

Appendix C Design and Cost Estimates

A. INTRODUCTION

1. General. This Appendix presents a discussion of applicable design considerations and construction methods utilized to establish a basis for the cost estimates. General requirements for real estate and operation and maintenance are also presented.

B. DESIGN AND CONSTRUCTION

2. Channels. A cutoff channel would be constructed in the flood plain to connect portions of the existing river system. The cutoff channel would bypass that portion of the existing channel that meanders outside of the proposed Aguadilla levee alignment.

3. Levees. Two levees would be constructed in the Rio Culebrinas floodplain to provide 100-year flood protection to the residences of the communities of Aguadilla and Espinar. Conventional earth handling equipment would be used to construct the levees. Construction material would be obtained from the designated borrow area. A geotechnical discussion of the suitability of materials is provided in Appendix B. The levees would be constructed to satisfy the hydraulic requirements presented in Appendix A and would have a minimum crest width of 3.0 meters with side slopes of 1 vertical on 2.5 horizontal (1V:2.5H). Also, both levees would be overbuilt 0.15 to 0.30 meters along certain reaches to compensate for long-term settlement.

Typical sections of the Aguadilla and Espinar levees are provided on Plates C-5 and C-6. The disposition of the materials removed from the project area (including debris), that are unsuitable for levee construction, would be in accordance with paragraph 7b. of this appendix.

4. Drainage Culvert Structures. Drainage culvert structures would be placed through the levees to provide for interior drainage. The Aguadilla levee would have three drainage structures and the Espinar levee would have one drainage structure. All culverts would have an invert elevation of -0.30 meters NVGD, and the corrugated metal pipe (CMP) coating and required thickness would be based on exposure to sea water and soil characteristics. A temporary diversion channel would be constructed at each structure site to divert water during construction.

a. Aguadilla Levee. The drainage structures in the Aguadilla levee would consist of AL-S-1 (3-60" CMP), AL-S-2 (6-60" CMP), and AL-S-3 (3-60" CMP). Flap gates and concrete headwalls with wingwalls would be provided on the floodside end of each structure. Refer to Plates C-2 and C-3 for site plan and typical section.

b. Espinar Levee. The drainage structure in the Espinar levee would consist of EL-S-1a. The structure would have 2-60" CMP with flap gates. A concrete headwall with wingwalls would be provided on the floodside end of the structure. Refer to Plates C-2 and C-3 for site plan and section.

5. Drainage Culverts. A 36-inch CMP culvert would be provided at each road ramp location (3) to maintain interior drainage along the protected side of the levee. Refer to Plate C-4 for a typical site plan and section.

6. Bank Protection. The levees would be grassed to provide general erosion protection. Riprap would be utilized as standard practice in protecting the intake and discharge areas for the proposed culvert drainage structures.

7. Borrow and Disposal Areas.

a. Borrow Area. A detailed geotechnical discussion of the materials within the borrow area is provided in Appendix B. The location of the borrow area is shown on Plate B-2 in Appendix B.

b. Disposal Area. A specific designated disposal area is not required. All debris and unsuitable material from construction of the project features would be placed in the flood plain adjacent to the levees or used as topsoil along the levee.

C. RELOCATIONS

8. General. This project has two local sponsors. The municipality of Aguada would be responsible for the Espinar levee and corresponding features, and the municipality of Aguadilla would be responsible for the Aguadilla levee and corresponding features. The project sponsors would be required to assume the costs for all relocations and alterations. These costs are based on the general alignments shown in the main report. Final alignments would be determined upon completion of detailed topographic surveys and would be adjusted as necessary to minimize impacts on existing structures and utilities. The recommended plan presented in this report would require some road relocations as discussed in the following

paragraphs. All relocation of utilities, electric transmission lines, or telephone lines would be the responsibility of the project sponsor.

9. Road Relocations. Three road ramps would be required where the proposed levee crosses Highway 418, Highway 115, and Highway 442. The road ramps would be constructed prior to construction of the levee, and a temporary road by-pass would be provided at each location. No other road relocations are anticipated. The locations of the proposed road ramps are shown on Plate C-1.

10. PR Hwy 418 Box Culvert. The existing box culvert (bridge) located in Cano Madre Vieja under the highway would be extended approximately 10 meters at each end to accommodate the proposed road ramp.

