## RECEIVED

## COMMONWEALTH OF KENTUCKY BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

JUN 05 2015

PUBLIC SERVICE COMMISSION

AN INVESTIGATION OF EXISTING AND FUTURE ) SERVICE OF BULLITT UTILITIES, INC. )

CASE NO 2014-00163

## FIRST SUPPLEMENT TO ANSWERS OF BULLITT UTILITIES, INC. TO COMMISSION STAFF'S POST-HEARING DATA REQUESTS

Comes Bullitt Utilities, Inc. ("Bullitt Utilities"), and for its First Supplement to

Commission Staff's Post-Hearing Data Requests, states as follows:

Information Request No. 3: Provide the revised/amended/updated report for the Hunters

Hollow sanitary sewer evaluation study.

Answer: See Attachment 3, which is a copy of the Hunters Hollow Sanitary Sewer

Evaluation Study dated January 19, 2015, and revised on May 28, 2015. A copy of the updated

large drawings of the Hunters Hollow collection system will be provided upon receipt from

BlueStone Engineers.

Respectfully submitted,

Robert C. Moore HAZELRIGG & COX, LLP 415 West Main Street, 1<sup>st</sup> Floor P. O. Box 676 Frankfort, Kentucky 40602-0676 (502) 227-2271

## **CERTIFICATE OF SERVICE**

I hereby certify that a true and correct copy of the foregoing was served by hand delivery on Jeff Derouen, Executive Director, Public Service Commission, 211 Sower Blvd., P.O. Box 615, Frankfort, Kentucky 40602 and by First Class United States Mail on Gregory T. Dutton and Jennifer Black Hans, Assistant Attorney General, 1024 Capital Center Drive, Suite 200,

l

Frankfort, Kentucky 40601-8204, and Mark Edison, 216 South Buckman Street, Suite 7 Shepherdsville, KY 40165-8041, on this the 5th day of June, 2015.

ā

Sant P. Mron

Robert C. Moore

## HUNTERS HOLLOW Sanitary Sewer Evaluation Study

Prepared for: Bullitt Utilities, Inc. Blue Lick Road Louisville, KY 40129

Prepared by:



3703 Taylorsville Road, Suite 205 Louisville, Kentucky 40220

January 19, 2015 Revised May 28, 2015

## HUNTERS HOLLOW SANITARY SEWER EVALUATION STUDY TABLE OF CONTENTS

		Page No.
Sectio	n One – Introduction & Background	1-1 to 1-2
1.1 1.2	Description of the Hunters Hollow and Hillview Study Area Historical Data Exhibit 1.1	
Sectio	on Two – Field Investigation & Results	2-1 to 2-7
2.1 2.2 2.3	Sanitary Sewer Manhole Inspections Closed Circuit Television Inspection Inspection Results	
Section	on Three – Recommendations	3-1 to 3-6
3.1 3.2 3.3 3.4	Rehabilitation Overview Rehabilitation Recommendations Flow Reduction Analysis Rehabilitation Costs	

## SECTIONONE

## INTRODUCTION & BACKGROUND

The Hunters Hollow Wastewater Collection System is a separate wastewater collections system managed and operated by Bullitt Utilities, Inc with approximately 35,188 linear feet of 8", 10", and 12" VCP and PVC sewers. The system also includes (2) pumping stations that divert within the collection area. The main system was televised and inspected during 2014. <u>The additional areas of Majestic Acres Subdivision</u> & Benjamin Woods Subdivision have been included for this update as of May, 2015.

The goals for the Sanitary Sewer Evaluation Study (SSES) include reducing or eliminating any bypassing or overflows experienced at the Hunters Hollow Wastewater Treatment Plant, as well as reducing or eliminating backups and surcharging in the collection system and pump stations. The results of this SSES will be used to identify system defects to help prioritize rehabilitation efforts so that repairs can be made to ultimately reduce the peak flows in the existing collection system. Improvements will be made annually based on these recommendations and findings. This evaluation included review of construction plans for various parts of the collection system and combining them into one system map that was then compared and updated based on the CCTV inspections. This final system map was then utilized as part of the SSES summary results. <u>The system maps have been updated based on the additional areas of Majestic Acres and Benjamin Woods Subdivisions</u>.

#### 1.1 Description of the Hunters Hollow and Hillview Study Area

The Hunters Hollow collection system is located in north Bullitt County and lies just south of the Jefferson County line in a primarily residential area called Hillview, bounded to the west by I-65, to the east by Pioneer Village, and to the south by Jeffie Lane. The collection system is divided into (4) four sub-areas named for their corresponding subdivision names and systems that gravity either to the Hunters Hollow Treatment Plant, or to a localized pumping station that pumps into the main collection system.

- Hunters Hollow Subdivision (HH1) includes the original portion of Hunters Hollow Subdivision, Smith Grove Subdivision (Shelby Circle) off of Smith Lane, and also the commercial area along Carter Avenue and Terry Blvd. This part of the collection system serves approximately 198 customers, mainly residential with a few commercial warehousing/offices. The system has approximately 8,744 linear feet (LF) of 8", 10", and 12" mainline sewer, comprised mainly of vitrified clay pipe (VCP) and Polyvinylchloride (PVC) pipe constructed in the 1960's and later. For sewers made with vitrified clay pipe, it is not surprising to find many defects during system investigations. Given that much of this system is part of the original collection system however, a good portion of HH1 is for the most part in acceptable condition.
- Hunters Hollow Subdivision 2 (HH2) includes Hunters Hollow Subdivision to the north of the original subdivision, with the Bigwood Way Pumping Station that diverts wastewater flow over to



1-1



Exhibit 1.1 – Hunters Hollow Service Area Map



r. ..

# SECTIONONE

HH1. This part of the collection system serves approximately 168 residential customers. The system has approximately 12,152 linear feet.(LF) of 8" sewer, comprised mainly of VCP.

 Hunters Hollow 3 (HH3) includes the Benjamin Woods Subdivision & Majestic Acres Subdivision located to the north and west of the original Hunters Hollow Subdivision, and includes the Ziniz Pump Station off Hillview Blvd that diverts flow from Majestic Acres (165 customers) over to HH1. Benjamin Woods ties 99 customers into the HH2 system by gravity. This part of the collection system serves approximately 264 residential customers. The system has approximately 10,829 linear feet (LF) of 8" sewer, comprised mainly of VCP and PVC pipe. <u>The additional CCTV</u> <u>inspections and summary has been provided for this area with this updated report.</u>

 Blue Lick Road (BL) includes collectors that provide service to small residences, and apartments west of Blue Lick Road, as well as commercial buildings running north along Blue Lick Road to the Jefferson County line. This collection area also connects to the Ziniz Pump Station which diverts flow back into HH1 and includes approximately 45' customers, with approximately 3,463 linear feet (LF) of 8'' sewer, comprised mainly of vitrified clay pipe VCP and PVC pipe.

Exhibit 1.1.1 provides a Service Area Map identifying the (4) four subareas listed.

#### 1.2 Historical Data

ي الم

Historical data for the Hunters Hollow system only included construction plans for various portions of the system, as well as recent monitoring information from usage of the Veolia temporary WWTP. Monitoring of flow indicated a typical dry weather flow of approximately160,000 gallons per day. Peak flows during wet weather events typically overloaded the 300,000 gallon temporary treatment system. These increases confirm increased wet weather flows throughout the study area, demonstrating the magnitude of inflow and infiltration at various locations within the system. No pump station run time data was available to analyze additional portions of wet weather impacts in the system. <u>Note that due to the temporary nature of operations with the Veolia Wastewater Treatment Plant no continuous records have been provided to compare normal operating conditions with wet weather conditions. Additionally, since no flow monitoring has been performed for various sections of the gravity system, no comparison is provided by watershed or basin. These items are recommended to be addressed in the "Corrective Action Plan" letter dated June 1, 2015.</u>



## SECTIONTWO

## SECTION 2: FIELD INVESTIGATION & RESULTS

The field investigation and inspection portion of this study generates the required information to analyze the sanitary collection system. The mainline sanitary sewers were televised for a major portion of the system and defects were noted. Manholes were inspected to determine if any major structural or other deficiencies could be found. Smoke testing was not currently performed, however as indicated in discussions with operation staff, smoke testing was performed approximately 10 years ago, with limited results (<u>as identified by Bullitt Utilities personnel, and no records/data has been provided to confirm</u>). No additional internal or external property assessments were performed on private property to verify basement connections or downspout connections to the system <u>(from recent discussion with some of the neighbors it does seem possible that both downspouts and possibly even sump pumps are connected to the sanitary sewer system – a private property canvassing would be required to gain additional information from residents to indicate if they have any illicit connections that could be removed.</u>

### 2.1 Sanitary Sewer Manhole Inspections

Field inspection and investigation was conducted to evaluate the sanitary sewer manhole structures that comprise the Hunters Hollow collection system in areas HH1, HH2, and BL. The inspections focused on issues related to Inflow and Infiltration concerns, structural deficiencies and gathering any additional "asbuilt" sewer information. <u>Additional inspections for manholes in area HH3 are now provided with this update.</u>

#### 2.1.1 Typical Defects Found During Manhole Inspections

The following details typical defects that are looked for during the inspection of sanitary sewer manholes.

#### Cover

Common defects that occur with the cover are wrong size or type, cracked, and below grade. Covers that are the wrong size for the intended frame are either too small and ultimately do not rest on the seat correctly. When the structure resides in the path of traffic, this situation creates the potential for the cover to come loose as vehicles travel over the cover.

#### Frame

Common defects that occur within the frame are lateral cracks, non-level frames, and offset frames. Structures that reside in the path of vehicular traffic require the frame to be level with the roadway to ensure that the cover remains at grade with the pavement. Vehicles



## SECTIONTWO

that travel over an uneven cover can cause structural damage to the manhole and / or the, frame,

### Wall/Cone

The materials used for the construction of walls and cones ranges from precast or cast in place concrete in newer construction to brick and mortar for earlier construction. Common defects that can be found within this component of the sewer include missing material, loose material and fractures or cracks. In areas of high ground water, cracks may keep growing due to the additional pressure of water and may lead to continual infiltration within the sewer.

