DEPARTMENT OF THE ARMY

BUFFALO DISTRICT, CORPS OF ENGINEERS

1776 NIAGARA STREET

BUFFALO, NEW YORK 14207

NCBED-DC 10 December 1981

SUBJECT: R.E. GINNA Nuclear Generating Plant, Town of Ontario, NY

Project Officer
United States Nuclear
Regulatory Commission
Washington, DC 20555

1. REFERENCE:

a. Statement of Work for CERC-GINNA Nuclear Power Plant Docket No. 50-244 (see Exhibit 1).

b. Rochester Gas and Electric Corporation letter to Director of Nuclear Reactor Regulation, dated 28 January 1981, transmitting RG&E responses to NCR Evaluation of SEP Topics II-3.A, II-3.B; II-3.C, "Hydrology, Flooding, and Ultimate Heat Sink" (see Exhibit 2).

c. U.S. Nuclear Regulatory Commission memorandum for Chief, Systematic Evaluation Program Branch, dated 3 March 1981, containing NRC responses to Rochester Gas and Electric comments on SEP Topics II-3.A, II-3.B, and II.3.C (see Exhibit 3).

d. U.S. Nuclear Regulatory Commission letter to Rochester Gas and Electric Corporation, dated 10 April 1981, transmitting NRC evaluation of Systematic Evaluation Program Topics II-3.A, II-3.B, II-3.C (see Exhibit 4).

e. Rochester Gas and Electric Corporation letter to Director of Nuclear Reactor Regulation, dated 1 May 1981, transmitting RG&E responses to NRC correspondence on SEP Topics III-3.A (24 Mar 81) and II-3.A, II-3.B, II-3.B.1 and II-3.C (10 Apr 81) (see Exhibit 5).

f. Rochester Gas and Electric Drawing Numbers 33013-171 and 33013-51E, Plan and Sections of GINNA revetment (not included).

g. Buffalo District, Corps of Engineers letter to Project Officer - U.S. Nuclear Regulatory Commission, dated 2 November 1981, transmitting Memorandum for the Record - Trip Report Concerning Stone Revetment at R.E. GINNA Nuclear Generating Plant (see Exhibit 6).

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PURPOSE OF REPORT

2. This letter report presents the results, conclusions, and recommendations arising from inspections of the engineering and operational aspects of the existing stone revetment along the lakeshore on Lake Ontario at the R.E. GINNA Nuclear Generating Plant.

SCOPE OF REPORT

3. This letter report will serve as the Corps of Engineers technical opinion on the adequacy of the existing stone revetment at the R.E. GINNA Nuclear Generating Plant.

AUTHORIZATION

4. This letter report was prepared by the Buffalo District, Corps of Engineers in response to Coastal Engineering Research Center Interagency Agreement No. NRC-03-81-110 Proposed Work Directive 1 entitled "Statement of Work for CERC GINNA Nuclear Power Plant Docket No. 50-244" (Reference 1a).

LOCATION AND DESCRIPTION OF EXISTING STONE REVETMENT

5. The R.E. GINNA Nuclear Generating Plant is located in the town of Ontario, NY, on the south shore of Lake Ontario, approximately 20 miles east of the city of Rochester, NY. The stone shore revetment is along the shoreline on the north side of the plant and protects the main building complex from wave attack by Lake Ontario. The licensee of the R.E. GINNA Nuclear Generating Plant is the Rochester Gas and Electric Corporation.

6. The stone revetment was constructed in two reaches: an estimated 420-foot long west reach and an estimated 400-foot long east reach. The east and west stone revetment reaches are separated by a 20-foot wide discharge canal from the generating plant (see Plates 1 and 2). According to Section A-A and Section B-B on Drawing No. 33013-51E Reference 1f), the stone revetment was initially constructed in the 1960's with two layers of 5-ton minimum armor stones laid up on a 1.0 vertical on 1.5 horizontal sideslope to a minimum elevation of 257.0 (msl). Due to the high lake levels that were predicted for Lake Ontario during the early 1970's, the crest elevation of the revetment was raised to a minimum of 261.0 (msl) by placement of cap stone along the top of the revetment. Typical cross-sections of the east and west reaches of the stone revetment are shown on Plates 3 and 4.

DESCRIPTION OF PROBLEMS UNDER INVESTIGATION

7. Section 3.3.0 of the Nuclear Regulatory Commission evaluation of the Systematic Evaluation Program (Reference 1d) states that visual observations during the SEP site visit indicate the revetment fronting the plant on the west side of the discharge canal is significantly degraded. The evaluation notes that portions of the revetment would be incapable of providing adequate protection from wave attack during a severe storm, up to and including the

Probable Maximum Water Level (PMWL), resulting from the Probable Maximum Surge (PMS) on Lake Ontario which is the design basis flood for the revetment. The NRC staff calculates that about 2.5 feet of water would be ponded in the vicinity of the screen house and discharge canal submerging emergency buses if the revetment is eroded significantly and the design basis storm occurs. An NRC analysis of the stability of the revetment indicates that the revetment would be capable of resisting the Lake Ontario PMWL and associated wave action and would, therefore, meet current regulatory criteria provided the revetment exists as designed.

