

# SEWER UTILITIES AND THEIR FACILITES (Why, What and How Much)

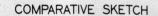
**KTC** Presentation

August 11, 2009

## PAST PRACTICES WERE VERY LABOR INTENSIVE WITH ALL STRUCTURES INCLUDING PIPE BEING MANUFACTURED ON SITE.

TODAY MOST STRUCTURES/PIPE ARE FABRICATED IN A CONTROLLED MANUFACTURING ENVIRONMENT AND INSTALLED ON SITE.

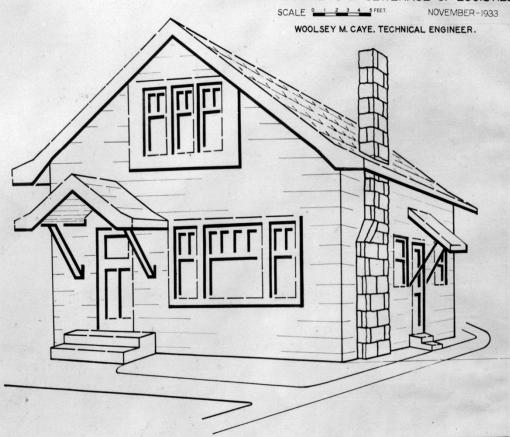
RESULTS ARE WHILE INFLATION MAY RISE AT 6% TO 7% ANNUALLY CONSTRUCTION TYPICALLY ONLY RAISES ANNUALLY 2.5% TO 3.5% DUE THE INCREASED EFFICIENCIES OF MATERIALS, MASS PRODUCTION, EQUIPMENT, TECHNOLOGY AND MANAGEMENT OF RESOURCES.

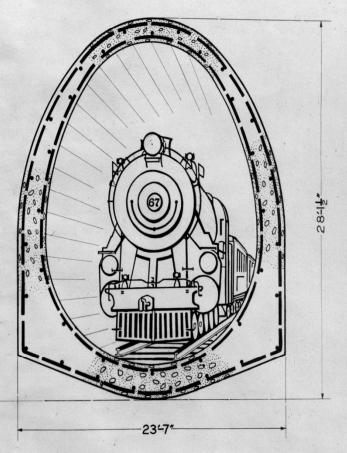


#### SOUTHWESTERN OUTFALL

CROSS SECTION WEST OF TAYLOR BOULEVARD

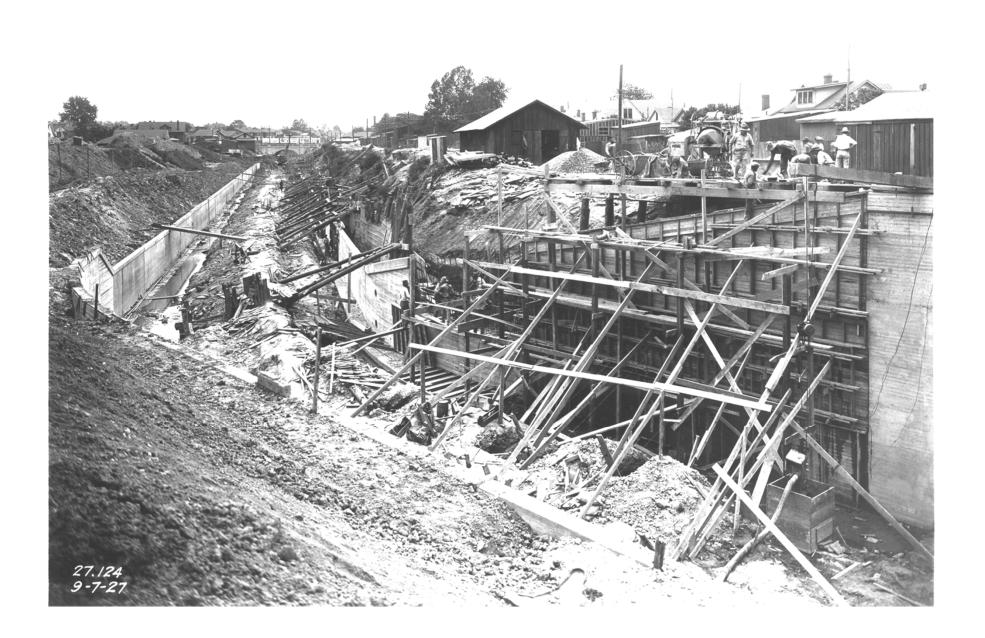
COMMISSIONERS OF SEWERAGE OF LOUISVILLE









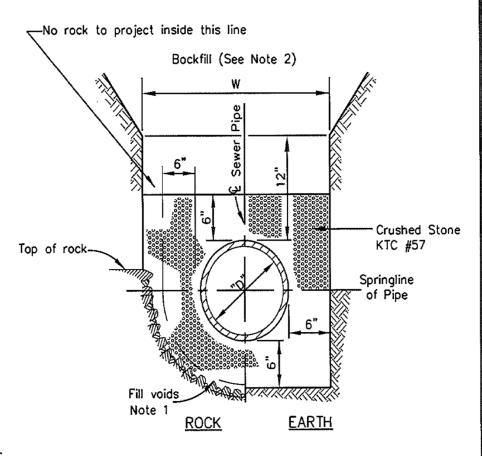


#### PAST PRCTICES RESULT IN ISSUES TODAY



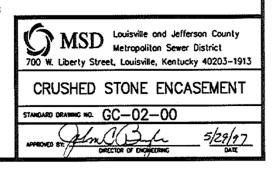
Maximum Allowable Trench Width 12" Above Outside Top of Pipe "W"	Inside Diameter of Pipe "D"
2'-6"	4"
2'-8"	6 <b>"</b>
2'-10"	8"
3'-0"	10"
3'-5"	12"
3'-9"	15"
4'-1"	18"
4'-4"	21"
4'-8"	24*
5'-1"	27"
5'-5"	30"
5'-10"	33"
6'-2"	36"
6'-8"	39"
6'-11"	42"
7'-6"	48"
D+2t+2'-8"	over 48

If "W" is exceeded, a Concrete Cradle shall be placed at such locations at the Contractor's expense. Applies to excavations in rock or earth.



#### NOTES:

- All rock loosened shall be removed; voids created by such removal shall be refilled with Crushed STone KTC #57.
- 2. Bockfill shall ne nated on the drawings.
- 3. Remove stone for pipe bells to provide full contact of bedding.



