STORM DRAIN DESIGN

TABLE OF CONTENTS

STORM DRAIN DESIGN

I. General

A. The Sonoma County Water Agency performs drainage review for the City of Cloverdale. Drainage calculations shall be submitted to the Water Agency for review at the same time improvement plans are submitted to the City for review.

B. Sonoma County Water Agency "Flood Control Design Criteria" shall be used for the design of all drainage improvements within the City of Cloverdale.

C. These standards are minimum standards and do not preclude the use of a higher standard.

II. Waterways Defined

A. A "waterway" is defined as being a natural or artificial channel or depression in the surface of the earth or an underground conduit system which provides a course for water flowing as a consequence of storm water runoff.

B. Major Waterways - having a tributary drainage area of four (4) square miles or more; shall require a design frequency of reoccurrence of once in 100 years.

C. Secondary Waterways - having a tributary drainage area of between one (1) and four (4) square miles; shall require a design frequency of reoccurrence of once in 25 years.

D. Minor Waterways - having a tributary drainage area less than one (1) square mile; shall require a design frequency of reoccurrence of once in 10 years.

III. Entrance and Exit Losses

Entrance and exit losses shall be calculated using the loss coefficients in Plate No. 1.

IV. Submittal Requirements

A. Assumptions used in preparing calculations shall be listed.

B. The design aids and references which are used in support of the calculations for design of drainage improvements shall be listed. Supply the Water Agency with copies of reference data. If computers are used, the input and output shall be sufficient to allow easy checking.

C. Hydrology map(s) shall be provided for both on and off-site drainage areas. The maps shall be of sufficient scale and detail to show drainage areas. Drainage areas shall be numbered and outlined to facilitate checking. The area of each drainage area shall be

shown on the map.

D. Hydrologic and hydraulic calculations showing beginning hydraulic gradeline, energy losses at junctions, bends, structures, friction slopes, etc. shall be submitted.

E. In addition to the calculations, the hydraulic gradeline, and the energy gradeline shall be shown for all open or closed drainage improvements except gutters.

F. Plan views, profiles, cross-sections, and details of all drainage facilities including a lot grading plan showing how each lot will drain shall be submitted.

G. Entrance capacity and gutter depth calculations shall be submitted for all drainage inlets.

H. Additional information may be required as determined by the Water Agency or the City Engineer.

PLATE 1 - BOX WIDTH IN FEET

PIPE DIAMETER

Kx/Ke	1.0'	1.5'	2.0'	2.5'	3.0'	4.0'	5.0'	6.0'
8"-12"	0.23/0.16	0.59/0.41	0.76/0.53	0.84/0.59	0.89/0.62	0.94/0.65	0.96/0.67	0.97/0.68
15"	0.03/0.02	0.40/0.23	0.63/0.44	0.76/0.53	0.83/0.58	0.90/0.63	0.94/0.63	0.96/0.67
18"		0.23/0.16	0.50/0.35	0.66/0.46	0.76/0.53	0.86/0.60	0.91/0.64	0.94/0.65
24"			0.23/0.16	0.44/0.31	0.59/0.41	0.76/0.59	0.84/0.59	0.89/0.62
30"				0.23/0.16	0.40/0.28	0.63/0.44	0.76/0.53	0.83/0.58
36"				0.06/0.04	0.23/0.16	0.50/0.35	0.66/0.46	0.76/0.53
42"					0.08/0.06	0.36/0.25	0.55/0.39	0.68/0.47
48"						0.23/0.16	0.44/0.31	0.59/0.41
54"						0.11/0.08	0.33/0.23	0.50/0.35
60"						0.03/0.02	0.23/0.16	0.40/0.28
66"							0.13/0.09	0.13/0.22
72"							0.06/0.04	0.23/0.16

Definitions:

Kx = Exit Loss coefficient
Exit loss for an outlet into a creek = 1.0

Ke = Entrance Loss coefficient
Loss coefficients are to be applied to the velocity head to determine the minor loss.

V. Materials

A. Storm sewer main lines shall be Class I, Class II, or Class III RCP or HDPE pipe as required by the Engineer and shown on the approved plans.

B. Storm drain laterals shall be PVC, SDR35, HDPE or RCP as approved by the Engineer.

C. Minimum diameter for all storm sewer main lines shall be 18".

VI. Manholes

A. A manhole is required at every horizontal or vertical change in alignment.

B. Maximum distance between manholes is 300 feet.

C. A manhole is required at the end of every main.

D. Minimize the number of manholes.

E. 60" diameter manholes are required for mains larger than 36" in diameter, or deeper than 7' (indicate manhole diameter on plans).

F. When pipe size increases, set inlet crown at least as high as the outlet crown.

VII. Cover

A. Minimum cover for all storm sewer lines is 24" from top of pipe to finished grade, or 12" from top of pipe to bottom of structural section, whichever is more restrictive.

B. If conditions do not allow for minimum cover, storm sewer line shall be capped or pipe material shall be changed per the direction of the Engineer.

VIII. Testing and Acceptance

A. All storm sewer lines shall be cleaned of construction debris and sediment before final inspection.

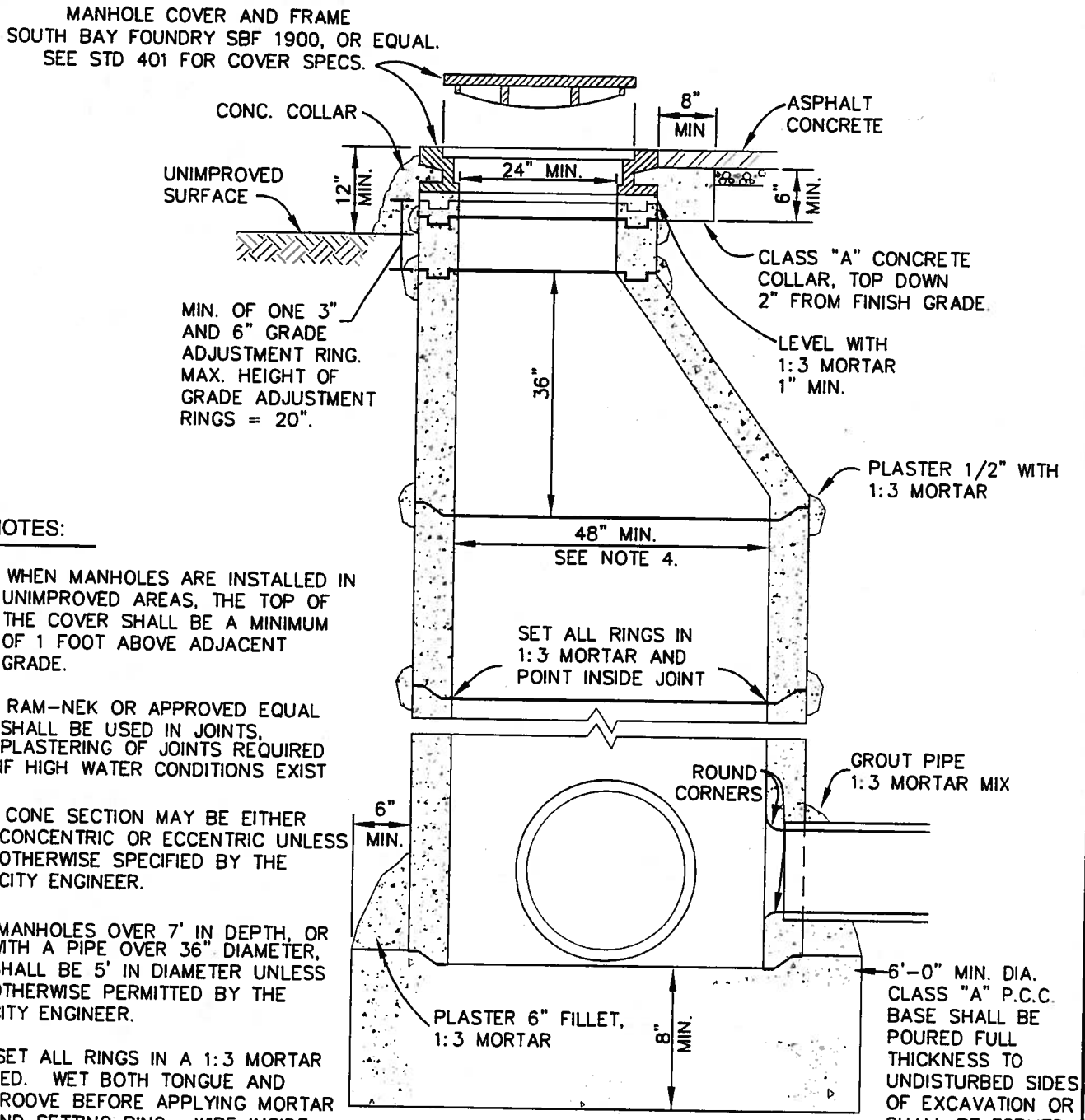
B. Prior to acceptance by the City, all storm sewer lines shall be video taped as required in this Standard Construction Specification.

