Drainage

- Back to Basics 101

Prepared by: Christopher Zukowski – District IV Construction

Drainage 101

- Preconstruction
- Construction
- Finals and Follow up

Preconstruction

1) Getting started
   - Review Plans & Specifications
     a) “A” Items
     b) New items that are unfamiliar
     c) Miscellaneous Details sheets for Catchbasins
   - Look for Utility conflicts
   - Set Up Drainage books(Volume#3)
   - Field inspect all CB’s, MH’s & Pipes for damage
   - Review PC-1 for 7 day cure time
   - Review Contractors Schedule of Work

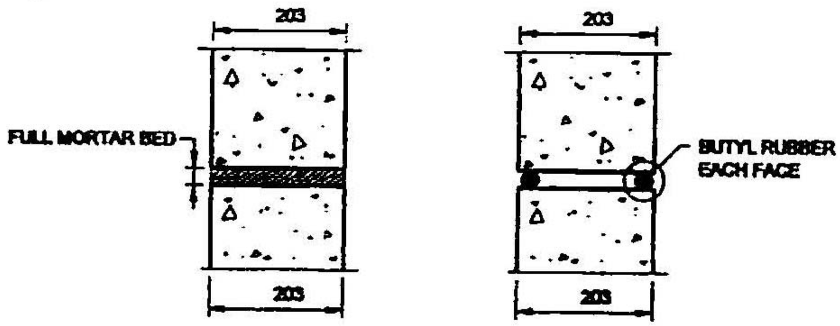
Preconstruction

- Equipment needed for drainage installations
  - OSHA approved trench box
  - Certified chains for rigging
  - Certified straps / slings
  - Ladder for trench box entry / exit
  - Jumping Jack compactor
  - Level and Rod
  - 4 foot level

Preconstruction

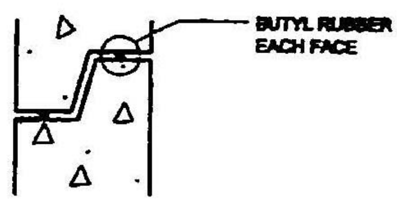
- Familiarize yourself with structure details
  - "Trained eye" for what you should expect to see in the field during installation
  - Review miscellaneous details for drainage structures
    - Note changes which may be project specific
      - New details include Butyl Rubber Joint detail between sump and riser section

Structure details



MORTAR JOINT DETAIL

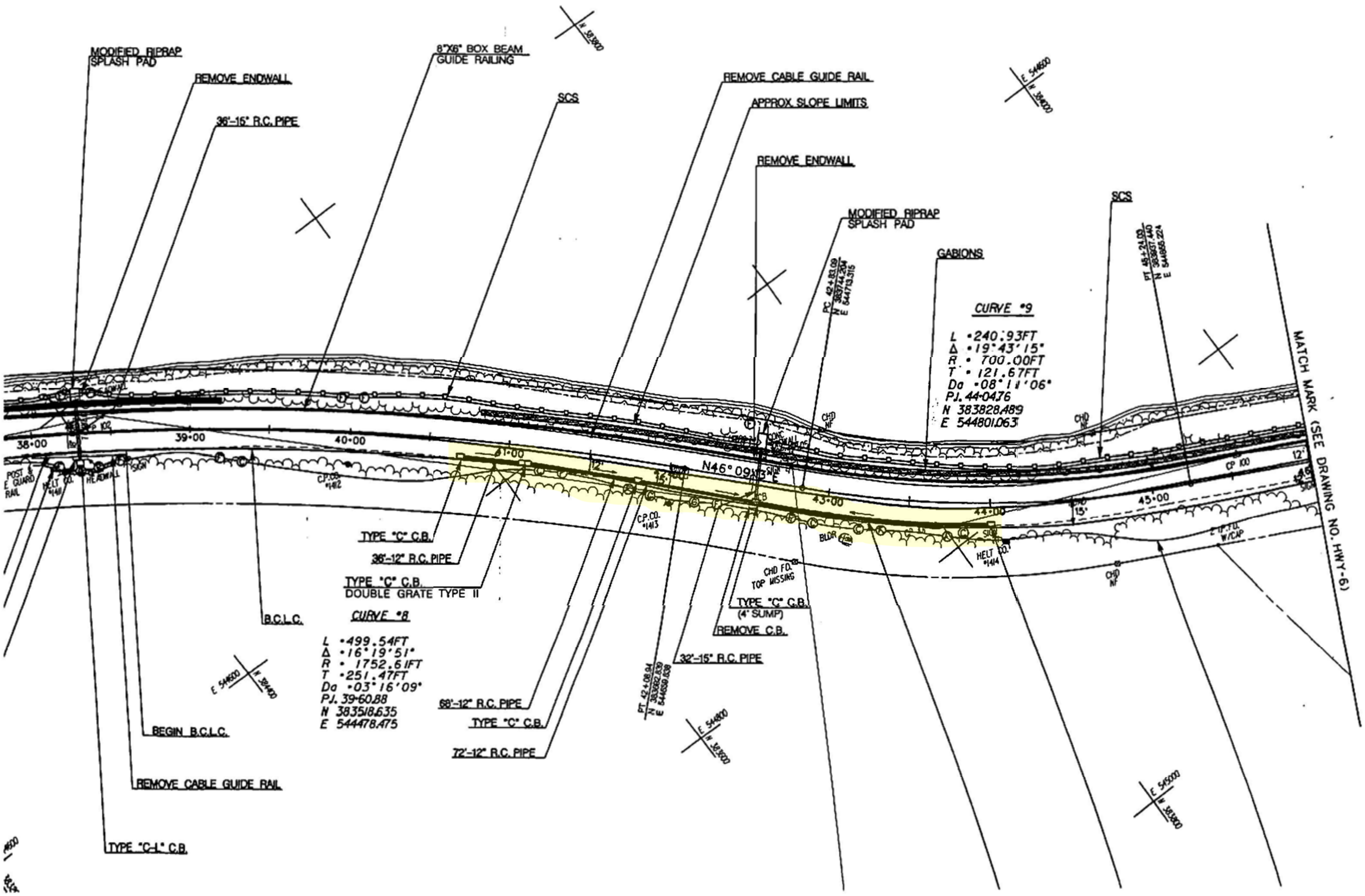
BUTYL RUBBER JOINT DETAIL



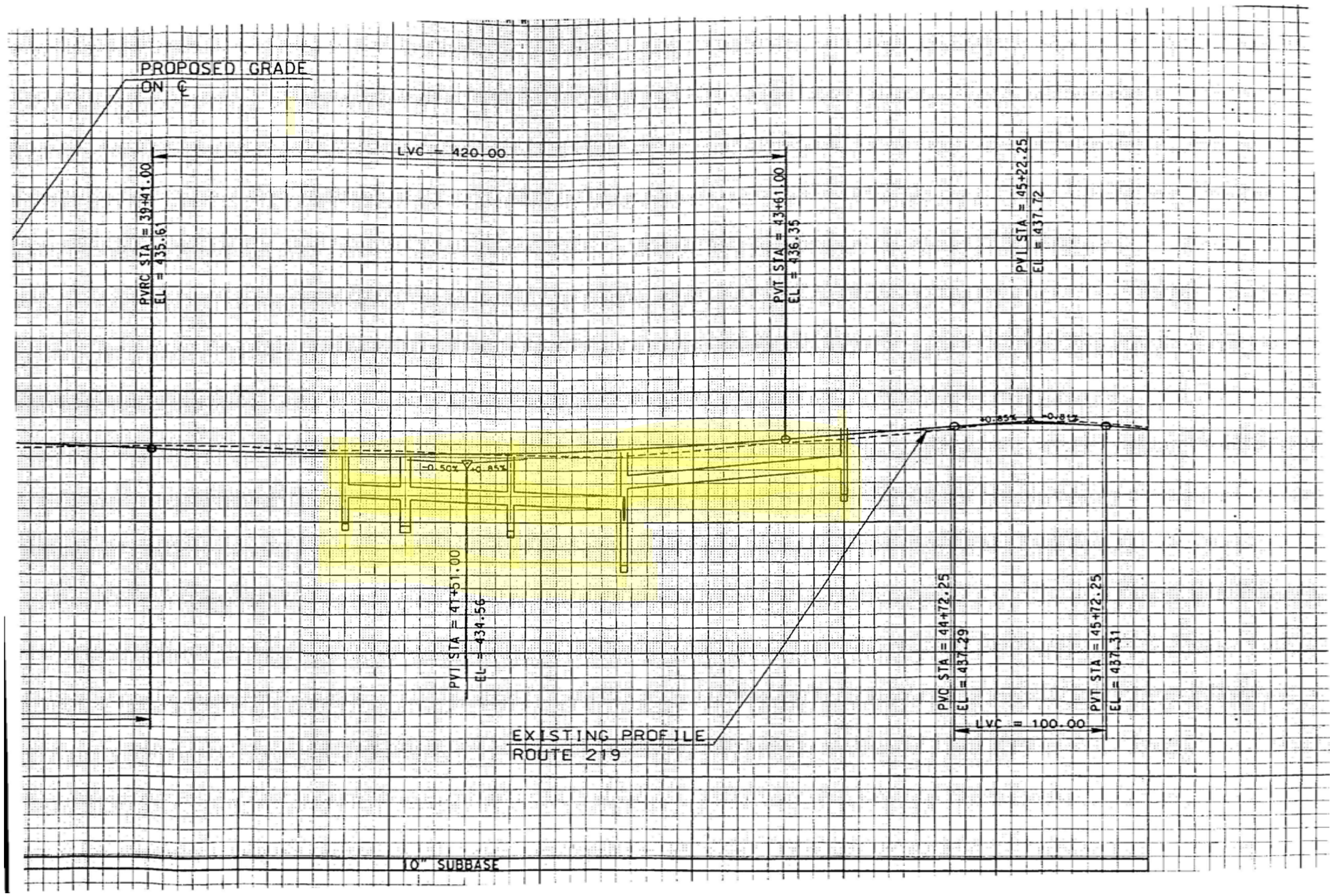
SHIP LAP JOINT DETAIL

(FOR USE WITH ROUND STRUCTURES ONLY)

Plans, Profiles & Cross Sections



Plans, Profiles & Cross Sections



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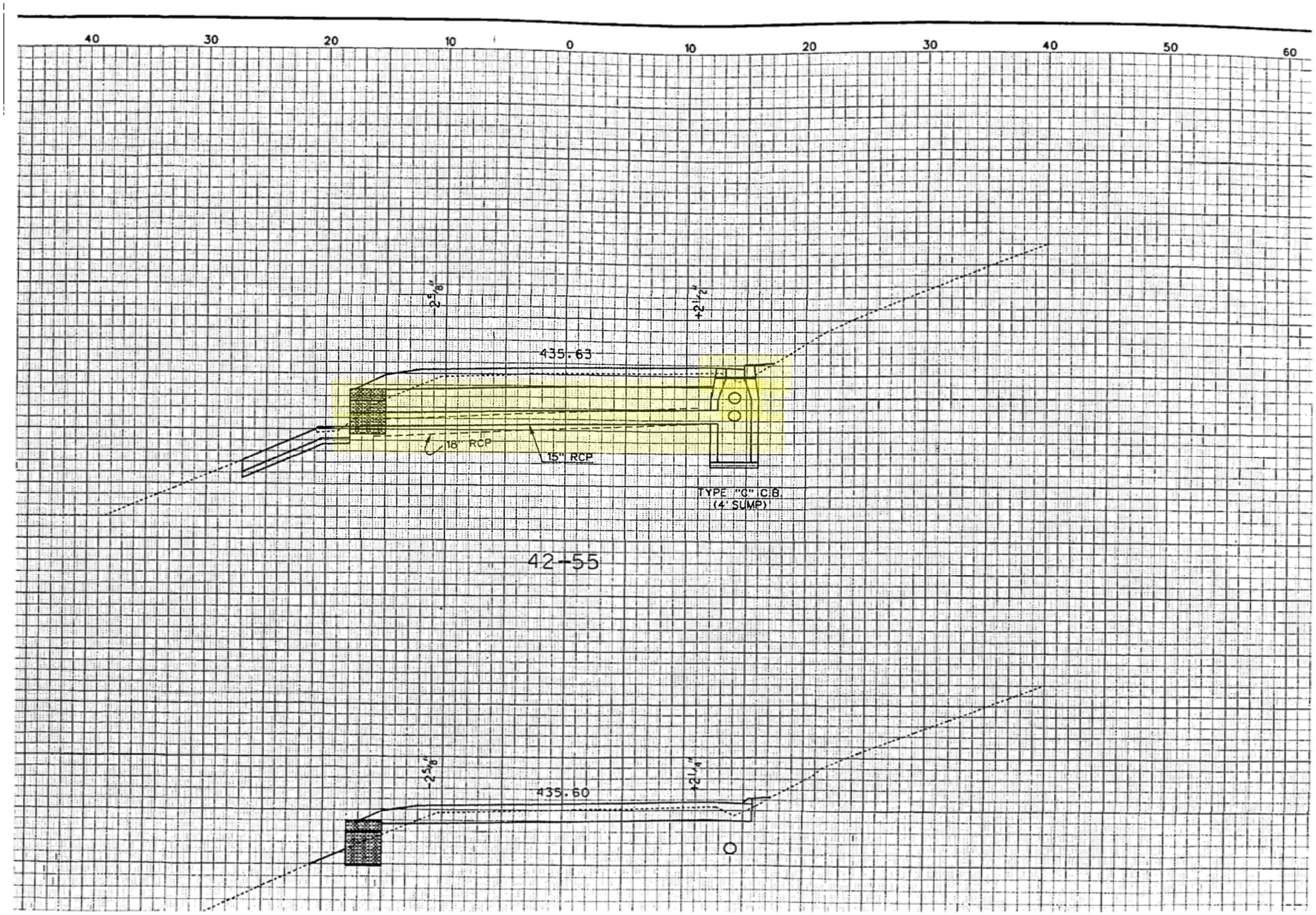
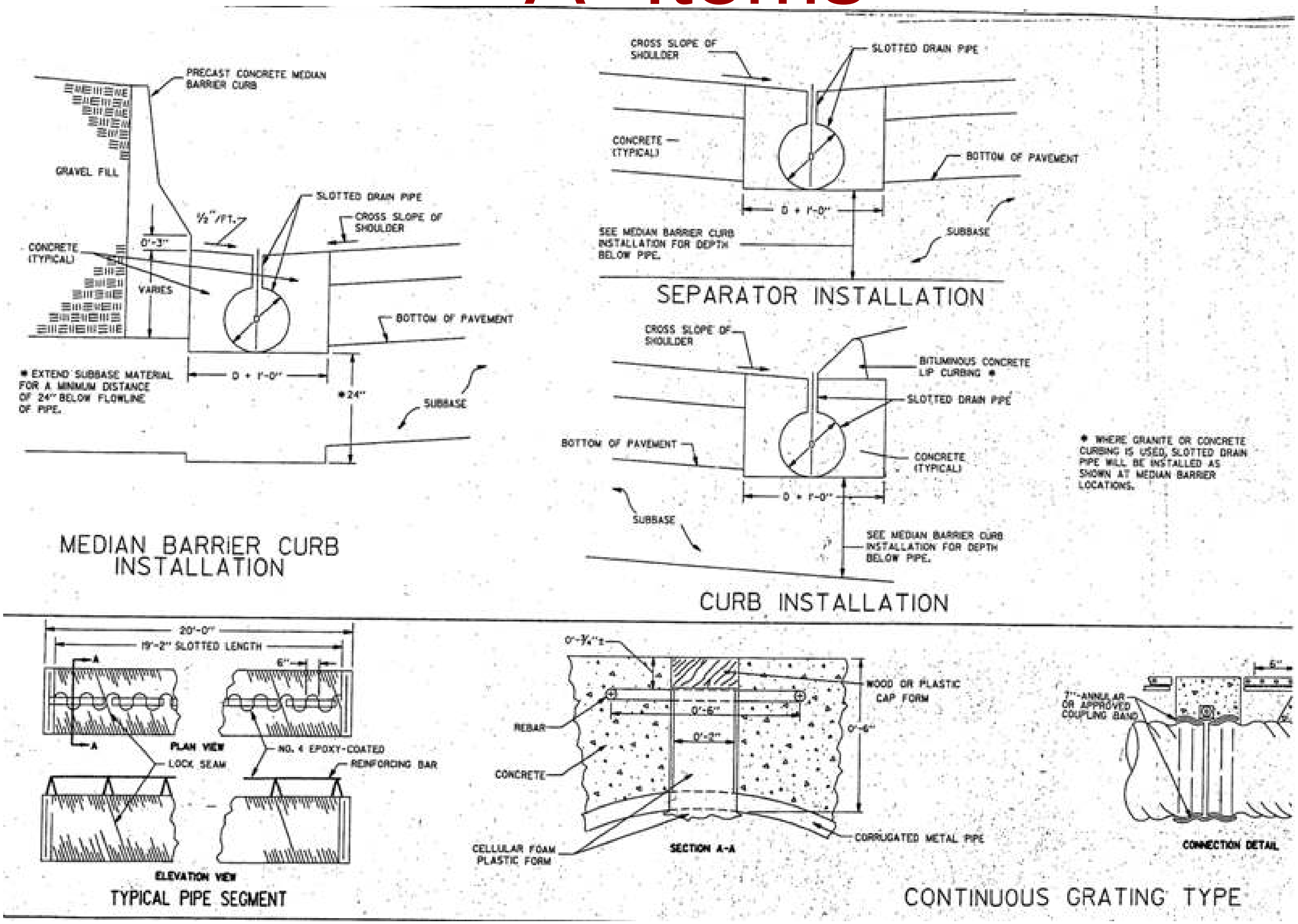


