CITY OF TALKEETNA

Matanuska Susitna Borough

SEWER CONDITION ASSESSMENT STUDY

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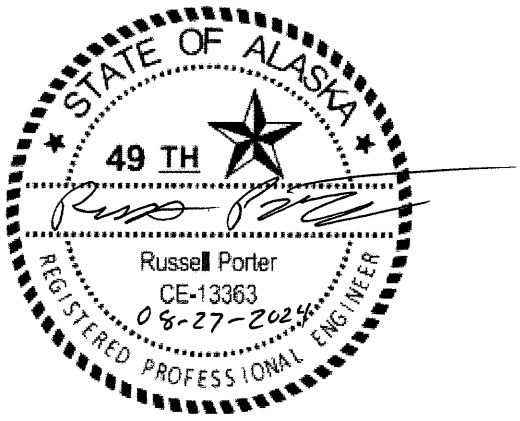

These documents were prepared under the supervision of a registered Professional Engineer.

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Executive Summary

The purpose of this study is to evaluate where Infiltration and Inflow (I&I) is taking place within the City of Talkeetna's sewer system for the Matanuska Susitna Borough. To determine this, a sewer condition assessment was performed on the City of Talkeetna's sanitary sewer system. The city contains approximately 25,000 linear feet (LF) of ductile iron gravity sewer main. The majority of the pipes are 8-inch in diameter. The age of the pipe is varied.

A Closed-Circuit Television (CCTV) inspection was completed on the gravity sewer mains by Frawner Corporation in early June 2024. Stephl Engineering LLC (Stephl) performed sewer structure inspections on sewer structures including manholes, cleanouts, and sewer lift stations.

The sewer system is overall in good condition. The sewer mainlines showed very little defects and sewer structures appear to be in structurally sound condition. Manholes inspected appear to be the highest contributor to I&I within the Talkeetna sewer system.

High levels of fats, oil and grease (FOG) buildup were observed in the downtown area during inspection of the sewer system. It is recommended that the Matanuska Susitna Borough ensure all restaurants have operational grease traps to minimize FOG buildup within the sewer system.

The repairs recommended were split into two separate projects. It is recommended that Phase I be completed and the city evaluate the effectiveness of Phase I within their system prior to performing Phase II work. It may be determined that Phase II is not necessary.

Nine methods of construction were evaluated for upgrading the pipes and manholes within the project area:

- Chemical Grouting (MH Rehab)
- Manhole Replacements
- Sewer Structures Internal Joint Seal (MH Rehab)
- Sewer Structures Lid Gaskets (MH Rehab)
- Sewer Structure Replacement
- Trenchless Point Repairs
- Cured in Place Pipe (CIPP) (Mainline and Lateral Lining)
- Open Cut
- Open Cut Point Repairs

Temporary bypassing of the sewer flow will be required to install new pipe, new sewer structures, and CIPP lining. Excavations for open cut work should expect high ground water based on infiltration observed in the sewer structures.

A description of the upgrade methods for each site is provided in the table below. The estimated construction costs below evaluate each site as a standalone project.

Project Cost Estimates		
Project Site	**Cost Estimate**	**Repair Method**
Phase I-Manhole Project	$894,650.00	MH Rehab, MH Replacement
Phase II-Mainline Repairs	$682,588.00	Open Cut/CIPP
Total estimated construction cost (all sites)	**$1,577,238.00**	

1.0 INTRODUCTION

This memorandum presents the results of the sewer pipe and sewer structure inspections performed by Stephl Engineering LLC (Stephl) and Frawner Corporation in May and June 2024 in Talkeetna, Alaska for the Matanuska Susitna Borough. The purpose of this report is to describe the inspection process and document the condition of the pipes and structures that were observed. In addition, repair recommendations and general cost estimates for rehabilitating the system are provided.

