at Lake Michigan.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table D-3

HYDROLOGIC-HYDRAULIC SUMMARY—UPPER OAK CREEK
YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Ryan Road/STH 100	260	10.06	1S	50	No	1,030	682.0	680.9	1.1	3.6	- -	1,620	684.5	682.2	2.3	5.9	0.3	1,830	685.0	682.7	2.3	6.4	0.8
Spillway	261	10.12	2S	- -	- -	1,030	682.0	682.0	0.0	- -	- -	1,620	684.5	684.5	0.0	- -	- -	1,830	685.0	685.0	0.0	- -	- -
Soo Line Railroad	265	10.24	1S	100	Yes	1,030	682.1	682.1	0.0	- -	- -	1,620	684.8	684.5	0.3	- -	- -	1,830	685.4	685.0	0.4	- -	- -
Private Bridge	270	10.25	1S	- -	- -	1,030	684.8	682.1	2.7	3.0	3.0	1,620	685.9	684.8	1.1	4.1	4.1	1,830	686.4	685.4	1.0	4.6	4.6
Private Bridge	275	10.46	1S	- -	- -	1,030	690.2	687.2	3.0	0.4	- -	1,620	691.3	688.4	1.9	1.5	0.3	1,830	691.5	688.7	2.8	1.7	0.5
Private Bridge	280	10.60	1I	- -	- -	1,030	- -	- -	- -	- -	- -	1,620	- -	- -	- -	- -	- -	1,830	- -	- -	- -	- -	- -
S. 13th Street/CTH V	285	10.69	1S	50	No	1,030	691.5	690.5	1.0	- -	- -	1,620	692.4	691.5	0.9	0.5	0.5	1,830	692.5	691.7	0.8	0.6	0.6
Pedestrian Bridge	286	10.72	1I	- -	- -	1,030	- -	- -	- -	- -	- -	1,620	- -	- -	- -	- -	- -	1,830	- -	- -	- -	- -	- -
IH 94 Northbound	290	10.97	1S	100	Yes	690	691.7	691.7	0.0	- -	- -	1,140	692.6	692.6	0.0	- -	- -	1,330	692.7	692.7	0.0	- -	- -
IH 94 Southbound	295	10.99	1S	100	Yes	690	691.8	691.7	0.1	- -	- -	1,140	692.6	692.6	0.0	- -	- -	1,330	692.8	692.7	0.1	- -	- -
S. 20th Street	300	11.24	1S	10	No	690	692.7	691.8	0.9	0.7	0.7	1,140	693.2	692.7	0.5	1.2	1.2	1,330	693.3	692.9	0.4	1.3	1.3
S. 27th Street/STH 41	305	11.70	1S	50	Yes	400	694.5	694.0	0.5	- -	- -	700	696.1	694.7	1.4	- -	- -	840	696.7	695.0	1.7	0.4	- -
S. 31st Street	310	11.97	1S	10	Yes	200	697.8	697.8	0.0	- -	- -	390	699.3	698.5	0.8	- -	- -	490	699.9	698.8	1.1	0.3	- -
Private Bridge	312	12.23	1S	- -	- -	200	702.8	702.2	0.6	- -	- -	390	704.1	702.7	1.4	0.1	0.1	490	704.8	702.8	2.0	0.8	0.8
W. Ryan Road/STH 100	315	12.52	1S	50	Yes	200	711.9	709.4	2.5	- -	- -	390	714.9	710.3	4.6	- -	- -	490	717.6	710.5	7.1	- -	- -
Concrete Drop Sill	316	12.69	2S	- -	- -	200	713.8	713.8	0.0	- -	- -	390	715.3	715.3	0.0	- -	- -	490	717.6	717.6	0.0	- -	- -
Concrete Drop Sill	317	12.90	2S	- -	- -	200	719.0	719.0	0.0	- -	- -	390	720.6	720.6	0.0	- -	- -	490	721.1	721.1	0.0	- -	- -
Concrete Drop Sill	318	13.07	2S	- -	- -	100	724.0	724.0	0.0	- -	- -	170	725.5	725.5	0.0	- -	- -	210	726.0	726.0	0.0	- -	- -
W. Southland Drive	320	13.18	1S	10	Yes	100	731.7	730.6	1.1	- -	- -	170	732.5	731.0	1.5	- -	- -	210	733.0	731.2	1.8	- -	- -
W. Woodward Drive	325	13.31	1S	10	Yes	50	733.8	733.6	0.2	- -	- -	90	734.4	734.0	0.4	- -	- -	110	734.6	734.2	0.4	- -	- -
W. Glenwood Drive	330	13.58	1S	10	Yes	10	743.4	741.8	1.6	- -	- -	30	744.6	742.0	2.6	- -	- -	40	744.8	742.1	2.7	0.2	0.2
Private Drive	331	13.60	1S	- -	- -	10	745.0	743.4	1.6	- -	- -	30	745.8	744.6	1.2	0.3	0.3	40	745.8	744.8	1.0	0.3	0.3
Private Drive	332	13.62	1S	- -	- -	10	745.7	745.0	0.7	- -	- -	30	746.4	745.8	0.6	0.3	0.3	40	746.5	745.8	0.7	0.4	0.4
W. Maple Crest Drive	333	13.64	1S	10	Yes	10	746.0	745.7	0.3	- -	- -	30	746.8	746.4	0.4	- -	- -	40	746.8	746.5	0.3	- -	- -
Reservoir Outlet	335	13.65	1S	- -	- -	10	747.3	746.0	1.3	- -	- -	30	747.8	746.8	1.0	- -	- -	40	747.9	746.8	1.1	- -	- -
Private Bridge	340	13.76	1S	- -	- -	20	748.6	747.3	1.3	- -	- -	50	748.6	747.8	1.6	- -	- -	60	748.6	747.9	0.7	- -	- -
W. Puetz Road	345	13.79	1S	50	No	20	750.9	748.8	2.1	- -	- -	50	752.6	749.0	3.0	0.1	0.1	60	752.6	749.0	3.6	0.1	0.1

[a]*Measured in miles above mouth at Lake Michigan.*

[b]*Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table D-4

HYDROLOGIC-HYDRAULIC SUMMARY—UPPER OAK CREEK YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Ryan Road/STH 100	260	10.06	1S	50	No	1,030	682.0	680.9	1.1	3.6	--	1,620	684.5	682.2	2.3	5.9	0.3	1,830	685.0	682.7	2.3	6.4	0.8
Spillway	261	10.12	2S	--	--	1,030	682.0	682.0	0.0	--	--	1,620	684.5	684.5	0.0	--	--	1,830	685.0	685.0	0.0	--	--
Soo Line Railroad	265	10.24	1S	100	Yes	1,030	682.1	682.1	0.0	--	--	1,620	684.8	684.5	0.3	--	--	1,830	685.4	685.0	0.4	--	--
Private Bridge	270	10.25	1S	--	--	1,030	684.8	682.1	2.7	3.0	3.0	1,620	685.9	684.8	1.1	4.1	4.1	1,830	686.4	685.4	1.0	4.6	4.6
Private Bridge	275	10.46	1S	--	--	1,030	687.6	687.1	0.5	--	--	1,620	689.2	688.0	1.2	--	--	1,830	689.8	688.3	1.5	--	--
Private Bridge	280	10.60	1I	--	--	1,030	--	--	--	--	--	1,620	--	--	--	--	--	1,830	--	--	--	--	--
S. 13th Street/CTH V	285	10.69	1S	50	Yes	1,030	689.3	688.9	0.4	--	--	1,620	691.5	690.1	1.4	--	--	1,830	692.1	690.7	1.4	0.3	0.3
Pedestrian Bridge	286	10.72	1I	--	--	1,030	--	--	--	--	--	1,620	--	--	--	--	--	1,830	--	--	--	--	--
IH 94 Northbound	290	10.97	1S	100	Yes	690	690.0	690.0	0.0	--	--	1,140	691.9	691.9	0.0	--	--	1,330	692.4	692.4	0.0	--	--
IH 94 Southbound	295	10.99	1S	100	Yes	690	690.0	690.0	0.0	--	--	1,140	692.0	691.9	0.1	--	--	1,330	692.4	692.4	0.0	--	--
S. 20th Street	300	11.24	1S	10	No	690	692.3	690.1	2.2	0.3	0.3	1,140	693.1	692.0	1.1	1.1	1.1	1,330	693.3	692.5	0.8	1.3	1.3
S. 27th Street/CTH 41	305	11.70	1S	50	Yes	400	693.6	692.8	0.8	--	--	700	695.4	693.8	1.6	--	--	840	695.6	694.0	1.6	--	--
S. 31st Street	310	11.97	1S	10	Yes	200	697.8	697.8	0.0	--	--	390	699.2	698.5	0.7	--	--	490	699.9	698.7	1.2	0.3	--
Private Bridge	312	12.23	1S	--	--	200	702.8	702.2	0.6	--	--	390	704.1	702.7	1.4	0.1	0.1	490	704.8	702.8	2.0	0.8	0.8
W. Ryan Road/STH 100	315	12.52	1S	50	Yes	200	711.9	709.4	2.5	--	--	390	714.9	710.3	4.6	--	--	490	717.6	710.5	7.1	--	--
Concrete Drop Sill	316	12.69	2S	--	--	200	713.8	713.8	0.0	--	--	390	715.3	715.3	0.0	--	--	490	717.6	717.6	0.0	--	--
Concrete Drop Sill	317	12.90	2S	--	--	200	719.0	719.0	0.0	--	--	390	720.6	720.6	0.0	--	--	490	721.1	721.1	0.0	--	--
Concrete Drop Sill	318	13.07	2S	--	--	100	724.0	724.0	0.0	--	--	170	725.5	725.5	0.0	--	--	210	726.0	726.0	0.0	--	--
W. Southland Drive	320	13.18	1S	10	Yes	100	731.7	730.6	1.1	--	--	170	732.5	731.0	1.5	--	--	210	733.0	731.2	1.8	--	--
W. Woodward Drive	325	13.31	1S	10	Yes	50	733.8	733.6	0.2	--	--	90	734.4	734.0	0.4	--	--	110	734.6	734.2	0.4	--	--
W. Glenwood Drive	330	13.58	1S	10	Yes	10	743.4	741.8	1.6	--	--	30	744.6	742.0	2.6	--	--	40	744.8	742.1	2.7	0.2	0.2
Private Drive	331	13.60	1S	--	--	10	745.0	743.4	1.6	--	--	30	745.8	744.6	1.2	0.3	0.3	40	745.8	744.8	1.0	0.3	0.3
Private Drive	332	13.62	1S	--	--	10	745.7	745.0	0.7	--	--	30	746.4	745.8	0.6	0.3	0.3	40	746.5	745.8	0.7	0.4	0.4
W. Maple Crest Drive	333	13.64	1S	10	Yes	10	746.0	745.7	0.3	--	--	30	746.8	746.4	0.4	--	--	40	746.8	746.5	0.3	--	--
Reservoir Outlet	335	13.65	1S	--	--	10	747.3	746.0	1.3	--	--	30	747.8	746.8	1.0	--	--	40	747.9	746.8	1.1	--	--
Private Bridge	340	13.76	1S	--	--	20	748.6	747.3	1.3	--	--	50	748.6	747.8	1.6	--	--	60	748.6	747.9	0.7	--	--
W. Puetz Road	345	13.79	1S	50	No	20	750.9	748.8	2.1	--	--	50	752.6	749.0	3.0	0.1	0.1	60	752.6	749.0	3.6	0.1	0.1

[a] *Measured in miles above mouth at Lake Michigan.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table D-5

HYDROLOGIC-HYDRAULIC SUMMARY—MITCHELL FIELD DRAINAGE DITCH YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Chicago & North Western Railway	500	0.14	1S	100	Yes	580	661.1[f]	661.1[f]	0.0	- -	- -	900	662.2	662.0[f]	0.2	- -	- -	1,050	662.7	662.4[f]	0.3	- -	- -
E. Rawson Avenue/ CTH BB	505	0.80	1S	50	Yes	560	665.3	665.0	0.3	- -	- -	830	666.5	665.6	0.9	- -	- -	950	667.0	665.8	1.2	- -	- -
E. College Avenue/ CTH ZZ	510	1.83	1S	50	No	450	672.6	672.1	0.5	- -	- -	560	673.8	672.9	0.9	0.4	- -	620	674.0	673.1	0.9	0.6	0.2
Private Bridge	515	2.15	1S	- -	- -	450	674.3	673.7	0.6	3.5	1.5	560	675.0	674.5	0.5	4.2	2.2	620	675.3	674.8	0.5	4.5	2.5
Airport Runway Culvert	520	2.60	1S	- -	- -	305	680.1	674.9	5.2	0.3	- -	310	680.3	675.4	4.9	0.5	- -	315	680.5	675.7	4.8	0.7	- -
Private Bridge	525	2.74	1S	- -	- -	640	680.1[g]	680.1[g]	0.0	3.4	1.5	1,010	680.3[g]	680.3[g]	0.0	3.6	1.7	1,180	680.5[g]	680.5[g]	0.0	3.8	1.9
Pedestrian Bridge	530	2.80	1S	- -	- -	640	680.1[g]	680.1[g]	0.0	1.1	- -	1,010	681.5	680.3[g]	1.2	2.5	0.9	1,180	681.9	680.5[g]	1.4	2.9	1.3
Private Bridge	535	3.10	1S	- -	- -	640	687.1	684.9	2.2	2.2	2.0	1,010	687.6	685.7	1.9	2.7	2.5	1,180	687.8	686.0	1.8	2.9	2.7
S. Howell Avenue/ STH 38	540	3.31	1S	50	Yes	640	692.0	689.8	2.2	- -	- -	1,010	693.8	690.5	3.3	- -	- -	1,180	694.6	690.7	3.9	- -	- -

[a] *Measured in miles above confluence with Oak Creek.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *The flood stage indicated represents the water surface elevation of Oak Creek at the confluence with the Mitchell Field Drainage Ditch.*

[g] *The flood stage indicated represents the water surface elevation due to the backwater from the airport runway culvert.*

Source: SEWRPC.

Table D-6

HYDROLOGIC-HYDRAULIC SUMMARY—NORTH BRANCH OAK CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Soo Line Railroad[f]	400	0.10	1S	100	Yes	1,210	685.3	682.7	2.6	- -	- -	2,000	687.8	684.0	3.8	- -	- -	2,320	689.3	684.4	4.9	- -	- -
Private Bridge	402	0.21	1S	- -	- -	1,210	687.2	686.4	0.8	2.4	0.6	2,000	688.7	688.6	0.1	3.9	2.1	2,320	689.9	689.8	0.1	5.1	3.3
Private Bridge	403	0.34	1I	- -	- -	1,210	- -	- -	- -	- -	- -	2,000	- -	- -	- -	- -	- -	2,320	- -	- -	- -	- -	- -
W. Puetz Road	405	0.92	1S	50	No	1,130	696.4	695.4	1.0	- -	- -	1,750	698.6	696.6	2.0	0.8	0.7	1,940	699.0	696.9	2.1	1.2	1.1
Private Bridge	407	1.71	1S	- -	- -	1,130	703.9	703.8	0.1	2.8	2.8	1,750	704.9	704.8	0.1	3.8	3.8	1,940	705.1	705.0	0.1	4.0	4.0
W. Wildwood Drive	410	2.00	1S	10	No	940	704.8	704.8	0.0	1.2	1.2	1,190	705.8	705.7	0.1	2.2	2.2	1,260	706.0	706.0	0.0	2.4	2.4
W. Drexel Avenue	415	2.21	1S	50	Yes	940	705.6	705.0	0.6	- -	- -	1,190	707.0	705.9	1.1	- -	- -	1,260	707.3	706.2	1.1	- -	- -
Soo Line Railroad	420	2.25	1S	100	Yes	890	709.4	705.6	3.8	- -	- -	1,130	710.9	706.9	4.0	- -	- -	1,190	711.4	707.3	4.1	- -	- -
S. 6th Street	425	2.41	1S	10	No	890	710.0	709.4	0.6	1.5	1.4	1,130	711.0	711.0	0.0	2.5	2.4	1,190	711.5	711.5	0.0	3.0	2.9
W. Marquette Avenue	430	3.04	1S	10	No	560	714.0	713.8	0.2	2.0	2.0	820	714.7	714.5	0.2	2.7	2.7	900	714.9	714.7	0.2	2.9	2.9
W. Rawson Avenue/ CTH BB	435	3.51	1S	50	Yes	560	714.8	714.5	0.3	- -	- -	820	715.9	715.2	0.7	- -	- -	900	716.3	715.4	0.9	- -	- -
S. 6th Street	436	3.86	1S	10	Yes	560	717.0	716.5	0.5	- -	- -	820	718.1	717.4	0.7	- -	- -	900	718.5	717.7	0.8	- -	- -
Spillway	437	3.90	4S	- -	- -	560	717.1	717.0	0.1	- -	- -	820	718.1	718.1	0.0	- -	- -	900	718.5	718.5	0.0	- -	- -
Spillway	438	4.20	4S	- -	- -	560	724.5	724.4	0.1	- -	- -	820	725.0	724.9	0.1	- -	- -	900	725.3	725.2	0.1	- -	- -
Private Bridge	439	4.35	1S	- -	- -	150	725.5	726.0	0.5	0.6	- -	220	725.8	725.5	0.3	0.9	- -	240	726.0	725.8	0.2	1.1	- -
Private Bridge	440	4.59	1S	- -	- -	150	730.3	729.4	0.9	- -	- -	220	731.3	729.9	1.4	- -	- -	240	731.5	730.1	1.4	- -	- -
Private Bridge	441	4.62	1S	- -	- -	150	730.6	730.3	0.3	- -	- -	220	731.7	731.3	0.4	- -	- -	240	732.0	731.5	0.5	- -	- -
Private Bridge	442	4.67	1S	- -	- -	150	731.2	730.8	0.4	- -	- -	220	732.3	731.8	0.5	- -	- -	240	732.6	732.1	0.5	- -	- -
Private Bridge	443	4.74	1S	- -	- -	150	731.3	731.3	0.0	- -	- -	220	732.4	732.4	0.0	- -	- -	240	732.7	732.7	0.0	- -	- -
Soo Line Railroad	444	4.75	1S	100	Yes	120	732.4	731.3	1.1	- -	- -	200	735.4	732.4	3.0	- -	- -	220	736.3	732.7	3.6	- -	- -
W. College Avenue/ CTH ZZ	445	4.91	1S	50	Yes	145	732.4[g]	732.4[g]	0.0	- -	- -	250	735.4[g]	735.4[g]	0.0	- -	- -	280	736.3[g]	736.3[g]	0.0	- -	- -
Private Bridge	450	4.94	1S	- -	- -	190	732.4[g]	732.4[g]	0.0	- -	- -	350	735.4[g]	735.4[g]	0.0	2.3	0.9	390	736.3[g]	736.3[g]	0.0	3.2	1.8
S. 13th Street	455	5.21	1S	50	Yes[h]	190	732.4	732.4[g]	0.0	- -	- -	350	735.4[g]	735.4[g]	0.0	0.4	- -	390	736.3[g]	736.3[g]	0.0	1.3	- -
W. Ramsey Avenue and IH 94 Box Culvert	460	5.65	1S	100	Yes	250	735.3	734.2	1.1	- -	- -	370	736.6	735.4[g]	1.2	- -	- -	410	737.0	736.3[g]	0.7	- -	- -
IH 94 Exit Ramp	462	5.85	1S	- -	- -	250	739.2	736.7	2.5	- -	- -	370	740.4	737.4	3.0	- -	- -	410	740.8	737.7	3.1	- -	- -

[a] *Measured in miles above confluence with Oak Creek.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *There is a drop of about 4.0 feet in the streambed at the downstream side of the Soo Line Railroad bridge.*

[g] *The flood stage indicated represents the water surface elevation due to the backwater from the Soo Line Railroad bridge at River Mile 4.75.*

[h] *The approach road is overtopped due to backwater from the Soo Line Railroad bridge. It is not due to an inadequate hydraulic capacity of the culverts at S. 13th Street.*

Source: SEWRPC.

Table D-7

HYDROLOGIC-HYDRAULIC SUMMARY—NORTH BRANCH OAK CREEK YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Soo Line Railroad[f]	400	0.10	1S	100	Yes	1,210	685.3	682.7	2.6	- -	- -	2,000	687.8	684.0	3.8	- -	- -	2,320	689.3	684.4	4.9	- -	- -
Private Bridge	402	0.21	1S	- -	- -	1,210	687.2	686.4	0.8	2.4	0.6	2,000	688.7	688.6	0.1	3.9	2.1	2,320	689.9	689.8	0.1	5.1	3.3
Private Bridge	403	0.34	1I	- -	- -	1,210	- -	- -	- -	- -	- -	2,000	- -	- -	- -	- -	- -	2,320	- -	- -	- -	- -	- -
W. Puetz Road	405	0.92	1S	50	No	1,130	696.4	695.4	1.0	- -	- -	1,750	698.6	696.6	2.0	0.8	0.7	1,940	699.0	696.9	2.1	1.2	1.1
Private Bridge	407	1.71	1S	- -	- -	1,130	703.9	703.8	0.1	2.8	2.8	1,750	704.9	704.8	0.1	3.8	3.8	1,940	705.1	705.0	0.1	4.0	4.0
W. Wildwood Drive	410	2.00	1S	10	No	940	704.8	704.8	0.0	1.2	1.2	1,190	705.8	705.7	0.1	2.2	2.2	1,260	706.0	706.0	0.0	2.4	2.4
W. Drexel Avenue	415	2.21	1S	50	Yes	940	705.6	705.0	0.6	- -	- -	1,190	707.0	705.9	1.1	- -	- -	1,260	707.3	706.2	1.1	- -	- -
Soo Line Railroad	420	2.25	1S	100	Yes	890	709.4	705.6	3.8	- -	- -	1,130	710.9	706.9	4.0	- -	- -	1,190	711.4	707.3	4.1	- -	- -
S. 6th Street	425	2.41	1S	10	No	890	710.0	709.4	0.6	1.5	1.4	1,130	711.0	711.0	0.0	2.5	2.4	1,190	711.5	711.5	0.0	3.0	2.9
W. Marquette Avenue	430	3.04	1S	10	No	560	714.0	713.8	0.2	2.0	2.0	820	714.7	714.5	0.2	2.7	2.7	900	714.9	714.7	0.2	2.9	2.9
W. Rawson Avenue/ CTH BB	435	3.51	1S	50	Yes	560	714.8	714.5	0.3	- -	- -	820	715.9	715.2	0.7	- -	- -	900	716.3	715.4	0.9	- -	- -
S. 6th Street	436	3.86	1S	10	Yes	560	717.0	716.5	0.5	- -	- -	820	718.1	717.4	0.7	- -	- -	900	718.5	717.7	0.8	- -	- -
Spillway	437	3.90	4S	- -	- -	560	717.1	717.0	0.1	- -	- -	820	718.1	718.1	0.0	- -	- -	900	718.5	718.5	0.0	- -	- -
Spillway	438	4.20	4S	- -	- -	560	724.5	724.4	0.1	- -	- -	820	725.0	724.9	0.1	- -	- -	900	725.3	725.2	0.1	- -	- -
Private Bridge	439	4.35	1S	- -	- -	150	725.4	725.0	0.4	0.5	- -	220	725.7	725.5	0.2	0.8	- -	240	725.9	725.8	0.1	1.0	- -
Private Bridge	440	4.59	1S	- -	- -	150	727.6	727.3	0.3	- -	- -	220	728.6	728.2	0.4	- -	- -	240	728.8	728.4	0.4	- -	- -
Private Bridge	441	4.62	1S	- -	- -	150	727.8	727.6	0.2	- -	- -	220	728.9	728.6	0.3	- -	- -	240	729.2	728.8	0.4	- -	- -
Private Bridge	442	4.67	1S	- -	- -	150	728.4	728.1	0.3	- -	- -	220	729.4	729.2	0.2	- -	- -	240	729.7	729.4	0.3	- -	- -
Private Bridge	443	4.74	1S	- -	- -	150	728.7	728.6	0.1	- -	- -	220	729.7	729.7	0.0	- -	- -	240	730.0	730.0	0.0	- -	- -
Soo Line Railroad	444	4.75	1S	100	Yes	120	729.8	728.7	1.1	- -	- -	200	732.7	729.7	3.0	- -	- -	220	733.5	730.0	3.5	- -	- -
W. College Avenue/ CTH ZZ	445	4.91	1S	50	Yes	145	729.8	729.8	0.0	- -	- -	250	732.7	732.7	0.0	- -	- -	280	733.5	733.5	0.0	- -	- -
Private Bridge	450	4.94	1S	- -	- -	145	729.8	729.8	0.0	- -	- -	250	732.7	732.7	0.0	- -	- -	280	733.5	733.5	0.0	- -	- -
S. 13th Street	455	5.21	1S	50	Yes	190	731.8	730.0	1.8	- -	- -	350	732.9	732.7	0.2	- -	- -	390	733.5	733.5	0.0	- -	- -
W. Ramsey Avenue and IH 94 Box Culvert	460	5.65	1S	100	Yes	250	735.3	734.2	1.1	- -	- -	370	736.6	735.0	1.6	- -	- -	410	737.0	735.1	1.9	- -	- -
IH 94 Exit Ramp	462	5.85	1S	- -	- -	250	739.2	736.7	2.5	- -	- -	370	740.4	737.4	3.0	- -	- -	410	740.8	737.7	3.1	- -	- -

[a] *Measured in miles above confluence with Oak Creek.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *There is a drop of about 4.0 feet in the streambed at the downstream side of the Soo Line Railroad bridge.*

Source: SEWRPC.

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Appendix E

HYDROLOGIC-HYDRAULIC SUMMARY FOR STRUCTURES IN THE ROOT RIVER WATERSHED

Table E-1

HYDROLOGIC-HYDRAULIC SUMMARY—ROOT RIVER
YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Main Street/STH 32	100	0.30	1I	--	--	3,400	--	--	--	--	--	4,500	--	--	--	--	--	4,900	--	--	--	--	--
State Street	105	0.53	1I	--	--	3,400	--	--	--	--	--	4,500	--	--	--	--	--	4,900	--	--	--	--	--
Marquette Street	110	1.19	1I	--	--	3,400	--	--	--	--	--	4,500	--	--	--	--	--	4,900	--	--	--	--	--
Footbridge	115	1.33	1I	--	--	3,400	--	--	--	--	--	4,500	--	--	--	--	--	4,900	--	--	--	--	--
E. 6th Street	120	1.45	1I	--	--	3,400	--	--	--	--	--	4,500	--	--	--	--	--	4,900	--	--	--	--	--
Chicago & North Western Railway	125	1.61	1I	--	--	3,400	--	--	--	--	--	4,500	--	--	--	--	--	4,900	--	--	--	--	--
Memorial Drive	130	1.70	1S	50	Yes	3,400	683.1	683.1	0.0	--	--	4,500	684.2	684.2	0.0	--	--	4,900	684.6	684.6	0.0	--	--
Footbridge	135	2.27	1I	--	--	3,400	--	--	--	--	--	4,400	--	--	--	--	--	4,900	--	--	--	--	--
W. 6th Street	140	2.73	1I	--	--	3,400	--	--	--	--	--	4,400	--	--	--	--	--	4,900	--	--	--	--	--
Liberty Street (west channel)	142	2.80	1S	10	Yes	3,400	586.0	585.9	0.1	--	--	4,400	587.0	586.9	0.1	--	--	4,900	587.4	587.3	0.1	--	--
Footbridge (west channel)	143	3.09	1S	--	--	3,400	587.0	586.9	0.1	--	--	4,400	588.2	588.2	0.0	0.2	--	4,900	588.8	588.7	0.1	0.8	--
Footbridge (east channel)	145	2.94	1S	--	--	3,400	586.6	586.6	0.0	--	--	4,400	587.9	587.6	0.3	0.0	--	4,900	588.4	588.0	0.4	0.5	--
Liberty Street (east channel)	150	3.15	1S	10	Yes	3,400	587.3	587.3	0.0	--	--	4,400	588.5	588.5	0.0	--	--	4,900	589.0	589.0	0.0	--	--
Spring Street/CTH C	155	3.39	1S	50	Yes	3,400	587.7	587.7	0.0	--	--	4,400	589.0	589.0	0.0	--	--	4,900	589.4	589.4	0.0	--	--
Luedtke Court	160	3.50	1S	10	Yes	3,400	588.4	588.3	0.1	--	--	4,400	589.9	589.7	0.2	--	--	4,900	590.3	590.1	0.2	--	--
Footbridge	163	3.72	1I	--	--	3,400	--	--	--	--	--	4,400	--	--	--	--	--	4,900	--	--	--	--	--
Footbridge	170	4.28	1I	--	--	3,300	--	--	--	--	--	4,300	--	--	--	--	--	4,800	--	--	--	--	--
Footbridge	175	4.57	1I	--	--	3,300	--	--	--	--	--	4,300	--	--	--	--	--	4,800	--	--	--	--	--
Footbridge	180	5.02	1I	--	--	3,300	--	--	--	--	--	4,300	--	--	--	--	--	4,800	--	--	--	--	--
Footbridge	185	5.10	1I	--	--	3,300	--	--	--	--	--	4,300	--	--	--	--	--	4,800	--	--	--	--	--
Racine Country Club Service Road	190	5.35	1S	--	--	3,300	607.7	607.6	0.1	--	--	4,300	608.5	608.4	0.1	--	--	4,800	608.9	608.8	0.1	--	--
Northwestern Avenue/STH 38	195	5.91	1S	50	Yes	3,300	623.1	622.9	0.2	--	--	4,300	624.2	623.9	0.3	--	--	4,800	624.6	624.4	0.2	--	--
Horlick Dam	200	5.97	2S	--	--	3,200	634.3	623.7	10.6	--	--	4,300	635.2	624.9	10.3	--	--	4,800	635.5	625.4	10.1	--	--
Green Bay Road/STH 31	210	9.38	1S	50	Yes	3,200	638.0	638.0	0.0	--	--	4,300	639.3	639.3	0.0	--	--	4,800	639.9	639.9	0.0	--	--
Abandoned North Shore Railroad Grade	215	9.94	1S	--	--	3,200	639.8	639.4	0.4	--	--	4,300	641.0	640.5	0.5	--	--	4,800	641.5	640.9	0.6	--	--
Johnson Park Service Drive	220	10.95	1S	--	--	3,200	644.6	644.6	0.0	--	--	4,300	645.6	645.6	0.0	--	--	4,800	646.1	646.0	0.1	0.2	--
Footbridge	225	11.46	1S	--	--	3,200	645.2	645.2	0.0	3.2	--	4,300	646.3	646.3	0.0	4.3	--	4,800	646.8	646.8	0.0	4.8	--
Four Mile Road	230	12.41	1S	50	Yes	2,900	653.3	653.3	0.0	--	--	4,000	654.4	654.4	0.0	--	--	4,400	654.8	654.7	0.1	--	--
Five Mile Road	235	13.56	1S	50	No	2,900	656.5	656.4	0.1	--	--	4,000	657.7	657.6	0.1	0.4	--	4,400	658.1	658.0	0.1	0.8	--
Six Mile Road/CTH G	240	14.75	1S	50	Yes	2,900	659.6	659.6	0.0	--	--	3,900	660.7	660.7	0.0	--	--	4,300	661.1	661.1	0.0	--	--
Seven Mile Road	245	15.91	1S	50	Yes	2,800	661.6	661.6	0.0	--	--	3,800	662.7	662.6	0.1	--	--	4,200	663.1	663.0	0.1	--	--
Chicago & North Western Railway	250	16.63	1S	100	Yes	2,900	663.0	663.0	0.0	--	--	3,900	664.1	664.0	0.1	--	--	4,300	664.5	664.4	0.1	--	--
S. Nicholson Road	255	17.71	1S	50	Yes	3,100	665.1	665.1	0.0	--	--	4,100	666.1	666.1	0.0	--	--	4,500	666.5	666.5	0.0	--	--
S. Howell Avenue/STH 38	260	18.96	1S	50	No	3,200	667.6	667.5	0.1	--	--	4,200	668.7	668.4	0.3	0.4	--	4,600	669.0	668.8	0.2	0.7	--
Soo Line Railroad	265	19.79	1S	100	Yes	3,300	670.5	670.4	0.1	--	--	4,300	671.4	671.4	0.0	--	--	4,700	671.8	671.7	0.1	--	--
S. 13th Street/CTH V	270	20.45	1S	50	No	3,300	672.5	672.2	0.3	0.9	--	4,300	673.5	673.2	0.3	1.9	--	4,700	673.8	673.5	0.3	2.2	--
IH 94 Northbound	275	21.95	1I	--	--	3,300	--	--	--	--	--	4,400	--	--	--	--	--	4,800	--	--	--	--	--
IH 94 Southbound	280	21.97	1I	--	--	3,300	--	--	--	--	--	4,400	--	--	--	--	--	4,800	--	--	--	--	--
S. 27th Street/USH 41	285	22.03	1S	50	No	3,300	675.3	675.1	0.2	1.7	--	4,400	676.3	676.1	0.2	2.7	0.4	4,800	676.6	676.4	0.2	3.0	0.7
W. County Line Road	290	22.16	1S	50	No	3,300	675.9	675.5	0.4	0.9	0.9	4,400	676.8	676.5	0.3	1.8	1.8	4,800	677.2	676.9	0.3	2.2	2.2
S. 43rd Street	295	23.31	1S	10	No	3,400	677.2	677.2	0.0	1.4	--	4,500	678.3	678.3	0.0	2.5	--	4,900	678.7	678.7	0.0	2.9	--
W. County Line Road	300	23.84	1S	50	No	3,400	677.9	677.9	0.0	2.3	--	4,500	679.1	679.0	0.1	3.5	--	4,900	679.5	679.5	0.0	3.9	--
S. 60th Street	305	25.53	1S	10	No	3,400	680.2	680.0	0.2	1.4	--	4,500	681.2	681.0	0.2	2.4	--	4,900	681.6	681.4	0.2	2.8	--

[a] *Measured in miles above mouth at Lake Michigan.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table E-2

HYDROLOGIC-HYDRAULIC SUMMARY—NORTH BRANCH ROOT RIVER YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Oakwood Road	310	26.17	1I	--	--	2,850	--	--	--	--	--	4,450	--	--	--	--	--	4,900	--	--	--	--	--
W. Ryan Road	315	27.92	1S	50	Yes	2,600	683.4	683.4	0.0	--	--	4,000	684.3	684.3	0.0	--	--	4,650	684.7	684.6	0.1	--	--
Work Farm Bridge	320	28.73	1I	--	--	2,600	--	--	--	--	--	4,200	--	--	--	--	--	4,900	--	--	--	--	--
W. Drexel Avenue	335	30.89	1S	50	No	2,700	694.2	693.6	0.6	0.0	--	4,300	695.2	694.9	0.3	1.0	0.0	5,150	695.6	695.6	0.0	1.4	0.4
Private Drive	355	31.92	1S	--	--	2,800	699.3	697.8	1.5	3.7	3.7	4,400	700.3	699.4	0.9	4.7	4.7	5,250	700.8	700.1	0.7	5.2	5.2
Private Drive	360	31.99	1S	--	--	2,900	700.0	699.7	0.3	6.3	6.3	4,500	701.3	700.8	0.5	7.6	7.6	5,350	702.0	701.4	0.6	8.3	8.3
W. Rawson Avenue/ CTH BB	365	32.37	1S	50	No	2,900	700.7	700.6	0.1	--	--	4,500	702.4	702.2	0.2	0.8	--	5,350	703.2	703.0	0.2	1.6	0.2
W. Loomis Road/ STH 36	370	33.73	1S	50	Yes	2,900	701.8	701.8	0.0	--	--	4,600	703.6	703.6	0.0	--	--	5,450	704.5	704.4	0.1	--	--
Parkway Drive	375	33.96	1S	10	No	2,900	703.8	702.6	1.2	0.5	--	4,600	705.4	704.4	1.0	2.1	--	5,450	706.0	705.3	0.7	2.7	--
S. 76th Street/ CTH V	380	34.41	1S	50	No	2,900	705.6	704.0	1.6	0.6	--	4,600	707.2	705.6	1.6	2.2	1.5	5,450	707.5	706.2	1.3	2.5	1.8
W. College Avenue/ CTH ZZ	390	35.66	1S	10	Yes	1,950	708.0	708.0	0.0	--	--	2,910	709.3	709.3	0.0	--	--	3,350	711.2	709.9	1.3	0.6	--
W. Grange Avenue	400	36.70	1S	50	Yes	1,950	714.6	714.4	0.2	--	--	2,910	715.7	715.3	0.4	--	--	3,350	716.1	715.6	0.5	--	--
S. 84th Street	410	37.06	1S	10	Yes	1,950	716.0	716.0	0.0	--	--	2,910	718.3	717.4	0.9	0.9	--	3,350	718.7	717.9	0.8	1.3	--
Parkway Drive	415	37.39	1S	10	No	1,950	717.4	717.1	0.3	2.1	--	2,910	718.8	718.5	0.3	3.5	0.1	3,350	719.0	718.9	0.1	3.7	0.3
W. Forest Home Avenue/STH 24	420	37.67	1S	50	Yes	1,950	718.1	718.0	0.1	--	--	2,910	719.6	719.2	0.4	--	--	3,350	720.0	719.5	0.5	--	--
Abandoned Speed Rail Bridge	425	38.42	1S	--	--	2,160	720.0	719.7	0.3	3.1	--	3,720	721.8	721.4	0.4	4.9	--	4,280	722.4	721.9	0.5	5.5	--
W. Layton Avenue/ CTH Y	430	38.62	1S	50	No	2,160	722.3	721.8	0.5	0.8	--	3,720	723.5	723.3	0.2	2.0	--	4,280	724.0	723.8	0.2	2.5	0.4
Rock Freeway (eastbound)/IH 43	435	38.68	1I	--	--	2,160	--	--	--	--	--	3,720	--	--	--	--	--	4,280	--	--	--	--	--
Rock Freeway (westbound)/IH 43	440	38.71	1I	--	--	2,160	--	--	--	--	--	3,720	--	--	--	--	--	4,280	--	--	--	--	--
W. Cold Spring Road	445	39.17	1S	10	No	1,800	724.3	724.1	0.2	0.1	--	3,000	725.8	724.9	0.7	1.6	0.1	3,500	726.1	725.2	0.9	1.9	0.4
Bicycle Trail Bridge	447	39.46	1I	--	--	1,800	--	--	--	--	--	3,000	--	--	--	--	--	3,500	--	--	--	--	--
S. 108th Street (northbound)/STH 100	450	39.59	1S	50	No	1,800	--	726.5	--	--	--	3,000	--	727.6	--	--	--	3,500	--	727.9	--	--	--
S. 108th Street (southbound)/STH 100	455	39.61	1S	50	No	1,800	726.6	--	--	--	--	3,000	727.8	--	--	--	--	3,500	728.1	--	--	--	--
W. Beloit Road/CTH T	460	39.79	1S	50	No	1,800	729.2	727.0	2.2	0.6	--	3,000	729.9	728.1	1.8	1.3	0.6	3,500	730.1	728.4	1.7	1.5	0.8
W. Morgan Avenue	465	40.38	1S	10	No	1,800	729.8	729.6	0.2	1.5	--	3,000	730.5	730.4	0.1	2.2	0.6	3,500	730.8	730.6	0.2	2.5	0.9
S. 116th Street	470	40.63	1S	10	No	1,800	730.6	730.3	0.3	1.5	--	3,000	731.2	731.2	0.0	2.1	0.0	3,500	731.5	731.4	0.1	2.4	0.3
W. Oklahoma Avenue/CTH NN	475	40.97	1S	50	No	1,050	733.1	732.5	0.6	0.4	--	1,780	733.8	733.2	0.6	1.1	--	2,000	734.0	733.5	0.5	1.3	--
Footbridge	480	41.12	1I	--	--	1,050	--	--	--	--	--	1,780	--	--	--	--	--	2,000	--	--	--	--	--
W. Cleveland Avenue	490	41.53	1S	50	No	710	743.5	740.3	3.2	1.2	--	1,260	744.0	741.4	2.6	1.7	--	1,410	744.2	741.6	0.6	1.9	0.0
Parkway Drive	495	41.95	1S	10	No	710	752.3	751.2	1.1	4.0	1.0	1,260	752.8	751.5	1.3	4.5	1.5	1,410	752.9	751.6	1.3	4.6	1.6

[a] *Measured in miles above confluence with the Root River.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table E-3

HYDROLOGIC-HYDRAULIC SUMMARY—NORTH BRANCH ROOT RIVER YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Oakwood Road	310	26.17	1I	- -	- -	2,850	- -	- -	- -	- -	- -	4,450	- -	- -	- -	- -	- -	4,900	- -	- -	- -	- -	- -
W. Ryan Road	315	27.92	1S	50	Yes	2,600	683.4	683.4	0.0	- -	- -	4,000	684.3	684.3	0.0	- -	- -	4,650	684.7	684.6	0.1	- -	- -
Work Farm Bridge	320	28.73	1I	- -	- -	2,600	- -	- -	- -	- -	- -	4,200	- -	- -	- -	- -	- -	4,900	- -	- -	- -	- -	- -
W. Drexel Avenue	335	30.89	1S	50	No	2,750	694.2	693.6	0.6	0.0	- -	4,350	695.2	695.0	0.2	1.0	0.0	5,250	695.6	695.6	0.0	1.4	0.4
Private Drive	355	31.92	1S	- -	- -	2,850	699.4	697.9	1.5	3.8	3.8	4,450	700.3	699.5	0.8	4.7	4.7	5,350	700.8	700.2	0.6	5.2	5.2
Private Drive	360	31.99	1S	- -	- -	2,950	700.0	699.7	0.3	6.3	6.3	4,550	701.3	700.8	0.5	7.6	7.6	5,450	702.0	701.5	0.5	8.3	8.3
W. Rawson Avenue/ CTH BB	365	32.37	1S	50	No	2,950	700.8	700.6	0.2	- -	- -	4,550	702.5	702.2	0.3	0.9	- -	5,450	703.3	703.1	0.2	1.7	0.3
W. Loomis Road/ STH 36	370	33.73	1S	50	Yes	2,950	701.9	701.9	0.0	- -	- -	4,650	703.6	703.6	0.0	- -	- -	5,550	704.5	704.5	0.0	- -	- -
Parkway Drive	375	33.96	1S	10	No	2,950	703.9	702.7	1.2	0.6	- -	4,650	705.5	704.5	1.0	2.2	- -	5,550	706.0	705.4	0.6	2.7	- -
S. 76th Street/ CTH V	380	34.41	1S	50	No	2,950	705.7	704.1	1.6	0.7	0.0	4,650	707.2	705.7	1.5	2.2	1.5	5,550	707.5	706.2	1.3	2.5	1.8
W. College Avenue/ CTH ZZ	390	35.66	1S	10	Yes	2,000	708.1	708.1	0.0	- -	- -	3,060	709.3	709.3	0.0	- -	- -	3,430	711.3	709.9	1.4	0.7	- -
W. Grange Avenue	400	36.70	1S	50	Yes	2,000	714.7	714.4	0.3	- -	- -	3,060	715.8	715.4	0.4	- -	- -	3,430	716.2	715.7	0.5	- -	- -
S. 84th Street	410	37.06	1S	10	Yes	2,000	716.1	716.1	0.0	- -	- -	3,060	718.5	717.6	0.9	1.1	- -	3,430	718.7	718.0	0.7	1.3	- -
Parkway Drive	415	37.39	1S	10	No	2,000	717.5	717.2	0.3	2.2	- -	3,060	718.9	718.6	0.3	3.6	0.2	3,430	719.1	718.9	0.2	3.8	0.4
W. Forest Home Avenue/STH 24	420	37.67	1S	50	Yes	2,000	718.2	718.1	0.1	- -	- -	3,060	719.7	719.3	0.4	- -	- -	3,430	720.1	719.6	0.5	- -	- -
Abandoned Speed Rail Bridge	425	38.42	1S	- -	- -	2,270	720.1	719.8	0.3	3.2	- -	3,900	722.0	721.6	0.4	5.1	- -	4,440	722.5	722.1	0.4	5.6	- -
W. Layton Avenue/ CTH Y	430	38.62	1S	50	No	2,270	722.4	721.9	0.5	0.9	- -	3,900	723.7	723.4	0.3	2.2	0.1	4,440	724.1	723.9	0.2	2.6	0.5
Rock Freeway (eastbound)/IH 43	435	38.68	1I	- -	- -	2,270	- -	- -	- -	- -	- -	3,900	- -	- -	- -	- -	- -	4,440	- -	- -	- -	- -	- -
Rock Freeway (westbound)/IH 43	440	38.71	1I	- -	- -	2,270	- -	- -	- -	- -	- -	3,900	- -	- -	- -	- -	- -	4,440	- -	- -	- -	- -	- -
W. Cold Spring Road	445	39.17	1S	10	No	2,220	724.6	724.4	0.2	0.4	- -	3,430	726.0	725.1	0.9	1.8	0.3	3,880	726.2	725.4	0.8	2.0	0.5
Bicycle Trail Bridge	447	39.46	1I	- -	- -	2,220	- -	- -	- -	- -	- -	3,430	- -	- -	- -	- -	- -	3,880	- -	- -	- -	- -	- -
S. 108th Street (northbound)/STH 100	450	39.59	1S	50	No	2,220	- -	726.9	- -	- -	- -	3,430	- -	727.8	- -	- -	- -	3,880	- -	728.1	- -	- -	- -
S. 108th Street (southbound)/STH 100	455	39.61	1S	50	No	2,220	727.1	- -	- -	- -	- -	3,430	728.1	- -	- -	- -	- -	3,880	728.4	- -	- -	- -	- -
W. Beloit Road/CTH T	460	39.79	1S	50	No	2,220	729.5	727.4	2.1	0.9	0.2	3,430	730.1	728.4	1.7	1.5	0.8	3,880	730.3	728.7	1.6	1.7	1.0
W. Morgan Avenue	465	40.38	1S	10	No	2,220	730.0	729.9	0.1	1.7	0.1	3,430	730.7	730.6	0.1	2.4	0.8	3,880	731.0	730.8	0.2	2.7	1.1
S. 116th Street	470	40.63	1S	10	Yes	2,220	730.5	730.5	0.0	- -	- -	3,430	731.2	731.2	0.0	- -	- -	3,880	731.5	731.5	0.0	- -	- -
W. Oklahoma Avenue/CTH NN	475	40.97	1S	50	No	1,770	732.9	732.1	0.8	0.2	- -	2,670	733.7	732.8	0.9	1.0	- -	2,840	733.8	733.1	0.7	1.1	- -
Footbridge	480	41.12	1I	- -	- -	1,770	- -	- -	- -	- -	- -	2,670	- -	- -	- -	- -	- -	2,840	- -	- -	- -	- -	- -
W. Cleveland Avenue	490	41.53	1S	50	Yes	780	737.5	737.3	0.2	- -	- -	1,350	738.9	738.7	0.2	- -	- -	1,510	739.3	739.1	0.2	- -	- -
Parkway Drive	495	41.95	1S	10	No	780	752.3	750.8	1.5	4.0	1.0	1,350	752.8	751.4	1.4	4.5	1.5	1,510	752.9	751.5	1.4	4.6	1.6

[a] *Measured in miles above confluence with the Root River.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table E-4

HYDROLOGIC-HYDRAULIC SUMMARY—HALE CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Parkway Drive	2,200	0.06	1S	10	Yes	940	734.7	733.9[f]	0.8	- -	- -	1,420	736.0	734.7[f]	1.3	1.0	0.7	1,520	736.2	734.9[f]	1.3	1.2	0.9
W. Cleveland Avenue	2,205	0.30	1S	50	No	800	735.6	735.5	0.1	1.5	0.9	1,240	736.8	736.6	0.2	2.7	2.1	1,400	737.0	736.8	0.2	2.9	2.3
Storm Sewer Outfall	2,210	0.99	4I	- -	- -	300	- -	736.4	- -	- -	- -	530	- -	737.7	- -	- -	- -	580	- -	737.9	- -	- -	- -

[a]Measured in miles above confluence with the Root River.

[b]Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.

[c]A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.

[d]The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.

[e]Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.

[f]The flood stage indicated represents the water surface elevation on the Root River.

Source: SEWRPC.

Table E-5

HYDROLOGIC-HYDRAULIC SUMMARY—HALE CREEK YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Parkway Drive	2,200	0.06	1S	10	Yes	970	734.4	733.7[f]	0.7	- -	- -	1,440	735.8	734.7[f]	1.1	0.8	0.5	1,560	736.0	734.8[f]	1.2	1.0	0.7
W. Cleveland Avenue	2,205	0.30	1S	50	Yes	800	734.6	734.5	0.1	- -	- -	1,240	736.0	736.0	0.0	- -	- -	1,400	736.2	736.2	0.0	- -	- -
Storm Sewer Outfall	2,210	0.99	4I	- -	- -	300	- -	734.9	- -	- -	- -	530	- -	736.4	- -	- -	- -	580	- -	736.7	- -	- -	- -

[a]Measured in miles above confluence with the Root River.

[b]Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.

[c]A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.

[d]The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.

[e]Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.

[f]The flood stage indicated represents the water surface elevation on the Root River.

Source: SEWRPC.

Table E-6

HYDROLOGIC-HYDRAULIC SUMMARY—EAST BRANCH ROOT RIVER YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Private Drive	90	0.89	1I	--	--	700	--	--	--	--	--	1,280	--	--	--	--	--	1,490	--	--	--	--	--
Private Drive	95	1.02	1I	--	--	700	--	--	--	--	--	1,280	--	--	--	--	--	1,490	--	--	--	--	--
S. 51st Street	100	1.48	1S	50	No	700	714.4	713.7	0.7	--	--	1,280	717.4	714.8	2.6	0.6	0.3	1,490	717.8	715.1	2.7	1.0	0.7
Footbridge	104	1.64	1I	--	--	700	--	--	--	--	--	1,280	--	--	--	--	--	1,490	--	--	--	--	--
W. Drexel Avenue	105	1.67	1S	50	No	700	716.3	715.9	0.4	--	--	1,280	717.8	717.5	0.3	1.0	--	1,490	718.1	717.9	0.2	1.3	--
Private Drive	110	1.85	1I	--	--	700	--	--	--	--	--	1,280	--	--	--	--	--	1,490	--	--	--	--	--
Private Drive	115	2.06	1I	--	--	700	--	--	--	--	--	1,280	--	--	--	--	--	1,490	--	--	--	--	--
Private Drive	120	2.27	1I	--	--	610	--	--	--	--	--	1,160	--	--	--	--	--	1,390	--	--	--	--	--
Private Drive	125	2.35	1I	--	--	610	--	--	--	--	--	1,160	--	--	--	--	--	1,390	--	--	--	--	--
Private Drive	133	2.52	1I	--	--	610	--	--	--	--	--	1,160	--	--	--	--	--	1,390	--	--	--	--	--
Private Drive	135	2.55	1I	--	--	610	--	--	--	--	--	1,160	--	--	--	--	--	1,390	--	--	--	--	--
Private Drive	140	2.81	1I	--	--	610	--	--	--	--	--	1,160	--	--	--	--	--	1,390	--	--	--	--	--
Private Drive	144	3.37	1I	--	--	460	--	--	--	--	--	860	--	--	--	--	--	1,010	--	--	--	--	--
Footbridge	145	3 38	1I	--	--	460	--	--	--	--	--	860	--	--	--	--	--	1,010	--	--	--	--	--
Footbridge	150	3.42	1I	--	--	460	--	--	--	--	--	860	--	--	--	--	--	1,010	--	--	--	--	--
Footbridge	155	3.47	1I	--	--	460	--	--	--	--	--	860	--	--	--	--	--	1,010	--	--	--	--	--
Footbridge	156	3.50	1I	--	--	460	--	--	--	--	--	860	--	--	--	--	--	1,010	--	--	--	--	--
Footbridge	157	3.55	1I	--	--	460	--	--	--	--	--	860	--	--	--	--	--	1,010	--	--	--	--	--
Footbridge	158	3.57	1I	--	--	460	--	--	--	--	--	860	--	--	--	--	--	1,010	--	--	--	--	--
Footbridge	159	3.60	1I	--	--	460	--	--	--	--	--	860	--	--	--	--	--	1,010	--	--	--	--	--
W. Rawson Avenue/ CTH BB	160	3.66	1S	50	No	440	745.1	743.7	1.4	0.1	0.1	820	745.8	744.8	1.0	0.8	0.8	960	745.9	745.1	0.8	0.9	0.9
Private Drive	165	3.71	1I	--	--	440	--	--	--	--	--	820	--	--	--	--	--	960	--	--	--	--	--
Private Drive	185	4.70	1I	--	--	260	--	--	--	--	--	430	--	--	--	--	--	510	--	--	--	--	--
Trailer Park Bridge	190	4.80	1S	--	--	260	757.9	756.3	1.6	2.2	1.9	430	758.7	757.0	1.7	3.0	2.7	510	759.1	757.3	1.8	3.4	3.1
W. College Avenue/ CTH ZZ	195	4.91	1S	50	No	260	--[f]	758.7	--	--	--	430	--[f]	760.7	--	--	--	510	--[f]	761.4	--	--	--

[a]*Measured in miles above confluence with the Root River.*

[b]*Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f]*No flood stages were determined upstream of this structure.*

Source: SEWRPC.

Table E-7

HYDROLOGIC-HYDRAULIC SUMMARY—TESS CORNERS CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
S. 92nd Street	1,700	0.54	1S	50	No	850	712.6	711.0	1.6	--	--	1,710	715.4	712.7	2.7	0.3	--	2,030	716.1	714.0	2.1	1.0	--
Whitnall Park Drive	1,705	0.58	1S	--	--	850	715.0	714.3	0.7	--	--	1,710	717.2	715.5	1.7	1.0	--	2,030	717.8	716.1	1.7	1.6	0.2
Whitnall Park Dam	1,710	0.84	2S	--	--	850	725.0	717.3	7.7	--	--	1,710	725.4	717.7	7.7	--	--	2,030	725.6	717.8	7.7	--	--
W. Rawson Avenue/ CTH BB	1,745	2.04	1S	50	Yes	850	740.1	737.5	2.6	--	--	1,710	742.5	738.2	4.3	--	--	2,030	743.2	738.5	4.7	--	--
Private Drive	1,750	2.33	1I	--	--	1,080	--	--	--	--	--	1,920	--	--	--	--	--	2,240	--	--	--	--	--

[a]*Measured in miles above confluence with the Root River.*

[b]*Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table E-8

HYDROLOGIC-HYDRAULIC SUMMARY—WHITNALL PARK CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. College Avenue	1,905	0.06	1S	--	--	980	712.5	710.9	1.6	--	--	1,860	714.9	713.2	1.7	0.2	0.1	2,190	715.2	713.2	2.0	0.5	0.4
S. 92nd Street	1,910	0.17	1S	50	No	980	714.2	714.1	0.1	--	--	1,860	716.0	714.9	1.1	0.8	--	2,190	716.3	715.2	1.1	1.1	--
Whitnall Park Drive	1,915	0.24	1S	--	--	980	716.4	715.2	1.2	0.5	--	1,860	717.4	716.4	1.0	1.5	0.7	2,190	717.6	716.7	0.9	1.7	0.9
Whitnall Park Dam	1,916	0.26	2S	--	--	980	718.0	716.6	1.4	--	--	1,860	718.8	717.6	1.2	--	--	2,190	718.9	717.8	1.1	--	--
Whitnall Park Drive	1,920	0.39	1S	--	--	980	719.1	718.1	0.7	0.9	--	1,860	720.4	719.0	1.4	--	--	2,190	720.6	719.3	1.3	--	--
Whitnall Park Dam	1,921	0.40	2S	--	--	980	722.4	719.1	3.6	--	--	1,860	723.0	720.4	2.6	--	--	2,190	723.1	720.6	2.5	--	--
Footbridge	1,925	0.49	1I	--	--	980	--	--	--	--	--	1,860	--	--	--	--	--	2,190	--	--	--	--	--
Footbridge	1,930	0.63	1I	--	--	980	--	--	--	--	--	1,860	--	--	--	--	--	2,190	--	--	--	--	--
Whitnall Park Dam	1,931	0.64	2S	--	--	980	726.7	724.4	2.3	--	--	1,860	727.0	725.1	1.9	--	--	2,190	727.1	725.5	1.6	--	--
Footbridge	1,935	0.80	1I	--	--	980	--	--	--	--	--	1,860	--	--	--	--	--	2,190	--	--	--	--	--
Whitnall Park Drive	1,940	0.97	1S	--	--	1,000	733.5	732.4	1.1	0.3	--	1,500	734.9	733.0	1.9	1.7	1.2	1,800	735.0	733.3	1.7	1.8	1.3
Whitnall Park Drive	1,945	1.43	1S	--	--	1,000	753.6	753.0	0.6	--	--	1,500	754.5	753.9	0.6	--	--	1,800	755.2	754.3	0.9	--	--
Whitnall Park Drive	1,950	1.47	1S	--	--	1,000	757.0	755.8	1.2	--	--	1,500	759.1	758.1	1.0	--	--	1,800	761.6	759.3	2.3	0.9	0.9
S. 108th Street/ STH 100	1,955	1.62	1S	50	Yes	734	760.6	758.8	1.8	--	--	1,160	762.5	760.2	2.3	--	--	1,373	764.0	762.1	1.9	--	--
Private Drive	1,959	1.68	1S	--	--	592	761.6	761.2	0.4	3.8	3.8	1,000	763.2	762.8	0.4	5.4	5.4	1,207	764.4	764.1	0.3	6.6	6.6
W. Forest Home Avenue/CTH 100	1,960	1.70	1S	50	Yes	592	762.3	761.6	0.7	--	--	1,000	764.2	763.2	1.0	--	--	1,207	765.3	764.4	0.9	--	--
Private Drive	1,965	1.78	1S	--	--	592	767.4	765.4	2.0	1.8	1.8	1,000	768.0	766.8	1.2	2.4	2.4	1,207	768.3	767.1	1.2	2.7	2.7
Private Drive	1,970	1.81	1S	--	--	592	768.5	767.5	1.0	1.6	1.6	1,000	768.8	768.1	0.7	1.9	1.9	1,207	769.0	768.4	0.6	2.1	2.1

[a] *Measured in miles above confluence with Tess Corners Creek.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table E-9

HYDROLOGIC-HYDRAULIC SUMMARY—WHITNALL PARK CREEK YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. College Avenue	1,905	0.06	1S	--	--	980	712.5	710.9	1.6	--	--	1,860	714.9	713.2	1.7	0.2	0.1	2,190	715.2	713.2	2.0	0.5	0.4
S. 92nd Street	1,910	0.17	1S	50	No	980	714.2	714.1	0.1	--	--	1,860	716.0	714.9	1.1	0.8	--	2,190	716.3	715.2	1.1	1.1	--
Whitnall Park Drive	1,915	0.24	1S	--	--	980	716.4	715.2	1.2	0.5	--	1,860	717.4	716.4	1.0	1.5	0.7	2,190	717.6	716.7	0.9	1.7	0.9
Whitnall Park Dam	1,916	0.26	2S	--	--	980	718.0	716.6	1.4	--	--	1,860	718.8	717.6	1.2	--	--	2,190	718.9	717.8	1.1	--	--
Whitnall Park Drive	1,920	0.39	1S	--	--	980	719.1	718.6	0.7	0.9	--	1,860	720.4	719.0	1.4	--	--	2,190	720.6	719.3	1.3	--	--
Whitnall Park Dam	1,921	0.40	2S	--	--	980	722.4	719.1	3.6	--	--	1,860	723.0	720.4	2.6	--	--	2,190	723.1	720.6	2.5	--	--
Footbridge	1,925	0.49	1I	--	--	980	--	--	--	--	--	1,860	--	--	--	--	--	2,190	--	--	--	--	--
Footbridge	1,930	0.63	1I	--	--	980	--	--	--	--	--	1,860	--	--	--	--	--	2,190	--	--	--	--	--
Whitnall Park Dam	1,931	0.64	2S	--	--	980	726.7	724.4	2.3	--	--	1,860	727.0	725.1	1.9	--	--	2,190	727.1	725.5	1.6	--	--
Footbridge	1,935	0.80	1I	--	--	980	--	--	--	--	--	1,860	--	--	--	--	--	2,190	--	--	--	--	--
Whitnall Park Drive	1,940	0.97	1S	--	--	1,040	733.5	732.4	1.1	0.3	--	1,560	735.1	733.1	2.0	1.9	1.4	1,870	735.1	733.3	1.8	1.9	1.4
Whitnall Park Drive	1,945	1.43	1S	--	--	1,040	753.6	753.0	0.6	--	--	1,560	754.7	753.9	0.8	--	--	1,870	755.4	754.4	1.0	--	--
Whitnall Park Drive	1,950	1.47	1S	--	--	1,040	757.2	756.0	1.2	--	--	1,560	760.6	758.3	2.3	--	--	1,870	761.8	759.5	2.3	1.1	1.1
S. 108th Street/ STH 100	1,955	1.62	1S	50	Yes	902	761.5	758.9	2.6	--	--	1,350	763.3	761.1	2.2	--	--	1,554	764.6	762.2	2.4	--	--
Private Drive	1,959	1.68	1S	--	--	760	762.3	761.9	0.4	4.5	4.5	1,200	763.9	763.5	0.4	6.1	6.1	1,398	765.0	764.7	0.3	7.2	7.2
W. Forest Home Avenue/CTH 100	1,960	1.70	1S	50	Yes	760	763.1	762.3	0.8	--	--	1,200	765.1	763.9	1.2	--	--	1,398	766.1	765.0	1.1	--	--
Private Drive[f]	1,965	1.78	1S	--	--	760	--	--	--	--	--	1,200	--	--	--	--	--	1,398	--	--	--	--	--
Private Drive	1,970	1.81	1S	--	--	760	765.6	765.6	0.0	--	--	1,200	768.6	766.7	1.9	1.0	0.7	1,398	768.7	767.2	1.5	1.1	0.8

[a] *Measured in miles above confluence with Tess Corners Creek.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *This structure is recommended to be removed and not replaced.*

Source: SEWRPC.

