



TO: Darwin Smith, Lake Stevens Sewer District  
 FROM: Mike Jauhola, Leigh Nelson  
 DATE: January 16, 2013  
 SUBJECT: City of Lake Stevens Downtown Framework Plan,  
 Sanitary Sewer Capacity

The City of Lake Stevens is in the process of updating its long-term vision for the Downtown Lake Stevens area. The following analysis will review the potential impacts to the sewer system operated by Lake Stevens Sewer District due to the changes in land use and density proposed in the plan. Deficiencies and upgrades to the sewer system both within and downstream of the area will be included.

**Existing and Future Development**

The City of Lake Stevens has provided an estimate of built floor areas with three areas of Downtown Lake Stevens, Downtown Core, Grade Road and Other for four land use types, Retail, Office/Employment, Residential and Public, for the years 2010 and 2030. These are shown in Tables 1 and 2.

**Table 1  
Downtown Current Development – 2010**

	Gross Building Area (SF)				<b>Total</b>
	Retail	Office/ Employment	Housing*	Public	
Downtown Core	130,000	20,000	100,000 (50 du) (148 Pop)	60,000	<b>310,000</b>
Grade Road	--	--	--	--	--
Other Downtown	--	--	670,000 (335 du) (995 Pop)		<b>670,000</b>
<b>TOTALS</b>	<b>130,000</b>	<b>20,000</b>	<b>770,000</b> <b>(385 du)</b> <b>(1,144 Pop)</b>	<b>60,000</b>	<b>980,000</b>

*\*Population is based on the average of 2.97 persons per household as per the 2010 Census. However, this is very conservative as multi-family or small lot housing, which is most of the expected new housing expected occur downtown, usually has fewer people per household.*

**Table 2  
Downtown Net Change from Current – 2010-2030**

	Gross Building Area (SF)				Total
	Retail	Office/ Employment	Housing*	Public	
Downtown Core	10,000	25,000	65,000 (33 du) (98 Pop)	--	<b>100,000</b>
Grade Road	5,000	25,000	80,000 (40 du) (119 Pop)	40,000	<b>150,000</b>
Other Downtown	--	--	215,000 (108 du) (321 Pop)		<b>215,000</b>
<b>TOTALS</b>	<b>15,000</b>	<b>50,000</b>	<b>360,000</b> <b>(181 du)</b> <b>(538 Pop)</b>	<b>40,000</b>	<b>465,000</b>

*\*This table shows the expected increase in square feet for retail, employment and government and the square feet, dwelling units and population increase for residential development expected over the next approximately 20 years.*

The number of residential units within the area was estimated assuming 2,000 square feet per unit. When compared to Snohomish County property records, this assumption appears to be more than double the average area per unit. For this analysis the number of existing residential units was determined using Snohomish County records and the number of future units assumed that each 1,000 square feet of new residential development is one equivalent residential unit (ERU).

The number of ERUs for non-residential land uses is determined assuming 3,394 square feet per ERU per the Commercial Water Use Analysis dated April 30, 2012 prepared by Lake Stevens Sewer District.

**Sewer Flows**

Sewer flows are calculated in order to identify capacity deficiencies in the sewer mains and lift stations downstream of the downtown area. Zoning was used to determine land uses and sewer flows for areas outside the downtown area that are tributary to the downstream sewer mains and to Lift Stations 1C and 2C.

The following assumptions are used to calculate sewer flows for the downtown areas in this analysis:

- Residential: 2.97 people/ ERU & 70 gallons/person/day (average)
- Commercial: 224 gallons/ERU/day (= 900cf/ERU/month) (average)
- Inflow & Infiltration: 1,100 gallon/acre/day
- Peaking Factor: 2.2 – 3.1, varies based on average sanitary flow

The following assumptions, as outlined in the *2007 Lake Stevens Sewer District Sanitary Sewer Comprehensive Plan (2007 Plan)*, are used to calculation sewer flows from outside the downtown area in this analysis:

- Residential: 2.97 people/ ERU & 70 gallons/person/day (average)
- Residential Inflow & Infiltration: 1,100 gallon/acre/day
- Peaking Factor: 2.2 – 3.1, varies based on average sanitary flow
- Commercial: 2,700 gallons/acre/day (peak)
- Schools: 16 gallons/student+staff/day (peak)

The projected peak hour sewer flow through each section of the sanitary sewer system is listed in Table 3. The sections of pipe that do not have capacity to convey this flow are highlighted in red on Figure 2.