1.1 Site Description and Background

The project area is located within the City of Talkeetna in the Matanuska-Susitna Borough (see the attached sewer location figures in Appendix A for a map of the Talkeetna Sewer System). The Talkeetna sewer inspections consisted of approximately 24,440 linear feet (LF) of ductile iron sewer pipe. The pipe inspected included 8-inch and 12-inch diameter pipes. A total of 86 sewer structures (lift stations, manholes, and clean-outs) were also inspected as part of project.

2.0 SEWER MAIN CONDITION ASSESSMENT

2.1 Inspection Procedure

Pipe Inspection Procedure

The closed-circuit television (CCTV) inspection work was completed by Frawner personnel using a color “pan and tilt” camera. The camera, mounted on self-propelled wheels, was lowered into sewer structures and driven through the pipes. The camera was stopped to inspect joints, service connections, and defects within the pipe. Cleaning of pipes was done before the pipes were inspected using a reverse jet nozzle. The pipe inspection was coded per the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) guidelines.

Upon completion of the inspection, the CCTV video data was converted to an electronic digital file and reviewed by Stephl Engineering staff. The CCTV inspections of sewer pipes were limited to visual observations of the interior of the pipe only. External inspections of the pipe wall were not performed during the field work. The pipe inspection findings were documented in the attached inspection logs in Appendix B.

The overall condition of the pipe was given a numeric score based on observed defects and given a value between 1 and 5.

CCTV Camera Truck in Operation

Typical CCTV Camera in Pipe

Sewer Structure Inspection Procedure

Sewer structures were inspected by Stephl Engineering staff. Sewer structure characteristics, including material of construction, pipe connection condition, general condition of components, component height, and any defects, were identified and recorded in written logs. These logs are accompanied by structure photographs in Appendix C. Structures were inspected from the surface unless the invert was requested to be inspected. Defects and the overall condition of the structures were scored on a likelihood of failure (between 1 and 5) on the same grading system as the pipe defects. The scoring system for LOF is shown in Table 1.

Likelihood of Failure (LOF)

A scale of 1 to 5 was assigned to the project pipes and sewer structures, with 1 being the lowest LOF and 5 being the highest LOF. Examples of each level of LOF are shown in Table 1.

Score	Simple Description	Detailed Description/Example Defect
1	Physically sound and in operating condition	• Asset meets service needs or asset likely to perform without work in the near-term capital planning period. • No to Minor pipe deterioration observed
2	Acceptable Condition	• Asset meets service needs but may require increased preventative maintenance work in the capital planning period. • Minor pipe/structure deterioration
3	Deterioration Evident	• Asset meets service needs but will require corrective maintenance work in the capital planning period. • Medium pipe/structure deterioration
4	Progressing to Failure	• Asset barely meets service needs and corrective maintenance is needed to maintain asset. • Significant deterioration
5	Pipe Failed	• Asset does not meet service needs and is failing. • Defects impeding or stopping function of pipe

Table 1 - LOF Guidelines

Consequence of Failure (COF)

In addition to a LOF score, a consequence of failure (COF) was assigned to each asset within the study area. The COF score is a method for a utility owner to compare and identify the risk associated with a particular asset and the consequence if it fails. A scale of 1 to 5 was utilized for this project, with 1 being the lowest COF and 5 being the highest COF. For this project, pipes located within areas that would disrupt businesses and residents throughout the town were given a higher score.

Priority Rating (LOF × COF)

Combining the two above rating systems via multiplication provides a rough estimate for which elements of a project should be given greater priority. This scale does not emphasize limiting infiltration, but rather sustaining the key components of the system. It is recommended that repair decisions not strictly be based on priority rating. Priority Ratings can be found in Appendix A.

2.2 Sewer Mains

Frawner Corporation was hired by Stephl to clean the sewer main's and collect CCTV footage for each pipe segment. Stephl was responsible for the review and grading of the pipes inspected.

