APPENDIX J

BOROUGH OF EMMAUS CAPACITY ANALYSIS

HANOVER ENGINEERING
ASSOCIATES, INC.

20 C Snyder Lane
Ephrata, PA 17522-9101
(717) 721-7444
FAX (717) 721-7447

January 16, 2002

RECEIVED
JAN 22 2001
SCHOOR DEPALMA INC.
KULPSVILLE

Mr. Ross Benner
Engineers and Design Professionals
1555 Bustard Road, Suite 50T
PO Box 304
Kulpsville, PA 19443-0304

RE: Upper Milford Township Act 537 Update
Project No. ES 00-14

Dear Mr. Benner:

Enclosed is a draft copy of the report investigating the option of Upper Milford Township discharging flow from 204 EDU's into the Emmaus Borough sanitary sewer system at manhole C223 on Pennsylvania Avenue.

In preparing the report, we included historical flow data, portable metering data, internal televisual inspection results and infiltration study results to present a comprehensive review of the Emmaus Borough option.

Feel free to comment and edit the report as necessary. Since this is a draft copy, please do not distribute copies. After receiving any comments and or corrections from your review, we will formally issue the report to the Borough, Upper Milford Township and DEP.

If you have any questions or require additional information please do not hesitate to call our office.

Sincerely,

David W. Wingeard, Jr.

Enclosure

cc: Dan DeLong (Emmaus Borough)
Brad Youst (Bethlehem Office)

M:\Emmaus\2000\ES 00-14\537 Update\act 537 update letter 1-16-02.doc

DRAFT

Existing Conditions

In order to determine the ultimate capacity of the system discharging into metering station No. 4, historical data from the meter was used. See exhibit A.

Using the data from metering station No. 4 for 1998, 1999 and 2000 it was determined that the average daily flow for the 3 year period was 649,058 gallons per day, and the average daily wet weather flow was 1,127,367 gallons per day as shown in figure 1. The total EDU count within the metering station No. 4 drainage basin was approximately 2,702 EDU's.

Using the above figures, the average daily flow per EDU in the metering station No. 4 drainage basin calculates to approximately 240 gallons and the average daily wet weather flow 420 gallons.

Figure 1
Data for Meter 4 Drainage Basin
Daily Flow

Year	Total Flow (Gallons)	Average Daily Flow (Gallons)	Average Flow/EDU (Gallons/Day)
1998	248,585,000	681,055	252
1999	223,226,000	611,578	226
2000	238,907,400	654,541	242
Average		649,058	240

Wet Weather Flow

Year	Total Flow (Gallons)	Average Daily Flow (Gallons)	Average Flow/EDU (Gallons/Day)
1998	6,088,000	1,014,667	376
1999	12,240,000	1,020,000	378
2000	15,493,000	1,291,083	478
Average		1,127,367	417

To further isolate the metering station No. 4 drainage basin, portable meters were placed in manholes C242, C286, and C294, as shown in exhibit B.

As shown in figure 2, the average daily flow for these locations was 76,700 gallons, 197,000 gallons and 282,000 gallons, respectively. Average daily wet weather flow was 135,600 gallons, 329,000 gallons and 470,000 gallons, respectively.

Figure 2
Portable Meter Data

MH. No.	Average Daily Flow (Gallons)	Wet Weather Flow (Gallons)
C242	76,700	135,600
C286	197,000	329,000
C294	282,000	470,000

To determine the total number of EDU's (including commercial) discharging into each of the metering manholes noted above, the Borough of Emmaus conducted a house count. As shown in figure 3, there are presently 202 EDU's discharging into MH C242, 470 into manhole C286, and 806 into manhole C294.

Figure 3
EDU Computation

Meter Location	Existing EDU's	Proposed EDU's	Total EDU's
MH. C242	202	224	426
MH. C286	470	224	694
MH. C294	806	224	1030

Based on data presented in figures 2 and 3, the existing average daily flow per EDU discharging into manhole C242 is 350 gallons; into manhole C286 is 420 gallons, and into manhole C294 is 380 gallons. The existing average daily wet weather flow per EDU is respectively 583 gallons, 700 gallons and 670 gallons. These figures are shown in figure 4.

Figure 4
Existing Flow Per EDU

MH. No.	Existing EDU's	Average Daily EDU Flow (Gallons)	Average wet weather EDU Flow (Gallons)
C242	202	380	670
C286	470	420	700
C294	806	350	583

Since the average daily flow, both normal and wet weather, for the portable meter location at manhole C286 is higher than the averages calculated for the entire metering station No. 4 drainage basin, these rates will be used for all further analysis. That is, 420 gallons/day/EDU for the average daily flow and 700 gallons/day/EDU for the average daily wet weather flow.

Analyzing each manhole section between manhole C242 and manhole C294, using as-built slopes, sizes, number of existing EDU's discharging, and allowing a 25% buffer for the remaining capacity, the manhole run C293 to C294 appears to be the most restrictive. For all of the runs analyzed, see figure 5.

Figure 5
Manhole Section Analysis-Existing

MH Section	Size (in.)	Design Flow (mgd)	Existing EDU's	Wet Weather (700g/EDU) (mgd)	25% Buffer (mgd)	Remaining Flow (mgd)	Additional Allowable EDU's
C242-C243	8"	0.491	202	0.141	0.088	0.262	374
C243-C252	8"	0.491	216	0.151	0.085	0.255	364
C252-C286	8"	0.737	470	0.329	0.102	0.306	437
C286-C288	8"	0.737	470	0.329	0.102	0.306	437
C288-C291	8"	0.840	554	0.388	0.113	0.339	484
C291-C292	8"	0.932	638	0.447	0.121	0.364	520
C292-C293	10"	0.775	722	0.505	0.068	0.202	289
C293-C294	10"	0.775	806	0.564	0.053	0.158	226

To further evaluate the subsystem draining into manhole C294, a nighttime infiltration study was performed to determine and verify infiltration into the system, as well as an internal televisual inspection of manhole runs C291 to C222 inclusive.

The nighttime infiltration study was performed in April of 2001 and the instantaneous flow readings indicated approximately 50,000 to 60,000 gallons/day of infiltration within the subsystem.

The internal televisual inspection of the manhole runs C291 to C222 inclusive were done in July of 2001. Particular attention was given to the condition of the 10-inch VCP between manhole C292 and C222 since there was evidence of surcharging in the upstream manholes and verbal recollections of Borough personnel.

Although, there were no structural failures such as cracked pipe, broken joints or pieces missing, there is visual evidence of a substantial number of sags within the 10-inch pipe. These sags range in depth from 1-inch to at least 4-inches. The field sheets for this televisual inspection are presented in exhibit C.