8. Rochester Gas and Electric Corporation responses regarding the NRC assessment on the SEP Topic Section 3.3.0 - Lake Ontario Flooding (References 1b and 1e) cite that inspections made by RG&E have been unable to find any visible evidence of degradation of the revetment fronting the plant on the west side of the discharge canal. RG&E determined that the revetment is structurally sound and comparable to the requirements of the original specifications. RG&E believes that the appearance of degradation indicated by the NRC may be due to the placement of loose fill on the revetment following upgrading (cap stone placement) that was performed in 1973. The RG&E response indicates that this loose fill performs no function in relation to the requirements of the revetment and is simply excess sub-base material which was used to fill natural occurring voids in the joints between individual armor stones.

9. The NRC staff has reviewed the design of the revetment, the flood design basis thereof, and the consequence of failure during a severe storm event if the armour stones were not adequate. The NRC assessment indicates that the original revetment design was adequate, however, a NRC site visit indicated that portions of the revetment on the west side of the discharge canal appeared to have been degraded in terms of the number and sizes of stones at several locations. Therefore, the Corps of Engineers was requested to provide a technical opinion of the adequacy of the existing revetment and to suggest ways that the revetment may be repaired if not found adequate.

OBSERVATIONS FROM FIELD INSPECTIONS

10. In response to several FONECONS betweens Mr. Charles Johnson of North Central Division, Corps of Engineers, and Mr. Richard Gorecki of Buffalo District, Corps of Engineers, the District Corps Office was requested to make a site inspection of a stone shore revetment at the R.E. GINNA Nuclear Generating Plant. The purpose of the site inspection was to make visual observations of the revetment in order to provide a technical opinion of the adequacy of the stone shore revetment which protects the main building complex from wave attack by Lake Ontario.

11. On 21 October 1981, Mr. Richard Gorecki of the Buffalo District Coastal Engineering Section and Mr. Jon Kolber of the Buffalo District Geotechnical Section met Mr. Gary Goetz of Rochester Gas and Electric Corporation at the R.E. GINNA plant site (References 1g). Mr. Goetz, the project engineer for

the revetment construction project, guided the Corps representatives on an inspection of both the east and west reaches of the stone revetment. The inspection team did not note any significant displacement of stones in the sideslope on the lakeward face of the structure nor any unusual depressions in the structure sideslope or crest. The fence which is adjacent to the backside of the west reach of the revetment appeared to be plumb and have an alignment that runs parallel to the revetment, thereby, indicating that there has been no appreciable movement of the fill material behind or under the revetment. On the east reach of the revetment, there were no apparent depressions or slippages evident in the backslope of the compacted earth dike, thereby, indicating that there has been no appreciable movement of the fill material under the revetment.

12. The armor stones on the lakeward face of both the east and the west revetment reaches were covered and obscured by stone in the 4 to 9-inch range in several areas. Therefore, it was impossible to positively determine the existence of two layers of armor stones at these locations, which were required by the final design, particularly, at the west end of the revetment where a larger concentration of the estimated 4 to 9-inch stone had been placed. It could not be verified that the revetment is of adequate design in the areas where the small stone had been placed without removing the small stones. Therefore, Mr. Gary Staley of NRC contacted the licensee and directed them to remove the small stones in a few locations such that a visual inspection of the revetment could be made to insure that the double layer of armor stone is in place.

13. On 13 November 1981, a second site inspection was conducted. The inspection team consisted of the following personnel:

Gary Goetz	-	Rochester Gas and Electric Corporation
George Wrobel	-	Rochester Gas and Electric Corporation
Gary Staley	-	Nuclear Regulatory Commission
Thomas Wilkinson	-	Corps of Engineers
Jonathan Kolber	-	Corps of Engineers
Richard Gorecki	-	Corps of Engineers

The licensee removed the small stones in two areas on the west end of the west reach of the revetment. Inspection of these two areas indicated that the double layer of armor stone is intact and that the small stone was not underlayer material as was suspected during the NRC Systematic Evaluation Program site visit. Further inspection of the west reach of the revetment disclosed an area, located approximately midway on the revetment, where there may have been minor movement of the armor stone layer. Discussions with Mr. Gary Goetz indicated that waste concrete had been dumped at this location and the toe stone could not be properly placed due to the concrete. The armor stone apparently slid on the concrete into what appears to be a stable position, thereby causing minor movement on the face of the revetment at this location.

14. The large void on the east revetment reach which was observed during the 21 October 1981 inspection was reexamined during the 13 November 1981 inspection. The void is about 100 feet east of the west end of the east revetment and extends for about 25 to 30 feet directly under the cap stones which bridge the void with little rock-to-rock contact over the void. This void is apparantly due to a construction oversight not a structural failure.

15. The east and west ends of the revetment reaches terminate and tie into the natural high bluff away from the main (reactor) building complex. Although erosion had occurred in these bluff areas, probably during the high lake levels of the early 1970's, there was no evidence of current active bank erosion since the bluff faces are covered with vegetative growth probably several years old.

