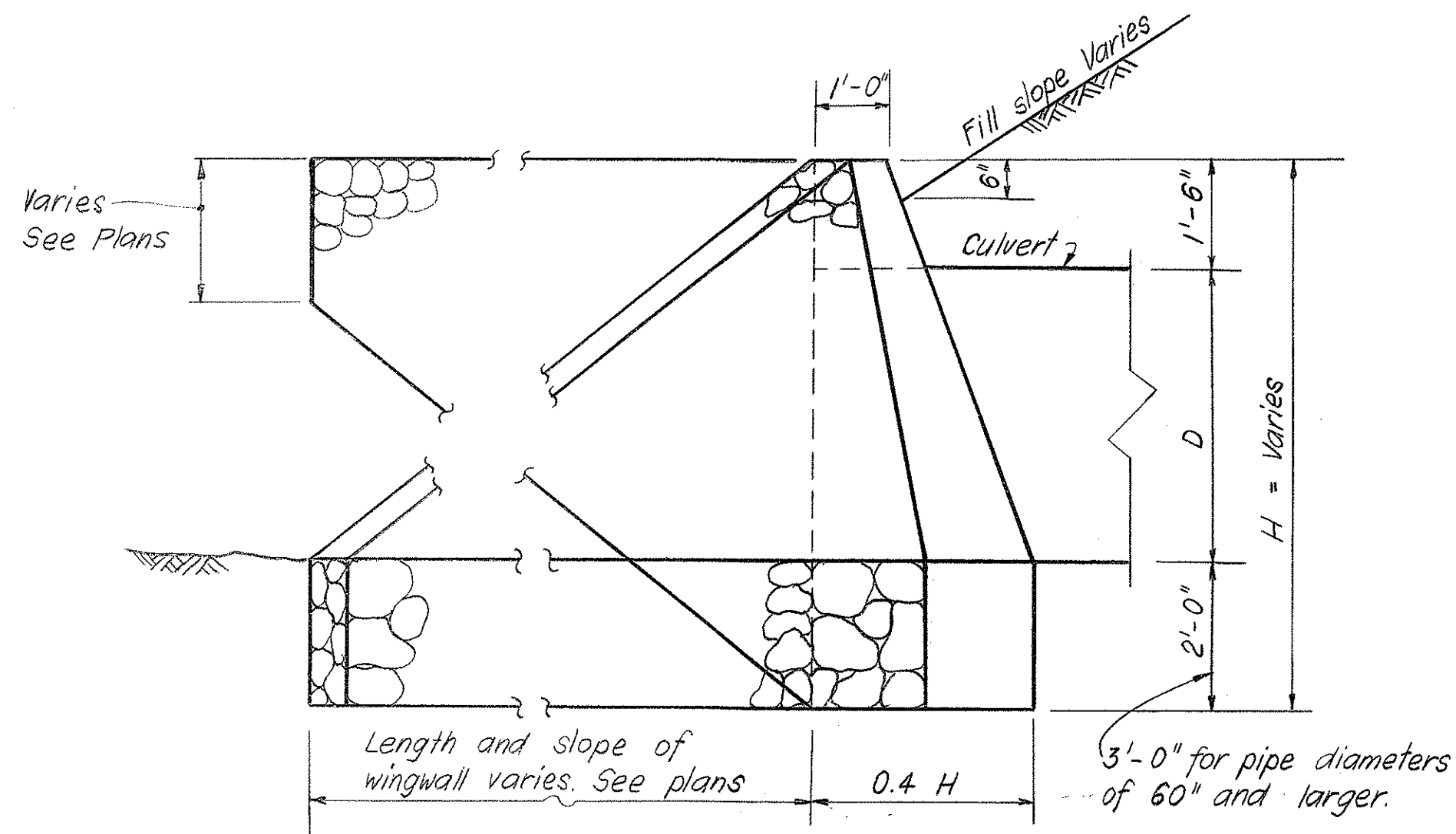
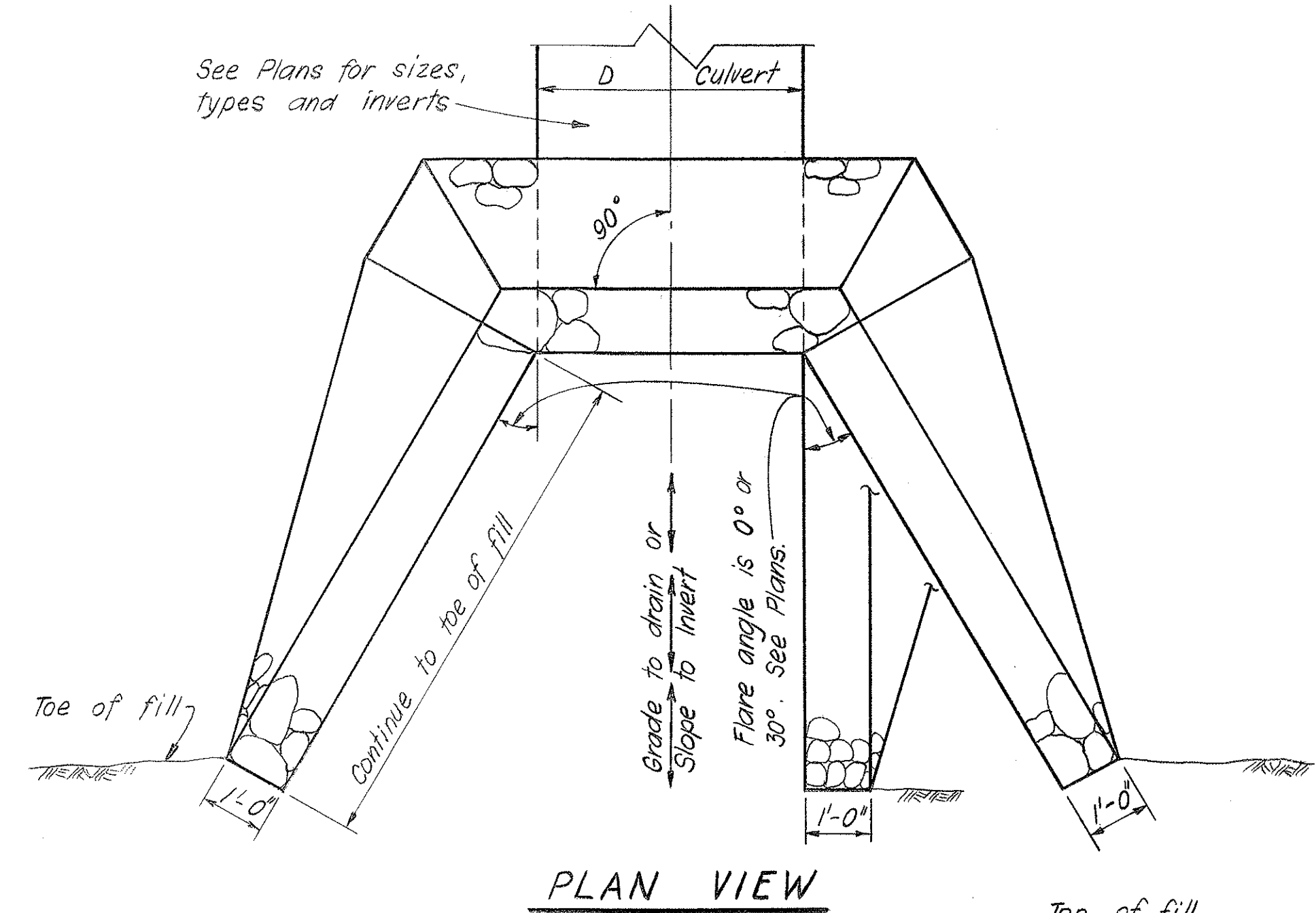


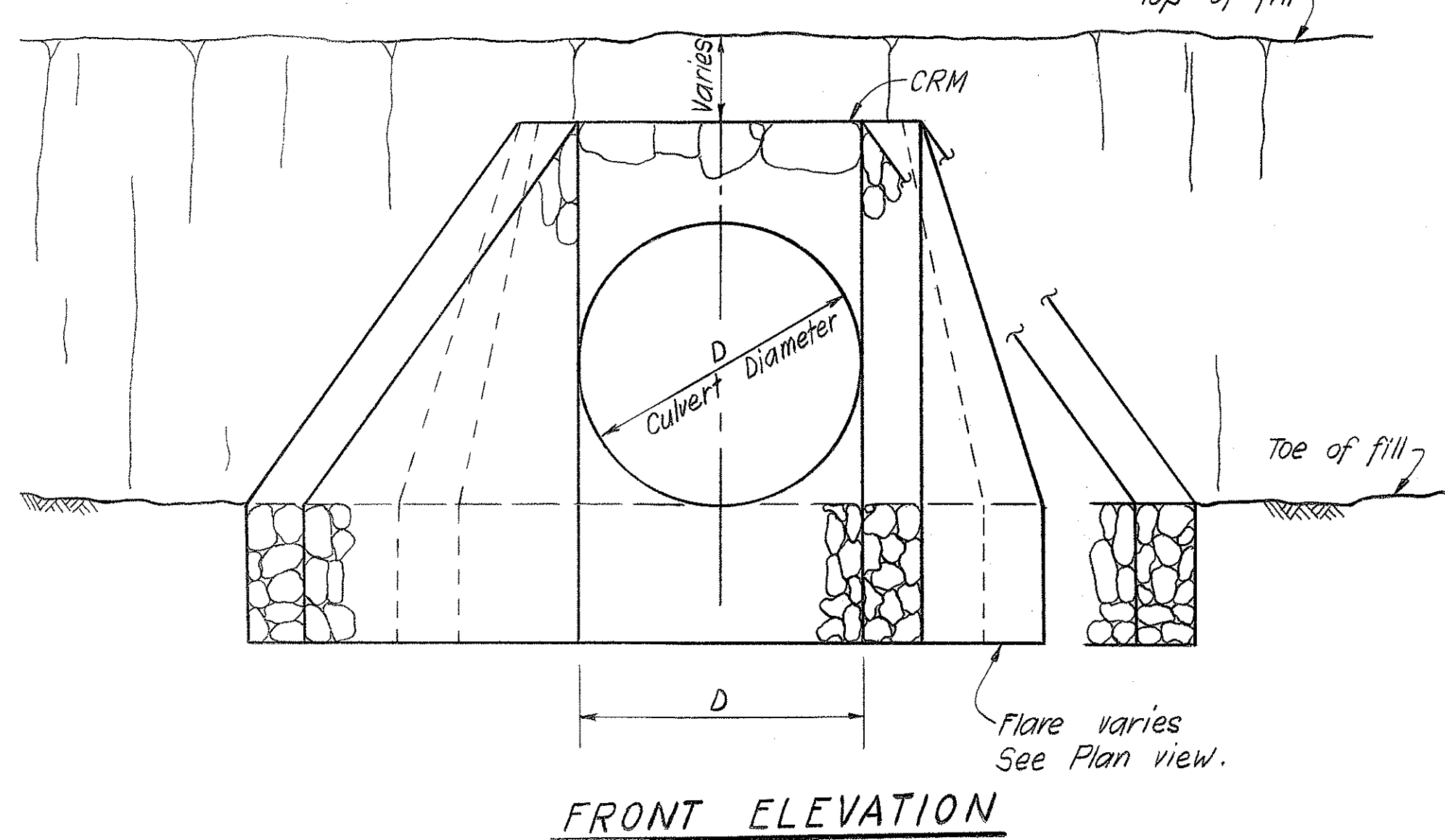
| STATE | PROJ. NO.  | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|-------|------------|-------------|-----------|--------------|
| HAW.  | BMD 66-343 | FY 71-72    | 31        | 88           |



SIDE ELEVATION

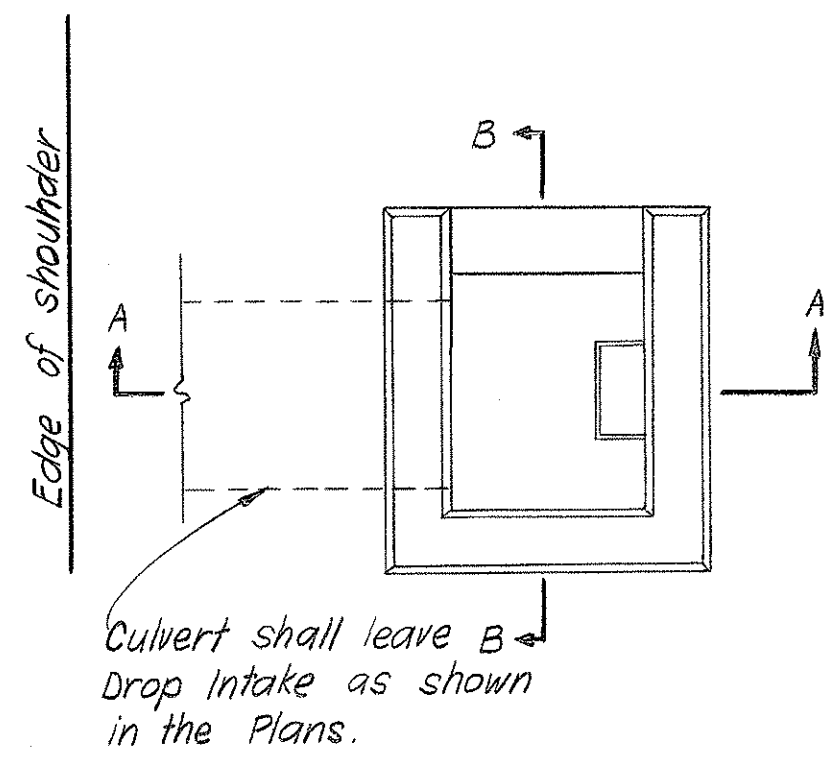


PLAN VIEW



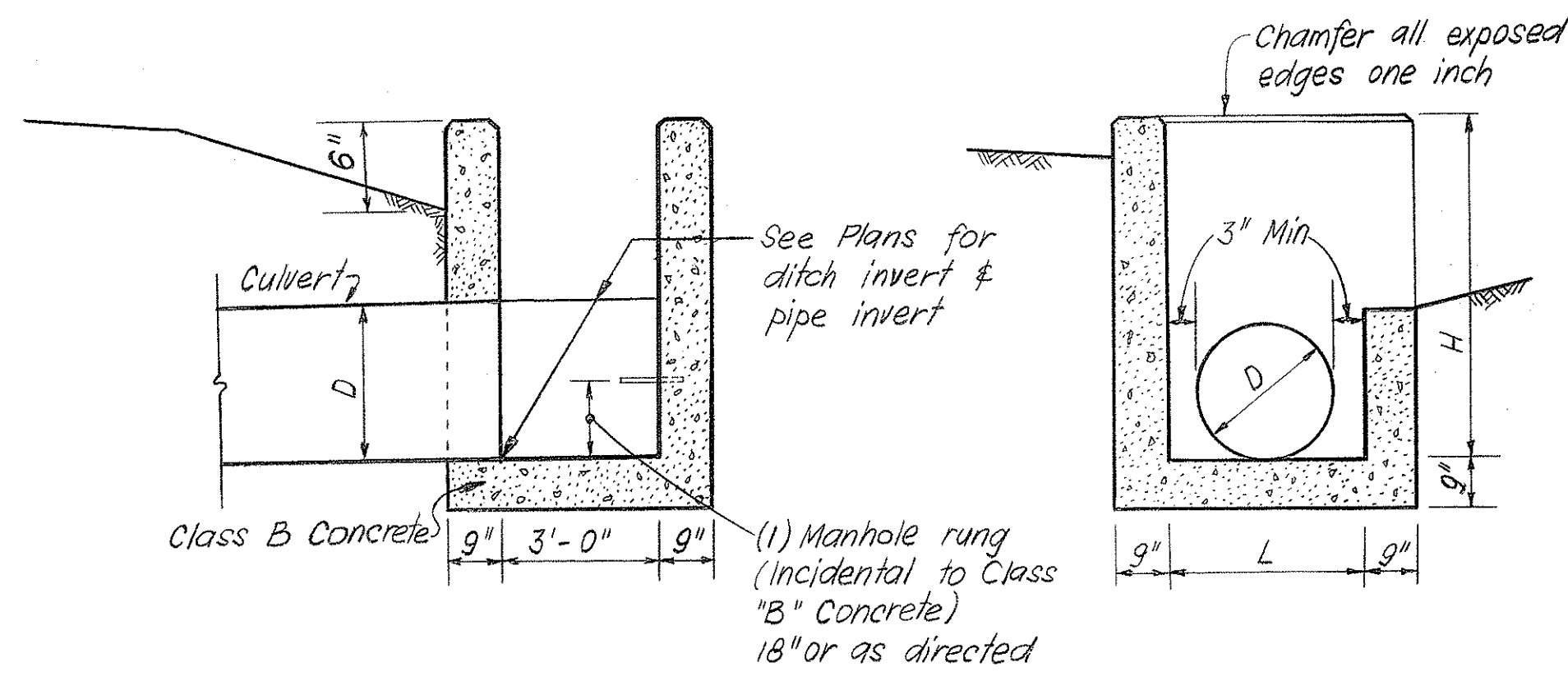
FRONT ELEVATION

DETAILS OF CRM INLET & OUTLET STRUCTURES  
SCALE : 1/2" = 1'-0"



PLAN

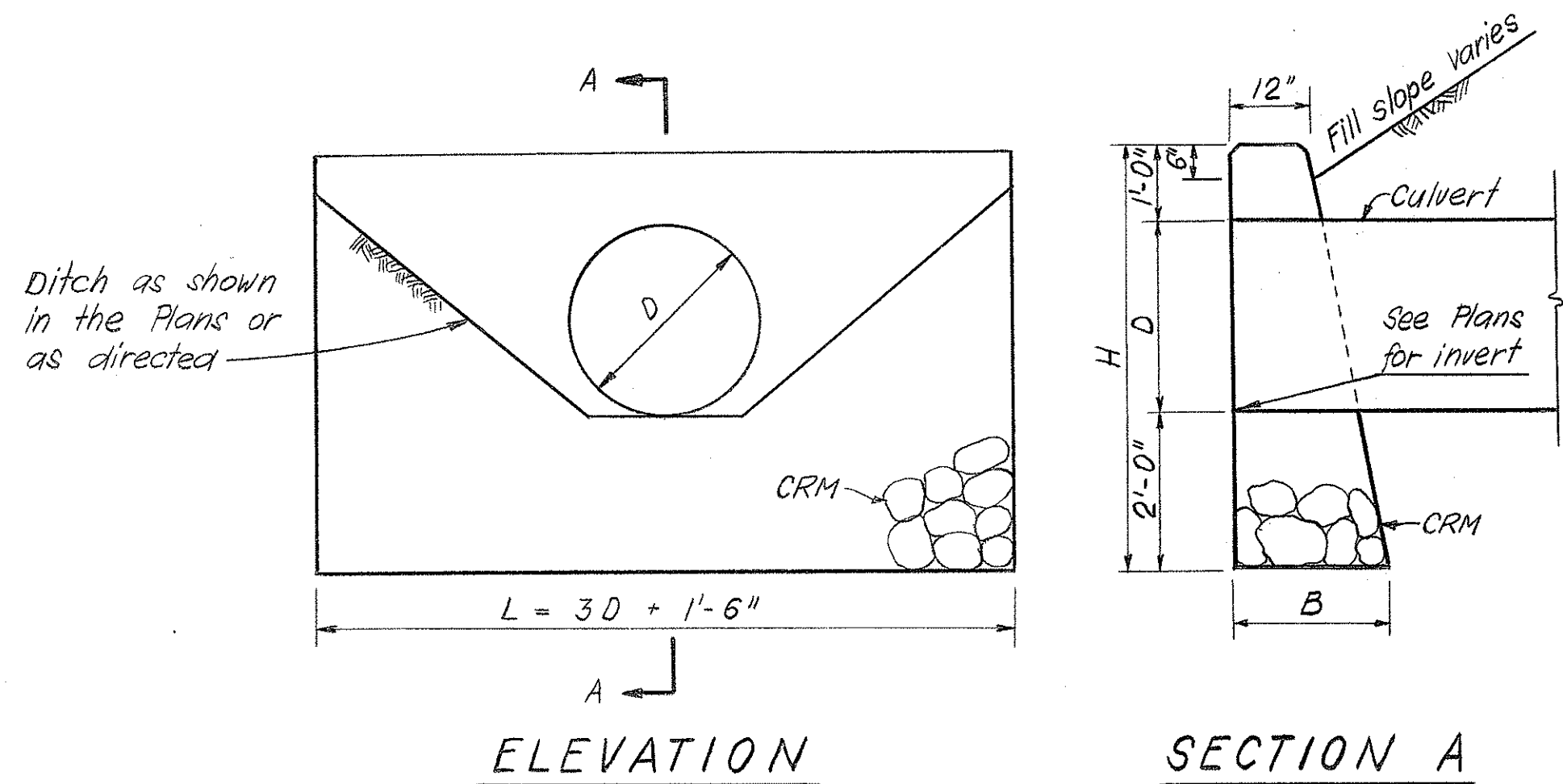
| D   | L = D + 12" | H     | Cu Yds |
|-----|-------------|-------|--------|
| 30" | 3'-6"       | 4'-9" | 2.3    |
| 36" | 4'-0"       | 5'-3" | 2.7    |



SECTION A

SECTION B

DETAILS OF CONCRETE DROP INTAKE  
SCALE : 1/2" = 1'-0"