Table E-10

HYDROLOGIC-HYDRAULIC SUMMARY—NORTHWEST BRANCH WHITNALL PARK CREEK: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Private Drive	2,200	0.04	1S	--	--	204	770.2	769.1	1.1	--	--	335	770.7	768.9	1.8	0.2	--	398	771.4	769.0	2.4	0.9	--
W. Janesville Road	2,205	0.09	1S	50	Yes	204	772.2	771.5	0.7	--	--	335	773.1	772.1	1.0	--	--	398	773.5	772.2	1.3	--	--
Private Drive	2,210	0.11	1S	--	--	200	772.8	772.8	0.0	--	--	275	775.3	773.7	1.6	0.4	0.4	311	775.5	774.2	1.3	0.6	0.6
W. Godsell Road	2,215	0.25	1S	10	Yes	200	776.0	775.7	0.3	--	--	275	776.6	776.1	0.5	--	--	311	776.9	776.3	0.6	--	--
W. Parnell Avenue	2,220	0.385	1S	10	Yes	200	782.5	780.9	1.6	--	--	275	782.6	781.0	1.6	--	--	311	782.9	781.3	1.6	--	--

[a] *Measured in miles above confluence with Whitnall Park Creek.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table E-11

HYDROLOGIC-HYDRAULIC SUMMARY—NORTHWEST BRANCH WHITNALL PARK CREEK: YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Private Drive	2,200	0.04	1S	--	--	305	768.6	768.6	0.0	--	--	473	768.6	768.6	--	--	--	545	769.2	768.8	0.4	--	--
W. Janesville Road	2,205	0.09	1S	50	Yes	305	771.9	769.4	2.5	--	--	473	772.4	770.2	2.2	--	--	545	772.6	770.7	1.9	--	--
Private Drive	2,210	0.11	1S	--	--	272	773.1	773.1	0.0	--	--	392	774.9	774.4	0.5	0.0	--	454	775.3	774.9	0.4	0.4	--
W. Godsell Road	2,215	0.25	1S	10	Yes	272	776.6	775.7	0.9	--	--	392	777.6	776.5	1.1	--	--	454	778.0	776.8	1.2	--	--
W. Parnell Avenue	2,220	0.385	1S	10	Yes	272	782.4	781.0	1.4	--	--	292	782.6	781.2	1.4	--	--	340	783.0	781.4	1.6	--	--

[a] *Measured in miles above confluence with Whitnall Park Creek.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table E-12

HYDROLOGIC-HYDRAULIC SUMMARY—NORTH BRANCH WHITNALL PARK CREEK: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Grange Avenue	2,300	0.24	1S	50	No	100	789.2	787.3	1.9	0.2	0.1	175	789.4	787.9	1.5	0.4	0.3	214	789.4	788.2	1.2	0.4	0.3
S. 112th Street	2,305	0.36	1S	10	No	128	790.5	789.7	0.8	0.9	0.3	190	790.8	790.0	0.8	1.2	0.6	216	791.0	790.1	0.9	1.4	0.8
W. Copeland Avenue	2,310	0.41	1S	10	No	128	791.5	790.5	1.0	0.7	--	190	791.7	790.8	0.9	0.9	--	216	791.9	791.0	0.9	1.1	--
W. Mallory Avenue	2,315	0.47	1S	10	No	128	793.4	792.9	0.5	0.6	0.6	190	793.5	793.2	0.3	0.7	0.7	216	793.6	793.3	0.3	0.8	0.8
W. Upham Avenue	2,320	0.53	1S	10	Yes	109	793.5	793.4	0.1	--	--	160	793.7	793.6	0.1	--	--	182	793.8	793.7	0.1	--	--
W. Abbott Avenue	2,325	0.58	1S	10	No	97	796.3	795.7	0.6	0.4	--	140	796.4	796.1	0.3	0.5	--	163	796.4	796.3	0.1	0.5	--
W. Woodside Drive	2,330	0.655	1S	10	No	97	798.4	797.2	1.2	0.6	--	140	798.6	797.4	1.2	0.8	--	163	798.6	797.5	1.1	0.8	--
W. Edgerton Avenue	2,335	0.78	1S	10	--	59	--[f]	799.7	--	--	--	85	--[f]	800.0	--	--	--	95	--[f]	800.0	--	--	--

[a] *Measured in miles above confluence with the Northwest Branch of Whitnall Park Creek.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f] *No flood stages were determined upstream of this structure.*

Source: SEWRPC.

Table E-13

HYDROLOGIC-HYDRAULIC SUMMARY—NORTH BRANCH WHITNALL PARK CREEK: YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood[a]						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[b]	Structure Type and Hydraulic Significance[c]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[d]	Instantaneous Peak Discharge (cfs)	Upstream Stage[e,f] (feet above NGVD)	Downstream Stage[e,f] (feet above NGVD)	Backwater[g] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[e,f] (feet above NGVD)	Downstream Stage[e,f] (feet above NGVD)	Backwater[g] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[e,f] (feet above NGVD)	Downstream Stage[e,f] (feet above NGVD)	Backwater[g] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Grange Avenue	2,300	0.24	1S	50	Yes	120	--	--	--	--	--	173	786.5	785.9	0.6	--	--	194	787.3	786.1	1.2	0.2	--
S. 112th Street	2,305	0.36	1S	10	Yes	135	--	--	--	--	--	202	788.8	788.3	0.5	1.4	1.0	230	789.4	789.1	0.3	2.0	1.6
W. Copeland Avenue	2,310	0.41	1S	10	Yes	135	--	--	--	--	--	202	790.1	788.8	1.3	--	--	230	790.8	789.4	1.4	0.0	--
W. Mallory Avenue	2,315	0.47	1S	10	Yes	135	--	--	--	--	--	202	791.4	791.1	0.3	--	--	230	792.9	791.9	1.0	0.1	--
W. Upham Avenue	2,320	0.53	1S	10	Yes	113	--	--	--	--	--	167	793.2	792.0	1.2	--	--	191	793.9	792.5	1.4	--	--
W. Abbott Avenue	2,325	0.58	1S	10	Yes	97	--	--	--	--	--	140	794.8	794.6	0.2	--	--	163	796.1	795.5	0.6	0.2	--
W. Woodside Drive	2,330	0.655	1S	10	Yes	97	--	--	--	--	--	140	796.0	796.0	0.0	--	--	163	796.6	796.3	0.3	--	--
W. Edgerton Avenue	2,335	0.78	1S	10	Yes	60	--	--	--	--	--	85	--	--	--	--	--	95	--[h]	799.3	--	--	--

[a]*Recommended plan includes routing flows up to and including a 10-year recurrence interval event through storm sewers.*

[b]*Measured in miles above confluence with the Northwest Branch of Whitnall Park Creek.*

[c]*Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[d]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[e]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[f]*The flood stage indicated is based on that flood flow in excess of the 10-year recurrence interval event, which would continue to be conveyed by the existing channel.*

[g]*Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[h]*No flood stages were determined upstream of this structure.*

Source: SEWRPC.

Table E-14

HYDROLOGIC-HYDRAULIC SUMMARY—CRAYFISH CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Chicago & North Western Railway	2,400	0.32	1S	100	Yes	385[f]	665.0	664.0[g]	1.0	--	--	385[f]	665.1[g]	665.1[g]	0.0	--	--	385[f]	665.5[g]	665.5[g]	0.0	--	--
E. County Line Road	2,405	0.38	1S	10	No	535	665.3	665.2	0.1	1.3	--	720	665.5	665.4	0.1	1.5	--	815	665.6	665.5[g]	0.1	1.6	--
E. Elm Road	2,410	0.91	1S	10	Yes	291	665.7	665.3	0.4	--	--	400	666.2	665.5	0.7	--	--	443	666.4	665.6	0.8	--	--

[a]*Measured in miles above confluence with the Root River.*

[b]*Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f]*Flow in excess of 385 cfs travels overland to the Root River along the east side of the Chicago & North Western Railway tracks.*

[g]*The flood stage indicated represents the water surface on the Root River.*

Source: SEWRPC.

Table E-15

HYDROLOGIC-HYDRAULIC SUMMARY—CRAYFISH CREEK
YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Chicago & North Western Railway[f]	2,400	0.91	1S	100	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
E. County Line Road	2,405	0.97	1S	10	- -	535	664.0	663.7	0.3	- -	- -	720	664.9	664.3	0.6	- -	- -	815	665.2	664.5	0.7	- -	- -
E. Elm Road	2,410	1.50	1S	10	Yes	291	665.0	664.3	0.7	- -	- -	400	665.8	665.2	0.6	- -	- -	443	666.2	665.5	0.7	- -	- -

[a]*Measured in miles above confluence with the Root River. The recommended plan includes rerouting Crayfish Creek downstream of W. County Line Road. The river miles listed reflect the new alignment.*

[b]*Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f]*This structure is recommended to be abandoned, with Crayfish Creek being rerouted to the Root River along an alignment east of this railroad.*

Source: SEWRPC.

Table E-16

HYDROLOGIC-HYDRAULIC SUMMARY—CALEDONIA BRANCH
YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Abandoned Electric Interurban Railway	2,500	0.43	1S	100	Yes	240	666.1	665.3	0.8	- -	- -	350	668.6	665.5	3.1	- -	- -	400	670.0	665.6	4.4	- -	- -

[a]*Measured in miles above confluence with Crayfish Creek.*

[b]*Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table E-17

HYDROLOGIC-HYDRAULIC SUMMARY—CALEDONIA BRANCH
YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Abandoned Electric Interurban Railway	2,500	0.43	1S	100	Yes	240	665.7	664.2	1.5	--	--	350	667.4	665.0[f]	2.4	--	--	400	667.5	665.3[f]	2.2	--	--

[a]*Measured in miles above confluence with Crayfish Creek.*

[b]*Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f]*The flood stage indicated represents the water surface on Crayfish Creek.*

Source: SEWRPC.

Table E-18

HYDROLOGIC-HYDRAULIC SUMMARY—104TH STREET BRANCH
YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Cold Spring Road	2,100	0.084	1S	10	Yes	310	724.9[f]	724.1[f]	--	--	--	560	725.8[f]	724.9[f]	--	--	--	620	726.1[f]	725.2[f]	--	--	--
S. 104th Street	2,105	0.185	1S	10	Yes	310	727.8	724.9[f]	1.9	--	--	560	729.3	725.8[f]	3.5	--	--	620	729.6	726.1[f]	3.5	--	--
Zoo Freeway	2,110	0.308	1S	100	Yes	310	735.1	728.9	6.2	--	--	560	737.8	730.4	7.4	--	--	620	738.4	730.8	7.6	--	--
Storm Sewer Outfall	2,115	0.385	4I	--	--	310	--	--	--	--	--	560	--	--	--	--	--	620	--	--	--	--	--

[a]*Measured in miles above confluence with the Root River.*

[b]*Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e]*Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

[f]*The flood stage indicated represents the water surface elevation on the Root River.*

Source: SEWRPC.

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Appendix F

HYDROLOGIC-HYDRAULIC SUMMARY FOR STRUCTURES IN THE LAKE MICHIGAN DIRECT DRAINAGE AREA

Table F-1

HYDROLOGIC-HYDRAULIC SUMMARY—FISH CREEK YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage[d] (feet above NGVD)	Downstream Stage[d] (feet above NGVD)	Backwater[e] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Dam	*3,700*	1.22	*2S*	--	--	520	614.6	610.2	4.4	--	--	700	615.1	611.2	3.9	--	--	*770*	*615.3*	*611.5*	*3.8*	--	--
N. Broadmoor Road/ Chicago & North Western Railway	3,710	1.57	1S	100	Yes	480	638.2	620.8	17.4	--	--	620	648.0	621.4	26.6	--	--	670	652.0	621.6	30.4	--	--
W. County Line Road	3,715	2.11	1S	10	Yes	480	648.0	645.0	3.0	--	--	720	650.8	648.0	2.8	--	--	820	655.7	652.0	3.7	--	--
Katherine Drive/ IH 43	3,720	2.75	1S	100	Yes	250	671.8	667.4	4.4	--	--	350	672.9	668.7	4.2	--	--	420	675.4	669.3	6.1	--	--
Port Washington Road/Zedler Lane	3,725	2.89	1S	50	No	180	678.6	675.7	2.9	--	--	240	681.1	676.2	4.9	0.1	0.1	330	681.2	676.9	4.3	0.2	0.2
Private Drive	3,730	3.39	1I	--	--	13	--	--	--	--	--	21	--	--	--	--	--	24	--	--	--	--	--

[a] *Measured in miles above mouth at Lake Michigan.*

[b] *Structure codes are as follows: 1-bridge or culvert; 2-dam, sill, or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *The flood stage indicated represents the water surface elevation approximately 50 feet from the bridge.*

[e] *Backwater is defined as the change in stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

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Appendix G

HYDROLOGIC-HYDRAULIC SUMMARY FOR STRUCTURES IN THE MENOMONEE RIVER WATERSHED

Table G-1

HYDROLOGIC-HYDRAULIC SUMMARY—MENOMONEE RIVER: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
27th Street Viaduct	545	2.10	1I	- -	- -	9,330	- -	- -	- -	- -	- -	14,300	- -	- -	- -	- -	- -	16,800	- -	- -	- -	- -	- -
Falk Dam	546	2.22	2S	- -	- -	9,330	590.4	590.1	0.3	- -	- -	14,300	594.2	594.0	0.2	- -	- -	16,800	595.7	595.5	0.2	- -	- -
35th Street Viaduct	560	2.65	1I	- -	- -	9,130	- -	- -	- -	- -	- -	14,000	- -	- -	- -	- -	- -	16,400	- -	- -	- -	- -	- -
Pedestrian Bridge	570	3.22	1I	- -	- -	8,420	- -	- -	- -	- -	- -	12,800	- -	- -	- -	- -	- -	14,900	- -	- -	- -	- -	- -
IH 94	575	3.65	1I	- -	- -	8,420	- -	- -	- -	- -	- -	12,800	- -	- -	- -	- -	- -	14,900	- -	- -	- -	- -	- -
Soo Line Railroad	580	3.71	1S	100	Yes	8,420	597.8	597.6	0.2	- -	- -	12,800	600.7	600.6	0.1	- -	- -	14,900	602.9	602.0	0.9	- -	- -
W. Bluemound Road	584	4.07	1I	- -	- -	8,420	- -	- -	- -	- -	- -	12,800	- -	- -	- -	- -	- -	14,900	- -	- -	- -	- -	- -
W. Wisconsin Avenue/STH 18	585	4.08	1I	- -	- -	8,420	- -	- -	- -	- -	- -	12,800	- -	- -	- -	- -	- -	14,900	- -	- -	- -	- -	- -
Soo Line Railroad	590	4.24	1S	100	Yes	7,800	603.6	603.2	0.4	- -	- -	11,700	606.9	606.1	0.8	- -	- -	13,700	608.4	607.5	0.9	- -	- -
Pedestrian Bridge	595	4.43	1I	- -	- -	7,800	- -	- -	- -	- -	- -	11,700	- -	- -	- -	- -	- -	13,700	- -	- -	- -	- -	- -
N. 45th Street	600	4.45	1S	10	Yes	7,800	610.1	608.3	1.8	- -	- -	11,700	612.6	610.9	1.7	- -	- -	13,700	613.7	612.1	1.6	- -	- -
Soo Line Railroad	605	4.56	1S	100	No	7,800	616.2	615.7	0.5	- -	- -	11,700	621.4	619.6	1.8	2.2	1.4	13,700	623.0	621.3	1.7	3.8	3.0
Stadium Freeway/ USH 41	610	4.63	1S	100	Yes	7,800	617.4	616.8	0.6	- -	- -	11,700	622.0	621.6	0.4	- -	- -	13,700	623.8	623.4	0.4	- -	- -
Private Bridge	615	4.88	1I	- -	- -	7,800	- -	- -	- -	- -	- -	11,700	- -	- -	- -	- -	- -	13,700	- -	- -	- -	- -	- -
N. Hawley Road	620	5.15	1I	- -	- -	7,800	- -	- -	- -	- -	- -	11,700	- -	- -	- -	- -	- -	13,700	- -	- -	- -	- -	- -
N. Hawley Road	620A	5.15	1S	50	No	7,800	626.4	626.4	0.0	- -	- -	11,700	632.8	629.5	3.3	4.4	- -	13,700	634.7	631.0	3.7	6.3	1.1
Abandoned Pedestrian Bridge	625	5.66	1I	- -	- -	7,800	- -	- -	- -	- -	- -	11,700	- -	- -	- -	- -	- -	13,700	- -	- -	- -	- -	- -
N. 68th Street	630	5.96	1S	50	No	7,800	637.7	637.3	0.4	- -	- -	11,700	642.3	640.2	2.1	0.1	- -	13,700	643.5	641.5	2.0	1.3	- -
N. 70th Street	635	6.10	1S	10	Yes	7,730	640.5	639.8	0.7	- -	- -	11,600	644.8	643.5	1.3	1.2	- -	13,600	645.5	644.5	1.0	1.9	- -
Pedestrian Bridge	637	6.69	1I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
Soo Line Railroad	640	6.70	1S	100	No	5,800	650.6	650.5	0.1	- -	- -	8,710	653.9	653.3	0.6	0.1	- -	10,200	655.8	654.6	1.2	2.0	- -
Pedestrian Bridge	645	6.72	1S	- -	- -	5,800	651.1	650.5	0.6	- -	- -	8,710	654.3	653.9	0.4	- -	- -	10,200	656.1	655.8	0.3	- -	- -
W. Harmonee Avenue	645A	6.79	1I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
Ford	646	7.23	4I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
Pedestrian Bridge	648	7.69	1I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
Paved Ford	649	7.82	4I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
N. Swan Boulevard	650	8.00	1S	50	No	5,800	669.7	669.4	0.3	4.9	- -	8,710	673.7	671.9	1.8	8.9	- -	10,200	675.2	672.9	2.3	10.4	0.0
Pedestrian Bridge	655	8.32	1I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
W. North Avenue	660	8.50	1S	50	Yes	3,480	675.8	675.6	0.2	- -	- -	4,780	678.3	678.0	0.3	- -	- -	5,390	679.5	679.1	0.4	- -	- -
W. Burleigh Street	665	9.68	1S	50	Yes	3,360	683.9	683.9	0.0	- -	- -	4,670	685.2	685.1	0.1	- -	- -	5,290	685.7	685.6	0.1	- -	- -
Limestone Ford	667	10.21	4I	- -	- -	3,350	- -	- -	- -	- -	- -	4,670	- -	- -	- -	- -	- -	5,290	- -	- -	- -	- -	- -
N. Mayfair Road/ STH 100	670	10.67	1S	50	Yes	3,220	694.0	694.0	0.0	- -	- -	4,510	695.3	695.3	0.0	- -	- -	5,130	695.8	695.8	0.0	- -	- -
Pedestrian Bridge	679	10.70	1I	- -	- -	3,220	- -	- -	- -	- -	- -	4,510	- -	- -	- -	- -	- -	5,130	- -	- -	- -	- -	- -
Private Bridge	680	10.94	1I	- -	- -	3,220	- -	- -	- -	- -	- -	4,510	- -	- -	- -	- -	- -	5,130	- -	- -	- -	- -	- -
Pedestrian Bridge	681	11.04	1S	- -	- -	3,220	695.9	695.9	0.0	3.2	0.7	4,510	697.0	697.0	0.0	4.3	1.8	5,130	697.4	697.4	0.0	4.7	2.2
Capitol Drive/ STH 190	685	11.20	1I	- -	- -	3,220	- -	- -	- -	- -	- -	4,510	- -	- -	- -	- -	- -	5,130	- -	- -	- -	- -	- -
Capitol Drive/ STH 190	685	11.20	1S	50	Yes	3,220	697.2	696.8	0.4	- -	- -	4,510	698.6	697.9	0.7	- -	- -	5,130	699.3	698.4	0.9	- -	- -
W. Hampton Avenue	690	12.52	1S	50	Yes	3,200	700.7	700.6	0.1	- -	- -	4,470	702.2	702.0	0.2	- -	- -	5,070	702.8	702.6	0.2	- -	- -
Zoo Freeway/USH 45	695	12.88	1S	100	Yes	2,700	704.9	704.9	0.0	- -	- -	3,790	706.1	706.1	0.0	- -	- -	4,290	706.6	706.6	0.0	- -	- -
Chicago & North Western Railway	700	13.42	1S	100	Yes	2,700	709.9	709.8	0.1	- -	- -	3,790	711.2	711.2	0.0	- -	- -	4,290	711.8	711.7	0.1	- -	- -
N. 124th Street	705	13.52	1S	50	No	2,700	711.0	710.8	0.2	- -	- -	3,790	713.0	712.4	0.6	0.1	0.0	4,290	713.7	713.0	0.7	0.8	0.7
Pedestrian Bridge	706	13.84	1I	- -	- -	2,700	- -	- -	- -	- -	- -	3,790	- -	- -	- -	- -	- -	4,290	- -	- -	- -	- -	- -
W. Silver Spring Road/CTH VV	710	14.64	1S	50	Yes	2,420	724.3	724.3	0.0	- -	- -	3,290	725.6	725.6	0.0	- -	- -	3,670	726.1	726.1	0.0	- -	- -
Chicago & North Western Railway	720	14.96	1S	100	Yes	2,420	727.0	727.0	0.0	- -	- -	3,290	728.5	728.5	0.0	- -	- -	3,670	729.1	729.1	0.0	- -	- -
W. Mill Road	725	15.98	1S	50	Yes	2,420	731.5	731.3	0.2	- -	- -	3,290	732.6	732.4	0.2	- -	- -	3,670	733.2	732.8	0.4	- -	- -

Table G-1 (continued)

Structure Identification and Selected Characteristics: Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	10-Year Recurrence Interval Flood: Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	50-Year Recurrence Interval Flood: Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	100-Year Recurrence Interval Flood: Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Appleton Avenue/ STH 175	730	16.56	1S	50	Yes	2,420	735.3	735.3	0.0	--	--	3,290	736.3	736.3	0.0	--	--	3,670	736.8	736.7	0.1	--	--
W. Good Hope Road	735	17.30	1S	50	Yes	2,420	738.8	738.6	0.2	--	--	3,290	740.0	739.4	0.6	--	--	3,670	740.4	739.7	0.7	--	--
Private Bridge	740	18.18	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	741	18.37	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	745	18.61	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	750	18.69	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	755	18.72	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	760	18.77	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	765	18.81	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	770	18.91	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Lilly Road	780	19.70	1S	50	Yes	2,420	750.6	750.6	0.0	--	--	3,290	751.8	751.5	0.3	--	--	3,670	752.3	751.9	0.4	--	--
Pedestrian Bridge	785	20.17	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Pedestrian Bridge	790	20.77	1I	--	--	900	--	--	--	--	--	1,220	--	--	--	--	--	1,360	--	--	--	--	--
Pilgrim Road	795	21.09	1S	50	Yes	900	762.1	761.8	0.3	--	--	1,220	762.8	762.3	0.5	--	--	1,360	763.0	762.5	0.5	--	--
Arthur Avenue	800	21.44	1S	10	Yes	900	771.1	770-9	0.2	--	--	1,220	772.0	771.8	0.2	--	--	1,360	772.2	771.9	0.3	--	--
Limestone Drop	804	21.71	3S	--	--	900	799.1	790.7	8.4	--	--	1,220	799.7	791.0	8.7	--	--	1,360	799.9	791.2	8.7	--	--
Pedestrian Bridge	805	21.78	1I	--	--	900	--	--	--	--	--	1,220	--	--	--	--	--	1,360	--	--	--	--	--
Main Street/STH 74	810	21.87	1S	50	Yes	900	815.9	815.9	0.0	--	--	1,220	816.8	816.8	0.0	--	--	1,360	818.0	817.9	0.1	--	--
Menomonee Falls Dam	815	21.89	2S	--	--	730	834.2	817.3	16.9	--	--	1,040	835.0	818.1	16.9	--	--	1,180	835.3	818.4	16.9	--	--
Roosevelt Drive	820	22.07	1S	10	Yes	730	834.9	834.8	0.1	--	--	1,040	835.7	835.6	0.1	--	--	1,180	836.0	835.8	0.2	--	--
Private Bridge	840	22.68	1S	--	--	730	840.2	840.0	0.2	0.6	--	1,040	841.4	841.2	0.2	1.8	--	1,180	841.9	841.7	0.2	2.3	--
County Line Road/CTH Q	845	23.43	1S	50	No	700	841.2	841.0	0.2	--	--	1,000	842.8	842.2	0.6	0.2	--	1,140	843.5	842.7	0.8	0.9	--
Footbridge	847	23.51	1I	--	--	700	--	--	--	--	--	1,000	--	--	--	--	--	1,140	--	--	--	--	--
Private Bridge	850	24.28	1S	--	--	700	842.1	842.0	0.1	2.1	0.3	1,000	843.4	843.4	0.0	3.4	1.6	1,140	844.0	844.0	0.0	4.0	2.2
STH 41 and 45	855	24.80	1S	100	No	890	843.0	842.4	0.6	--	--	1,110	844.5	843.5	1.0	--	--	1,220	845.4	844.1	1.3	0.4	0.1
Footbridge	857	24.87	1I	--	--	890	--	--	--	--	--	1,110	--	--	--	--	--	1,220	--	--	--	--	--
Lilac Lane	860	25.23	1S	10	No	500	843.9	843.8	0.1	0.2	--	680	845.4	845.4	0.0	1.7	--	790	845.4	845.4	0.0	1.7	--
Mequon Road	865	25.89	1S	50	Yes	500	845.1	845.0	0.1	--	--	680	845.9	845.8	0.1	--	--	790	846.0	845.9	0.1	--	--
River Lane	870	25.94	1S	10	Yes	500	845.4	845.4	0.0	--	--	680	846.1	846.0	0.1	--	--	790	846.7	846.2	0.5	--	--
Footbridge	871	25.96	1I	--	--	500	--	--	--	--	--	680	--	--	--	--	--	790	--	--	--	--	--
Footbridge	872	26.31	1I	--	--	500	--	--	--	--	--	680	--	--	--	--	--	790	--	--	--	--	--
Footbridge	873	26.47	1I	--	--	500	--	--	--	--	--	680	--	--	--	--	--	790	--	--	--	--	--
Private Drive	874	26.53	1S	--	--	500	847.1	846.1	1.0	1.7	0.5	680	847.3	847.0	0.3	1.9	0.7	790	847.7	847.5	0.2	2.3	1.1
Footbridge	874A	26.81	1I	--	--	500	--	--	--	--	--	680	--	--	--	--	--	790	--	--	--	--	--
Soo Line Railroad	875	26.88	1S	100	Yes	500	847.3	847.2	0.1	--	--	680	847.7	847.5	0.2	--	--	790	848.0	847.8	0.2	--	--
Freistadt Road	880	27.13	1S	50	Yes	330	848.4	848.3	0.1	--	--	490	849.3	849.1	0.2	--	--	560	849.8	849.5	0.3	--	--
STH 145	885	27.25	1S	50	Yes	330	848.6	848.6	0.0	--	--	490	849.6	849.6	0.0	--	--	560	850.1	850.1	0.0	--	--

[a] *Measured in miles above confluence with the Milwaukee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table G-2

HYDROLOGIC-HYDRAULIC SUMMARY—MENOMONEE RIVER: YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
27th Street Viaduct	545	2.10	1I	- -	- -	9,330	- -	- -	- -	- -	- -	14,300	- -	- -	- -	- -	- -	16,800	- -	- -	- -	- -	- -
Falk Dam	546	2.22	2S	- -	- -	9,330	590.4	590.1	0.3	- -	- -	14,300	594.2	594.0	0.2	- -	- -	16,800	595.7	595.5	0.2	- -	- -
35th Street Viaduct	560	2.65	1I	- -	- -	9,130	- -	- -	- -	- -	- -	14,000	- -	- -	- -	- -	- -	16,400	- -	- -	- -	- -	- -
Pedestrian Bridge	570	3.22	1I	- -	- -	8,420	- -	- -	- -	- -	- -	12,800	- -	- -	- -	- -	- -	15,100	- -	- -	- -	- -	- -
IH 94	575	3.65	1I	- -	- -	8,510	- -	- -	- -	- -	- -	12,900	- -	- -	- -	- -	- -	15,100	- -	- -	- -	- -	- -
Soo Line Railroad	580	3.71	1S	100	Yes	8,510	597.8	597.7	0.1	- -	- -	12,900	600.8	600.6	0.2	- -	- -	15,100	603.0	602.1	0.9	- -	- -
W. Bluemound Road	584	4.07	1I	- -	- -	8,510	- -	- -	- -	- -	- -	12,900	- -	- -	- -	- -	- -	15,100	- -	- -	- -	- -	- -
W. Wisconsin Avenue/STH 18	585	4.08	1I	- -	- -	8,510	- -	- -	- -	- -	- -	12,900	- -	- -	- -	- -	- -	15,100	- -	- -	- -	- -	- -
Soo Line Railroad	590	4.24	1S	100	Yes	7,900	603.7	603.3	0.4	- -	- -	11,900	607.0	606.4	0.6	- -	- -	14,000	608.7	608.0	0.7	- -	- -
Pedestrian Bridge	595	4.43	1I	- -	- -	7,900	- -	- -	- -	- -	- -	11,900	- -	- -	- -	- -	- -	14,000	- -	- -	- -	- -	- -
N. 45th Street	600	4.45	1S	10	Yes	7,900	610.2	608.4	1.6	- -	- -	11,900	612.5	611.2	1.3	- -	- -	14,000	613.6	612.7	0.9	- -	- -
Soo Line Railroad	605	4.56	1S	100	No	7,900	614.4	613.3	1.1	- -	- -	11,900	618.9	616.6	2.3	- -	- -	14,000	621.6	619.2	2.4	2.4	1.6
Stadium Freeway/ USH 41	610	4.63	1S	100	Yes	7,900	616.0	615.5	0.5	- -	- -	11,900	620.6	620.0	0.6	- -	- -	14,000	622.5	622.0	0.5	- -	- -
Private Bridge	615	4.88	1I	- -	- -	7,900	- -	- -	- -	- -	- -	11,900	- -	- -	- -	- -	- -	14,000	- -	- -	- -	- -	- -
N. Hawley Road	620	5.15	1I	- -	- -	7,900	- -	- -	- -	- -	- -	11,900	- -	- -	- -	- -	- -	14,000	- -	- -	- -	- -	- -
N. Hawley Road	620A	5.15	1S	50	Yes	7,900	622.9	622.7	0.2	- -	- -	11,900	626.5	626.4	0.1	- -	- -	14,000	628.1	628.1	0.0	- -	- -
Abandoned Pedestrian Bridge	625	5.66	1I	- -	- -	7,900	- -	- -	- -	- -	- -	11,900	- -	- -	- -	- -	- -	14,000	- -	- -	- -	- -	- -
N. 68th Street	630	5.96	1S	50	Yes	7,900	633.8	633.8	0.0	- -	- -	11,900	638.1	637.6	0.5	- -	- -	14,000	640.6	639.4	1.2	- -	- -
N. 70th Street	635	6.10	1S	10	Yes	7,900	636.2	635.9	0.3	- -	- -	11,900	640.1	639.7	0.4	- -	- -	14,000	642.4	641.7	0.7	- -	- -
Pedestrian Bridge	637	6.69	1I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
Soo Line Railroad	640	6.70	1S	100	No	5,800	650.4	650.4	0.0	- -	- -	8,710	653.7	653.2	0.5	- -	- -	10,200	655.6	654.4	1.2	1.8	- -
Pedestrian Bridge	645	6.72	1S	- -	- -	5,800	651.0	650.4	0.6	- -	- -	8,710	654.1	653.7	0.4	- -	- -	10,200	656.0	655.6	0.4	- -	- -
W. Harmonee Avenue	645A	6.79	1I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
Ford	646	7.23	4I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
Pedestrian Bridge	648	7.69	1I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
Paved Ford	649	7.82	4I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
N. Swan Boulevard	650	8.00	1S	50	No	5,800	669.7	669.4	0.3	4.9	- -	8,710	673.7	671.9	1.8	8.9	- -	10,200	675.2	672.9	2.3	10.4	0.0
Pedestrian Bridge	655	8.32	1I	- -	- -	5,800	- -	- -	- -	- -	- -	8,710	- -	- -	- -	- -	- -	10,200	- -	- -	- -	- -	- -
W. North Avenue	660	8.50	1S	50	Yes	3,480	675.8	675.6	0.2	- -	- -	4,780	678.3	678.0	0.3	- -	- -	5,390	679.5	679.1	0.4	- -	- -
W. Burleigh Street	665	9.68	1S	50	Yes	3,360	683.9	683.9	0.0	- -	- -	4,670	685.2	685.1	0.1	- -	- -	5,290	685.7	685.6	0.1	- -	- -
Limestone Ford	667	10.21	4I	- -	- -	3,350	- -	- -	- -	- -	- -	4,670	- -	- -	- -	- -	- -	5,290	- -	- -	- -	- -	- -
N. Mayfair Road/ STH 100	670	10.67	1S	50	Yes	3,220	694.0	694.0	0.0	- -	- -	4,510	695.3	695.3	0.0	- -	- -	5,130	695.8	695.8	0.0	- -	- -
Pedestrian Bridge	679	10.70	1I	- -	- -	3,220	- -	- -	- -	- -	- -	4,510	- -	- -	- -	- -	- -	5,130	- -	- -	- -	- -	- -
Private Bridge	680	10.94	1I	- -	- -	3,220	- -	- -	- -	- -	- -	4,510	- -	- -	- -	- -	- -	5,130	- -	- -	- -	- -	- -
Pedestrian Bridge	681	11.04	1S	- -	- -	3,220	695.9	695.9	0.0	3.2	0.7	4,510	697.0	697.0	0.0	4.3	1.8	5,130	697.4	697.4	0.0	4.7	2.2
Capitol Drive/ STH 190	685	11.20	1I	- -	- -	3,220	- -	- -	- -	- -	- -	4,510	- -	- -	- -	- -	- -	5,130	- -	- -	- -	- -	- -
Capitol Drive/ STH 190	685	11.20	1S	50	Yes	3,220	697.2	696.8	0.4	- -	- -	4,510	698.6	697.9	0.7	- -	- -	5,130	699.3	698.4	0.9	- -	- -
W. Hampton Avenue	690	12.52	1S	50	Yes	3,200	700.7	700.6	0.1	- -	- -	4,470	702.2	702.0	0.2	- -	- -	5,070	702.8	702.6	0.2	- -	- -
Zoo Freeway/USH 45	695	12.88	1S	100	Yes	2,700	704.9	704.9	0.0	- -	- -	3,790	706.1	706.1	0.0	- -	- -	4,290	706.6	706.6	0.0	- -	- -
Chicago & North Western Railway	700	13.42	1S	100	Yes	2,700	709.9	709.8	0.1	- -	- -	3,790	711.2	711.2	0.0	- -	- -	4,290	711.8	711.7	0.1	- -	- -
N. 124th Street	705	13.52	1S	50	No	2,700	711.0	710.8	0.2	- -	- -	3,790	713.0	712.4	0.6	0.1	0.0	4,290	713.7	713.0	0.7	0.8	0.7
Pedestrian Bridge	706	13.84	1I	- -	- -	2,700	- -	- -	- -	- -	- -	3,790	- -	- -	- -	- -	- -	4,290	- -	- -	- -	- -	- -
W. Silver Spring Road/CTH VV	710	14.64	1S	50	Yes	2,420	724.3	724.3	0.0	- -	- -	3,290	725.6	725.6	0.0	- -	- -	3,670	726.1	726.1	0.0	- -	- -
Chicago & North Western Railway	720	14.96	1S	100	Yes	2,420	727.0	727.0	0.0	- -	- -	3,290	728.5	728.5	0.0	- -	- -	3,670	729.1	729.1	0.0	- -	- -
W. Mill Road	725	15.98	1S	50	Yes	2,420	731.5	731.3	0.2	- -	- -	3,290	732.6	732.4	0.2	- -	- -	3,670	733.2	732.8	0.4	- -	- -

Table G-2 (continued)

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Appleton Avenue/ STH 175	730	16.56	1S	50	Yes	2,420	735.3	735.3	0.0	--	--	3,290	736.3	736.3	0.0	--	--	3,670	736.8	736.7	0.1	--	--
W. Good Hope Road	735	17.30	1S	50	Yes	2,420	738.8	738.6	0.2	--	--	3,290	740.0	739.4	0.6	--	--	3,670	740.4	739.7	0.7	--	--
Private Bridge	740	18.18	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	741	18.37	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	745	18.61	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	750	18.69	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	755	18.72	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	760	18.77	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	765	18.81	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Private Bridge	770	18.91	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Lilly Road	780	19.70	1S	50	Yes	2,420	750.6	750.6	0.0	--	--	3,290	751.8	751.5	0.3	--	--	3,670	752.3	751.9	0.4	--	--
Pedestrian Bridge	785	20.17	1I	--	--	2,420	--	--	--	--	--	3,290	--	--	--	--	--	3,670	--	--	--	--	--
Pedestrian Bridge	790	20.77	1I	--	--	900	--	--	--	--	--	1,220	--	--	--	--	--	1,360	--	--	--	--	--
Pilgrim Road	795	21.09	1S	50	Yes	900	762.1	761.8	0.3	--	--	1,220	762.8	762.3	0.5	--	--	1,360	763.0	762.5	0.5	--	--
Arthur Avenue	800	21.44	1S	10	Yes	900	771.1	770.9	0.2	--	--	1,220	772.0	771.8	0.2	--	--	1,360	772.2	771.9	0.3	--	--
Limestone Drop	804	21.71	3S	--	--	900	799.1	790.7	8.4	--	--	1,220	799.7	791.0	8.7	--	--	1,360	799.9	791.2	8.7	--	--
Pedestrian Bridge	805	21.78	1I	--	--	900	--	--	--	--	--	1,220	--	--	--	--	--	1,360	--	--	--	--	--
Main Street/STH 74	810	21.87	1S	50	Yes	900	815.9	815.9	0.0	--	--	1,220	816.8	816.8	0.0	--	--	1,360	818.0	817.9	0.1	--	--
Menomonee Falls Dam	815	21.89	2S	--	--	730	834.2	817.3	16.9	--	--	1,040	835.0	818.1	16.9	--	--	1,180	835.3	818.4	16.9	--	--
Roosevelt Drive	820	22.07	1S	10	Yes	730	834.8	834.7	0.1	--	--	1,040	835.6	835.5	0.1	--	--	1,180	836.0	835.8	0.2	--	--
Private Bridge	840	22.68	1S	--	--	730	838.2	838.2	0.0	--	--	1,040	839.3	839.3	0.0	--	--	1,180	839.7	839.7	0.0	0.1	--
County Line Road/CTH Q	845	23.43	1S	50	Yes	700	840.2	840.0	0.2	--	--	1,000	841.5	841.0	0.5	--	--	1,140	842.2	841.4	0.8	--	--
Footbridge	847	23.51	1I	--	--	700	--	--	--	--	--	1,000	--	--	--	--	--	1,140	--	--	--	--	--
Private Bridge	850	24.28	1S	--	--	700	841.9	841.6	0.3	1.9	0.1	1,000	842.6	842.6	0.0	2.6	0.8	1,140	843.1	843.1	0.0	3.1	1.3
STH 41 and 45	855	24.80	1S	100	No	890	842.8	842.2	0.6	--	--	1,110	843.9	842.8	1.1	--	--	1,220	845.2	843.3	1.9	0.2	--
Footbridge	857	24.87	1I	--	--	890	--	--	--	--	--	1,110	--	--	--	--	--	1,220	--	--	--	--	--
Lilac Lane	860	25.23	1S	10	Yes	500	843.7	843.7	0.0	--	--	680	845.0	844.9	0.1	1.3	--	790	845.3	845.2	0.1	1.6	--
Mequon Road	865	25.89	1S	50	Yes	500	845.1	845.0	0.1	--	--	680	845.7	845.6	0.1	--	--	790	846.0	845.9	0.1	--	--
River Lane	870	25.94	1S	10	Yes	500	845.4	845.3	0.1	--	--	680	846.0	845.9	0.1	--	--	790	846.7	846.1	0.6	--	--
Footbridge	871	25.96	1I	--	--	500	--	--	--	--	--	680	--	--	--	--	--	790	--	--	--	--	--
Footbridge	872	26.31	1I	--	--	500	--	--	--	--	--	680	--	--	--	--	--	790	--	--	--	--	--
Footbridge	873	26.47	1I	--	--	500	--	--	--	--	--	680	--	--	--	--	--	790	--	--	--	--	--
Private Drive	874	26.53	1S	--	--	500	847.1	846.1	1.0	1.7	0.5	680	847.3	846.9	0.4	1.9	0.7	790	847.7	847.5	0.2	2.3	1.1
Footbridge	874A	26.81	1I	--	--	500	--	--	--	--	--	680	--	--	--	--	--	790	--	--	--	--	--
Soo Line Railroad	875	26.88	1S	100	Yes	500	847.3	847.2	0.1	--	--	680	847.7	847.5	0.2	--	--	790	848.0	847.8	0.2	--	--
Freistadt Road	880	27.13	1S	50	Yes	330	848.4	848.3	0.1	--	--	490	849.3	849.1	0.2	--	--	560	849.8	849.5	0.3	--	--
STH 145	885	27.25	1S	50	Yes	330	848.6	848.6	0.0	--	--	490	849.6	849.6	0.0	--	--	560	850.1	850.1	0.0	--	--

[a] *Measured in miles above confluence with the Milwaukee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table G-3

HYDROLOGIC-HYDRAULIC SUMMARY—WOODS CREEK: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Stadium Freeway Outlet/USH 41	2005	0.00	4S	100	No	830	--	592.5[e]	--	--	--	1,070	--	596.0[e]	--	--	--	1,160	--	597.4[e]	--	--	--
Stadium Freeway Inlet/USH 41	2005	0.25	4S	100	No	780	602.2	--	--	--	--	990	609.8	--	--	--	--	1,080	610.2	--	--	--	--
Soo Line Railroad	2010	0.265	1S	100	Yes	790	610.1	602.2	7.9	--	--	1,020	611.8	609.8	2.0	--	--	1,120	612.0	610.2	1.8	--	--
Tunnel Outlet	2010A	0.33	4S	--	--	640	--	610.2	--	--	--	810	--	612.0	--	--	--	880	--	612.2	--	--	--
Tunnel Inlet	2010A	0.44	4S	--	--	640	612.6	--	--	--	--	810	614.2	--	--	--	--	880	614.6	--	--	--	--
Drop Structure	2011	0.48	3S	--	--	630	612.6	612.6	0.0	--	--	790	614.2	614.2	0.0	--	--	850	614.6	614.6	0.0	--	--
VA Center Tunnel Outlet	2012	0.635	4S	--	--	610	--	617.0	--	--	--	760	--	617.5	--	--	--	820	--	617.6	--	--	--
VA Center Tunnel Inlet	2012	0.916	4S	--	--	440	629.8	--	--	--	--	540	630.3	--	--	--	--	580	630.5	--	--	--	--
Pedestrian Bridge	2033	0.935	1I	--	--	440	--	--	--	--	--	540	--	--	--	--	--	580	--	--	--	--	--
Pedestrian Bridge	2034	1.00	1I	--	--	440	--	--	--	--	--	540	--	--	--	--	--	580	--	--	--	--	--
Storm Sewer Outfall	2035	1.095	4I	--	--	440	--	649.8	--	--	--	540	--	650.3	--	--	--	580	--	650.5	--	--	--

[a]Measured in miles above confluence with the Menomonee River.

[b]Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.

[c]A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.

[d]Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.

[e]The flood stage indicated represents the water surface elevation on the Menomonee River.

Source: SEWRPC.

Table G-4

HYDROLOGIC-HYDRAULIC SUMMARY—WOODS CREEK: YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Stadium Freeway Outlet/USH 41	2005	0.00	4S	100	Yes	830[e]	--	592.5[f]	--	--	--	1,070[g]	--	596.0[f]	--	--	--	1,160[h]	--	597.4[f]	--	--	--
Stadium Freeway Inlet/USH 41	2005	0.25	4S	100	Yes	790	598.2	--	--	--	--	1,020	599.1	599.1	--	--	--	1,120	599.6	--	--	--	--
Soo Line Railroad	2010	0.265	1S	100	Yes	790	603.1	598.2	4.9	--	--	1,020	605.7	599.1	6.6	--	--	1,120	607.0	599.6	7.4	--	--
Tunnel Outlet	2010A	0.33	4S	--	--	640	--	603.9	--	--	--	810	--	606.1	--	--	--	880	--	607.4	--	--	--
Tunnel Inlet	2010A	0.44	4S	--	--	640	611.6	--	--	--	--	810	612.8	--	--	--	--	880	613.2	--	--	--	--
Drop Structure	2011	0.48	3S	--	--	630	611.6	611.6	--	--	--	790	612.8	612.8	0.0	--	--	850	613.2	613.2	0.0	--	--
VA Center Tunnel Outlet	2012	0.635	4S	--	--	610	--	617.0	--	--	--	760	--	617.5	--	--	--	820	--	617.6	--	--	--
VA Center Tunnel Inlet	2012	0.916	4S	--	--	440	629.8	--	--	--	--	540	630.3	--	--	--	--	580	630.5	--	--	--	--
Pedestrian Bridge	2033	0.935	1I	--	--	440	--	--	--	--	--	540	--	--	--	--	--	580	--	--	--	--	--
Pedestrian Bridge	2034	1.00	1I	--	--	440	--	--	--	--	--	540	--	--	--	--	--	580	--	--	--	--	--
Storm Sewer Outfall	2035	1.095	4I	--	--	440	--	649.8	--	--	--	540	--	650.3	--	--	--	580	--	650.5	--	--	--

[a]Measured in miles above confluence with the Menomonee River.

[b]Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.

[c]A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.

[d]Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.

[e]Of this total, 480 cfs would be conveyed by the proposed relief culvert.

[f]The flood stage indicated represents the water surface elevation on the Menomonee River.

[g]Of this total, 530 cfs would be conveyed by the proposed relief culvert.

[h]Of this total, 520 cfs would be conveyed by the proposed relief culvert.

Source: SEWRPC.

Table G-5

HYDROLOGIC-HYDRAULIC SUMMARY—HONEY CREEK: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Honey Creek Parkway	950	0.17	1S	10	No	2,510	652.4	652.1	0.3	1.2	0.6	3,350	653.6	653.3	0.3	2.4	1.8	3,600	653.8	653.6	0.2	2.6	2.0
Portland Avenue	955	0.50	1S	10	Yes	2,510	664.2	663.5	0.7	--	--	3,350	667.5	664.5	3.2	--	--	3,600	668.5	664.8	3.7	--	--
Honey Creek Parkway	960	0.61	1S	10	Yes	2,510	669.0	668.6	0.4	--	--	3,350	672.7	669.9	2.8	0.5	0.1	3,600	672.9	670.7	2.2	0.7	0.3
W. Wisconsin Avenue	965	0.91	1S	50	No	2,410	681.7	680.8	0.9	1.7	1.5	3,100	682.4	682.2	0.2	2.4	2.2	3,200	683.0	682.8	0.2	3.0	2.8
Honey Creek Parkway	970	1.10	1S	10	Yes	2,410	682.3	682.3	0.0	--	--	3,100	683.2	683.2	0.0	--	--	3,200	683.7	683.7	0.0	--	--
W. Bluemound Road	975	1.22	1S	50	Yes	2,410	683.2	683.2	0.0	--	--	3,100	684.6	684.6	0.0	--	--	3,200	685.1	685.1	0.0	--	--
Honey Creek Parkway	980	1.39	1S	10	Yes	2,335	685.6	685.6	0.0	--	--	2,950	687.8	687.8	0.0	--	--	3,025	689.1	688.0	1.1	--	--
Drop Structure	982	1.44	3S	--	--	2,335	686.6	686.6	0.0	--	--	2,950	689.0	689.0	0.0	--	--	3,025	690.0	690.0	0.0	--	--
Drop Structure	983	1.52	3S	--	--	2,260	687.0	686.6	0.4	--	--	2,800	689.0	689.0	0.0	--	--	2,850	690.0	690.0	0.0	--	--
Drop Structure	984	1.81	3S	--	--	2,260	691.2	690.2	1.0	--	--	2,800	691.7	691.1	0.6	--	--	2,850	691.8	691.4	0.4	--	--
S. 84th Street	985	1.83	1S	50	Yes	2,260	692.8	691.3	1.5	--	--	2,800	693.8	691.7	2.1	--	--	2,850	693.9	691.8	2.1	--	--
East-West Freeway Tunnel Outlet/IH 94	990	1.99	1S	--	--	2,100	--	694.2	--	--	--	2,500	--	695.2	--	--	--	2,500	--	695.3	--	--	--
W. Arthur Avenue Tunnel Inlet	1080	4.32	4S	--	--	1,180	722.4	--	--	--	--	1,900	724.4	--	--	--	--	2,280	727.9	--	--	--	--
Pedestrian Bridge	1085	4.57	1I	--	--	1,180	--	--	--	--	--	1,900	--	--	--	--	--	2,280	--	--	--	--	--
W. Beloit Road	1090	4.68	1S	50	Yes	1,180	725.4	725.4	0.0	--	--	1,900	727.0	726.9	0.1	--	--	2,280	728.7	728.7	0.0	--	--
S. 76th Street	1095	5.11	1S	50	Yes	1,180	727.4	727.2	0.2	--	--	1,900	728.9	728.7	0.2	--	--	2,280	729.9	729.7	0.2	--	--
W. Oklahoma Avenue	1100	5.27	1S	50	Yes	970	728.7	728.6	0.1	--	--	1,560	730.3	730.2	0.1	--	--	1,870	731.2	731.1	0.1	--	--
S. 72nd Street	1105	5.51	1S	10	Yes	970	730.0	729.9	0.1	--	--	1,560	731.6	731.5	0.1	--	--	1,870	732.9	732.2	0.7	--	--
Drop Structure	1112	5.69	3S	--	--	970	731.2	730.6	0.6	--	--	1,560	732.5	732.1	0.4	--	--	1,870	733.2	733.2	0.0	--	--
Drop Structure	1114	5.94	3S	--	--	970	734.4	733.7	0.7	--	--	1,560	735.6	735.0	0.6	--	--	1,870	736.2	735.6	0.6	--	--
W. Morgan Avenue	1115	5.96	1S	50	Yes	970	736.1	736.0	0.1	--	--	1,560	737.7	737.6	0.1	--	--	1,870	738.9	738.2	0.7	--	--
S. 68th Street	1120	6.18	1S	50	Yes	970	740.0	739.9	0.1	--	--	1,560	741.0	740.8	0.2	--	--	1,870	741.4	741.2	0.2	--	--
W. Howard Avenue Tunnel Outlet	1125	6.54	1S	50	Yes	740	--	743.4	--	--	--	1,130	--	744.7	--	--	--	1,310	--	745.2	--	--	--
W. Forest Home Avenue Tunnel Inlet	1130	6.56	1S	50	Yes	740	743.5	--	--	--	--	1,130	744.8	--	--	--	--	1,310	745.3	--	--	--	--
S. 60th Street	1135	7.06	1S	50	Yes	740	746.6	746.6	0.0	--	--	1,130	748.3	748.3	0.0	--	--	1,310	749.0	749.0	0.0	--	--
W. Cold Spring Road	1140	7.19	1S	50	Yes	740	748.7	748.7	0.0	--	--	1,130	750.0	750.0	0.0	--	--	1,310	750.6	750.6	0.0	--	--
Airport Freeway/IH 894	1145	7.53	1S	100	Yes	470	750.2	750.1	0.1	--	--	670	751.6	751.6	0.0	--	--	760	752.2	752.2	0.0	--	--
Dam	1146	7.56	2S	--	--	470	754.8	750.2	4.6	--	--	670	755.5	751.6	3.9	--	--	760	755.8	752.2	3.6	--	--
W. Layton Avenue/ CTH Y	1150	7.80	1S	50	No	350	758.2	756.7	1.5	--	--	560	759.9	758.0	1.9	0.7	0.4	640	759.9	758.0	1.9	0.7	0.4
Private Drive	1152	8.11	1S	--	--	350	760.1	760.1	0.0	3.4	--	560	760.5	760.5	0.0	3.8	--	640	760.7	760.7	0.0	4.0	--
W. Loomis Road/ STH 36	1155	8.53	1S	50	Yes	270	760.9	760.7	0.2	--	--	380	761.6	761.2	0.4	--	--	430	761.9	761.3	0.6	--	--
Old Loomis Road Bridge	1157	8.55	1S	--	--	270	761.0	760.9	0.1	--	--	380	763.6	761.9	1.7	--	--	430	764.0	762.3	1.7	--	--

[a] *Measured in miles above confluence with the Menomonee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table G-6

HYDROLOGIC-HYDRAULIC SUMMARY—HONEY CREEK: YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Honey Creek Parkway	950	0.17	1S	10	No	2,610	652.1	651.3	0.8	0.9	0.3	3,500	653.1	652.6	0.5	1.9	1.3	3,700	653.3	652.9	0.4	2.1	1.5
Portland Avenue	955	0.50	1S	10	Yes	2,610	664.3	663.6	0.7	--	--	3,500	668.1	664.7	3.4	--	--	3,700	668.9	664.9	4.0	--	--
Honey Creek Parkway	960	0.61	1S	10	Yes	2,610	670.0	668.7	1.3	--	--	3,500	672.7	670.4	2.3	0.5	0.1	3,700	673.1	671.1	2.0	0.9	0.5
W. Wisconsin Avenue	965	0.91	1S	50	No	2,520	681.8	680.9	0.9	1.8	1.6	3,220	682.7	682.5	0.2	2.7	2.5	3,350	683.1	682.9	0.2	3.1	2.9
Honey Creek Parkway	970	1.10	1S	10	Yes	2,520	682.4	682.4	0.0	--	--	3,220	683.5	683.5	0.0	--	--	3,350	683.9	683.9	0.0	--	--
W. Bluemound Road	975	1.22	1S	50	Yes	2,520	683.4	683.4	0.0	--	--	3,220	685.0	685.0	0.0	--	--	3,350	685.4	685.4	0.0	--	--
Honey Creek Parkway	980	1.39	1S	10	Yes	2,450	685.9	685.9	0.0	--	--	3,080	689.3	688.1	1.2	--	--	3,175	689.7	688.5	1.2	--	--
Drop Structure	982	1.44	3S	--	--	2,450	687.0	687.0	0.0	--	--	3,080	690.1	690.1	0.0	--	--	3,175	690.6	690.6	0.0	--	--
Drop Structure	983	1.52	3S	--	--	2,370	687.1	687.0	0.1	--	--	2,940	690.1	690.1	0.0	--	--	3,000	690.6	690.6	0.0	--	--
Drop Structure	984	1.81	3S	--	--	2,370	691.3	690.4	0.9	--	--	2,940	691.8	691.5	0.3	--	--	3,000	691.9	691.7	0.2	--	--
S. 84th Street	985	1.83	1S	50	Yes	2,370	693.0	691.4	1.6	--	--	2,940	694.0	691.8	2.2	--	--	3,000	694.2	691.9	2.3	--	--
East-West Freeway Tunnel Outlet/IH 94	990	1.99	4S	--	--	2,220	--	694.4	--	--	--	2,650	--	695.4	--	--	--	2,650	--	695.5	--	--	--
W. Arthur Avenue Tunnel Inlet	1080	4.32	4S	--	--	1,250	722.5	--	--	--	--	1,930	724.5	--	--	--	--	2,270	727.7	--	--	--	--
Pedestrian Bridge	1085	4.57	1I	--	--	1,250	--	--	--	--	--	1,930	--	--	--	--	--	2,270	--	--	--	--	--
W. Beloit Road	1090	4.68	1S	50	Yes	1,250	725.6	725.5	0.1	--	--	1,930	727.1	727.0	0.1	--	--	2,270	728.6	728.6	0.0	--	--
S. 76th Street	1095	5.11	1S	50	Yes	1,250	727.6	727.4	0.2	--	--	1,930	728.9	728.7	0.2	--	--	2,270	729.8	729.7	0.1	--	--
W. Oklahoma Avenue	1100	5.27	1S	50	Yes	1,020	728.8	728.8	0.0	--	--	1,580	730.4	730.3	0.1	--	--	1,860	731.1	731.1	0.0	--	--
S. 72nd Street	1105	5.51	1S	10	Yes	1,020	730.1	730.1	0.0	--	--	1,580	731.6	731.5	0.1	--	--	1,860	732.8	732.2	0.6	--	--
Drop Structure	1112	5.69	3S	--	--	1,020	731.3	730.7	0.6	--	--	1,580	732.5	732.1	0.4	--	--	1,860	733.2	733.2	0.0	--	--
Drop Structure	1114	5.94	3S	--	--	1,020	734.5	733.8	0.7	--	--	1,580	735.7	735.1	0.6	--	--	1,860	736.2	735.6	0.6	--	--
W. Morgan Avenue	1115	5.96	1S	50	Yes	1,020	736.2	736.2	0.0	--	--	1,580	737.7	737.6	0.1	--	--	1,860	738.9	738.2	0.7	--	--
S. 68th Street	1120	6.18	1S	50	Yes	1,020	740.1	740.0	0.1	--	--	1,580	741.0	740.9	0.1	--	--	1,860	741.3	741.1	0.2	--	--
W. Howard Avenue Tunnel Outlet	1125	6.54	1S	50	Yes	840	--	743.8	--	--	--	1,200	--	744.9	--	--	--	1,370	--	745.4	--	--	--
W. Forest Home Avenue Tunnel Inlet	1130	6.56	1S	50	Yes	840	743.9	--	--	--	--	1,200	745.0	--	--	--	--	1,370	745.5	--	--	--	--
S. 60th Street	1135	7.06	1S	50	Yes	840	747.1	747.1	0.0	--	--	1,200	748.6	748.6	0.0	--	--	1,370	749.3	749.3	0.0	--	--
W. Cold Spring Road	1140	7.19	1S	50	Yes	840	749.1	749.1	0.0	--	--	1,200	750.3	750.2	0.1	--	--	1,370	750.8	750.8	0.0	--	--
Airport Freeway/IH 894	1145	7.53	1S	100	Yes	600	750.5	750.4	0.1	--	--	850	751.8	751.7	0.1	--	--	970	752.3	752.2	0.1	--	--
Dam[e]	1146	7.56	2S	--	--	--	--	--	--	--	--	--	--	--	--	--	--	970	--	--	--	--	--
W. Layton Avenue/ CTH Y	1150	7.80	1S	50	Yes	450	750.8	750.8	0.0	--	--	640	752.4	751.9	0.5	--	--	760	753.4	752.9	0.5	--	--
Private Drive[f]	1152	8.11	1S	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
W. Loomis Road/ STH 36	1155	8.53	1S	50	Yes	270	754.7	754.6	0.1	--	--	380	755.8	755.8	0.0	--	--	430	756.5	756.4	0.1	--	--
Old Loomis Road Bridge[e]	1157	8.55	1S	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

[a]Measured in miles above confluence with the Menomonee River.

[b]Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.

[c]A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.

[d]Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.

[e]Structure is recommended to be removed.

[f]Structure is located on stream reach recommended to be abandoned.

Source: SEWRPC.