STORM DRAIN STANDARD PLANS

DESCRIPTION

400 SERIES – STORM DRAIN

400	Storm Drain Manhole
401	Standard Manhole Frame and Cover
402	Standard Pre-cast Concrete Storm Drain Manhole Reducer Slab
403	Pre-cast Catch Basin Hood
404	Curb Opening Catch Basin
405	Catch Basin for Pipes Larger Than 24"
406	Storm Drain Gallery
407	Temporary Redwood Box Field Inlet
408	Typical Storm Drain Outfall Detail
409	Sidewalk Drain
410	Sidewalk Cross Drain
411	Typical Lot Drainage
412	H.D.P.E. Trench Installation Detail



NOTES:

1. WHEN MANHOLES ARE INSTALLED IN UNIMPROVED AREAS, THE TOP OF THE COVER SHALL BE A MINIMUM OF 1 FOOT ABOVE ADJACENT GRADE.
2. RAM-NEK OR APPROVED EQUAL SHALL BE USED IN JOINTS, PLASTERING OF JOINTS REQUIRED IF HIGH WATER CONDITIONS EXIST
3. CONE SECTION MAY BE EITHER CONCENTRIC OR ECCENTRIC UNLESS OTHERWISE SPECIFIED BY THE CITY ENGINEER.
4. MANHOLES OVER 7' IN DEPTH, OR WITH A PIPE OVER 36" DIAMETER, SHALL BE 5' IN DIAMETER UNLESS OTHERWISE PERMITTED BY THE CITY ENGINEER.
5. SET ALL RINGS IN A 1:3 MORTAR BED. WET BOTH TONGUE AND GROOVE BEFORE APPLYING MORTAR AND SETTING RING. WIPE INSIDE OF JOINTS SMOOTH AND PLASTER OUTSIDE OF JOINT WITH 1/2" LAYER OF MORTAR.
6. CONSTRUCT ALL FLOW CHANNELS OF PIPE WHEREVER POSSIBLE. AFTER BASE IS POURED, BREAK OUT TOP HALF OF PIPE FLUSH WITH INSIDE FACE OF M.H. WALL AND CONSTRUCT U-SHAPED CHANNEL. MAKE ELEVATION CHANGES GRADUALLY AND DIRECTIONAL CHANGES WITH SMOOTH CURVES. SET RING BASE IN MORTAR.
7. ALL SECTIONS OF MANHOLE MUST BE OF IDENTICAL MAKE AND MANUFACTURER.

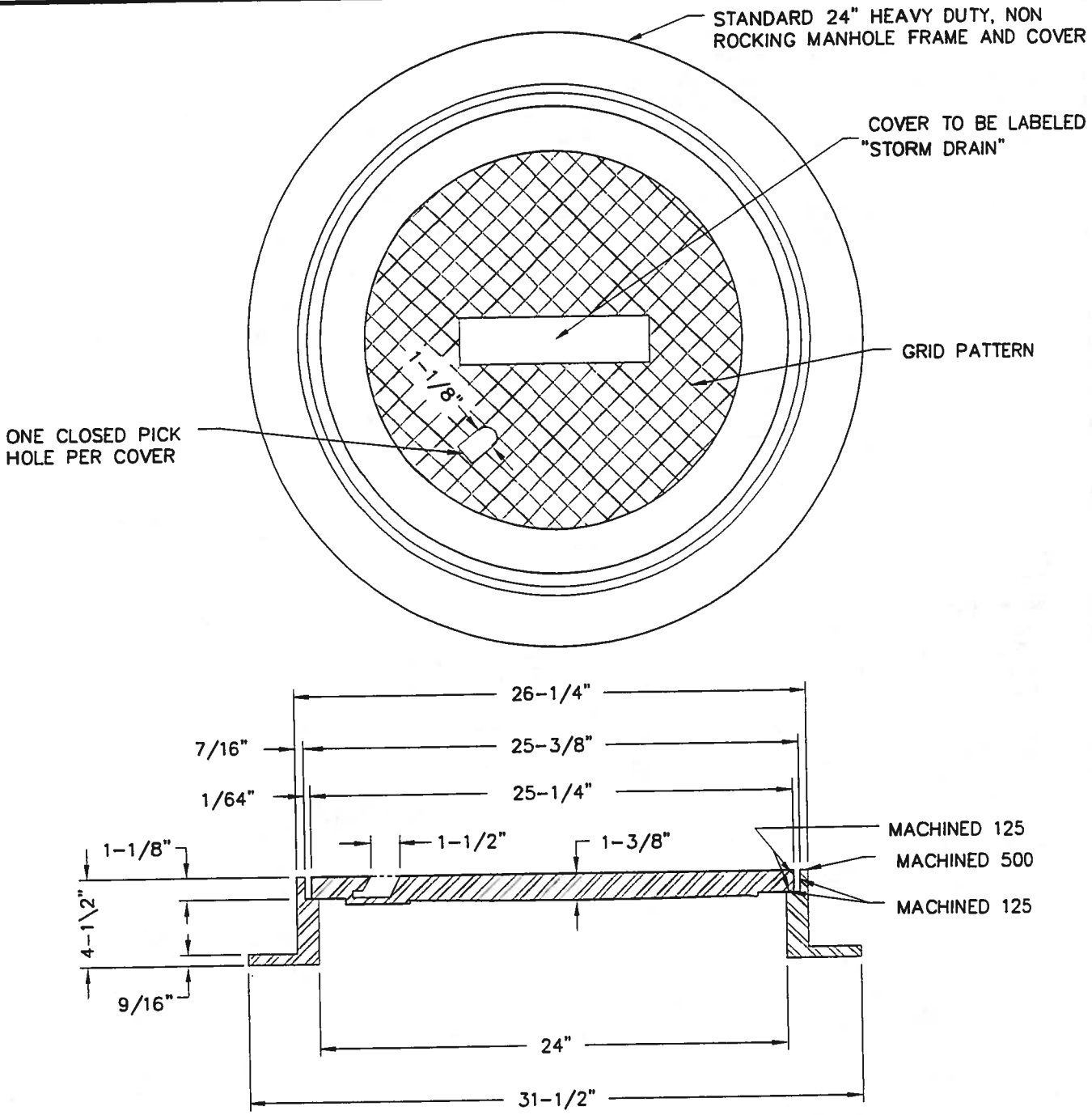
CITY OF CLOVERDALE CALIFORNIA

STORM DRAIN MANHOLE

STD. NO. 400

SCALE: NONE	DRAWN: CLG	CHK: JHG	APPVD:	DATE: APR. 2004

FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG

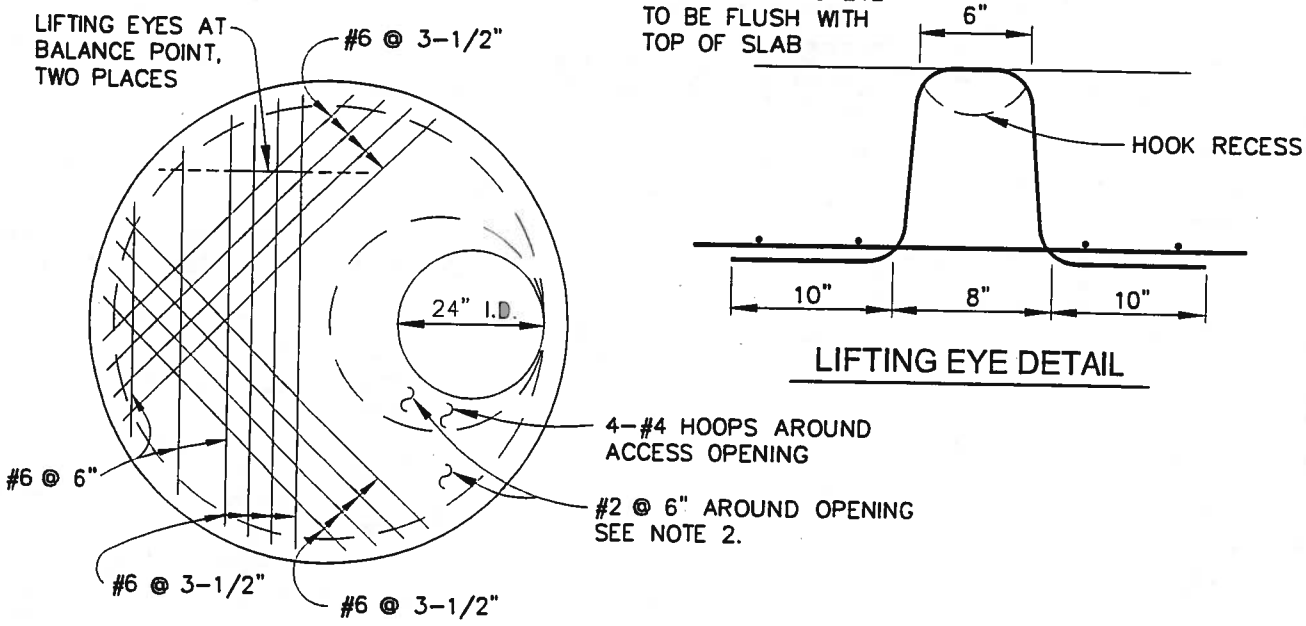


NOTES:

1. ALL CASTINGS SHALL BE DIPPED IN APPROVED ASPHALT PAINT.
2. ALL MATERIAL USED IN MANUFACTURING SHALL CONFORM TO A.S.T.M. DESIGNATION 48-30, OR TO UNITED STATES GOVERNMENT SPECIFICATIONS QQI-652B.
3. MINIMUM WEIGHT COMPONENTS: COVER - 130 POUNDS
   FRAME - 135 POUNDS

