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The City of Rossland
1899 Columbia Avenue
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Attn: Mike Thomas, P.Eng, City Engineer

RE: WASHINGTON STREET INFRASTRUCTURE UPGRADING & REPAIR STUDY

WSA Engineering Ltd. would like to thank the City of Rossland for the opportunity to provide them with this study. We trust that the information provided here will be helpful to the City in their planning and grant applications for future infrastructure replacement and upgrading work.

We look forward to working with the City on future engineering projects.

Respectfully submitted,

WSA ENGINEERING LTD.

Ralf Waters, M. Eng., P. Eng.
Senior Civil Engineer

RW:er



The City of Rossland
Washington Street Infrastructure Upgrade &
Repair Study

Prepared for the City of Rossland by:



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1. INTRODUCTION

1.1 Purpose

WSA Engineering Ltd. (WSA), on behalf of the City of Rossland (the City), has completed the following infrastructure upgrade and repair study for Washington Street between Columbia Avenue and Plewman Way. Washington St. and Plewman Way have been identified as “Major Roads” in the City’s OCP because they provide a major access route through the City to the Red Mountain Ski Resort. Their road surface and the underground utility infrastructure are old and in need of repair or upgrading. New developments in the area are also making it necessary to upgrade some of the underground utilities. This report identifies upgrades and repairs to the existing infrastructure and road surface of Washington St. and Plewman Way that will be required within the next 20 years.

This report will assess the existing condition of the City’s underground infrastructure along Washington St. between Columbia Ave. and Plewman Way, including domestic water, sanitary sewer, and storm sewer. Surface features such as sidewalks, curb and gutter, and road surface drainage will also be assessed. Existing infrastructure details will be summarized and recommendations for upgrades and repairs will be provided. Cost estimates for recommended upgrades and repairs will be provided.

1.2 Method

WSA reviewed existing engineering reports and studies, mapping, and plans in order to determine required upgrades and repairs to the Washington St. infrastructure. The “City of Rossland – Master Drainage Plan” prepared by Reid Crowther & Partners Ltd. in 1995 was referred to for the storm water system. The “City of Rossland – Red Mountain Sector Planning Report” prepared by Urban Systems in 2003 was referred to for the sanitary sewer system. The “City of Rossland – Water Model Study” prepared by Urban Systems in 2008 was used to assess domestic water system upgrades.

Maps and plans provided by the City were reviewed with a representative from the Public Works Department to gain information about the condition of the existing infrastructure. WSA consulted with City representatives from the Public Works and Engineering Department to establish the City’s priorities for infrastructure upgrades along this route.

1.3 Background

The City of Rossland is located at the junction of Highway 22 and Highway 3B in the southern Kootenays, 10 km west of Trail and 10 km north of the US/Canada border on Highway 22 in the

Kootenay Boundary Regional District of British Columbia. It is a quiet residential town with a population of approximately 3,600. The City is currently experiencing significant growth and much of its infrastructure is old and in need of repair and/or upgrading.

2. ASSESSMENT

2.1 Inventory of Existing Domestic Water System

The existing domestic water system, consisting of mains, service connections, valves, and hydrants along Washington St. is old and in need of repairs and upgrades. The water main on Washington St. from Columbia Ave. to the intersection of Plewman Way consists of a 250mm dia. cast iron bell and spigot pipe with lead filled joints dating from around 1900. Some of the hydrants are sub-standard and hydrant leads are undersized. The City Public Works representative informed WSA that many of the water services are undersized, serve more than one dwelling, and require upgrading.

Between Columbia Ave. and 1st Ave., there are eleven existing commercial service connections. These services vary in size from 19mm to 150mm. Some of the service connections serve more than one building. There are three control valves located at the intersection with 1st Ave. where a 100mm asbestos-concrete (AC) main joins from the west and a 150mm cast iron main joins from the east.

Between 1st Ave. and 2nd Ave., there are six existing residential service connections of varying and unknown sizes. One of these services serves two homes. There is an upgraded hydrant located on the NE corner of Washington St. and 1st Ave. which is fed from the 150mm cast iron main on 1st Ave. with a 100mm lead. There is another upgraded hydrant located on the SE corner of Washington St. and 2nd Ave. which is fed from the Washington St. main with a 100mm lead. There are five additional control valves located at the intersection with 2nd Ave. One valve is on a 200mm AC main joining from the west and another is on a 100mm steel main joining from the west. There is also a 200mm cast iron main joining from the east with a control valve.