“A” Items

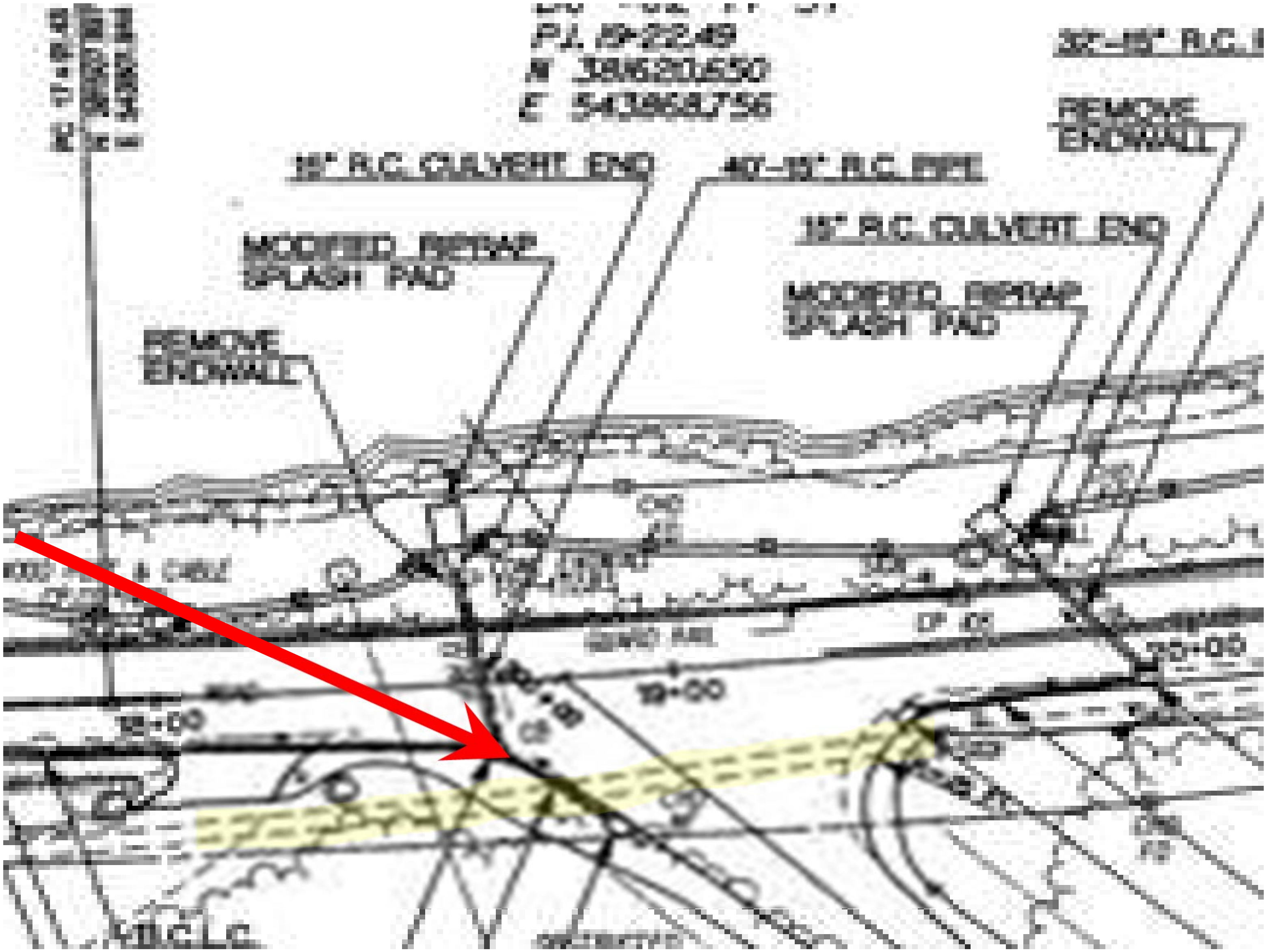
Schedule of Prices as quoted on the "Proposal Form"

ITEM NUM	ITEMS	UNIT	QTY	UNIT PRICE	AMOUNT
0601318A	PARTIAL DEPTH PATCH	c.f.	105	180.00	$18,900.00
0601604A	ASPHALTIC PLUG EXPANSION JOINT SYSTEM	l.f.	56	110.00	$6,160.00
0602001	DEFORMED STEEL BARS	lb.	560	1.00	$560.00
0602910A	DRILLING HOLES AND GROUTING DOWELS	ea.	55	100.00	$5,500.00
0606001	CEMENT RUBBLE MASONRY	c.y.	280	280.00	$78,400.00
0651001	BEDDING MATERIAL	c.y.	260	18.00	$4,680.00
0651011	12'' R.C. PIPE	l.f.	2250	30.00	$67,500.00
0651012	15'' R.C. PIPE	l.f.	580	70.00	$40,600.00
0651013	18'' R.C. PIPE	l.f.	32	74.00	$2,368.00
0651015	24'' R.C. PIPE	l.f.	12	80.00	$960.00
0651021	48'' R.C. PIPE	l.f.	60	200.00	$12,000.00
0651351A	12'' SLOTTED PIPE	l.f.	380	35.00	$13,300.00
0652009	12'' R.C. CULVERT END	ea.	1	1,500.00	$1,500.00
0652010	15'' R.C. CULVERT END	ea.	10	1,500.00	$15,000.00
0652011	18'' R.C. CULVERT END	ea.	2	1,600.00	$3,200.00
0653100	CLEAN EXISTING CULVERT - 12'' TO 42'' DIAMETER	l.f.	750	10.00	$7,500.00
0703010	STANDARD RIPRAP	c.y.	55	120.00	$6,600.00
0703011	INTERMEDIATE RIPRAP	c.y.	10	120.00	$1,200.00
0703012	MODIFIED RIPRAP	c.y.	70	120.00	$8,400.00
0704002 *	GABIONS	c.y.	1700	240.00	$408,000.00
0707001	MEMBRANE WATERPROOFING (WOVEN GLASS FABRIC)	s.y.	395	28.00	$11,060.00
0714020	TEMPORARY SHEET PILING	s.f.	1670	10.00	$16,700.00
0725002	BAGGED STONE	c.f.	120	6.00	$720.00
0751711	6'' UNDERDRAIN	l.f.	3100	20.00	$62,000.00
0751831	6'' OUTLET FOR UNDERDRAIN	l.f.	100	16.00	$1,600.00
0803002	PAVED DITCH	s.y.	175	50.00	$8,750.00
0814002	RESET GRANITE STONE CURBING	l.f.	140	35.00	$4,900.00
0815001	BITUMINOUS CONCRETE LIP CURBING	l.f.	12000	3.00	$36,000.00

"A" Items


PRECAST CONCRETE MEDIAN BARRIER CURB
GRAVEL FILL
SLOTTED DRAIN PIPE
CROSS SLOPE OF SHOULDER
CONCRETE (TYPICAL)
0'-3"
VARIES
BOTTOM OF PAVEMENT
* EXTEND SUBBASE MATERIAL FOR A MINIMUM DISTANCE OF 24" BELOW FLOWLINE OF PIPE.
D + 1'-0"
*24"
SUBBASE
MEDIAN BARRIER CURB INSTALLATION
SEE MEDIAN BARRIER CURB INSTALLATION FOR DEPTH BELOW PIPE.
SEPARATOR INSTALLATION
BITUMINOUS CONCRETE LIP CURBING *
* WHERE GRANITE OR CONCRETE CURBING IS USED, SLOTTED DRAIN PIPE WILL BE INSTALLED AS SHOWN AT MEDIAN BARRIER LOCATIONS.
CURB INSTALLATION
20'-0"
19'-2" SLOTTED LENGTH
6"
PLAN VIEW
NO. 4 EPOXY-COATED REINFORCING BAR
LOCK SEAM
ELEVATION VIEW
TYPICAL PIPE SEGMENT
WOOD OR PLASTIC CAP FORM
REBAR
0'-6"
0'-2"
CONCRETE
CELLULAR FOAM PLASTIC FORM
SECTION A-A
CORRUGATED METAL PIPE
7"-ANNULAR OR APPROVED COUPLING BAND
CONNECTION DETAIL
CONTINUOUS GRATING TYPE

Utility Conflicts



CONSTRUCTION

Construction

- Review Contractor’s schedule
  - Typical start drainage run at lowest point or outlet
  - All drainage structures shall be staked prior installation
  - Utilize District Survey to check staking if confidence is not high

Construction

- Other methods can be utilized to check contractors accuracy
  - Field inspection of area
    - Scale distances to fixed objects
    - Utilize lock level to check grades
    - Compute change in elevation over 4 feet and check with a 4 foot level and tape measure
    - Ask contractor questions

Construction

- Ask the contractor
  - What is the invert at this structure?
  - Where is the next structure located?
  - Did you site the correct entrance into the structure?
  - What is the percent slope of the pipe?

Is he confident in his responses?

Changes are easier to correct at this point!

Typical start of Drainage at low end

Staking and placement of catchbasin

Construction Staking

Catch Basin offsets must be staked

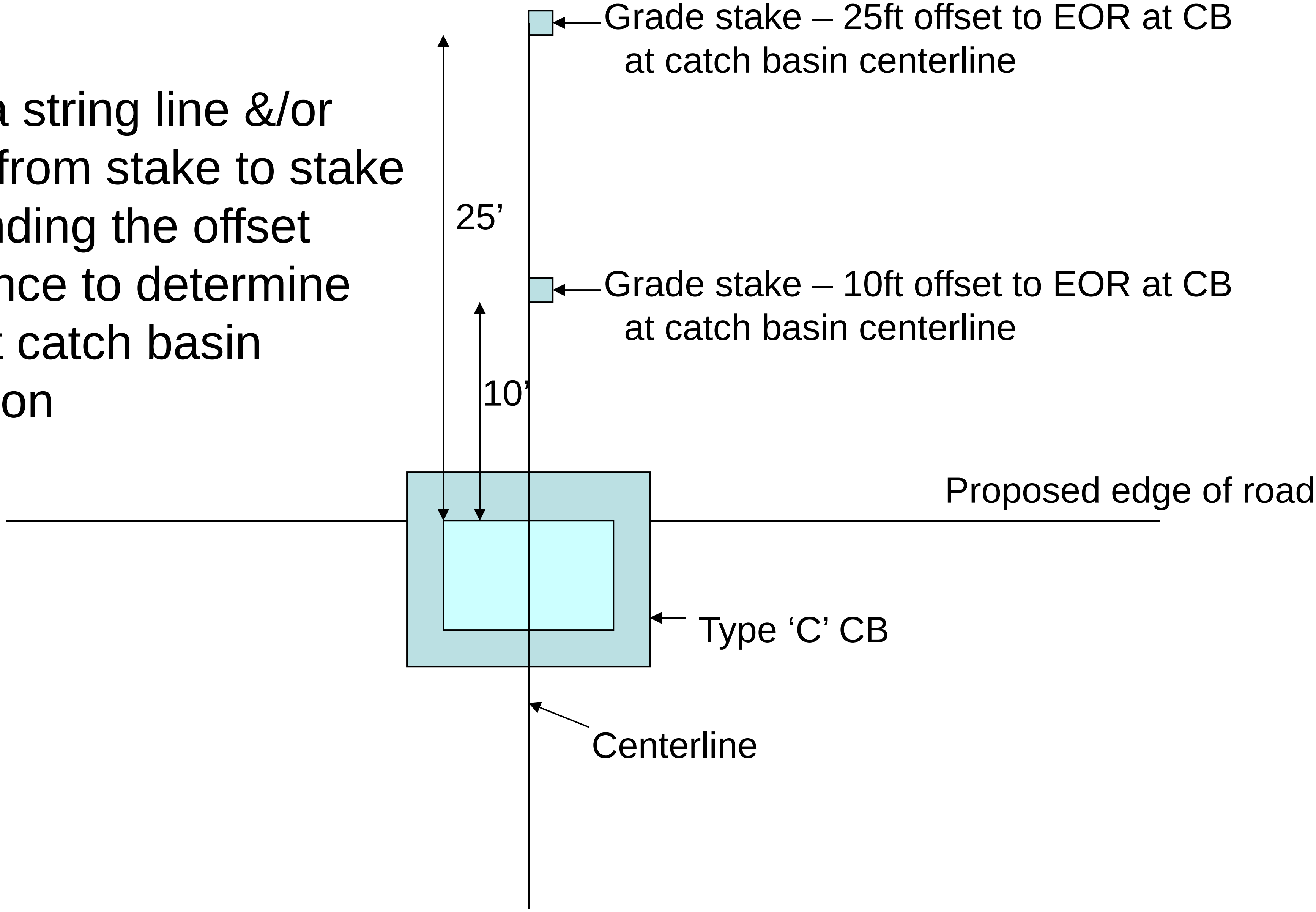
* minimum of 2 offsets required per catch basin

The catch basin offsets will provide all the information necessary to set the structure