- Approximately 24,440 linear feet of CCTV video were inspected between the 81 pipe segments.
- All the pipes observed were ductile iron and most were in good working condition. Of the 81 pipes surveyed, only 10 of them were recommended for repair. The repairs are considered minor for these piping segments.

- Existing pipes within the downtown area of Talkeetna took additional cleaning effort due to Fats, Oil and Grease (FOG) buildup within the pipes.

Appendix A contains maps that detail the layout of the sewer system along with LOF's and COF's for pipe inspection. Appendix B explains the PACP codes that were used to document the pipes in this report. Within Appendix B is a spreadsheet that provides general information and notes of the pipe's characteristics, including the location and orientation of connections and defects and repair recommendations. The CCTV video recording data is contained in Appendix D. These surveys were completed in late May and early June 2024. The infiltration observed within this report could be more extensive at different times in the year. It is recommended that future inspections take place when groundwater is at the highest levels of the year to ensure that I&I related defects are captured during inspections.

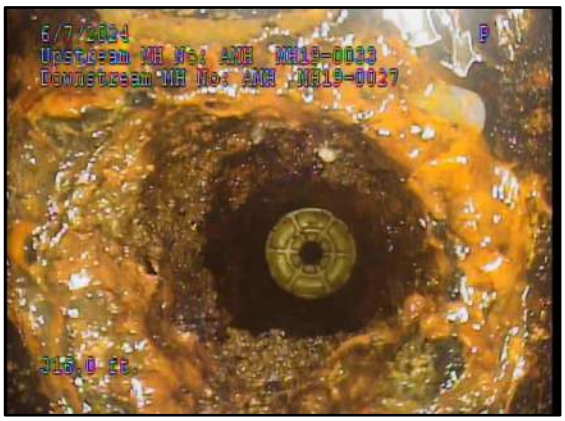
Significant Sewer Pipe Defects

The following significant defects were identified during the pipe inspection work. Not all defects are listed below. For complete descriptions of defects see the sanitary sewer inspection summaries and inspection logs located in Appendix B. The CCTV recordings are documented in Appendix D.

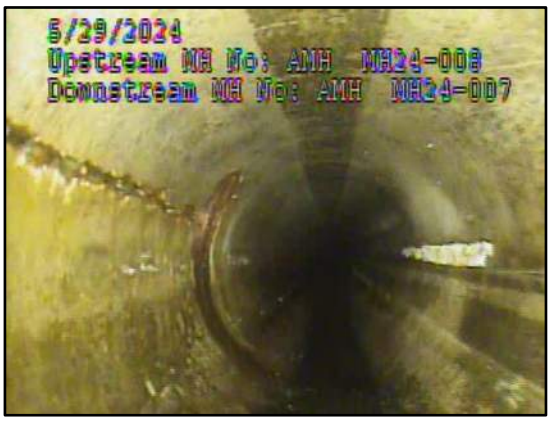
- MH 19-0013 to MH 19-0018: Defective point repair patch, 79 LF from 19-0018
- MH 19-0028 to MH 19-0030: Large mineralized joint separation, 11 LF from 19-0030
- MH 19-0033 to MH 19-0027: Infiltration runner from capped connection, 85 LF from 19-0027
- MH 24-008 to MH 24-007: Longitudinal fracture and infiltration runner at service connection, 37 LF from 24-008

MH 19-0013 to MH 19-0018, defective repair patch with I&I coming through

MH 19-0028 to MH 19-0030, large joint separation, gasket visible



MH 19-0033 to MH 19-0027, Infiltration runner from capped service connection



MH 24-008 to MH 24-007, longitudinal fracture and infiltration runner at tap connection

2.3 Sewer Structures

Summary of Sewer Structures

Stephl performed sewer structure inspections from May 29th to June 7th, 2024. Approximately 86 structures were inspected during the site visit. Ten (10) of them were cleanouts, three (3) were lift stations, and 73 were manholes.