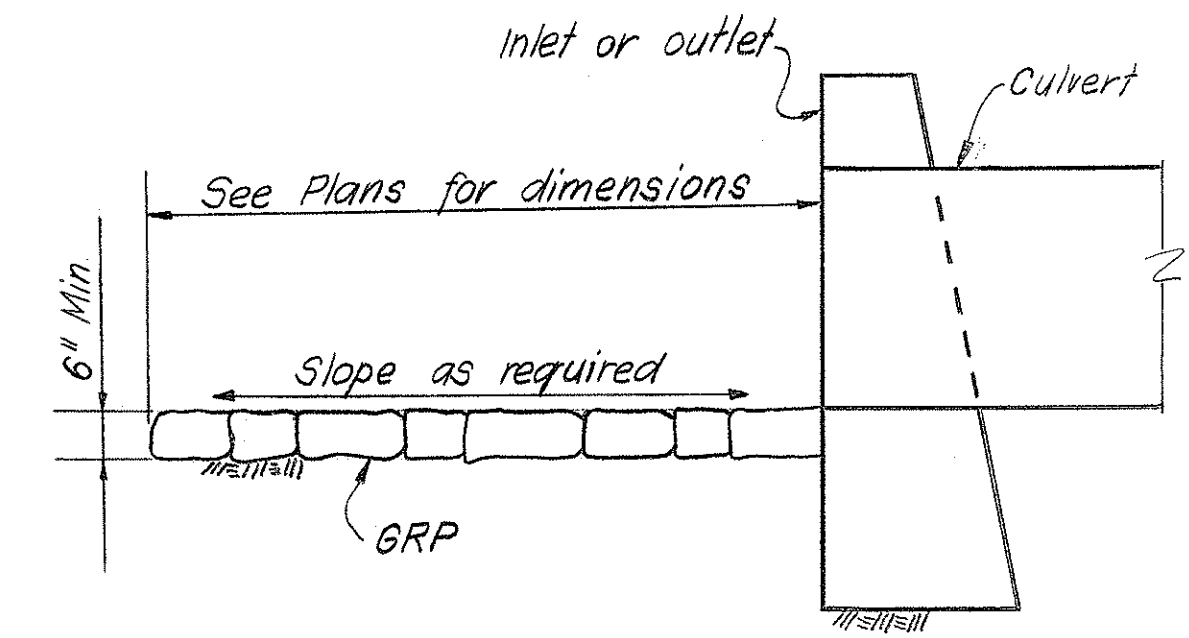


ELEVATION

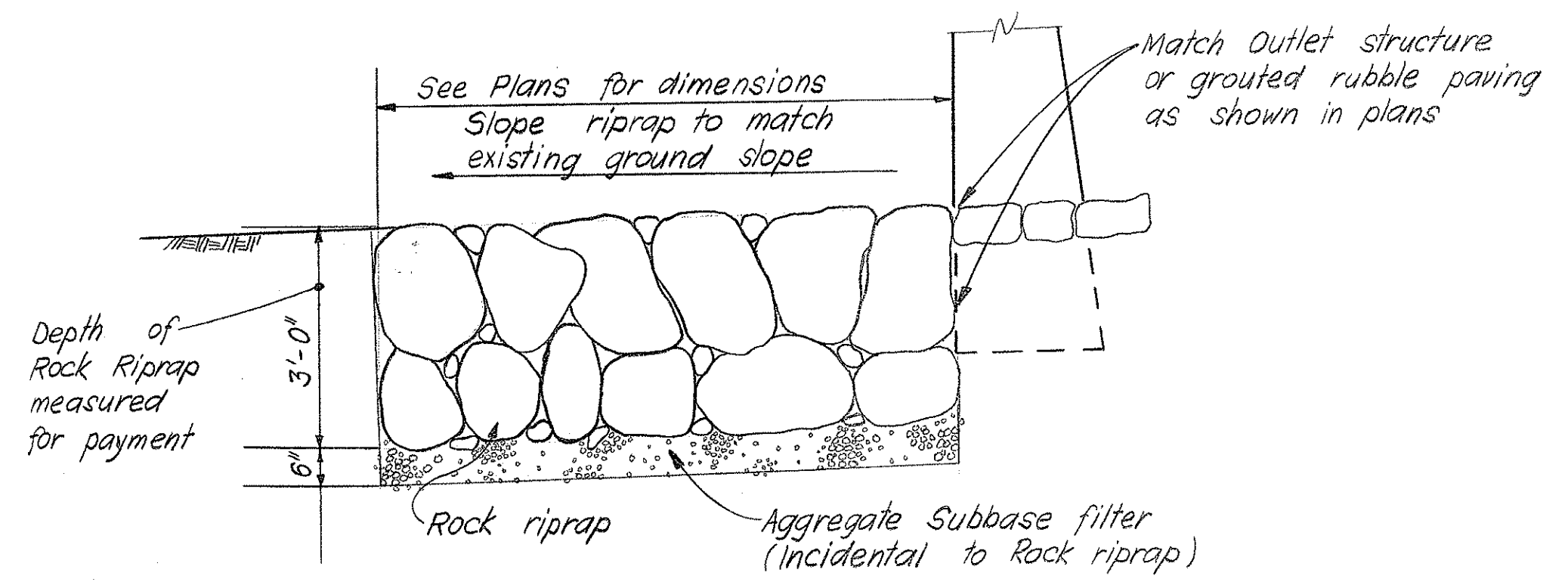
SECTION A

| D   | B     | L      | H     | Cu Yd |
|-----|-------|--------|-------|-------|
| 24" | 2'-0" | 7'-6"  | 5'-0" | 1.9   |
| 30" | 2'-3" | 9'-0"  | 5'-6" | 2.7   |
| 36" | 2'-6" | 10'-6" | 6'-0" | 3.7   |

DETAILS OF CRM HEADWALL & ENDWALL  
SCALE : 1/2" = 1'-0"



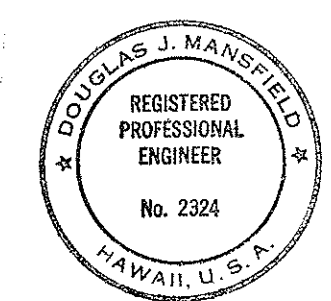
DETAILS OF GROUTED RUBBLE PAVING  
NO SCALE



DETAILS OF ROCK RIPRAP  
NO SCALE

GENERAL NOTES FOR DRAINAGE STRUCTURES

- For horizontal & vertical geometry of roadway see Plan & Profile sheets.
- Structural Plate Culverts shall have their vertical dimensions increased by 5% from a full circular cross section before any fill is placed.
- Culvert ends shall be cut flush with face of inlet or outlet, or as directed.
- Top of cut slope
- Toe of fill slope
- Cut & fill slopes shall be constructed in accordance with Dwg No C1, Typical Roadway Sections, except as required to match inlets & outlets.



This work was prepared by me or under my supervision.  
*Douglas J. Mansfield*

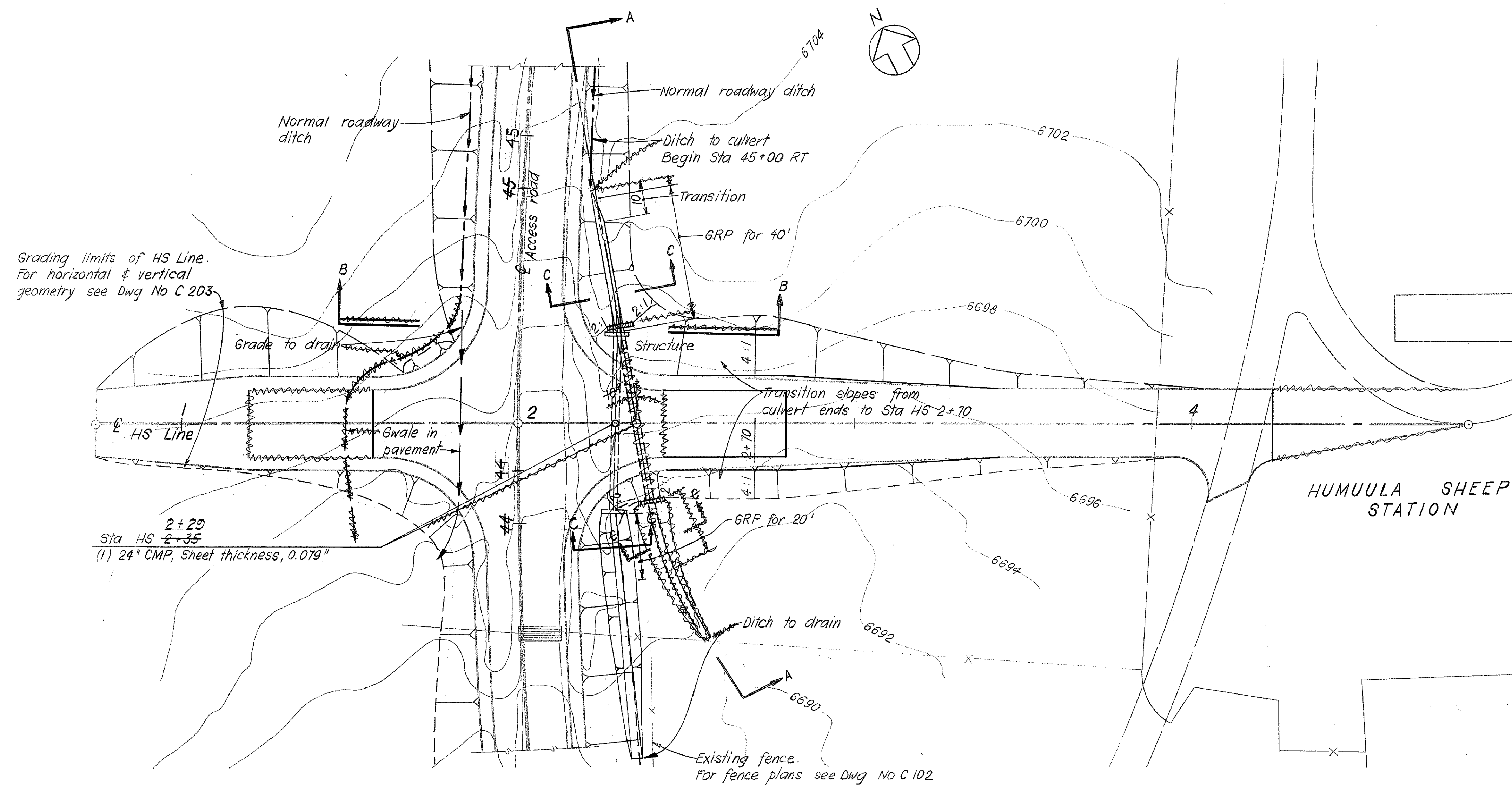
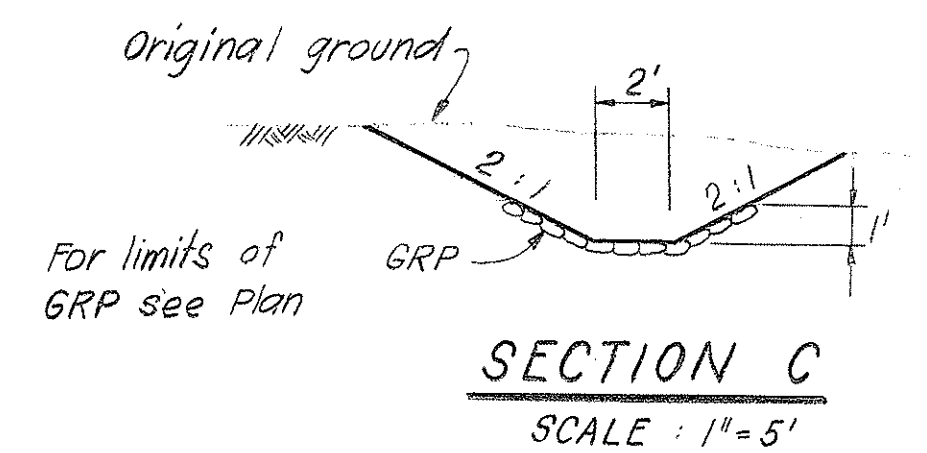
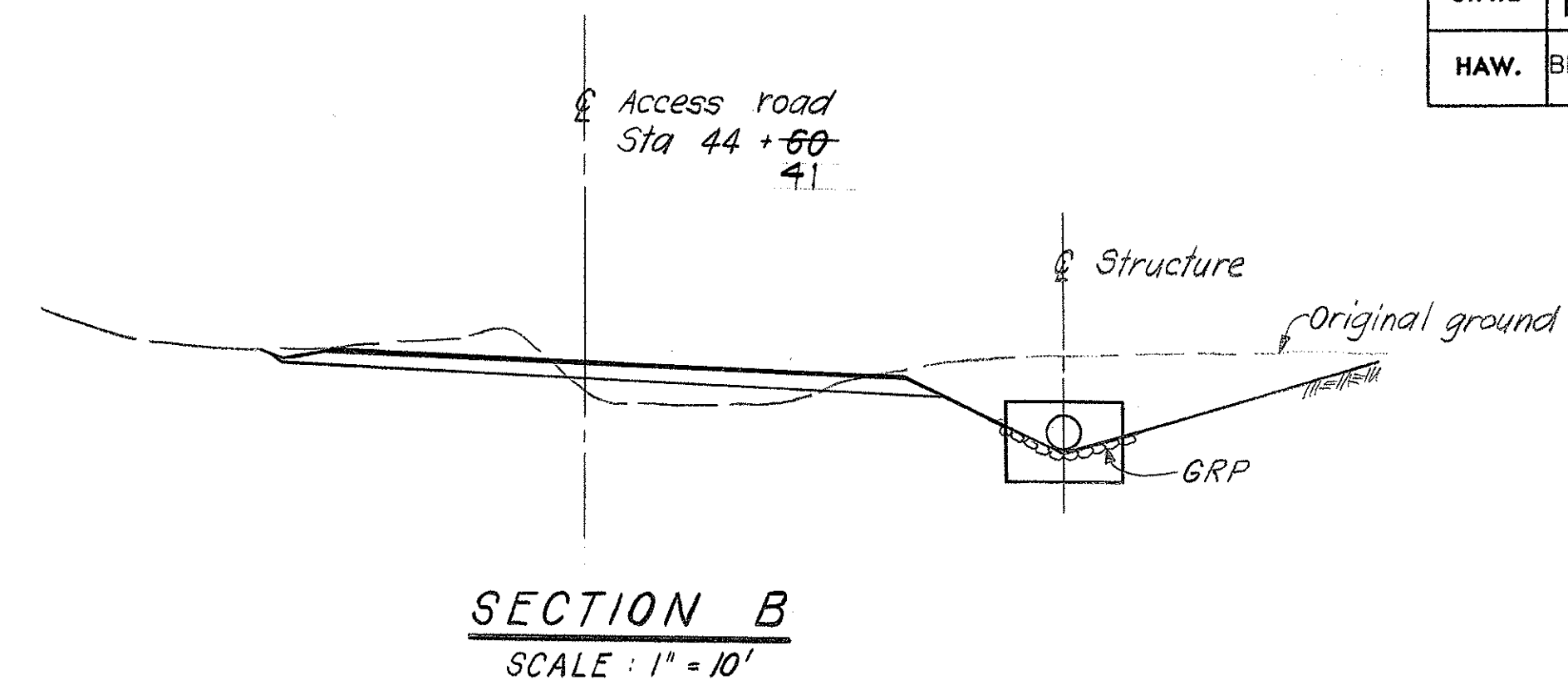
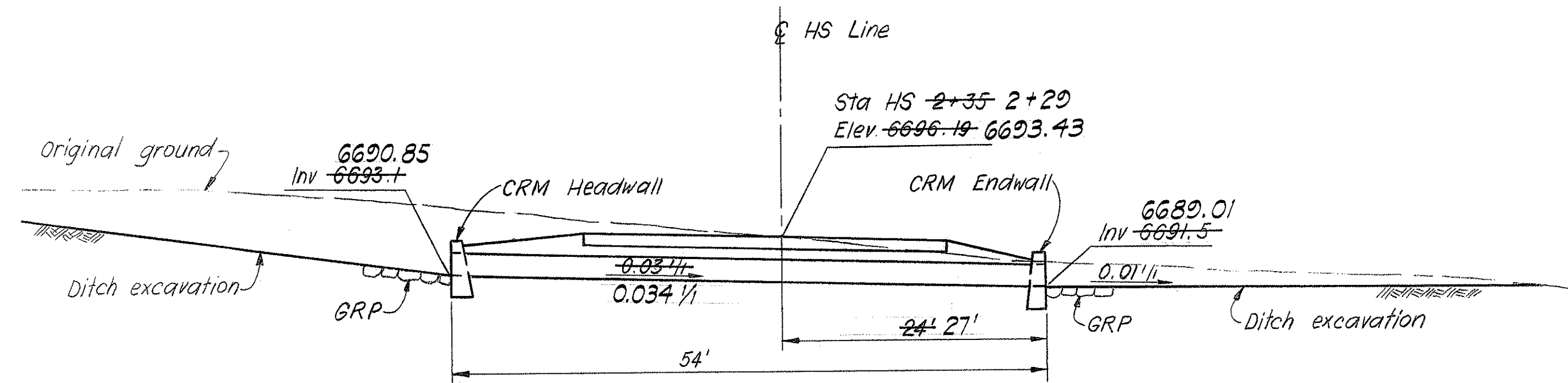
STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

DRAINAGE STRUCTURES  
MISCELLANEOUS DETAILS  
MAUNA KEA OBSERVATORY ACCESS ROAD  
PROJ. NO. BMD 66 - 343

SCALE : AS NOTED  
DATE : MARCH 1972  
SHEET No. 1 OF 10 SHEETS C501

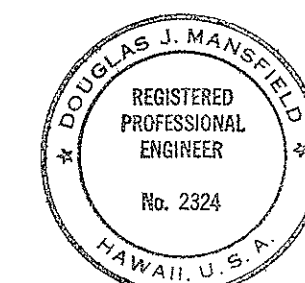
|                   |      |
|-------------------|------|
| SURVEY PLOTTED BY | DATE |
| DRAWN BY          |      |
| CHECKED BY        |      |
| NOTED BY          |      |
| ORIGINAL PLAN     |      |
| NOTE BOOK         |      |
| No.               |      |

| STATE | PROJ. NO.  | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|-------|------------|-------------|-----------|--------------|
| HAW.  | BMD 66-343 | FY 71-72    | 32        | 88           |



| <u>QUANTITIES</u>     | <u>STRUCTURE</u> |             |
|-----------------------|------------------|-------------|
|                       | <u>NO 2</u>      |             |
| Structure excavation  | <del>32</del>    | 33.4 Cu Yd  |
| Ditch excavation      | <del>65</del>    | 76.3 Cu Yd  |
| Cement Rubble Masonry | <del>4</del>     | 3.8 Cu Yd   |
| 24" CMP               | <del>54</del>    | 54.5 Lin Ft |
| Grouted Rubble Paving | <del>11</del>    | 2.6 Cu Yd   |

HUMUULA SHEEP  
STATION



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**STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION**

### DRAINAGE STRUCTURE DETAILS

MAUNA KEA OBSERVATORY ACCESS ROAD

PROJ. NO. BMD 66 - 343

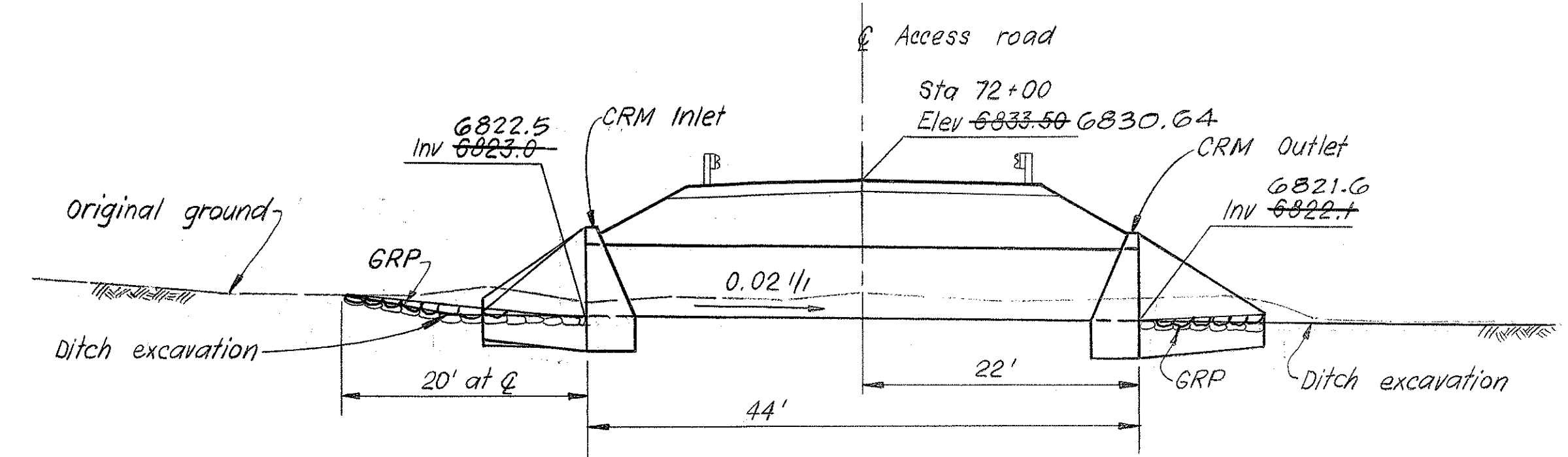
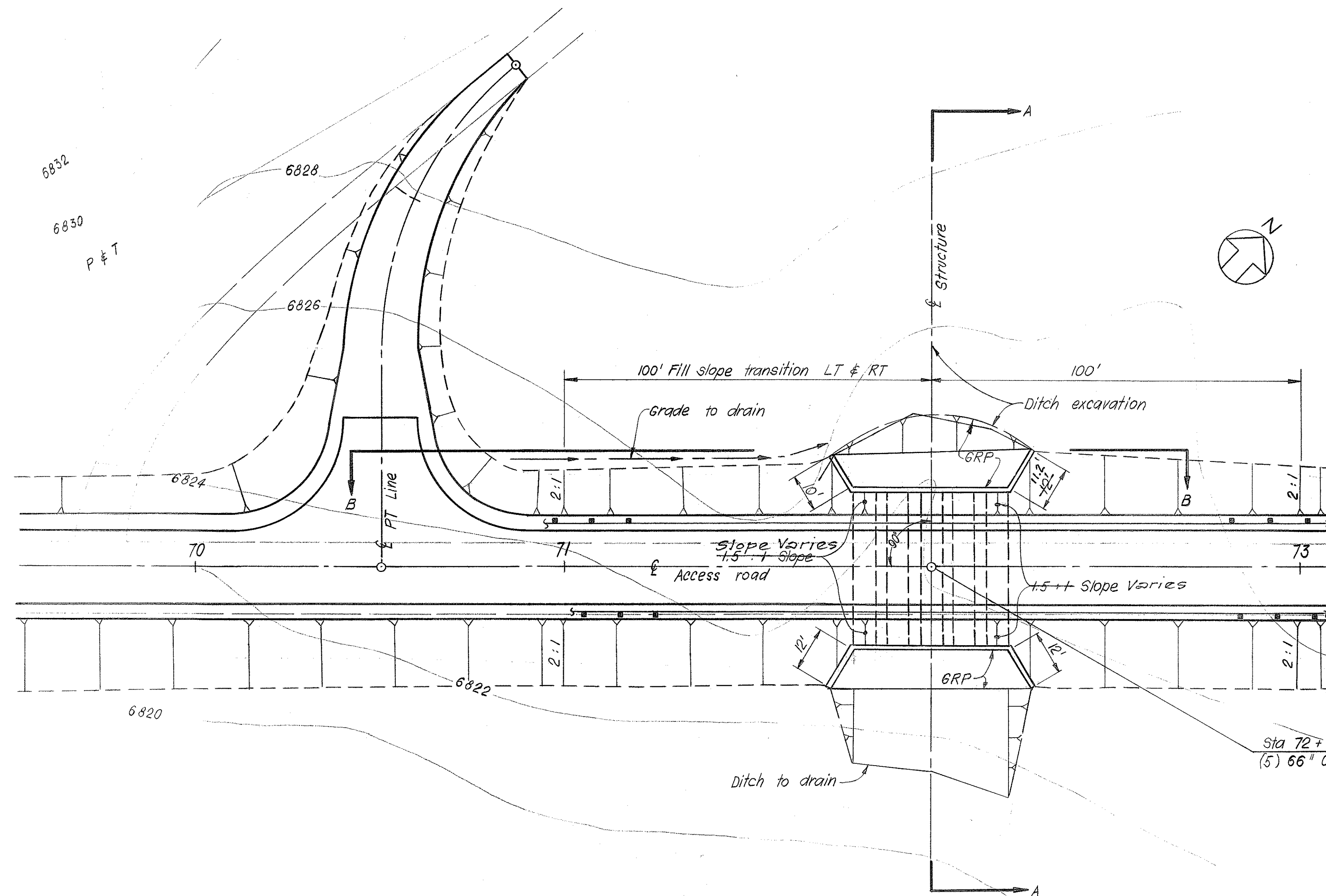
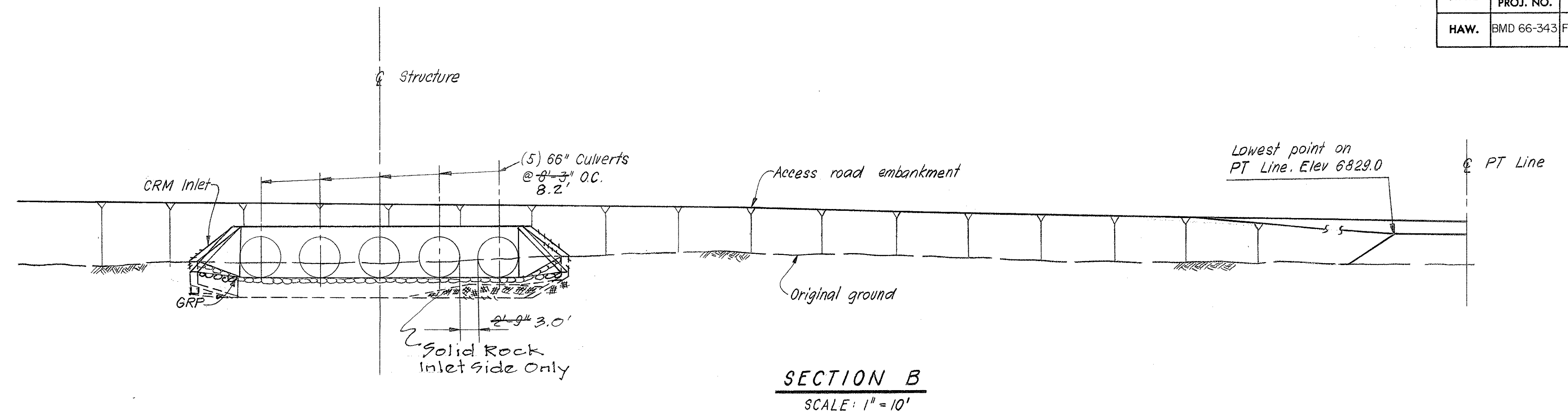
SCALE : AS NOTED