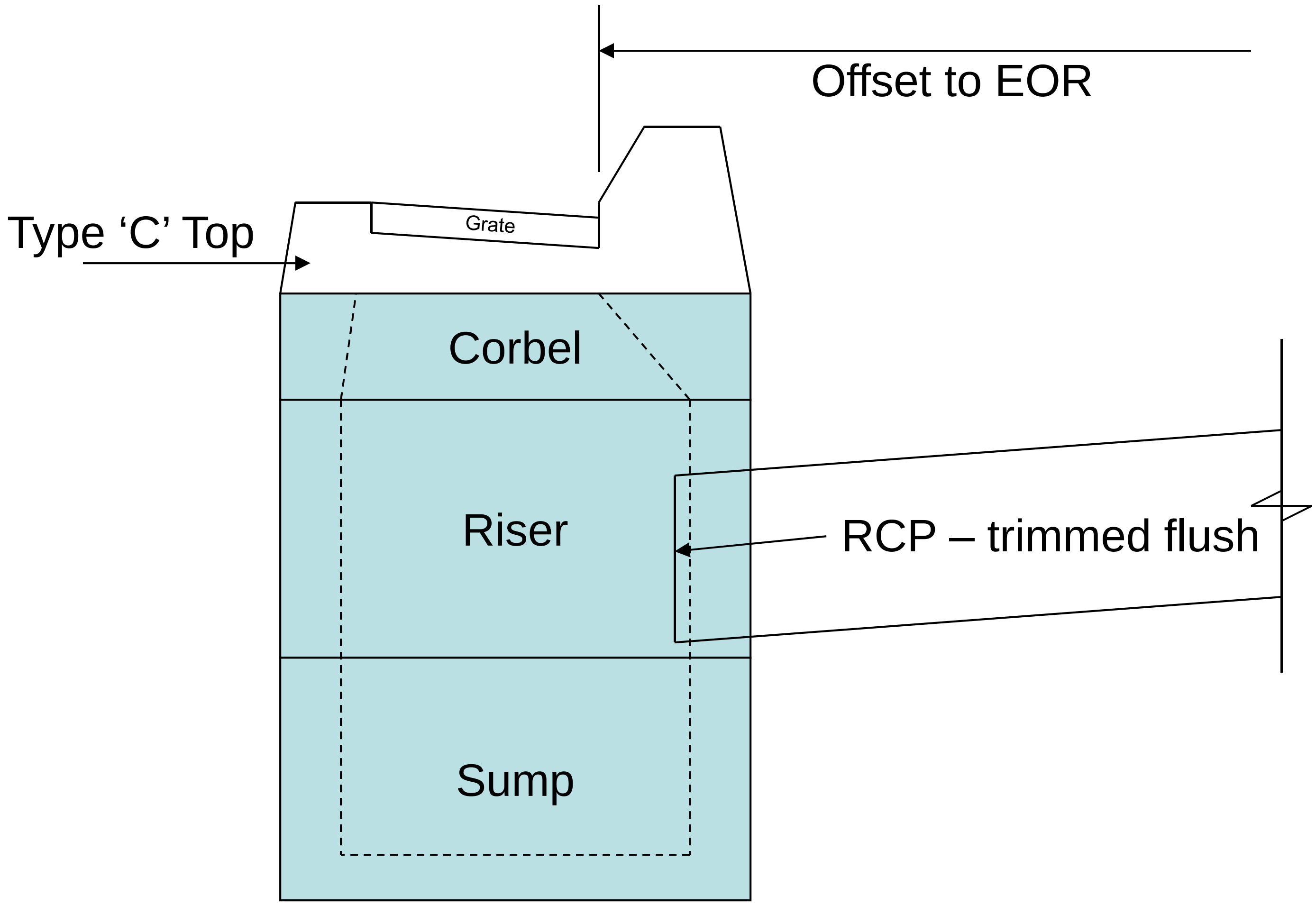
* **Catch basin number and corresponding station number**
* **Top of frame elevation**
* **Distance (offset) to Edge of Road**
* **The 2 stakes (or other reference point i.e. PK nails) provide proper alignment**
* **Cut or fill distance required to Top of Frame elevation**

Proper Catch Basin Staking

Pull a string line &/or tape from stake to stake extending the offset distance to determine exact catch basin location

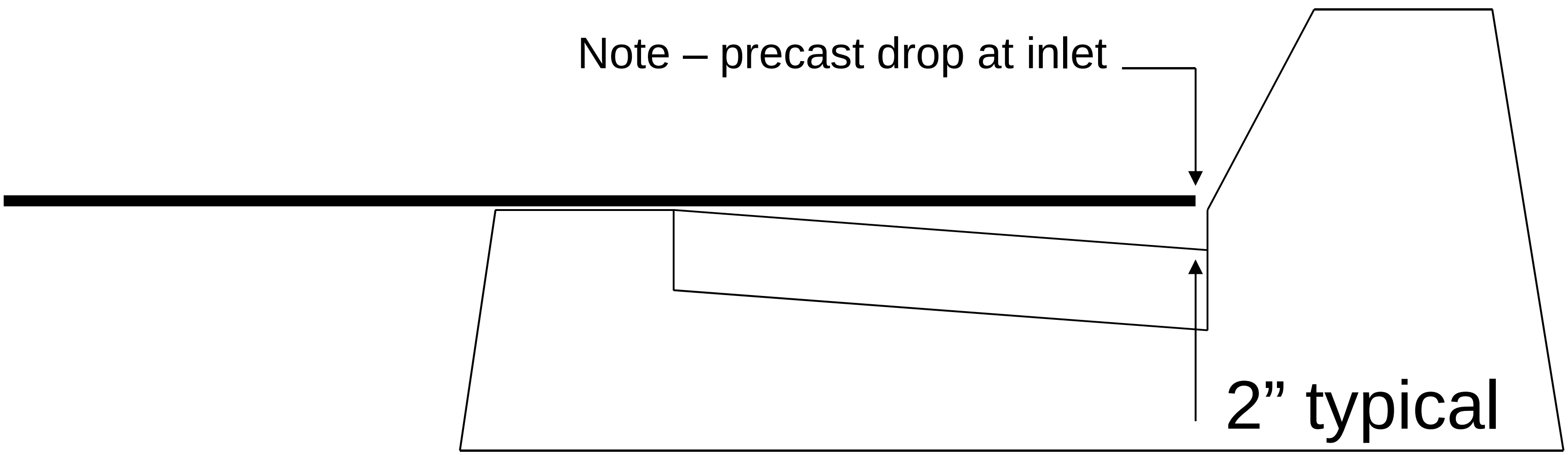


Catch Basin Details

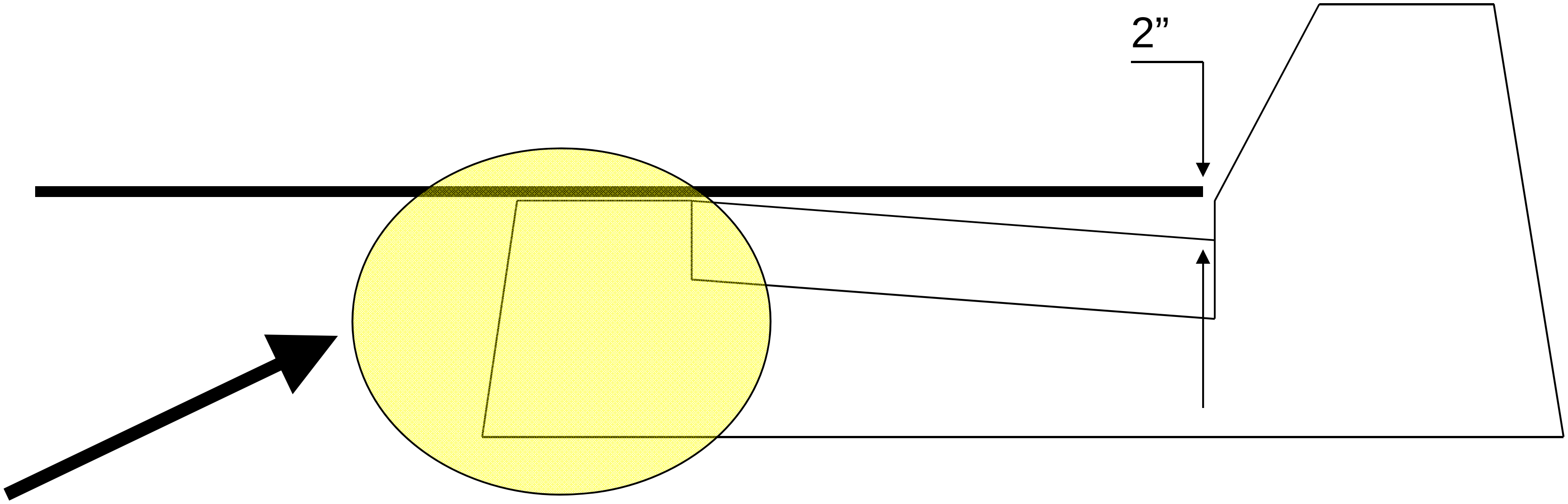


Catch Basin Details

Type ‘C’ Tops



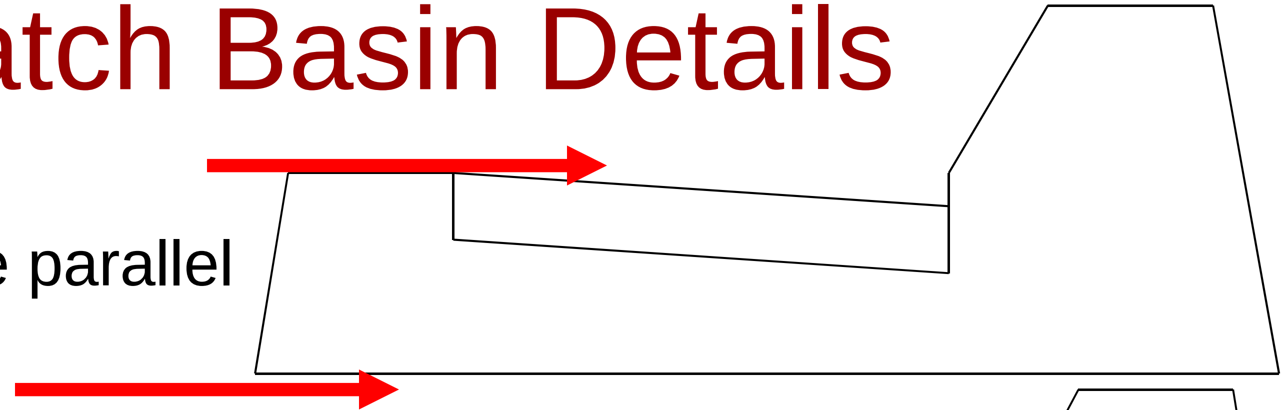
Catch Basin Details



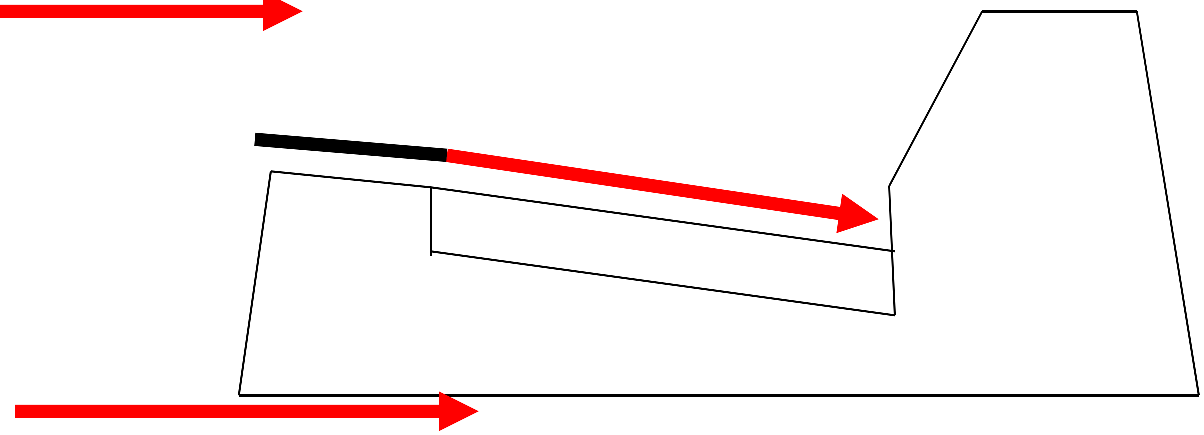
All Type C Catch Basins are not created equal.
Front of catch basin varies with each manufacturer.
Check your basins to ensure proper installation