#### Bench

The bench of a manhole is usually built of bricks and mortar in older manholes and concrete in newer construction. Common defects that occur are cracks in the bench and infiltration where the wall meets the bench. These areas of concern should be corrected with a high strength cement or mortar material. The material selected would require a short cure time in, order to minimize restrictions of flow from the upstream pipe during repairs;

#### Channel

The trough is commonly built from vitrified clay, brick, and concrete. Defects that occur within this component primarily consist of cracks, and obstructions. Cracks are corrected by applying the same type of cement or mortar material as described above in the "bench" discussion.

#### Steps

Steps are commonly made from cast iron; or steel materials. Over time, the material deteriorates making the step unsafe, or the connection to the manhole wall fails resulting in missing steps. Prior to replacing missing or unsafe steps, the entire manhole should be assessed for other rehabilitation issues.

#### 2.1.2 Inspection Protocol / Techniques

The following steps detail the protocol and techniques used during the inspection to identify and quantify possible defects with each component of a sanitary manhole. Manhole inspections consisted of the following general format:

- Manholes were located by the field inspection crews with a reasonable effort, defined as an on-the-ground search using available system maps. Buried manholes were not uncovered.
- If crews were unable to locate manholes, they were designated as "could not locate" (CNL).

SECTION TWO - 20 - d

## Field Investigation & Results

- 3) A detailed inspection of each structure was performed by the field crews from the surface (no confined space entry occurred in any case), addressing applicable items on a standard inspection form. Visual inspections included the following information, documented in the appropriate fields using standard manhole inspection codes:
  - General information regarding the inspection conditions, date/time, crew, location, flow depth, surcharging, silt build-up, and ponding evidence;
    - Type, depth, and diameter of manhole structural assets (manhole, cover, and barrel);
    - The type/material and condition of pertinent internal structures;
    - Size and quantification of defects;
    - The size, material, and condition of pipe connections; and,
    - Documentation of observations in the comment field.

#### 2.1.3 Inspection Results

The defects identified can be categorized into two primary areas; either Inflow and Infiltration concerns or structural deficiencies.

Of the 153 total manholes identified in the Hunters Hollow system, 12 could not be located and 41 were in area HH3.



Figure 2.1.2 Manhole Inspection

For Area HH3, 41 manholes were inspected with 7 not located/buried (and one manhole located on the Bluelick Airfield "M22" was bolted down and could not be opened).

Table 2.1.1 lists the manholes that could not be found or were buried

Table 2.1.1 Manholes Not Found/Buried (Addi Manholes Not Found/Buried in HH3)

MANHOLE ID				
002 (Smith)	065 (HH1)			
006 <sup>-</sup> (Smith) <sup>1</sup>	076 (HH1)			
009 (Smith)	077 (HH1)			
010 (Smith)	080 (HH1)			
012 (Smith)	054 (BL)			
014 (Smith)	BL4A(BL)			

MANHOLE ID				
A2 (HH3)	M21 (HH3)			
A13 (HH3) 🗀				
M3 (HH3)				
M8 (HH3)				
M12 (HH3)				
M20 (HH3)				

Most all of the manholes inspected were in fair condition with typical concrete walls and benches with either VCP or PVC channels. Most manholes did not have cones and most all manhole covers were cast iron with fitting lids. A few manholes near the existing treatment plant were

## Field Investigation & Results

O

**m** 

deteriorating due to prior system backups and overflows. These manholes are listed in Table 2.1.2 along with a few other manholes in the system that require repairs.

			-
	MANHOLE ID		. 0
WWTP_1	074 (HH1)	045 (HH2)	
WWTP_2	066 (HH1)	046 (HH2)	c
023 (HH1)	068 (HH1)	BL1 (BL)	
019 (HH1)	069 (HH1)	BL2 (BL)	
0.18 (HH1)	027 (HH2)	BL3 (BL)	
017 (HH1)	025 (HH2)	BL4 (BL)	
075 (HH1)	034 (HH2)	BL5 (BL)	
		-	

Table 2.1.2 Manholes Requiring Grouting/Repair

There were no chimney seals found on any of the manholes in the system, and a number of manholes showed some signs of leakage at the chimney rings. Installation of either chemical or mechanical chimney seals is recommended for all of the manholes in the Hunters Hollow system.

Area HH3 manholes were similar to other portions of the Hunters Hollow collection system, however it must be noted that most of the manholes were constructed in the roadside ditches as opposed to being in the streets. Not only were these manholes located either in or next to the roadside ditch but most of the manholes in HH3 had frames that were simply laying on top of the manhole structure (not bolted or sealed). Most were shown to have infiltration occurring at the frame and the rings. Only those manholes in pavement did not have loose frames, however still exhibited <u>leakage/infiltration around the frame and rings (even below pavement). While some</u> manholes do exhibit signs of surcharging/backups, the walls, benches, and pipes all look <u>good and do not exhibit signs of cracking or leaking (the sewer lines are PVC in Area</u> HH3). It is occurring from the top frame and rings (which is apparent), and possible also from private property in this area.

#### 2.2 **Closed Circuit Television Inspection**

SlueStone ....

**SECTION**TWO

 $T_{1,0}$ 

CCTV inspections were performed on a major portion of the sanitary sewer gravity lines in the Hunters Hollow system from 8-inch to 12-inch in diameter. This includes approximately 24,359 LF of sanitary sewer pipe (for Areas BL, HH1, and HH2). An additional 9,186 LF was inspected for Area HH3. CCTV inspections are used to identify main line defects and discrepancies to help prioritize required improvements

SECTIONTWO

.ي آتاي

Ľ

\_ لين <mark>م</mark>

ъč

0

**5**.

### 2.2.1 Inspection Protocol / Techniques

ದ್ದೇ

The CCTV inspections were conducted by Pipe Eyes, LLC and divided into areas similar to this report. Some areas were found to have severe root intrusions, intruding joints or obstacles that inhibited the camera from passing through the pipe. CCTV inspections for Area HH3 were performed by Martin's Pipeline Inspection and provided in separate reports for both Majestic Acres and Benjamin Oaks Subdivision.

The inspection identified pipe materials, pipe deficiencies, laterals, pipe connections and general condition of the pipes.

Additional steps taken during the inspection to increase the quality of the inspection and quantify possible defects are listed.

 If an obstruction in the line did not allow the camera to pass, the field crew attempted to enter the camera from the opposite manhole in order to complete the inspection of the line segment up to the original obstruction.

2) If the field crews found configurations that were different than what was shown from original system data, changes were marked on a field map for later updating.

3) All inspection videos and associated reports were submitted in digital format and were coded in PACP 4.4 format.

4) Typical Defect Codes used during the CCTV process included:

Deposits/Grease

Roots

Hole

Obstacle or Obstruction (some utilities)

Fracture

Sag

Joint Offset/Repair Point

Collapse (or pipe failure)

Tap Intrusion

Infiltration (Dripper, Weeper, Runner or Gusher)

5) Defect Condition/Severity Codes are based on the following color scheme:

Ð

2-5

Black – very minor

Green – minor

Blue – moderaté

SECTION TWO

 $e_{i,j} C^{\mathbf{L}}_{i,j}$ 

2.3

0 0

12

Б

 $\mathsf{D}_{U'}$ 

fe <sub>o</sub>r

G

C

E

Brown – poor

Red - severe

Inspection Results

Qverall the pipes inspected showed a random series of defects. Even older sections tended to show similarly both good and bad sections of pipe with typical defects. All three areas of the system have lines that should be prioritized for improvements.

C

c

C

The Blue Lick (BL) area included a number of defects all on the same line segments such as holes, cracks and/or fractures, major root intrusions, and signs of significant Infiltration and Inflow (mainly Melody Lane and Brooks Run off North Triangle Lane at Blue Lick Road). These sewers were added to the system at a later date and seem to be missing manholes that would normally be installed between pipe segments.

The Hunters Hollow 2 (HH2) area included major defects including those listed above, as well as line sags, significant amounts of deposits, and even a portion of collapsed line (mostly line: segments in the rear of houses paralleling Earlywood Way, or close to the Hunters Hollow pump station off Bigwood Way).

The Hunters Hollow (HH) area is similar to the HH2 area except that there are fewer/shorter linesegments classified as severe that require improvements to be made. Some of these line segments additionally are located under pavements and may be easier to access than areas behind homes in HH2.

<u>The Hunters Hollow 3 (HH3) included some areas with deposits and just a few line</u> <u>segments that indicate Inflow due to holes or pipe cracking. HH3 includes newer</u> <u>subdivisions with PVC pipe including Majestic Acres and Benjamin Woods subdivisions.</u> <u>Of the additional 41 pipe segments televised only 8 have defects or major deposits.</u>

If a section of pipe has three (3) or more structural defects, but appears to be sound in terms of slope, overall integrity and operational capabilities, the section can be considered for CIPP lining. In cases where there are numerous minor structural issues along with some major structural issues such as holes in the pipe, the section is recommended for spot repairs and possibly also CIPP lining. Many of these repairs may simply require spot repairs at the location of the pipe section that is offset, or has a hole or fracture.

At some locations, the sanitary collection system has significant deposits of grease. These pipes should be prioritized for some heavy cleaning, in conjunction with major root cutting. Some of the pipes contain major root intrusion, enough to warrant root treatment or other maintenance or improvement. Some pipes were nearly full or completely blocked by roots creating blockages that may result in, or contribute to, surcharging in the sewer (see Figure 2.3.1). These pipes should be prioritized for Root Cutting and root control measures in the

2-6 \_\_\_\_\_\_\_\_\_\_



ර Q SECTION 3: Recommendations

Recommendations

פירים

G

F

O

D

П

Ω

r:

 $\square_{\mathbb{C}^l}$ 

F

Ċ

q.