## TOOLS OF THE TRADE AND OUR CUSTOMERS





















#### **TELEINSPECTION**



### WHAT DOES OUR FUTURE HOLD AND HOW WILL THE FUTURE LOOK BACK ON US?



### PIPE TYPES































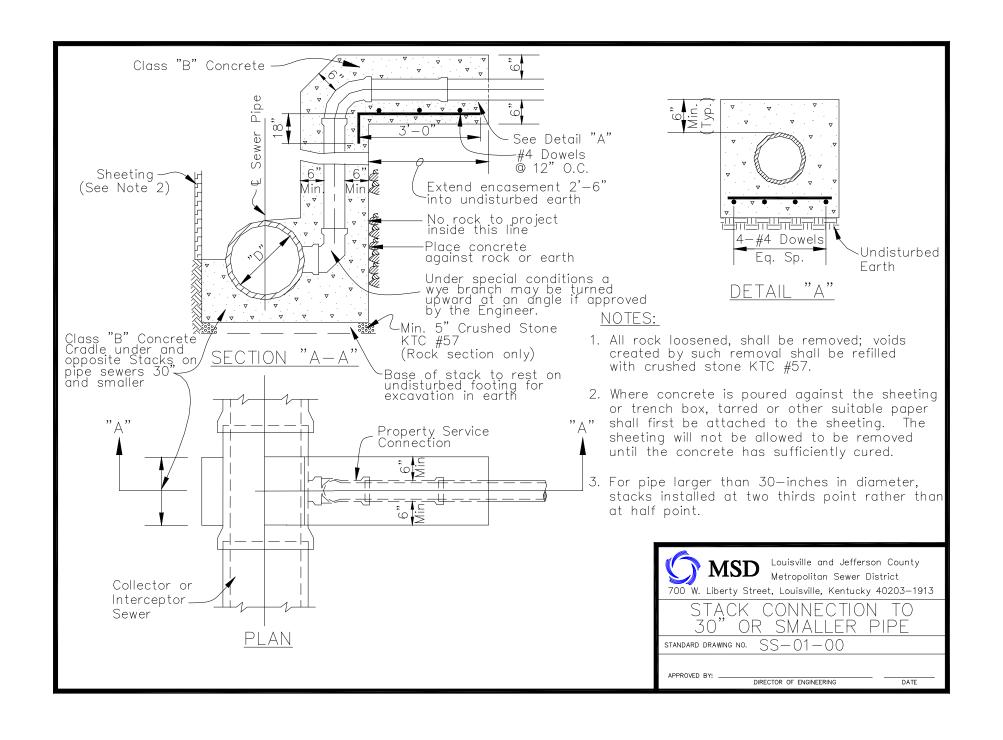


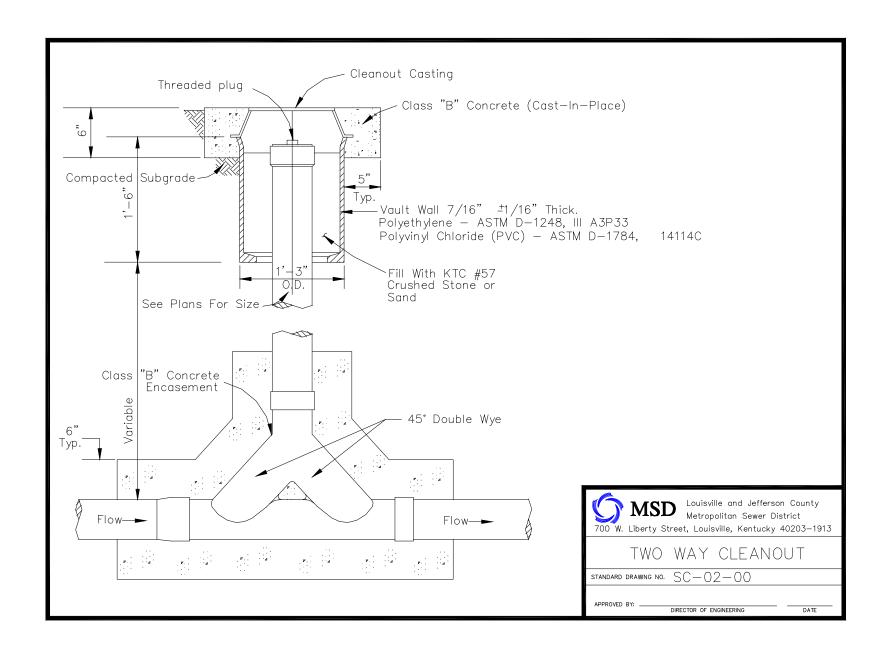












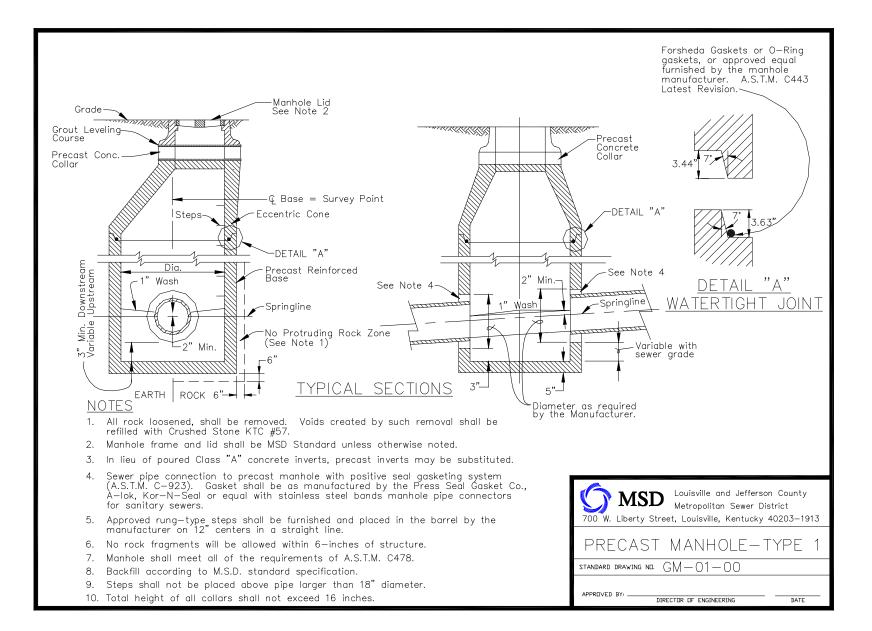


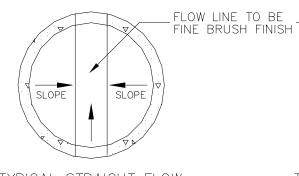




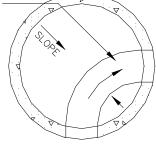


## **MANHOLES**





TYPICAL STRAIGHT FLOW