REVISED : SEP. 1972

DATE: MARCH 1972

**SHEET No. 2 OF 10 SHEETS** C502

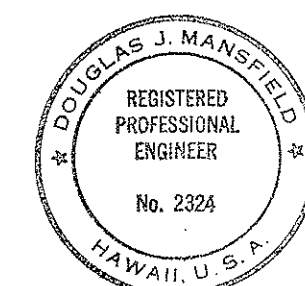
| STATE | PROJ. NO.  | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|-------|------------|-------------|-----------|--------------|
| HAW.  | BMD 66-343 | FY 71-72    | 33        | 88           |



#### QUANTITIES

|                       | STRUCTURE NO 3 |        |
|-----------------------|----------------|--------|
| Structure excavation  | 660 562.7      | Cu Yd  |
| Ditch excavation      | 134 170.2      | Cu Yd  |
| Cement Rubble Masonry | 108 90.2       | Cu Yd  |
| 66" Culvert Pipe      | 220 227.1      | Lin Ft |
| Grouted Rubble Paving | 16 43.1        | Cu Yd  |

**STRUCTURE NO 3 STA 72+00**



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STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

#### DRAINAGE STRUCTURE DETAILS

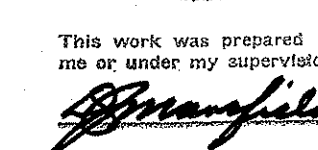
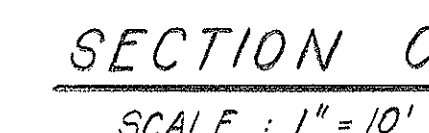
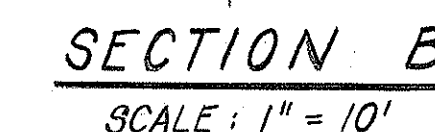
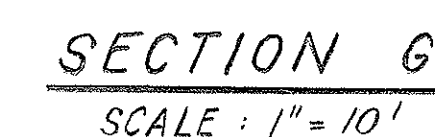
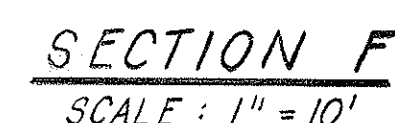
MAUNA KEA OBSERVATORY ACCESS ROAD  
PROJ. NO. BMD 66 - 343

SCALE: AS NOTED DATE: MARCH 1972

SHEET No. 3 OF 10 SHEETS C503

QUANTITIES

|                       |                 |                   |                 |                  |        |
|-----------------------|-----------------|-------------------|-----------------|------------------|--------|
| Structure excavation  | <del>-229</del> | <del>-193.8</del> | <del>-178</del> | <del>218.7</del> | Cu Yd  |
| Ditch excavation      | <del>-118</del> | <del>143.2</del>  | <del>-102</del> | <del>231.8</del> | Cu Yd  |
| Cement Rubble Masonry | <del>-52</del>  | <del>53.7</del>   | <del>-52</del>  | <del>53.1</del>  | Cu Yd  |
| 66" Culvert Pipe      | <del>-54</del>  | <del>54.7</del>   | <del>-54</del>  | <del>54.7</del>  | Lin Ft |
| Grouted Rubble Paving | <del>-22</del>  | <del>31.7</del>   | <del>-22</del>  | <del>30.8</del>  | Cu Yd  |

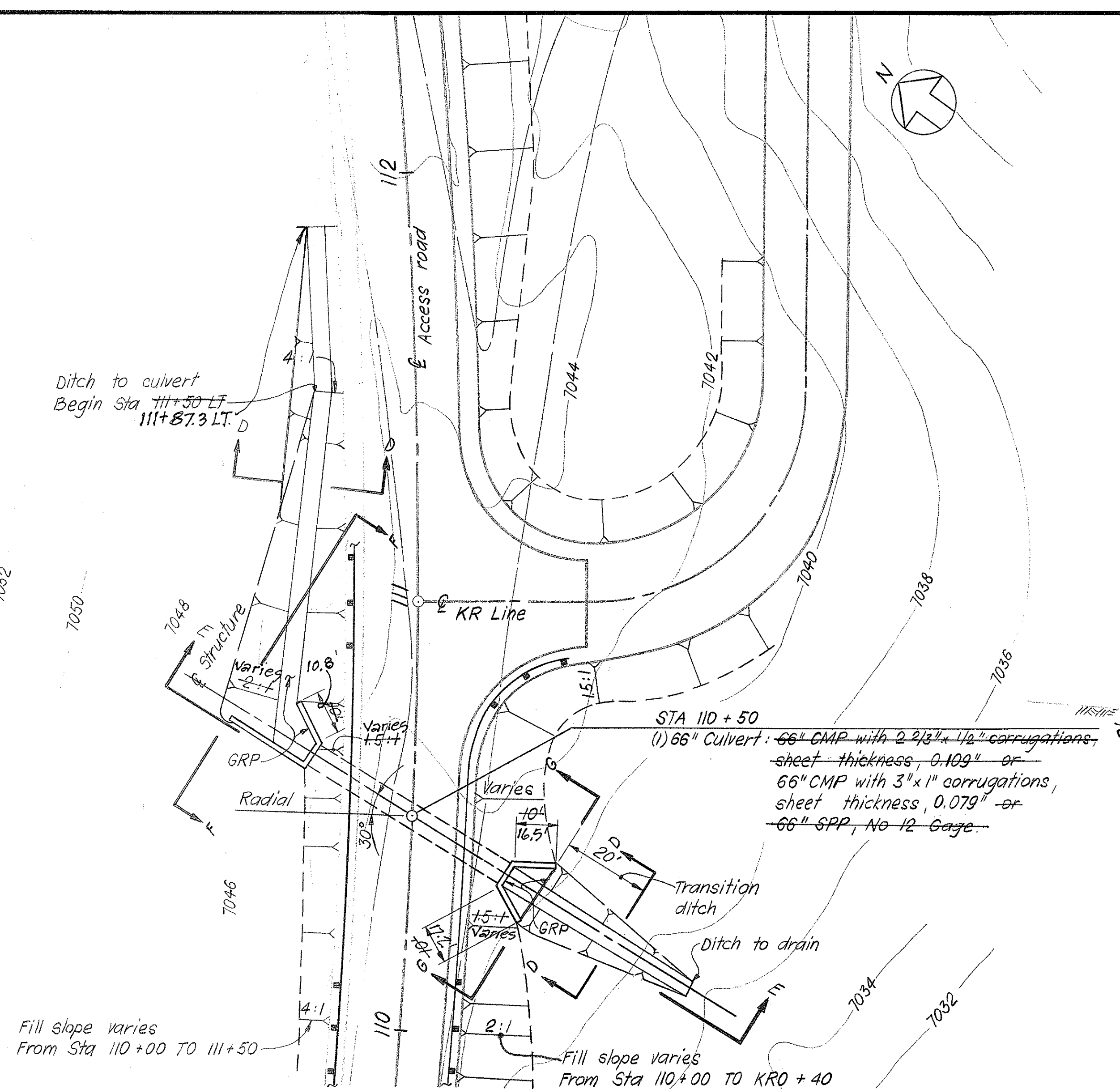


## DRAINAGE STRUCTURE DETAILS

PROJ. NO. BMD 66 - 343

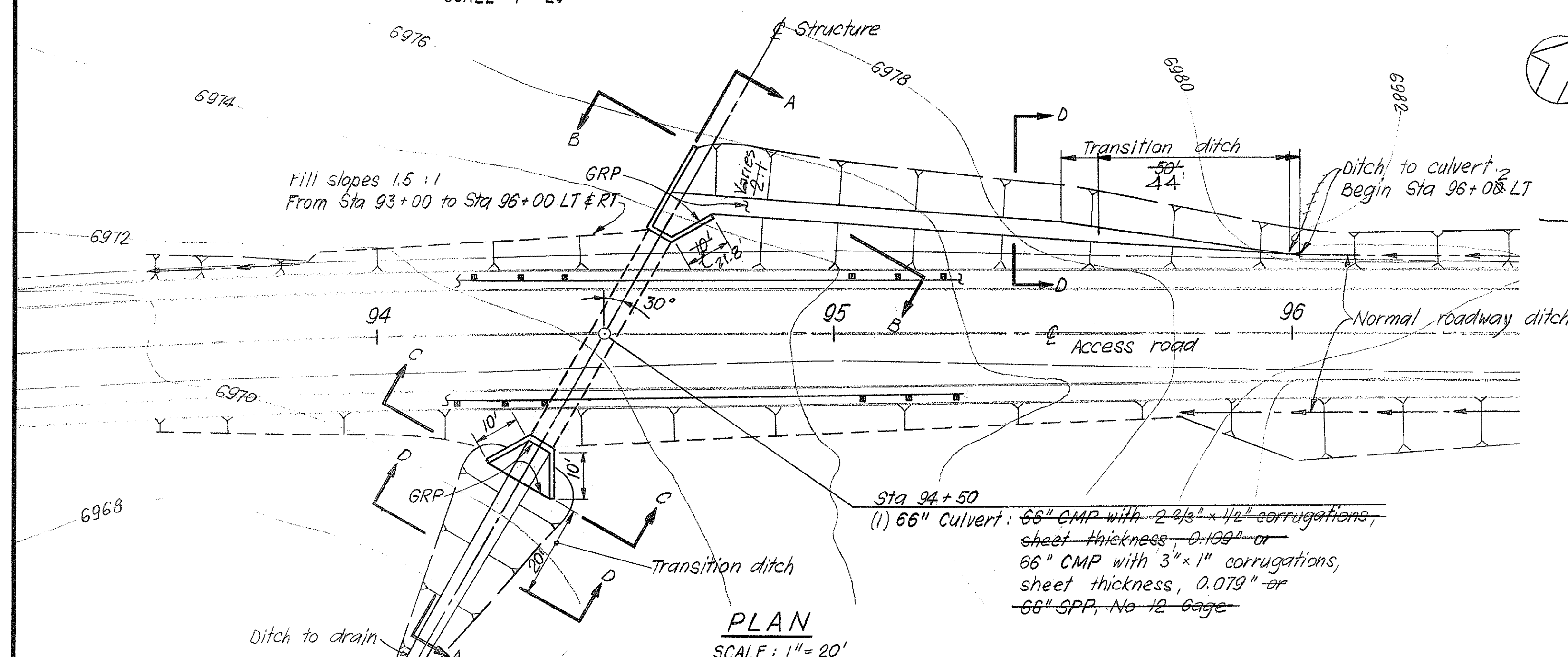
DATE : MARCH 1972

|                          |      |
|--------------------------|------|
| SHEET No. 4 OF 10 SHEETS | C504 |
|--------------------------|------|



PLAN  
SCALE : 1" = 20'