The sewer flows to the two lift stations immediately downstream of the downtown area, LSs 1C and 2C, for the existing, 2030 and Buildout conditions (per the 2007 Plan) are listed in Table 4.

**Table 4**  
**Flows to LSs 1C & 2C (gpm)**

	<b>Current Capacity</b>	<b>Existing Tributary</b>	<b>2030</b>	<b>Buildout</b>
LS 1C	900 <sup>1</sup>	1,180	960	1,010
LS 2C	700	965 <sup>2</sup>	1,710	2,250

<sup>1</sup> The District utilizes a portable diesel pump to supplement the pumping capacity of LS 1C during high flow events.

<sup>2</sup> Existing tributary flow is calculated conservatively by adding the pumping capacity of the 5 upstream lift stations (650 gpm). These upstream stations can be sequenced to maintain system capacity.

It should be noted that currently, flows from LS 2C are also pumped by LS 1C. A new force main from LS 2C is proposed to route flows around LS 1C. For the 2030 and Buildout conditions, it is assumed that the new force main is in service.

### **Sewer System Upgrades**

Downtown Framework Plan  
Table 3 - Sewer Pipe Capacity

Upstream MH	Downstream MH	Pipe Diameter (in)	Pipe Length (LF)	Pipe Slope (%)	Mannings' Capacity (gpm)	Ex Total Flow (gpm)	2030 Total Flow (gpm)
Lift Station 1C							
A2A	LS#1	12	16	16.33%	6479	1176	958
A2	A2A	15	9	3.85%	5704	1176	958
Mitchell Road							
A3	A2	8	27	2.64%	884	291	643
G1	A3	8	256	4.96%	1211	238	502
G2	G1	8	252	4.76%	1187	238	502
G3	G2	8	222	2.79%	908	217	438
G4	G3	8	551	0.30%	298	217	438
118th Ave NE							
G5	G4	10	53	0.63%	783	217	438
G61	G5	8	215	5.42%	1266	17	26
G62	G61	8	242	7.91%	1530	8	12
20th Street NE							
G113	G62	8	118	3.32%	991	6	10
G63	G113	8	177	6.71%	1409	2	3
117th Ave NE							
G64	G63	8	121	5.79%	1309	2	3
N Lakeshore Drive							
B1	A2	15	304	0.43%	1906	896	364
B2	B1	15	392	0.15%	1126	896	364
B3	B2	15	407	0.15%	1126	896	364
B4	B3	15	356	0.14%	1088	896	364
B6	B4	15	192	0.19%	1267	894	361
B7	B6	15	165	0.13%	1048	891	356
B8	B7	15	222	0.14%	1088	890	352
B9	B8	15	67	0.24%	1424	887	348
B11	B9	15	272	0.14%	1088	886	343
B12	B11	15	269	0.83%	2649	878	333
B13	B12	8	83	0.60%	421	5	5
B91	B13	8	117	0.35%	322	4	4
B92	B91	6	172	1.38%	297	3	3
123rd Ave NE							
B14	B12	10	135	5.02%	2209	855	300
B20	B14	8	274	5.37%	1260	111	223
B22	B20	8	155	2.70%	894	101	204
B24	B22	8	252	2.58%	874	92	191
B25	B24	8	395	1.68%	705	2	4

Downtown Framework Plan  
Table 3 - Sewer Pipe Capacity

Upstream MH	Downstream MH	Pipe Diameter (in)	Pipe Length (LF)	Pipe Slope (%)	Mannings' Capacity (gpm)	Ex Total Flow (gpm)	2030 Total Flow (gpm)
20th Street NE							
B15	B14	8	452	0.35%	322	44	81
B16	B15	8	263	0.38%	335	40	65
B17	B16	8	267	4.95%	1210	31	48
B18	B17	8	267	6.08%	1341	18	33
B19	B18	8	181	7.84%	1523	5	9
LS 2C							
D1	PS	10	100	0.10%	312	965	1708
20th Street NE							
D13	D1	10	155	2.84%	1662	423	468
D15	D13	10	293	4.85%	2172	408	449
20th Street NE							
D2	D1	10	140	1.12%	1044	520	1190
D3	D2	8	247	1.92%	754	49	348
Hartford Road							
D6	D3	8	188	0.47%	373	48	347
Grade Road							
D7	D6	8	67	0.45%	365	32	50
D9	D7	8	287	0.36%	326	31	49
D10	D9	8	219	0.00%	17	30	48
D11	D10	8	357	0.17%	224	29	48
D12	D11	8	359	0.33%	312	23	39
D39	D12	8	412	0.29%	293	19	34
125th Ave NE							
C1	D2	10	322	0.27%	512	469	852
C2	C1	10	282	0.30%	540	444	751
18th Ave NE (east)							
C3	C2	8	355	0.68%	448	11	32
C4	C3	8	212	6.79%	1417	3	12
18th Ave NE (west)							
C5	C2	10	435	0.29%	531	434	722
Main Street							
C7	C5	10	279	0.35%	583	433	721
C10	C7	15	440	0.22%	1364	406	694