Table G-7

HYDROLOGIC-HYDRAULIC SUMMARY—UNDERWOOD CREEK: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Drop Structure	1190	0.22	3S	--	--	2,990	676.0	676.0	0.0	--	--	4,800	677.8	677.8	0.0	--	--	5,760	678.9	678.9	0.0	--	--
Drop Structure	1195	0.63	3S	--	--	2,990	681.5	681.5	0.0	--	--	4,800	683.8	683.8	0.0	--	--	5,760	684.9	684.9	0.0	--	--
Drop Structure	1196	0.67	3S	--	--	2,990	684.6	681.5	3.1	--	--	4,800	686.0	683.8	2.2	--	--	5,760	686.7	684.9	1.8	--	--
Zoo Freeway/USH 45	1200	0.75	1I	--	--	2,610	--	--	--	--	--	4,190	--	--	--	--	--	5,030	--	--	--	--	--
Drop Structure	1201	0.80	3S	--	--	2,610	689.9	687.8	2.1	--	--	4,190	691.5	690.3	1.2	--	--	5,030	692.4	691.3	1.1	--	--
Soo Line Railroad	1202	0.81	1S	100	No	2,610	692.5	691.2	1.3	--	--	4,190	694.6	693.0	1.6	--	--	5,030	698.5	694.1	4.4	0.7	0.3
N. Mayfair Road/ STH 100	1205	1.27	1S	50	Yes	2,610	696.6	696.6	0.0	--	--	4,190	698.9	698.8	0.1	--	--	5,030	700.1	700.1	0.0	--	--
Drop Structure (Chicago & North Western Railroad)	1210	1.46	3S	--	--	2,610	700.5	699.4	1.1	--	--	4,190	702.7	701.1	1.6	--	--	5,030	703.7	701.9	1.8	--	--
W. Watertown Plank Road	1215	1.50	1I	--	--	2,290	--	--	--	--	--	3,620	--	--	--	--	--	4,310	--	--	--	--	--
Drop Structure	1216	1.53	3S	--	--	2,290	704.7	704.7	0.0	--	--	3,620	707.8	707.8	0.0	--	--	4,310	709.4	709.4	0.0	--	--
Drop Structure	1217	1.63	3S	--	--	2,290	706.3	705.5	0.8	--	--	3,620	708.0	708.0	0.0	--	--	4,310	709.6	709.6	0.0	--	--
Drop Structure	1218	1.69	3S	--	--	2,290	707.9	707.9	0.0	--	--	3,620	709.5	709.5	0.0	--	--	4,310	709.9	709.9	0.0	--	--
N. 115th Street	1220	1.87	1S	10	Yes	2,290	710.4	710.0	0.4	--	--	3,620	714.5	711.6	2.9	--	--	4,310	717.0	712.3	4.7	--	--
United Parcel Service	1230	2.57	1S	--	--	860	722.9	718.7	4.2	0.1	--	1,370	723.4	720.1	3.3	0.6	--	1,640	723.7	720.4	3.3	0.9	--
Footbridge	1232	2.58	1S	--	--	860	723.1	723.0	0.1	1.1	--	1,370	723.7	723.7	0.0	1.7	0.2	1,640	724.1	724.1	0.0	2.1	0.6
Private Bridge	1240	2.67	1S	--	--	860	723.8	723.3	0.5	1.0	--	1,370	724.4	724.0	0.4	1.6	0.4	1,640	724.7	724.4	0.3	1.9	0.7
Private Bridge	1245	2.69	1S	--	--	860	724.6	724.1	0.5	1.1	0.3	1,370	725.1	724.7	0.4	1.6	0.8	1,640	725.3	724.9	0.4	1.8	1.0
Private Bridge	1250	2.73	1S	--	--	860	725.7	725.0	0.7	0.6	0.3	1,370	726.4	725.6	0.8	1.3	1.0	1,640	726.7	725.9	0.8	1.6	1.3
Private Bridge	1255	2.83	1S	--	--	860	726.9	726.9	0.0	0.3	--	1,370	729.2	728.0	1.2	2.6	0.6	1,640	729.8	728.4	1.4	3.2	1.2
Soo Line Railroad	1260	3.10	1S	100	Yes	860	731.4	731.2	0.2	--	--	1,370	732.6	732.3	0.3	--	--	1,640	733.1	732.8	0.3	--	--
Private Bridge	1265	3.12	1S	--	--	860	732.9	731.8	1.1	1.7	--	1,370	733.4	733.2	0.2	2.2	--	1,640	733.7	733.3	0.4	2.5	--
Wall Street	1270	3.25	1S	10	No	860	736.4	735.7	0.7	1.0	--	1,370	737.5	736.9	0.6	2.1	0.7	1,640	737.8	737.1	0.7	2.4	1.0
Elm Grove Shopping Center Outlet	1271	3.31	4S	--	--	860	--	736.8	--	--	--	1,370	--	737.5	--	--	--	1,640	--	737.7	--	--	--
Elm Grove Shopping Center Inlet	1271A	3.41	4S	--	--	860	737.2	--	--	--	--	1,370	741.2	--	--	--	--	1,640	742.8	--	--	--	--
Watertown Plank Road	1275	3.43	1S	50	Yes	860	738.4	738.3	0.1	--	--	1,370	741.6	741.6	0.0	--	--	1,640	743.7	743.1	0.6	0.6	0.6
Private Bridge	1276	3.45	1S	--	--	860	738.4	738.4	0.0	--	--	1,370	741.9	741.8	0.1	--	--	1,640	744.4	743.7	0.7	1.3	1.3
Private Bridge	1280	3.50	1S	--	--	860	739.8	738.8	1.0	--	--	1,370	743.1	743.1	0.0	2.0	--	1,640	744.6	744.6	0.0	3.5	0.8
Soo Line Railroad	1290	3.55	1S	100	No	860	741.4	741.4	0.0	--	--	1,370	743.9	743.3	0.6	--	--	1,640	745.7	744.7	1.0	0.2	--
Juneau Boulevard	1295	3.67	1S	10	No	640	742.8	742.1	0.7	0.5	--	1,070	744.6	744.6	0.0	2.3	1.7	1,310	746.4	746.4	0.0	4.1	3.5
Village Hall Bridge	1300	3.76	1S	10	No	640	743.7	742.8	0.8	0.3	0.2	1,070	744.7	744.6	0.1	1.3	1.2	1,310	746.4	746.4	0.0	3.0	2.9
Marcella Avenue	1305	4.48	1S	10	No	640	748.0	747.2	0.8	0.1	--	1,070	749.1	748.2	0.9	1.2	1.0	1,310	749.5	748.6	0.9	1.6	1.4
North Avenue/CTH M	1310	4.82	1S	50	No	620	749.5	749.3	0.2	--	--	1,050	751.7	750.6	1.1	0.6	0.0	1,280	752.1	751.1	1.0	1.0	0.4
Private Drive	1313	5.48	1S	--	--	530	753.8	753.7	0.1	--	--	890	755.5	754.3	1.2	--	--	1,090	756.1	754.5	1.6	0.2	--
Clearwater Road	1315	5.59	1S	10	No	530	757.2	756.2	1.0	1.1	0.3	890	757.8	757.1	0.7	1.7	0.9	1,090	758.1	757.6	0.5	2.0	1.2
Private Bridge	1316	5.87	1I	--	--	530	--	--	--	--	--	890	--	--	--	--	--	1,090	--	--	--	--	--
Dam	1317	5.88	2S	--	--	530	761.5	760.9	0.6	--	--	890	762.1	761.5	0.6	--	--	1,090	762.3	761.7	0.6	--	--
Santa Maria Court	1320	5.99	1S	10	Yes	530	767.2	766.0	1.2	--	--	890	769.4	767.2	2.2	0.6	0.4	1,090	769.8	767.5	2.3	1.0	0.8
Woodbridge Road	1325	6.08	1S	10	Yes	530	783.2	781.7	1.5	--	--	890	783.6	783.0	0.6	--	--	1,090	784.4	783.1	1.3	--	--
Indian Creek Parkway	1330	6.20	1S	10	Yes	530	792.5	791.1	1.4	--	--	890	796.7	793.1	3.6	0.6	0.6	1,090	797.2	793.1	4.1	1.1	1.1
Soo Line Railroad	1335	6.32	1S	100	Yes	420	799.6	798.3	1.3	--	--	770	801.5	799.7	1.8	--	--	820	802.3	800.4	1.9	--	--
Private Bridge	1336	6.37	1I	--	--	420	--	--	--	--	--	770	--	--	--	--	--	820	--	--	--	--	--
Private Bridge	1337A	6.41	1I	--	--	420	--	--	--	--	--	770	--	--	--	--	--	820	--	--	--	--	--
Private Bridge	1337	6.48	1I	--	--	420	--	--	--	--	--	770	--	--	--	--	--	820	--	--	--	--	--
Private Bridge	1338	6.50	1I	--	--	420	--	--	--	--	--	770	--	--	--	--	--	820	--	--	--	--	--
Private Bridge	1339	6.51	1S	--	--	420	806.7	805.5	1.2	--	--	770	808.7	806.1	2.6	1.3	0.5	820	809.0	806.1	2.9	1.6	0.8
Dam	1339A	6.58	2I	--	--	420	--	--	--	--	--	770	--	--	--	--	--	820	--	--	--	--	--
Private Bridge	1345	6.64	1S	--	--	420	817.0	816.2	0.8	--	--	770	818.6	818.4	0.2	1.0	0.7	820	819.2	819.1	0.1	1.6	1.3
Pilgrim Parkway	1350	6.68	1S	50	No	420	820.0	819.8	0.2	2.6	--	770	820.5	820.2	0.3	3.1	--	820	820.9	820.5	0.4	3.5	--
Pedestrian Bridge	1351	6.69	1I	--	--	420	--	--	--	--	--	770	--	--	--	--	--	820	--	--	--	--	--
Pedestrian Bridge	1352	6.73	1I	--	--	420	--	--	--	--	--	770	--	--	--	--	--	820	--	--	--	--	--
Pedestrian Bridge	1352A	6.89	1I	--	--	420	--	--	--	--	--	770	--	--	--	--	--	820	--	--	--	--	--
Park Bridge	1353	7.24	1S	--	--	90	822.4	822.4	0.0	0.5	--	120	823.1	823.1	0.0	1.3	0.3	130	823.6	823.6	0.0	1.8	0.8
Footbridge	1354	7.33	1I	--	--	90	--	--	--	--	--	120	--	--	--	--	--	130	--	--	--	--	--
Soo Line Railroad	1355	7.68	1S	100	Yes	66	824.8	824.2	0.6	--	--	72	825.3	824.3	1.0	--	--	74	825.4	824.4	1.0	--	--

[a]*Measured in miles above confluence with the Menomonee River.*

[b]*Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table G-8

HYDROLOGIC-HYDRAULIC SUMMARY—UNDERWOOD CREEK: YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Drop Structure	1190	0.22	3S	- -	- -	2,920	676.0	676.0	0.0	- -	- -	4,750	677.7	677.7	0.0	- -	- -	5,730	678.9	678.9	0.0	- -	- -
Drop Structure	1195	0.63	3S	- -	- -	2,920	681.4	681.4	0.0	- -	- -	4,750	683.8	683.8	0.0	- -	- -	5,730	684.8	684.8	0.0	- -	- -
Drop Structure	1196	0.67	3S	- -	- -	2,920	684.6	681.4	3.2	- -	- -	4,750	686.0	683.8	2.2	- -	- -	5,730	686.7	684.8	1.9	- -	- -
Zoo Freeway/USH 45	1200	0.75	1I	- -	- -	2,920	- -	- -	- -	- -	- -	4,750	- -	- -	- -	- -	- -	5,730	- -	- -	- -	- -	- -
Drop Structure	1201	0.80	3S	- -	- -	2,550	689.8	687.6	2.2	- -	- -	4,100	691.4	690.2	1.2	- -	- -	4,930	692.3	691.3	1.0	- -	- -
Soo Line Railroad	1202	0.81	1S	100	No	2,550	692.4	691.1	1.3	- -	- -	4,100	694.3	693.0	1.3	- -	- -	4,930	698.4	694.2	4.2	0.6	0.2
N. Mayfair Road/ STH 100	1205	1.27	1S	50	Yes	2,550	696.5	696.5	0.0	- -	- -	4,100	698.7	698.7	0.0	- -	- -	4,930	700.0	700.0	0.0	- -	- -
Drop Structure (Chicago & North Western Railroad)	1210	1.46	3S	- -	- -	2,550	700.4	699.3	1.1	- -	- -	4,100	702.6	701.0	1.6	- -	- -	4,930	703.6	701.8	1.8	- -	- -
W. Watertown Plank Road	1215	1.50	1I	- -	- -	2,550	- -	- -	- -	- -	- -	4,100	- -	- -	- -	- -	- -	4,930	- -	- -	- -	- -	- -
Drop Structure	1216	1.53	3S	- -	- -	2,240	704.6	704.6	0.0	- -	- -	3,540	707.6	707.6	0.0	- -	- -	4,230	709.2	709.2	0.0	- -	- -
Drop Structure	1217	1.63	3S	- -	- -	2,240	706.2	705.4	0.8	- -	- -	3,540	707.9	707.9	0.0	- -	- -	4,230	709.4	709.4	0.0	- -	- -
Drop Structure	1218	1.69	3S	- -	- -	2,240	707.8	707.8	0.0	- -	- -	3,540	709.4	709.4	0.0	- -	- -	4,230	709.8	709.8	0.0	- -	- -
N. 115th Street	1220	1.87	1S	10	Yes	2,240	710.2	709.9	0.3	- -	- -	3,540	714.2	711.5	2.7	- -	- -	4,230	716.7	712.2	4.5	- -	- -
United Parcel Service	1230	2.57	1S	- -	- -	760	722.3	718.4	3.9	- -	- -	1,250	723.4	719.5	3.9	0.6	- -	1,520	723.6	720.2	3.4	0.8	- -
Footbridge	1232	2.58	1S	- -	- -	760	722.6	722.6	0.0	0.6	- -	1,250	723.6	723.6	0.0	1.6	0.1	1,520	723.9	723.9	0.0	1.9	0.4
Private Bridge	1240	2.67	1S	- -	- -	760	723.5	722.9	0.6	0.7	- -	1,250	724.3	723.9	0.4	1.5	0.3	1,520	724.6	724.2	0.4	1.8	0.6
Private Bridge	1245	2.69	1S	- -	- -	760	724.4	723.9	0.5	0.9	0.1	1,250	725.0	724.6	0.4	1.5	0.7	1,520	725.2	724.8	0.4	1.7	0.9
Private Bridge	1250	2.73	1S	- -	- -	760	725.5	724.8	0.7	0.4	0.1	1,250	726.3	725.5	0.8	1.2	0.9	1,520	726.6	725.7	0.9	1.5	1.2
Private Bridge	1255	2.83	1S	- -	- -	760	726.7	726.7	0.0	0.1	- -	1,250	728.9	727.8	1.1	2.3	0.3	1,520	729.5	728.2	1.3	2.9	0.9
Soo Line Railroad	1260	3.10	1S	100	Yes	760	731.1	731.0	0.1	- -	- -	1,250	732.3	732.1	0.2	- -	- -	1,520	732.9	732.6	0.3	- -	- -
Private Bridge	1265	3.12	1S	- -	- -	760	732.6	731.6	1.0	1.4	- -	1,250	733.2	733.0	0.2	2.0	- -	1,520	733.6	733.3	0.3	2.4	- -
Wall Street	1270	3.25	1S	10	Yes	760	735.3	735.3	0.0	- -	- -	1,250	737.3	736.7	0.6	1.9	0.5	1,520	737.6	737.0	0.6	2.2	0.8
Elm Grove Shopping Center Outlet	1271	3.31	4S	- -	- -	760	- -	736.8	- -	- -	- -	1,250	- -	737.3	- -	- -	- -	1,520	- -	737.6	- -	- -	- -
Elm Grove Shopping Center Inlet	1271A	3.41	4S	- -	- -	760	737.1	- -	- -	- -	- -	1,250	739.8	- -	- -	- -	- -	1,520	742.5	- -	- -	- -	- -
Watertown Plank Road	1275	3.43	1S	50	Yes	760	738.0	738.0	0.0	- -	- -	1,250	740.3	740.3	0.0	- -	- -	1,520	743.4	742.8	0.6	0.3	0.3
Private Bridge	1276	3.45	1S	- -	- -	760	738.0	738.0	0.0	- -	- -	1,250	740.4	740.0	0.0	- -	- -	1,520	744.1	743.4	0.7	1.0	1.0
Private Bridge	1280	3.50	1S	- -	- -	760	739.5	738.5	1.0	- -	- -	1,250	741.5	741.5	0.0	0.4	- -	1,520	744.3	744.3	0.0	3.2	0.5
Soo Line Railroad	1290	3.55	1S	100	Yes	760	741.0	740.9	0.1	- -	- -	1,250	743.4	742.9	0.5	- -	- -	1,520	745.2	744.3	0.9	- -	- -
Juneau Boulevard	1295	3.67	1S	10	Yes	490	741.5	741.5	0.0	- -	- -	810	744.1	744.1	0.0	1.8	1.2	990	745.9	745.9	0.0	3.6	3.0
Village Hall Bridge	1300	3.76	1S	10	Yes	490	742.1	741.9	0.2	- -	- -	810	744.3	744.1	0.2	0.9	0.8	990	745.9	745.9	0.0	2.5	2.4
Marcella Avenue	1305	4.48	1S	10	Yes	490	747.2	746.7	0.5	- -	- -	810	748.6	747.6	1.0	0.7	0.5	990	749.0	748.0	1.0	1.1	0.9
North Avenue/CTH M	1310	4.82	1S	50	Yes	460	749.0	748.9	0.1	- -	- -	760	750.0	749.8	0.2	- -	- -	920	751.4	750.4	1.0	0.3	- -
Private Drive	1313	5.48	1S	- -	- -	270	752.9	752.8	0.1	- -	- -	480	753.7	753.5	0.2	- -	- -	600	754.0	753.7	0.3	- -	- -
Clearwater Road	1315	5.59	1S	10	Yes	270	756.5	755.0	0.5	- -	- -	480	757.1	756.0	1.1	1.0	0.2	600	757.4	756.4	1.0	1.3	0.5
Private Bridge	1316	5.87	1I	- -	- -	270	- -	- -	- -	- -	- -	480	- -	- -	- -	- -	- -	600	- -	- -	- -	- -	- -
Dam	1317	5.88	2S	- -	- -	270	761.0	760.6	0.4	- -	- -	480	761.5	760.8	0.7	- -	- -	600	761.7	761.0	0.7	- -	- -
Santa Maria Court	1320	5.99	1S	10	Yes	270	765.7	764.9	0.8	- -	- -	480	767.0	765.8	1.2	- -	- -	600	767.6	766.3	1.3	- -	- -
Woodbridge Road	1325	6.08	1S	10	Yes	270	781.2	780.1	1.1	- -	- -	480	782.8	781.4	1.4	- -	- -	600	783.6	782.1	1.5	- -	- -
Indian Creek Parkway	1330	6.20	1S	10	Yes	270	790.9	789.7	1.2	- -	- -	480	792.2	790.9	1.3	- -	- -	600	792.7	791.5	1.2	- -	- -
Soo Line Railroad	1335	6.32	1S	100	Yes	200	797.7	796.8	0.9	- -	- -	330	798.9	797.7	1.2	- -	- -	410	799.6	798.2	1.4	- -	- -
Private Bridge	1336	6.37	1I	- -	- -	200	- -	- -	- -	- -	- -	330	- -	- -	- -	- -	- -	410	- -	- -	- -	- -	- -
Private Bridge	1337A	6.41	1I	- -	- -	200	- -	- -	- -	- -	- -	330	- -	- -	- -	- -	- -	410	- -	- -	- -	- -	- -
Private Bridge	1337	6.48	1I	- -	- -	200	- -	- -	- -	- -	- -	330	- -	- -	- -	- -	- -	410	- -	- -	- -	- -	- -
Private Bridge	1338	6.50	1I	- -	- -	200	- -	- -	- -	- -	- -	330	- -	- -	- -	- -	- -	410	- -	- -	- -	- -	- -
Private Bridge	1339	6.51	1S	- -	- -	200	804.8	803.9	0.9	- -	- -	330	806.0	804.9	1.1	- -	- -	410	806.6	805.4	1.2	- -	- -
Dam	1339A	6.58	2I	- -	- -	200	- -	- -	- -	- -	- -	330	- -	- -	- -	- -	- -	410	- -	- -	- -	- -	- -
Private Bridge	1345	6.64	1S	- -	- -	200	815.3	814.5	0.8	- -	- -	330	816.6	815.6	1.0	- -	- -	410	817.0	816.2	0.8	- -	- -
Pilgrim Parkway	1350	6.68	1S	50	No	200	817.7	817.5	0.2	0.3	- -	330	818.9	818.8	0.1	1.5	- -	410	819.8	819.8	0.0	2.4	- -
Pedestrian Bridge	1351	6.69	1I	- -	- -	200	- -	- -	- -	- -	- -	330	- -	- -	- -	- -	- -	410	- -	- -	- -	- -	- -
Pedestrian Bridge	1352	6.73	1I	- -	- -	200	- -	- -	- -	- -	- -	330	- -	- -	- -	- -	- -	410	- -	- -	- -	- -	- -
Pedestrian Bridge	1352A	6.89	1S	- -	- -	200	- -	- -	- -	- -	- -	330	- -	- -	- -	- -	- -	410	- -	- -	- -	- -	- -
Park Bridge	1353	7.24	1S	- -	- -	90	822.4	821.7	0.7	0.6	- -	120	822.5	822.2	0.3	0.7	- -	130	822.5	822.4	0.1	0.7	- -
Footbridge	1354	7.33	1I	- -	- -	90	- -	- -	- -	- -	- -	120	- -	- -	- -	- -	- -	130	- -	- -	- -	- -	- -
Soo Line Railroad	1355	7.68	1S	100	Yes	66	824.8	824.2	0.6	- -	- -	72	825.3	824.3	1.0	- -	- -	74	825.4	824.4	1.0	- -	- -

[a] *Measured in miles above confluence with the Menomonee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table G-9

HYDROLOGIC-HYDRAULIC SUMMARY—SOUTH BRANCH UNDERWOOD CREEK: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
W. Bluemound Road	1800	0.05	1S	50	Yes	1,520	715.8	715.7	0.1	--	--	2,030	718.0	718.0	0.0	--	--	2,260	719.6	719.6	0.0	--	--
Soo Line Railroad	1805	0.15	1S	100	Yes	1,520	716.9	716.3	0.6	--	--	2,030	718.5	718.2	0.3	--	--	2,260	719.8	719.7	0.1	--	--
IH 94	1810	0.57	1S	100	Yes	1,520	719.4	719.1	0.3	--	--	2,030	720.6	720.4	0.2	--	--	2,260	721.4	721.3	0.1	--	--
Theodore Trecker Way Tunnel Outlet	1815	1.08	4S	--	--	980	--	722.3	--	--	--	1,300	--	723.4	--	--	--	1,430	--	723.9	--	--	--
Greenfield Avenue	1816	1.73	4S	--	--	540	725.6	--	--	--	--	650	726.0	--	--	--	--	690	726.3	--	--	--	--

[a]*Measured in miles above confluence with the Underwood Creek.*

[b]*Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table G-10

HYDROLOGIC-HYDRAULIC SUMMARY—DOUSMAN DITCH: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Soo Line Railroad	1355	0.03	1S	100	Yes	310	821.4	821.4	0.0	--	--	510	822.6	822.6	0.0	--	--	620	823.2	823.1	0.1	--	--
North Avenue/CTH M	1360	0.06	1S	50	Yes	310	821.5	821.5	0.0	--	--	510	822.7	822.7	0.0	--	--	620	823.8	823.3	0.5	--	--
Pedestrian Bridge	1365	0.20	1I	--	--	310	--	--	--	--	--	510	--	--	--	--	--	620	--	--	--	--	--
Gebhardt Road	1370	0.63	1S	10	Yes	310	823.3	823.3	0.0	--	--	510	824.6	824.6	0.0	--	--	620	825.5	825.4	0.1	--	--
Private Drive	1372	1.26	1S	--	--	260	825.6	825.6	0.0	--	--	400	826.5	826.4	0.1	--	--	470	826.7	826.7	0.0	--	--
Private Drive	1375	1.40	1I	--	--	260	--	--	--	--	--	400	--	--	--	--	--	470	--	--	--	--	--
Private Drive	1376	1.64	1S	--	--	260	827.2	827.1	0.1	1.4	0.9	400	827.8	827.8	0.0	2.0	1.5	470	827.8	827.8	0.0	2.0	1.5
Private Drive	1377	1.87	1S	--	--	260	828.4	827.8	0.6	1.0	0.2	400	828.5	828.1	0.4	1.1	0.3	470	828.6	828.2	0.4	1.2	0.4
Dam	1378	2.03	2S	--	--	260	829.1	829.1	0.0	--	--	400	829.5	829.5	0.0	--	--	470	829.6	829.6	0.0	--	--
Private Drive	1380	2.36	1S	--	--	260	830.0	829.2	0.8	2.5	2.5	400	830.4	829.6	0.8	2.9	2.9	470	830.5	829.8	0.7	3.0	3.0
Wisconsin Avenue Storm Sewer Outlet	1381	2.47	4I	--	--	260	--	--	--	--	--	400	--	--	--	--	--	470	--	--	--	--	--

[a]*Measured in miles above confluence with the Underwood Creek.*

[b]*Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c]*A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d]*Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table G-11

HYDROLOGIC-HYDRAULIC SUMMARY—DOUSMAN DITCH: YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Soo Line Railroad	1355	0.03	1S	100	Yes	70	819.7	819.7	0.0	- -	- -
North Avenue/CTH M	1360	0.06	1S	50	Yes	70	819.7	819.7	0.0	- -	- -
Pedestrian Bridge	1365	0.20	1I	- -	- -	70	- -	- -	- -	- -	- -
Gebhardt Road	1370	0.63	1S	10	Yes	70	820.9	820.9	0.0	- -	- -
Private Drive[e]	1372	1.26	1S	- -	- -	- -	- -	- -	- -	- -	- -
Private Drive[e]	1375	1.40	1I	- -	- -	- -	- -	- -	- -	- -	- -
Private Drive[e]	1376	1.64	1S	- -	- -	- -	- -	- -	- -	- -	- -
Private Drive[e]	1377	1.87	1S	- -	- -	- -	- -	- -	- -	- -	- -
Dam[e]	1378	2.03	2S	- -	- -	- -	- -	- -	- -	- -	- -
Private Drive[e]	1380	2.36	1S	- -	- -	- -	- -	- -	- -	- -	- -
Wisconsin Avenue Storm Sewer Outlet[e]	1381	2.47	4I	- -	- -	- -	- -	- -	- -	- -	- -

Name	50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Soo Line Railroad	150	820.7	820.7	0.0	- -	- -	200	821.3	821.3	0.0	- -	- -
North Avenue/CTH M	150	820.8	820.7	0.1	- -	- -	200	821.3	821.3	0.0	- -	- -
Pedestrian Bridge	150	- -	- -	- -	- -	- -	200	- -	- -	- -	- -	- -
Gebhardt Road	150	822.0	822.0	0.0	- -	- -	200	822.6	822.5	0.1	- -	- -
Private Drive[e]	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Private Drive[e]	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Private Drive[e]	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Private Drive[e]	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Dam[e]	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Private Drive[e]	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Wisconsin Avenue Storm Sewer Outlet[e]	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

[a] *Measured in miles above confluence with the Underwood Creek.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

[e] *Structure is located within proposed detention basin.*

Source: SEWRPC.

Table G-12

HYDROLOGIC-HYDRAULIC SUMMARY—LITTLE MENOMONEE RIVER: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantandous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
N. Lovers Lane Road/ STH 100	1400	0.09	1S	50	Yes	1,040	701.4	701.4	0.0	--	--	1,480	702.8	702.8	0.0	--	--	1,700	703.5	703.5	0.0	--	--
Pedestrian Bridge	1405	0.52	1I	--	--	1,040	--	--	--	--	--	1,480	--	--	--	--	--	1,700	--	--	--	--	--
W. Silver Spring Drive	1410	1.11	1S	50	Yes	1,040	702.8	702.8	0.0	--	--	1,480	703.8	703.8	0.0	--	--	1,700	704.3	704.3	0.0	--	--
Chicago & North Western Railway	1415	1.45	1S	100	Yes	1,040	705.2	704.8	0.4	--	--	1,480	706.1	705.6	0.5	--	--	1,700	706.5	706.0	0.5	--	--
W. Appleton Avenue	1420	1.57	1S	50	Yes	1,040	706.0	706.0	0.0	--	--	1,480	707.3	707.3	0.0	--	--	1,700	707.8	707.8	0.0	--	--
W. Mill Road	1425	2.40	1S	50	No	1,040	710.7	709.5	1.2	0.1	--	1,480	711.4	710.2	1.2	0.8	--	1,700	711.6	710.4	1.2	1.0	--
Fond du Lac Freeway/ STH 145	1430	2.56	1S	100	Yes	1,140	711.0	711.0	0.0	--	--	1,610	711.8	711.8	0.0	--	--	1,820	712.0	712.0	0.0	--	--
W. Leon Terrace	1435	2.61	1S	10	No	1,140	711.2	711.1	0.1	1.0	0.6	1,610	711.8	711.8	0.0	1.6	1.2	1,820	712.1	712.0	0.1	1.9	1.5
Park Bridge	1437	3.37	1I	--	--	740	--	--	--	--	--	990	--	--	--	--	--	1,100	--	--	--	--	--
W. Good Hope Road/ CTH PP	1440	3.66	1S	50	Yes	740	712.7	712.5	0.2	--	--	990	713.4	713.1	0.3	--	--	1,100	713.6	713.3	0.3	--	--
N. Granville Road/ CTH F	1445	3.74	1S	10	Yes	740	714.1	713.5	0.6	--	--	990	714.7	714.1	0.6	0.4	--	1,100	714.9	714.4	0.5	0.6	--
W. Calumet Road	1450	4.17	1S	10	Yes	740	715.4	715.4	0.0	--	--	990	715.9	715.9	0.0	--	--	1,100	716.4	716.1	0.3	--	--
W. Bradley Road	1455	4.69	1S	50	Yes	400	717.3	717.3	0.0	--	--	560	718.0	717.9	0.1	--	--	640	718.3	718.2	0.1	--	--
Wisconsin & Southern Railroad	1456	4.77	1S	100	Yes	400	717.5	717.4	0.1	--	--	560	718.2	718.2	0.0	--	--	640	718.5	718.5	0.0	--	--
Chicago & North Western Railway	1464	5.88	1I	--	--	400	--	--	--	--	--	560	--	--	--	--	--	640	--	--	--	--	--
Chicago & North Western Railway	1465	5.88	1S	100	Yes	400	719.2	719.2	0.0	--	--	560	720.0	720.0	0.0	--	--	640	720.4	720.3	0.1	--	--
W. Brown Deer Road	1470	5.92	1S	50	Yes	400	719.4	719.2	0.2	--	--	560	720.4	720.0	0.4	--	--	640	720.8	720.4	0.4	--	--
Park Bridge	1475	6.56	1I	--	--	400	--	--	--	--	--	560	--	--	--	--	--	640	--	--	--	--	--
W. County Line Road	1485	6.95	1S	50	No	470	719.9	719.6	0.3	0.9	--	650	720.6	720.6	0.0	1.6	0.4	730	721.1	721.1	0.0	2.1	0.9

[a] *Measured in miles above confluence with the Menomonee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

Source: SEWRPC.

Table G-13

HYDROLOGIC-HYDRAULIC SUMMARY—BUTLER DITCH: YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS

Structure Identification and Selected Characteristics						10-Year Recurrence Interval Flood						50-Year Recurrence Interval Flood						100-Year Recurrence Interval Flood					
Name	Number	River Mile[a]	Structure Type and Hydraulic Significance[b]	Recommended Design Frequency (years)	Adequate Hydraulic Capacity[c]	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)	Instantaneous Peak Discharge (cfs)	Upstream Stage (feet above NGVD)	Downstream Stage (feet above NGVD)	Backwater[d] (feet)	Depth at Low Point in Bridge Approach Road (feet)	Depth on Road at Centerline of Bridge (feet)
Campbell Drive	1604	0.24	1S	10	Yes	470	733.1	732.2	0.9	--	--	780	733.3	732.8	0.5	--	--	950	734.0	733.2	0.8	--	--
Overview Drive	1608	0.64	1S	10	Yes	470	744.2	743.9	0.3	--	--	780	745.2	744.5	0.7	--	--	950	745.8	744.8	1.0	--	--
Hampton Road/CTH KK	1615	1.02	1S	50	Yes	470	748.2	748.1	0.1	--	--	780	749.5	748.7	0.8	--	--	950	750.2	749.0	1.2	--	--
Lisbon Road/CTH K	1620	1.35	1S	50	Yes	320	753.1	753.1	0.0	--	--	590	754.0	753.7	0.3	--	--	760	754.6	754.0	0.6	--	--
Lilly Road	1625	1.76	1S	10	Yes	230	754.8	754.7	0.1	--	--	420	755.8	755.5	0.3	--	--	520	756.3	756.0	0.3	--	--
Dam	1630	1.81	2S	--	--	230	755.6	755.6	0.0	--	--	420	756.5	756.5	0.0	--	--	520	756.9	756.9	0.0	--	--
Lisbon Road	1645	3.40	1S	50	Yes	160	772.1	771.4	0.7	--	--	300	773.2	772.2	1.0	--	--	380	774.8	772.7	2.1	0.3	--

[a] *Measured in miles above confluence with the Menomonee River.*

[b] *Structure code is as follows: 1-bridge or culvert; 2-dam, sill or weir; 3-drop structure or natural channel drop; 4-fords, outfalls, or inlet or outlet structures. Hydraulically significant structures are denoted by an S; hydraulically insignificant structures are denoted by an I.*

[c] *A bridge has an adequate hydraulic capacity if it will remain open during a flood having a recurrence interval equal to or less than the recommended design frequency. A bridge is hydraulically inadequate if the approach road or bridge is overtopped by a flood having a recurrence interval equal to or less than the recommended design frequency.*

[d] *Backwater is defined as the change in the stage from the upstream side of the hydraulic structure to the downstream side.*

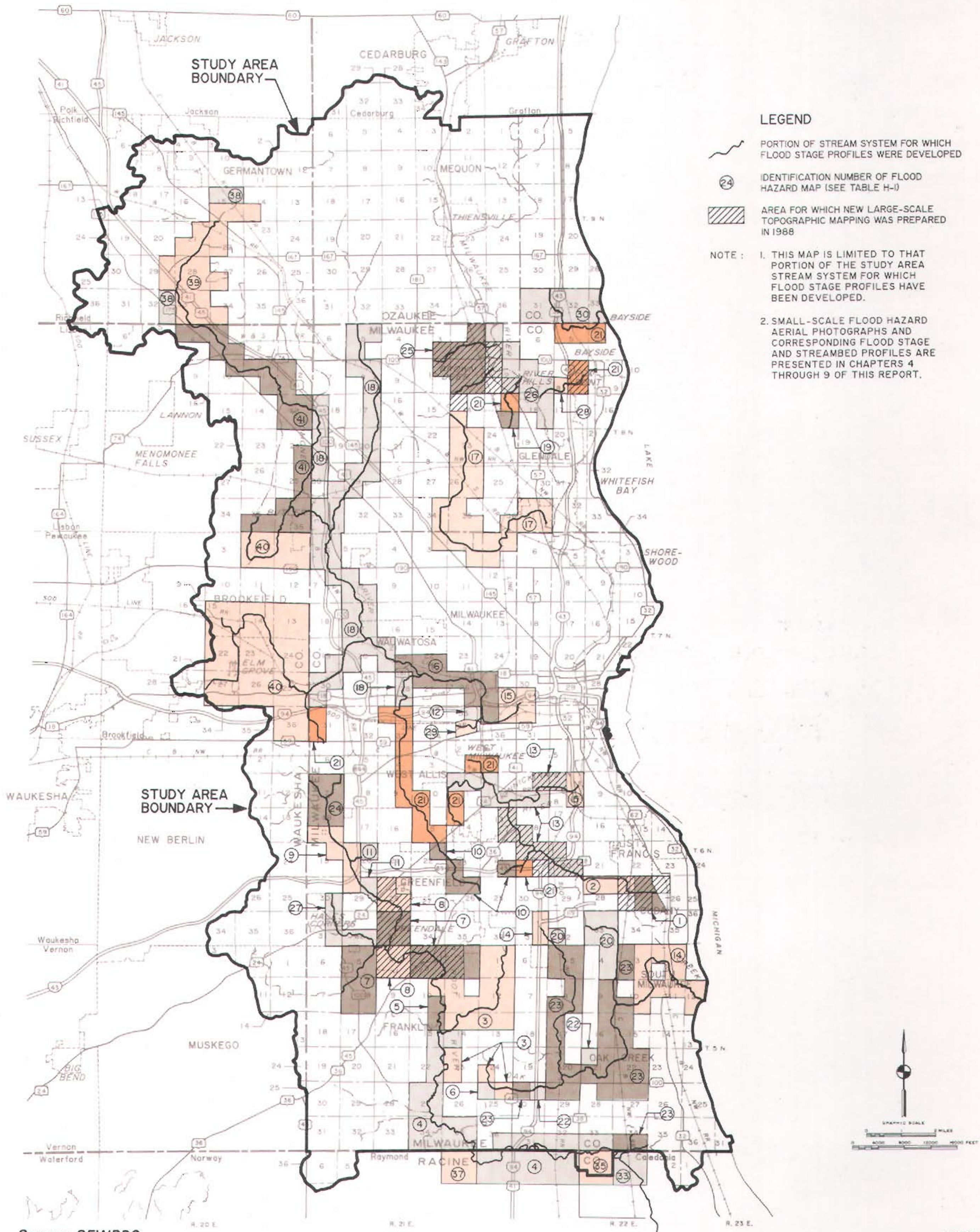
Source: SEWRPC.

Appendix H

LARGE-SCALE TOPOGRAPHIC MAPPING IN THE MILWAUKEE METROPOLITAN SEWERAGE DISTRICT STUDY AREA

Map H-1

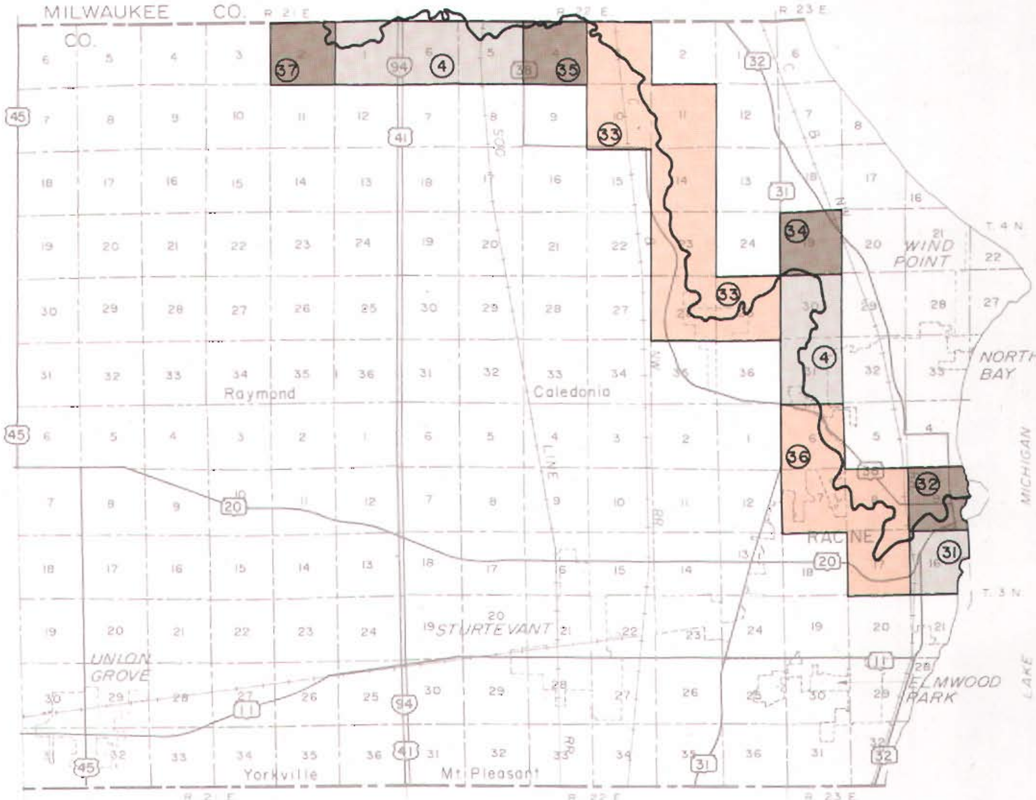
INDEX TO LARGE-SCALE TOPOGRAPHIC FLOOD HAZARD MAPPING AND AERIAL PHOTOGRAPHY IN THE MILWAUKEE METROPOLITAN SEWERAGE DISTRICT STUDY AREA



Source: SEWRPC.

Map H-2

INDEX TO LARGE-SCALE TOPOGRAPHIC FLOOD HAZARD MAPPING FOR THE ROOT RIVER MAIN STEM IN RACINE COUNTY



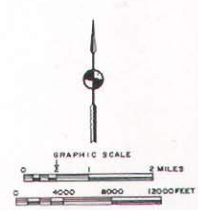
LEGEND

PORTION OF STREAM SYSTEM FOR WHICH FLOOD STAGE PROFILES WERE DEVELOPED

(4) IDENTIFICATION NUMBER OF FLOOD HAZARD MAP (SEE TABLE H-I)

NOTE: 1. THIS MAP IS LIMITED TO THAT PORTION OF THE STUDY AREA STREAM SYSTEM FOR WHICH FLOOD STAGE PROFILES HAVE BEEN DEVELOPED.

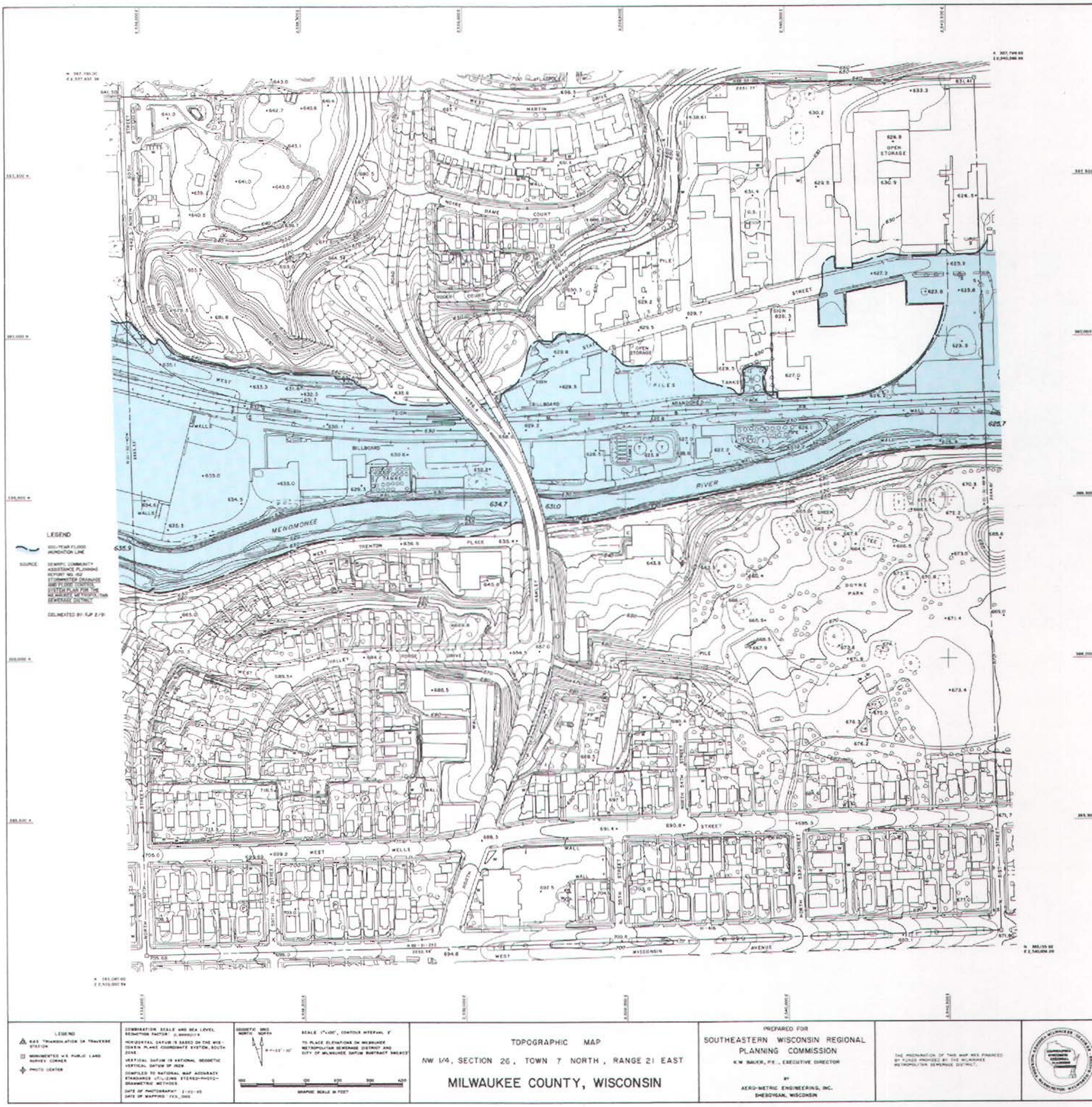
2. SMALL SCALE FLOOD HAZARD AERIAL PHOTOGRAPHS AND CORRESPONDING FLOOD STAGE AND STREAMBED PROFILES ARE PRESENTED IN CHAPTER 6 OF THIS REPORT.



Source: SEWRPC.

Map H-3

TYPICAL FLOOD HAZARD MAP FOR A PORTION OF THE MILWAUKEE METROPOLITAN SEWERAGE DISTRICT STUDY AREA



Source: SEWRPC.

Table H-1

SELECTED INFORMATION PERTAINING TO LARGE-SCALE FLOOD HAZARD MAPPING AND AERIAL PHOTOGRAPHY IN THE MILWAUKEE METROPOLITAN SEWERAGE DISTRICT STUDY AREA

Identification Number on Maps H-1 and H-2	Civil Division		Scale	Contour Interval (feet)	Agency or Community from Which Flood Hazard Mapping Can be Obtained	Date of Photography Used for Map Preparation
	County	City, Village, or Town				
1	Milwaukee	City of Cudahy	1" = 100'	2	City of Cudahy	1958
2	Milwaukee	Cities of Cudahy and Milwaukee	1" = 100'	2	Milwaukee County Airport Engineer	1966
3	Milwaukee	City of Franklin	1" = 100'	2	City of Franklin	1963
4	Milwaukee and Racine	Cities of Franklin and Oak Creek, Towns of Raymond and Caledonia	1" = 200'	2	Southeastern Wisconsin Regional Planning Commission	1965
5	Milwaukee	City of Franklin	1" = 100'	2	Southeastern Wisconsin Regional Planning Commission	1967
6	Milwaukee	City of Franklin	1" = 100'	2	Southeastern Wisconsin Regional Planning Commission	1983
7	Milwaukee	City of Franklin and Village of Greendale	1" = 200'	5	Milwaukee Metropolitan Sewerage District	1951
8	Milwaukee	City of Franklin and Village of Greendale	1" = 200'	5	Milwaukee Metropolitan Sewerage District	1952
9	Milwaukee	City of Greenfield	1" = 100'	2	City of Greenfield	1974
10	Milwaukee	City of Greenfield	1" = 100'	2	City of Greenfield	1975
11	Milwaukee	City of Greenfield	1" = 100'	2	City of Greenfield	1976
12	Milwaukee	City of Milwaukee	1" = 100'	2	Milwaukee County Department of Public Works	1969
13	Milwaukee	Cities of Milwaukee and West Allis, Village of West Milwaukee	1" = 200'	2	U. S. Department of the Interior, U. S. Geological Survey	1975
14	Milwaukee	Cities of Milwaukee and South Milwaukee	1" = 100'	2	Southeastern Wisconsin Regional Planning Commission	1980
15	Milwaukee	City of Milwaukee	1" = 100'	2	Southeastern Wisconsin Regional Planning Commission	1982
16	Milwaukee	Cities of Milwaukee and Wauwatosa	1" = 100'	2	Southeastern Wisconsin Regional Planning Commission	1985
17	Milwaukee	City of Milwaukee	1" = 100'	2	Southeastern Wisconsin Regional Planning Commission	1986
18	Milwaukee	Cities of Milwaukee and Wauwatosa	1" = 100'	2	Southeastern Wisconsin Regional Planning Commission	1988

Table H-1 (continued)

Identification Number on Maps H-1 and H-2	Civil Division		Scale	Contour Interval (feet)	Agency or Community from Which Flood Hazard Mapping Can be Obtained	Date of Photography Used for Map Preparation
	County	City, Village, or Town				
19	Milwaukee	City of Milwaukee	1" = 100'	1	Milwaukee County Department of Parks, Recreation and Culture	1987
20	Milwaukee	Cities of Milwaukee and Oak Creek	1" = 100'	2	Milwaukee County Airport Engineer	1980
21	Milwaukee	Cities of Milwaukee and West Allis, Villages of Bayside and Fox Point	1" = 400'	N/A[a]	Southeastern Wisconsin Regional Planning Commission	1985
22	Milwaukee	City of Oak Creek	1" = 100'	2	State of Wisconsin, Department of Transportation	1970
23	Milwaukee	City of Oak Creek	1" = 100'	2	City of Oak Creek	1961
24	Milwaukee	City of West Allis	1" = 200'	2	City of West Allis	1973
25	Milwaukee	Village of Brown Deer	1" = 100'	2	Village of Brown Deer	1964
26	Milwaukee	Villages of Brown Deer and River Hills	1" = 200'	2	Southeastern Wisconsin Regional Planning Commission	1969
27	Milwaukee	Village of Hales Corners	1" = 100'	2	Village of Hales Corners	1975
28	Milwaukee	Village of River Hills	1" = 100'	2	Village of River Hills	1966
29	Milwaukee	Wood (Post Office)	1" = 100'	5	U. S. Veterans Administration	1972
30	Ozaukee	City of Mequon	1" = 200'	2	City of Mequon	c. 1960
31	Racine	City of Racine	1" = 200'	2	Racine County	1969
32	Racine	City of Racine	1" = 200'	2	Racine County	1976
33	Racine	Town of Caledonia	1" = 200'	2	Racine County	1967
34	Racine	Town of Caledonia	1" = 200'	2	Racine County	1968
35	Racine	Town of Caledonia	1" = 200'	2	Racine County	1971
36	Racine	Town of Mt. Pleasant and City of Racine	1" = 200'	2	Racine County	1967
37	Racine	Town of Raymond	1" = 200'	2	Racine County	1974
38	Washington	Village of Germantown	1" = 100'	2	Village of Germantown	1964
39	Washington	Village of Germantown	1" = 100'	2	Village of Germantown	1985
40	Waukesha	City of Brookfield	1" = 200'	2	Waukesha County	1986
41	Waukesha	Village of Menomonee Falls	1" = 100'	2	Waukesha County	1987

[a]*N/A indicates not applicable (ratioed and rectified aerial photographs).*

Source: SEWRPC.

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Appendix I

DOCUMENTATION OF SUPPLEMENTAL PLANNING WORK

The alternative and recommended flood control and related drainage system plans for the watercourses for which the Milwaukee Metropolitan Sewerage District has assumed jurisdiction for flood control purposes under that District's adopted watercourse policy plan are documented in Chapters IV through IX of this report. The plans set forth in those chapters were completed under the direction of the Advisory Committee on Stormwater Drainage and Flood Control Planning for the Milwaukee Metropolitan Sewerage District and District Service Areas, a committee of knowledgeable and concerned public officials and citizens.

As certain of the system plans were completed and the recommendations of the Advisory Committee made known to the Milwaukee Metropolitan Sewerage District, the District began efforts directed toward implementation of selected recommendations. These efforts were conducted concurrently with the completion of the Advisory Committee's work on the remaining watercourses. The efforts included meetings, hearings, and supplemental technical work requested by the District and undertaken by the Regional Planning Commission staff.

Under these plan implementation efforts three separate supplemental studies were completed and provided to the District at the District's request. The purpose of this appendix is to document herein these three supplemental analyses. Appendix I-1 reproduces a memorandum report dated November 17, 1988, attendant to the evaluation of additional alternatives for the Lincoln Creek subwatershed. Appendix I-2 reproduces a letter report dated June 19, 1990, attendant to the evaluation of additional alternatives for the Edgerton Channel portion of the Wilson Park Creek subwatershed. Appendix I-3 reproduces a letter report dated October 24, 1990, attendant to the evaluation of additional alternatives for the North Branch of the Root River. It should be noted that the supplemental technical analyses documented in these three work efforts did not warrant any changes in the recommendations of the Commission staff or of the Advisory Committee as set forth in the body of this report.

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EVALUATION OF ADDITIONAL ALTERNATIVES FOR THE LINCOLN CREEK SUBWATERSHED: NOVEMBER 17, 1988

FURTHER EVALUATIONS COMPLETED DURING THE PRELIMINARY ENGINEERING PHASE OF THE LINCOLN CREEK SYSTEM PLAN IMPROVEMENTS

November 17, 1988

FURTHER ALTERNATIVE EVALUATIONS COMPLETED DURING THE PRELIMINARY ENGINEERING PHASES OF THE PROJECT

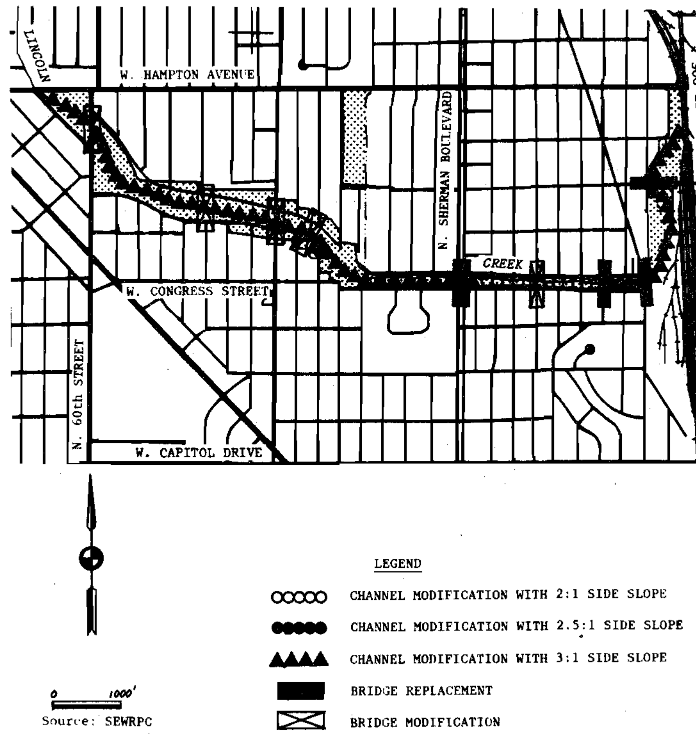
During the preliminary engineering phase of the detailed design of the Lincoln Creek improvements, concerns were expressed by elected officials and citizens regarding use of a partial concrete lining for the reaches of Lincoln Creek between the Soo Line Railroad crossing River Mile 2.01 and the westerly crossing of W. Hampton Avenue (River Mile 4.41). Within this reach, alternatives were also evaluated by the District's design consultant providing for partial vertical walls under one option, and for an enclosed box culvert under another option for the stream reach between N. 35th Street and Sherman Boulevard. These alternatives were evaluated because of the limited right-of-way existing between the roadways on each side of the channel.

Because of these concerns, the District, in October 1988, asked for a review of the alternatives which had been considered over the years as part of the various studies which had been completed on the Lincoln Creek subwatershed flood problems. A summary description of those alternatives is provided in Table V-7. Upon review of those alternatives by the District, it was requested that three alternatives be reconsidered. All three of these alternatives would provide for a channel lined primarily with turf but with riprap along the bottom low-flow portion of the channel. Under one alternative, the channel would be designed assuming no upstream storage and only minimal use of berms and dikes and would be sized to fully contain the 100-year flood flows as does the initially recommended alternative. Under the second alternative, the channel would be designed assuming maximum upstream storage and the use of dikes and floodwalls where appropriate to minimize the width of the channel improvements and fully contain the 100-year flood flows. The third alternative also provides for no upstream storage. However, the channel width was limited

-2-

MAP V-13

INITIALLY RECOMMENDED FLOOD CONTROL PLAN



Source: SEWRPC

-3-

to that which could fit between the existing Congress Streets. This would result in the continued flooding of some parkway lands, some public streets, and some structures. The alternative provides for floodproofing of those structures. These three additional alternatives are described in the following sections. All three of these alternatives had been rejected previously primarily because the channel flow velocities concerned were found to be significantly higher than 6 feet per second. This may be expected to result in relatively frequent scouring of the banks covered only with vegetative cover. However, in order to address the expressed concerns, these alternatives were re-analyzed, including provision of costs for relandscaping, regrading, and sediment removal following scour. In addition to discussing these three riprap and turf-lined channel alternatives, for comparative purposes, a brief description is also presented below of the initially recommended alternative and of a revised alternative providing for a box culvert channel enclosure for a portion of the stream between N. 35th Street and Sherman Boulevard. A summary of the costs and selected characteristics for the initially-recommended alternative, the initially-recommended alternative refined by the use of the channel enclosure, and for the three riprap and turf-lined channel alternatives are set forth in Table V-8.

Initially Recommended Flood Control Plan

For the subject reach between the Soo Line railroad (former Chicago, Milwaukee, St. Paul and Pacific Railway) and W. Hampton Avenue, the initially recommended flood control plan called for major channel modifications with the resulting channel being concrete-lined up to an elevation two feet above the 10-year recurrence interval flood level, the remainder of the channel being turf-lined, all as shown on Map V-13. The proposed channel would have a bottom width of 30 feet, except in the reach between N. 37th Street and Sherman Boulevard where the channel bottom width would vary from 20 to 30 feet. The channel side slopes would accommodate the available distance between the adjacent roadways. In the reach between N. 35th Street to N. 37th Street, the side slopes would be one vertical to two and one-half horizontal; from N. 37th Street to N. Sherman Boulevard, the side slopes would be one on two; with the remainder of the channel having side slopes of one on three. The streambed would also be lowered from one to six feet with an average depth of excavation of about two feet. Typical cross sections of both the existing and proposed channel are shown in Figure V-11.

In addition to the channel modification, this flood control plan includes the replacement of the existing bridges at W. Glendale Avenue, N. 35th Street, N. 37th Street, and N. Sherman Boulevard, and modification of three pedestrian bridges as well as the bridges at N. 51st Street and N. 60th Street.

The costs associated with this plan for the subject reach are summarized in Table V-8. The capital cost of this plan is estimated at about $12,310,000, including $9,000,000 for channel modification and $3,310,000 for bridge replacement and modification. The operation and maintenance costs for the subject reach are estimated to approximate $12,000 per year. The average annual cost of the plan for the subject reach is $793,000.

Initially Recommended Plan Refinement with Channel Enclosure

As noted above, additional alternatives were evaluated by the District's engineering consultant for the reach between N. 35th Street and N. Sherman Boulevard due to the restrictive right-of-way. These alternatives consisted of major channelization with vertical side walls along this reach and channel enclosure. Because the use of vertical walls would result in walls of up to 13 feet in height, that alternative was considered undesirable for public safety reasons. The consultant therefore considered further the enclosure of the channel in a triple reinforced concrete box culvert between N. 35th Street and N. Sherman Boulevard. The two outer cells would be 21 feet wide by 16 feet high, while the center cell would be 24 feet wide by 16 feet high. Also, the proposed streambed profile would be altered along this reach so as to match the existing invert at N. 35th Street. The streambed would gradually be lowered to match the preliminary recommended invert at N. Sherman Boulevard. Channel modifications as recommended above would be carried out along the remainder of the 2.4-mile-long stream reach.

Under this plan, the existing bridge at W. Glendale Avenue would be replaced while modifications would be made to two pedestrian bridges as well as the bridges at N. 51st Street and N. 60th Street.

Table V-7

SUMMARY OF ALTERNATIVE FLOOD CONTROL MEASURES EVALUATED FOR LOWER LINCOLN CREEK

Number	Alternative	Study in Which Evaluation Was Made[a]	Comments
1	No Action	SEWRPC 1977, SEWRPC 1982, SEWRPC 1987	Does not solve problem; remaining annual average damages of $837,000
2	Structure Removal--Removal of 1,595 residential units and floodproofing of 26 industries and businesses	SEWRPC 1977	Estimated cost of about $100 million based upon market values. Presents a large tax base loss.
3	Structure Floodproofing and Elevation of 1,595 residential units and 26 industries and businesses	SEWRPC 1977, SEWRPC 1982, MMSD-SEWRPC 1987	Responsibility for implementation rests with property owners; complete implementation, therefore, is unlikely; street and yard flooding would remain.
4	Major Channelization (turf-lined open channel with 4 to 1 side slopes, 30 foot bottom width, 120 to 250 foot top width)	SEWRPC 1977, SEWRPC 1982, MMSD-SEWRPC 1987	Channel velocities under flood conditions are too high for turf-lining, channel erosion would occur; channel would be too large to fit between existing utilities and roads at some locations.
5	Major Channelization (concrete-lined open channel with varying side slopes, 30-foot bottom width, 100 to 200 foot top width)	SEWRPC 1977, SEWRPC 1982, MMSD-SEWRPC 1987	Recommended as most cost-effective and practical alternative under MMSD stormwater drainage and flood control system plan. Found by J.C. Zimmerman Engineering Corp. to require remodification for reach between N. 35th Street and and N. Sherman Blvd due to right-of-way restrictions between existing Congress Streets.
6	Major Channelization. Concrete-lined open channel with short reach of vertical side walls	MMSD-J.C. Zimmerman 1987	Similar to Alternative 5 above except that channel cross section is changed between N. 35th Street and N. Sherman Blvd so as to have vertical concrete side walls. These walls were considered to present a serious safety hazard.
7	Major Channelization (concrete-lined open channel with partial channel enclosure)	MMSD-J.C. Zimmerman 1987	Similar to Alternative 5 above except that channel would be enclosed in three reinforced concrete box culverts between N. 35th Street and N. Sherman Blvd. More expensive than open channel design but eliminates safety hazard and allows for added green space area.
8	Selective Bridge Replacement	SEWRPC 1982	Eliminates only some of the flood damages. Replacement of N. Sherman Blvd bridge would decrease upstream stage but increase downstream flood flows and stages, producing additional damages.
9	Detention Storage-maximum storage considered using all available sites	SEWRPC 1982 MMSD-SEWRPC 1987	Eliminates only some of the flood damages. Has little impact on flood flows and stages downstream of Sherman Blvd
10	Combination of Detention Storage and Channel Modification	SEWRPC 1982	Channel modification required is similar to that which is required for strictly channel modification without dentention storage. Therefore, cost savings--both monetary and environmental--are minimal.
11	Diking	SEWRPC 1977, SEWRPC 1982, MMSD-SEWRPC 1987	Dikes and floodwalls would restrict view of channel. Expensive stormwater pumping facilities and storm sewer reconstruction would be required.
12	Diversion-Re-Routing of Storm Sewers to Convey Stormwater to Milwaukee River	SEWRPC 1982	Judged to be prohibitively costly.

[a]Report References:
SEWRPC Community Assistance Planning Report No. 13, Flood Control Plan for Lincoln Creek, Milwaukee County, Wisconsin, 1977.
SEWRPC Community Assistance Planning Report No. 13, 2nd Edition, Flood Control Plan for Lincoln Creek, Milwaukee, Wisconsin, 1982
MMSD Stormwater Drainage and Flood Control System Plan, Chapter V, 1987.
MMSD-J. C. Zimmerman Engineering Corp., Preliminary Engineering Memorandum, Flood Control Plan for Lincoln Creek, 1987

Table V-8

PRINCIPAL FEATURES, COSTS, AND NONECONOMIC CONSIDERATIONS OF ALTERNATIVE FLOOD CONTROL PLANS FOR LOWER LINCOLN CREEK BETWEEN THE SOO LINE RAILROAD (R.M. 2.01) AND W. HAMPTON AVENUE (R.M. 4.41)

No.	Name	Description	Costs (dollars): Capital	Costs (dollars): Amortized Capital[a]	Costs (dollars): Annual Operation and Maintenance	Costs (dollars): Total	Key Considerations: Positive	Key Considerations: Negative
1.	Initially Recommended Channelization with Partial Concrete Lining	a. Channel Modification	$ 9,000,000		$ 12,000		o Requires little maintenance o Eliminates streambank erosion o Lowest cost alternative which resolves all flooding and erosion problems	o Provides least amount of vegetative lined channel o Requires steep channel side slopes
		b. Bridge Replacement and Modification	3,310,000					
		Subtotal	$12,310,000	$ 781,000	$ 12,000	$ 793,000		
2.	Initially Recommended Channelization Refined to Include Channel Enclosure	a. Channel Modification	7,050,000		8,000		o Provides about 9 acres of usable open space over box culvert o Requires little maintenance o Eliminates streambank erosion	o Highest initial capital and average annual cost o Channel covering results in loss of 2,700 feet of open stream channel o Regulatory aproval for channel enclosure is not assured
		b. Channel Enclosure	9,260,000		3,000			
		c. Bridge Replacement and Modification	1,260,000					
		Subtotal	$17,570,000	$1,114,000	$ 11,000	$1,125,000		
3.	Reevaluated Channelization with Riprap and Turf Lining and No Detention	a. Channel Modification	2,450,000		10,000		o Next to lowest initial capital cost o Provides best available option for maintenance of aquatic life	o High and variable maintenance cost o Severe erosion of banks during major storm events o Inconsistent with Wisconsin Dept. of Natural Resources Milwaukee River Priority Watershed Program o Sediment has negative impact on downstream aquatic life o Requires vacating of about 2,000 feet of N. Congress Street and removal of 7 homes and one apartment building o Largest channel cross section with resulting least usable adjacent open space o Regulatory approval is not assured due to erosion problem o Costs for downstream sediment removal could be high if material to be removed is classified as hazardous
		b. Bridge Replacement and Modification	3,310,000					
		c. Dikes and Floodwalls	240,000		4,000			
		d. Removal of eight structures	600,000					
		e. Utility Replacement	450,000					
		f. Chánnel Regrading and Resodding Due to Erosion[b]	--		300,000			
		g. Sediment Removal[c]			38,000			
		Subtotal	$ 7,050,000	$ 447,000	$352,000	$ 799,000		

Table V-8 (continued)

No.	Name	Description	Costs (dollars): Capital	Costs (dollars): Amortized Capital[a]	Costs (dollars): Annual Operation and Maintenance	Costs (dollars): Total	Key Considerations: Positive	Key Considerations: Negative
4.	Reevaluated Channelization with Riprap and Turf Lining and Detention Storage at Army Reserve Property	a. Channel Modification	$ 2,780,000		$ 13,000		o Provides best available option for maintenance of aquatic life	o High and variable maintenance cost o Severe erosion of banks during major storm events o Inconsistent with Wisconsin Dept. of Natural Resources Milwaukee River Priority Watershed Program o Sediment has negative impact on downstream aquatic life o Requires acquiring land from Army Reserve for upstream detention basin o Requires steep channel side slopes o Regulatory approval is not assured due to erosion problem o Costs for downstream sediment removal could be high if material to be removed is classified as hazardous
		b. Bridge Replacement and Modification	3,310,000					
		c. Dikes and Floodwalls	230,000		4,000			
		d. Detention Basin	3,830,000		84,000			
		e. Channel Regrading and Resodding Due to Erosion[d]	--		160,000			
		f. Sediment Removal[c]	--		20,000			
		Subtotal	$10,150,000	$ 644,000	$281,000	$ 925,000		
5.	Reevaluated Channelization with Riprap and Turf Lining and No Detention Storage with Floodproofing	a. Channel Modification	$ 2,780,000		$ 13,000		o Lowest initial capital cost o Provides best available option for maintenance of aquatic life	o High and variable maintenance cost o Severe erosion of banks during major storm events o Inconsistent with Wisconsin Dept. of Natural Resources Milwaukee River Priority Watershed Program o Sediment has negative impact on downstream aquatic life o Some yard and street flooding will continue to occur o Requires steep channel side slopes o Complete voluntary resolution of flood problem unlikely o Does not meet system plan objectives of providing 2 feet of freeboard for flood protection o Regulatory approval is not assured due to erosion problem o Costs for downstream sediment removal could be high if material to be removed is classified as hazardous
		b. Bridge Replacement and Modification	3,310,000					
		c. Dikes and Floodwalls	270,000		4,000			
		d. Floodproofing of up to 112 houses[e]	670,000					
		e. Channel Regrading and Resodding Due to Erosion[b]			290,000			
		f. Sediment Removal[c]			35,000			
		Subtotal	$ 7,030,000	$ 446,000	$ 342,000	$ 788,000		

[a]Amortized capital cost is based on an interest rate of 6 percent and a project life of 50 years.