Catch Basin Details

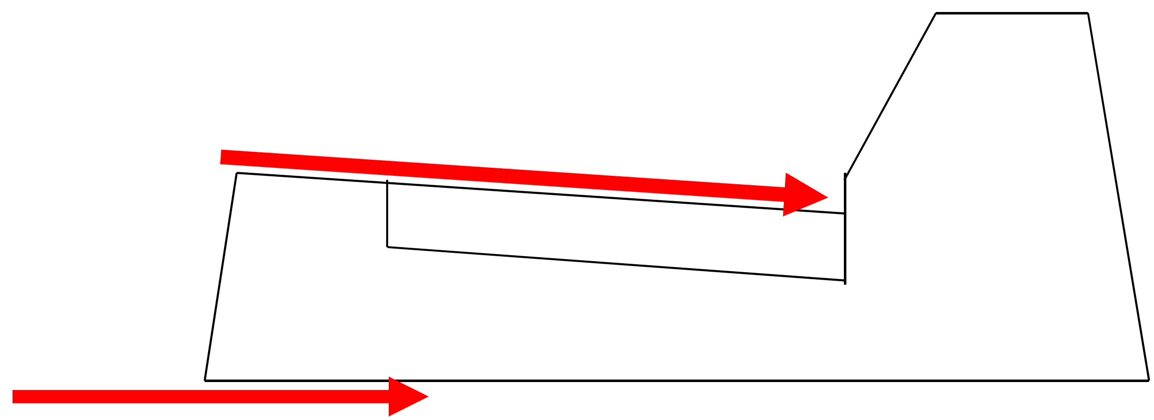
Top and bottom are parallel



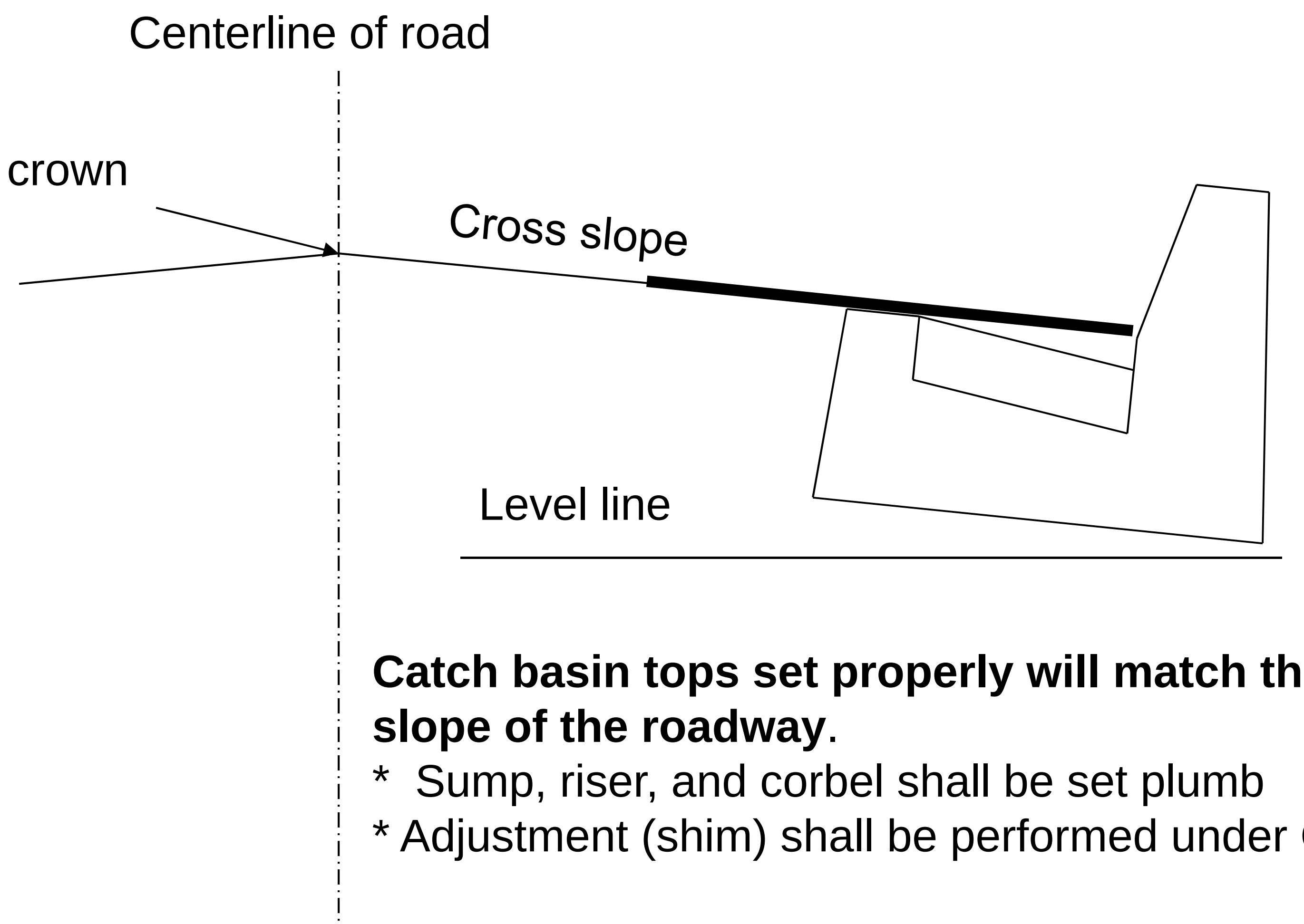
Bottom is level, top slopes slightly



Bottom is level, top slopes consistently from front edge to curb



Catch Basin Details

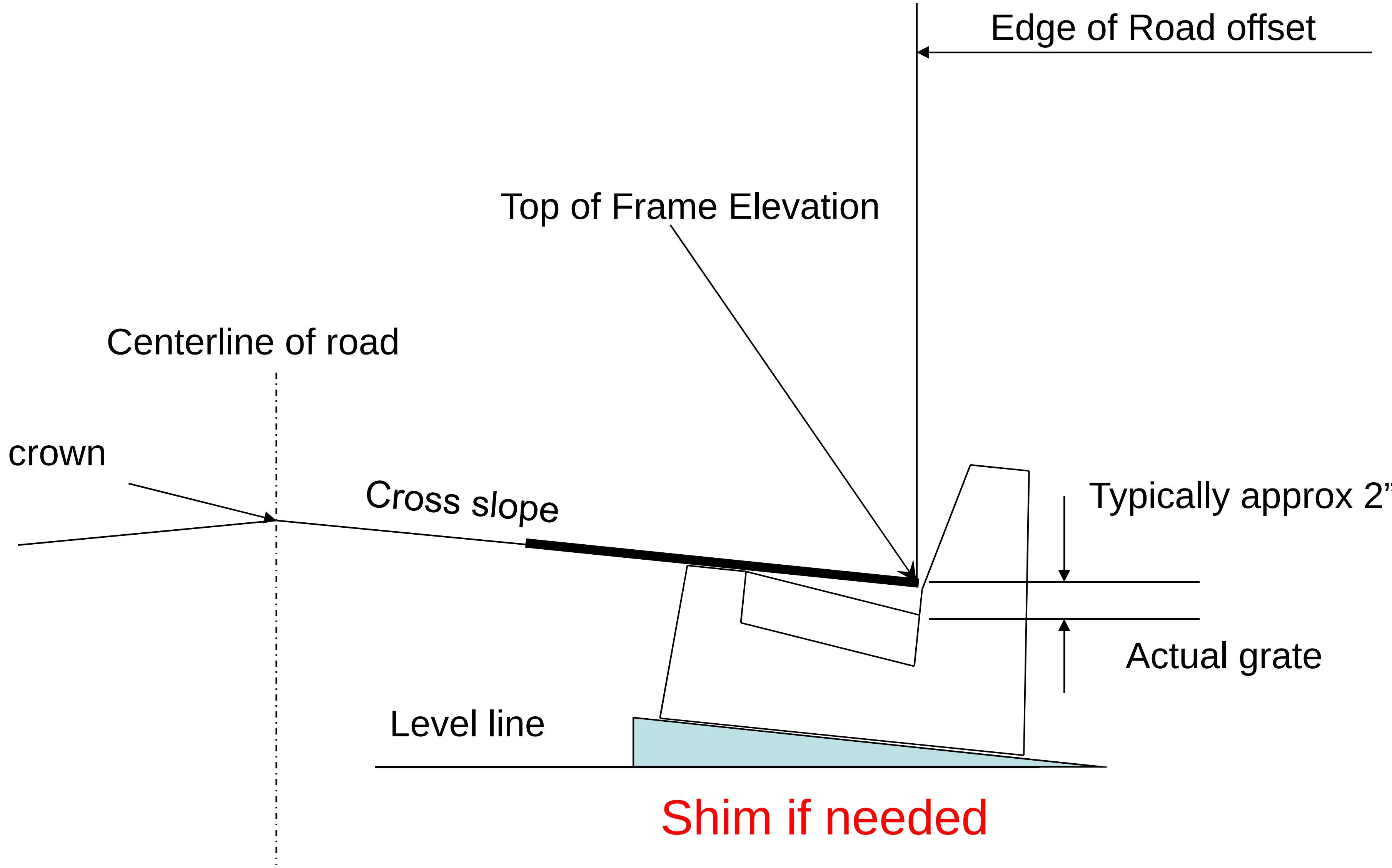


Catch basin tops set properly will match the cross slope of the roadway.

* Sump, riser, and corbel shall be set plumb

* Adjustment (shim) shall be performed under CB top.

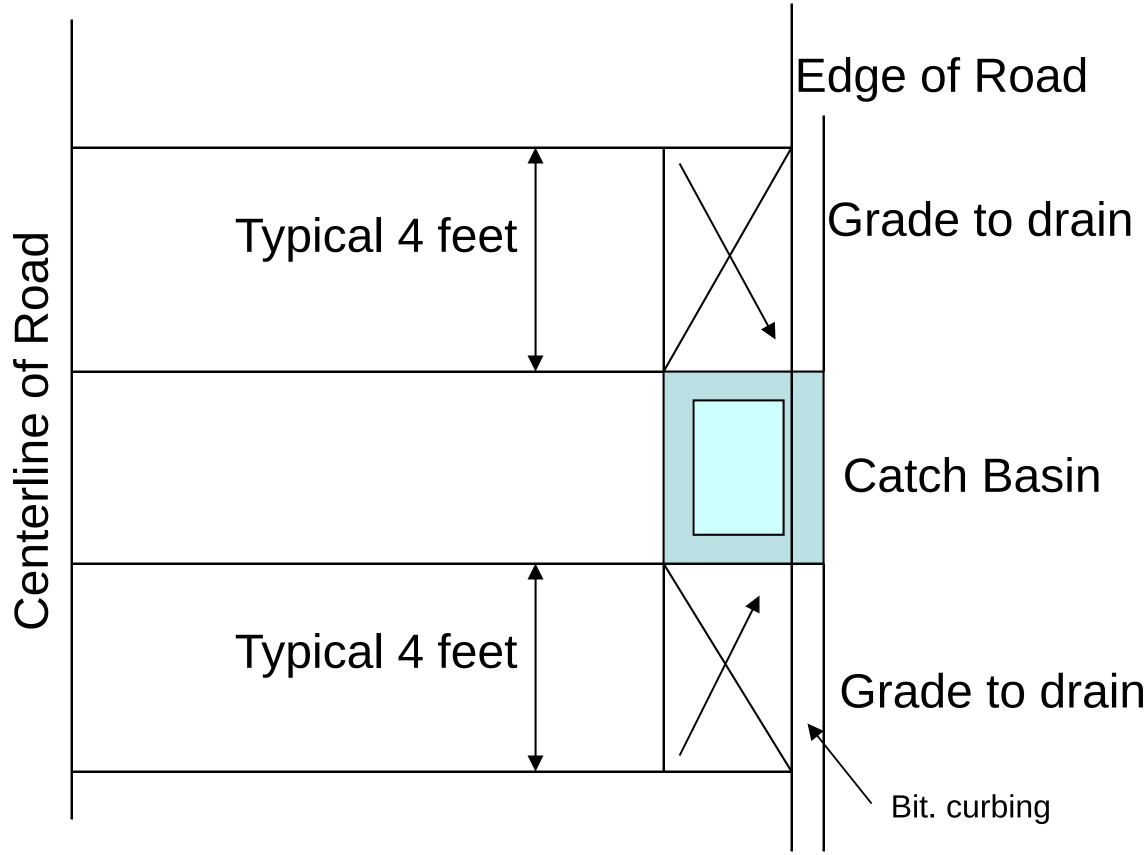
Catch Basin Details



Catch Basin Details

Paving Details

* Screed should not have to be raised to clear a catch basin
* Rake men should remove excess Bituminous Concrete at catch basin
* Excess Bituminous Concrete can be left on shoulder to be removed later
* Rake men shall grade to drain as shown below.



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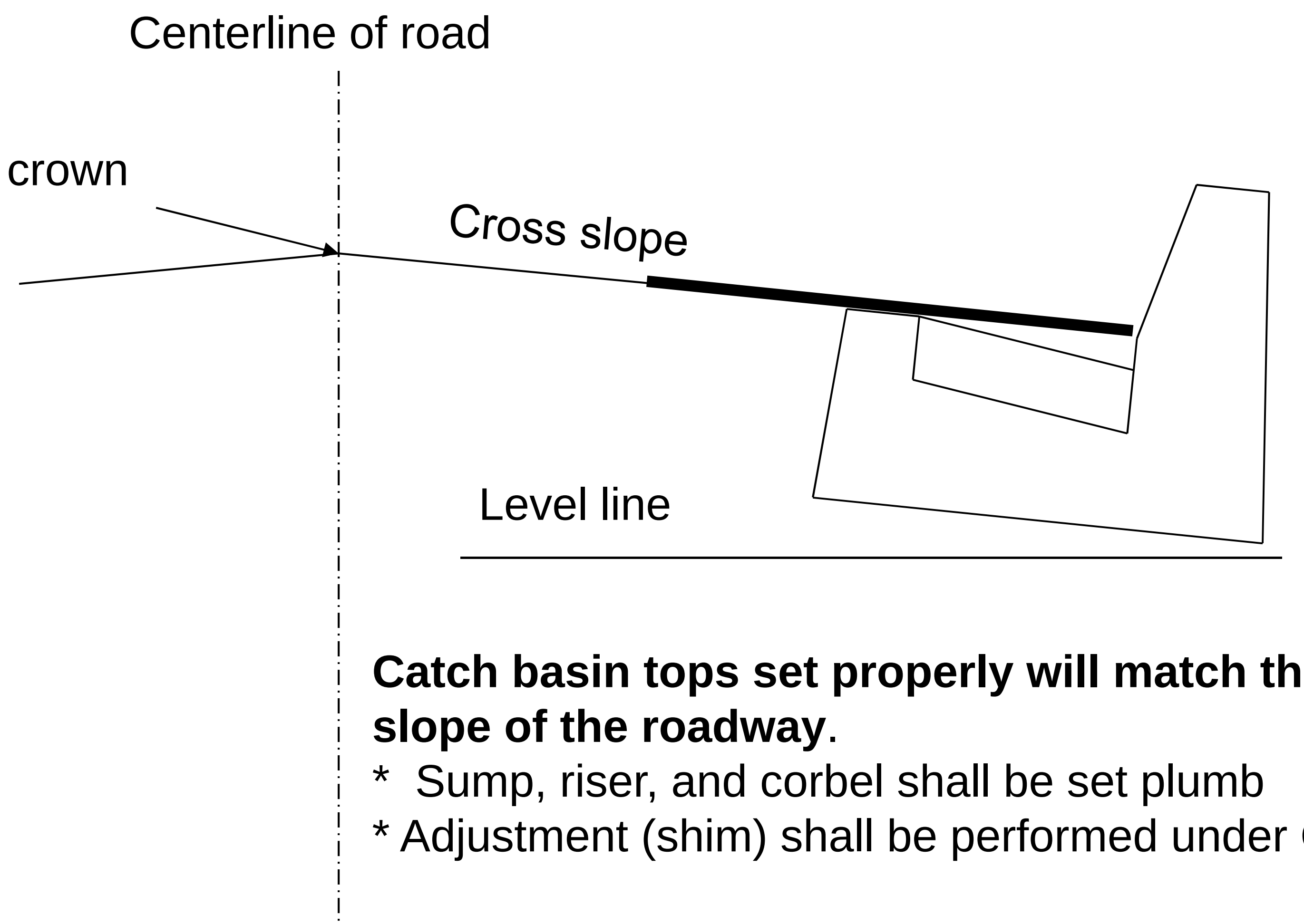

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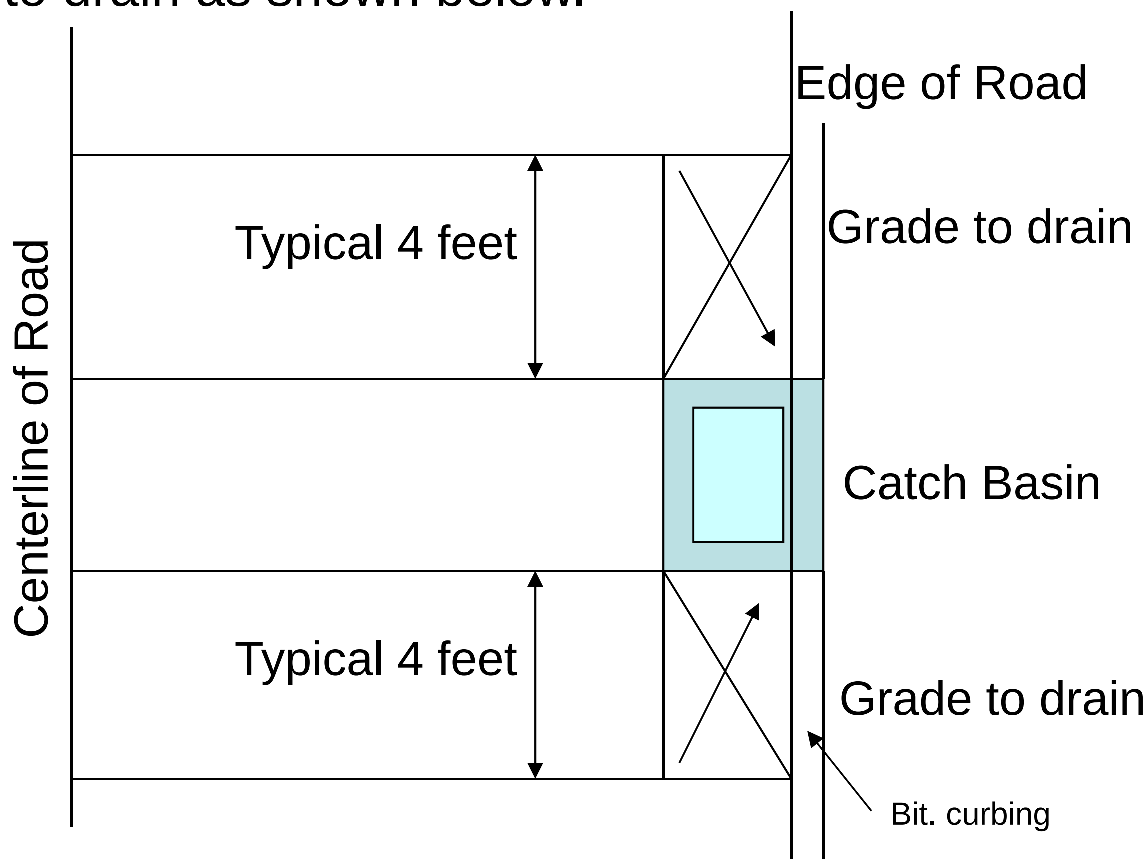