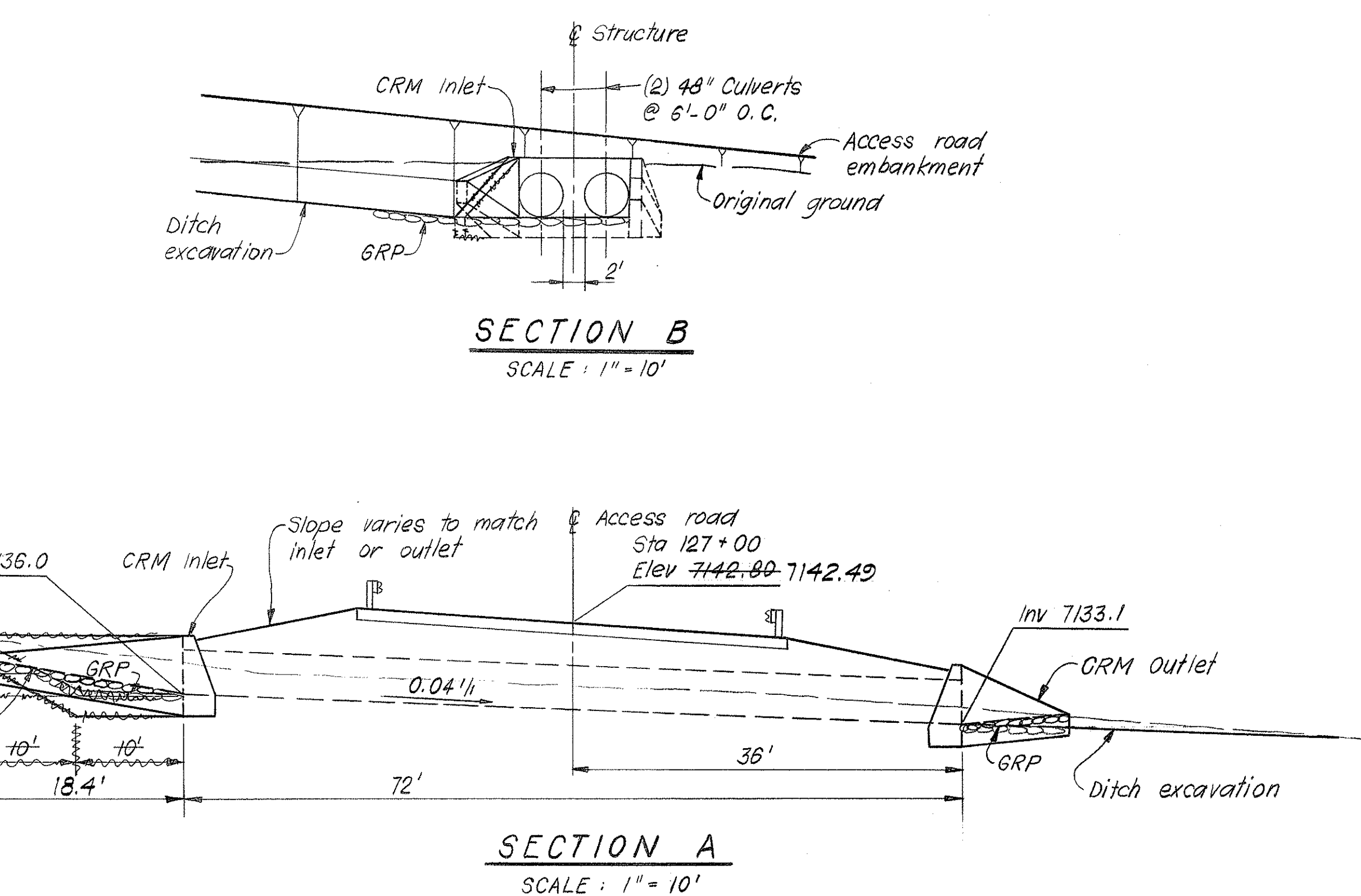
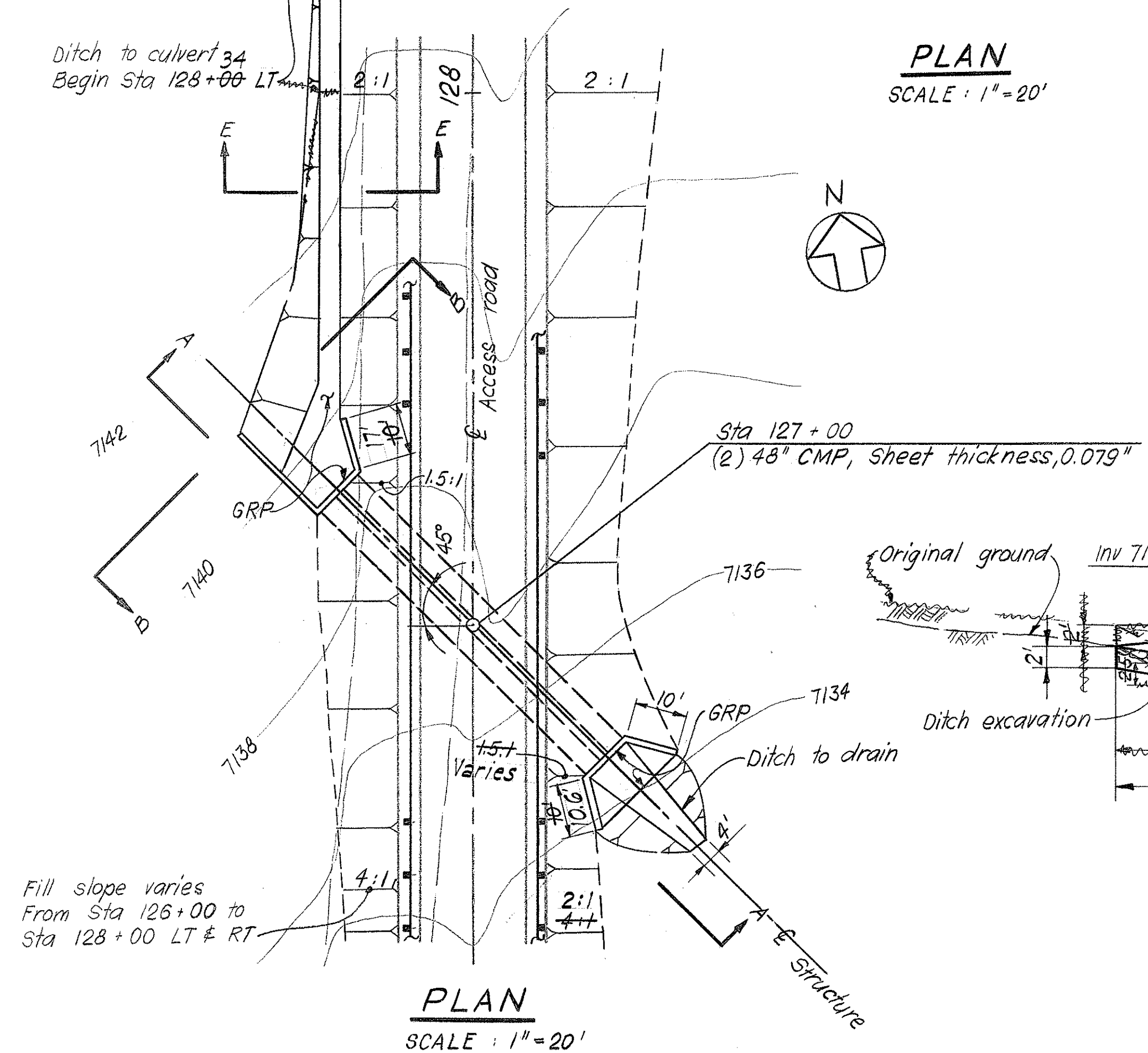
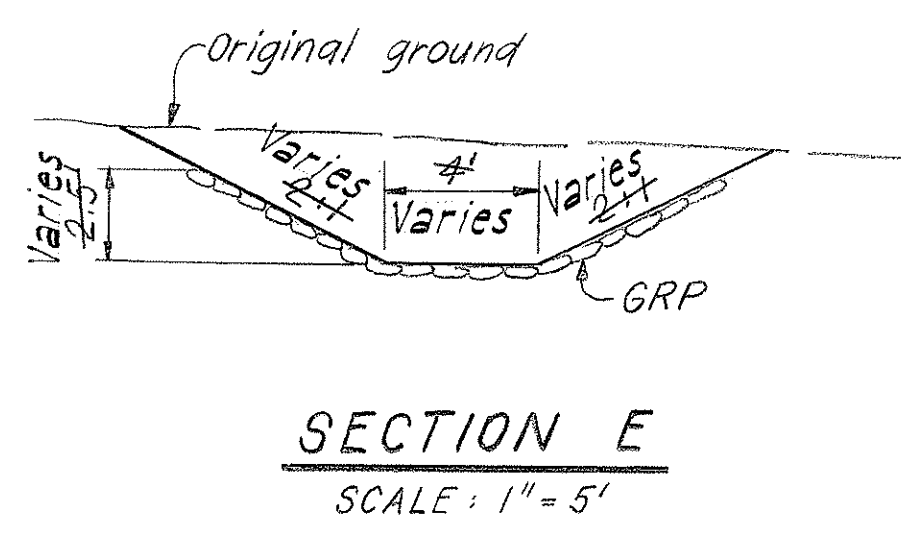
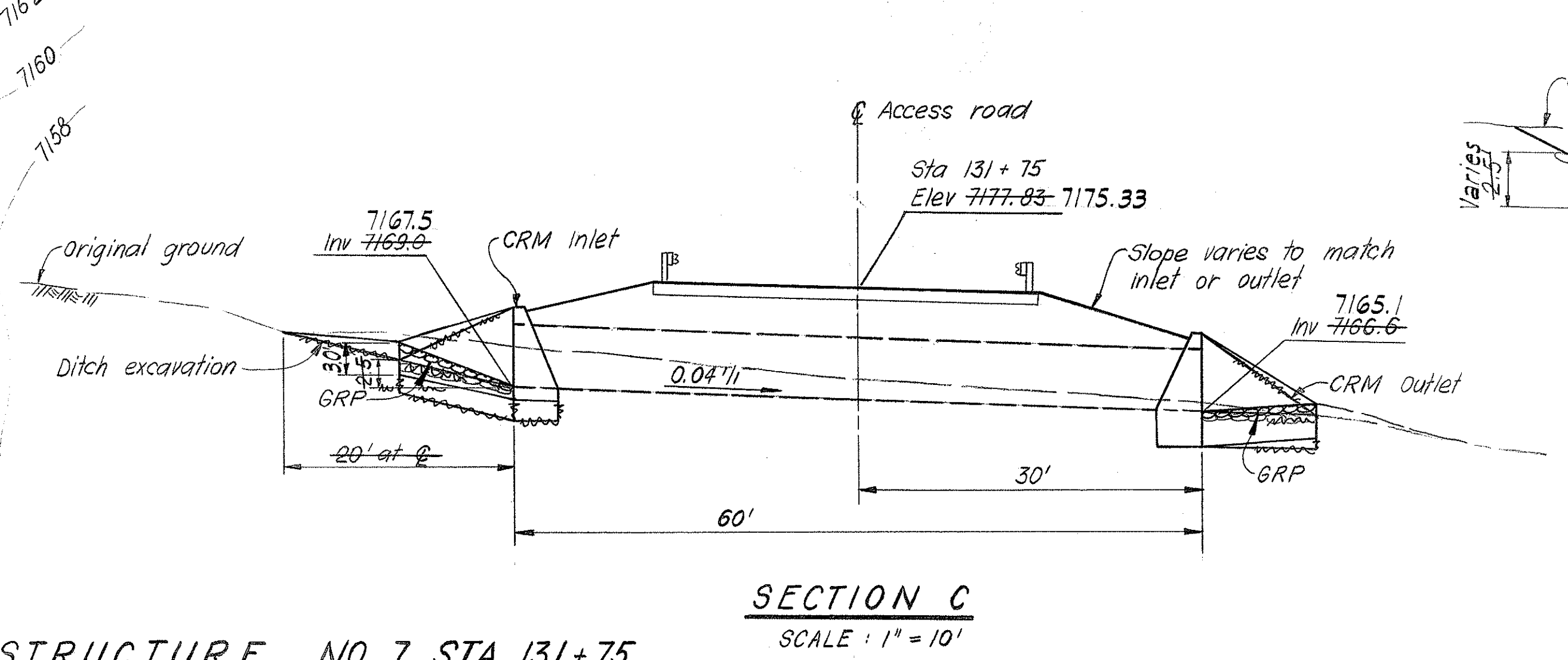
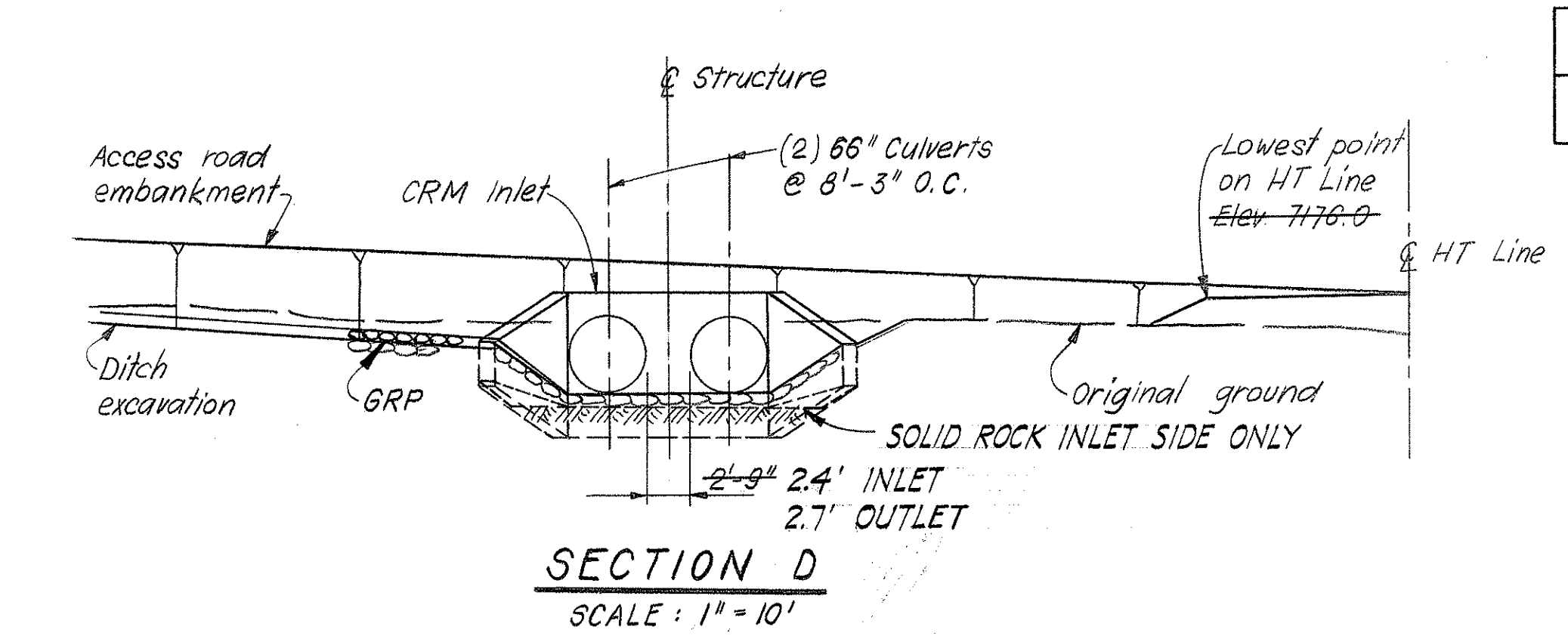
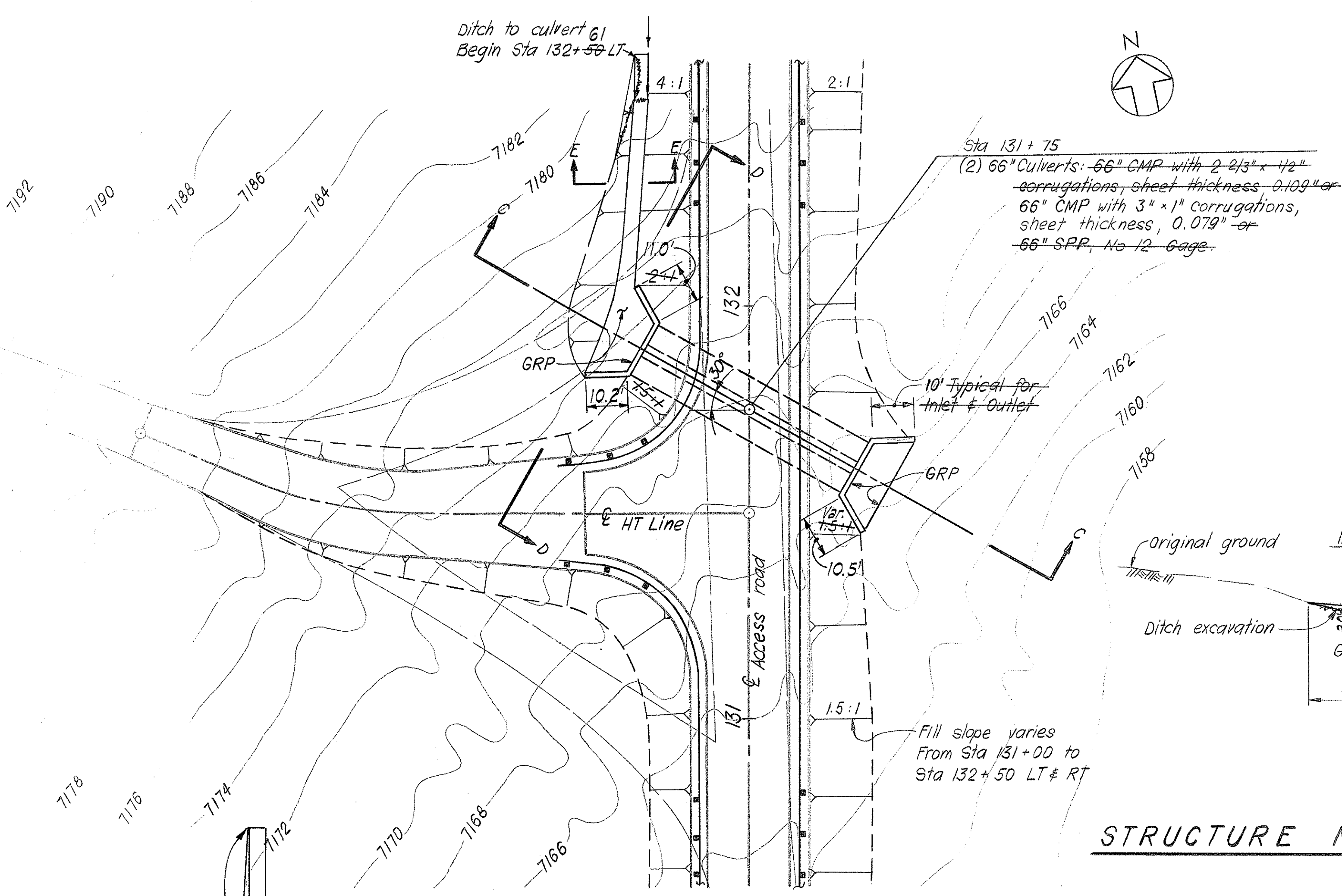
STRUCTURE NO 5 STA 110+50



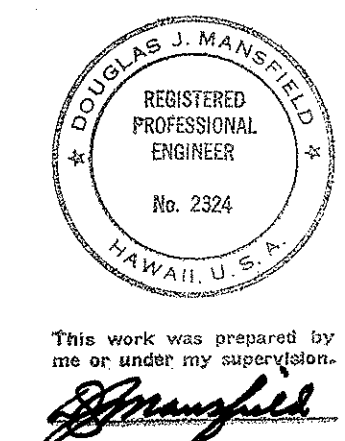
PLAN  
SCALE: 1" = 20'

|                  |                                    |
|------------------|------------------------------------|
| ORIGINAL<br>PLAN | SURVEY PLOTTED BY _____ DATE _____ |
| NOTE BOOK        | DRAWN BY _____ "                   |
|                  | TRACED BY _____ "                  |
|                  | DESIGNED BY _____ "                |
|                  | QUANTITIES BY _____ "              |
| No. _____        | CHECKED BY _____ "                 |

| STATE | PROJ. NO.  | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|-------|------------|-------------|-----------|--------------|
| HAW.  | BMD 66-343 | FY 71-72    | 35        | 88           |



| <u>QUANTITIES</u>     | <u>STRUCTURE</u>      |                      |        |
|-----------------------|-----------------------|----------------------|--------|
|                       | <u>NO 6</u>           | <u>NO 7</u>          |        |
| Structure excavation  | 217.4 <del>-22+</del> | <del>318</del> 309.8 | Cu Yd  |
| Ditch excavation      | 44.7 <del>+02</del>   | <del>56</del> 81.1   | Cu Yd  |
| Cement Rubble Masonry | 30.6 <del>-3+</del>   | <del>64</del> 43.4   | Cu Yd  |
| 48" CMP               | 145.5 <del>+44</del>  |                      | Lin Ft |
| 66" Culvert Pipe      |                       | <del>120</del> 121.5 | Lin Ft |
| Grouted Rubble Paving | 26.8 <del>+6</del>    | <del>14</del> 26.7   | Cu Yd  |



STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

**DRAINAGE STRUCTURE DETAILS**

MAUNA KEA OBSERVATORY ACCESS ROAD

PROJ. NO. BMD 66 - 343

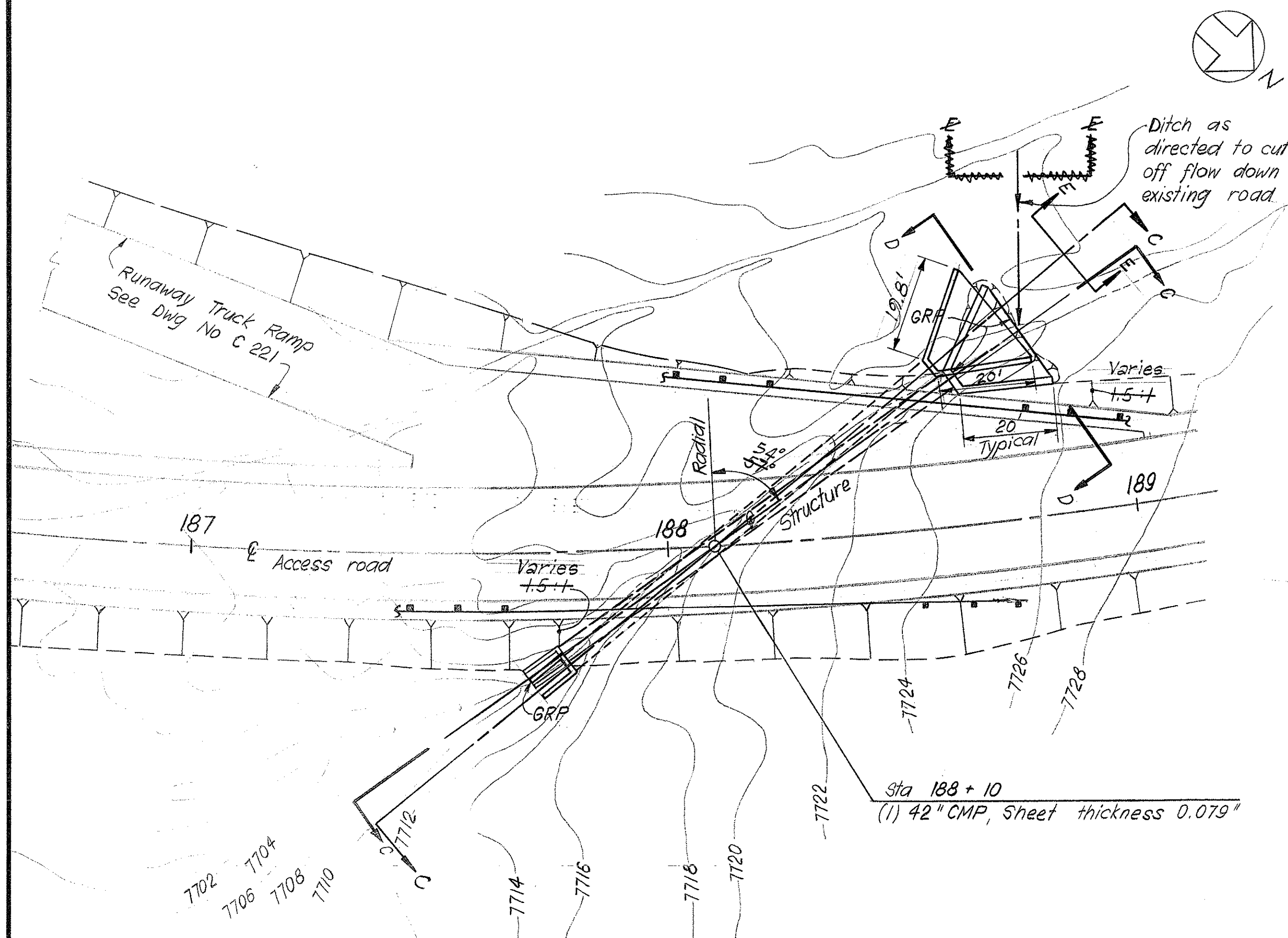
SCALE: AS NOTED

DATE: MARCH 1972

SHEET No. 5 OF 10 SHEETS C505

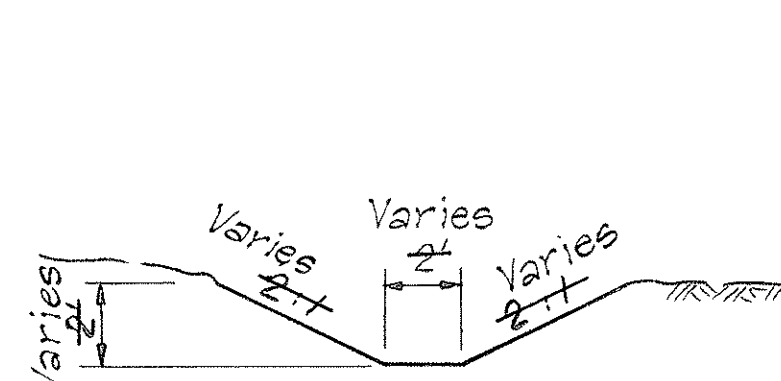
|               |      |
|---------------|------|
| DESIGNED BY   | DATE |
| DRAWN BY      |      |
| CHECKED BY    |      |
| NOTED BY      |      |
| QUANTITIES BY |      |
| CREATED BY    |      |

| STATE | PROJ. NO.  | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|-------|------------|-------------|-----------|--------------|
| HAW.  | BMD 66-343 | FY 71-72    | 36        | 88           |