CONCLUSIONS

16. The stone revetment has been in place for approximately 15 years. Based upon a review of the material furnished by NRC (References 1a through 1f) and on visual observations from the 21 October 1981 and 13 November 1981 site inspections, there is no evidence where the existing revetment is in any immediate or foreseeable future danger of failing. The revetment appears to be structurally sound and stable with no evidence of any major structure stability problem and based on its performance to date, the anticipated durability and survivability of the revetment, as constructed, should exceed the life of the plant (i.e., the nuclear vessel which has an estimated life of about 25 years). The two site inspections verified that the revetment has not degraded from the original design and that the small stone at various locations along the lakeward face of the revetment is waste material that had been placed to fill voids between the large armor stones. Although there are some cracked armor stones, the actual gradation appears to be larger than required to provide adequate protection from wave attack, such that even the cracked stones should be of sufficient size to withstand the most severe wave attack that could be expected at the site.

17. There is the possibility that the revetment ends adjacent to the high bluffs can be flanked by erosion during high lake levels or during an extreme infrequent storm, thereby, causing damage to the revetment. However, the main building complex is far enough away from the ends of the revetment that there would be no immediate danger to the facility even if the revetment is flanked and damaged.

RECOMMENDATIONS

18. The east side of the revetment is in excellent condition, however, the large void should be filled with concrete or large enough stone such that they will not pass through the voids in the armor layer.

19. A monitoring program should be implemented by the licensee in order to detect future movement of the armor stone. The program should consist of an initial survey to establish vertical and horizontal control and to establish

