Trow

Sewer and Waterworks Rehabilitation, 2010 Resolute Bay, Nunavut August 26 to September 1, 2010

Prepared For:
Department of Community & Government Services
Government of Nunavut

Trow Associates Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Tel: (613) 688-1899 Fax: (613) 225-7337

Project No: OTT00020430A
Report date: September, 2010

Table of Contents

1. Contract Work **1**

1.1 Access Vault Cleaning 1

1.2 Backflow Preventer Installation 2

1.3 Leak Detection (Correlation) 3

1.4 CCTV Sanitary Line Inspection 4

2. Out-of-Contract Issues **6**

2.1 Chlorine in Water 6

2.2 Sanitary Connection – South Camp Inn 6

2.3 Fire Hydrants 6

2.4 Service Boxes 7

1. Contract Work

The scope of work for this project included:

1. The cleaning and sterilization of all access vaults (AVs) within the Hamlet;
2. The installation of 28 backflow preventers on all existing bleeds;
3. Leak detection on the entire watermain system; and,
4. CCTV inspection of the sanitary system.

1.1 Access Vault Cleaning

Overview

Access vault cleaning took place from August 26 to August 28, 2010 by Kudlik Construction Limited (Kudlik). A total of 4 personnel were used for various tasks throughout. Initially, all sanitary lines were flushed (three times in total). A sewage vacuum truck was then used to remove organic waste from the sanitary cleanouts and the AV interior. Stones and other large objects were removed manually. The interior of the structure (walls, ceiling and floor) was then sprayed with water and brushed to remove dirt and debris. Finally, the interior was sterilized with a chlorine solution. Small chlorine discs were placed on the floor of the structure. A total of 32 AVs were cleaned in their entirety.

Observations

1. Two AVs did not appear on the drawing. AV"A" was located north-west of AV20 and AV"B" was located south of the macerator. AV15, appearing on the drawing, was not located during the course of work.
2. AV44 runs to AV13 and not AV12 as indicated in the drawings.
3. During cleaning, some AVs were noted to contain sump pumps. These sump pumps did not appear to be in a serviceable condition and so were removed, in all cases.
4. AV"A", 40 and 41 contained ice. Half of the depth of the AV"A" structure contained ice. In AV 40 and 41, the floor, to a depth of about 300 mm, was ice. As a result, these AVs were only sterilized with the chlorine solution as full cleaning could not be carried out.
5. Line flushing could not be completed beyond ~10m from AV"A" or at all between AV 41 & 42.
6. AV 40, 41, 42, 43 and 44 did not have access ladders installed.

1.2 Backflow Preventer Installation

Overview

Backflow preventer installation on existing bleeds took place from August 29 to August 31, 2010 by Kudlik. Again, 4 personnel were used in various roles throughout installation. Work consisted of installation of new bleed lines (3/4" PE tubing), a new valve on the watermain end (3/4" ball valve), and the installation of the backflow preventer itself (3/4", 'KITZ', single-check, backflow preventer).

Installation commenced with the removal of the existing bleed line and valve. There existed a wide variety of sizes and materials used for previous maintenance on the bleeds. Kudlik had on hand several sizes of reducers, compression couplers, elbows, etc. However, due to the frequency of this scenario, there were not enough parts and incorrect parts on hand to complete all installation work. In some cases, the original valve was left installed onto the new bleed but left open, with a new valve installed following the original valve. Exact format of installation differs from AV-to-AV, however the basic outline is: a ball valve connected to the watermain end of the bleed; ¾" PE tubing is connected from the ball valve to the backflow preventer; the backflow preventer is mounted on to a raised position on the wall, using stainless steel wall clamps; tubing is then run from the backflow preventer to the sanitary cleanout, where it is connected to the cleanout through brass fittings.

Installation of backflow preventers was completed on the following AVs: 2, 4, 6, 7, 11, 12, 14, 16, 17, 19, 21, 23, 25 and 27. AVs that contained existing bleeds and where installation of backflow preventers could not be completed were AVs: 8, 28, 29, 30 and 40. AVs 42, 43 and 44 contained existing, incomplete bleed assemblies. Following installation, all bleed valves were opened between 30 – 100%. AV 11 was not opened as even very little flow caused the cleanout to spill over. During the same inspection, all cleanout lids were confirmed as being present and placed over top of the cleanouts.