Between 2nd Ave. and 3rd Ave., there is one 25mm service connection which serves several homes to the west. There is a 100mm ductile main with a valve joining from an alley to the east.

Between 3rd Ave. and 4th Ave., there are four service connections of various sizes and materials. On the north side of 3rd Ave., is a 25mm copper service which serves several homes to the east. There is also a service in the middle of the block which serves two dwellings. There is a small service and a short section of main with a control valve that serves the school. There is an

upgraded hydrant at the NE corner of Washington St. and 3rd Ave. with a 100mm lead connecting to the cast iron main.

Between 4th Ave. and 5th Ave., there are four service connections of various sizes and materials. At the SW corner of Washington St. and 5th Ave. there is an old style hydrant with a 100mm lead to the main.

Between 5th Ave. and 6th Ave., there are six service connections of various sizes and materials. Several of these services serve more than one dwelling. At 6th Ave., the 250mm cast iron main joins with a 250mm AC main to the east and a 350mm AC main coming down Plewman Way. There is a 25mm service connection on the 350mm main which serves several dwellings on Turner Ave. to the west.

2.2 Inventory of Existing Sanitary Sewer System

The existing sanitary sewer system along Washington St. and Plewman Way consists of an old 200mm and 150mm vitrified clay (tile) main and tile services which require repairs and upgrades. There is a section of the tile main between Columbia Ave. and 1st Ave. which has been repaired with a PVC liner. Many of the sanitary manholes are constructed of brick, are in poor condition, and should be replaced.

Between Columbia Ave. and 1st Ave., the 200mm tile main runs down the center of the road with a parallel 100mm tile service connection which serves several of the commercial buildings on the east side. There are two brick manholes and one concrete manhole along this section. There is also a short section of 100mm main joining from the alley to the west and a main of unknown size coming under the building on the SE corner of Washington St. and 1st Ave.

Between 1st Ave. and 2nd Ave., the 200mm tile main moves to the east side of the road. There are four service connections of unknown size and/or material. There is a short main of unknown size and material that joins at the alley by house #2130 with no manhole. This main may service more than one dwelling. Just up the street from this junction, a 200mm main which services more than one building joins from the east with no manhole. At the alley south of 2nd Ave., a 100mm PVC main joins from the west and a 100mm tile main joins from the east at a concrete manhole. There is an abandoned tile service from the west just north of this manhole. A 100mm tile main joins south of 2nd Ave. with no manhole. This main services several buildings on the west side of the road north of 2nd Ave.

Between 2nd Ave. and 3rd Ave., there are no service connections but several mains join along the route. A 150mm PVC main joins from the alley on the east side at a concrete manhole. Just north of this manhole, a 150mm tile main joins with no manhole. This pipe comes down 3rd Ave. to the east and runs parallel to the 200mm Washington St. main before joining. There is an old brick manhole located on the south side of the intersection with 3rd Ave. A 150mm tile main joins at this manhole from 3rd Ave. to the west. This main services the Red Mountain Resort.

Between 3rd Ave. and 4th Ave., there two service connections joining the main from the east. Just north of the intersection with 3rd Ave., the main splits with no manhole into two parallel 200mm tile mains. One of these continues north under the sidewalk to a concrete manhole in Jubilee St. and turns to 200mm PVC to the east up Jubilee St. The other main continues north to a shallow manhole at the intersection with Jubilee St. A short stub of 150mm tile main from the west with no apparent service connections joins at this manhole. The 200mm tile main continues north from this manhole.

Between 4th Ave. and 5th Ave., there are no service connections. A 150mm tile main joins from the west on the north side of the 4th Ave. intersection with no manhole. This main services several homes in the neighborhood to the west of Washington St.

Between 5th Ave. and 6th Ave., the 200mm tile main crosses over to the west side of Washington St. and changes to a 150mm tile main at a manhole. There are two service connections from the west along this section of pipe. A 100mm tile main joins from the west at a manhole in the middle of the block.