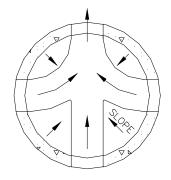
TYPICAL CURVE FLOW



TYPICAL 3-WAY FLOW

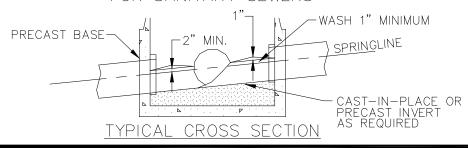
SLOPE





TYPICAL 4-WAY FLOW

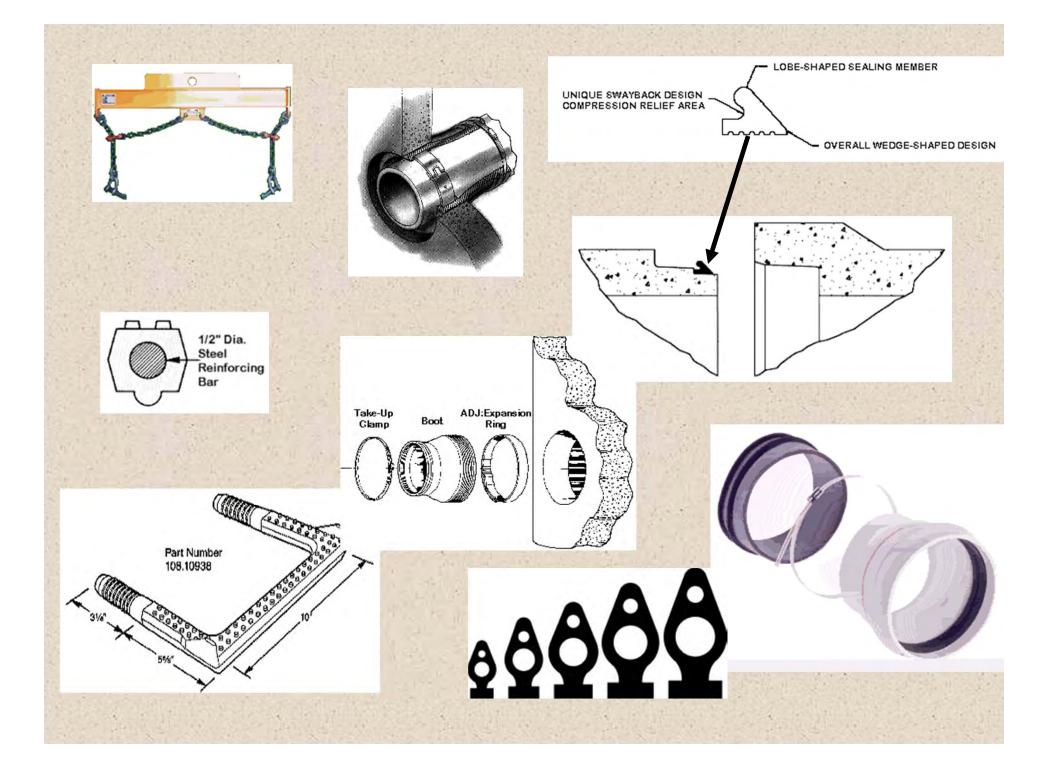
## TYPICAL CHANNELIZATION DETAILS FOR SANITARY SEWERS





**PRECAST** 

**CRITERIA** 













HUMIDTY
AND
MOISTURE
BENDS
AND
DISPERSES
LASER
LIGHT



























## **CASTINGS**





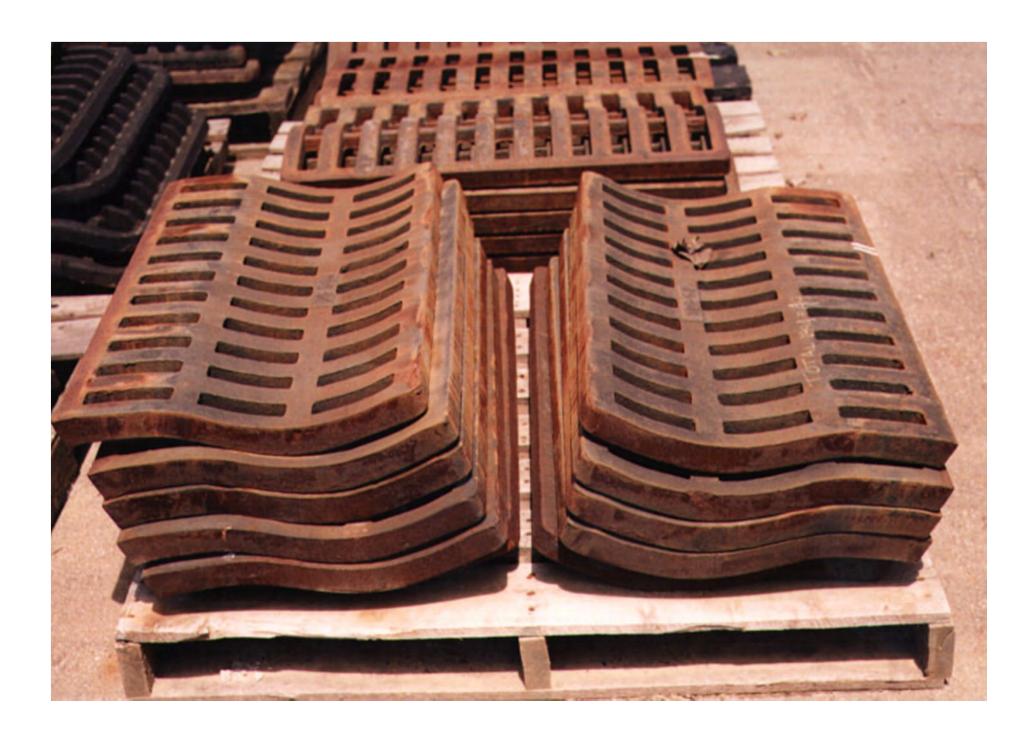




























DOES
THIS
MEET
SPEC?

