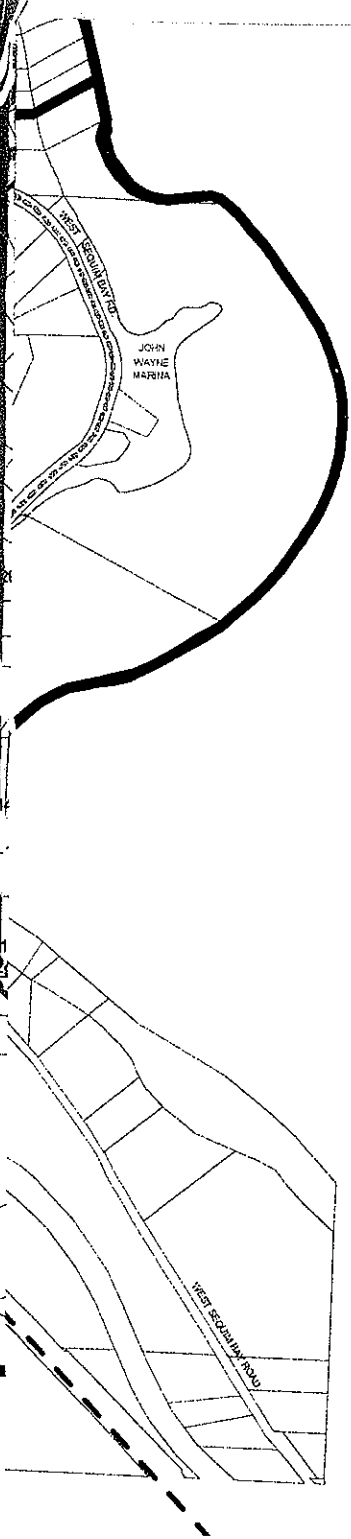


**Appendix J**  
**Full Base Map**





CITY OF SEQUIM  
WASTEWATER COMPREHENSIVE PLAN  
SEWER BASEMAP



**Gray & Osborne, Inc.**  
CONSULTING ENGINEERS



**Appendix K**  
**WEF Wastewater Collection Systems Management**  
**Summary**



Table 4.1 Preventive maintenance tasks and frequency.<sup>a</sup>

System	Daily	Weekly	Monthly	Quarterly	Semi-annually	Annually	As needed
Electrical							
Medium-voltage switchgear				1 <sup>a</sup>		2	
Phase transformer(s)				1		2	
Incoming service				1		2	
Main circuit breaker/disconnect				1		2	
Metering section				1		2	
Ground fault						2	
Automatic transfer switch		1					
Bus, vertical and horizontal						2	
Bus cables/stab-ins						2	
Motor control center			1		2		
Branch circuit breakers				1		2	
Motor starters		1		2			
Motor overload relays					2		
Relays						2	
Indicating lights	1		2				
Voltage/current readings	1						
Infrared scan						2	
Power factor capacitors		1		2			
Supervisory control							
Relays				2			
Wiring			1		2		
Fuses		1		2			

Table 4.1 Preventive maintenance tasks and frequency (continued).<sup>a</sup>

System	Daily	Weekly	Monthly	Quarterly	Semi-annually	Annually	As needed
Supervisory control (continued)							
Circuit breakers					2		
Pump sequencing		1			2		
Pump operating levels		1			2		
Compressors, bubbler		1				2	
Pneumatic piping/valves				1		2	
Pressure switches		1			2		
Alarms and levels	1				2		
Indicating lights	1						
Floats	1					2	
Pumps							
Bearings (vibration)		1				2	
Alignment				1		2	
Coupling				1		2	
Lubrication						1	1
Packing						2	
Mechanical seals		1				2	
Mounting						2	
Balance						2	
Impeller clearance						2	
Capacity		1					
Suction pressure		1					



**Table 4.1 Preventive maintenance tasks and frequency (continued).<sup>a</sup>**

System	Daily	Weekly	Monthly	Quarterly	Semi-annually	Annually	As needed
<b>Pumps (continued)</b>							
Discharge pressure		1					
Station calibration						1, 2	
Running time	1						
Overhaul							2
<b>Motors</b>							
Bearings			1			2	
Balance						2	
Conduit box connections						2	
Lubrication							1
Insulation resistance						2	
Running temperatures		1				2	
Full load amperes		1					
Voltage		1					
Vibration analysis						2	
Alignment		1				2	
Coupling		1				2	
Overhaul							2
<b>Valves</b>							
Suction				1		2	
Discharge				1		2	
Check		1				2	

**Table 4.1 Preventive maintenance tasks and frequency (continued).<sup>a</sup>**

System	Daily	Weekly	Monthly	Quarterly	Semi-annually	Annually	As needed
<b>Valves (continued)</b>							
Pressure relief		1				2	
Gate				1		2	
Plug					1		
<b>Miscellaneous</b>							
Piping						1	
Pipe restraints				1		2	
Bubbler system	1			2			
Auxiliary systems							1, 2
Water	1			2			
Sump	1			2			
Blowers/fans	1			2			
Heating system	1			2			
Cooling system	1			2			
Engine generator sets	1		2				
Lighting	1			2			

<sup>a</sup> Level 1 maintenance is performed by the operator. Level 2 maintenance is performed by maintenance personnel.



**Appendix L**  
**WRF Nitrification Calculations**



## Nitrification Calculations

### City of Sequim Wastewater Comprehensive Plan

Capacity of treatment plant for nitrification is based on a conventional design approach found in Metcalf and Eddy (3rd Ed.)

