

ANALYSIS/REPORT

ALTERNATIVE SANITARY SEWER TRUNK EXTENSIONS

(For the Development East of Hanson Boulevard)



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Comm. No. 12974-01
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(For the Development East of Hanson Boulevard)**

CITY OF ANDOVER, MINNESOTA

COMMISSION NO. 12974-01

I hereby certify that this Report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

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**ALTERNATIVE SANITARY SEWER TRUNK EXTENSIONS
(For the Development East of Hanson Boulevard)
CITY OF ANDOVER, MINNESOTA**

I. EXECUTIVE SUMMARY

The City of Andover’s current Sanitary Sewer Comprehensive Plan proposes four sanitary sewer trunk extensions to serve approximately 1,000 acres of rural land east of Hanson Boulevard and within the 2020 MUSA boundary. These extensions require significant acquisition of private property and could overload a portion of the existing trunk sanitary sewer system based on projected development densities. This Analysis was conducted to develop alternative trunk extensions to meet the projected development demands east of Hanson Boulevard, but without the need for significant upgrades to the existing sanitary sewer system. The Opinions of Probable Cost for the Alternatives (A - H) developed are as follows:

Alternative	Opinion of Probable Cost
A. Crosstown Boulevard Alternative*	\$3,081,796
B. Pipe Bursting Alternative	\$3,848,806
C. Prairie Road Alternative	\$2,455,340
D. Prairie Road Alternative No. 2	\$2,683,925
E. 150th Lane Alternative*	\$1,892,641
F. Xeon Street Alternative	\$3,048,823
G. Yellow Pine Lift Station Alternative	\$2,580,623
H. Lift Station No. 4 Rerouting Alternative*	\$2,472,443

*Requires significant net development density reduction, which is not considered feasible.

Five of the Alternatives (B, C, D, F, and G) examined have sufficient sewer capacity to accommodate the anticipated future flows, assuming that the area develops at a net density of 2.45 units per acre. The remaining three Alternatives (A, E, and H) do not currently have sufficient sewer capacity and reducing the net development density would be required in order to prevent overloading the sanitary sewer system. For Crosstown Boulevard (Alternative A), the net development density would have to be reduced to 1.70 units per acre; for 150th Lane (Alternative E) a reduction to 0.70 units per acre would be required, or for Lift Station No. 4 Rerouting (Alternative H) a net development density reduction to 2.07 units per acre would be required. However, the City has indicated

reducing the net development density is not a viable option; therefore those Alternatives are not feasible.

Of the five viable Alternatives remaining, the Prairie Road, Prairie Road No. 2, and Yellow Pine Lift Station Alternatives are the most economical. The recommended Alternative is the Yellow Pine Lift Station Alternative because it maximizes the utilization of the existing trunk sewers and provides the City with the flexibility to accommodate the timing of developing areas. The City has the ability to install segments of the trunk lines to serve areas adjacent to Crosstown Boulevard as they develop, without having to construct the entire trunk extension, as this would be required for both the Prairie Road Alternative and the Prairie Road No. 2 Alternative.

II. INTRODUCTION AND INITIATION OF ANALYSIS/REPORT

The City of Andover's current Sanitary Sewer Comprehensive Plan proposes the following four trunk line extension alternatives to serve approximately 1,000 acres of rural land east of Hanson Boulevard and within the 2020 MUSA boundary.

- A central trunk line extending from 150th Lane NW to the east and northeast through private property crossing The Burlington Northern and Santa Fe Railway Company (BNSF), and east to Prairie Road.
- A southerly trunk line extending north from the Shadowbrook Development to Andover Boulevard, then west to Prairie Road.
- The Crown Point Trunk extending north and east from Coon Creek and the BNSF Railway to the north 2020 MUSA limits, west of Butternut Street Extended.
- The Bluebird Trunk extending east and north from the Yellow Pine Street / 155th Avenue NW intersection.

These trunk extensions require significant acquisition of private property and could potentially overload a portion of the existing sanitary sewer trunk system.

The purpose of this Analysis is to provide the City with Alternatives to meet development demands without overloading the existing sanitary sewer system. The Analysis was conducted in two phases. The objective of the first phase was to develop Alternatives that would direct the flow to the existing Bluebird and Coon Creek trunk sanitary sewers east of

Hanson Boulevard, while utilizing the existing easements and right-of-ways as much as possible. After completing this phase, TKDA met with the City to discuss the results and determined that additional Alternatives should be developed in a second phase. The objective of the second phase Alternatives was to divert a portion of the sanitary flow east of Hanson Boulevard to the Pinewood trunk sanitary sewer service area.

III. **BACKGROUND**

A. Developable Area

According to Chapter 9 of the December 1999 Draft of the City of Andover's Comprehensive Plan, there are 1,778 remaining gross acres east of Hanson Boulevard and within the 2020 MUSA boundary. The net developable acres identified in Table No. 1 were determined by removing the wetland and floodplain areas identified by the City's Sanitary System GIS Map (Figure No. 1) from the gross area. The number of units to be served within the net developable acres was determined assuming that, 1) the area served by Lift Station No. 4 (Chesterton Commons Lift Station) develops to the ultimate capacity of the lift station, and 2) the remaining areas develop at a net density of 2.45 units per acre. Table No. 1 summarizes the information used to estimate the total number of future units to be served.

**TABLE NO. 1
REMAINING ACRES AND UNITS**

Location	Remaining Acres	Units/Acre	Remaining Units
Lift Station No. 4 Service Area	244	2.10	513
West of RR, South of 157th Avenue	182	2.45	446
East of RR, South of Barnes	152	2.45	372
East of RR, North of Barnes	418	2.45	1,024
Total	996		2,355

The future units to be served by Lift Station No. 4 was determined by subtracting the existing units served (285 units) from the ultimate capacity of the lift station. According to the Trunk Sanitary Sewer Analysis for Designated Rural Reserve Areas prepared by WSB & Associates, dated November 2003, the existing lift station will

accommodate flows from 530 units and an additional 268 units can be added with an upgrade of the pumps for a total ultimate capacity of 798 units.

The assumed net development density of 2.45 units per acre was based on the average of actual development densities from 1995 to 2003, provided by the City. Based on these assumptions, it is estimated that 2,355 future units are to be served east of Hanson Boulevard.

B. Existing Trunk System Capacity and Projected Flows

The theoretical maximum capacities of the trunk lines listed in Table No. 2 were calculated using Manning's equation. The pipe slopes were obtained from record drawings and the trunk lines were assumed to be flowing full. A roughness coefficient (n) of 0.012 was used for reinforced concrete pipe (RCP), and a roughness coefficient (n) of 0.010 was used for polyvinyl chloride (PVC) pipe

The roughness coefficient for RCP was based on the "Concrete Pipe Design Manual" published by the American Concrete Pipe Association, which recommends an "n" value of 0.012 to 0.013. The American Society of Civil Engineers (ASCE) and Water Pollution Control Federation (WPCF) "Manual for Design and Installation of Sanitary and Storm Sewers" lists a range of "n" values for PVC pipe of 0.011 to 0.015, however, the Uni-Bell PVC Pipe Association recommends an "n" design value of 0.009. A roughness coefficient of 0.010 for PVC pipe was selected for this analysis based on this information and is consistent with the "n" value used in the Comprehensive Plan.

The peak flow rate represents the highest volume of water received by the sewer on a daily basis, which typically occurs in the early morning. The peak flow rate is generally three to four times higher than the average flow rate in trunk sewers of this size. The average flow rate the trunk can accommodate was estimated by dividing the peak flow by the standard Metropolitan Council of Environmental Services (MCES) peaking factors. The standard MCES peaking factors are used to account for daily flow fluctuation and minor inflow/infiltration within allowable pipe leakage standards.