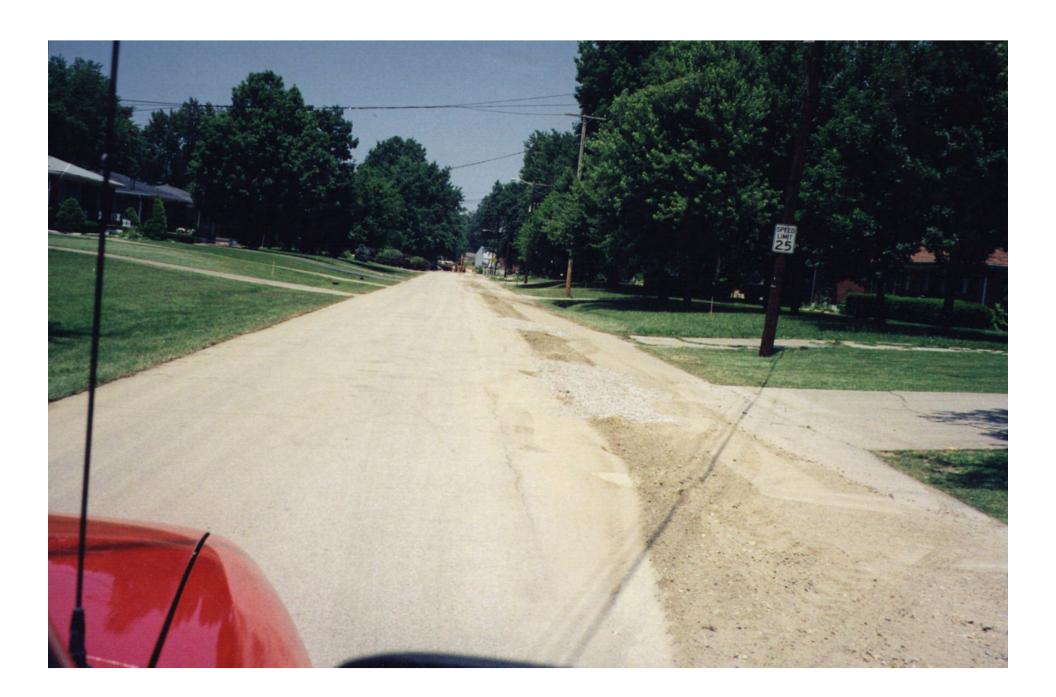


# PAVEMENT TO BE RESTORED











### A NORMAL DAY AT WORK







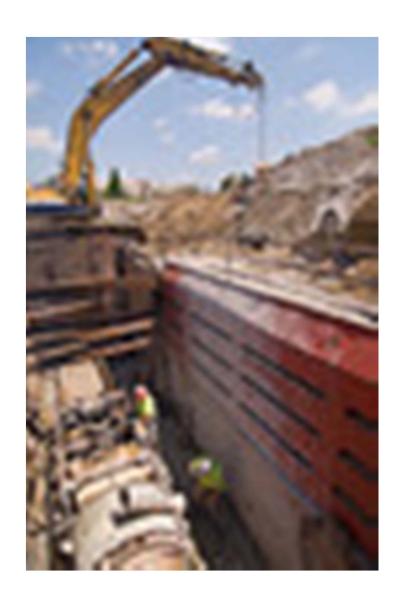


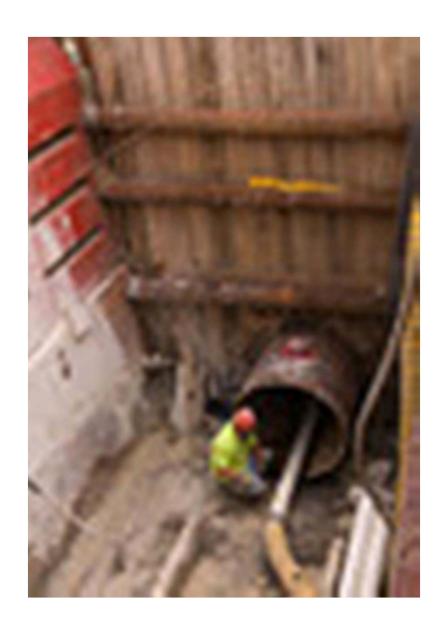
#### CHAOS- A GOOD DAY AT WORK



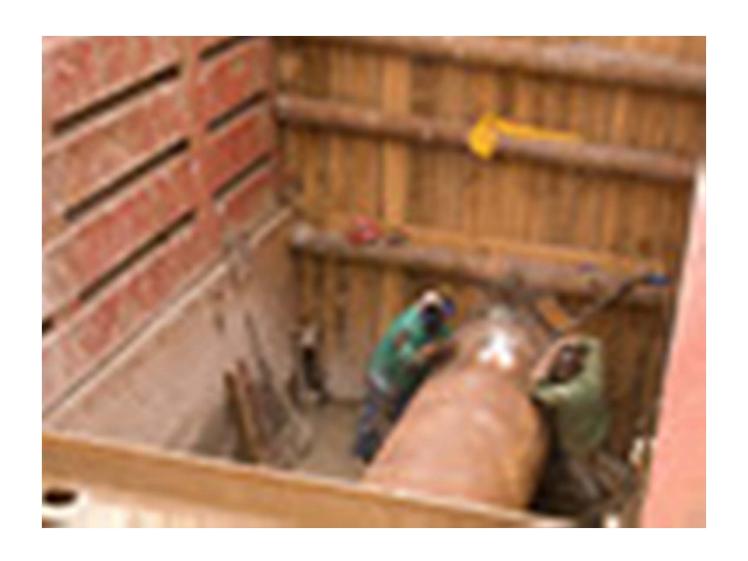
# BORE & JACK



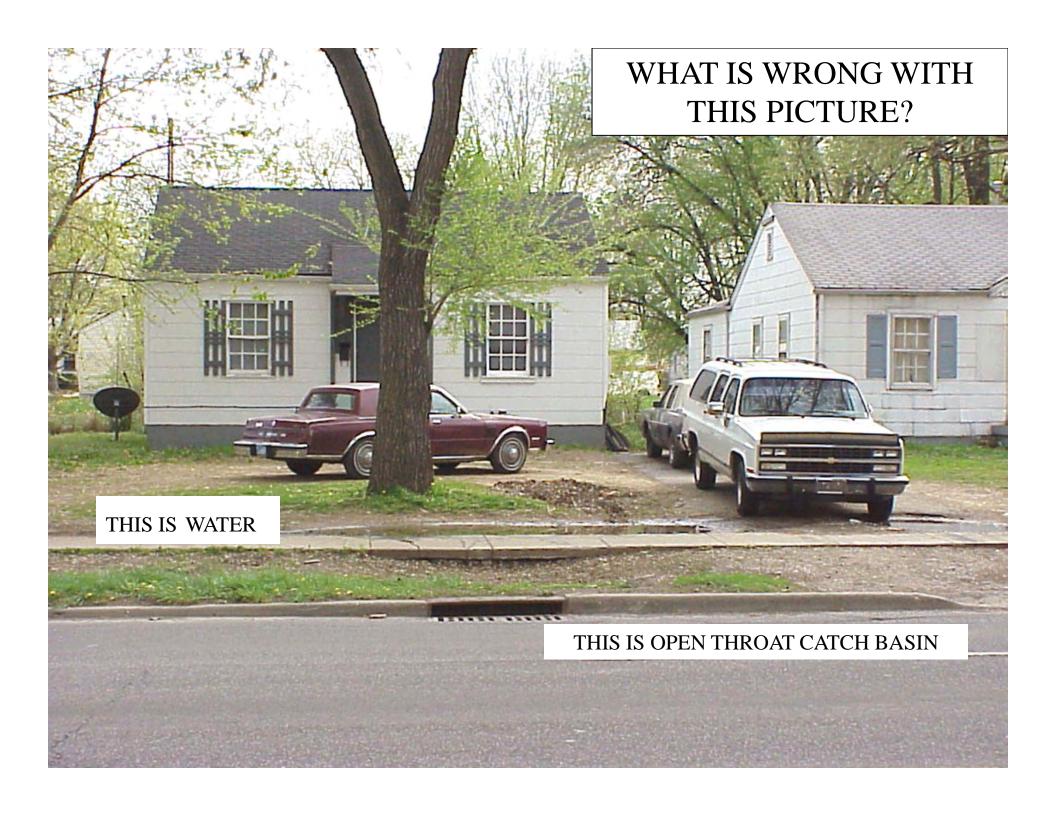








## **DRAINS**



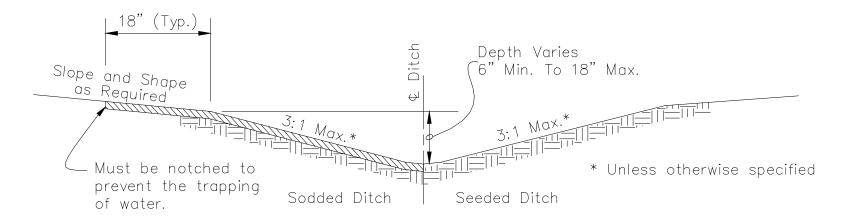