Maximum nitrifier growth rate is a function of Temperature

$$\mu_{N, \text{MAX}(T)} = (0.45)e^{0.098(T-15)}$$

Maximum nitrifier growth rate is a function of Temperature

for  $T = 10^\circ \text{C}$

$$\mu_{N, \text{MAX}(T=10)} = 0.28$$

for  $\text{NH}_3\text{-N} = 1 \text{ mg/L}$  (treatment goal)

$\text{DO} = 2 \text{ mg/L}$  (oxidation ditch DO level)

$k_{Nd} = 0.05 \text{ day}^{-1}$  (nitrifier endogenous decay rate)

Nitrifier growth rate is a function of half reaction constant ( $K_N$ ) and DO concentration as follows:

$$\mu_N = \mu_{N, \text{MAX}(T=10)} \left[ 1 / (1 + K_N) \right] \left[ \text{DO} / (K_{DO} + \text{DO}) \right]$$

$$\mu_N = (0.28) \left[ 1 / (0.5 + 1) \right] \left[ 2 / (0.3 + 2) \right]$$

$$= (0.28)(0.667)(0.87)$$

$$= 0.16 \text{ day}^{-1}$$

Minimum solids residence time (SRT) required for nitrification

$$\text{SRT}_{\text{MIN}} = 1 / (\mu_N + k_{Nd})$$

$$= 1 / (0.16 + 0.05)$$

$$= 4.8$$

Using a safety factor of 2

$$\text{Design SRT} = (2)(4.8)$$

$$= 9.6 \text{ days}$$



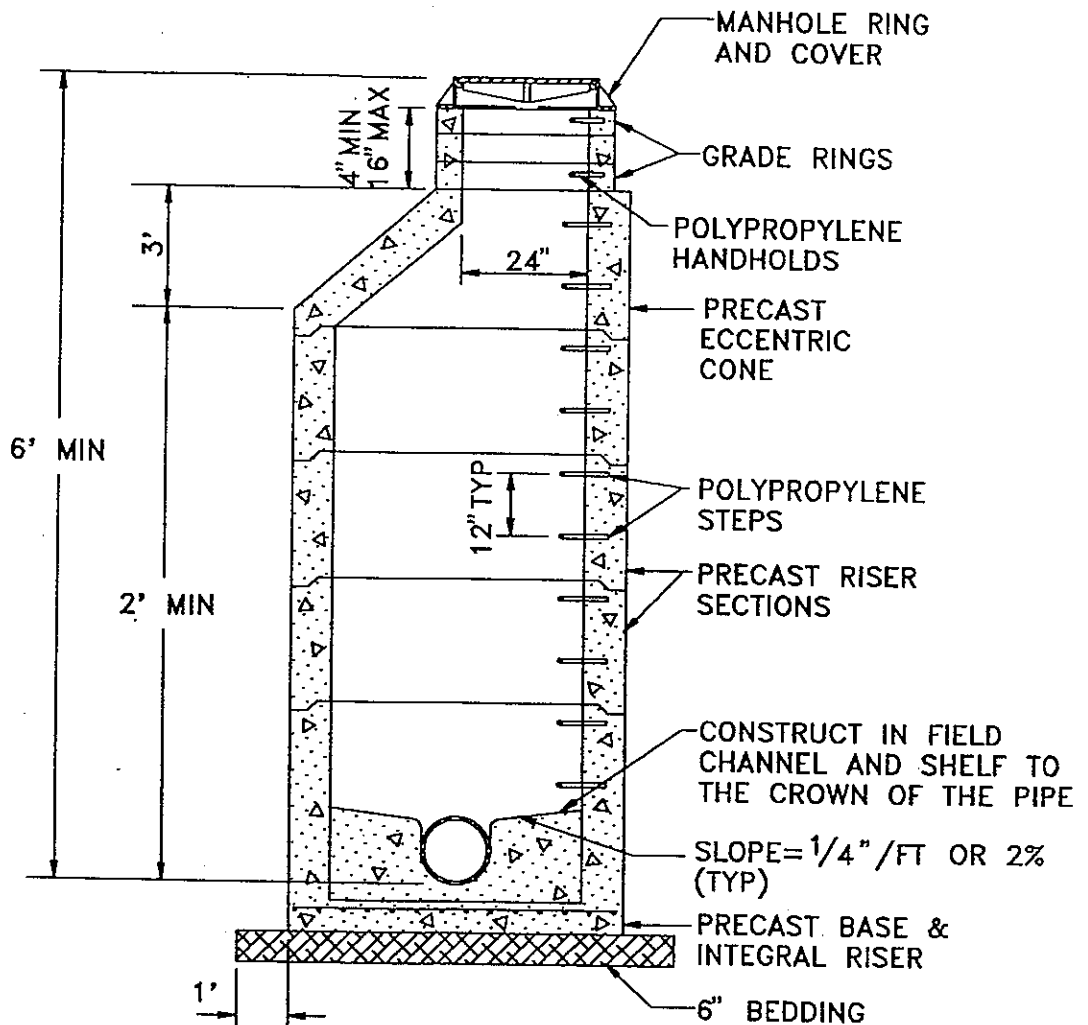
**Appendix M**  
**Developer Standards**