Observations

1. A total of 14 backflow preventers were installed (of 22 existing, including the incomplete bleed assemblies).
2. 15 backflow preventers were left in the town's garage along with a mixture of ¾" to 1" elbows, tubing, compression couplers, tube inserts, wall clamps and ball valves.
3. It was stated by Aziz Kheraj, water system maintainer, that he would send a labourer around to all AVs to reduce the flow rate from the bleeds. Aziz stated that higher flow rates on the bleeds cause a significant pressure loss over the entire system.
4. AV6 contained 2 bleeds; 1 apparently redundant. 1 backflow preventer was installed but the second bleed could not be completely shut off or removed. As a result, there is a slight leak from the second bleed.

1.3 Leak Detection (Correlation)

Overview

Leak detection took place from August 28 to August 31, 2010 by Echologics. Chris Oates, Senior Field Specialist, conducted the investigation. Equipment used included: 2 transmitter and accelerometer/microphone assemblies, 1 receiver and laptop analysis system and 2 hydrophone transmitters.

First, the accelerometers are magnetically fixed to either end of a watermain run (known as "surface mounted"). If metal connections are not available, it is possible to attach the accelerometers to the watermain using a hook assembly. The accelerometers are then connected to the wireless transmitter. An audio check is conducted by connecting headphones to the transmitter to ensure proper installation. With the headphones connected, flow through the pipe can be heard as can any other vibrations.

Next, a flow test is conducted. This test was carried out in the new development area where it is suspected that leaks do not exist and is performed to determine a baseline for how a solid (leak-free) pipe "sounds". An accelerometer is connected to either end of a run, ideally where a fire hydrant is located. The software is then set to record the flow frequency. After analysing flow for 5 to 10 minutes, the analysis software calculates a benchmark frequency for a solid pipe. Watermain run distance (between transmitters), pipe material, density and average flow velocity are manually input as variables. Next, a leak is "created" by charging a fire hydrant. The location of the "leak" is then calculated by the software, using the variables defined by the user. These variables are not always known and sometimes require assumptions but can be determined by trial-and-error, using the known distance from one transmitter to the fire hydrant as the constant (i.e. if the "leak" location calculated by the software is the distance from one of the transmitters to the fire hydrant, then the variables used are considered correct). This entire process took place over a 4-hour period.

Leak detection is conducted throughout the entire system by using the above-mentioned technique. In most cases, leak locations can be confirmed by physically verifying the calculated location by using an accelerometer/microphone as a geophone. The microphone is placed directly over top of the leak, at ground level, in an attempt to "hear" the leak. Depending on where this technology is used, there can be interference from local excavation, traffic, wireless networks, radio frequencies, etc. The transmitters and receiver work on the 450MHz band. Transmitters and receivers can be up to 1 km apart to send/receive data.

Accelerometers can be used on lengths of pipe up to a maximum of 150 – 200m in length. From 150 – 300m in length, hydrophones can be used in place of accelerometers but these devices require the hydrophones to be in direct contact with water in the main. There also exists equipment for leak detection along much larger gauge and transmission lines. This equipment was not on hand for this project.

Observations

1. All water lines (minus frozen sections) were investigated.
2. Run from water treatment plant to AV2 was too long to allow for leak detection by accelerometers. Hydrophones were not able to be installed.
3. Leaks were detected in the following locations:
   a. 5m south of AV2 on supply side of water line;
   b. 8.1m north of AV21;
   c. 25.8m north of AV21;
   d. At fire hydrant of AV3;
   e. 1m north of AV6;
   f. 56m west of AV23, at civic address 44 service box;
   g. 7m south of AV23;
   h. 7m north-east of AV27;
   i. 8.5m south of AV7; and,
   j. 5m north AV10; and,
   k. 11m north of AV10.

1.4 CCTV Sanitary Line Inspection

Overview

CCTV inspection took place from August 30 to September 1, 2010 by Veolia. Two technicians conducted the investigation using a mini (man-fed) CCTV camera with 2 reels of cable and a video recording/computer system.

Inspection consisted of one technician feeding the camera from the cleanout within the AVs or from the macerator. The second technician analysed real-time video from the computer station. Overall, the sanitary system was reported to be in good condition. Frozen AVs and partially frozen lines (as reported in the Access Vault Cleaning section) led to the inability to inspect those sections.

Observations

1. The following was observed during the sanitary line survey:
   a. Blockage: between AV2 & AV3. Could not survey from 59m to 87m from AV2.
   b. Blockage: 3m south of AV21
   c. Gasket protruding: 6m south of AV4 at service connection.
   d. Water infiltration: service box for civic address 44 (between AV25 and AV23)
   e. Blockage: 25.5m east of AV28
   f. Hump: between AV16 & AV14. Could not survey from 28.5m to 42m east of AV16
   g. As stated above, no inspection possible from AV40 to AV42.

