REPORT

PROBABLE MAXIMUM HURRICANE FLOOD ANALYSIS

OYSTER CREEK NUCLEAR UNIT NO.1

OYSTER CREEK, NEW JERSEY

FOR

JERSEY CENTRAL POWER & LIGHT COMPANY

INTRODUCTION

This report presents the results of our flood analysis for the Oyster Creek Nuclear Unit No.1 , Oyster Creek, New Jersey. The Oyster Creek Plant is located at approximately Latitude 39°49' on the eastern coastline of New Jersey 1.5 nautical miles inland from the western shoreline of Barnegat Bay as shown on Plate 1.

All elevations unless otherwise indicated are in feet and refer to Mean Sea Level Datum as Zero.

PURPOSE

The purpose of our study was to perform flood analyses to establish design criteria for suitable flood protection of Class 1 structures. The Oyster Creek Nuclear Unit No.1 plant layout is shown on Plate 2.

SCOPE

The scope of our analysis included an evaluation of the following:

1.. Wind-generated waves.

2. Flood levels.

3. Wave forces.

Work pertinent to this analysis conducted prior to this report included:

1. Hurricane storm surge analyses resulting in a probable maximum hurricane (PMH) stillwater level of +22 feet Mean Sea Level (MSL) at the western side of Barnegat Bay fronting the Oyster Creek Unit No. 1 during a high astronomical tide condition.* (Reference 1)
2. Procedure for routing the open coast surge into Barnegat Bay.** (Reference 2)

BASIC DATA AND ASSUMPTIONS

Basic data and assumptions for our analysis included:

1. The PMH stillwater level at the western side of Barnegat Bay was taken at +22 feet MSL as requested by the AEC.
2. A surge hydrograph giving maximum stillwater levels at the western side of Barnegat Bay was developed by using the Barnegat Bay surge hydrograph of Reference 2.
3. A wind field for the PMH parameters was developed for use in calculating wind-generated waves.
4. The calculation methods for wave generation of Coastal Engineering Research Center (CERC), "Shore Protection, Planning, and Design," Technical Report No. 4, 1966, were used.

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* D. J. Skovolt, AEC letter to R. H. Sims dated 12-29-71.

** Theodore E. Haeussner, Report-Determination of M.P.H. Flood Height for Oyster Creek, Units 1 and 2, Copy No. 1, December 21, 1968.

PROBABLE MAXIMUM STILLWATER LEVELS AT THE PLANT SITE

The open coast surge was calculated in References 1 and 2. Its effects were routed into Barnegat Bay to determine the probable maximum stillwater levels at the plant site. The PMH parameters used by the AEC (Reference 1) in calculating the open coast surge were:

1. A central pressure index of 27.10 inches of mercury.
2. An asymptotic pressure of 30.70 inches of mercury.
3. A radius of maximum winds of 39 nautical miles.
4. A maximum gradient wind speed of 133.0 miles per hour.
5. A forward translational speed of 12 knots and 23 knots.
6. A bottom friction factor of 0.008.
7. An initial rise in water level of 1.1 feet.
8. An astronomical high spring tide of 4.2 feet above Mean Low Water (MLW).

In evaluating the stillwater levels at the plant site on the western shore of Barnegat Bay, the following were considered:

1. The amount and duration of tidal overflow of Island Beach (the beach island).
2. The amount and duration of tidal inflow through Barnegat Inlet and through the eroded sections of the beach island.
3. The extent of wind setup across Barnegat Bay.
4. Local wave setup.

These four items were analyzed in Reference 2 for an open coast PMH stillwater elevation of 16.75 feet MSL. The result was a maximum stillwater elevation of 19.5 feet MSL at the plant site that occurred one hour after the maximum open coast stillwater elevation.

The approximate stillwater hydrograph was developed at the plant site as shown on Plate 3 by considering the following:

1. The open coast surge hydrographs of the AEC (Reference 1) and of Reference 2.
2. The surge hydrograph for Barnegat Bay of Reference 2.
3. The inflow-overflow curves of Reference 2.
4. The hurricane wind field developed using the PMH parameters of the AEC.

By using the AEC open coast surge hydrograph in conjunction with the open coast surge hydrograph and inflow-overflow curves of Reference 2, an approximate time history of additional inflow-overflow was determined for use in adjusting the Barnegat Bay surge hydrograph of Reference 2 upward to a peak value of +22 feet MSL. This stillwater hydrograph also includes the effects of wind and wave setup, and is, therefore, used as the plant site stillwater hydrograph. The hurricane wind field developed using the PMH parameters was adjusted for nearshore land effects and was then propagated across Barnegat Bay. Component wind velocities were calculated along the storm traverse as shown on Plate 4 in order to consider wind setup and wind-generated waves. The time history of these component winds is shown on Plate 5. This wind profile and the stillwater hydrograph, shown on Plate 3, including the effects of wind and wave setup, at the plant site, were used in the following analyses.

WIND-GENERATED WAVES

GENERAL

Wave characteristics are dependent upon wind speed, wind duration, water depth and fetch length. Generated waves were calculated coincidental with the maximum surge hydrograph to determine the maximum flood elevation.

FETCH

Deepwater fetches were not considered because the larger deep-water-generated waves would break on reaching Island Beach. The elevation of the island, ranging from 0 to +40 feet, as shown on Plate 4, would be reduced by approximately five feet along its lower elevations by wave erosion. Most of the erosion would occur primarily during the surge recession when wave direction would be offshore rather than onshore. Therefore, the critical wave conditions would be the shallow water waves generated within Barnegat Bay. The fetch distance would be approximately five nautical miles (along the hurricane traverse) across Barnegat Bay from Island Beach to the Oyster Creek Plant Unit No.1 as shown on Plate 6.

WIND

As hurricanes move towards the coast, wind speeds and directions are dependent upon location and time. In order to prepare a wind distribution for the purpose of wave forecasting, the wind vectors along the storm traverse were calculated using the hurricane wind field. A component wind profile was then plotted as shown on Plate 5 using the time history of average wind vectors over the fetch length.

WAVE CHARACTERISTICS

Shallow water waves were generated by using Fig.1-32 of CERC, T.R. No.4*. These significant shallow water wave heights and periods, based on the fetch length, component wind profile and average water depth are plotted on Plate 7. The generated wave height and period profiles have a phase shift in time of +0.5 hour over the wind profile to allow for the generation and travel of waves to the site. The maximum significant wave height and period is 8.7

*U.S.Army Coastal Engineering Research Center (1966). Shore Protection Planning and Design, Technical Report No.4, 3rd Edition.

feet and 6.3 seconds, respectively. This significant wave occurs during stillwater level of +21.3 feet Mean Sea Level as shown on Plate 7 at the site location.

The significant wave height was obtained from statistical analysis of synoptic weather charts. Approximate relationships of the significant wave height to other parameters of the normal wave spectra were defined. The maximum wave height curve*, as shown on Plate 7 is based on the significant wave height curve. The maximum wave height is 14.5 feet but will not occur at the site because of insufficient water depth.

DESIGN WAVES

Selection of design waves depends on the offshore waves at the site, the structures being considered, and the available water depths fronting the structures. Generated wave conditions during the PMH occurrence were propagated shoreward to the plant structures. Topographic data indicate that the elevation of Highway 9 to the east of the plant site is about 18 to 19 feet MSL. As shown on Plate 8 the top of fill elevation surrounding the plant site will be at least +23 feet MSL, and this fill will be graded towards Highway 9, east of the plant. Therefore, as land elevations rise abruptly to the west, waves would break progressively westward and would not reach the plant site area. The only wave action that could reach the plant site would result from possible waves traveling up the 100 to 140 feet wide intake and discharge channels. This wave action would be small because of channel friction, trees, vegetation, and other obstructions adjacent to the channels, the two bridges in the intake and discharge channels, the 90 degree curvature of the channels in the plant area, and the fact that the intake and discharge structures are located on the westward side of the power plant. Therefore the largest wave

*Considered as the one percent wave in this analysis as requested by the AEC.

that could possibly reach the intake and discharge structures is on the order of one foot.

FLOOD LEVELS

The generated waves coming from the east, break far eastward of the site because the minimum top of levee elevation at the plant is +23. Maximum waves that might break in the area of Highway 9 will depend on the available water depth. Time histories of the maximum wave heights without breaking (H_b) that might reach and runup on the graded plant fill are shown on Plate 7. Using these data, the maximum design wave height was computed as 3.1 feet during a stillwater elevation of +22 feet MSL. Runup would be less than one foot; therefore, there will be no wave overtopping of the +23 feet MSL top of plant fill.

The top of both the intake and discharge structures is at elevation 15 feet MSL. Because these structures are located on the western side of the plant, they will not experience as high a stillwater level as the eastern side of the plant which is directly exposed to the wave and wind setup. Maximum stillwater levels against the intake and discharge structures would be less than +20 feet MSL. However, during maximum stillwater levels, a one-foot wave could pass across the intake and discharge structures and runup on the 2;1 backfilled slope in front of the turbine building. Maximum runup would be about 2.2 feet for a smooth slope and about one foot for a rough slope such as rip-rap, resulting in a maximum flood elevation of 22.2 feet MSL. Therefore, the +23 feet top of backfill elevation in front of the turbine building would not be overtopped.

The maximum flood level for plant structures would be caused by the maximum stillwater level, or +22 feet MSL. Plate 10 illustrates the boundaries of flooded land in the vicinity of the Oyster Creek Nuclear Unit No.1 during a stillwater level of +22 feet MSL.

WAVE FORCES

There will be no wave forces against plant structures except for the intake and discharge structures because the plant grade elevation of 23 feet MSL protects plant strucutres from wave action. As wave action is small at the intake and discharge structures, the maximum wave forces against these structures will essentially be the hydrostatic pressures resulting from a stillwater elevation of +22 feet MSL. The generated waves will break to the east of the plant site against the graded fill during the higher water levels. For design purposes the maximum significant wave height that may break against this graded fill is 3.1 feet.

CONCLUSIONS

Based on the above discussions and analyses the following is concluded:

1. The maximum stillwater elevation at the site, as determined by the AEC, is +22 feet MSL.
2. With the surrounding top of the plant site fill to at least Elevation +23 feet MSL, plant structures are protected against wave runup.
3. The maximum flood elevation for plant structures is +22 feet MSL.
4. Plant structures are protected against wave forces.

The following Plates are attached and complete this Report:

Plate 1	-	Site Location
Plate 2	-	Plot Plan
Plate 3	-	PMH Stillwater Level at Oyster Creek Nuclear Unit No.1
Plate 4	-	Storm Traverse
Plate 5	-	Component Wind Profile
Plate 6	-	Storm Traverse Depth Profile
Plate 7	-	Wave Characteristics and Stillwater Levels versus Time.
Plate 8	-	Site Plan
Plate 9	-	Intake & Turbine Area Excavation and Backfill Plan and Sections.
Plate 10	-	Boundaries of Flooded Land during the PMH Occurrence.