The number of units that can be served by the trunk line was determined using the average daily flow anticipated per unit. This number, based on historical flow rates examined by the City, is 225 gallons per day per unit (gpdu).

**TABLE NO. 2
TRUNK MAXIMUM THEORETICAL CAPACITY**

Location	d (in)	N	Slope (ft/ft)	Peak Flow (MGD)	MCES Peak Factor	Ave Flow (MGD)	No. Units
12" Bluebird Trunk	12	0.012	0.0022	1.169	3.6	0.325	1,444
15" Bluebird Trunk	15	0.012	0.0015	1.751	3.4	0.515	2,289
18" Bluebird Trunk	18	0.012	0.0012	2.547	3.3	0.772	3,430
18" Pinewood Trunk	18	0.010	0.0012	3.056	3.2	0.955	4,244
12" Shadowbrook Trunk	12	0.010	0.0022	1.403	3.5	0.401	1,782
21" Coon Creek Trunk	21	0.010	0.0010	4.208	3.0	1.403	6,234
24" Coon Creek Trunk	24	0.012	0.0008	4.478	3.0	1.493	6,634
24" Crosstown Trunk	24	0.012	0.0008	4.478	3.0	1.493	6,634
18" Bunker Lake Trunk	18	0.012	0.0012	2.547	3.3	0.772	3,430
30" Bunker Lake Trunk	30	0.012	0.0010	9.077	2.5	3,631	16,138

The available capacities for each respective section of the trunk are shown in Table No. 3. They were determined by removing the capacity utilized by units currently served by the trunk lines. The number of units served in each respective addition was provided by the City. A detailed breakdown of the units served according to development is provided in the Appendix. The Post Office, Riverway Clinic, Fairbanks Commercial Area, and Clocktower Commons Commercial Area were not included in this Table because the nature of commercial flows is different than that of the residential flows. The peaking factors are smaller and peak flow from commercial areas do not necessarily occur at the same time of the day as the peak flow from residential areas, therefore the impact on this Analysis was considered insignificant.

**TABLE NO. 3
TRUNK AVAILABLE CAPACITY**

Location	Units Currently Served	Available Sewer Capacity for New Units
12" Bluebird Trunk	671	773
15" Bluebird Trunk	925	1,364
18" Bluebird Trunk	1,200	2,230
18" Pinewood Trunk	1,123	3,121
12" Shadowbrook Trunk	455	1,327
21" Coon Creek Trunk	784	5,450
24" Coon Creek Trunk	2,774	3,860
24" Crosstown Trunk	4,633	2,001
18" Bunker Lake Trunk	695	2,735
30" Bunker Lake Trunk	5,844	10,294

IV. ALTERNATIVES USING TRUNK SEWERS EAST OF HANSON BOULEVARD

The following pages detail Alternatives A through F. They were developed on the basis of utilizing the existing Bluebird and Coon Creek trunk sewers east of Hanson Boulevard and constructing new trunk extensions within existing easements and right-of-ways as much as possible.

A. Crosstown Boulevard Alternative

The Crosstown Boulevard Alternative, illustrated in Figure No. 2, consists of the following:

1. A 12" gravity sanitary sewer on Crosstown Boulevard from Yellow Pine Street to Prairie Road. The service area would include the area northwest and immediately south of Crosstown Boulevard, and an area east of Prairie Road adjacent to 157th Avenue. Alternative trunk sewer alignments could be extended from the 12" sanitary sewer stub on 155th Avenue NW, but a larger area would require a lift station for service.

2. A 12” gravity sanitary sewer extending north from Shadowbrook Lift Station to Andover Boulevard, then west to Prairie Road and north to 149th Lane Extended. The service area would include the area east of the BNSF Railway and south of 155th Avenue Extended, as well as a low area east of Prairie Road, which the sewer on Crosstown Boulevard cannot serve by gravity.

Lateral lift stations may be required for the areas immediately south and west of the Nordeen Addition (located near the intersection of 156th Avenue and Kumquat Street) and a small area west of University Avenue and north of 150th Lane. As illustrated in Figure No. 2, a portion of the service area will be served by the proposed trunk extension and a portion of the service area will be served by laterals from existing trunk lines. A majority of the area south of Crosstown Boulevard and west of the BNSF Railway will be served by lateral extensions from the 12” trunk in the Winslow Addition, with the exception of 20 acres to be served by laterals through the Fox Woods Addition.

**TABLE NO. 4
CROSSTOWN BOULEVARD ALTERNATIVE**

Location	Additional Area	Additional Units	Total Units Served	% of Theoretical Maximum Capacity
Lift Station No. 4	244	513	798	100%
12" Bluebird Trunk	238	583	1767	122%
15" Bluebird Trunk	238	583	2021	88%
18" Bluebird Trunk	258	632	2345	68%
12" Shadowbrook Trunk	494	1210	1665	93%
21" Coon Creek Trunk	494	1210	1994	32%
24" Coon Creek Trunk	752	1842	5129	77%

The advantage of this Alternative is that the City can provide sanitary sewer service to the area along Crosstown Boulevard and 157th Avenue once the 12” Crosstown Trunk Extension is complete.

The disadvantage of this Alternative, as shown in Table No. 4, is that the projected flow exceeds the theoretical maximum capacity by 22%. This value indicates that there is potential for surcharging the sewer on 150th Lane. Surcharging occurs when

the amount of flow exceeds the capacity of pipe. As a result, the water level in the manholes rise until there is sufficient hydraulic head to push the flow through the pipe. Problems arise when the water level exceeds the elevation of a residential connect and creates a sewer back-up into the basement.

The potential for surcharging would depend upon: 1) if the development exceeds the projected density, 2) the average daily flow per unit exceeds 225 gpdu, or 3) there is an excess amount of inflow/infiltration into the sewer. The City would need to implement an aggressive maintenance program to prevent inflow/infiltration and strictly regulate the rate of development for this Alternative, or regulate the development density. Reducing the density from 2.45 to 1.70 units per acre would reduce the projected flow to within 10% of the maximum theoretical capacity of the 12" gravity sewer on 150th Lane.

The Shadowbrook Lift Station would also require an upgrade to accommodate the future flow rates if the Alternative is implemented. According to the supplement to the Shadowbrook Addition Feasibility Report prepared by TKDA, the ultimate design capacity of the lift station is 1,000 units, if the current 3 hp pumps are replaced with 10 hp pumps. The service area proposed in this Alternative comprises 1,161 units in addition to those already served, or a total of 1,616 units. The upgrade required would consist of a pump upgrade, additional wet well capacity, and possibly a larger forcemain.

The Opinion of Probable Cost for this Alternative is \$3,081,796. This includes an estimated cost of \$1,060,949 for the 12" Crosstown Trunk Extension, and \$2,020,847 for the Shadowbrook Trunk Extension.

B. Pipe Bursting Alternative

The Pipe Bursting Alternative, illustrated in Figure No. 2A, is similar to the Crosstown Boulevard Alternative, except the 12" sewer on 150th Lane is to be replaced with a 15" sewer. Due to the depth of the sewer and relative location of residences on 150th Lane, pipe bursting was considered the most viable construction technique for the sewer replacement. Pipe bursting is a trenchless technology which uses a machine to burst or split the existing pipe and push broken fragments into surrounding soil while simultaneously pulling a new pipeline.