Downtown Framework Plan  
Table 3 - Sewer Pipe Capacity

Upstream MH	Downstream MH	Pipe Diameter (in)	Pipe Length (LF)	Pipe Slope (%)	Mannings' Capacity (gpm)	Ex Total Flow (gpm)	2030 Total Flow (gpm)
C19	C10	8	135	0.27%	283	268	485
16th Ave NE							
C11	C10	15	258	0.56%	2176	138	220
C12	C11	8	379	0.37%	331	136	217
C13	C12	8	372	0.40%	344	120	193
C16	C13	8	300	0.54%	400	83	155
C17	C16	8	151	12.57%	1928	5	6
C37	C17	8	311	0.40%	344	5	6
129th Ave NE							
C35	C37	8	355	0.68%	448	2	2
127th Ave NE							
C14	C13	8	392	0.96%	533	33	35
C15	C14	8	211	1.06%	560	2	2
Boys & Girls Club Parking Lot							
C141	C19	8	111	6.03%	1335	16	18
C142	C141	8	12	4.26%	1122	16	18
C143	C142	8	201	0.40%	344	16	18
C144	C143	8	407	0.39%	340	12	14
128th Drive NE							
C18	C16	8	407	0.39%	340	38	38
C38	C18	8	323	0.58%	414	38	38
C39	C38	8	68	0.62%	428	30	31
C40	C39	8	83	0.90%	516	30	31

Upgrades are required to both the gravity sanitary sewer conveyance system and pumped systems. Estimated project costs are shown below. Where these projects were included in the 2007 Plan and 2010 Amendment, the cost has been adjusted using the ENR Construction Cost Index (October 2007 = 8612, January 2013 = 9418).

In replacing the gravity systems, it is assumed that new pipes will be installed at the same slope as the existing systems. The following gravity sewer system projects are required to convey the projected sewer flows from the Downtown area:

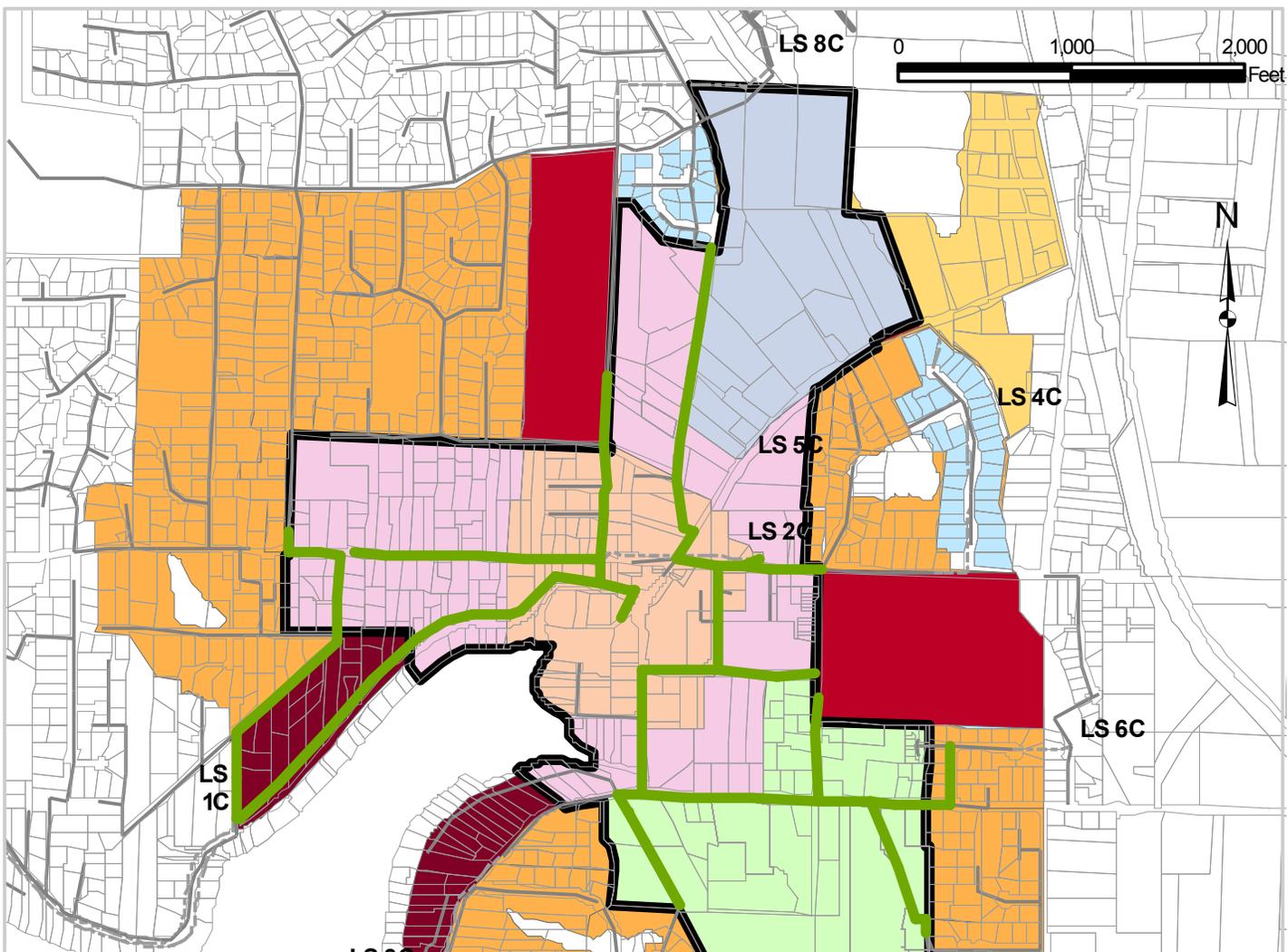
- Project E2-B – Replace approximately 1,560 feet of 10-inch diameter pipe with 12-inch diameter pipe in Main Street, 18<sup>th</sup> Street NE, 125<sup>th</sup> Avenue NE and 20<sup>th</sup> Street NE.  
**Estimated Project Cost - \$1,170,000**
- 16<sup>th</sup> Avenue NE – Replace approximately 135 feet of 8-inch diameter pipe with 12-inch diameter pipe on 16<sup>th</sup> Street NE, west of Main Street.  
**Estimated Project Cost - \$97,000**
- Mitchell Road – Replace approximately 550 feet of 8-inch diameter pipe with 10-inch diameter pipe in Mitchell Road south of 19<sup>th</sup> Street NE.  
**Estimated Project Cost - \$344,000**
- Hartford Drive – Install approximately 1,700 feet of 8-inch diameter sewer pipe in Hartford Drive, north of Grade Road.  
**Estimated Project Cost - \$990,000**

One section of very flat pipe in Grade Road was shown to have insufficient capacity but is not shown as being replaced because of the low flow through this section. Additionally, there are many portions of deteriorating concrete pipe within the Downtown area that will need to be rehabilitated or replaced in the future. These have not been identified in this analysis.

The following lift station projects (in order of priority for completion) as outlined in the 2007 Plan, are required to convey the projected sewer flows from the Downtown area:

- Projects E2- A – Construct new wet well storage for LS 2C and modify float controls at LSs 3C, 4C and 5C.  
**Estimated Project Cost - \$776,000**
- Projects E1- A – Increase capacity of LS 1C from 900 to 1,100 gpm by activating existing 8-inch diameter force main and replace auxillary generator.  
**Estimated Project Cost - \$285,000**

- Projects E2- C – Increase capacity of LS 2C from 700 to 1,000 gpm and construct 3,800 LF of 12-inch diameter force main to bypass LS 1C using existing 8-inch force main.  
**Estimated Project Cost - \$4,485,000**
- Projects E1-B – Rehabilitate components of LS 1C including wet well, dry pit, pumps, control panel and instrumentation.  
**Estimated Project Cost - \$897,000**
- Projects E2- E – Construct new 6,900 LF 12-inch force main downstream of LS 1C in Vernon Road, including 3,800 LF 8-inch diameter parallel force main and upgrade LS 2C.  
**Estimated Project Cost - \$5,065,000**
- Projects E1-C – Upgrade LS 1C by installing new impellers and utilizing new 8-inch diameter force main to be installed by Project E2-E.  
**Estimated Project Cost - \$26,000**



