KELLER ENGINEERING

PIPE LINING FEASABILITY REPORT
CARLETON CONDOMINIUM CORPORATION NO. 145
OTTAWA ONTARIO

File # 1220675
December 12th, 2022

Ottawa / Kingston / Calgary
www.kellerengineering.com

PIPE LINING FEASABILITY REPORT

1.0 TERMS OF REFERENCE

Keller Engineering investigated the application of sanitary pipe lining at Carleton Condominium Corporation No. 145 (CCC 145), located at 151 Bay Street, in Ottawa, Ontario. Our mandate was to determine the feasibility of lining the sanitary stack pipes throughout the building in comparison to performing a full replacement and provide recommendations.

2.0 LIMITATIONS

This report is based on, and limited to, verbal information supplied to Keller Engineering by the Property Manager and Contractors, visual observations made during our inspections of the building, and the contents of our previous report #1210306 “Sanitary Drainpipe Condition Assessment“ issued May 2, 2022. Only those items that can be observed and are reasonably obvious to Keller Engineering or have been otherwise identified by other parties and listed during this investigation are included in this report.

No destructive testing or inspection openings were made as part of this assessment, and it is noted that large portions of building components were obstructed by interior finishes at the time of previous inspections.

The work reflects Keller Engineering’s best judgement in light of the information reviewed. There is no warranty expressed or implied by Keller Engineering that this assessment will uncover all potential deficiencies and risks of liabilities associated with the subject property. Keller Engineering believes, however, that the level of review carried out in this assessment is appropriate to meet the objectives as outlined in the Terms of Reference. We cannot guarantee the completeness or accuracy of information supplied by any third party.

This report has been prepared for the sole use of Carleton Condominium Corporation No. 145, and cannot be reproduced or otherwise used by any third party unless approval is obtained from Keller Engineering. No portion of this report may be used as a separate entity; it is written to be read in its entirety.

Detailed technical specifications and drawings should be prepared by a qualified professional for any work decided upon as a result of this report.

Keller Engineering is not a professional quantity surveyor, cost estimator, or construction contractor. Construction probable costs outlined below are budget figures only, based on the current market conditions, and are in present dollars. All estimated costs are before taxes. The actual costs of construction may vary considerably depending on the time of year when tendering is conducted, the actual detailed scope of work and the economic climate of the construction industry.

3.0 INTRODUCTION

Based on our previous investigation and report “Sanitary Drainpipe Condition Assessment“ issued May 2, 2022, it was determined that the sanitary drain piping at Carleton Condominium Corporation No. 145 (CCC 145) has reached the end of its service life. The building representatives have reported multiple isolated sanitary drainpipe leaks throughout the building, and the condition of the sanitary pipes is expected to continue to deteriorate at an advanced rate, which will result in the number of leaks and potential water damage to increase over time. It was recommended that a sanitary piping replacement be undertaken before widespread sanitary system leaks worsen and cause more frequent mess and damage throughout the building.

Keller approached a pipe lining company to review the possibility of installing cured in place pipe lining (CIPP) on the vertical drain stacks of high rises, as a potential solution which would forgo the requirements of a complete replacement. This option was reported to CCC 145 as a possible cost saving solution, however the application was only a partial solution that would not address all the problems that are affecting the sanitary piping at CCC 145. The representatives of CCC 145 decided this option warranted additional research due to the anticipated lower cost and requested that Keller Engineering perform a more detailed investigation into the feasibility of pipe lining at CCC 145.

4.0 SUMMARY

Benefits of pipe lining

- Reduced construction time and occupant impact due to fewer wall openings and reduced interior finish removals.
- Initial installation cost is lower than vertical stack only replacement, due to the reduction of interior finish removals.
- Lined sections of cast iron pipe extend the service life of the existing pipe by reducing the frequency of pipe failures and leakage.