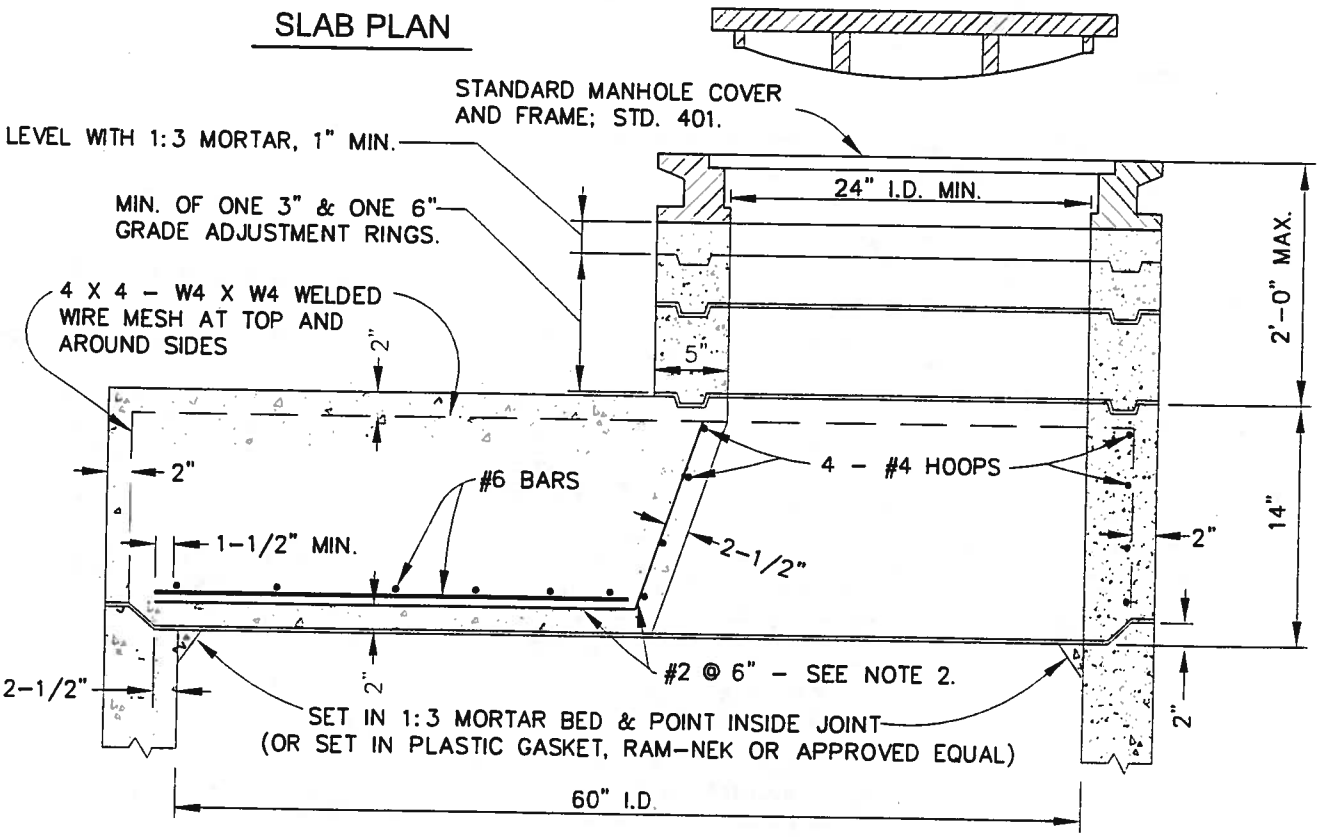
CITY OF CLOVERDALE CALIFORNIA	STANDARD MANHOLE FRAME AND COVER	STD. NO. 401
SCALE: NONE | DRAWN: CLG | CHK: JHG | APPVD:		DATE: APR. 2004

FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG



SLAB PLAN

LIFTING EYE DETAIL



NOTES:

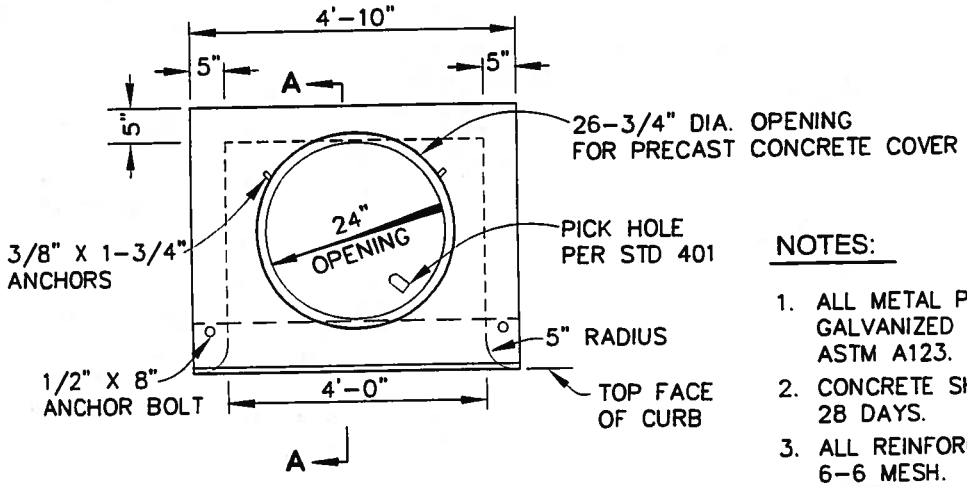
1. FOR DETAILS OF BASE AND BARREL SECTIONS, SEE CITY STD 400
2. #2 BARS BENT UP AND SPACED 6" O.C. AROUND 24" OPENING. HORIZONTAL LEGS TO FAN OUT EQUALLY SPACED, TO 2-1/2" CLEAR AT EDGE OF SLAB.

STANDARD PRECAST CONCRETE STORM DRAIN MANHOLE REDUCER SLAB

STD. NO. 402

SCALE: NONE	DRAWN: CLG	CHK: JHG	APPVD:	DATE: APR. 2004

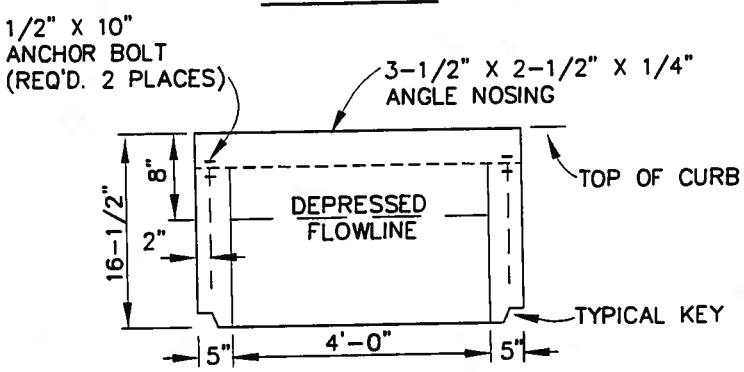
FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG



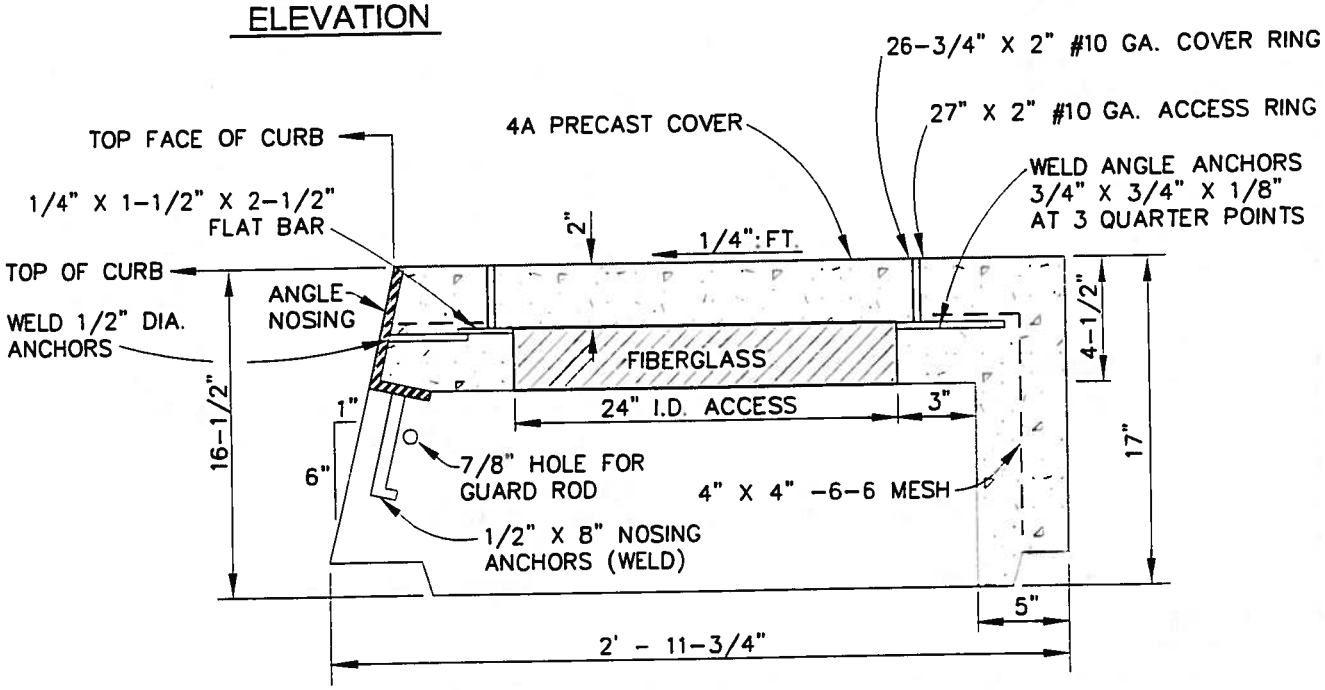
PLAN

NOTES:

1. ALL METAL PARTS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION PER ASTM A123.
2. CONCRETE SHALL TEST 3000 PSI AT 28 DAYS.
3. ALL REINFORCING SHALL BE 4" X 4" - 6-6 MESH.
4. WEIGHT OF UNIT COMPLETE = 1500± LBS. COVER ONLY = 100± LBS.
5. 3/4" GALVANIZED STEEL GUARD ROD FOR OPENINGS IN EXCESS OF 9".
6. BASE MAY BE PRECAST OR CAST IN PLACE TO SUIT.