**SANITARY SEWER NOTES:**

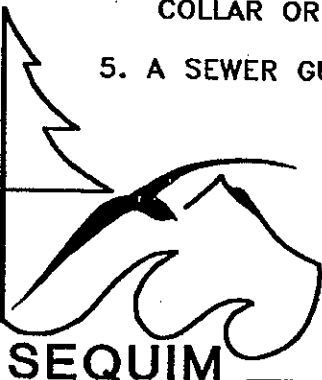
1. ALL WORK IN CITY RIGHT-OF-WAY REQUIRES A PERMIT FROM THE CITY OF SEQUIM. PRIOR TO ANY WORK COMMENCING, THE CONTRACTOR SHALL ARRANGE FOR A PRECONSTRUCTION MEETING AT THE SITE TO BE ATTENDED BY ALL MAJOR CONTRACTORS, REPRESENTATIVES OF INVOLVED UTILITIES AND THE CITY OF SEQUIM. CONTACT THE PUBLIC WORKS DEPARTMENT AT THE CITY OF SEQUIM TO SCHEDULE THE MEETING (683-4908). THE CONTRACTOR IS RESPONSIBLE TO HAVE HIS SET OF APPROVED PLANS AT THE MEETING.
2. MINIMUM GRADE ON ALL SIDE SEWERS SHALL BE TWO PERCENT AND PLACED AT LEAST FIVE FEET DEEP AT THE PROPERTY LINE.
3. ALL SEWER PIPE SHALL BE FROM THE FOLLOWING LIST OF MATERIALS, UNLESS OTHERWISE NOTED. ONLY ONE TYPE OF MATERIAL SHALL BE UTILIZED BETWEEN STRUCTURES UNLESS SHOWN OTHERWISE ON THE APPROVED PLANS.
  - A. PVC CONFORMING TO ASTM D-3034, SDR 35; OR ASTM F789.
  - B. DUCTILE IRON PIPE, CLASS 50, UNLESS NOTED OTHERWISE.
4. TRENCHING, BEDDING, AND BACKFILL SHALL BE IN ACCORDANCE WITH CITY STANDARD DETAIL.
5. ALL PVC PIPE ENTERING OR LEAVING A CONCRETE STRUCTURE SHALL HAVE A RUBBER SEALING GASKET, AS SUPPLIED BY THE PIPE MANUFACTURER, FIRMLY SEALED PERPENDICULAR TO THE PIPE AXIS, AROUND THE PIPE EXTERIOR, AND CAST INTO THE CONCRETE STRUCTURE.
6. SANITARY SEWER MANHOLE RING AND COVER SHALL CONFORM TO WSDOT STANDARD PLAN B-25, TYPE 1, STANDARD. COVERS SHALL BE MARKED "SEWER", WITH 2-INCH RAISED LETTERS. MINIMUM WEIGHT OF THE FRAME SHALL BE 210 POUNDS. MINIMUM WEIGHT OF THE COVER SHALL BE 150 POUNDS.
7. ALL PIPE AND SERVICES SHALL BE INSTALLED WITH CONTINUOUS TRACER TAPE INSTALLED 12 INCHES TO 18 INCHES UNDER THE FINAL GROUND SURFACE. THE MARKER SHALL BE PLASTIC NON-BIODEGRADABLE, METAL CORE OR BACKING MARKED "SANITARY" THAT CAN BE DETECTED BY A STANDARD METAL DETECTOR. TAPE SHALL BE TERRA TAPE D OR APPROVED EQUAL.
8. SANITARY SEWERS SHALL BE CLEANED AND TESTED CONFORMING TO REQUIREMENTS OF WSDOT SPECIFICATION 7-17.3(4). A REPRESENTATIVE OF THE CITY MUST BE PRESENT DURING TESTING.





**NOTES:**

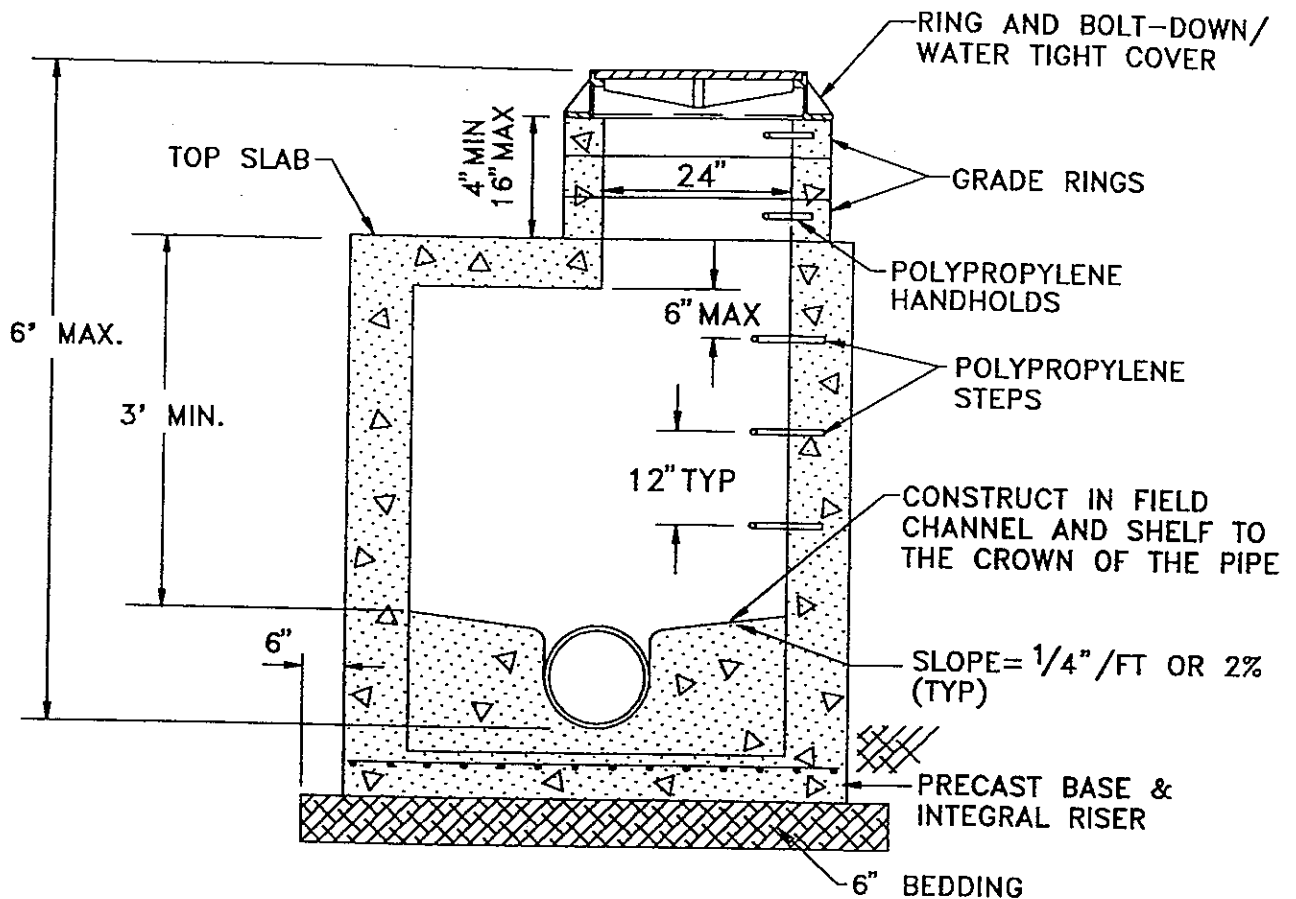
1. PRECAST MANHOLES SHALL MEET THE REQUIREMENTS OF ASTM C478. JOINTS SHALL BE RUBBER GASKETED CONFORMING TO ASTM C443 AND SHALL BE GROUTED FROM THE INSIDE. LIFT HOLES SHALL BE GROUTED FROM THE OUTSIDE AND INSIDE OF THE MANHOLE.
2. STEPS IN MANHOLE SHALL HAVE 6" MINIMUM CLEARANCE. HANDHOLES IN ADJUSTMENT SECTION SHALL HAVE 3" MINIMUM CLEARANCE THE FIRST STEP OR HANDHOLD SHALL BE A MAXIMUM OF 12" FROM THE TOP OF THE COVER.
3. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MINIMUM.
4. CONNECTION TO MANHOLE SHALL BE MADE BY KOR-N-SEAL BOOT, SAND COLLAR OR A-LOCK.
5. A SEWER GUARD SHALL BE INSTALLED IN ANY MANHOLE SUBJECT TO FLOODING.