The key goal of this analysis was to perform a condition assessment on the sanitary sewer collection. system and develop various cost effective rehabilitation improvements to alleviate excessive inflow and infiltration in the Hunters Hollow system, D م<sup>2</sup>میں میں کر م روب میں میں میں میں م

Rehabilitation Overview

HRFF

C

ក់បី

n

Ę,

a o

b

Ð

ò

JD

Ð

The evaluation of the sanitary collection system assessed condition grades of 3(Moderate), 4(Poor), and 5(Severe) for rehabilitation and repairs. The condition assessment included evaluating the extent of the rehabilitation for the sanitary sewers.

It is noted that besides the Blue Lick area (BL) that requires rehabilitation, line segments in both Hunters Hollow (HH) and Hunters Hollow 2 (HH2) require repairs to fix holes and fractures mostly on lines in easements behind houses. This could be due to settlement in those areas (as compared to lines that run in the streets). Many of these same line segments have been listed for root cutting and cleaning as well. Prioritization of these line segments by removing roots, providing heavy cleaning, and providing point repairs followed by some CIPP lining should remove a majority of the public 1&1 occurring in the main system. Prioritzation of these top 25 line segments (as indicated on Table 3.1 located at the end of Section 3) will eliminate almost all of the severe, poor, and moderate defects identified from the line inspections. An additional 8 line segments have been added for Area HH3 and are listed in Table 3.2 summary located at the end of Section 3.

3.2 Rehabilitation Recommendations

A capital improvement program should be implemented to reduce or eliminate the public and private sources of inflow and infiltration into the Hunters Hollow collection system. The removal of sources of direct inflow into mainline sewers typically results in significant improvements on the sanitary collection system during wet weather events. While infiltration is problematic in terms of the length of time, clear water may affect the sanitary collection system (infiltration can last for days or weeks after a storm event), inflow sources have a nearly immediate impact on the available capacity of the sanitary collection system. For purposes of this report only rehabilitation to sewer mainlines is provided. Evaluation of I&I from private sources (i.e. laterals and downspouts) is beyond the scope of this study.

#### 3.2.1 Sanitary-Sewer Mainlines

Based on the evaluation, approximately 4,500 linear feet of 8-inch and 12-inch sanitary sewer is recommended for repairs and/or lining. These sewers showed multiple signs of inflow, and rated high in defects. The segments recommended are those that have structural deficiencies that could affect the operation of the sanitary collection system. The sanitary sewers will need to be

3-1

<u>a Erstando – Tyto Selling ander a</u>

a a

. i.

	-0	<u>א ט</u> ק –	<u> </u>			
	, ç D	D	ະ <sup>ເ</sup> ວິ ເ ເ	م <sup>د</sup> مرح آ	н	
cleaned and	d roots cut as pa	art of recomme	ended improvement	s. Table 3:2	2:1(a) lists the sewer	
ci c seaments n	ecommended for	r root cuttings	Table 3 2 1(b) list		nal sewer soomooto	
	laal <sup>2</sup> aa baasa la	- i i i B			nal sewer segments	
	leo for neavy cle	aning due to o	deposits" (in addition	to the segme	ents for root cutting).	
	(c) lists the Top	25 sewer se	gments recommend	ed for repairs	and: possible: CIPP:	
E Lining due t	to identification o	f severe inflov	w (note that/some o	of these are a	so listed on the root	
	the heavy cleaning	o Indistas well)	, L	Ъ 1		
		ig list as welly.			о <sup>о</sup>	
		10 5 (a) Sewer Se	ີ U ເງຊູ <sub>ນ</sub> aments Prioritized	"BED CYT	tina 'JE	
भुद्धु च ूः २०	. G (	□ □	9///0//11/0///220 		ang 💡 -	
	AREA	PRIORITY	SEGMENT ID	STREET '		
	Blue Lick	Sevëre.	Unknow to BL5	Melody	1	
မျို <sup>ဆာ</sup> ကား	HH2	Severe	068_069	Earlywood		
	HH2	Poor	074-082	Easement		
	<u> В</u> н	Poor	015_016	Angelina :		
	HH Line are	Poor	013_014	Arbor Tr		•
21	HH2	Moderate	033_034	Cadenza		
<u>62</u>	HH2	Moderate	036_037	Fawn Ct	ъ	
( <u>7</u>	HH2 G	Moderate	004_075	Easement		•
Ē	нн2	Moderate	077_079	Baracha	-	
D	нн	Moderate	002_006	Angelina		
		Moderate	025_027	Bigoak		
-		wooerate	20152/19301	Medium		
	.L	l				
	a -		0			
	~ ~ ~					
C	੍ਹ ਨੂੰ		-			
D D	ې Table 3.2.1(b)	⊏ Addi Sewer S	egments Prioritize	d Ìor Heavy (	Òleanˈing	
D D	Table 3.2.1(b)	E Addl Sewer S	egments Prioritize	d for Heavy (	Čleaniing 1	
с с	Table 3.2.1(b)	E Addl Sewer S PRIORITY	egments Prioritize	d for Heavy (	Èlean'ing	
	Table 3.2.1(b)	C Addl Sewer S PRIORITY Severe	egments Prioritize	d for Heavy ( STREET Carissa	Èleaniing	
C C	Table 3.2.1(b)	E Addl Sewer S PRIORITY Severe Poor Moderate	egments Prioritize SEGMENT ID 042_043 06_07 018_019	d for Heavy ( STREET Carissa Angelina Easement	Cleaning	
	Table 3.2.1(b) AREA HH2 HH HH2 HH2 HH2	C Addl Sewer S PRIORITY Severe Poor Moderate	egments Prioritize <b>SEGMENT ID</b> 042_043 06_07 018_019	d for Heavy ( STREET Carissa Angelina Easement	Èlean'ing	
с с б	Table 3.2.1(b) AREA HH2 HH HH2 HH2	E Addi Sewer, S PRIORITY Severe Poor Moderate	egments Prioritize SEGMENT ID 042_043 06_07 018_019 □ □ □	d for Heavy ( STREET Carissa Angelina Easement	Cleaning	
c C	Table 3.2.1(b) AREA HH2 HH HH2 HH2 (Addl Sewe	C Addl Sewer S PRIORITY Severe Poor Moderate r Segments F	egments Prioritize SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav	d for Heavy ( STREET Carissa Angelina Easement 7 y Cleaning (f	Cleaning           	
с с f	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe	E Addi Sewer S PRIORITY Severe Poor Moderate r Segments F	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (f	Cleaning       <u>   3))</u>	•
с с Г Г	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe AREA HH3	E Addl Sewer, S PRIORITY Severe Poor Moderate r Segments F PRIORITY Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9 A8	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (I STREET Wild Wav	Cleaning       <u>   3))</u>	•
ດ ດ ເ ເ ເ ເ ເ 	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe AREA HH3 HH3 HH3	E Addl Sewer, S PRIORITY Severe Poor Moderate <u>r Segments F</u> PRIORITY Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13	d for Heavy ( STREET Carissa Angelina Easement 7 <u>y Cleaning (f</u> STREET Wild Way Jennymac	Cleanïng   	
с с f f	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe AREA HH3 HH3 HH3 HH3	E Addi Sewer, S PRIORITY Severe Poor Moderate r Segments F PRIORITY Severe Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13 M3_M9	d for Heavy ( STREET Carissa Angelina Easement 7 V Cleaning (I STREET Wild Way Jennymac Majestic	Cleaning	
с с	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe (Addl Sewe AREA HH3 HH3 HH3 HH3 HH3	E Addl Sewer, S PRIORITY Severe Poor Moderate r Segments F PRIORITY Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13 M3_M9 	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (I STREET Wild Way Jennymac Majestic	Cleanïng	•
с с с	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe AREA HH3 HH3 HH3	E Addl Sewer S PRIORITY Severe Poor Moderate <u>r Segments F</u> PRIORITY Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13 M3_M9 C C	d for Heavy ( STREET Carissa Angelina Easement 7 <u>y Cleaning (f</u> STREET Wild Way Jennymac Majestic	Cleanïng	•
	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe AREA HH3 HH3 HH3 HH3 HH3 HH3	E Addi Sewer S PRIORITY Severe Poor Moderate r Segments F PRIORITY Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13 M3_M9 C (1)	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (I STREET Wild Way Jennymac Majestic	Cleaning	
	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe (Addl Sewe AREA HH3 HH3 HH3 HH3	E Addl Sewer, S PRIORITY Severe Poor Moderate r Segments F PRIORITY Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13 M3_M9 C C	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (I STREET Wild Way Jennymac Majestic	Cleaning	
с с б о	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe AREA HH3 HH3 HH3 HH3 HH3 HH3 HH3 HH	E Addl Sewer, S PRIORITY Severe Poor Moderate r Segments F PRIORITY Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13 M3_M9 C C	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (f STREET Wild Way Jennymac Majestic	Cleanïng	• • • •
	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe AREA HH3 HH3 HH3 HH3 HH3 HH3	C Addl Sewer S PRIORITY Severe Poor Moderate r Segments F PRIORITY Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13 M3_M9 C C C C C C C C C C C C C	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (f STREET Wild Way Jennymac Majestic	Cleanïng	
	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe (Addl Sewe AREA HH3 HH3 HH3 HH3 HH3 HH3 HH3 HH	C Addi Sewer, S PRIORITY Severe Poor Moderate r Segments F PRIORITY Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 0 0 0 0 0 0 0 0 0 0 0 0 0	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (I STREET Wild Way Jennymac Majestic	Cleaning	• • • •
	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe (AREA HH3 HH3 HH3 HH3 HH3 HH3 HH3	C Addi Sewer, S PRIORITY Severe Poor Moderate r Segments F PRIORITY Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 0 0 0 0 0 0 0 0 0 0 0 0 0	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (f STREET Wild Way Jennymac Majestic	Cleaning	
	Table 3.2.1(b) AREA HH2 HH HH2 (Addi Sewe AREA HH3 HH3 HH3 HH3 HH3	C Addi Sewer, S PRIORITY Severe Poor Moderate <u>r Segments F</u> PRIORITY Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13 M3_M9 C C C C C C C C C C C C C	d for Heavy ( STREET Carissa Angelina Easement 7 <u>y Cleaning (f</u> STREET Wild Way Jennymac Majestic	Cleaning	
	Table 3.2.1(b) AREA HH2 HH HH2 (Addl Sewe AREA HH3 HH3 HH3 HH3 HH3 HH3	C Addl Sewer S PRIORITY Severe Poor Moderate r Segments F Severe Severe Severe Severe	egments Prioritized SEGMENT ID 042_043 06_07 018_019 C Prioritized for Heav SEGMENT ID A9_A8 A14_A13 M3_M9 C C C C C C C C C C C C C	d for Heavy ( STREET Carissa Angelina Easement 7 Y Cleaning (I STREET Wild Way Jennymac Majestic	Cleaning	• • •