- Thirty-eight (38) structures had significant defects to the base.
- Four (4) structures had damage to the cone.
- Thirteen (13) structures had damage to chimneys.
- Fifteen (15) structures had roots encroaching.
- Thirty-seven (37) manholes had I&I related defects. Fifty one percent of the structures inspected showed I&I related defects.

The repair recommendations for cleanouts are limited and are mostly aimed to prevent surface runoff from entering the system.

The lift stations' repair recommendations are minimal as the structures appear to be in good condition. The mechanical components of the lift stations were not inspected; only the structural condition of the lift stations was evaluated.

Maps in Appendix A show the layout of the applicable sections of the sewer system and their respective LOF and COF ratings. Appendix C contains a spreadsheet which highlights the data gathered from the eighty-six sewer structures inspected. It is followed by each individual structure report and photos of the respective asset.

The inspections were completed in May and early June 2024. Evidence of infiltration (heavy mineralization, flowlines) was recorded as infiltration for repair purposes. Additional I&I defects may be present that were not observed due to the time of year the inspections were completed.

Significant Structure Defects

Photos showing significant structure defects are shown below. Manholes 19-0017 and 19-0018 were excluded because the pipes inside have been sealed from the structure itself, with the manholes being entirely filled with groundwater. Not all significant defects are shown in the images below. For complete descriptions of structures and defects see the sewer structure inspection summary and inspection reports located in Appendix C.

- MH 19-0021: Infiltration along cone-base joint with 1” thick mineralization
- MH 19-0021: Infiltration at effluent pipe connection
- MH 19-0027: Frame and chimney offset
- MH 19-0028: Infiltration and cone-base offset
- MH 19-0030: Infiltration gusher and eroding shelf
- MH 19-0031: Chimney and cone offset and fracture
- MH 24-0017: Root growth along frame and cone
- MH 25-003: Infiltration runner at influent connection
- MH 25-004: Infiltration along cracks in base
- MH 25-0010: Infiltration from cracks in base

MH 19-0021, infiltration at cone-base joint

MH 19-0023, infiltration at North connection

MH 19-0027, frame-chimney offset

MH 19-0028, infiltration and offset

MH 19-0030, infiltration and eroding shelf

MH 19-0031, cone and chimney offset

MH 24-0017, root growth along frame and cone

MH 25-003, infiltration at influent connection

MH 25-004, infiltration and cracks in base

MH 25-010, infiltration from cracks in base

2.4 Condition Assessment Conclusions

The existing sewer system is in overall good condition. The observed structural defects within the sewer system are minor however I&I related defects were observed during inspection work. Sewer manholes at the time of inspection were observed to contribute a much higher percentage of I&I than the city's sewer mains.

The downtown area took extensive cleaning to perform inspection on the project sewer lines. High levels of FOG were observed within these lines.

3.0 CONSTRUCTION METHODS

The following construction methods are recommended for evaluation for projects in Talkeetna and how to repair and reduce I&I related defects within the sewer system.

3.1 Manhole Replacement

Replacing a manhole will ensure any I&I issues are corrected if installed properly. Additionally, elements of a manhole such as the chimney and shelf can be replaced without disturbing the rest of the manholes' structure. External wraps and sealants can be installed prior to backfilling the manhole. WrapidSeal is an external heat shrinking joint sealant that is installed on new manholes joints and chimneys throughout the country to prevent I&I. Proper pipe connections are also essential to preventing I&I. Z-Boots are rubber boots that can be cast directly into the manhole when it is made that provide a leak proof connection and can be tightened in the future if necessary. The cost to replace a manhole in Talkeetna is approximately $1,500 per vertical foot per manhole.

