US Army Corps
of Engineers
New York District

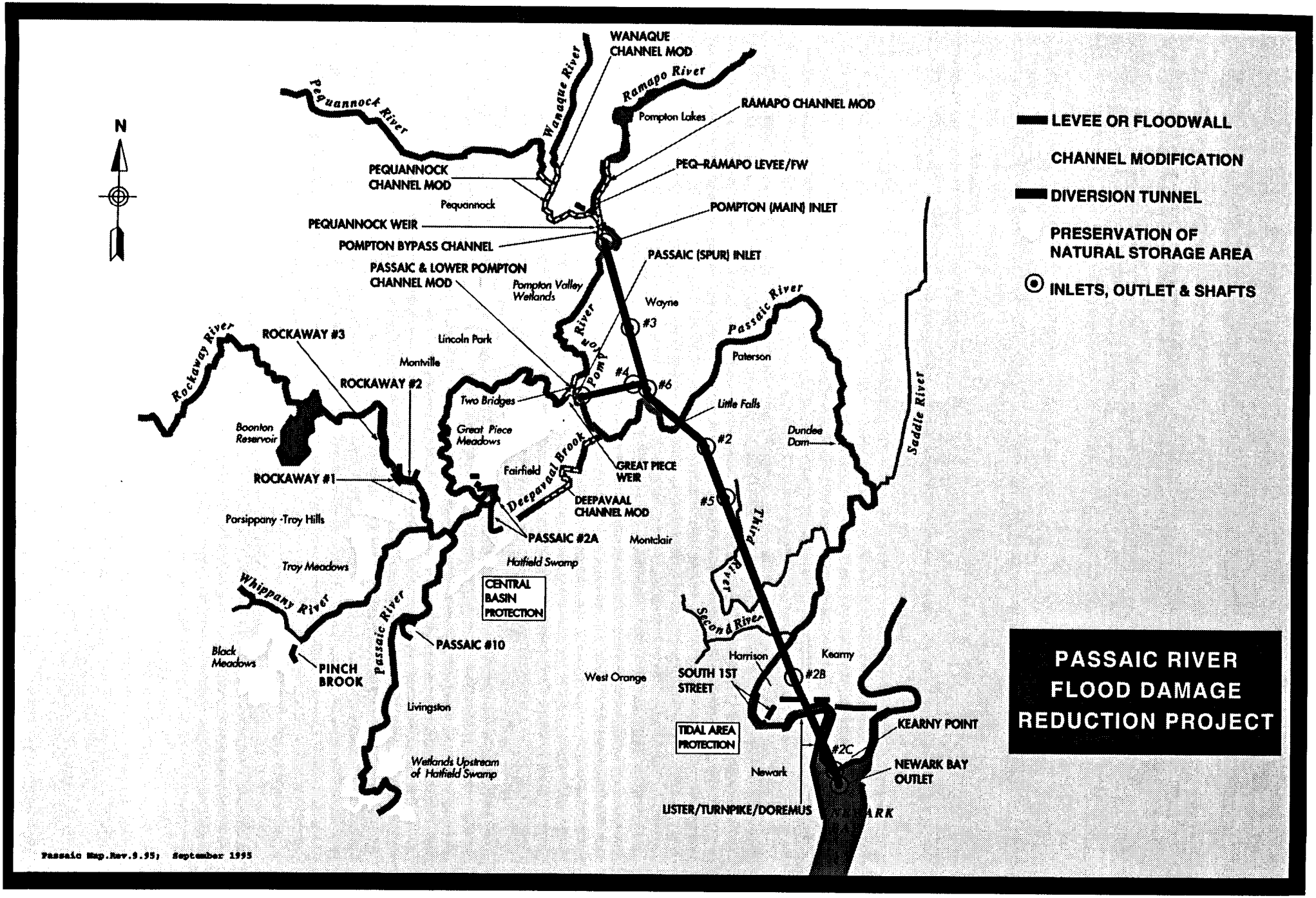
DRAFT

General Design Memorandum

Passaic River
Flood Damage Reduction Project

Appendix J - Passaic Levee # 10

September 1995


PASSAIC RIVER
FLOOD DAMAGE
REDUCTION PROJECT
LEVEE OR FLOODWALL
CHANNEL MODIFICATION
DIVERSION TUNNEL
PRESERVATION OF
NATURAL STORAGE AREA
INLETS, OUTLET & SHAFTS
N
WANAQUE
CHANNEL MOD
RAMAPO CHANNEL MOD
PEQ-RAMAPO LEVEE/FW
POMPTON (MAIN) INLET
PASSAIC (SPUR) INLET
PEQUANNOCK
CHANNEL MOD
PEQUANNOCK WEIR
POMPTON BYPASS CHANNEL
PASSAIC & LOWER POMPTON
CHANNEL MOD
ROCKAWAY #3
ROCKAWAY #2
ROCKAWAY #1
GREAT PIECE
WEIR
DEEPAVAAL
CHANNEL MOD
PASSAIC #2A
PASSAIC #10
PINCH
BROOK
CENTRAL
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PROTECTION
TIDAL AREA
PROTECTION
SOUTH 1ST
STREET
KEARNY POINT
NEWARK BAY
OUTLET
LISTER/TURNPIKE/DOREMUS
#2
#2B
#2C
#3
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Pequannock River
Wanaque River
Ramapo River
Pompton Lakes
Pequannock
Pompton Valley
Wetlands
Wayne
Pompton River
Passaic River
Paterson
Little Falls
Dundee
Dam
Saddle River
Rockaway River
Lincoln Park
Montville
Boonton
Reservoir
Two Bridges
Great Piece
Meadows
Fairfield
Deepavaal Brook
Porsippany -Troy Hills
Troy Meadows
Whippany River
Hatfield Swamp
Montclair
Third River
Second River
Black
Meadows
Passaic River
Harrison
Kearny
West Orange
Livingston
Wetlands Upstream
of Hatfield Swamp
Newark
Passaic Map.Rev.9.95; September 1995

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PASSAIC 10 LEVEE SYSTEM

Passaic River Flood Damage Reduction Project
New Jersey

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SECTION 1-INTRODUCTION

1.1 PROJECT AUTHORIZATION

Section 101(a) (18) of the Water Resources Development Act of 1990 (P.L.101-640), as modified by Section 102 (p) of the Water Resources Development Act of 1992 (P.L.102-580) authorized the construction of the Passaic River Flood Damage Reduction Project which includes the Passaic 10 Levee System.

1.2 SITE DESCRIPTION

The Passaic 10 levee system is located within the Central Basin on the right bank of the Passaic River in the Livingston Township in Essex County, New Jersey. The levee system will surround an industrialized area consisting of office buildings and various industries.

1.3 PURPOSE

This design memorandum will serve as a basis for final design, plans and specifications for the construction of the Passaic 10 levee system in the Livingston Township in Essex County, New Jersey.

1.4 LOCAL SPONSOR

The New Jersey Department of Environment Protection will serve as lead sponsor for the Passaic 10 levee system will be responsible for the operations and maintenance of the Passaic 10 levee and its features.