Proposed Upper Milford Expansion

Upper Milford Township is proposing to connect approximately 204 EDU's into the Borough system at manhole C223 on Pennsylvania Avenue. In addition, the Borough has projected a need for an additional 20 EDU's, making a total of 224 proposed EDU's discharging into the metering station No. 4 drainage basin via manhole C242, C286 and C294.

Looking at figure 6, it can be seen that the manhole section C293 to C294 will only have a future capacity of 2 EDU's after the addition of the 224 EDU's while the manhole section C243 to C252, which is upstream and the second restrictive section, has capacity for 140 future EDU's.

Figure 6
Manhole Section Analysis – Proposed

MH Section	Size (In)	Proposed Additional EDU's	Remaining Capacity (EDU's)	Total EDU's Left For Future
C242-C243	8"	224	374	150
C243-C252	8"	224	364	140
C252-C286	8"	224	437	213
C286-C288	8"	224	437	213
C288-C291	8"	224	484	260
C291-C292	8"	224	520	296
C292-C293	10"	224	289	65
C293-C294	10"	224	226	2

Options

Based on all of the data presented, we will now explore the possible options to address the situation.

1. No-action alternative.

   - Allow Upper Milford Township to connect to the Borough's system, make no attempt to improve the capacity of the lower section of the subsystem, and hope no surcharging or overflow conditions occur.

   - Force Upper Milford Township to convey their flow via another route outside of the Borough, possibly requiring construction of pump station(s).

2. Conduct an Infiltration and Inflow rehabilitation program to reduce the Infiltration and Inflow within the contributing area to obtain the needed capacity.

   - Using the 1990 Census, the Borough of Emmaus had an average household size of 2.38 people and 5717 people living in the meter 4 drainage basin. Using EPA analysis developed in 1991, there is excessive infiltration when the flow exceeds 120 gpcd. These figures show that infiltration within this area should not exceed 290 gpd per EDU and 655 gpd per EDU for inflow.

     With this in mind, the average daily flow per EDU at manhole C294 was 350 gallons and the average daily wet weather flow per EDU at manhole C294 was 583 gallons.

     With approximately 29,000 linear feet of sewer mains within the area draining into MH. C294 and using a cost of $5.50 per linear feet for internal televising, air testing and grouting. The cost of internal rehabilitation would be approximately $160,000.00 and would not include any external repairs.

3. Replace the existing 10-inch VCP pipe (approximately 975') with 12-inch PVC pipe to increase the capacity by either pipe bursting or conventional trench excavating.

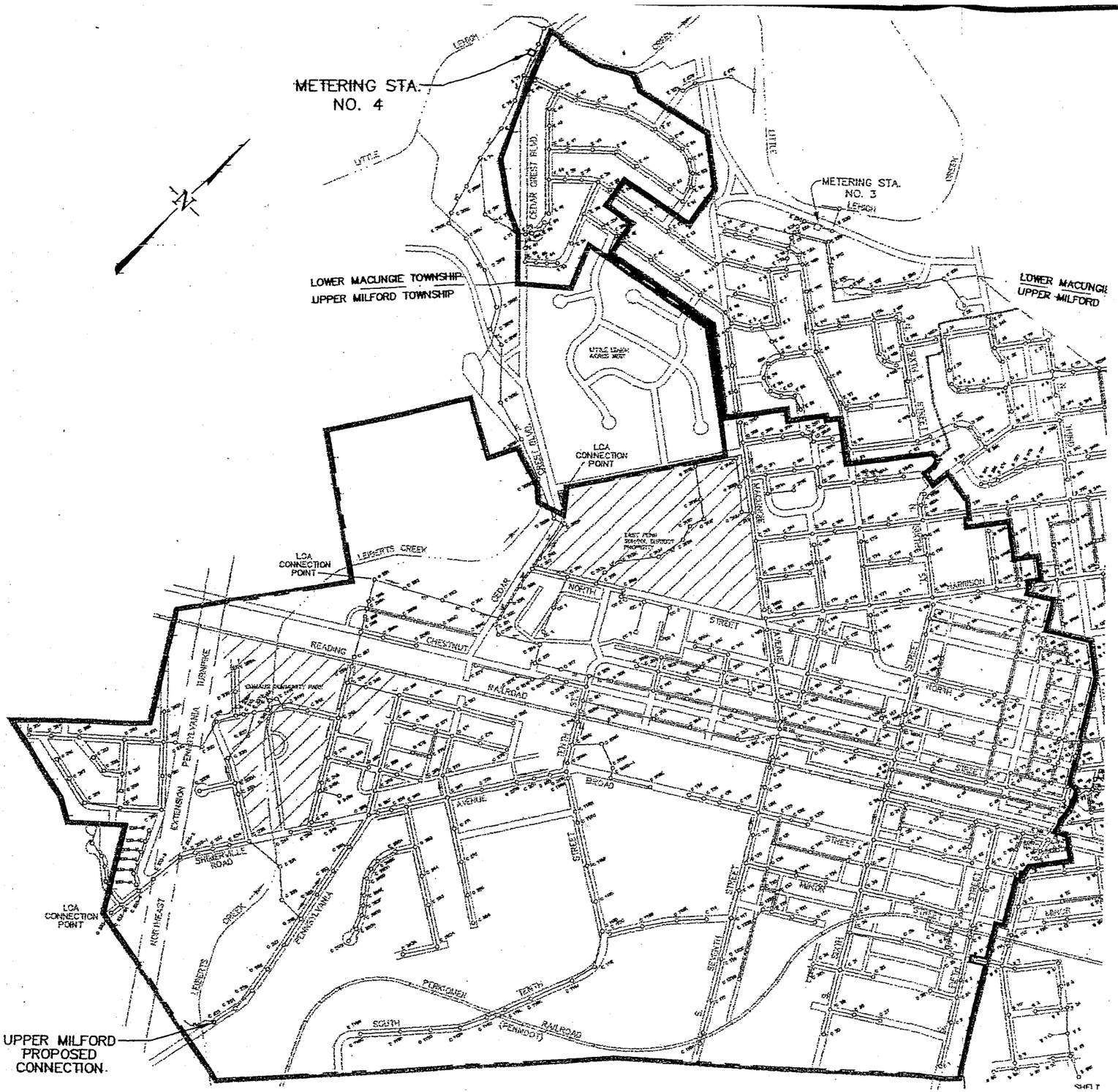
   - With pipe bursting, there is the need to excavate insertion pits for the process. There will be approximately seven (7) lateral connections that must also be excavated to physically connect the lateral to the new pipe. The pits and lateral connection pits will be in grass areas, and the paved roadways. Depth of the pits will vary from 8 feet to 15 feet. Since there are sags in the existing 10-inch line, there is a strong possibility there will be sags in the new 12-inch replacement line using pipe bursting construction methods.