On Plewman Way, there is a 150mm tile main coming from the NW which joins the 150mm Washington St. main at a shallow manhole at the NW corner of the intersection of Washington St. and Plewman Way. The 150 mm tile main has been upgraded to a 150mm PVC main uphill of house # 1970.

2.3 Inventory of Existing Storm Water System

The existing storm water system along Washington St. consists of a 380mm tile main from Columbia Ave. up to 3rd Ave. There is no storm water system between 3rd Ave. and 6th Ave. On Plewman Way, there is a 300mm steel storm main which continues down 6th Ave. to the east. The catch basins are old, spaced too far apart, and are not located to effectively capture the storm runoff. There are no proper storm water manholes along Washington St., with catch basins serving as manholes. There are no service connections from the commercial roof tops to the storm sewer.

Between Columbia Ave. and 1st Ave., there is a shallow 380mm tile main. There are two catch basins on the north side of the Columbia Ave. intersection. A 150mm storm pipe joins the main from the alley to the east. There is a catch basin located on the SE corner of the 1st Ave. intersection.

Between 1st Ave. and 2nd Ave., there are two catch basins on the north side of the 1st Ave. intersection which join the 380mm main. There is also a catch basin located at the SE corner of the 2nd Ave. intersection which is not effectively placed.

Between 2nd Ave. and 3rd Ave., a storm water pipe joins from the east on the north side of 2nd Ave. with a catch basin on the NE corner of the 2nd Ave. intersection. At 3rd Ave., a 450mm concrete storm main joins from the east. There are two catch basins located of the north side of the 3rd Ave. intersection.

On Plewman Way, there is a 300mm steel storm water main which continues down 6th Ave. to the east. There are a few catch basins along this main which ineffectively capture the storm water runoff.

2.4 Inventory of Existing Sidewalks, Curb and Gutter, and Road Surface Drainage

There currently exist some concrete and asphalt sidewalks and curb and gutter on Washington St. between Columbia Ave. and 4th Ave. Much of the sidewalk is in poor condition and the curb and gutter does not adequately function in directing the storm runoff to catch basins. Between Columbia Ave. and 1st Ave. there is a 3.4 m wide concrete sidewalk with curb and gutter on the west side. On the east side is a 3 m wide concrete sidewalk with curb and gutter. The roadway in this section is 15 m wide. Between 1st Ave. and 2nd Ave. there is 3.5 m wide asphalt sidewalk and curb on the west side. On the east side is 1 m wide concrete sidewalk with curb and gutter and a grass boulevard. Between 2nd Ave. and 3rd Ave. there is an asphalt sidewalk and curb of varying width on the west side and a 2 m concrete sidewalk and curb and gutter on the east side. Between 3rd Ave. and 4th Ave. there is a 1.8 m wide concrete sidewalk with curb and gutter on the east side of the roadway.

There is a total of approximately 1900 m² of existing sidewalk and 750 m of curb and gutter on Washington St. between Columbia Ave. and 4th Ave.

The road surface along the entire stretch of Washington St. between Columbia St. and Plewman Way is not crowned properly to ensure adequate runoff drainage during storms. Storm water runoff flows down the roadway and is not adequately captured by the poorly located existing catch basins.

3.0 RECOMMENDED UPGRADES/REPAIRS AND COST ESTIMATES

3.1 Domestic Water System Upgrades

Based on our inventory of the existing domestic water system on Washington St. and Plewman Way and on discussions with City personnel, WSA recommends that the entire 250mm cast iron water main be upgraded to 250mm PVC. This upgrade will begin at the existing 250mm AC main on Columbia Ave. and end at the 350mm AC main at the intersection with 6th Ave. We recommend that the new water main be located on the west side of Washington St. in order to assure adequate separation from the sanitary and storm sewers. A section of the 350mm AC main on Plewman Way will also need to be relocated and replaced with PVC pipe. Figure 1A and 1B show the location of the recommended upgrades and replacements.

We also recommend that all service connections, curb stops, and isolation valves be replaced. The existing commercial service connections should be replaced with a minimum 25mm for buildings with no fire sprinkler systems and 50mm dia. pipe for buildings with fire sprinklers. For domestic services, a minimum 20mm dia. pipe is required. Wherever water mains join from side streets, they shall be replaced with the same diameter of PVC pipe to the edge of pavement replacement on Washington St.