**TABLE NO. 5
PIPE BURSTING ALTERNATIVE**

Location	Additional Area	Additional Units	Total Units Served	% of Theoretical Maximum Capacity
Lift Station No. 4	244	513	798	100%
12" Trunk Upgraded to 15"	238	583	1,767	52%
15" Bluebird Trunk	238	583	2,021	88%
18" Bluebird Trunk	258	632	2,345	68%
12" Shadowbrook Trunk	494	1,210	1,665	93%
21" Coon Creek Trunk	494	1,210	1,994	32%
24" Coon Creek Trunk	752	1,842	5,129	77%

The advantage of this Alternative over the Crosstown Boulevard Alternative is that the projected flow does not exceed the theoretical maximum capacity of the 15" replacement pipe, as shown in Table No. 5.

The disadvantage of this Alternative is that any lateral sewer connections on 150th Lane would have to be replaced. The pipe bursting method destroys the lateral pipe connections and they would have to be repaired by open cut methods, which are disruptive to the residences.

The Opinion of Probable Cost for this Alternative is \$3,848,806. This includes an estimated cost of \$767,010 for the pipe bursting, \$1,060,949 for the 12" Crosstown Trunk Extension and \$2,020,847 for the Shadowbrook Trunk Extension.

C. Prairie Road Alternative

The Prairie Road Alternative, illustrated in Figure No. 3, consists of the following:

1. A 12" gravity sanitary sewer on Prairie Road from 140th Lane to Crosstown Boulevard.
2. A trunk lift station on Prairie Road north of Coon Creek.

This service area would include most of the area east of the BNSF Railway. The area west of the BNSF Railway would be served by lateral lines from the existing sanitary trunk system. Lateral lift stations may be required for the areas immediately south and

west of the Nordeen Addition and a small area west of University Avenue and north of 150th Lane.

**TABLE NO. 6
PRAIRIE ROAD ALTERNATIVE**

Location	Additional Area	Additional Units	Total Units Served	% of Theoretical Maximum Capacity
Lift Station No. 4	244	513	798	100%
12" Bluebird Trunk	162	397	1,581	109%
15" Bluebird Trunk	162	397	1,835	80%
18" Bluebird Trunk	182	446	2,159	63%
12" Shadowbrook Trunk	20	49	504	28%
21" Coon Creek Trunk	570	1,397	2,181	35%
24" Coon Creek Trunk	752	1,842	5,129	77%

The advantage of this Alternative, as shown in Table No. 6, is that the sanitary flow from approximately 570 acres of the future development is diverted directly to the 21" sewer on 140th Lane to reduce the peak flow rates anticipated through the 12" Bluebird and Shadowbrook Trunks. The projected flow still exceeds the theoretical maximum capacity by 9%, but the potential to surcharge the sewer on 150th Lane is greatly reduced compared to the Crosstown Boulevard Alternative. A preliminary hydraulic analysis indicated potential backups in the manholes on 150th Lane, but adjacent residences would not be affected due to the depth of the sewer.

The disadvantage of this Alternative is that development east of the BNSF Railway would be dependant upon construction of the Prairie Road Trunk. A trunk lift station would also be required on the north side of Coon Creek. The depth of the lift station would be approximately 35 feet and 5 hp pumps would be required.

The Opinion of Probable Cost for the Prairie Road Alternative is \$2,455,340, assuming the sewer is installed at a depth to allow serving the area north of 157th Avenue by gravity. This includes an estimated cost of \$2,205,340 for the 12" gravity sanitary sewer on Prairie Road, and \$250,000 for the trunk lift station.

D. Prairie Road Alternative No. 2

The Prairie Road Alternative No. 2, illustrated in Figure No. 3A is similar to the Prairie Road Alternative, except that the depth of the sewer on Prairie Road would be increased to provide potential gravity sewer service north of 157th Avenue. This would allow the City to serve developments in the area east of Crosstown Boulevard and north of 157th Avenue through either the trunk on 150th Lane or the trunk on 140th Lane. The area could be served initially by the lift station on the west side of Crosstown and diverted to the south once the Prairie Road Trunk construction is complete (Figure No. 3A). The impact of this flow diversion on the existing trunk system is shown in Table No. 7.

**TABLE NO. 7
PRAIRIE ROAD ALTERNATIVE NO. 2**

Location	Additional Area	Additional Units	Total Units Served	% of Theoretical Maximum Capacity
Lift Station No. 4	184	387	672	84%
12" Bluebird Trunk	162	397	1,455	101%
15" Bluebird Trunk	162	397	1,709	75%
18" Bluebird Trunk	182	446	2,033	59%
12" Shadowbrook Trunk	20	49	504	28%
21" Coon Creek Trunk	630	1,523	2,307	37%
24" Coon Creek Trunk	812	1,968	5,129	77%

Prairie Road Alternative No. 2 requires approximately 1,000 feet of sewer to be constructed at a depth greater than 35 feet to serve the area north of 157th Avenue by gravity. The disadvantage of this is increased installation cost due to the sewer depth, but the advantage is the lateral lift stations adjacent to the Nordeen Addition and University Avenue would not be required.

The Opinion of Probable Cost for the Prairie Road Alternative No. 2 is \$2,683,925. This includes an estimated cost of \$2,433,925 for the 12" gravity sanitary sewer on Prairie Road, and \$250,000 for the trunk lift station.

E. 150th Lane Alternative

The 150th Lane Alternative, illustrated in Figure No. 4, consists of the following:

1. A 12" gravity sanitary sewer on Crosstown Boulevard from Yellow Pine Street to Prairie Road. The service area would include the area northwest and immediately south of Crosstown Boulevard, and an area east of Prairie Road adjacent to 157th Avenue.
2. A 12" gravity sanitary sewer extending east from 150th Lane, then northeast through private property and crossing the BNSF Railway to Prairie Road. The service area would include the area east of the Winslow Hills 3rd Addition and an area on the east side of the BNSF Railway from 156th Avenue Extended to 146th Lane.

Lateral lift stations may be required for the areas immediately south and west of the Nordeen Addition and a small area west of University Avenue and north of 150th Lane. The area south of Andover Boulevard would be served by lateral lines to the Shadowbrook Lift Station. A portion of the area east of the Fox Woods Addition would be served through that Addition by lateral sewer extensions.

**TABLE NO. 8
150TH LANE ALTERNATIVE**

Location	Additional Area	Additional Units	Total Units Served	% of Theoretical Maximum Capacity
Lift Station No. 4	244	513	798	100%
12" Bluebird Trunk	580	1421	2,605	180%
15" Bluebird Trunk	580	1421	2,859	125%
18" Bluebird Trunk	600	1470	3,183	93%
12" Shadowbrook Trunk	152	372	827	46%
21" Coon Creek Trunk	152	372	1,156	19%
24" Coon Creek Trunk	752	1,842	5,129	77%

This is not a viable Alternative because of the capacity limitations of the 12" and 15" portions of the Bluebird Trunk, as shown in Table No. 8. The 12" piping on 150th Lane could be replaced as discussed in the Pipe Bursting Alternative, but this would

be ineffective due to the potential overloading of the 15" sewer. The cost of this Alternative is provided; however, in the event that the City considers development limitations based on available sewer capacity. Reducing the density from 2.45 to 0.70 units per acre would reduce the projected flow to within 10% of the maximum theoretical capacity of the 12" gravity sewer on 150th Lane. Reducing the density from 2.45 to 1.85 units per acre would reduce the projected flow to within 10% of the maximum theoretical capacity of the 15" gravity sewer on Bluebird Street.