Respectfully submitted,

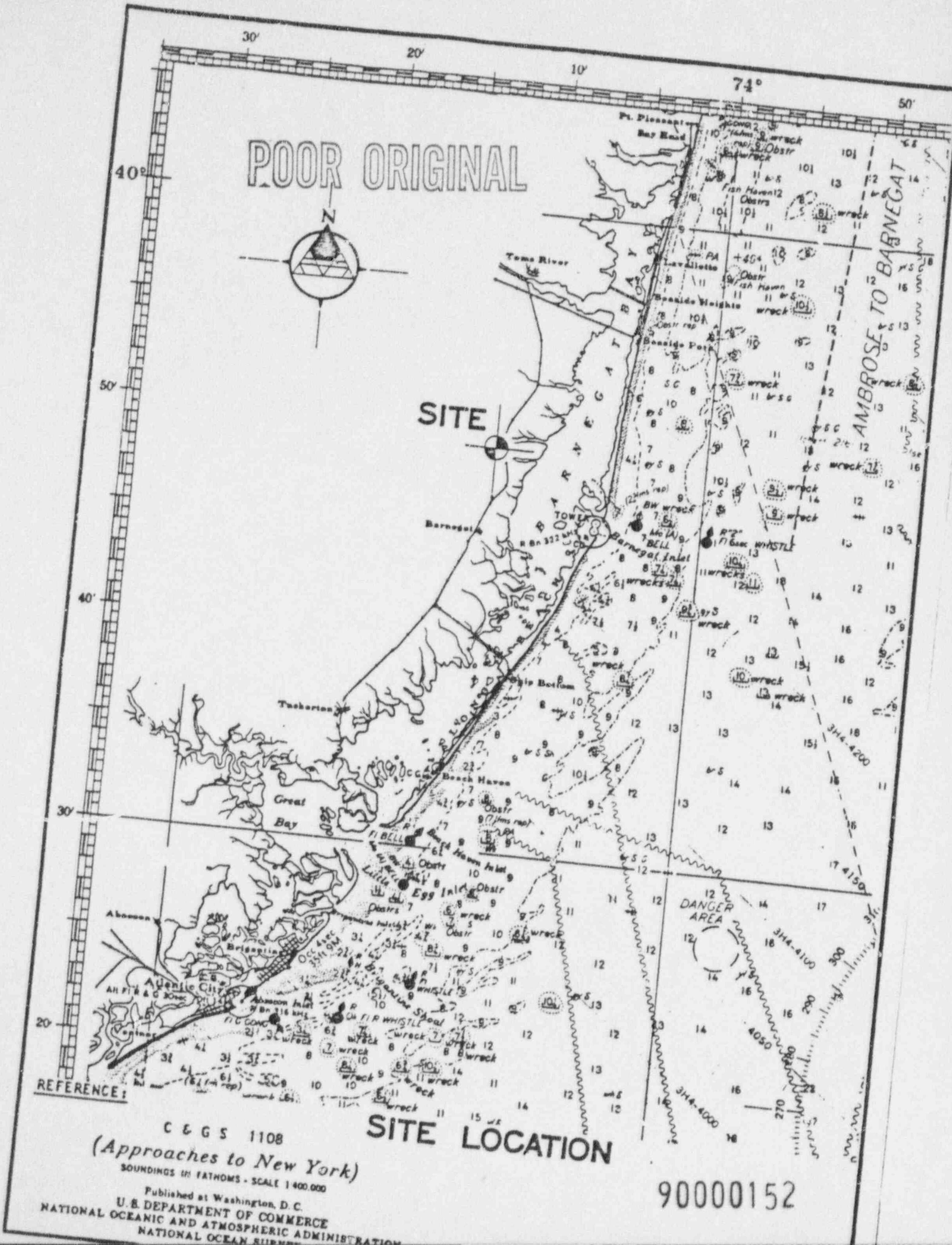
DAMES & MOORE

(for)

Philip Sherlock

PS-UK-bak
(5 copies submitted)

90000151



POOR ORIGINAL
N
SITE
Toms River
Lavallette
Seaside Heights
Seaside Park
Barnegat
Barnegat Inlet
Tuckerton
Beach Haven
Great Bay
Little Egg Inlet
Brigantine
Atlantic City
Absecon
Ventnor
DANGER AREA
AMBROSE TO BARNEGAT
Pt. Pleasant
Bay Head
30′
20′
10′
71°
50′
40°
50′
40′
30′
20′
REFERENCE:
C & GS 1108
(Approaches to New York)
SOUNDINGS IN FATHOMS - SCALE 1:400,000
Published at Washington, D.C.
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
SITE LOCATION
90000152


N
MONUMENT (TYPICAL)
Nº 1
TRANSITION
LIMITS OF PARTIAL GRADING OF PREVIOUS CONTRACT
℄ SITE
C.W. PUMPS
INTAKE STRUCTURE
CONDENSATE STORAGE TANK
CHLORINATION BUILDING
ROAD
EXIST. FIRE LINE
TIMBER BULKHEAD
DILUTION DISCHARGE
DISCHARGE FOR FUTURE UNIT
DISCHARGE UNIT Nº1
℄ ROAD
PRETREATMENT BUILDING
Nº 4
TIMBER BULKHEAD
LIMITS OF PARTIAL GRADING OF PREVIOUS CONTRACT
EXISTING BERM
DISCHARGE CANAL
EXISTING BERM
ELEVATED WATER TANK
TUR
REVISIONS

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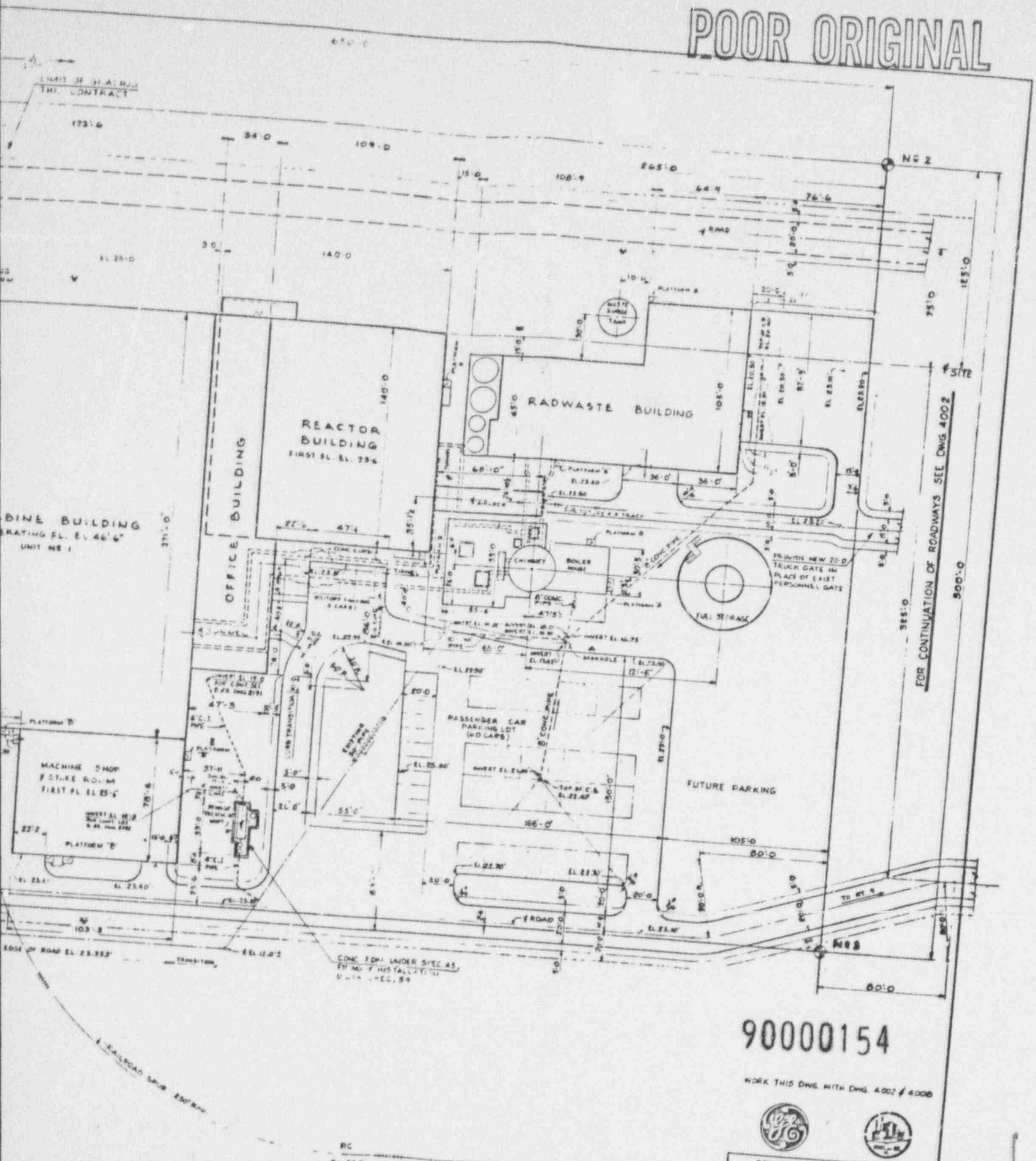

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WORK THIS DWG. WITH DWG. 4002 & 4008

NOTES

1. FOR LOCATION OF MONUMENTS & TEMPORARY FACILITIES, SEE DWG. 4619.
2. ALL DIMENSIONS ARE TO O.F. OF BUILDING WALLS AT GRADE
3. FOR ROADWAY CROSS-SECTIONS, TYP. FENCING DETAILS, & DETAILS OF MANHOLE, CATCH BASINS AND [illegible] 4008
4. FOR CONTINUATION OF AREAS OUTSIDE SEE DWG 4002
5. FOR ENTRANCE PLATFORM DETAILS SEE DWG. 4008
6. [symbol] - INDICATES FIRE HYDRANT LOCATION
7. [symbol] - INDICATES POST INDICATOR VALVE LOCATION
8. FOR FENCE SEE DWG. 4001

GENERAL ELECTRIC COMPANY
ATOMIC POWER EQUIPMENT DEPT.
SAN JOSE, CALIFORNIA

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
NEW YORK, N.Y.