ELEVATION



SECTION A-A

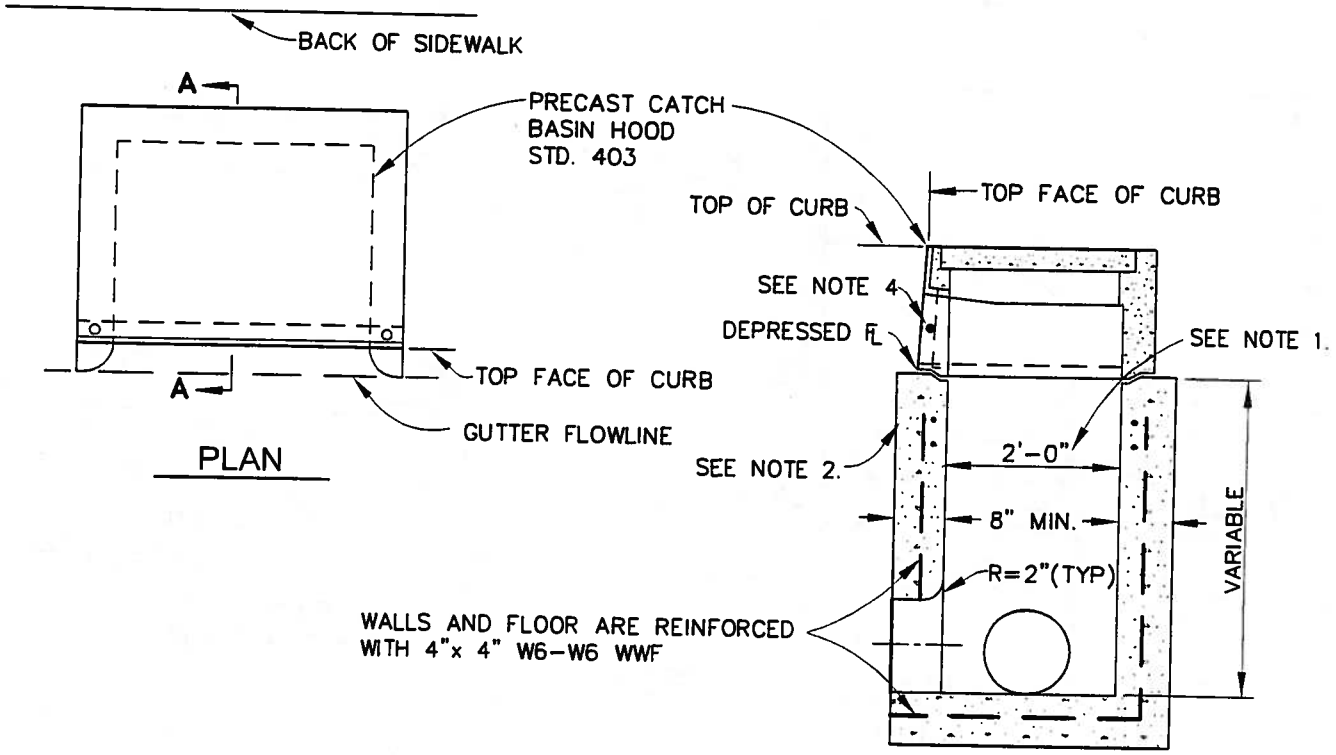
APPROVED ALTERNATES:
CENTRAL PRE-CAST PRODUCTS MODEL 4AC
PHEONIX PRECAST CONC. PRODUCTS MODEL P-2448-C

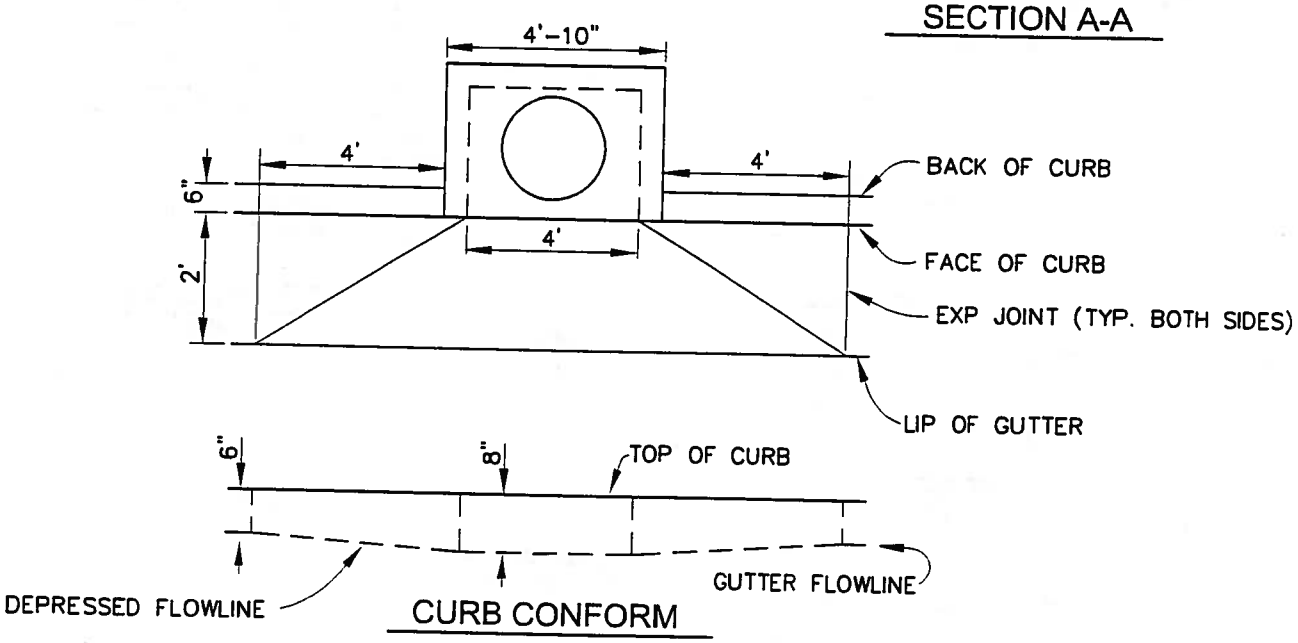
PRECAST CATCH BASIN HOOD

STD. NO. 403

SCALE: NONE	DRAWN: CLG	CHK: JHG	APPVD:	DATE: APR. 2004

FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG





NOTES:

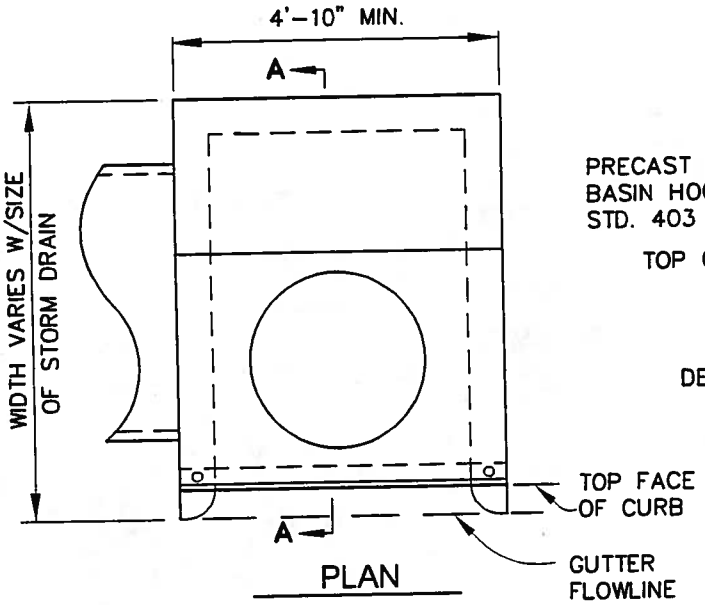
1. IF PIPE INTO OR OUT OF THE CATCH BASIN IS LARGER THAN 24", UNIT SHALL BE TAILOR MADE BY SUPPLIER, OR FIELD FABRICATED PER CITY STD. 405.
2. APPROVED ALTERNATES FOR CURB INLET BASE SECTIONS: CENTRAL PRE-CAST PRODUCTS BASE SECTION MODEL 4A; PHOENIX PRECAST CONC. PRODUCTS BASE SECTION MODEL D14,2
3. ALL HOOD, BASE, AND PIPE CONNECTIONS SHALL BE GROUTED.
4. 3/4" GALVANIZED STEEL GUARD ROD MUST BE INSTALLED AT CENTER OF OPENINGS IN EXCESS OF 9" INCHES IN LENGTH.