[b]Costs provided are an average annual amount. Costs are expected to vary annually from very low amounts to $940,000.

[c]Costs are based upon an assumption that materials removed can be disposed of in the confined disposal facility. If materials are classified as hazardous, then costs for disposal could be increased significantly.

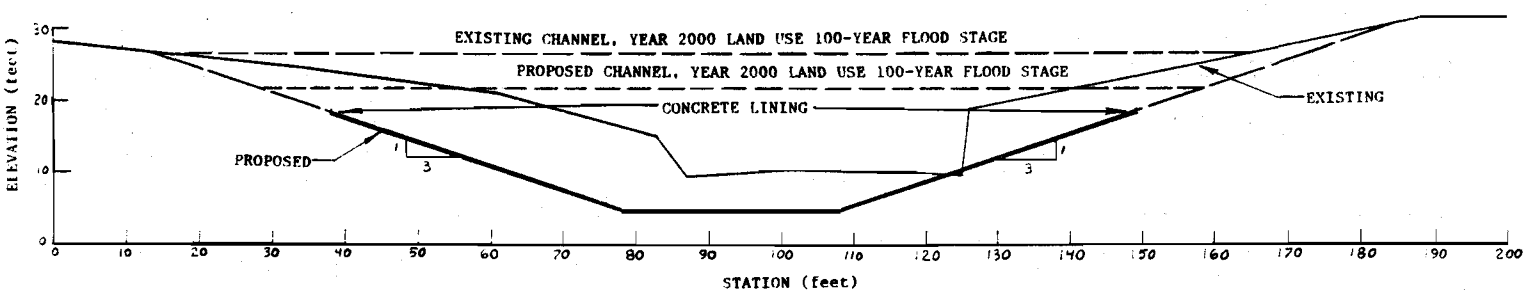
[d]Costs provided are an average annual amount. Costs expected to vary from very low amounts to $640,000.

[e]In order to make alternatives comparable, costs were included for floodproofing 11 homes which were within the floodplain and 101 homes which would be located along flooded streets and could incur secondary flooding.

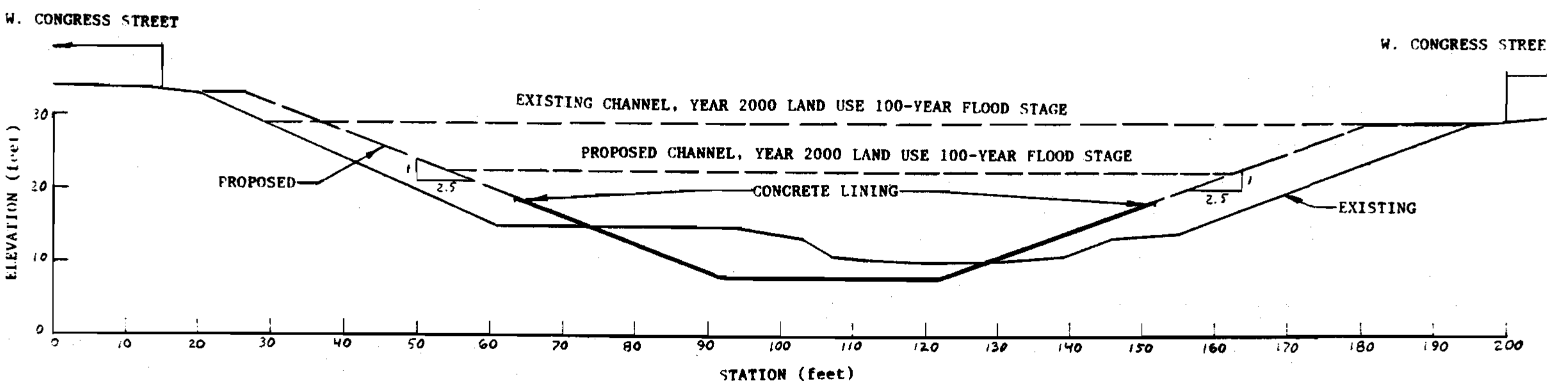
Source: SEWRPC

FIGURE V-11

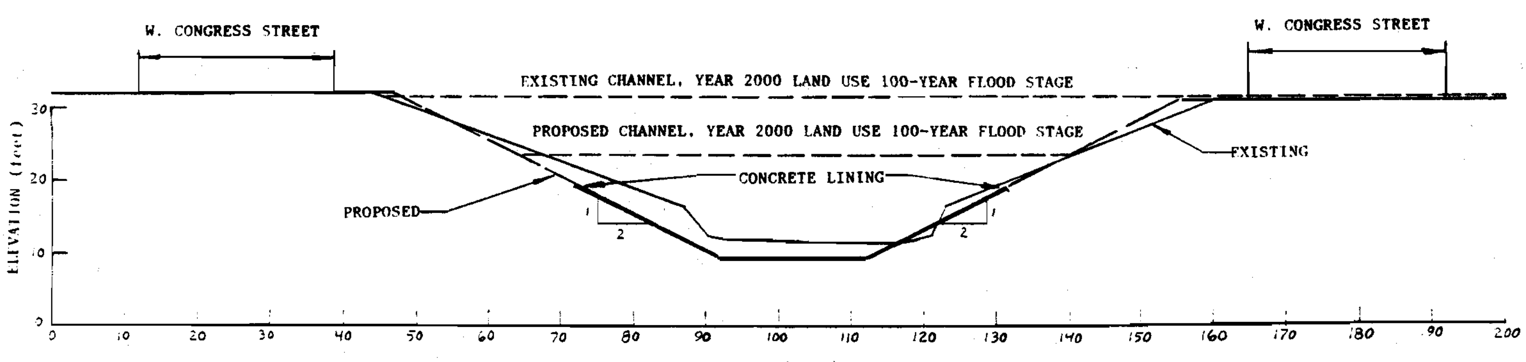
TYPICAL CHANNEL CROSS SECTIONS
INITIALLY RECOMMENDED FLOOD CONTROL PLAN



SOO LINE RAILROAD TO N. 35th STREET

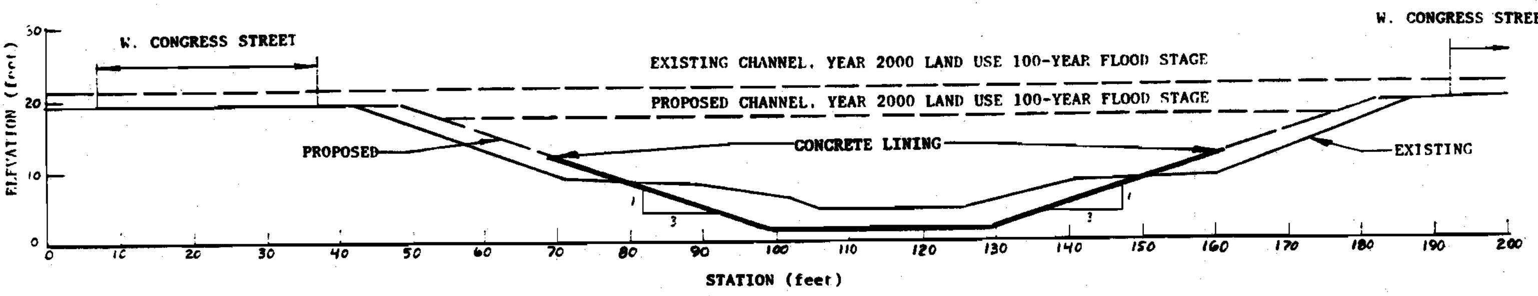


N. 35th STREET TO N. 37th STREET

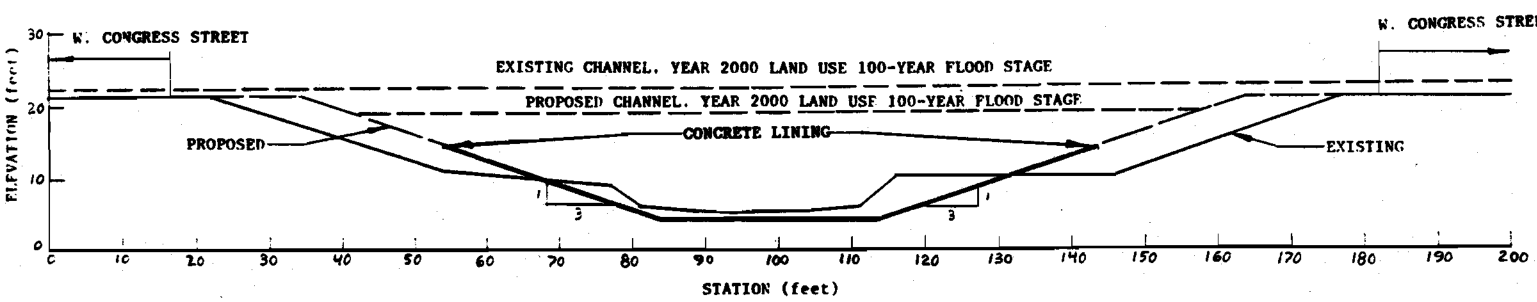


N. 37th STREET TO RIVER MILE 2.95

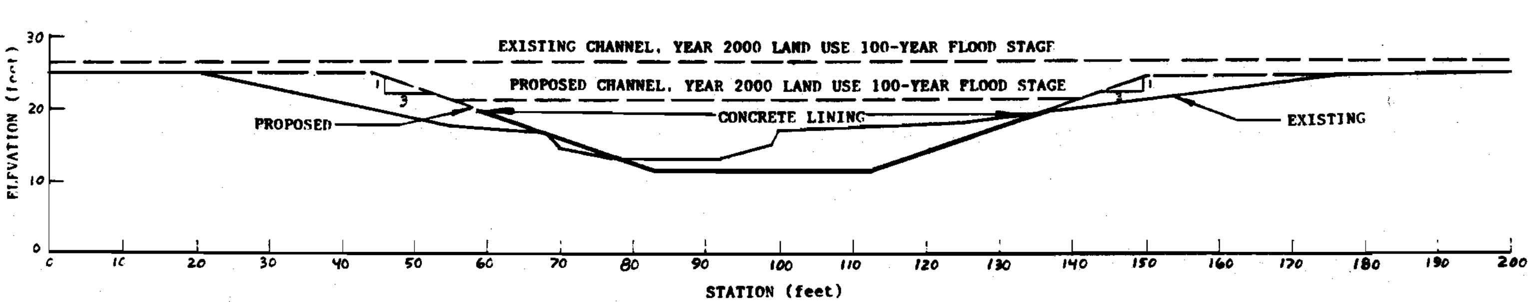
FIGURE V-11 (continued)



RIVER MILE 2.95 TO N. SHERMAN BOULEVARD



N. SHERMAN BOULEVARD TO N. 51st STREET



N. 51st STREET TO W. HAMPTON AVENUE

Source: SEWRPC

The costs associated with this refined plan are summarized in Table V-8. The capital cost of the plan for the subject reach is estimated at about $17,570,000, including $7,050,000 for channel modification, $9,260,000 for channel enclosure, and $1,260,000 for bridge replacement and modification. The operation and maintenance costs for the subject reach are estimated to approximate $11,000 per year. The average annual cost of the plan for the subject reach is $1,125,000.

Reevaluation of Riprap and Turf-Lined Channel Without Detention Storage

The riprap and turf-lined channel alternative reevaluated is shown graphically on Map V-14 for the subject reach. Both upstream and downstream of the subject reach, this alternative would be identical to the initially recommended flood control plan described in the preceding sections of this chapter. Within the subject reach, major channel modifications would be made with the resulting channel bottom being riprap-lined to an elevation two feet above the invert. The remainder of the channel would be turf-lined. The hydrologic and hydraulic models developed under the Lincoln Creek flood control study were used to develop flood flows and stages for this alternative. As shown in Table V-9, the resulting flows are about two percent lower than those for the initially recommended channel which was partially concrete-lined. This decrease results from the higher friction factor relating to the turf and riprap lining.

The channel for this alternative would have a bottom width of 30 feet and side slopes of one vertical on three horizontal between the Soo Line Railroad (former CMSTP&P Railway) bridge and N. 35th Street. Between N. 35th Street and a point about 350 feet downstream of N. Sherman Boulevard the channel would have a bottom width of 30 feet and side slopes of one vertical on 2.5 horizontal. Along the next 350 feet to N. Sherman Boulevard the channel would have a bottom width of 30 feet and again have side slopes of one vertical on three horizontal. Between N. Sherman Boulevard and W. Hampton Avenue the channel would have a bottom with of 30 feet and side slopes of one vertical on 3.5 horizontal. The streambed profile through this 2.4-mile long reach would be the same as for the partially concrete-lined channel described earlier under the initially recommended plan and would provide for deepening of the channel

Table V-9

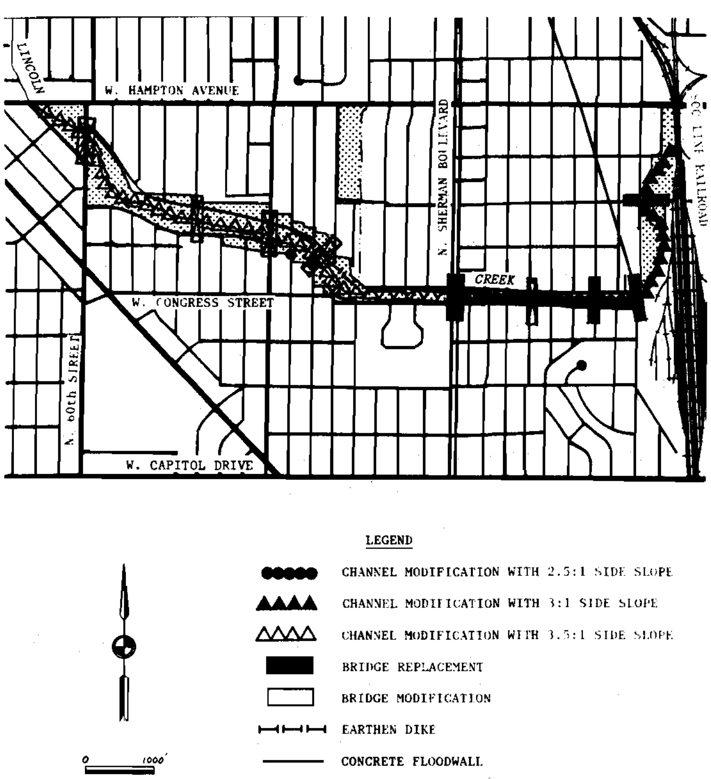
COMPARISON OF 100-YEAR RECURRENCE INTERVAL FLOOD FLOWS (CFS) ALONG LOWER LINCOLN CREEK--YEAR 2000 PLANNED LAND USE

Location	River Mile	Initially Recommended Plan Partially Concrete-Lined Channel With or Without Enclosure (Alternative 1 and 2)	Riprap and Turf-Lined Channel Without Storage (Alternative 3 & 5)	Percent Difference	Riprap and Turf-Lined Channel With Storage (Alternative 4)	Percent Difference
At Mouth	0.00	14,000	13,690	-2.2	12,600	-10.0
Upstream of N. Green Bay Road	0.44	13,960	13,670	-2.1	12,550	-10.1
Upstream of Confluence with Crestwood Creek	0.60	12,650	12,440	-1.7	11,240	-11.1
Downstream of W. Cameron Avenue	1.52	12,200	11,990	-1.7	10,760	-11.8
Upstream of N. 32nd Street	1.91	12,080	11,860	-1.8	10,660	-11.8
Downstream of N. 35th Street	2.51	9,790	9,580	-2.1	8,340	-14.8
Downstream of N. Sherman Blvd.	3.02	9,430	9,250	-1.9	7,940	-15.8
At N. 46th Street Extended	3.21	8,560	8,450	-1.3	6,990	-18.3
Downstream of N. 60th Street	4.22	5,860	5,860	0.0	4,310	-26.4
Upstream of W. Hampton Avenue	4.42	4,600	4,600	0.0	3,060	-33.5
Downstream of W. Villard Avenue	4.75	2,170	2,170	0.0	610	-71.9

Source: SEWRPC

MAP V-14

RIPRAP AND TURF-LINED CHANNEL WITHOUT DETENTION STORAGE



Source: SEWRPC

from one to six feet with an average depth of excavation of about two feet. Under this alternative the channel would have an average depth of 19 feet. The top width of the channel would range from 110 to 190 feet with an average width of about 160 feet. Typical cross sections of both the existing and proposed channel are shown on Figure V-12.

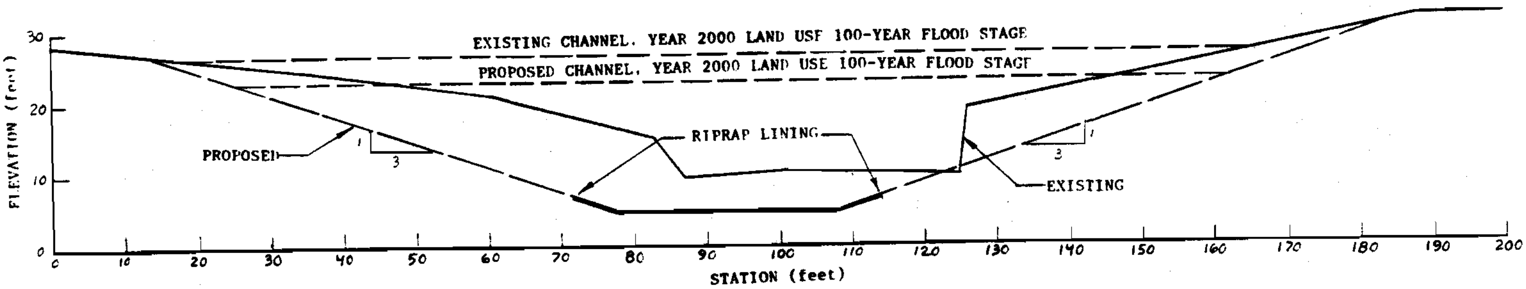
The proposed channel may be expected to fit the existing parkway lands except for that reach between N. 37th Street and N. Sherman Boulevard, a distance of 0.39 mile. Within this reach the proposed channel would encroach on W. Congress Street on both the north and the south side of the parkway by up to 14 feet, or alternatively, would encroach about 28 feet on one or the other, requiring the closure of one of the roadways within this reach. Currently, eight properties along the north side of the parkway and nine properties along the south side front upon W. Congress Street within this reach. Thus, this alternative includes provisions for removal of eight properties, removal of about 0.39 mile of the Congress Street roadway on the north side of the Creek, and relocation of the utilities in and under that roadway.

In addition to the channel modifications, this alternative includes the replacement of the existing bridges at W. Glendale Avenue, N. 35th Street, N. 37th Street, and N. Sherman Boulevard, and modification of three pedestrian bridges and the bridges at N. 51st Street and N. 60th Street.

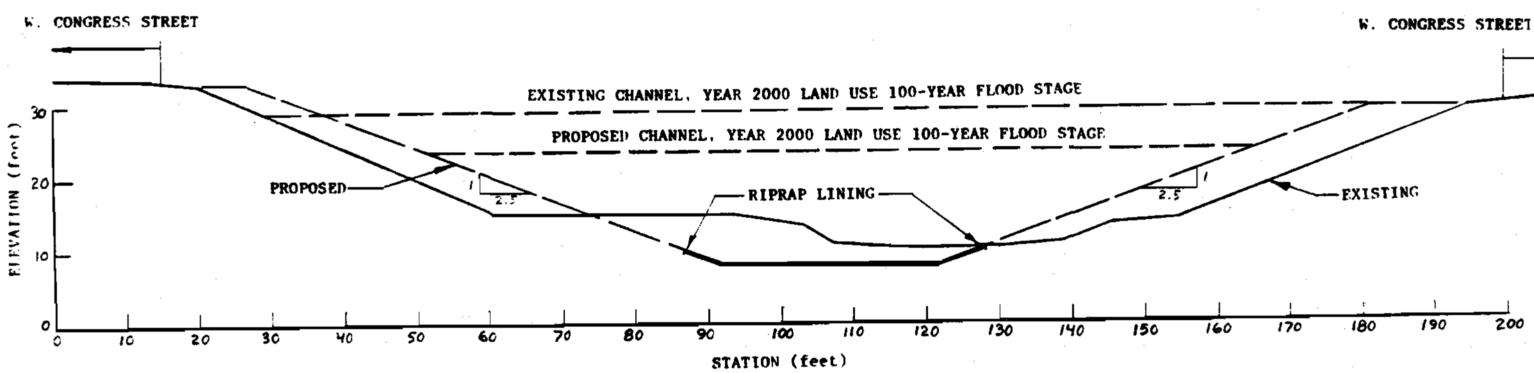
This alternative would also require the construction of a total of 1500 feet of earthen dikes with an average height of 2.0 feet and 320 feet of concrete floodwalls with an average height of two feet. More specifically, a concrete floodwall would be constructed along the south channel bank beginning at N. 47th Street extended and running 320 feet upstream. From that point about 310 feet of earthen dike would be constructed, also along the south channel bank. In addition, about 1,190 feet of earthen dike would be constructed along the north channel bank between N. 47th Street extended and N. 50th Street extended. These dikes and floodwall are intended to provide additional freeboard above the 100-year recurrence interval flood stage along this reach as the anticipated flood stages would be at or near the top of the planned channel.

FIGURE V-12

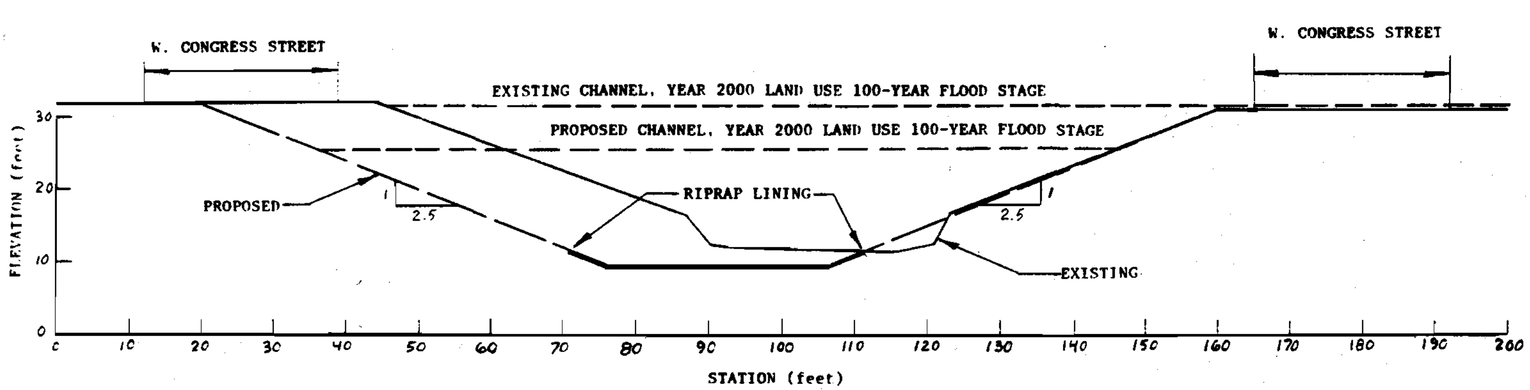
TYPICAL CHANNEL CROSS SECTIONS
RIPRAP AND TURF-LINED CHANNEL
WITHOUT DETENTION STORAGE



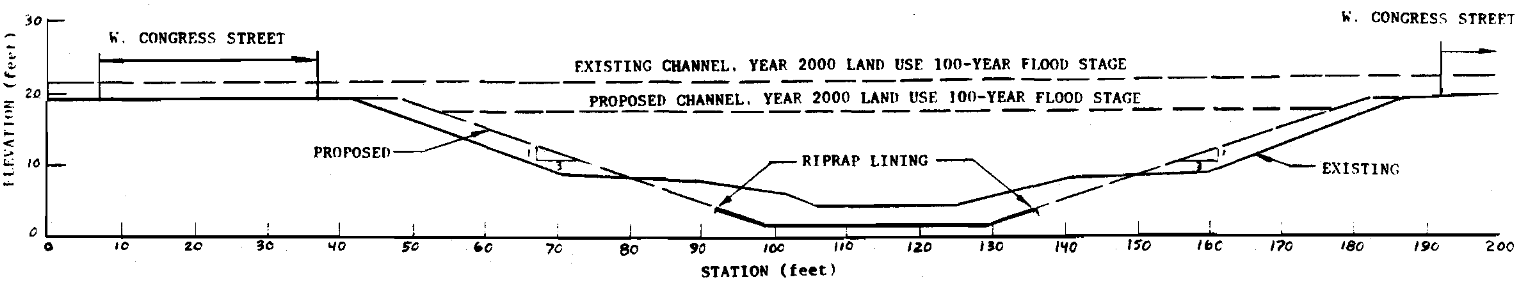
SOO LINE RAILROAD TO N. 35th STREET



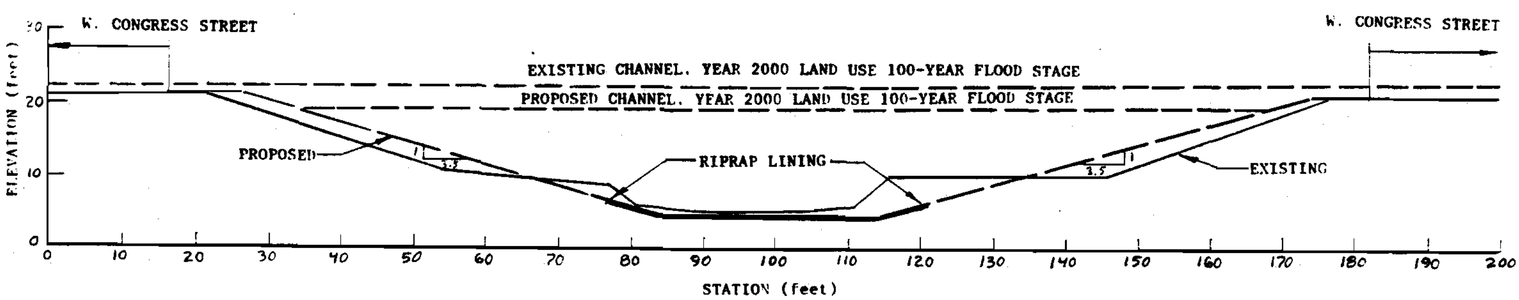
N. 35th STREET TO N. 37th STREET



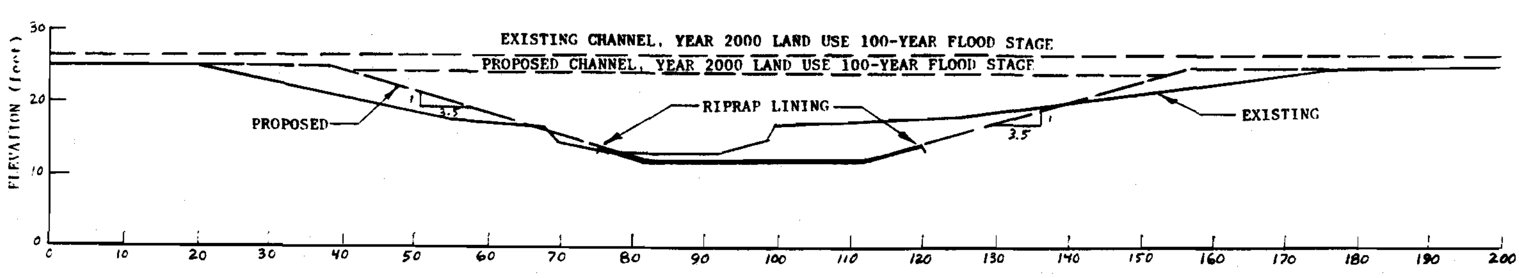
N. 37th STREET TO RIVER MILE 2.95



RIVER MILE 2.95 TO N. SHERMAN BOULEVARD



N. SHERMAN BOULEVARD TO N. 51st STREET



N. 51st STREET TO W. HAMPTON AVENUE

Source: SEWRPC

The results of the hydraulic simulation modeling indicate that the channel velocity within the subject reach during a 100-year recurrence interval event may be expected to range from six to ten feet per second, with an average velocity of about eight fps. During a 10-year recurrence interval flood, the channel velocity may be expected to range from six to nine fps, with an average velocity of about seven fps. Design standards developed under the MMSD flood control system plan recommend a maximum channel velocity of six fps for a turf lining to avoid erosion of the vegetation and banks. The proposed channel could be expected to suffer from erosion problems during minor as well as major flood events. Because of the relatively steep gradient of the channel through the reach concerned, velocities of flood events as low as the one-year recurrence flood event may be expected to generate velocities high enough to cause erosion and scour.

The costs associated with this alternative are summarized in Table V-8. The capital cost of this alternative within the subject reach is estimated at about $7,050,000, including $2,450,000 for channel modification, $3,310,000 for bridge replacement and modification, and $240,000 for dikes and floodwalls, $600,000 for removal of seven houses and one apartment building, and $450,000 for utility relocation. The operation and maintenance costs for the subject reach are estimated to approximate $352,000 per year, of which $338,000 would be for turf replacement and regrading to restore eroded banks following storm events resulting in scouring channel flow velocities and for sediment removal. The average annual cost of this alternative is $799,000.

Reevaluated Riprap and Turf-Lined Channel With Detention Storage

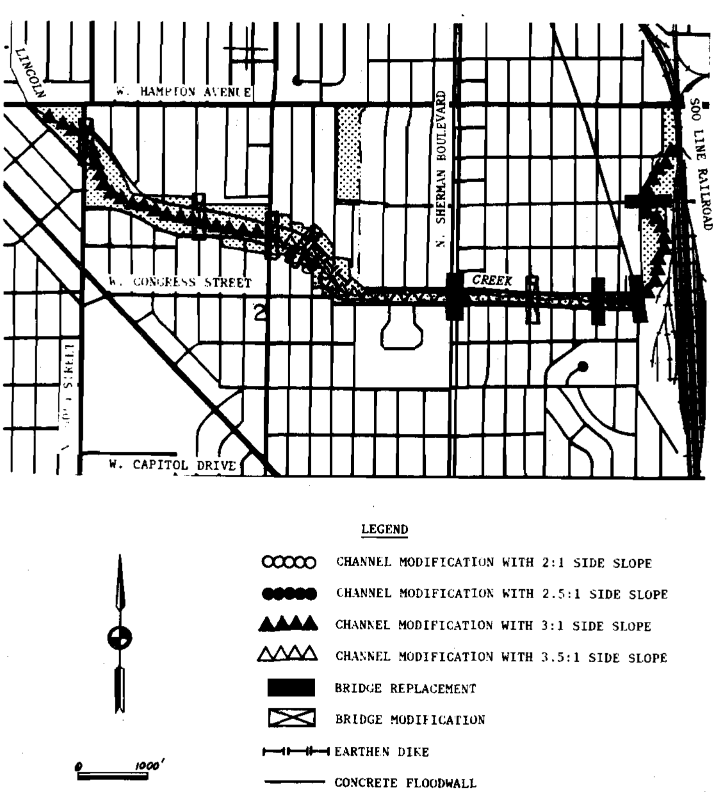
The riprap and turf-lined channel alternative with detention storage is shown graphically on Map V-15 for the subject reach. This alternative is similar to that described above except for the addition of floodwater storage along Upper Lincoln Creek, upstream from the subject reach. Two hydrologic simulations were made for the evaluation of this alternative. The first simulation assumed an on-stream floodwater detention basin located on the U.S. Army Reserve property upstream of W. Silver Spring Drive. The second simulation assumed "maximum floodwater storage" and included detention basins at the Brynwood Country Club; upstream of W. Green Tree Road; at the Havenwoods Environmental

Awareness Center; and at the Army Reserve property. Both simulations produced essentially the same flood flows along Lower Lincoln Creek, indicating that the three additional detention basins upstream of the Army Reserve property would not have a significant impact on downstream flood flows and stages. Therefore, the construction of only one detention basin at the Army Reserve property is recommended to be included under this alternative. As shown in Table V-9, the resulting flood flows were 10 to 72 percent lower than those for the initially recommended partially concrete-lined channel without detention storage, with the largest decrease occurring along the reach immediately downstream of the detention basin.

The resulting channel for the reach between the Soo Line Railroad (former CMSTP&P Railway) bridge and N. 35th Street would have a bottom width of 30 feet and side slopes of one vertical on three horizontal. Between N. 35th Street and N. 37th Street the channel would have a bottom width of 30 feet and side slopes of one vertical on 2.5 horizontal. Between N. 37th Street and a point about 350 downstream of N. Sherman Boulevard the channel would have a bottom width varying from 20 to 30 feet and side slopes of one vertical on two horizontal. Along the next 350 feet to N. Sherman Boulevard, the channel would have a bottom width of 30 feet and would again have side slopes of one vertical on three horizontal. Between N. Sherman Boulevard and N. 51st Street the channel would have a bottom width of 30 feet and side slopes of one vertical on 3.5 horizontal. Finally, between N. 51st Street and W. Hampton Avenue the proposed channel would have a bottom width of 30 feet and side slopes of one vertical on three horizontal. Within this 2.4-mile long reach the proposed channel bottom would be lined with riprap to an elevation which is two feet above the proposed invert, with the remainder of the channel being turf-lined. The proposed streambed profile would be the same as for the partially concrete-lined channel described under the initially recommended plan and provides for deepening the channel from one to six feet with an average depth of excavation of about two feet. The proposed channel would have an average depth of about 19 feet. The top width of the channel would range from 110 to 190 feet with an average width of about 150 feet. Typical cross sections of both the existing and proposed channels are shown on Figure V-13.

MAP V-15

RIPRAP AND TURF-LINED CHANNEL
WITH DETENTION STORAGE



Source: SEWRPC

In addition to the channel modifications, this alternative would include the replacement of the existing bridges at W. Glendale Avenue, N. 35th Street, N. 37th Street, and N. Sherman Boulevard, and modification of three pedestrian bridges and the bridges at N. 51st Street and N. 60th Street.

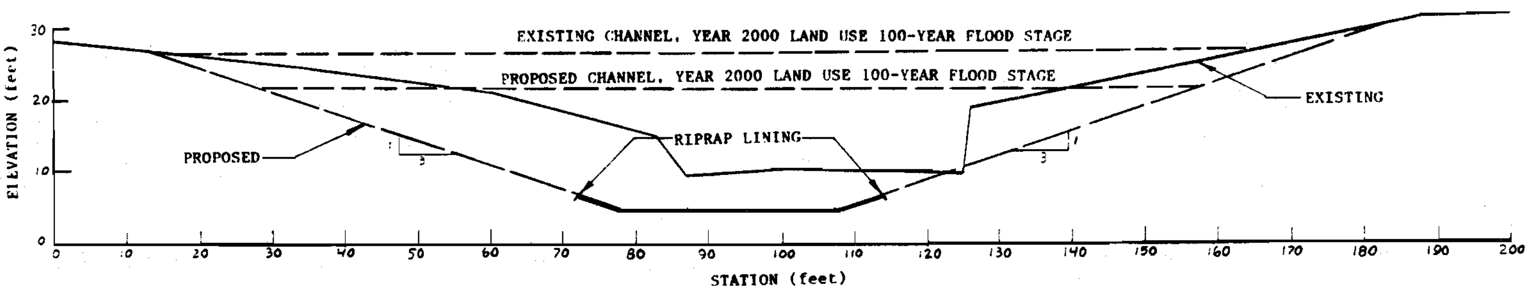
This alternative would also require the construction of a total of 1,160 feet of earthen dikes with an average height of 2.0 feet and 320 feet of concrete floodwall with an average height of two feet. More specifically, a concrete floodwall would be constructed along the south channel bank beginning at N. 47th Street extended and running 320 feet upstream. From that point about 310 feet of earthen dike would be constructed, also along the south bank. In addition, about 850 feet of earthen dike would be constructed along the north channel bank between N. 47th Street extended and N. 49th Street extended. These dikes and floodwall are intended only to provide additional freeboard above the 100-year recurrence interval flood stage along this reach as the anticipated flood stages would be at or near the top of the planned channel.

Finally, this alternative includes the construction of a 280 acre-foot detention basin along Upper Lincoln Creek within the U.S. Army Reserve property as shown on Map V-16. The proposed basin would have an overall depth of 10 feet and at maximum storage volume would cover 28 acres in area. An additional approximately five acres might be required for access and fencing. Outflow from the basin would be controlled by a six-foot diameter circular concrete pipe.

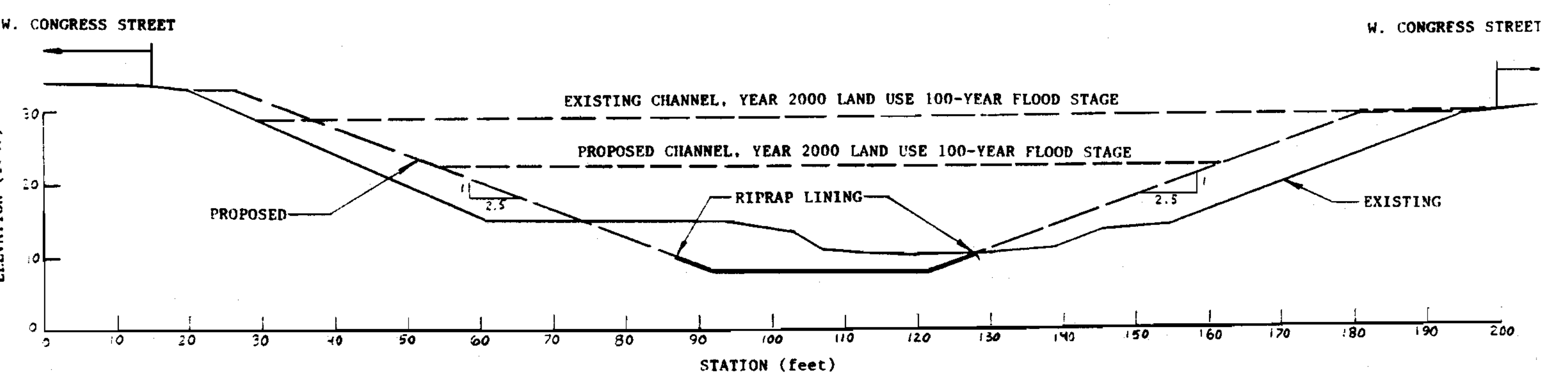
The proposed channel between the Soo Line Railroad bridge and W. Hampton Avenue may be expected to fit within the existing parkway lands and should not encroach on the W. Congress Street roadways. The results of the hydraulic analysis indicate that the channel velocity within this reach during a 100-year recurrence interval event would range from five to eleven feet per second, with an average velocity of about seven fps. During a 10-year recurrence interval flood event, the channel velocity would range from five to ten fps, with the average velocity of approximately seven fps. Therefore, severe erosion and scour problems could be expected to occur along this channel reach during major flood events. For an approximately 700-foot-long reach between

FIGURE V-13

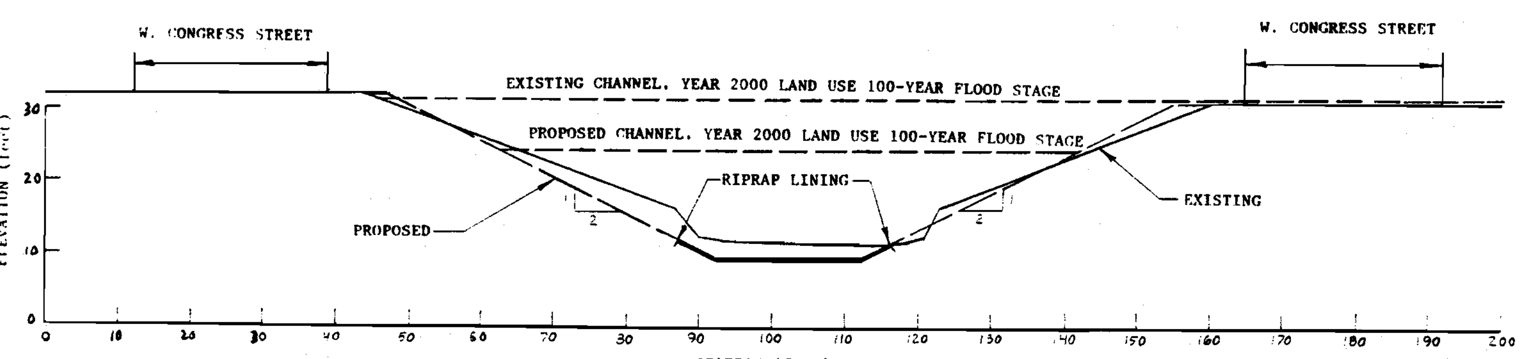
TYPICAL CHANNEL CROSS SECTIONS
RIPRAP AND TURF-LINED CHANNEL
WITH DETENTION STORAGE



SOO LINE RAILROAD TO N. 35th STREET

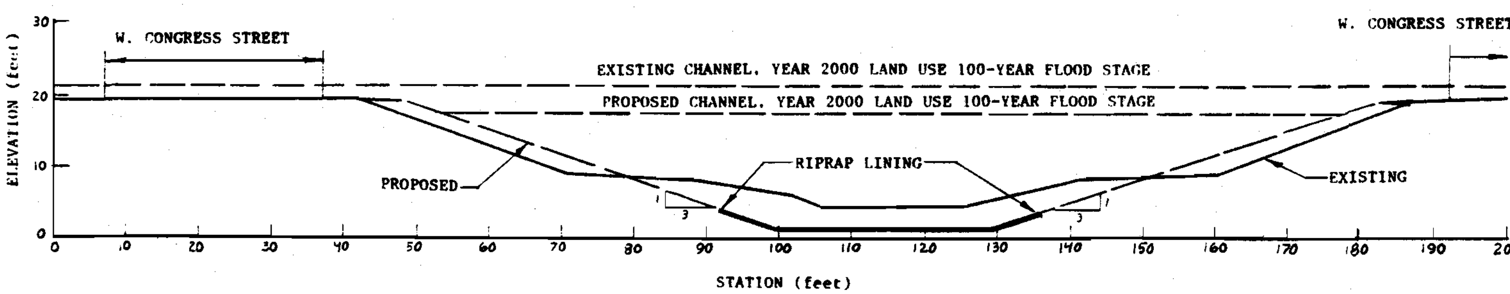


N. 35th STREET TO N. 37th STREET

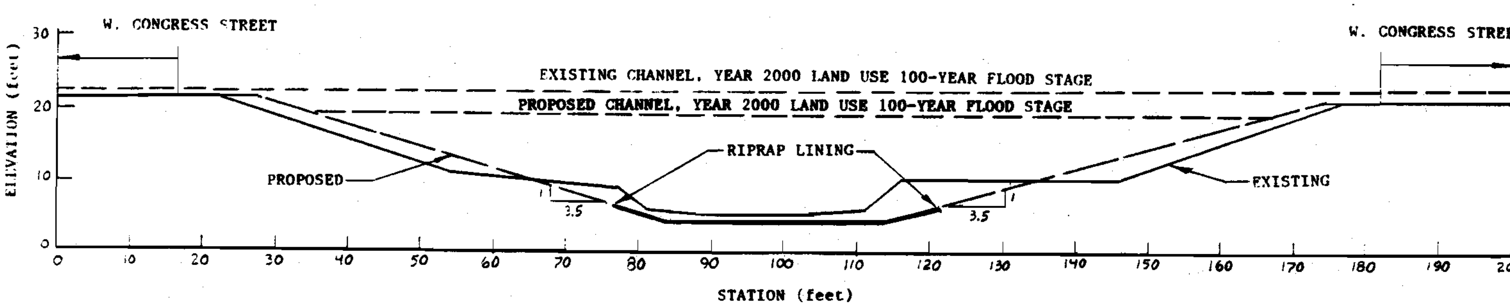


N. 37th STREET TO RIVER MILE 2.95

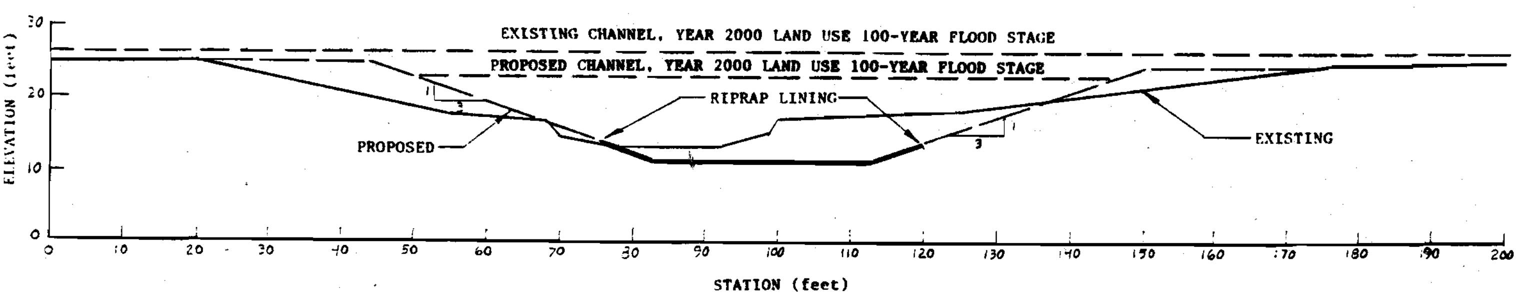
FIGURE V-13 (continued)



RIVER MILE 2.95 TO N. SHERMAN BOULEVARD



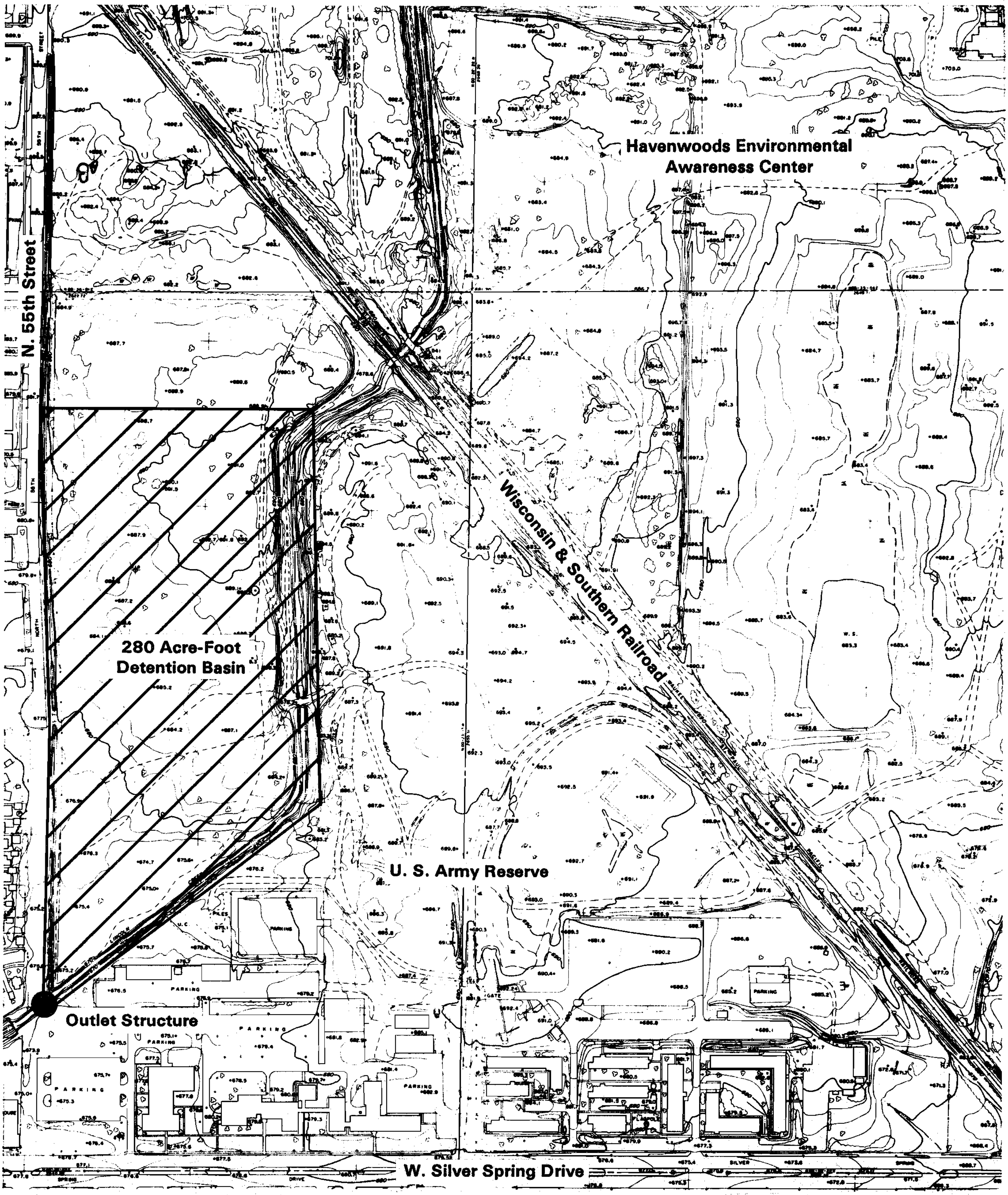
N. SHERMAN BOULEVARD TO N. 51st STREET



Source: SEWRPC

N. 51st STREET TO W. HAMPTON AVENUE

MAP V-16
PROPOSED DETENTION BASIN AT ARMY RESERVE PROPERTY



Source: SEWRPC.

river miles 2.80 and 2.93, the planned channel would extend to within about five feet of W. Congress Street. In order to avoid undercutting of the channel embankment and possible collapse of portions of W. Congress Street, it may be necessary to install steel sheet piles along W. Congress Street and the costs to include an allowance for such sheeting. The need for these steel piles would be determined based on additional geotechnical analysis of the proposed channels.

The costs associated with this alternative are summarized in Table V-8. The estimated capital cost of this alternative for the subject channel reach would be $10,150,000; $2,780,000 for channel modification, $3,310,000 for bridge replacement and modification, $230,000 for dikes and floodwalls, and $3,830,000 for detention storage. The operation and maintenance costs for the subject reach are estimated to approximate $281,000 per year, of which about $180,000 would be for channel revegetation, regrading, and restoration following storm events which result in scouring velocities and for sediment removal. The average annual cost of this alternative is $925,000.

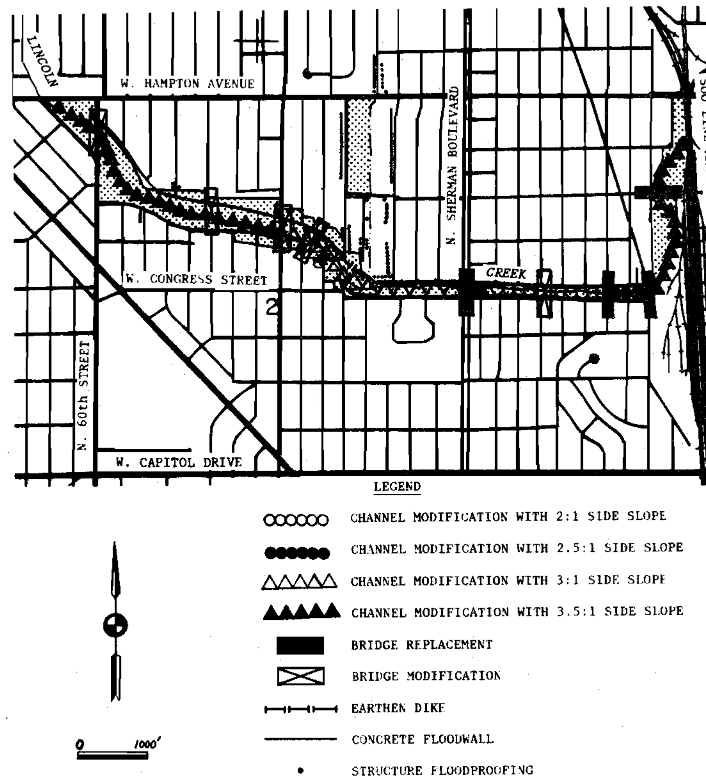
Reevaluated Riprap and Turf-Lined Channel without Detention Storage Using Confined Channel Cross Section

Under this riprap and turf-lined channel alternative, the channel cross section would be the same as under the previously discussed alternative which included detention. However, no detention would be provided upstream. The same bridge replacements included under the previous alternative would also be constructed.

This alternative would also include earthen dikes and floodwalls, including 320 feet of concrete floodwalls along the south channel bank with an average height of four feet beginning at N. 47th Street extended. From that point, about 310 feet of earthen dike with an average height of 3.5 feet would be constructed. In addition, about 1,190 feet of earthen dike with an average height of 3.5 feet would be constructed along the north channel bank between N. 47th Street extended and N. 50th Street extended. These dikes and floodwall are intended to eliminate overland flooding along this reach during a 100-year recurrence interval flood under planned land use conditions.

MAP V-17

CONFINED RIPRAP AND TURF-LINED CHANNEL WITH STRUCTURE FLOODPROOFING AND WITHOUT DETENTION STORAGE



Source: SEWRPC

For an approximately 700-foot-long reach between river miles 2.80 and 2.93, the planned channel would extend to within about five feet of W. Congress Street. In order to avoid undercutting of the channel embankment and possible collapse of portions of W. Congress Street, it may be necessary to install sheet piles along W. Congress Street and the costs to include an allowance for such sheeting. The need for these steel piles would be determined based on additional geotechnical analysis of the proposed channels.

Under this alternative, the flood flows would not be confined to the channel as shown on Map V-17. Parkway lands and yards would continue to be flooded along a 0.2-mile reach of Lincoln Creek and along a 0.5-mile reach of a tributary located along N. 47th Street. This alternative also includes the floodproofing of 112 structures which may be expected to be within the flood hazard area. Of this total, 11 may be expected to experience direct overland flooding and 101 structures may be expected to experience secondary flooding through foundation drains and sanitary sewer backups.

The costs associated with this alternative are summarized in Table V-8. The estimated capital cost of this alternative for the subject channel reach would be $7,030,000; $2,780,000 for channel modification, $3,310,000 for bridge replacement and modification, $270,000 for dikes and floodwalls, and $670,000 for structure floodproofing. The operation and maintenance costs for the subject reach are estimated to approximate $342,000 per year, of which about $325,000 would be for channel revegetation, regrading, and restoration following storm events which result in scouring velocities and for sediment removal. The average annual cost of this alternative is $788,000

Evaluation of Alternatives

The costs of the channel improvements under the initially recommended alternative providing for a partial concrete lining, the reevaluated alternative providing for riprap and turf lining with no detention, and for the reevaluated alternative with no detention storage and with floodproofing are all approximately equal, with average annual costs ranging from $788,000 to $799,000. The cost of the reevaluated alternative with a turf-lined channel and detention storage may be expected to be about 20 percent higher than these

three alternatives, with an average annual cost of about $925,000. The channel enclosure alternative may be expected to be about 40 percent more costly than the three channel improvement alternatives without detention storage, with an average annual cost of $1,125,000.

In terms of downstream impacts and appearance, the alternative providing for upstream detention at the Army Reserve site is the most favorable in that it does not include even a partial concrete lining and has the least adverse impact on downstream flows and stages. About 33 acres of land on the Army Reserve site would have to be secured, however, for a flood control detention basin. The detention basin site could be used for other purposes during periods of dry weather. The three alternatives providing for no concrete lining are more favorable to the maintenance of local aquatic life habitat, than the lined channel alternatives. These alternatives may be expected to have a negative impact on downstream water quality--and fish life--due to the erosion and resulting downstream sedimentation expected. Sediment would be discharged to Lincoln Creek and during severe storm events, would be carried to the Milwaukee River and the downstream empoundments and the Milwaukee harbor estuary. The construction of channels which may be expected to experience serious erosion problems would be inconsistent with the purpose and objectives of the Milwaukee River Priority Watershed Program which seeks to reduce erosion in the watershed and which would provide funding for streambank stabilization projects. The plan providing for partial concrete lining and channel enclosure would have the advantage of creating an open space area of about nine acres in extent above the enclosure that could be landscaped and improved for park and recreation use.

In terms of implementability, the reevaluated alternative without detention would require vacating about 0.39 mile of Congress Street and the removal of eight structures, a serious disadvantage. The alternative providing for riprap and turf lining with floodproofing, by relying on individual actions of private property owners would probably not be fully implemented, leaving a residual flood problem. Approval of regulatory agencies is not assured for the channel enclosure portion under the enclosure alternative nor under the three riprap and turf-lined alternatives due to the attendant erosion problems. The reevaluated alternative with detention would require use of the Army Reserve site.

All three of the reevaluated alternatives providing for riprap and turf lining would have high continuing through variable costs for channel maintenance. Such maintenance is labor-intensive and may be expected to become more costly over time. In addition, this maintenance work may be expected to entail repeated vehicular and equipment activity along the channel similar to construction work as the channel maintenance work is carried out.

The initially recommended partially-lined alternative and the two riprap-turf-lined alternatives which are confined to the existing right-of-way limits have relatively steep side slopes resulting in more difficult maintenance and possible public safety problems.

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EVALUATION OF ADDITIONAL ALTERNATIVES FOR THE EDGERTON CHANNEL PORTION OF THE WILSON PARK CREEK SUBWATERSHED: JUNE 19, 1990

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

916 N. EAST AVENUE • P.O. BOX 1607 • WAUKESHA, WISCONSIN 53187-1607 • TELEPHONE (414) 547-6721

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June 29, 1990

Mr. Wallace White
Executive Director
Milwaukee Metropolitan Sewerage District
260 W. Seeboth Street
P.O. Box 3049
Milwaukee, Wisconsin 53201-3049

Dear Mr. White:

In accordance with the terms of the letter agreement entered into on March 9, 1990, between the Milwaukee Metropolitan Sewerage District and this Commission, the Commission staff has prepared descriptions and evaluations of additional alternative flood control and stormwater drainage plans for the reach of Wilson Park Creek known locally as the Edgerton Channel in the City of Cudahy. This work represents an extension of the work carried out under the District's stormwater drainage and flood control planning program. This letter report is intended to document the findings of the evaluations of the additional alternatives considered.

STUDY AREA DESCRIPTION

The study area defined for the evaluations includes the entire drainage area tributary to the Edgerton Channel as that channel crosses under the Chicago & North Western Transportation Company railway just upstream of General Mitchell International Airport. The boundaries of this 540-acre drainage area and the boundaries of the seven subbasins identified within the drainage area are shown on the map attached hereto as Exhibit A. With minor refinements made to reflect the topographic information contained on the new large-scale topographic maps prepared by the Milwaukee Metropolitan Sewerage District in 1989, the study area is the same study area considered in the previous evaluations of alternatives conducted under the District's stormwater drainage and flood control program and under the Kinnickinnic River watershed study as documented in SEWRPC Planning Report No. 32, <u>A Comprehensive Plan for the Kinnickinnic River Watershed</u>.

The study area is drained by the Edgerton Channel which flows from just upstream of S. Whitnall Avenue to a drop structure on the General Mitchell International Airport property just west of the Chicago & North Western Transportation Company railway. From that point, the stream flows north and west in a concrete-lined channel and then in a channel enclosure through the airport property.

The study area in 1985 included about 320 acres of developed land, of which about 125 acres were in residential uses and about 195 acres were in industrial, commercial, and transportation uses. The remaining 220 acres of land in the study area were in open space uses, including about 18 acres of wetland. As a part of the work herein being reported on, the wetland areas in the study area, as shown on Exhibit B, were delineated in the field since these areas could impact on the flood control alternatives being considered. The wetland area located east of S. Whitnall Avenue had been mapped on the State wetland inventory as an area having a size of about six acres. The field inventory indicated that the wetland actually covers about 11 acres. About three acres of previously unmapped wetland were identified in the field between S. Whitnall Avenue and S. Barland Avenue extended. A third wetland area of about four acres located north of the Edgerton Channel and west of S. Delaware Street extended was identified as being essentially identical to that shown on the State wetland inventory. Other existing land use features of special consideration include two abandoned landfills, the location and areal extent of which are shown on Exhibit B.

DRAINAGE AND FLOOD CONTROL PROBLEMS

Relatively severe flooding problems occur within the study area as documented in the District stormwater drainage and flood control system plan and in the Kinnickinnic River watershed plan. Currently, there are approximately 38 homes located within the 100-year recurrence interval flood hazard area, as that area has been delineated on the basis of planned land use and existing channel conditions. These homes may be expected to experience basement and first floor flooding under a major runoff event. An additional approximately 78 homes may be expected to incur basement flooding from sanitary sewer backups and clear water infiltration under a major runoff event. The average annual flood damages are estimated to total about $212,000, with a 100-year recurrence interval flood expected to cause damages totaling about $800,000.