   - The cost of replacing the entire 975 feet of the existing 10-inch VCP pipe by conventional trenching methods would likely be prohibitive. The fact that the line crosses under Cedar Crest Boulevard, that paving blocks were used for roadway paving in one area of the apartment complex, and also the fact that there is a rather large carport built over the line downstream of manhole C293, increase the cost of the project. It is estimated that the project cost for this bypass would be approximately $223,000.00 as shown in exhibit D.

4. Construct a 12-inch PVC pipe bypass to increase capacity.

   - Construct a 12-inch bypass from manhole C291 to manhole C302B, following Leiberts Creek and Cedar Crest Boulevard as shown on Exhibit E. The location of the line would be in grass and some scrub tree areas. There are no roads to cross and only one stream crossing to construct. The capacity of the 12-inch line at minimum grade would be approximately 1.079 mgd. or 1,540 EDU's using 700gpd/EDU. It is estimated that the project cost for this bypass would be approximately $166,000.00 as shown in exhibit F.

EXHIBIT A



NO.	REVISIONS	DATE

METERING STATION NO. 4 -- DRAINAGE BASIN

BOROUGH OF EMMAUS
LEHIGH COUNTY
PENNSYLVANIA

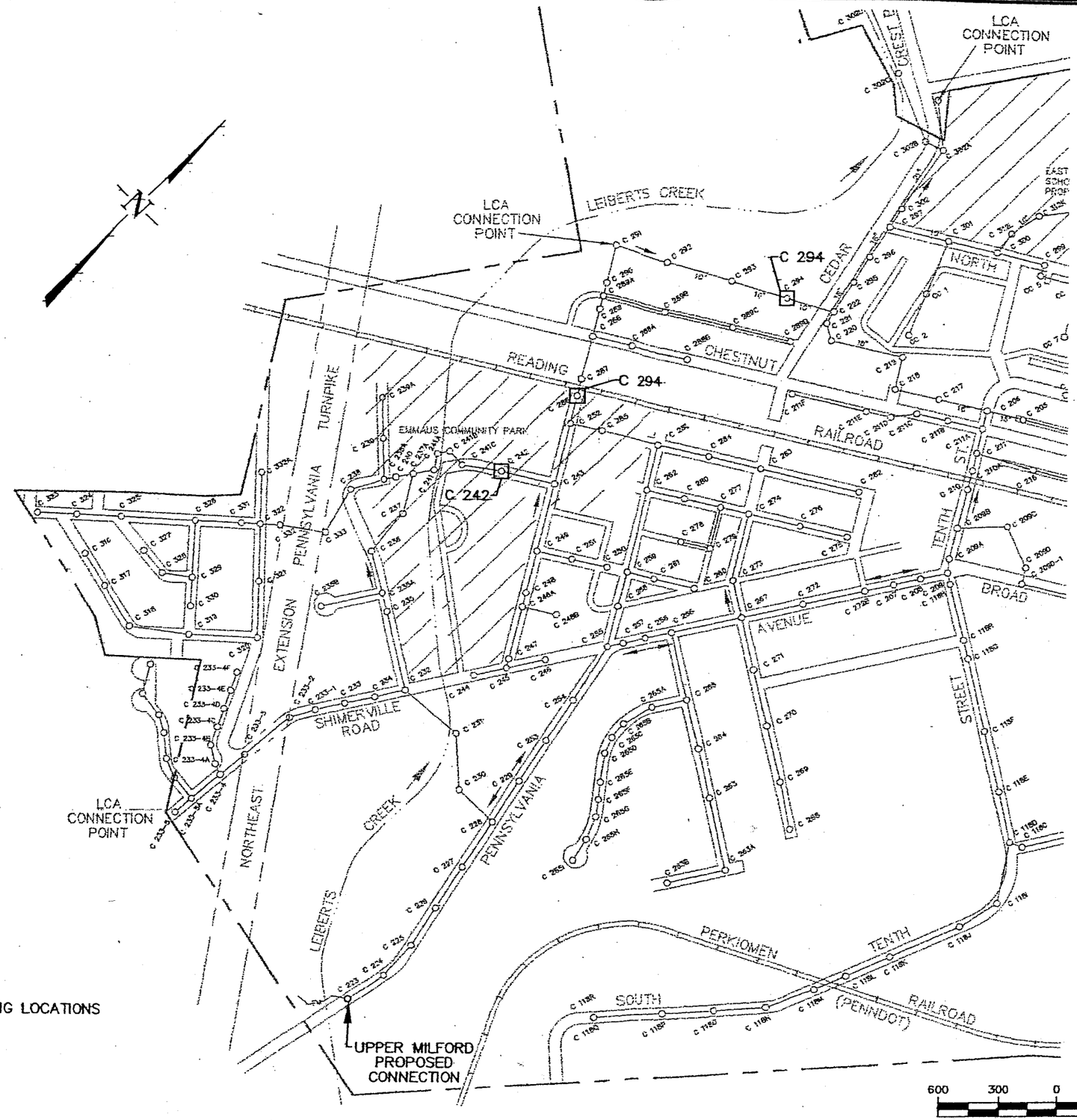
DRAWN BY: DES
CHECKED BY: DWW
DATE: 01.16.02
SCALE: 1" = 1000'

HANOVER ENGINEERING
ASSOCIATES, INC.
20C SNYDER LANE
EPHRATA, PA 17522-9101
(717) 721-7444

PROJECT NO.
ES00-14

EXHIBIT
A

EXHIBIT B



☐ – PORTABLE METERING LOCATIONS

NO.	REVISIONS	DATE

PORTABLE METERING LOCATIONS

BOROUGH OF EMMAUS
LEHIGH COUNTY
PENNSYLVANIA

DRAWN BY: DES
CHECKED BY: DWW
DATE: 01.16.02
SCALE: 1" = 600'

HANOVER ENGINEERING ASSOCIATES, INC.
20C SNYDER LANE
EPHRATA, PA 17522-9101
(717) 721-7444

PROJECT NO.
ES00-14

EXHIBIT
B

EXHIBIT C

TELEVISION INSPECTION LOG

CLIENT: Emmaus Borough JOB: SANITARY Sewer
DATE: 7-27-01 TIME: 0100 SHEET 1 OF 1
VIDEO TAPE #: 01

CALL Mr. REHAB YOUR SEWER SYSTEM REHABILITATION EXPERT

(1) UPSTREAM MANHOLE NUMBER	TYPE	DEPTH	(2) DOWNSTREAM MANHOLE NUMBER	TYPE	DEPTH	SHAPE	PIPE SIZE	PIPE TYPE	LENGTH RUN	LENGTH TV'D	FLOW	STREET/LOCATION	DRAIN. AREA	PIPE NO.	OPERATOR
C291	2	25.5	C292	2	25.0	1	18	1	281	281		OFF Chestnut			DJC