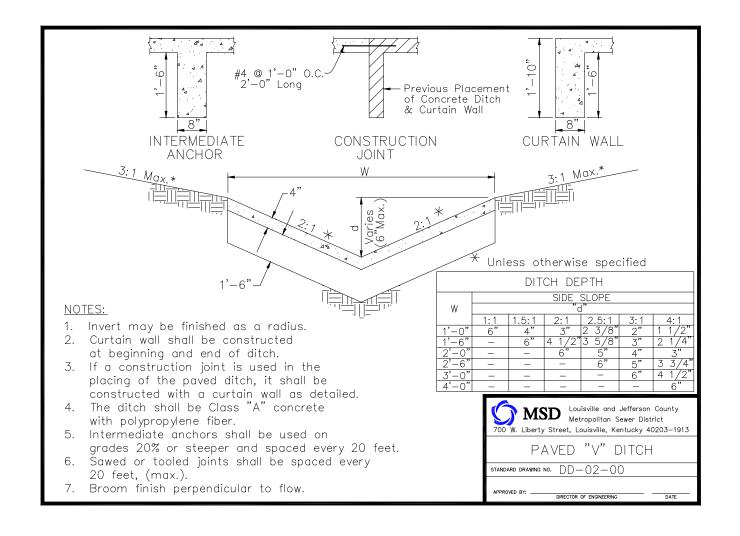
## NOTES:

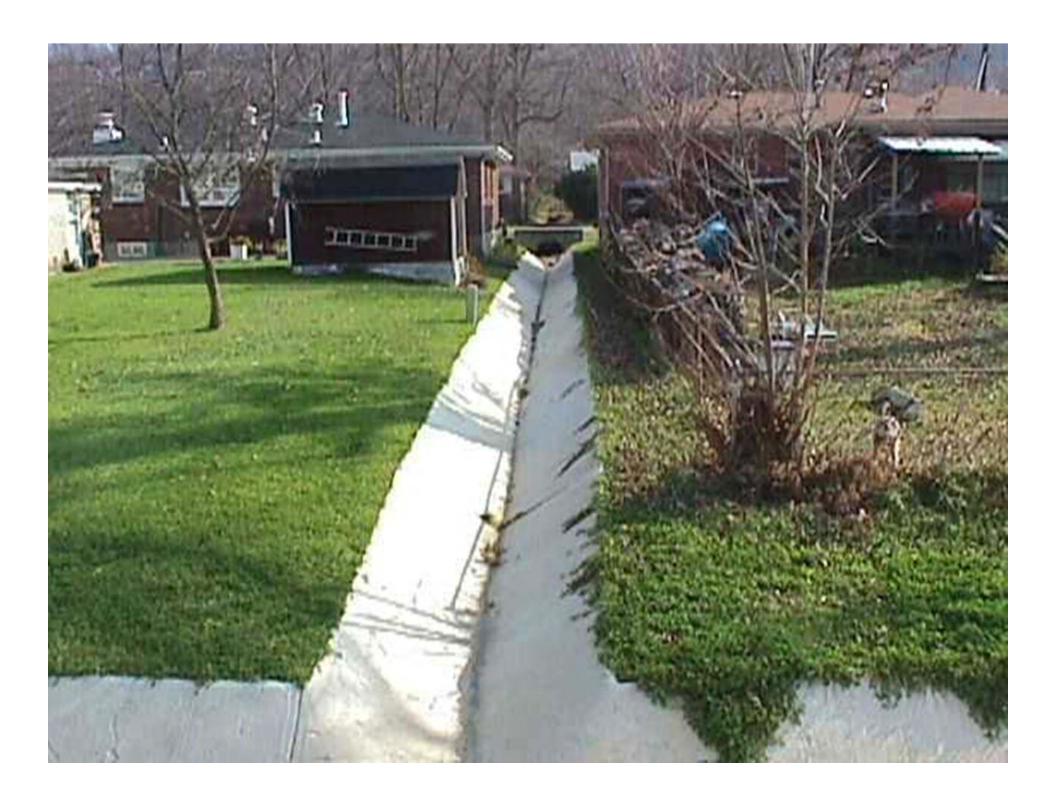
- 1. Sodded or seeded ditches should <u>not</u> be used where slopes are 10% or greater or where the velocity is greater than 4 feet per second.
- 2. Sod shall be placed so that ditches shall be free—draining at the edge of all pavements and driveways.
- 3. Ditch lining shall be designed for full bank flow.