The Opinion of Probable Cost for this Alternative is \$1,892,641. This includes an estimated cost of \$1,060,949 for the 12" Crosstown Trunk Extension and \$831,692 for the 12" 150th Lane Trunk Extension.

F. Xeon Street Alternative

The Xeon Street Alternative, illustrated in Figure No. 5, consists of the following:

1. A 12" gravity sanitary sewer on Crosstown Boulevard from Yellow Pine Street to Prairie Road. The service area would include the area northwest and immediately south of Crosstown Boulevard, and an area east of Prairie Road adjacent to 157th Avenue.
2. A 12" gravity sanitary sewer on Andover Boulevard from Bluebird Street to Xeon Street, then north on Xeon Street and northeast through private property crossing the BNSF Railway to Prairie Road. The service area would include the area east of the Winslow Hills 3rd Addition and an area on the east side of the BNSF Railway from 156th Avenue Extended to 146th Lane.

Lateral lift stations may be required for the areas immediately south and west of the Nordeen Addition and a small area west of University Avenue and north of 150th Lane. The area south of Andover Boulevard would be served by lateral lines to the Shadowbrook Lift Station.

**TABLE NO. 9
XEON STREET ALTERNATIVE**

Location	Additional Area	Additional Units	Total Units Served	% of Theoretical Maximum Capacity
Lift Station No. 4	244	513	798	100%
12" Bluebird Trunk	142	348	1532	106%
15" Bluebird Trunk	142	348	1786	78%
18" Bluebird Trunk	600	1470	3183	93%
12" Shadowbrook Trunk	152	372	827	46%
21" Coon Creek Trunk	152	372	1156	19%
24" Coon Creek Trunk	752	1842	5129	77%

The advantage of this Alternative, as shown in Table No. 9, is that the City can provide sanitary sewer service to the area along Crosstown Boulevard and 157th Avenue once the 12" Crosstown Trunk Extension is complete. This Alternative also eliminates a southerly trunk line and the need for new trunk lift stations or trunk lift station upgrades. Similar to the Prairie Road Alternative, the projected flow exceeds the theoretical maximum capacity by 6%, but the potential to surcharge the sewer on 150th Lane is greatly reduced compared to the Crosstown Boulevard Alternative. A preliminary hydraulic analysis indicated potential backups in the manholes on 150th Lane, but adjacent residences would not be affected due to the depth of the sewer.

The disadvantage of this Alternative is that development in the Xeon Street Trunk service area will be dependant upon acquisition of property east of the Winslow Addition.

The Opinion of Probable Cost for this Alternative is \$3,048,823. This includes an estimated cost of \$1,060,949 for the 12" Crosstown Trunk Extension, and \$1,987,874 for the 12" Xeon Street Trunk Extension.

V. PINEWOOD TRUNK ALTERNATIVES

Alternatives G and H were developed to examine the feasibility of diverting a portion of the sanitary flow east of Hanson Boulevard to the Pinewood Trunk Sewer.

In order to examine the Pinewood Trunk Alternatives, the capacity of the Crosstown Boulevard Trunk, Bunker Lake Trunk, the proposed bypass lift station, and the potential impact on the Pinewood Trunk service area were also considered.

The theoretical maximum capacities of the Crosstown and Bunker Lake Trunks are listed in Table No. 2 and the capacity of the bypass lift station was based on a Memorandum prepared by Short, Elliot, and Hendrickson (SEH), dated January 24, 2003. According to the Memorandum, a proposed bypass lift station at Hanson Boulevard would alleviate overloading concerns for the existing trunk system (specifically the Crosstown Trunk) in the City of Andover. The Memorandum states that 1.99 MGD would be diverted from the Crosstown Trunk to the Bunker Lake Trunk, and the anticipated flow in the Coon Creek Trunk downstream of the lift station would be approximately 2.5 MGD. Using MCES peaking factors as in Table No. 2, 1.99 MGD was converted to and is the equivalent of 2,601 units.

A. Yellow Pine Lift Station Alternative

The Yellow Pine Lift Station Alternative, illustrated in Figure No. 6, consists of the following:

1. A 12" gravity sanitary sewer on Crosstown Boulevard from Yellow Pine Street to Prairie Road. The service area would include the area northwest and immediately south of Crosstown Boulevard, and an area east of Prairie Road adjacent to 157th Avenue. Alternative trunk sewer alignments could be extended from the 12" sanitary sewer stub on 155th Avenue NW and through Sophie's Manner.
2. A trunk lift station at the intersection of Crosstown Boulevard and Yellow Pine Street. The service area would include the entire service area of Lift Station No. 4 and the areas adjacent to Crosstown Boulevard and 157th Avenue that would be served by gravity.

3. A sanitary sewer forcemain along Crosstown Boulevard from Yellow Pine Street to the manhole west of Tower Drive.
4. A 12" gravity sanitary sewer extending east from 150th Lane, then northeast through private property and crossing the BNSF Railway to Prairie Road. The service area would include the area east of the Winslow Hills 3rd Addition and an area on the east side of the BNSF Railway from 156th Avenue Extended to 146th Lane.

Lateral lift stations may be required for the areas immediately south and west of the Nordeen Addition and a small area west of University Avenue and north of 150th Lane. The area south of Andover Boulevard would be served by lateral lines to the Shadowbrook Lift Station. If the 12" trunk line was extended from the sanitary sewer stub on 155th Avenue NW, the lateral lift station service area would increase to include a majority of the area east of the BNSF Railway.

TABLE NO. 10
YELLOW PINE LIFT STATION ALTERNATIVE
(Assuming bypass lift station at Hanson Boulevard is constructed)

Location	Units Served	Additional Area	Additional Units	Total Units Served	% of Theoretical Maximum Capacity
Lift Station No. 4	285	244	513	798	100%
12" Bluebird Trunk	110	438	1,073	1,183	82%
15" Bluebird Trunk	364	438	1,073	1,437	63%
18" Bluebird Trunk	639	458	1,122	1,761	51%
12" Shadowbrook Trunk	455	152	372	827	46%
21" Coon Creek Trunk	784	152	372	1,156	19%
24" Coon Creek Trunk (before bypass LS)	2,213	610	1,495	3,708	56%
24" Coon Creek Trunk (after bypass LS)				1,106	17%
18" Pinewood Trunk	1123	318	779	2976	70%
24" Coon Creek Trunk (after Pinewood Trunk)				4082	62%
24" Crosstown Trunk	4818	304	745	5563	84%
18" Bunker Lake Trunk	695		2601	3296	96%
30" Bunker Lake Trunk				9375	58%

As shown in Table No. 10, there is sufficient sewer capacity in the Pinewood Trunk to accept the sanitary flow from the area north of Crosstown Boulevard in the Bluebird Trunk service area. Also, this flow diversion will not exceed the maximum theoretical capacity of the Crosstown or Bunker Lake Trunks.

A trunk lift station would also be required at the intersection of Crosstown Boulevard and Yellow Pine Street. The depth of the lift station would be approximately 30 feet and 10 hp pumps would be required.

If the Harstad property south of Crosstown Boulevard were to develop before construction of the trunk lift station, it could be served by gravity through the existing 12" sanitary sewer on Yellow Pine Street. Under this scenario, the percent of maximum theoretical capacity would increase from 82% to 89% for the 12" Bluebird Trunk and decrease from 70% to 66% for the 18" Pinewood Trunk.