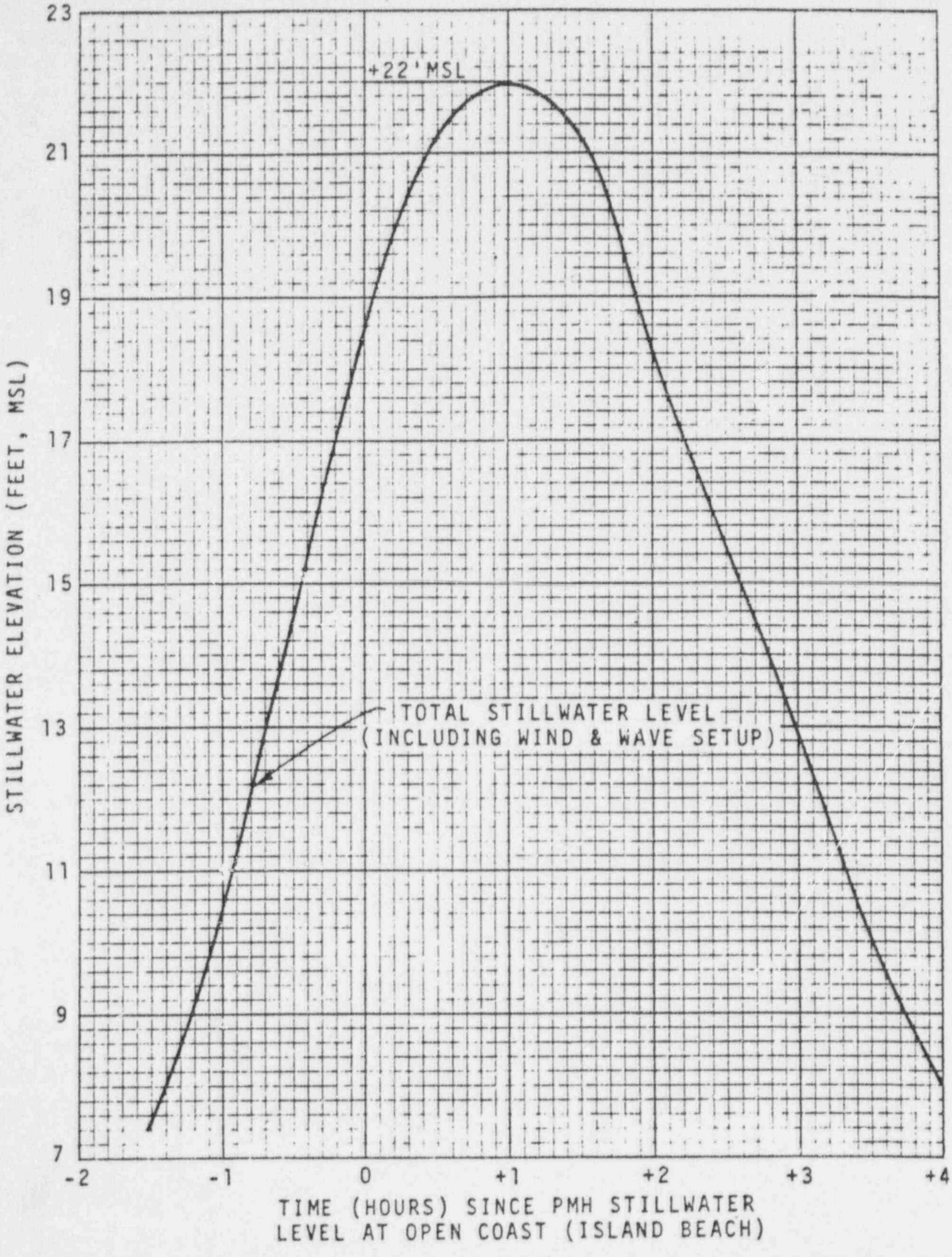
PLOT PLAN
SHEET No. 1

JERSEY CENTRAL POWER & LIGHT CO.
OYSTER CREEK STATION - UNIT #1

W.O. 2299

DAMES & MOORE

DWG [illegible]



PMH STILLWATER LEVEL

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AT OYSTER CREEK NUCLEAR UNIT I

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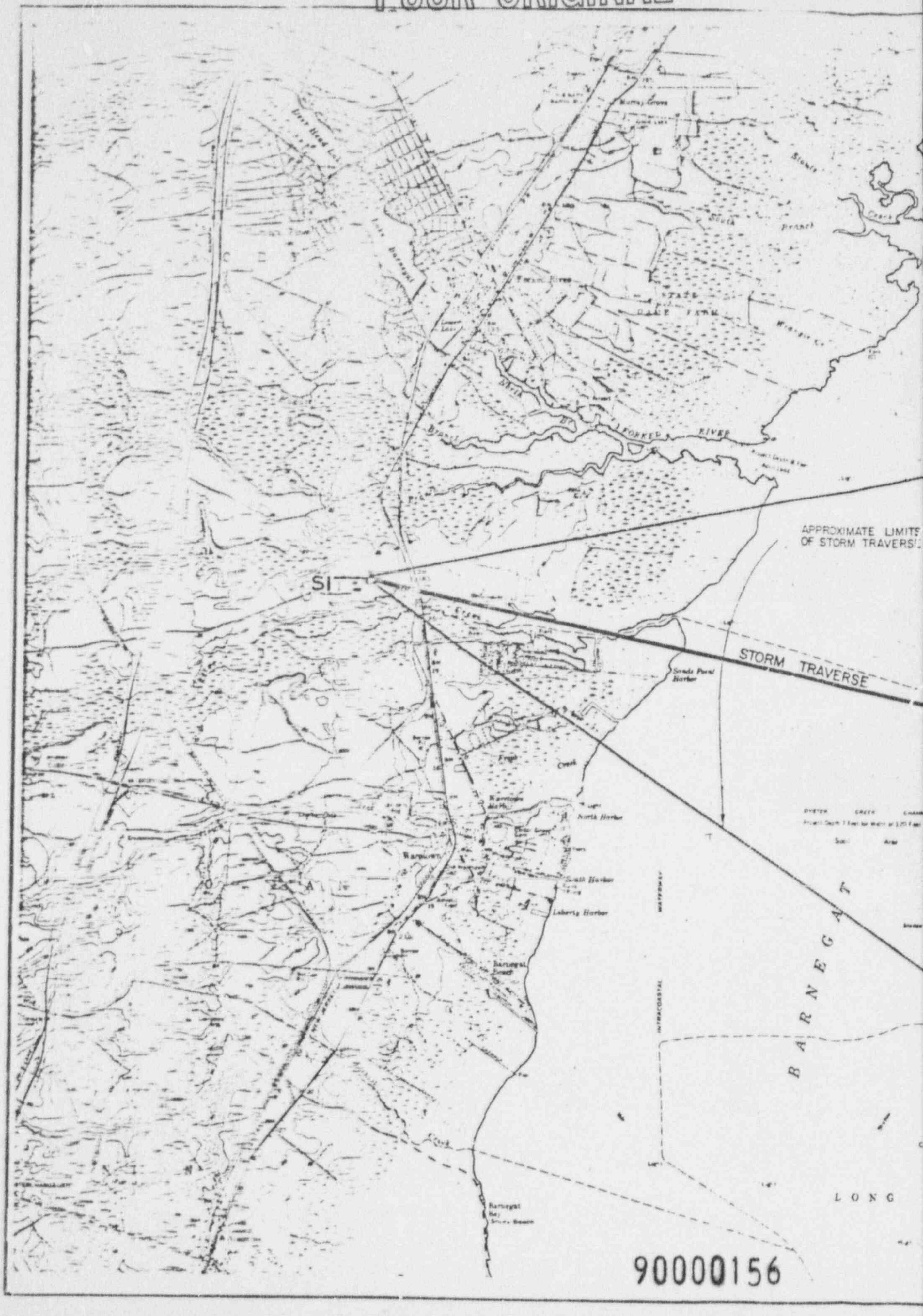
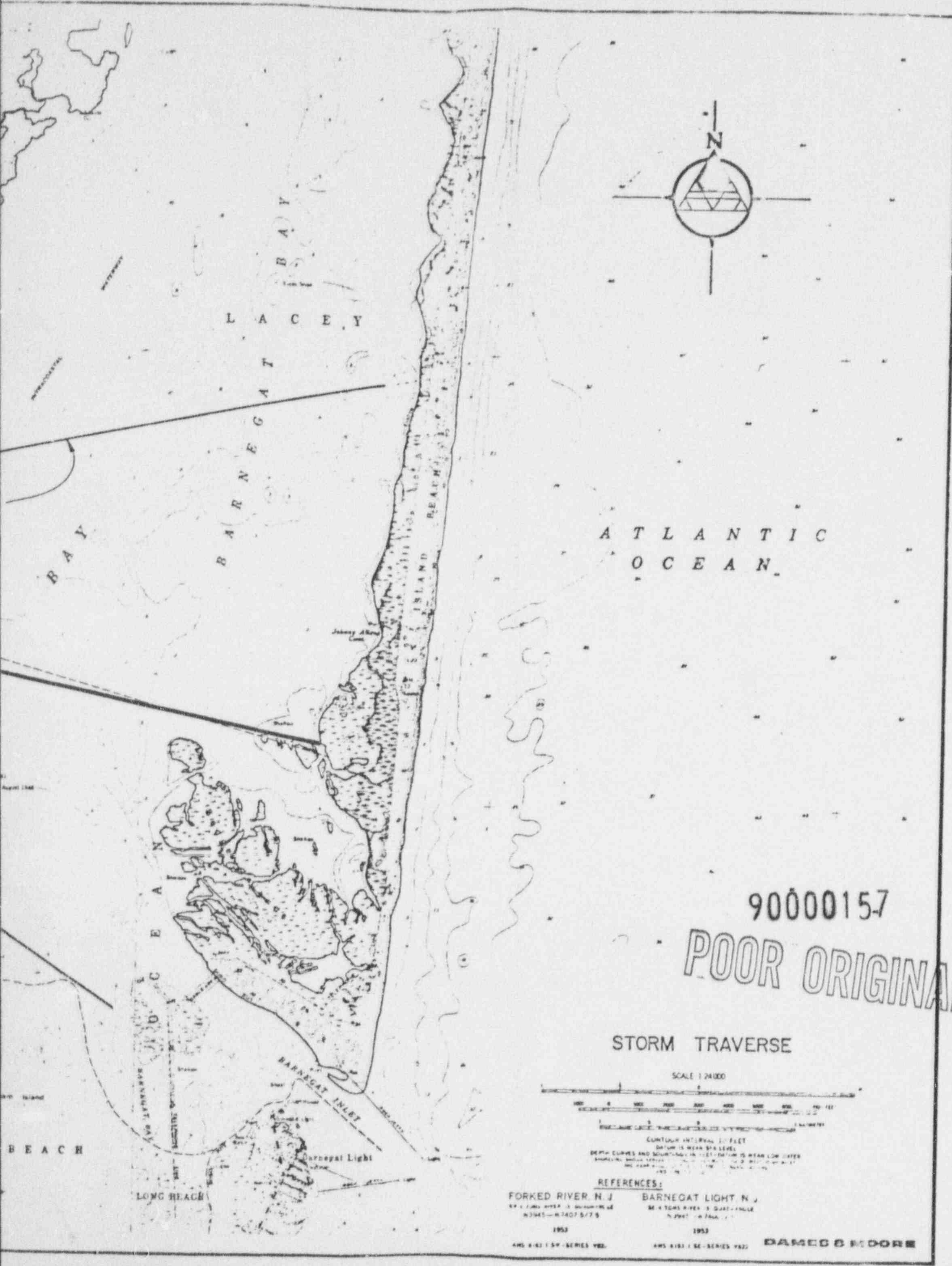
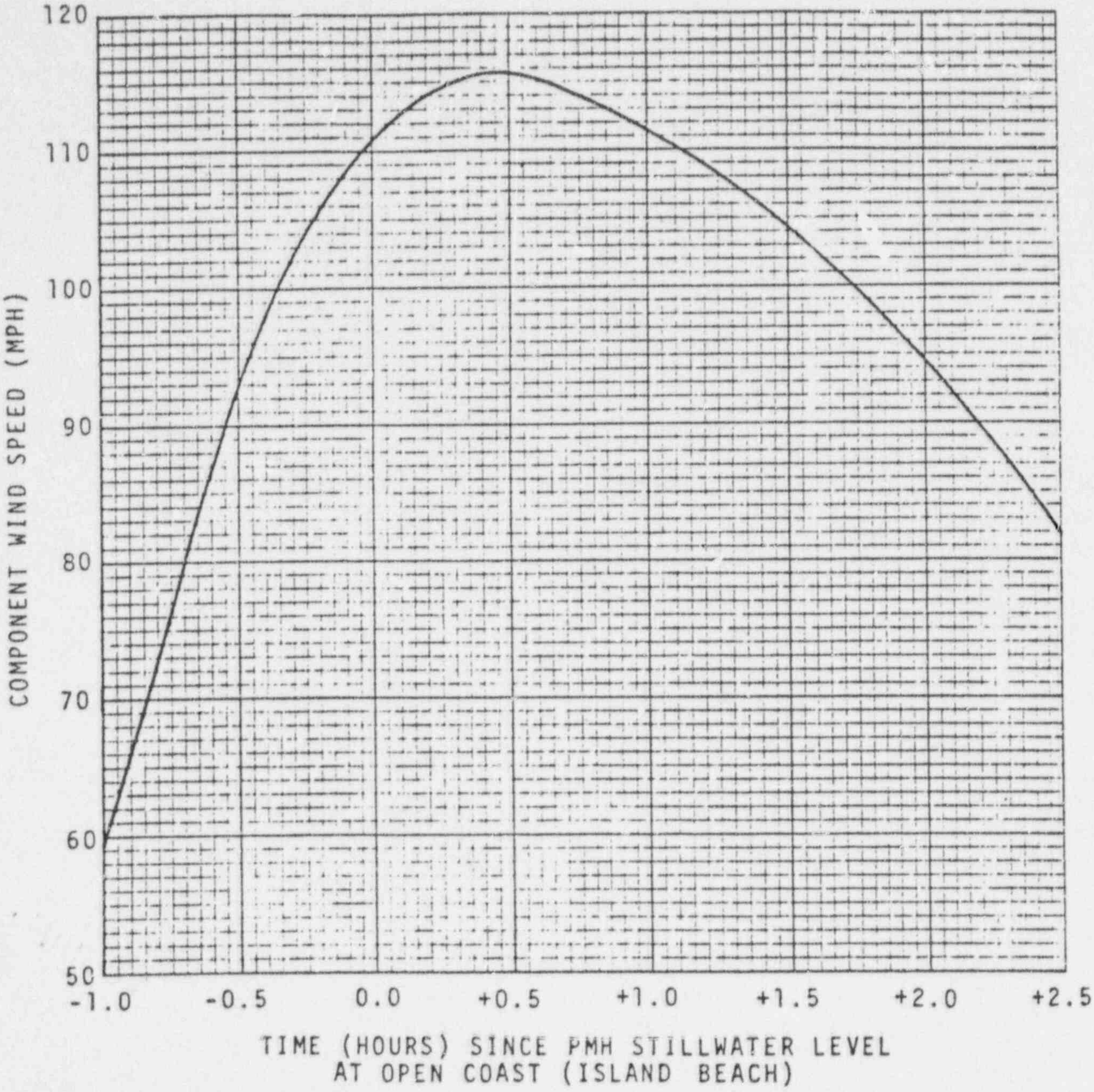
PLATE 3