## TYPE I MANHOLE

DATE	9 FEB 94	DRAWN	VIV
		DETAIL	SQM-S1





**NOTES:**

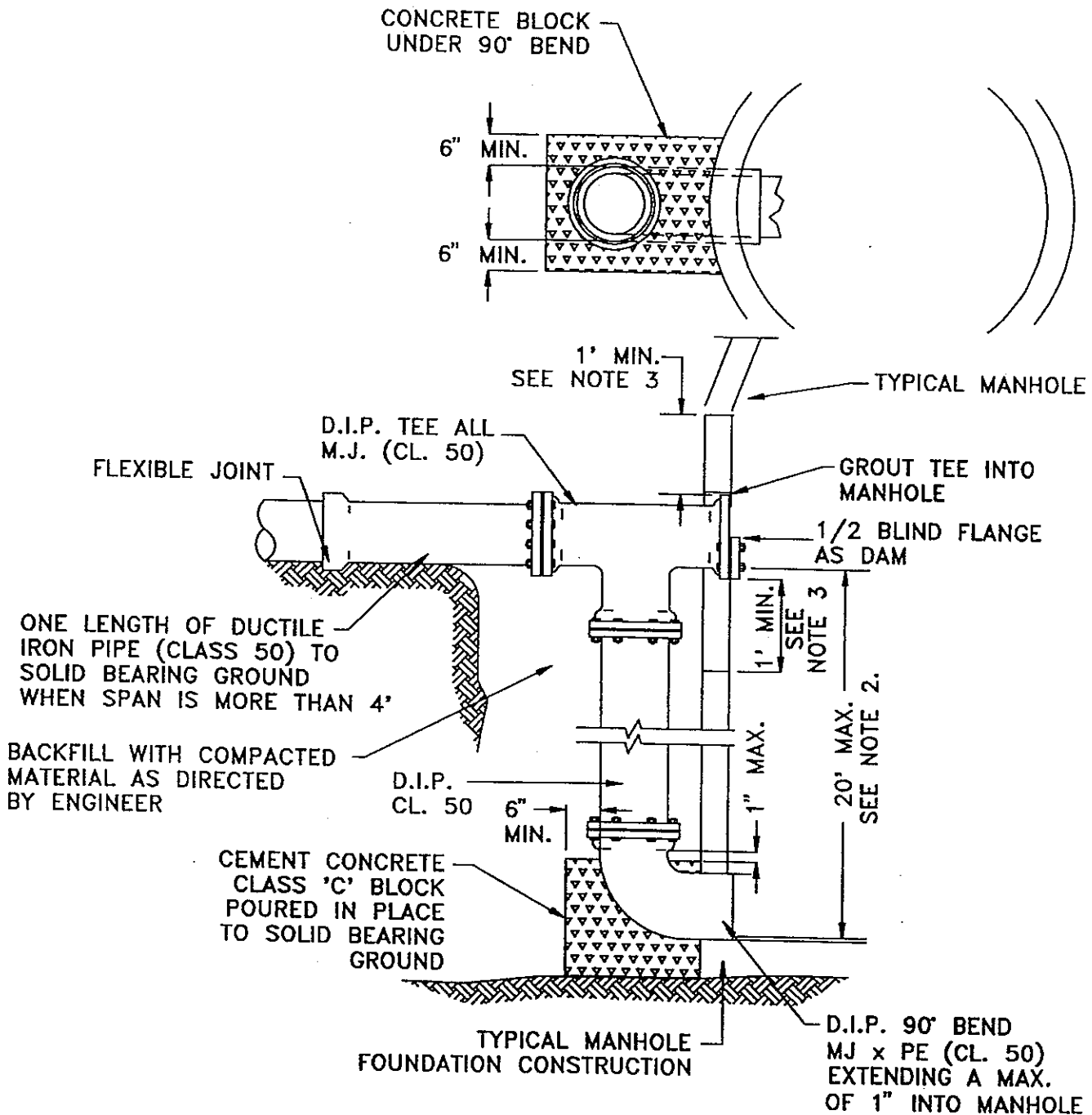
1. PRECAST MANHOLES SHALL MEET THE REQUIREMENTS OF ASTM C478. JOINTS SHALL BE RUBBER GASKETED CONFORMING TO ASTM C443 AND SHALL BE GROUTED FROM THE INSIDE. LIFT HOLES SHALL BE GROUTED FROM THE OUTSIDE AND INSIDE OF THE MANHOLE.
2. STEPS IN MANHOLE SHALL HAVE 6" MINIMUM CLEARANCE. HANDHOLES IN ADJUSTMENT SECTION SHALL HAVE 3" MINIMUM CLEARANCE. THE FIRST STEP OR HANDHOLD SHALL BE A MAXIMUM OF 12" FROM THE TOP OF THE COVER.
3. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MINIMUM.
4. CONNECTION TO MANHOLE SHALL BE MADE BY KOR-N-SEAL BOOT, SAND COLLAR OR A-LOCK.
5. A SEWER GUARD SHALL BE INSTALLED IN ANY MANHOLE SUBJECT TO FLOODING.