3.2 Lid, Frame and Joint Seals

Seepage through joints was a common observation in the manholes experiencing I&I as seen in in the images below. Without excavating, this issue can be solved by installing an internal joint seal band. Cretex Specialty Products is one manufacturer of this type of repair and can be seen in Image 2. The band is made of an elastic rubber with stainless steel expansion bands that form a compression seal over the joint. The elastic material allows the band to maintain the seal if the manhole should move and can be tightened and compressed in the future. A similar band can be installed in the chimney of a manhole to stop I&I through the grade rings or beneath the frame. The chimney seals and joint seals are estimated to cost up to $1000 and $2000 each, respectively.

I&I seeping through joints

Cretex Internal Pipe Joint Seal

3.3 Pipe Connections

During the site visit, many pipe connections were observed to be missing grout around the pipe connection to the manhole or had I&I coming through the grout. It is recommended to grout all pipe connections to mitigate potential for I&I. Connections that have I&I coming through the grout should be chiseled out and have new grout installed. Chemical grouting should be installed prior to installing new grout (see below). Newer manholes can have a rubber boot installed to prevent I&I. These boots should not be grouted so they can be tightened in the future.

3.4 Chemical Grout

Chemical grouting is an effective method for stopping infiltration. Depending on the system used, minimal equipment may be required. This method of repair would be used to stop I&I coming through cracks, fractures, and small holes in the manhole wall or shelf. Typical installation would require drilling a hole into the manhole near the defect with I&I, installing a mechanical packer, and injecting the chemical grout under pressure. The grout reacts with water to create a foam

that blocks the groundwater from entering the sewer system. The type of system used will result in either a hydrophilic or hydrophobic foam or gel.

Hydrophilic grouts can create a closed cell foam or a non-cellular gel when it reacts with water. The grout expands up to eight times its volume when activated. Hydrophilic grouts continuously react with water after initial expansion which allows it to bond extremely well to wet surfaces. This makes it a good choice for areas constantly susceptible to groundwater. The foam or gel created is also flexible, maintaining its seal while the manhole moves or shifts. Hydrophilic grouts require constant contact with water to maintain volume and can shrink, losing its seal, if there is no water to react with.

Hydrophobic grout creates a rigid foam when it reacts with water. Resin is mixed with a catalyst immediately prior to installation to create the grout. Hydrophobic grout expands up to 29 times in volume when activated. The foam is susceptible to compression and will likely begin to leak if any movement in the manhole should occur. Should the groundwater level recede below the level of the foam, hydrophobic grouts will not shrink.

Chemical grouting is separated into two separate categories for the purpose of cost estimating. The first category is chemical grouting connections, which is priced at $1,500 per manhole. This price includes all sewer main connections that need repair in the manhole. The second category of chemical grouting is for repairing cracks within the structure. This process is estimated at $1,000 per manhole and includes chemical grouting for all relevant defects within a structure. Manholes were counted separately for each process and can qualify for both. These processes are intended to be performed by a contractor.

Pressure chemical grouting

Chemical grouting with cartridge gun

3.5 Removing and Replacing Manhole Shelfs

Removing a shelf along the base of a manhole can be used to correct a variety of issues. Improperly constructed inverts were found on several manholes, including one that allowed an I&I runner on MH24-001A. Water pooling along the shelf was seen in MH25-0025. Multiple manholes experienced infiltration along the shelf-base connection. Some manholes that had infiltration in upper joints were still seeing erosion of the shelf from the I&I.

The process of replacing a manhole's shelf first involves the demolition of the current shelf and invert. This is normally done with a pneumatic jackhammer that breaks the shelf into small chunks. The material is hauled up and out of the manhole, exposing the bottom of the sealed base. Repairs to the base would be performed which may include chemical grouting. Concrete is then mixed above ground according to manufacturer recommendations. It is lowered into the manhole and applied via hand or trowel to provide a calculated slope into the invert. The invert should be on grade with the influent and effluent pipe connections. Care must also be taken to not apply excessive material in the channel, which could restrict flow. Once applied, materials should be smoothed by hand or trowel.