APPROXIMATE LIMITS
OF STORM TRAVERS
SI
STORM TRAVERSE
FORKED RIVER
B A R N E G A T
L O N G



N
L A C E Y
B A Y
B A R N E G A T B A Y
A T L A N T I C
O C E A N
ISLAND BEACH
O C E A N
BARNEGAT INLET
Barnegat Light
LONG BEACH
B E A C H
STORM TRAVERSE
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
REFERENCES:
FORKED RIVER, N.J
BARNEGAT LIGHT, N.J
1953
1953
DAMES & MOORE

PLATE 1



COMPONENT WIND PROFILE

FOR 5 NAUTICAL MILE FETCH

(FETCH SHOWN ON PLATES 4 & 6)

90000158

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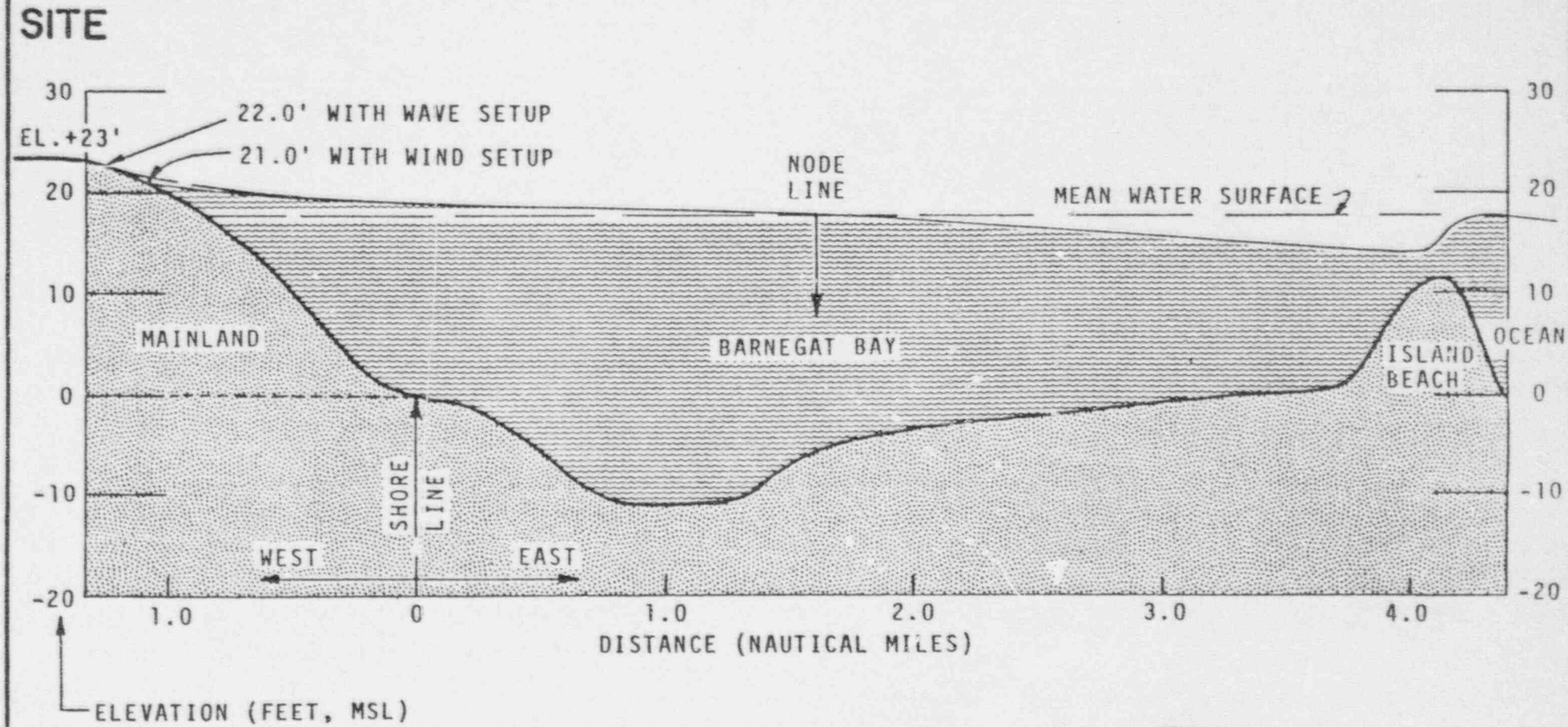

POOR ORIGINAL

STORM TRAVERSE DEPTH PROFILE

9000159

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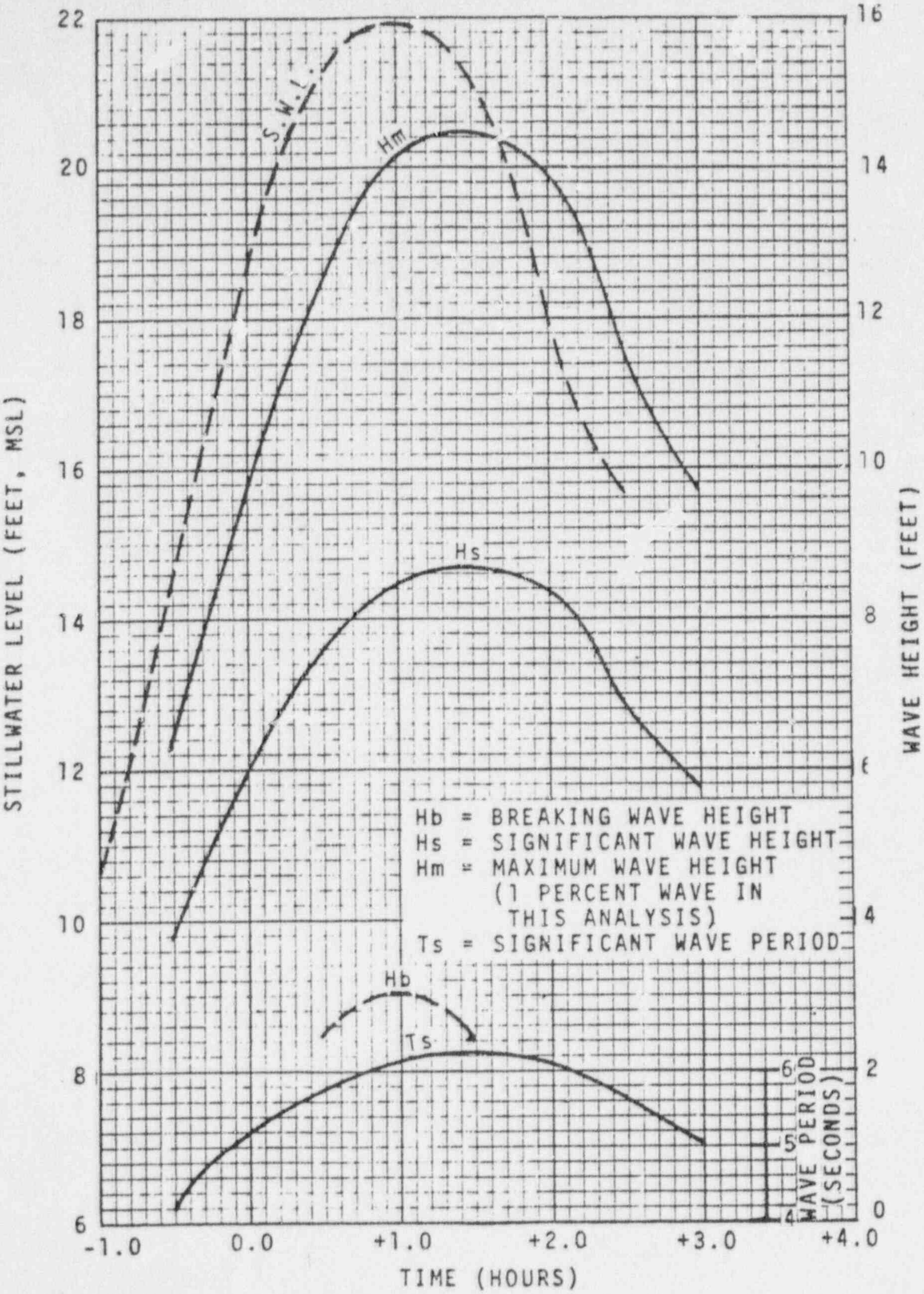
PLATE 6