11. Utilities. Water lines, sewer lines, electric power lines, and telephone lines would require relocation. The location of the areas of anticipated impacts on existing utilities are provided on Plate C-1. The estimated costs for relocation of these utilities are included in the cost estimate.

D. OPERATIONS AND MAINTENANCE

12. General. The project sponsor would be responsible for operation and maintenance of the improvements and features proposed in this report upon completion of the construction project. The Contractor would be responsible for all maintenance during the construction contract.

13. Inspection. Joint field inspections with personnel from the U.S. Army Corps of Engineers and the local sponsor would be conducted on a regular basis to evaluate the performance and condition of the various project features. Additional field inspections would be conducted following a significant storm event.

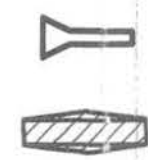
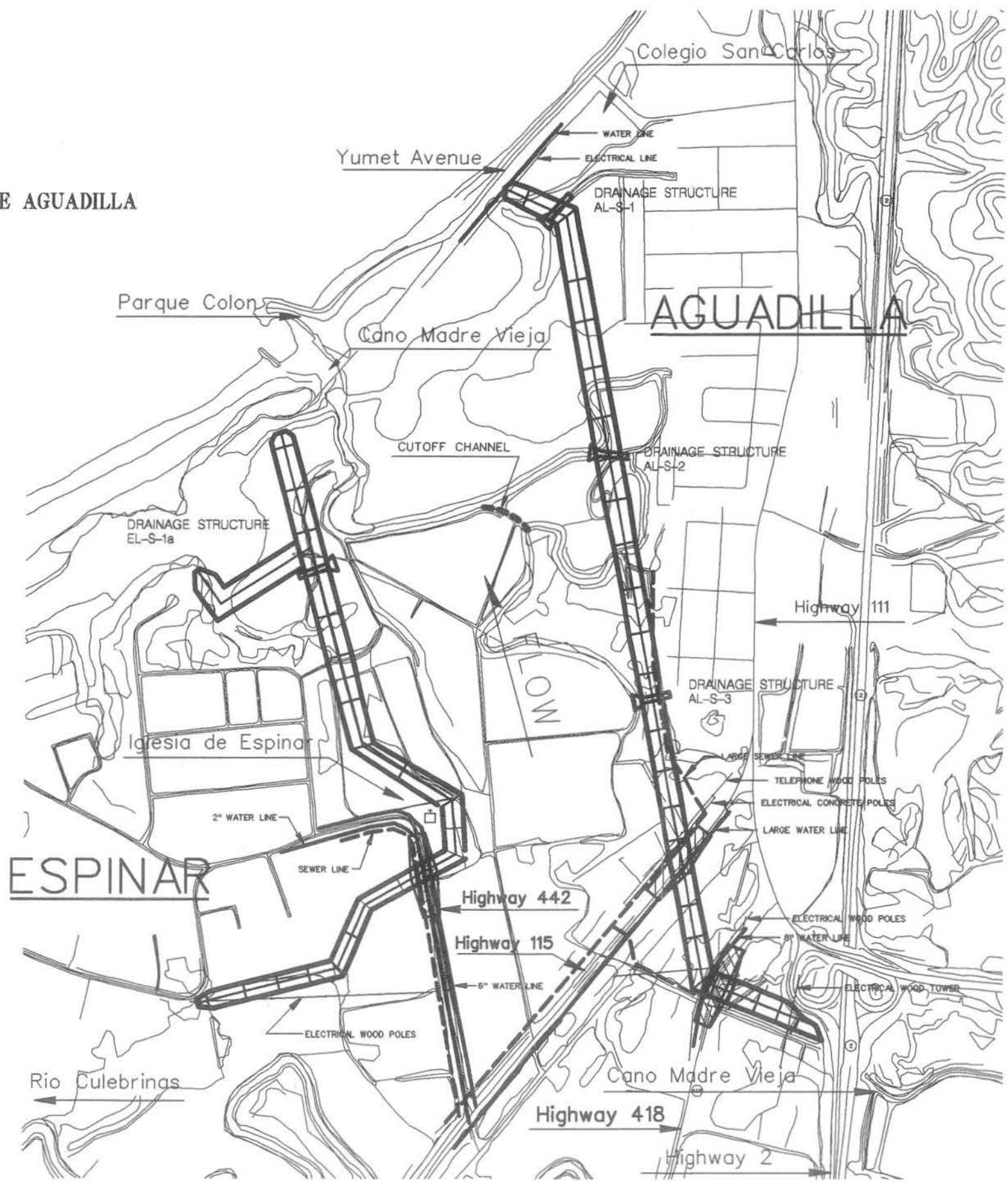
14. Estimated Annual Costs. The estimated annual operation and maintenance cost for the project is \$15,000. These costs are based on removing accumulated debris and sediment adjacent to the control structures and repairing the riprap protection on an annual basis or as required after a significant storm event. Levee maintenance would consist of periodic mowing and erosion repair.