SECTION 2-PROPOSED PLAN

2.0 The present plan consist of an earthen levee approximately 4830 feet long with a 10-foot wide top width and 3H:1V side slopes except between stations 9+50 and 15+50 where 4H:1V side slopes will be used on the exterior slopes. The top of the levee will be constructed to elevation 178.1 from station 0+00 to 18+00, elevation 178.4 from station 19+00 to 33+00, elevation 178.6 from station 34+00 to end. A mitigation plan for environmental impacts is part of the project features and consists of creation/re-creation of 9.1 acres of palustrine forested, 1.6 acres of palustrine scrub/shrub, and 1.9 acres of palustrine emergent wetlands. The use of two pump stations with

vertical turbine submersible pumps, sluice gates, and flap valves are included for mitigation of the interior drainage ponds to maintain the present wetland hydrology. A floodwall will be constructed where an existing sanitary sewer line passes thru the levee. The floodwall consists of a 10' long reinforced concrete wall section flanked by a 2'x2' concrete abutment on each side. The wall section allows for the passage of an elevated 52 inch sanitary sewer line. A reinforced concrete I-wall section will provide transition from the abutment into the earthen levee. The abutment and I-wall sections will be supported by steel sheetpiling. The use of a concrete I-wall in lieu of a levee was considered to minimize disruption to the wetlands. However, the floodwall proved too costly.

SECTION 3-OPERATION AND MAINTENANCE

3.1 GENERAL

The operation and maintenance of the levee system will be the responsibility of the state of New Jersey who will be the local sponsor of the project. An operation and maintenance manual will be prepared prior to the turnover of the completed project to the local sponsor which will address the general procedures and specific maintenance and operations instructions which the local sponsor would be responsible for upon completion of the project. ER 1110-2-401 dated 30 September 1994 provides instruction for the preparation of the operation and maintenance manual. These general procedures and specific maintenance and operations instructions are outlined in Attachment I. Section 208.10, Title 33, of the Code of Federal Regulations contains regulations for the operation and maintenance of local flood-protection works approved by the Secretary of the Army in accordance with authorities contained in Section 3 of the Flood Control Act of 22 June 1936, as amended and supplemented (a copy of Section 208.10 is included as Attachment I).

3.2 MAINTENANCE

The levee system and its integral features shall be maintained continuously in such a manner as to obtain maximum flood-protection benefits. A permanent committee, consisting of or headed by an official usually called the Superintendent, who shall be responsible for the continuing maintenance of the project should be appointed by the local sponsor. The local sponsor shall provide such maintenance as may be required to insure the serviceability of the levee protection during times of flood. Measures shall be taken to repair damage caused by erosion and above-normal floods, and to promote growth of the vegetative cover. Periodic inspections of the levee shall be made by the local sponsor.

3.3 OPERATIONS

During flood periods, the levee should be monitored closely for erosion damages, bank sloughing, damages to vegetation, damages to floodwall, damages to drainage structures, damages to pumping stations, and stone protection displacement. Upon inspection, corrective measures should be taken to repair all damaged areas immediately after each high water period.

SECTION 4-ENVIRONMENTAL CONCERNS

4.1 FISH AND WILDLIFE RESOURCES

Due to the setback nature of the levee system significant effects on the aquatic resources do not occur. However, wetlands associated with the project area will be lost and are a concern. The levee footprint for the project will cause the loss of 4.8 acres of wetlands including 4.0 acres of palustrine forested, 0.4 acres of palustrine scrub/shrub, 0.4 acres of palustrine emergent wetlands. Additionally, another 2.2 acres of wetland consists of 1.5 acres of palustrine forested, 0.3+ acres of palustrine scrub/shrub, 0.3+ acres of palustrine emergent wetlands will be lost at a soil borrow area contiguous to the levee site.

These losses will be offset by converting a leaf disposal site (2.7 acres) into 2.4 acres of forested, 0.1 acres of scrub/shrub, and 0.2 acres of emergent palustrine wetlands. The area will be site prepared including recontouring to existing wetland surface elevations and planted with 1,100 trees, and 465 shrubs. The understory and fringe will be seeded. Tree protection will be provided.

An additional onsite mitigation area is contained at the northeast corner of the levee system where levee fill will be obtained. Here material from the leaf compost site will be used to form the proper organic bed for wetland planting. Plantings include 3.1 acres of forested, 0.9 acres of scrub/shrub, and 1.1 emergent/shallow water palustrine wetlands. Contouring to existing wetland elevations will be performed before planting. Panting will consist of 1,300 trees and 900 shrubs. The understory and fringe will be seeded. Tree protection will be provided.

The levee will contain within it, wetlands, mostly palustrine forested, and scrub/shrub. The wetlands will be maintained by the use of two pump stations with vertical turbine submersible pumps, sluice gates, and flap valves. A coincident rainfall runoff analysis has been performed to size pumps and concept viability.

Offsite mitigation will take place in the Hatfield Swamp at a site of a former wetland, which has been filled. This site is 2.5 miles northeast from the levee system. Soil removed from the site will form a mound which can be used by fauna during times of flooding. The site will be contoured to surrounding wetland elevation. This site will consist of 3.6 acres of forested, 0.6 acres of scrub/shrub, and 0.6 acres of emergent palustrine wetlands. Planting will include 1,560 trees, and 580 shrubs. The understory and fringe will be seeded. Tree protection will be provided.

The tree species to be used for all three sites include pin oak, red maple, silver maple, sweetgum, and cottonwood. The shrubs include red stem dogwood, arrowwood, swamp rose, and pussy willow. Areas seeded will contain; meadow fescue, redtop, deer tongue, alsike clover, birdsfoot trefoil, and meadow foxtail.

Tree protection will include individual commercial tree protectors. The site will be monitored during and after planting to insure the success of the wetlands.

The mitigation areas (7.8 acres) in the immediate vicinity of the levee which will be converted to or recreated as wetlands are contiguous or nearly contiguous to Green Acres land. These sites can be conveyed to the State of Jersey to offset the adverse effects to Green Acres lands within the project.

4.2 INTRODUCTION

Cultural resources studies for the Passaic #10 Levee System and Ponding Area were carried out in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and in accordance with procedures specified in a Programmatic Agreement (PA) among the U.S. Corps of Engineers, New York District (Corps), the Advisory Council on Historic Preservation (ACHP), and the New Jersey Historic Preservation Office (NJHPO). The PA, which was finalized in March 1993, applies to all elements of the Passaic River Flood Protection Project.

A Native American archaeological site that is eligible for listing on the National Register of Historic Places under Criteria D ("likely to yield information important in prehistory or history") is located within the bounds of the Passaic #10 Levee System. The site, designated Site 28-Ex-78, is located on a terrace which projects westward into the wetlands adjoining the Passaic River. In addition, landforms determined to be sensitive for prehistoric sites are located within the wetlands portion of the Passaic #10 project area.

The proposed borrow-site and the levee's northern tie-in will have adverse effects upon site 28-Ex-78. Mitigation, probably in

the form of an archaeological excavation, will be undertaken prior to construction in order for the Corps to fulfill its Section 106 responsibilities.

Additional evaluation is required in the wetlands areas designated as "sensitive," in order to obtain more information regarding the eligibility status of these resources. A more detailed account of cultural activities at the proposed Passaic #10 Levee System follows below.

4.3 SITE 28-EX-78

Site 28-Ex-78 is located on a glacial till terrace, overlooking the Passaic River and wetlands, at the 173-foot contour elevation. Artifacts recovered during the recent investigation suggest that it dates to the Late Archaic period (ca. 4000-2000 B.C.)

The site was initially discovered during a cultural resources survey for a gas pipeline that now borders the eastern edge of the project area. The archaeologists who conducted the earlier investigation performed only minimal testing. They concluded that the site centered on the crest of the terrace slope, and extended as far east as Eisenhower Parkway, and as far south as the industrial park. It is assumed that the eastern portions of the site were destroyed by the construction of the pipeline. Because this earlier investigation focused upon the pipeline's relatively narrow right-of-way, there had been no determination of the site's date, function, or its western and northern boundaries. In consultation with the NJHPO, a field-testing program was developed that would provide the needed information.