WAVE CHARACTERISTICS & STILLWATER LEVELS VS. TIME

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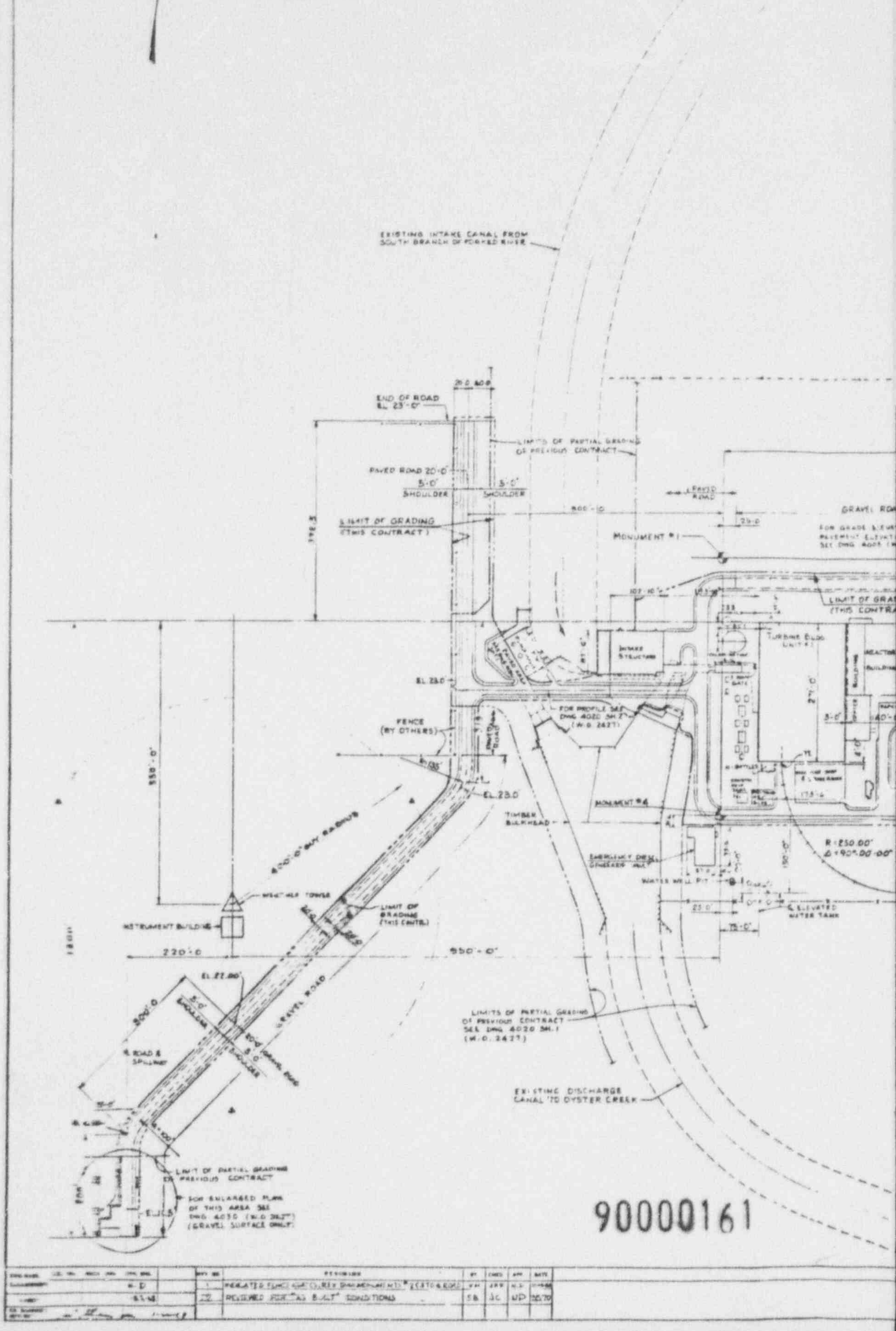
PLATE 7

POOR ORIGINAL



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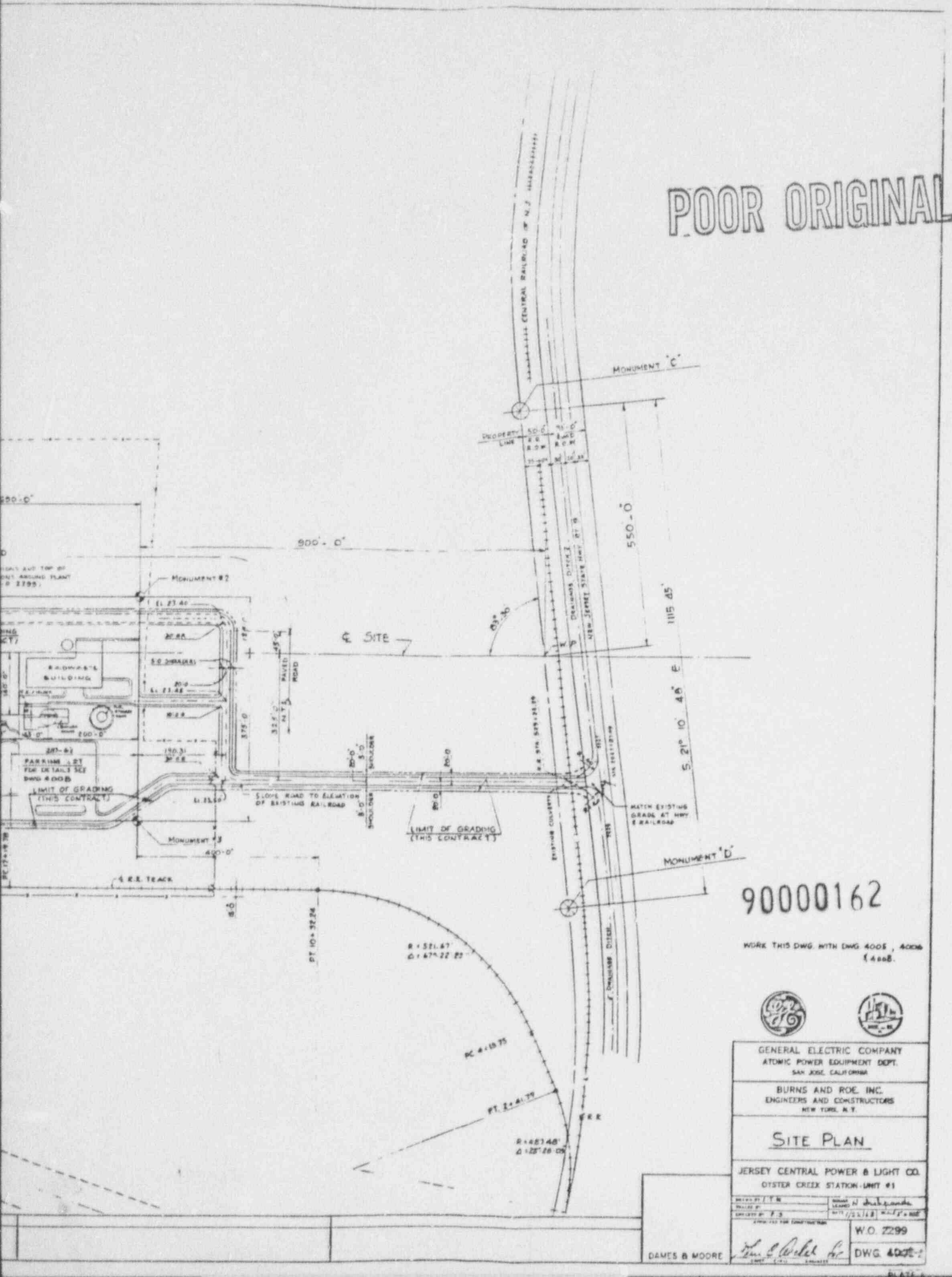
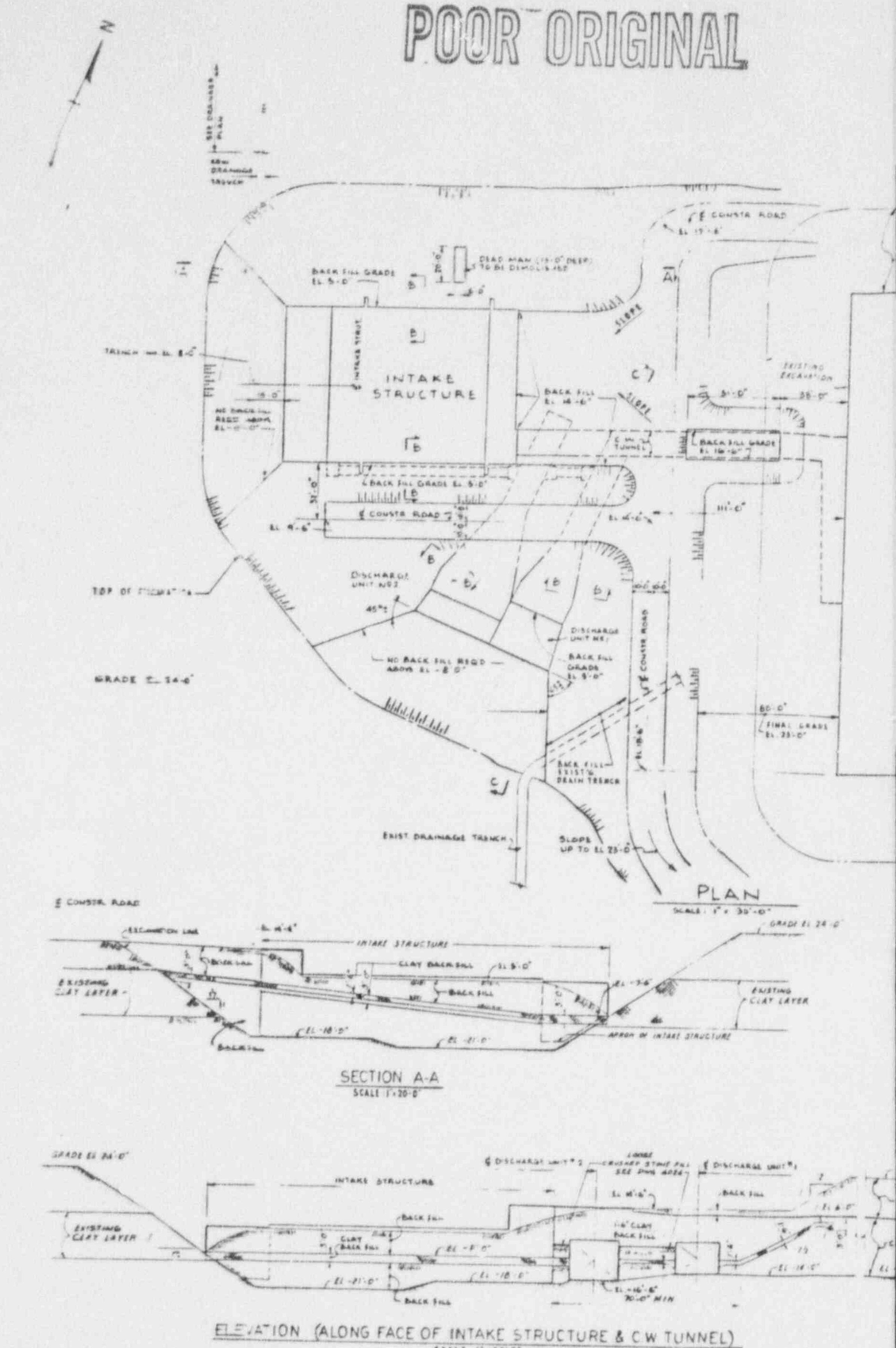

POOR ORIGINAL
CENTRAL RAILROAD OF N.J.
MONUMENT "C"
PROPERTY LINE
50'-0"
R.R. R.O.W.
75'-0"
R.O.W.
550'-0"
900'-0"
Monument #2
€ SITE
RADWASTE BUILDING
PAVED ROAD
DRAINAGE DITCH
NEW JERSEY STATE HWY. RT. 9
1115.45'
S. 21° 10' 48" E
PARKING LOT
FOR DETAILS SEE DWG 4008
LIMIT OF GRADING (THIS CONTRACT)
SLOPE ROAD TO ELEVATION OF EXISTING RAILROAD
SHOULDER
LIMIT OF GRADING (THIS CONTRACT)
MATCH EXISTING GRADE AT HWY. & RAILROAD
EXISTING CULVERTS
Monument #3
400'-0"
€ R.R. TRACK
MONUMENT "D"
90000162
WORK THIS DWG. WITH DWG 4005, 4006 & 4008.
R = 521.67'
PT. 10+32.24
PC 4+13.75
PT. 2+41.79
R = 483.48'
GENERAL ELECTRIC COMPANY
ATOMIC POWER EQUIPMENT DEPT.
SAN JOSE, CALIFORNIA
BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
NEW YORK, N.Y.
SITE PLAN
JERSEY CENTRAL POWER & LIGHT CO.
OYSTER CREEK STATION - UNIT #1
W.O. 2299
DAMES & MOORE
DWG. 4002