				<u>ר ה-</u>	nimennarinis	
rijt⊂ ooo	G	7;	ដ ភ្ល័ង	20 20 20 20	C*.	
	Table 3.2.1(	c) Sewer Se	gments Prioritized	for Repairs		
	<u></u>	<u> </u>	<u> </u>	Dec		й ()
	AREA	PRIORITY	SEGMENT ID	STREET	κ.	
	Blue Lick	Severe	Unknow to BL5	Melody		
ິມໂຕ ຍິ່ຍ	Blue Lick	Severe	BL3_BL4	Melody		
	Blue Lick	Severe	BL4_BL5	Melody z	2	
	HH2	Severe	_033_034	Cadenza	0	
	e HH. P	Severe	015_016	Anglelina		$e^{\mathbf{D}}$
	HH2 E	Severe	046_047	Bally Castl	ᇉᅟᆋᅶᇗ	N.
	HH2	Severe	042_043_ '-	Carissa		
	Blue Lick <sub>µ</sub>	Severe	Unknown_BL5	Blue Lick	<u> </u>	
	HH2	Severe	034 <u>-</u> 035 ដ	Cadenza	n	
	਼ ਸ਼ੁਮ	Severe <sup>1</sup>	008_010	Cannon		
<b>۳</b> ٦	HH2	Severe	059_061	Easement		
L -	HH2	-Severe	037_34	Fawn Ct		
_	Blue Lick	Severe	BL4_BL6	Blue Lick	-	
- F -	Blue Lick	Severe	Unknown_BL5	Blue Lick		'n
×.	НĤ	Poor	002_006	Angelina		ų
£	HH2 <sup>,</sup>	Severe	029_044	Bigoak		
, C	HH2	Severe	048_051	Easement		
	HH2	Poor	_ 036_037	Fawn Ct		
<b>D</b>	HH2	Severe	<u>ី</u> 2050_051	Bally Cast		
	HH2	Severe	066_068	Earlywood	D	
J	HH2	Poor	004_075	Easement		1
ú	HH2	. Severe	066_067	Earlywood		C
L	Blue Lick	Severe	067_068	Blue Lick	н. - С	
	нн	Poor	006 <u>-</u> 007	Angelina	a	
- ۲]	НН	Severe	024_026	Bigoak		
. ц <sub>С</sub>	НН	Poor	025_027	Bigoak		
- -	Blue Lick	Severe	BL3_BL5	Blue Lick		
Ľ	HH2	Poor	C 044_045	Bigoak		
1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	(Addl Sewei	r Segments I	Prioritized for Repa	irs for HH3)		
ບໍ່ ບໍ່	AREA	PRIORITY	SEGMENT ID	STREET		
۲.,	HH3	Severe	A10_A11	Jennýmac		
	I <u>H</u> H3	Severe	A6_A7	Jennymac:		
, <b>-</b> 0	HH3	Severe	A7_A10,	Jennymac		
	HH3	Moderate	M10_M9	Wild Way	D (	
	I HH3	I Moderat	1 M11 M10	Wild Way		

cuon system include mose with major opstacles (such as dulities). Table 3.2.1 additional sewer segments recommended for utility removal, not already listed in the Top 25 segments, or in the table for root removal.  $\begin{bmatrix} 1 & -1 & -1 \\ -1 & -1 & -1 \end{bmatrix}$ .-۲ Ľ 

Ŀ,

S,

р С

IJ

3-3.

٥

BlueStone

٢.

	0							
	<u> </u>	ne ne po ne	д nO и		ייי זרג בי <u>ט</u> ב 0	¢		-
	ECTION	THREE "			roging Constants	nmendations		C CT
								pq.
	n (							٦.
	ະ ບ	Table 3.2.1	(d):Sewer Seg	ments Requirin	g Utility Removal	. <u> </u>		<u> </u>
<u>0,01</u> 0 6 65	′¦c0			C		ت <sup>لر</sup>	·	
	_	AREA	PRIORITY	SEGMENT ID	STREET	Ó		
Ū D	2		Moderate	008_010	Cannon	П		ا ,ر.
			Widderate			о <u>с</u> . О	~	
	ů ,					. – –		
	·3.2.2	Sanitary Sewer Man	holes			·		
	<sup>а</sup> Ц т.				202000°-		•	-Få
<u>ຼັ ພະລະ</u>	ີບ Ine:co ຕ	indition assessment of	the sanitary m	anholes assesse	d.conditions such	as root intrusion,		cj
	infiltrat	ion and structural g	defects, Mani	ole rehabilitațio	n recommendatio	ons include the:		,2
	installa	ition of mechanical and	1 non-mechani	cal chimney seals	s,∉epoxy lining of th	e manholes; and		ات کان
ាញ់ <b>ដែន គ</b> ្នា ជ	manho	e arouting. Currently	no manholes :	are being recomm	nended for epoxy	ت ا Ining however a		c
<u>["</u>	few a	re listed to be clear	ed and rear	uted as shown	on Table 3.2.20	n) for monholog		، اي م
b in a p	50000	wonded for some	icu and regio			a) for mannoles		{ž
τς <b>μ</b>	recom	mended for repair.						ں _
	<b>1</b>	Table 2	0.0%-1.44			٥		لْر _
		Table 3.	.2.2(a) Manno	les Recommend	led for Repair	n	· C	ᄀᇎๅ
	1	MANHOLE ID	REH		PRIORITY	ר ד		rş
		WWTP_1 (HH1)	New	Rings/Collar/Clea	ining 'Severe			τζ
r. l.		WWTP_2 (HH1)	Nếw	Rings/Collar/Clea	ning Severe			Fa
ತನು -೨		023 (HH1)	.Clear	ing/Grouting	Moderate			ក្ន
0.0 61		019 (HH1)	Clear	ing/Grouting	Moderate			_ [
	ר מ	018 (HH1)	Clear	ing/Grouting	Moderate			1
		017 (HH1)	Clear	ing/Grouting	. Moderate	_		<sup>6</sup> 0
ים ביו			<u>Clear</u>	ing/Grouting	Moderate			1
	•		Clear	ing/Grouting	Moderate	4	G	·•
		068 (HH1)	Clear	ung/Grouting	Moderate			
u . E		069 (HH1)	Clear	ning/Grouting	Moderate	1		Ч
o z cP		027 (HH2)	_ Clear	ing/Grouting	Moderate	-		
E 12	C.	025 (HH2)	Clear	ning/Grouting	Moderate	<u> </u>		
. :	-	034 (HH2)	Clear	ning/Grouting	Moderate			υ
r.		045 (HH2)	Clear	ning/Grouting	Moderate	E	. •	أيتم
	a	046 (HH2)	Clèar	ning/Grouting c	Moderate			ij
C	_	BL1 (BL)	Clear	ning/Grouting	Moderate.	4		Ì
«с <sub>а</sub> е, п				ning/Grouting	Moderate.	_{		r
ат, Ф сте		BL3 (BL)	Clear	ung/Grouting	Moderate	-{		-~> (
с <u>р</u>		BL5 (BL)	Clear	ning/Grouting	Moderate			
чо го 20	There	were no chimney sea	ils found on ai	ny of the manhol	les in the system,	and a number of		្នុះភ្នំ
: г	manho	oles showed some siar	ns of leakage a	t the chimney rin	gs. Installation of	either chemical or		
	mecha	anical chimnev seals	is recommend	led for all of the	e manholes in the	Hunters Hollow		- 1
-	evetor	n (Installation of chil	nnev seals is	needed in all of	f area HH3 to elin	ninate leakage at		
, · · ·		ama and since Ad	litionally all	manholog ant i		to have frames		ł.
	<u>e m</u>	<u>anie and rings. Add</u>	nuonany, an i	namioles not if	i pavement need	to nave trames		
	<u>reinst</u>	alled and sealed corr	ectly.)					ļ

3-4

BlueStone

ŗ,

1 7,

من المسلم ال المسلم ار دی آ

4

[ -[<sup>-</sup>]