**LEGEND**

Downtown Pipes

**Existing Sewerlines:**

**DIAMETER**

- UNKNOWN PIPE SIZE
- 6" - 8" SEWER PIPE
- 10" SEWER PIPE
- 12" SEWER PIPE
- 15" - 18" SEWER PIPE
- 21" - 24" SEWER PIPE
- 30" - 36" SEWER PIPE
- FORCE MAIN

Downtown

**Downtown Areas**

- Built Out
- Core
- Grade Road
- Other

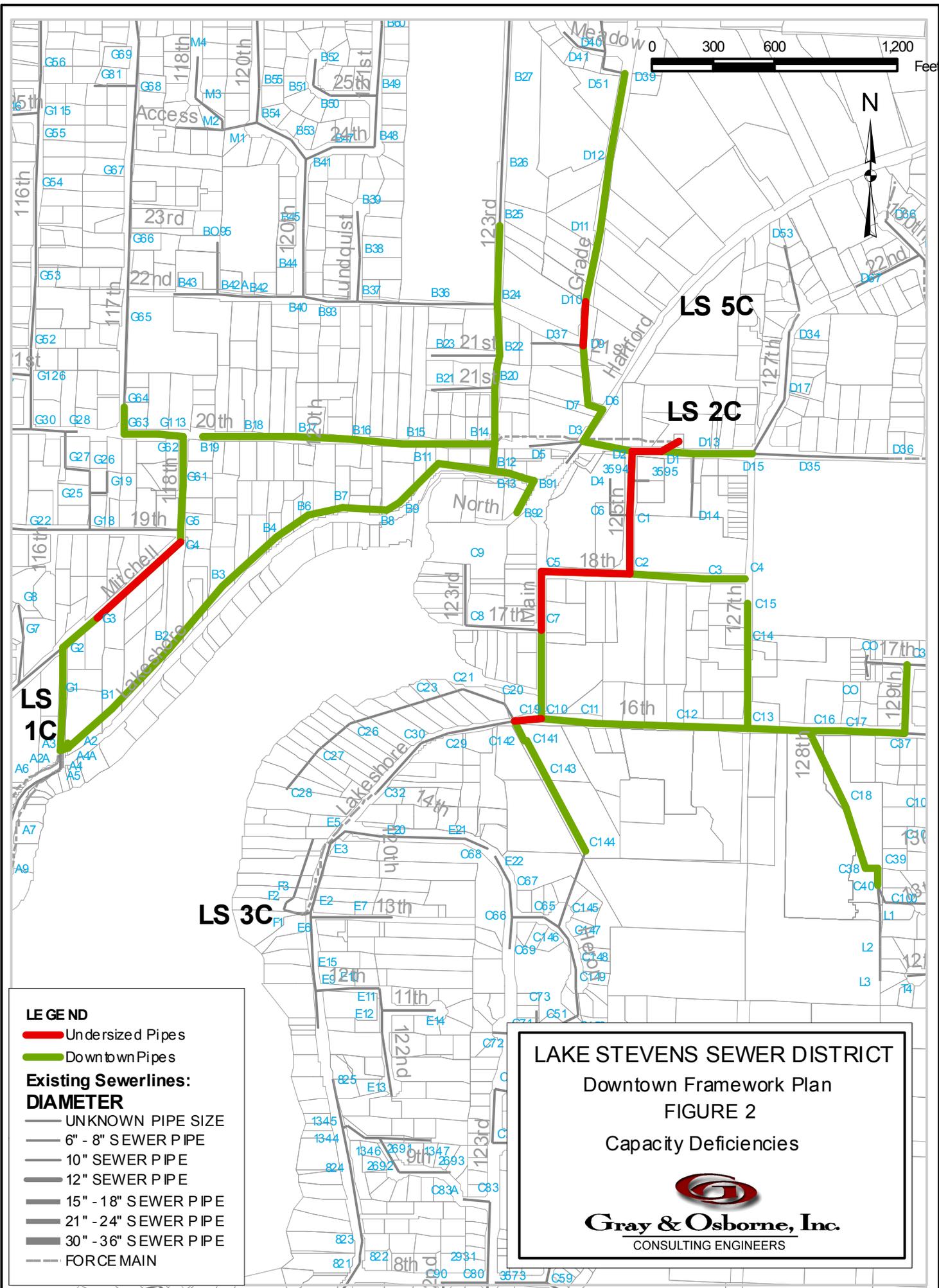
**Zoning - Outside Downtown Area**

- General Industrial
- High Density Residential
- Light Industrial
- Med Density Residential
- Mixed Use
- Planned Business District
- Public/ Semi-Public
- Waterfront Residential
- Existing Planned Areas