The Opinion of Probable Cost for the Yellow Pine Lift Station Alternative is \$2,580,623. This includes an estimated cost of \$1,060,949 for the 12" gravity sanitary sewer on Crosstown Boulevard, \$831,692 for the 12" 150th Lane Trunk Extension, and \$687,982 for the trunk lift station and forcemain.

B. Lift Station No. 4 Rerouting Alternative

The Lift Station No. 4 Alternative, illustrated in Figure No. 7, would consist of rerouting the flow from Lift Station No. 4 to the Pinewood Trunk service area. Rerouting the flow would remove 798 units from the ultimate service area of the 12" Bluebird Trunk on 150th Lane.

Constructing a forcemain to Lift Station No. 3 (Fox Hollow Lift Station) was considered, but determined not to be feasible due to the capacity of the downstream gravity sewer. The ultimate service area of Lift Station No. 3 consists of 517 units. The addition of the Lift Station No. 4 ultimate service area would increase the service area of Lift Station No. 3 to 1,315 units. However, the capacity of the 10" gravity sewer downstream of Lift Station No. 3 is only 1,170 units.

The only pipe with sufficient capacity to accept the discharge of Lift Station No. 4 is the 18" Pinewood Trunk.

TABLE NO. 11
LIFT STATION NO. 4 REROUTING ALTERNATIVE
(Assuming bypass lift station at Hanson Boulevard is constructed)

Location	Units Served	Additional Area	Additional Units	Total Units Served	% of Theoretical Maximum Capacity
Lift Station No. 4	285	244	513	798	100%
12" Bluebird Trunk	386	580	1,421	1,807	125%
15" Bluebird Trunk	640	580	1,421	2,061	90%
18" Bluebird Trunk	915	600	1,470	2,385	70%
12" Shadowbrook Trunk	455	152	372	827	46%
21" Coon Creek Trunk	784	152	372	1,156	19%
24" Coon Creek Trunk (before bypass LS)	2,489	752	1,842	4,331	65%
24" Coon Creek Trunk (after bypass LS)				1,730	26%
18" Pinewood Trunk	1123	176	431	2067	49%
24" Coon Creek Trunk (after Pinewood Trunk)				3797	57%
24" Crosstown Trunk	4533	304	745	5278	80%
18" Bunker Lake Trunk	695		2601	3296	96%
30" Bunker Lake Trunk				9090	56%

The advantage of this Alternative over the Yellow Pine Lift Station Alternative is that a new trunk lift station would not be required. The disadvantage of this Alternative, as shown in Table No. 11, is that the projected flow exceeds the theoretical maximum capacity of the 12" gravity sewer on 150th Lane by 25%. Reducing the density from 2.45 to 2.07 units per acre would reduce the projected flow to within 10% of the maximum theoretical capacity of the 12" gravity sewer on 150th Lane.

A pump upgrade for the lift station will be required once the Lift Station No. 4 service area exceeds 530 units. If the Lift Station No. 4 Rerouting Alternative is implemented, the pump upgrade should consider new head conditions resulting from a rerouted forcemain.

The Opinion of Probable Cost for the Lift Station No. 4 Rerouting Alternative is \$2,472,443. This includes an estimated cost of \$1,060,949 for the 12" gravity sanitary

sewer on Crosstown Boulevard, \$831,692 for the 12" 150th Lane Trunk Extension, and \$579,802 for the forcemain.

VI. RECOMMENDATION

Five of the Alternatives (B, C, D, F, and G) examined have sufficient sewer capacity to accommodate the anticipated future flows, assuming that the area develops at a net density of 2.45 units per acre. The remaining three Alternatives (A, E, and H) do not currently have sufficient sewer capacity and reducing the net development density would be required in order to prevent overloading the sanitary sewer system. For Crosstown Boulevard (Alternative A), the net development density would have to be reduced to 1.70 units per acre; for 150th Lane (Alternative E) a reduction to 0.70 units per acre would be required, or for Lift Station No. 4 Rerouting (Alternative H) a net development density reduction to 2.07 units per acre would be required. However the City has indicated reducing the net development density is not a viable option, therefore those Alternatives are not feasible.

Of the five viable Alternatives remaining, the Prairie Road, Prairie Road No. 2, and Yellow Pine Lift Station Alternatives are the most economical. The recommended Alternative is the Yellow Pine Lift Station Alternative because it maximizes the utilization of the existing trunk sewers and provides the City with the flexibility to accommodate the timing of developing areas. The City has the ability to install segments of the trunk lines to serve areas adjacent to Crosstown Boulevard as they develop, without having to construct the entire trunk extension. This would be required for both the Prairie Road Alternative and the Prairie Road No. 2 Alternative.

APPENDIX

**Sewer Capacity Analysis
Sanitary Sewer Analysis East of Hanson Blvd
City of Andover, Minnesota
Commission No. 12974-01**

UNITS SERVED ACCORDING TO DEVELOPMENT

	Bluebird Trunk			Pinewood	Coon Creek Trunk			Crosstown	Bunker Lake Trunk	
	12"	15"	18"	18"	12"	21"	24"	24"	18"	30"
Winslow Hills 2nd Addition	55									
Winslow Hills 3rd Addition	55									
Chesterson Commons	220									
<i>Cambridge</i>	56									
<i>Lift Station No. 4</i>	285									
12" Bluebird Trunk		671								
Elementary School		88								
Winslow Hills 3rd Addition		67								
Oak Bluff		99								
15" Bluebird Trunk			925							
Hartfiel's/Sharon's/Fox Woods			133							
Old Colony/Creekview			142							
Middle School/City Complex				139						
Pinewood Estates				174						
Andover Boulevard				23						
West of City Complex				21						
Woodland Estates				165						
<i>Woodland Estates 2nd Addition</i>				70						
<i>Woodland Estates 4th Addition</i>				78						
<i>Grey Oaks</i>				352						
<i>Fox Hollow</i>				101						
<i>Shadowbrook</i>					455					
12" Coon Creek Trunk						455				
Hills of Bunker Lake 5th						134				
<i>Cherrywood Estates</i>						26				
Crown Pointe East						169				
21" Coon Creek Trunk							784			
Crown Pointe							49			
Weybridge							135			
Foxberry/Jonathon							120			
Hills of Bunker Lake							373			
Anoka County							42			
Hanson Blvd Commercial							60			
140th Lane NW							11			
18" Bluebird Trunk							1,200			
18" Pinewood Trunk								1,123		
24" Coon Creek Trunk								2,774		
Kensington Estates								233		
Red Oaks/Northwoods								503		
East of Red Oaks									195	
Andover Station/Kottke									500	
18" Bunker Lake Trunk										695
Red Oaks 5th										67
Hidden Creek										365
Andover Commercial Park I										84
24" Crosstown Trunk										4,633
Units Served	671	925	1,200	1,123	455	784	2,774	4,633	695	5,844
Available Capacity	773	1,364	2,230	3,121	1,327	5,450	3,860	2,001	2,735	10,294

**Crosstown Boulevard Trunk
Opinion of Probable Cost
Sanitary Sewer Analysis East of Hanson Boulevard
City of Andover, Minnesota
TKDA Commission No. 12974-01**