## **HEADWALLS**















6-20-95



DEBRIS IN FRONT OF CULVERT









## **DRIVEWAYS**



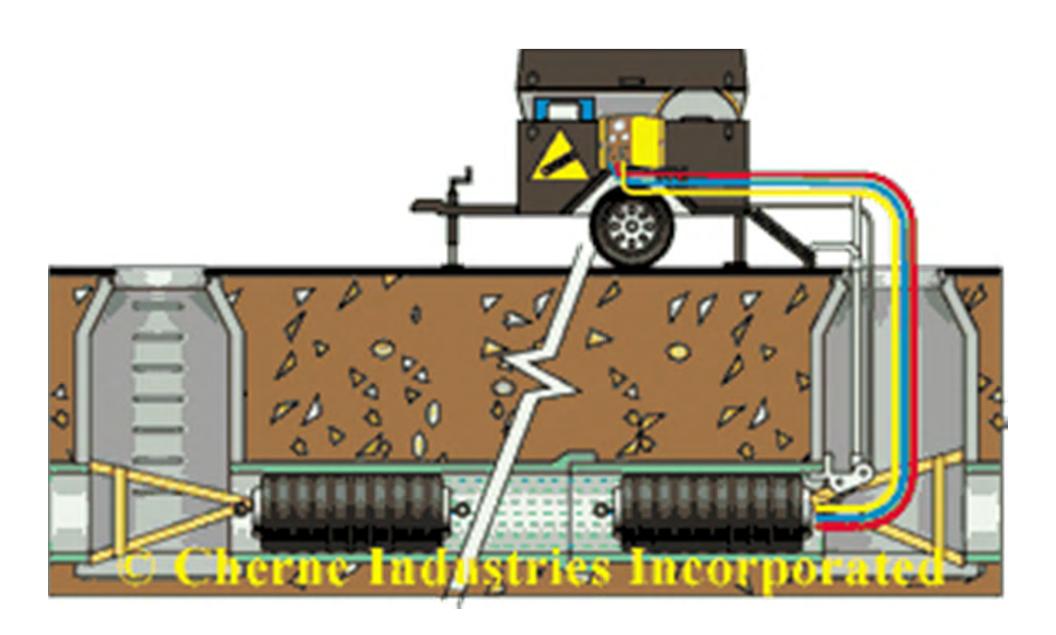


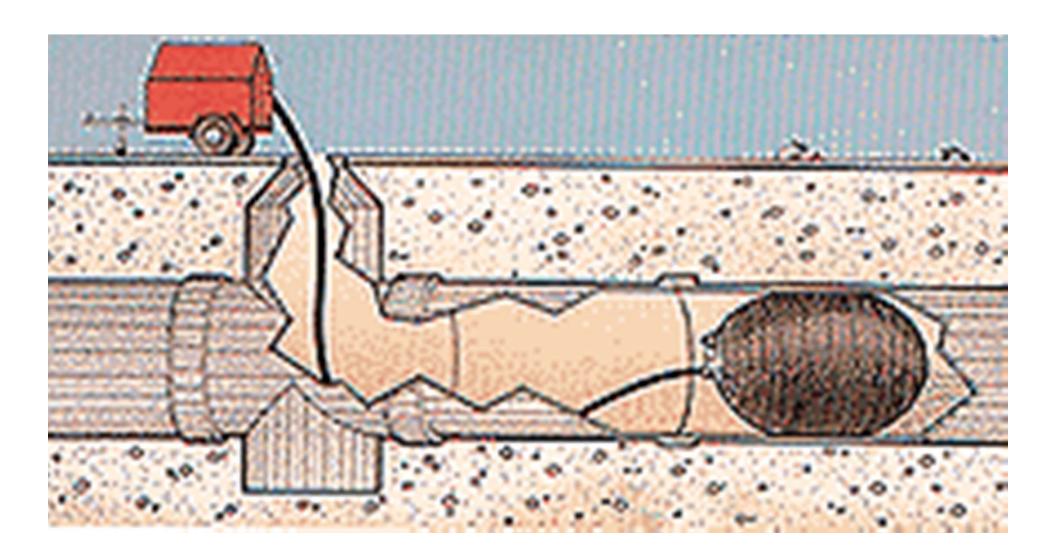


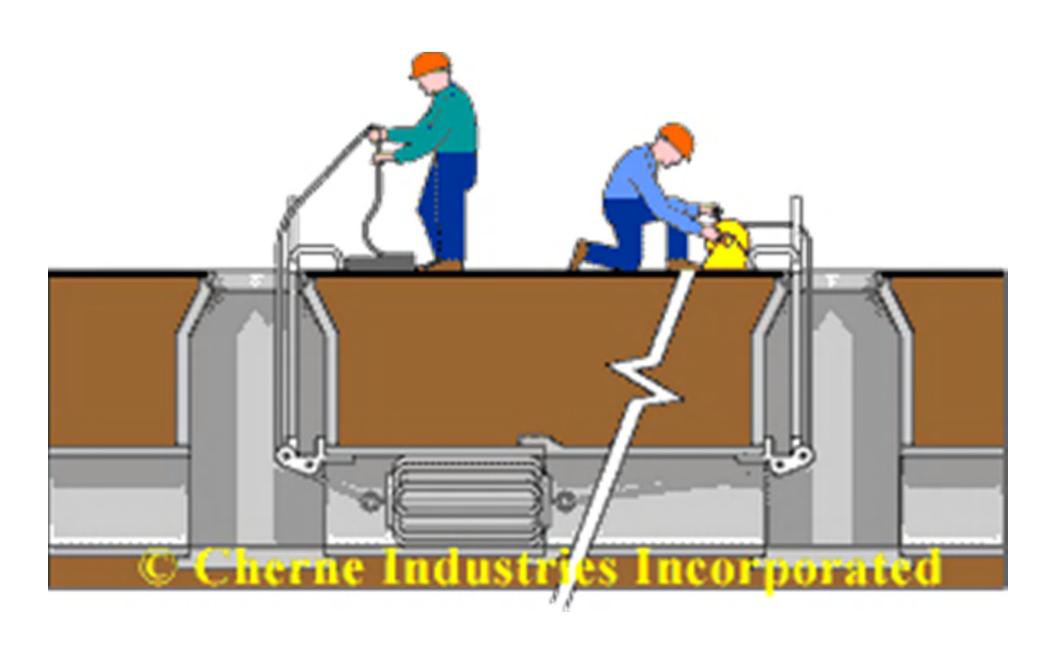


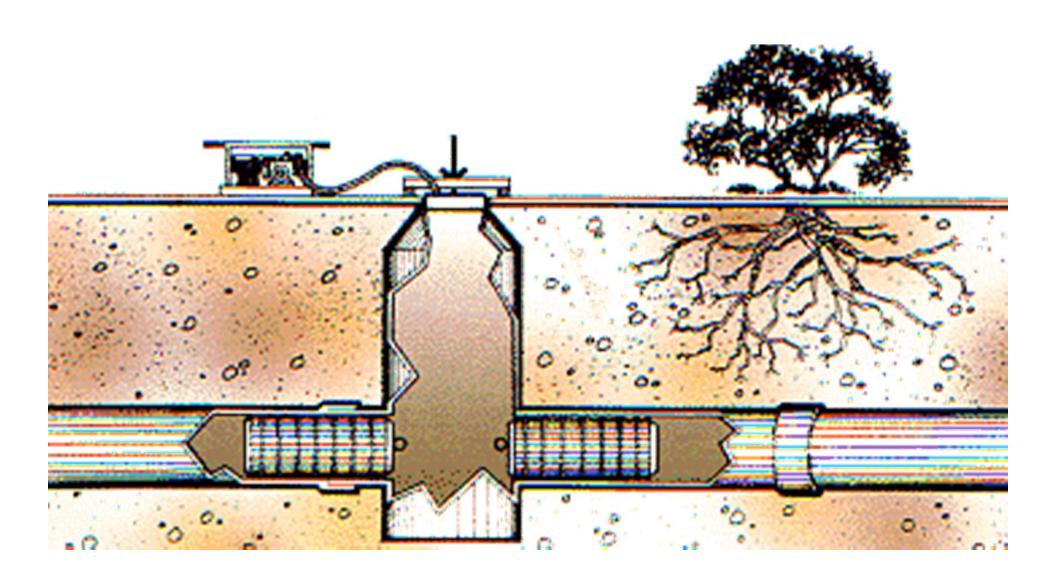
## **TESTING**





















INFI	LTR	ATIC	N/E	XFIL	TRA	OIT	N TEST
OEWEDO							
SEWERS INFILTRAT	ION TEST-	GROUND	│ WATER MU	JST BE AT	LEAST 2 F	EET ABO	/E PIPE
	TION TE OT	MUOTOD		ET OF HE	4D 0D 1E	20	
EXFILIRA	HON 1EST	- MUST CR	EAIE 3 FE	ET OF HE	AD OR LES	55	
ALLOWAE	LE LEAKA	GE = 150*	DIAMETER	*(LENGTH	/5280)/24		
150 GALLO	ON/INCH D	IAMETER/N	MILE/DAY				
DIAMETER	R- INCH						
LENGTH- I	FEET						
MANHOLE	S						
0.1 GALLO	N/FT OF D	DIAMETER/	FT OF HEA	AD)			
SAMPLE	CALCULAT	ION					
24" PIPE,	350 LF, W	ATER 2 FE	ET ABOVE	CROWN C	F PIPE		
LEAKAGE	= 150*24*(3	350/5280)/ <i>2</i>	24 HOURS				
=	0 043182	GALLONE	PER HOUR				
		60 FOR M					
	0 16572	CALLON	PER MINUT	=			
=	0.10372	OALLON F	LIX WIINUT	_			