CURB OPENING CATCH BASINS

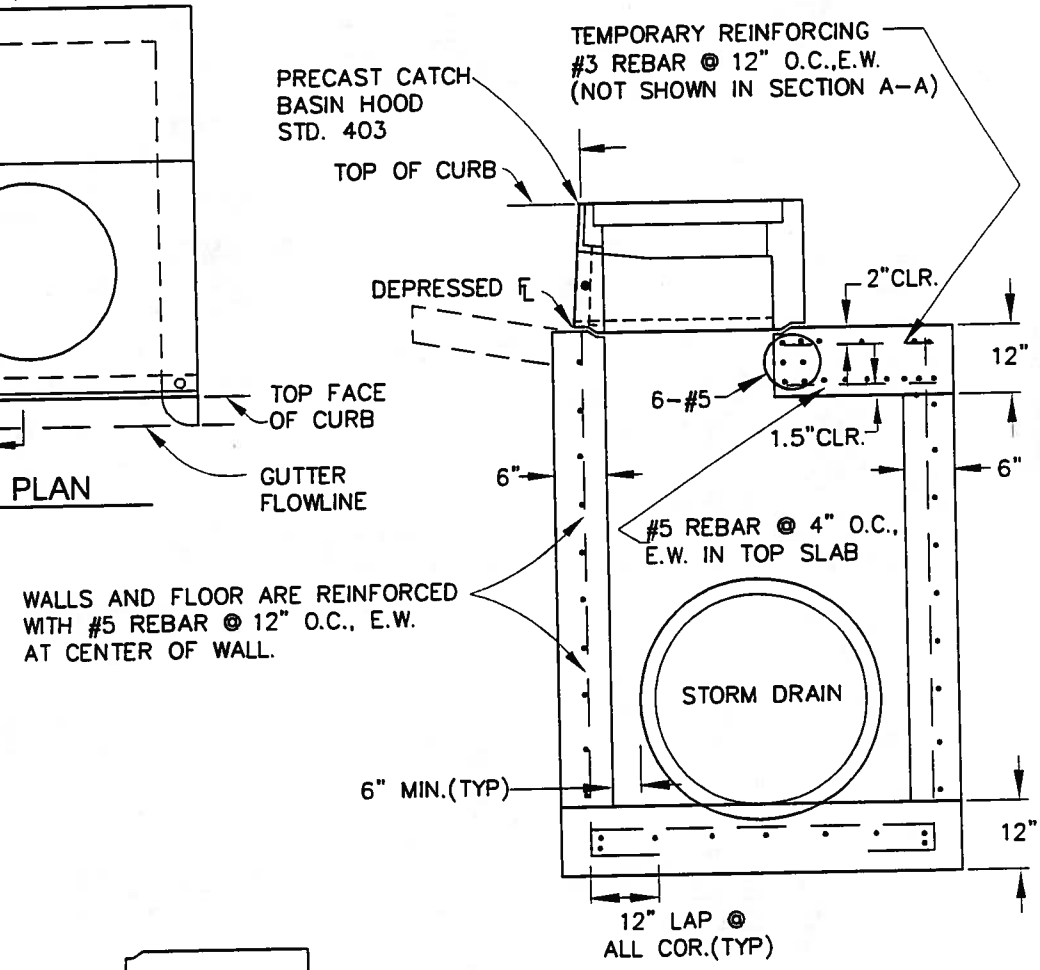
STD. NO. 404

SCALE: NONE	DRAWN: LMM	CHK: JHG	APPVD:	DATE: APR. 2004

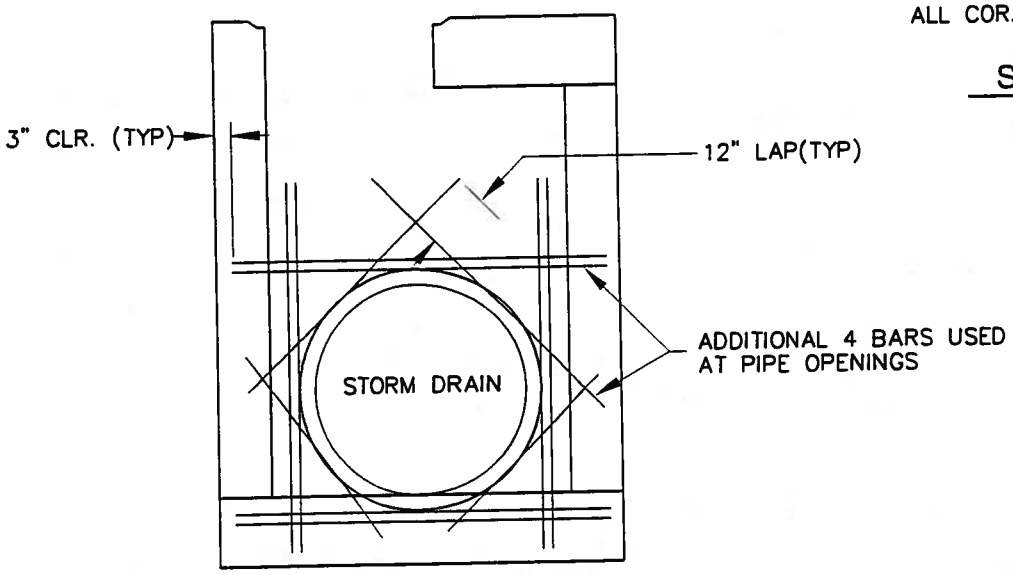
FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG



PLAN



SECTION A-A



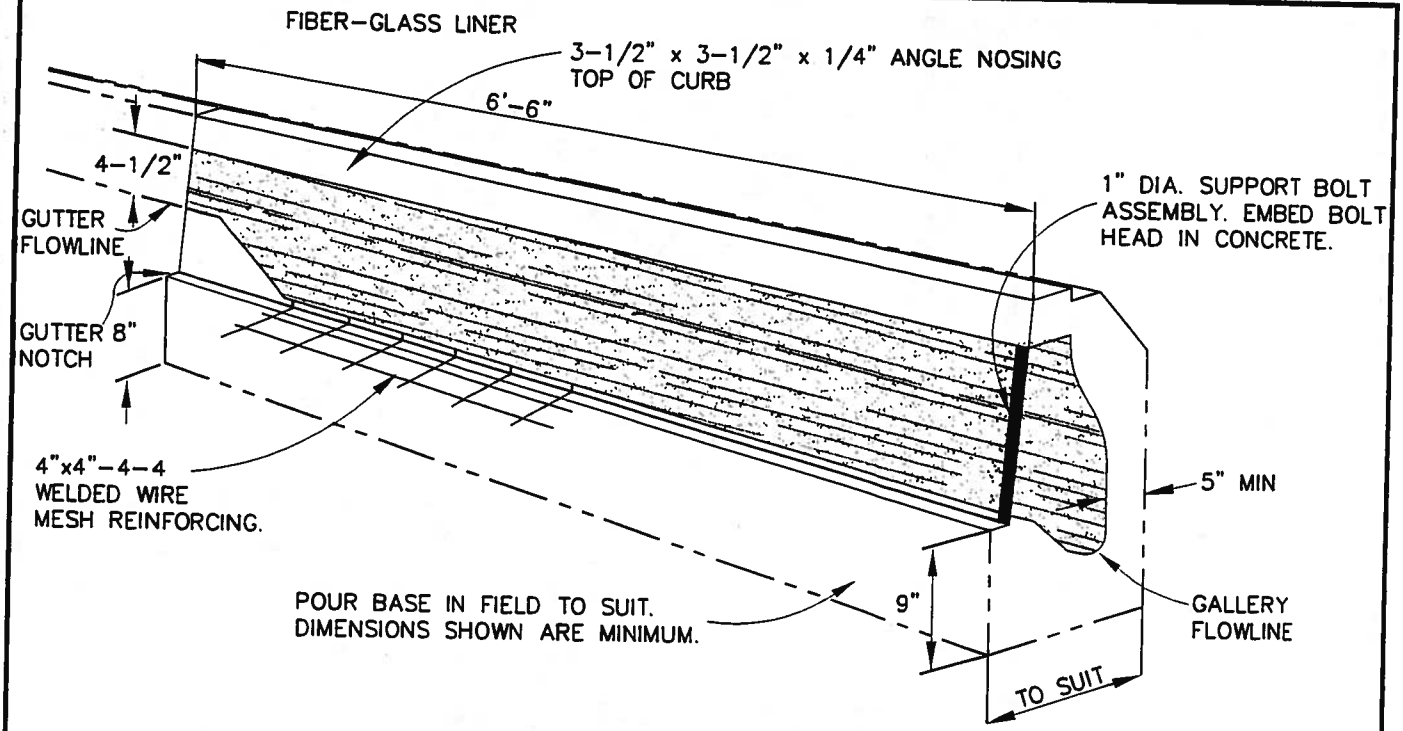
REINFORCING USED @ OPENINGS

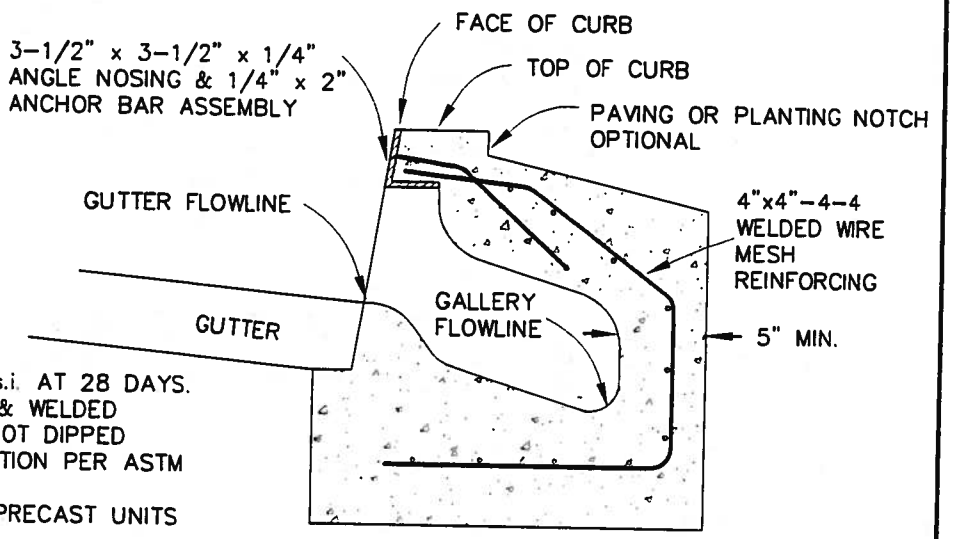
CATCH BASIN FOR PIPES LARGER THAN 24"

STD. NO. 405

SCALE: NONE	DRAWN: LMM	CHK: JHG	APPVD:	DATE: APR. 2004

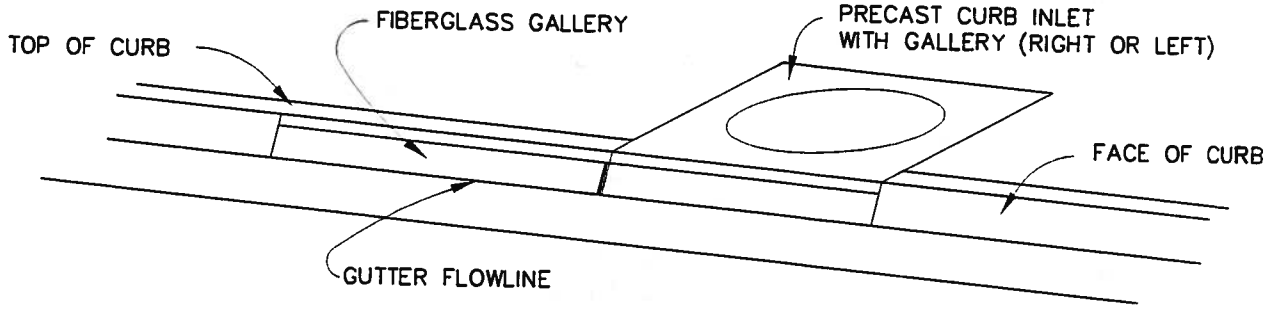
FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG





NOTES:

1. CONCRETE SHALL BE 3000p.s.i. AT 28 DAYS.
2. NOSING ASSEMBLY (ANGLED & WELDED ANCHOR BARS) SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION PER ASTM SPEC. A123-59.
3. EITHER CAST-IN-PLACE OR PRECAST UNITS ARE ACCEPTABLE.