Several lengths of pipe as indicated on drawings were noted as incorrect, based on the CCTV survey. These will be included in the final report from Veolia.

2. Out-of-Contract Issues

It is our Professional Obligation to report matters when it is believed to represent a health and safety concern. Of primary concern was the lack of chlorine detected in the drinking water. A disconnected and exposed sanitary service line and the questionable serviceability of the system's fire hydrants are of further concern. Please see each item below for additional information.

2.1 Chlorine in Water

During leak detection, the technician from Echologics was attempting to confirm if water found on the surface of the road was from the watermain or if it was simply a pooling of ground water. On August 29, 2010, he took several samples between AV 27 and AV 28 over a suspected leak and tested them against a chlorine reagent. Results indicated no presence of chlorine. In an attempt to confirm if these results were indeed accurate, he later tested tap water again which again showed a negative result for the presence of chlorine.

Aziz Kheraj tested the tap water on August 29, 2010, using a reagent, showed a negative result. He then tested the level via electronic means which showed only 0.03ppm of chlorine. He stated that this would be taken care of but subsequent testing by Echologics on August 29 and 30, 2010, remained negative.

2.2 Sanitary Connection – South Camp Inn

It was observed that the sanitary service connection, north-east of the South Camp Inn has disconnected at a joint, leading to sewage runoff on the ground, near the service box for the South Camp Inn (north of AV 10).

2.3 Fire Hydrants

All fire hydrants were documented on August 30, 2010. The fire hydrants were not flow tested. However, it was mentioned by the Fire Chief that he is aware of approximately 3 hydrants that are no longer serviceable or are shut off. He could not describe the access vault location of the three.

The hydrant at AV5 has apparently been patched using a rubber fragment, held in place by a saddle.

The hydrant assembly at AV3 leaks from somewhere below the flange, when charged.

2.4 Service Boxes

While conducting further investigation work for leaks discovered around service boxes, it was noted that there is a variety of diameters and material used for service lines, valves, connections, etc. that are not documented. Some services appear to have been privately repaired. A service box was also noted as being buried by gravel (south-west corner of the elementary school, north of AV3).

Trow Associates Inc.

Curtis Roach, EIT
Field Services
Infrastructure Services

Steven Burden, P.Eng.
Manager – Municipal
Infrastructure Services

Appendix A:
List of Access Vaults

AV	CLEANED	EXISTING BLEED	BACKFLOW PREVENTER INSTALLED	COMMENTS
"A"	SANITIZED	N	N/A	Not on drawing/north of AV 21. AV half full of water and frozen.
2	Y	Y	Y	
3	Y	N	N/A	
4	Y	Y	Y	
5	Y	N	N/A	
6	Y	Y	Y	There existed 2 bleeds on line. One bleed was replaced, second bleed leaks.
7	Y	Y	Y	
8	Y	Y	N	Insufficient materials to complete backflow preventer installation.
9	Y	N	N	
10	Y	N	N	
11	Y	Y	Y	
12	Y	Y	Y	
13	Y	N	N/A	
14	Y	Y	Y	
16	Y	Y	Y	
17	Y	Y	Y	
18	Y	N	N/A	
19	Y	Y	Y	
20	Y	N	N	
21	Y	Y	Y	Original gate valve left in place.

AV	CLEANED	EXISTING BLEED	BACKFLOW PREVENTER INSTALLED	COMMENTS
23	Y	Y	Y	
25	Y	Y	Y	
27	Y	Y	Y	
28	Y	Y	N	Insufficient materials to complete backflow preventer installation.
29	Y	Y	N	Insufficient materials to complete backflow preventer installation.
30	Y	N	N/A	
32	Y	N/A	N/A	Sanitary line only.
33	Y	N/A	N/A	Sanitary line only.
34	Y	N/A	N/A	Sanitary line only.
35	Y	N/A	N/A	Sanitary line only.
40	SANITIZED	Y	N	Frozen. No access ladder.
41	SANITIZED	N	N/A	Frozen. No access ladder.
42	Y	Y	N	Insufficient materials to complete backflow preventer installation. No access ladder.
43	Y	Y	N	Existing bleed consists of valve only. Insufficient materials to complete backflow preventer installation. No access ladder.
44	Y	Y	N	Existing bleed consists of valve only. Insufficient materials to complete backflow preventer installation. No access ladder.
"B"	N	N/A	N/A	Not on drawing/south of macerator. Structure is walls and ceiling only. Sanitary only.