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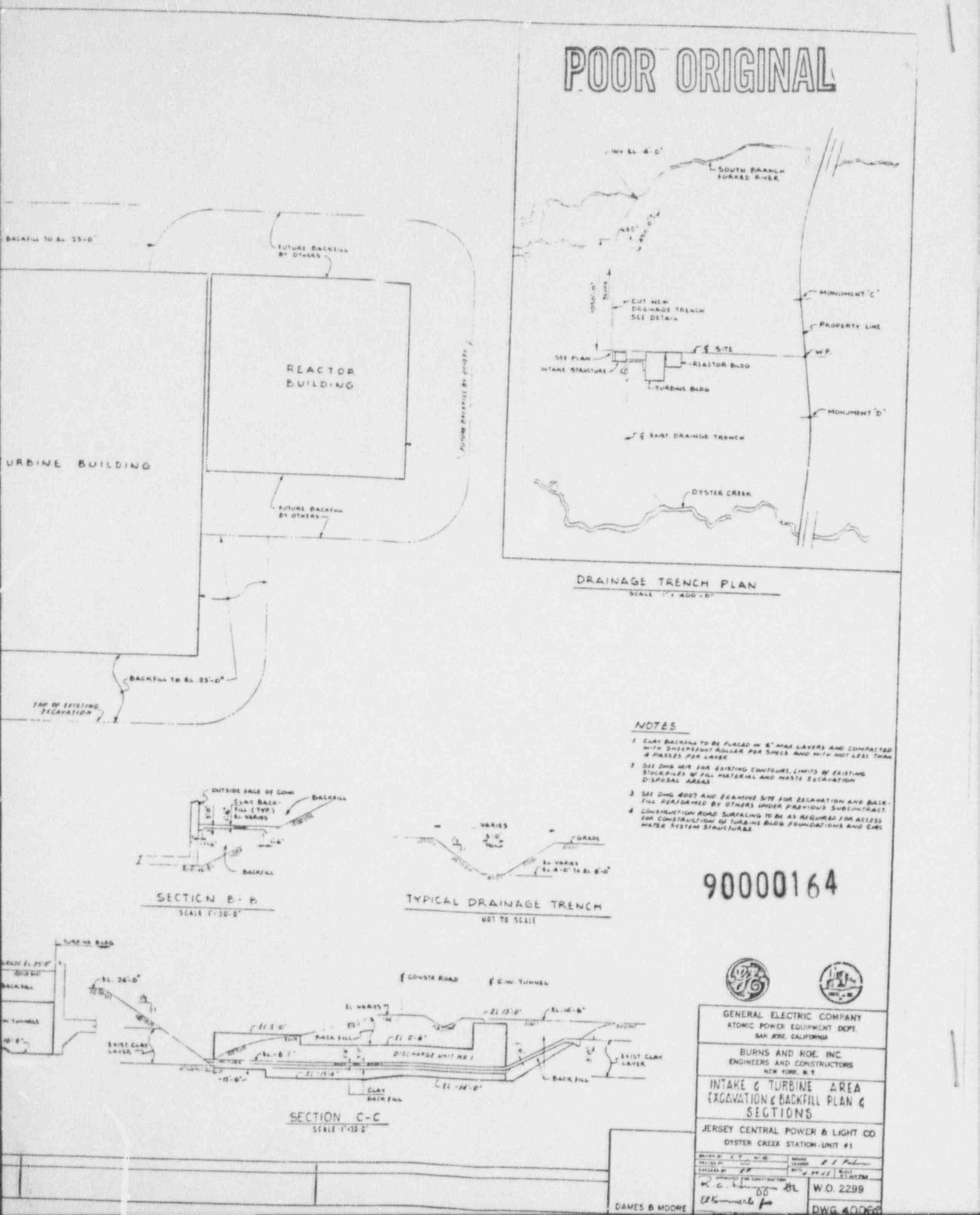
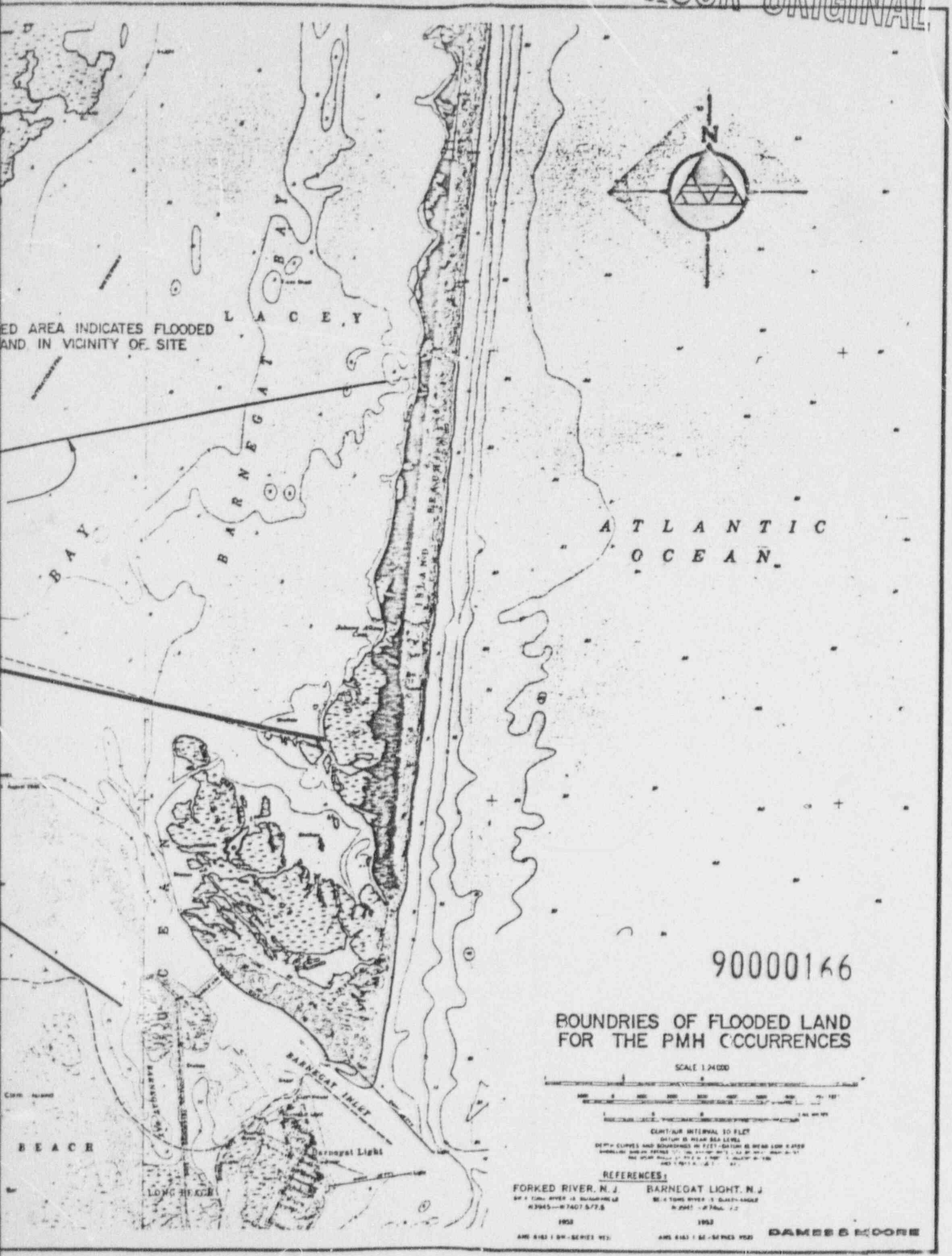
1	REVISED PLAN REV TO INCLUDE AS BUILT CHANGES			
2	REVIEWED FOR "AS BUILT" CONDITIONS	SB	JC	ND


POOR ORIGINAL
SOUTH BRANCH FORKED RIVER
CUT NEW DRAINAGE TRENCH SEE DETAIL
SEE PLAN
INTAKE STRUCTURE
REACTOR BLDG
TURBINE BLDG
MONUMENT 'C'
PROPERTY LINE
W.P.
MONUMENT 'D'
OYSTER CREEK
DRAINAGE TRENCH PLAN
REACTOR BUILDING
TURBINE BUILDING
FUTURE BACKFILL BY OTHERS
NOTES
SECTION B-B
TYPICAL DRAINAGE TRENCH
NOT TO SCALE
90000164
SECTION C-C
DISCHARGE UNIT NO 1
GENERAL ELECTRIC COMPANY
ATOMIC POWER EQUIPMENT DEPT.
SAN JOSE, CALIFORNIA
BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
NEW YORK, N.Y.
INTAKE & TURBINE AREA
EXCAVATION & BACKFILL PLAN &
SECTIONS
JERSEY CENTRAL POWER & LIGHT CO.
OYSTER CREEK STATION-UNIT #1
W.O. 2299
DAMES & MOORE

POOR ORIGINAL

90000165



90000166

PLATE 10

Docket No. 50-219

ATTACHMENT E

OYSTER CREEK NUCLEAR GENERATING STATION

CODES AND STANDARDS FOR
CATEGORY 1 STRUCTURES

90000167

December, 1979

NOTE 1	OYSTER CREEK COMPONENT/SUBSYSTEM	QUALITY GROUP: PLANT DESIGN	QUALITY GROUP: R.G. 1.26 SRP 3.2.2	SEISMIC: PLANT DESIGN	SEISMIC: R.G. 1.29 SRP 3.2.1	REMARKS
	STRUCTURES					
	1. REACTOR BLDG			CLASS I	SEISMIC	R.G. 1.29 C.1.0/(V.3.5)
	2. DRYWELL, TORUS, VENTS	ASME SEC. VIII 1962 Edition & IV		CLASS I	CATEGORY I (SEE)	R.G. 1.29 C.1.o/(V.3.5)
	3. CONTROL ROOM PANELS	1270N-5 1272N-5		CLASS I	I	R.G. 1.29 C.1.n/(V.3.5)
	4. SPENT FUEL POOL	1271N SEC. VIII		CLASS I	I	R.G. 1.29 C.1.1/(V.3.5
	5. VENT STACK	ASA, IEEE, ASTM, AWS, NBFU & FED	N/A	CLASS I	NSI (OBE)	
	6. TURBINE BLDG.	STATE & LOCAL		CLASS II		
	7. RADWASTE BLDG.			CLASS II	NONSEISMIC CATEGORY I (OBE)	SEE SRP 11.3
2,3	9. INTAKE & DISCHARGE			CLASS II	SEISMIC I	IF THIS IS ULTIMATE HEA SINK IT SHOULD BE SI R.G. 1.29(1g).
	10. SCREEN HOUSE			CLASS II		
	EQUIPMENT NSSS					
,2,3	1. REACTOR VESSEL	ASME BPV SECT. I	ASME BPV SECT. III A	CLASS I	SEISMIC I	Pg. IV-1-1/R.G. 1.29 C.1.a/(V.3.5)
,2	2. CRDS Housing	ASME BPV SECT. I	A	CLASS I	SEISMIC	R.G. 1.29 (C.2/(V.3.5)
,2	Supports	GE	-----------	CLASS I	SEISMIC I	R.G. 1.29 C.2/(V.3.5)
,2,3	3. RV SUPPORTS	GE	N/A	CLASS I	SEISMIC I	R.G. 1.29 C.2/(V.3.5)
,2,3	4. FUEL ELEMENTS	GE		CLASS I	SEISMIC I	R.G. 1.29 C.1.b/(V.3.5)
,2,3	5. CORE SHROUD	GE		CLASS I	SEISMIC I	R.G. 1.29 C.1.b/(V.3.5)
,2,3	6. CORE SUPPORTS	GE		CLASS I	SEISMIC I	R.G. 1.29 C.1.b/(V.3.5)
,2,3	7. STEAM SEPARATOR	ASME S IX		CLASS I	SEISMIC I	R.G. 1.29 C.1.b/(V.3.5)