There are three existing fire hydrants along Washington St. which will require an upgrade of the leads to 150mm PVC. The hydrant at 5th Ave. should be upgraded along with the lead and a new hydrant and lead is required at the intersection with Plewman Way.

It is recommended that the old mains and services that are replaced be removed to facilitate the efficient installation of other underground utilities and future repairs on Washington St.

The results from the Urban Systems 2008 “Water Model Study” were consulted to help identify water system upgrades which may be necessary to provide adequate pressure and fire flows to new housing developments in Rossland. Scenario 1 of the study recommends increasing the 250mm dia. main on Washington St. to a 300mm PVC pipe. If the City chooses to implement Scenario 1, then our recommended upgrade should be changed to indicate a 300mm PVC main rather than the 250mm PVC pipe.

Table 1 lists the recommended water system upgrades for Washington St. Itemized cost estimates for all work required for recommended water system upgrades are included at the end of this report in Appendix A.

Table 1: Recommended Domestic Water System Upgrades			
Location	Number of services to be replaced	Hydrant assembly replacements	Recommended replacement material and dia.
Columbia Ave. to 1 st Ave.	7x25mm 3x50mm	0	114m of 250mm PVC 15m of 150mm PVC
1 st Ave. to 2 nd Ave.	7x20mm 1x150mm hydrant	0	145m of 250mm PVC 15m of 150mm PVC 10m of 100mm PVC
2 nd Ave. to 3 rd Ave.	1x150mm hydrant	0	88m of 250mm PVC 23m of 200mm PVC 28m of 100mm PVC
3 rd Ave. to 4 th Ave.	4x20mm 1x50mm 1x150mm hydrant	0	75m of 250mm PVC 25m of 150mm PVC 12m of 100mm PVC
4 th Ave. to 5 th Ave.	3x20mm	0	97m of 250mm PVC
5 th Ave. to 6 th Ave.	3x20mm 1x25mm 1x50mm 1x150mm hydrant	1	92m of 250mm PVC 17m of 200mm PVC
Plewman Way.	1x50mm 1x150mm hydrant	1	105m of 350mm PVC 17m of 250mm PVC

3.2 Sanitary Sewer Upgrades

The sanitary sewer system along Washington St. is in need of replacement and upgrades. The sanitary main consists of 200mm tile pipe from Columbia Ave. to 5th Ave, 150mm tile pipe up to the bottom of Plewman Way, and 100mm tile pipe part way up Plewman Way. We recommend that all of the tile pipe and services be replaced with PVC pipe. The new sanitary main should be located along the east side of Washington St. Figure 2A and 2B show the location of the recommended upgrades and replacements.

The “City of Rossland – Red Mountain Sector Planning Report” prepared by Urban Systems in 2003 lists the 200mm sanitary main on Washington St. between Columbia Ave. and 3rd Ave. as requiring an upgrade to a 250mm PVC pipe. We therefore recommend that this section of sanitary pipe be upgraded to 250mm PVC. We also recommend that the 200mm tile main from

3rd Ave. to 5th Ave. and the 150mm tile main from 5th to Plewman Way be upgraded to 200mm PVC. The 150mm tile pipe on Plewman Way should be upgraded to a 150mm PVC pipe up to a new manhole at house #1970. There are also sections of larger services and cross street mains that require upgrading to PVC pipe and/or to a larger diameter.

Between Columbia Ave. and 1st Ave. there is an existing 100mm tile service on the east side which serves several buildings. This should be upgraded to a 150mm PVC pipe or individual services should be installed if elevations permit. The 100mm tile main on the west side of Washington St. between 2nd Ave. and 3rd Ave. should be upgraded to a 150mm PVC pipe. The 150mm tile main coming from 3rd Ave. to the west should be upgraded to a 300mm PVC pipe. The 200mm dual mains between 3rd Ave. and 4th Ave. should be replaced with a single 200mm PVC pipe.

Table 2 provides a summary of recommended upgrades for Washington St. Itemized cost estimates for all work required for recommended sanitary sewer upgrades are included at the end of this report in Appendix A.