	N PRESS	URE AIR T	<b>E313</b>		
LASTIC	PIPE				
=0.0085*	D*K/Q				
- SHORT	EST TIME ALLOWED FC	 DR PRESSURE TO DROP 1 F	PSI		
)- PIPE IN	  SIDE DIAMETER (INCH)				
- LENGTI	 H OF TEST PIPE (FEET)				
Q- 0.0015,	(FT^3/MIN/FT^2 OF INTE	ERNAL SURFACE AREA)			
(- 0.0004 <i>′</i>	  9 D*L BUT NOT LESS T	HAN 1			
F GROUN	 ID WATER PRESENT TE	 EST PRESSURES MUST INC	 REASE 0.43 FOR	EVERY FOT OF V	WATER ABOVE PIPE
PIPE ID	T /TIME MINI/400 FT	Q (ALLOWABLE AIR LOSS)			
INCH	MINUTE:SEC	FT/3/MIN)			
4	3:46	0.0015			
-	5.40	0.0015			
6	5:40	0.0010			
-	5:40 7:34	0.0015			
6					
6	7:34	0.0015			
6 8 10	7:34 9:26	0.0015 0.0015			
6 8 10 12	7:34 9:26 19:12	0.0015 0.0015 0.0015			
6 8 10 12 15	7:34 9:26 19:12 11:20	0.0015 0.0015 0.0015 0.0015			
6 8 10 12 15 18	7:34 9:26 19:12 11:20 14:10	0.0015 0.0015 0.0015 0.0015 0.0015			
6 8 10 12 15 18 21	7:34 9:26 19:12 11:20 14:10 19:50	0.0015 0.0015 0.0015 0.0015 0.0015 0.0015			
6 8 10 12 15 18 21 24	7:34 9:26 19:12 11:20 14:10 19:50 22:47	0.0015 0.0015 0.0015 0.0015 0.0015 0.0015			
6 8 10 12 15 18 21 24 27	7:34 9:26 19:12 11:20 14:10 19:50 22:47 4:51	0.0015 0.0015 0.0015 0.0015 0.0015 0.0015 0.0015			

<b>_OV</b>	V PRESS	SURE AIR T	EST	<b>S</b>		
ONCRET	E PIPE					
=(0.00037	*D^2*L/Q					
- MINIMUI	M TIME ALLOWED FOR	PRESSURE TO DROP FROM	// 3.5 PSI TO	2.5 PSI		
)- PIPE IN	SIDE DIAMETER (INCH)					
- LENGTH	OF TEST PIPE (FEET)					
Q- ALLOW	ABLE AIRE LOSS, (FT^	3/MIN)				
F GROUNI	D WATER PRESENT TE	ST PRESSURES MUST INCF	REASE 0.43 F	FOR EVERY F	OT OF WATER	R ABOVE PIPE
PIPE ID	T (TIME MIN/100 FT)	Q (ALLOWABLE AIR LOSS)				
INCH	MINUTE	FT^3/MIN)				
12	1.8	3				
15	2.1	4				
18	2.4	5				
21	3					
24	3.6	6				

# Recommended Standards for Wastewater Facilities

1997 Edition



ILLINDIS
INCIANA
IOWA
MICHIGAN
MINISTOTA
MISSOLINI
NEW YORK
DHIO
ONTARIO
PENNSYLVANIA
WISCONINI

Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.

- b. soil conditions,
- service and branch connections into the water main and sewer line,
- compensating variations in the horizontal and vertical separations,
- e. space for repair and alterations of water and sewer pipes.

#### f. off-setting of pipes around manholes.

#### 8.6.2 Parallel installation

Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

#### 8.6.3 Crossings

Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

#### 8.6.4 Exception

The reviewing authority must specifically approve any variance from the requirements of Sections 8.6.2 and 8.6.3 when it is impossible to obtain the specified separation distances. Where sewers are being installed and Section 8.6.2 and 8.6.3 cannot be met, the sewer materials shall be water main pipe or equivalent and shall be pressure tested to ensure water tightness.

#### 8.6.5 Force mains

There shall be at least a 10 foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18 inch vertical separation at crossings as required in Section 8.6.3.

#### 38.2 Relation to Water Works Structures

While no general statement can be made to cover all conditions, it is generally recognized that sewers shall meet the requirements of the appropriate reviewing agency with respect to minimum distances from public water supply wells or other water supply sources and structures.

All existing waterworks units, such as basins, wells, or other treatment units, within 200 feet (60 m) of the proposed sewer shall be shown on the engineering plans.

Soil conditions in the vicinity of the proposed sewer within 200 feet (60 m) of waterworks units shall be determined and shown on the engineering plans.

#### 38.3 Relation to Water Mains

#### 38.31 Horizontal and Vertical Separation

Sewers shall be laid at least 10 feet (3 m) horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot (3 m) separation, the appropriate reviewing agency may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18 inches (460 mm) above the top of the sewer.

If it is impossible to obtain proper horizontal and vertical separation as described above, both the water main and sewer must be constructed of slip-on or mechanical joint pipe complying with public water supply design standards of the agency and be pressure tested to 150 psi (1034 kPa) to assure watertightness before backfilling.

#### 38.32 Crossings

Sewers crossing water mains shall be laid to provide a minimum vertical distance of 18 inches (460 mm) between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to maintain line and grade.

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, one of the following methods must be specified:

a. The sewer shall be designed and constructed equal to water pipe, and shall be pressure tested at 150 psi (1034 kPa) to assure water tightness prior to backfilling.