<b>SEGINARI HKEF</b>	<u> </u>	с <sup>с</sup>	Recommen	ndations
	ŕ	_ ۲ <sub>۵</sub> {		۵
		ے م		° ° ° °
33 Elow Reduction Analysis	, <sup>0</sup>			6
	00	цр		r D
As a part of this evaluation, a flow reduc	tion analysis	was per	riormed to determine the estim	'같 nated peak
flow reduction that could result from the	recommende	d rehabi	litation plan. Table 3.3.1 repr	esents the
estimated peak flow reduction calculated u	Ising typical v	alues fo	or other systems <sup>0</sup>	
	3-9 Γ΄ ς,			
	3.1.Estimated	Flow I	Reduction	
AND REPAIR		ŪNIT		Credit
Sanitary Manhole Chimney Seal		,		
In Non-Paved Area	ີ 50	EA	656 C	34,768
In Paved Area	103	EA	156.	16,068
Sanitary Sewer Repair	<sup>1</sup> ם م			
Point Repair	19 '20	EA EA	1440 <sup>11</sup> 700	27,360
8-inch CIPP Lining (4500 LF)	6.82		- 500	14,400
·			TOTAL (GPD)	96.006
Table 3.3.2 Estim	nated Flow R	éductió	n (from HH3 Area)	,
DESCRIPTION OF REHABILITATION	OLIANTITIŻ		FLOW REDUCTION / UNIT	Credit
Sanifary Manhole Chimney Seat	QUANTITY		(GPD)	(GPD)
In Non-Paved Area	33,	FA	656	21.648
In Paved Area	8	EA	156	1.248
Sanitary Sewer Repair				
Point Repair	<u> </u>	EA	<u>720</u>	2,160
Total E	C ntimoto Ele			25,055
	stimate Fic	ow Rec	$\frac{1}{2} \frac{1}{2} \frac{1}$	
	a a	<u> </u>		
	D C.	<u>ت</u> _ ۲		
3.4 Rehabilitation Costs				
C ,	C	. U Е		
The estimated project cost for the rehabil	litation improv	rements	for the Hunters Hollow collection	ion system
has been estimated at approximately \$41	5,837. Table	9 3.4.1 I	ists the items and estimated co	osts for the
rehabilitation and repairs. (This total h	as been inc	reased	to account for improvement	ts in Area
<u>ННЗ.</u>	پ	5-	Ε	
	· .	- <u>-</u> [] -	an P	
By undertaking the various recommend	ed improvem	ents to	correct the deficiencies in th	ne sanitary
collection system, the inflow and infiltrat	ion will be re	educed	in the Hunters Hollow collection	on system.
Additionally, a systematic and on-going c	leaning, and	root cor	ntrol program should be provide	ed for over
the long-term.	,	÷	· ·	
		·, ·		
ی <sup>ت</sup> د د	U	. · · ·		51
			-	

		- <b>U</b> r	üc.	<u></u>		y
			- 1 0	,o	ರಸರ	G
*				ecommen	dations	
		ີ ດີ ຕິ ໂລຼຼີດ [Probable Co	المجمع المحالي المحالي المحالي المحالي المحالي المحالي المحالي المحالي المحالي	ີ ເຊັ່		۰
- جم د <sup>יت</sup>	DESCRIPTION	OLIAN				Ţ
<u>с</u>	Mobilization-Bonds and Insurance	1 5				{
	Maintenance of Traffic	1 5	<u> </u>	\$15,000.00	\$15,000.00	{
	8-inch Cured-in-Place, Pipe	4500	of of stra	\$28.50	\$128,250,00	1
<u>مريح</u> 1	8-inch Spot Lining	1 <sup>2</sup> 5.0		\$4,000,00	<u>\$128,250.00</u>	1
дp	8-inch Pipe Replacement	250 9		- \$300.00	, <u>\$75,000,00</u>	
	8-inch Point Repairs	160	<u>с</u> с, с	\$325.00	\$53,000.00	1
	Heavy Cleaning	6.000	FT.	<u>\$323.00</u> \$3.00	S18 000.00	-
C.	Root Cutting	3500	FT	\$4.00	\$14.000:00	ŀ
	Additional CCTV and Field Inspections	10.829	<u></u> Та	94.00 93.00	\$14,000.00	ľ
r.	Manhole Repair/Grouting	C 21	Ë A-	\$3.00	532,487.00	
	Manhola Chimpay Saal Machanical	P 60		31,350.00	528,350.00	-
	Bunase Dumping	.50	EA	\$375.00	\$18,750.00	-
ŗ '	bypass Fullping		LS	\$15,000.00	\$15,000.00	J.
De	a د	ugg o <sub>o</sub>	ESTIMATED	τοται =	\$415 837 00	
					<u> </u>	
a u KreC	u Table 3 4 2 Addi Probable	Constructio	<u>Costs for Area</u>		<del>\$\$10,007.00</del>	c
a b kin oD ka	c <u>Table 3.4.2 Addi Probable</u>	Constructio	<u>Costs for Area</u>	<u></u>		c
n <b>d</b> An <b>d</b> A	DESCRIPTION		n Costs for Area			ے ا
	DESCRIPTION	Constructio	n Costs for Área			
	Table 3.4.2 Addl Probable       DESCRIPTION       8-inch Point Repairs       Heavy Cleaning	Constructio	<u>TITY/UNIT</u> FT	UNIT PRICE \$325.00	ITEM TOTAL \$16,250.00	
	Table 3.4.2 Addi Probable       DESCRIPTION       8-inch Point Repairs       Heavy Cleaning       Manbola Repair/Graditing	Constructio	TITY/UNIT FT	UNIT PRICE \$325.00 \$3.00	□ ITEM TOTAL \$16,250.00 \$1,920.00	
	Table 3.4.2 Addi Probable       DESCRIPTION       8-inch Point Repairs       Heavy Cleaning       Mänhole Repair/Grouting	Constructio Constructio COUAN 150 640 21 5 5 5 5 5 5 5 5 5 5 5 5 5	TITY/UNIT FT FT EA	UNIT PRICE \$325.00 \$3.00 \$1,350.00	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00	
	Table 3.4.2 Addl Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Manhole Repair/Grouting         Manhole Chimney Seal-Mechanical	Constructio Constructio CUAN 150 640 21 21 21 21 21 21 21 21 21 21	<u>EOMINTED</u> n Costs for Área TITY/UNIT FT FT EA ⊐ EA	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00	
	Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Grouting         Mänhole Chimney Seal-Mechanical	Constructio Constructio QUAN 150 640 21, 21, 21, 21, 21, 21, 21, 21,	<u>EOTIMATED</u> <u>n Costs for Area</u> TITY/UNIT FT FT EA □ EA ESTIMATED	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 \$61,895.00	
	Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Groüting         Mänhole Chimney Seal-Mechanical		TITY/UNIT FT FT EA ⊐ EA ESTIMATED	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b>	
	Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Groüting         Mänhole Chimney Seal-Mechanical	Constructio Constructio QUAN 150 640 21 21 21 21 21 21 21 21 21 21	ESTIMATED	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b>	
	Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Grouting         Mänhole Chimney Seal-Mechanical         E         Total Estimated Probable Comparison	Construction QUAN 150 640 21 21 41 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ESTIMATED	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b>	
	Image: Constraint of the state of the s	Construction	TITY/UNIT FT FT EA EA ESTIMATED	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	□ ITEM ŤOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b>	
	Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Groüting         Mänhole Chimney Seal-Mechanical         Total Estimated Probable Company	Construction Construction QUAN 150 640 21. 21. 21. 21. 21. 21. 21. 21.	TITY/UNIT FT FT EA EA ESTIMATED	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b>	
	Image: Constraint of the state of the s	Constructio	ESTIMATED	UNIT PRICE S325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b> \$61,895.00	
	Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Grouting         Mänhole Chimney Seal-Mechanical         C         Total Estimated Probable Co         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C         C    <	Construction	$\frac{\text{EOTIMATED}}{n \text{ Costs for Area}}$ $\frac{\text{TITY/UNIT}}{\text{FT}}$ $\frac{\text{FT}}{\text{EA}}$ $\frac{\text{EA}}{\text{ESTIMATED}}$ $\frac{1}{2}$	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b> \$61,895.00	
	Image: Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Groüting         Mänhole Chimney Seal-Mechanical         Image: Comparison of the second seco		TITY/UNIT FT FT EA EA ESTIMATED	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	□ ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b> \$61,895.00	
	Image: Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Groüting         Mänhole Chimney Seal-Mechanical         Image: Comparison of the second seco	Constructio	ESTIMATED	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	U ITEM TOTAL \$16,250.00 \$1,920.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b> \$61,895.00	
	Image: Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Groüting         Mänhole Chimney Seal-Mechanical         Image: Comparison of the second seco	Construction QUAN 150 640 21 41 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	$\frac{\text{EOTIMATED}}{n \text{ Costs for Årea}}$ $\frac{\text{TITY/UNIT}}{\text{FT}}$ $\frac{\text{FT}}{\text{EA}}$ $\frac{\text{EA}}{\text{ESTIMATED}}$ $\frac{1}{2}$ $\frac{1}{2$	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	L C C C C C C C C C C C C C	
	Image: Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Groüting         Mänhole Chimney Seal-Mechanical         Image: Comparison of the second seco	Construction QUAN 150 640 P 21 21 21 21 21 21 21 21 21 21	TITY/UNIT FT FT EA ESTIMATED	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL =	U ITEM TOTAL \$16,250.00 \$28,350.00 \$15,375.00 <b>\$61,895.00</b> \$61,895.00	
	Table 3.4.2 Addi Probable         DESCRIPTION         8-inch Point Repairs         Heavy Cleaning         Mänhole Repair/Groüting         Mänhole Chimney Seal-Mechanical         Total Estimated Probable Company         E         E         E         E         E         E         Mänhole Chimney Seal-Mechanical	Constructio	$\frac{1}{1} \frac{1}{1} \frac{1}$	UNIT PRICE \$325.00 \$3.00 \$1,350.00 \$375.00 TOTAL = 732.00	U ITEM TOTAL \$16,250.00 \$28,350.00 \$15,375.00 \$61,895.00 \$61,895.00	

## HUNTERS HOLLOW Sanitary Sewer Evaluation Study

Prepared for: Bullitt Utilities, Inc. Blue Lick Road Louisville, KY 40129

Prepared by:



3703 Taylorsville Road, Suite 205 Louisville, Kentucky 40220

January 19, 2015 *Revised May 28, 2015* 

## HUNTERS HOLLOW SANITARY SEWER EVALUATION STUDY TABLE OF CONTENTS

		Page No.
Sectio	n One – Introduction & Background	1-1 to 1-2
1.1 1.2	Description of the Hunters Hollow and Hillview Study Area Historical Data Exhibit 1.1	
Sectio	n Two – Field Investigation & Results	2-1 to 2-7
2.1 2.2 2.3	Sanitary Sewer Manhole Inspections Closed Circuit Television Inspection Inspection Results	
Sectio	n Three – Recommendations	3-1 to 3-6
3.1 3.2 3.3 3.4	Rehabilitation Overview Rehabilitation Recommendations Flow Reduction Analysis Rehabilitation Costs	

## INTRODUCTION & BACKGROUND

The Hunters Hollow Wastewater Collection System is a separate wastewater collections system managed and operated by Bullitt Utilities, Inc with approximately 35,188 linear feet of 8", 10", and 12" VCP and PVC sewers. The system also includes (2) pumping stations that divert within the collection area. The main system was televised and inspected during 2014. <u>The additional areas of Majestic Acres Subdivision</u> & Benjamin Woods Subdivision have been included for this update as of May, 2015.