Table 2: Recommended Sanitary Sewer System Upgrades			
Location	Number of services to be replaced	Recommended replacement pipe and dia.	Number of new manholes
Columbia Ave. to 1 st Ave.	2x100mm	120m of 250mm PVC 10m of 150mm PVC	3
1 st Ave. to 2 nd Ave.	4x100mm	144m of 250mm PVC 20m of 200mm PVC 35m if 150mm PVC	6
2 nd Ave. to 3 rd Ave.	1x100mm	88m of 250mm PVC 151m of 150mm PVC	2
3 rd Ave. to 4 th Ave.	0	68m of 200mm PVC 46m of 300mm PVC	2
4 th Ave. to 5 th Ave.	0	111m of 200mm PVC 27 m of 150mm PVC	1
5 th Ave. to 6 th Ave.	2x100mm	90m of 200mm PVC 11m of 150mm PVC	1
Plewman Way.	0	12m of 200mm PVC 92m of 150mm PVC	3

3.3 Storm Water Sewer Upgrades

The Storm Water Sewer system along Washington St. is in need of replacement and upgrades. The entire system is made up of tile pipe and the existing catch basins are not effectively capturing the storm runoff. The City of Rossland's Master Drainage Plan prepared by Reid Crowther & Partners Ltd. in 1995 gives some recommendations for future upgrades to the storm sewer system on Washington Street. The report's "low priority" recommended upgrades includes upsizing the Washington St. main between Columbia Ave. and 3rd Ave. to 525mm PVC. According to the City, the current number and spacing of catch basins is inadequate for storm water removal.

Based on this information, we recommend that the existing 380mm tile storm main be replaced with a 525mm PVC main. The new main should be located in the center of Washington St. in order to provide adequate setback from the other underground utilities. In addition, all existing top inlet catch basins be upgraded to top and side inlet style and that the number of catch basins be increased to improve storm water capture. New precast manholes should be provided where catch basin leads join the new main and as shown in Figures 3A and 3B. The existing storm water mains on 2nd Ave. and 3rd Ave. will tie into the new 525mm main at new manholes.

Between Columbia Ave. and 1st Ave., there are several commercial buildings with flat roofs. It is believed that some of the roof leads from these buildings connect to the sanitary sewer. We recommend that the roof leads along this stretch of Washington St. be connected to the new 525mm PVC storm main.

Between 3rd Ave. and Plewman Way, a new storm water system should be constructed to control runoff down this section of Washington St. We recommend that a 450mm PVC main be installed up to the bottom of Plewman Way. A new 305mm PVC storm main should be constructed up Plewman Way as far as the existing catch basin near house # 1970. New side inlet catch basins should also be installed where shown in the attached drawings. At the intersection of Washington St. and 6th Ave., the storm water pipe will be directed down Washington St. rather than down 6th Ave. as is currently the case.

Table 3 lists the proposed storm sewer upgrades for Washington St. Itemized cost estimates for all work required for recommended storm water system upgrades are included at the end of this report in Appendix A.

Table 3: Recommended Storm Water System Upgrades				
Location	Number of new CBs with leads	Recommended new 150mm services	Number of new manholes	Recommended replacement pipe and dia.
Columbia Ave. to 1 st Ave.	4	12	3	125m of 525mm PVC
1 st Ave. to 2 nd Ave.	6	N/A	3	144m of 525mm PVC
2 nd Ave. to 3 rd Ave.	2	N/A	2	80m of 525mm PVC
3 rd Ave. to 4 th Ave.	2	N/A	0	76m of 450mm PVC
4 th Ave. to 5 th Ave.	2	N/A	1	97m of 450mm PVC
5 th Ave. to 6 th Ave.	4	N/A	2	220m of 450mm PVC
Plewman Way.	2	1	2	80m of 305mm PVC

3.4 Sidewalk, Curb and Gutter, and Road Surface Drainage Upgrades

The existing sidewalk and curb and gutter are in poor condition and do not provide adequate drainage into catch basins. Further more, the sidewalk and curb will need to be removed and replaced to facilitate the recommended water, sanitary and storm system upgrades. In order to improve the storm drainage system along Washington St., we recommend that new curb and gutter be installed along its entire length. We also recommend that the road prism be rebuilt to provide adequate cross slope and crown to facilitate good storm runoff drainage and capture in the recommended catch basin upgrades. We estimate that approximately 1400 lineal meters of new curb and gutter and 1900 m² of new sidewalk will be required to complete the infrastructure upgrade project. Figure 4A and 4B show the location of the recommended upgrades and replacements. These drawings also indicate where there is an opportunity to widen Washington St. between 4th Ave. and Plewman Way to 15 meters from the existing 11 meter width.