# COSTS

TABLE 1 PIPE INSTALLATION

### INSTALLED IN NON PAVED AREA

### INSTALLED IN PAVED AREA

PIPE SIZE					C	OST A	T D	ЕРТН					PIPE SIZE					C	OST A	ΓD	ЕРТН		
INCH	5.0	00	10	.00	2	0.00	3	0.00	4	0.00	5	0.00	INCH		5.00	]	10.00		20.00		30.00	40.00	50.0
144" RCP					\$	2,265	\$	2,770	\$	3,365	\$	3,775	144" RCP					\$	2,940	\$	3,800	\$ 4,755	\$ 5,51
120" RCP			_		\$	1,940	\$	2,320	\$	2,820	\$	3,325	120" RCP	_		-		\$	2,560	\$	3,250	\$ 4,060	\$ 4,87
108" RCP					\$	1,755	\$	2,250	\$	2,740	\$	3.250	108" RCP					\$	2,345	\$	3,130	\$ 3,905	\$ 4,70
96" RCP					\$	1,660	\$	2,160	\$	2,655	\$	3,150	96" RCP	-				\$	2,220	\$	2,985	\$ 3,745	\$ 4,51
78" RCP			\$	530	\$	1,470	\$	1,963	\$	2,500	\$	2,950	78" RCP			\$	815	\$	1,995	\$	2,735	\$ 3,520	\$ 4,21
72" RCP			\$	480	\$	1,265	\$	1,762	\$	2,345	\$	2,750	72" RCP			\$	745	\$	1,755	\$	2,475	\$ 3,190	\$ 3,90
66" RCP			\$	435	\$	1,225	\$	1,720	\$	2,255	\$	2,700	66" RCP			\$	685	\$	1,670	\$	2,365	\$ 3,105	\$ 3,75
60" RCP			\$	380	\$	1,185	\$	1,675	\$	2,165	\$	2,655	60" RCP			\$	610	\$	1,585	\$	2,255	\$ 2,925	\$ 3,59
48" RCP			\$	310	\$	1,105	\$	1,595	\$	2,144	\$	2,570	48" RCP	_		\$	520	\$	1,475	\$	2,115	\$ 2,820	\$ 3,40
36" RCP	\$	250	S	270	\$	1,060	\$	1,550	\$	2,123	\$	2,520	36" RCP	\$	370	\$	455	\$	1,385	\$	2,005	\$ 2,710	\$ 3,24
30" RCP	\$	225	S	240	\$	1,030	\$	1,515	\$	2,100	\$	2,490	30" RCP	\$	345	\$	420	\$	1,335	\$	1,940	\$ 2,643	\$ 3,15
27" RCP	\$	190	\$	205	\$	1,000	\$	1,485	\$	2,060	\$	2,450	27" RCP	\$	300	\$	375	\$	1,275	\$	1,875	\$ 2,560	\$ 3,06
24" RCP	\$	185	\$	195	\$	990	\$	1,470	\$	2,050	\$	2,440	24" RCP	\$	280	\$	340	\$	1,220	\$	1,790	\$ 2,455	\$ 2,93
21" RCP	\$	180	\$	190	\$	980	\$	1,465	\$	2,040	\$	2,430	21" RCP	\$	275	\$	330	\$	1,215	\$	1,785	\$ 2,450	\$ 2,93
18" RCP	\$	175	. \$	185	\$	975	\$	1,455	\$	1,940	\$	2,420	18" RCP	\$	260	\$	300	\$	1,160	\$	1,710	\$ 2,255	\$ 2,80
15" PVC	\$	165	\$	175	\$	965	\$	1,445	\$	1,925	\$	2,405	15" PVC	\$	245	\$	280	\$	1,125	\$	1,660	\$ 2,195	\$ 2,73
12" PVC	\$	160	\$	165	\$	955	\$	1,435	\$	1,915	\$	2,395	12" PVC	\$	235	\$	270	\$	1,115	\$	1,655	\$ 2,190	\$ 2,72
10" PVC	\$	155	\$	160	\$	950	\$	1,430	\$	1,910	\$	2,390	10" PVC	\$	230	\$	265	\$	1,110	\$	1,650	\$ 2,180	\$ 2,72
8" PVC	\$	150	\$	155	\$	945	\$	1,425	\$	1,905	\$	2,387	8" PVC	\$	225	\$	260	\$	1,105	\$	1,645	\$ 2,180	\$ 2,71
6" PVC	\$	95	S	100	\$	870	S	1,340	\$	1,805	\$	2,269	6" PVC	\$	170	\$	195	\$	1,010	\$	1,520	\$ 2,030	\$ 2,54

### BORE/JACK OPERATION

PIPE SIZE			1	DEPTH		
INCH	10	.00		20.00	30.00	50.00
144" RCP			\$	3,865	\$ 3,965	\$ 4,170
120" RCP			\$	3,685	\$ 3,800	\$ 3,980
108" RCP			\$	3,480	\$ 3,580	\$ 3,750
96" RCP	<del></del>		\$	3,275	\$ 3,360	\$ 3,520
78" RCP			\$	2,965	\$ 3,035	\$ 3,180
72" RCP	\$	2,365	\$	2,432	\$ 2,500	\$ 2,605
66" RCP	\$	1,855	\$	1,900	\$ 1,970	\$ 2,035
60" RCP	\$	1,830	\$	1,880	\$ 1,925	\$ 2,015
48" RCP	\$	1,140	\$	1,185	\$ 1,230	\$ 1,320
36" RCP	\$	1,135	\$	1,185	\$ 1,230	\$ 1,320
33" RCP	\$	1,130	\$	1,180	\$ 1,225	\$ 1,315
30" RCP	\$	1,125	\$	1,175	\$ 1,220	\$ 1,310
27" RCP	\$	1,095	\$	1,140	\$ 1,185	\$ 1,275
24" RCP	\$	580	\$	630	\$ 675	\$ 765
21" RCP	\$	580	\$	630	\$ 675	\$ 765
18" RCP	\$	585	\$	630	\$ 675	\$ 765
15" PVC	\$	585	\$	630	\$ 675	\$ 7 <b>65</b>
12" PVC	\$	585	\$	630	\$ 675	\$ 765
10" PVC	\$	575	\$	625	\$ 670	\$ 760
8" PVC	\$	575	\$	625	\$ 670	\$ 760
6" PVC	\$	<b>5</b> 75	\$	625	\$ 670	\$ 760

## SANITARY PUMP STATION

MGD PUMP F	LOW RANGE	\$/GPD
0	0.25	\$0.88
0.25	0.5	\$0.66
0.5	1	\$0.44
1	5	\$0.38
5	25	\$0.16
25	100	\$0.09
100	150	\$0.08
150	200	\$0.07

## OPERATION AND MAINTENANCE COST

PIPE SIZE		O&M	PIPE SIZE	O&M
INCH	PE	R 100 LF	INCH	PER 100 LF
144" RCP	\$	11.62	36" C905	\$ 8.22
120" RCP	\$	9.68	30" C905	\$ 6.85
108" RCP	\$	8.71	24" C905	\$ 5.48
96" RCP	\$	7.74	20" C905	\$ 4.57
78" RCP	\$	6.29	18" C905	\$ 4.11
72" RCP	\$	5.81	16" C905	\$ 3.66
66" RCP	\$	5.32	14" C905	\$ 3.20
60" RCP	\$	4.84	12" C900	\$ 2.74
48" RCP	\$	3.87	10" C900	\$ 2.28
36" RCP	\$	2.90	8" C900	\$ 1.83
30" RCP	\$	2.42	6" C900	\$ 1.37
27" RCP	\$	2.18		
24" RCP	\$	1.94		
21" RCP	\$	1.69		
18" RCP	\$	1.45		
15" PVC	\$	1.21		
12" PVC	\$	0.97		
10" PVC	\$	0.81		
8" PVC	\$	0.65		
6" PVC	\$	0.48		

# THE END.

# PUMP STATION.