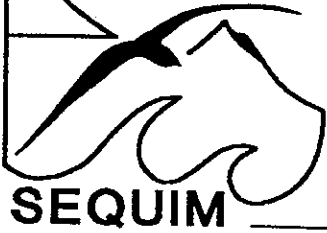
**SHALLOW MANHOLE  
(LESS THAN 6' DEPTH)**

DATE	9 FEB 94	DRAWN	VIV	DETAIL	SQM-S2
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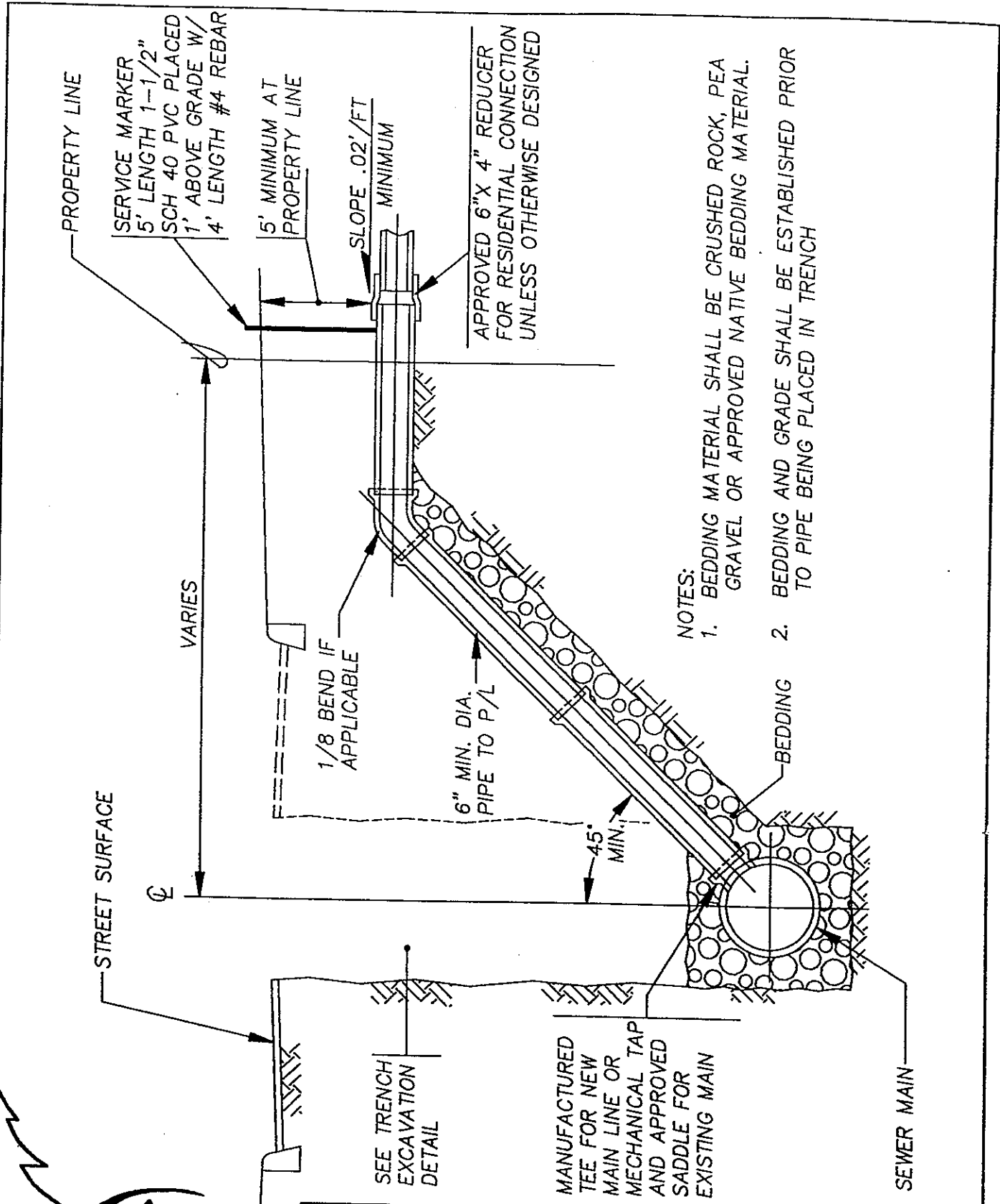


- NOTE:
1. THE INTERIOR OF ALL DUCTILE IRON SHALL BE COATED WITH EPOXY OR TNEC 66.
  2. DEPTHS OVER 20' MAY BE ALLOWED IF MEGA-LUG JOINTS ARE USED.
  3. MAINTAIN A MINIMUM OF 1' BETWEEN MANHOLE JOINTS AND TEE.