Fieldwork, consisting of shovel-testing and surface inspection, was conducted in June 1993 by Kittatinny Archaeological Research, Inc. The principal investigators were Philip A. Perazio and Kenneth M.Joire. The area examined enclosed the potential impact areas associated with the proposed alignment alternatives for the levee's northern tie-in above the 170 ft. contour line. It consists of two fields separated by a narrow band of woods. The eastern-most field is entirely cultivated. The western-most field, which corresponds to the portion of the terrace that slopes to the west towards the river and wetlands, contains cultivated as well as fallow and wooded sections. The tested area is bounded by the industrial park to the south, the pipeline to the east, a dirt road to the north, and the remnants of a stone wall and low lying wooded wetlands to the west.

Testing strategies employed by the contractor were aimed towards obtaining as much information as possible about the site's size and function while minimizing impacts to its integrity. Fortunately the fieldwork began shortly after the site

had been plowed and rainwashed, thus allowing the crew to base much of their assessment on surface observation, collection, and mapping rather than excavation.

Slightly different field methods were used in the two fields. In the eastern field, the presence of the site, although not its boundaries, had been previously confirmed. Thus, in order to delineate the boundaries, a series of transects were set at 25-feet intervals from the edges of the field, extending inward towards the center. These were then walked by the archaeologists who noted the distribution of artifacts. Prehistoric materials were found across the field's entire surface. The first occurrence of an artifact in each transect was noted and flagged. Diagnostic artifacts and several other artifacts of interest were plotted onto the project map and retrieved for analysis.

In the previously uninvestigated western field, the principal objective was to determine how far the site extended down the slope and to the west. Transects were set at 10-foot intervals to ensure adequate coverage. All artifacts were collected and plotted. Shovel tests were excavated in the unplowed fallow and wooded areas that border the field to the west and the north. Again, prehistoric artifacts were found to be equally distributed across the field.

Based on analysis of the artifacts and their distribution, the contractor has concluded that the site's boundaries are consistent with those identified in the original survey, except that the site actually extends somewhat further to the west, measuring approximately 500 feet east-west by 420 feet north-south. Additional testing would be required to determine whether any cultural features are present extending into the plowzone.

The artifacts recovered here suggest that Site 28-Ex-78 was occupied during the Late Archaic Period (4000 B.C. to 2000 B.C.) and may represent the remains of small transient procurement sites focused on the exploitation of food resources from lower lying, wetter areas. Similarly dated sites, and components of sites, have been found nearby.

The NJHPO has concurred with the investigation's findings, and recommends that the project be designed to avoid direct and indirect impacts to Site 28-Ex-78.

4.4 INVESTIGATION AND GEOMORPHOLOGICAL STUDY OF PROJECT AREA WETLANDS

In addition to the investigation described above, a study was undertaken to assess the archaeological potential of landforms and surfaces within the project area wetlands that are presently buried or submerged but which may have been associated with Native American cultural activities in the past. The study also generated contextual data for the investigation cited above. Research objectives included the identification of previous courses of the Passaic and its tributaries, former uplands/lowlands boundaries and stratigraphic evidence of formerly inhabitable areas such as natural levees and other dry, elevated landforms. Landscape transformations dating from the time of Euro-American occupation were also considered.

Like the uplands component of the Passaic #10 investigation, this phase of the research design was developed in consultation with the NJHPO. Archaeologists from the Rutgers Center for Public Archaeology were retained to undertake the study. Co-Principal Investigators were John Cavallo and Gail Ashley, a geomorphologist. Lynn Rakos also co-authored the report.

Based upon a literature review, some fieldwork, and examination of existing geotechnical data gathered by the Corps, the contractor initiated a paleoenvironmental reconstruction of the project area. A continuous stratum of clay or clayey silt was noted at uniform depths in several borings, suggesting that at one time the project area was located at the margins of Glacial Lake Passaic. The Basin's many swamps, including adjacent Hatfield Swamp, are remnants of the lake. It is hypothesized that upland prehistoric sites, such as Site 28-Ex-78, and especially those with Middle and Late Archaic components, are associated with the seasonal exploitation of the diverse and plentiful resources of the swamp/riverine ecosystem which developed following the draining of the lake nearly 8000 year ago. Deeply buried peat deposits, tangible evidence of these vast post-glacial swamps, have been found throughout the Basin. One such deposit, extending approximately 5 feet in depth, was detected in a boring taken in the southern portion of the project area.

Field observations and analysis of the borings enabled the contractor to delineate areas of fill and disturbance throughout the project area wetlands. These are of low archaeological potential and require no further evaluation.
Undisturbed deposits were detected in a small area of higher topographic relief located in the southwestern portion of the project area. The contractor recommended that this area be tested more intensively. If cultural resources are encountered here, it is also recommended that pollen and macroplant remains be

extracted from the peat deposit and analyzed. The NJHPO has concurred with the findings of the investigation as well as with the contractor's recommendations.

4.5 PROJECT EFFECTS AND RECOMMENDATIONS

The project's upland component, as it is presently designed, will destroy all of site 28-Ex-78. The northern levee tie-in will impact the southern portion of the site, nearest to the industrial park. The six acre borrow-site, located to the northeast of the levee, will impact the remaining areas of the site. Mitigation, probably in the form of a complete archaeological excavation of Site 28-Ex-78 will be undertaken.

In the wetlands, the levee is situated at the site of higher topographic relief that has been targeted for further investigation. Additional testing will be necessary to determine whether prehistoric materials are located here. If no materials are found, the Section 106 process for the wetlands will be completed with a finding of no effect. If materials are encountered, a determination of adverse effect will be made and plans for mitigation developed.

SECTION 5-GEOTECHNICAL CONSIDERATIONS

5.1 GENERAL GEOLOGY

The project area is within the Piedmont Plateau, also known as the Lowlands. During the Wisconsin glacial period, this area was covered by glacial Lake Passaic. There was up to 90 feet of varved clay and silt deposited over a thin layer of ground moraine material, when Lake Passaic drained. The Passaic 10 area is generally underlain by a Triassic-age, soft, red shale or siltstone, that is interbedded with sandstone. In this area, as the glacier melted, fine-textured materials, silts and clays, were deposited. As the lake drained fluvial deposits of silts, sands, and gravels occurred. Kettles and basins with organic deposits also were formed. Overlying the glacial soils, alluvial silts and sands are found. These alluvial soils vary in thickness in the project area from about 2 to 20 ft and are generally thicker in the lower floodplain areas. The Passaic 10 area lies within a seismic 2 zone according to the seismic map in EM -1110-2-190

5.2 SUBSURFACE INVESTIGATIONS

5.2.1 General Subsurface investigations were conducted in late August and early September of 1993. A total of 10 holes were located along the proposed levee alignment. Some drill holes had companion holes to allow for the retrieval of

undisturbed soil samples. Holes P-10-9A were drilled on an alternate levee alignment. All holes were continuously splitspooned, using SPT standards, to a depth of 18 feet. Two holes, P-10-4 and P-10-9, were drilled to a depth of 51.5 feet. After reaching a depth of 18 feet these two holes were sampled on 5 foot centers. A flight auger was used to clean out and advance the holes. None of the holes encountered rock. In one area an organic deposit, typical of a kettle or basin, was encountered to a depth of 6 feet.