Item	Unit	Quantity	Unit Price	Total Amount
Mobilization	LS	1	\$ 35,000.00	\$ 35,000.00
Clearing and Grubbing	ACRE	1	\$ 4,000.00	\$ 5,990.82
Remove Bituminous Pavement	SY	15,016	\$ 3.00	\$ 45,046.67
Remove and Replace Curb and Gutter	LF	9,020	\$ 12.00	\$ 108,240.00
Aggregate Base Class 5	TON	5,203	\$ 10.00	\$ 52,028.90
Bituminous Base	TON	1,982	\$ 38.00	\$ 75,318.03
Bituminous Wear	TON	1,487	\$ 42.00	\$ 62,434.68
12" PVC Sanitary Sewer (14'-16')	LF	1,550	\$ 33.00	\$ 51,150.00
12" PVC Sanitary Sewer (19'-22')	LF	2,960	\$ 45.00	\$ 133,200.00
24" Steel Casing - Jacked	LF	150	\$ 150.00	\$ 22,500.00
Granular Pipe Bedding	CY	1,036	\$ 8.00	\$ 8,284.44
Connect to Existing Sanitary Sewer	EA	1	\$ 2,000.00	\$ 2,000.00
Std. Sanitary Manhole (0-10' Deep)	EA	13	\$ 1,900.00	\$ 24,700.00
Extra Depth Sanitary Manhole	LF	109	\$ 100.00	\$ 10,900.00
8" DIP	LF	250	\$ 30.00	\$ 7,500.00
Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
Sodding	SY	7,249	\$ 3.50	\$ 25,371.11
Dewatering	LS	1	\$ 25,000.00	\$ 25,000.00
Subtotal				\$ 709,664.65
15% Construction Contingency				\$ 106,449.70
Subtotal				\$ 816,114.34
Indirect Costs (30%)				\$ 244,834.30
Subtotal				\$ 1,060,948.65
Easement Acquisition				\$ -
Crosstown Boulevard Trunk Estimated Project Cost				\$ 1,060,948.65
Shadowbrook Trunk Project Cost				\$ 2,020,847.00
Crosstown Boulevard Alternative				\$ 3,081,795.65

**Prairie Road Trunk
Opinion of Probable Cost
Sanitary Sewer Analysis East of Hanson Boulevard
City of Andover, Minnesota
Commission No. 12974-01**

Item	Unit	Quantity	Unit Price	Total Amount
Mobilization	LS	1	\$ 75,000.00	\$ 75,000.00
Clearing and Grubbing	Acre	3.7	\$ 4,000.00	\$ 14,719.93
Remove Bituminous Pavement	SY	36,894	\$ 3.00	\$ 110,683.33
Remove and Replace Curb and Gutter	LF	6,200	\$ 12.00	\$ 74,400.00
Remove Watermain	LF	1,300	\$ 5.00	\$ 6,500.00
Aggregate Base Class 5	TON	12,784	\$ 10.00	\$ 127,839.25
Bituminous Base	TON	4,870	\$ 38.00	\$ 185,062.53
Bituminous Wear	TON	3,653	\$ 42.00	\$ 153,407.10
12" PVC Sanitary Sewer (11'-14')	LF	3,750	\$ 30.00	\$ 112,500.00
12" PVC Sanitary Sewer (14'-17')	LF	1,200	\$ 35.00	\$ 42,000.00
12" PVC Sanitary Sewer (17'-20')	LF	2,670	\$ 40.00	\$ 106,800.00
12" PVC Sanitary Sewer (20'-23')	LF	1,200	\$ 45.00	\$ 54,000.00
12" PVC Sanitary Sewer (26'-29')	LF	1,300	\$ 55.00	\$ 71,500.00
12" PVC Sanitary Sewer (29'-32')	LF	800	\$ 60.00	\$ 48,000.00
12" PVC Sanitary Sewer (32'-35')	LF	380	\$ 65.00	\$ 24,700.00
24" Steel Casing - Jacked	LF	150	\$ 150.00	\$ 22,500.00
Granular Pipe Bedding	CY	2,544	\$ 8.00	\$ 20,355.56
Connect to Existing Sanitary Sewer	Each	1	\$ 2,000.00	\$ 2,000.00
Std. Sanitary Manhole (0-10' Deep)	Each	30	\$ 1,900.00	\$ 57,000.00
Extra Depth Sanitary Manhole	LF	255	\$ 100.00	\$ 25,500.00
Lift Station	LS	1	\$ 200,000.00	\$ 200,000.00
8" DIP	LF	1,300	\$ 30.00	\$ 39,000.00
8" Gate Valve	Each	1	\$ 900.00	\$ 900.00
Hydrant	Each	3	\$ 1,700.00	\$ 5,100.00
Reconnect Water Service	Each	10	\$ 250.00	\$ 2,500.00
1" Water Service	LF	300	\$ 10.00	\$ 3,000.00
Temporary Water Service	LS	1	\$ 10,000.00	\$ 10,000.00
Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
Seeding	Acre	3.7	\$ 2,000.00	\$ 7,400.00
Dewatering	LS	1	\$ 25,000.00	\$ 25,000.00
Subtotal				\$ 1,642,367.70
15% Construction Contingency				\$ 246,355.15
Subtotal				\$ 1,888,722.85
Indirect Costs (30%)				\$ 566,616.86
Subtotal				\$ 2,455,339.71
Easement Acquisition				\$ -
Total Estimated Project Cost				\$ 2,455,339.71

**Prairie Road No. 2 Trunk
Opinion of Probable Cost
Sanitary Sewer Analysis East of Hanson Boulevard
City of Andover, Minnesota
Commission No. 12974-01**

Item	Unit	Quantity	Unit Price	Total Amount
Mobilization	LS	1	\$ 80,000.00	\$ 80,000.00
Clearing and Grubbing	Acre	3.7	\$ 4,000.00	\$ 14,719.93
Remove Bituminous Pavement	SY	36,894	\$ 3.00	\$ 110,683.33
Remove and Replace Curb and Gutter	LF	6,200	\$ 12.00	\$ 74,400.00
Remove Watermain	LF	1,300	\$ 5.00	\$ 6,500.00
Aggregate Base Class 5	TON	12,784	\$ 10.00	\$ 127,839.25
Bituminous Base	TON	4,870	\$ 38.00	\$ 185,062.53
Bituminous Wear	TON	3,653	\$ 42.00	\$ 153,407.10
12" PVC Sanitary Sewer (17'-20')	LF	3,750	\$ 40.00	\$ 150,000.00
12" PVC Sanitary Sewer (20'-23')	LF	1,200	\$ 45.00	\$ 54,000.00
12" PVC Sanitary Sewer (23'-26')	LF	2,670	\$ 50.00	\$ 133,500.00
12" PVC Sanitary Sewer (26'-29')	LF	1,200	\$ 55.00	\$ 66,000.00
12" PVC Sanitary Sewer (32'-35')	LF	1,300	\$ 65.00	\$ 84,500.00
12" PVC Sanitary Sewer (35'-38')	LF	800	\$ 80.00	\$ 64,000.00
12" PVC Sanitary Sewer (38'-41')	LF	380	\$ 100.00	\$ 38,000.00
24" Steel Casing - Jacked	LF	150	\$ 150.00	\$ 22,500.00
Granular Pipe Bedding	CY	2,544	\$ 8.00	\$ 20,355.56
Connect to Existing Sanitary Sewer	Each	1	\$ 2,000.00	\$ 2,000.00
Std. Sanitary Manhole (0-10' Deep)	Each	30	\$ 1,900.00	\$ 57,000.00
Extra Depth Sanitary Manhole	LF	429	\$ 100.00	\$ 42,900.00
Lift Station	LS	1	\$ 200,000.00	\$ 200,000.00
8" DIP	LF	1,300	\$ 30.00	\$ 39,000.00
8" Gate Valve	Each	1	\$ 900.00	\$ 900.00
Hydrant	Each	3	\$ 1,700.00	\$ 5,100.00
Reconnect Water Service	Each	10	\$ 250.00	\$ 2,500.00
1" Water Service	LF	300	\$ 10.00	\$ 3,000.00
Temporary Water Service	LS	1	\$ 10,000.00	\$ 10,000.00
Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
Seeding	Acre	3.7	\$ 2,000.00	\$ 7,400.00
Dewatering	LS	1	\$ 25,000.00	\$ 25,000.00
Subtotal				\$ 1,795,267.70
15% Construction Contingency				\$ 269,290.15
Subtotal				\$ 2,064,557.85
Indirect Costs (30%)				\$ 619,367.36
Subtotal				\$ 2,683,925.21
Easement Acquisition				\$ -
Total Estimated Project Cost				\$ 2,683,925.21