**LAKE STEVENS SEWER DISTRICT**  
 Downtown Framework Plan  
**FIGURE 1**  
 Sewer Capacity Analysis



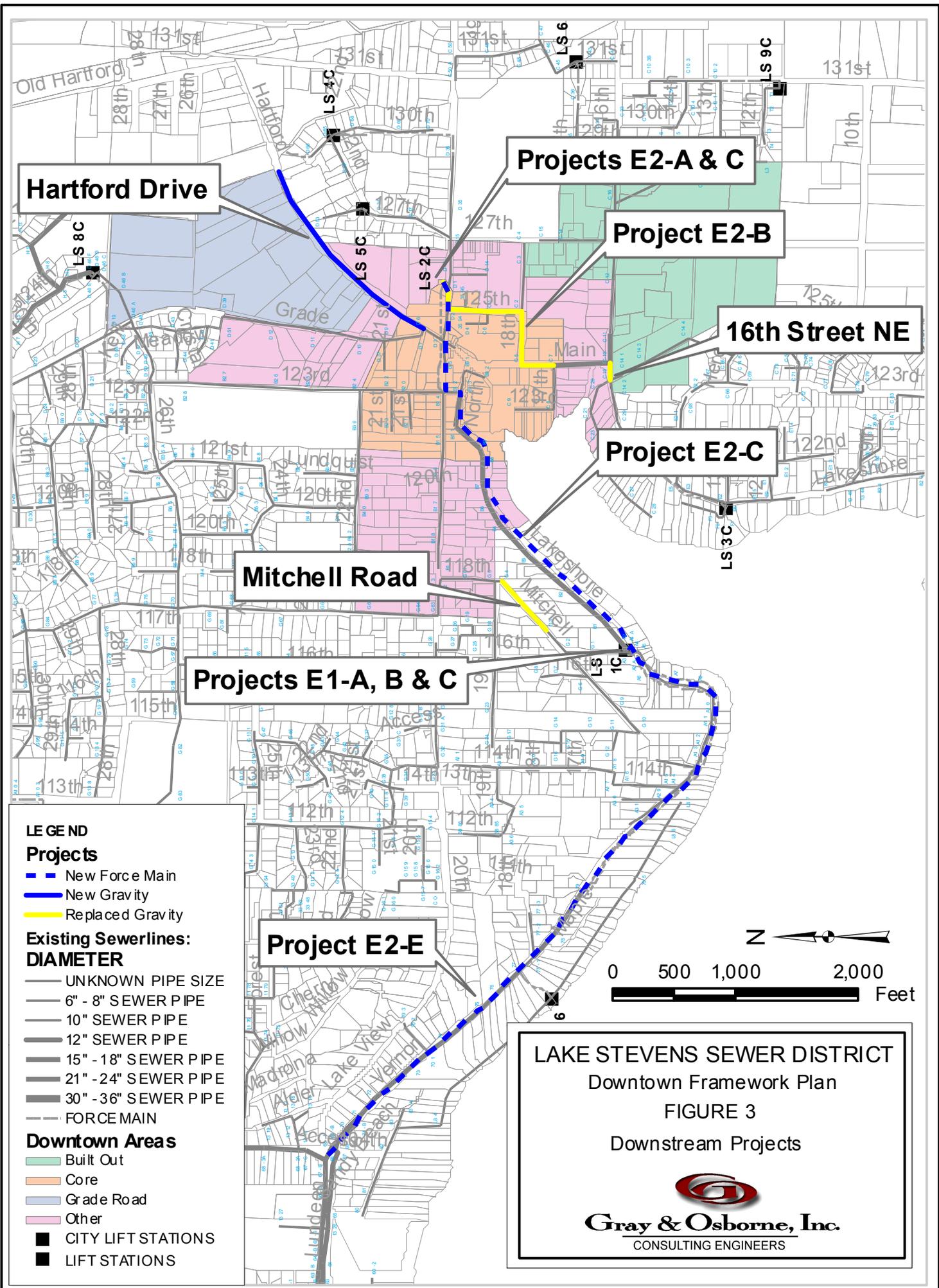
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- LEGEND**
- Undersized Pipes
  - Downtown Pipes
- Existing Sewerlines:**
- DIAMETER**
- UNKNOWN PIPE SIZE
  - 6" - 8" SEWER PIPE
  - 10" SEWER PIPE
  - 12" SEWER PIPE
  - 15" - 18" SEWER PIPE
  - 21" - 24" SEWER PIPE
  - 30" - 36" SEWER PIPE
  - FORCE MAIN

