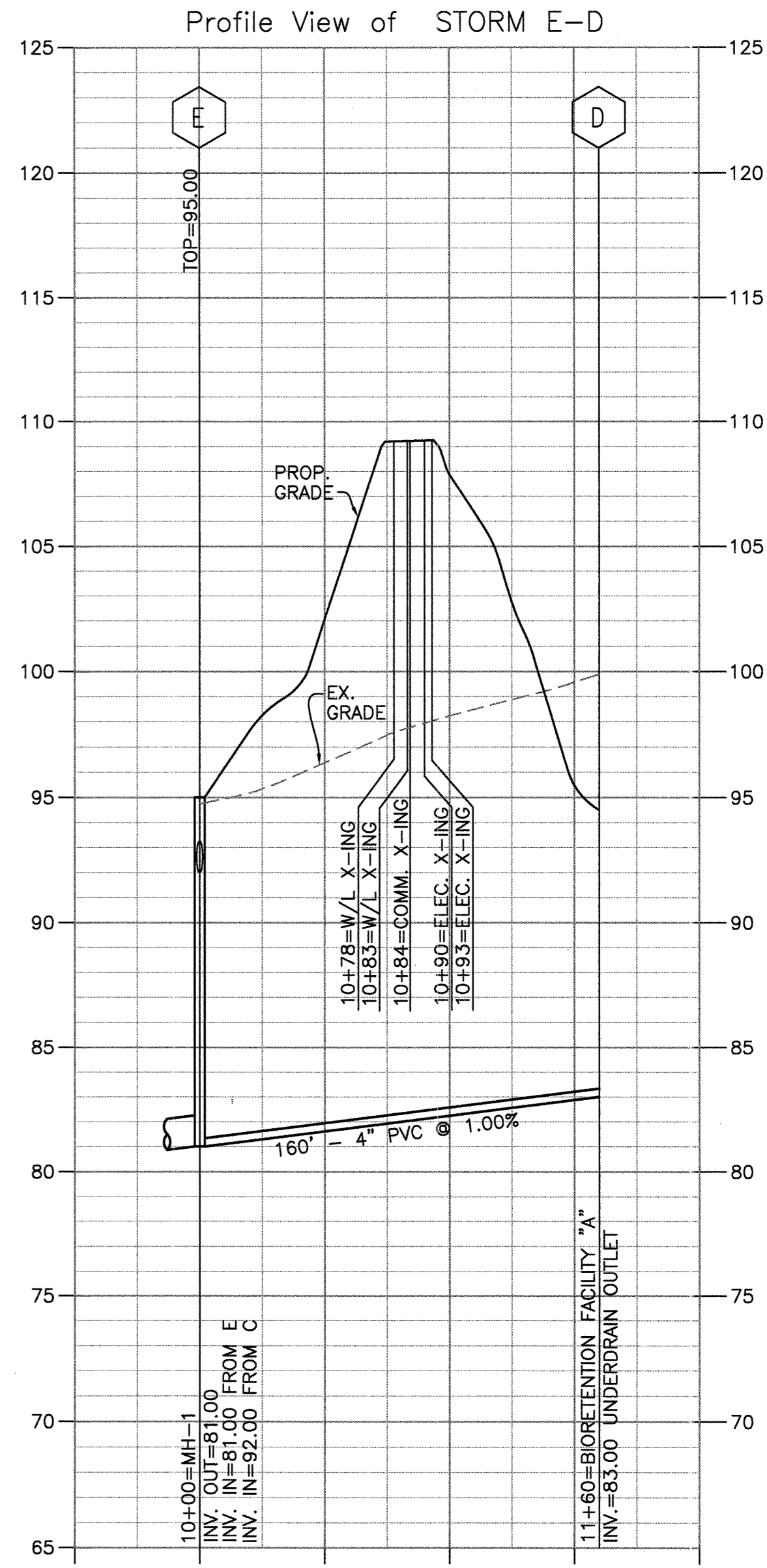
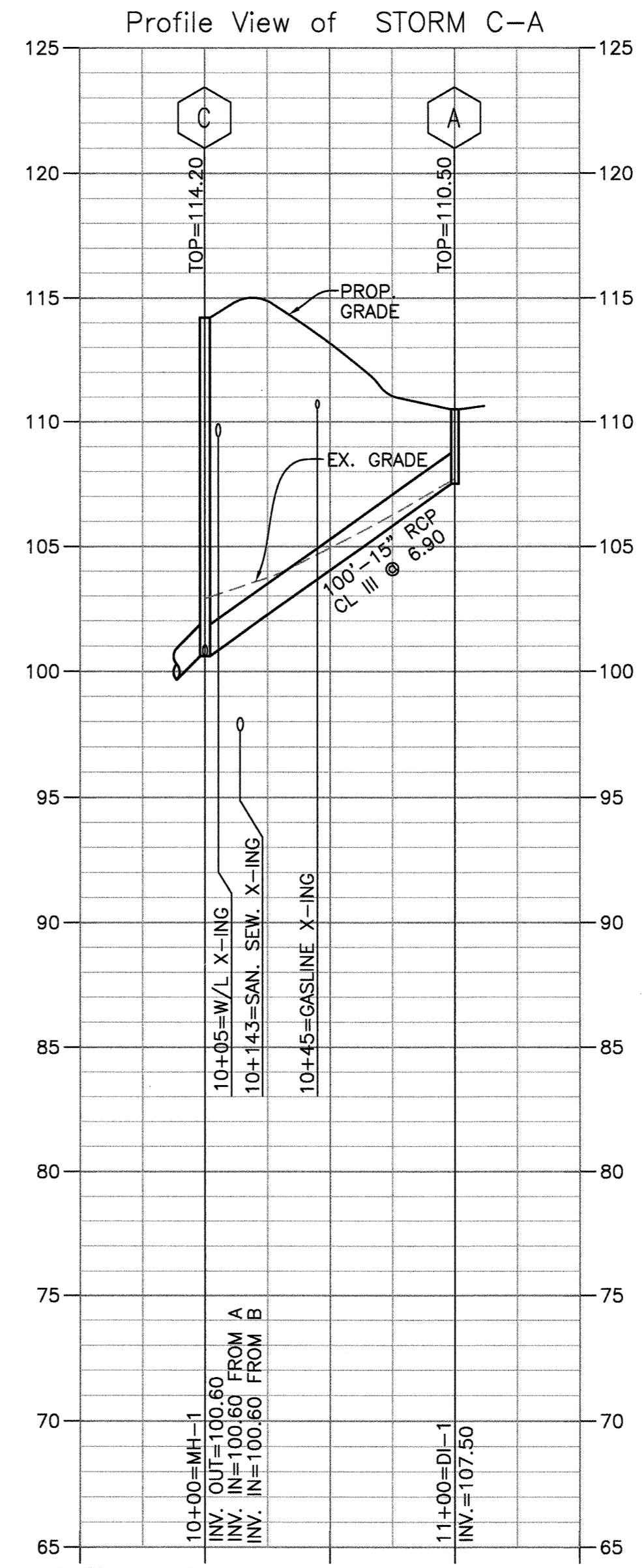
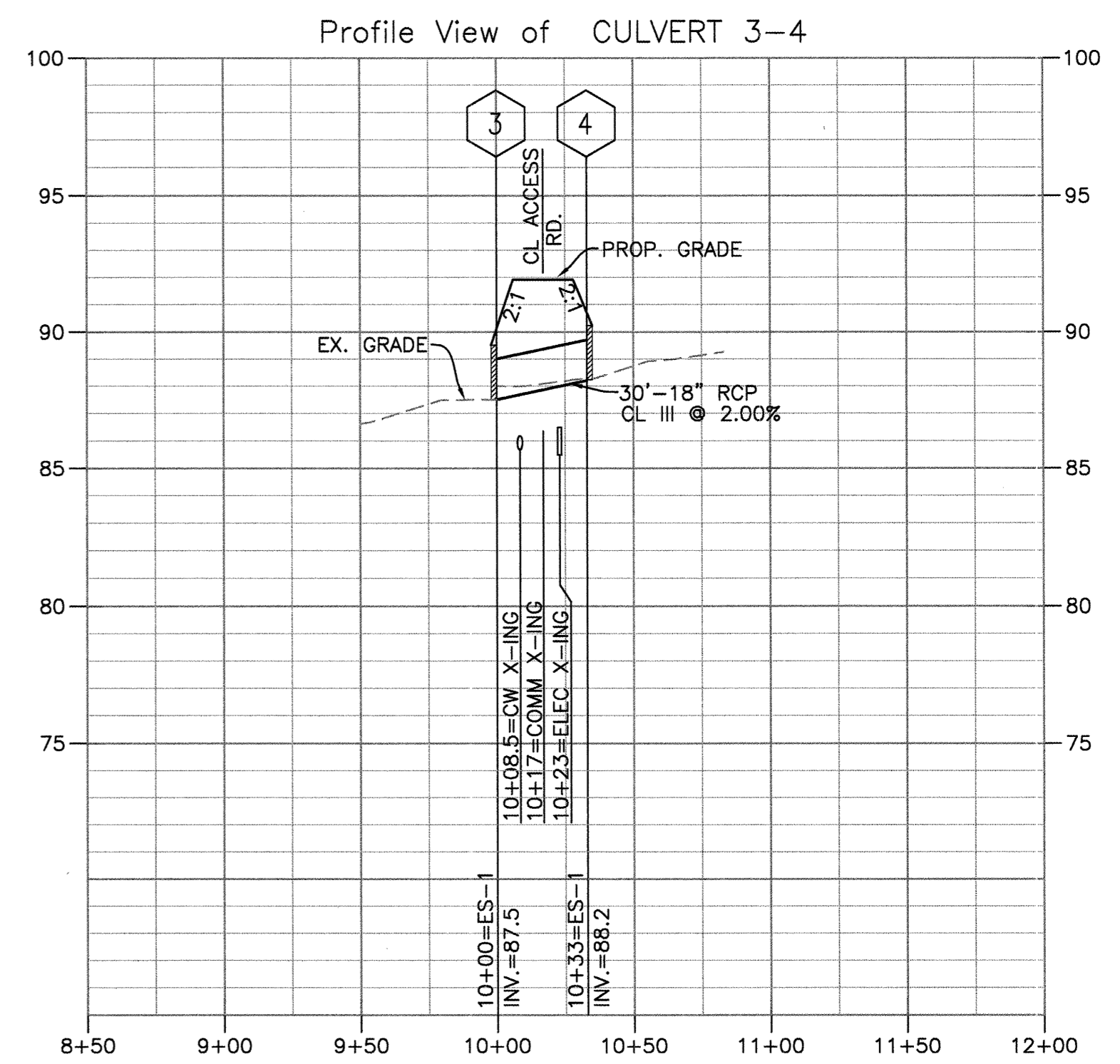
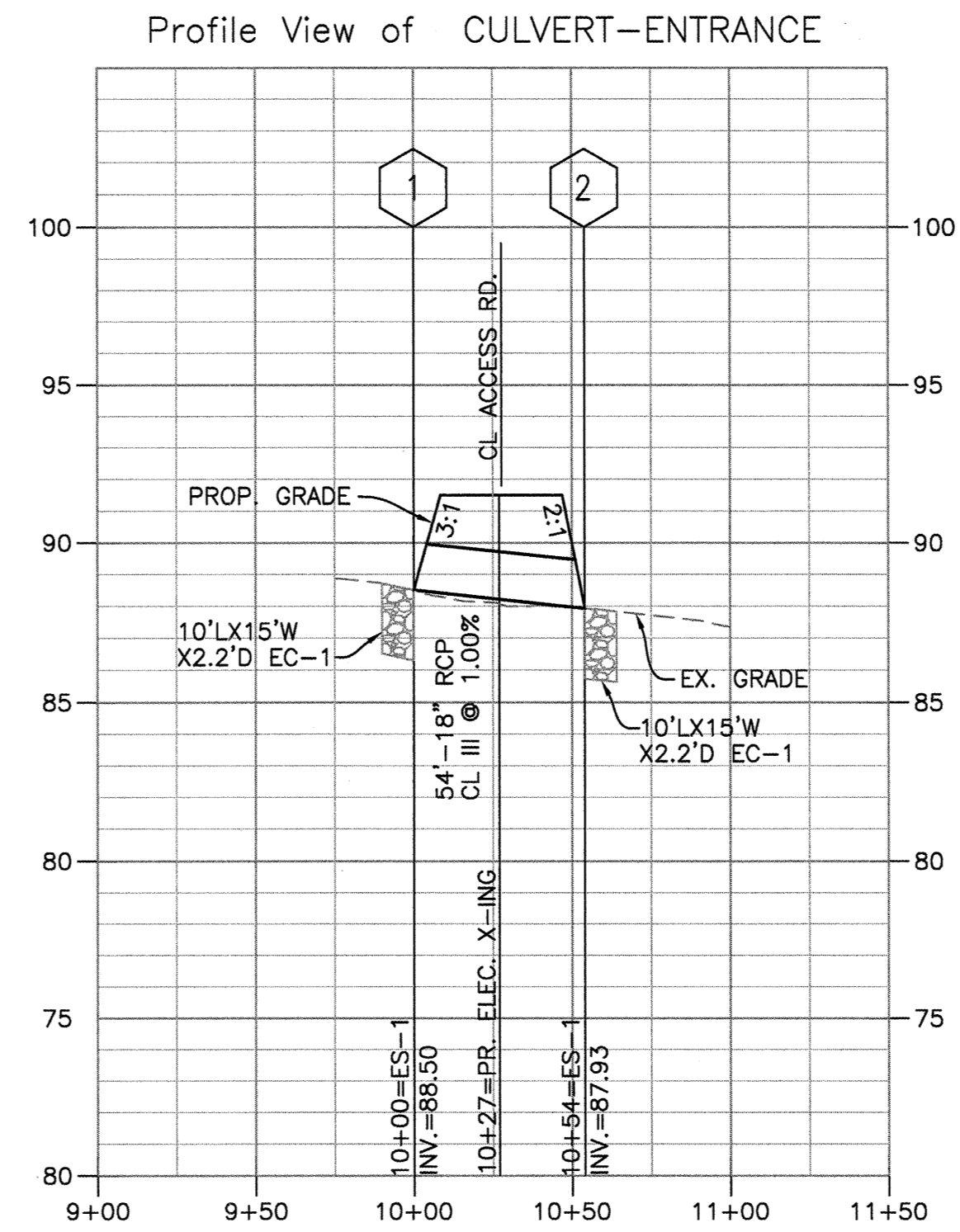
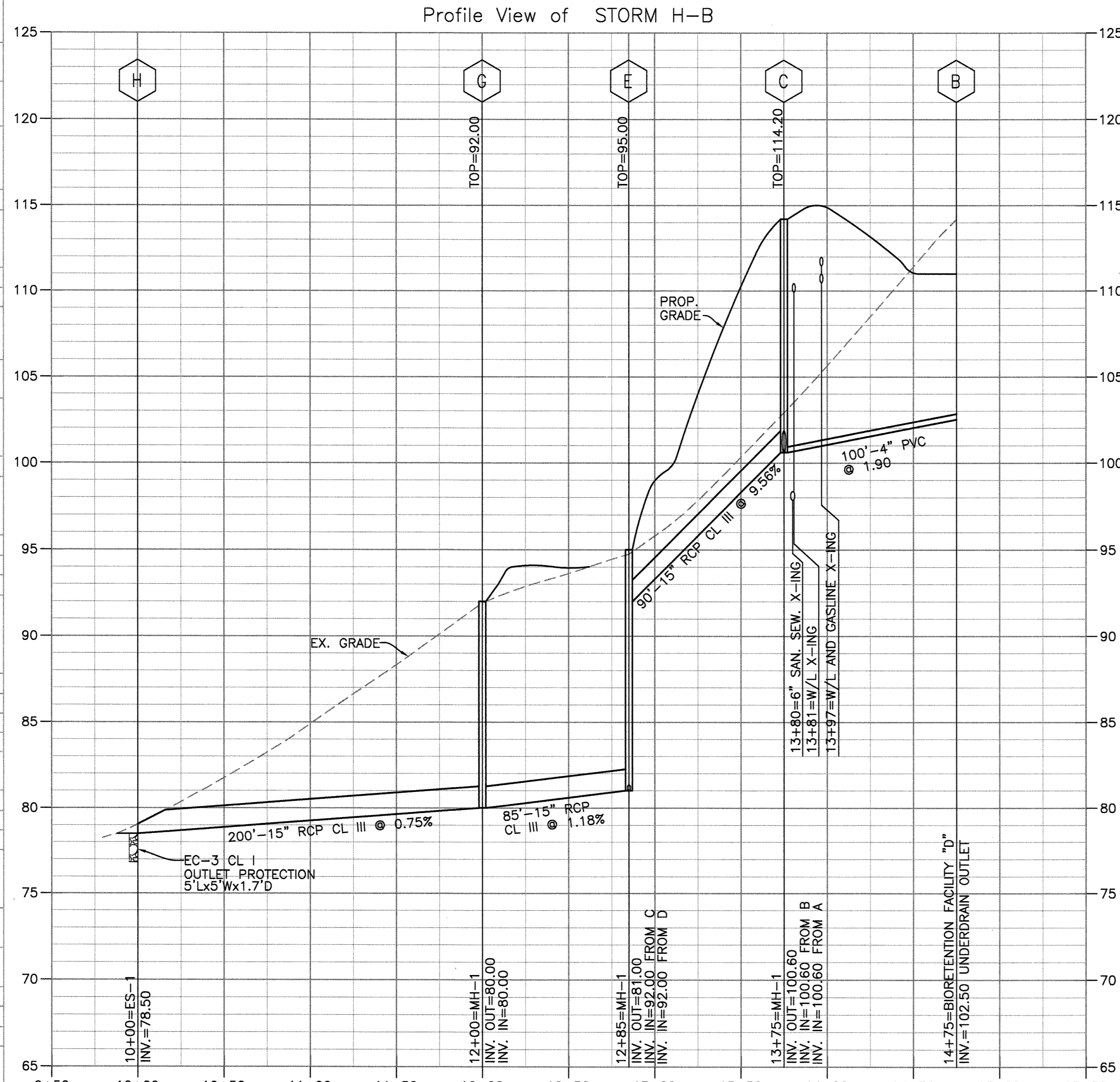


VDOT CULVERT OUTLET PROTECTION: EC-1 (HDA 06-03)	
Step 1 - Determine if Culvert Outlet Protection is required for protection of swale or channel	
A. Compute culvert outlet velocity for 2 year design storm:	3.72 fps
B. Compare 2 year design storm culvert outlet velocity to allowable velocity for outlet swale/channel material or lining. Allowable velocity: -Swale/channel material type based on field