STATION	CLOCK POSITION	FLOW	VIDEO FOOTAGE	OBSERVATIONS AND COMMENTS
0+00			2528	MH C291, Begin Run
0+02			2550	BEGIN Pipe
0+03		500	2555	SHEAR CRACK, LEAKING
1+68			2916	LIGHT ROOTS @ JOINT
1+78			2941	MODERATE ROOTS @ JOINT
2+70			3142	BEGIN SAG
2+79			3212	END PIPE, END SAG
2+81			3255	MH C292, END RUN

manhole type:
1. brick 2. precast 3. block
4. coated/parged 5. other

manhole = 0+00
1. upstream manhole
2. downstream manhole

pipe type
1. VCP 2. ACP 3. RCP
4. CIP/DIP 5. PVC 6. other

TELEVISION INSPECTION LOG

CLIENT: Emmaus Borough JOB: Sanitary Sewer
DATE: 7-27-01 TIME: 1320 SHEET 1 OF 1
VIDEO TAPE #: 01

CALL Mr. REHAB FOR YOUR SEWER SYSTEM REHABILITATION EXPERT

(1) UPSTREAM MANHOLE NUMBER	TYPE	DEPTH	(2) DOWNSTREAM MANHOLE NUMBER	TYPE	DEPTH	SHAPE	PIPE SIZE	PIPE TYPE	LENGTH RUN	LENGTH TVD	FLOW	STREET/LOCATION	BRANCH AREA	USE	OPERATOR
C292		25.0	C293	2	12.0	1	10	1	363	296	—	OFF Chestnut			JAC

STATION	CLOCK POSITION	FLOW	VIDEO FOOTAGE	OBSERVATIONS AND COMMENTS
0+00			3235	MH C292, Begin Rw
0+02			3245	BEGIN Pipe
0+19			3321	SLIGHT ROOTS @ JOINT
0+31			3349	BEGIN SAG
1+03			3511	END SAG
1+22			3547	ROLLED Rubber Gasket 3:00
1+30			3613	BEGIN SAG
1+38			3629	END SAG
1+89	1:00	250	3738	SERVICE CONNECTION, CUT-IN
2+04		500	3823	LEAKING JOINT
2+29			4002	BEGN SAG
2+53			4110	END SAG
2+54	12:00	3500	4115	SERVICE CONNECTION, CUT-IN
2+96			4433	SILT Build-up, Cannot Pass
+			4455	END Inspection
+				
+				
+				
+				
+				
+				
+				
+				

manhole type:
1. brick 2. precast 3. block
4. coated/parged 5. other

manhole = 0+00
1. upstream manhole
2. downstream manhole

pipe type
1. VCP 2. ACP 3. RCP
4. CIP/DIP 5. PVC 6. other

2 Laterals

TELEVISION INSPECTION LOG

CLIENT: Emmaus Borough JOB: Sanitary Sewer
DATE: 7-27-01 TIME: SHEET 1 OF 1
VIDEO TAPE #: 01

CALL MR REHAB — YOUR SEWER SISTER! REHABILITATION EXPERT

(1) UPSTREAM MANHOLE NUMBER	TYPE	DEPTH	(2) DOWNSTREAM MANHOLE NUMBER	TYPE	DEPTH	INFLOW	PIPE SIZE	PIPE TYPE	LENGTH RUN	LENGTH TVD	FLOW	STREET/LOCATION	DRAIN. AREA	PIPE NO.	OPERATOR
C292	2	5.0	C293	2	12.0	2	10	1	363	67		OFF Chestnut			JAC

STATION	CLOCK POSITION	FLOW	VIDEO FOOTAGE	OBSERVATIONS AND COMMENTS
0+00			4456	MH C293, Begin Run
0+02			4500	BEGIN PIPE, BEGIN SAG, SILT & Debris
0+67			4733	SAME Point as encountered on previous Set-up
+				
+			4805	END INSPECTION
+				
+				
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+				
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+				
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+				
+				
+				
+				

manhole type:
1. brick 2. precast 3. block
4. coated/parged 5. other

manhole = 0+00
1. upstream manhole
2. downstream manhole

pipe type
1. VCP 2. ACP 3. RCP
4. CIP/DIP 5. PVC 6. other

TELEVISION INSPECTION LOG

CLIENT: Emmaus Borough JOB: Sanitary Sewer
DATE: 1-26-01 TIME: 2306 SHEET 1 OF 1
VIDEO TAPE #: 01

CALL Mr. REHAB YOUR SEWER SYSTEM REHABILITATION EXPERT

(1) UPSTREAM MANHOLE NUMBER	TYPE	DEPTH	(2) DOWNSTREAM MANHOLE NUMBER	TYPE	DEPTH	PIPE SIZE	PIPE TYPE	LENGTH RUN	LENGTH TVD	FLOW	STREET/LOCATION	TRANS. AREA	PIPE USE	OPERATOR
C293	2	12.0	C294	2	15.0	1	10	326	326		Cedar Crest BLVD			JAC

STATION	CLOCK POSITION	FLOW	VIDEO FOOTAGE	OBSERVATIONS AND COMMENTS
0+00			001	MH 293, Begin Run
0+02			015	Begin Pipe
0+97	9:00		107	SERVICE CONNECTION
1+60	1:00		552	SERVICE CONNECTION
2+92	10:00		941	SERVICE CONNECTION
3+24			1057	END PIPE, Minor Moderate SAGS THROUGHOUT
3+26			1130	mH C294, END RUN
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				

manhole type:
1. brick 2. precast 3. block
4. coated/parged 5. other

manhole = 0+00
1. upstream manhole
2. downstream manhole

pipe type
1. VCP 2. ACP 3. RCP
4. CIP/DIP 5. PVC 6. other

F. Lombardo

TELEVISION INSPECTION LOG

CLIENT: Emmaus Borough JOB: Sanitary Sewer
DATE: 7-26-01 TIME: 2350 SHEET 1 OF 1
VIDEO TAPE #: 01

CALL Mr. REHAB YOUR SEWER SYSTEM REHABILITATION EXPERT

(1) UPSTREAM MANHOLE NUMBER	TYPE	DEPTH	(2) DOWNSTREAM MANHOLE NUMBER	TYPE	DEPTH	SHAPE	PIPE SIZE	PIPE TYPE	LENGTH RUN	LENGTH TVD	FLOW	STREET/LOCATION	DRAIN AREA	USE	OPERATOR
C 294	2	16.0	C 222	2	14.6	1	10	1	285	165		Cedar Crest Blvd			JAC