<b>DROP CONNECTION</b>			
DATE	9 FEB 94	DRAWN	VIV
		DETAIL	SQM-S3



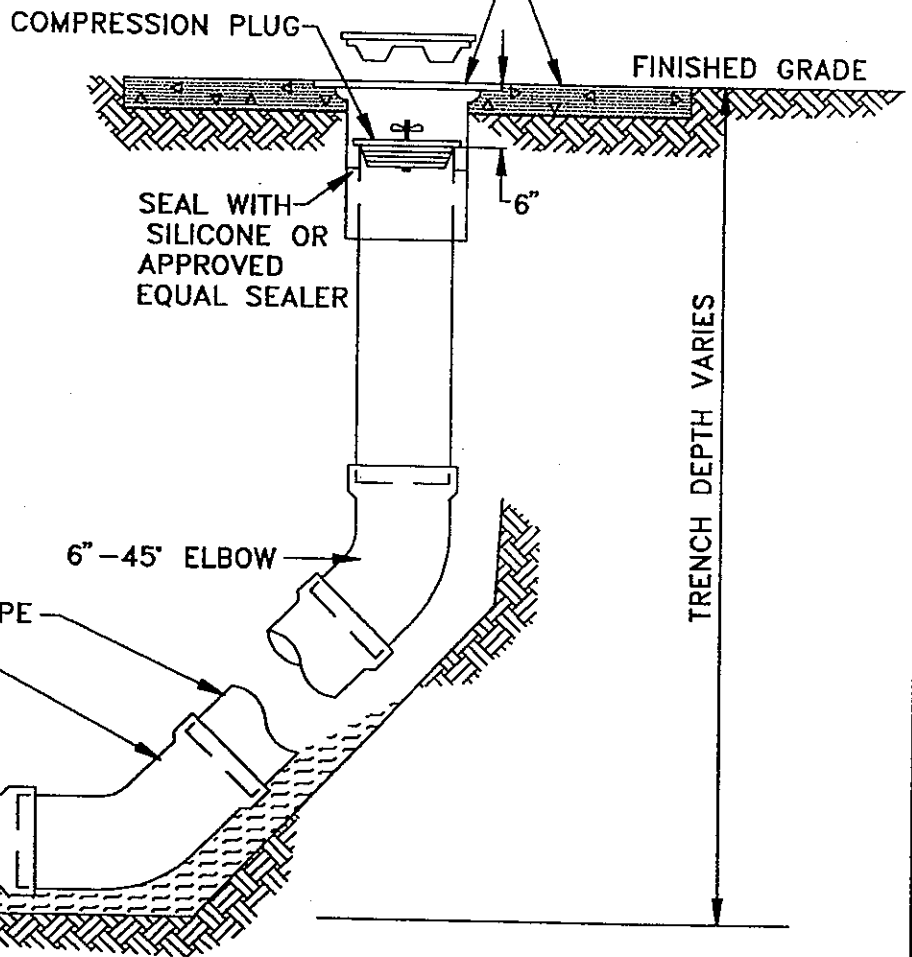
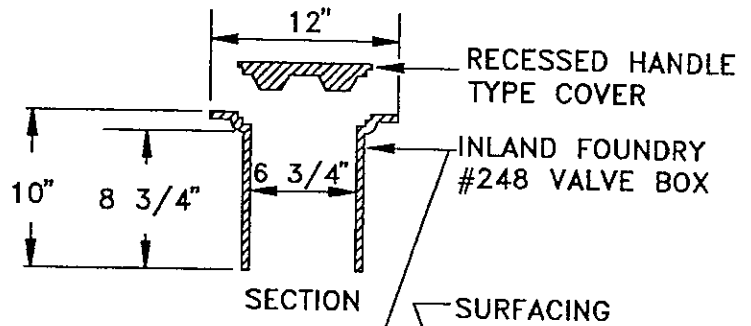
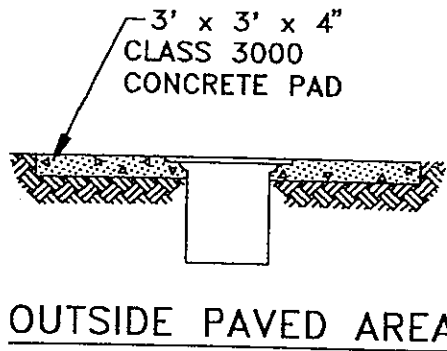


- NOTES:
1. BEDDING MATERIAL SHALL BE CRUSHED ROCK, PEA GRAVEL OR APPROVED NATIVE BEDDING MATERIAL.
  2. BEDDING AND GRADE SHALL BE ESTABLISHED PRIOR TO PIPE BEING PLACED IN TRENCH

# SANITARY SEWER LATERAL SERVICE CONNECTION

DATE	9 FEB 94	DRAWN	VIV	DETAIL	SQM-S4
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NOTE:

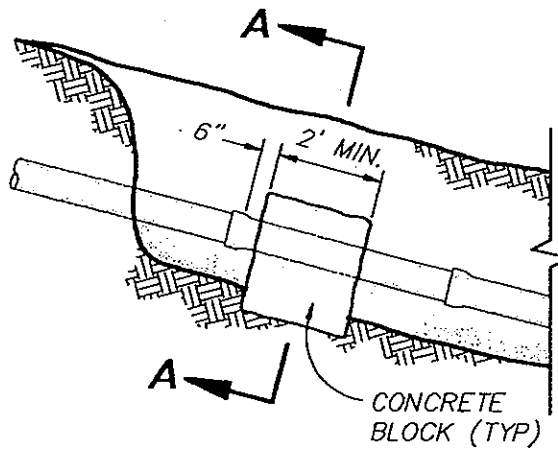
ALL SEWER PIPE SHALL BE  
ASTM 3034 SDR 35.