5.2.2 Material Types The soils encountered at Passaic 10 are typical glacier deposited materials. The soils are a mixture of fine sands, silts, and clays. A typical shallow borehole showed a fine-grained material, silt or clay, for its entire depth some with interbedded layers of sand. The deep holes exhibited the same pattern. At deeper depths an occasional layer of sand was encountered between the fine layers.

5.2.3 Soft Area An area of soft organic material was found along the levee alignment between stations 10+50 and 16+50, as deep as 6 feet along the plastic clay or soft elastic silt followed by 4 feet of silty sand and then a very stiff layer of clay. The organic later is compressible and its effect on the levee design will be discussed in the following paragraphs.

5.3 LEVEE DESIGN

5.3.1 General The typical levee is a 6 to 10 foot high, compacted earth structure with a 10 foot wide crest and 3H:1V side slopes. The fill material for the levee is assumed to be a silt - clay mixture typical of the area. The exact nature of the material will be determined prior to completion of plans and specifications. The levee cross-section changes slightly for a 600-foot reach in a soft area. The crest in this reach is 10 feet wide and the downstream slope is still 3H:1V, but the upstream slope is a 4H:1V slope to satisfy criteria. A filter fabric is included at the interface of the levee and the existing ground to improve slope stability and to facilitate levee construction and the movement of construction equipment.

5.3.2 Slope Stability Slope stability analyses were performed using the Corps version of UTEXAS3 by Dr. Stephen Wright. Criteria and conditions for analysis are from the Corps EM 1110-2-1913, Design and Construction of Levees, Table 6-1. Earthquake analyses were not performed because of the low probability of an earthquake occuring during high water events, and because of the material types involved. The strength of the fill material was assumed for a silt-clay mixture, and the strength values for the clay and organic layers were determined from undisturbed sampling and laboratory strength tests. Sand

strengths were based on correlations of SPT results found in reference soil mechanics books. The stability results will be reevaluated when the strength of the actual fill material has been determined. The shear strengths used for slope stability analysis were as follows:

TABLE J-1
LEVEE AND FOUNDATION STRENGTHS

MATERIAL	"Q"		"R"		"S"	
	o	c,psf	o	c,psf	o	c,psf
FILL	0	500	10	1000	32	0
SILT	0	2500	4.2	740	30.7	0
SILTY SAND	32	0	32	0	32	0
STIFF CLAY	0	2500	4.2	740	30.7	0
ORGANICS	0	200	7	294	33	0
SOFT CLAY	0	500	4.2	740	30.7	0

5.3.2.1 Typical Section

The typical section analyzed for the majority of the levee alignment was an 11.1 foot high levee with a 10 foot crest and 3H:1V side slopes. The loading conditions analyzed were end of construction, steady seepage, and sudden drawdown. The levee was assumed to be constructed of a silt clay material with an assumed strength. The details of the slope stability analyses are shown on plates G-1 thru G-9 and discussed in more detail in the Geotechnical Attachment. The height of 11.1 feet is the maximum height of the levee. The homogeneous soil cross-section is typical of the firm foundation areas of the levee alignment. The stability results are summarized as follows:

TABLE J-2
LEVEE STABILITY 3H:1V

CONDITION	CRITERIA		FACTOR OF SAFETY
End of construction	1.3		4.0
Steady Seepage	1.4		1.4
Sudden Drawdown	1.0	178-167(elev.)	1.2
	1.0	178-167(elev.)	1.0

The conditions analyzed satisfy the EM criteria. Sudden drawdown was analyzed for a range of drawdown elevations because of the differing tailwater conditions. For the first condition shown, the tailwater is drawn down from an elevation of 170 to 167. For the smaller drawdown the tailwater remains at elevation 170. The tailwaters differ because of drainage limits and the time of drainage for the area inside of the levee.

5.3.2.2 Soft Area The soft foundation area is 600 foot long (along the levee alignment) with soft organic material underlain by silt, clay and some sand. The organic layer is classified either as an OH or an OL material as defined by the Unified Soil Classification system. This material contains silt, roots, some clay, and is moist to very wet and had blow counts of 1 and 2 during sampling. One hole, P-10-3, was drilled to 18 feet deep. Holes P-10-3A, 3AU, 3BU, and 3CU were attempts to recover undisturbed samples and to define the soft area. The slope stability analyses for this area showed that a 4H:1V side slope is necessary for the upstream (riverside) slope to meet the sudden drawdown criteria. The results of the stability analysis are as follows:

TABLE J-3
LEVEE STABILITY 4H-1V

CONDITION	CRITERIA		CALC. F.S.
End of Construction	1.3		1.7
Steady Seepage	1.4	w/o reinf	1.2
	1.4	w/o reinf	1.4
Sudden Drawdown	1.0	178-168(elev)	1.1
	1.0	178-172(elev)	1.3

A geotextile was also added at the interface of the foundation (organics) and the levee fill for facilitating the construction of the levee and movement of construction equipment. This geotextile will add strength and increase the factor of safety for all slope stabilities, but its effect is shown only for the steady seepage condition. The other conditions met the stability

criteria without consideration of the geotextile. The minimum strength of the geotextile was assumed to be 1500 pounds per foot, which is a typical geotextile strength.

5.3.3 Settlement Settlement in the soft area will be primarily from the consolidation of the organic layer. The calculated settlement of the organic layer on the levee centerline is 25.2 inches over 8.8 years. The clay layer settles 0.1 inch in six days. This yields a total settlement of 25.3 inches in 8.8 years. The difference in reaction of the soil layers may be due to their depositional backgrounds and preloading conditions. The clay has been preloaded by Lake Passaic, while the organics were deposited during drainage of Lake Passaic. The difference in past loading is about a half ton. The additional loading of the levee is seen as insignificant by the clay layer, while the organic layer becomes heavily loaded. Settlement halfway to the toe is 22 inches and at the toe is 7.5 inches. Thus differential settlement is significant but should pose no problem with the levee. Settlement in the other areas was not calculated formally because of the small consolidation of the clay layer. The 0.1 inch clay settlement can be translated across the entire levee area, therefore settlement in these firm areas is not significant. Settlement within the levee itself was not calculated. When the borrow material is identified a settlement calculation of the levee material will be performed. Normally about 2-6 inches of settlement can be expected in a levee constructed of silt-clay glacial soils.

5.3.4 Seepage No analysis for through seepage was performed because the permeability of the assumed silt-clay fill is considered relatively impermeable for the short term flood events. Under-seepage was considered as minor because the organics, silts, and clays which compose the foundation are relatively impermeable. The organics had a calculated permeability of 3 x 10(-8) cm/sec. The clay had a calculated permeability of 6 x 10(-7) cm/sec. The permeabilities were calculated from the consolidation test data, which is considered to be reliable for fine-grained soils. The sand layers below the fine-grained materials are not expected to have an effect on the under seepage because of the low permeabilities of the overlying layers. A toe drain is not necessary because of the relative impermeability of the soils involved. However, an inspection trench with a maximum depth of 6 ft. will be specified.

5.3.5 HTRW The HTRW site investigation performed for this levee indicated that a few of the soil samples tested showed levels of contamination exceeding New Jersey soil cleanup limits but less than federal (RCRA) limits. These HTRW data were reviewed with the State and the following agreements reached regarding disposal of excavated materials obtained from stripping

and ditching operations. See Attachment J for full results of HTRW site investigations.