15. O&M Manual. Operation and maintenance of the project facilities would be performed in accordance with instructions prepared and incorporated in the "Operation and Maintenance Manual" which would be furnished to the project sponsor. The O&M Manual would be prepared in accordance with ER 1110-2-401.

[REDACTED]

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BAHIA DE AGUADILLA



CMP DRAINAGE STRUCTURES
ROAD RAMP ACROSS LEVEE



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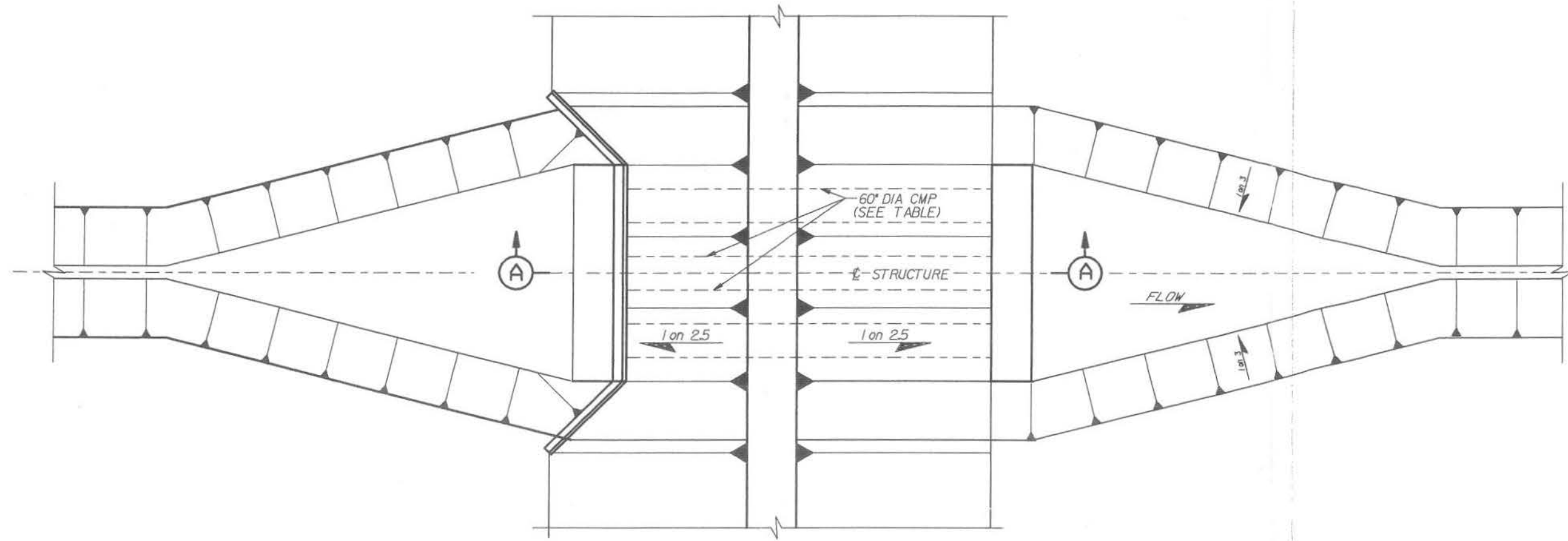
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RIO CULEBRINAS @ AGUADA /AGUADILLA, PUERTO RICO
DETAILED PROJECT REPORT