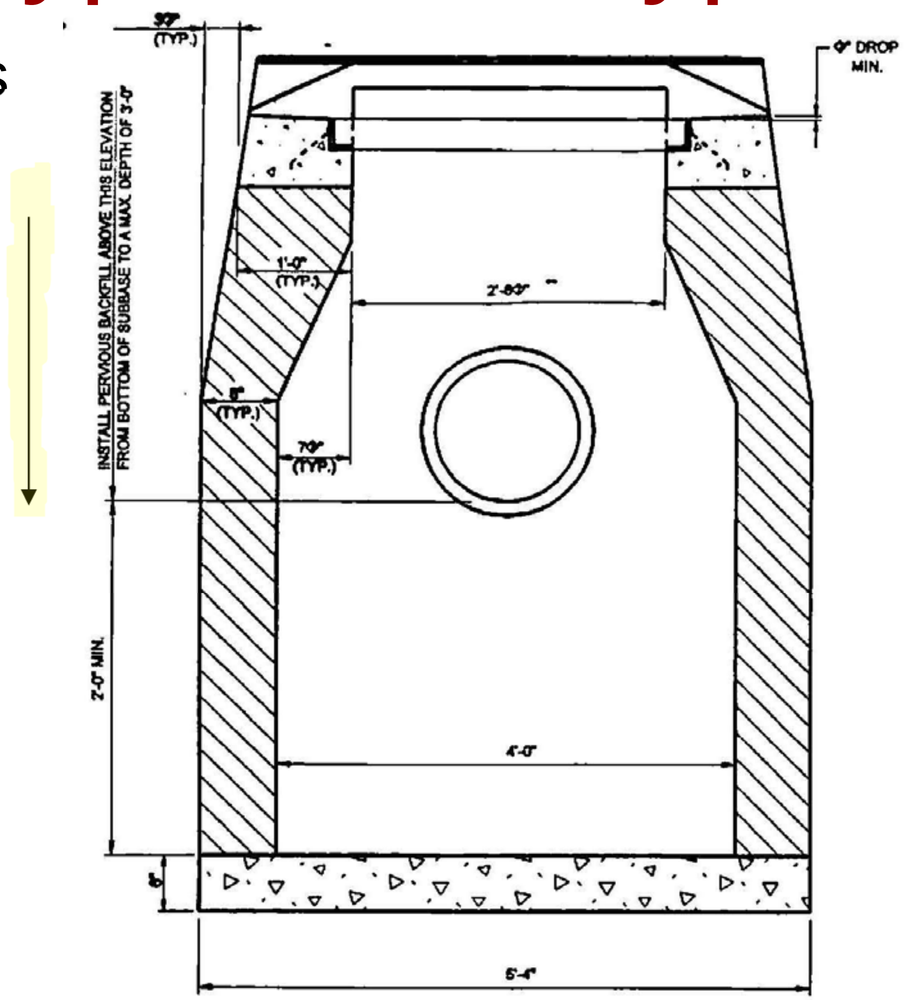
Structures

- Common details
  - Pervious material shall be used for backfilling
    - In no case to a depth greater than 3 feet (1 meter) below the bottom of the subbase.
    - Drainage openings **may** be formed in the four walls of the structure at or immediately above the bottom of the pervious backfill to convey subsurface drainage.
      - The openings shall be covered with geotextile.

Type ‘C’ CB typical

Limits of Pervious

Bottom of subbase to max 3 feet



SECTION A

TYPE "C" & "C-L" CATCH BASIN
(TYPE "C" TOP SHOWN)

* maximum corbelling allowed (3”)

Is this structure per SPEC?

Note excessive corbelling

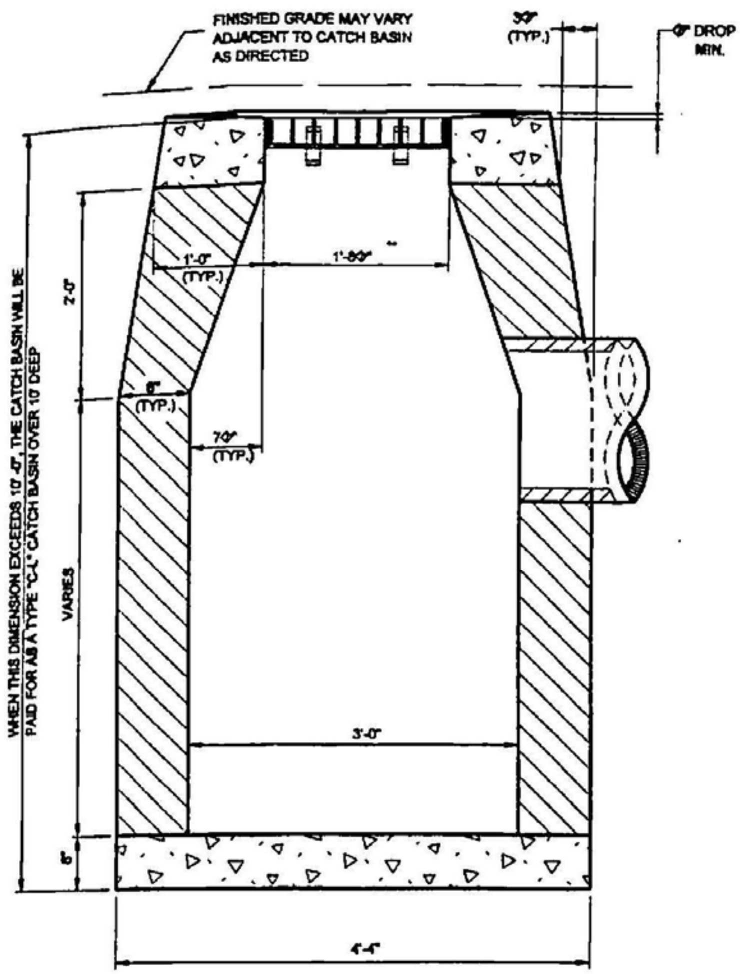
Is this structure per SPEC?

Is this structure per SPEC?

Pipe not flush cut

Type ‘CL’ CB typical

When maximum depth exceeds 10 feet, the basin will paid as CB over 10’ DEEP



SECTION B

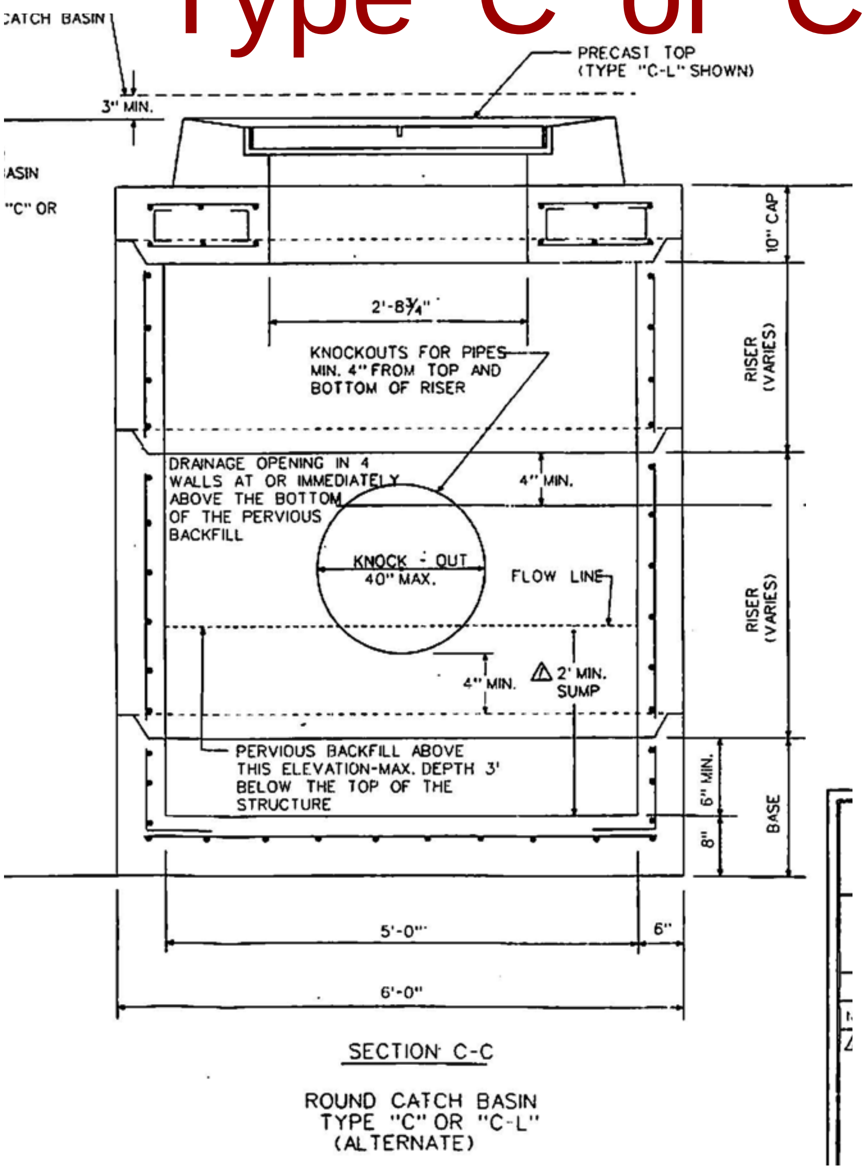
TYPE "C-L" CATCH BASIN

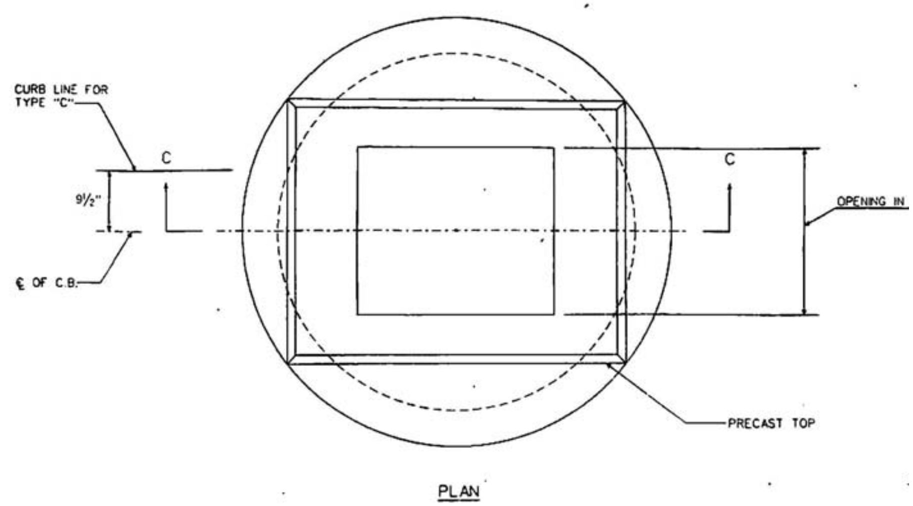
Discuss plan notes:

limits of pervious backfill

maximum corbelling allowed (3

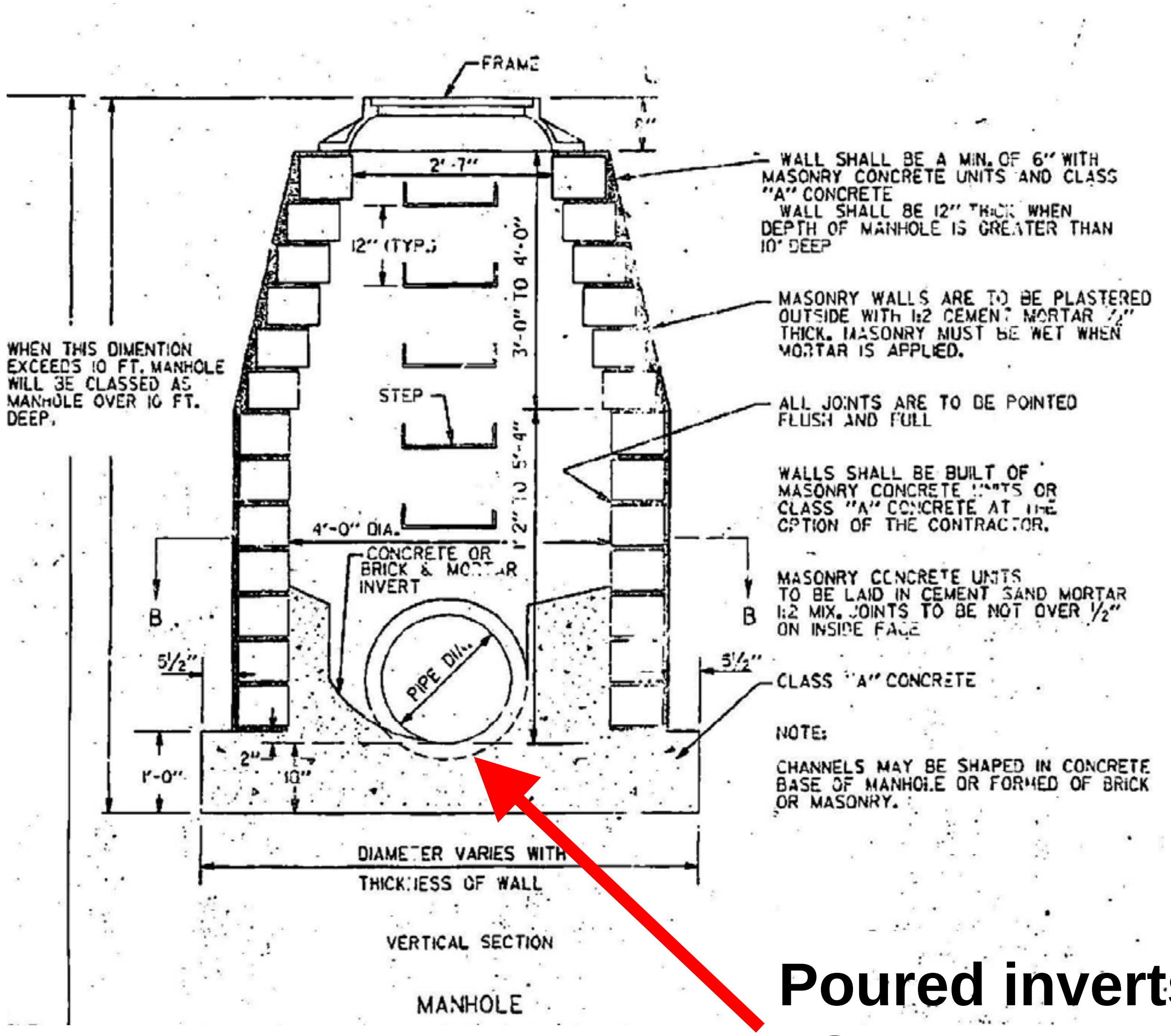
Type 'C' or 'CL' CB (alternative)





For use where RCP would enter the structure on a corner (not permissible with a typical structure)

Manhole



Poured inverts

Concrete or Brick and mortar

Laying Pipe

- Site the next structure for proper alignment – RCP pipe not allowed to enter a corner of a structure – use round precast if needed
- Set up the laser
- Check the invert at first structure
- Flush cut RCP inside structures

What is wrong with this?