This process is recommended to be performed by a general contractor. A rapid setting, high early strength, non-shrinking material is recommended for the shelf's cementitious element. Removing and repairing a shelf costs approximately $4,000 to $5,000 per manhole.

3.6 Open Cut Excavation

This method involves removing and replacing the existing pipe with a new pipe within a trenched excavation. Open cut work requires equipment to excavate, place the new pipe, and backfill and compact. The depth of the pipe would determine the size of the excavation. A deeper pipe will require a larger excavation footprint to safely complete the work which would also have a larger impact on traffic and surrounding homeowners. Due to the high groundwater in Talkeetna, dewatering the excavation to complete the work would be vital and expensive. This option would be best suited for pipes with bellies and/or large defects that would prevent trenchless methods of repair. Additionally, several of the recommended open cut sections are adjacent to manholes that are recommended to be replaced. These repairs would be best done in tandem with one another.

Open cut pipe work for eight-inch pipe is estimated to cost approximately $1,000 per foot of pipe. This estimate does not include mobilization of equipment to Talkeetna to complete the work. Bypassing the sewer flow would also be necessary. A pump and temporary piping would be used

to divert the flow from one manhole to another downstream manhole while the work is being completed.

3.7 Cured in Place Piping (CIPP) Lining – Sewer Main

CIPP is a lining system in which a thin flexible tube of fabric is impregnated with resin and expanded by means of internal pressure to fit tightly against the inner wall of a defective pipe. Curing of the resin takes place by one of the following methods: steam, hot water, or ultraviolet light (UV). A CIPP liner can be installed through minor bends and grade breaks without excavation. The CIPP process provides a structural rehabilitation of the pipe. In this case, the CIPP liner would be designed for the "fully deteriorated" condition. This means that the host pipe could lose its structural strength in the future and the CIPP liner would be a stand-alone pipe. The liner would be designed for the site conditions (depth of burial, ovality of the host pipe, operating pressure, traffic loads, etc.).

CIPP lining would require cleaning and preparation of the host pipe prior to installation. A thorough CCTV inspection is completed prior to insertion to locate any defects that might prevent the successful installation of the liner. Groundwater infiltration can be problematic during liner installation and would be identified and evaluated depending upon the CIPP system being installed. Needed repairs can be completed with a variety of different trenchless point repairs.

Once the liner is pulled or inverted into the host pipe, it is inflated by means of internal pressure depending on the system used. Hot water curing inflates the liner by filling it with water and circulating the water along the length of the liner to cure. Ultraviolet liners are inflated with air and then cured by a chain of UV lights being pulled from one end to the other. Once cured, the ends of the liner are cut flush or nearly flush to the end of the pipe and a cutter robot will then reinstate any services along the pipe. After the services are reinstated, the pipe is cleaned of any lining debris and can be placed back into service. The advantages of UV cured liners is the equipment can be portable and fit onto a plane for shipping to remote locations. Hot water and steam cured liners require equipment for circulating and heating the water, which can be expensive to mobilize. See the images below for hot water and UV systems.

Hot water cured CIPP

Hot water cured CIPP

Equipment required for hot water CIPP

Hot water cured CIPP complete

Pulling UV cured CIPP into place

Equipment for UV cured CIPP

Curing UV CIPP liner

UV cured CIPP liner complete

Installation of a CIPP liner can be completed without excavation, as access to the pipe can be accomplished from inside the sewer structures. CIPP is resistant to corrosion and has a manufacturer recommended design life of 50 years.

- Advantages
  - Minimal amount of excavation
  - Results in a fully structural pipe
  - Typically 30 percent the cost of open cut replacement
- Disadvantages
  - Specialized installers and equipment required
  - 50-year design life compared to the 75-year design life of other alternatives
  - Does not address inconsistent pipe invert issues or bellies
  - High cost to mobilize equipment

Grade breaks, bellies, and other repairs requiring excavation would be completed prior to installation.