In addition to the identified flooding problems, there are stormwater drainage problems which should also be specifically considered in any evaluation of alternatives. Areas in the vicinity of the intersection of S. Barland Avenue, S. Whitnall Avenue, and S. Nicholson Avenue, including the roadway intersection itself, are reported by the City Engineer to be subject to periodic flooding due to an inadequate drainage system. As a solution to that problem, the City has planned the construction of an additional storm sewer southerly from this intersection along S. Nicholson Avenue to the Edgerton Channel. Construction of this sewer has been deferred until the Edgerton Channel improvement has been completed, which improvement was envisioned by the City to provide a lower outlet for the storm sewer than currently exists. In addition, storm sewers draining the residential areas located both to the north and south of the Edgerton Channel have been constructed with outlet inverts below the current channel bottom at five locations in anticipation of a lower channel bottom in the future. These outfalls are located at the intersection of the Edgerton Channel with S. Vermont Avenue, S. Illinois Avenue (2), S. Vermont Avenue, and S. Nicholson Avenue.

BASIC ASSUMPTIONS

The alternative analyses carried out under this planning effort were based upon the following assumptions:

1. That the study area will be essentially fully developed for urban uses, with the exception of the existing wetland areas. New urban development was assumed to be primarily industrial, as reflected by the current City zoning, as shown on the map attached hereto as Exhibit B.

2. That the street layout proposed on the legally adopted Official Maps for the City of Cudahy will be developed. The Official Map calls for the connections of S. Delaware Avenue, S. Illinois Avenue, and S. Vermont Avenue across the Edgerton Channel; the extension of E. Edgerton Avenue east to S. Whitnall Avenue and west to S. Pennsylvania Avenue; and the extension of S. Barland Avenue north to E. Edgerton Avenue extended.

ALTERNATIVE PLANS

Eight alternative drainage and flood control plans were considered as agreed-upon in the interagency meetings concerning this matter held on February 14 and 16, 1989, and attended by representatives of the City of Cudahy, Milwaukee Metropolitan Sewerage District, the Wisconsin Department of Natural Resources, and the Southeastern Wisconsin Regional Planning Commission. In addition, a variation of two of the eight alternatives was also considered based upon comments made at an interagency project status review meeting held on April 17, 1990. Thus, in total, ten alternative plans were evaluated. Because of the inter-relationship between the stormwater drainage system and the flood control system in the study area, each alternative flood control system plan includes a stormwater drainage system component. The costs of the stormwater drainage components are presented separately. Costs are included for street channel crossings in locations where existing or planned channels are to be crossed by planned streets as described above.

Each alternative is briefly described below. A summary of the costs and a description of selected characteristics of each of the ten flood control and stormwater drainage systems is set forth in Table 1. The local costs for stormwater drainage and planned local roadway channel crossings under each of the alternatives, are set forth in Table 2. The flood control system plan and local stormwater drainage system and channel crossing costs, as well as non-economic considerations associated with each of the nine alternatives considered, are set forth in Table 3.

<u>Alternative No. 1--Combination of Detention Storage and Structure Floodproofing</u>

Alternative Plan No. 1 would provide for the construction of a detention storage facility to be located on the Edgerton Channel immediately upstream of S. Whitnall Avenue, as shown on the map attached hereto as Exhibit C. An

earthen embankment approximately 2,160 feet in length and varying in height from two to 13 feet would be constructed immediately east of, and parallel to, S. Whitnall Avenue and along the north side of the detention facility. The detention facility would have a capacity of about 50 acre-feet and would have a surface area of about 10 acres under a 100-year recurrence interval flood event. The bottom of the storage facility would be formed by the existing land surface, with a low point at about elevation 678.0 feet above National Geodetic Vertical Datum (NGVD). The storage facility would receive runoff from about 134 acres, or about 25 percent of the study area as shown on Exhibit C. This detention alternative would reduce, but not eliminate, flood damages along the downstream reaches of the Edgerton Channel. Thus, in addition to the storage facility, it would be necessary to floodproof 80 structures to fully resolve the flooding problems. The stormwater drainage system designed to convey stormwater to the storage facility is also shown on Exhibit C.

The estimated capital costs of the flood control plan elements of this alternative would be $1,539,000, with an average annual operating cost of $23,800. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 1.75. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $844,000.

<u>Alternative No. 2--Combination of Enhanced Detention Storage and Structure Floodproofing</u>

Alternative Plan No. 2 is similar to Alternative Plan No. 1. It would also provide for the construction of a detention storage facility to be located on the Edgerton Channel immediately upstream of S. Whitnall Avenue, as shown on the map attached hereto as Exhibit D. An earthen embankment approximately 1,200 feet in length and varying in height from one to nine feet would be constructed immediately east of, and parallel to, S. Whitnall Avenue. Under this alternative, the capacity of the storage facility would be increased over that which can be obtained by maintaining the existing topography, with the storage area being excavated to a bottom elevation of approximately 678.0 feet NGVD with three on one side slopes around the perimeter. The facility would have about 74 acre-feet of storage capacity and would have a surface area of about 17 acres under 100-year recurrence interval event. The storage facility would receive runoff from about 198 acres, or about 37 percent of the study area. This is 64 acres larger than the area directed to the detention facility under Alternative No 1. The 64 acres include the area generally between S. Whitnall Avenue and S. Meyer Place north of the intersection of S. Whitnall Avenue, S. Barland Avenue, and S. Nicholson Avenue. This area and the associated changes in the storm sewer system are shown on Exhibit D. This detention alternative would reduce, but not eliminate, flood damages along the reach of Edgerton Channel concerned. Thus, in addition to the storage capacity, it would be necessary to floodproof 63 structures to fully resolve the flooding problems. The stormwater drainage system designed to convey stormwater to the storage facility is also shown on Exhibit D.

Table 1

COST ESTIMATES FOR ALTERNATIVE FLOOD CONTROL PLANS FOR
EDGERTON CHANNEL IN THE CITY OF CUDAHY

No.	Name	Description	Capital	Amortized[a] Capital	Annual Operation and Maintenance	Total Annual Cost	Annual Benefits	Benefit-Cost Ratio
1.	Combination of Detention Storage and Structure Floodproofing	a. Storage Facility	$ 792,000					
		b. Structure Floodproofing[b]	747,000					
		Total	$1,539,000	$ 97,600	$23,800	$121,400	$212,000[c]	1.75
2.	Combination of Enhanced Detention Storage and Structure Floodproofing	a. Storage Facility	2,108,000					
		b. Structure Floodproofing[d]	664,000					
		Total	$2,772,000	$175,800	$63,000	$238,800	$212,000[c]	0.89
3.	Maximum Detention Storage	a. Storage Facility	2,268,000					
		Total	$2,268,000	$143,800	$68,000	$211,800	$212,000c	1.00
4.	Combination of Channel Modification and Channel Enclosure	a. Channel Modification	281,000					
		b. Channel Enclosure	1,058,000					
		c. Bridge and Road Replacements[e]	937,000					
		Total	$2,276,000	$144,300	$ 1,900	$146,200	$212,000[c]	1.45
5.	Combination of Maximum Detention Storage and Channel Modification	a. Storage Facility	2,268,000					
		b. Channel Modifications	124,000					
		c. Bridge and Road Replacements[f]	--					
		Total	$2,392,000	$151,700	$68,600	$220,300	$212.000[c]	0.96
6.	Combination of Diversion Channel and Channel Modification	a. Diversion Channel	$ 526,000					
		b. Channel Modification	241,000					
		c. Bridge Replacement[g]	925,000					
		d. New Bridge[h]	163,000					
		Total	$1,855,000	$117,600	$ 2,000	$119,600	$212,000[c]	1.77
6a.	Combination of Diversion Channel, Channel Modification, and Channel Filling	a. Diversion Channel	526,000					
		b. Channel Modification	241,000					
		c. Channel Filling and Storm Sewer Replacement	160,000					
		d. Bridge Replacement[g]	925,000					
		e. New Bridge[h]	163,000					
		Total	$2,015,000	$128,000	$ 2,000	$130,000	$212,000[c]	1.63
7.	Combination of Detention Storage, Diversion Channel, and Channel Modification	a. Storage Facility	792,000					
		b. Diversion Channel	366,000					
		c. Channel Modification	139,000					
		d. Bridge Replacement[f]	--					
		Total	$1,297,000	$ 82,200	$25,300	$107,500	$212,000[c]	1.97
7a.	Combination of Detention Storage, Diversion Channel, Channel Modification, and Channel Filling	a. Storage Facility	792,000					
		b. Diversion Channel	366,000					
		c. Channel Modification	139,000					
		d. Channel Filling and Storm Sewer Replacement	160,000					
		e. Bridge Replacement[f]	--					
		Total	$1,457,000	$ 92,400	$25,300	$117,700	$212,000[c]	1.80
8.	Combination of Detention Storage, Channel Modification and Channel Enclosure	a. Storage Facility	792,000					
		b. Channel Modification	244,000					
		c. Channel Enclosure	648,000					
		d. Bridge and Road Replacements[e]	939,000					
		Total	$2,623,000	$166,300	$25,700	$192,000	$212,000c	1.10

[a]Amortized capital cost is based on an interest rate of 6 percent and a project life of 50 years.

[b]Includes costs for floodproofing of 17 buildings within the floodplain and 63 buildings which are immediately adjacent to the floodplain and could incur secondary flooding. The cost for only resolving the direct flooding of the 17 buildings is $78,000.

[c]Includes benefits associated with resolving both direct flooding damages of $55,000 per year and secondary flooding damages of $157,000 per year.

[d]Includes costs for floodproofing of 15 buildings within the floodplain and 48 buildings which are immediately adjacent to the floodplain and could incur secondary flooding. The cost for only resolving the direct flooding of the 15 buildings is $69,000.

[e]Includes cost for reconstructing S. Nicholson Road and an existing frontage road over the proposed culvert, and new bridges at the Chicago & North Western Railway and at the utility road just upstream of the railway. Costs are not included for the replacement of the S. Pennsylvania Avenue bridge since the bridge is being replaced for transportation purposes.

[f]The only bridge replacement under this alternative is at S. Pennsylvania Avenue. No cost is included for this replacement since that bridge is to be replaced for transportation purposes.

[g]Includes cost for replacement of the bridges at the Chicago & North Western Railway and at the utility road just upstream of the railway. Costs are not included for the replacement of the S. Pennsylvania Avenue bridge since that bridge is being replaced for transportation purposes.

[h]Includes cost for new bridges at S. Nicholson Road and S. Whitnall Avenue.

Source: SEWRPC

The estimated capital costs of the flood control plan elements of this alternative would be $2,772,000, with an average annual operating cost of $63,000. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 0.89. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $884,000.

Alternative No. 3--Maximum Detention Storage and Structure Floodproofing

Alternative Plan No. 3 is similar to Alternative Plan No. 2. It would also provide for the construction of a detention storage facility on the Edgerton Channel immediately upstream of S. Whitnall Avenue, as shown on the map attached hereto as Exhibit E. This storage facility would be the same as that proposed under Alternative No. 2. In addition, a storage facility would also be constructed between S. Whitnall Avenue and S. Nicholson Avenue, providing an additional 22-acre feet of storage and covering about 5.5 acres. Thus, a total of 96 acre-feet of storage capacity would be provided under this alternative. The facility would include about 650 feet of earthen berm to contain the stormwater on the west and part of the south side of the detention area. Under this alternative, the storage facilities would receive runoff from about 260 acres, or about 48 percent of the study area. This is 62 acres larger than the area directed to the storage facility under Alternative No. 2. The 62-acre area directed to the second detention facility is generally located between S. Nicholson Avenue and S. Whitnall Avenue, and south of the proposed detention facility. This area and the associated changes in the storm sewer system are shown on Exhibit E. This detention alternative would fully eliminate flood damages along the reach of Edgerton Channel concerned. The stormwater drainage system designed to convey stormwater to the storage facilities is also shown on Exhibit E.

The estimated capital costs of the flood control plan elements of this alternative would be $2,268,000, with an average annual operating cost of $68,000. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 1.00. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $884,000.

Alternative No. 4--Combination of Channel Modification and Channel Enclosure

Alternative Plan No. 4 would provide for channel modifications along about 0.5 mile of the stream--a 0.4-mile reach upstream of the existing channelization, on the airport, and a 0.1-mile reach between S. Nicholson Avenue and S. Whitnall Avenue, as shown on the map attached hereto as Exhibit F. The proposed channel would be turf lined and would have a bottom width of 10 feet with side slopes of one on three. The existing channel invert would be lowered from 2.0 to 4.5 feet. Upstream of the Chicago & North Western Transportation Company railway line the channel would be realigned to accommodate local land use proposals and existing drainage easements. Also under this alternative, 0.3 mile of the channel downstream of S. Nicholson Avenue would be enclosed in a 10-foot high by 6-foot wide reinforced concrete box culvert. The alternative also calls for replacement of the Chicago & North Western railway bridge and the railway service road bridge, the construction of a new bridge at the

S. Pennsylvania Avenue crossing, and the replacement of pavement for S. Nicholson Avenue over the proposed box culvert. These improvements may be expected to eliminate all flood damages related to this channel resulting from flood events up to an including the 100-year recurrence interval event. The stormwater drainage system designed to convey stormwater to the channel and channel enclosure is also shown on Exhibit F.

The estimated capital costs of the flood control plan elements of this alternative would be $2,276,000, with an average annual operating cost of $1,900. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 1.45. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $555,000.

Alternative No. 5--Combination of Maximum Detention Storage and Channel Modification

Alternative Plan No. 5 is similar to Alternative Plan No. 3 in that it provides for the construction of two stormwater storage facilities east of S. Nicholson Avenue having a combined storage capacity of 96 acre-feet, as shown on the map attached hereto as Exhibit G. About 260 acres, or about 48 percent of the study area, would be tributary to the storage facilities. In addition, this alternative plan would provide for a channel realignment along a 0.3 mile reach of the stream, between the existing railway service road bridge and S. Delaware Avenue extended, as shown on the map attached hereto as Exhibit G. The proposed channel would be turf lined and would have a bottom width of four feet with side slopes of one on three. The existing channel invert would be lowered by about 1.5 feet at the upstream end and would be realigned to accommodate local land use proposals and existing drainage easements. The lower channel west of Delaware Avenue would provide for a better outlet for the storm sewers in S. Delaware Avenue and would result in the removal of residual floodplain areas beyond the current development. This alternative also calls for the construction of a new bridge at the S. Pennsylvania Avenue crossing. These improvements may be expected to eliminate all flood damages related to this channel resulting from flood events up to and including the 100-year recurrence interval event. The stormwater drainage system designed to convey stormwater to the storage facilities and the realigned channel is also shown on Exhibit G.

The estimated capital costs of the flood control plan elements of this alternative would be $2,392,000, with an average annual operating cost of about $68,600. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 0.96. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $884,000.

Alternative No. 6--Combination of Diversion Channel and Channel Modification

Alternative Plan No. 6 would provide for channel modification along about a 0.4-mile reach of the stream upstream of the existing channelization on the airport, as shown on the map attached hereto as Exhibit H. Between the existing airport channelization and Pennsylvania Avenue, the proposed channel

would be turf lined and would have a bottom width of 10 feet with side slopes of one on three. The existing channel invert would be lowered from 2.0 to 4.5 feet. Upstream of S. Pennsylvania Avenue the proposed channel would be turf lined and have a bottom width of 4 feet with side slopes of one on three. The channel would be lowered by one to two feet. Upstream of the Chicago & North Western Transportation Company railway line the channel would be realigned to accommodate local land use proposals and existing drainage easements. Also under this alternative, a new approximately 0.6 mile long diversion channel would be constructed between S. Whitnall Avenue and S. Pennsylvania Avenue in a corridor south of S. Edgerton Avenue. The diversion channel would have a 20-foot bottom width, average depth of about five feet, and side slopes of one on three. This alternative also calls for replacement of the Chicago & North Western railway bridge and the railway service road bridge, as well as the construction of new bridges at S. Pennsylvania Avenue, S. Nicholson Avenue, and S. Whitnall Avenue crossings. These improvements may be expected to eliminate all flood damages related to this channel resulting from flood events up to an including the 100-year recurrence interval event. The stormwater drainage system designed to convey stormwater to the channel modification and new diversion channel is also shown on Exhibit H.

The estimated capital costs of the flood control plan elements of this alternative would be $1,855,000, with an average annual operating cost of $2,000. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 1.77. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $1,020,000.

Alternative No. 6A--Combination Diversion Channel, Channel Modification, and Channel Filling

Alternative Plan No. 6A is the same as Alternative Plan No 6 except that the existing 0.3 mile channel downstream of Nicholson Avenue would be filled with a storm sewer laid below the channel bottom to collect local drainage currently discharged to the channel. This new storm sewer to be laid along the existing channel would vary in size from 12 to 36 inches in diameter. The stormwater drainage system designed to convey stormwater to the diversion channel and modified channel is also generally the same as shown for Alternative Plan No. 6 shown on Exhibit H.

The estimated capital costs of the flood control plan elements of this alternative would be $2,015,000, with an average annual operating cost of $2,000. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 1.63. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $861,000.

Alternative No. 7--Detention Storage, Diversion Channel, and Channel Modification

Alternative Plan No. 7 represents a combination of components from Alternative No. 1 and Alternative No. 6. As shown on the map attached hereto as Exhibit I, a detention storage facility would be constructed east of S. Whitnall Avenue

Table 2

LOCAL STORM SEWER AND ROAD CONSTRUCTION COSTS FOR ALTERNATIVE FLOOD CONTROL PLANS FOR THE EDGERTON CHANNEL IN THE CITY OF CUDAHY

No.	Name	Component	Estimated Capital Cost
1.	Combination of Detention Storage and Structure Floodproofing	Storm Sewer System	$ 670,000
		Local Road Bridges	174,000
		Total	$ 844,000
2.	Combination of Enhanced Detention Storage and Structure Floodproofing	Storm Sewer System	710,000
		Local Road Bridges	174,000
		Total	$ 884,000
3.	Maximum Detention Storage	Storm Sewer System	710,000
		Local Road Bridges	174,000
		Total	$ 884,000
4.	Combination of Channel Modification and Channel Closure	Storm Sewer System	540,000
		Local Road Crossings	15,000
		Total	$ 555,000
5.	Combination of Maximum Detention Storage and Channel Modification	Storm Sewer System	710,000
		Local Road Bridges	174,000
		Total	$ 884,000
6.	Combination of Diversion Channel and Channel Modification	Storm Sewer System	615,000
		Local Road Bridges	405,000
		Total	$1,020,000
6A.	Combination of Diversion Channel, Channel Modification, and Channel Filling	Storm Sewer System	615,000
		Local Road Bridges	246,000
		Total	$ 861,000
7.	Combination of Detention Storage, Diversion Channel, and Channel Modification	Storm Sewer System	835,000
		Local Road Bridges	328,000
		Total	$1,163,000
7A.	Combination of Detention Storage, Diversion Channel, Channel Modification, Channel Filling, and Storm Sewer Replacement	Storm Sewer System	835,000
		Local Road Crossings	169,000
		Total	$1,004,000
8.	Combination of Detention Storage, Channel Modification, and Channel Enclosure	Storm Sewer System	670,000
		Local Road Crossings	15,000
		Total	$ 685,000

Source: SEWRPC

as in Alternative No. 1. The facility would have a capacity of about 50 acre-feet of storage and would have a surface area of about 10 acres under a 100-year recurrence interval event. About 134 acres of the study area would be tributary to the storage facility. In addition, a diversion channel would be constructed from S. Nicholson Avenue to S. Pennsylvania Avenue in an alignment south of Edgerton Avenue. This channel would have a 20-foot bottom width and have an average depth of about five feet with one on three side slopes. In addition, the channel between the railway service road bridge and S. Delaware Avenue would be modified and realigned to accommodate local land use proposals and existing drainage easements. This channel would have a bottom width of four feet and with side slopes of one one three. The channel would be lowered from one to two feet. This alternative also calls for the replacement of the S. Pennsylvania Avenue bridge. The stormwater drainage system designed to convey stormwater to the storage facility, channel modification, and bypass channel is also shown on Exhibit I.

The estimated capital costs of the flood control plan elements of this alternative would be $1,297,000, with an average annual operating cost of $25,300. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 1.97. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $1,163,000.

<u>Alternative No. 7A--Combination Detention Storage, Diversion Channel, Channel Modification, and Channel Filling</u>

Alternative Plan No. 7A is the same as Alternative Plan No. 7, except that the existing 0.3-mile channel downstream of Nicholson Avenue would be filled with a storm sewer laid below the channel bottom to collect local drainage currently discharged to the channel. This new storm sewer to be laid along the existing channel would vary in size from 12 to 36 inches in diameter. The stormwater drainage system designed to convey stormwater to the storage facility, diversion channel, and modified channel is also generally the same as shown for Alternative Plan No. 7 shown on Exhibit I.

The estimated capital costs of the flood control plan elements of this alternative would be $1,457,000, with an average annual operating cost of $25,300. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 1.80. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $1,004,000.

<u>Alternative No. 8--Combination of Detention Storage, Channel Modification, and Channel Enclosure</u>

Alternative Plan No. 8 is similar to Alternative No. 4, with the inclusion of the same detention storage facility included in Alternative No. 1. The storage facility would be located east of S. Whitnall Avenue and provide about 50 acre-feet of storage on a 10-acre site. In addition, this alternative provides for channel modifications along about 0.5 mile of the stream--a 0.4-mile reach upstream of the existing channelization on the airport, and a 0.1-mile reach between S. Nicholson Avenue and S. Whitnall Avenue, as shown on

the map attached hereto as Exhibit J. The proposed channel would be turf lined and would have a bottom width of four feet with side slopes of one on three. The existing channel invert would be lowered from 2.0 to 4.5 feet. Upstream of the Chicago & North Western Transportation Company railway line the channel would be realigned to accommodate local land use proposals and existing drainage easements. Also under this alternative, 0.3 mile of the channel downstream of S. Nicholson Avenue would be enclosed in a 6-foot high by 6-foot wide reinforced concrete box culvert. The alternative also calls for replacement of the Chicago & North Western railway bridge and the railway service road bridge, the construction of a new bridge at the Pennsylvania Avenue crossing, and the replacement of pavement for S. Nicholson Avenue over the proposed box culvert. These improvements may be expected to eliminate all flood damages related to this channel resulting from flood events up to an including the 100-year recurrence interval event. The stormwater drainage system designed to convey stormwater to the storage facilities, channel, and channel enclosure is also shown on Exhibit J.

The estimated capital costs of the flood control plan elements of this alternative would be $2,623,000, with an average annual operating cost of $25,700. As shown in Table 1, the cost of the average annual flood abatement benefits is about $212,000, resulting in a benefit-cost ratio of about 1.10. The capital cost for the associated local stormwater drainage and future channel crossings is estimated to be $685,000.

COMPARISON OF ALTERNATIVE PLANS

The alternative plans were compared with respect to cost, implementability, development restrictions, water quality impacts, local utility and bridge cost construction impacts, and open space aesthetic and safety considerations. The costs and non-monetary considerations are listed in Table 3.

<u>Costs</u>

Review of Table 3 indicates that the total capital cost of Alternative Nos. 1, 7, and 7A are nearly the same and are the lowest capital cost alternatives. When considering both capital cost and operation and maintenance cost, as indicated in Table 3 by the total annual cost including the amortized capital cost, Alternative Nos. 1, 4, 6, 6A, 7, and 7A all have about the same total annual cost of from $140,000 per year to $150,000, all lower than the other alternatives. These costs include both the direct flood control plan cost as well as local storm sewer and bridge costs.

<u>Implementability</u>

Alternative Nos. 1 and 2 require significant floodproofing of private property. Because such floodproofing would be voluntary, complete implementation of these two alternatives is unlikely and therefore there would likely be significant residual flooding problems remaining if these alternatives were selected. All of the alternatives except Alternative No. 4 require the purchase, or obtaining easements of land not currently under public ownership for implementation, in some cases, for detention storage sites and other cases for the construction of a diversion channel. Thus, these alternatives may be more

difficult to implement than Alternative No. 4 which would be constructed entirely on current public rights-of-way.

<u>Development Restrictions</u>

To varying degrees, all of the alternatives except Alternative No. 4, have some limitations on development potential within the area. In Alternative Nos. 1, 2, 3, 5, 7, 7A, and 8, land must be obtained for detention storage. In the case of Alternative Nos. 1, 7, 7A, and 8, the detention storage represents an area, most of which is currently designated as wetland and, therefore, has restricted development potential in any case. In total about 12 acres of land would be used for the detention storage site, including buffer areas. Of this total, about 10 acres is currently classified as wetland. Under Alternative Nos. 2, 3, and 5, larger areas are required for the detention storage representing additional potential loss of developable land. Under Alternative No. 2, about 18 acres are required, of which 11 acres are currently wetland. Under Alternative Nos. 3 and 5, about 24 acres are required for the storage facility, of which about 14 acres are currently classified as wetland. Under Alternative Nos. 6, 6A, 7, and 7A, the construction of a diversion channel would be required in the corridor south of E. Edgerton Avenue. This diversion channel would have a top width of about 60 to 75 feet and would result in the loss of some developable land south of Edgerton Avenue and in addition, west of S. Delaware Avenue as the diversion channel flows northwesterly to the existing channel. Under these alternatives, about 8 to 10 acres of land, none of which is classified as wetland, would be unavailable for development due to the construction of the diversion channel. In addition, under Alternative 7 and 7A, about 12 acres would be used for the detention storage site, of which about 10 acres are currently classified as wetland. Thus, with regard to developable land restriction considerations, Alternative No. 4 is the most favorable.

Under Alternative Plan Nos. 6, 6A, 7, and 7A, a diversion channel would be constructed in the open area south of E. Edgerton Avenue. Such construction through a largely undeveloped area offers flexibility in defining the location and configuration of the channel and can serve to reduce construction costs when compared to retrofitting such a channel or other facilities in developed areas. It would be possible to design the diversion channel as part of a greenway which could provide a desirable open space amenity for the planned residential and industrial land uses envisioned in the area south of E. Edgerton Avenue.

<u>Water Quality Impacts</u>

The water quality impacts associated with all alternatives providing for detention storage are more favorable than the alternatives without detention storage. The detention facilities could be designed to provide for a permanent wet pond thereby potentially having significant reduction in pollutants and positive water quality impacts downstream. The alternatives without detention storage would generally be similar to each other in terms of water quality impacts, with there being no significant enhancement of the water quality under those alternatives. In this regard, consideration should be given to the fact that the downstream channel is now largely lined with

concrete or enclosed in a structure. The maintenance of the existing wetland areas and perhaps enhancement of the existing wetland areas could provide some water quality benefits under any of the alternatives being considered.

<u>Local Utility and Bridge Considerations</u>

As noted in Tables 2 and 3, the local bridge and utility costs are lowest under Alternative Nos. 4 and 8. Local stormwater drainage problems do exist in part because of the lack of depth in the existing Edgerton Channel. These problems would generally be resolved under Alternative Nos. 4, and 6A. In addition, these problems would be at least partially resolved under Alternative Nos. 6 and 7.

<u>Open Space, Aesthetics, and Hazards</u>

Field inspection of the subject area indicates that the existing channel located between S. Nicholson Avenue and S. Delaware Avenue is unsightly, unsafe, and has tended to collect trash. Because of the restrictions between the residential structures on each side of the channel, the channel area itself appears to be used as a yard area. In addition, the City reports that there is a rat problem in the channel and in the wetland area east of S. Nicholson Avenue. The rat problem requires regular bating. Thus, it would appear that the best alternatives in this regard would be Alternative Nos. 4, 6A, and 7A, which would enclose or fill the channel.

<u>Storage Considerations</u>

Under Alternative Nos. 1, 2, 3, 5, 7, 7A, and 8, storage facilities are envisioned for flood control purposes. Under these alternatives, multiple uses of the storage facilities for water quality and aesthetic purposes are possible. As noted previously, storage would be provided under the other alternative plans for water quality management purposes only.

Should a storage component be included in the selected plan, careful consideration should be given to the type of storage facilities to be provided. Typically, storage facilities can be categorized as detention or retention. Detention storage facilities provide for the temporary storage of stormwater accompanied by controlled release. Dry detention facilities normally drain completely between runoff events. Wet detention facilities temporarily store floodwaters on top of a permanent pool of water used for other purposes. Retention storage facilities provide for the long-term storage of stormwater without full release to the surface water drainage system. Stormwater retention and wet detention basins with normal water levels at the water table elevation can provide significant reductions in nonpoint source pollutant loadings to the downstream watercourses and if carefully designed, can provide an aesthetically pleasing amenity.

In wet detention and retention basins, pollutants are removed through both sedimentation of particulates and biological assimilation of dissolved nutrients. In dry detention basins particulates are removed through sedimentation. Both retention basins and wet detention basins require careful maintenance in order to function properly as nonpoint source pollution control measures.

Table 3

PRINCIPAL FEATURES, COSTS, AND NONECONOMIC CONSIDERATIONS OF ALTERNATIVE FLOOD CONTROL PLANS FOR THE EDGERTON CHANNEL IN THE CITY OF CUDAHY

No.	Name	Description	Costs (dollars): Capital	Costs (dollars): Amortized Capital[a]	Costs (dollars): Annual Operation and Maintenance	Costs (dollars): Total	Key Considerations: Positive	Key Considerations: Negative
1.	Combination of Detention Storage and Structure Floodproofing	a. Direct Flood Control Costs o Storage Facility o Structure Floodproofing Subtotal	 $ 792,000 747,000 $1,539,000	 $ 97,600	 $23,800	 $121,400	o Could provide water quality benefits o Maintains and potentially enhances wetland area o Channel downstream of Delaware Avenue maintained in current state o Lowest cost of alternatives.	o Complete, voluntary implementation for floodproofing unlikely and therefore left with a significant residual flood problem o Overland flooding of yards and streets and attendant problems remain. o Potential loss of land for development. o Channel between Delaware Ave. and Nicholson Ave. remains aesthetic and hazard problem. o Does not provide means to fully resolve stormwater drainage problems.
		b. Incremental Local[f] Storm Sewer and Bridge Costs	289,000	18,300	--	18,300		
		Total	$1,828,000	$115,900	$23,800	$139,700		
2.	Combination of Enhanced Detention Storage and Structure Floodproofing	a. Direct Flood Control Costs o Storage Facility o Structure Floodproofing Subtotal	 2,108,000 664,000 $2,772,000	 $175,800	 $63,000	 $238,800	o Could provide water quality benefits. o Maintains and potentially enhances wetland area. o Channel downstream of Delaware Avenue maintained in current state.	o Complete, voluntary implementation for floodproofing unlikely and therefore left with a significant residual flood problem. o Overland flooding of yards and streets and attendant problems remain. o Loss of land for development. o Uncertainty with regard to impact on adjacent landfill. o Channel between Delaware Ave. and Nicholson Ave. remains an aesthetic and hazard problem. o Does not provide means to fully resolve stormwater drainage problems. o Uncertainty regarding costs for excavated material disposal. o High operation and maintenance cost. o Highest capital cost alternative.
		b. Incremental Local[f] Storm Sewer and Bridge Costs	329,000	20,900	--	20,900		
		Total	$3,101,000	$196,700	$63,000	$259,700		
3.	Maximum Detention Storage	a. Direct Flood Control Costs Sewer Costs o Storage Facility Subtotal	 2,268,000 $2,268,000	 $143,800	 $68,000	 $211,800	o Could provide water quality benefits o Channel downstream of Delaware Avenue maintained in current state.	o Loss of land for development. o Channel between Delaware Ave. and Nicholson Ave. remains aesthetic and hazard problem. o Does not provide means to fully resolve stormwater drainage problems. o Uncertainty regarding impact on adjacent landfill. o Uncertainty regarding costs for excavated material disposal. o High operation and maintenance cost.
		b. Incremental Local[f] Storm Sewer and Bridge Costs	329,000	20,900	--	20,900		
		Total	$2,597,000	$164,700	$68,000	$232,700		
4.	Combination of Channel Modification and Channel Enclosure	a. Direct Flood Control Costs o Channel Modification o Channel Enclosure o Bridge and Road Replacements[b] Subtotal	 281,000 1,058,000 937,000 $2,276,000	 $144,300	 $ 1,900	 $146,200	o Provides means to fully resolve stormwater drainage problems. o Requires no land acquisition o Provides additional open space in area between Delaware Ave. and Nicholson Ave. o Reduces local roadway plan cost. o One of lowest cost alternatives.	o Provides no water quality benefits. o Represents loss of potential water resource
		b. Incremental Local[f] Storm Sewer and Bridge Costs	0	0	--	0		
		Total	$2,276,000	$144,300	$ 1,900	$146,200		
5.	Combination of Maximum Detention Storage and Channel Modification	a. Direct Flood Control Costs o Storage Facility o Channel Modifications o Bridge and Road Replacements[c] Subtotal	 2,268,000 124,000 -- $2,392,000	 $151,700	 $68,600	 $220,300	o Could provide water quality benefits. o Channel downstream of of Delaware Avenue maintained in current state. o Provides channel location in available right-of-way and	o Loss of land for development. o Channel between Delaware Ave. and Nicholson Ave. remains aesthetic and hazard problem. o Does not provide means to fully resolve stormwater drainage problems.

No.	Name	Description	Costs (dollars) Capital	Amortized Capital[a]	Annual Operation and Maintenance	Total	Key Considerations Positive	Negative
5.	Continued.	b. Incremental Local[f] Storm Sewer and Bridge Costs	329,000	20,900	--	20,900	allows local development plan to be carried out.	o Uncertainty regarding impact on adjacent landfill. o Uncertainty regarding costs for excavated material disposal. o One of highest capital cost alternatives o High operation and maintenance cost
		Total	$2,721,000	$172,600	$68,600	$241,200		
6.	Combination of Diversion Channel and Channel Modification	a. Direct Flood Control Costs					o Provides means to partially resolve stormwater drainage problems. o One of lowest cost alternative. o Provides new open channel	o Loss of land for development o Channel between Delaware Ave. and Nicholson Ave. remains an aesthetic and hazard problem. o Provides no water quality benefits.
		o Diversion Channel	526,000					
		o Channel Modification	241,000					
		o Bridge Replacement[d]	925,000					
		o New Bridge[e]	163,000					
		Subtotal	$1,855,000	$117,600	$ 2,000	$119,600		
		b. Incremental Local[f] Storm Sewer and Bridge Costs	465,000	29,500	--	29,500		
		Total	$2,320,000	$147,100	$ 2,000	$149,100		
6A.	Combination of Diversion Channel, Channel Modification, Channel Filling, and Storm Sewer Replacement	a. Direct Flood Control Costs					o Provides means to fully resolve stormwater drainage problems o One of lowest cost alternative o Provides additional open space in area between Delaware Ave. and Nicholson Ave. o Reduces local road costs	o Loss of land for development o Provides no water quality benefits
		o Diversion Channel	526,000					
		o Channel Modification	241,000					
		o Channel Filling and Storm Sewer Replacement	160,000					
		o Bridge Replacement[d]	925,000					
		o New Bridge[e]	163,000					
		Subtotal	$2,015,000	$128,000	$ 2,000	$130,000		
		b. Incremental Local[f] Storm Sewer and Bridge Costs	306,000	19,400	--	19,400		
		Total	$2,321,000	$147,400	$ 2,000	$149,400		
7.	Combination of Detention Storage, Diversion Channel, and Channel Modification	a. Direct Flood Control Costs					o Could provide water quality benefits o Provides means to partially resolve stormwater drainage problems. o One of lowest cost alternatives o Provides new open channel	o Loss of land for development o Channel between Delaware Ave. and Nicholson Ave. remains an aesthetic and hazard problem. o May involve public ownership of land assessed for sewer, water, and street improvements.
		o Storage Facility	792,000					
		o Diversion Channel	366,000					
		o Channel Modification	139,000					
		o Bridge Replacement[c]	--					
		Subtotal	$1,297,000	$ 82,200	$25,300	$107,500		
		b. Incremental Local[f] Storm Sewer and Bridge Costs	608,000	38,600	--	38,600		
		Total	$1,905,000	$120,800	$25,300	$146,100		
7a.	Combination of Detention Storage, Diversion Channel, and Channel Modification	a. Direct Flood Control Costs					o Could provide water quality benefits o Provide means to fully resolve stormwater drainage problems o One of lowest cost alternatives o Provides additional open space between Delaware Avenue and Nicholson Avenue o Reduces local road costs	o Loss of land for development
		o Storage Facility	792,000					
		o Diversion Channel	366,000					
		o Channel Modification	139,000					
		o Channel Filling and Storm Sewer Replacement	160,000					
		o Bridge Replacement[c]	--					
		Subtotal	$1,457,000	$ 92,400	$25,300	$117,700		
		b. Incremental Local[f] Storm Sewer and Bridge costs	449,000	28,500	--	28,500		
		Total	$1,906,000	$120,900	$25,300	$146,200		
8.	Combination of Detention Storage, Channel Modification, and Channel Enclosure	a. Direct Flood Control Costs					o Could provide water quality benefits. o Provide means to fully resolve stormwater drainage problems. o Provide additional open space in area between Delaware Ave. and Nicholson Ave. o Reduces local roadway plan cost.	o Alternative with one of the highest capital cost. o Potential loss of land for development. o One of highest capital cost alternatives. o Represents loss of potential water resource o May involve public ownership of land assessed for sewer, water, and street improvements
		o Storage Facility	792,000					
		o Channel Modification	244,000					
		o Channel Enclosure	648,000					
		o Bridge and Road Replacements[b]	939,000					
		Subtotal	$2,623,000	$166,300	$25,700	$192,000		
		b. Incremental Local[f] Storm Sewer and Bridge Costs	130,000	8,200	--	$ 8,200		
		Total	$2,753,000	$174,500	$25,700	$200,200		

[a]Amortized capital cost is based on an interest rate of 6 percent and a project life of 50 years.

[b]Includes cost for reconstructing S. Nicholson Road and an existing frontage road over the proposed culvert, and new bridges at the Chicago & North Western Railway and at the utility road just upstream of the railway. Costs are not included for the replacement of the S. Pennsylvania Avenue bridge since that bridge is being replaced for transportation purposes.

[c]The only bridge replacement under this alternative is at S. Pennsylvania Avenue. No cost is included for this replacement since that bridge is being replaced for transportation purposes.

[d]Includes cost for replacement of the bridges at the Chicago & North Western Railway and at the utility road just upstream of the railway. Costs are not included for the replacement of the S. Pennsylvania Avenue bridge since that bridge is being replaced for transportation purposes.

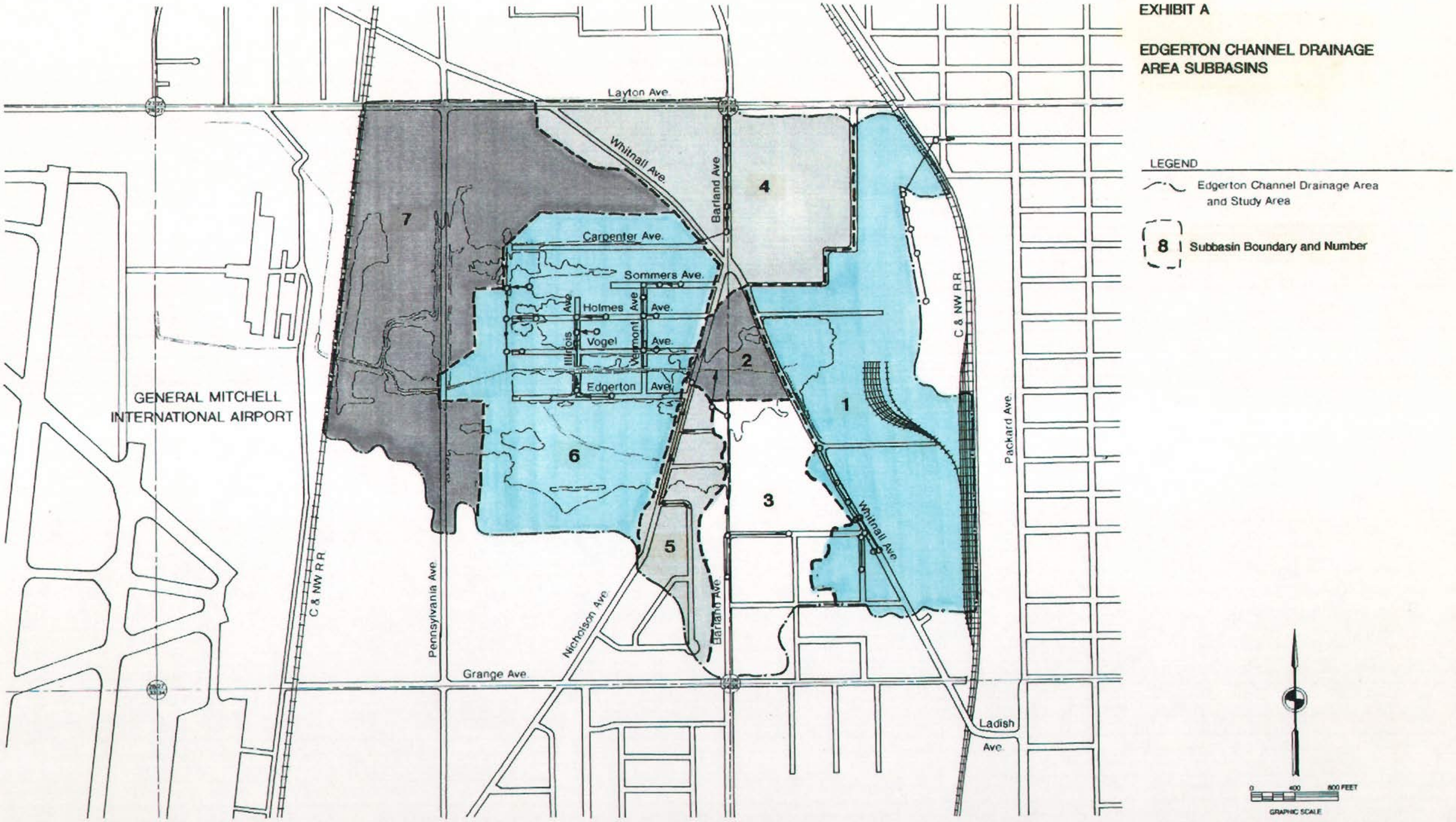
[e]Includes cost for new bridges at S. Nicholson Road and S. Whitnall Avenue.

[f]Difference between local cost of Alternative 4 and local costs of other alternatives.

Source: SEWRPC

EXHIBIT A

EDGERTON CHANNEL DRAINAGE AREA SUBBASINS



SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

EDGERTON CHANNEL STUDY AREA - CITY OF CUDAHY - MILWAUKEE COUNTY, WISCONSIN

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LAKE TOWNSHIP

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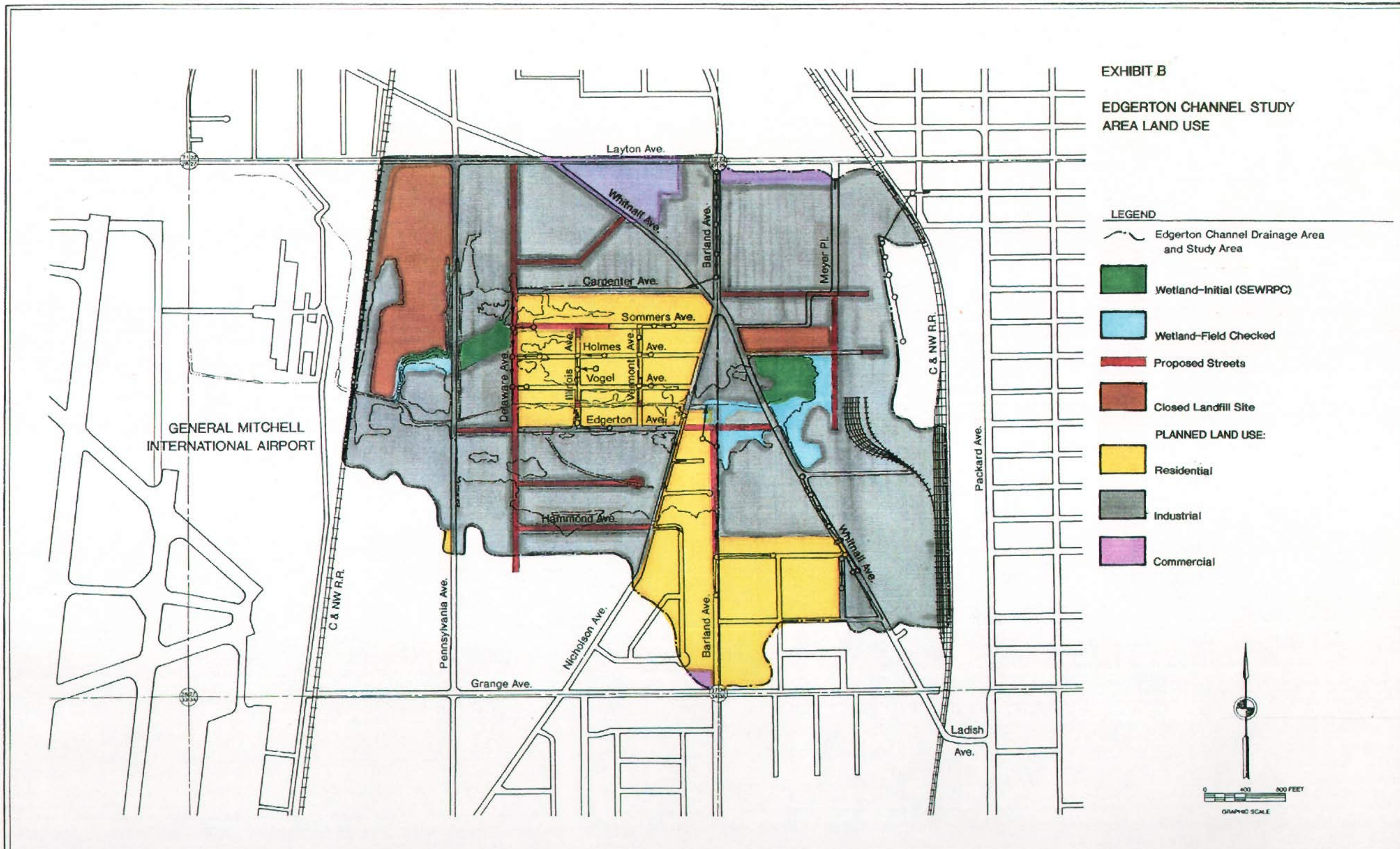

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION	EDGERTON CHANNEL STUDY AREA – CITY OF CUDAHY – MILWAUKEE COUNTY, WISCONSIN	T 6 N R 22 E LAKE TOWNSHIP

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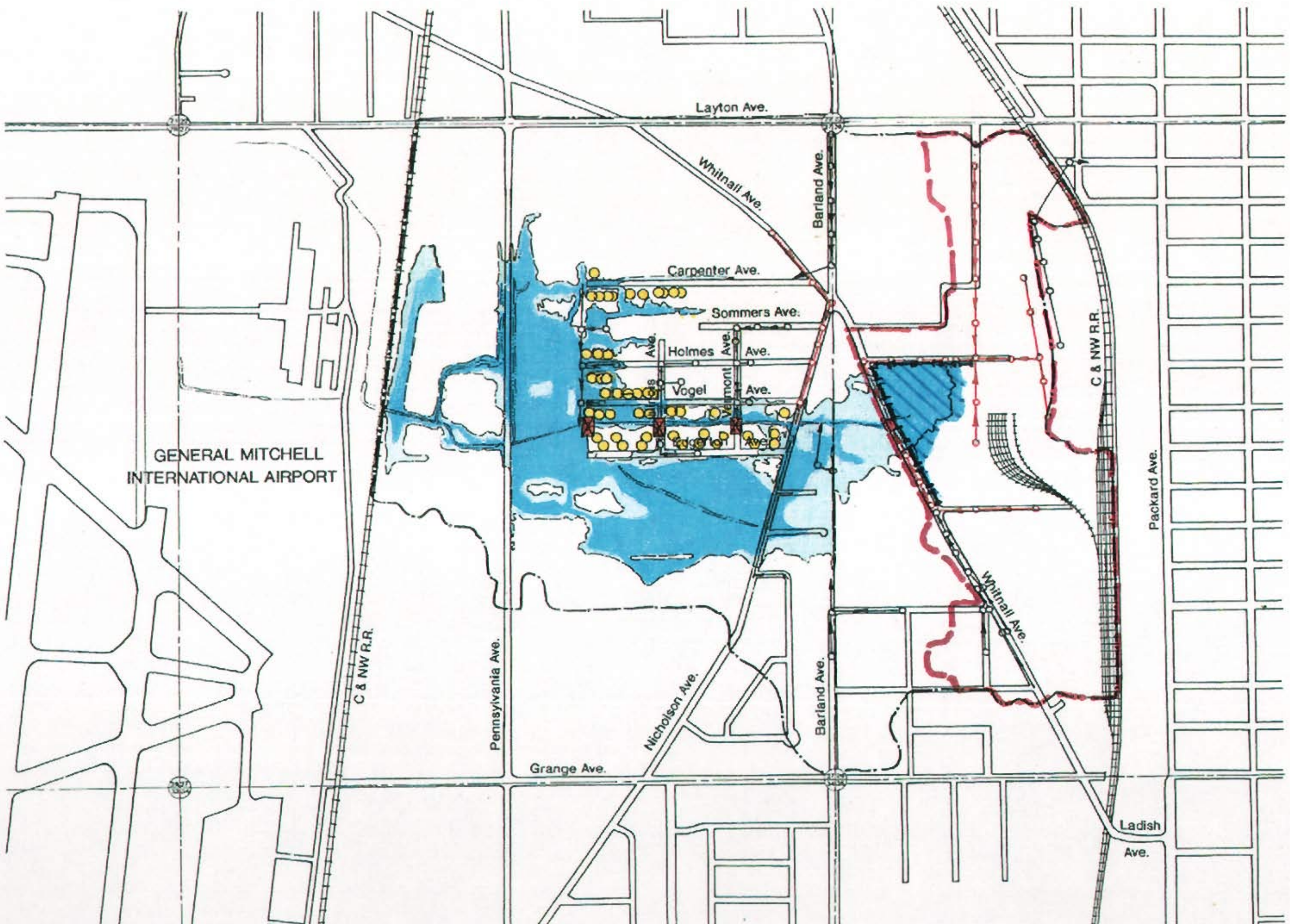

EXHIBIT C

ALTERNATIVE PLAN 1: COMBINATION OF DETENTION STORAGE AND STRUCTURE FLOODPROOFING ALONG EDGERTON DITCH IN THE CITY OF CUDAHY

LEGEND

- Edgerton Channel Drainage Area and Study Area
- 100-Year Recurrance Interval Floodplain Under Planned Land Use and Planned Channel Conditions
- 100-Year Recurrance Interval Floodplain Under Planned Land Use and Existing Channel Conditions Which Would be Eliminated Under Planned Channel Conditions
- Proposed Detention Basin
- Proposed Earthen Dike
- Proposed Outlet Structure
- Proposed Storm Sewer
- Structure Floodproofing
- Drainage Area Tributary to Proposed Detention Basin
- Proposed New Bridge

0 400 800 FEET
GRAPHIC SCALE

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

EDGERTON CHANNEL STUDY AREA - CITY OF CUDAHY - MILWAUKEE COUNTY, WISCONSIN

T 6 N R 22 E

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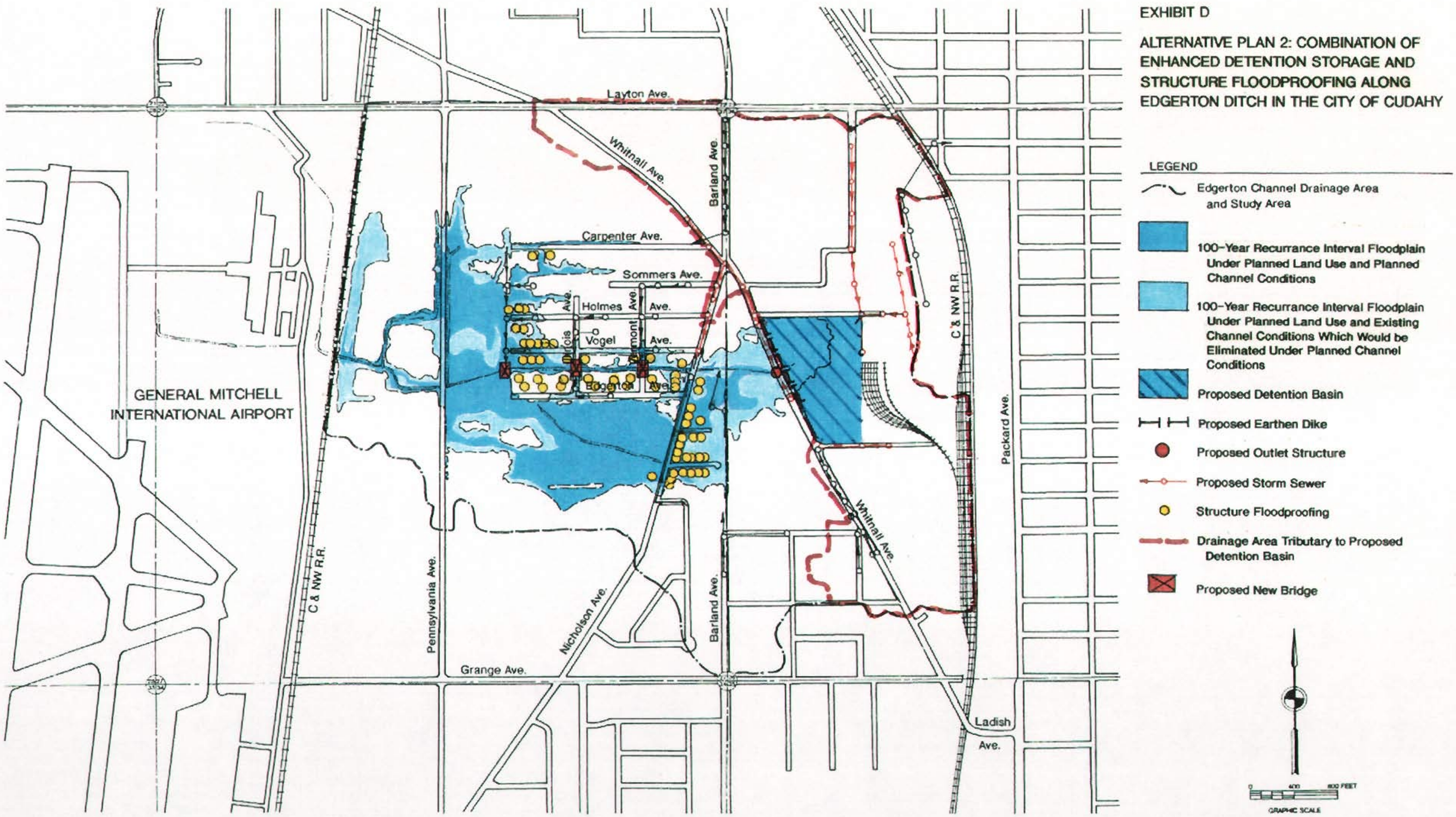
EXHIBIT D

ALTERNATIVE PLAN 2: COMBINATION OF ENHANCED DETENTION STORAGE AND STRUCTURE FLOODPROOFING ALONG EDGERTON DITCH IN THE CITY OF CUDAHY



SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

EDGERTON CHANNEL STUDY AREA - CITY OF CUDAHY - MILWAUKEE COUNTY, WISCONSIN

T 6 N R 22 E

LAKE TOWNSHIP

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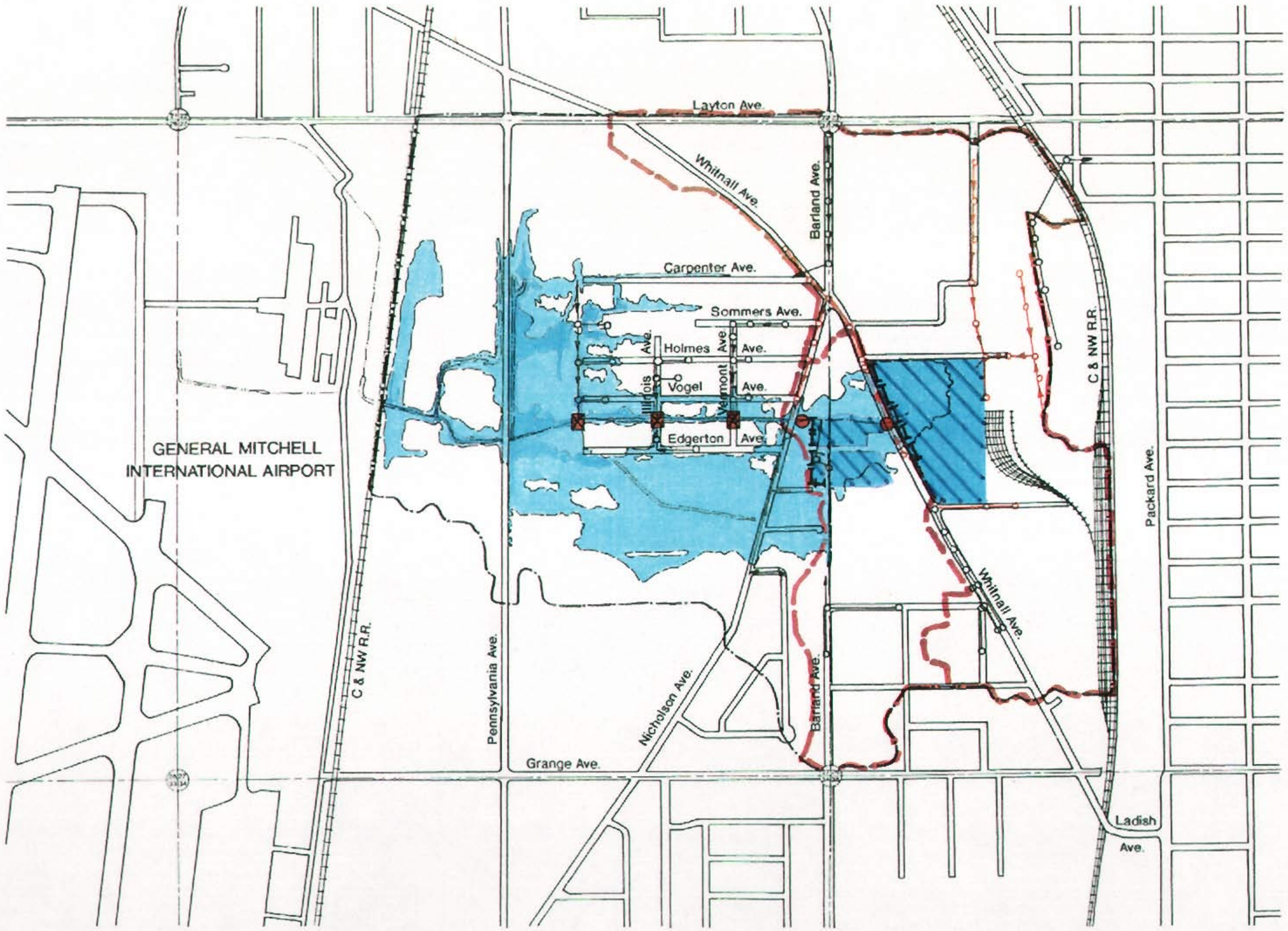
EXHIBIT E

ALTERNATIVE PLAN 3: MAXIMUM DETENTION STORAGE ALONG EDGERTON DITCH IN THE CITY OF CUDAHY



LEGEND

Edgerton Channel Drainage Area and Study Area

100-Year Recurrance Interval Floodplain Under Planned Land Use and Planned Channel Conditions

100-Year Recurrance Interval Floodplain Under Planned Land Use and Existing Channel Conditions Which Would be Eliminated Under Planned Channel Conditions

Proposed Detention Basin

Proposed Earthen Dike

Proposed Outlet Structure

Proposed Storm Sewer

Drainage Area Tributary to Proposed Detention Basin

Proposed New Bridge

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION	EDGERTON CHANNEL STUDY AREA – CITY OF CUDAHY – MILWAUKEE COUNTY, WISCONSIN	T 6 N R 22 E LAKE TOWNSHIP

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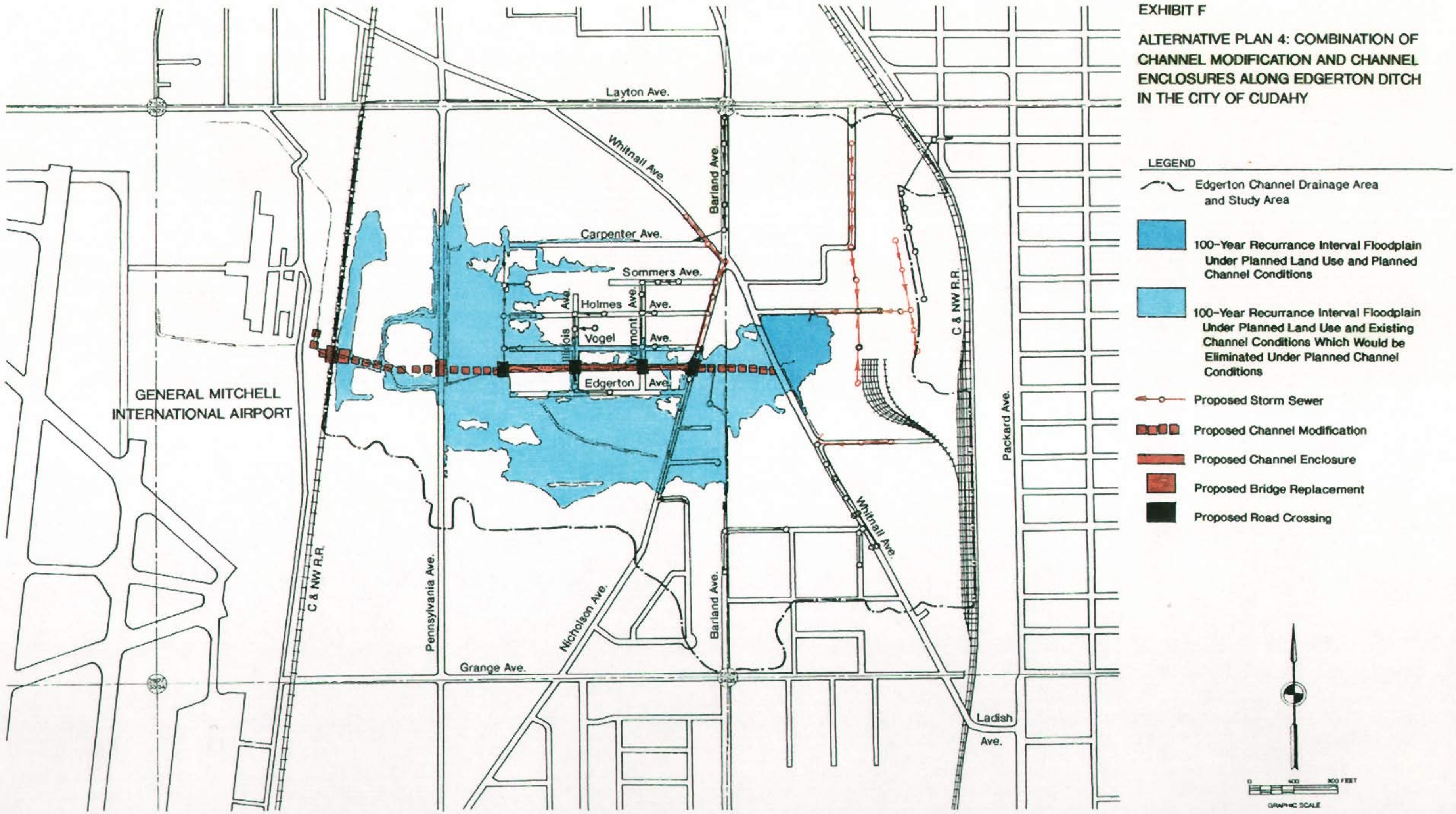
EXHIBIT F