TABLE J-4
HTRW DISPOSAL REQUIREMENTS

Excavated Soil Type	HTRW level	Disposal
Topsoil/organic	Clean	Stockpile and use on surface of levee to promote vegetation
Topsoil/organic	Exceeds State limits	Fill low areas adjacent to levee and cover with clean fill
Inorganic	Clean	Reuse in levee section
Inorganic	Exceeds State limits	Use in levee section but cover with clean fill

It should be noted that the ground surface within the levee footprint will be stripped to a depth of 6 inches. Samples of the excavated material will be periodically tested during construction to determine if contaminants are present.

5.3.6 Slope Protection The only slope protection required for the levees is a good, established stand of grass on the slopes. The velocities are less than 5 feet per second, therefore, according to EM 1110-2-1601, a grassed slope is sufficient protection. Some stone will be necessary at the inlets and outlets of drainage culverts. The stone will be locally available stone and will have a size requirement of being from 4 to 8 inches in diameter.

5.4 CONSTRUCTION MATERIALS

5.4.1 General The Materials Resource Study prepared by The RBA Group/Arora and Associates,P.C. , September 1994, lists sources of potential borrow material and stone in the area. The sources listed are used and approved by the NJDOT. Table J-5 identifies some of these potential sources of material located in the general area near the Passaic 10 levee.

5.4.2 Borrow Material About 92,000 cubic yards of earth fill are required for the levee in-place which includes a 1.25 shrinkage factor. A borrow area located adjacent to the north end of the levee has been identified as a potential source for levee fill. This borrow area will be excavated to elevation 162. Additional borrow material needed for the levee fill will be

obtained from a borrow area located at the Hatfield Swamp site approximately four (4) miles from the site. At this time the borrow areas has not been investigated for levee fill use. Satisfactory earth fill borrow material is also readily available in close proximity to the project. Some quarries in the area will sell overburden for fill and some contractors sell soil for fill that is excess from projects on which they are working. Alternatives include use of lightweight aggregates, fly ash, or a levee which is a composite of these materials. The Materials Resource Study states that fly ash should not be considered as fill material because of economics. The Materials Resources Study also lists some potential fill sources. The borrow areas will be investigated during the preparation of the plans and specifications. Identification of additional sources of satisfactory borrow material, if necessary will be accomplished during plans and specifications. The borrow area located on site will be backfilled with waste material from the construction operations and the material excavated from the soil removal area identified on the plans. The borrow area will be brought back up to elevation 164 or higher.

5.4.3 Aggregates and Stone Any stone or aggregates required may be obtained from quarries located within a 50 mile radius. There are many quarries in the area which the NJDOT uses as sources as stated and listed in the Materials Resource Study. A list of approved quarries will be included in the specifications.

TABLE J-5
POTENTIAL MATERIALS SOURCES - A

Ready Mixed Concrete

Company Name	Plant Location
Blue Circle-Raia, Inc.	E. Newark, Jersey City, NJ
County Concrete Co.	Morristown, NJ
Premco/Colonial Concrete	Pompton Lakes, Newark, Elizabeth, Jersey City, NJ

Stone - Riprap, Crushed Stone
for Aggregates, Bedding, Erosion Protection

Company Name	Plant Location
Mt. Hope Rock Products	Mt. Hope, NJ
Passaic Crushed Stone, Inc.	Pompton Lakes, NJ
Ringwood Quarry	Clifton, NJ
Riverdale Quarry Co.	Riverdale, NJ
Stone Industries, Inc.	Haledon, NJ
Blue Circle-Raia	Hamburg, NJ
Fanwood Quarry	Westfield, NJ
Millington Quarry, Inc.	Millington, NJ
Wimpey Minerals, Inc.	Lake Hopoatcong, NJ

Natural Aggregates - Sand and Gravel

Company Name	Plant Location
Saxton Falls Sand and Gravel	Stanhope, NJ

5.4.4 Steel Sheet Piling Two sizes of steel sheet piling will be needed for the floodwall, PZ-27 and PZ-35, and may be obtained from three state producers. Sheet piling specified shall conform to ASTM A328 criteria. Approximately 230 SF of PZ-35 and 900 SF of PZ-27 sheet piling will be needed for the floodwall. The Materials Resource Study lists three NJDOT approved suppliers of steel sheet piling.

TABLE J-6
POTENTIAL MATERIALS SOURCES - B

Company Name	Location
Bethlehem Structural Steel Products, Corp.	Bethlehem, PA
Shoreline Steel Supply Co.	New Haven, MI
Syro Steel Corp.	Girard, OH

5.4.5 Reinforcement Steel The reinforcement specified shall conform to ASTM A615 criteria. Grade 60 or Grade 40 may be used. Approximately 6100 pounds of reinforcement will be needed for the construction of the floodwall. Two producers and two fabricators/suppliers were identified in the Material Resource Study and are listed below.

TABLE J-7
POTENTIAL MATERIALS SOURCES - C

Company Name	Location
N.J. Steel (Producer)	Sayerville, NJ
Auburn Steel Co. (Producer)	Auburn, NY
Barker (Fabricator/Supplier)	Keasbey, NJ
Thompson Materials (Fabricator/ Supplier)	Whippany, NJ

SECTION 6-SITE DEVELOPMENT

6.1 GENERAL

6.1.1 Levee The development of the levee includes.

(a) Earth embankment with 10' wide crown and 3H:1V side slopes.

(b) Interior drainage ditch.

(c) Conrete floodwall.

(d) Two pump station locations

(e) One cross over ramp

(f) 4 pipe outlets with sluice gates and flapgates.

(g) Soil (Leaf Pile) Removal Area.

6.2 ACCESS

Access to the levee site for operation and maintenance purposes will be at cross over location off Dorsa Avenue. Turn

around area will be provided at the northern and southern ends of the levee. Cross over access road will have a 12-foot wide soil surface. The crown slope will be 1/2 inch per foot. Side slopes for all fills will be 3H:1V except where otherwise noted on plans. Access along the levee will be available to the public where possible.

6.3 INTERIOR DRAINAGE DITCH

A 5-foot wide ditch will be constructed along the toe of the levee at a 10 foot offset from the toe and at specific locations to facilitate the drainage of isolated and low areas along the levee toe. The side slopes of the ditches will be 2H:1V in order to minimize disturbance to the site.

6.4 FLOODWALL

A reinforced concrete floodwall will be constructed at the location where the levee alignment crosses an existing above ground concrete sanitary gravity sewer line that is not to be disturbed. A special closure structure is required to maintain the integrity of the levee. A combination steel sheetpile I-wall and reinforced concrete wall is configured to make the closure. The sheetpile solution is selected to minimize the potential for interference with the pipe concrete supports and footings which are spaced approximately 15 feet on centers.

A provision is made for the pipe to be replaced or maintained independent of the wall with minimal disturbance. The total length of the I-Wall floodwall, including the portions embedded into the levee, is approximately 84 feet. The total length of the reinforced concrete closure wall is 14 feet including abutments. The height of the wall, above ground elevation, is 7.1 feet. The reinforced concrete wall extends 12 feet into the levee to provide an effective transition and the top of wall is set 6-inches above the levee to facilitate maintenance. See Plate S-1 for design details and the Structural Attachment for design assumptions and analysis.

6.5 PUMP STATIONS

Two Pump stations will be incorporated into the levee system as a means to assist in the drainage and drawdown of floodwaters during periods of high frequency floods as well as serve as part of the mitigation plan being developed for the project. The two pumping stations will be designed to maintain an elevation of 168.0 within the interior side of levee for a certain frequency period as determined by the New Jersey Historic Preservation Office (NJHPO). A more detailed design of the pump stations will be accomplished during the plans and specifications when the operational aspects and plans of these pumps can be determined.