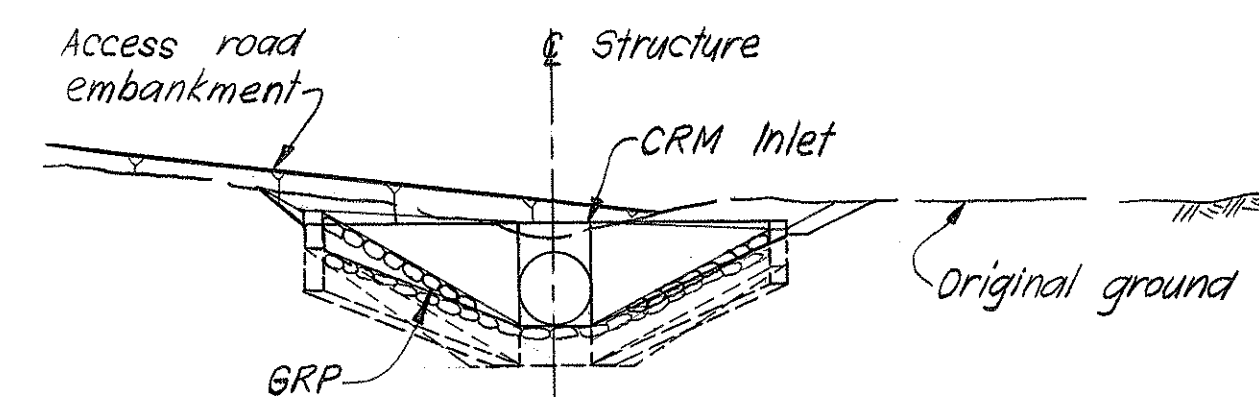


**PLAN**  
SCALE: 1" = 20'

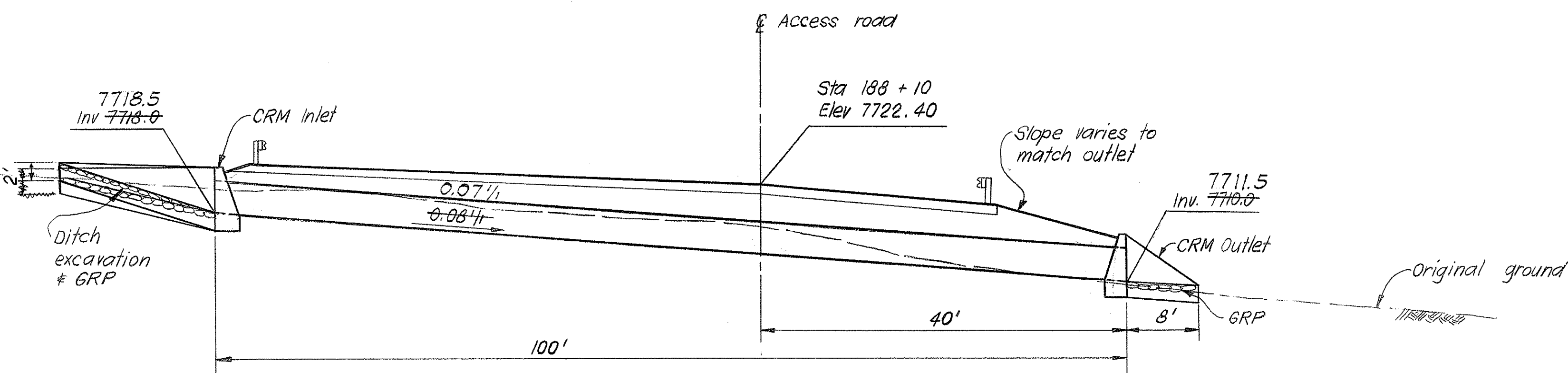
**STRUCTURE NO 9 STA 188 + 10**



**SECTION E**  
SCALE: 1" = 5'



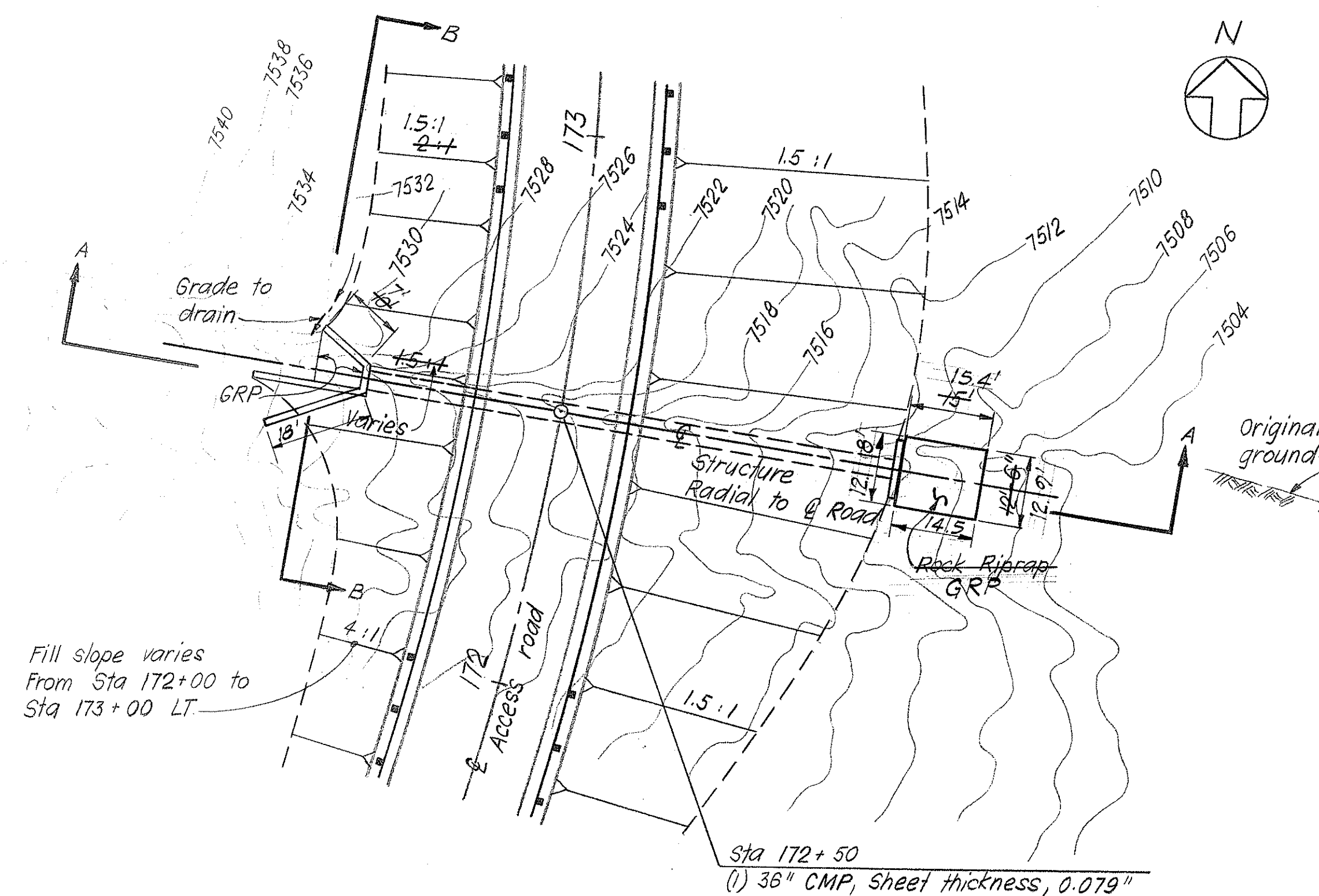
**SECTION D**  
SCALE: 1" = 10'



**SECTION C**  
SCALE: 1" = 10'

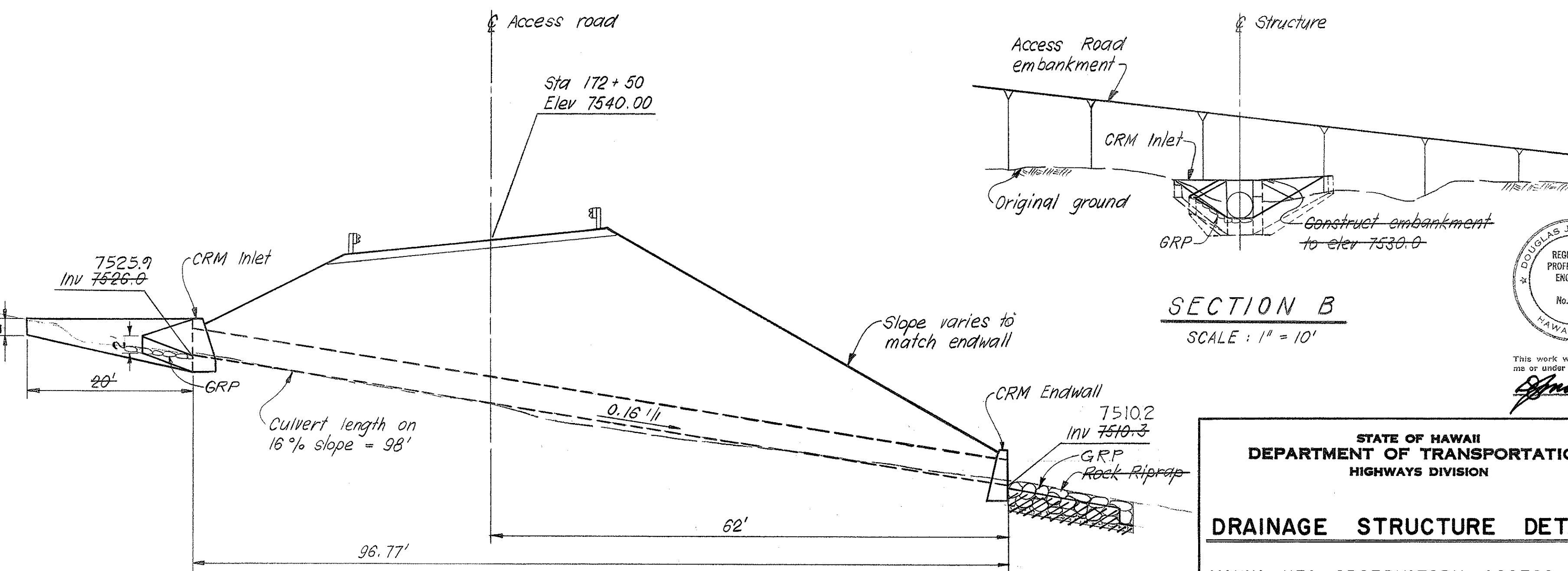
**QUANTITIES**

|                       | NO 8     | NO 9      |        |
|-----------------------|----------|-----------|--------|
| Structure excavation  | 91.6 +66 | 95 164.2  | Cu Yd  |
| Ditch excavation      | 5.3      | 16 27.5   | Cu Yd  |
| Cement Rubble Masonry | 12.7 +3  | 21 22.7   | Cu Yd  |
| 36" CMP               | 99.0 98  |           | Lin Ft |
| 42" CMP               |          | 100 101.0 | Lin Ft |
| Grouted Rubble Paving | 10.2 +   | 5 8.1     | Cu Yd  |
| Rock Riprap           | 21       |           | Cu Yd  |

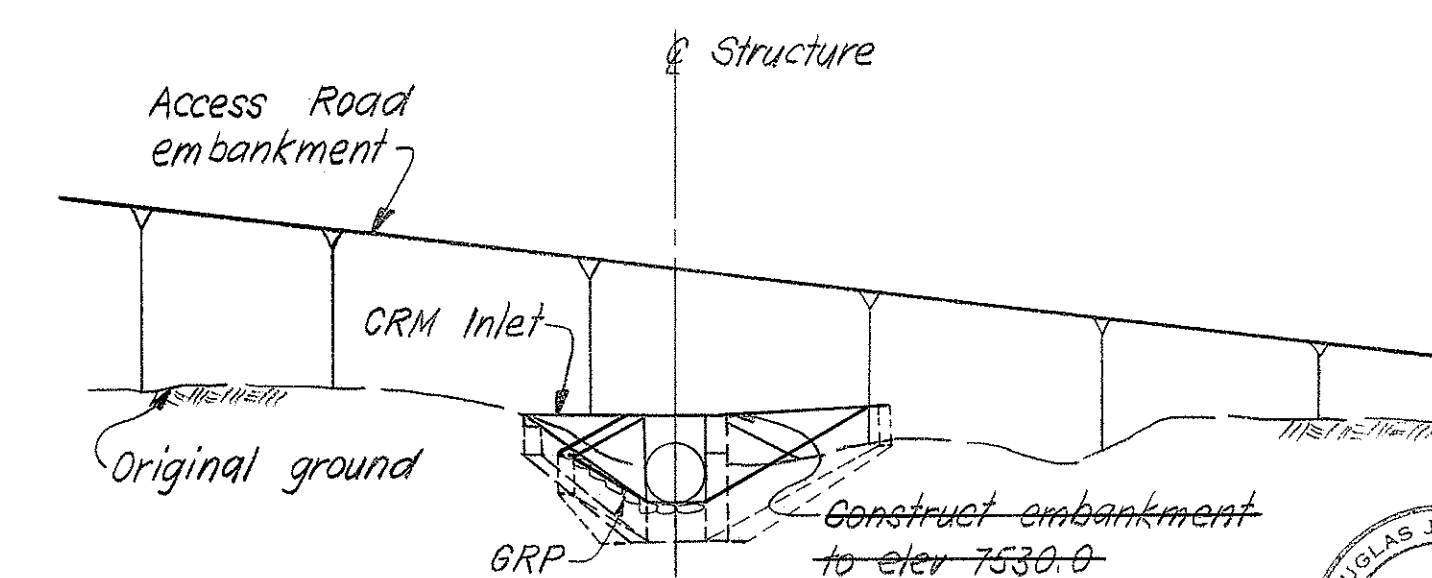


**PLAN**  
SCALE: 1" = 20'

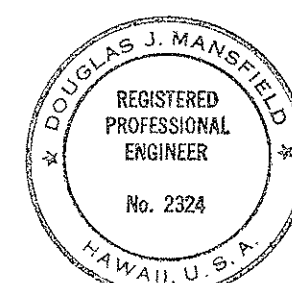
**STRUCTURE NO 8 STA 172 + 50**



**SECTION A**  
SCALE: 1" = 10'



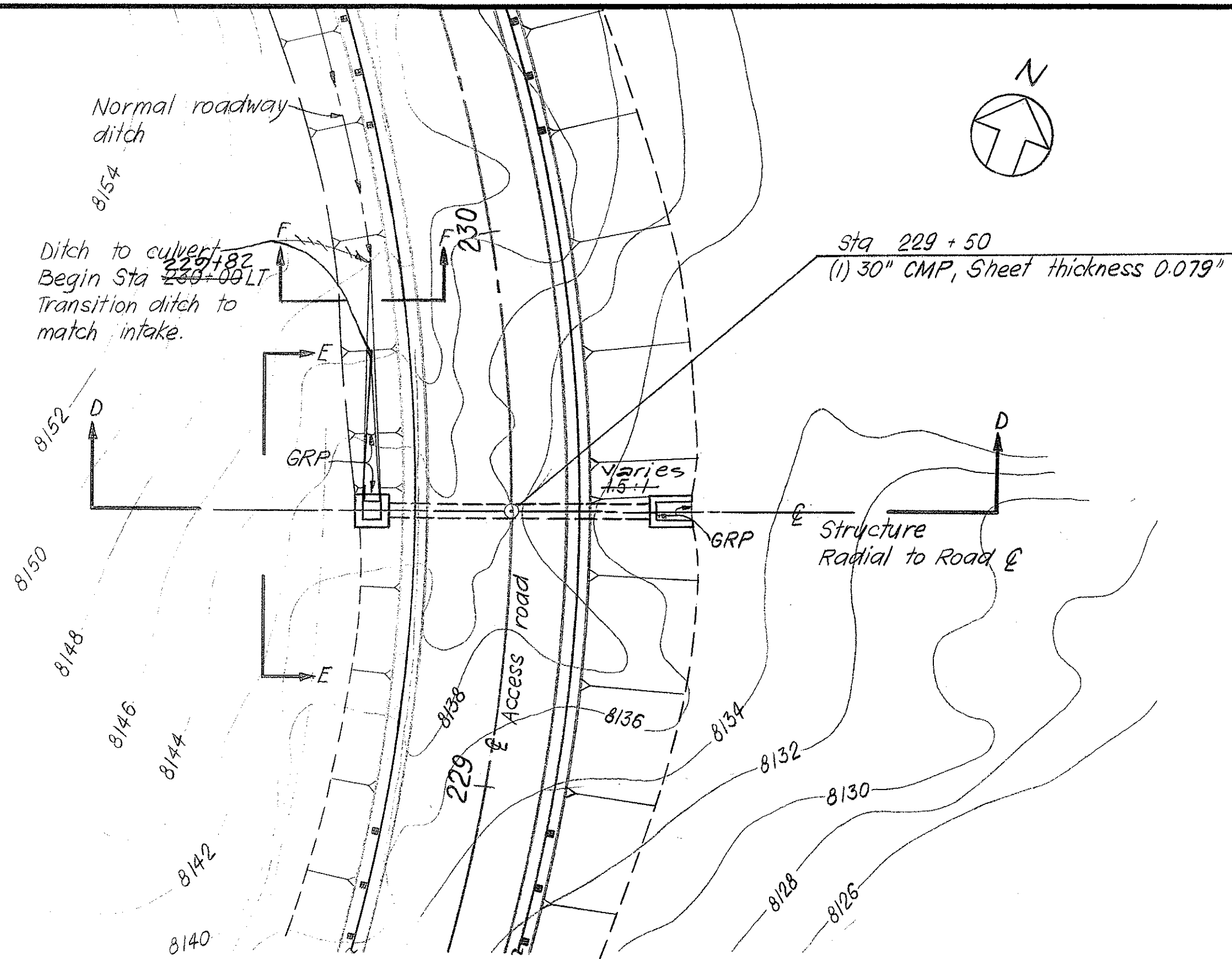
**SECTION B**  
SCALE: 1" = 10'



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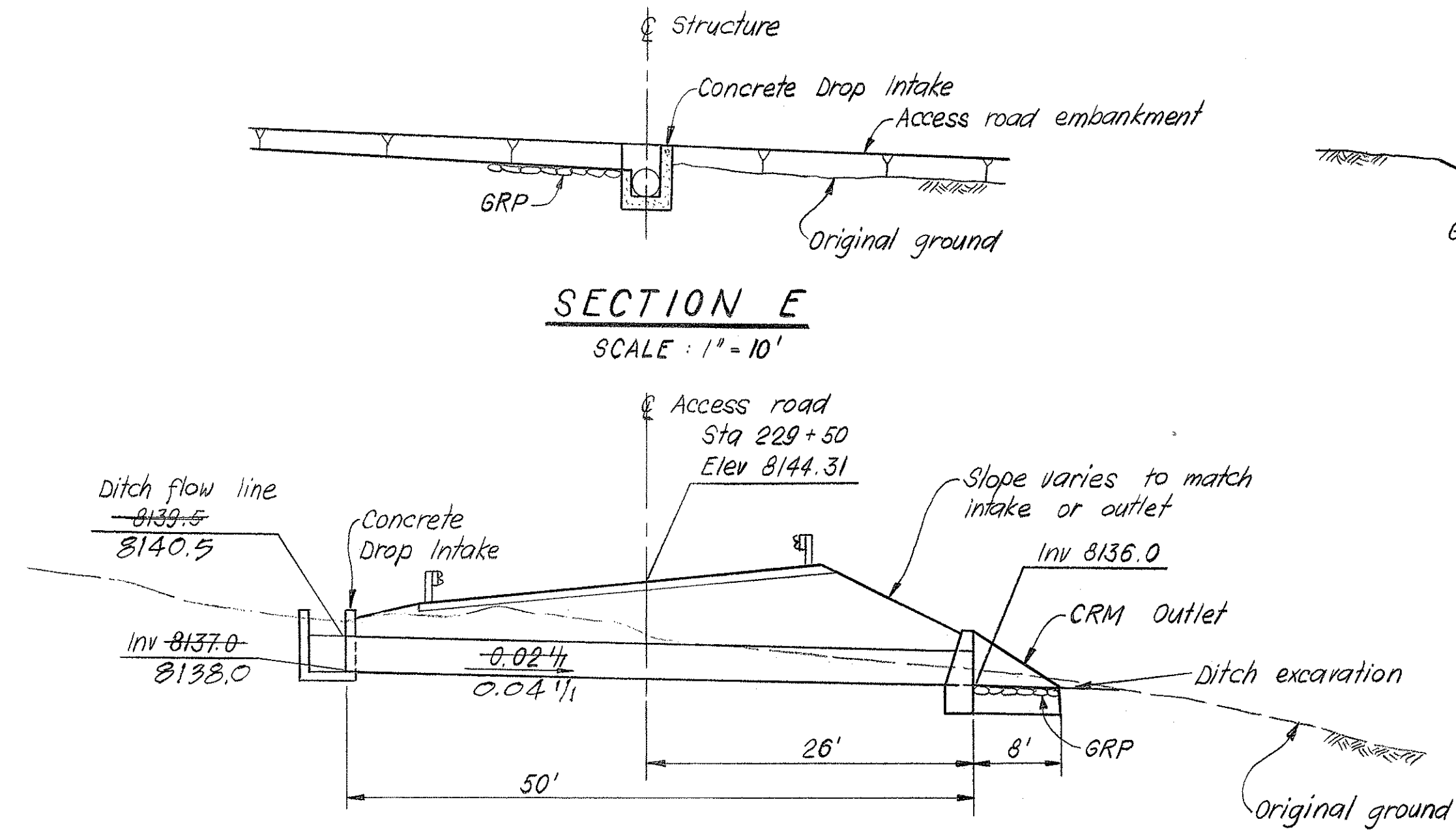
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|----------------------------------------------------------------------|------------------|
| STATE OF HAWAII<br>DEPARTMENT OF TRANSPORTATION<br>HIGHWAYS DIVISION |                  |
| <b>DRAINAGE STRUCTURE DETAILS</b>                                    |                  |
| MAUNA KEA OBSERVATORY ACCESS ROAD                                    |                  |
| PROJ. NO. BMD 66 - 343                                               |                  |
| SCALE: AS NOTED                                                      | DATE: MARCH 1972 |
| SHEET No. 6 OF 10 SHEETS C506                                        |                  |

| STATE | PROJ. NO.  | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|-------|------------|-------------|-----------|--------------|
| HAW.  | BMD 66-343 | FY 71-72    | 37        | 88           |



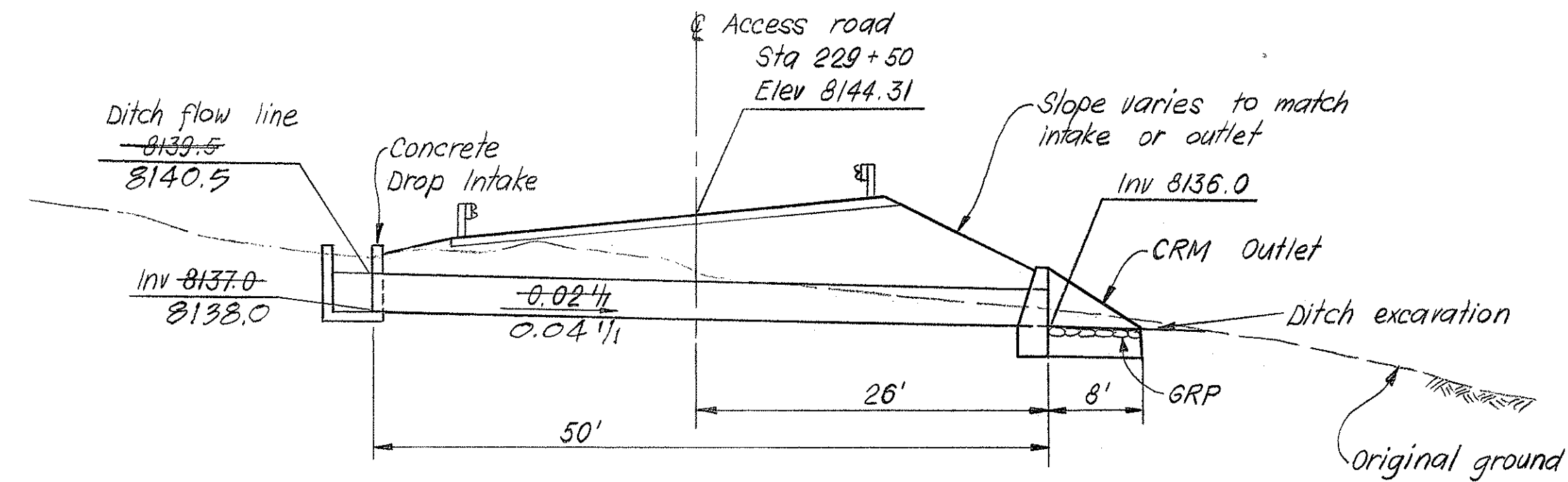
PLAN  
SCALE: 1" = 20'