ALTERNATIVE PLAN 4: COMBINATION OF CHANNEL MODIFICATION AND CHANNEL ENCLOSURES ALONG EDGERTON DITCH IN THE CITY OF CUDAHY



SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

EDGERTON CHANNEL STUDY AREA – CITY OF CUDAHY – MILWAUKEE COUNTY, WISCONSIN

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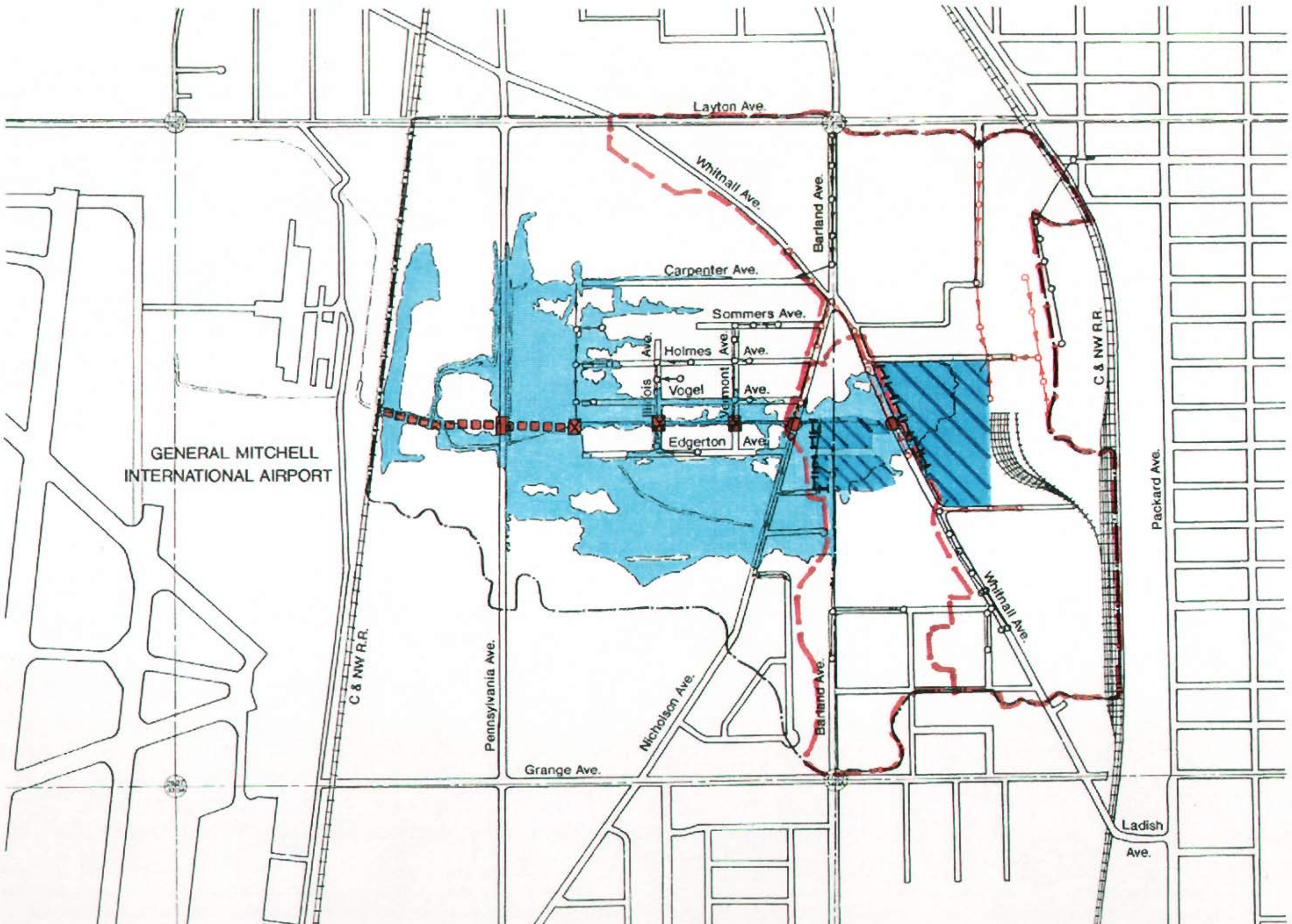
EXHIBIT G

ALTERNATIVE PLAN 5: COMBINATION OF MAXIMUM DETENTION STORAGE AND CHANNEL MODIFICATION ALONG EDGERTON DITCH IN THE CITY OF CUDAHY



LEGEND

- Edgerton Channel Drainage Area and Study Area
- 100-Year Recurrance Interval Floodplain Under Planned Land Use and Planned Channel Conditions
- 100-Year Recurrance Interval Floodplain Under Planned Land Use and Existing Channel Conditions Which Would be Eliminated Under Planned Channel Conditions
- Proposed Detention Basin
- Proposed Earthen Dike
- Proposed Outlet Structure
- Proposed Storm Sewer
- Drainage Area Tributary to Proposed Detention Basin
- Proposed Channel Modification
- Proposed Bridge Replacement
- Proposed New Bridge

0 400 800 FEET
GRAPHIC SCALE

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

EDGERTON CHANNEL STUDY AREA - CITY OF CUDAHY - MILWAUKEE COUNTY, WISCONSIN

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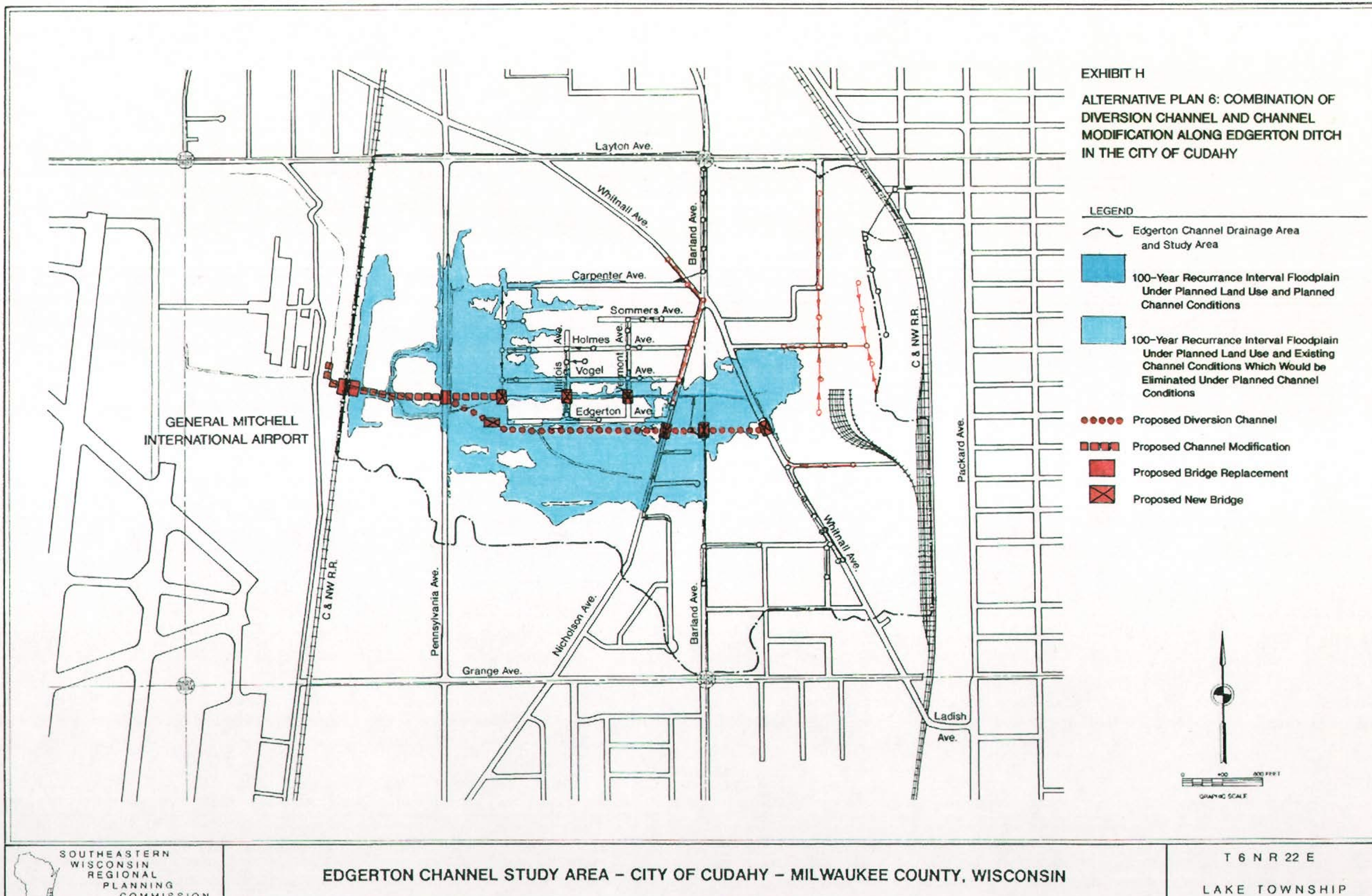
EXHIBIT H
ALTERNATIVE PLAN 6: COMBINATION OF DIVERSION CHANNEL AND CHANNEL MODIFICATION ALONG EDGERTON DITCH IN THE CITY OF CUDAHY
LEGEND
Edgerton Channel Drainage Area and Study Area
100-Year Recurrance Interval Floodplain Under Planned Land Use and Planned Channel Conditions
100-Year Recurrance Interval Floodplain Under Planned Land Use and Existing Channel Conditions Which Would be Eliminated Under Planned Channel Conditions
Proposed Diversion Channel
Proposed Channel Modification
Proposed Bridge Replacement
Proposed New Bridge
Layton Ave.
Whitnall Ave.
Barland Ave.
Carpenter Ave.
Sommers Ave.
Holmes Ave.
Vogel Ave.
Edgerton Ave.
GENERAL MITCHELL INTERNATIONAL AIRPORT
C & NW R.R.
Pennsylvania Ave.
Nicholson Ave.
Grange Ave.
Packard Ave.
Ladish Ave.
GRAPHIC SCALE
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
EDGERTON CHANNEL STUDY AREA - CITY OF CUDAHY - MILWAUKEE COUNTY, WISCONSIN
T 6 N R 22 E
LAKE TOWNSHIP

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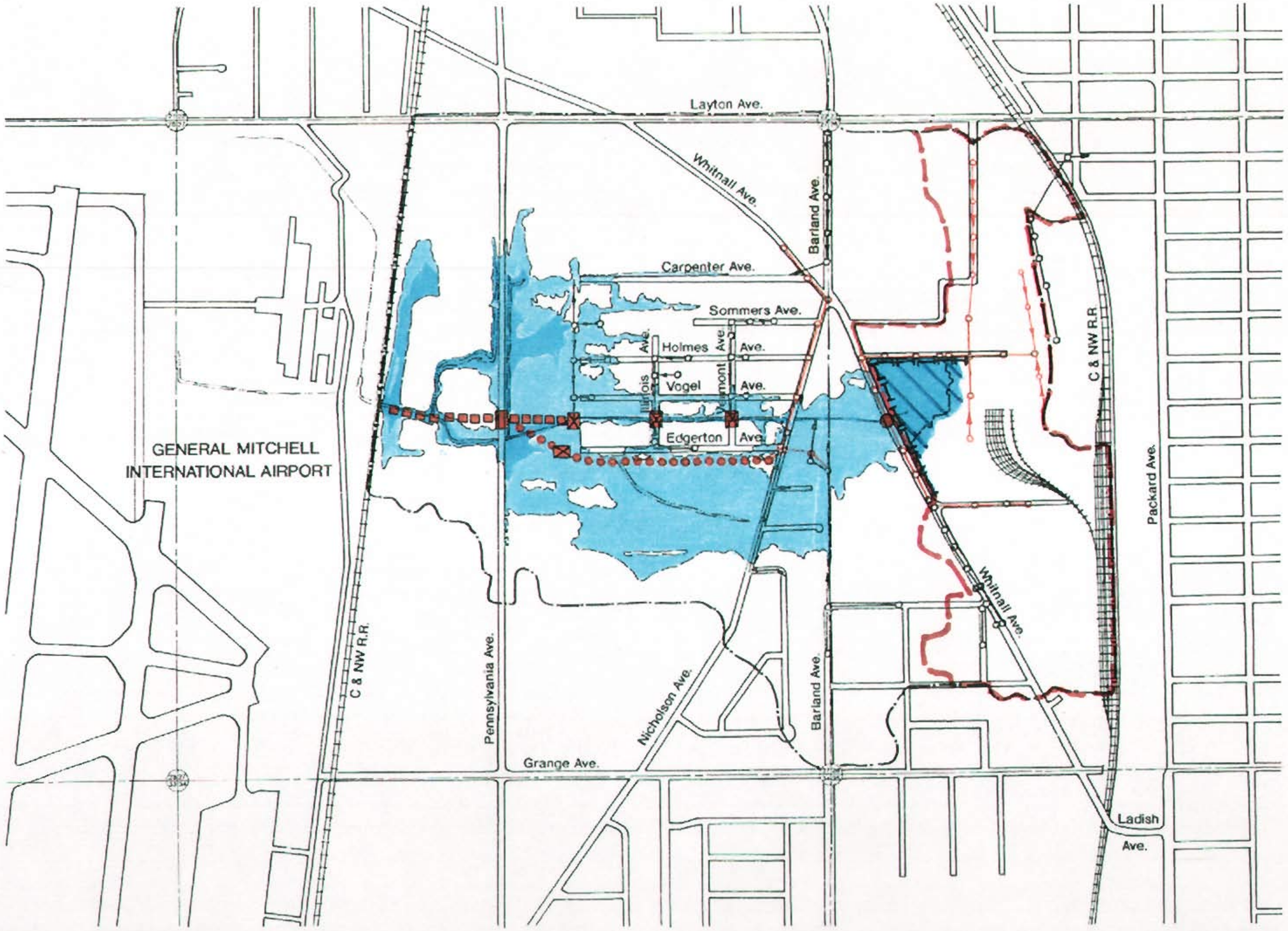

EXHIBIT I

ALTERNATIVE PLAN 7: COMBINATION OF DIVERSION CHANNEL, DETENTION STORAGE AND CHANNEL MODIFICATION ALONG EDGERTON DITCH IN THE CITY OF CUDAHY

LEGEND

- Edgerton Channel Drainage Area and Study Area
- 100-Year Recurrance Interval Floodplain Under Planned Land Use and Planned Channel Conditions
- 100-Year Recurrance Interval Floodplain Under Planned Land Use and Existing Channel Conditions Which Would be Eliminated Under Planned Channel Conditions
- Proposed Detention Basin
- Proposed Earthen Dike
- Proposed Outlet Structure
- Proposed Storm Sewer
- Drainage Area Tributary to Proposed Detention Basin
- Proposed Diversion Channel
- Proposed Channel Modification
- Proposed Bridge Replacement
- Proposed New Bridge

0 400 800 FEET

GRAPHIC SCALE

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

EDGERTON CHANNEL STUDY AREA - CITY OF CUDAHY - MILWAUKEE COUNTY, WISCONSIN

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LAKE TOWNSHIP

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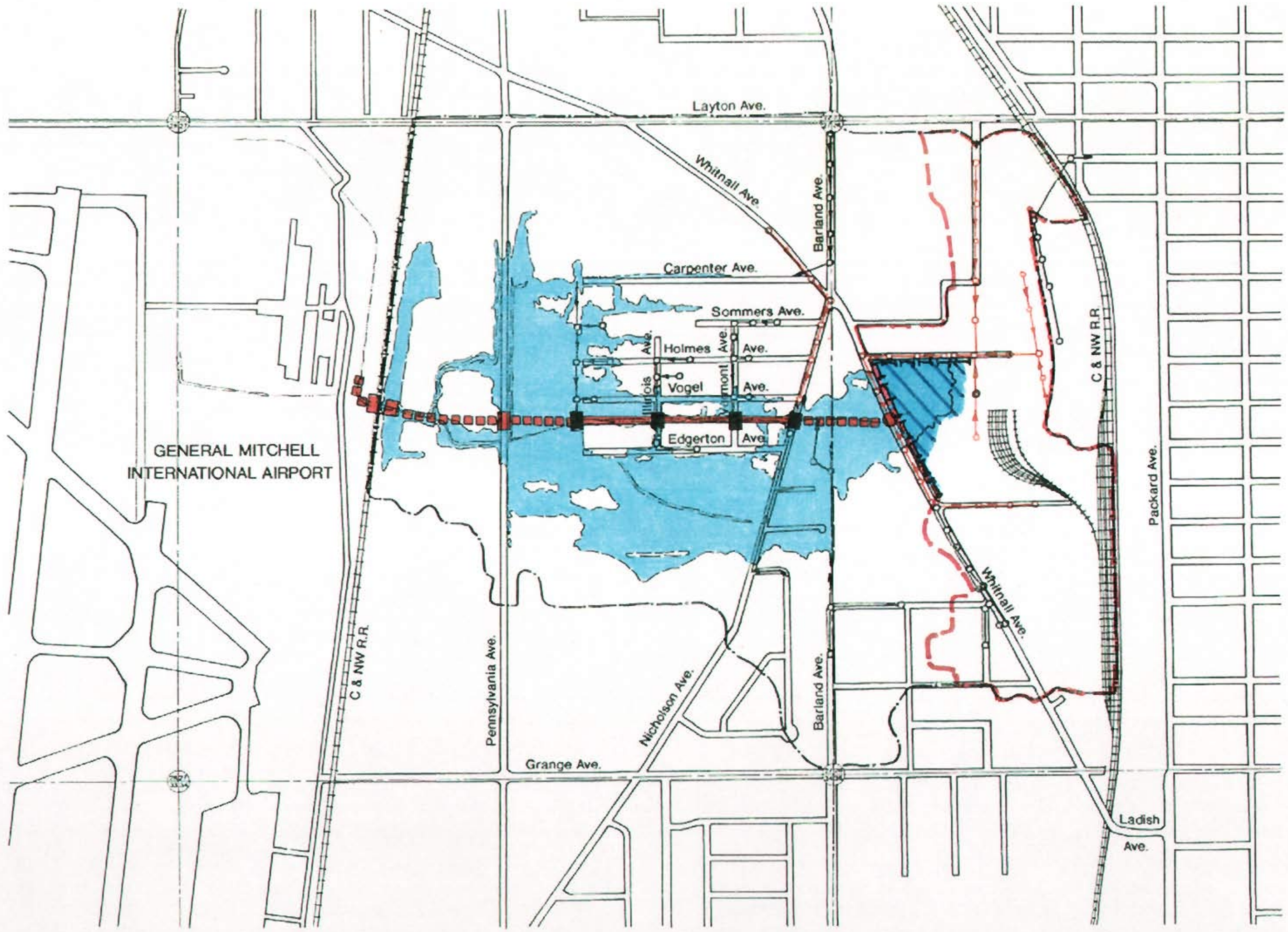
EXHIBIT J

ALTERNATIVE PLAN 8: COMBINATION OF DETENTION STORAGE, CHANNEL MODIFICATION,AND CHANNEL ENCLOSURE ALONG EDGERTON DITCH IN THE CITY OF CUDAHY



LEGEND

- Edgerton Channel Drainage Area and Study Area
- 100-Year Recurrance Interval Floodplain Under Planned Land Use and Planned Channel Conditions
- 100-Year Recurrance Interval Floodplain Under Planned Land Use and Existing Channel Conditions Which Would be Eliminated Under Planned Channel Conditions
- Proposed Detention Basin
- Proposed Earthen Dike
- Proposed Outlet Structure
- Proposed Storm Sewer
- Drainage Area Tributary to Proposed Detention Basin
- Proposed Channel Modification
- Proposed Channel Enclosure
- Proposed Bridge Replacement
- Proposed Road Crossing

GRAPHIC SCALE

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

EDGERTON CHANNEL STUDY AREA - CITY OF CUDAHY - MILWAUKEE COUNTY, WISCONSIN

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Maintenance requirements for wet basins include periodic inspection, mowing of embankments, weed and algae control, litter removal, and periodic dredging and disposal of accumulated sediments. The cost of periodic dredging is the largest maintenance cost. That cost can be reduced by confining the accumulation of most of the inflowing sediment to a settling pond located at the inlet of a retention or wet detention basin. Means of disposal of dredged sediment vary, depending on the level of contamination of the sediment. Sediments with high concentrations of toxic or hazardous substances must be disposed of in specially designed containment areas or landfills. Sediment to be dredged should be tested to determine the appropriate means of disposal.

Dry detention basins, which drain completely between flood events, are not as effective in reducing nonpoint source pollutant loadings as are retention or wet detention basins. While some sediment accumulation will occur, much of it will be scoured from the bottom of the basin and discharged downstream by subsequent storm events.

There are concerns that the polluted sediments that are deposited in storage ponds may contaminate fish and wildlife populations with toxic substances, and that disposal of dredged sediments may require special handling precautions and the use of hazardous waste disposal sites. Concentrations of toxic substances such as heavy metals in the tissue of fish living in urban waterways may be expected to be higher than in fish from non-urban waterways. However, unlike polychlorinated biphenyls and some other toxic organic substances, most metals do not bioconcentrate within the food chain. Metal levels in fish, wildlife, and other predators tend to be similar to levels found in primary producers or in benthic organisms. Fish can acquire the metals from absorption through their gills and skin, and from ingestion of contaminated food supplies. Urban ponds may contain resident panfish and game fish with excellent growth rates. Because of the potential elevated metal levels, however, such resident fish should not be consumed by humans. Similarly, because of potentially high bacterial levels, urban ponds should not be used for full body contact recreational activities.

Studies conducted by researchers at the Wisconsin Department of Natural Resources, the Northeastern Illinois Planning Commission, the State of Florida, the University of Alabama, and the Washington Council of Governments have all concluded that, while metal concentrations are high in the bottom sediments of urban ponds, such sediments are not hazardous and, therefore, should not need to be disposed of in a special hazardous waste disposal site, but could, if dried, be disposed of in a sanitary landfill or applied under controlled conditions to agricultural lands. The metal content of bottom sediments in an urban pond may be expected to be similar to the metal content in street debris collected by street sweepers; such debris also normally being disposed of in sanitary landfills.

Wetland Considerations

As described earlier, there are about 18 acres of wetland within the study area. The wetland areas located generally west of Barland Avenue extended, totaling about 11 acres, are located wholly or partially within areas

considered for stormwater storage sites under Alternative Nos. 1, 2, 3, 5, 7, 7A, and 8. A site inspection of the wetlands concerned revealed that the wetlands consist of shallow marsh, fresh (wet) meadow, with scattered wet to wet-mesic lowland hardwoods growing along the wetland edge. Past disturbances to the plant community include dumping and wetland filling, with water level changes due to ditching and wetland filling. No federal- or State-designated rare, threatened, or endangered species were observed during the field inspection. An inventory of the plant species within the wetland area is attached hereto as Exhibit K.

Care must be taken in these areas to provide the storage in a manner which will result in enhancement of the wetlands. Depending upon the details of the designs, it may be necessary to obtain permits from the U.S. Army Corps of Engineers and/or the Wisconsin Department of Natural Resources for the phase of the work involving the wetland areas. In any case, it is recommended these agencies be contacted if construction in the wetland areas is envisioned. Assuming proper consideration of the wetland impacts, it is expected that the storage can be enhanced or created under any alternative.

LOCAL REACTION TO THE ALTERNATIVES

On April 30, 1990, the City of Cudahy Common Council held a meeting to review and discuss the alternatives described herein. The City indicated the following criteria were considered important in the evaluation as set forth in a May 8, 1990, letter to the Milwaukee Metropolitan Sewerage District:

1. Project should solve drainage problems without requiring voluntary citizen participation in floodproofing existing structures.

2. Project should not require the purchase and removal of any existing dwellings.

3. Project should improve the "health and safety" for area residents to the greatest extent possible.

4. Project should not adversely affect future development in the area.

   a. Limit or eliminate the use of undeveloped land for drainage purposes.

   b. Align the proposed drainage facility with existing and/or future lot lines.

5. Project should improve the aesthetics of the area.

Based upon the April 30 review, the Common Council of the City of Cudahy went on record favoring Alternative No. 4.

We trust this letter report is fully responsive to the request set forth in the letter agreement entered into between this Commission and the District on March 9, 1990. Should you so desire, the Commission staff will be pleased to meet with you, your staff, or members of the District governing body to discuss the report.

Sincerely,

Kurt W. Bauer
Executive Director

EXHIBIT K

PREMLIMINARY VEGETATION SURVEY
EDGERTON CHANNEL STUDY AREA WETLANDS

Date: April 3, 5, 1990

Observers: Donald M. Reed, Principal Biologist
Rachel E. Lang, Assistant Biologist
Southeastern Wisconsin Regional Planning Commission

Location: City of Milwaukee in the Northwest and Southwest and Northeast and Northwest one-quarters of U.S. Public Land Survey Sections 26 and 27, respectively, Township 6 North, Range 22 East, Town of Lake, Milwaukee County, Wisconsin.

Species List: Plant Community Area No. 1

TYPHACEAE
Typha latifolia--Broad-leaved cat-tail
Typha angustifolia--Narrow-leaved cat-tail

GRAMINEAE
Poa pratensis--Kentucky bluegrass
Calamagrositis canadensis--Canada bluejoint grass
Phalaris arundinacea[1]--Reed canary grass

CYPERACEAE
Scirpus validus--Soft-stemmed bulrush
Carex blanda--Wood sedge
Carex stricta--Tussock sedge
Carex lacustris--Lake sedge

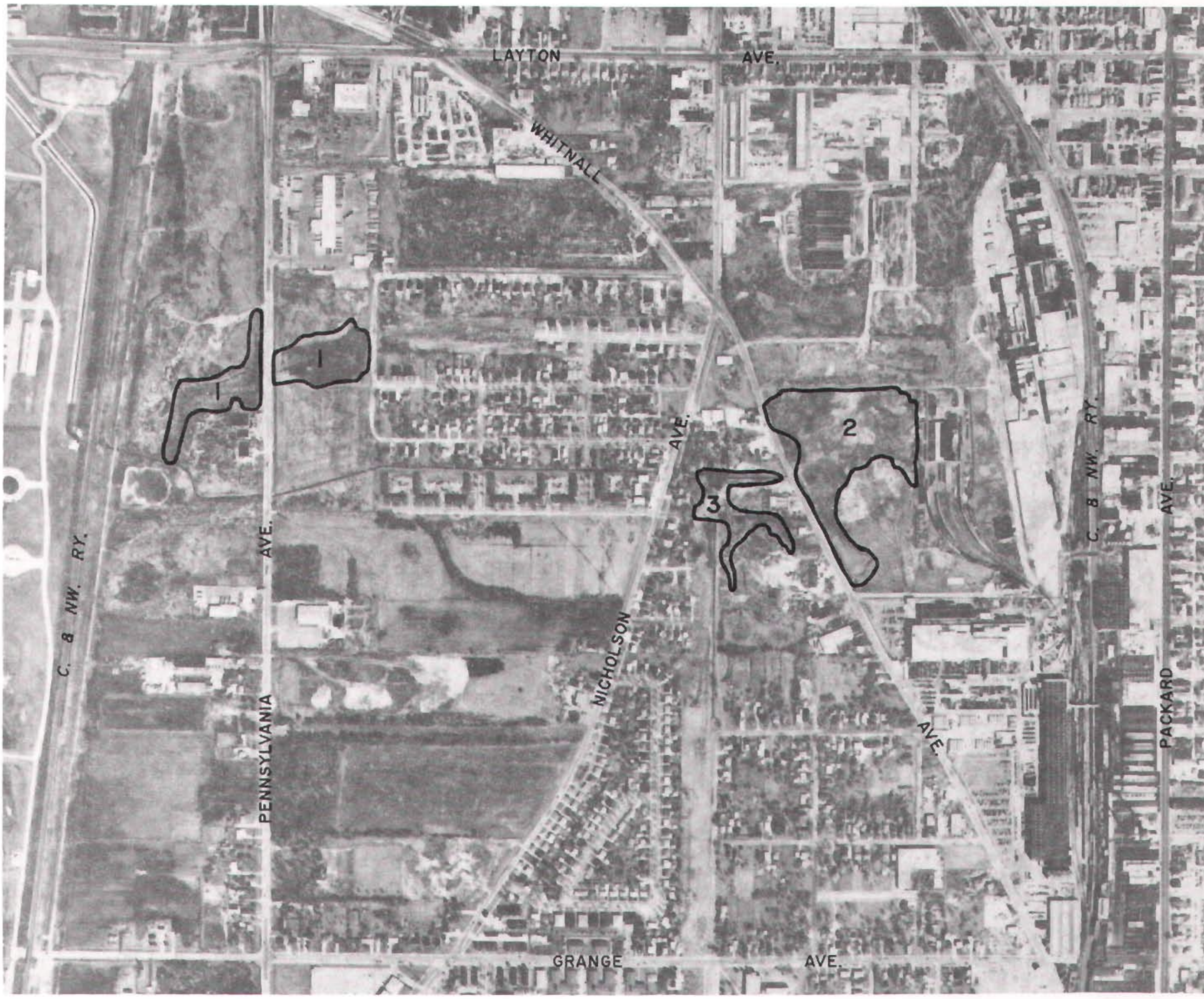
SALICACEAE
Populus deltoides--Cottonwood
Salix interior[2]--Sand-bar willow
Salix discolor--Pussy willow
Salix sp.--Willow

ULMACEAE
Ulmus americana--American elm

POLYGONACEAE
Rumex crispus[1,3]--Curly dock
Polygonum pensylvanicum--Pinkweed

SAXIFRAGACEAE
Ribes americanum--Wild black currant

ROSACEAE
Fragaria virginiana--Wild strawberry
Geum aleppicum[3]--Yellow avens



LEGEND

PLANT COMMUNITY AREA

3 PLANT COMMUNITY AREA IDENTIFICATION NUMBER

-2-

Rosa palustris[3]--Swamp rose

ACERACEAE
Acer negundo[3]--Boxelder

ONAGRACEAE
Oenothera biennis--Evening primrose

UMBELLIFERAE
Daucus carota[1,3]--Queen Anne's lace

CORNACEAE
Cornus stolonifera--Red osier dogwood

OLEACEAE
Fraxinus pennsylvanica--Green ash

HYDROPHYLLACEAE
Hydrophyllum virginianum--Virginia waterleaf

LABIATAE
Lycopus sp.--Bugleweed

COMPOSITAE
Solidago gigantea--Giant goldenrod
Aster lucidulus--Swamp aster
Aster pilosus--Frost aster
Aster simplex--Marsh aster
Cirsium vulgare[1,3]--Bull thistle

Total number of plant species: 32
Number of alien, or non-native, plant species: 4 (13 percent)

This approximately 6.3-acre wetland plant community area consists of shallow marsh, fresh (wet) meadow, shrub-carr and willow thicket with second growth southern wet-mesic lowland hardwoods growing along the wetland edge. Disturbances to the plant community include past wetland filling, water level changes due to ditching and stream realignment, and past agricultural activities along the wetland edge. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1] Alien, or non-native, plant species.

[2] Dominant shrub species.

[3] Growing along the wetland edge.

-3-

Plant Community Area No. 2

TYPHACEAE
Typha latifolia[1]--Broad-leaved cat-tail

GRAMINEAE
Poa pratensis--Kentucky bluegrass
Phalaris arundinacea[2]--Reed canary grass
Setaria sp.[2,3]--Foxtail grass

CYPERACEAE
Scirpus americanus--Chairmaker's rush
Carex stricta--Tussock sedge
Carex sp.--Sedge

SALICACEAE
Salix (fragilis?)[2,3]--Crack willow
Salix nigra--Black willow

ULMACEAE
Ulmus americana[3]--American elm

POLYGONACEAE
Rumex crispus[2,3]--Curly dock
Polygonum sp.--Smartweed

ROSACEAE
Fragaria virginiana--Wild strawberry
Rosa palustris[3]--Swamp rose
Crataegus sp.[3]--Hawthorn

ANACARDIACEAE
Rhus radicans[3]--Poison ivy
Rhus typhina[3]--Staghorn sumac

ACERACEAE
Acer negundo[3]--Boxelder

VITACEAE
Vitis riparia--River-bank grape

ONAGRACEAE
Oenothera biennis--Evening primrose

UMBELLIFERAE
Daucus carota[2,3]--Queen Anne's lace

CORNACEAE
Cornus stolonifera--Red osier dogwood
Cornus racemosa[3]--Grey dogwood

OLEACEAE
Fraxinus pennsylvanica--Green ash

-4-

CAPRIFOLIACEAE
Viburnum opulus[2,3]--High-bush cranberry

COMPOSITAE
Helianthus grosseserratus--Sawtooth sunflower
Rudbeckia laciniata--Green-headed coneflower
Ambrosia trifida--Giant ragweed
Xanthium strumarium[2,3]--Cocklebur
Achillea millefolium[2,3]--Yarrow
Solidago gigantea--Giant goldenrod
Aster lucidulus--Swamp aster
Aster pilosus--Frost aster
Aster simplex--Marsh aster
Cirsium arvense[2,3]--Canada thistle

Total number of plant species: 35
Number of alien, or non-native, plant species: 9 (26 percent)

This approximately 10.5-acre wetland plant community area consists of shallow marsh, and fresh (wet) meadow, with scattered southern wet to wet-mesic lowland hardwoods growing along the wetland edge. Disturbances to the plant community include dumping and wetland filling with water level changes due to ditching and filling. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1] Dominant plant species.

[2] Alien, or non-native, plant species.

[3] Growing along the wetland edge.

-5-

Plant Community Area No. 3

CUPRESSACEAE
Thuja occidentalis[1]--White cedar

TYPHACEAE
Typha latifolia--Broad-leaved cat-tail

GRAMINEAE
Phalaris arundinacea[2]--Reed canary grass

CYPERACEAE
Carex sp.--Sedge

JUNCACEAE
Juncus torreyi--Torrey's rush

SALICACEAE
Populus tremuloides[1]--Quaking aspen
Salix babylonica[2,3]--Weeping willow
Salix interior--Sand-bar willow
Salix sp.--Willow

ULMACEAE
Ulmus americana--American elm

POLYGONACEAE
Polygonum sp.--Smartweed

ROSACEAE
Fragaria virginiana--Wild strawberry
Rosa palustris--Swamp rose
Prunus serotina[1]--Black cherry
Crataegus sp.[1]--Hawthorn

ACERACEAE
Acer negundo[1]--Boxelder

CORNACEAE
Cornus stolonifera--Red-osier dogwood

OLEACEAE
Fraxinus pennsylvanica--Green ash

CAPRIFOLIACEAE
Lonicera X bella[2]--Hybrid honeysuckle

COMPOSITAE
Solidago gigantea--Giant goldenrod
Solidago altissima[1]--Tall goldenrod
Cirsium vulgare[1,2]--Bull thistle

-6-

Total number of plant species: 22
Number of alien, or non-native, plant species: 4 (18 percent)

This approximately 2.5-acre wetland plant community area consists of shallow marsh, fresh (wet) meadow, and shrub-carr with scattered southern wet-mesic lowland hardwoods. Disturbances to the plant community include water level changes due to ditching and channel realignment, and past filling and dumping. No federal- or state-designated rare, threatened or endangered species were observed during the field inspection.

---

[1] Alien, or non-native, plant species.

[2] Growin along the wetland edge.

[3] Planted tree species.

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EVALUATION OF ADDITIONAL ALTERNATIVES FOR THE NORTH BRANCH OF THE ROOT RIVER: OCTOBER 24, 1990

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

916 N. EAST AVENUE • P.O. BOX 1607 • WAUKESHA, WISCONSIN 53187-1607 • TELEPHONE (414) 547-6721 TELECOPIER (414) 547-1103

Serving the Counties of KENOSHA, MILWAUKEE, OZAUKEE, RACINE, WALWORTH, WASHINGTON, WAUKESHA

Mr. Wallace White
Executive Director
Milwaukee Metropolitan Sewerage District
260 W. Seeboth Street
P.O. Box 3049
Milwaukee, Wisconsin 53201-3049

October 24, 1990

Dear Mr. White:

In accordance with the terms of the letter agreement entered into on June 26, 1990, between the Milwaukee Metropolitan Sewerage District and this Commission, the Commission staff has prepared descriptions and evaluations of additional alternative flood control and stormwater drainage plans for the North Branch of the Root River. This work represents an extension of the work carried out under the District's stormwater drainage and flood control planning program. This letter report is intended to document the findings of the evaluations of the additional alternatives considered.

STUDY AREA DESCRIPTION

The study area defined for the evaluations consists of the drainage area tributary to the North Branch of the Root River above W. Forest Home Avenue. All of the significant flooding and drainage problems on the North Branch of the Root river occur above the W. Forest Home Avenue crossing. The boundaries of this 13.9-square-mile drainage area and its relationship to the rest of the drainage area of the North Branch of the Root River are shown on Map 1.

As shown on Map 1, the study area is located within southwestern Milwaukee County and southeastern Waukesha County. The area includes portions of the Cities of Greenfield, New Berlin, and West Allis; and the Villages of Greendale and Hales Corners. From its origin near the intersection of Sunny Slope Road and Ferguson Road in the City of New Berlin, the North Branch of the Root River flows in an easterly direction to W. Lincoln Avenue in the City of West Allis, a distance of about 1.1 miles; thence southerly for about 2.4 miles to W. Beloit Road in the City of Greenfield; and thence southeasterly for about 2.3 miles to W. Forest Home Avenue in the City of Greenfield. The entire perennial stream length of the North Branch of the Root River as well as the 0.9-mile of intermittent portion of the North Branch extending to W. Lincoln Avenue, is recommended for District jurisdiction in the policy plan developed by the District.

The major tributaries of the North Branch of the Root River in the study area include Wildcat Creek, Hale Creek, and the West Branch of the Root river, all as shown on Map 2. None of the tributaries to the North Branch were

recommended for District jurisdiction in the policy plan. However, system planning was conducted under the District's system planning effort for Hale Creek since that tributary had a history of flood damage problems, and any flood control measures carried out along this stream were anticipated to have an impact on flood flows and stages and recommended flood control measures along the North Branch of the Root River. Complete system planning analyses were not carried out for the other tributaries in the District's system planning effort. However, consideration was given to the hydrologic impact of these tributaries on the North Branch Root River.

Existing land uses within the study area are shown on Map 7 of Chapter II in the District stormwater drainage and flood control plan.[1] In 1985, about 80 percent of the study area was developed for urban use, including residential, commercial, institutional, and urban open space uses. In addition, Commission staff review of aerial photographs, subdivision plats, and field inspections indicates that the available developable open land within the study area is rapidly being developed. Under year 2010 planned land use conditions, the study area is expected to be nearly 100 percent developed in urban uses including in this land use category urban parkway land along much of the North Branch of the Root River. These parkway lands are assumed to remain in their current use. The developed areas of the subwatershed are generally provided with a full range of municipal street improvements, including paved streets with curbs and gutters and attendant storm sewers. Accordingly, surface runoff is generally conveyed quickly from most individual sites through storm sewers to the study area.

DRAINAGE AND FLOOD CONTROL PROBLEMS

Relatively severe flooding problems occur within the study area as documented in the District stormwater drainage and flood control system plan. Structural flood damages are concentrated along three reaches: between W. Forest Home Avenue and W. Layton Avenue in the City of Greenfield; between W. National Avenue and W. Lincoln Avenue in the City of West Allis on the North Branch of the Root River; and along the entire length of Hale Creek in the City of West Allis. All of these reaches are located through relatively narrow parkway lands and serve to illustrate the consequences of allowing urban development to take place too close to a major stream channel. Structure damages due to overland flooding have been more severe along the City of Greenfield reach, with several homes having experienced first-floor flooding. Nuisance flooding along the North Branch Root River in the City of West Allis is also common. Parkway and roadway in these areas are flooded several times a year, causing nuisance conditions for through traffic and for people who rely on these drives for access to their homes. Safety is also a concern and the parkway and roadways are barricaded several times per year to limit access.

[1] SEWRPC Community Assistance Planning Report No. 152, A Stormwater Drainage and Flood Control System Plan for the Milwaukee Metropolitan Sewerage District.

Currently, there are nine homes in the City of West Allis and 42 homes in the City of Greenfield along the North Branch of the Root River and nine homes and nine commercial buildings in the City of West Allis along Hale Creek which are located within the 100-year recurrence interval flood hazard area, as that area has been delineated on the basis of planned land use and existing channel conditions. These structures may be expected to experience basement and first floor flooding under a major runoff event. The average annual flood damages due to direct flooding of structures within the study area are estimated to total about $66,410, with a 100-year recurrence interval flood expected to cause damages totaling about $1,200,000.

Another stormwater drainage problem in the City of West Allis concerns the construction of storm sewers which have been designed to discharge to the North Branch of the Root River and Hale Creek with invert elevations below the existing streambeds. These sewers were constructed under the assumption that major channel modifications, including lowering of the streambed, would be carried out along these two stream reaches. These storm sewers operate with either partially blocked or negatively sloped outfalls, thus reducing their effective conveyance capacity and resulting in poor drainage and street and other nuisance flooding in areas away from the stream channels. Frequent surcharging of the storm sewer system discharging to Hale Creek at W. Lincoln Avenue and S. 111th Street has been documented by the City of West Allis engineering department. The storm sewer outfall at this location consists of a reinforced concrete box culvert 6.5 feet wide by 4.0 feet high carrying runoff from about 170 acres of high-density residential development located north of W. Lincoln Avenue. Since this outfall was constructed with an invert elevation about two feet below the existing streambed, only about one-half of its intended conveyance area is available. This has resulted in surcharging of the tributary storm sewers and flooding of residential streets several times a year. Investigations conducted under the District's stormwater drainage and flood control system planning effort revealed six storm sewer outfalls--three on the North Branch of the Root River and three on Hale Creek--with inverts located below the existing streambed. Providing a suitable outlet for these storm sewers was considered in developing the alternative plan under the District's stormwater drainage and flood control system planning program.

ALTERNATIVE PLANS

Three new alternative drainage and flood control plans were considered as agreed-upon in the interagency meetings concerning this matter held on June 7, 1990, and attended by representatives of the Milwaukee Metropolitan Sewerage District, the Wisconsin Department of Natural Resources, and the Southeastern Wisconsin Regional Planning Commission. In addition, a variation of one of the three alternatives was also considered by the Commission staff after review of the three alternatives initially considered. Thus, in total, four new alternative plans were evaluated. In addition, for comparative purposes, a description is also presented below of the initially recommended alternative developed in the District stormwater drainage and flood control system planning effort and of a refinement of the initially recommended alternative. That refinement provided for removal of all of the structures located in the

floodplain in the City of Greenfield, in lieu of a combination of floodproofing, elevation, and removal of those structures. Thus, in total, six alternative plans are described herein.

All six of the alternative plans described below include provisions for minor channel deepening along the North Branch of the Root River and Hale Creek in the City of West Allis, as shown on Map 3. This channel modification consists of lowering the streambed by up to 4.2 feet along a 1.6-mile long reach of the North Branch Root River between W. Morgan Avenue and the Parkway Drive bridge at River Mile 41.95, and by up to 2.6 feet along the entire 1.0-mile length of Hale Creek. This deepening is required to provide a free outlet for existing storm sewers that were constructed with outlet inverts at elevations below the existing channel bottom. The proposed channel would have bottom widths ranging from 6 to 10 feet and side slopes of one on three. The channel would be riprap-lined to an elevation two feet above the proposed streambed, with the remainder being turf-lined. In order to accommodate the lower streambed profile, bridge replacement would be required at S. 116th Street, at W. Cleveland Avenue on the North Branch Root River, and at W. Cleveland Avenue on Hale Creek. Also, a pedestrian bridge at River Mile 41.12 would need to be replaced.

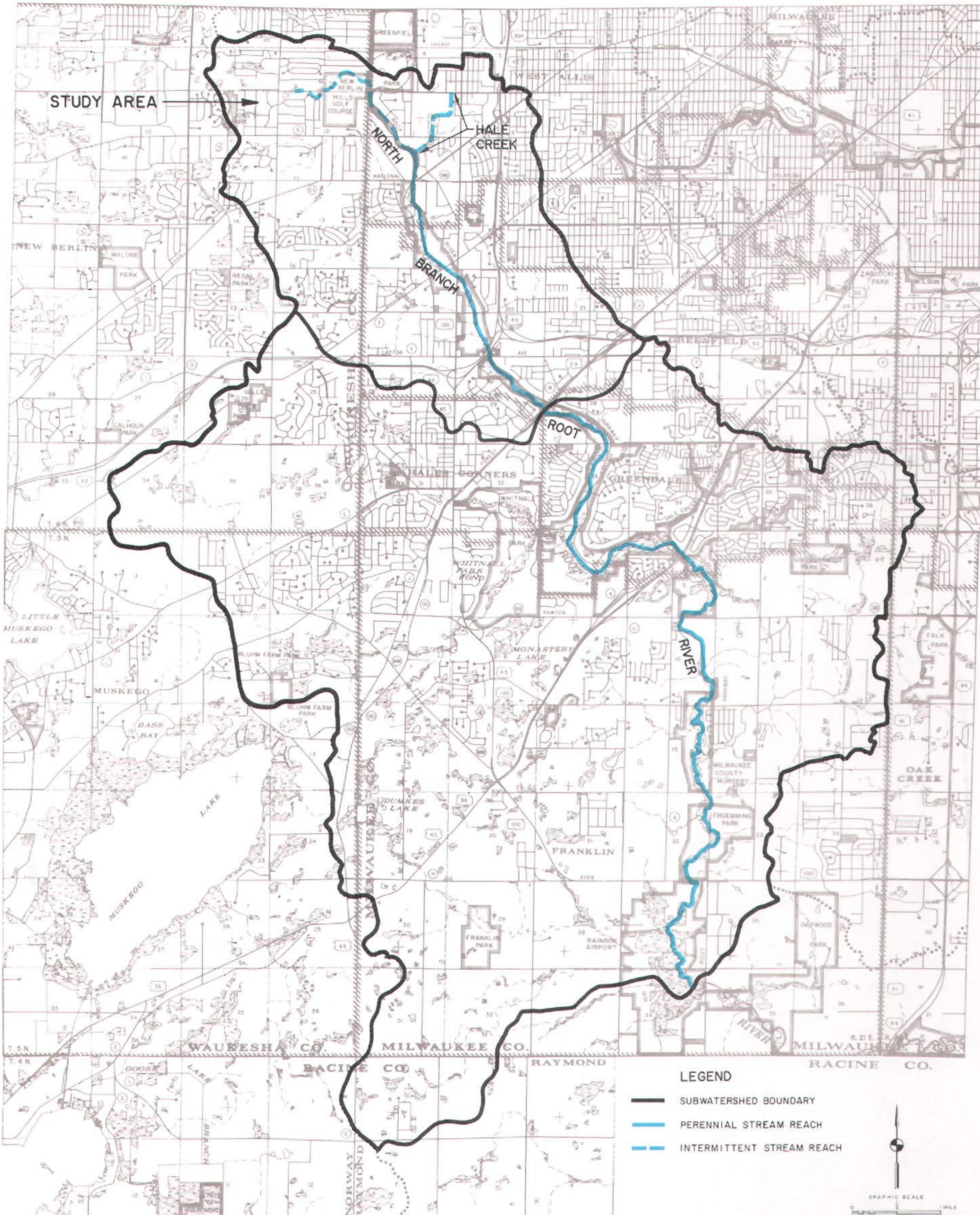
This channel deepening would reduce the number of homes and commercial buildings in the floodplain in the City of West Allis by 17 structures. In addition, the channel deepening would significantly reduce the frequency and extent of the flooding of Parkway Drive in the City of West Allis, which has caused access and safety concerns and which requires expenditure of public works resources. In addition, this channel deepening would help resolve local stormwater drainage problems related to storm sewer outfalls with invert elevation. The channel modifications, if properly designed, could be accommodated in a manner which would minimize any negative environmental impacts and that the channel could be constructed in a manner which may improve its usefulness for aquatic life and could be aesthetically pleasing. The detailed design of the channel should consider such environmental-related features as low flow channels, aquatic habitat restoration, and stream meanders.

With regard to the channel modification component of the project, the costs set forth in this report have specifically been increased to include special provisions for low flow channel construction, special erosion control elements, and plantings to maintain a natural appearance for and along the channel. These costs were considered over and above the costs for clearing, excavation, seeding, riprap, bridge replacement, and conventional construction erosion control. Estimates for the cost of the special provisions resulted in an increase in cost of the project capital of about $200,000, or about 17 percent.

The hydrologic/hydraulic analyses needed to evaluate each alternative were conducted using the models developed for the North Branch of the Root River as described in Chapter VI of the District's stormwater drainage and flood control system plan. The hydrologic model was refined for use in evaluating additional alternatives set forth herein by dividing the channel system into shorter reaches in order to provide more flow output locations as needed to properly consider the impacts of storage at six selected sites. In addition,

Map 1

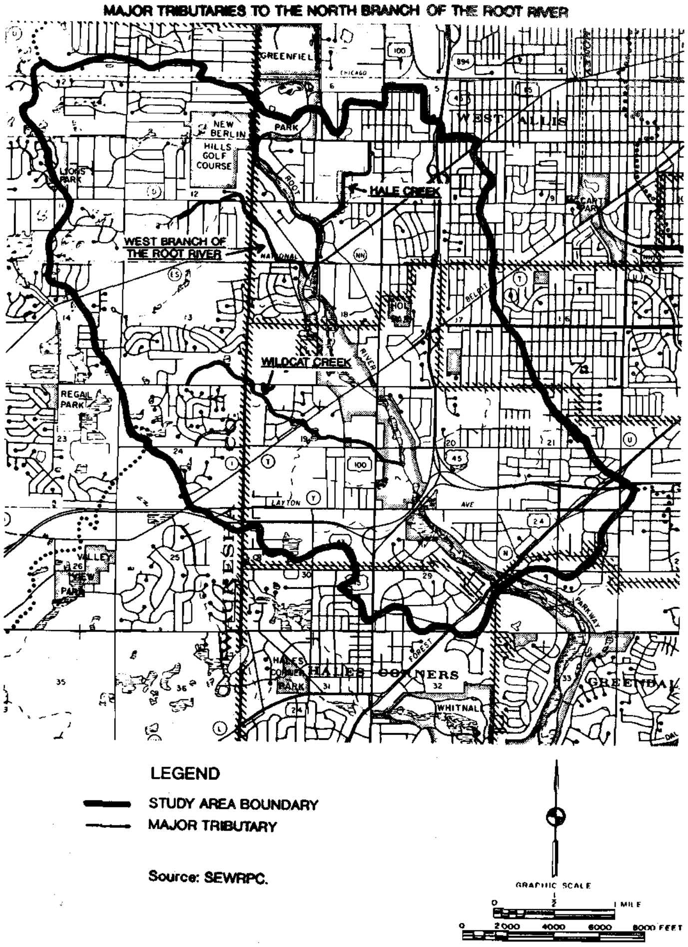
THE NORTH BRANCH OF THE ROOT RIVER SUBWATERSHED



Source: SEWRPC.

Map 2

MAJOR TRIBUTARIES TO THE NORTH BRANCH OF THE ROOT RIVER



because of the urbanized nature of the study area, and its attendant rapid conveyance of runoff through storm sewers, simulations were performed using a 15-minute time intervals for rainfall and flow estimates as was used in the *previous analysis*. This was done to ensure that peak flow rates which are of relatively short duration in some locations were not under estimated. A 100-year recurrence interval 4-hour rainfall event was used in the hydrologic simulation since that event was determined to cause the largest peak flow rate in the reach of the North Branch of the Root River between Forest Home and N. Layton Avenue. Under the District's stormwater drainage and flood control system planning, a range of design storm periods had been analyzed to determine the storm which caused the largest peak. These refinements to the hydrologic model result in minor changes in the peak flow calculations developed under the earlier planning efforts. However, the differences in flow rate estimates are not significant--being less than 5 percent in all instances.

A summary of the costs and a description of selected characteristics of each of the alternative stormwater drainage and flood control system plans is set forth in Table 1. The peak flood flows and associated stages at selected locations in the study for each alternative are shown on Tables 2 and 3.

Alternative Plan 1--Initially Recommended Flood Control Plan

The stormwater drainage and flood control plan for Hale Creek and the portion of the North Branch of the Root River within the study area, as included under Alternative Plan 1 and as recommended in the Milwaukee Metropolitan Sewerage District stormwater drainage and flood control system plan, included a combination of structure floodproofing, elevation, and removal, with minor channel deepening. No newly *constructed floodwater storage facilities* are proposed under the initially recommended plan. However, substantial natural storage is included by the recommended preservation of all riverine area wetlands and floodlands in the study area. In addition, it would be possible to provide stormwater detention facilities for water quality purposes at appropriate locations for that purpose alone.

Alternative Plan 1 for the North Branch of the Root River and Hale Creek in the City of West Allis is shown on Map 3. The alternative includes lowering the streambed, as described in the previous section, along a 1.6-mile long reach of the North Branch Root River and along the entire 1.0-mile length of Hale Creek. This deepening is intended to reduce the number of homes in the floodplains and reduce the frequency and duration of the flooding of parkway drives. In addition, this channel lowering will provide an outlet for existing storm sewers that were constructed with outlet inverts at elevations below the existing channel bottom. In addition, it is recommended that three houses along the North Branch of the Root River and five house along Hale Creek be floodproofed and that one house along the North Branch of the Root River and one house along Hale Creek be removed. This alternative flood control plan for the North Branch of the Root River in the City of Greenfield consists of floodproofing 14 houses, elevating 15 houses above the flood elevation, and removing 13 structures from the floodplain.

In the case of residential structures, floodproofing was assumed to be feasible if the design flood stage was below the first-floor elevation. Structure elevation was considered feasible for residential structures with basements if the estimated cost of elevating the structure and floodproofing the basement was less than the estimated removal cost. Structures to be elevated were assumed to have the first floor raised to an elevation at least two feet above the 100-year recurrence interval flood stage to provide adequate freeboard. For aesthetic reasons, structure elevation was limited to a maximum of four feet. Structures that would have to be elevated more than four feet were considered for removal.

As shown in Table 1, the total capital cost of the initially recommended flood control plan as set forth in Alternative Plan 1 is estimated at about $3.5 million, with an average annual operation and maintenance cost of about $5,400. The total annual cost of capital and operation and maintenance is estimated to be about $228,000. The value of the average annual *flood abatement benefits* is about $66,400, resulting in a benefit-cost ratio of about 0.29. These benefits do not include those associated with the reduction in stormwater drainage and nuisance flooding of roadways, yards, and parkway areas which are generally not quantified. If these benefits were added, the benefit-cost ratio would be greater.

This alternative could be expanded to provide water quality benefits by providing wet detention basins at five of the six sites shown on Map 4. No basin would be provided at the Cold Spring Road site since the tributary area to that site is too large and the corresponding required wet basin size would be larger than could practically be constructed. The capital cost of the five basins would be about $1,100,000 if sized to provide a reduction of about 50 percent in the nonpoint source sediment loadings from the areas tributary to those basins. The basins would have no flood control benefits.

Alternative Plan 2--Refined Initially Recommended Flood Control Plan

Alternative Plan 2 is the same as Alternative Plan 1--the initially recommended plan--except that all the structures located within the floodplain in the City of Greenfield would be removed rather than providing for a combination of floodproofing, elevation, and removal. This refinement to the initially recommended plan has been considered by the Milwaukee Metropolitan Sewerage District in response to a survey of affected residents who indicated a large majority preference for an alternative providing *for removal of* all the structures in the floodplain. The District staff had, at one time, prepared a memorandum recommending adoption of the initially recommended plan, with the modification providing for removal of all structures in the floodplain in the City of Greenfield.

As shown in Table 1, the total capital cost of the flood control plan under Alternative Plan 2 for Hale Creek and the North Branch of the Root River within the study area is estimated at about $6.1 million, with an average annual operation and maintenance cost of about $5,400. The total annual cost of capital and operation and maintenance is estimated to be $391,000. The value of the average annual flood abatement benefits is about $66,400, resulting in a benefit-cost ratio of about 0.17. These benefits do not include those

associated with the reduction in stormwater drainage and nuisance flooding of roadways, yards, and parkway which are generally not quantified. If these benefits were added, the benefit-cost ratio would be greater.

Alternative 2 could be expanded *to provide water* quality benefits by providing wet detention basins at five of the six sites shown on Map 4 in the same manner as under Alternative Plan 1, at a capital cost of about $1,100,000.

Alternative Plan 3--Maximum Detention Storage Utilizing No Excavation

Under Alternative Plan 3, detention storage facilities would be constructed at all potential open space sites in the study area which appear to have a potential for providing a reduction in downstream flood flows and stages. A review of the study area indicated six such potential sites, as shown on Map 4. Under this alternative, the detention facilities would be limited to that which can be developed with no major excavation. This storage would be provided over and above the natural storage in the study area which would also be preserved. The area tributary to, and selected characteristics of, each of the six detention facilities as proposed under Alternative Plan 3 are shown in Table 4. The areal extent of each detention facility, as well as the outlet location, diking, and other appurtenant facilities associated with each detention storage facility are shown on Maps 5 through 10. The Cold Spring Road site basin sizing was developed assuming the preliminary grading plan prepared by Milwaukee County under a park development proposal. A total of about 550 acre-feet of storage covering about 126 acres is envisioned at the six sites under this alternative.

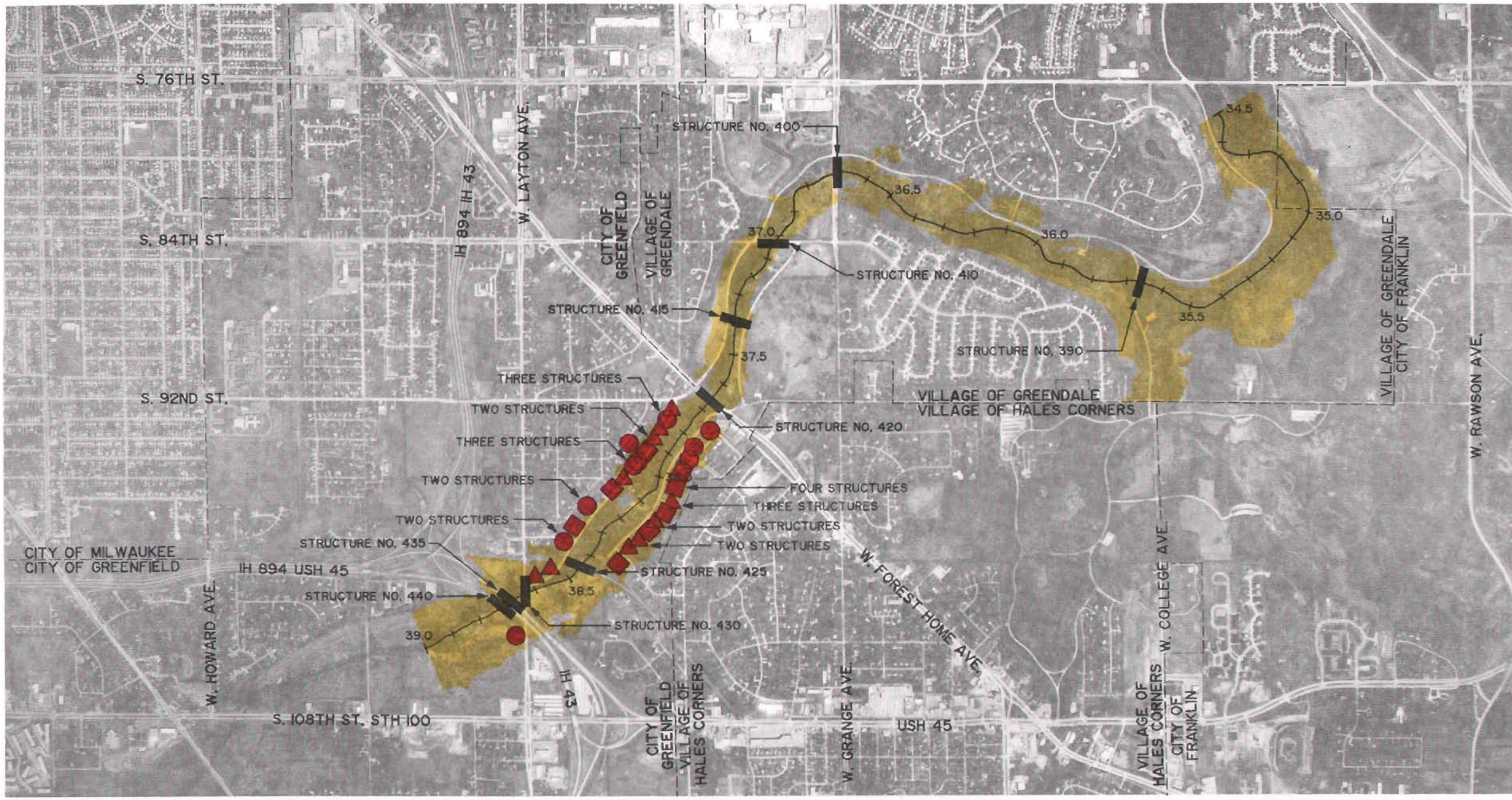
The impact of the detention storage facilities on downstream flood flows and *stages under this alternative* is summarized in Tables 2 and 3. As can be seen, 100-year recurrence interval flood flows under planned land use conditions are reduced from 28 to 73 percent in the study area, compared to Alternative Plans 1 and 2, which have no newly constructed storage facilities. Flow rates at W. Layton Avenue and at W. Forest Home Avenue in the City of Greenfield are expected to be reduced 41 and 33 percent, respectively. The associated flood stages between W. Layton Avenue and W. Forest Home Avenue were reduced from 0.5 foot to 1.1 feet, compared to stages under Alternative Plans 1 and 2. Hydrographs illustrating the impact of the detention storage facilities are attached hereto as Exhibit A.