9000168

NOTE	OYSTER CREEK COMPONENT/SUBSYSTEM	QUALITY GROUP: PLANT DESIGN	QUALITY GROUP: R.G. 1.26 SRP 3.2.2	SEISMIC: PLANT DESIGN	SEISMIC: R.G. 1.29 SRP 3.2.1	REMARKS
1,2,3	8. STEAM DRYER	ASME S IX	N/A	CLASS I	SEISMIC I	R.G. 1.29 C.1.b/V.3.5
	9. PIPING FROM REACTOR VESSEL TO 1st ISOLATION VALVE EXTERNAL TO DRYWELL	ASME SI 1965 to first ISO VALVE OUTSIDE DRYWELL then ANSI B31.1-1965 & NUC Code Cases to 2nd ISO valve.	ASME BPV SIII C1 A	CLASS I	SEISMIC I	R.G. 1.29 C.1.a
	RECIRCULATION SYSTEM					
1	1. PUMPS	ASA B31.1	ASME BPV SIII C1 A	CLASS I	SEISMIC I	VI-1-1/R.G. 1.29 C.1.a
1	2. VALVES	ASME BPV I	" A	CLASS I	SEISMIC I	IV-1-2/R.G. 1.29 C.1.a
1	3. PIPING	ASME BPV I ASA B31.1	" A	CLASS I	SEISMIC I	IV-1-2/R.G. 1.29 C.1.A
	EMERGENCY SYSTEMS					
	1. ISOLATION CONDENSER					
2,3	SHELL	ASME BPV SECT. VIII	C	CLASS I	SEISMIC I	IV-1-2 R.G. 1.29 C.2
1,2,3	TUBE	ASME BPV S.III C1.A	ASME BPV SIII C2 B	CLASS I SIII CLASS 2	SEISMIC I	R.G. 1.29 C.1.b
1,2,3	PIPING	ASME Sec. 1 1965	ASME BPV SIII CLASS 2 B	CLASS I	SEISMIC I	R.G. 1.29 C.1.b
3*	2. LIQUID POISON SYS. * Only if CRDS fails to operate	ASME 31-1965 ANSI B-31.1-1965 & NCC	ASME BPV SIII CLASS 2 B	CLASS I	SEISMIC I	R.G. 1.29 C.1.b
	PUMP	ASME SIII C1C	B			
	TANK	API	B			
	3. CORE SPRAY SYS.					
1,3	PIPING	ASA B31.1	ASME BPV SIII C2 A/B	CLASS I	SEISMIC I	R.G. 1.29 C.1.c/VI.6.2
	4. REACTOR BLDG			"	CLASS I	
2	CLOSED LOOP COOLING	ANSI-B31.1-1965 & Nuclear Code Cases	ASME BPV SIII CL 3 C	CLASS I	SEISMIC I	V.3.5/R.G. 1.29 C.1.g
3	5. AUTOMATIC DEPRESSUR-		A			Part of ECCS; should be Seismic I, Class 2

NOTE	OYSTER CREEK COMPONENT/SUBSYSTEM	QUALITY GROUP		SEISMIC		REMARKS
		PLANT DESIGN	R.G. 1.26 SRP 3.2.2	PLANT DESIGN	R.G. 1.29 SRP 3.2.1	
1						
	REACTOR EMERGENCY SYS.					
3	SERVICE WATER SYSTEM	ASME BPV SI & IX TO 1st ISO-LATION VALVE REST ASA 1331.1-1955+ CHANGES TO 1966	ASME BPV SIII CLASS 3 C	CLASS I	SEISMIC I	R.G. 1.29 C.1.g/X-3-2
3	CONTAINMENT SPRAY SYSTEM	ASA B31.1 ASME S VIII TO 1st VALVE OUTSIDE CONTAINMENT	ASME BPV SIII CLASS 2 B	CLASS I	SEISMIC I	R.G. 1.29 C.I.c/VI-7-1
X	STANDBY GAS TREAT. SYS	GE	B**	CLASS I	SEISMIC I*	No description of system *if system removes H_2 **no req't if post accid fission product removal is not basis. O.C. uses H_2 inerting system
X	SPENT FUEL AND NEW FUEL STORAGE FACILITIES	ASTM, A373, A245, 6VA, B&C ASTM, A240 Cl 304L		CLASS I	SEISMIC	Fuel Handling Not Covered by R. G. 1.26:R.G. 129 C.I.L requires seism I
	EMERGENCY ELEC. SYS.					
1,3	BATTERIES	ASA, ASTM, ASTM, IEEE NEMA, NFBU NEMA, LOCAL	N/A	CLASS I	SEISMIC I	R.G. 1.29 (C.1.q) CLASS IE ONSITE POWER SUPPLIES IEEE 344. SRP 8.3.
2,3	DIESEL GENERATOR	ASME, ASA, ASTM, IEEE, NEMA, NFBU DEMH, LOCAL	N/A			R.G. 1.29 C.1.q Class IE Onsite Power
2,3	EMERGENCY BUSSES, ETC.	ASA, IEEE, ASTM, NEMA	N/A			R.G. 1.29 C.1.8 Class IE Onsite Power Supplies IEEE 344. SRP 8.3.

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NOTE	OYSTER CREEK COMPONENT/SUBSYSTEM	QUALITY GROUP			SEISMIC		REMARKS
1		PLANT DESIGN	R.G. 1.26 SRP 3.2.2		PLANT DESIGN	R.G. 1.29 SRP 3.2.1	
	STEAM SYSTEM						
1	1. Piping to Ist.I.V.	ASME BPV SECT. I	ASME BPV A III CLASS I	A	CLASS I	SEISMIC I	R.G. 1.29 C.1.a/IV-1-2
	2. Piping to Turb SV	ASA B31.1	ASME BPV SIII CLASS 2	B		SEISMIC I	R.G. 1.29 C.1.e
1	3. MSIV VALVE	ASME BPV SECT. L ASA B31.1 GE SPECS	ASME BPV SIII CLASS 1	A	CLASS I	SEISMIC I	R.G. 1.29 C.1.a/IV-1-2
	4. TURBINE STOP VALVE		ANSI B31.1.1.0	D		NON SEISMIC I	SRP 3.2.1
1	5. SAFETY VALVE	ASME BPV SECT. I XNCC-1271N	ASME BPV SIII CLASS 1	A	CLASS I	SEISMIC I	R.G. 1.29 C.1.a/IV-1-2
1	6. RELIEF VALVE	ASME BPV SECT 1	ASME BPV SIII CLASS 1	A	CLASS I	SEISMIC I	R.G. 1.29 C.1.a/IV-1-2
	SHUTDOWN COOLING SYSTEMS	-------	-------		CLASS II	---------	X-2-2
2	PUMPS	ASME BPV SECT.III	ASME BPV SIII CLASS 2	C	CLASS II	SEISMIC I	R.G. 1.29-C.1.d
2	SHUTDOWN COOLING TUBE	ASME BPV SIII CLASS C	ASME BPV SIII CLASS 2	C	CLASS II	SEISMIC I	R.G. 1.29 C.1.d

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NOTE 1	OYSTER CREEK COMPONENT/SUBSYSTEM	QUALITY GROUP		SEISMIC		REMARKS
		PLANT DESIGN	R.G. 1.26 SRP 3.2.2	PLANT DESIGN	R.G. 1.29 SRP 3.2.1	
2	x SHELL	ASME BPV SECT. VIII	ASME BPV SIII CLASS 2 C	CLASS II SIII CLASS 2	SEISMIC I	R.G. 1.29 C.1.g
	CONDENSATE STORAGE TANKS & PUMPS			CLASS II Analysed for 0.11g seismic event - O.K.	SEISMIC II	CONDENSATE STORAGE SYSTEM IS RELATED TO SAFETY; ECCS SMALL BREAKS USE CRD WHICH HAS NORMA SUCTION FROM CST ISOLATION CONDENSER CAN ALSO TAKE SUCTIO FROM CST.
X	LIQUID WASTE SYSTEM	API 650 STANDARD	ASME BPV SIII CLASS 3 D	CLASS II		WASTE MANAGEMENT SYSTEMS IS UNDER DEVELOPMENT SRP 5.4.8 REQUIRES THAT PIPING FROM THE RECIRCULATION LOOP TO THE OUTERMOST ISOLATION VALVE BE CLASS A, SEISMIC I
X	REACTOR CLEANUP SYS.	ASME BPV SIII CLASS C	ASME BPV SIII CLASS 3 C	CLASS II	NON-SEISMIC	X-2-1
X	AIR COMPRESSOR & RECEIVERS		NOT COVERED BY R.G. 1.26	CLASS II	NON-SEISMIC	AIR OPERATED VALVES IMPORTANT T SAFETY ARE REQUIRED TO HAVE SEISMIC ACCUMULATORS
2,3	STATION AUXILIARY BUSSES		N/A	CLASS II		
X	MOISTURE SEPARATORS AND REHEATERS	ASME SEC. VIII	N/A	CLASS II		

NOTE 1 - #1 denotes equipment required to hold together to prevent a LOCA due to the seismic event
#2 denotes equipment required to shutdown & hold in safe shutdown condition following seismic event
#3 denotes equipment required if plant experiences a LOCA
X denotes equipment not needed for safety during seismic event

NOTE	OYSTER CREEK COMPONENT/SUBSYSTEM	QUALITY GROUP PLANT DESIGN	QUALITY GROUP R.G. 1.26 SRP 3.2.2	SEISMIC PLANT DESIGN	SEISMIC R.G. 1.29 SRP 3.2.1	REMARKS
1						
	INSTRUMENT AND CONTROL					
2, 3	REACTOR LEVEL INSTR.	B31.1 SI & VI		CLASS I	SEISMIC I	R.G. 1.29 C.1.k/V.3.6
2, 3	FEED WATER CONTROL VALVES	ASA, IEEE, ASME, ASTM, ANS, NBFU, & STATE & LOCAL		"	"	"
2*	LIQUID POISON SYS. INSTR.			"	"	"
	ANUAL REACTOR CONTROL	ASA & IEEE	N/A	"	"	"
2, 3	CONTROL ROD INST			"	"	"
2, 3	CONT. ROD POSITION INDICATING SYST.			"	"	"
				"	"	"
2, 3	REACTOR PROTECTION SYSTEM			"	"	"
2, 3	NEUTRON MONITOR SYSTEM	ASME III Cl.A		"	"	"
	FUEL RUPTURE DETECTION SYST.	Pressure Parts		"	"	"
	AREA MONITORS			CLASS I	---------	-------------------
X	TURBINE GENERATOR	ASME, ASA, ASTM, IEEE, NEMA, NBFU STDS OF TUBULAR EXCHANGER MANUFACTURERS ASSOCIATION CLASS R. NJ & LOCAL CODES	N/A	Class II		No Seismic Req't/V-3-6
						No Seismic Req't/V-3-6
X	CONDENSER	HEAT EXCHANGER INSTITUTE	N/A	Class II	Dynamic analysis for 0.11g seismic event	
	FEEDWATER SYSTEM HEATERS PUMPS	ASME S1-1965 RV TO 1st VALVE OUTSIDE CONTAINMENT ASME SECT. VIII & TFMA STDS.		CLASS II	*	