permanent points at which subsequent survey data would be obtained. Cross-sections of the revetment should be obtained at stations located approximately 100 feet apart. On the lakeward side of both the east and west reaches of the revetment, permanent survey points on each cross-section station should be established at the toe of the revetment, the top of the revetment, and top of the cap stone. On the west reach of the revetment, permanent survey points should also be established on the top and base of the concrete retaining wall while on the east reach, survey points should be established on the crest and at the toe of the earth dike. Recommended permanent survey points for each cross-section station are shown on Plates 5 and 6. In addition, nearshore lake bottom elevations should be obtained at each station out to the wading depth limit. The initial survey should be conducted in the spring and be compared to "as built" drawings in order to determine if there has been any settlement since construction of the revetment. Each subsequent survey should be made at 2 year intervals and be compared to the initial and previous survey in order to detect any movement of the armor stones.

20. This Letter Report presents the Buffalo District, Corps of Engineers assessment of the structural adequacy of the stone revetment at the R.E. GINNA plant in accordance with the Statement of Work for CERC-GINNA Nuclear Power Plant - Document No. 50-244. The separate business Letter Report, as required by Work Requirement "E" of the Statement of Work, will be forwarded in the near future. If you have any questions concerning, the content of this Letter Report, please contact Mr. Richard Gorecki (FTS 473-2230) of my Coastal Engineering staff.

Sincerely,

GEORGE P. JOHNSON
Colonel, Corps of Engineers
Commanding

3 Incl
1. Plates 1-6
2. Exhibits 1-6
3. Appendix

CF:
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Fort Belvoir, VA 22060

NRC Contracting Officer, DC
U.S. Nuclear Regulatory Commission
Washington, DC 20555

J.P. Knight, DE
U.S. Nuclear Regulatory Commission
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Director, Division of Engineering
ATTN: C. Poslusny
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Mr. B.L. Grenier
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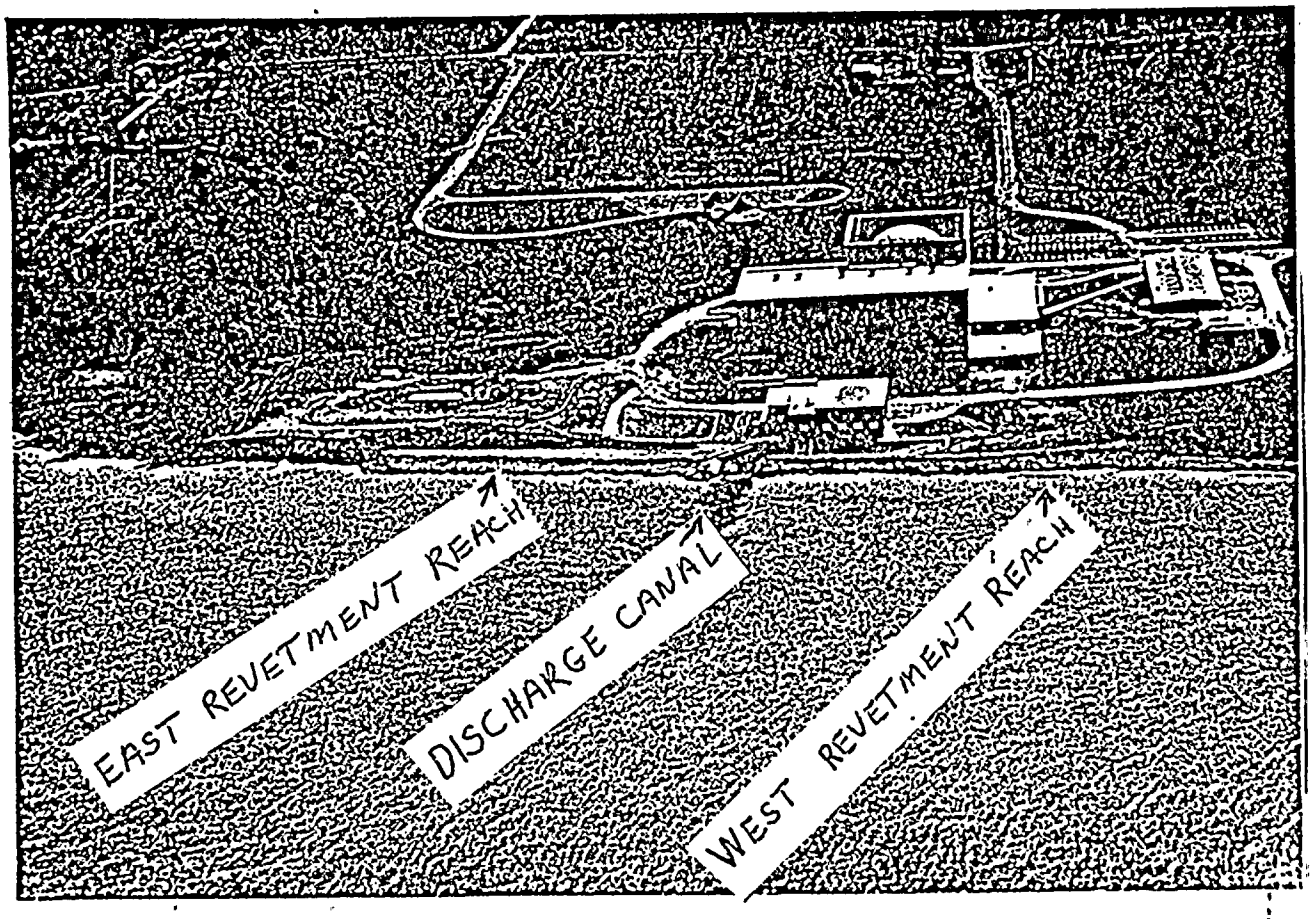