3.8 Trenchless Sewer Main Point Repair

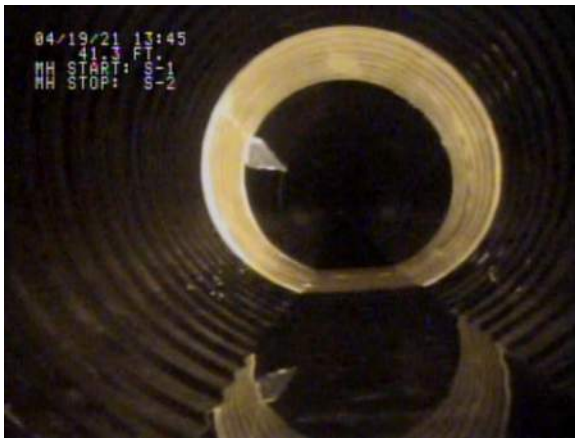
A point repair is a localized repair designed to repair holes and other defects in pipes. A woven piece of fiberglass mat is wetted with epoxy resin. The mat is wrapped around a packer and pulled through the sewer main into place. The packer is inflated to press the mat tightly to the host pipe and cures ambiently. Once cured, the packer is removed leaving a section of cured fiberglass patch. Point repairs are typically two to four feet long and are often used in conjunction with CIPP to protect the liner during installation. Point repairs can also be used alone to fix holes, offset joints, pipe separations, or cover protrusions. Point repairs do not do well with significant

infiltration, as the groundwater can wash away the resin and prevent curing. Accelerators can be used to decrease the cure time of the resin if needed. The point repair process can be seen in the images below.

Resin installed over fiberglass matt

Wetted mat is wrapped around packer

Install into pipe and pull into place



Cured point repair

3.9 CIPP Lining - Sewer Lateral

Sewer services would be CIPP-lined from the sewer main to a distance chosen by City of Talkeetna officials. Typical distances include installing from the Sewer main the easement/ROW line, or up to a cleanout outside of the residence or business. CIPP Service Lining requires minimal excavation, if any, and provides a fully structural lateral service repair.

CIPP liners designed for lateral services are installed using air or water inversion. They can be installed from the main line or a cleanout on the lateral. Lateral CIPP lining requires minimal excavation and can fully rehabilitate a service nearing the end of its useful life. Many methods

of service lining exist. The LMK T-Liner® lateral lining system is available from a contractor in Anchorage.

The T-Liner® System

The T-liner® is a lateral lining system designed to rehabilitate a lateral and provide a watertight connection to the sewer main. The T-liner® is a one-piece, T-shaped CIPP liner sized for the lateral and the main pipe at the service connection. Each system is sized for each individual lateral connection. The T-Liner® uses a patented hydrophilic gasket around the service to main connection and the lateral CIPP termination point to prevent infiltration after rehabilitation.

The T-Liner® system consists of a full-circle repair to the main pipe that extends several inches to either side of the service connection as seen in Figure 5. The liner is installed in the main pipe and pulled into place. LMK recommends using a cleanout on the lateral to verify the location of the connection. CCTV equipment is typically used to obtain an accurate measurement when pulling the system into the proper position.

Once positioned, air pressure is applied, the main portion is inflated, and the service portion is inverted into the existing service. The liner is typically cured using steam; however, an ambient cure can also be used. After installation and curing, the lateral liner is inspected with a CCTV camera to ensure proper installation. Typically, two to four service liners can be installed in a day.

If no cleanout exists, a Vac-A-Tee cleanout could be installed on the lateral to allow for CCTV during installation. The Vac-A-Tee system is used to trenchlessly install a new cleanout. The new cleanout would be installed at the easement and/or ROW line. The cleanout would consist of a patented PVC saddle with a DR36 PVC riser pipe. The PVC saddle snaps onto the lateral pipe and is sealed with a marine caulk as seen in Figure 6.