4.0 CONCLUSION

WSA's assessment of the City of Rossland's infrastructure along Washington St. between Columbia Ave. and Plewman Way indicates that significant upgrades and replacements are required.

The domestic water system is old and in poor condition and all mains and services are recommended for replacement. The City would like to replace the old cast iron bell and spigot with lead filled joints with PVC. There are also pipe sizing upgrades which have been identified in previous studies which should be completed during this project. The total cost for the recommended water system upgrades is estimated at \$256,500.00 (see Appendix A for a breakdown of costs).

The sanitary sewer system is old tile pipe and is undersized in some areas. The mains and services require upgrades and replacement. Sections of the sanitary sewer system have been identified in previous studies as requiring upgrades in order to handle increased flows from new developments at Red Mountain. We recommend that all mains and services be replaced with PVC pipe and that pipe sizes are upgraded as indicated in this report. The total cost for these upgrades is estimated at \$382,520.00 (see Appendix A for a breakdown of costs).

The storm water system is old and does not adequately control storm runoff. Much of Washington St. does not have curb and gutter with catch basins and there are often runoff problems during storms. Previous studies have indicated that some size upgrades are required along Washington St. Between Columbia Ave. and 1st Ave., there are some commercial roof drains which should be connected to the storm water main and there may be some cross-connections to the sanitary sewer that should be removed. We recommend that a new storm water main be installed and new catch basins added to provide good runoff capture. The total cost for these upgrades is estimated at \$444,550.00 (see Appendix A for a breakdown of costs).

All existing sidewalk and curb and gutter are recommended for replacement due to poor condition and to facilitate other infrastructure upgrades. New sidewalk, curb and gutter, and road surface profiles are recommended along much of Washington St. to improve storm runoff control. The total cost of the sidewalk, curb and gutter and road surface upgrades is estimated at \$450,860.00 (see Appendix A for a breakdown of costs).

A miscellaneous category is also included in the cost estimate which includes traffic control, duck-boards, signage and barriers, and removal/disposal of existing infrastructure. The cost for these miscellaneous items is estimated at \$135,000.00.

All cost estimates in this report are Class C estimates. These estimates were prepared with limited site information and are based on probable conditions affecting the project. These estimates are adequate for program planning and approval of design concepts. Due to the limited scope of this study and the possibility of additional costs being incurred during this work that are unaccounted for in this study, a contingency of 30% (\$500,829.00) has been added on to the total cost of the works listed above. Ten percent (\$166,943.00) has been added for engineering design services that will be required to complete the upgrade and replacement work. The total cost estimate for the recommended work in this report, including contingency and engineering is \$2,337,202.00

APPENDIX A – SCHEDULE OF QUANTITIES AND PRICES

FIGURES

Figure 1A & 1B - Recommended Water System Upgrades (1:1000)

Figure 2A & 2B - Recommended Sanitary System Upgrades (1:1000)

Figure 3A & 3B - Recommended Storm Water System Upgrades (1:1000)

Figure 4A & 4B - Recommended Sidewalk, Curb and Gutter, and Road Drainage Upgrades (1:1000)

Figure 5A - Composite Drawing of Recommended Upgrades and Replacements (1:1000)

Figure 5B - Composite Drawing of Existing Infrastructure and Recommended Upgrades and Replacements (1:1000)