**150th Lane Trunk
Opinion of Probable Cost
Sanitary Sewer Analysis East of Hanson Boulevard
City of Andover, Minnesota
Commission No. 12974-01**

Item	Unit	Quantity	Unit Price	Total Amount
Mobilization	LS	1	\$ 20,000.00	\$ 20,000.00
Clearing and Grubbing	ACRE	1.0	\$ 4,000.00	\$ 4,000.00
Curb and Gutter	LF	6,200	\$ 8.00	\$ 49,600.00
Aggregate Base Class 5	TON	3,461	\$ 10.00	\$ 34,611.50
Bituminous Base	TON	1,319	\$ 30.00	\$ 39,556.00
Bituminous Wear	TON	989	\$ 30.00	\$ 29,667.00
12" PVC Sanitary Sewer (11'-14')	LF	1,200	\$ 30.00	\$ 36,000.00
12" PVC Sanitary Sewer (17'-20')	LF	1,450	\$ 40.00	\$ 58,000.00
12" PVC Sanitary Sewer (26'-29')	LF	300	\$ 55.00	\$ 16,500.00
24" Steel Casing - Jacked	LF	150	\$ 100.00	\$ 15,000.00
Granular Pipe Bedding	CY	689	\$ 8.00	\$ 5,511.11
Connect to Existing Sanitary Sewer	EA	1	\$ 2,000.00	\$ 2,000.00
Std. Sanitary Manhole (0-10' Deep)	EA	9	\$ 1,900.00	\$ 17,100.00
Extra Depth Sanitary Manhole	LF	57	\$ 100.00	\$ 5,700.00
Temporary Water Service	LS	1	\$ 10,000.00	\$ 10,000.00
Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
Seeding	ACRE	1	\$ 2,000.00	\$ 2,000.00
Dewatering	LS	1	\$ 25,000.00	\$ 25,000.00
Subtotal				\$ 385,245.61
15% Construction Contingency				\$ 57,786.84
Subtotal				\$ 443,032.45
Indirect Costs (30%)				\$ 132,909.74
Subtotal				\$ 575,942.19
Easement Acquisition	SF	204,600	\$ 1.25	\$ 255,750.00
150th Lane Trunk Estimated Project Cost				\$ 831,692.19
Crosstown Boulevard Trunk Project Cost				\$ 1,060,949.00
150th Lane Alternative				\$ 1,892,641.19

**Xeon Street Trunk
Opinion of Probable Cost
Sanitary Sewer Analysis East of Hanson Boulevard
City of Andover, Minnesota
Commission No. 12974-01**

Item	Unit	Quantity	Unit Price	Total Amount
Mobilization	LS	1	\$ 60,000.00	\$ 60,000.00
Clearing and Grubbing	ACRE	5.3	\$ 4,000.00	\$ 21,200.00
Remove Bituminous Pavement	SY	13,533	\$ 3.00	\$ 40,599.00
Remove Curb and Gutter	LF	8,400	\$ 4.00	\$ 33,600.00
Curb and Gutter	LF	15,200	\$ 8.00	\$ 121,600.00
Remove Watermain	LF	1,300	\$ 5.00	\$ 6,500.00
Aggregate Base Class 5	TN	8,485	\$ 10.00	\$ 84,854.00
Bituminous Base	TN	3,233	\$ 38.00	\$ 122,836.27
Bituminous Wear	TN	2,424	\$ 42.00	\$ 101,824.80
12" PVC Sanitary Sewer (11'-14')	LF	1,200	\$ 30.00	\$ 36,000.00
12" PVC Sanitary Sewer (17'-20')	LF	1,300	\$ 40.00	\$ 52,000.00
12" PVC Sanitary Sewer (20'-23')	LF	3,150	\$ 45.00	\$ 141,750.00
12" PVC Sanitary Sewer (23'-26')	LF	600	\$ 50.00	\$ 30,000.00
12" PVC Sanitary Sewer (26'-29')	LF	1,200	\$ 55.00	\$ 66,000.00
24" Steel Casing - Jacked	LF	150	\$ 150.00	\$ 22,500.00
Granular Pipe Bedding	CY	1,689	\$ 8.00	\$ 13,511.11
Connect to Existing Sanitary Sewer	EA	1	\$ 2,000.00	\$ 2,000.00
Std. Sanitary Manhole (0-10' Deep)	EA	19	\$ 1,900.00	\$ 36,100.00
Extra Depth Sanitary Manhole	LF	195	\$ 100.00	\$ 19,500.00
8" DIP	LF	1,300	\$ 30.00	\$ 39,000.00
8" Gate Valve	EA	2	\$ 900.00	\$ 1,800.00
Hydrant	EA	3	\$ 1,700.00	\$ 5,100.00
Reconnect Water Service	EA	20	\$ 250.00	\$ 5,000.00
1" Water Service	LF	600	\$ 10.00	\$ 6,000.00
Temporary Water Service	LS	1	\$ 10,000.00	\$ 10,000.00
Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
Sodding	SY	4,840	\$ 3.50	\$ 16,940.00
Seeding	ACRE	4.3	\$ 2,000.00	\$ 8,600.00
Dewatering	LS	1	\$ 25,000.00	\$ 25,000.00

Subtotal \$ **1,144,815.18**

15% Construction Contingency \$ 171,722.28

Subtotal \$ **1,316,537.45**

Indirect Costs (30%) \$ 394,961.24

Subtotal \$ **1,711,498.69**

Easement Acquisition SF 221,100 \$ 1.25 \$ 276,375.00

Xeon Street Trunk Estimated Project Cost \$ **1,987,873.69**

Crosstown Boulevard Trunk Project Cost \$ **1,060,949.00**

Xeon Street Alternative \$ **3,048,822.69**

**Shadowbrook Trunk
Opinion of Probable Cost
Sanitary Sewer Analysis East of Hanson Boulevard
City of Andover, Minnesota
Commission No. 12974-01**