As previously noted, this alternative flood control plan for Hale Creek and the North Branch of the Root River within the study area also consists of lowering the streambed as described in the previous section, along a 1.6-mile long reach of the North Branch of the Root River and along the entire 1.0-mile length of Hale Creek.

The detention facilities and channel improvements provided under this alternative would reduce, but not eliminate the flood damages within the study area. In addition, in order to resolve the residual flooding problems within the City of West Allis, it is recommended that one house along the North Branch of the Root River and four houses along Hale Creek be floodproofed. Within the City of Greenfield, the residual flooding impacts 35 houses. For purposes of this alternative, it was assumed these structures would be removed. Of the 35

Map 3

THE RECOMMENDED FLOOD CONTROL SYSTEM PLAN FOR THE NORTH BRANCH OF THE ROOT RIVER



LEGEND

- 100-YEAR RECURRENCE INTERVAL FLOODPLAIN-YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS
- 39.0 APPROXIMATE EXISTING CHANNEL CENTERLINE AND RIVER MILE STATIONING
- STRUCTURE FLOODPROOFING
- STRUCTURE ELEVATION
- STRUCTURE TO BE REMOVED

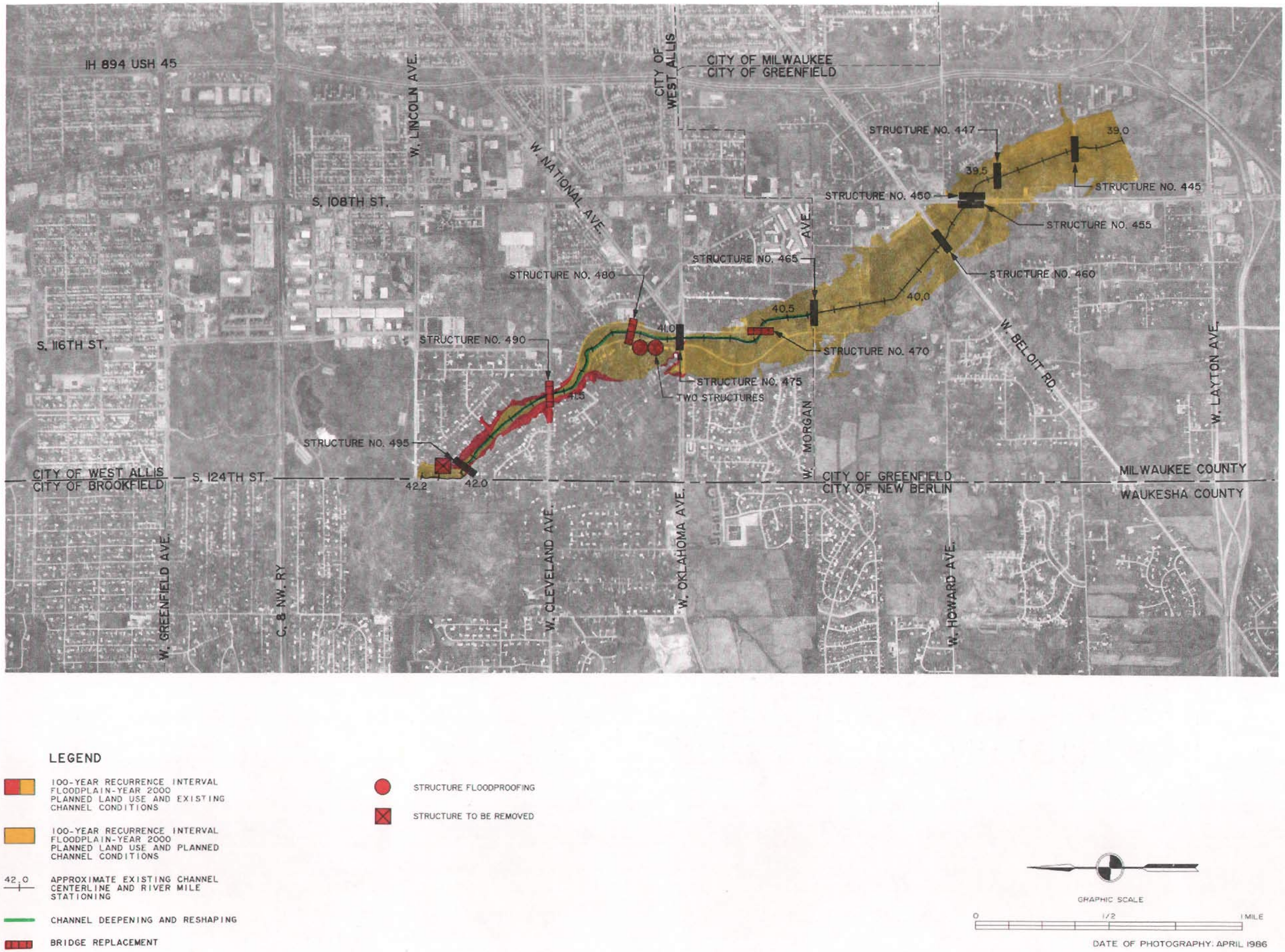
GRAPHIC SCALE

0 1/2 1 MILE

DATE OF PHOTOGRAPHY: APRIL 1986

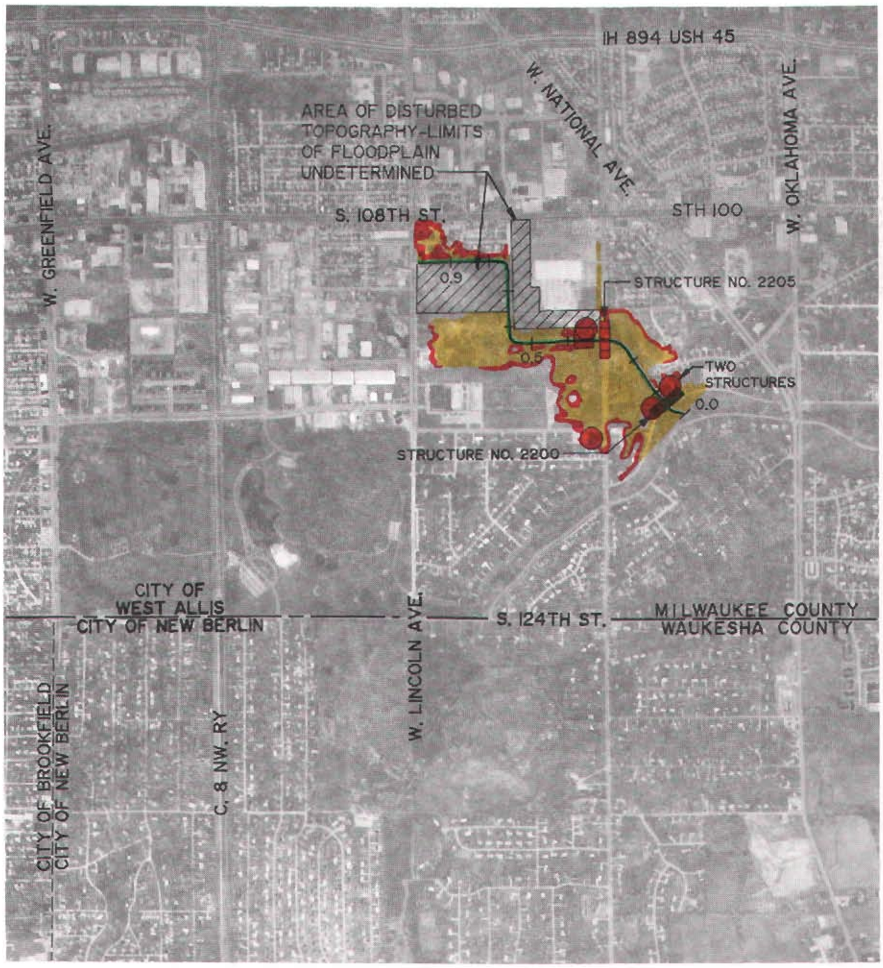
Map 3

THE RECOMMENDED FLOOD CONTROL SYSTEM PLAN FOR THE NORTH BRANCH OF THE ROOT RIVER



Map 3

THE RECOMMENDED FLOOD CONTROL SYSTEM PLAN FOR HALE CREEK



LEGEND

- 100-YEAR RECURRENCE INTERVAL FLOODPLAIN-YEAR 2000 PLANNED LAND USE AND EXISTING CHANNEL CONDITIONS
- 100-YEAR RECURRENCE INTERVAL FLOODPLAIN-YEAR 2000 PLANNED LAND USE AND PLANNED CHANNEL CONDITIONS
- 0.5 APPROXIMATE EXISTING CHANNEL CENTERLINE AND RIVER MILE STATIONING
- STRUCTURE FLOODPROOFING
- STRUCTURE TO BE REMOVED
- CHANNEL DEEPENING AND RESHAPING
- BRIDGE REPLACEMENT

GRAPHIC SCALE

0 1/2 1 MILE

DATE OF PHOTOGRAPHY: APRIL 1986

Source: SEWRPC.

Table 1

COST ESTIMATES FOR ALTERNATIVE FLOOD CONTROL PLANS FOR
HALE CREEK AND THE NORTH BRANCH OF THE ROOT RIVER UPSTREAM OF W. FOREST HOME AVENUE

No.	Name	Description	Capital	Cost (dollars): Total Amortized Capital[a]	Cost (dollars): Annual Operation and Maintenance	Cost (dollars): Total	Benefit Cost Analysis: Annual Benefits (dollars)	Benefit Cost Analysis: Economic Benefit-Cost Ratio
1.	Initially Recommended Alternative--Combination Structure Floodproofing, Elevation, and Removal with Minor Channel Deepening	a. 1.6 miles of channel modification along North Branch of the Root River	$ 835,000[b]	$ 53,100	$3,300[b]	$ 56,300		
		b. 1.0 mile of channel modifications along Hale Creek	555,000[c]	35,200	2,100[c]	37,300		
		c. Replacement of four bridges	124,000[d,e]	7,900	--	7,900		
		d. Floodproof 22 structures (8 in West Allis, 14 in Greenfield)	107,000[f]	6,800	--	6,800		
		e. Elevate 15 structures (all in Greenfield)	517,000[g]	32,800	--	32,800		
		f. Remove 15 structures (2 in West Allis, 13 in Greenfield)	1,378,000[h]	87,400	--	87,400		
		Total	$3,516,000[i]	$223,100	$5,400	$228,500	$ 66,410[j]	0.29
2.	Refined Initially Recommended Alternative--Combination Structure Floodproofing, Elevation, and Removal, with Minor Channel Deepening	a. 1.6 mile of channel modification along North Branch of the Root River	835,000[b]	53,000	3,300[b]	56,300		
		b. 1.0 mile of channel modification along Hale Creek	555,000[c]	35,200	2,100[c]	37,300		
		c. Replacement of four bridges	124,000[d,e]	7,900	--	7,900		
		d. Floodproof 8 structures (all in West Allis)	39,000[f]	2,500	--	2,500		
		e. Remove 44 structures (2 in West Allis, 42 in Greenfield)	4,524,000[h]	286,800	--	286,800		
		Total	$6,072,000[i]	$385,400	$ 5,400	$390,800	$ 66,410[j]	0.17
3.	Maximum Detention Storage Utilizing Minimum Excavation	a. 1.6 mile of channel modification along North Branch of the Root River	835,000[b]	53,000	3,300[b]	56,300		
		b. 1.0 mile of channel modification along Hale Creek	555,000[c]	35,200	2,100[c]	37,300		
		c. Replacement of four bridges	124,000[d,e]	7,900	--	7,900		
		d. Detention basin on North Branch of the Root River at W. Cold Spring Road	3,033,000[k]	192,300	50,000[k]	242,300		
		e. Detention basin on Wildcat Creek upstream of S. 112th Street	521,000[l]	33,000	16,000[l]	49,000		
		f. Detention basin on Wildcat Creek upstream of S. 124th Street	130,000[m]	8,300	5,000[m]	13,300		
		g. Detention basin on West Branch of the Root River upstream of W. National Avenue	732,000[n]	46,400	22,000[n]	68,400		
		h. Detention basin on Hale Creek at W. Cleveland Avenue	432,000[n]	27,400	13,000[n]	40,400		
		i. Detention basin on North Branch of the Root River at New Berlin Hills Golf Course.	466,000[m]	29,500	14,000[m]	43,500		

Table 1 (cont'd)

No. Name	Description	Capital	Cost (dollars): Total Amortized Capital[a]	Cost (dollars): Annual Operation and Maintenance	Cost (dollars): Total	Benefit Cost Analysis: Annual Benefits (dollars)	Benefit Cost Analysis: Economic Benefit-Cost Ratio
3. continued	j. Floodproof 5 structures (all in West Allis)	$ 25,000[f]	$ 1,600	--	$ 1,600		
	k. Remove 35 structures (all in Greenfield)	3,468,000[o]	219,900	--	219,900		
	Total	$10,321,000[p]	$654,500	$125,400	$779,900	$ 66,410[j]	0.09
4. Maximum Detention Storage Utilizing Selected Excavation at Two Sites	a. 1.6 miles of channel modification along North Branch of the Root River	835,000[b]	53,000	3,300[b]	56,300		
	b. 1.0 mile of channel modification along Hale Creek	555,000[c]	35,200	2,100[c]	37,300		
	c. Replacement of four bridges	124,000[d,e]	7,900	--	7,900		
	d. Detention basin on North Branch of the Root River at W. Cold Spring Road	2,987,000[k]	189,400	50,000[k]	239,400		
	e. Detention basin on Wildcat Creek upstream of S. 112th St.	521,000[l]	33,000	16,000[l]	49,000		
	f. Detention basin on Wildcat Creek upstream of S. 124th St.	998,000[m]	63,300	30,000[m]	93,300		
	g. Detention basin on West Branch of the Root River upstream of W. National Avenue	732,000[n]	46,400	22,000[n]	68,400		
	h. Detention basin on Hale Creek at W. Cleveland Avenue	3,735,000[n]	236,800	42,000[n]	278,800		
	i. Detention basin on North Branch of the Root River at New Berlin Hills Golf Course	466,000[m]	29,500	14,000[m]	43,500		
	j. Floodproof 1 structure (in West Allis)	5,000[f]	300	--	300		
	k. Remove 16 structures (all in Greenfield)	1,500,000[o]	95,100	--	95,100		
	Total	$12,458,000[p]	$789,900	$179,400	$969,300	$ 66,410[j]	0.07
5. Maximum Detention Utilizing Maximum Excavation	a. 1.6 miles of channel modification along North Branch of the Root River	835,000[b]	53,000	3,300[b]	56,300		
	b. 1.0 mile of channel modification along Hale Creek	555,000[c]	35,200	2,100[c]	37,300		
	c. Replacement of four bridges	124,000[d,e]	7,900	--	7,900		
	d. Detention basin on North Branch of the Root River at W. Cold Spring Road	8,928,000[k]	566,000	50,000[k]	616,000		
	e. Detention basin on Wildcat Creek upstream of S. 112th St.	521,000[l]	33,000	16,000[l]	49,000		
	f. Detention basin on Wildcat Creek upstream of S. 124th St.	998,000[m]	63,300	30,000[m]	93,300		
	g. Detention basin on West Branch of the Root River upstream of W. National Avenue	732,000[n]	46,400	22,000[n]	68,400		
	h. Detention basin on Hale Creek at W. Cleveland Avenue	3,735,000[n]	236,800	42,000[n]	278,800		
	i. Detention basin on North Branch of the Root River at New Berlin Hills Golf Course	466,000[m]	29,500	14,000[m]	43,500		

Table 1 (cont'd)

No.	Name	Description	Capital	Cost (dollars): Total Amortized Capital[a]	Cost (dollars): Annual Operation and Maintenance	Cost (dollars): Total	Benefit Cost Analysis: Annual Benefits (dollars)	Benefit Cost Analysis: Economic Benefit-Cost Ratio
		j. Floodproof 1 structure (in West Allis)	5,000[f]	300	--	300		
		k. Remove 9 structures (all in Greenfield)	801,000[o]	50,800	--	50,800		
		Total	$17,700,000[p]	$1,122,200	$179,400	$1,301,600	$ 66,410[j]	0.05
6.	Refined Detention Utilizing Maximum Storage	a. 1.6 miles of channel modification along North Branch of the Root River	835,000[b]	53,000	3,300[b]	56,300		
		b. 1.0 mile of channel modification along Hale Creek	555,000[c]	35,200	2,100[c]	37,300		
		c. Replacement of four bridges	124,000[d,e]	7,900	--	7,900		
		d. Detention basin on North Branch of the Root River at W. Cold Spring Road	8,932,000[k]	566,300	50,000[k]	616,300		
		e. Detention basin on Wildcat Creek upstream of S. 112th St.	521,000[l]	33,000	16,000[l]	49,000		
		f. Detention basin on Wildcat Creek upstream of S. 124th St.	998,000[m]	63,300	30,000[m]	93,300		
		g. Detention basin on Hale Creek at W. Cleveland Avenue	3,735,000[n]	236,800	42,000[n]	278,800		
		h. Detention basin on North Branch of the Root River at New Berlin Hills Golf Course	341,000[m]	21,600	11,000[m]	32,600		
		i. Floodproof 1 structure (in West Allis)	5,000[f]	300	--	300		
		j. Remove 10 structures (all in Greenfield)	887,000[o]	56,300	--	56,300		
		Total	$16,933,000[p]	$1,073,700	$154,400	$1,228,100	$ 66,410[j]	0.05

[a]Amortized capital cost is based on an interest rate of 6 percent and a project life of 50 years.

[b]The cost of this channel modification would be borne by the Milwaukee Metropolitan Sewerage District.

[c]The cost of this channel modification would be borne by the City of West Allis.

[d]Costs for bridges at W. Cleveland Avenue on the North Branch of the Root River and W. Cleveland Avenue on Hale Creek were previously assigned under the Commission's adopted regional transportation system plan. These two bridges would have a capital cost of $465,000.

[e]Of the total $124,000 capital cost, $12,000 would be borne by the MMSD for removal of the existing bridges, $93,000 would be borne by the City of West Allis for the replacement bridge at S. 116th Street, and $19,000 would be borne by Milwaukee County for the replacement of one pedestrian bridge.

[f]The cost of structure floodproofing would be borne by the individual property owners.

[g]The cost of structure elevation would be borne by the individual property owners.

[h]Of the total cost for structure removal, $94,000 would be borne by the City of West Allis for the removal of one house along Hale Creek; and the remainder would be borne by the MMSD.

[i]As designed, Alternative Plans 1 and 2 do not provide significant water quality benefits. Wet detention storage could be added at five of the six detention site locations considered in Alternative Plan 3 at a cost of about $1,100,000, which would reduce nonpoint source sediment loadings by about a 50 percent. No water quality basin would be provided at the Cold Spring Road site.

[j]Benefits due to provision of adequate outlets for storm sewers and due to abatement of nuisance flooding of roadways are not normally quantified and are not included. If these benefits were included, it would result in a higher benefit-cost ratio.

[k]The cost of this detention basin would be borne by the MMSD.

[l]The cost of construction and maintenance of this basin would be subject to negotiation between the MMSD, the City of Greenfield, and, if water quality measures are included, the State of Wisconsin.

[m]The cost of construction and maintenance of this basin would be subject to negotiation between the MMSD, the City of New Berlin, and, if water quality measures are included, the State of Wisconsin.

[n]The cost of construction and maintenance of this basin would be subject to negotiation between the MMSD, the City of West Allis, and, if water quality measures are included, the State of Wisconsin.

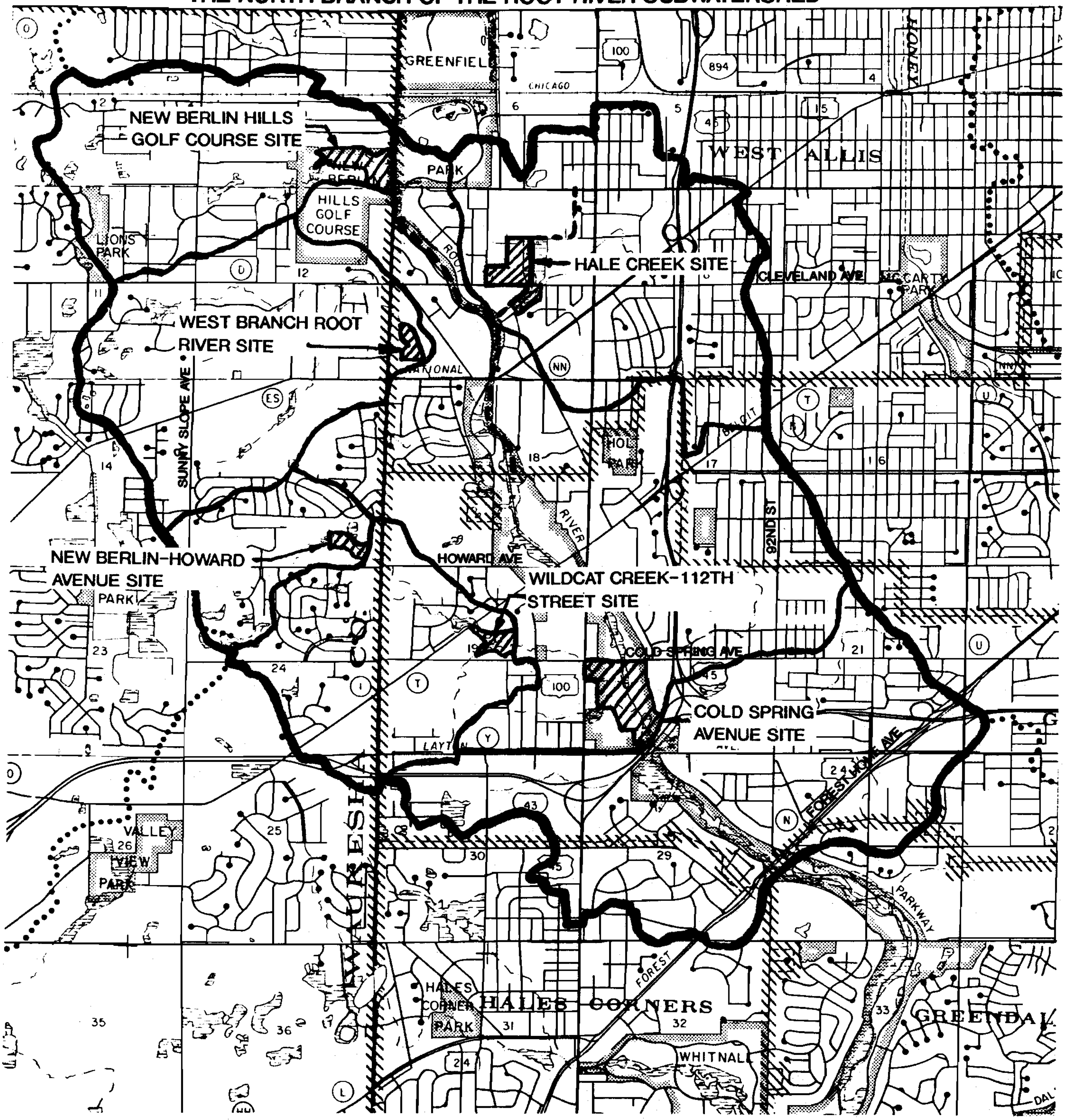
[o]The cost of structure removal would be borne entirely by the MMSD.

[p]As designed, Alternative Plans 3, 4, 5, and 6 do not provide significant water quality benefits. Wet detention storage could be provided over and above the storage needed for flood control at five of the detention storage locations, at a cost of about $700,000, which would reduce downstream nonpoint source sediment loadings by about 50 percent. No water quality basin would be provided at the Cold Spring Road site.

Source: SEWRPC

Map 4

LOCATION OF POTENTIAL DETENTION STORAGE BASINS IN THE NORTH BRANCH OF THE ROOT RIVER SUBWATERSHED



LEGEND

STUDY AREA BOUNDARY

DETENTION BASIN TRIBUTARY AREA

DETENTION BASIN

PROPOSED CHANNEL DEEPENING AND SHAPING

Source: SEWRPC.

GRAPHIC SCALE

0 1/2 1 MILE

0 2000 4000 6000 8000 FEET

Table 2

COMPARISON OF PEAK FLOOD FLOWS UNDER ALTERANTIVE PLAN CONDITIONS

Location	River Mile	100-Year Recurrence Interval Flood Discharge (cubic feet per second)								
		Alternatives No. 1 and 2 Initially Recommended Flood Control System Plan	Alternative 3		Alternative 4		Alternative 5		Alternative 6	
			Discharge	Percent Change	Discharge	Percent Change	Discharge	Percent Change	Discharge	Percent Change
North Branch Root River										
W. Forest Home Avenue	37.70	4,540	3,050	-33	1,940	-57	1,450	-68	1,500	-67
IH-43	38.68	4,870	2,850	-41	1,630	-66	560	-88	810	-83
W. Cold Spring Road	39.16	3,800	2,720	-28	2,030	-46	2,160	-43	2,540	-33
W. Morgan Avenue	40.38	3,800	2,650	-43	1,850	-51	1,850	-51	2,330	-39
W. National Avenue	40.94	2,790	1,460	-48	640	-77	640	-77	880	-68
Upstream of Confluence with Hale Creek	41.32	1,460	390	-73	390	-73	390	-73	630	-57
Hale Creek										
At Mouth	0.00	1,540	1,250	-19	340	-78	340	-78	340	-78

Table 3

COMPARISON OF PEAK FLOOD STAGES UNDER ALTERNATIVE PLAN CONDITIONS

Location	River Mile	100-Year Recurrence Interval Flood Stage (feet above NGVD)								
		Alternatives No. 1 and 2 Initially Recommended Flood Control System Plan	Alternative 3		Alternative 4		Alternative 5		Alternative 6	
			Flood Stage	Difference (feet)	Flood Stage	Difference (feet)	Flood Stage	Difference (feet)	Flood Stage	Difference (feet)
North Branch Root River										
W. Forest Home Avenue (Upstream side)	37.675	720.1	719.3	-0.8	718.0	-2.1	717.3	-2.8	717.4	-2.7
Abandoned Speed Rail Bridge (Downstream side)	38.42	722.0	721.2	-0.8	719.7	-2.3	719.0	-3.0	719.1	-2.9
Abandoned Speed Rail Bridge (Upstream side)	38.423	722.5	721.4	-1.1	719.9	-2.6	719.2	-3.3	719.2	-3.3
W. Layton Avenue (Downstream side)	38.62	723.9	722.8	-1.1	721.3	-2.6	720.4	-3.5	720.5	-3.4
W. Layton Avenue (Upstream side)	38.625	724.1	723.1	-1.0	721.3	-2.8	720.5	-3.6	720.5	-3.6
W. Cold Spring Road (Upstream side)	39.175	726.2	725.8	-0.4	727.6	+1.4	727.6	+1.4	727.5	+1.3
S. 108th Street/STH 100 (Upstream side)	39.61	728.4	727.5	-0.9	728.0	-0.4	728.0	-0.4	728.1	-0.3
W. Morgan Avenue (Upstream side)	40.385	730.9	730.2	-0.7	729.9	-1.0	730.0	-0.9	730.2	-0.7
W. National Avenue (Downstream side)	40.97	733.4	732.6	-0.8	731.8	-1.6	731.9	-1.5	732.3	-1.1
W. National Avenue (Upstream side)	40.975	733.7	732.9	-0.8	731.9	-1.8	731.9	-1.8	732.4	-1.3
W. Cleveland Avenue (Downstream side)	41.53	739.3	736.0	-3.3	736.1	-3.2	736.1	-3.2	737.0	-2.3
W. Lincoln Avenue (Downstream side)	42.18	756.8	755.2	-1.6	755.2	-1.6	755.2	-1.6	755.6	-1.2
Hale Creek										
Root River Parkway Drive (Downstream side)	0.06	734.7	733.5	-1.2	732.2	-2.5	732.2	-2.5	732.8	-1.9
Root River Parkway Drive (Upstream side)	0.065	735.7	734.2	-1.3	732.2	-3.5	732.2	-3.5	732.8	-2.9

houses in the City of Greenfield, 16 are expected to have first floor flooding. Thus, consideration could also be given to floodproofing the remaining 19 houses.

As shown in Table 1, the total capital cost of this flood control plan under Alternative No. 3 for Hale Creek and the North Branch of the Root River within the study area is estimated at about $10.3 million, with an average annual operation and maintenance cost of $125,400. The total annual cost of capital and operation and maintenance is estimated to be $780,000. The value of the average annual flood abatement benefits is about $66,400, resulting in a benefit-cost ratio of about 0.09. These benefits do not include those associated with the reduction in stormwater drainage and nuisance flooding of roadways, yards, and parkway which are generally not quantified. If these benefits were added, the benefit-cost ratio would be greater.

The detention basins discussed above do not include a permanent wet basin and would, thus, have a limited water quality impact. This alternative could be expanded to provide water quality benefits by providing wet detention basins at five of the six sites shown on Map 4. No basin would be provided at the Cold Spring Road site since the tributary area to that site is too large and the corresponding required wet basin size would be larger than could practically be constructed. The capital cost of the five basins would be about $700,000 if sized to provide a reduction of about 50 percent in the nonpoint source sediment loadings from the areas tributary to those basins.

Alternative Plan 4--Maximum Detention Storage Utilizing Minimum Excavation
Alternative Plan 4 is similar to Alternative Plan 3 in that detention storage facilities would be constructed at all potential open space sites in the study area which appear to have a potential for providing a reduction in downstream flood flows and stages. These sites are shown on Map 4. Under this alternative, the detention facilities would be limited to that which can be developed with no major excavation as in Alternative Plan 3, except at two sites--the New Berlin Howard Avenue site and the Hale Creek site--where it appeared the excavation could be incorporated to add storage at relatively low cost. Thus, the storage capacity at these two sites was increased by excavating selected areas as shown on Maps 11 and 12. The area tributary to, and selected characteristics of, each of the six detention facilities as envisioned under Alternative Plan 4 are shown in Table 5. A total of about 800 acre-feet of storage covering about 145 acres is envisioned at the six sites under this alternative.

The impact of the detention storage facilities on downstream flood flows and stages under this alternative is summarized in Tables 2 and 3. As can be seen, 100-year recurrence interval flood flows under planned land use conditions are reduced 46 to 78 percent in the study area, compared to Alternative Plans 1 and 2, which have no newly constructed storage facilities. Flow rates at W. Layton Avenue and at W. Forest Home Avenue in the City of Greenfield are expected to be reduced 66 and 57 percent, respectively. The associated flood stages between W. Layton Avenue and W. Forest Home Avenue were reduced from 2.0 feet to 2.7 feet, compared to stages under Alternative Plans 1 and 2.

Table 4

SELECTED CHARACTERISTICS OF DETENTION STORAGE FACILITIES UNDER ALTERNATIVE NO. 3--MAXIMUM DETENTION STORAGE UTILIZING MINIMUM EXCAVATION

Detention Basin Name	Area Tributary To Basin (sq. mi.)	100-Year Recurrence Interval Event Data: Maximum Elevation (feet above NGVD)	Storage Volume (acre-feet)	Storage Area (acres)	Average Depth (feet)	Peak Outflow Rate (cfs)
New Berlin Hills Golf Course Site	1.44	770.4	130	22.4	5.8	55
West Branch Root River Site	1.86	747.8	38	10.0	3.8	794
Wildcat Creek--Howard Ave. Site	0.59	810.6	12	2.5	4.8	416
Wildcat Creek--112th Street Site	1.88	754.0	92	12.5	7.4	600
Hale Creek Site	2.03	735.4	67	20.0	3.4	1,224
Cold Spring Site	11.32	725.2	210	58.7	3.6	2,854
Total	--	--	549	126.1	--	--

Hydrographs illustrating the impact of the detention facilities under Alternative Plan 3 are attached hereto as Exhibit B.

As previously noted, this alternative flood control plan for Hale Creek and the North Branch of the Root River within the study area also consists of lowering the streambed as described in the previous section, along a 1.6-mile long reach of the North Branch of the Root River and along the entire 1.0-mile length of Hale Creek.

The detention facilities and channel improvements provided under this alternative would reduce, but not eliminate the flood damages within the study area. In addition, in order to resolve the residual flooding problems within the City of West Allis it is recommended that one house along the North Branch of the Root River be floodproofed. Within the City of Greenfield, the residual flooding impacts 16 houses. For purposes of this alternative, it was assumed these structures would be removed. Of the 16 houses in the City of Greenfield, four are expected to have first floor flooding. Thus, consideration could be given to floodproofing the remaining 12 houses.

As shown in Table 1, the total capital cost of this flood control plan under Alternative Plan 4 for Hale Creek and the North Branch of the Root River within the study area is estimated at about $12.5 million, with an average annual operation and maintenance cost of $179,400. The total annual cost of capital and operation and maintenance is estimated to be $969,000. The value of the average annual flood abatement benefits is about $66,400, resulting in a benefit-cost ratio of about 0.07. These benefits do not include those associated with the reduction in stormwater drainage and nuisance flooding of roadways, yards, and parkway which are generally not quantified. If these benefits were added, the benefit-cost ratio would be greater. In a manner similar to Alternative Plan 4, the detention facility could be modified to have water quality benefit at a capital cost of about $700,000.

Alternative Plan 5--Maximum Detention Storage Utilizing Maximum Excavation
Alternative Plan 5 is similar to Alternative Plans 3 and 4 in that detention storage facilities would be constructed at the six open space sites in the study area which appear to have a potential for providing a reduction in downstream flood flows and stages. These sites are shown on Map 4. Under this alternative, about 390 acre-feet of additional storage would be provided by excavation at the Cold Spring Road storage site over and above the storage envisioned under Alternative Plan 4, as shown on Map 13. The excavation at the Cold Spring Road site under Alternative Plan 5 will likely result in groundwater inflow into the storage facility. The soils in the area are primarily Houghton muck and Drummer and Sebewa silty loams and generally have a high groundwater table. For costing purposes, a groundwater drain system was assumed around the site to limit inflow. The practicality of excavating storage at this site should be examined in more detailed facility planing if the alternative is given further consideration. The area tributary to, and selected characteristics of, each of the six detention facilities as envisioned under Alternative Plan 5 are shown in Table 6. A total of about 1,200 acre-feet of storage covering about 148 acres is envisioned at the six sites under this alternative.

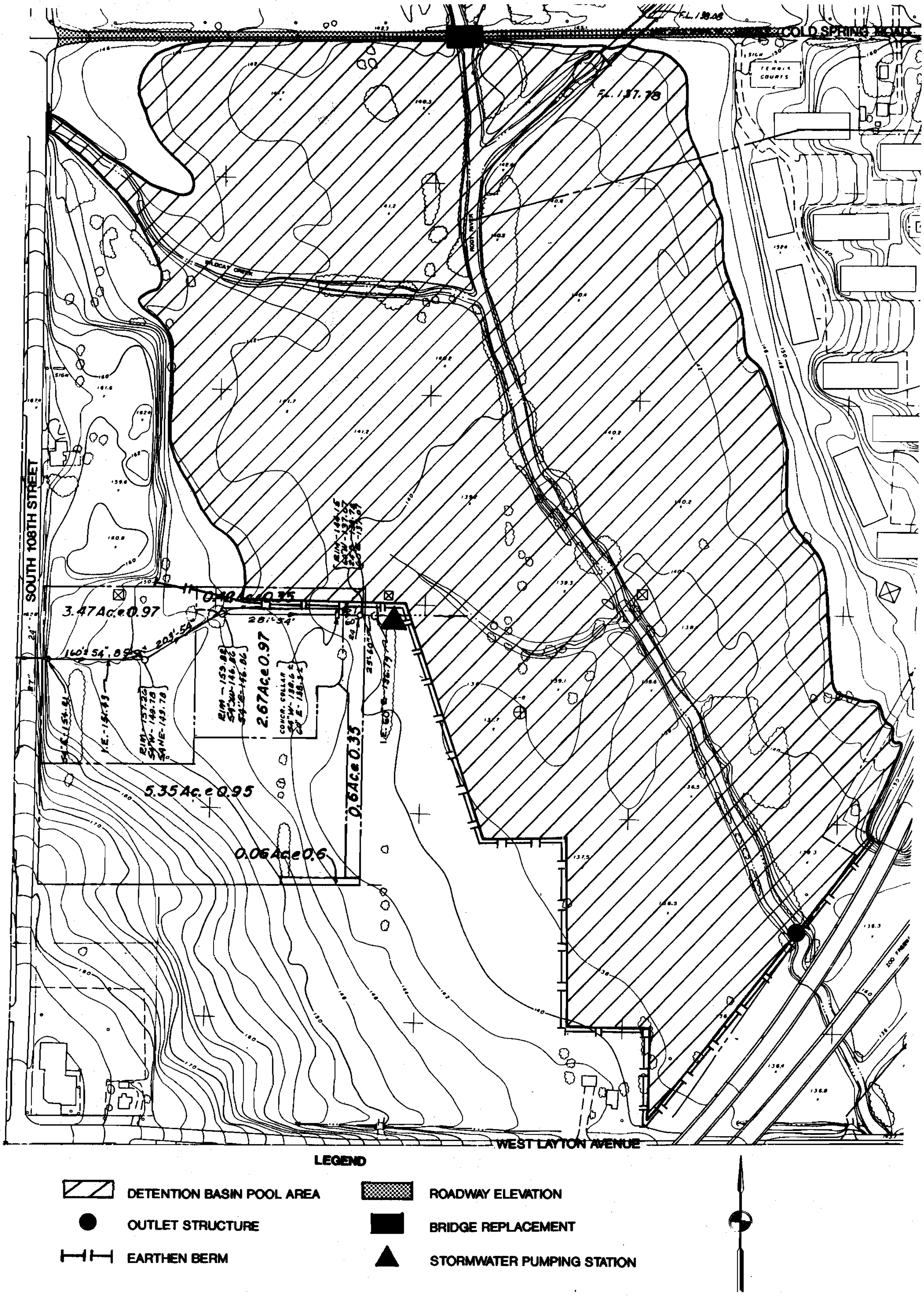
Table 5

SELECTED CHARACTERISTICS OF DETENTION STORAGE FACILITIES UNDER ALTERNATIVE NO. 4--MAXIMUM DETENTION STORAGE UTILIZING MINIMUM EXCAVATION

Detention Basin Name	Area Tributary To Basin (sq. mi.)	100-Year Recurrence Interval Event Data: Maximum Elevation (feet above NGVD)	Storage Volume (acre-feet)	Storage Area (acres)	Average Depth (feet)	Peak Outflow Rate (cfs)
New Berlin Hills Golf Course Site	1.44	770.4	130	22.4	5.8	55
West Branch Root River Site	1.86	747.8	38	10.0	3.8	794
Wildcat Creek--Howard Ave. Site	0.59	810.6	40	6.2	6.4	127
Wildcat Creek--112th Street Site	1.88	751.7	65	11.1	5.8	544
Hale Creek Site	2.03	732.8	170	30.5	5.6	338
Cold Spring Site	11.32	727.6	362	65.0	5.6	1,627
Total	--	--	805	145.2	--	--

Map 5

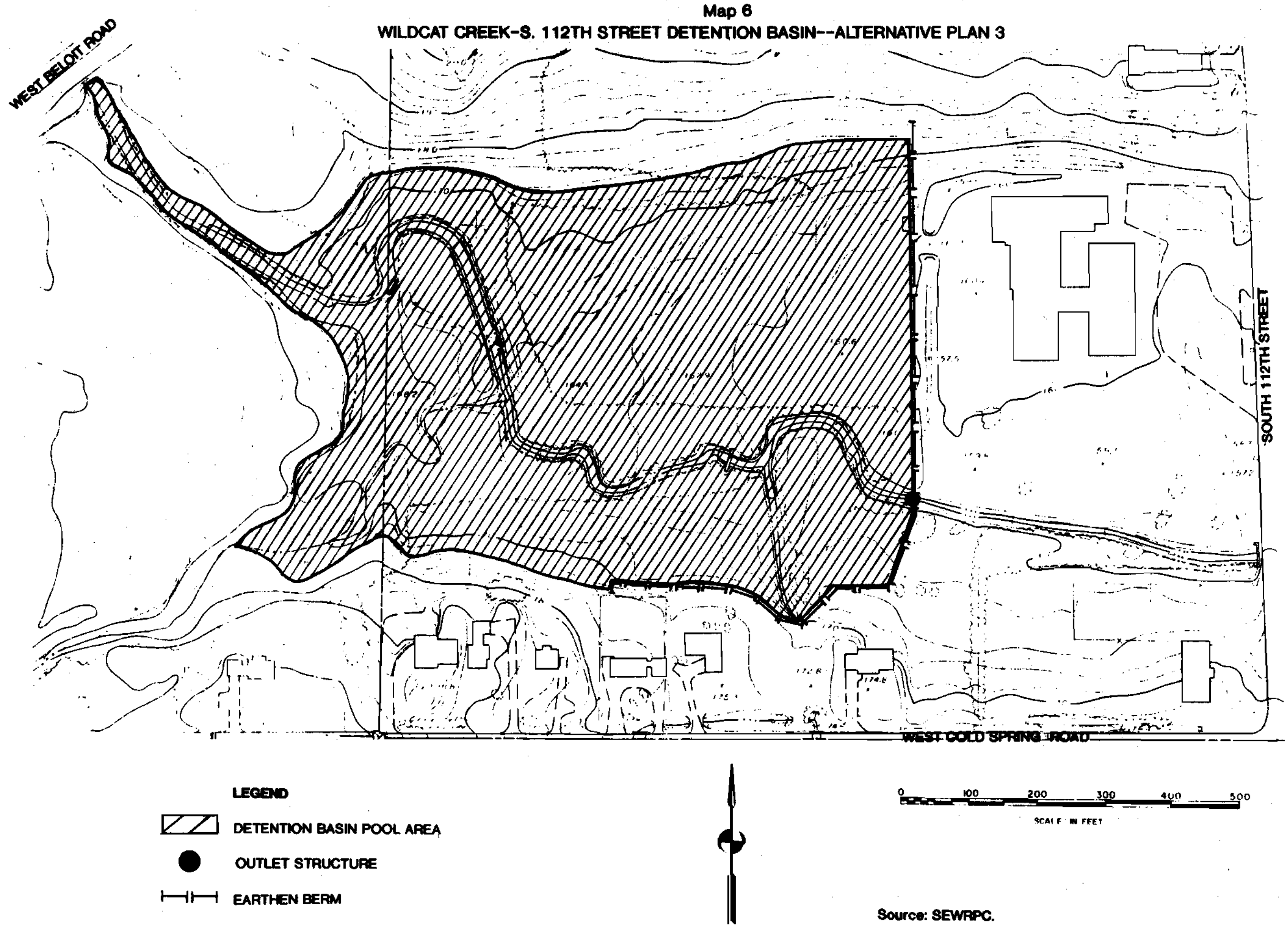
W. COLD SPRING ROAD DETENTION BASIN--ALTERNATIVE PLAN 3



Source: SEWRPC.

Map 6

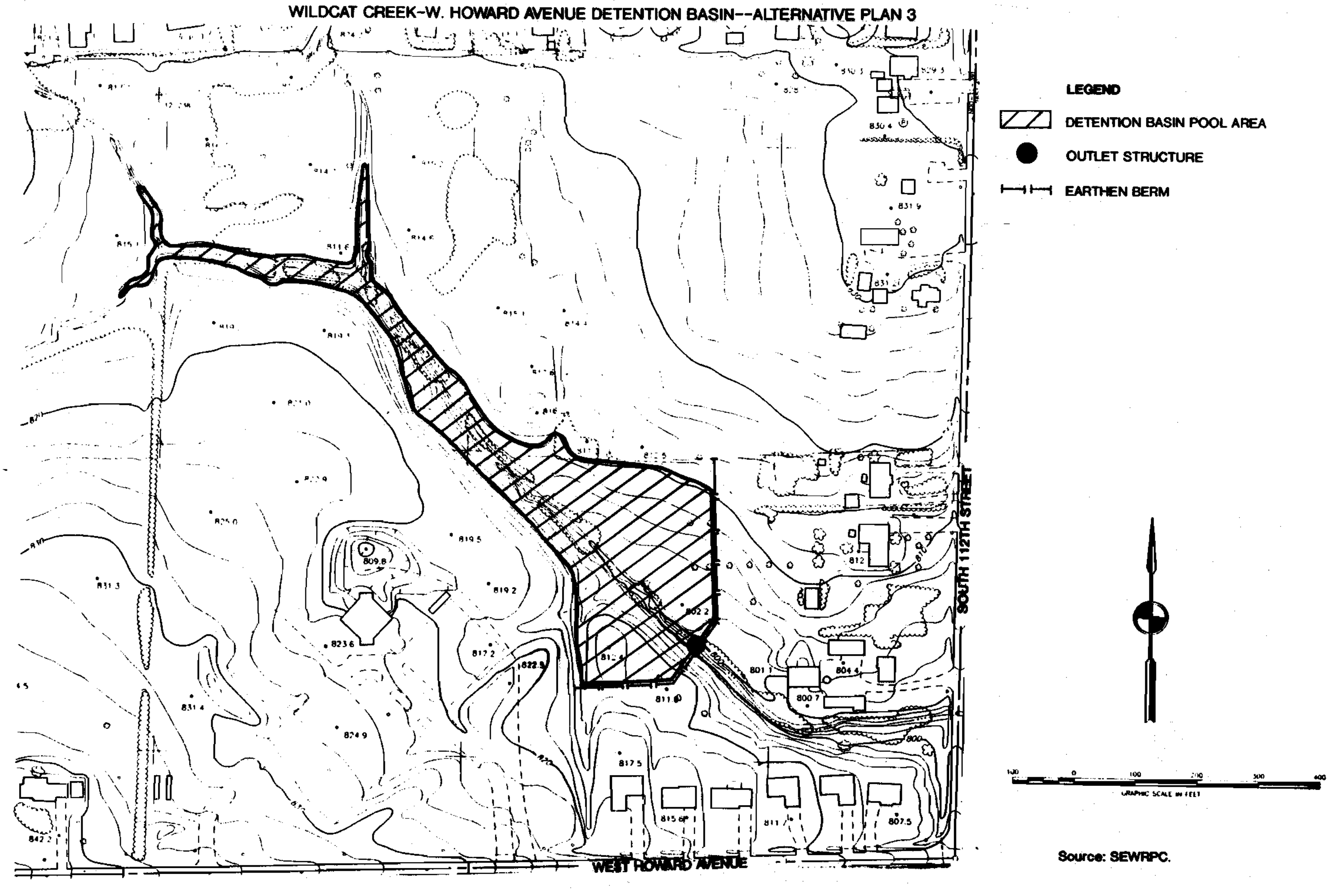
WILDCAT CREEK-S. 112TH STREET DETENTION BASIN--ALTERNATIVE PLAN 3



Source: SEWRPC.

Map 7

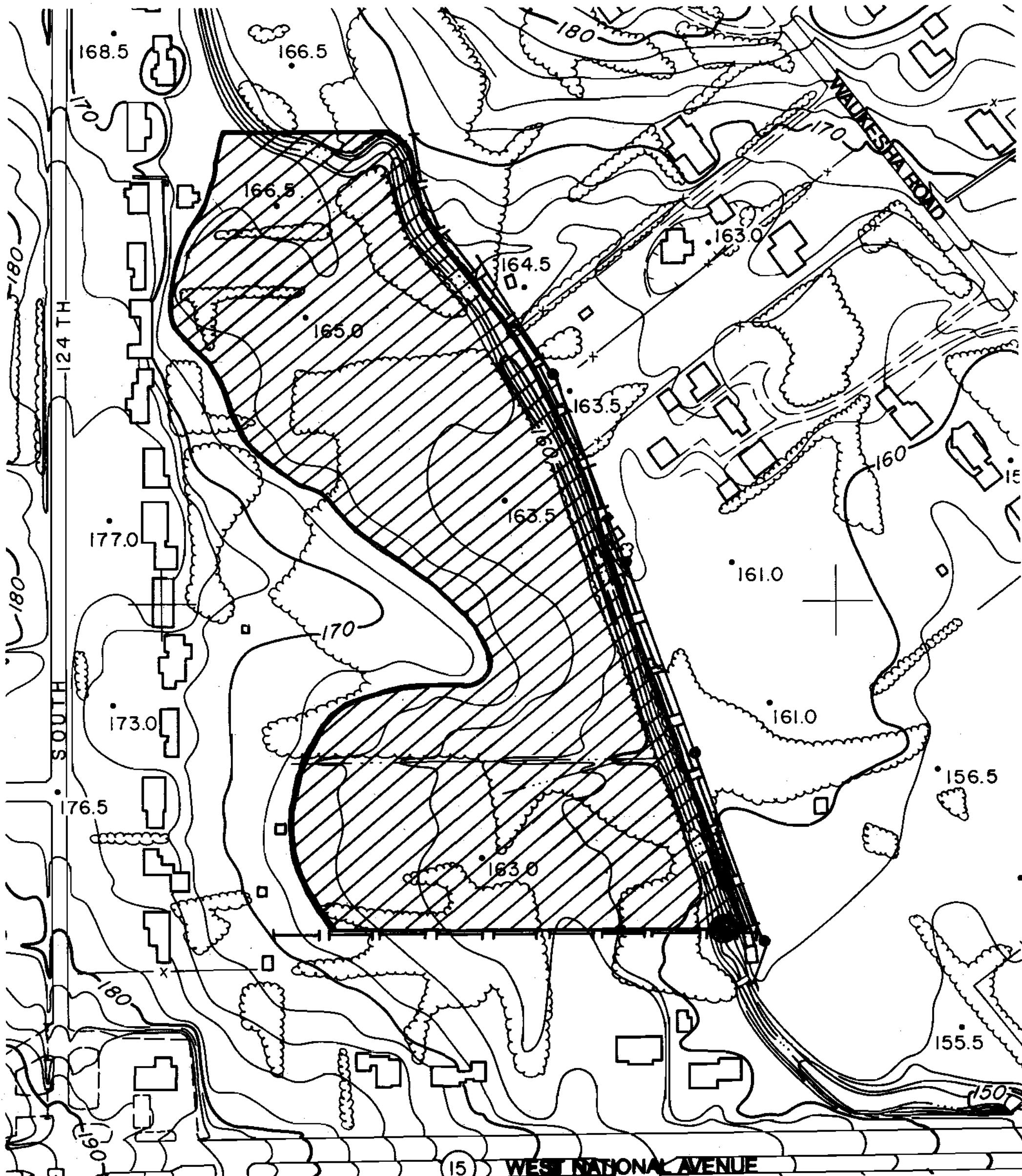
WILDCAT CREEK-W. HOWARD AVENUE DETENTION BASIN--ALTERNATIVE PLAN 3



Source: SEWRPC.

Map 8

WEST BRANCH OF THE ROOT RIVER DETENTION BASIN--ALTERNATIVE PLAN 3



LEGEND

DETENTION BASIN POOL AREA

OUTLET STRUCTURE

EARTHEN BERM

STORM SEWER

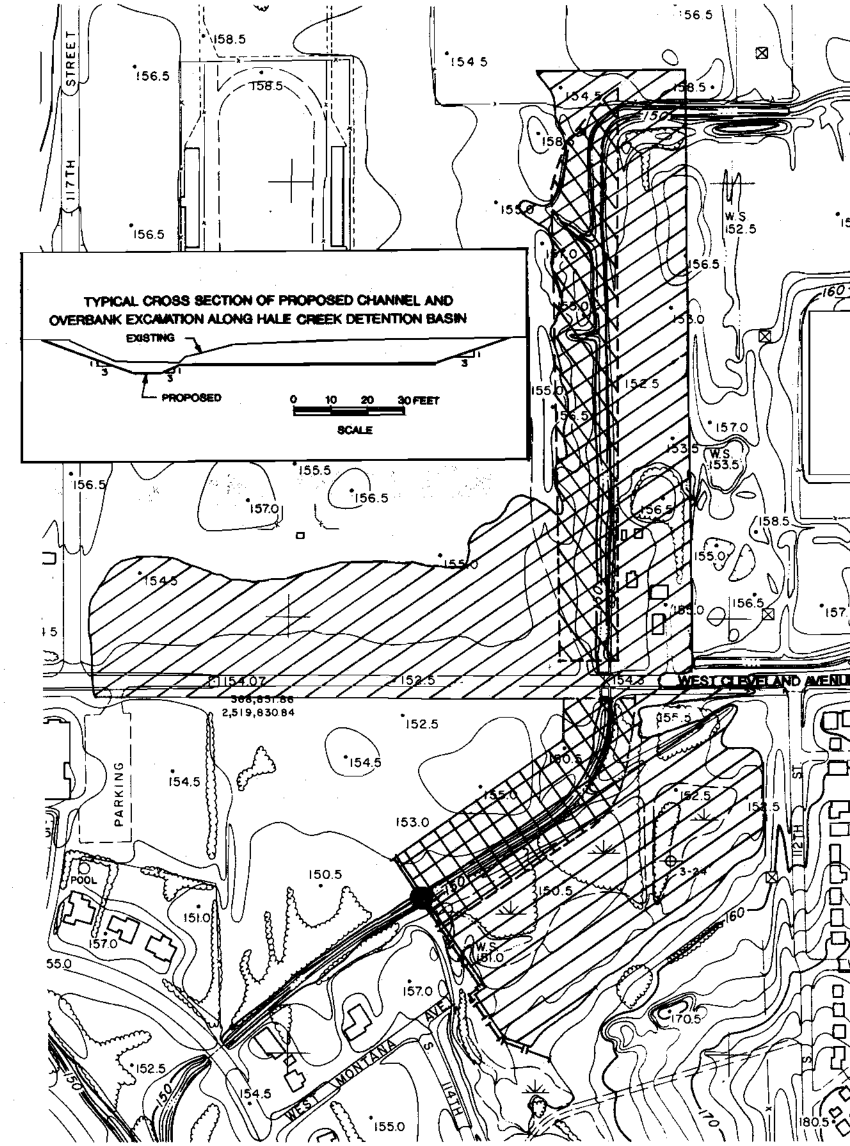
200 0 200 400

SCALE IN FEET

SOURCE: SEWRPC

Map 9

HALE CREEK DETENTION BASIN--ALTERNATIVE PLAN 3



LEGEND

DETENTION BASIN POOL AREA

OUTLET STRUCTURE

EARTHEN BERM

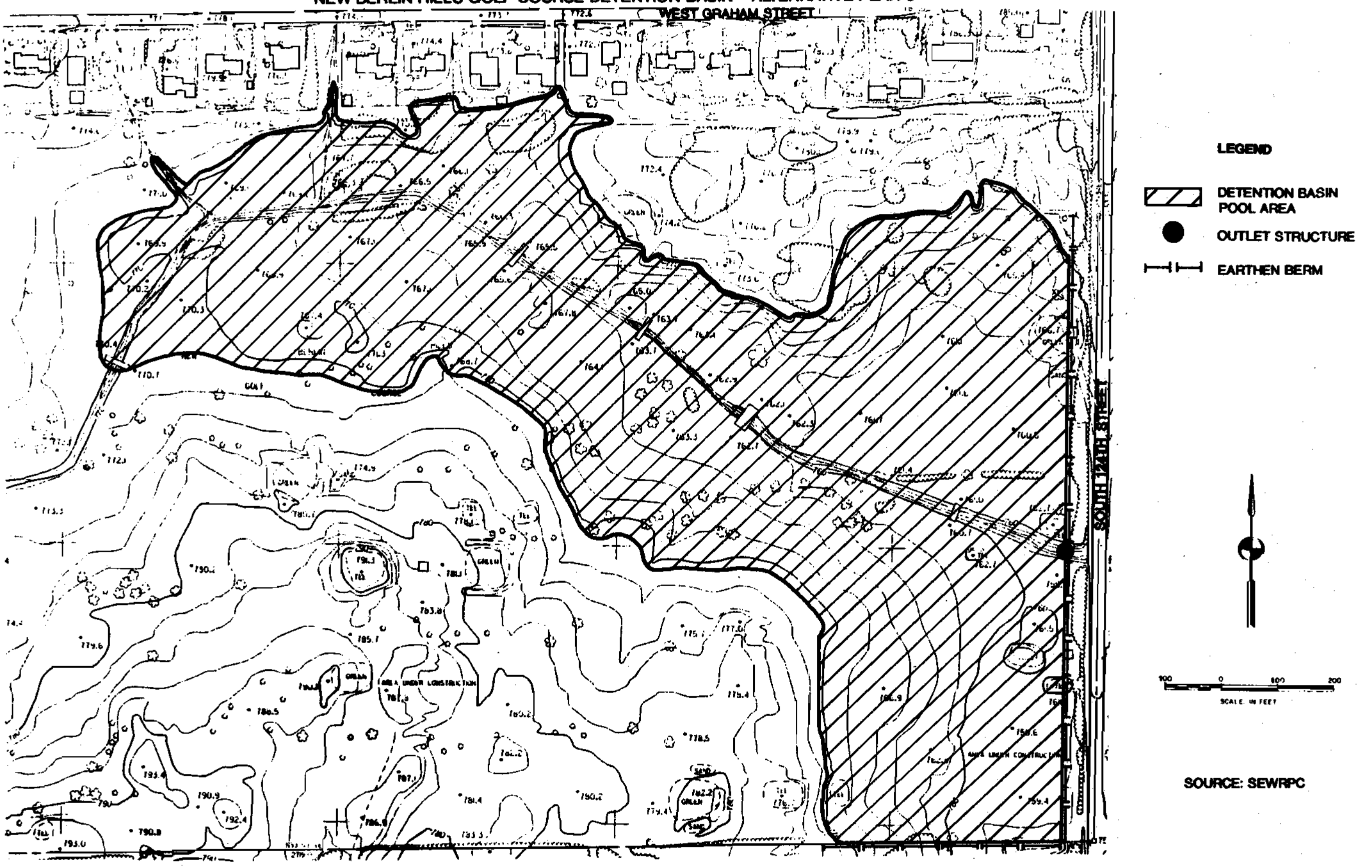
AREA OF EXCAVATION

0 200 400

SCALE IN FEET

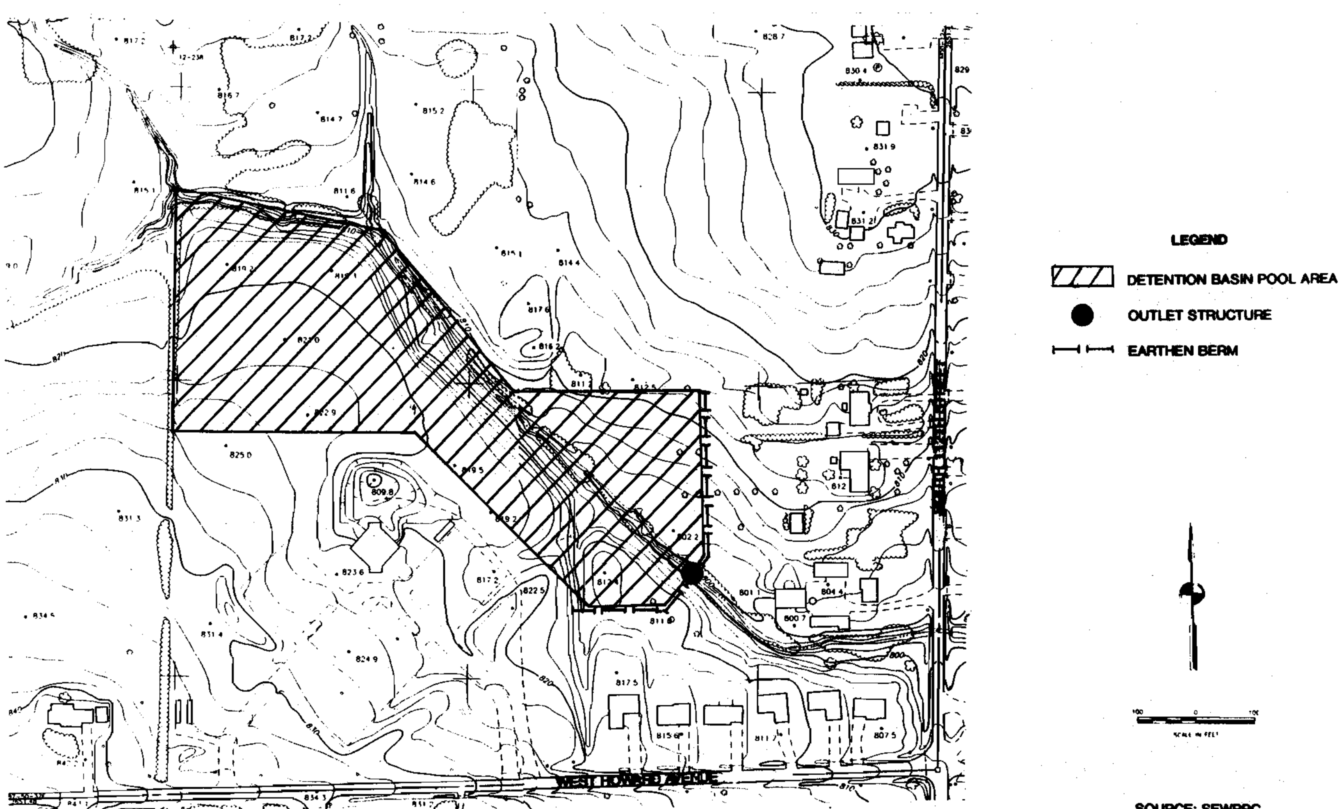
Map 10

NEW BERLIN HILLS GOLF COURSE DETENTION BASIN--ALTERNATIVE PLAN 3



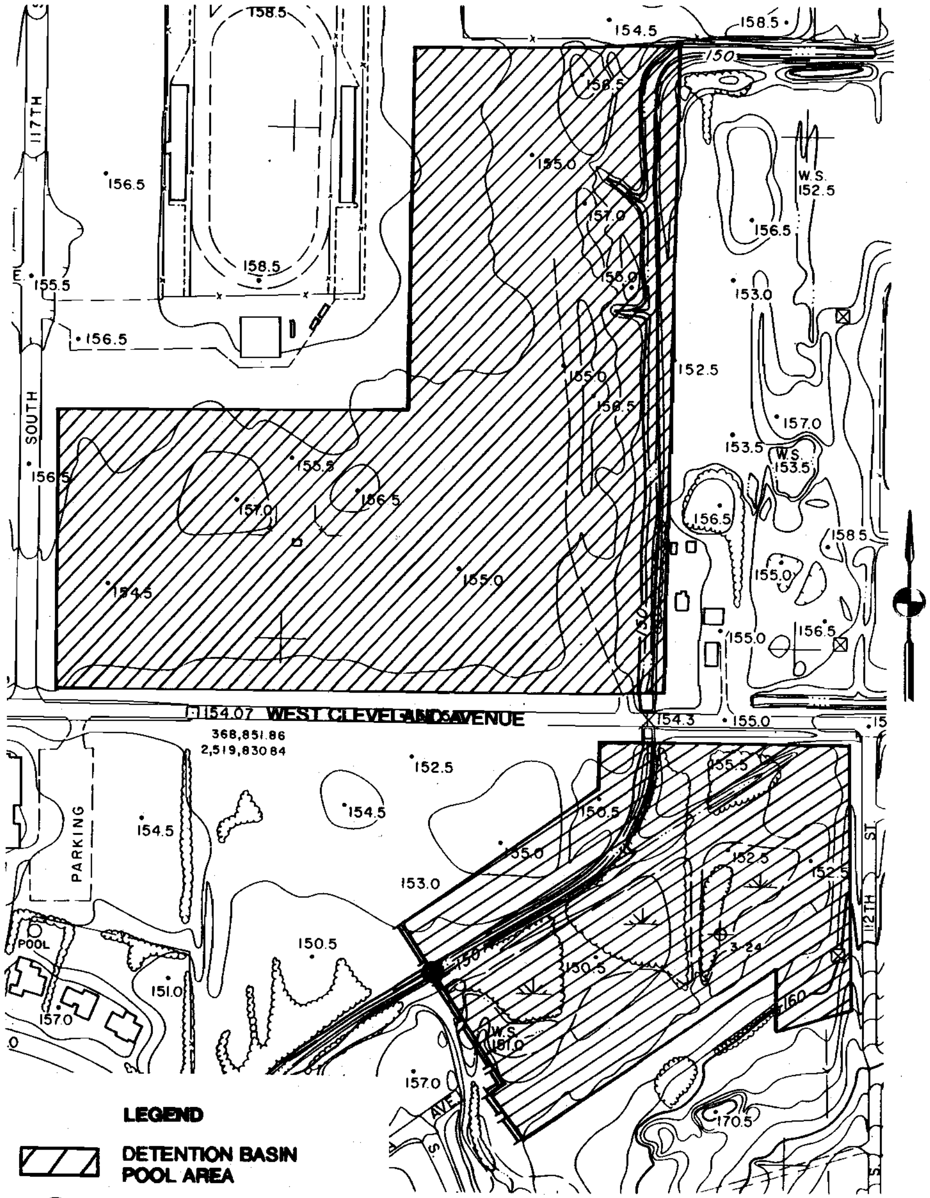
Map 11

WILDCAT CREEK-W. HOWARD AVENUE DETENTION BASIN--ALTERNATIVE PLAN 4



Map 12

HALE CREEK DETENTION BASIN--ALTERNATIVE PLAN 4



LEGEND

DETENTION BASIN POOL AREA

OUTLET STRUCTURE

EARTHEN BERM

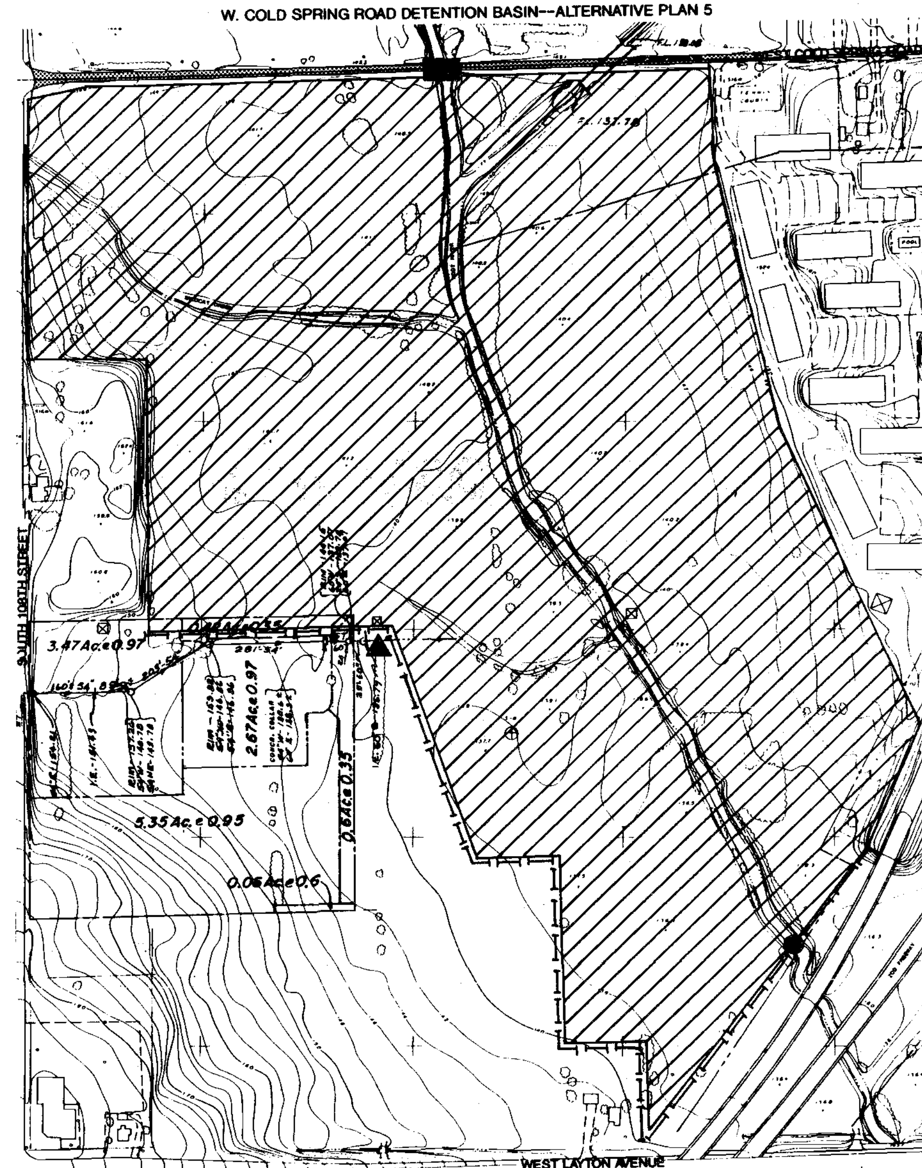
200 0 200 400

SCALE IN FEET

SOURCE: SEWRPC

Map 13

W. COLD SPRING ROAD DETENTION BASIN--ALTERNATIVE PLAN 5



LEGEND

DETENTION BASIN POOL AREA

OUTLET STRUCTURE

EARTHEN BERM

ROADWAY ELEVATION

BRIDGE REPLACEMENT

STORMWATER PUMPING STATION

0 100 200

SCALE IN FEET

Table 6

SELECTED CHARACTERISTICS OF DETENTION STORAGE FACILITIES UNDER ALTERNATIVE NO. 5--MAXIMUM DETENTION STORAGE UTILIZING MINIMUM EXCAVATION

Detention Basin Name	Area Tributary To Basin (sq. mi.)	100-Year Recurrence Interval Event Data: Maximum Elevation (feet above NGVD)	Storage Volume (acre-feet)	Storage Area (acres)	Average Depth (feet)	Peak Outflow Rate (cfs)
New Berlin Hills Golf Course Site	1.44	770.4	130	22.4	5.8	55
West Branch Root River Site	1.86	747.8	38	10.0	3.8	794
Wildcat Creek--Howard Ave. Site	0.59	810.6	40	6.2	6.4	127
Wildcat Creek--112th Street Site	1.88	751.7	65	11.1	5.8	544
Hale Creek Site	2.03	732.8	170	30.5	5.6	338
Cold Spring Site	11.32	727.6	751	68.7	11.0	560
Total	--	--	1,194	148.1	--	--

The impact of the detention storage facilities on downstream flood flows and stages under this alternative is summarized in Tables 2 and 3. As can be seen, 100-year recurrence interval flood flows under planned land use conditions are reduced from 43 to 88 percent in the study area, compared to Alternative Plans 1 and 2, which have no newly constructed storage facilities. Flow rates at W. Layton Avenue and at W. Forest Home Avenue in the City of Greenfield are expected to be reduced 88 and 68 percent, respectively. The associated flood stages between W. Layton Avenue and W. Forest Home Avenue were reduced from 2.8 feet to 3.5 feet, compared to stages under Alternative Plans 1 and 2. Hydrographs illustrating the impact of the detention facilities under Alternative Plan 5 are attached hereto as Exhibit C.