R.E. GINNA Nuclear Generating Plant

PLATE 1

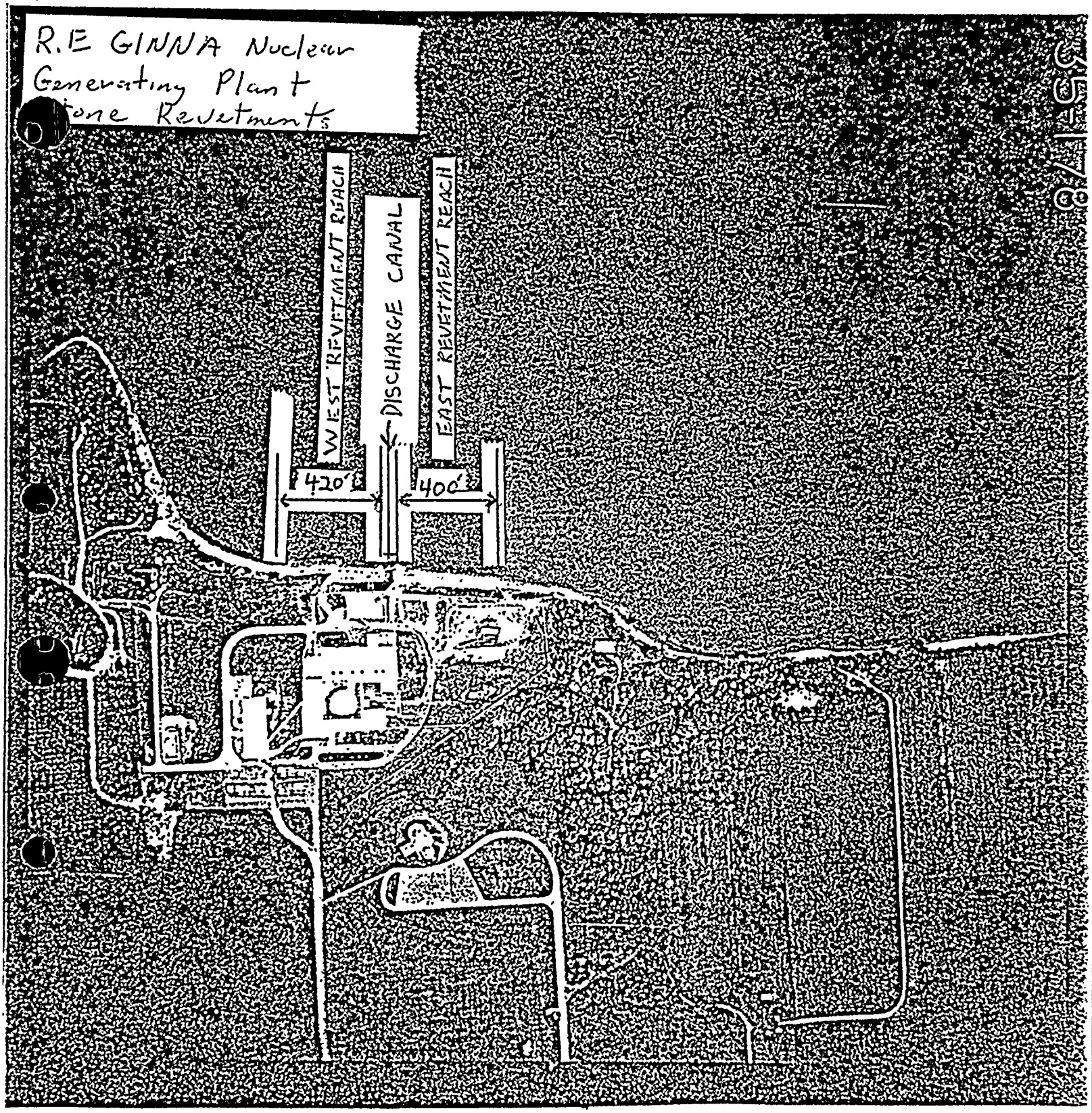