Laying Pipe

- Proper brick/block and mortar where pipe enters structure – 8” thick minimum
- Concrete block or brick only – **NO RED BRICK**
- Allow cure time prior to backfilling – if possible
- Ensure pipes are fully connected
  - Gasket installed
  - Asphalt joint

Backfilling before proper cure time

Laying Pipe

- Bedding Material
  - 4” minimum
  - 12” in rock
  - Sand or stone in wet conditions

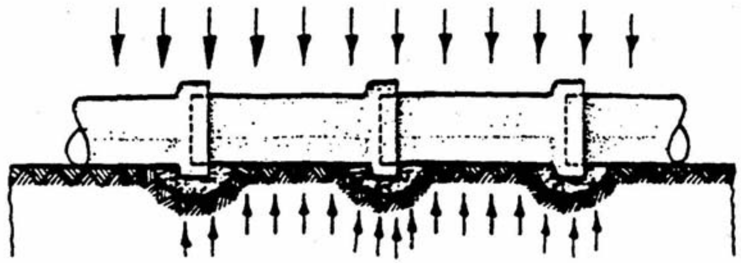
Reinforced concrete pipe is forgiving, however Corrugated metal and ADS are not.
Care must be taken to evenly backfill the pipe for proper installation

Corrugated Metal Pipe

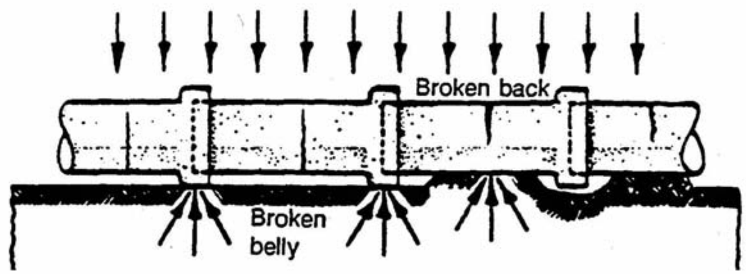
Corrugated Metal Pipe

Corrugated Metal Pipe

Bedding



Properly prepared bedding evenly distributes loads.
Improperly prepared bedding may result in stress concentrations.



Improperly prepared bedding.

Figure 4-16 Transverse or circumferential cracks

Bedding

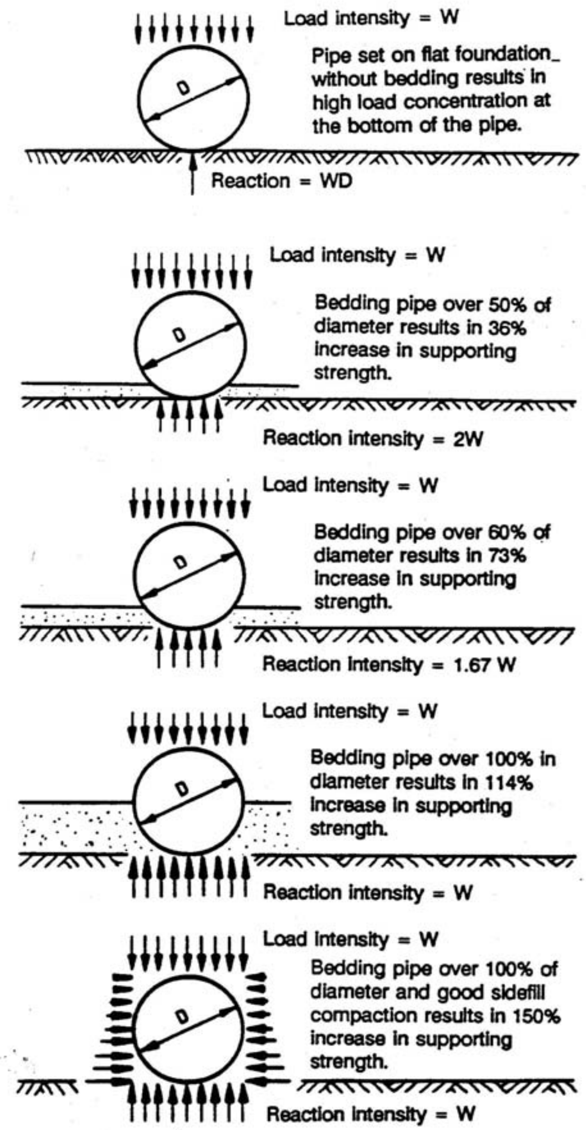
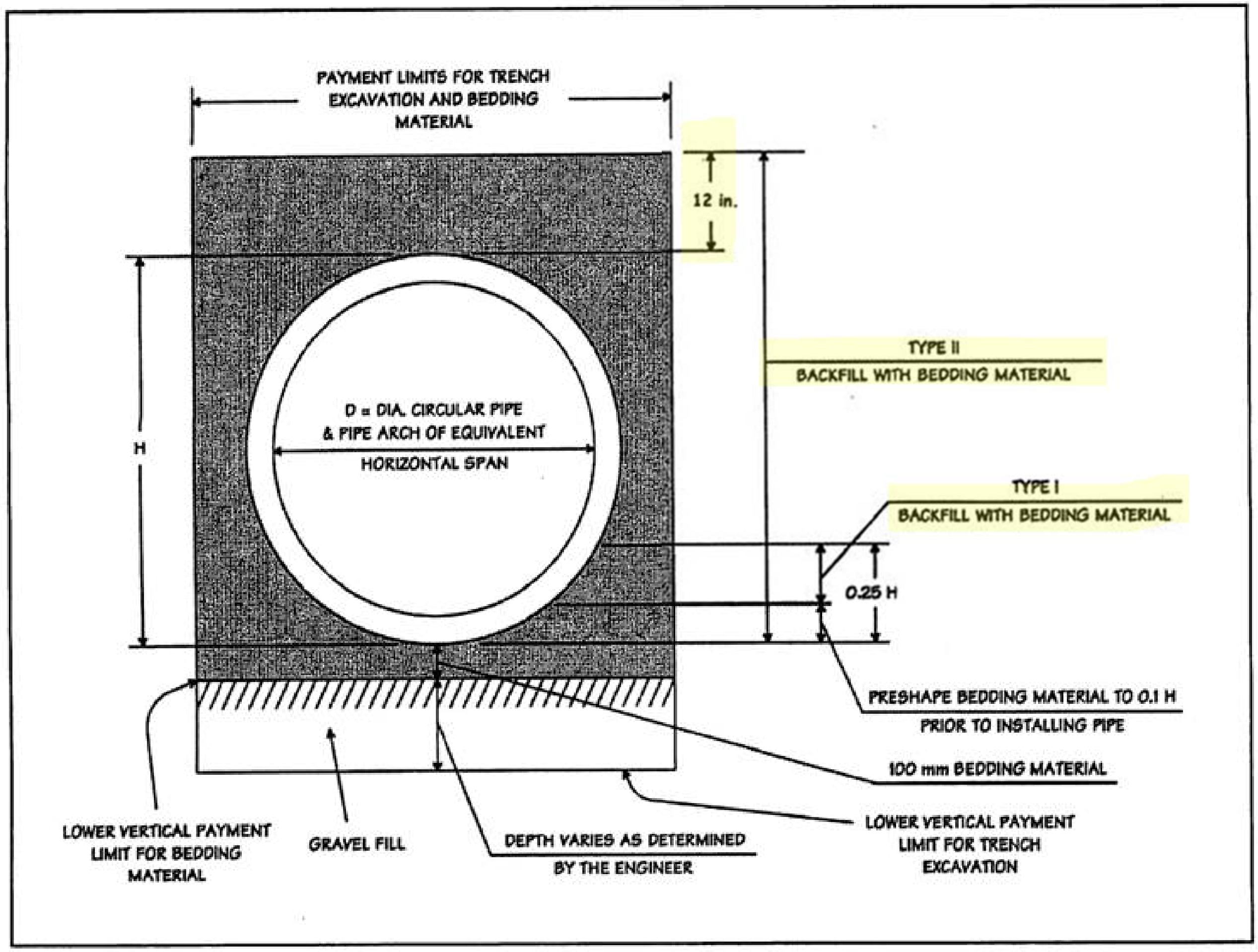