Access from levee to pumping area will have a soil surface with 15-foot width and side slopes constructed similar to the adjoining levee. The pumps will be a vertical turbine pump with a 15 hp motor and a capacity of 1350 gpm at 30 feet TDH. The pumps will be mounted in a 8-foot diameter by 10-foot concrete overflow sump (manhole). Electrical power to each pump station will be supplied by a new 30 KVA pad mounted transformer located near the pump control panel. The pump control panel will be mounted on steel support frame near the pump station. Power to each pad mounted transformer will be supplied by a new underground medium voltage power cables that connect onto the overhead medium voltage primary lines along Eisenhower Parkway.

6.6 STORM DRAINAGE

6.6.1 Design Criteria Design of culverts for the levee are discussed in the Hydrology and Hydraulics Attachment. A 1-hour 25-year design storm occurrence is considered adequate for the determination of drainage requirements for calculations of the riprap aprons located at the pipe outlets. Rainfall data was obtained from the rainfall-duration-frequency data developed for the general area, which indicates a rainfall of 2.4 inches per hour with a frequency of 25 years on the average for the Passaic 10 levee area.

6.6.2 Drainage Design Drainage design is in accordance with the requirements of TM 5-820-1 and TM 5-820-4. The design discharge was determined by the rational formula, Q= C(I-F)A for a particular drainage area. See Attachment D for culvert design computations. Rip rap will be used to dissipate energy at outlets where flow velocity exceeds five(5) feet per second during the design storm.

6.6.3 Drainage Facilities The required drainage consists of toe ditches which will be graded to drain into pipe culverts and natural swales as shown on site plans. Contributing drainage areas were determined from aerial photography layout supplemented by detailed topography and cross sections. A vegetative cover of grasses should provide sufficient protection from erosion since velocities within the ditches did not exceed 5 feet per second. Erosion Control Matting will be considered where velocities are expected to exceed 4 feet per second.

6.7 EROSION AND SEDIMENTATION CONTROL

A detailed erosion and sedimentation control plan is shown on plates P-31 and P-32. Erosion and Sediment control measures will be developed in accordance with requirements as established by the New Jersey State Soil Conservation Committee.

Temporary control measures consisting of silt fences, silt ditches, gravel filter basins, stabilized construction entrance,

Temporary control measures consisting of silt fences, silt ditches, gravel filter basins, stabilized construction entrance, and temporary seeding will be implemented and maintained during the construction at each site. These temporary measures will be located within the site to contain sediment runoff expected from construction operations. Implementation of temporary control measures will require adjustments and/or additions by field personnel to the initial proposed sediment control plan for construction. All temporary control measures will be maintained until permanent measures have been established.

Permanent erosion control measures will include establishment of proper ground cover within 30 days of completion of construction in any area, and placing mulching, erosion control matting, and/or rip rap potection where necessary to reduce erosion. All pipe outlets will be rip rapped. During construction, contractor will be required to accomplish his temporary and/or permanent seeding operations within seven (7) days following the completion and/or suspension of any grading operations for any particular area.

6.7 Stone Protection for Pipe Outlets No riprap or stone protection has been designed for the levee except at drainage outlets and for temporary erosion control measures. Water flows are not expected to reach magnitudes great enough to cause serious erosive damage. Stone protection for pipe outlets was designed in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey. Stone protection for pipe outlets will be either Class A for a rip rap thickness of 1 foot or Class B for a rip rap thickness of 1.5 foot. These stone protection Classes have been used successfully in construction projects in another state for the range of anticipated velocities. A stone class which is specified by the New Jersey Department of Transportation (NJDOT) for use as erosion control stone may be utilized for stone at pipe outlets. The stone for erosion control shall be of a hard, durable nature and shall range in size as follows:

TABLE J-8
STONE PROTECTION FOR PIPE OUTLETS

Class	Size
A	2" - 6"
B	5" - 15"

While no specific gradation is required, the various size of stone shall be equally distributed within the required size range.

6.7.2 Riprap and Filter Stone for Temporary Erosion Control

Rip rap as required for the temporary gravel filter basins shall be graded to meet the following requirements:

Class I Rip Rap. Stone shall vary in weight from 5 to 200 pounds. At least 30 percent of the total weight of the rip rap shall be in individual pieces weighing a minimum 60 pounds each. Not more than 10 percent of the total weight of the rip rap may be in individual pieces weighing less than 15 pounds each. The filter stone for the temporary gravel filter basins shall be graded to meet the following requirements:

TABLE J-9
STONE PROTECTION FOR TEMPORARY EROSION CONTORL

Sieve Size	Percentage of Total, by Weight Passing
1.5"	100
1.0"	90-100
0.75"	20-55
0.5"	0-10
0.375"	0-5

6.8 SOIL REMOVAL AREA

An adjacent exterior area approximately between levee stations 31+00 and 35+50 is known to contain leaf piles and possibly other low level contaminants which will be excavated and removed and disposed of in the borrow pit near the completion of the levee construction and upon the depletion of the borrow material.

SECTION 7-HYDROLOGY AND HYDRAULIC ANALYSIS

7.0 Hydrology and hydraulic analysis was performed for three major elements of the Passaic #10 project: 1) interior drainage analysis, 2) exterior slope protection analysis, and 3) risk and uncertainty analysis. Interior drainage analysis was performed in accordance with EM 1110-2-1413 dated 15 January 1987 and addressed the following alternatives: 1) gravity outlets, 2) increased ponding storage, 3) pumping capacity, and 4) providing a fix at the point of damage. Exterior slope protection analysis consisted of evaluating the need for protecting the levee

exterior slopes from erosion. Risk and uncertainty analysis was performed in accordance with EC 1105-2-105 and consisted of assessing the reliability of various levels of levee protection. Supporting analysis and conclusions for the aforementioned hydrology and hydraulic analysis is presented in Attachment F.

SECTION 8-REAL ESTATE PLAN

8.1 GENERAL

This Real Estate Plan is for the Passaic #10 Levee/Floodwall Project, Feature Design Memorandum. This project feature consists of a "U-shaped" levee designed to protect a small light industrial park in Livingston Township, Essex County, New Jersey. Essex County is located in northeastern New Jersey, approximately five miles west of New York City. The Phase I General Design Memorandum entitled "Flood Protection Feasibility - Main Stem Passaic River" dated December 1987, of which this feature was a part, was approved by the Chief of Engineers in February 1989.

8.2 REAL ESTATE REQUIREMENTS

8.2.1. General Requirements The project site is a heavily wooded area, located approximately one mile north of Highway 10 (Mount Pleasant Avenue), on the west side of Eisenhower Parkway. It borders on a well-established, active industrial park. Current usage is for parkland and wetland areas. The wetland areas and buffers are regulated by the New Jersey Department of Environmental Protection (NJDEP). Two municipally-owned pump stations are located between the levee and the Passaic River which will remain, with access being provided via a ramp over the levee in the vicinity of Dorsa Avenue. All lands required for this feature are owned by Essex County or Livingston Township.

The project involves construction of a levee, approximately 4,750 feet in length, with an average top width of 10 feet, and 3H:1V side slopes, and 80' of floodwall to accommodate an existing sanitary sewer line. On each side of the levee, 5 feet from the toe is required for operation and maintenance purposes. The total acreage required for the levee is 9.68 acres.

Areas on the interior of the levee will be periodically flooded to an elevation of 170.0. These ponding areas will encompass a total of 10.00 acres.