Item	Unit	Quantity	Unit Price	Total Amount
Mobilization	LS	1	\$ 60,000.00	\$ 60,000.00
Clearing and Grubbing	Acre	2.4	\$ 4,000.00	\$ 9,449.04
Remove Bituminous Pavement	SY	28194	\$ 3.00	\$ 84,583.33
Remove and Replace Curb and Gutter	LF	7800	\$ 12.00	\$ 93,600.00
Aggregate Base Class 5	TON	9769	\$ 10.00	\$ 97,693.75
Bituminous Base	TON	3722	\$ 38.00	\$ 141,423.33
Bituminous Wear	TON	2791	\$ 42.00	\$ 117,232.50
12" PVC Sanitary Sewer (11'-14')	LF	600	\$ 30.00	\$ 18,000.00
12" PVC Sanitary Sewer (14'-17')	LF	800	\$ 35.00	\$ 28,000.00
12" PVC Sanitary Sewer (17'-20')	LF	1400	\$ 40.00	\$ 56,000.00
12" PVC Sanitary Sewer (20'-23')	LF	1100	\$ 45.00	\$ 49,500.00
12" PVC Sanitary Sewer (23'-26')	LF	500	\$ 50.00	\$ 25,000.00
12" PVC Sanitary Sewer (26'-29')	LF	800	\$ 55.00	\$ 44,000.00
12" PVC Sanitary Sewer (32'-35')	LF	1200	\$ 65.00	\$ 78,000.00
12" PVC Sanitary Sewer (35'-38')	LF	1700	\$ 80.00	\$ 136,000.00
12" PVC Sanitary Sewer (39'-41')	LF	500	\$ 100.00	\$ 50,000.00
24" Steel Casing - Jacked	LF	150	\$ 150.00	\$ 22,500.00
Granular Pipe Bedding	CY	1944	\$ 8.00	\$ 15,555.56
Lift Station Upgrade	LS	1	\$ 100,000.00	\$ 100,000.00
Connect to Existing Sanitary Sewer	Each	2	\$ 2,000.00	\$ 4,000.00
Std. Sanitary Manhole (0-10' Deep)	Each	18	\$ 1,900.00	\$ 34,200.00
Extra Depth Sanitary Manhole	LF	326	\$ 100.00	\$ 32,600.00
Temporary Water Service	LS	1	\$ 10,000.00	\$ 10,000.00
Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
Seeding	Acre	2.2	\$ 2,000.00	\$ 4,400.00
Dewatering	LS	1	\$ 25,000.00	\$ 25,000.00

Subtotal \$ **1,351,737.51**

15% Construction Contingency \$ 202,760.63

Subtotal \$ **1,554,498.13**

Indirect Costs (30%) \$ 466,349.44

Subtotal \$ **2,020,847.57**

Easement Acquisition \$ -

Shadowbrook Trunk Estimated Project Cost \$ **2,020,847.57**

Crosstown Boulevard Trunk Project Cost \$ **1,060,949.00**

Crosstown Boulevard Alternative \$ **3,081,796.57**

**Yellow Pine Lift Station
Opinion of Probable Cost
Sanitary Sewer Analysis East of Hanson Boulevard
City of Andover, Minnesota
Commission No. 12974-01**

Item	Unit	Quantity	Unit Price	Total Amount
Mobilization	LS	1	\$ 25,000.00	\$ 25,000.00
Curb and Gutter	LF	100	\$ 8.00	\$ 800.00
Aggregate Base Class 5	TON	112	\$ 10.00	\$ 1,116.50
Bituminous Base	TON	43	\$ 30.00	\$ 1,276.00
Bituminous Wear	TON	32	\$ 30.00	\$ 957.00
10" HDPE Sanitary Forcemain (Directional Drilled)	LF	3,100	\$ 40.00	\$ 124,000.00
15" PVC Sanitary Sewer (29'-32')	LF	100	\$ 65.00	\$ 6,500.00
Granular Pipe Bedding	CY	22	\$ 8.00	\$ 177.78
Connect to Existing Sanitary Sewer	Each	1	\$ 2,000.00	\$ 2,000.00
Outside Drop Manhole w/ Protective Liner	Each	1	\$ 10,000.00	\$ 10,000.00
Forcemain Cleanout Manhole	Each	4	\$ 7,500.00	\$ 30,000.00
Lift Station	LS	1	\$ 200,000.00	\$ 200,000.00
Temporary Pumping	LS	1	\$ 10,000.00	\$ 10,000.00
Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
Dewatering	LS	1	\$ 25,000.00	\$ 25,000.00

Subtotal \$ **451,827.28**

15% Construction Contingency \$ 67,774.09

Subtotal \$ **519,601.37**

Indirect Costs (30%) \$ 155,880.41

Subtotal \$ **675,481.78**

Easement Acquisition SF 10,000 \$ 1.25 \$ 12,500.00

Trunk Lift Station and Forcemain Cost \$ **687,981.78**

150th Lane Trunk Estimated Project Cost \$ **831,692.19**

Crosstown Boulevard Trunk Project Cost \$ **1,060,949.00**

Yellow Pine Lift Station Alternative \$ **2,580,622.97**

**Lift Station No. 4 Rerouting
 Opinion of Probable Cost
 Sanitary Sewer Analysis East of Hanson Boulevard
 City of Andover, Minnesota
 Commission No. 12974-01**

Item	Unit	Quantity	Unit Price	Total Amount
Mobilization	LS	1	\$ 25,000.00	\$ 25,000.00
Curb and Gutter	LF	100	\$ 8.00	\$ 800.00
Aggregate Base Class 5	TON	112	\$ 10.00	\$ 1,116.50
Bituminous Base	TON	43	\$ 30.00	\$ 1,276.00
Bituminous Wear	TON	32	\$ 30.00	\$ 957.00
8" HDPE Sanitary Forcemain (Directional Drilled)	LF	7,000	\$ 35.00	\$ 245,000.00
15" PVC Sanitary Sewer (29'-32')	LF	100	\$ 65.00	\$ 6,500.00
Granular Pipe Bedding	CY	22	\$ 8.00	\$ 177.78
Connect to Existing Sanitary Sewer	Each	1	\$ 2,000.00	\$ 2,000.00
Outside Drop Manhole w/ Protective Liner	Each	1	\$ 10,000.00	\$ 10,000.00
Forcemain Cleanout Manhole	Each	6	\$ 7,500.00	\$ 45,000.00
Temporary Pumping	LS	1	\$ 10,000.00	\$ 10,000.00
Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
Dewatering	LS	1	\$ 25,000.00	\$ 25,000.00
Subtotal				\$ 387,827.28
15% Construction Contingency				\$ 58,174.09
Subtotal				\$ 446,001.37
Indirect Costs (30%)				\$ 133,800.41
Subtotal				\$ 579,801.78
Easement Acquisition	SF		\$ 1.25	\$ -
Trunk Lift Station and Forcemain Cost				\$ 579,801.78
150th Lane Trunk Estimated Project Cost				\$ 831,692.19
Crosstown Boulevard Trunk Project Cost				\$ 1,060,949.00
Lift Station No. 4 Rerouting Alternative				\$ 2,472,442.97

**Pipe Bursting
Opinion of Probable Cost
Sanitary Sewer Analysis East of Hanson Boulevard
City of Andover, Minnesota
Commission No. 12974-01**

Item	Unit	Quantity	Unit Price	Total Amount
Mobilization	LS	1	\$ 30,000.00	\$ 30,000.00
Equipment Access Pits	LS	2	\$ 150,000.00	\$ 300,000.00
15" HDPE Sanitary Sewer (Pipe Bursting)	LF	815	\$ 150.00	\$ 122,250.00
6" Sanitary Sewer Service Connection to Existing Manhole	LF	150	\$ 12.00	\$ 1,800.00
EA	EA	2	\$ 2,000.00	\$ 4,000.00
Temporary Pumping	LS	1	\$ 40,000.00	\$ 40,000.00
Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
Subtotal				\$ 513,050.00
15% Construction Contingency				\$ 76,957.50
Subtotal				\$ 590,007.50
Indirect Costs (30%)				\$ 177,002.25
Subtotal				\$ 767,009.75
Easement Acquisition	SF		\$ 1.25	\$ -
Pipe Bursting Cost				\$ 767,009.75
Shadowbrook Trunk Project Cost				\$ 2,020,847.00
Crosstown Boulevard Trunk Project Cost				\$ 1,060,949.00
Pipe Bursting Alternative				\$ 3,848,805.75