PROJECT PLAN
ROAD RAMPS /UTILITIES RELOCATIONS

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

NOT TO SCALE DATE: NOVEMBER 1999



SITE PLAN

RIO CULEBRINAS @ AGUADA /AGUADILLA, PUERTO RICO
 DETAILED PROJECT REPORT

**AQUADILLIA / ESPINAR
 CONTROL STRUCTURES**

SITE PLAN

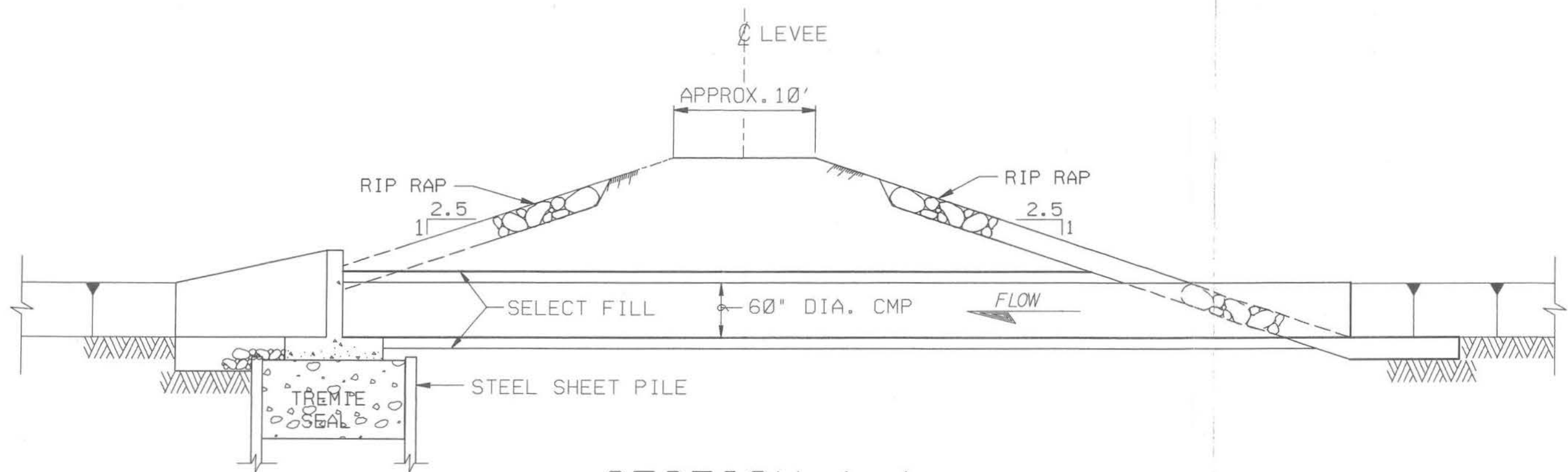
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(REVISED: MARCH 2001)



SECTION A-A

STRUCTURE	LEVEE STATION	NO CMP	CMP SIZE (INCHES)	GATE TYPE	INVERT EL. (FEET)	CHANNEL INVERT (FEET)	TOP OF LEVEE (FEET)	TOTAL LENGTH OF PIPE (FEET)
AL-S-1	1+39.5	3	60	FLAP	-1.0	-1.0	12.04	215
AL-S-2	6+05.5	6	60	FLAP	-1.0	-1.0	14.34	946.1
AL-S-3	10+52.9	3	60	FLAP	-1.0	-1.0	15.35	275
EL-S-1A	2+50.0	2	60	FLAP	-1.0	-1.0	14.44	315

NOTE:

HEADWALL DISTANCE DOES NOT INCLUDE WINGWALL DISTANCE.

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J. D. H.	