Drawbacks of pipe lining

- Limited number of companies perform vertical stack lining services in the region, which would make competitive bidding impossible.
- Lining the main stacks doesn’t address the aging branch piping and reoccurring clogs in the stack connections.
- If the sanitary branch piping is replaced as part of the project, there are no cost savings to pipe lining.
- Water penetrating between the liner and existing cast iron pipe can cause corrosion to continue and allow future leaks in the system to continue.
- Pipe lining is a temporary measure and complete sanitary piping system replacement still needs to be budgeted for in the future.

5.0 DISCUSSION & CONCLUSIONS

Cast in place pipe lining (CIPP) technology was developed in the early 1970s and first patented in 1975. Since then, it has grown in popularity as a method of repairing or restoring underground drain piping in difficult to access locations. There are several companies who produce CIPP systems, each with their own materials, resins, and methods of application, however they all follow the same basic principals. Typical CIPP systems use fabric sleeve impregnated with resin that is

inserted into the pipe, then the sleeve is expanded to fill the pipe and the resin is cured to harden the material. This forms a composite pipe within the original cast iron pipe, sealing leaks and cracks, and restoring flow in the pipe. In theory, this should extend the pipe's service life by protecting it from further corrosion and scale which cause leaks and blockages.
In below ground sanitary and sewer applications CIPP is a proven technology that is widely used. Many municipalities, including the City of Ottawa, use this technology to help extend the service life of their existing below ground sewer piping. CIPP is also gaining popularity in repairing and maintaining main sanitary lines from buildings to the city sewer system. Replacing main sanitary drain piping to the sewer typically involves removing sections of basement concrete floors and excavating deep holes from the building to the street to access the pipes. In these applications the piping is typically straight runs of larger diameter piping with few or no lateral connections. It should be noted that in underground applications small amounts of leakage are unlikely to present problems and the primary concern with below ground piping is that flow is not obstructed. In these instances, CIPP can offer significant cost savings versus complete replacement of pipes.

Multi-floor buildings such as CCC 145 have large vertical primary drainpipes referred to as stacks which extend the height of the building. On each floor there is smaller branch piping which connects each drain point to the main stack. The wastewater flows from the branch piping inside each unit, into the shared stack where it runs down to the main building drain, and ultimately to the city sewer. There is a parallel vent stack which connects to each fixture branch arm downstream of the p-trap to equalize pressure in the system. Figure 1 shows the typical stack, branch, and vent piping configuration for a multi level building.

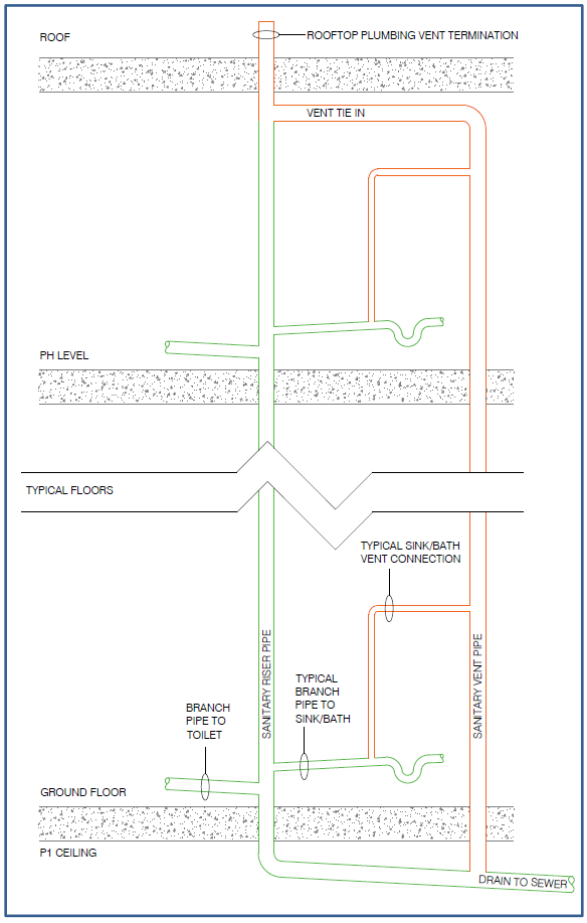

Figure 1 Typical sanitary piping configuration. The typical floors have been omitted for clarity.