# CLEANOUT



DATE	9 FEB 94	DRAWN	VIV	DETAIL	SQM-S5
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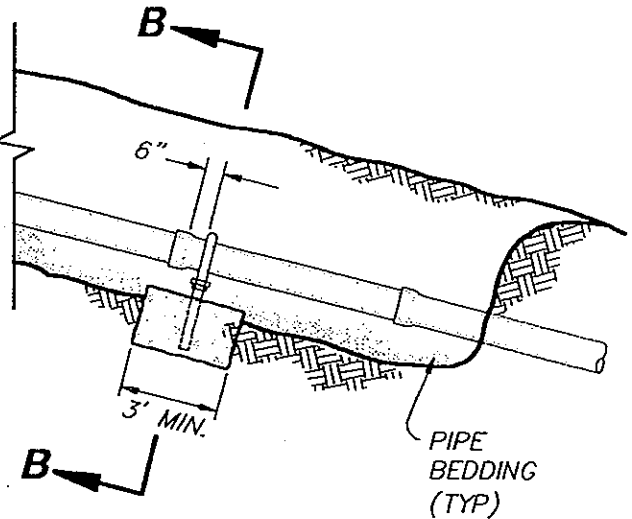




**CONCRETE BLOCK ANCHOR**

N.T.S.

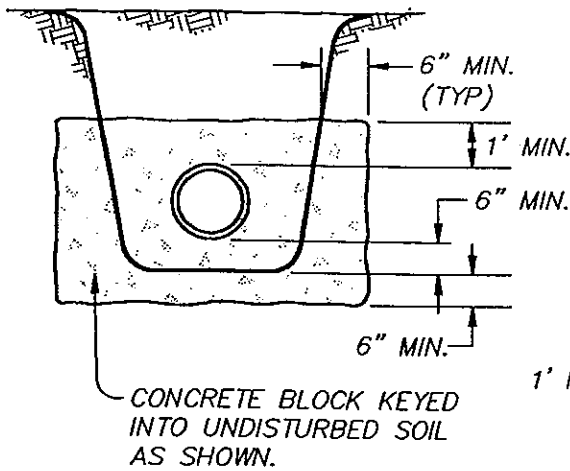
1 ANCHOR PER JOINT OF PIPE



**STRAP - FOOTING ANCHOR**

N.T.S.

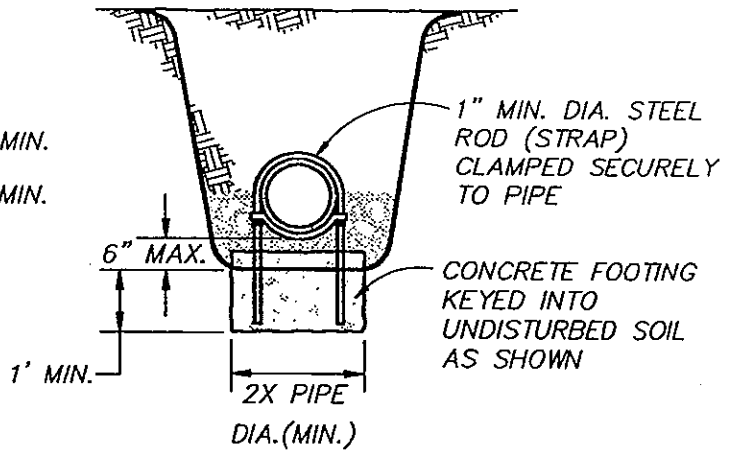
1 ANCHOR PER JOINT OF PIPE



CONCRETE BLOCK KEYED INTO UNDISTURBED SOIL AS SHOWN.

**SECTION A-A**

N.T.S.



1" MIN. DIA. STEEL ROD (STRAP) CLAMPED SECURELY TO PIPE

CONCRETE FOOTING KEYED INTO UNDISTURBED SOIL AS SHOWN

**SECTION B-B**

N.T.S.

NOTE: FOR SLOPES GREATER THAN 20%.