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DETAILED PROJECT REPORT

AGUADILLA / ESPINAR
CONTROL STRUCTURE

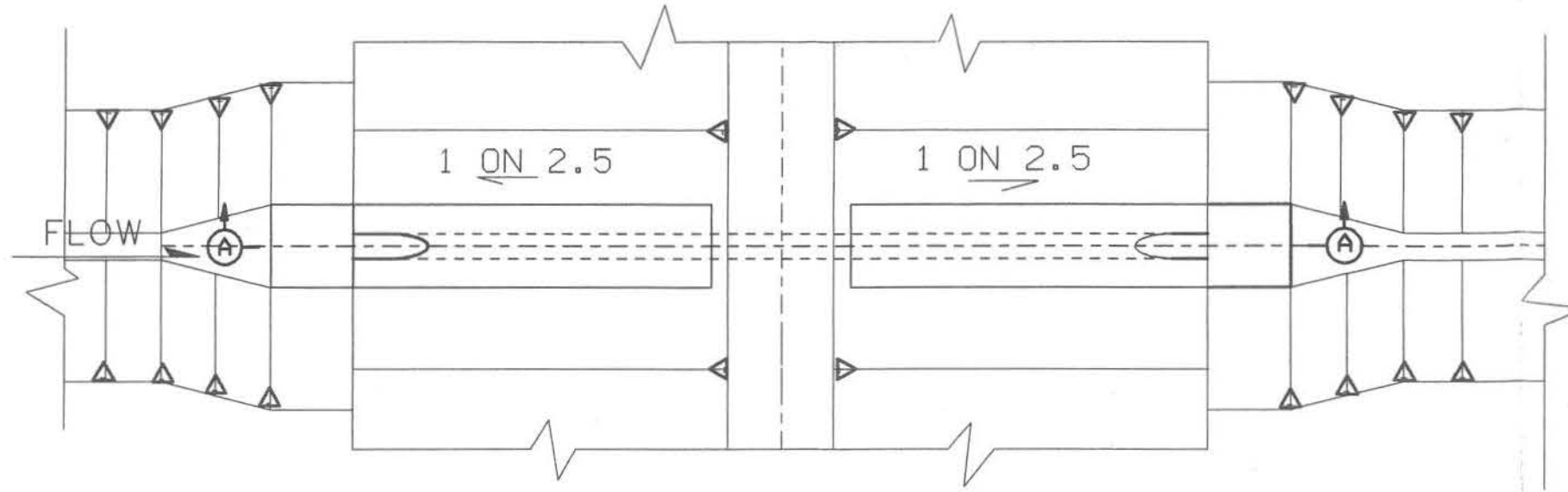
TYPICAL SECTION

DEPARTMENT OF THE ARMY
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JACKSONVILLE, FLORIDA

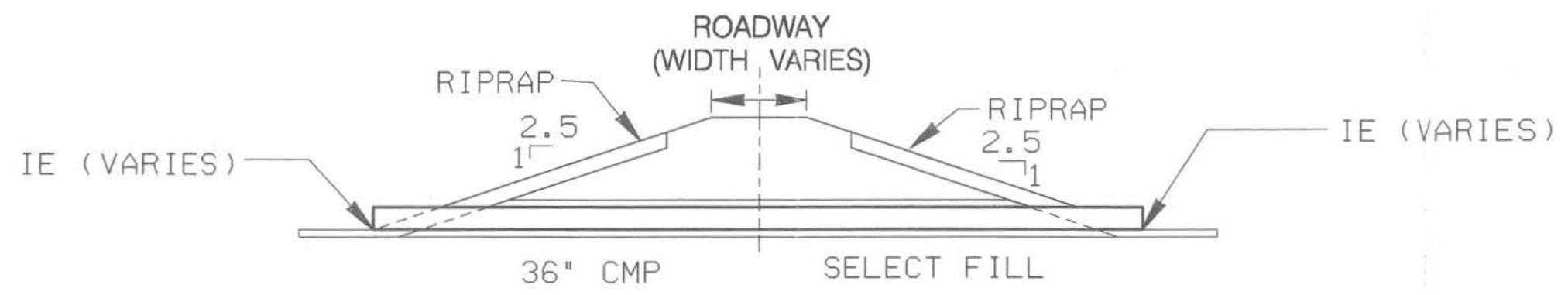
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PLATE C-3