STRUCTURE NO 11 STA 229 + 50

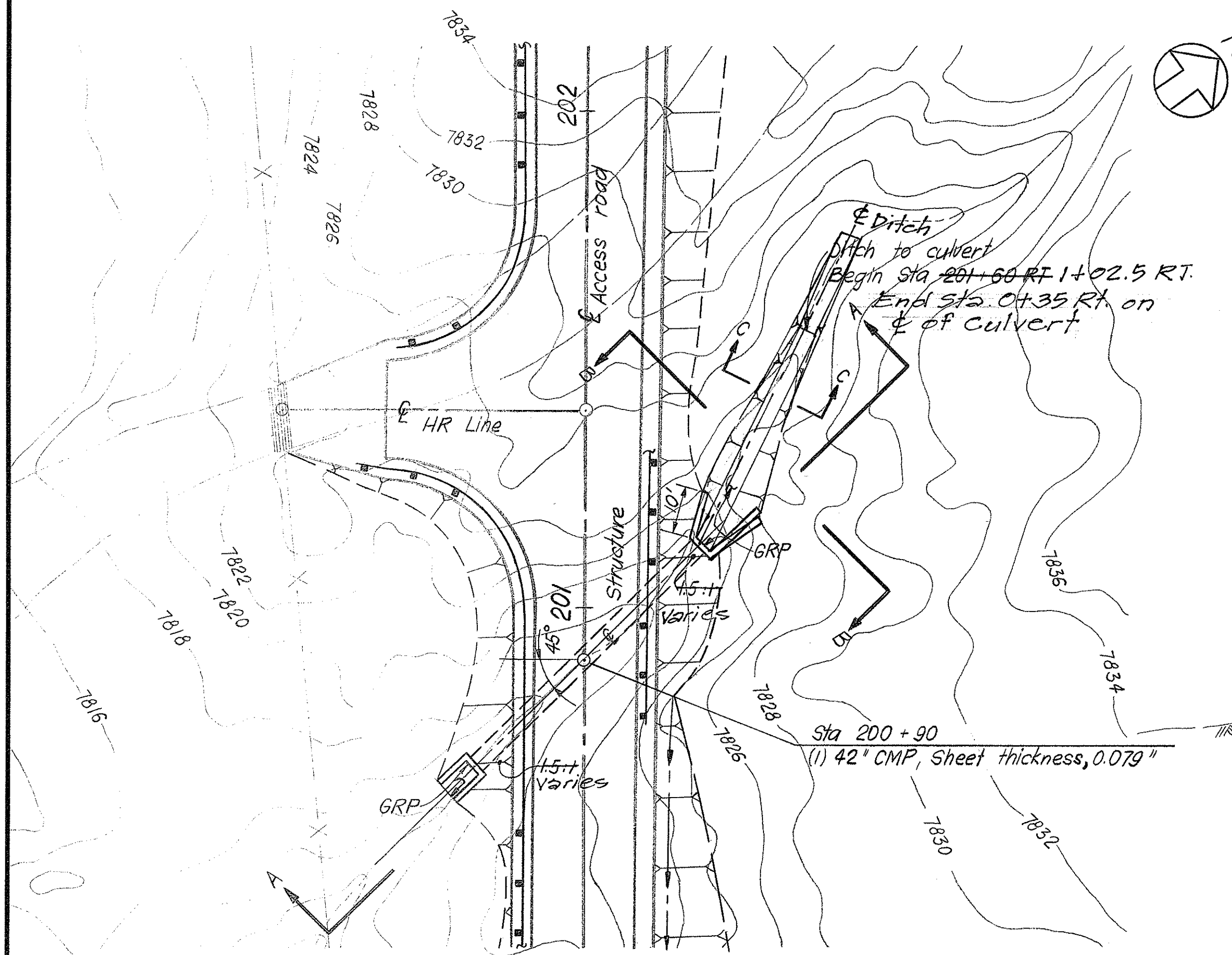


SECTION E  
SCALE: 1" = 10'

SECTION F  
SCALE: 1" = 5'

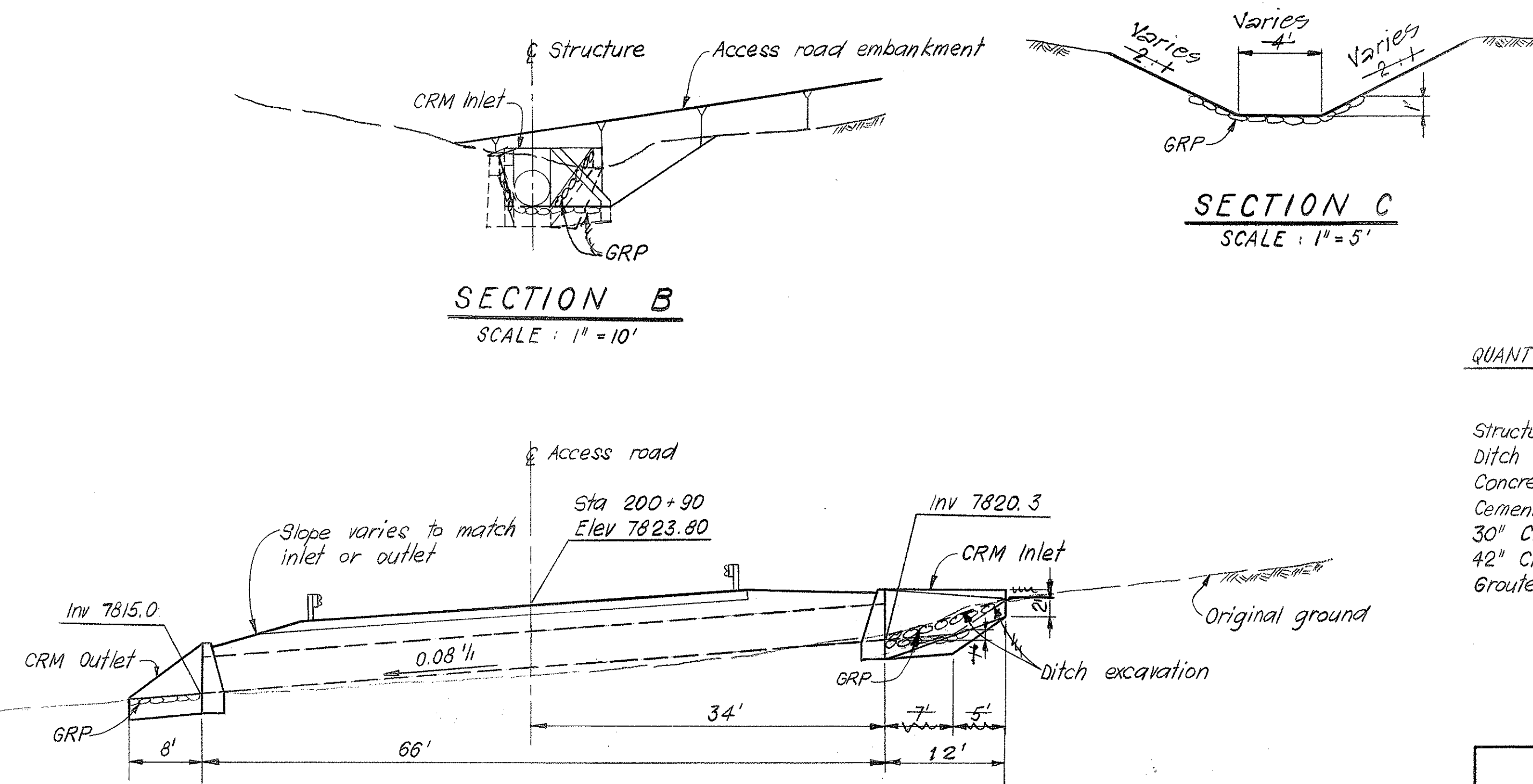


SECTION D  
SCALE: 1" = 10'



PLAN  
SCALE: 1" = 20'

STRUCTURE NO 10 STA 200 + 90

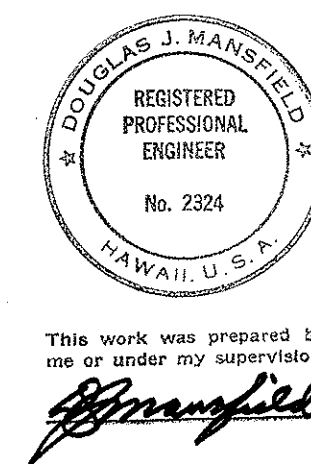


SECTION B  
SCALE: 1" = 10'

SECTION C  
SCALE: 1" = 5'

SECTION A  
SCALE: 1" = 10'

| QUANTITIES            | STRUCTURE |                |
|-----------------------|-----------|----------------|
|                       | NO 10     | NO 11          |
| Structure excavation  | 89.7-88   | -72-43.7 Cu Yd |
| Ditch excavation      | 21.7-27   | -8-5.2 Cu Yd   |
| Concrete              |           | 2.3 Cu Yd      |
| Cement Rubble Masonry | 17.1-16   | 6.2 Cu Yd      |
| 30" CMP               |           | 50.5 Lin Ft    |
| 42" CMP               | 66.6      | Lin Ft         |
| Grouted Rubble Paving | 14.3-8    | -4-3.1 Cu Yd   |



STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

**DRAINAGE STRUCTURE DETAILS**

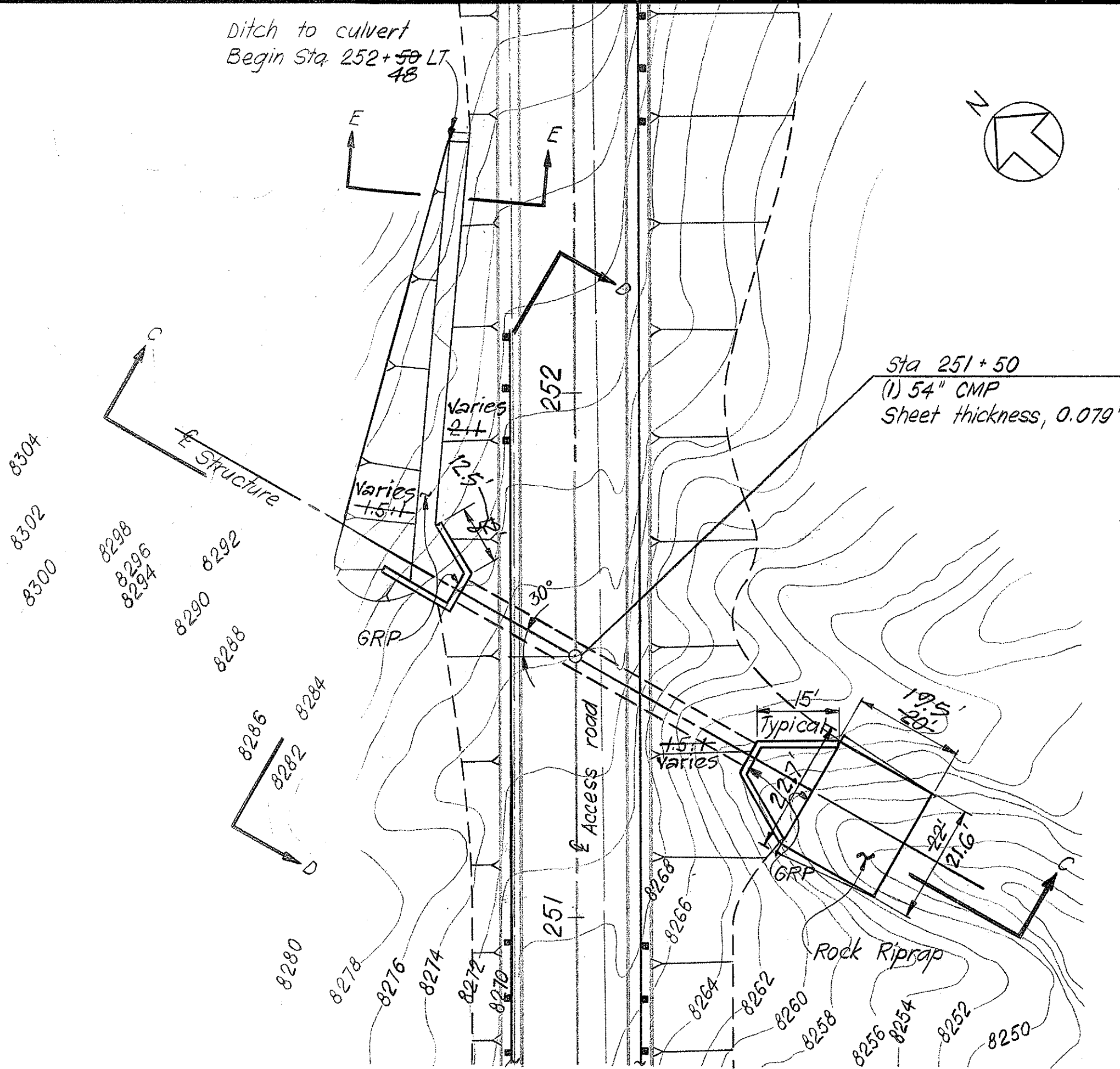
MAUNA KEA OBSERVATORY ACCESS ROAD  
PROJ. NO. BMD 66 - 343

SCALE: AS NOTED DATE: MARCH 1972

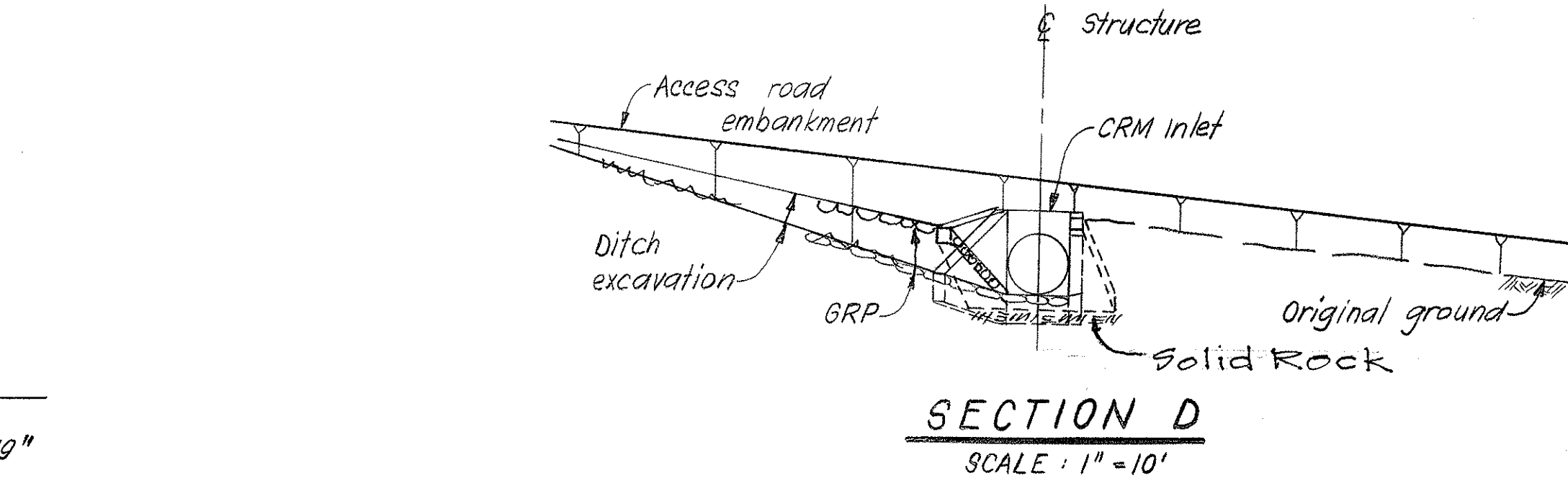
SHEET No. 7 OF 10 SHEETS C507

|               |      |
|---------------|------|
| ORIGINAL PLAN | DATE |
| DRAWN BY      |      |
| DESIGNED BY   |      |
| CHECKED BY    |      |
| NOTE BOOK     |      |
| No.           |      |

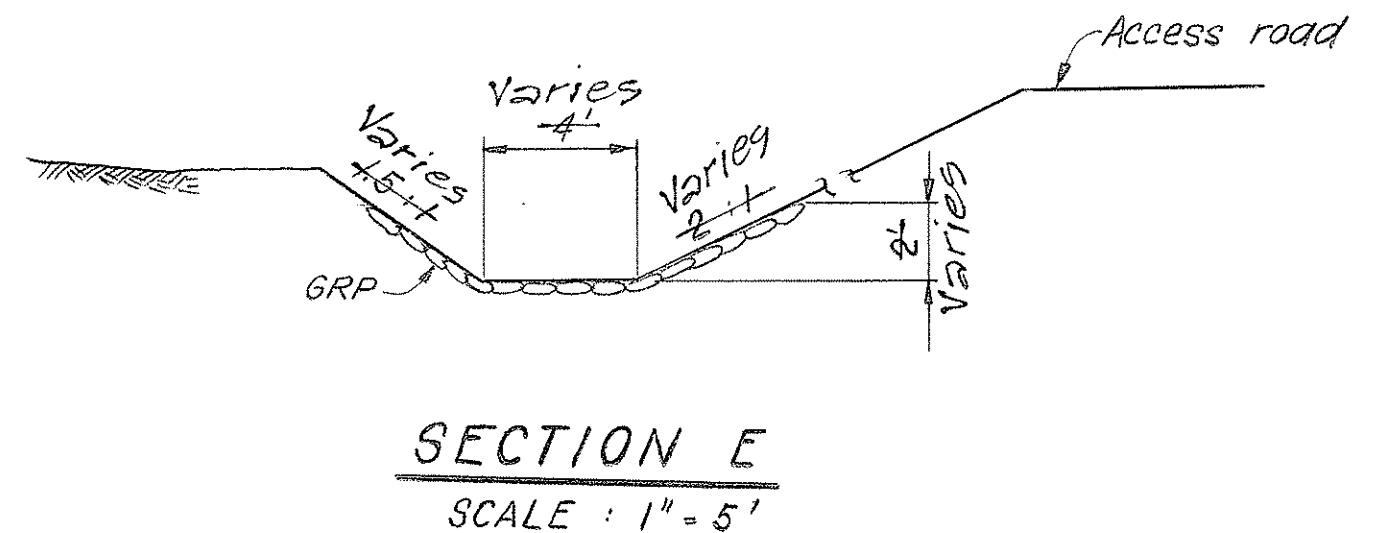
| STATE | PROJ. NO.  | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|-------|------------|-------------|-----------|--------------|
| HAW.  | BMD 66-343 | FY 71-72    | 38        | 88           |



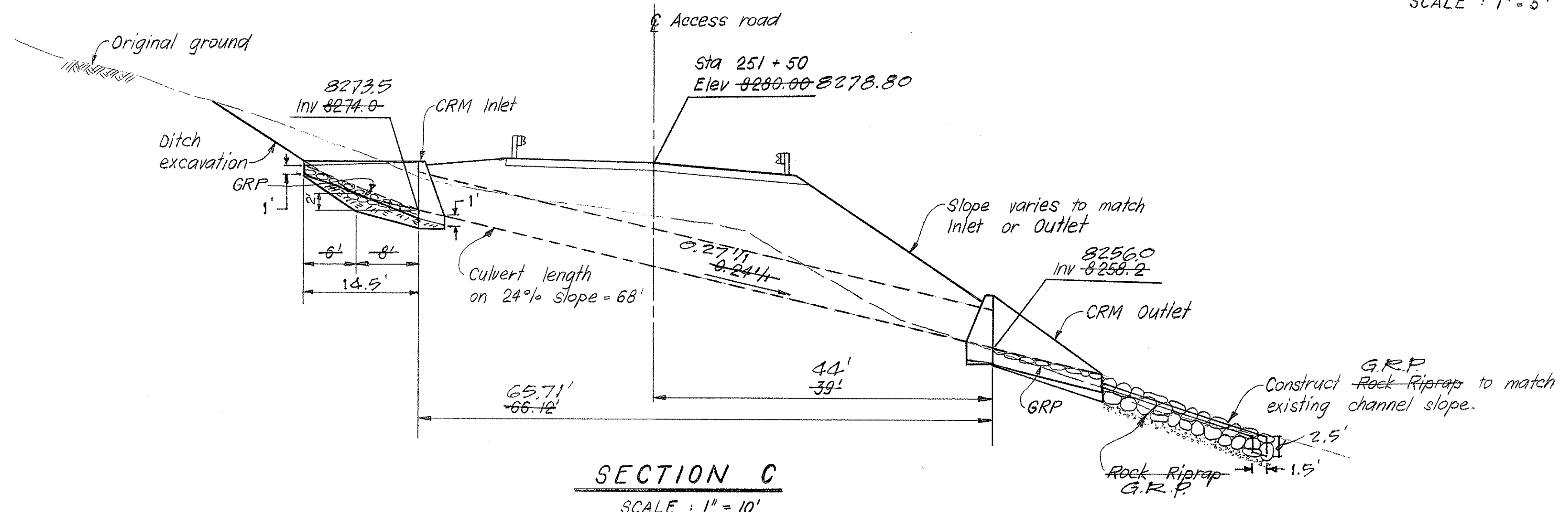
**PLAN**  
SCALE: 1" = 20'