STORM DRAIN GALLERY

STD. NO. 406

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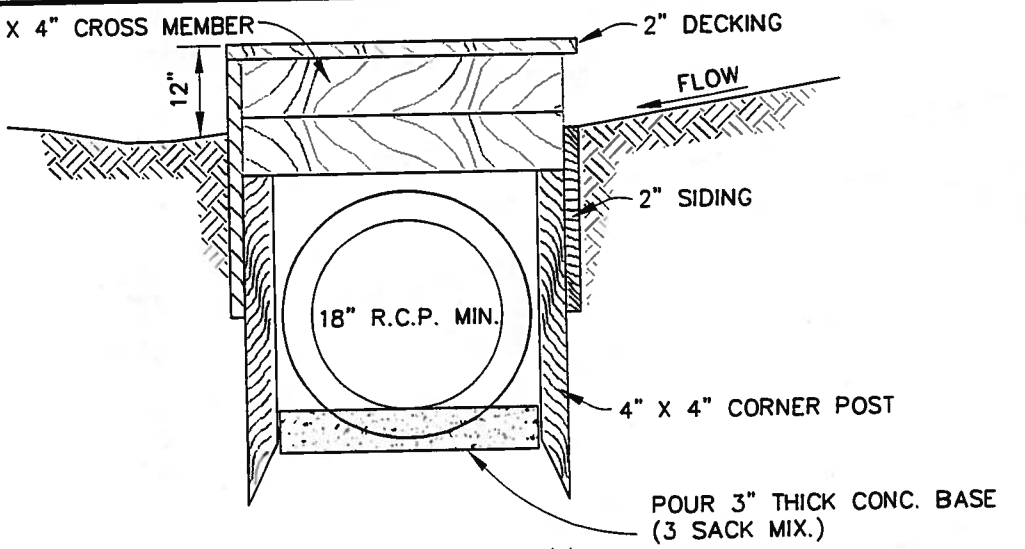
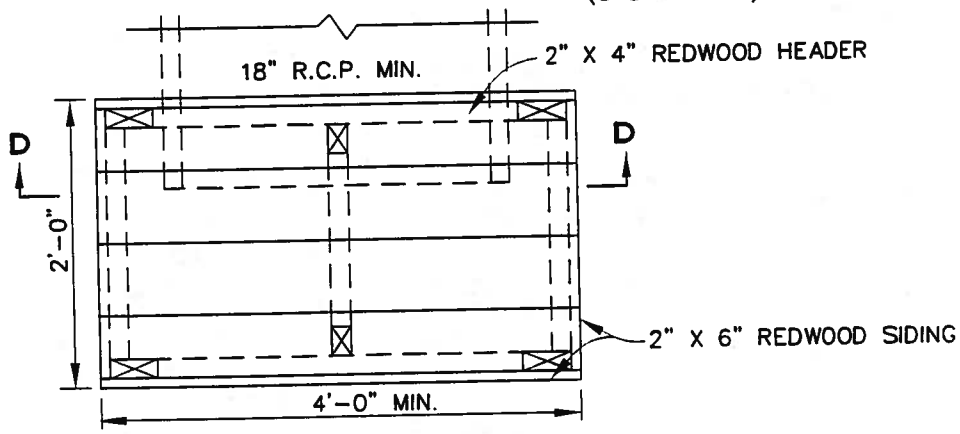
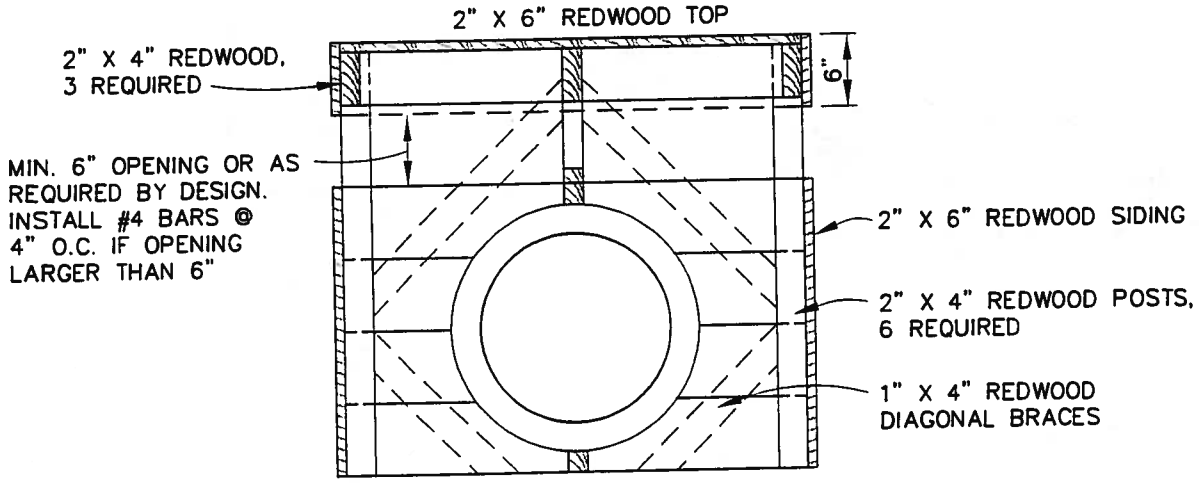
FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG







SECTION D-D

NOTES:

1. ALL WOOD SHALL BE CONSTRUCTION HEART REDWOOD OR BETTER.
2. HOT DIPPED GALVANIZED NAILS SHALL BE USED THROUGHOUT.
3. THIS DETAIL IS TO BE USED IF THE DURATION OF USE IS LESS THAN 2 YEARS. USE A CONCRETE STRUCTURE IF LONGER DURATION.

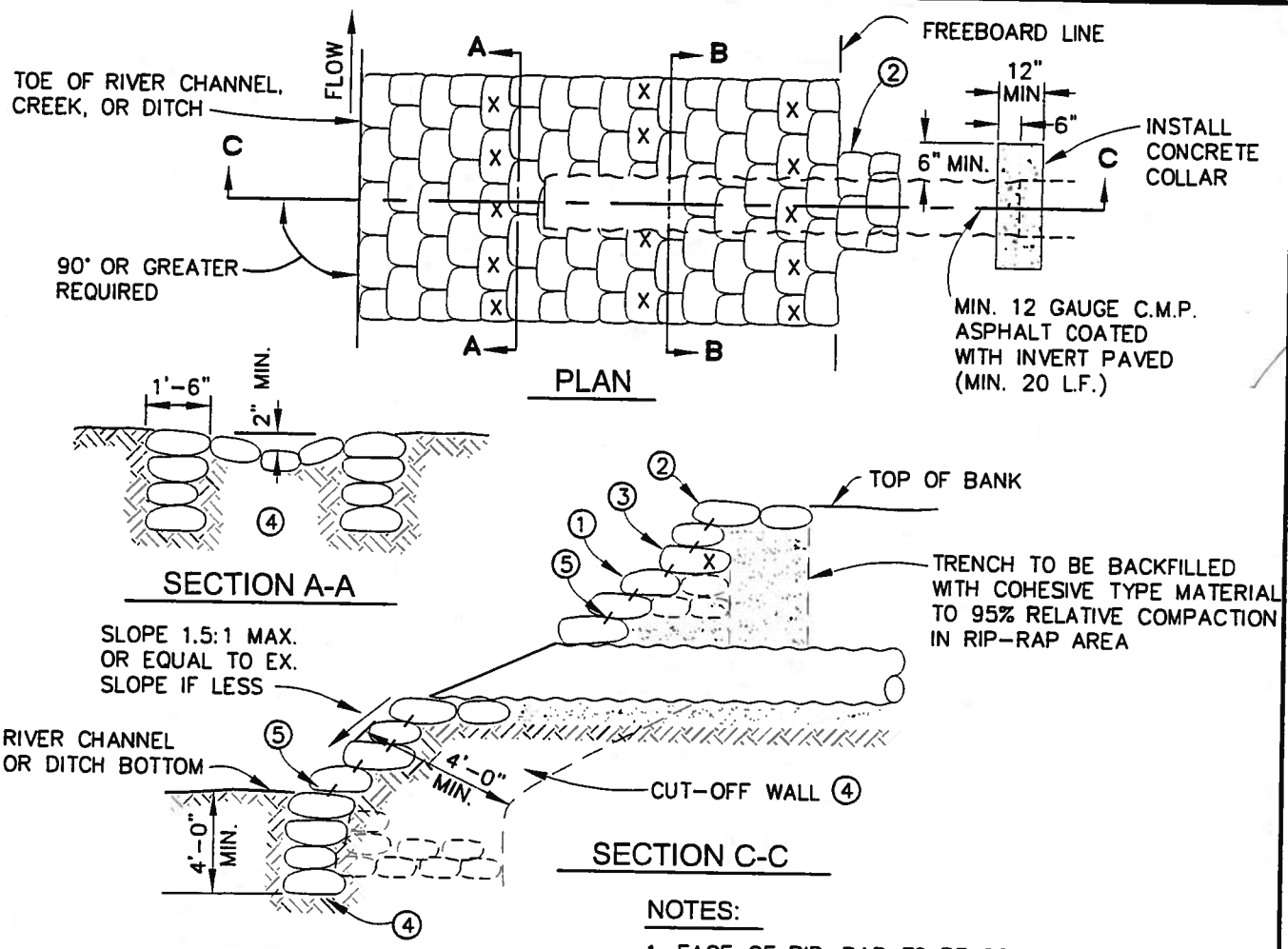
CITY OF CLOVERDALE CALIFORNIA

TEMPORARY REDWOOD BOX FIELD INLET

STD. NO. 407

SCALE: NONE	DRAWN: CLG	CHK: JHG	APPVD:	DATE: APR. 2004

FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG



NOTES:

1. FACE OF RIP-RAP TO BE COINCIDENT WITH EXISTING (OR FUTURE DESIGN) SIDE SLOPE OF CHANNEL.
2. CARRY RIP-RAP TO TOP OF BANK IN TRENCH EXCAVATION ABOVE FREEBOARD.
3. SACK CONCRETE RIP-RAP PLACED ON UNDISTURBED SOIL. ANY OVER EXCAVATION MUST BE FILLED WITH SACKS, NO EARTH BACKFILL WILL BE PERMITTED. (EVERY FIFTH COURSE TO BE A HEADER COURSE. ⊗)
4. INSTALL CUT-OFF WALL UPSTREAM & DOWNSTREAM TO AN ELEVATION WHICH IS EQUAL TO THE FREEBOARD ELEVATION OR TOP OF PIPE, WHICH EVER IS HIGHER, & ACROSS THE BOTTOM WITH 4.0 MINIMUM DEPTH.
5. IN ALL TOP COURSES AND THROUGHOUT, IF SIDE SLOPE IS STEEPER THAN 1:1 AND/OR HIGHER THAN 10 FEET, DRIVE ONE #4 REINFORCING BAR 18" LONG THROUGH EACH SACK. DO NOT LEAVE ENDS OF BARS EXPOSED, NOR DRIVE INTO DIRT.
6. OUTFALLS TO BE APPROVED BY FISH AND GAME AND FLOOD CONTROL AS APPROPRIATE.

CITY OF CLOVERDALE, CALIFORNIA

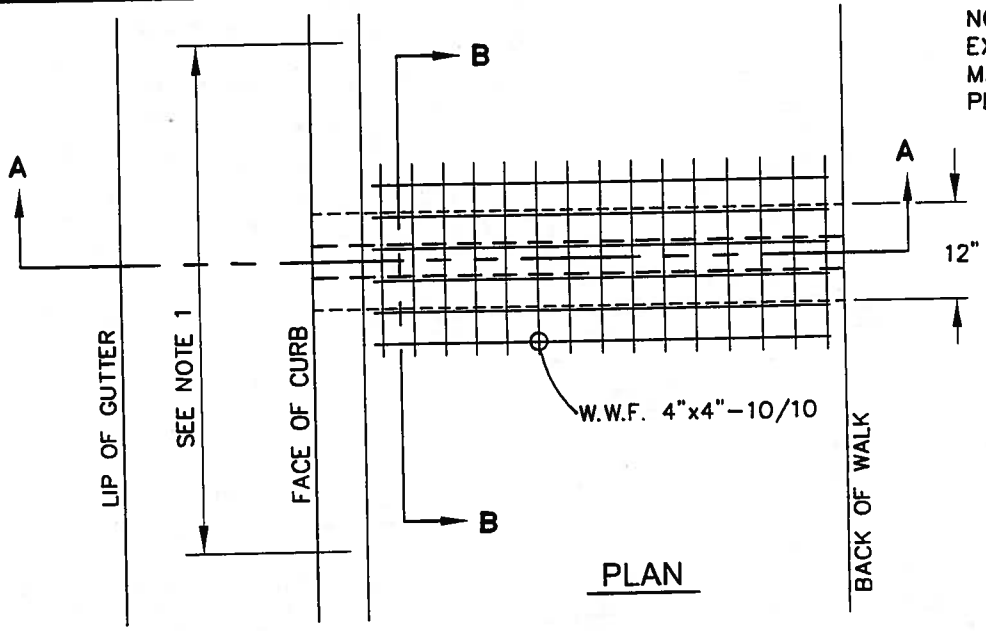
TYPICAL STORM DRAIN OUTFALL DETAIL

STD. NO. 408

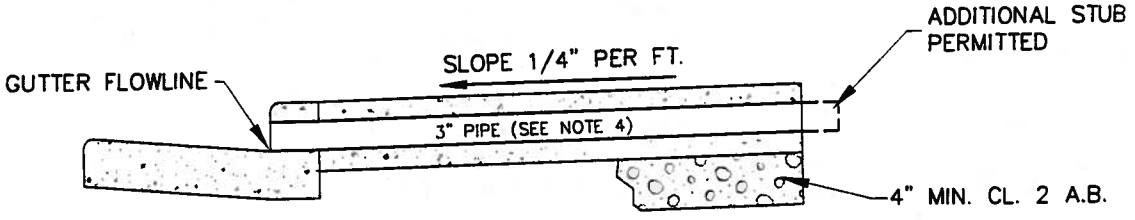
SCALE: NONE	DRAWN: CLG	CHK: JHG	APPVD:	DATE: APR. 2004

FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG

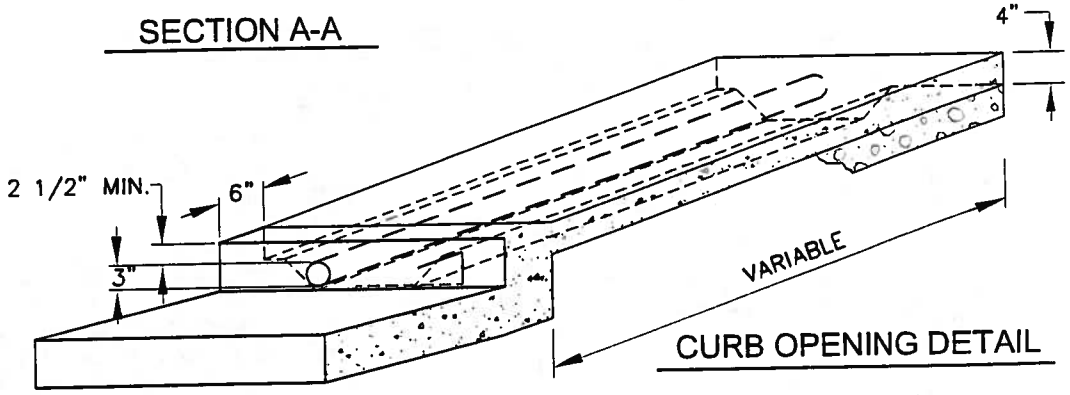
NOTE: IF SIDEWALK IS EXISTING, A 12" SECTION MAY BE SAWCUT TO PLACE 3" P.V.C. & W.W.F.



PLAN



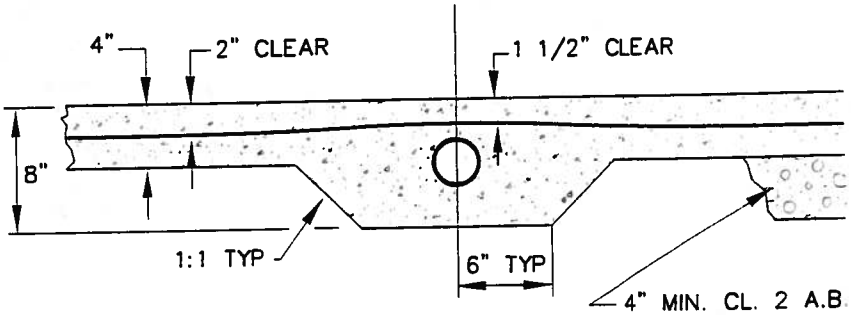
SECTION A-A



CURB OPENING DETAIL

NOTES:

1. WIRE MESH SHALL BE 2' WIDE. LENGTH SHALL EQUAL SIDEWALK WIDTH MINUS 4". IF SIDEWALK IS EXISTING, SEE NOTE ABOVE.
2. ON–SITE DRAINAGE AND LOCATION OF CURB OUTLETS SHALL BE BY THE OWNER TO THE SATISFACTION OF THE CITY ENGINEER.
3. DRAIN PIPE SHALL BE INSTALLED SO THAT TOP OF PIPE IS 2–1/2" MIN. BELOW FINISH GRADE AT BACK OF SIDEWALK.
4. SIDEWALK DRAIN TO BE 3" SCH. 40, HEAVY WALL, RIDGID POLYVINYL CHLORIDE PIPE OR APPROVED SUBSTITUTE.