As previously noted, this alternative flood control plan for Hale Creek and the North Branch of the Root River within the study area also consists of lowering the streambed as described in the previous section, along a 1.6-mile long reach of the North Branch of the Root River and along the entire 1.0-mile length of Hale Creek.

The detention facilities and channel improvements provided under this alternative would reduce, but not eliminate the flood damages within the study area. In addition, in order to resolve the residual flooding problems within the City of West Allis it is recommended that one house along the North Branch of the Root River be floodproofed. Within the City of Greenfield, the residual flooding impacts nine houses. For purposes of this alternative, it was assumed these structures would be removed. Of the nine houses in the City of Greenfield, none are expected to have first floor flooding. Thus, consideration could be given to floodproofing these nine houses.

As shown in Table 1, the total capital cost of this flood control plan under Alternative Plan 5 for Hale Creek and the North Branch of the Root River within the study area is estimated at $17.7 million, with an average annual operation and maintenance cost of $179,400. The total annual cost of capital and operation and maintenance is estimated to be about $1.3 million. The value of the average annual flood abatement benefits is about $66,400, resulting in a benefit-cost ratio of about 0.05. These benefits do not include those associated with the reduction in stormwater drainage and nuisance flooding of roadways, yards, and parkway which are generally not quantified. If these benefits were added, the benefit-cost ratio would be greater. In a manner similar to Alternative Plan 4, the detention facilities under Alternative Plan 6 could be modified to have water quality benefits, at a capital cost of about $700,000.

<u>Alternative Plan 6--Refined Detention Storage Utilizing Maximum Excavation</u>

Alternative Plan 6 is the same as Alternative Plan 5 with regard to three of the six storage sites. However, one of the storage facilities--the West Branch Root River site facility--was eliminated. This site is relatively small and is relatively close to, and impacts on, surrounding private properties, making the likelihood of implementation low. In addition, the size of the New Berlin Hills Golf Course site was reduced to eliminate encroachment of the facility on surrounding private properties. Finally, the capacity of the outlet of the Cold Spring site was adjusted to reflect the increased flows

needed to accommodate the changes at the two aforementioned sites. The area tributary to, and selected characteristics of, each of the five remaining detention facilities as envisioned under Alternative Plan 6 are shown in Table 7. A total of about 1,100 acre-feet of storage covering about 134 acres is envisioned at the five sites under this alternative.

The impact of the detention storage facilities on downstream flood flows and stages under this alternative is summarized in Tables 2 and 3. As can be seen, 100-year recurrence interval flood flows under planned land use conditions are reduced from 33 to 83 percent in the study area, compared to Alternative Plans 1 and 2, which have no newly constructed storage facilities. Flow rates at W. Layton Avenue and at W. Forest Home Avenue in the City of Greenfield are expected to be reduced 83 and 67 percent, respectively. The associated flood stages between W. Layton Avenue and W. Forest Home Avenue were reduced from 2.7 feet to 3.3 feet, compared to stages under Alternative Plans 1 and 2. Hydrographs illustrating the impact of the detention facilities under Alternative Plan 6 are attached hereto as Exhibit D.

As previously noted, this alternative flood control plan for Hale Creek and the North Branch of the Root River within the study area also consists of lowering the streambed as described in the previous section, along a 1.6-mile long reach of the North Branch of the Root River and along the entire 1.0-mile length of Hale Creek.

The detention facilities and channel improvements provided under this alternative would reduce, but not eliminate the flood damages within the study area. In addition, in order to resolve the residual flooding problems within the City of West Allis, it is recommended that one house along the North Branch of the Root River be floodproofed. Within the City of Greenfield, the residual flooding impacts 10 houses. For purposes of this alternative, it was assumed these structures would be removed. Of the 10 houses, none are expected to have first floor flooding. Thus, consideration could be given to floodproofing these 10 houses.

As shown in Table 1, the total capital cost of this flood control plan under Alternative Plan 6 for Hale Creek and the North Branch of the Root River within the study area is estimated at about $16.9 million, with an average annual operation and maintenance cost of $154,000. The total annual cost of capital and operation and maintenance is estimated to be about $1.2 million. The value of the average annual flood abatement benefits is about $66,400, resulting in a benefit-cost ratio of about 0.05. These benefits do not include those associated with the reduction in stormwater drainage and nuisance flooding of roadways, yards, and parkway which are generally not quantified. If these benefits were added, the benefit-cost ratio would be greater. In a manner similar to Alternative Plan 4, the detention facilities under Alternative Plan 6 could be modified to provide water quality benefits, at a capital cost of $700,000.

Table 7

SELECTED CHARACTERISTICS OF DETENTION STORAGE FACILITIES UNDER ALTERNATIVE NO. 6--MAXIMUM DETENTION STORAGE UTILIZING MINIMUM EXCAVATION

Detention Basin Name	Area Tributary To Basin (sq. mi.)	100-Year Recurrence Interval Event Data: Maximum Elevation (feet above NGVD)	Storage Volume (acre-feet)	Storage Area (acres)	Average Depth (feet)	Peak Outflow Rate (cfs)
New Berlin Hills Golf Course Site	1.44	768.0	82	17.6	4.6	319
Wildcat Creek--Howard Ave. Site	0.59	810.6	40	6.2	6.4	127
Wildcat Creek--112th Street Site	1.88	751.7	65	11.1	5.8	544
Hale Creek Site	2.03	732.8	170	30.5	5.6	338
Cold Spring Site	11.32	727.5	744	68.7	10.9	807
Total	--	--	1,101	134.1	--	--

COMPARISON OF ALTERNATIVE PLANS

The alternative plans were compared with respect to cost, implementability, development restrictions and surrounding land use impacts, water quality impacts, and open space aesthetic and safety considerations. The costs and non-monetary considerations are listed in Table 8.

Costs

Review of Table 8 indicates that the total capital and total annual cost of Alternative Plans 1 and 2 are the lowest, with the costs increasing as the amount of storage is increased under Alternatives 3, 4, 5, and 6. The costs of Alternative Plan 3 are nearly double the costs of Alternative Plan 1. This indicates that the costs of detention generally exceeds the cost of the alternative option--in this case floodproofing, elevation, and removal of structures. Annual operation and maintenance costs are also increased substantially as the amount of detention storage increases.

As noted later in this section, the alternatives providing for detention storage can be provided with facilities to reduce nonpoint source loadings and improve water quality at a lower cost than providing for such water quality facilities under Alternative Plans 1 and 2 where no detention storage is provided. The savings in water quality facility costs, however, are relatively small compared to the increased costs of Alternatives 3, 4, 5, and 6 over and above the costs for Alternatives 1 and 2.

Implementability

Alternative Plan 1 requires significant floodproofing and elevation of private property structures. Because such floodproofing would be voluntary, complete implementation of these two alternatives is unlikely and therefore, there would likely be significant residual flooding problems remaining if this alternative was selected. Alternative Plan 2 also has limited floodproofing involving 8 structures. Thus, to a much lesser extent, complete resolution of the flooding problem is unlikely in that alternative. Alternative Plans 3, 4, 5, and 6, all require obtaining easements, or purchasing about 150 to 180 acres of land not currently utilized for drainage and flood control purposes, assuming the storage area required plus a buffer and access area. Some of the land is privately owned and some is publicly owned but designated for other purposes not fully compatible with floodwater storage, even on a temporary basis. The proposed construction of detention facilities is certain to raise objections from property owners and, thus, hinder implementation.

Development Restrictions and Surrounding Land Use Impacts

To varying degrees, Alternative Plans 3, 4, 5, and 6 have some limitations on development potential within the area. In these alternatives, from 150 to 180 acres of land must be obtained for detention storage. This will restrict the uses for which the land can be used. In the case of Alternative Plans 4, 5, and 6, the impacts are most severe in that the Hale Creek site would utilize a large athletic field complex for floodwater storage, requiring loss of those facilities. At the Cold Spring Road site, the excavation required under Alternative Plans 5 and 6 would be inconsistent with current county plans for the construction of park facilities at the site. The storage basin at the Cold

Spring Road site under Alternative Plans 3 and 4 could also limit, to a lesser extent, the uses of the site intended by the County.

Water Quality Impacts

By modifying the facilities or adding facilities at the six storage sites shown on Map 4, all the alternative plans could be modified to provide water quality benefits. The capital cost to do so would be about $1,100,000 for Alternative Plans 1 and 2; and about $700,000 under Alternative Plans 3, 4, 5, and 6. For these costs, storage ponds could be constructed at all the sites to provide about 50 percent reduction in nonpoint source sediment loadings.

It should be noted that a detailed urban nonpoint source evaluation should be conducted to assess the best means of achieving water quality improvement in the study area. Such a planning effort may indicate a different mix and location for water facilities than use of the six sites discussed herein. Under Alternative Plans 5 and 6, potential water quality problems exist due to construction-related activity erosion resulting from the large areas to be excavated.

Open Space, Aesthetics, and Hazards

Under Alternative Plan 2, about 30 acres of new parkland would be created, providing for more open spaces in a highly urbanized area. Thus, this alternative has positive impacts in this regard. Under Alternative Plans 5 and 6, significant excavation would be required at the Hale Creek and, most importantly, the Cold Spring Road site. The area to be excavated includes primary environmental corridor at the Cold Spring site and wetland areas at both sites. The potential negative environmental impact of this excavation make these two alternatives undesirable. Thus, these two alternatives are unlikely to be implemented unless costly mitigation site work is possible to offset the negative impacts. Approval by the regulatory agencies involved of Alternative Plans 5 and 6 is unlikely to be achieved.

The use of each of the six sites as storage sites would require that the sites be maintained as open land. Such open areas could have limited potential recreational value. In this regard, it should be noted that most of the areas within the detention sites would be maintained in open use under the current development pattern. Information on the size of the site, the current uses of the site, and any development restrictions are provided in Table 9.

FURTHER ALTERNATIVE CONSIDERATIONS BASED UPON REVIEW OF REPORT DRAFT

This letter report was reviewed in draft form at an interagency staff meeting held on September 28, 1990, at the Milwaukee Metropolitan Sewerage District offices and attended by representatives of the Milwaukee Metropolitan Sewerage District, the Wisconsin Department of Natural Resources, and the Regional Planning Commission. During that meeting, certain refinements were requested to the draft report. All of these requested changes have been incorporated into the appropriate text and tables of this report. In addition, it was requested that the report include a discussion of three additional variations of the alternatives considered. These variations include: 1) the option of providing storage at the Hale Creek site only; 2) the option of providing

Table 8

PRINCIPAL FEATURES, COSTS, AND NONECONOMIC CONSIDERATIONS OF ALTERNATIVE FLOOD CONTROL PLANS FOR HALE CREEK AND THE NORTH BRANCH OF THE ROOT RIVER ABOVE W. FOREST HOME AVENUE

No.	Name	Description	Costs (dollars): Capital	Costs (dollars): Amortized Capital[a]	Costs (dollars): Annual Operation and Maintenance	Costs (dollars): Total	Key Considerations: Positive	Key Considerations: Negative
1.	Initially Recommended Alternative--Combination Structure Floodproofing, Elevation, and Removal With Minor Channel Deepening	a. 2.6 miles of channel modification	$ 1,390,000	$ 88,200	$ 5,400	$ 93,600	o Lowest cost of alternative o Provides outlet for six storm storm sewer outfalls currently below grade o Reduces frequent flooding of parkway roads in West Allis	o Complete, voluntary implementation for floodproofing unlikely and therefore left with a significant residual flood problem o Construction of channel modification results in a small increase in downstream flood discharges and stages, thus requiring the obtainment of easements.
		b. Replace four bridges	124,000[b]	7,900	--	7,900		
		c. Floodproof 22 structures, elevate 15 structures, and remove 15 structures	2,002,000	127,000	--	127,000		
		Total	$ 3,516,000	$ 223,100	$ 5,400	$ 228,500		
2.	Refined Initially Recommended Alternative--Combination Structure Floodproofing, Elevation, and Removal, with Minor Channel Deepening	a. 2.6 miles of channel modification	1,390,000	88,200	5,400	93,600	o Removal of structures could provide for expansion of the parkway corridor. o Provides outlet for six storm sewer outfalls currently below grade. o Reduces frequent flooding of parkway roads in West Allis	o Complete, voluntary implementation for floodproofing unlikely and therefore left with with a significant residual flood problem o Construction of channel modification results in a small increase in downstream flood discharges and stages, thus requiring the obtainment of easements.
		b. Replace four bridges	124,000[b]	7,900	--	7,900		
		c. Floodproof 8 structures and remove 44 structures	4,563,000	289,300	--	289,300		
		Total	$ 6,072,000	$385,400	$ 5,400	$390,800		

Table 8 (cont'd)

No.	Name	Description	Costs (dollars) Capital	Amortized Capital[a]	Annual Operation and Maintenance	Total	Key Considerations Positive	Negative
3.	Maximum Detention Storage Utilizing Minimum Excavation	a. 2.6 miles of channel modification	$ 1,390,000	$ 88,200	$ 5,400	$ 93,600	o Reduces downstream flood discharges and stages o Removal of structures could provide for expansion of parkway corridor o Could reduce channel erosion due to reduction in flood discharges o Provides outlet for six storm sewer outfalls currently below grade o Reduces frequent flooding of parkway roads in West Allis	o Complete, voluntary implementation for floodproofing unlikely and therefore left with a significant residual problem. o Loss of land for development. o Construction of detention basin in conflict with park development plan. o Significantly higher annual cost than alternatives 1 and 2.
		b. Replace four bridges	124,000[b]	7,900	--	7,900		
		c. Storage facilities	5,314,000	336,900	120,000	456,900		
		d. Floodproof 5 structures and remove 35 structures	3,493,000	221,500	--	221,500		
		Total	$10,321,000	$654,500	$125,400	$779,900		
4.	Maximum Detention Storage Utilizing Selected Excavation at Two Sites	a. 2.6 miles of channel modification	1,390,000	88,200	5,400	93,600	o Reduces downstream flood discharges and stages o Removal of structures could provide for expansion of parkway corridor o Could reduce channel erosion due to reduction in flood discharges o Provides outlet for six storm sewer outfalls currently below grade o Reduces frequent flooding of parkway roads in West Allis	o Loss of land for development. o Construction of detention basin in conflict with park development plan. o Loss of athletic field at Nathan Hale High school due to excavation for detention basin o Significantly higher annual cost than alternatives 1 and 2.
		b. Replace four bridges	124,000[b]	7,900	--	7,900		
		c. Storage facilities	9,439,000	598,400	174,000	772,400		
		d. Floodproof 1 structure and remove 16 structures	1,505,000	95,400	--	95,400		
		Total	$12,458,000	$ 789,900	$179,400	$ 969,300		
5.	Maximum Detention Utilizing Maximum Excavation	a. 2.6 miles of channel modification	1,390,000	88,200	5,400	93,600	o Reduces downstream flood discharges and stages o Could reduce channel erosion due to reduction in flood discharges o Provides outlet for six storm sewer outfalls currently below grade o Reduces frequent flooding of parkway roads in West Allis	o Loss of land for develement o Loss of wetland area due to detention basin excavation o Construction of detention basin in conflict with park development plans o Loss of athletic field at Nathan Hale High School due to excavation for detention basin o Highest annual cost of alternatives
		b. Replace four bridges	124,000[b]	7,900	--	7,900		
		c. Storage facilities	15,380,000	975,000	174,000	1,149,000		
		d. Floodproof 1 structure and remove 9 structures	806,000	51,100	--	51,100		
			$17,700,000	$1,122,200	$179,400	$1,301,600		
6.	Refined Detention Utilizing Maximum Storage	a. 2.6 miles of channel modification	1,390,000	88,200	5,400	93,600	o Reduces downstream flood discharges and stages o Could reduce channel erosion due to reduction in flood discharges o Provides outlets for six storm sewer outfalls currently below grade o Reduces frequent flooding of parkway roads in West Allis	o Loss of land for develoopment o Loss of wetland area due to detention basin excavation o Construction of detention basin in conflict with park development plans o Loss of athletic field at Nathan Hale High School due to excavation for detention basin o Significantly higher annual cost than Alternatives 1 and 2
		b. Replace four bridges	124,000[b]	7,900	--	7,900		
		c. Storage facilities	14,527,000	921,000	149,000	1,070,000		
		d. Floodproof 1 structure and remove 10 structures	892,000	56,600	--	56,600		
		Total	$16,933,000	$1,073,700	$154,400	$1,228,100		

[a]Amortized capital cost is based on an interest rate of 6 percent and a project life of 50 years.

[b]Cost for bridges at W. Cleveland Avenue on the North Branch of the Root River and W. Cleveland Avenue on Hale Creek were previously assigned under the Commission's adopted regional transportation system plan. These two bridges would have a capital cost of $465,000.

Source: SEWRPC

Table 9

SELECTED CHARACTERISTICS OF DETENTION BASIN SITES

Basin Location	Basin Area (acres)	Current Site Use	Site Development Limitation
W. Cold Spring Road	59-69	Milwaukee County Parkway-undeveloped	o About 50 percent of site is classified as wetland o About 85 percent of site is classified as primary environmental corridor o About 90 percent of site is classified as floodplain o All of site is currently County parkland
Wildcat Creek- S. 112th Street	11-12	Church athletic field, residential, urban open space	o About 50 percent of site is classified as wetland
Wildcat Creek- W. Howard Avenue	2-6	Church athletic field, urban open space	--
West Branch of the Root River	10	Residential, urban open space	o All of site is classified as isolated natural area o About 40 percent of site is classified as floodplain
Hale Creek	20-30	High School athletic field, urban open space	o About 40 percent of site is classified as wetland o About 40 percent of site is classified as isolated natural area o All of site is classified as floodplain
New Berlin Hills Golf Course	18-22	Golf course	o All of site is currently developed for open space use o About 70 percent of site is classified as floodplain

Consideration of Additional Storage Facilities Between W. Forest Home Avenue and W. Layton Avenue

During the review of the six alternative plans developed and evaluated in this report, it was noted that there is a significant increase in the 100-year recurrence interval flood flows between W. Layton Avenue and W. Forest Home Avenue, as shown on Table 2. This results from the runoff from a 2.6-square-mile drainage area which enters the stream in this reach. Drainage from both north and south of the channel is tributary within this reach. Because the drainage enters at several locations, more than one detention basin would be required. There is a limited amount of open space available north of W. Layton Avenue and east of the North Branch of the Root River which could be used for the storage of runoff from a portion of the tributary area. However, the provision of storage at this site in conjunction with the other sites would result in another alternative similar to Alternative Nos. 3 through 6. Since the costs for those alternatives are substantially greater than Alternative Plans 1 and 2, it was not deemed necessary to quantitatively evaluate this additional storage.

CONCLUDING STATEMENT

This letter report provides details and an evaluation of six alternative plans for resolving flooding and drainage problems along the North Branch of the Root River. The alternatives evaluated include the plan initially recommended by the Advisory Committee for the District's stormwater drainage and flood control planning; a refinement of that plan providing for removal of the affected homes in the City of Greenfield as developed by the District during plan implementation; as well as four alternatives providing for various degrees of additional storage. The report includes the provision of additional data and information of the six alternatives and details of a seventh alternative as requested during the meeting held at the District offices on September 28, 1990, to review a draft of this report.

We trust that this letter report fully satisfies the agreement between the District and the Commission. Should you or your staff have any questions or comments concerning the information presented in this report, please do not hesitate to call.

Sincerely,

Kurt W. Bauer
Executive Director

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Enclosures

structure removal in the City of West Allis, with no channel improvement; and 3) the option to provide storage to reduce flood flows tributary to the North Branch of the Root River between W. Forest Home Avenue and W. Layton Avenue. Each of these refinements is discussed in the following paragraphs:

Provision of Storage at the Hale Creek Site

The District and the Wisconsin Department of Natural Resources requested that the option providing storage only at the Hale Creek site be evaluated as a measure to deal primarily with the identified flooding and drainage problems in the City of West Allis. As noted previously, there are currently 27 structures located within the floodplain in the City of West Allis, including nine residences along the North Branch of the Root River, and nine residences and nine commercial buildings along Hale Creek. The option requested to be considered to resolve these flooding conditions would be to provide the channel improvements and the Hale Creek detention facility as included in Alternative Plan 6. In addition, in order to resolve residual flooding in the City of West Allis, the floodproofing of one house and the removal of one house would be required.

As shown in Table 10, the total capital cost of this flood alternative control plan--Alternative Plan 7--for the portion of Hale Creek and the North Branch of the Root River within the City of West Allis is estimated at about $5.4 million, with an average annual operation and maintenance cost of $47,400. The total annual cost of capital and operation and maintenance is estimated to be $387,000. The value of the average annual flood abatement benefits is about $29,700, resulting in a benefit-cost ratio of about 0.08.

Table 10 also includes a comparison of these costs with costs for the portion of Alternative Plan 2 in the City of West Allis. The costs of the detention basin at the Hale Creek site, channel modification, and removal and floodproofing of two structures in the City of West Allis, as set forth under Alternative Plan 7, are about three times more costly than the costs for the West Allis portion of Alternative Plan 2, which includes items 2a., 2b., 2c., 2d., and a part of 2e. in Table 1 and have an equivalent annual cost of $117,000.

Provision of Structure Removal in the City of West Allis With No Channel Modification

If the channel modification components of the alternative plans were not constructed, one option would be to purchase all of the homes impacted by the flooding. Under this option, the flood damage problem would be resolved. However, the residual flooding of streets, including the Parkway Drive, and of yards, as well as the problems associated with the six storm sewer outlets located in the reach concerned would not be resolved. The cost for removal of the 27 structures in the floodplain would entail an estimated cost of $4.3 million based upon the current market value of the structures, plus allowances for relocation and miscellaneous costs. This results in an equivalent annual cost of about $273,000. This cost may be compared to the cost of the West Allis portion of Alternative Plan 2 which has an equivalent annual cost of $117,000 as shown in Table 10.

Table 10

COST ESTIMATES FOR ADDITIONAL ALTERNATIVE FLOOD CONTROL OPTIONS FOR HALE CREEK AND THE NORTH BRANCH OF THE ROOT RIVER IN THE CITY OF WEST ALLIS

No.	Name	Description	Cost (dollars) Capital	Total Amortized Capital[a]	Annual Operation and Maintenance	Total	Benefit Cost Analysis Annual Benefits (dollars)	Economic Benefit-Cost Ratio
2A.	Refined Initially Recommended Alternative--Combination Structure Floodproofing, Elevation, and Removal, with Minor Channel Deepening-West Allis only.	a. 1.6 mile of channel modification along North Branch of the Root River	835,000[b]	53,000	3,300[b]	56,300		
		b. 1.0 mile of channel modification along Hale Creek	555,000[c]	35,200	2,100[c]	37,300		
		c. Replacement of four bridges	124,000[d,e]	7,900	--	7,900		
		d. Floodproof 8 structures (all in West Allis)	39,000[f]	2,500	--	2,500		
		e. Remove 2 structures	205,000	13,000	--	13,000		
		Total	$1,758,000	$111,600	$ 5,400	$117,000	$ 29,700	0.25
7.	Detention Utilizing Storage at the Hale Creek Site Only-West Allis improvements only	a. 1.6 miles of channel modification along North Branch of the Root River	835,000[b]	53,000	3,300[b]	56,300		
		b. 1.0 mile of channel modification along Hale Creek	555,000[c]	35,200	2,100[c]	37,300		
		c. Replacement of four bridges	124,000[d,e]	7,900	--	7,900		
		d. Detention basin on Hale Creek at W. Cleveland Avenue	3,735,000[g]	236,800	42,000[h]	278,800		
		e. Floodproof 1 structure (in West Allis)	5,000[f]	300	--	300		
		f. Remove 1 structure	104,000	6,600	--	6,600		
		Total	$5,358,000	$339,800	$47,400	$387,200	$ 29,700	0.08

[a]Amortized capital cost is based on an interest rate of 6 percent and a project life of 50 years.

[b]The cost of this channel modification would be borne by the Milwaukee Metropolitan Sewerage District.

[c]The cost of this channel modification would be borne by the City of West Allis.

[d]Costs for bridges at W. Cleveland Avenue on the North Branch of the Root River and W. Cleveland Avenue on Hale Creek were previously assigned under the Commission's adopted regional transportation system plan. These two bridges would have a capital cost of $465,000.

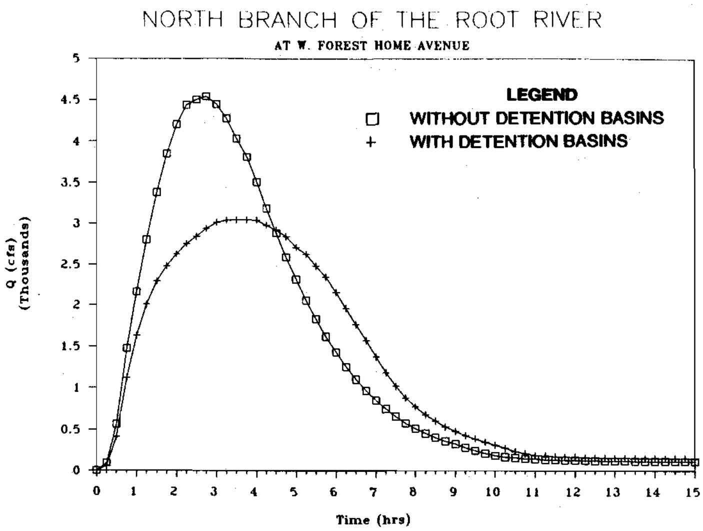
[e]Of the total $124,000 capital cost, $12,000 would be borne by the MMSD for removal of the existing bridges, $93,000 would be borne by the City of West Allis for the replacement bridge at S. 116th Street, and $19,000 would be borne by Milwaukee County for the replacement of one pedestrian bridge.

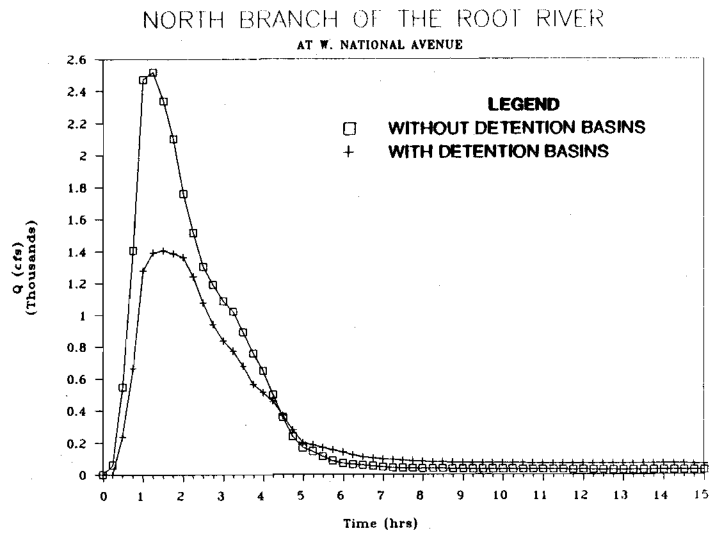
[f]The cost of structure floodproofing would be borne by the individual property owners.

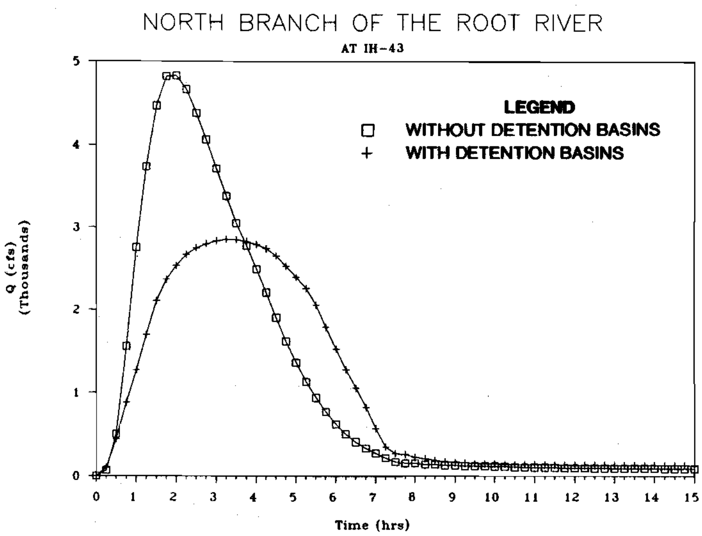
[g]The cost of construction and maintenance of this basin would be subject to negotiation between the MMSD, the City of West Allis, and, if water quality measures are included, the State of Wisconsin.

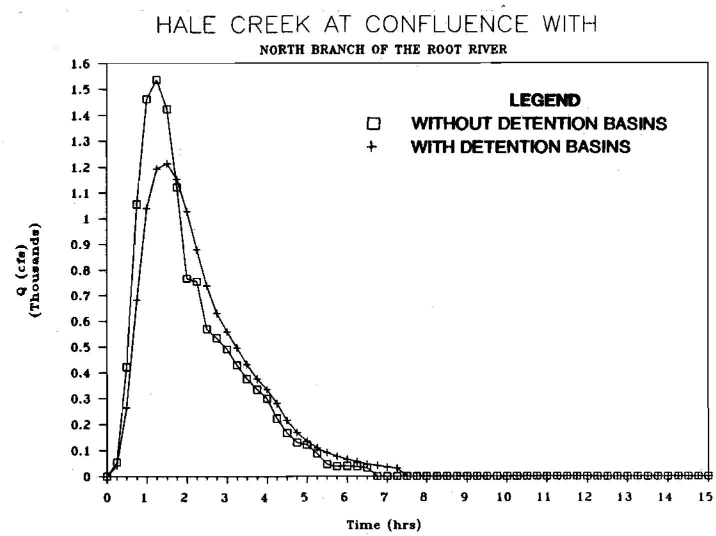
Source: SEWRPC

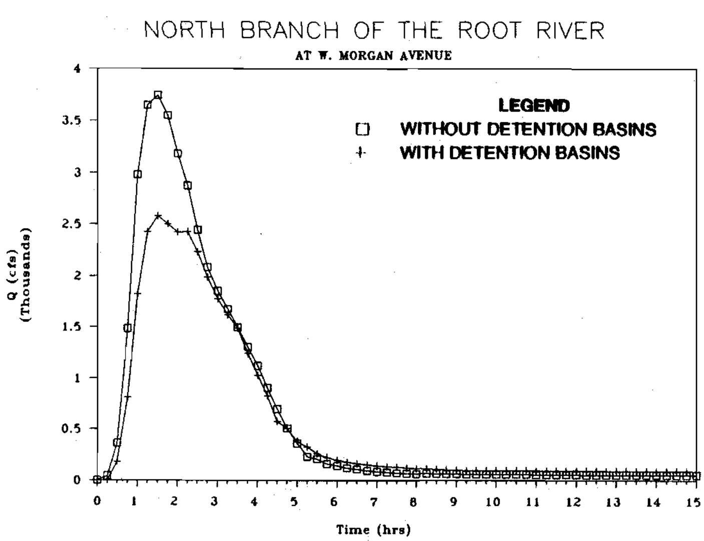
EXHIBIT A
HYDROGRAPHS FOR ALTERNATIVE PLAN 3

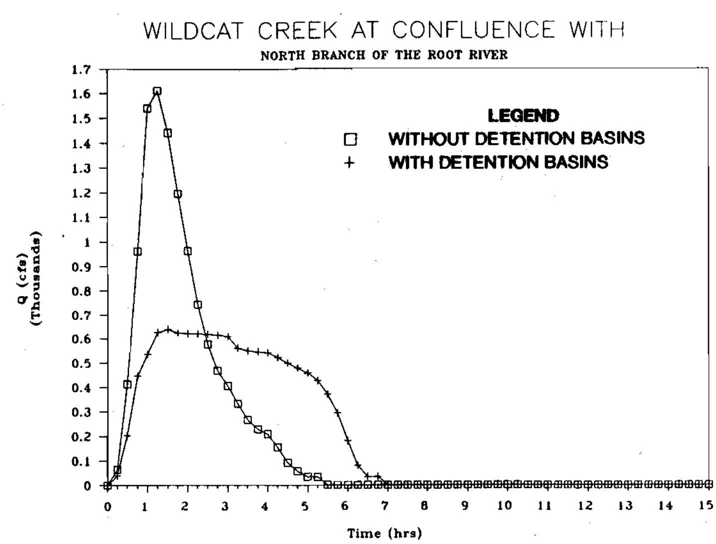








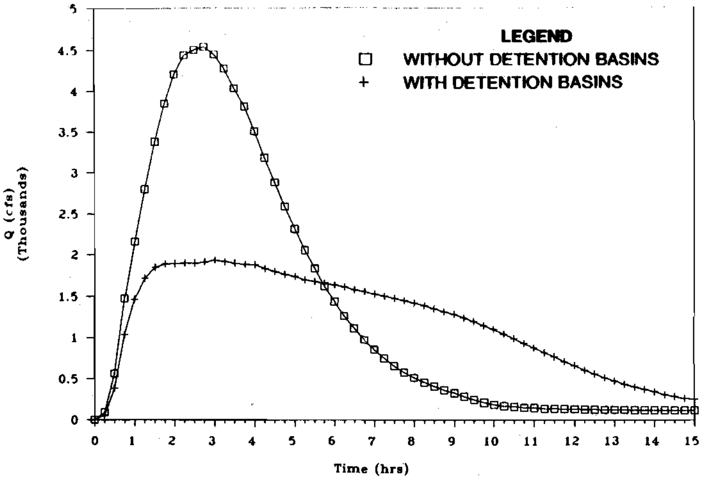




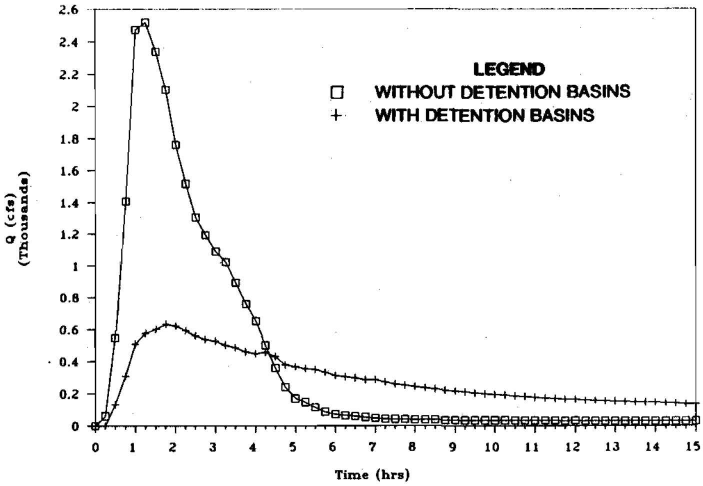
SOURCE: SEWRPC

EXHIBIT B
HYDROGRAPHS FOR ALTERNATIVE PLAN 4

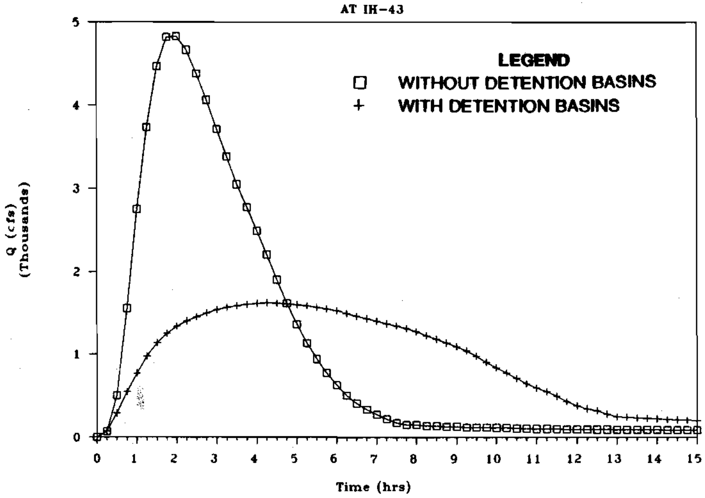
NORTH BRANCH OF THE ROOT RIVER
AT W. FOREST HOME AVENUE



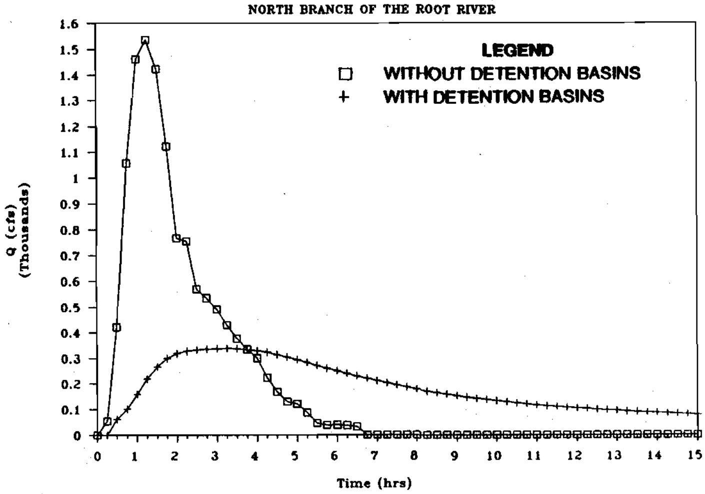
NORTH BRANCH OF THE ROOT RIVER
AT W. NATIONAL AVENUE



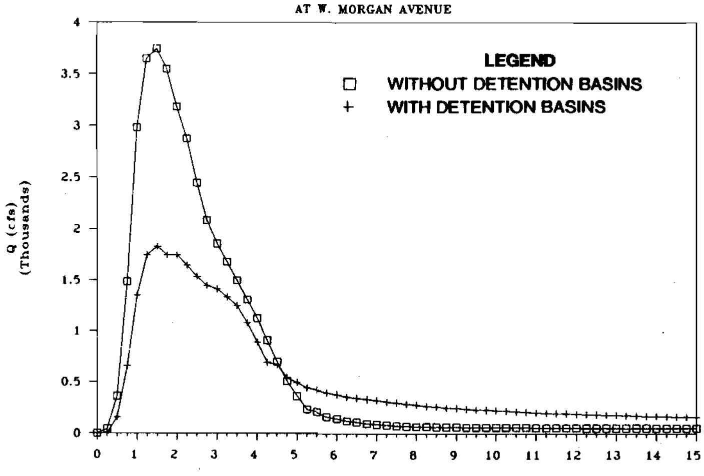
NORTH BRANCH OF THE ROOT RIVER
AT IH-43



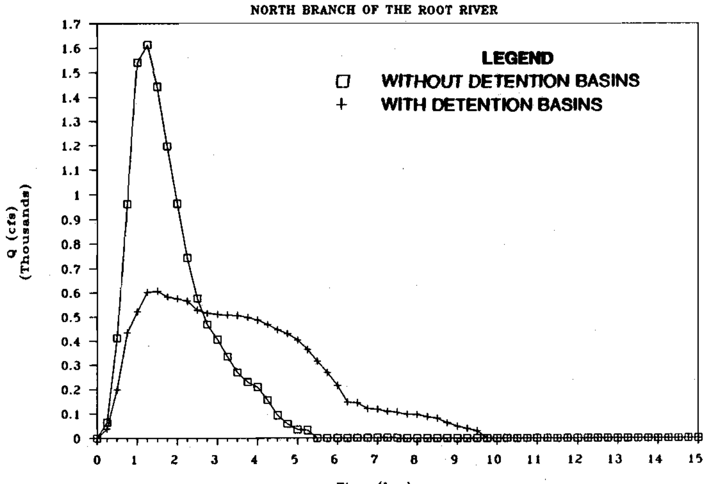
HALE CREEK AT CONFLUENCE WITH
NORTH BRANCH OF THE ROOT RIVER



NORTH BRANCH OF THE ROOT RIVER
AT W. MORGAN AVENUE



WILDCAT CREEK AT CONFLUENCE WITH
NORTH BRANCH OF THE ROOT RIVER

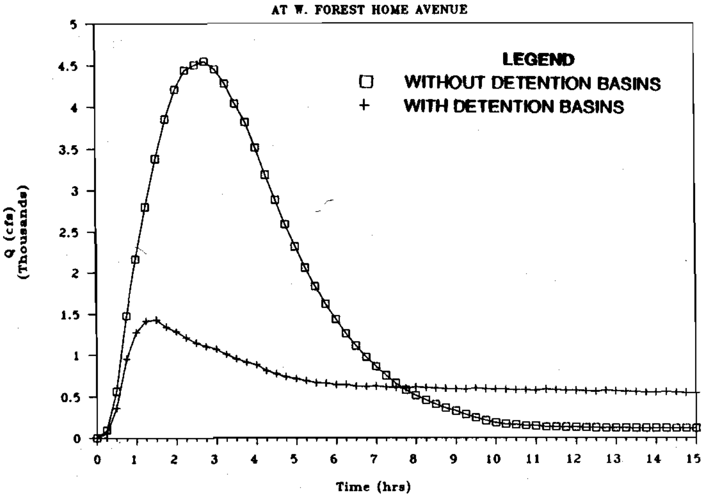


SOURCE: SEWRPC

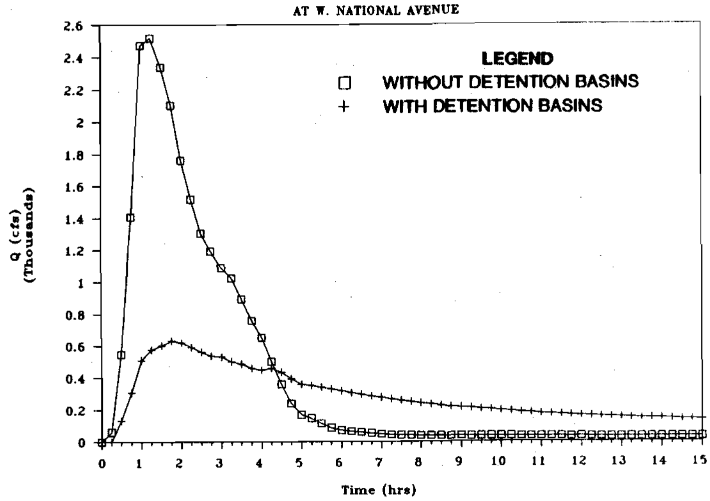
EXHIBIT C
HYDROGRAPHS FOR ALTERNATIVE PLAN 5

NORTH BRANCH OF THE ROOT RIVER

AT W. FOREST HOME AVENUE

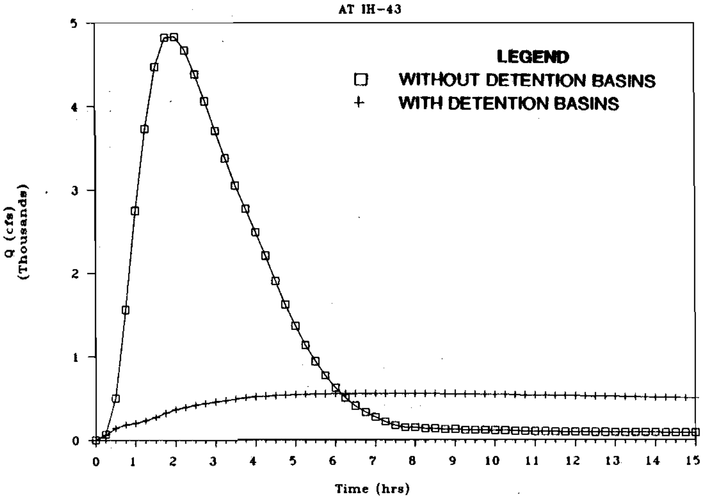


AT W. NATIONAL AVENUE



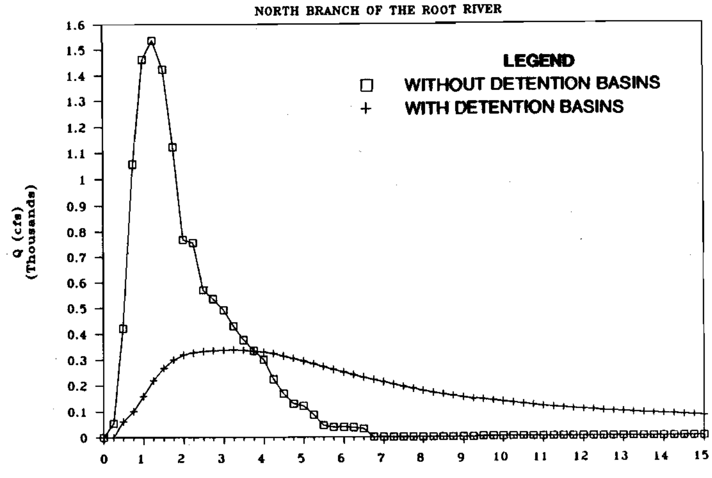
NORTH BRANCH OF THE ROOT RIVER

AT IH-43



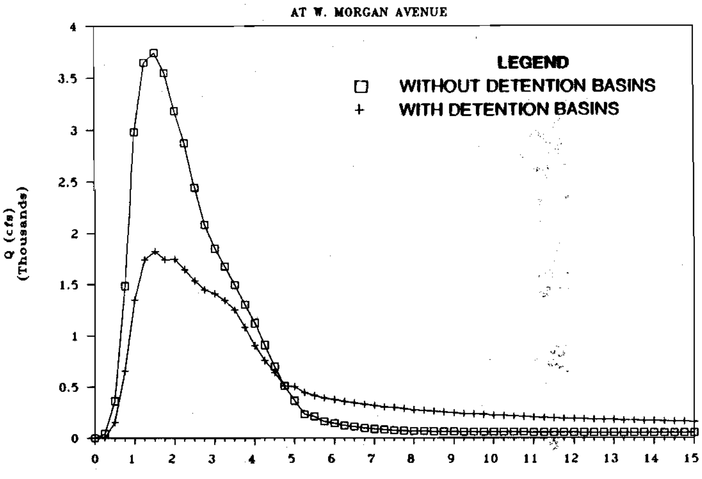
HALE CREEK AT CONFLUENCE WITH

NORTH BRANCH OF THE ROOT RIVER



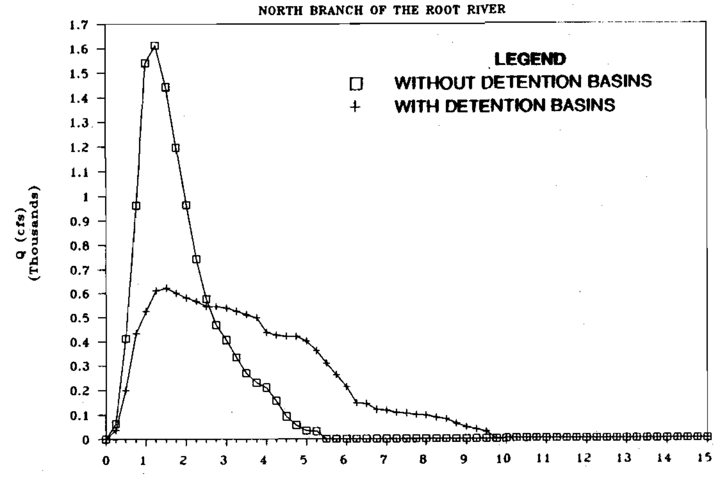
NORTH BRANCH OF THE ROOT RIVER

AT W. MORGAN AVENUE



WILDCAT CREEK AT CONFLUENCE WITH

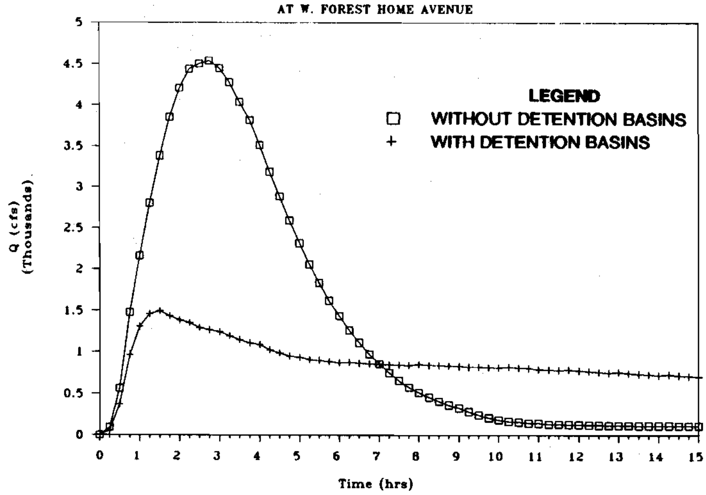
NORTH BRANCH OF THE ROOT RIVER



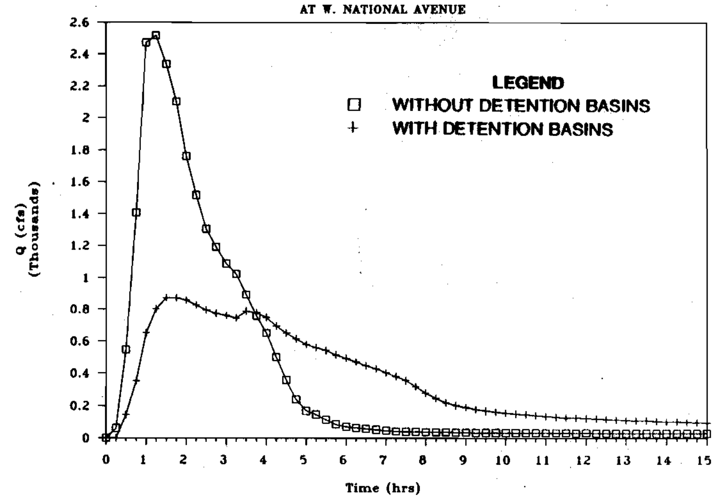
SOURCE: SEWRPC

EXHIBIT D
HYDROGRAPHS FOR ALTERNATIVE PLAN 6

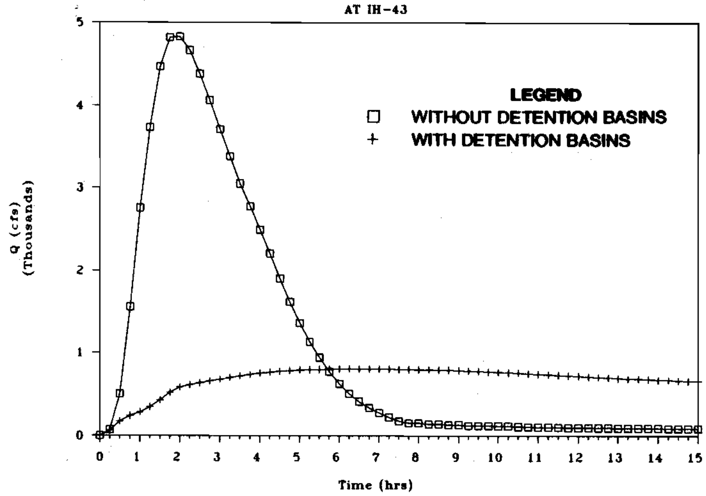
NORTH BRANCH OF THE ROOT RIVER
AT W. FOREST HOME AVENUE



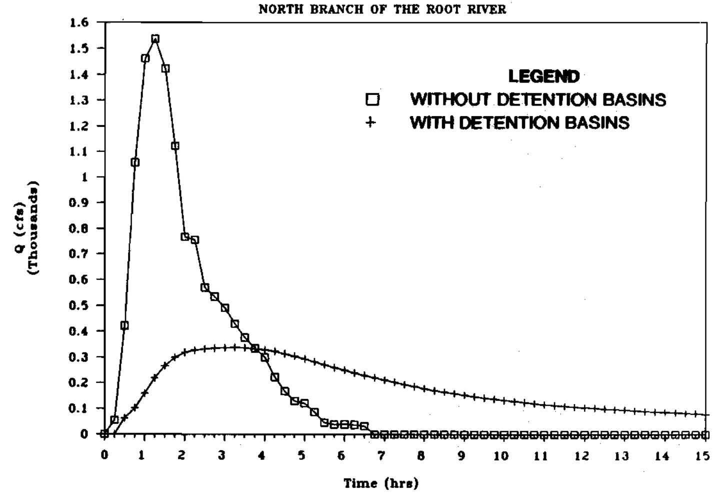
NORTH BRANCH OF THE ROOT RIVER
AT W. NATIONAL AVENUE



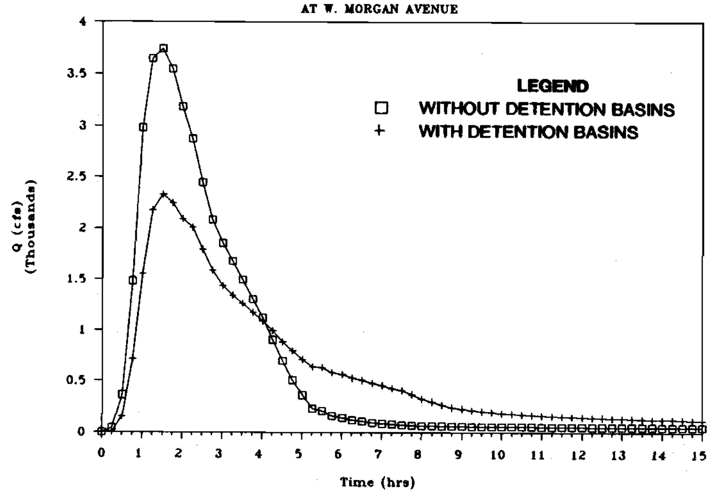
NORTH BRANCH OF THE ROOT RIVER
AT IH-43



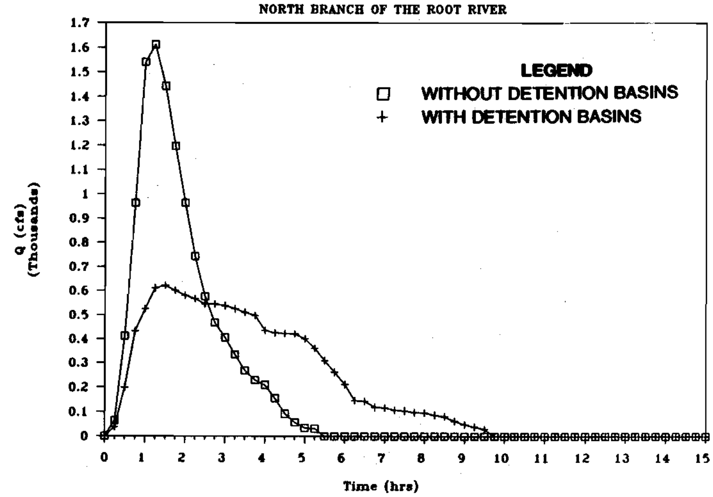
HALE CREEK AT CONFLUENCE WITH
NORTH BRANCH OF THE ROOT RIVER



NORTH BRANCH OF THE ROOT RIVER
AT W. MORGAN AVENUE



WILDCAT CREEK AT CONFLUENCE WITH
NORTH BRANCH OF THE ROOT RIVER



SOURCE: SEWRPC

Special acknowledgement is due Messrs. Michael G. Hahn and Ronald J. Printz, SEWRPC Principal Engineers, for their contribution to the preparation of this report.