The sewer service cannot be active during the installation and curing of the liner. Sewer flow in the main must be bypassed or plugged during installation of the T-liner®.

T-liner system at the sewer main

Vac-A-Tee cleanout system

Typical T-Liner® Construction Process

- Locate existing cleanout or install the Vac-A-Tee cleanout
- Identify the sewer connection location with a CCTV camera
- Clean and inspect the lateral via the cleanout
- Install flow control for the sewer main and sewer service
- Repair leaks in the service with chemical grout
- Install T-Liner®
- Perform post installation CCTV of the sewer service
- Restore the ground surface at cleanout excavation

4.0 PHASING

The phasing of the construction work will be affected by which sewer system components are selected by Talkeetna to be upgraded. It is assumed that a multi-year project will be implemented for pipe and manhole repairs. Temporary bypassing of the sewage flow will be required to complete some of the upgrades on the sewer main pipe and any sewer structures that require replacement.

Phase I – Manhole Rehabilitation Construction

It is recommended the first phase of the sewer system upgrades be to repair existing manholes. Manhole I&I related defects are typically cheaper to repair than sewer mainline or lateral defects. Talkeetna had a much higher percentage of manhole related defects than sewer mainline defects. The reduction of I&I is unknown since quantifying the volume of I&I taking place was not part of the scope of work. I&I volumes vary depending on the time of year and seasonal conditions, however in typical sewer systems, owners will see a reduction of approximately 30-40% if repair recommendations are executed. See Appendix A Phase I Construction Maps for which sewer structures are recommended for repairs. The following cost estimate details the work that is

recommended for Phase I and the estimated cost to perform this work. The total estimated project cost is $894,650.

Sewer Structure Repairs				
Description	**Quantity**	**Type**	**Unit Price ($)**	**Total Cost ($)**
Replace Manhole	7	EA	$ 22,000	$ 154,000
Internal Joint Seal Bands	22	EA	$ 3,500	$ 77,000
Chemical-Grout Connections	36	EA	$ 1,500	$ 54,000
Chemical-Grout Cracks	22	EA	$ 1,000	$ 22,000
Replace Element of Structure	14	EA	$ 5,000	$ 70,000
Remove and Re-pour Shelf	9	EA	$ 5,000	$ 45,000
Mobilization	1	LS	$ 100,000	$ 100,000
Sanitary Sewer Bypass	1	LS	$ 20,000	$ 20,000
Surface Restoration	1	LS	$ 75,000	$ 75,000
Subtotal				$ 617,000
20% Project Management and Engineering Fee				$ 123,400
25% Contingency				$ 154,250
Grand Total				$ 894,650

Phase II– Sewer Mainline Construction Projects

It is recommended that prior to constructing Phase II that the repairs completed in Phase I be evaluated for effectiveness on reducing I&I Depending on the percent of I&I reduced, Phase II may not be deemed necessary. Phase II includes sewer mainline repairs. A combination of open cut repairs, trenchless point repairs, and sewer service repairs are recommended below. The total estimated project cost is $682,588.

Sewer Pipe Repairs				
Description	**Quantity**	**Type**	**Unit Price ($)**	**Total Cost ($)**
Sewer Main CIPP	625	LF	$ 350	$ 218,750
Sewer Service CIPP	2	EA	$ 5,000	$ 10,000
Point Repair CIPP	4	EA	$ 3,000	$ 12,000
Excavate & Repair	2	EA	$ 15,000	$ 30,000
Mobilization	1	LS	$ 100,000	$ 100,000
Sanitary Sewer Bypass	1	LS	$ 25,000	$ 25,000
Surface Restoration	1	LS	$ 75,000	$ 75,000
Subtotal				$ 470,750
20% Project Management and Engineering Fee				$ 94,150
25% Contingency				$ 117,688
Grand Total				$ 682,588