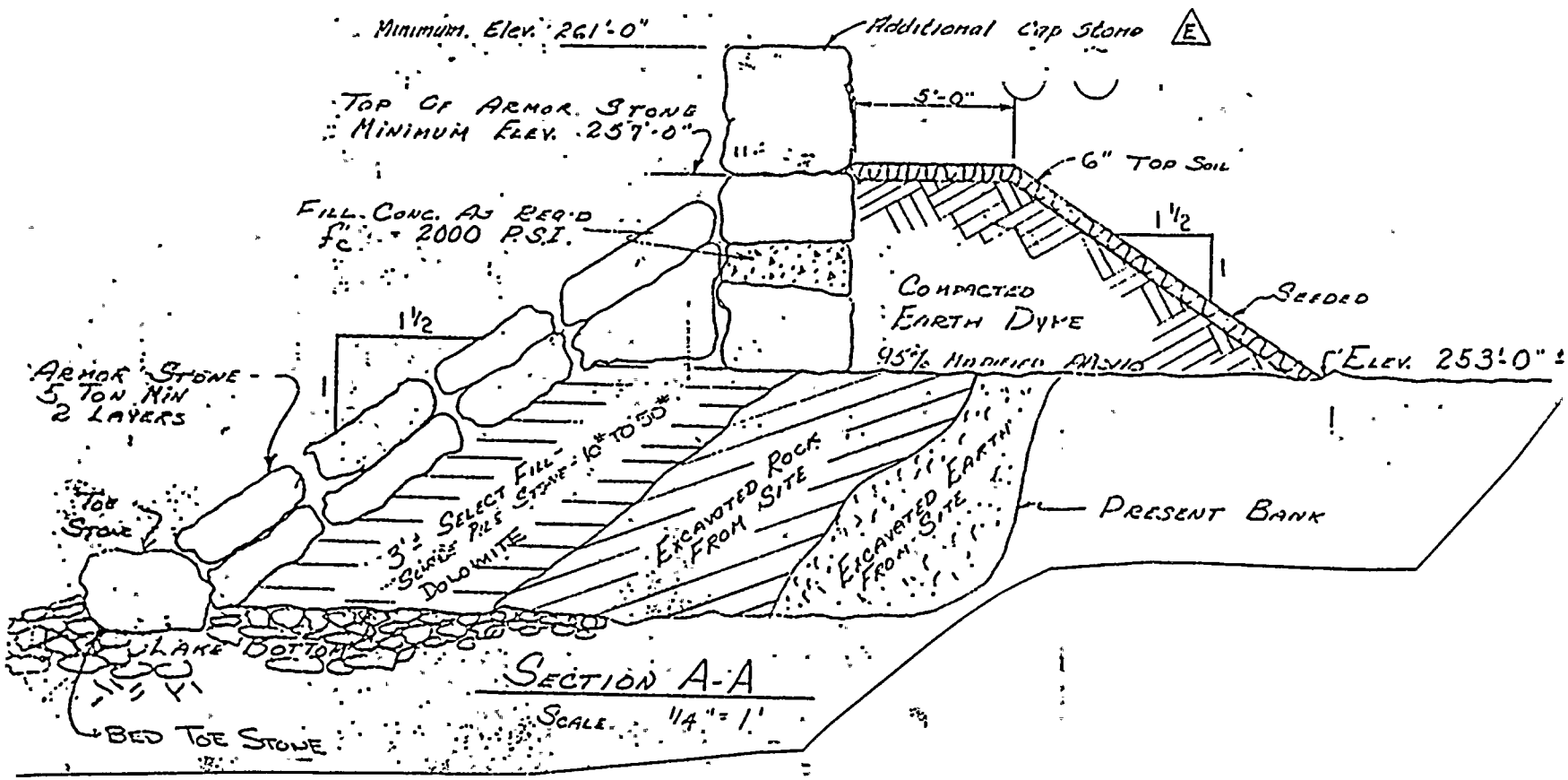
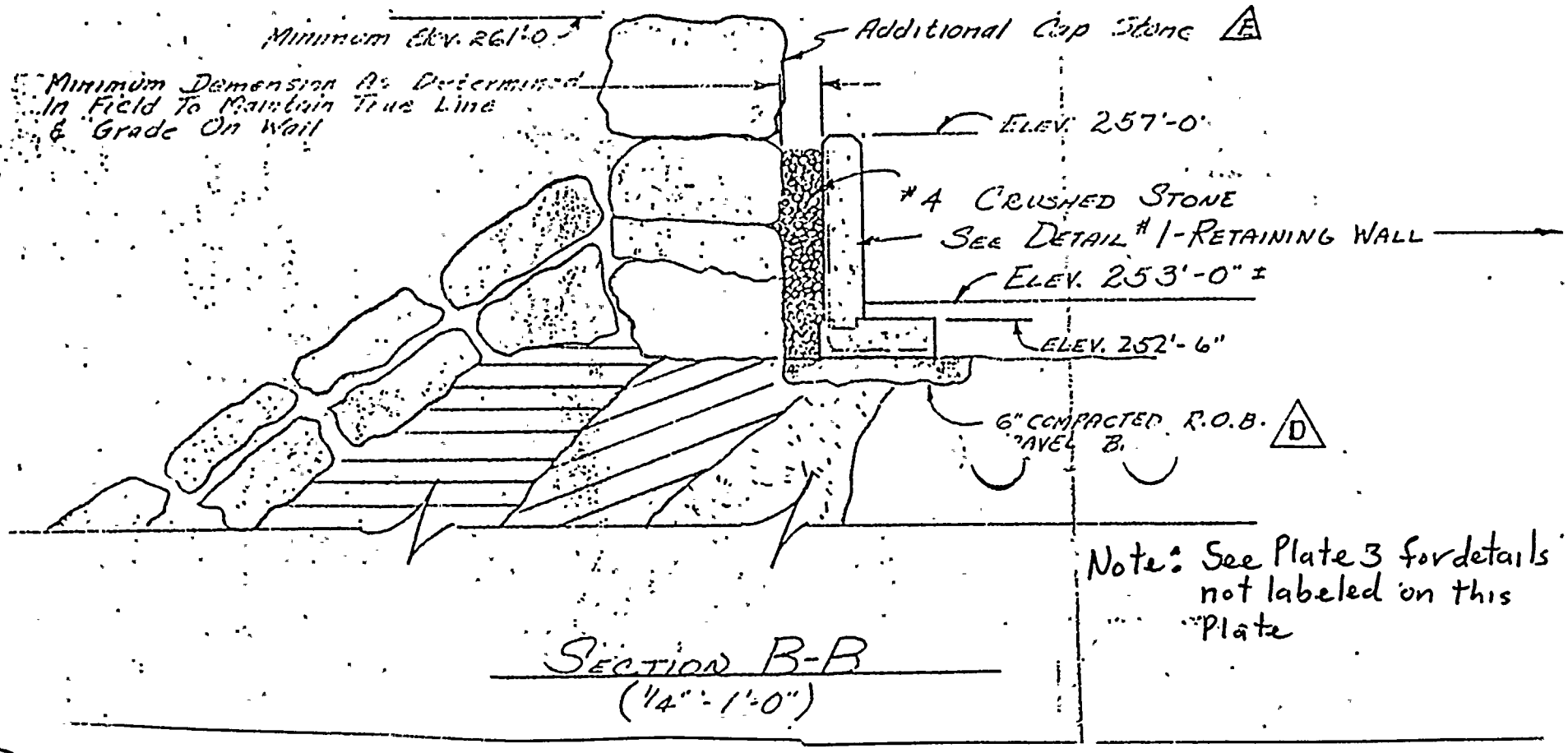