This layout means that the main sanitary stacks have smaller lateral branch connections on each floor, with some washroom stacks having as many as 3 lateral connections per floor and the typical vent stacks have 1 or 2 lateral connections per floor. These lateral connections pose a significant challenge to lining vertical piping stacks and it is estimated there are as many as 1,700 branch connections at CCC 145. When lining vertical stacks, the two common methods of handling the branch connections are gapping and connection reinstatement.

Gapping Method

The gapping method is when sections of pipe liner are installed in straight sections of pipe between the branch connection points. The liner can be inserted through existing cleanouts if available. If cleanouts are not available, wall openings and pipe modifications will be required every few floors to install the required cleanouts. This method has the disadvantage that it creates gaps in the pipe liner at each branch connection point as shown in Figure 2. While the majority of the piping is lined, these discontinuities leave sections of pipe unprotected, as well as possible intrusion points for water to get behind the liner. The liner is a close fit to the interior diameter of the pipe however it is not necessarily bonded to the pipe surface. Water seeping between the liner and cast-iron pipe can continue corroding the pipe and lead to future system leakage and pipe failure.

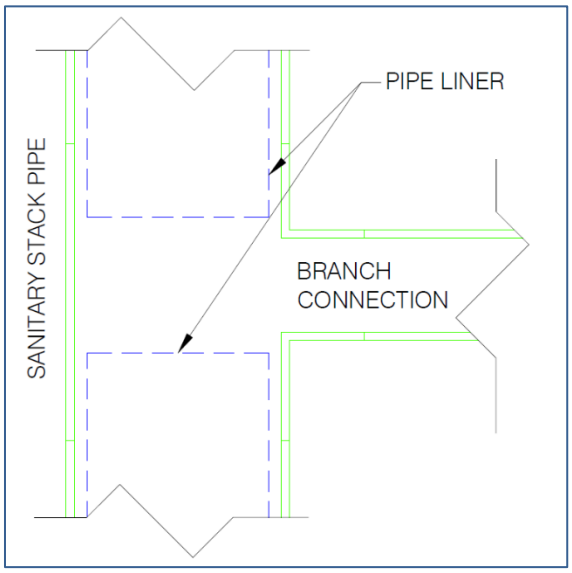

Figure 2 Example of a gapped branch connection showing unlined sections of stack and branch piping.

In 2018 the Uniform Plumbing Code (UPC) banned pipe lining entirely in cast iron drains as a result of reported issues with leakage caused by water seeping between the liner and pipe. This decision has since been reversed with additional scrutiny placed on required sealing of liner edges to the pipe to prevent water from getting between them, however this still adds a level of uncertainty. This type of lining method is typically installed as a way of reducing the number of future leaks, with re-occurring leaks to be fixed on a case-by-case basis.

Connection Reinstatement Method

The connection reinstatement method is performed when the liner is installed as a solid tube inside the pipe, covering all of the branch connection openings. Once a section of pipe has been lined, the branch piping needs to be disconnected and the liner is drilled out. The branch piping is located inside the walls so for this method wall openings must be made at every branch connection and the plumbing disconnected. This method of lining results in less exposed sections of the original cast iron piping, and less liner edges for water to get behind, however it still does not line the cast iron branch connection as shown in Figure 3. Further to this many of the branch connections at CCC 145 cannot be accessed for reinstatement of the branch opening because they are imbedded in firestopping mortar as shown in Figure 4.