**LAKE STEVENS SEWER DISTRICT**  
 Downtown Framework Plan  
 FIGURE 2  
 Capacity Deficiencies

  
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**Hartford Drive**

**Projects E2-A & C**

**Project E2-B**

**16th Street NE**

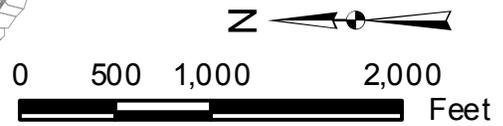
**Project E2-C**

**Mitchell Road**

**Projects E1-A, B & C**

**Project E2-E**

- LEGEND**
- Projects**
- New Force Main
  - New Gravity
  - Replaced Gravity
- Existing Sewerlines:**
- DIAMETER**
- UNKNOWN PIPE SIZE
  - 6" - 8" SEWER PIPE
  - 10" SEWER PIPE
  - 12" SEWER PIPE
  - 15" - 18" SEWER PIPE
  - 21" - 24" SEWER PIPE
  - 30" - 36" SEWER PIPE
  - FORCE MAIN
- Downtown Areas**
- Built Out
  - Core
  - Grade Road
  - Other
- CITY LIFT STATIONS
  - LIFT STATIONS



**LAKE STEVENS SEWER DISTRICT**  
 Downtown Framework Plan  
 FIGURE 3  
 Downstream Projects



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**Lake Stevens Sewer District  
Downtown Framework Plan  
Preliminary Cost Estimate  
16th Avenue NE, West of Main Street**

<u>Item</u>	<u>Quantity</u>		<u>Unit Cost</u>	<u>Total</u>
1 Mobilization/Demobilization	1	LS	\$ 6,000	\$ 6,000
2 Surveying, Staking and As-Built Dwgs	1	LS	\$ 900	\$ 900
3 Environmental Controls	1	LS	\$ 700	\$ 700
4 Trench Excavation Safety Systems	1	LS	\$ 900	\$ 900
5 Dewatering	1	LS	\$ 700	\$ 700
6 Temporary Bypass Pumping	1	LS	\$ 1,700	\$ 1,700
7 Traffic Control	1	LS	\$ 900	\$ 900
8 Locate Existing Utilities	1	LS	\$ 900	\$ 900
9 Removal of Structures and Obstructions	1	LS	\$ 4,500	\$ 4,500
10 12" PVC (Including bedding, backfill)	135	LF	\$ 90	\$ 12,150
in ROW	135			
in unimp easmnt	0			
11 48" Precast Manhole (Basic to 8')	2	EA	\$ 4,000	\$ 8,000
12 Connection to Existing Manhole	0	EA	\$ 2,500	\$ -
13 Special Excavation of Unsuitable Material	3	CY	\$ 40	\$ 120
14 Foundation Gravel	23	TN	\$ 25	\$ 575
15 Gravel Base	190	TN	\$ 25	\$ 4,750
16 Asphalt Treated Base	16	TN	\$ 150	\$ 2,400
17 Asphalt Concrete Pavement	11	TN	\$ 150	\$ 1,650
18 Sawcutting	280	LF	\$ 4	\$ 1,120
19 Planing Bituminous Pavement	380	SY	\$ 4	\$ 1,520
20 Hot Mix Asphalt	56	TN	\$ 120	\$ 6,720
21 Hydroseeding	0	SY	\$ 3	\$ -
Subtotal				\$ 56,205
Contingency (20%)				\$ 11,241
Subtotal				\$ 67,446
Sales Tax (8.5%)				\$ 5,733
Total				\$ 73,179
<b>Total Construction Cost (Rounded)</b>				<b>\$ 74,000</b>
All Overhead (30%)				\$ 23,000
<b>Total Project Cost (Rounded)</b>				<b>\$ 97,000</b>

**Lake Stevens Sewer District  
Downtown Framework Plan  
Preliminary Cost Estimate  
Mitchell Road, South of 19th Street NE**