R.E GINNA Nuclear
Generating Plant
Stone Revetments
WEST REVETMENT REACH
DISCHARGE CANAL
EAST REVETMENT REACH
420'
400'

PLATE 2



TYPICAL SECTION – EAST REVETMENT REACH

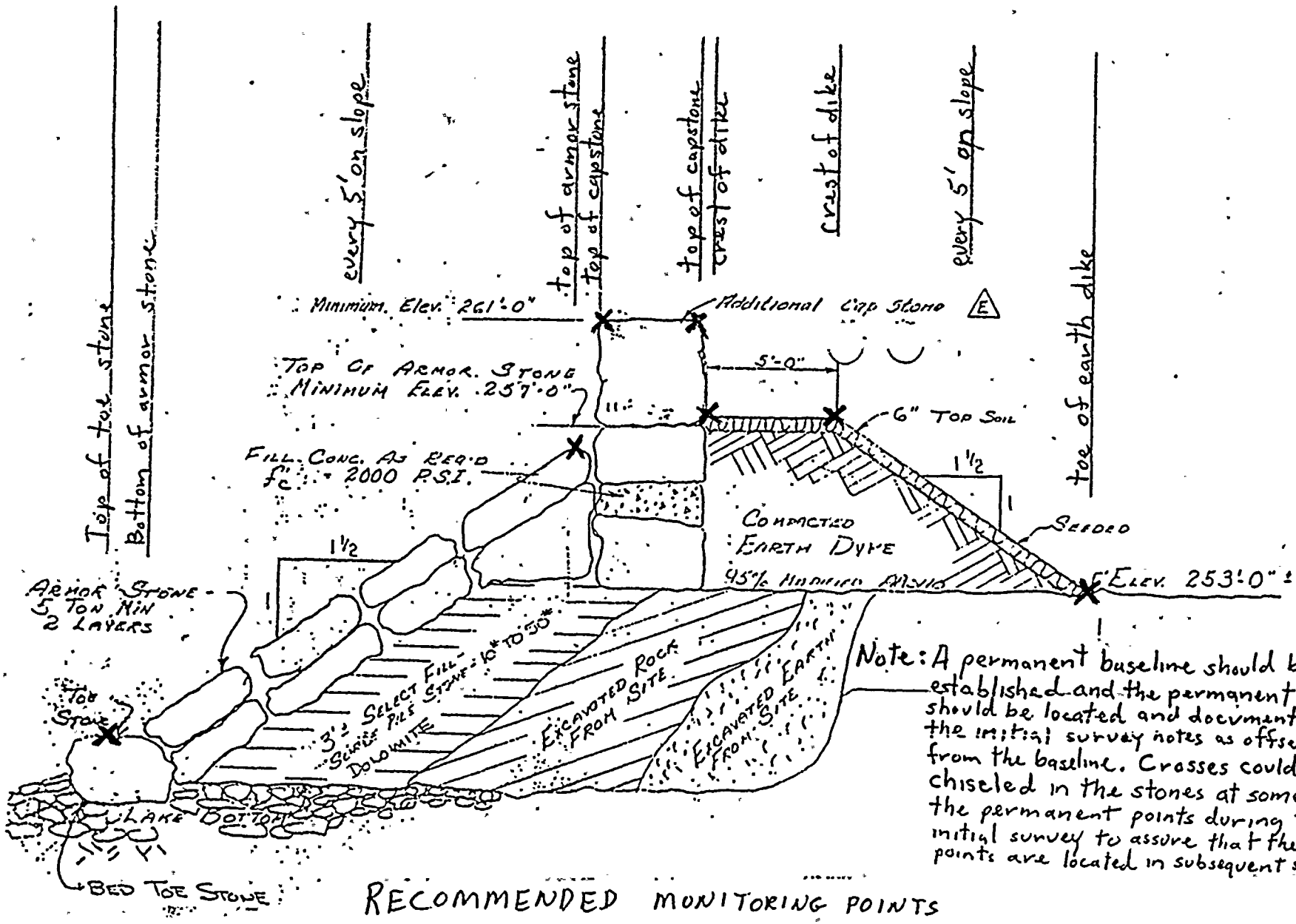
PLATE 3



Note: See Plate 3 for details not labeled on this Plate

TYPICAL SECTION – WEST REVETMENT REACH

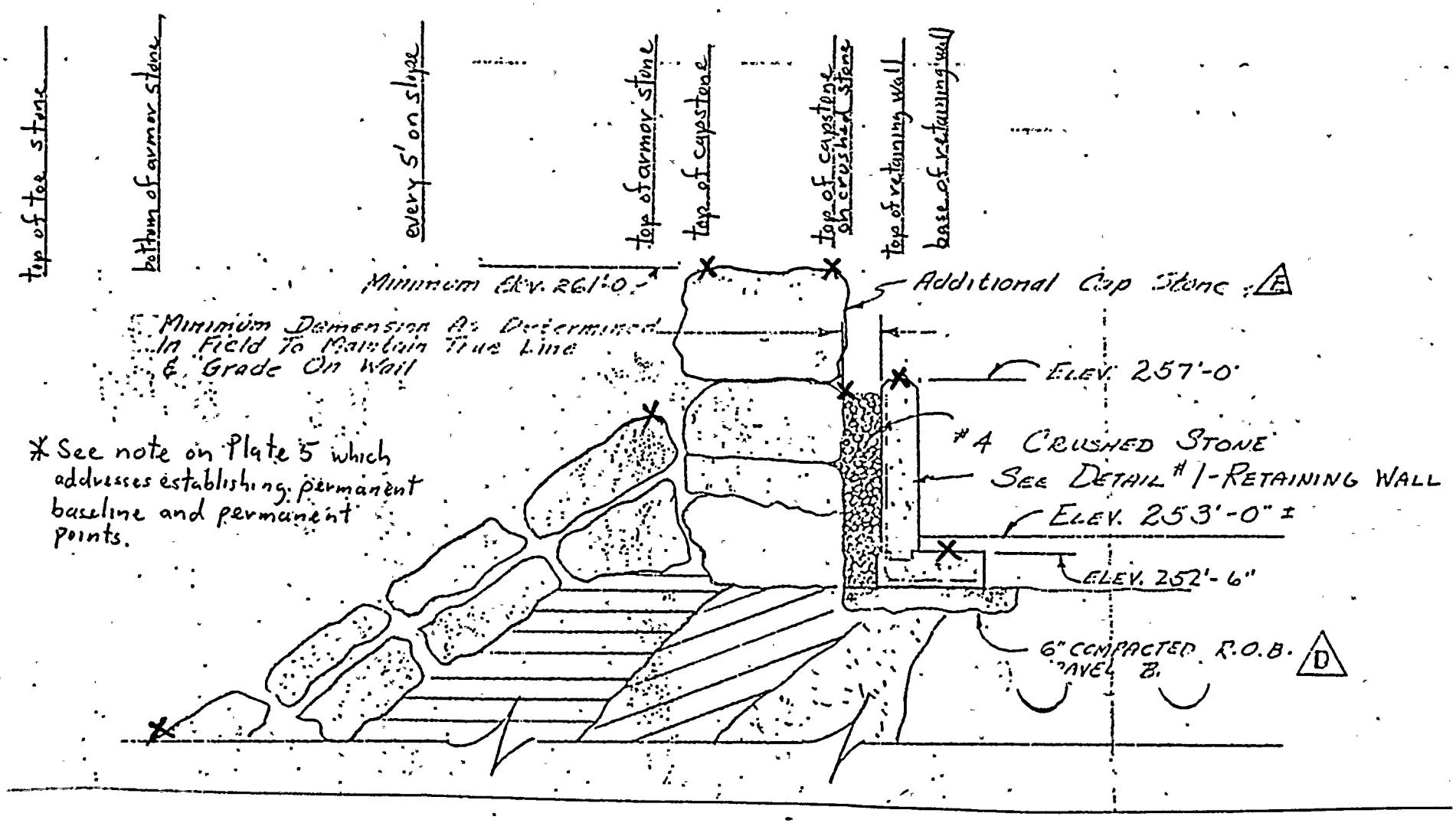
PLATE 4



Note: A permanent baseline should be established and the permanent points should be located and documented in the initial survey notes as offsets from the baseline. Crosses could be chiseled in the stones at some of the permanent points during the initial survey to assure that the same points are located in subsequent surveys.

RECOMMENDED MONITORING POINTS
EAST REVETMENT REACH

PLATE 5



* See note on Plate 5 which addresses establishing permanent baseline and permanent points.

RECOMMENDED MONITORING POINTS
WEST REVETMENT REACH

PLATE 6

Coastal Engineering Research Center
Interagency Agreement No. NRC-03-81-110
Proposed Work Directive 1

STATEMENT OF WORK FOR CERC
GINNA NUCLEAR POWER PLANT
DOCKET NO. 50-244

A. Background

One high priority activity in NRC is an ongoing systematic safety evaluation of operating nuclear power reactors with respect to current licensing requirements and state-of-the-art technology. At one operating reactor site, GINNA (Docket No. 50-244) on the southern shore of Lake Ontario, a site visit has resulted in questions related to the adequacy of the existing rock revetment along the lakeshore. In particular, portions of the revetment on the west side of the discharge canal appeared to have been degraded in terms of the number and sizes of stones in several locations. Subsequent to discussing the subject with the licensee, the NRC staff was informed that adequate rock had been provided.

The NRC staff has reviewed the design of the revetment, the flood design bases therefore, and the consequences of failure during a severe storm event should the rock not be adequate. The staff's assessment indicates the original revetment design was adequate.

The licensee's design and potential deficiencies have been documented in the following material, copies of which are attached:

1. Hydrologic Engineering Safety Review for R. E. Ginna Nuclear Generating Plant.

2. Rochester Gas and Electric Corp. Comments on NRC's Hydrologic Engineering Safety Evaluation, January 28, 1981 and May 1, 1981.

3. NRC Response to RG&E Comments on Hydrologic Engineering Safety Review, March 3, 1981.

4. RG&E Drawing Numbers 33013-171 and 33013-5IE, Plan and sections of Ginna Revetment.