Wetlands mitigation areas will also be required for the project. The first site is an irregularly-shaped area on the northwest quadrant of the site, comprising approximately 1.92 acres. The second site is on the northeast quadrant, comprising approximately 6.21 acres. It will be used as a borrow area

during construction, and then backfilled with levee spoil material and leaves, and converted to a wetlands mitigation site upon completion of construction.

During construction, a contractor office area of approximately 0.43 of an acre and a staging area consisting of approximately 0.90 of an acre will be required for a two year period. In addition, a strip along the length of the levee, with a width starting 5' from the levee toe and ending 20' from the toe on each side, will be required during construction, totalling 3.43 acres. Access to the site will be via Dorsa Avenue, a public road.

8.2.2. Federally-owned Land There is no Federally-owned land in the project area.

8.2.3. Navigational Servitude The Passaic River is not a navigable waterway in the vicinity of this project feature, and construction does not require any acquisition of lands below the ordinary high water mark (OHWM).

8.3. PUBLIC LAW 91-646 RELOCATIONS

There are no relocations under Public Law 91-646, as amended, associated with this project feature.

8.4 NON-FEDERAL SPONSOR'S ACQUISITION ABILITIES

The non-Federal Sponsor for this project is the State of New Jersey, acting through the Department of Environmental Protection (NJDEP). Unlike other portions of the Passaic River Flood Damage Reduction Project, because all of the property to be acquired for this project feature is owned by Essex County or Livingston Township, the Sponsor will acquire the real estate interests necessary for construction, operation and maintenance. The NJDEP has the necessary manpower and experience to acquire the real estate for this project feature, and has condemnation authority.

8.5 BASELINE COST ESTIMATE FOR REAL ESTATE

A detailed real estate cost estimate, in MCACES format, is included in Appendix D Cost Engineering. Land payments are estimated at $24,767, and administrative costs are estimated at $15,835. Total real estate costs, including a 10% contingency, are estimated at $44,663. A 10% contingency is considered appropriate because of the public ownership of the property.

8.6 REAL ESTATE MAPPING

Real estate mapping will be prepared during the Plans and Specifications phase.

8.7 MINERAL ACTIVITY

There is no known mineral activity in the vicinity of the project.

8.8 PROPOSED ESTATES

The proposed estates to be acquired for the project are as follows:

A flood protection levee easement (Estate No. 9) will be acquired for construction, operation and maintenance of the levee:

"A perpetual and assignable right and easement in the land described in Schedule A, Tract No. _____, to construct, maintain, repair, operate, patrol and replace a flood protection levee, including all appurtenances thereto; reserving, however, to the owners, their heirs and assigns, all such rights and privileges in the land as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines."

A flowage easement (Estate No. 6) will be acquired for the ponding areas on the levee interior:

"The perpetual right, power, privilege and easement occasionally to overflow, flood and submerge the land described in Schedule A, Tract No. ___, in connection with the operation and maintenance of the Passaic #10 Levee/Floodwall Project as authorized by the Act of Congress approved _____, together with all right, title and interest in and to the structures and improvements now situate on the land, except fencing; provided that no structures for human habitation shall be constructed or maintained on the land, that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the United States in charge of the project, and that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill; the above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used and enjoyed without interfering with

the use of the project for the purposes authorized by Congress or abridging the rights and easement hereby acquired; provided further that any use of the land shall be subject to Federal and State laws with respect to pollution."

Fee (Estate No. 1) will be acquired for the wetland mitigation area and the borrow area that will later be converted to a wetland mitigation area:

"The fee simple title to the land described in Schedule A, Tract No. _____, subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines."

A temporary work area easement (Estate No. 15) will be acquired for the staging and office areas:

"A temporary easement and right-of-way in, on, over and across the land described in Schedule A, Tract No. ___, for a period not to exceed two years, beginning with the date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a work area, including the right to move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines."

"Because the lands required for the project are already publicly-owned, it is likely that the NJDEP will request that title remain with the local municipalities, and that a right-of-entry be granted to the Government for construction of the project. Operation and maintenance responsibilities may also be delegated to the local municipalities through a sub-agreement. These details have not yet been finalized. If this occurs, a request for approval of any non-standard estate to be used will be forwarded."

8.9 ACQUISITION SCHEDULE

Real estate acquisition milestones are as follows:

Receipt of final design drawings*	1 May 97
PCA execution	1 Nov 97
Transmittal of right-of-way drawings to NJDEP	2 Nov 97
Survey and mapping complete	28 Feb 98
Title work complete	28 Feb 98
Appraisals complete	31 Mar 98
Negotiations complete	30 Apr 98
Closings complete	30 May 98
Construction contract advertisement	30 Jun 98

* Note: This schedule is based upon the assumption that no design changes will be made during the Plans and Specifications phase, 1 May 97 - 30 Apr 98.

8.10 UTILITY AND FACILITY RELOCATIONS

Inspection of the site and examination of tax assessment records indicate that there are electric and gas lines in the project area, as well as two access roads leading to municipally-owned wastewater treatment plants. No utility or facility relocations have yet been identified. If any relocations are determined to be necessary, Attorney's Opinions of Compensability will be prepared during the Plans and Specifications phase.

8.11 ENVIRONMENTAL CONCERNS

A hazardous, toxic and radioactive waste investigation of this site determined no significant risk of encountering contamination on the project lands.

8.12 ATTITUDE OF AFFECTED LANDOWNERS

The property required for construction of this project feature is owned by the County and the Township. It is expected that the local municipalities will be supportive of the project. Adjacent property owners in the industrial park are expected to be in favor of the project because of the protection it will afford.

SECTION 9-COST ESTIMATE

9.0 The total estimated first cost including contingencies for construction of the levee is $2,797,507. See Attachment G for detailed cost estimate. The fully dunded estimated cost equates

to $3,222,175. Anticipated construction period is 12 months. A possible schedule of construction activities for proposed levee construction is shown on Plate No. J-035. The contractor will be required to furnished a more detailed schedule as part of the initial construction phase.

SECTION 10-ECONOMICS

10.0 The eonomic benefits for the Passaic #10 levee/floodwall system consist of benefits from inundation and industrial content growth. Total benefits for this system are expected to begin to accrue 118 months prior to the completion of the entire tunnel project. Planning, Engineering and Design (PED) cost expended to date (sunk costs) were excluded from the economic cost analysis. Ths results in a $57,535 reduction in the first project cost which totals $2,797,507. The annual cost of the levee/floodwall systm estimated to be $275,681 which includes the annual operaton and mtenance costf $47,144. Current benefit analyses for these afforementioned catgories as well as advance of base year benefit and economic development cost methodologies can be viewed in the Passaic River Flood Damage Reduction Project, General Design Memorandum (GDM) dated September 1995, Appendix I - Economics. Benefits for the Passaic #10 levee/floodwall system at a 7 3/4% rate in October 1994 prices were estimated at $577,100. This results in a benefit-to-cost ratio of 2.09. to 1 and net benefits of $301,419.

SECTION 11-RECOMMENDATION

11.0 It is recommended that this FDM be approved as presented to serve as a basis for preparing final plans and specifications for construction of the levee.