Appendix A

City of Rosland - Washington Street Infrastructure Upgrade & Replacement Study

CLASS "C" COST ESTIMATES

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	SIDEWALK, CURB & GUTTER, AND ROAD SURFACE				
1	Remove existing asphalt - 12,180m ² - as a separate operation (estimated quantity based on location of recommended upgrades under Washington St.)	Cubic metre	1218	\$70.00	\$85,260.00
2	Sawcutting of asphalt and concrete	Lineal metre	300	\$7.00	\$2,100.00
3	Remove and dispose of concrete curbs and gutters as separate item (in areas affected by service upgrades only)	Lineal metre	750	\$6.00	\$4,500.00
4	Remove and dispose of concrete sidewalks as a separate operation (in areas affected by service upgrades only)	Square metre	1900	\$10.00	\$19,000.00
5	Supply and install new curb and gutter	Lineal metre	1400	\$80.00	\$112,000.00
6	Supply and install new sidewalk, 100mm thick, c/w granular base	Square metre	1900	\$120.00	\$228,000.00
	SUBTOTAL				\$450,860.00
	WATER WORKS				
1	Pipe - 350mm diam PVC, <u>imported</u> backfill	Lineal metre	105	\$350.00	\$36,750.00
2	Pipe - 250mm diam PVC, <u>imported</u> backfill	Lineal metre	628	\$250.00	\$157,000.00
3	Pipe - 200mm diam PVC, <u>imported</u> backfill	Lineal metre	40	\$200.00	\$8,000.00
4	Pipe - 150mm diam PVC, <u>imported</u> backfill	Lineal metre	55	\$180.00	\$9,900.00
5	Pipe - 100mm diam PVC, <u>imported</u> backfill	Lineal metre	50	\$120.00	\$6,000.00
6	Tie-in - all sizes	Each	13	\$2,000.00	\$26,000.00
7	Service connection - 20mm diam., all lengths	Each	17	\$2,000.00	\$34,000.00
8	Service connection - 25mm diam., all lengths	Each	8	\$2,000.00	\$16,000.00
9	Service connection - 50mm diam., all lengths	Each	6	\$2,500.00	\$15,000.00
10	Isolation Valves, all sizes	Each	19	\$2,000.00	\$38,000.00
11	Hydrant assembly	Each	2	\$3,500.00	\$7,000.00
12	Hydrant lead 150mm - c/w tee and isolating valve	Each	5	\$3,500.00	\$17,500.00
	SUBTOTAL				\$256,500.00
	SANITARY SEWER				

1	Pipe - 150mm diam. PVC, imported backfill.	Lineal metre	326	\$200.00	\$65,200.00
2	Pipe - 200mm diam. PVC at ___ to ___ m depth., imported backfill.	Lineal metre	301	\$220.00	\$66,220.00
3	Pipe - 250mm diam. PVC, imported backfill.	Lineal metre	352	\$275.00	\$96,800.00
4	Pipe - 300mm diam. PVC, imported backfill.	Lineal metre	46	\$300.00	\$13,800.00
5	Tie-in -all sizes to sewer or existing manhole	Each	14	\$2,000.00	\$28,000.00
6	Manhole base, lid, slab, cover and frame 1050mm diam.	Each	18	\$5,000.00	\$90,000.00
7	Service connection - 100mm diam., all lengths	Each	9	\$2,500.00	\$22,500.00
SUBTOTAL					\$382,520.00
STORM WATER					
1	Pipe - 305mm diam. PVC, imported backfill.	Lineal metre	80	\$250.00	\$20,000.00
2	Pipe - 450mm diam. PVC, imported backfill.	Lineal metre	393	\$300.00	\$117,900.00
3	Pipe - 525mm diam. PVC, imported backfill.	Lineal metre	349	\$350.00	\$122,150.00
4	Service connection 150mm diam., all lengths	Each	13	\$3,500.00	\$45,500.00
5	Tie-in - all sizes to sewer or existing manhole	Each	4	\$2,000.00	\$8,000.00
6	Manhole base, lid, slab, cover and frame 1050mm diam.	Each	13	\$5,000.00	\$65,000.00
7	Catch basin - side inlet c/w lead	Each	22	\$3,000.00	\$66,000.00
SUBTOTAL					\$444,550.00
MISCELLANEOUS					
1	Temporary duck-boards, signage, barriers (to be provided by contractor)	Lump Sum	1	\$20,000.00	\$20,000.00
2	Removal and disposal of existing infrastructure	Lump Sum	1	\$100,000.00	\$100,000.00
3	Traffic control	Day	30	\$500.00	\$15,000.00
SUBTOTAL					\$135,000.00

SUBTOTAL: \$1,669,430.00

CONTINGENCY + 30%: \$500,829.00

ENGINEERING + 10%: \$166,943.00

TOTAL: \$2,337,202.00