Figure 4-17 Correlation of bedding and supporting strength for rigid pipe

Pipe Installations

Figure 2-4.4

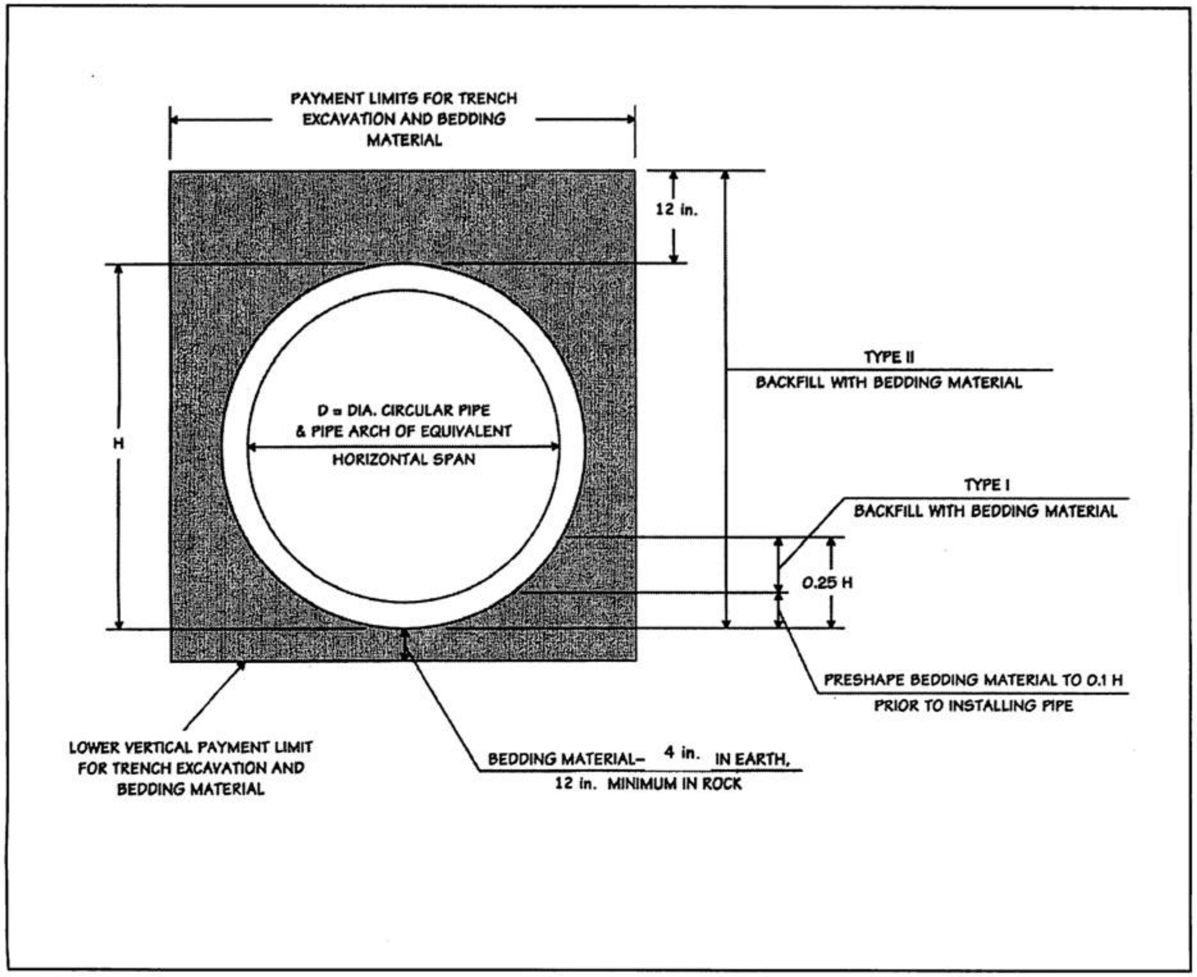
Pipe Installations with Gravel Fill



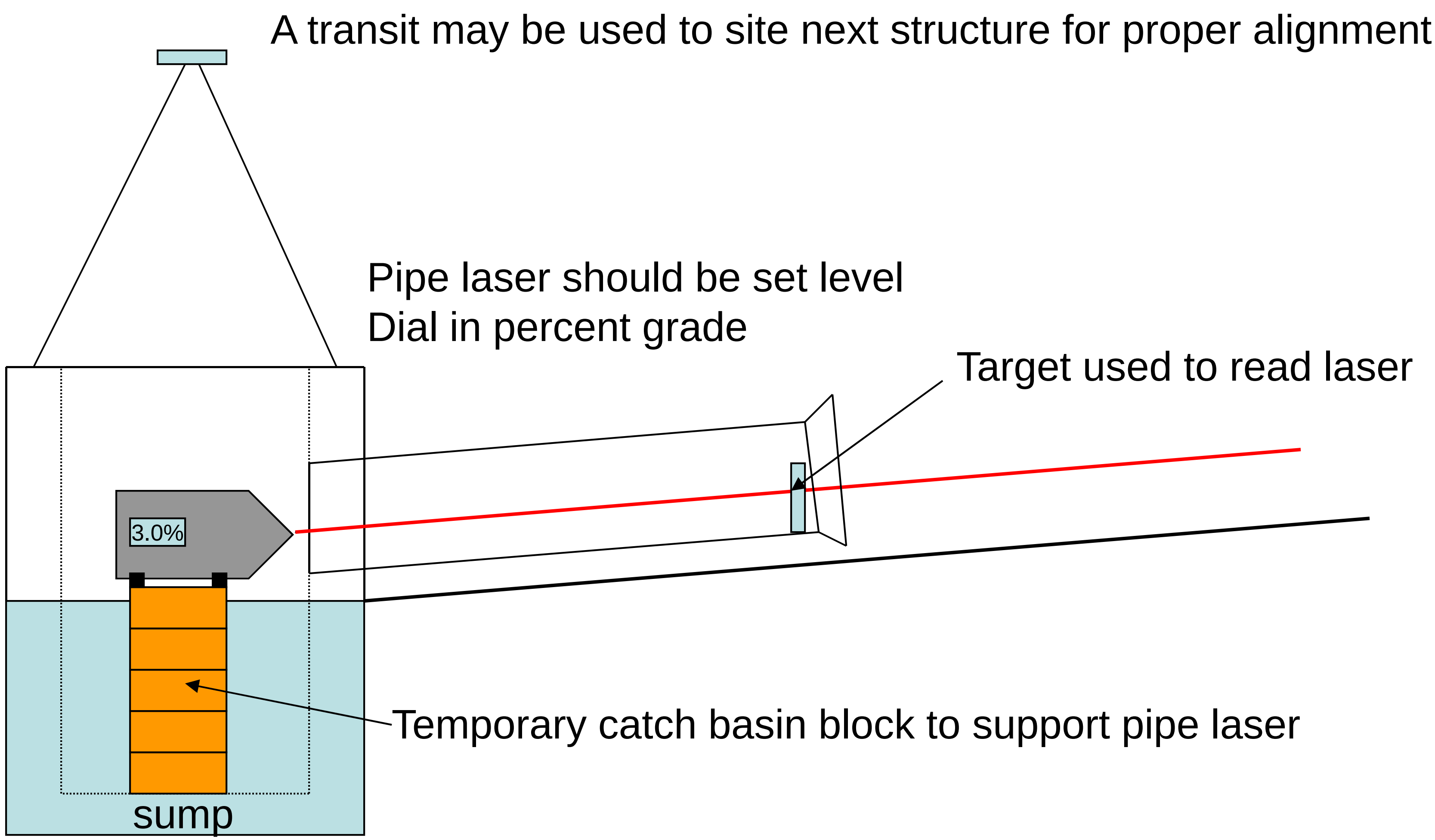
Pipe Installations

Figure 2-4.5

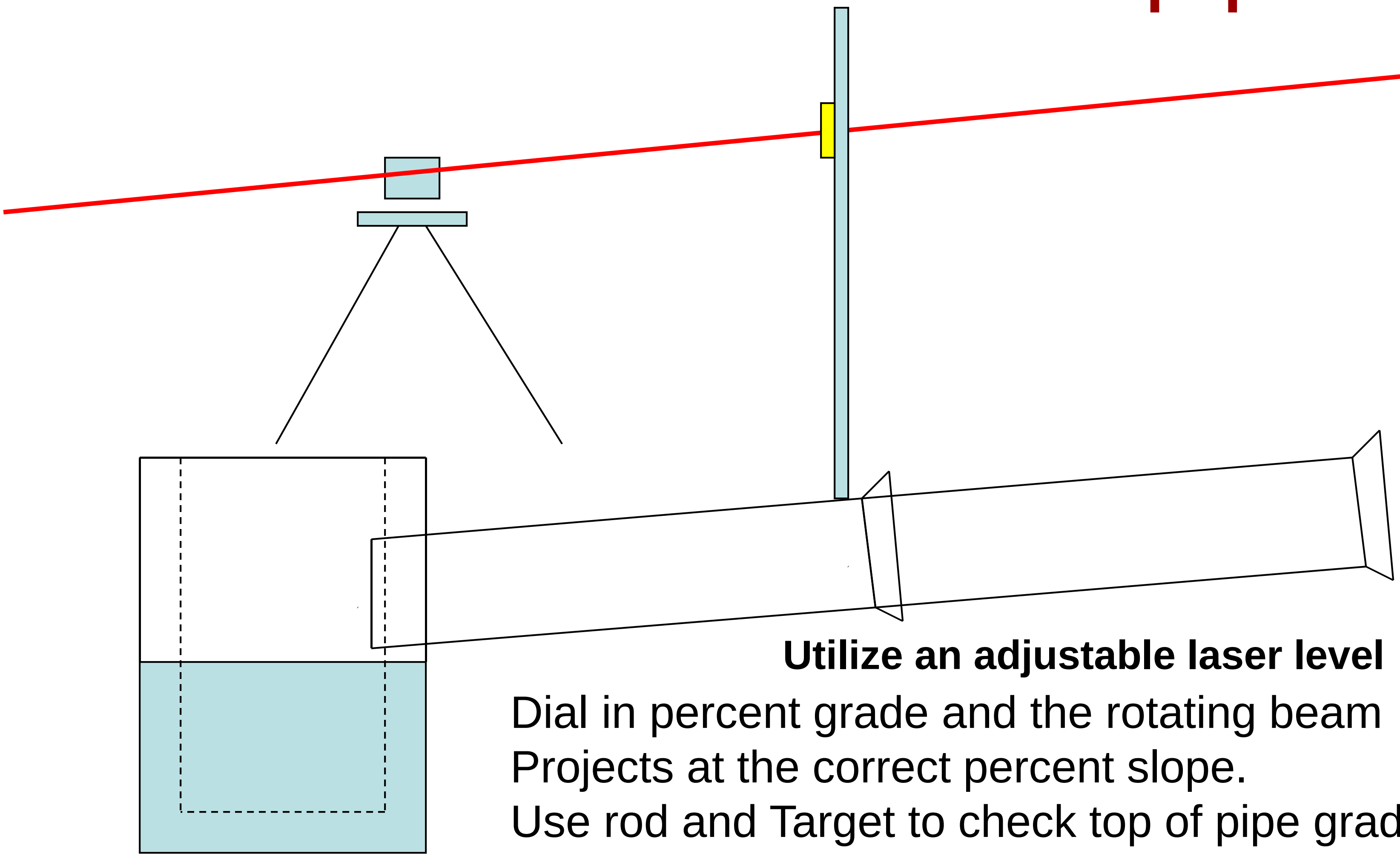
Pipe Installations without Gravel Fill



Setting Pipe



Alternative Method to set pipe



Utilize an adjustable laser level

Dial in percent grade and the rotating beam
Projects at the correct percent slope.
Use rod and Target to check top of pipe grade
at end of each length of pipe

Setting Pipe

- Without specialty tools
  - Contractor may choose to calculate the invert required at each 8 foot pipe section and check with a level and rod
  - Contractor may utilize a 4 foot level
    - More common for small runs

Finals and Follow up

Volume 3 Documentation

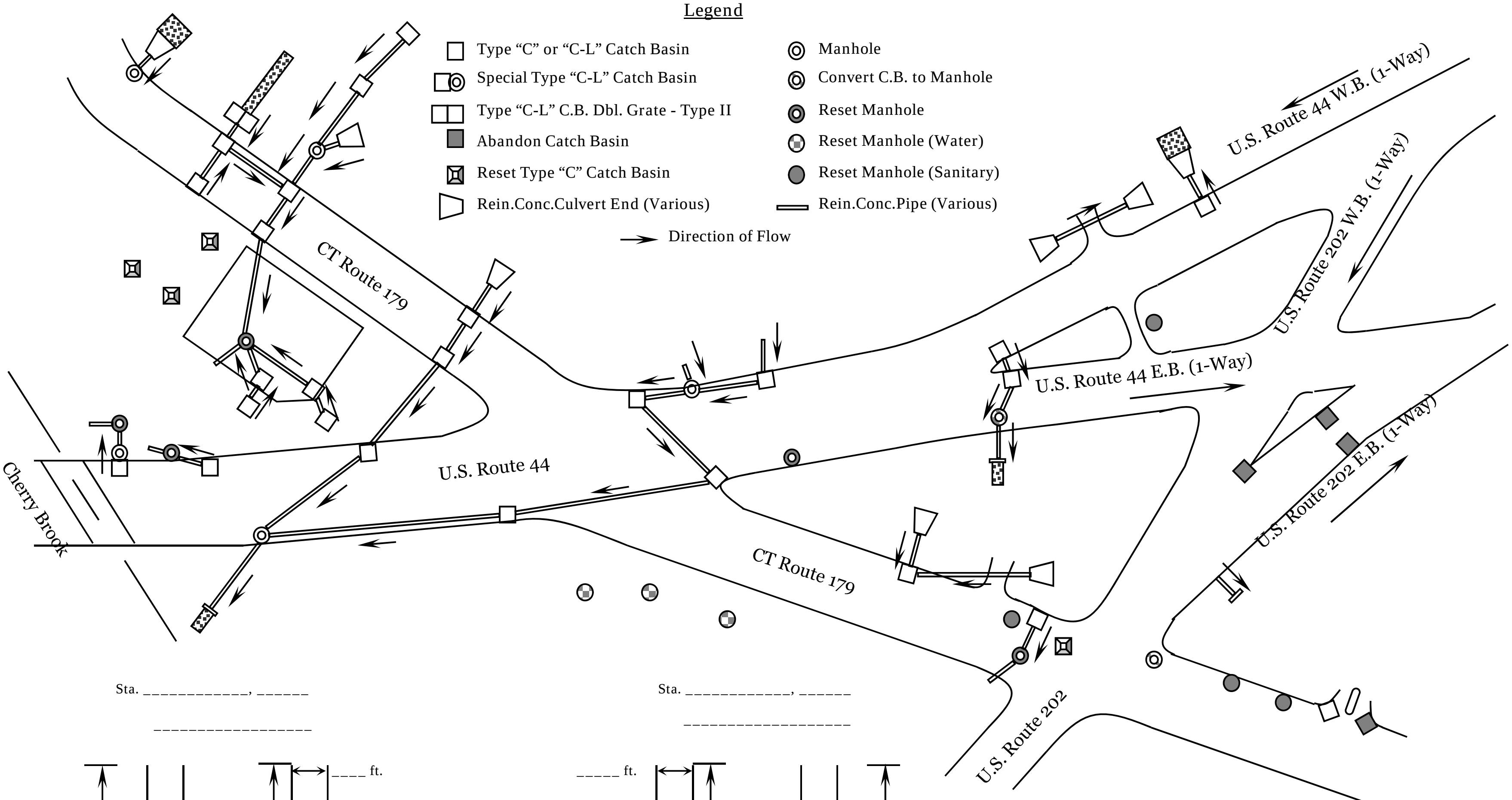
- All drainage must be in documented in its own Volume 3 book. (i.e. Volume 3 Book 2)
- The Volume 3 Drainage book must include a summary sheet for all items paid within the book.
- The item totals must match the SiteManager contract line item totals for each item.

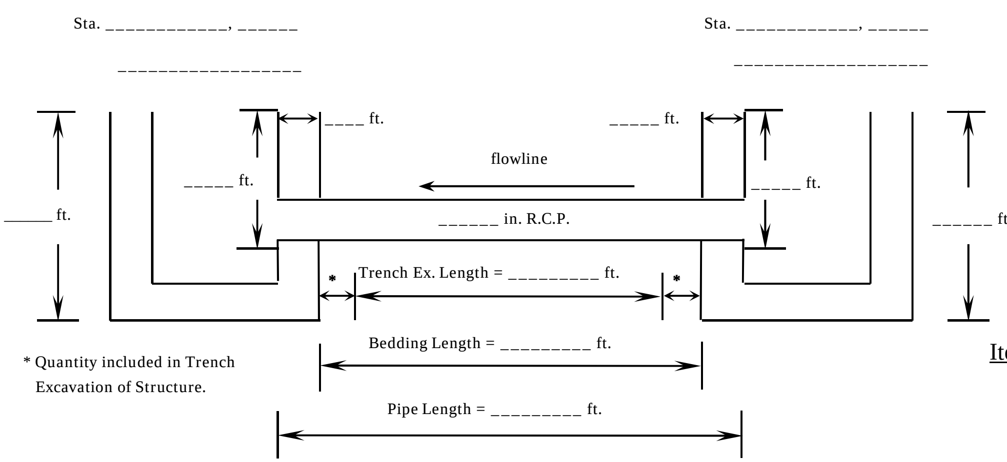
Sample of drainage summary sheet

PROJECT #023-116
VOLUME III
BOOK II

DRAINAGE ITEM PAYMENT INDEX

Date Paid	SM ID#	Ref. Page (Vol III, Book II or DWR)	12" R.C. Pipe 0651011	15" R.C. Pipe 0651012	18" R.C. Pipe 0651013	24" R.C. Pipe 0651015	30" R.C. Pipe 0651017	15" R.C. Pipe - Class V 0651052	12" R.C. Culvert End 0652009	18" R.C. Culvert End 0652011	24" R.C. Culvert End 0652013	Reset Manhole (Water) 1304025A	Reset Manhole (Sanitary) 1403501	Manhole (5' dia.) 9003	Manhole (5' dia. over 10' Deep) 9004
12/13/04	lavignj	2								1.00					
12/13/04	lavignj	3			44.00										
12/14/04	lavignj	4									1.00				
12/14/04	lavignj	5				136.00									
12/14/04	lavignj	6				8.00									
12/17/04	moyniht	7			108.00										
12/21/04	moyniht	10			36.00										
12/22/04	moyniht	12			16.00										
12/23/04	moyniht	14			16.00										
12/23/04	lavignj	15									1.00				
12/23/04	lavignj	16				10.00									
12/23/04	lavignj	19				49.00									
01/04/05	moyniht	21				138.00									
02/28/05	moyniht	24				196.00									
11/10/06	lavignj	25		32.00											
03/02/05	moyniht	28		4.00											
04/20/05	moyniht	37								1.00					
04/20/05	moyniht	38								1.00					
04/22/05	moyniht	39		56.00											
05/06/05	moyniht	05/06/05											2.00		
05/31/05	moyniht	43												1.00	
06/01/05	moyniht	44					6.00								
06/02/05	moyniht	45				20.00									
Original Quantities			*32.00 L.F.*	*640.00 L.F.*	*304.00 L.F.*	*1,320.00 L.F.*	*56.00 L.F.*	*40.00 L.F.*	*1.00 ea.*	*3.00 ea.*	*2.00 ea.*	*2.00 ea.*	*4.00 ea.*	*1.00 ea.*	*1.00 ea.*
PROJECT TOTAL			*0.00*	*92.00*	*220.00*	*557.00*	*6.00*	*0.00*	*0.00*	*3.00*	*2.00*	*0.00*	*2.00*	*1.00*	*0.00*

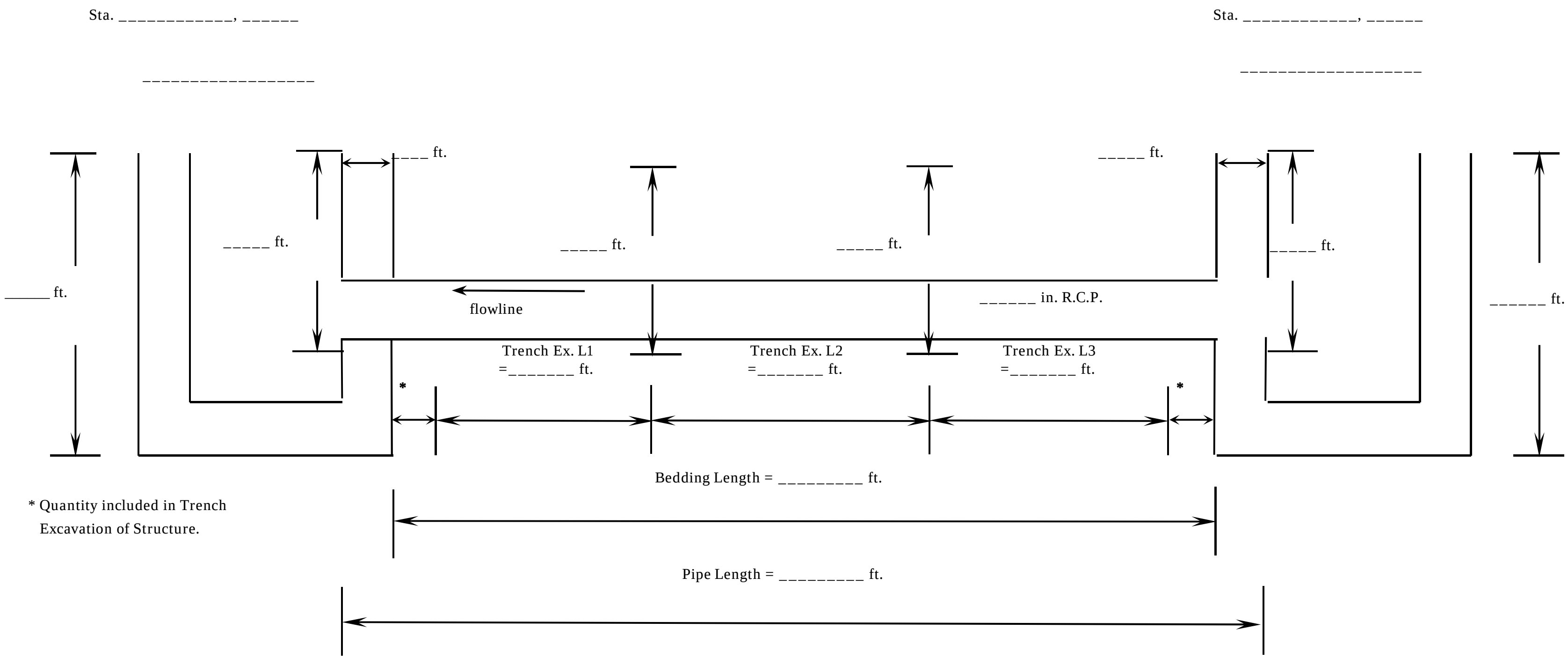




Drainage Summary
(paid on DWR dated)

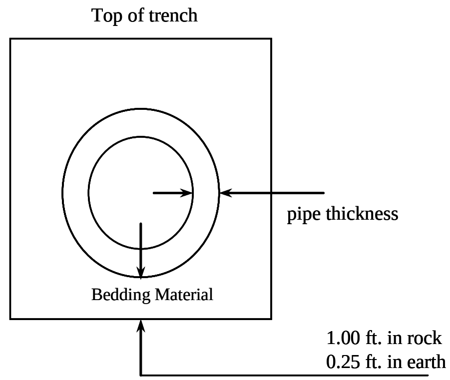
Item #	Item Description	Quantity

Sample



Sta. _____________, ______
____
Sta. _____________, ______
____
_____ ft.
_____ ft.
_____ ft.
_____ ft.
_____ ft.
_____ ft.
_____ ft.
______ ft.
______ ft.
flowline
______ in. R.C.P.
Trench Ex. L1
=_______ ft.
Trench Ex. L2
=_______ ft.
Trench Ex. L3
=_______ ft.
*
*
Bedding Length = _________ ft.
Pipe Length = _________ ft.
* Quantity included in Trench
Excavation of Structure.