**SECTION D**  
SCALE: 1" = 10'

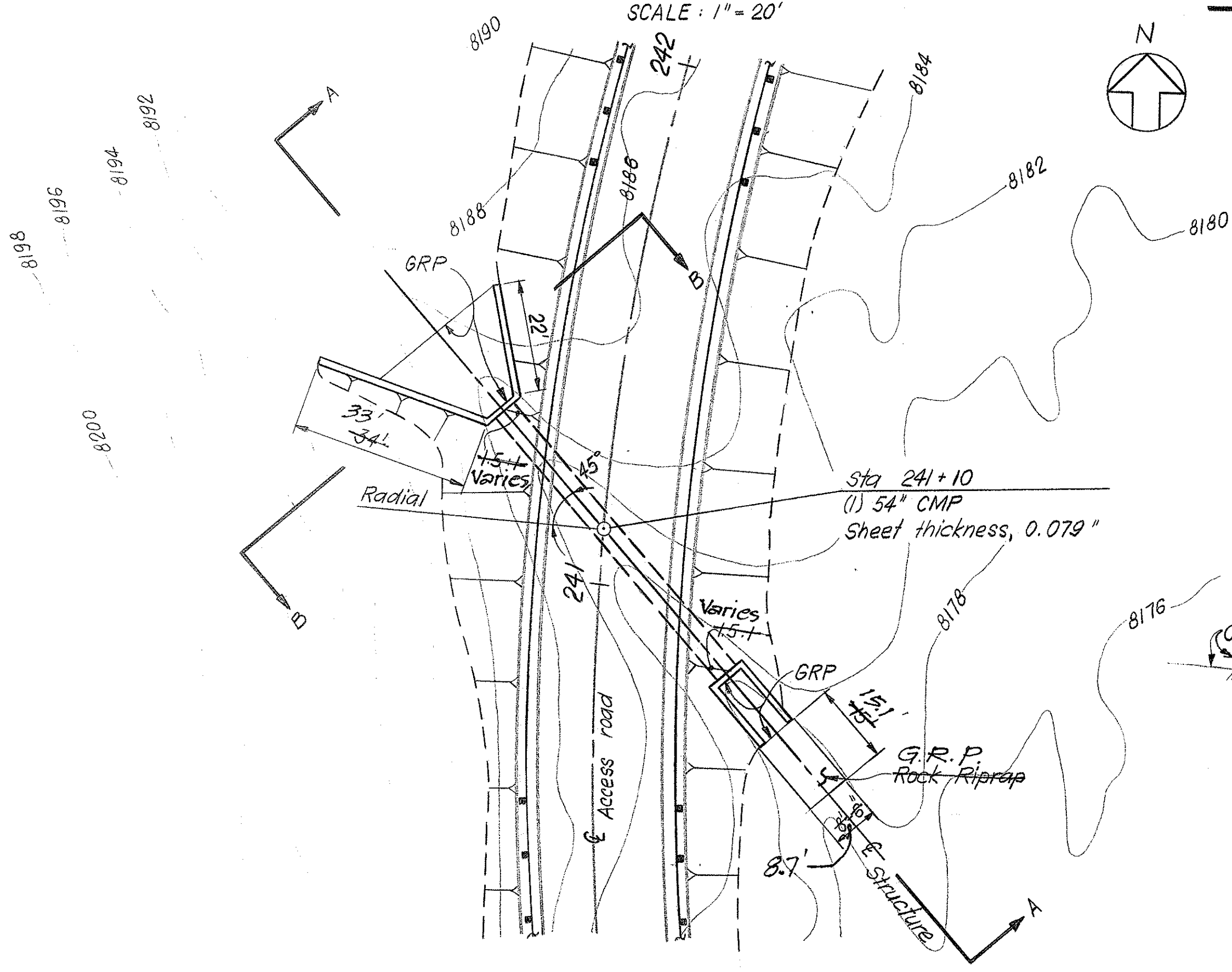


**SECTION E**  
SCALE: 1" = 5'

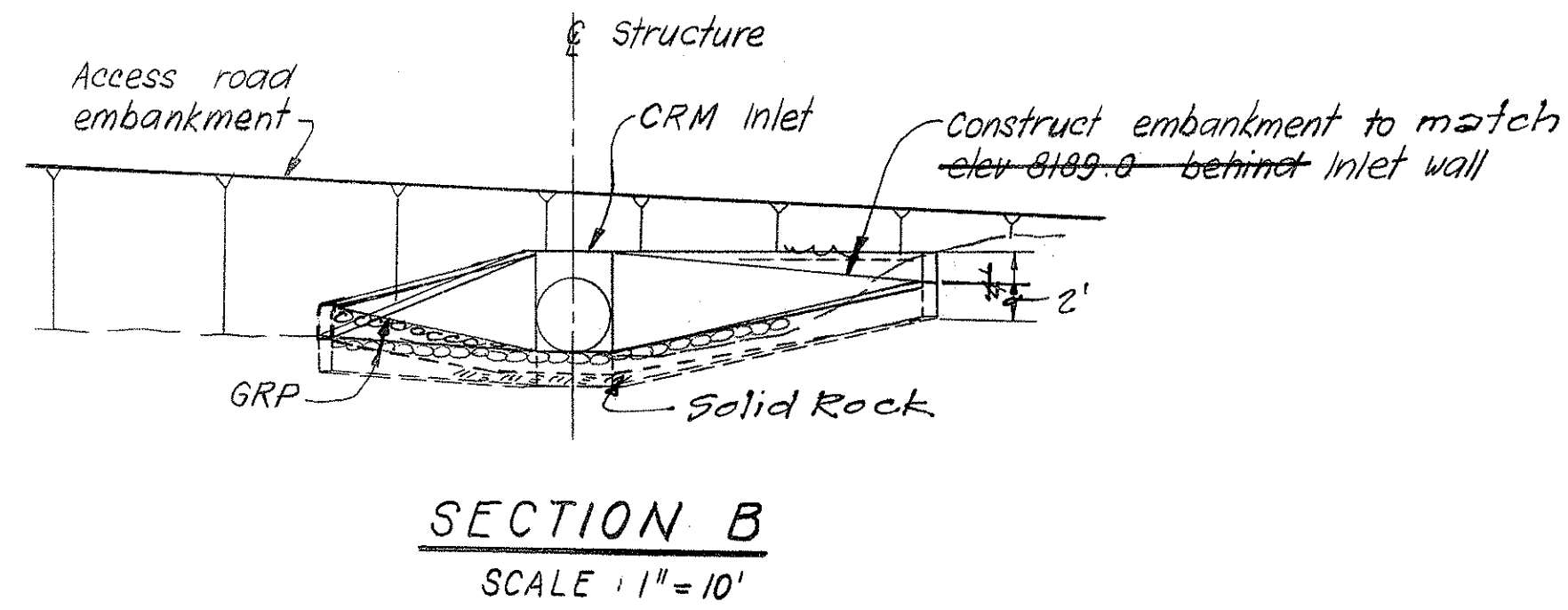


**SECTION C**  
SCALE: 1" = 10'

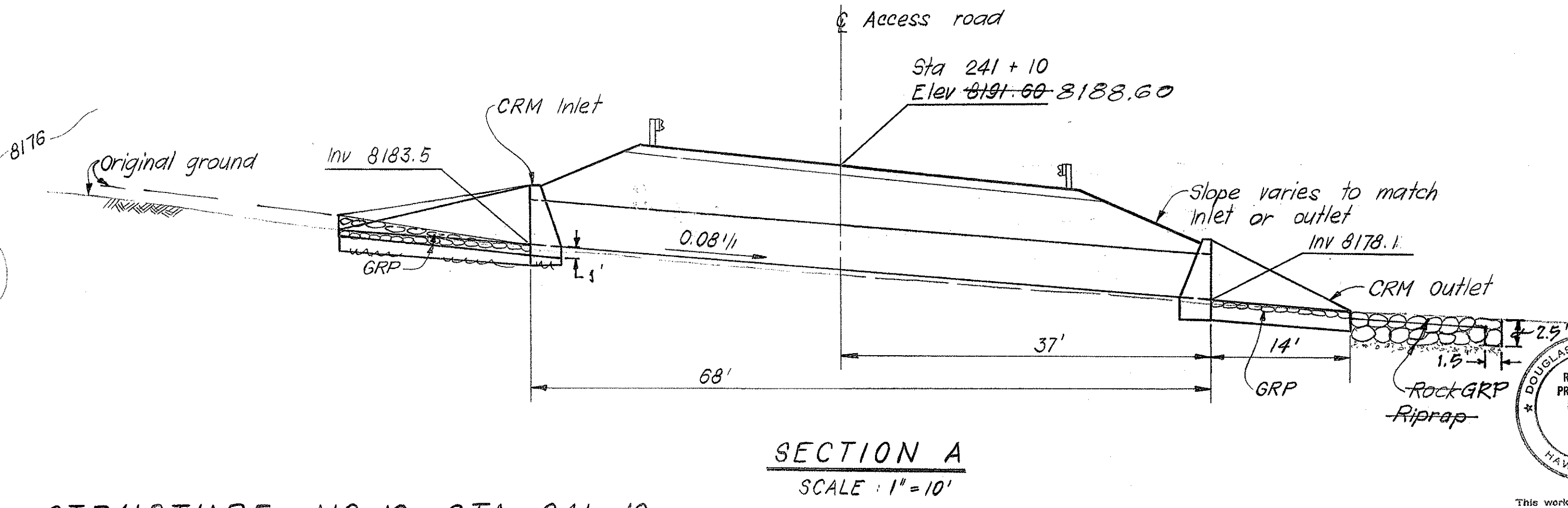
**STRUCTURE NO 13 STA 251+50**



**PLAN**  
SCALE: 1" = 20'



**SECTION B**  
SCALE: 1" = 10'



**SECTION A**  
SCALE: 1" = 10'

**STRUCTURE NO 12 STA 241+10**

| QUANTITIES            | STRUCTURE |          |
|-----------------------|-----------|----------|
|                       | NO 12     | NO 13    |
| Structure excavation  | 138.2+76  | 158.8+89 |
| Ditch excavation      | 13.1      | 121.7-62 |
| Cement Rubble Masonry | 37        | 26-22    |
| 54" CMP               | 68.6      | 68.6     |
| Grouted Rubble Paving | 7.0       | 24.7-17  |
| Rock Riprap           | 14        | 49       |

STATE OF HAWAII  
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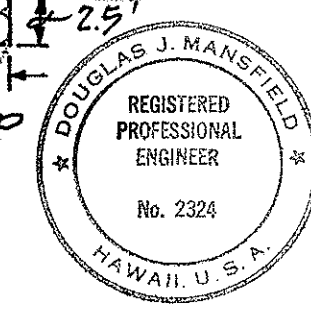
**DRAINAGE STRUCTURE DETAILS**

MAUNA KEA OBSERVATORY ACCESS ROAD  
PROJ. NO. BMD 66 - 343

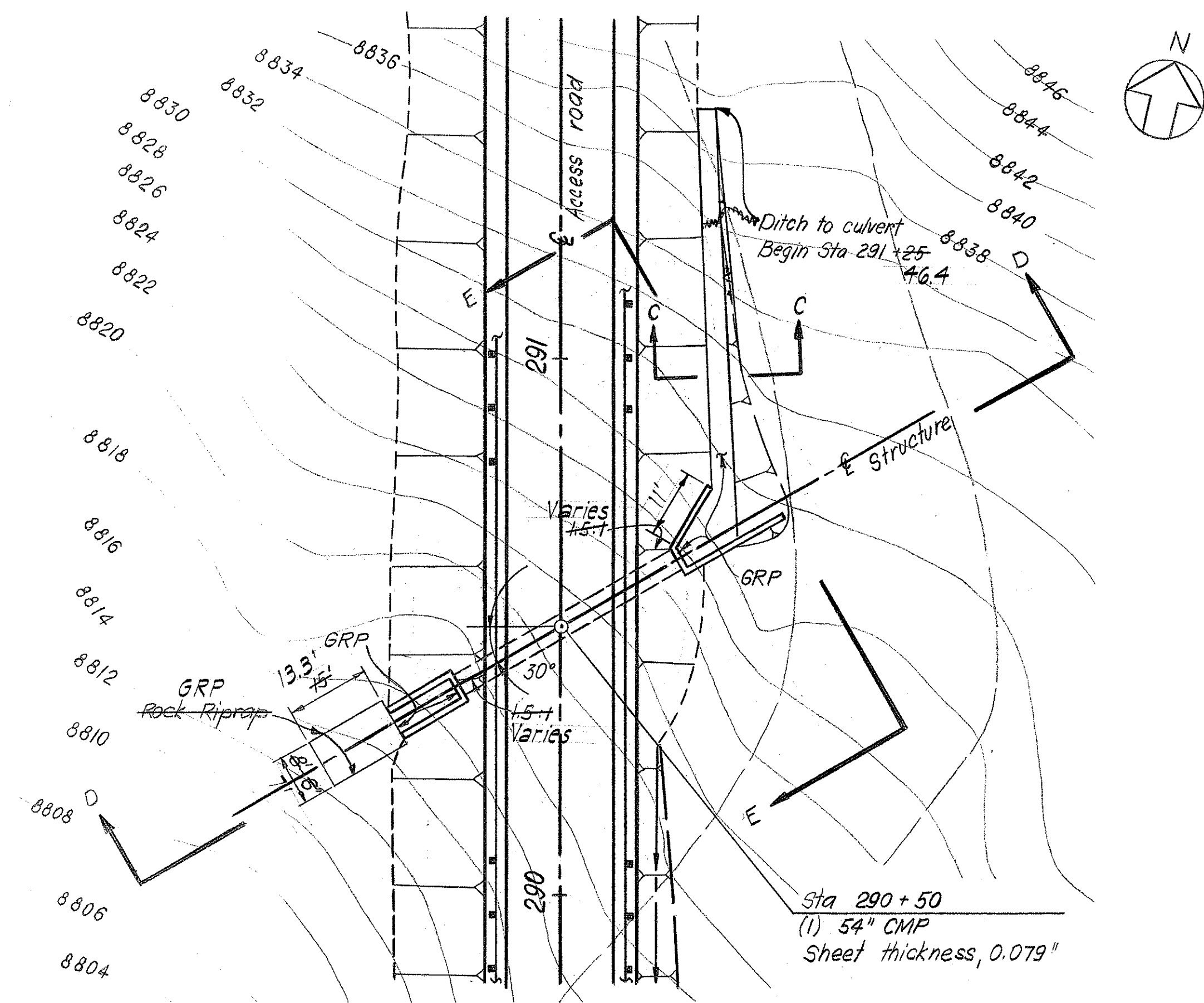
SCALE: AS NOTED      DATE: MARCH 1972

SHEET No. 8 OF 10 SHEETS C508

|                   |      |
|-------------------|------|
| SURVEY PLOTTED BY | DATE |
| DESIGNED BY       |      |
| NOTED BY          |      |
| CHECKED BY        |      |

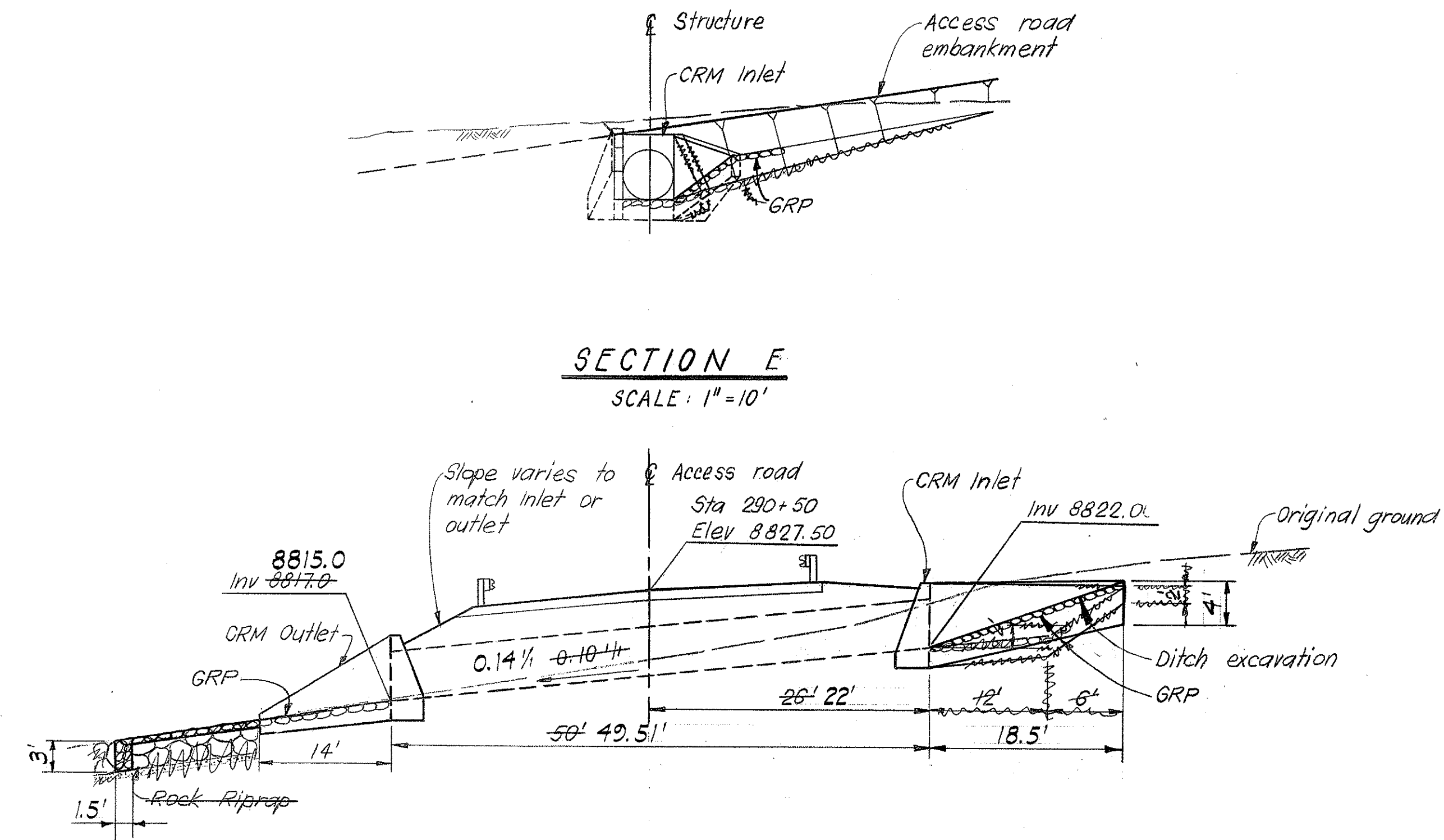


| STATE | PROJ. NO.  | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|-------|------------|-------------|-----------|--------------|
| HAW.  | BMD 66-343 | FY 71-72    | 39        | 88           |



PLAN  
SCALE: 1" = 20'

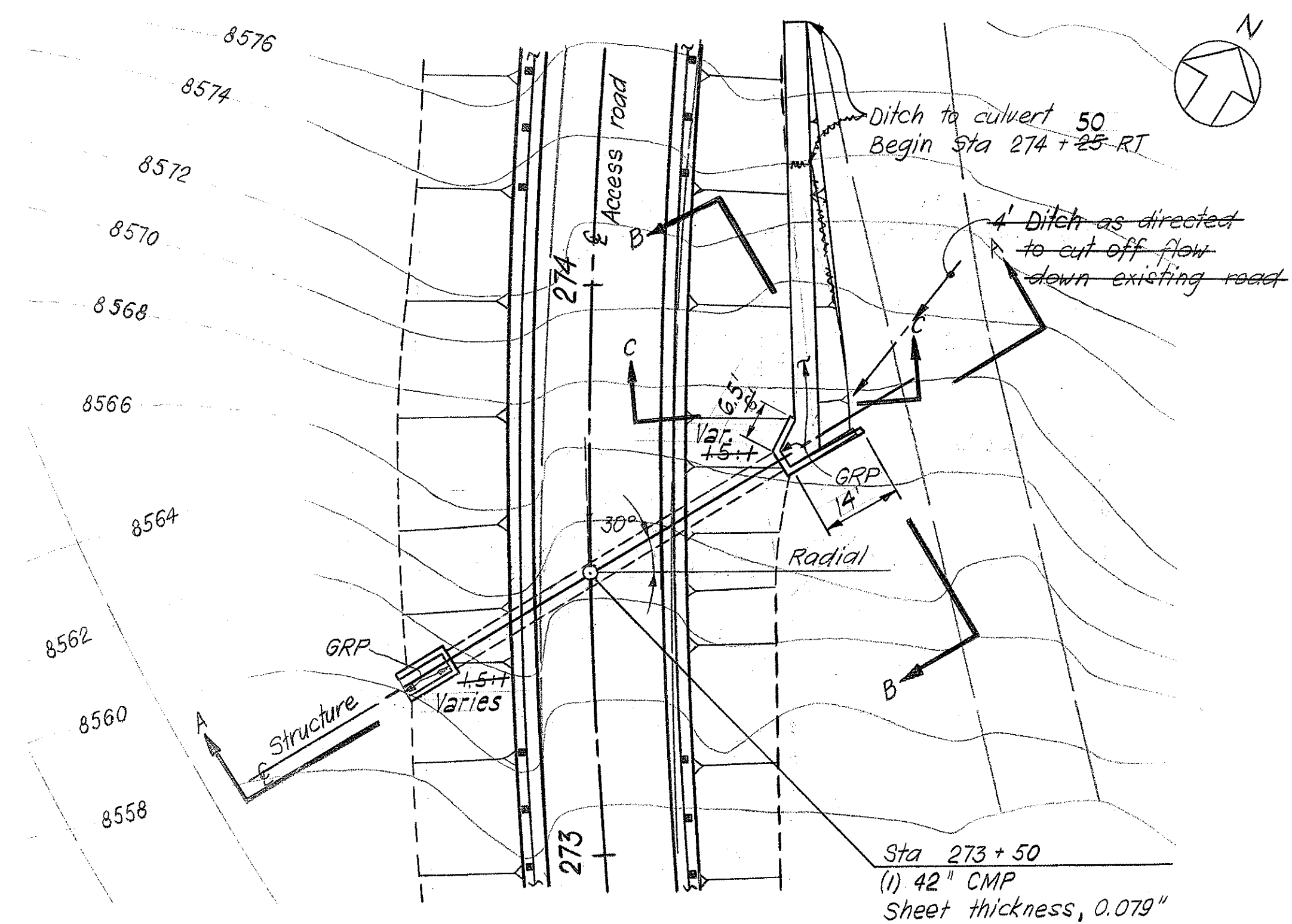
STRUCTURE NO 15 STA 290+50



SECTION D  
SCALE: 1" = 10'