The goals for the Sanitary Sewer Evaluation Study (SSES) include reducing or eliminating any bypassing or overflows experienced at the Hunters Hollow Wastewater Treatment Plant, as well as reducing or eliminating backups and surcharging in the collection system and pump stations. The results of this SSES will be used to identify system defects to help prioritize rehabilitation efforts so that repairs can be made to ultimately reduce the peak flows in the existing collection system. Improvements will be made annually based on these recommendations and findings. This evaluation included review of construction plans for various parts of the collection system and combining them into one system map that was then compared and updated based on the CCTV inspections. This final system map was then utilized as part of the SSES summary results. <u>The system maps have been updated based on the additional areas of Majestic Acres and Benjamin Woods Subdivisions</u>.

#### 1.1 Description of the Hunters Hollow and Hillview Study Area

The Hunters Hollow collection system is located in north Bullitt County and lies just south of the Jefferson County line in a primarily residential area called Hillview, bounded to the west by I-65, to the east by Pioneer Village, and to the south by Jeffie Lane. The collection system is divided into (4) four sub-areas named for their corresponding subdivision names and systems that gravity either to the Hunters Hollow Treatment Plant, or to a localized pumping station that pumps into the main collection system.

- Hunters Hollow Subdivision (HH1) includes the original portion of Hunters Hollow Subdivision, Smith Grove Subdivision (Shelby Circle) off of Smith Lane, and also the commercial area along Carter Avenue and Terry Blvd. This part of the collection system serves approximately 198 customers, mainly residential with a few commercial warehousing/offices. The system has approximately 8,744 linear feet (LF) of 8", 10", and 12" mainline sewer, comprised mainly of vitrified clay pipe (VCP) and Polyvinylchloride (PVC) pipe constructed in the 1960's and later. For sewers made with vitrified clay pipe, it is not surprising to find many defects during system investigations. Given that much of this system is part of the original collection system however, a good portion of HH1 is for the most part in acceptable condition.
- Hunters Hollow Subdivision 2 (HH2) includes Hunters Hollow Subdivision to the north of the original subdivision, with the Bigwood Way Pumping Station that diverts wastewater flow over to





Exhibit 1.1 – Hunters Hollow Service Area Map



HH1. This part of the collection system serves approximately 168 residential customers. The system has approximately 12,152 linear feet (LF) of 8" sewer, comprised mainly of VCP.

- Hunters Hollow 3 (HH3) includes the Benjamin Woods Subdivision & Majestic Acres Subdivision located to the north and west of the original Hunters Hollow Subdivision, and includes the Ziniz Pump Station off Hillview Blvd that diverts flow from Majestic Acres (165 customers) over to HH1. Benjamin Woods ties 99 customers into the HH2 system by gravity. This part of the collection system serves approximately 264 residential customers. The system has approximately 10,829 linear feet (LF) of 8" sewer, comprised mainly of VCP and PVC pipe. <u>The additional CCTV</u> inspections and summary has been provided for this area with this updated report.
- Blue Lick Road (BL) includes collectors that provide service to small residences, and apartments west of Blue Lick Road, as well as commercial buildings running north along Blue Lick Road to the Jefferson County line. This collection area also connects to the Ziniz Pump Station which diverts flow back into HH1 and includes approximately 45 customers, with approximately 3,463 linear feet (LF) of 8" sewer, comprised mainly of vitrified clay pipe VCP and PVC pipe.

Exhibit 1.1.1 provides a Service Area Map identifying the (4) four subareas listed.

#### 1.2 Historical Data

**ECTIONONE** 

Historical data for the Hunters Hollow system only included construction plans for various portions of the system, as well as recent monitoring information from usage of the Veolia temporary WWTP. Monitoring of flow indicated a typical dry weather flow of approximately160,000 gallons per day. Peak flows during wet weather events typically overloaded the 300,000 gallon temporary treatment system. These increases confirm increased wet weather flows throughout the study area, demonstrating the magnitude of inflow and infiltration at various locations within the system. No pump station run time data was available to analyze additional portions of wet weather impacts in the system. <u>Note that due to the temporary nature of operations with the Veolia Wastewater Treatment Plant no continuous records have been provided to compare normal operating conditions with wet weather conditions. Additionally, since no flow monitoring has been performed for various sections of the gravity system, no comparison is provided by watershed or basin. These items are recommended to be addressed in the "Corrective Action Plan" letter dated June 1, 2015.</u>



## **SECTION 2: FIELD INVESTIGATION & RESULTS**

The field investigation and inspection portion of this study generates the required information to analyze the sanitary collection system. The mainline sanitary sewers were televised for a major portion of the system and defects were noted. Manholes were inspected to determine if any major structural or other deficiencies could be found. Smoke testing was not currently performed, however as indicated in discussions with operation staff, smoke testing was performed approximately 10 years ago, with limited results (<u>as identified by Bullitt Utilities personnel, and no records/data has been provided to confirm</u>). No additional internat or external property assessments were performed on private property to verify basement connections or downspout connections to the system (<u>from recent discussion with some of the neighbors it does seem possible that both downspouts and possibly even sump pumps are connected to the sanitary sewer system – a private property canvassing would be required to gain additional information from residents to indicate if they have any illicit connections that could be removed.</u>

#### 2.1 Sanitary Sewer Manhole Inspections

Field inspection and investigation was conducted to evaluate the sanitary sewer manhole structures that comprise the Hunters Hollow collection system in areas HH1, HH2, and BL. The inspections focused on issues related to Inflow and Infiltration concerns, structural deficiencies and gathering any additional "asbuilt" sewer information. <u>Additional inspections for manholes in area HH3 are now provided with this update.</u>

## 2.1.1 Typical Defects Found During Manhole Inspections

The following details typical defects that are looked for during the inspection of sanitary sewer manholes.

#### Cover

Common defects that occur with the cover are wrong size or type, cracked, and below grade. Covers that are the wrong size for the intended frame are either too small and ultimately do not rest on the seat correctly. When the structure resides in the path of traffic, this situation creates the potential for the cover to come loose as vehicles travel over the cover.

#### Frame

Common defects that occur within the frame are lateral cracks, non-level frames, and offset frames. Structures that reside in the path of vehicular traffic require the frame to be level with the roadway to ensure that the cover remains at grade with the pavement. Vehicles



that travel over an uneven cover can cause structural damage to the manhole and / or the frame.

### Wall/Cone

The materials used for the construction of walls and cones ranges from precast or cast in place concrete in newer construction to brick and mortar for earlier construction. Common defects that can be found within this component of the sewer include missing material, loose material and fractures or cracks. In areas of high ground water, cracks may keep growing due to the additional pressure of water and may lead to continual infiltration within the sewer.

#### Bench

The bench of a manhole is usually built of bricks and mortar in older manholes and concrete in newer construction. Common defects that occur are cracks in the bench and infiltration where the wall meets the bench. These areas of concern should be corrected with a high strength cement or mortar material. The material selected would require a short cure time in order to minimize restrictions of flow from the upstream pipe during repairs.

#### Channel

The trough is commonly built from vitrified clay, brick, and concrete. Defects that occur within this component primarily consist of cracks, and obstructions. Cracks are corrected by applying the same type of cement or mortar material as described above in the "bench" discussion.

#### Steps

Steps are commonly made from cast iron, or steel materials. Over time, the material deteriorates making the step unsafe, or the connection to the manhole wall fails resulting in missing steps. Prior to replacing missing or unsafe steps, the entire manhole should be assessed for other rehabilitation issues.

## 2.1.2 Inspection Protocol / Techniques

The following steps detail the protocol and techniques used during the inspection to identify and quantify possible defects with each component of a sanitary manhole. Manhole inspections consisted of the following general format:

- Manholes were located by the field inspection crews with a reasonable effort, defined as an on-the-ground search using available system maps. Buried manholes were not uncovered.
- If crews were unable to locate manholes, they were designated as "could not locate" (CNL).



- SECTIONTWO
  - 3) A detailed inspection of each structure was performed by the field crews from the surface (no confined space entry occurred in any case), addressing applicable items on a standard inspection form. Visual inspections included the following information, documented in the appropriate fields using standard manhole inspection codes:
    - General information regarding the inspection conditions, date/time, crew, location, flow depth, surcharging, silt build-up, and ponding evidence;
    - Type, depth, and diameter of manhole structural assets (manhole, cover, and barrel);
    - The type/material and condition of pertinent internal structures;
    - Size and quantification of defects;
    - The size, material, and condition of pipe connections; and,
    - Documentation of observations in the comment field.

### 2.1.3 Inspection Results

The defects identified can be categorized into two primary areas; either Inflow and Infiltration concerns or structural deficiencies.

Of the 153 total manholes identified in the Hunters Hollow system, 12 could not be located and 41 were in area HH3.