STATION	CLOCK POSITION	FLOW	VIDEO FOOTAGE	OBSERVATIONS AND COMMENTS
0+00			1131	MH C294, Begin Run
0+02			1145	Begin Pipe
1+05	2:00		1444	SERVICE CONNECTION
1+22	10:00		1515	SERVICE CONNECTION
1+65			1925	ROCK IN LINE CANNOT PASS
+			2017	END INSPECTION, SAGS THROUGHOUT

manhole type:
1. brick 2. precast 3. block
4. coated/parged 5. other

manhole = 0+00
1. upstream manhole
2. downstream manhole

pipe type
1. VCP 2. ACP 3. RCP
4. CIP/DIP 5. PVC 6. other

2 Extends

TELEVISION INSPECTION LOG

CLIENT: Emmaus Borough JOB: Sanitary Sewer
DATE: 7-26-01 TIME: 0015 SHEET 1 OF 1
VIDEO TAPE #: 01

CALL Mr. REHAB — YOUR SEWER SYSTEM REHABILITATION EXPERT

(1) UPSTREAM MANHOLE NUMBER	TYPE	END DIA	(2) DOWNSTREAM MANHOLE NUMBER	TYPE	DEPTH	SHAPE	PIPE SIZE	PIPE TYPE	LENGTH RUN	LENGTH TVD	FLOW	STREET/LOCATION	DRAIN AREA	YOKE SIZE	OPERATOR
C294	2	15.0	C222	2	14.6	2	10	1	285	120		Cedar Crest Blvd			JAC

STATION	CLOCK POSITION	FLOW	VIDEO FOOTAGE	OBSERVATIONS AND COMMENTS
0+00			2018	MH C222 Begin Run
0+02			2035	Begin Pipe, Begin SAG
0+21			2245	End SAG
1+20			2454	Rock in Line, Same Point encountered on Previous Set-up.
+				
+			2527	End Inspection
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				
+				

manhole type:
1. brick 2. precast 3. block
4. coated/parged 5. other

manhole = 0+00
1. upstream manhole
2. downstream manhole

pipe type
1. VCP 2. ACP 3. RCP
4. CIP/DIP 5. PVC 6. other

EXHIBIT D

PROBABLE CONSTRUCTION COST OPINION

In Place Construction Cost

Date: January 7, 2002
Project: Upper Milford 537 Update

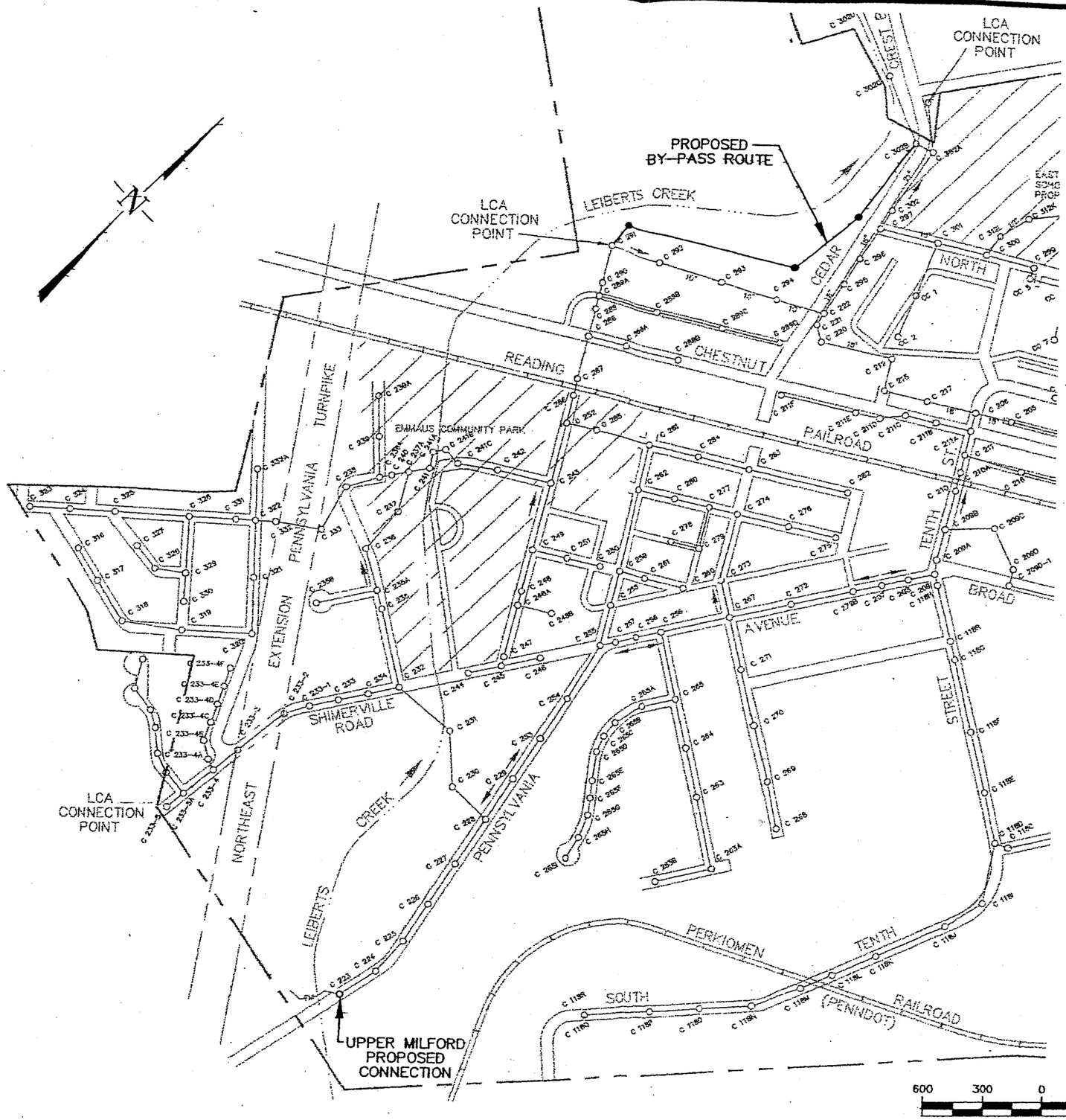
Computed By: DWW
Checked By:

Project No: ES 00-14

Item No.	Item Description	Units	Quantity	Unit Cost	Total Cost
1.00	12 - inch PVC pipe	LF	925	$50.00	$46,250.00
2.00	6 - inch PVC pipe	LF	100	$30.00	$3,000.00
3.00	12-inch x 6-inch tee or wyes	LF	7	$75.00	$525.00
4.00	4 foot diameter precast manholes	EA	3	$1,900.00	$5,700.00
4.10	Manhole frames and covers	EA	3	$450.00	$1,350.00
5.00	Connections to existing manholes	EA	2	$1,200.00	$2,400.00
6.00	Replace piping in casing @ Cedar Crest Blv	LF	50	$75.00	$3,750.00
7.00	Bypass pumping	HR	150	$75.00	$11,250.00
8.00	Bituminous paving restoration	LF	575	$20.00	$11,500.00
9.00	Lawn restoration	LF	350	$4.00	$1,400.00
10.00	Special restoration (paving block)	SF	420	$30.00	$12,600.00
11.00	Concrete curbing replacement	LF	40	$15.00	$600.00
12.00	Sidewalk replacement	SF	120	$5.00	$600.00
13.00	Car port reconstruction	SF	2000	$20.00	$40,000.00
14.00	Utility coordination	LS	1	$5,000.00	$5,000.00
15.00	Erosion and Sedimentation control	LS	1	$1,000.00	$1,000.00
16.00	Mobilization and Demobilization	LS	1	$3,000.00	$3,000.00
17.00	Bonds and Insurances	LS	1	$5,000.00	$5,000.00
18.00	Work Zone Traffic Control	LS	1	$4,000.00	$4,000.00
	TOTAL PROBABLE CONSTRUCTION COST				$158,925.00
	Engineering and Legal fees (25%)		1	$40,000.00	$40,000.00
	Contingincies (15%)		1	$24,000.00	$24,000.00
	TOTAL PROBABLE PROJECT COST				$222,925.00

Hanover Engineering Associates, Inc. is not a construction contractor and therefore probable construction cost opinions are based solely upon our experience with construction. This requires Hanover Engineering Associates, Inc. to make a number of assumptions as to actual conditions which will be encountered on the site; the specific decisions of other design professionals engaged; the means and methods of construction the contractor will employ; the cost and extent of labor, equipment, and materials the contractor will employ; contractor's techniques in determining prices and market conditions at the time, and other factors over which Hanover Engineering Associates, Inc. has no control. Given these assumptions which must be made, Hanover Engineering Associates, Inc. states that the above probable construction cost opinion to be a fair and reasonable estimate for construction costs.

EXHIBIT E



NO.	REVISIONS	DATE

PROPOSED BY-PASS ROUTE

BOROUGH OF EMMAUS
LEHIGH COUNTY
PENNSYLVANIA

DRAWN BY: DES
CHECKED BY: DJWW
DATE: 01.16.02
SCALE: 1" = 600'

HANOVER ENGINEERING
ASSOCIATES, INC.
200 SNYDER LANE
EPHRATA, PA 17522-9101
(717) 721-7444

PROJECT NO.
ES00-14

EXHIBIT
E

EXHIBIT F

PROBABLE CONSTRUCTION COST OPINION

New Sanitary Sewer By-pass

Date: January 7,2002
Project: Upper Milford 537 Update

Computed By: DWW
Checked By:

Project No: ES 00-14

Item No.	Item Description	Units	Quantity	Unit Cost	Total Cost
1.00	12-inch PVC pipe	LF	2050	$40.00	$82,000.00
2.00	4' diameter precast manholes	EA	6	$1,300.00	$7,800.00
2.10	Manhole frames and covers	EA	6	$450.00	$2,700.00
3.00	Stream crossing	LF	50	$100.00	$5,000.00
4.00	Connections to existing manholes	EA	2	$800.00	$1,600.00
5.00	Field restoration	LF	1850	$2.00	$3,700.00
6.00	Bituminous paving restoration	LF	200	$20.00	$4,000.00
7.00	Mobilization / Demobilization	LS	1	$2,000.00	$2,000.00
8.00	Bonds and Insurances	LS	1	$3,000.00	$3,000.00
9.00	Erosion and Sedimentation Control	LS	1	$5,000.00	$5,000.00
10.00	Work Zone Traffic Control	LS	1	$1,000.00	$1,000.00
	TOTAL PROBABLE CONSTRUCTION COST				$117,800.00
	Engineering and Legal	LS	25%		$30,000.00
	Contingencies	LS	15%		$18,000.00
	TOTAL PROBABLE PROJECT COST				$165,800.00

Hanover Engineering Associates, Inc. is not a construction contractor and therefore probable construction cost opinions are based solely upon our experience with construction. This requires Hanover Engineering Associates, Inc. to make a number of assumptions as to actual conditions which will be encountered on the site; the specific decisions of other design professionals engaged; the means and methods of construction the contractor will employ; the cost and extent of labor, equipment, and materials the contractor will employ; contractor's techniques in determining prices and market conditions at the time, and other factors over which Hanover Engineering Associates, Inc. has no control. Given these assumptions which must be made, Hanover Engineering Associates, Inc. states that the above probable construction cost opinion to be a fair and reasonable estimate for construction costs.

BOARD OF SUPERVISORS
UPPER MILFORD TOWNSHIP
LEHIGH COUNTY
5831 Kings Highway South
P.O. Box 210, Old Zionsville, PA 18068-0210
Phone (610) 966-3223 Fax (610) 966-5184

May 21, 2003

Mr. J. Bradley Youst, P.E.
Hanover Engineering Co.
252 Brodhead Rd., Suite 100
Bethlehem, PA 18017-8937

RE: Upper Milford Township Sewage Flow

Dear Brad:

Upper Milford Township is progressing with their Act 537 (Sewerage Facilities Planning) update. The preliminary existing EDU connection numbers appear to be coming in at slightly over 300 EDU's and this is without projecting or adding any reserve for future growth within the Leibert Creek Basin or accounting for the potential for the future of the area in the basin west of the PA Turnpike.

Coming to this realization and also in light of the concerns raised by Mr. Karl Schreiter, P.E. of Schreiter Engineering Associates, Inc. (Letter Dated 5/21/2003 attached) I am concerned if the Township should continue to pursue the Pennsylvania Avenue gravity connection at the risk of creating the potential for an overflow condition in Boroughs' system.

In reviewing the H.E.A. 1-16-02 Analysis Report and knowing proposed overflow regulations are on the horizon and NPDES Phase II, etc. I requests that you consider Mr. Schreiters observation and offer a response so Upper Milford's consultants can continue to pursue the alternatives to the "Vera Cruz" project.

You should also know that as part of this update the Township is also looking at the areas of S. 7th St.Extension and Pike St. (off S. 6th St.) for the purpose of solving the existing malfunctioning septic systems. This area would have the potential for approximately 22 connections and the alternatives, other than flowing through the Emmaus System, are minimal.

In accordance with the Emmaus/L.C.A. Upper Milford Agreement the Township would need final approval by the Borough and enter into an amended flow agreement before proceeding with any extension activities.

Please consider this and respond at your earliest convenience.