Drainage Notes and Factors



General Notes (for Trenching)

Top of trench (within cut) = existing grade
Top of trench (within fill) = 1.00 ft. above top of culvert
Bottom of trench = elevation as shown on plans
Length $_{\text{R.C.P.}}$ = Field measured length of installed R.C.P.
Length $_{\text{bedding mat.}}$ = Length $_{\text{R.C.P.}}$ - thickness of walls of C.B./M.H.
Length $_{\text{trench ex.}}$ = 2.00 ft. - Length $_{\text{bedding mat.}}$ - 2.00 ft.
where 2.00 ft. = width of excavation included in the computations for the C.B./M.H.
Depth of trench = top of trench - bottom of trench + 1.00 ft. (in rock)
= top of trench - bottom of trench (in earth)

Trench Excavation (for C.B., M.H.)

<u>For Type “C” or “C-L” Catch Basin</u>
Length $_{\text{C.B. Ex.}}$ = 2.00 ft. + 5.333 ft.* + 2.00 ft. = 9.333 ft.
Width $_{\text{C.B. Ex.}}$ = 2.00 ft. + 4.333 ft.* + 2.00 ft. = 8.333 ft.
<u>Area $_{\text{C.B. Ex.}}$</u> = Length $_{\text{C.B. Ex.}}$ X Width $_{\text{C.B. Ex.}}$
= 9.333 ft. X 8.333 ft. = **<u>77.77 ft^2</u>**.

<u>For Type “C-L” Catch Basin Double Grate - Type II</u>
Length $_{\text{C.B. (Dbl.Grate) Ex.}}$ = 2.00 ft. + 7.875 ft.* + 2.00 ft. = 11.875 ft.
Width $_{\text{C.B. (Dbl.Grate) Ex.}}$ = 2.00 ft. + 4.333 ft.* + 2.00 ft. = 8.333ft.
<u>Area $_{\text{C.B. (Dbl.Grate) Ex.}}$</u> = Length $_{\text{C.B. (Oversized) Ex.}}$ X Width $_{\text{C.B. (Oversized) Ex.}}$
= 11.875 ft. X 8.333 ft. = **<u>98.95 ft^2</u>**.

<u>For Special Type “C-L” Catch Basin</u>
<u>Area $_{\text{C.B (Special Type “C-L”) Ex.}}$</u> = Calculated Individually.

<u>For Manhole</u>
<u>Area $_{\text{M.H. Ex.}}$</u> = $\pi D^2/4$:
where D = (2.00 ft. + M.H. Footprint Dia.* + 2.00 ft.)
= π(2.00 ft. + 6.00 ft.* + 2.00ft)^2 / 4
= π(10.00 ft.)^2 / 4 = **<u>78.54 ft^2</u>**.

<u>For Manhole (5.0’ dia.)</u>
<u>Area M.H. Ex.</u> = $\pi D^2/4$:
where D = (2.00 ft. + M.H. Footprint Dia.* + 2.00 ft.)
= π(2.00 ft. + 7.00 ft.* + 2.00 ft)^2 / 4
= π(11.00 ft.)^2 / 4 = **<u>95.03 ft^2</u>**.

Trench Excavation (for R.C.C.E.)

<u>For 12” Reinforced Concrete Culvert End</u>
Length $_{\text{12” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 6.031 ft. + 1.00 ft.$^{\#}$ = 8.031 ft.
Width 1 $_{\text{12” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 1.00 ft.$^{\#}$ + 1.00 ft$^{\#}$ = 3.00 ft.
Width 2 $_{\text{12” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 2.00 ft.$^{\#}$ + 1.00 ft.$^{\#}$ = 4.00 ft.
<u>Area $_{\text{12” R.C.C.E. Ex.}}$</u> = 8.031 ft. X 1/2 (3.00 ft. + 4.00 ft.)
= 8.031 ft. X 3.50 ft. = **<u>28.11 ft^2</u>**.

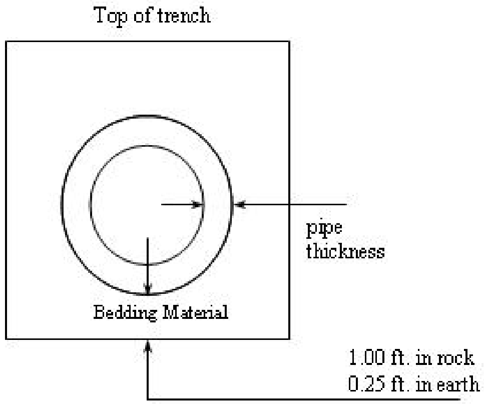
<u>For 15” Reinforced Concrete Culvert End</u>
Length $_{\text{15” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 6.057 ft. + 1.00 ft.$^{\#}$ = 8.057 ft.
Width 1 $_{\text{15” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 1.25 ft.$^{\#}$ + 1.00 ft$^{\#}$ = 3.25 ft.
Width 2 $_{\text{15” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 2.50 ft.$^{\#}$ + 1.00 ft.$^{\#}$ = 4.50 ft.
<u>Area $_{\text{15” R.C.C.E. Ex.}}$</u> = 8.057 ft. X 1/2 (3.25 ft. + 4.50 ft.)
= 8.057 ft. X 3.88 ft. = **<u>31.26 ft^2</u>**.

<u>For 18” Reinforced Concrete Culvert End</u>
Length $_{\text{18” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 6.083 ft. + 1.00 ft.$^{\#}$ = 8.083 ft.
Width 1 $_{\text{18” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 1.50 ft.$^{\#}$ + 1.00 ft$^{\#}$ = 3.50 ft.
Width 2 $_{\text{18” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 3.00 ft.$^{\#}$ + 1.00 ft.$^{\#}$ = 5.00 ft.
<u>Area $_{\text{18” R.C.C.E. Ex.}}$</u> = 8.083 ft. X 1/2 (3.50 ft. + 5.00 ft.)
= 8.083 ft. X 4.25 ft. = **<u>34.35 ft^2</u>**.

<u>For 24” Reinforced Concrete Culvert End</u>
Length $_{\text{24” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 6.125 ft. + 1.00 ft.$^{\#}$ = 8.125 ft.
Width 1 $_{\text{24” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 2.00 ft.$^{\#}$ + 1.00 ft$^{\#}$ = 4.00 ft.
Width 2 $_{\text{24” R.C.C.E. Ex.}}$ = 1.00 ft.$^{\#}$ + 4.00 ft.$^{\#}$ + 1.00 ft.$^{\#}$ = 6.00 ft.
<u>Area $_{\text{24” R.C.C.E. Ex.}}$</u> = 8.125 ft. X 1/2 (4.00 ft. + 6.00 ft.)
= 8.125 ft. X 5.00 ft. = **<u>40.63 ft^2</u>**.

<u>For 30” Reinforced Concrete Culvert End</u>
Length $_{\text{30” R.C.C.E. Ex.}}$ = 1.50 ft.$^{\#}$ + 6.146 ft. + 1.50 ft.$^{\#}$ = 9.146 ft.
Width 1 $_{\text{30” R.C.C.E. Ex.}}$ = 1.50 ft.$^{\#}$ + 2.50 ft.$^{\#}$ + 1.50 ft$^{\#}$ = 5.50 ft.
Width 2 $_{\text{30” R.C.C.E. Ex.}}$ = 1.50 ft.$^{\#}$ + 5.00 ft.$^{\#}$ + 1.50 ft.$^{\#}$ = 8.00 ft.
<u>Area $_{\text{30” R.C.C.E. Ex.}}$</u> = 9.146 ft. X 1/2 (5.50 ft. + 8.00 ft.)
= 9.146 ft. X 6.75 ft. = **<u>61.74 ft^2</u>**.

Drainage Notes and Factors



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$\text{Length}_{\text{bedding mat.}}$ = $\text{Length}_{\text{R.C.P.}}$ - thickness of walls of C.B./M.H.
$\text{Length}_{\text{trench ex.}}$ = 2.00 ft. - $\text{Length}_{\text{bedding mat.}}$ - 2.00 ft.
where 2.00 ft. = width of excavation included in the computations for the C.B./M.H.
Depth of trench = top of trench - bottom of trench + 1.00 ft. (in rock)
= top of trench - bottom of trench (in earth)

Trench Excavation (for R.C.P.)

Volume = $\text{Length}_{\text{Trench Ex.}}$ X $\text{Depth}_{\text{Ave.}}$ X Width

for 12.00 in. RCP, **width** = 1.00 ft + 2.00 ft. = **3.00 ft.**

for 15.00 in. RCP, **width** = 1.25 ft + 2.00 ft. = **3.25 ft.**

for 18.00 in. RCP, **width** = 1.50 ft + 2.00 ft. = **3.50 ft.**

for 24.00 in. RCP, **width** = 2.00 ft + 2.00 ft. = **4.00 ft.**

for 30.00 in. RCP, **width** = 2.50 ft + 3.00 ft. = **5.50 ft.**

Bedding Material

Volume = $\text{Length}_{\text{Bedding}}$ X Bedding Factor@
(note: values are C.Y. per L.F.)

for 12" RCP,
in earth (4" below RCP): **factor** = **0.0640**
in rock (12" below RCP): **factor** = **0.1380**

for 15" RCP,
in earth (4" below RCP): **factor** = **0.0740**
in rock (12" below RCP): **factor** = **0.1521**

for 18" RCP,
in earth (4" below RCP): **factor** = **0.0844**
in rock (12" below RCP): **factor** = **0.1708**

for 24" RCP,
in earth (4" below RCP): **factor** = **0.1065**
in rock (12" below RCP): **factor** = **0.2052**

for 30" RCP,
in earth (4" below RCP): **factor** = **0.1709**
in rock (12" below RCP): **factor** = **0.3067**

Excel Forms

- Drainage forms can be found on the share drive, use the following link:
  - \\Sdcdbs60\Groups\DOTSHARE\ConstManual\Approved_Forms

Common mistakes to avoid

- Make payments for complete drainage runs only.
- Pay complete catch basins.
- Make sure all comps are reviewed, checked and signed.

Common mistakes to avoid

- If an item, such as rip rap, geotextile, or compacted granular fill is paid in other books, as well as the drainage book, make sure the represented item quantity is properly referenced in the drainage book summary sheet so all item totals match.

PROJECT #051-254
VOLUME III
BOOK II
Section 2
DRAINAGE ITEM PAYMENT INDEX

Date Paid	SM ID#	Ref. Page (Vol III, Book II sect 2)	Trench Excavation (0-3.0 M) 0205003	Rock in Trench Excavation (0-3.0 M) 0205004	Type 'C' CB 0507001	250mm Conc. Pipe 0651010	Type 'CL' CB 0507201	600mm RCCE 0652013	Manhole 1.525m 0507682	750mm RCP 0651017	750mm RCCE 0652014	600mm RCP 0651015	Bedding Material 0651001	300mm RCP 0651011	375mm RCP 0651012	450mm RCP 0651013	200 mm HDPE 0651236
05/06/05	leavenb	3	45.49	3.50					1.00	12.00	1.00		4.97				
11/16/05	zukowsc	33	67.10	22.50	1.00								6.33	40.00			
12/28/05	zukowsc	33					1.00										
11/28/05	zukowsc	35	37.92		1.00								5.96				43.00
11/30/05	leavenb	37	34.65		1.00								5.40				39.00
12/15/05	zukowsc	39	8.97	28.16									5.62				
12/28/05	zukowsc	39														26.80	
04/12/06	zukowsc	41	31.00	2.40	1.00								3.16				23.00
05/18/06	zukowsc	43	19.01		1.00								1.37		8.00		
05/23/06	leavenb	45	11.54		1.00								0.50				4.00
				26.37	Reference dwr leavenb 051005-1 and 051105-1 for details												
				28.65	Reference dwr leavenb 060305-1 for details												
Original Quantities			*630 m3*	*165 m3*	*11 ea*	*8 m*	*0 ea*	*1 ea*	*0 ea*	*45 m*	*1 ea*	*25 m*	*345m3*	*55 m*	*50 m*	*0 m*	*108 m*
PROJECT TOTAL			*255.68*	*111.58*	*6.00*	*0.00*	*1.00*	*0.00*	*1.00*	*12.00*	*1.00*	*0.00*	*33.31*	*40.00*	*8.00*	*26.80*	*109.00*

Clearly reference payments made elsewhere so item totals match SiteManager

Testing

- Ensure all precast concrete products have PC-1's.
- Field verify cast dates
- Field inspect all precast for damage, reject if necessary look for the following:
  - Cracked or broken bells or spigots
  - Transverse of Longitudinal cracks
  - Exposed rebar

Per Construction Manual Volume 2

2-4.16 **ver. 1.2 (April 2006)**

- **Individual units may be rejected for any of the following conditions:**
  - **Units do not bear proper identification**
  - **Structures show evidence of honeycomb or patching in excess of 30 sq. in.**

Individual units may be rejected for any of the following conditions:

- Structures have the following defects:
  - Fractures or cracks passing through the wall
  - Defects that indicate imperfect concrete mix
  - Surface defects which indicate honeycombing
  - Damaged or cracked ends which prevent making satisfactory joints
  - Damage caused by mishandling by the contractor

Samples of RCP which should be rejected.

Samples of RCP which should be rejected.

Cracking

Samples of RCP which should be rejected.

Notice patching of damaged Pipe.

Project Completion

- Are all structures clean?
  - Has construction debris been removed from sumps
    - Removal of concrete block for laser installation
    - Removal of excess mortar from parging operation

Are all structures clean?

Are all structures clean?

Project Completion

- Has final pointing & parging been completed?

Pointing and Parging

Parging Required

Form 816 - Supplemental

- Drainage method payment to change
  - Trench excavation, bedding, and pipe to be included in the pay item for the pipe.
  - Catch basins / manholes will include the excavation per vertical foot