boring/observations or proposed lining. -Allowable velocity for natural swale/channel material based on VDOT Drainage Manual Chapter 7 - Appendix 7D-2.	3.5 fps
C. If two year design storm culvert outlet velocity is equal to or less than allowable velocity for swale/channel material, no Culvert Outlet Protection is required for swale/channel. Go to Step 2.	
D. If two year design storm culvert outlet velocity is greater than allowable velocity for swale/channel material, Culvert Outlet Protection is required. Go to Step 3.	
Step 2 - Determine Culvert Outlet Protection required for culvert end protection	
A. Compute culvert outlet velocity for culvert design storm (10 yr.)	fps
B. If culvert outlet velocity for culvert design storm is less than 6 fps, Culvert Outlet Protection is not required for culvert end protection. Stop.	
C. If culvert outlet velocity for design storm is 6 fps or greater, Culvert Outlet Protection is required for culvert end protection. Go to Step 3.	
Step 3 - Determine Class of Culvert Outlet Protection to use.	
A. When Culvert Outlet Protection is required by either Step 1 or Step 2, the Class of EC-1 to be specified shall be based on the culvert design storm outlet velocity with the following velocity limitations.	
- EC-1 Class 1: maximum outlet velocity is 6 fps.	
- EC-1 Class 2: maximum outlet velocity is 8 fps.	
- EC-1 Class 3: maximum outlet velocity is 14 fps.	
- EC-1 Class 4: maximum outlet velocity is 19 fps.	
- Use Special Design Culvert Outlet Protection for outlet velocity greater than 19 fps.	
Go to Step 4.	
Step 4 - Determine Type of EC-1 Installation to use.	
When Culvert Outlet Protection is required by either Step 1 or Step 2, specify the Type of Installation to use based on the total hydraulic opening of the culvert installation.	
- Use Type A Installation for culvert installations with a total hydraulic opening of less than 7 square feet.	
- Use Type B Installation for culvert installations with a total hydraulic opening of 7 square feet or greater.	
Summary Plan Description	
2.75 Sq. Yds. Standard EC-1 Class 1 Required. Type <u>A</u> Installation	



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STORM DRAIN PROFILES, DETAILS AND COMPUTATIONS

DATE: 01/14/11
ENGINEER: LCG
CAD: KAB
CHECKED: WBS
JOB#: 109-084

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No. 00000025453

PLAN REVISIONS -

SHEET C4.21
18 OF 80

SCALE
H: 1" = 50'
V: 1" = 5'