If you have any questions you can call me at 610-966-3223.

Sincerely,

Daniel A. DeLong
Township Manager

DAD:ck

Enclosures
Cc: UMT Board of Supervisors
K. Gorr
J. Clapper
K. Schreiter
R. Benner
Brian Miller

Corrected Copy

MEMORANDUM

DATE: February 2, 2004

TO: Borough Manager Kathy Gorr, Council and Solicitor

FROM: Jeffry D. Clapper, Public Works Director

SUBJECT: Wastewater Conveyance Request
S. 7th Street Extension and Pike Street, Upper Milford Township

I have received a request from Lehigh County Authority for conveyance of additional sewage flow from 28 residential units located in the above referenced location. 23 units exist, and 5 EDU's (equivalent dwelling unit) are requested for future growth. The request from LCA is attached.

I discussed the request with Brad Youst from Hanover Engineering Associates, Inc., and received his comments, which are also attached.

I recommend that Council approve LCA's request provided the following conditions are met:

1. The July 1, 1987 agreement between the Borough of Emmaus, Upper Milford Township and Lehigh County Authority be amended to include these additional units, and to make reference to or index all current agreements or connection points that currently exist.

2. All of the sewage flows should be introduced into the sewer system on S. 7th Street

3. LCA construct at their own expense all sewer mains, laterals and all appurtenances at their own expense in accordance with Borough utility standards.

4. LCA must require that a potable water meter be installed on any dwelling that is not currently metered.

5. LCA and Upper Milford Township comply with all requirements of the July 1, 1987 intermunicipal agreement.

Should you have any questions or require additional information, please do not hesitate to contact me.

Cc: Upper Milford Township
Lehigh County Authority
Brad Youst, Hanover Engineering Associates, Inc.

HANOVER ENGINEERING ASSOCIATES, INC.

252 Brodhead Road, Suite 100
Bethlehem, Pennsylvania 18017-8944
(610) 691-5644
FAX (610) 691-6968

Rec'd 1-29-04

Copied 1/30/04 ck

Copy: R. Brewer BOS 537 file.

January 28, 2004

Ms. Kathy Gorr, Manager
Borough of Emmaus
28 S. 4th Street
Emmaus, PA 18049-3899

RE: LCA Wastewater Conveyance Request
S. 7th and Pike Streets
Upper Milford Township
HEA Project ES04-03

Dear Kathy:

Our office has reviewed the referenced request for conveyance of sewage flow from residences in the vicinity of South 7th Street Extension and Pike Street. The request includes the letter to your attention, dated September 23, 2003, with supporting documentation, from Frank Leist, LCA Capital Works Manager.

The request seeks approval to transport sewage flows from 28 residential EDU's in Upper Milford Township through the Borough's system for treatment at the City of Allentown plant. This includes 23 existing units plus 5 units of potential future growth. The additional flow would be debited against the Township's treatment capacity at the City's plant, and would not affect the Borough's treatment allocation. Due to the limited service area and relatively low flow, transportation service billing would be based on water meter readings, in accordance with the intermunicipal agreement.

According to the request, some or all the flow from these units would be directed to the Borough sewer in South 7th Street. One alternative being considered would direct a portion of the flow to the sewer in South 6th Street via a low pressure force main.

A general review of the Borough's sewer system drawings downstream of the proposed points of connection indicates that the proposed flow, estimated at 7,000 gallons per day (28 EDU's x 250 GPD), should not create any overflow conditions within the customary 5-year planning period. However, in discussion with Jeff Clapper, it appears that there may be practical limitations to making significant additions to the flow in the 6th Street sewer.

According to Jeff Clapper, there have been instances of sewer surcharging in the manhole south of the Conrail crossing and in the Chestnut Street sewer between 6th and 7th Streets. This is consistent with our review of the sewer record drawings, which show that these lines have relatively flat slopes and thus less hydraulic capacity than the upstream sewers. There is no evidence of similar limitations in the system downstream of the proposed connection on 7th Street.

Accordingly, we would recommend approval of the request for conveyance of sewage flow from the requested 28 residential EDU's, with billing based on water meter readings, but would recommend that all of this flow be directed to the Borough's sewer system via a new connection at the southern end of the system in South 7th Street. Additionally, the Borough's approval should be conditioned upon Upper Milford Township and LCA complying with all other requirements of the intermunicipal Agreement of July 1, 1987, as amended July 5, 1995.

If you have any questions regarding this information, please contact the undersigned.

Respectfully,

HANOVER ENGINEERING ASSOCIATES, INC.

J. Bradley Youst, P.E.

JBY:msw
I:\Proj\EmmausSewer\Es04-03-LCAs7th&PikeStreetsSewer\Docs\EvaluationLetter.doc
cc: Mr. Jeffry Clapper, Public Works Director
Mr. Frank Leist, Lehigh County Authority
Mr. Dan DeLong, Upper Milford Township

SCHREITER ENGINEERING ASSOCIATES, Inc.
7 Raleigh Drive
Downingtown, PA 19335-1103

May 21, 2003

Daniel A. DeLong, Township Manager
Upper Milford Township
PO Box 210
Old Zionsville, PA 18068-0210

Subject: Upper Milford Township
Act 537 Plan Revision
SEA Project 050-001

Dear Dan:

As discussed at our meeting of May 20, 2003, we have concerns regarding the available capacity in the Borough of Emmaus sanitary sewer system. These concerns are based on our review of the capacity analysis completed by Hanover Engineering Associates, Inc dated January 16, 2002.

Based on our review of the data presented in the report, it appears that the sewer capacity calculations were made using average daily flow values for both dry and wet weather conditions. Based on current conditions stated in Title 25 PaCode Chapter 94, flow capacity must be a function of peak flow conditions, not average flow conditions. Furthermore, the available capacity must be based on a "worst case" scenario to assure that sufficient hydraulic capacity is available to transport peak contributions of inflow/ infiltration during major wet weather events without creating surcharge conditions in the sewer system.

Based on the values presented in Figure 5, the existing capacity analysis was based on an average flow wet weather flow rate of 700 gpd/edu. Based on dry weather flow data presented in Figure 4, this wet weather unit flow rate is less than twice the dry weather average unit flow rate. Therefore, actual peak flow conditions could be significantly higher thus reducing or eliminating any available capacity in the Borough's collection system for use by Upper Milford Township. It is recommended that actual metering data be presented to document actual peak flow rates that were recorded at each metering point during any flow metering work completed by the Borough as part of this study.

Currently, we have developed two alternatives associated with the Leibert's creek drainage basin that utilize the Borough of Emmaus collection system. It is important that

this issue be addressed by the Borough to certify that capacity is available in their collection system for use by the Township. Without this certification, both alternatives involving the Borough's collection system cannot be further evaluated due to lack of available capacity. No further evaluation on these alternatives can be completed until this issue is resolved.