Figure 2.1.2 Manhole Inspection For Area HH3, 41 manholes were inspected with 7 not located/buried (and one manhole located on the Bluelick Airfield "M22" was bolted down and could not be opened).

Table 2.1.1 lists the manholes that could not be found or were buried

Table 2.1.1 Manholes Not Found/Buried (Addl\_Manholes Not Found/Buried in HH3)

MANHOLE ID				
002 (Smith)	065 (HH1)			
006 (Smith)	076 (HH1)			
009 (Smith)	077 (HH1)			
010 (Smith)	080 (HH1)			
012 (Smith)	054 (BL)			
014 (Smith)	BL4A(BL)			

MANHOLE ID					
A2 (HH3)	M21 (HH3)				
A13 (HH3)					
M3 (HH3)					
M8 (HH3)					
M12 (HH3)					
M20 (HH3)					

Most all of the manholes inspected were in fair condition with typical concrete walls and benches with either VCP or PVC channels. Most manholes did not have cones and most all manhole covers were cast iron with fitting lids. A few manholes near the existing treatment plant were

deteriorating due to prior system backups and overflows. These manholes are listed in Table **2.1.2** along with a few other manholes in the system that require repairs.

MANHOLE ID					
WWTP_1	074 (HH1)	045 (HH2)			
WWTP_2	066 (HH1)	046 (HH2)			
023 (HH1)	068 (HH1)	BL1 (BL)			
019 (HH1)	069 (HH1)	BL2 (BL)			
018 (HH1)	027 (HH2)	BL3 (BL)			
017 (HH1)	025 (HH2)	8L4 (BL)			
075 (HH1)	034 (HH2)	BL5 (BL)			

Table 2.1.2 Manholes Requiring Grouting/Repair

There were no chimney seals found on any of the manholes in the system, and a number of manholes showed some signs of leakage at the chimney rings. Installation of either chemical or mechanical chimney seals is recommended for all of the manholes in the Hunters Hollow system.

Area HH3 manholes were similar to other portions of the Hunters Hollow collection system, however it must be noted that most of the manholes were constructed in the roadside ditches as opposed to being in the streets. Not only were these manholes located either in or next to the roadside ditch but most of the manholes in HH3 had frames that were simply laying on top of the manhole structure (not bolted or sealed). Most were shown to have infiltration occurring at the frame and the rings. Only those manholes in pavement did not have loose frames, however still exhibited leakage/infiltration around the frame and rings (even below pavement). While some manholes do exhibit signs of surcharging/backups, the walls, benches, and pipes all look good and do not exhibit signs of cracking or leaking (the sewer lines are PVC in Area HH3). I&I is occurring from the top frame and rings (which is apparent), and possible also from private property in this area.

## 2.2 Closed Circuit Television Inspection

CCTV inspections were performed on a major portion of the sanitary sewer gravity lines in the Hunters Hollow system from 8-inch to 12-inch in diameter. This includes approximately 24,359 LF of sanitary sewer pipe (for Areas BL, HH1, and HH2). An additional 9,186 LF was inspected for Area HH3. CCTV inspections are used to identify main line defects and discrepancies to help prioritize required improvements



ECTIONTWO

## 2.2.1 Inspection Protocol / Techniques

The CCTV inspections were conducted by Pipe Eyes, LLC and divided into areas similar to this report. Some areas were found to have severe root intrusions, intruding joints or obstacles that inhibited the camera from passing through the pipe. CCTV inspections for Area HH3 were performed by Martin's Pipeline Inspection and provided in separate reports for both Majestic Acres and Benjamin Oaks Subdivision.

The inspection identified pipe materials, pipe deficiencies, laterals, pipe connections and general condition of the pipes.

Additional steps taken during the inspection to increase the quality of the inspection and quantify possible defects are listed.

- If an obstruction in the line did not allow the camera to pass, the field crew attempted to enter the camera from the opposite manhole in order to complete the inspection of the line segment up to the original obstruction.
- 2) If the field crews found configurations that were different than what was shown from original system data, changes were marked on a field map for later updating.
- 3) All inspection videos and associated reports were submitted in digital format and were coded in PACP 4.4 format.
- 4) Typical Defect Codes used during the CCTV process included:
  - Deposits/Grease
  - Roots
  - Hole
  - Obstacle or Obstruction (some utilities)
  - Fracture
  - Sag
  - Joint Offset/Repair Point
  - Collapse (or pipe failure)
  - Tap Intrusion
  - Infiltration (Dripper, Weeper, Runner or Gusher)
- 5) Defect Condition/Severity Codes are based on the following color scheme:
  - Black very minor
  - Green minor
  - Blue moderate



- Brown poor
- Red severe

#### 2.3 Inspection Results

Overall the pipes inspected showed a random series of defects. Even older sections tended to show similarly both good and bad sections of pipe with typical defects. All three areas of the system have lines that should be prioritized for improvements.

The Blue Lick (BL) area included a number of defects all on the same line segments such as holes, cracks and/or fractures, major root intrusions, and signs of significant infiltration and inflow (mainly Melody Lane and Brooks Run off North Triangle Lane at Blue Lick Road). These sewers were added to the system at a later date and seem to be missing manholes that would normally be installed between pipe segments.

The Hunters Hollow 2 (HH2) area included major defects including those listed above, as well as line sags, significant amounts of deposits, and even a portion of collapsed line (mostly line segments in the rear of houses paralleling Earlywood Way, or close to the Hunters Hollow pump station off Bigwood Way).

The Hunters Hollow (HH) area is similar to the HH2 area except that there are fewer/shorter line segments classified as severe that require improvements to be made. Some of these line segments additionally are located under pavements and may be easier to access than areas behind homes in HH2.

<u>The Hunters Hollow 3 (HH3) included some areas with deposits and just a few line</u> <u>segments that indicate Inflow due to holes or pipe cracking.</u> HH3 includes newer <u>subdivisions with PVC pipe including Majestic Acres and Benjamin Woods subdivisions.</u> <u>Of the additional 41 pipe segments televised only 8 have defects or major deposits.</u>

If a section of pipe has three (3) or more structural defects, but appears to be sound in terms of slope, overall integrity and operational capabilities, the section can be considered for CIPP lining. In cases where there are numerous minor structural issues along with some major structural issues such as holes in the pipe, the section is recommended for spot repairs and possibly also CIPP lining. Many of these repairs may simply require spot repairs at the location of the pipe section that is offset, or has a hole or fracture.

At some locations, the sanitary collection system has significant deposits of grease. These pipes should be prioritized for some heavy cleaning, in conjunction with major root cutting. Some of the pipes contain major root intrusion, enough to warrant root treatment or other maintenance or improvement. Some pipes were nearly full or completely blocked by roots creating blockages that may result in, or contribute to, surcharging in the sewer (see Figure 2.3.1). These pipes should be prioritized for Root Cutting and root control measures in the



# SECTIONTWO

future. Section 3 provides a summary for recommended repairs, root cutting, and heavy cleaning for line segments.

One important inflow point that should be addressed is at Manhole A14, on Wild Way. As with other manholes in HH3, the manhole is located in the center of the roadside ditch, but additionally has a large portion of the frame cut out to allow direct inflow from the ditch into the manhole. In addition, perforated pipe has been



Figure 2.3.1 Root Intrusion

installed directly into the manhole from the adjacent yard and needs to be removed (this most likely comes from the side yard of the house directing drainage into the manhole).



# **SECTION**THREE

## **SECTION 3: Recommendations**

The key goal of this analysis was to perform a condition assessment on the sanitary sewer collection system and develop various cost effective rehabilitation improvements to alleviate excessive inflow and infiltration in the Hunters Hollow system.

### 3.1 Rehabilitation Overview

The evaluation of the sanitary collection system assessed condition grades of 3(Moderate), 4(Poor), and 5(Severe) for rehabilitation and repairs. The condition assessment included evaluating the extent of the rehabilitation for the sanitary sewers.

It is noted that besides the Blue Lick area (BL) that requires rehabilitation, line segments in both Hunters Hollow (HH) and Hunters Hollow 2 (HH2) require repairs to fix holes and fractures mostly on lines in easements behind houses. This could be due to settlement in those areas (as compared to lines that run in the streets). Many of these same line segments have been listed for root cutting and cleaning as well. Prioritization of these line segments by removing roots, providing heavy cleaning, and providing point repairs followed by some CIPP lining should remove a majority of the public 1&I occurring in the main system. Prioritzation of these top 25 line segments (as indicated on Table 3.1 located at the end of Section 3) will eliminate almost all of the severe, poor, and moderate defects identified from the line inspections. <u>An additional 8 line segments have been added for Area HH3 and are listed in Table 3.2 summary located at the end of Section 3.</u>

## 3.2 Rehabilitation Recommendations

A capital improvement program should be implemented to reduce or eliminate the public and private sources of inflow and infiltration into the Hunters Hollow collection system. The removal of sources of direct inflow into mainline sewers typically results in significant improvements on the sanitary collection system during wet weather events. While infiltration is problematic in terms of the length of time, clear water may affect the sanitary collection system (infiltration can last for days or weeks after a storm event), inflow sources have a nearly immediate impact on the available capacity of the sanitary collection system. For purposes of this report only rehabilitation to sewer mainlines is provided. Evaluation of I&I from private sources (i.e. laterals and downspouts) is beyond the scope of this study.

## 3.2.1 Sanitary Sewer Mainlines.

Based on the evaluation, approximately 4,500 linear feet of 8-inch and 12-inch sanitary sewer is recommended for repairs and/or lining. These sewers showed multiple signs of inflow, and rated high in defects. The segments recommended are those that have structural deficiencies that could affect the operation of the sanitary collection system. The sanitary sewers will need to be

cleaned and roots cut as part of recommended improvements. Table 3.2.1(a) lists the sewer segments recommended for root cutting. Table 3.2.1(b) lists the additional sewer segments recommended for heavy cleaning due to deposits (in addition to the segments for root cutting). Table 3.2.1(c) lists the Top 25 sewer segments recommended for repairs and possible CIPP Lining due to identification of severe inflow (note that some of these are also listed on the root cutting and the heavy cleaning list as well).