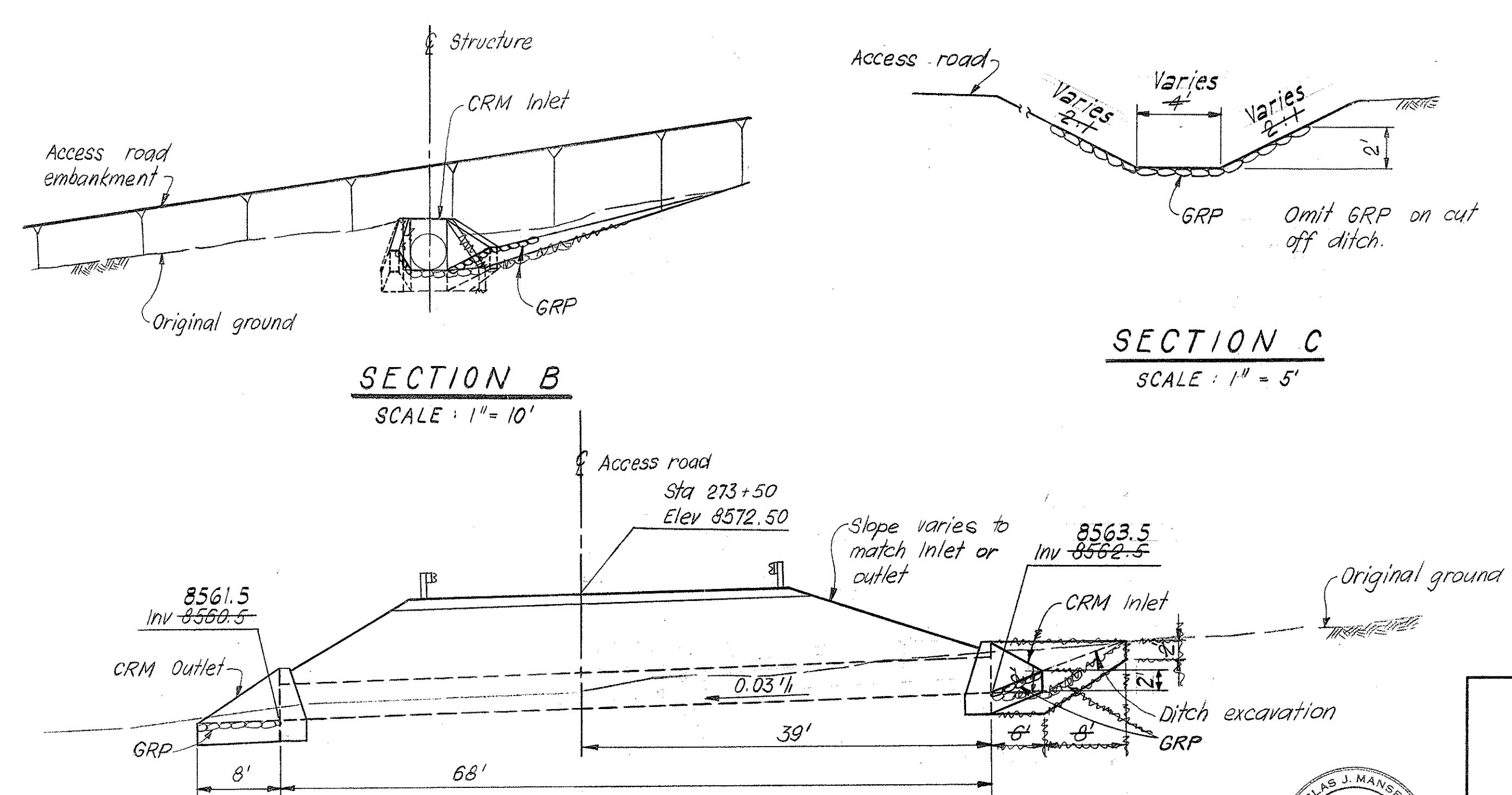
#### QUANTITIES

|                       | NO 14 | NO 15 |        |
|-----------------------|-------|-------|--------|
| Structure excavation  | 28.4  | 123.0 | Cu Yd  |
| Ditch excavation      | 70.6  | 34.5  | Cu Yd  |
| Cement Rubble Masonry | 17.4  | 31.7  | Cu Yd  |
| 42" CMP               | 68.5  |       | Lin Ft |
| 54" CMP               |       | 50.7  | Lin Ft |
| Grouted Rubble Paving | 8.4   | 12.9  | Cu Yd  |
| Rock Riprap           |       | 14    | Cu Yd  |



PLAN  
SCALE: 1" = 20'

STRUCTURE NO 14 STA 273+50



SECTION A  
SCALE: 1" = 10'

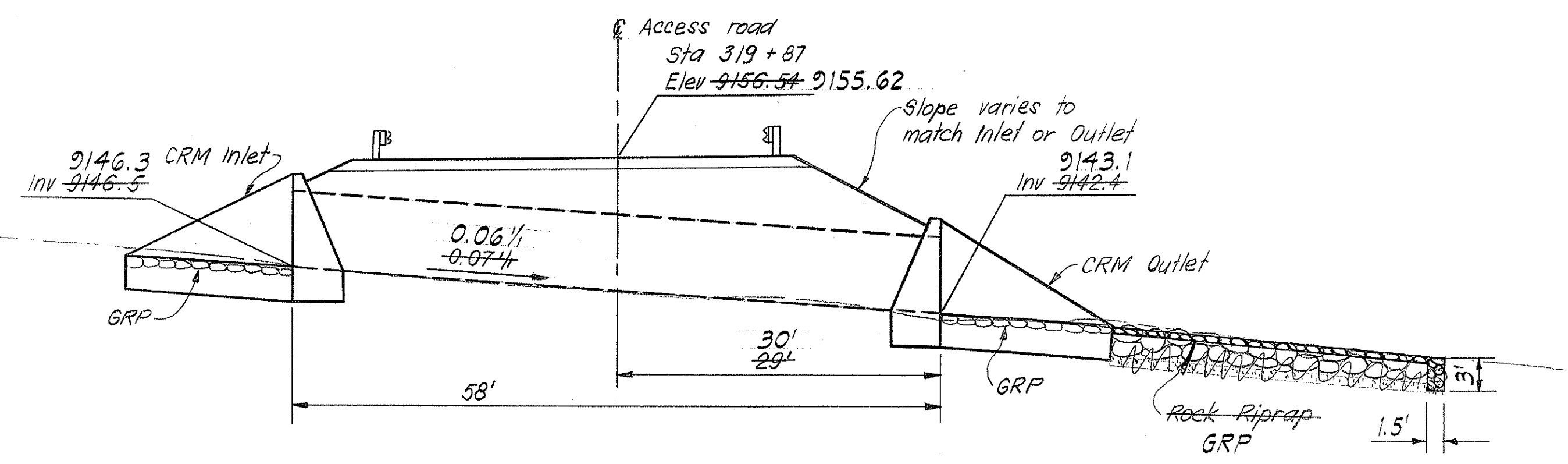
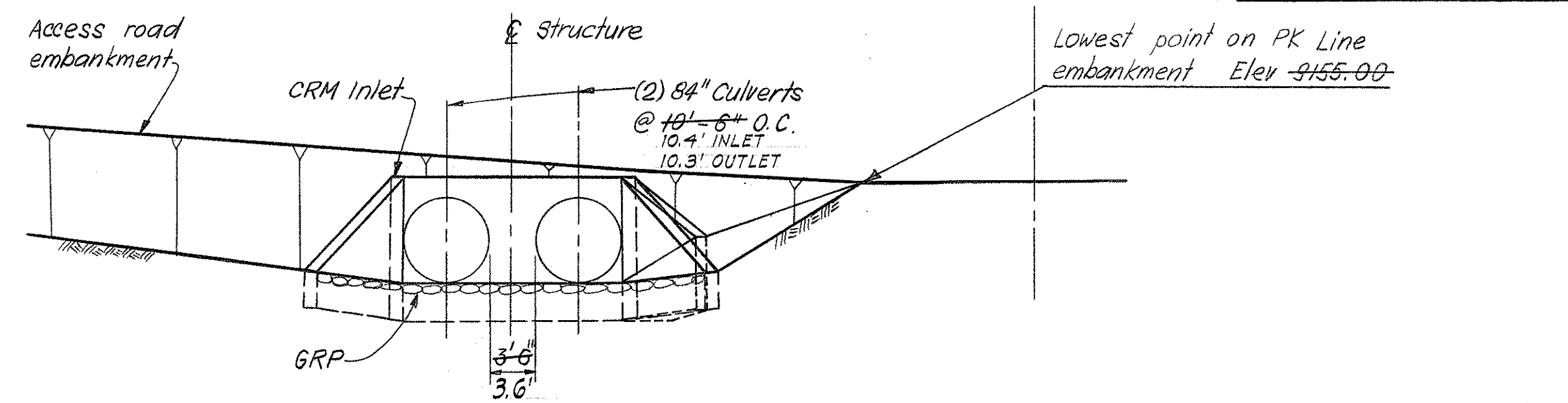
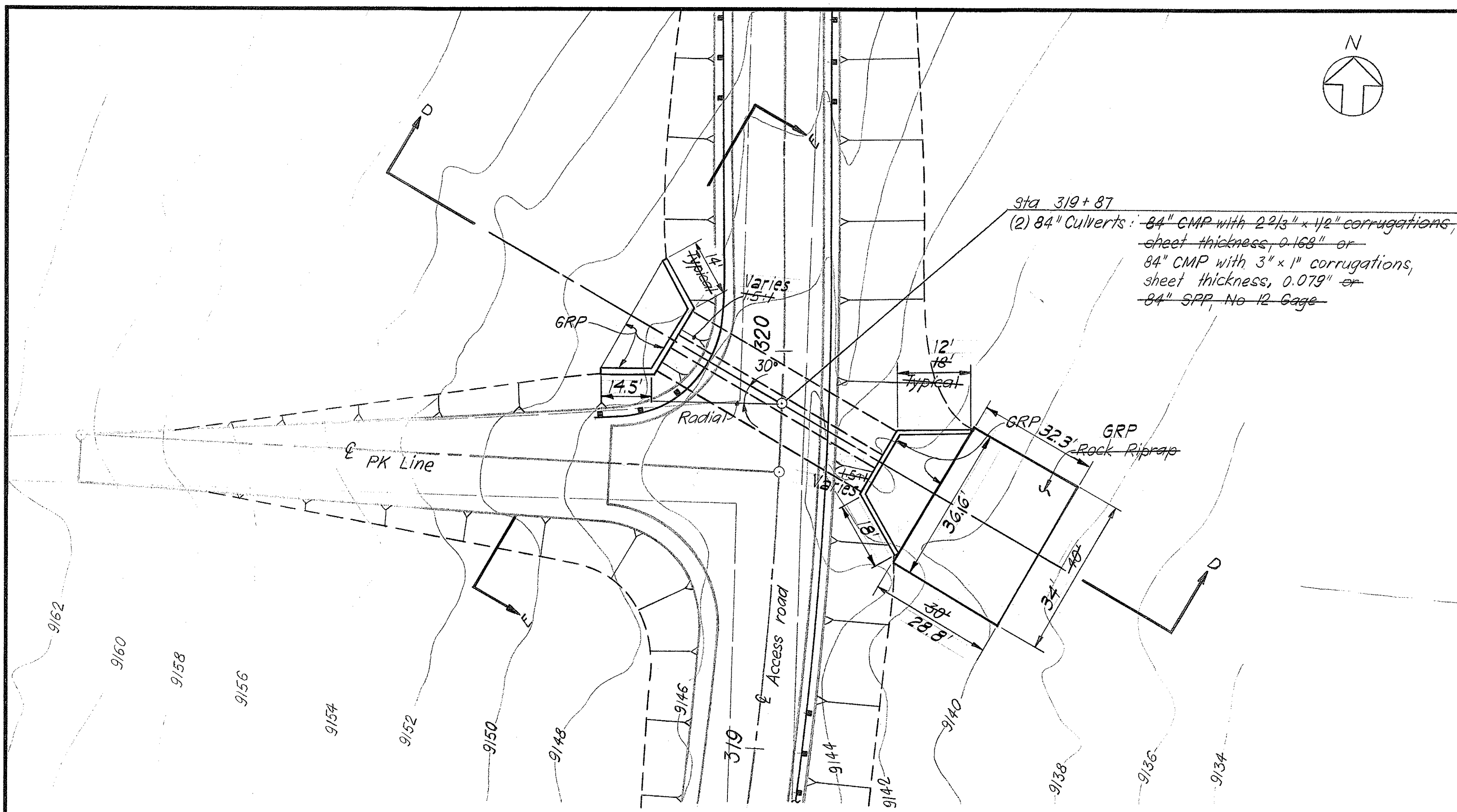
SECTION C  
SCALE: 1" = 5'

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

DRAINAGE STRUCTURE DETAILS  
MAUNA KEA OBSERVATORY ACCESS ROAD  
PROJ. NO. BMD 66 - 343  
SCALE: AS NOTED  
DATE: MARCH 1972  
SHEET No. 9 OF 10 SHEETS C509

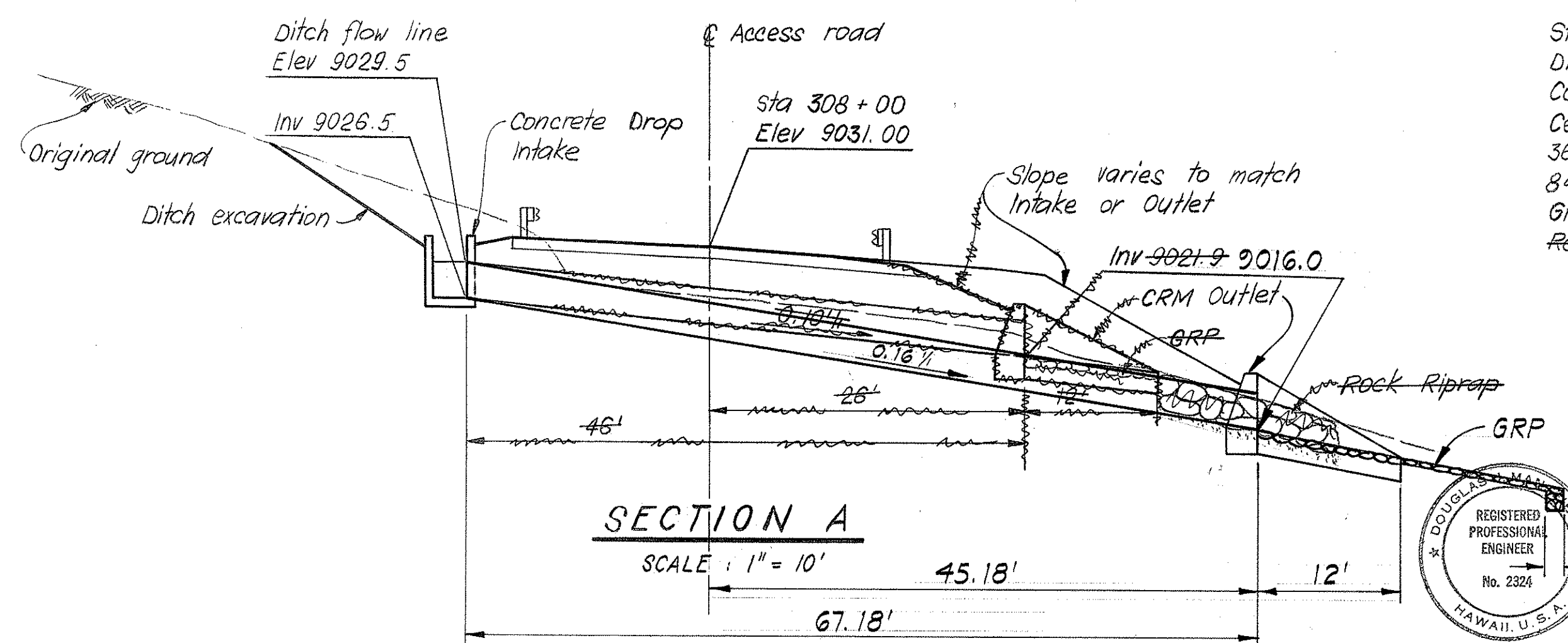
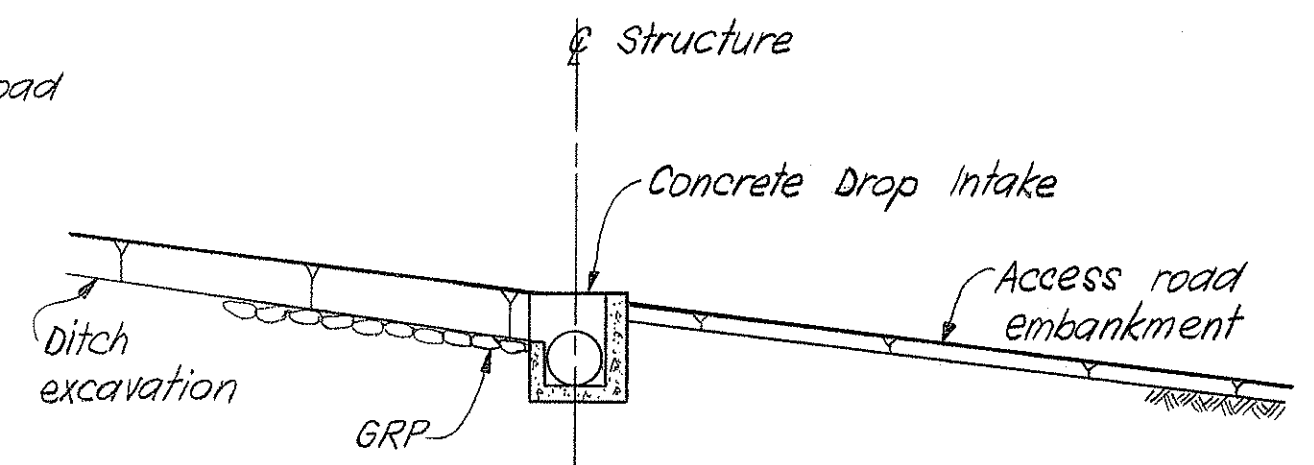
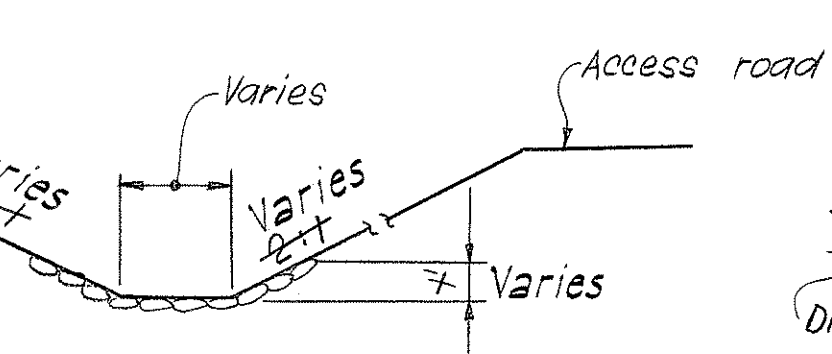
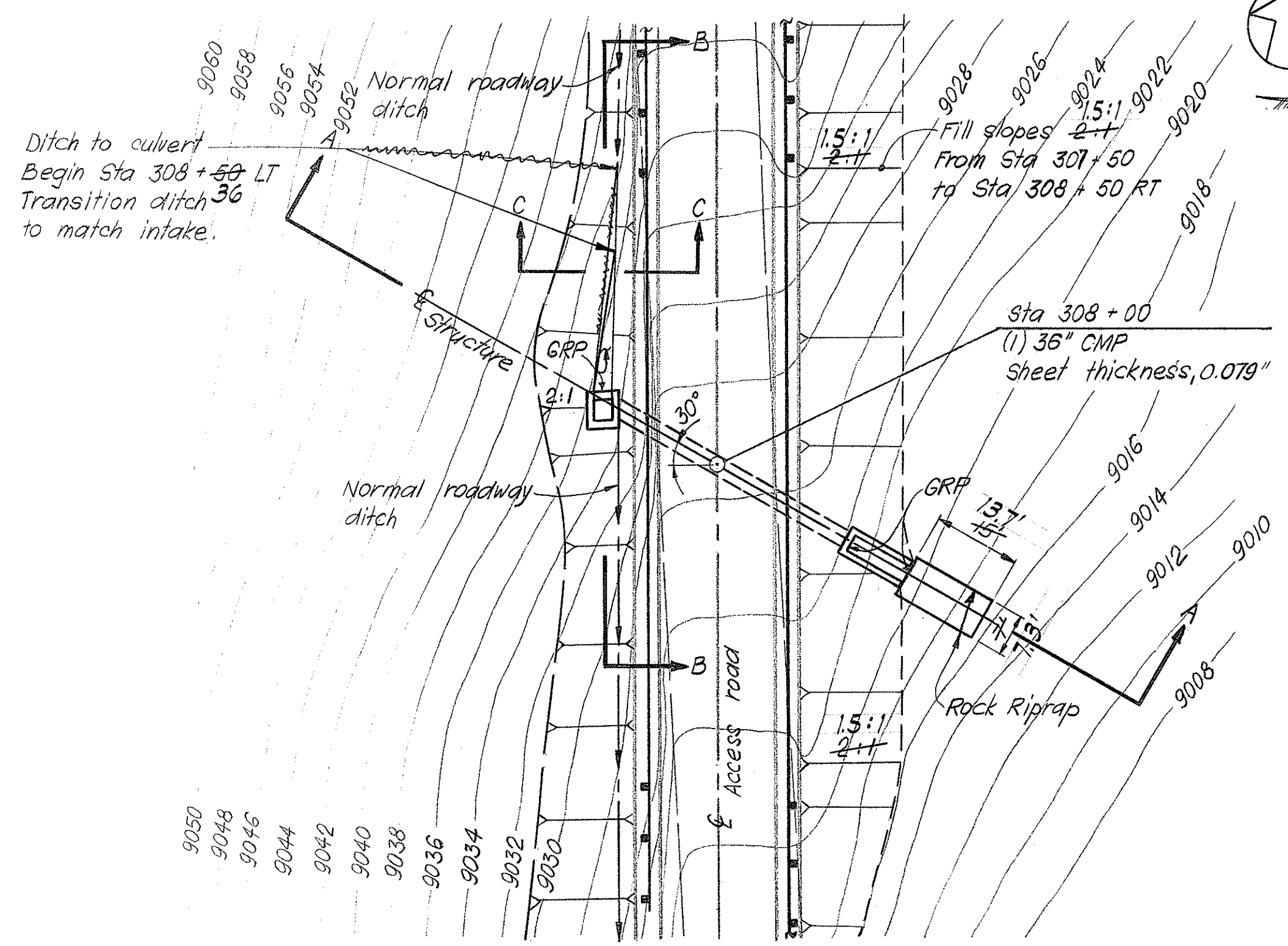
|                   |      |
|-------------------|------|
| SURVEY PLOTTED BY | DATE |
| DRAWN BY          |      |
| DESIGNED BY       |      |
| NOTED BY          |      |
| CHECKED BY        |      |

| STATE | PROJ. NO.  | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|-------|------------|-------------|-----------|--------------|
| HAW.  | BMD 66-343 | FY 71-72    | 40        | 88           |



PLAN  
SCALE: 1" = 20'

STRUCTURE NO 17 STA 319+87



PLAN  
SCALE: 1" = 20'

STRUCTURE NO 16 STA 308+00

| QUANTITIES            | STRUCTURE |                  |
|-----------------------|-----------|------------------|
|                       | NO 16     | NO 17            |
| Structure excavation  | 83.8-66   | 519 482.2 Cu Yd  |
| Ditch excavation      | 23.3-43   | 97.2 Cu Yd       |
| Concrete              | 2.9-27    | Cu Yd            |
| Cement Rubble Masonry | 8.7-8     | 79- 84.7 Cu Yd   |
| 36" CMP               | 68.6-46   | Lin Ft           |
| 84" Culvert Pipe      |           | 46- 115.2 Lin Ft |
| Grouted Rubble Paving | 4.8-5     | 12- 38.2 Cu Yd   |
| Rock Riprap           | 12        | 133- 64 Yd       |

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

DRAINAGE STRUCTURE DETAILS  
MAUNA KEA OBSERVATORY ACCESS ROAD  
PROJ. NO. BMD 66 - 343  
SCALE: AS NOTED  
DATE: MARCH 1972

SHEET No. 10 OF 10 SHEETS  
C510

|                   |      |
|-------------------|------|
| SURVEY PLOTTED BY | DATE |
| DRAWN BY          |      |
| DESIGNED BY       |      |
| NOTE BOOK         |      |
| CHECKED BY        |      |
| No.               |      |