If you have any questions, do not hesitate to contact us.

Very truly yours,

Karl E. Schreiter Jr., PE, DEE
President

Cc: R. Benner, Shoor DePalma
J. Boldaz, Shoor DePalmaoo

HANOVER ENGINEERING
ASSOCIATES, INC.

To Joe Baldar

BETHLEHEM OFFICE
252 Brodhead Road, Suite 100
Bethlehem, PA 18017-8937

610-691-5644
FAX 610-691-6968

WE ARE TELECOPYING TO YOU 3 PAGES, INCLUDING THIS PAGE.

PLEASE DELIVER TO:

NAME: Jeff Clapper
COMPANY: Emmaus
DEPARTMENT: Public Works
FAX NUMBER:
SENT BY: J. Bradley Youst, P.E.
DATE: June 1, 2003

DESCRIPTION/ COMMENTS: Please see attached correspondence regarding Emmaus sewer system capacity relative to U. Milford Vera Cruz Area Act 537 Planning.

Brad Youst

Copies To: Kathy Gorr
Dan DeLong
Schoor DePalma
Karl Schreiter

☐ HARD COPY WILL FOLLOW. ☒ HARD COPY WILL NOT FOLLOW (unless requested)

CC: _____ FAX NO. _____ ☐ HARD COPY
CC: _____ FAX NO. _____ ☐ HARD COPY

If you do not receive all the pages, please call back as soon as possible.

TELECOPY OPERATOR: _____

HANOVER ENGINEERING ASSOCIATES, INC.

252 Brodhead Road, Suite 100
Bethlehem, Pennsylvania 18017-8937
(610) 691-5644
FAX (610) 691-6968

June 12, 2003

Via facsimile (610) 965-0705

Mr. Jeff Clapper, Coordinator
Public Works Department
Borough of Emmaus
28 S. 4th Street
Emmaus, PA 18049-3899

RE: Upper Milford Township
Act 537 Plan Update
HEA Project ES00-14

Dear Jeff:

Our office is in receipt of a letter dated May 21, 2003, from Dan DeLong, Upper Milford Township Manager, and the letter of the same date from Karl Schreiter, P.E., as referenced in Dan's letter. The following comments are presented for your consideration.

We have prepared the enclosed calculations of pipe capacity, based on single highest wet weather flow event. Using these calculations, it can be seen that the C252-C286 sewer line has a limiting remaining capacity of 0.143 mgd. This amount is likely to be less than that required for the Township's current project estimate of 300 EDU's. The Township's consultant should consider these capacity calculations in any further study for servicing the Vera Cruz area.

Although we feel that the "real world" conditions show this approach to be over-conservative for this portion of the Borough sewer system, it does, technically, meet the DEP Design Manual criteria for design of new systems. It should also be noted that the calculations do not reflect the remediation phase of the Borough's I&I reduction program, which was not implemented at the time of acquisition of this data.

If you have any questions regarding this information, please contact the undersigned.

Respectfully,

HANOVER ENGINEERING ASSOCIATES, INC.

J. Bradley Youst, P.E.
Borough Utility Engineer

JBY:mSW:I:\Proj\EmmausSewer\Es00-14-UMilfordAct537Update\Docs\UMilford537review2.doc
cc: Ms. Kathy Gorr, Borough Manager, (610) 965-0705
Mr. Dan DeLong, U. Milford Township Manager, (610) 966-5184
Schoor Depalma, Kulpsville office, (215) 361-6160
Mr. Karl Schreiter, P.E., (610) 518-1362
Dave Wingeard, HEA, (717) 721-7447

SEWER CAPACITY ANALYSIS BASED ON SINGLE HIGHEST WET WEATHER FLOW EVENT

The Borough of Emmaus obtained actual flow data at three manholes in the portion of the sewer system that would serve a Township connection for the Vera Cruz area. The recorded peak hourly and instantaneous maximum flow rates at these three locations are noted in the following table. Using this data and the number of connected EDU's above each of these three locations, the instantaneous maximum flow per connected EDU can be determined for purposes of projecting the maximum flow rate and checking capacity of other sewer lines within the same "reach" of the system.

Highest Single Peak Flow Readings From Portable Metering Data

Meter location (MH. No.)	Peak Hourly Flow Rate (gallons per day)	Instantaneous Maximum Flow Rate (gallons per day)	Total Number of EDU's	Peak Hour Flow/EDU (gallons per day)	Instantaneous Maximum Flow/EDU (gallons per day)
C242	170,000	180,000	202	842	891
C286	550,000	580,000	470	1170	1234
C294	770,000	790,000	806	955	980

The peak unit flow rates can then be applied to the individual pipe runs, and, after adding a reserve for potential expansion within the Borough, the theoretical remaining pipe capacity can be determined.

Manhole Section Capacity Analysis

MH Section	Size (in.)	As-built Flow Capacity (mgd)	Existing EDU's	Computed Instantaneous Peak Flow (mgd)	Reserve for 22 Future Borough EDU's * (mgd)	Remaining Capacity (mgd)
C242-C243	8"	0.491	202 (x 891)	0.180	0.014	0.297
C243-C252	8"	0.491	216 (x 1234)	0.267	0.014	0.210
C252-C286	8"	0.737	470 (x 1234)	0.580	0.014	0.143
C286-C288	8"	0.737	470 (x 980)	0.461	0.014	0.262
C288-C291	8"	0.840	554 (x 980)	0.543	0.014	0.283
C291-C292	10"	0.932	638 (x 980)	0.625	0.014	0.293
C292-C293	10"	0.775	722 (x 980)	0.708	0.014	0.053
C293-C294	10"	0.775	806 (x 980)	0.790	0.014	-0.029

* Based on 250 GPD/EDU x 2.5 peak factor = 625 GPD/EDU x 22 EDU's = 0.014 mgd
(Peak factor based on DEP Wastewater Facilities Design Manual, Section 24)

Flow data shows that, although the instantaneous peak flow in C293-C294 exceeds the pipe capacity (i.e., surcharging occurs), this condition has not resulted in problems, since sewer depths do not result in backup of flow in the service laterals. Additionally, the remediation phase of the Borough's I&I reduction program was not yet implemented at the time of acquisition of the above data. However, using the existing data and the conservative "peak instantaneous flow" criteria, it can be seen that the controlling 8-inch pipes are C252-C286 and C243-C252, with remaining capacities of 0.143 and 0.210 mgd, respectively. (It has already been established that replacement of the 10-inch pipes from C292 to C294 is warranted if the Vera Cruz area is connected to the system.)

Prepared by: Hanover Engineering Associates, Inc. June 12, 2003