AREA	PRIORITY	SEGMENT ID	STREET
Blue Lick	Severe	Unknow to BL5	Melody
HH2	Severe	068_069	Earlywood
HH2	Poor	074-082	Easement
HH	Poor	015_016	Angelina
HH	Poor	013_014	Arbor Tr
HH2	Moderate	033_034	Cadenza
HH2	Moderate	036_037	Fawn Ct
HH2	Moderate	004_075	Easement
HH2	Moderate	077_079	Baracha
нн	Moderate	002_006	Angelina
НН	Moderate	025_027	Bigoak
нн	Moderate	26152 19501	Medium

Table 3.2.1(a)	Sewer	Segments	Prioritized fo	or Root Cutting
----------------	-------	----------	----------------	-----------------

Table 3.2.1(b) Addl Sewer Segments Prioritized for Heavy Cleaning

AREA	PRIORITY	SEGMENT ID	STREET
HH2	Severe	042_043	Carissa
НН	Poor	06_07	Angelina
HH2	Moderate	018_019	Easement

(Addl Sewer Segments Prioritized for Heavy Cleaning (HH3))

Severe	A9_A8	Wild Way
<b>D</b>		-
Severe	A14_A13	Jennymac
Severe	M3_M9	Majestic
	Severe	Severe M3_M9

 	······································		
AREA	PRIORITY	SEGMENT ID	STREET
Blue Lick	Severe	Unknow to BL5	Melody
Blue Lick	Severe	BL3_BL4	Melody
Blue Lick	Severe	BL4_BL5	Melody
HH2	Severe	033_034	Cadenza
HH	Severe	015_016	Anglelina
HH2	Severe	046_047	Bally Castl
HH2	Severe	042_043	Carissa
Blue Lick	Severe	Unknown_BL5	Blue Lick
HH2	Severe	034_035	Cadenza
НН	Severe	008_010	Cannon
HH2	Severe	059_061	Easement
HH2	Severe	037_34	Fawn Ct
Blue Lick	Severe	BL4_BL6	Blue Lick
Blue Lick	Severe	Unknown_BL5	Blue Lick
НH	Poor	002_006	Angelina
HH2	Severe	029_044	Bigoak
HH2	Severe	048_051	Easement
HH2	Poor	036_037	Fawn Ct
HH2	Severe	050_051	Bally Cast
HH2	Severe	066_068	Earlywood
HH2	Poor	004_075	Easement
HH2	Severe	066_067	Earlywood
Blue Lick	Severe	067_068	Blue Lick
HH	Poor	006_007	Angelina
HH	Severe	024_026	Bigoak
HH	Poor	025_027	Bigoak
Blue Lick	Severe	BL3_BL5	Blue Lick
HH2	Poor	044_045	Bigoak

Table 3.2.1(c) Sewer Segments Prioritized for Repairs

(Addl Sewer Segments Prioritized for Repairs for HH3)

AREA	PRIORITY	SEGMENT ID	STREET
HH3	Severe	A10_A11	Jennymac
HH3	Severe	A6_A7	Jennymac
HH3	Severe	A7_A10	Jennymac
ННЗ	Moderate	M10_M9	Wild Way
HH3	Moderat	M11_M10.	Wild Way

Other line segments that have deficiencies that could affect the operation of the sanitary collection system include those with major obstacles (such as utilities). **Table 3.2.1(d)** lists the additional sewer segments recommended for utility removal, not already listed in the Top 25 segments, or in the table for root removal.

AREA	PRIORITY	SEGMENT ID	STREET
НН	Moderate	008_010	Cannon
HH	Moderate	015_16	Angelina

## Table 3.2.1(d) Sewer Segments Requiring Utility Removal

#### 3.2.2 Sanitary Sewer Manholes

The condition assessment of the sanitary manholes assessed conditions such as root intrusion, infiltration and structural defects. Manhole rehabilitation recommendations include the installation of mechanical and non-mechanical chimney seals, epoxy lining of the manholes, and manhole grouting. Currently no manholes are being recommended for epoxy lining, however a few are listed to be cleaned and regrouted as shown on **Table 3.2.2(a)** for manholes recommended for repair.

MANHOLE ID	<b>REHAB ТҮРЕ</b>	PRIORITY
WWTP_1 (HH1)	New Rings/Collar/Cleaning	Severe
WWTP_2 (HH1)	New Rings/Collar/Cleaning	Severe
023 (HH1)	Cleaning/Grouting	Moderate
019 (HH1)	Cleaning/Grouting	Moderate
018 (HH1)	Cleaning/Grouting	Moderate
017 (HH1)	Cleaning/Grouting	Moderate
075 (HH1) <sup>-</sup>	Cleaning/Grouting	Moderate
074 (HH1)	Cleaning/Grouting	Moderate
066 (HH1)	Cleaning/Grouting	Moderate
068 (HH1)	Cleaning/Grouting	Moderate
069 (HH1)	Cleaning/Grouting	Moderate
027 (HH2)	Cleaning/Grouting	Moderate
025 (HH2)	Cleaning/Grouting	Moderate
034 (HH2)	Cleaning/Grouting	Moderate
045 (HH2)	Cleaning/Grouting	Moderate
046 (HH2)	Cleaning/Grouting	Moderate
BL1 (BL)	Cleaning/Grouting	Moderate.
BL2 (BL)	Cleaning/Grouting	Moderate
BL3 (BL)	Cleaning/Grouting	Moderate
BL4 (BL)	Cleaning/Grouting	Moderate
BL5 (BL)	Cleaning/Grouting	Moderate

Table 3.2.2(a) Manholes Recommended for Repair

There were no chimney seals found on any of the manholes in the system, and a number of manholes showed some signs of leakage at the chimney rings. Installation of either chemical or mechanical chimney seals is recommended for all of the manholes in the Hunters Hollow system. (Installation of chimney seals is needed in all of area HH3 to eliminate leakage at the frame and rings. Additionally, all manholes not in pavement need to have frames reinstalled and sealed correctly.)

### 3.3 Flow Reduction Analysis

As a part of this evaluation, a flow reduction analysis was performed to determine the estimated peak flow reduction that could result from the recommended rehabilitation plan. **Table 3.3.1** represents the estimated peak flow reduction calculated using typical values for other systems.

DESCRIPTION OF REHABILITATION AND REPAIR	N OF REHABILITATION FLOW REDUCTION ND REPAIR QUANTITY UNIT (GPD)		FLOW REDUCTION / UNIT (GPD)	Credit (GPD)
Sanitary Manhole Chimney Seal				
In Non-Paved Area	50	EA	656	34 768
In Paved Area	103	EA	156	16.068
Sanitary Sewer Repair				
Manhole Grouting	19	ĒΑ	1440	27,360
Point Repair	20	EA	720	14,400
8-inch CIPP Lining (4500 LF)	6.82	IDM	500	3410
			TOTAL (GPD)	96.006

Table 3.3.1 Estimated Flow Reduction

Table 3.3.2 Estimated Flow Reduction (from HH3 Area)

DESCRIPTION OF REHABILITATION AND REPAIR	QUANTITY	TITY UNIT (GPD)		Credit (GPD)
Sanitary Manhole Chimney Seal				
In Non-Paved Area	33	EA	656	21.648
In Paved Area	8.	EA	156	1.248
Sanitary Sewer Repair				
Point Repair	3	ΕA	720	2,160
			TOTAL (ODD)	

TOTAL (GPD) 25,056

Total Estimate Flow Reduction = 121,062 GPD

#### 3.4 Rehabilitation Costs

The estimated project cost for the rehabilitation improvements for the Hunters Hollow collection system has been estimated at approximately \$415,837. Table 3.4.1 lists the items and estimated costs for the rehabilitation and repairs. (*This total has been increased to account for improvements in Area HH3.*)

By undertaking the various recommended improvements to correct the deficiencies in the sanitary collection system, the inflow and infiltration will be reduced in the Hunters Hollow collection system. Additionally, a systematic and on-going cleaning, and root control program should be provided for over the long-term.



# SECTIONTHREE

DESCRIPTION	QUAN	TITY/UNIT		
Mobilization-Bonds and Insurance	1	LS	\$15,000.00	\$15,000.00
Maintenance of Traffic	1	LS	\$15,000.00	\$15,000.00
8-inch Cured-in-Place Pipe	4500	FT	\$28.50	\$128,250.00
8-inch Spot Lining	1	EA	\$4,000.00	\$4,000.00
8-inch Pipe Replacement	250	LF	\$300.00	\$75,000.00
8-inch Point Repairs	160	FT	\$325.00	\$52,000.00
Heavy Cleaning	6,000	FT	\$3.00	\$18,000.00
Root Cutting	3500	FT	\$4.00	\$14,000.00
Additional CCTV and Field Inspections	10,829	۶T	\$3.00	\$32,487.00
Manhole Repair/Grouting	21	EA	\$1,350.00	\$28,350.00
Manhole Chimney Seal-Mechanical	50	EA	\$375.00	\$18,750.00
Bypass Pumping	1	LS	\$15,000.00	\$15,000.00

Table 3.4.1 Opinion of Probable Construction Costs

## ESTIMATED TOTAL = \$415,837.00

## Table 3.4.2 Addl Probable Construction Costs for Area HH3

DESCRIPTION	QUANTITY/UNIT			
8-inch Point Repairs	150	FT	\$325.00	\$16,250.00
Heavy Cleaning	640	FT	\$3.00	\$1,920.00
Manhole Repair/Grouting	21	EA	\$1,350.00	\$28,350.00
Manhole Chimney Seal-Mechanical	41	EA	\$375.00	\$15,375.00

ESTIMATED TOTAL = \$61,895.00

## Total Estimated Probable Construction Cost = 477,732.00