<u>Item</u>	<u>Quantity</u>		<u>Unit Cost</u>	<u>Total</u>
1 Mobilization/Demobilization	1	LS	\$ 22,000	\$ 22,000
2 Surveying, Staking and As-Built Dwgs	1	LS	\$ 3,300	\$ 3,300
3 Environmental Controls	1	LS	\$ 2,800	\$ 2,800
4 Trench Excavation Safety Systems	1	LS	\$ 3,300	\$ 3,300
5 Dewatering	1	LS	\$ 2,800	\$ 2,800
6 Temporary Bypass Pumping	1	LS	\$ 6,900	\$ 6,900
7 Traffic Control	1	LS	\$ 3,500	\$ 3,500
8 Locate Existing Utilities	1	LS	\$ 3,300	\$ 3,300
9 Removal of Structures and Obstructions	1	LS	\$ 17,100	\$ 17,100
10 12" PVC (Including bedding, backfill)	550	LF	\$ 90	\$ 49,500
in ROW	550			
in unimp easmnt	0			
11 48" Precast Manhole (Basic to 8')	3	EA	\$ 4,000	\$ 12,000
12 Connection to Existing Manhole	0	EA	\$ 2,500	\$ -
13 Special Excavation of Unsuitable Material	11	CY	\$ 40	\$ 440
14 Foundation Gravel	91	TN	\$ 25	\$ 2,275
15 Gravel Base	770	TN	\$ 25	\$ 19,250
16 Asphalt Treated Base	64	TN	\$ 150	\$ 9,600
17 Asphalt Concrete Pavement	43	TN	\$ 150	\$ 6,450
18 Sawcutting	1,110	LF	\$ 4	\$ 4,440
19 Planing Bituminous Pavement	1,530	SY	\$ 4	\$ 6,120
20 Hot Mix Asphalt	228	TN	\$ 120	\$ 27,360
21 Hydroseeding	0	SY	\$ 3	\$ -
			Subtotal	\$ 202,435
			Contingency (20%)	\$ 40,487
			Subtotal	\$ 242,922
			Sales Tax (8.5%)	\$ 20,648
			Total	\$ 263,570
			<b>Total Construction Cost (Rounded)</b>	<b>\$ 264,000</b>
			All Overhead (30%)	\$ 80,000
			<b>Total Project Cost (Rounded)</b>	<b>\$ 344,000</b>

**Lake Stevens Sewer District  
Downtown Framework Plan  
Preliminary Cost Estimate  
Hartford Drive, North of Grade Road**

<u>Item</u>	<u>Quantity</u>		<u>Unit Cost</u>	<u>Total</u>
1 Mobilization/Demobilization	1	LS	\$ 61,000	\$ 61,000
2 Surveying, Staking and As-Built Dwgs	1	LS	\$ 11,000	\$ 11,000
3 Environmental Controls	1	LS	\$ 9,000	\$ 9,000
4 Trench Excavation Safety Systems	1	LS	\$ 11,000	\$ 11,000
5 Dewatering	1	LS	\$ 9,000	\$ 9,000
6 Temporary Bypass Pumping	1	LS	\$ 22,000	\$ 22,000
7 Traffic Control	1	LS	\$ 11,000	\$ 11,000
8 Locate Existing Utilities	1	LS	\$ 11,000	\$ 11,000
9 Removal of Structures and Obstructions	1	LS	\$ 53,000	\$ 53,000
10 8" PVC (Including bedding, backfill) in ROW	1,700	LF	\$ 65	\$ 110,500
in unimp easmnt	1,700			
	0			
11 48" Precast Manhole (Basic to 8')	7	EA	\$ 4,000	\$ 28,000
12 Connection to Existing Manhole	1	EA	\$ 2,500	\$ 2,500
13 Special Excavation of Unsuitable Material	32	CY	\$ 40	\$ 1,280
14 Foundation Gravel	290	TN	\$ 25	\$ 7,250
15 Gravel Base	2,400	TN	\$ 25	\$ 60,000
16 Asphalt Treated Base	200	TN	\$ 150	\$ 30,000
17 Asphalt Concrete Pavement	140	TN	\$ 150	\$ 21,000
18 Sawcutting	3,410	LF	\$ 4	\$ 13,640
19 Planing Bituminous Pavement	4,800	SY	\$ 4	\$ 19,200
20 Hot Mix Asphalt	710	TN	\$ 120	\$ 85,200
21 Hydroseeding	0	SY	\$ 3	\$ -
			Subtotal	\$ 576,570
			Contingency (20%)	\$ 115,314
			Subtotal	\$ 691,884
			Sales Tax (8.5%)	\$ 58,810
			Total	\$ 750,694
			<b>Total Construction Cost (Rounded)</b>	<b>\$ 760,000</b>
			All Overhead (30%)	\$ 230,000
			<b>Total Project Cost (Rounded)</b>	<b>\$ 990,000</b>