TYPICAL 36" CMP CULVERT PLAN



SECTION

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 DETAILED PROJECT REPORT

TYPICAL 36" CMP
 CULVERT STRUCTURE
 SITE PLAN AND SECTION

DEPARTMENT OF THE ARMY
 JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
 JACKSONVILLE, FLORIDA

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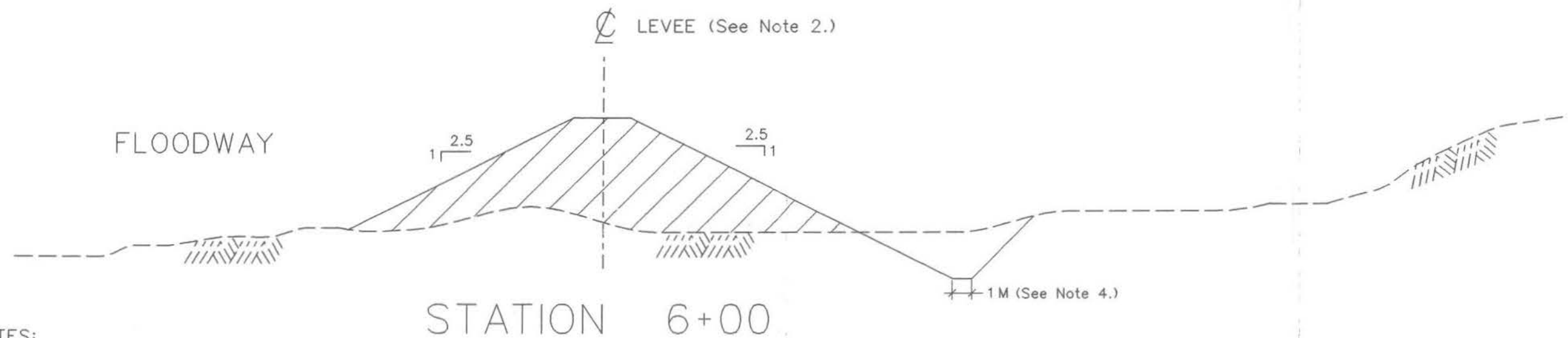
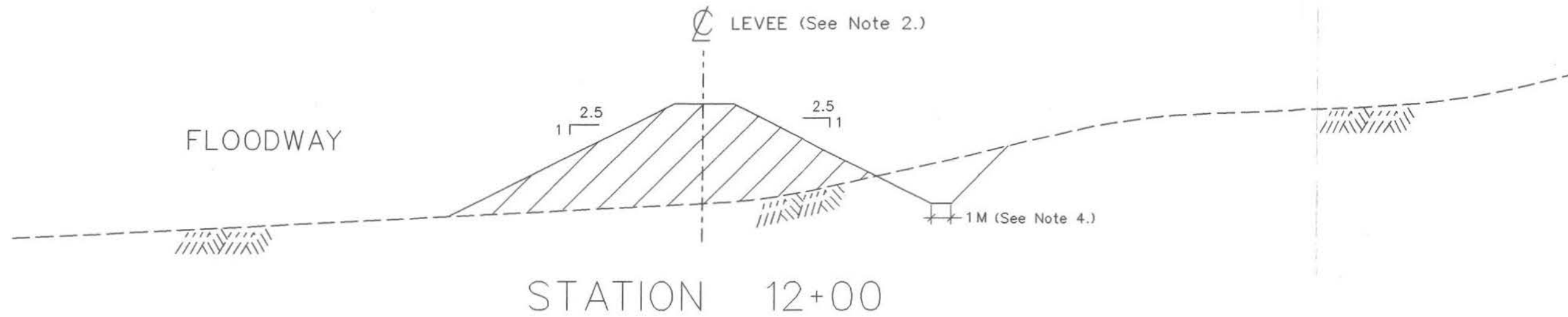
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PLATE C-4

WEST

EAST



NOTES:

1. DRAINAGE STRUCTURES WOULD BE PROVIDED THROUGH THE LEVEES AT APPROXIMATELY AS FOLLOWS:

- AL-S-1 AT STATION 1+39.5 (3-60" CMP W/ FLAPGATES)
- AL-S-2 AT STATION 6+05.5 (6-CMP" CMP W/ FLAPGATES)
- AL-S-3 AT STATION 10+52.9 (3-60" CMP W/ FLAPGATES)

2. LEVEE CROWN WIDTH IS 3 METERS. ELEVATIONS AT STATION POINTS ALONG THE LEVEE ARE PROVIDED IN APPENDIX A.

3. ROAD RAMPS WOULD BE CONSTRUCTED AT PR HIGHWAYS 115 AND 418, AND LOW-FLOW DRAINAGE CULVERTS WOULD BE INSTALLED ON THE PROECTED SIDE OF THE LEVEE.