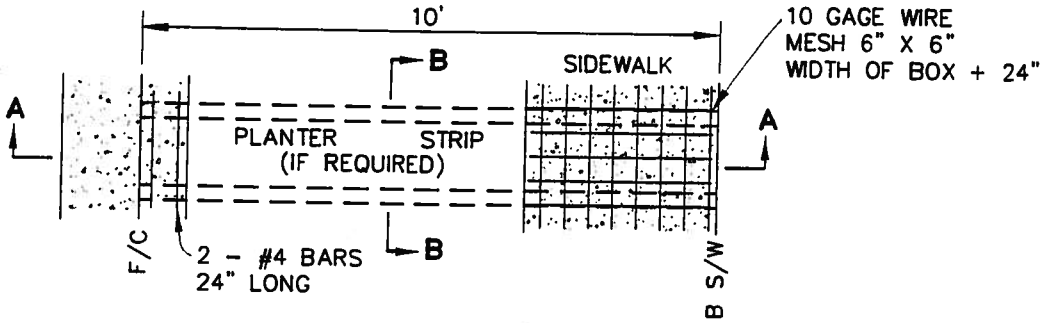
SECTION B-B

SIDEWALK DRAIN

STD. NO. 409

SCALE: NONE	DRAWN: LMM	CHK: JHG	APPVD:	DATE: APR. 2004

FILE: BMAP–STD\CLOVER\STD\CLOV400–411.DWG



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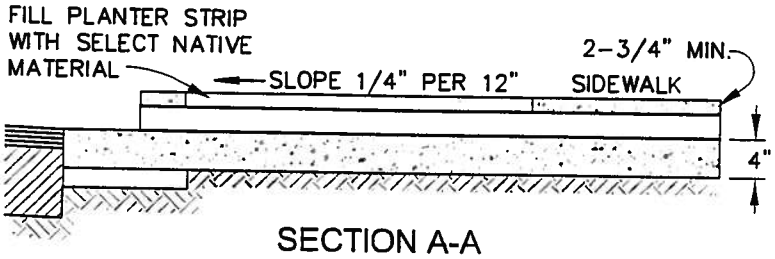
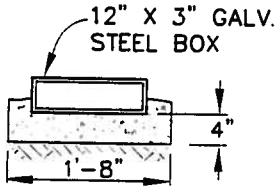


SECTION A-A



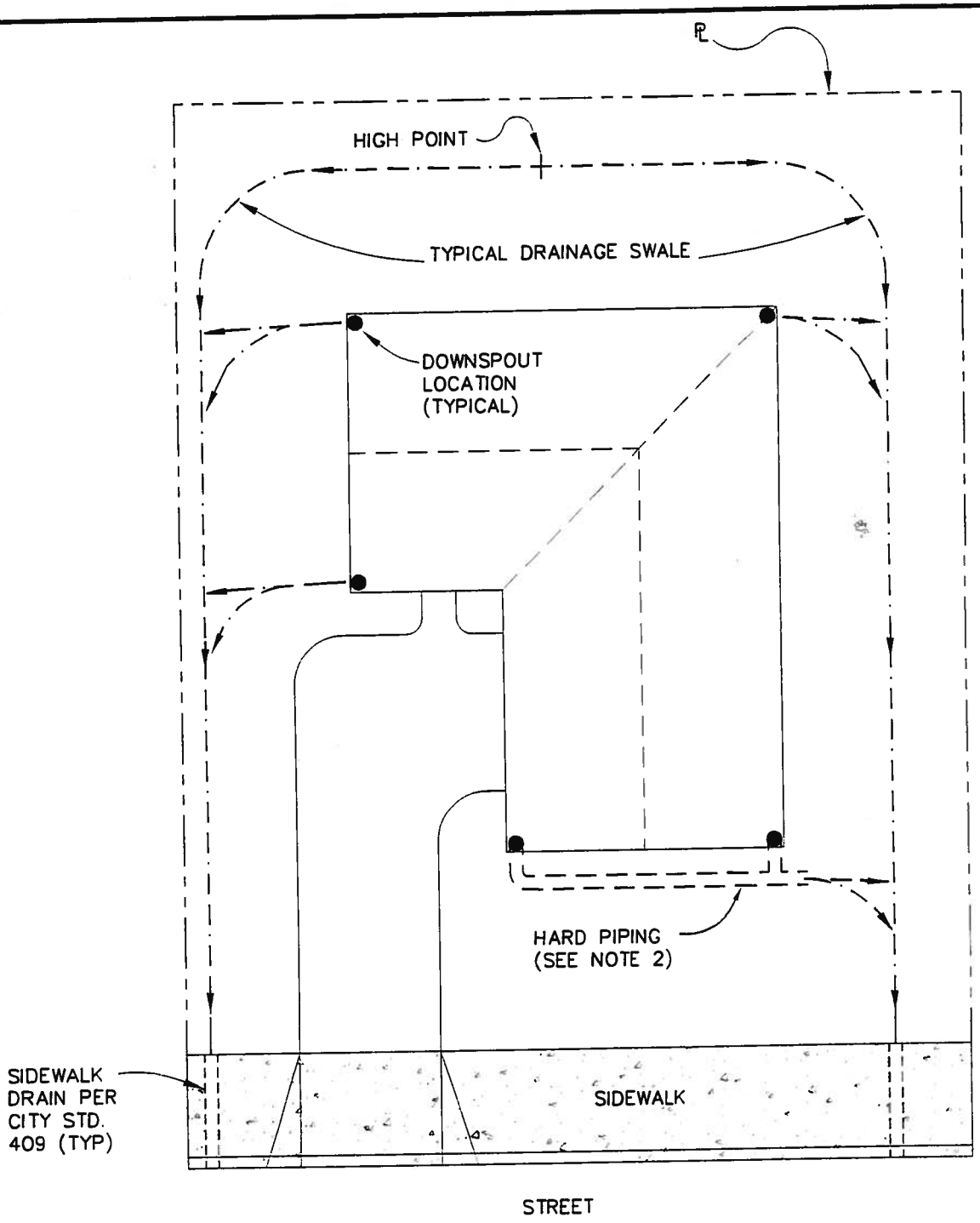
SECTION B-B

NOTES:

1. WITH APPROVAL OF THE CITY ENGINEER, WIDTH OF BOX MAY VARY FROM 6" TO 12".
2. GALVANIZED STEEL TO BE 1/4" THICK.
3. ALL CONCRETE SHALL BE CLASS "A" (6 SACKS PER CUBIC YARD).

CITY OF CLOVERDALE CALIFORNIA	SIDEWALK CROSS DRAIN				STD. NO. 410
	SCALE: NONE	DRAWN: LMM	CHK: JHG	APPVD:	DATE: APR. 2004

FILE: BMAP-STD\CLOVER\STD\CLOV400-411.DWG



NOTES:

1. ALL ROOF DRAINAGE MUST BE ROUTED FROM EACH DOWNSPOUT THROUGH SURFACE SWALES TO SIDEWALK DRAIN OR OTHER APPROVED DRAINAGE STUCTURE.
2. HARD PIPING SHALL BE FLEXIBLE A.D.S. PIPE WITH POSITIVE DRAINAGE TO SWALES, AS APPROVED BY THE CITY ENGINEER OR BUILDING OFFICIAL.
3. ALL CONCENTRATED DRAINAGE FROM A PARCEL MUST BE INTERCEPTED INTO AN UNDERGROUND SYSTEM PRIOR TO CROSSING SIDEWALKS.
4. ALL HARD PIPING SHALL BE BURIED.

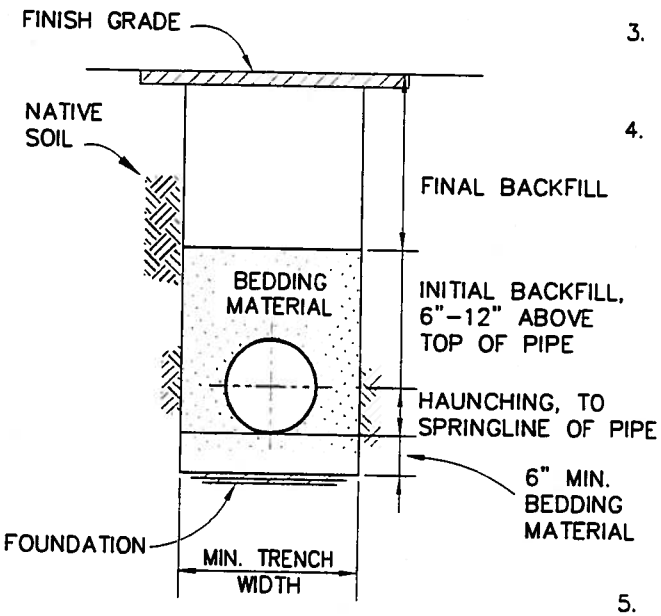
CITY OF CLOVERDALE CALIFORNIA

TYPICAL LOT DRAINAGE

STD. NO. 411

SCALE: NONE	DRAWN: LMM	CHK: JHG	APPVD:	DATE: MAY 2004

FILE: BMAP-STD\CLOVER\STD\CLOV400-412.DWG



TYPICAL TRENCH CROSS-SECTION

(N.T.S.)

NOTES:

1. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER AND REPLACE WITH A FOUNDATION OF CLASS I OR II MATERIAL AS DEFINED IN ASTM D2321, "STANDARD PRACTICE FOR INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY–FLOW APPLICATIONS," LATEST EDITION; AS AN ALTERNATIVE AND AT THE DISCRETION OF THE ENGINEER, THE TRENCH BOTTOM MAY BE STABILIZED USING A WOVEN GEOTEXTILE FABRIC.

2. BEDDING: SUITABLE MATERIAL SHALL BE CLASS I, II, OR III, AND INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION.

3. HAULING AND INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE CLASS I, II, OR III, AND INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION.

4. UNLESS OTHERWISE SPECIFIED BY THE ENGINEER, MINIMUM TRENCH WIDTHS SHALL BE AS FOLLOWS:

NOMINAL ø IN INCHES	MIN. RECOMMENDED TRENCH WIDTH
4"	21"
6"	23"
8"	25"
10"	28"
12"	31"
15"	34"
18"	39"
24"	48"
30"	66"
36"	78"
42"	83"
48"	89"
60"	102"

5. MINIMUM COVER: MINIMUM RECOMMENDED DEPTHS OF COVER FOR VARIOUS LIVE LOADING CONDITIONS ARE SUMMARIZED IN THE FOLLOWING TABLE. UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE TAKEN FROM THE TOP OF PIPE TO THE GROUND SURFACE.

SURFACE LIVE LOADING CONDITION	MINIMUM RECOMMENDED COVER IN INCHES
H25 (FLEXIBLE PAVEMENT)	24"
H25 (RIGID PAVEMENT)	24"
E80 RAILWAY	24"
HEAVY CONSTRUCTION	48"

*TOP OF PIPE TO BOTTOM OF BITUMINUS PAVEMENT SECTION.

CITY OF CLOVERDALE CALIFORNIA	HDPE TRENCH INSTALLATION DETAIL				STD. NO. 412
	SCALE: NONE	DRAWN: CLG	CHK: JHG	APPVD:	DATE: APR. 2004

FILE: BMAP-STD\CLOVER\STD\CLOV400-412.DWG