*=The FWS is used as re-dundant ECCS to the ADS for Small Brks and single failure requirements. This would require that the FWS seismic I, Amend. 38 presents results of seismic analysis to show that the feedwater in

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QUALITY STANDARDS

NRC QUALITY GROUP A	NRC QUALITY GROUP B	NRC QUALITY GROUP C	NRC QUALITY GROUP D
ASME Boiler and Pressure Vessel Code, Section III			ASME, Sec. VIII (pressure vessels) ANSI B31.1.0 (piping and valves) Mfg. Stds. (pumps)
Class 1	Class 2	Class 3	
or	or		
ASME Boiler and Pressure Vessel Code, Section III			
Class A (pressure vessels)	Class C (pressure vessels)	--	--

NRC Quality Group A equivalent to Licensee Safety Class 1
NRC Quality Group B equivalent to Licensee Safety Calss 2) Also seismic Category I

NRC Quality Group C equivalent to Licensee Safety Class 3) Not always seismic Category I

NRC Quality Croup D equivalent to Licensee Safety Class 4 or NNS) Non-seismic Category I

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ATTACHMENT F

OYSTER CREEK NUCLEAR GENERATING STATION

LOADS COMBINATION

90000175

December, 1979

QUESTION

1. A Describe the load combinations and provide the stress level tables as requested per question IV-1.

ANSWER

The information requested is presented in the attached Tables 1-A-1 through 1-A-5.

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TABLE 1-A-1

ALLOWABLE STRESSES FOR DRYWELL CONCRETE SHIELD

Loading Condition	Reinforced Steel Maximum Allowable Tension Stress	Reinforced Steel Maximum Allowable Compression Stress	Concrete Maximum Allowable Compression Stress	Concrete Maximum Allowable Shear Stress	Concrete Maximum Allowable Peripheral Shear
1. Dead Load Plus Live Load Plus Overpressure Plus Maximum Temperature Plus Design Earthquake	0.5 Fy	0.34 Fy	$0.45\ f'_c$	$1.1\sqrt{f'_c}$	$2\sqrt{f'_c}$
2. Dead Load Plus Live Load Plus Maximum Temperature Plus Overpressure Plus Double Design Earthquake	0.5 Fy	0.34 Fy	$0.45\ f'_c$	$1.467\sqrt{f'_c}$	$2.667\sqrt{f'_c}$
3. Dead Load Plus Live Load Plus Maximum Temperature Plus Design Earthquake Plus Jet Force	0.667 Fy	0.454 Fy	$0.60\ f'_c$	$1.467\sqrt{f'_c}$	$2.667\sqrt{f'_c}$

NOTES:

a. Dead loads and live loads include contributing maximum loadings from building floors, columns and walls, pool walls, slabs and plug.

b. Overpressure = Maximum 20 psi reaction from compressible joint.

c. Temperature = 55° F maximum gradient

d. Design earthquake = Loads due to 0.11g basic ground acceleration and includes proportions of the drywell vessel, the surrounding building, the reactor vessel and reactor building equipment.

e. Jet Force = 566 kips over a 3.14 ft^2 area at any point of the spherical portion and 466 kips over a 2.54 ft^2 area at any point of the cylindrical portion (below El. 94'-9").

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9000177

TABLE 1-A-2

ALLOWABLE STRESSES FOR REACTOR VESSEL CONCRETE PEDESTAL

Loading Condition	Reinforced Steel Maximum Allowable Tension Stress	Reinforced Steel Maximum Allowable Compression Stress	Concrete Maximum Allowable Compression Stress	Concrete Maximum Allowable Shear Stress
1. Dead Load Plus Equipment Load Plus Jet Load Plus Temperature Plus Design Earthquake	0.25 Fy	0.10 Fy	$0.133\ f'_c$ (bending) $0.116\ f'_c$ (direct)	$0.55\sqrt{f'_c}$
2. Dead Load Plus Equipment Load Plus Jet Load Plus Temperature Plus Double Design Earthquake	0.25 Fy	0.10 Fy	$0.267\ f'_c$ (bending) $0.232\ f'_c$ (direct)	$1.1\sqrt{f'_c}$

NOTES:
a. Jet plus seismic loads per J. A. Blume's "Earthquake Analysis: Reactor Pressure Vessel."
b. Temperature = 40°F maximum gradient

TABLE 1-A-3

ALLOWABLE STRESSES FOR CONCRETE VENTILATION STACK

Loading Condition	Reinforced Steel Maximum Allowable Tension Stress	Reinforced Steel Maximum Allowable Compression Stress	Concrete Maximum Allowable Compression Stress	Concrete Maximum Allowable Shear Stress
1. Dead Load Plus Wind Load	0.30 Fy	-	$0.375\ f'_c$	$1.1\sqrt{f'_c}$
2. Dead Load Plus Wind Plus Temperature	0.54 Fy	-	$0.67\ f'_c$	$1.1\sqrt{f'_c}$
3. Dead Load Plus Design Earthquake Load	0.30 Fy	-	$0.375\ f'_c$	$1.1\sqrt{f'_c}$
4. Dead Load Plus Design Earthquake Plus Temperature	0.54 Fy	-	$0.67\ f'_c$	$1.1\sqrt{f'_c}$
5. Dead Load Plus Double Design Earthquake	0.96 Fy	-	$0.67\ f'_c$	$1.1\sqrt{f'_c}$

NOTES:
a. Maximum wind velocity = 110 mph
b. Seismic loads per J. A. Blume's "Earthquake Analysis: Ventilation Stack."
c. Temperature = 100°F maximum gradient

TABLE 1-A-4

ALLOWABLE STRESSES FOR
a) REACTOR BUILDING FLOOR SLABS, BEAMS, COLUMNS, WALLS, STORAGE POOLS AND FOUNDATION
b) CONTROL ROOM SLABS AND WALLS
c) BATTERY ROOM SLAB AND WALLS
d) EMERGENCY DIESEL GENERATOR AND TANK VAULT
*e) INTAKE STRUCTURE (SERVICE WATER AND CIRCULATING WATER PUMP AREAS)
f) STARTUP TRANSFORMER FOUNDATION

Loading Condition	Reinforced Steel Maximum Allowable Tension Stress	Reinforced Steel Maximum Allowable Compression Stress	Concrete Maximum Allowable Compression Stress	Concrete Maximum Allowable Shear Stress	Reinforced Concrete Shear Walls Allowable Unit Stress	Concrete Maximum Allowable Peripheral Shear	Concrete Maximum Allowable Bearing
1. Dead Load Plus Live Load Plus Operating Load Plus Design Earthquake	0.5 Fy	0.34 Fy	0.45 f'_c	1.1 f'_c	0.05 f'_c	2 f'_c	0.25 f'_c (Full A) 0.375 f'_c $(<1/3\ A)$
2. Dead Load Plus Live Load Plus Operating Load Plus Wind	0.667 Fy	0.454 Fy	0.60 f'_c	1.467 f'_c		2.667 f'_c	0.333 f'_c (Full A) 0.50 f'_c $(<1/3\ A)$
3. Dead Load Plus Live Load Plus Operating Load Plus Double Design Earthquake	0.9 Fy	0.6 Fy	0.9 f'_c	1.7 f'_c		3.4 f'_c	0.333 f'_c (Full A) 0.50 f'_c $(<1/3\ A)$

* Although the intake structure is defined as a Class II structure, the supporting slabs and walls for the service water and circulating water pumps have been investigated and have been found adequate to withstand seismic loads of 0.11g and 0.22g using the tabulated allowable stresses.

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9000179

TABLE 1-A-5

ALLOWABLE STRESSES FOR STRUCTURAL STEEL FOR:

a) REACTOR BUILDING ROOF STEEL, CRANEWAY COLUMNS, CRANE GIRDERS, VERTICAL BRACING

b) DRYWELL RADIAL STEEL FRAMING AND RECIRCULATING

c) REACTOR BUILDING PLATFORMS

					A325 H.S. Bolts With Thread Excluded from Shear Plane		A141 Rivets	
Loading Condition	Tension On Net Section	Shear On Gross Section	Compression	Bending Tension and Compression	Tension (psi)	Shear (psi)	Tension (psi)	Shear (psi)
1. Dead Load Plus Live Load Plus Operating Load Plus Design Earthquake	0.60 Fy	0.40 Fy	Varies with Slenderness Ratio	0.60 Fy* to 0.66 Fy	40,000 (0.50 Fy)	22,000 (0.27 Fy)	20,000 (0.56 Fy)	15,000 (0.42 Fy)
2. Dead Load Plus Live Load Plus Operating Load Plus Wind (For steel listed as item "a" above)	0.80 Fy	0.533 Fy	Varies with Slenderness	0.80 Fy* to 0.88 Fy	53,300 (0.667 Fy)	29,300 (0.37 Fy)	26,700 (0.74 Fy)	20,000 (0.56 Fy)

* 0.60 Fy or 0.80 Fy is reduced for members with excessive unbraced compression flange length in accordance with A.I.S.C. Specifications.

Docket No. 50-219

ATTACHMENT G

OYSTER CREEK NUCLEAR GENERATING STATION

METHOD OF COMBINING STRESSES

90000181

December, 1979

QUESTION

IV. Structures

1. Please provide tables, similar to tables V-3-2 and V-3-3 in the FD&SAR for all Class I structures and components. Specify the method for combining loads to a loss-of-coolant with "normal" and seismic loads.

ANSWER

a. ALLOWABLE STRESSES FOR CLASS I PIPING

	Loading Condition	Allowable Stress
1.	Thermal Expansion	S_A
2.	M.O.L. + S.L.	S_h
3.	M.O.L. + 2 × S.L.	Safe shutdown can be achieved.

M.O.L. = Maximum operating loads including design pressure and temperature, weight of piping and contents including insulation and the effect of supports and other sustained external loadings.

S. L. = Seismic loads due to the design earthquake.

2 × S. L. = Seismic loads due to twice the design earthquake.

S_A = $f\,(1.25\,S_c + 0.25\,S_h)$.

where:

f = stress range reduction factor for cyclic conditions.

S_c = allowable stress in cold condition per ASA B31.1.

S_h = allowable stress in the hot condition (design temperature) per ASA B31.1.

The two classes of structures applicable to the earthquake design requirements are as follows:

Class I - Structures and equipment whose failure could cause significant release of radioactivity or which are vital to a proper shutdown of the plant and the removal of decal heat.

Class II - Structures and equipment which are both essential and nonessential to the operation of the station, but which are not essential to a proper shutdown.

b. REACTOR VESSEL SUPPORTS

1. Seismic - Allowable stress = normal A1SC allowable stresses.

2. Seismic + Jet - Allowable stress = 150% of normal A1SC allowable stresses.

3. 2 Seismic - Allowable stress = 150% of normal A1SC allowable stresses.

c. INSTRUMENTATION

The control room panels and auxiliary racks are usually shipped assembled and therefore these units must be designed for normal shipping shock which is in the order of several g's acceleration. Certain components are removed and padded to reduce vibration effect and excessive acceleration. In all cases, however, the design analysis is made of the panels and instruments. All relays in safety circuits are energized; and since they are capable of closing against 1.0 g, they can certainly maintain contact during an acceleration of 0.22 g.