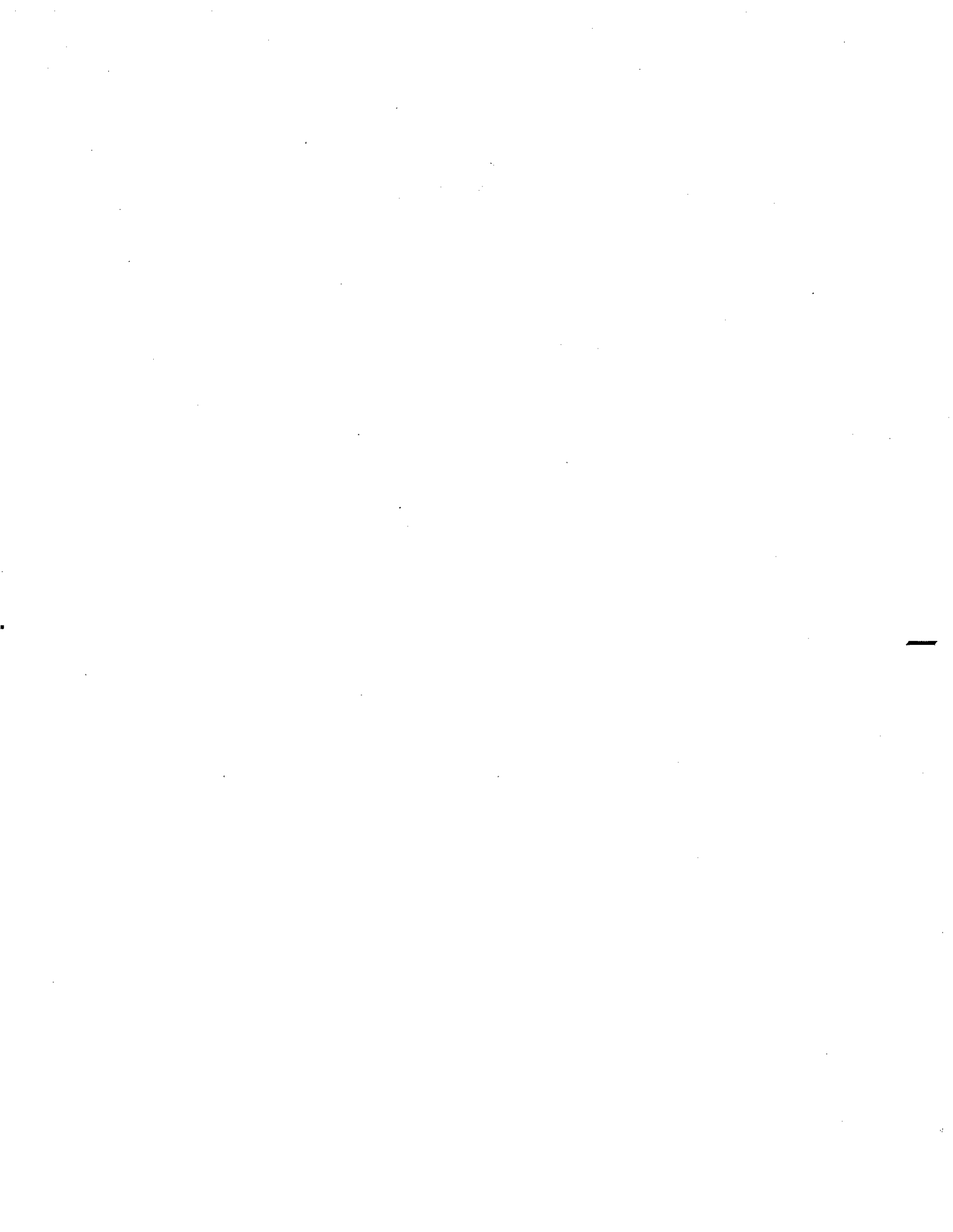


**PIPE ANCHOR DETAIL**

DATE	9 FEB 94	DRAWN	VIV	DETAIL	SQM-S6
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**Appendix N**  
**Cost Estimates**



City of Sequim  
Wastewater Comprehensive Plan  
Cost Estimates

CIP #1

<u>NO.</u>	<u>ITEM</u>	<u>UNIT</u>	<u>UNIT PRICE</u>	<u>QUANTITY</u>	<u>COST</u>
1	Mobilization /demobilization	LS	\$26,000	1	\$26,000
2	Line 12-inch sewer pipe (19-3-2 to 20-2-39)	FT	\$64	3390	\$217,000
3	Lateral Reinstatement	EA	\$250	67	\$17,000
	SUBTOTAL				\$260,000
	Tax				\$21,000
	SUBTOTAL				\$282,000
	Contingency @ 25%				\$70,000
	TOTAL ESTIMATED CONSTRUCTION COST				\$352,000
	Engineering, Legal, Administration @ 25%				\$88,000
	<b>PROJECT TOTAL</b>				<b>\$440,000</b>

City of Sequim  
Wastewater Comprehensive Plan  
Cost Estimates

CIP #2

<u>NO.</u>	<u>ITEM</u>	<u>UNIT</u>	<u>UNIT PRICE</u>	<u>QUANTITY</u>	<u>COST</u>
1	Mobilization /demobilization	LS	\$28,000	1	\$28,000
2	Line 24-inch sewer pipe (20-2-39 to 20-2-33)	FT	\$146	1740	\$254,000
3	Lateral Reinstatement	EA	\$250	8	\$2,000
	SUBTOTAL				\$284,000
	Tax				\$23,000
	SUBTOTAL				\$307,000
	Contingency @ 25%				\$77,000
	TOTAL ESTIMATED CONSTRUCTION COST				\$384,000
	Engineering, Legal, Administration @ 25%				\$96,000
	<b>PROJECT TOTAL</b>				<b>\$480,000</b>

City of Sequim  
Wastewater Comprehensive Plan  
Cost Estimates

CIP #3

<u>NO.</u>	<u>ITEM</u>	<u>UNIT</u>	<u>UNIT PRICE</u>	<u>QUANTITY</u>	<u>COST</u>
1	Mobilization /demobilization	LS	\$46,000	1	\$46,000
2	Line 8-inch sewer pipe (24-1-9 to 19-2-21)	FT	\$55	3090	\$170,000
3	Replace 8-inch pipe with 18-inch pipe (19-2-21 to 19-1-14)	FT	\$92	2400	\$221,000
4	Lateral Reinstatement	EA	\$250	75	\$19,000
	SUBTOTAL				\$455,000
	Tax				\$37,000
	SUBTOTAL				\$493,000
	Contingency @ 25%				\$123,000
	TOTAL ESTIMATED CONSTRUCTION COST				\$616,000
	Engineering, Legal, Administration @ 25%				\$154,000
	<b>PROJECT TOTAL</b>				<b>\$770,000</b>

City of Sequim  
Wastewater Comprehensive Plan  
Cost Estimates

CIP #4

<u>NO.</u>	<u>ITEM</u>	<u>UNIT</u>	<u>UNIT PRICE</u>	<u>QUANTITY</u>	<u>COST</u>
1	Mobilization /demobilization	LS	\$7,000	1	\$7,000
2	Line 8-inch sewer pipe	FT	\$54	1140	\$61,000
3	Lateral Reinstatement	EA	\$250	11	\$3,000
	SUBTOTAL				\$71,000
	Tax				\$6,000
	SUBTOTAL				\$77,000
	Contingency @ 25%				\$19,000
	TOTAL ESTIMATED CONSTRUCTION COST				\$96,000
	Engineering, Legal, Administration @ 25%				\$24,000
	<b>PROJECT TOTAL</b>				<b>\$120,000</b>