B. Objective

The objective of this work directive is to obtain from the Coastal Engineering Research Center a technical opinion of the adequacy of the existing revetment at the GINNA site, and to suggest ways that the revetment may be readily repaired if not found adequate.

Exhibit 1

C. Work Requirements

Subtask 1

You are requested to review the attached material, visit the site, observe the revetment and review any technical specification the licensee has developed to provide for revetment inspection and maintenance.

Subtask 2

Upon completion of your visit, and no later than December 31, 1981 you should provide a brief letter report that fully addresses each of the following:

a. The extent to which the existing revetment presently conforms to the design. Included should be identification of the location of any areas which do not contain rock of acceptable size or gradation.

b. If the conclusion is that the revetment is not adequate, identify the extent of nonconformance in terms of numerical estimates of areas and rock volumes of different rock size ranges or categories and practical ways in which design adherence can be achieved.

c. Identify licensee representatives views on a and b above.

d. Identify the anticipated durability and survivability of the revetment for the next 10 years, 20 years and for longer periods under the existing or proposed, technical specification.

D. Level of Effort and Period of Performance

The anticipated level of effort is approximately two-man weeks over three months. The entire work directive is to be completed by December 31, 1981.

E. Reporting Requirements

At completion of task 2 a letter report, as described, is to be submitted to the Project Officer with copies to: the NRC Contracting Officer, DC; the Director, Division of Engineering, NRR, ATTN: C. Poslusny; J. P. Knight, DE, NRR; and B. L. Grenier, NRR. A separate business letter report is to be prepared with copies to the same individuals. This report is to contain:

a. a brief summary of the work performed;

b. estimates of total funds expended for 1) manpower, 2) computer services, 3) travel and 4) miscellaneous;

c. any problems or delays encountered.

NOTE: Cost information for each plant must be gathered by the NRC as a legal requirement to properly assess licensing fees to the utilities.

F. Meetings and Travel

A site visit of one professional employee to observe the revetment and have technical discussions with the licensee will be required. The trip will be 1 to 2 days in duration.