4. INVERT ELEVATION VARIES. REFER TO TABLE A-9 IN APPENDIX A.



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DETAILED PROJECT REPORT

TYPICAL SECTIONS
AGUADILLA LEVEE

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

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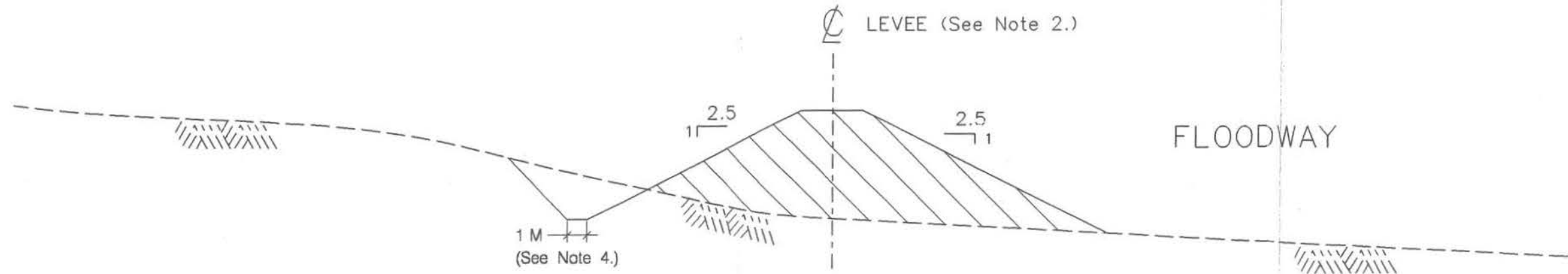
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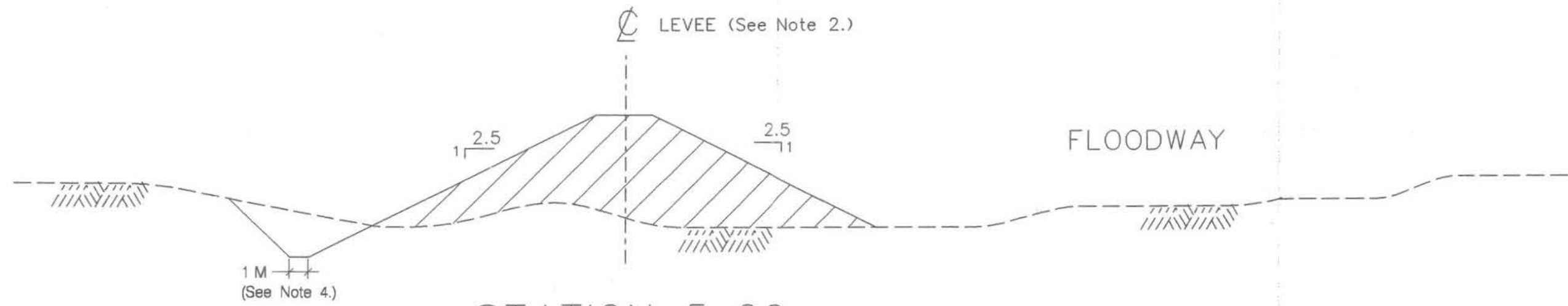
PLATE C-5

WEST

EAST



STATION 10+00



STATION 5+00

NOTES:

1. A DRAINAGE STRUCTURE EL-S-1a WOULD BE PLACED THROUGH THE LEVEE AT APPROXIMATELY STATION 2+50. STRUCTURE WOULD CONSIST OF 2-60" CMP WITH FLAPGATES.
2. LEVEE CROWN WIDTH IS 3 METERS. ELEVATIONS AT STATION POINTS ALONG THE LEVEE ARE PROVIDED IN APPENDIX A.
3. A ROAD RAMP WOULD BE CONSTRUCTED AT PR HIGHWAY 442, AND A LOW-FLOW DRAINAGE CULVERT WOULD BE INSTALLED ON THE PROTECTED SIDE ON THE LEVEE.
4. INVERT ELEVATION VARIES. REFER TO TABLE A-9 IN APPENDIX A.



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 DETAILED PROJECT REPORT

TYPICAL SECTIONS
 ESPINAR LEVEE

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 JACKSONVILLE, FLORIDA

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