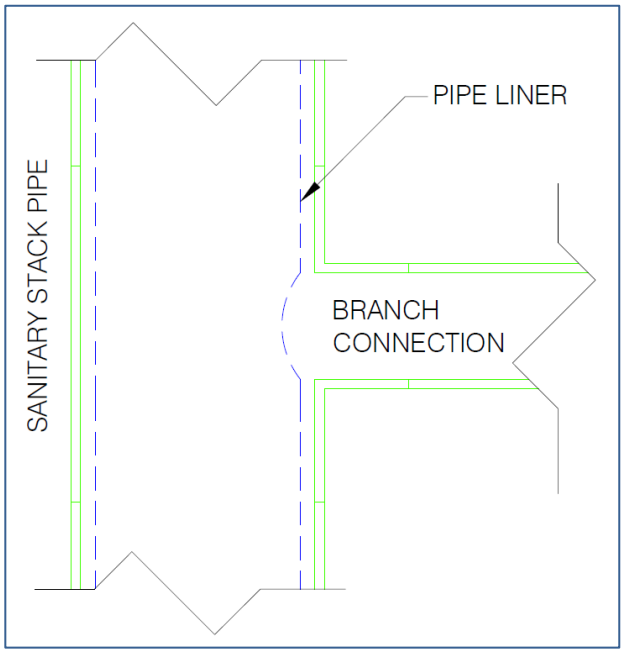

Figure 3 Example of pipe lining connection reinstatement showing unlined branch connection.

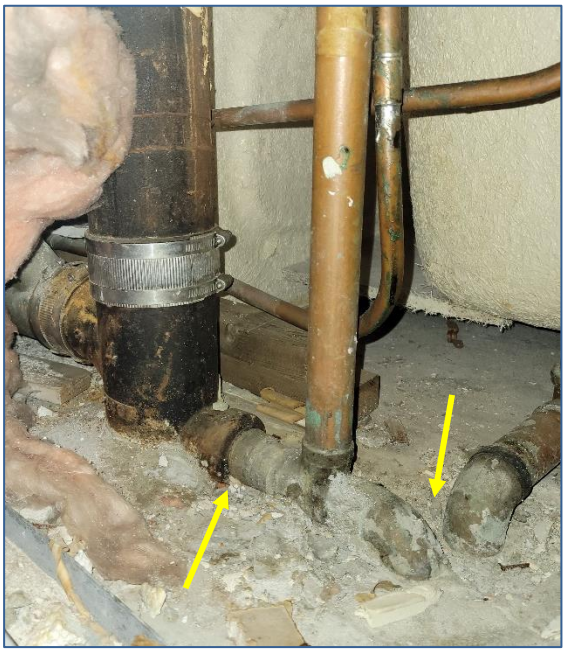

Figure 4 Example of bathtub branch piping at CCC 145 embedded in mortar.

Other Methods

There are several other methods used in CIPP to make lateral connections such as formed T liners, precut lateral connection openings, robot guided connection reinstatement from the main pipe and lateral connection inserts. While it is theoretically possible to use some of these methods and produce a full coverage lining system, due to the small diameter of piping and large number branch connections, it would be impractical and the cost to attempt it would exceed the cost of full replacement.

Additional consideration should also be given to the availability of contractors in the region. There are multiple installers of CIPP systems in the region, however very few of them have experience working with this type of vertical stack project. The vast majority of installers of CIPP systems use it in below ground drain applications and we are only aware of a single company in the Toronto area who has performed vertical stack lining in the past. This limitation on manpower and

knowledge base would make it impossible to get competitive bidding on a project and we typically see a sharp increase in price when there is low availability of qualified contractors.

Stack lining does not address the branch piping, which would need to be addressed separately. Due to the limitations in methods, materials and contractors, complete lining projects should typically be reserved for applications where preservation of surface finishes is the primary goal rather than cost and future reliability.

6.0 RECOMMENDATIONS

Due to the limitations of pipe lining technologies and the fact that many of the defects and reoccurring issues observed at CCC 145 would not be fully addressed by the pipe lining method, it is our opinion that the pipe lining method does not provide an adequate solution to the condition and ongoing problems with the sanitary stacks.

Our recommendation to proceed with sanitary pipe replacement of the stacks and branch piping at CCC 145, as provided on our “Sanitary Drainpipe Condition Assessment“ issued May 2, 2022 remains unchanged, as this is the only solution that addresses all the issues present at CCC 145 and ensuring many trouble free years and the lowest long term cost.

Trusting this meets with your present requirements, please feel free to contact us should you require further information.

Chris O’Brien, P.Eng