DRAWING INDEX

SHEET	PLATE	TITLE
1	J-001	DRAWING INDEX
2	J-002	GENERAL MAP LEVEE
3	J-003	BORROW AND WASTE DISPOSAL AREA
4	J-004	TYPICAL SECTIONS
5	J-005	DRAINAGE DETAILS
6	J-006	PLAN AND PROFILE - STA. 0+25.21 TO 8+00
7	J-007	PLAN AND PROFILE - STA. 8+00 TO 16+00
8	J-008	PLAN AND PROFILE - STA. 16+00 TO 24+00
9	J-009	PLAN AND PROFILE - STA. 24+00 TO 32+00
10	J-010	PLAN AND PROFILE - STA. 32+00 TO 40+00
11	J-011	PLAN AND PROFILE - STA. 40+00 TO 48+53.80
12	J-012	SITE PLAN FLOODWALL
13	J-013	SITE PLAN PUMP STATION NO. 1
14	J-014	SITE PLAN PUMP STATION NO. 2
15	J-015	CROSS SECTIONS - LEVEE STA. 0+00 TO 3+50
16	J-016	CROSS SECTIONS - LEVEE STA. 4+00 TO 7+50
17	J-017	CROSS SECTIONS - LEVEE STA. 8+00 TO 11+50
18	J-018	CROSS SECTIONS - LEVEE STA. 12+00 TO 15+50
19	J-019	CROSS SECTIONS - LEVEE STA. 16+00 TO 19+50
20	J-020	CROSS SECTIONS - LEVEE STA. 20+00 TO 23+50
21	J-021	CROSS SECTIONS - LEVEE STA. 24+00 TO 27+50
22	J-022	CROSS SECTIONS - LEVEE STA. 28+00 TO 30+50
23	J-023	CROSS SECTIONS - LEVEE STA. 31+00 TO 33+00
24	J-024	CROSS SECTIONS - LEVEE STA. 33+00 TO 35+50
25	J-025	CROSS SECTIONS - LEVEE STA. 36+00 TO 39+50
26	J-026	CROSS SECTIONS - LEVEE STA. 40+00 TO 43+50
27	J-027	CROSS SECTIONS - LEVEE STA. 44+00 TO 47+50
28	J-028	CROSS SECTIONS - LEVEE STA. 48+00 TO 51+30.43
29	J-029	CROSS SECTIONS - ROAD CROSSOVER STA. 0+25 TO 1+69.93
30	J-030	CROSS SECTIONS - ROAD CROSSOVER STA. 1+75 TO 2+49.16
31	J-031	TEMPORARY EROSION CONTROL DETAILS
32	J-032	EROSION CONTROL PLAN
33	J-033	REAL ESTATE REQUIREMENTS
34	J-034	FLOODWALL DETAILS

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
US Army Corps of Engineers
CORPS OF ENGINEERS

Passaic River Flood Damage Reduction Project

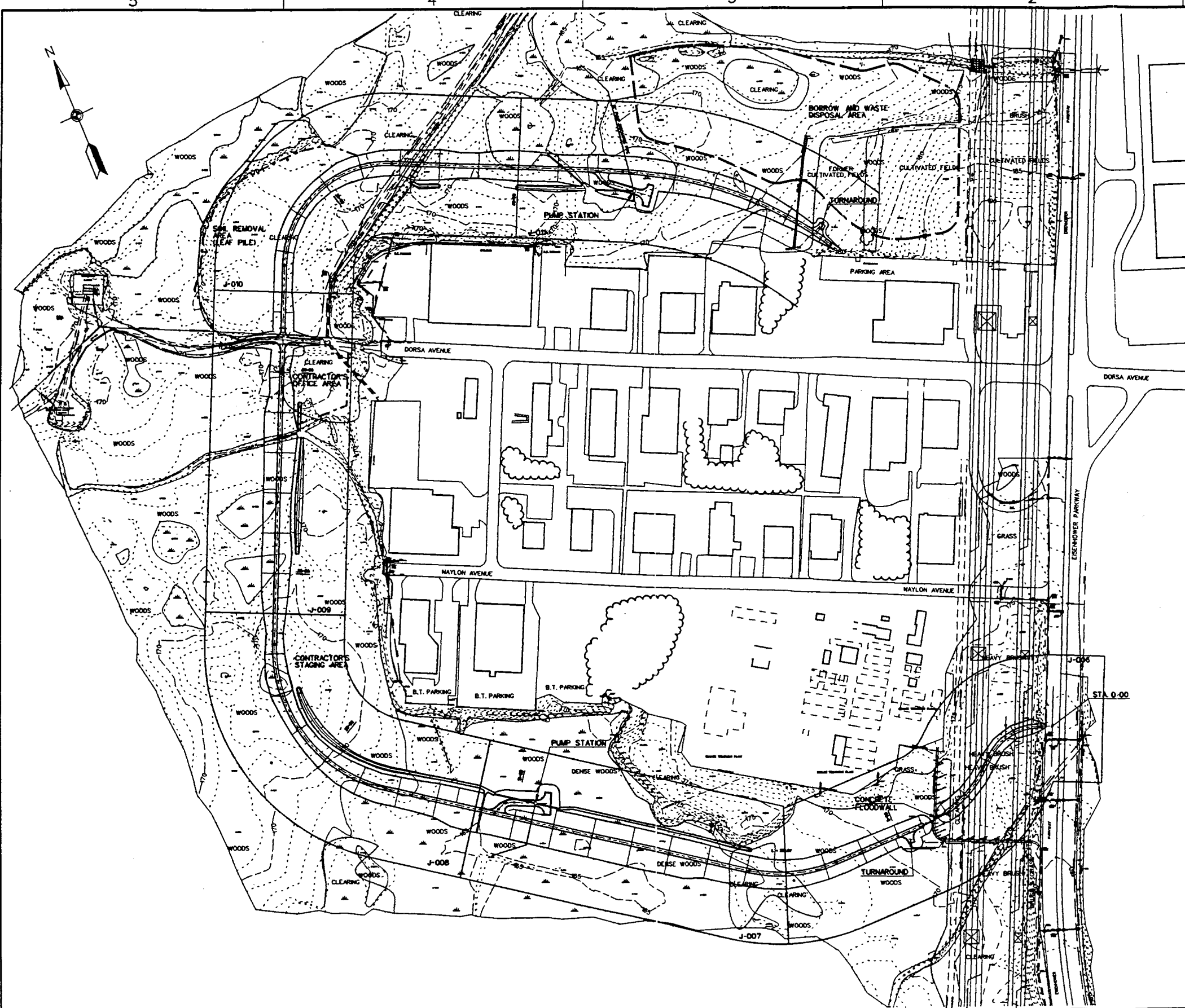
FEATURE DESIGN MEMORANDUM

DRAWING INDEX

REVISED:

DATED: 30 JUNE 1995 | PREPARED BY: WILMINGTON DISTRICT

PIOINDEX.DGN | PLATE NO. J-001



SHEET LEGEND

- BUILDINGS
- BUILDING UNDER CONSTRUCTION
- UNCURBED ROADS
- ROADS, PARKING AREAS
- DRIVES
- DIRT ROADS
- WATERS EDGE AND SWAMP OUTLINE
- TOPO
- STONE FENCE
- FENCE
- BRUSH LINE
- SWAMP SYMBOL
- WOODED AREA
- POWERLINE
- GUIDE RAIL
- SINGLE TREE
- TOWER
- MANHOLE
- CATCH BASIN
- FIRE HYDRANT
- TEL MANHOLE
- FLUSH CB GRATE
- UTILITY POLE
- MONITOR WELL
- LIGHT POLE
- GUY WIRE
- TEST HOLE
- SIGN
- VALVE

CURVE DATA

Δ - DEFLECTION ANGLE
D - DEGREE OF CURVE
R - RADIUS OF CURVE
T - TANGENT LENGTH
L - LENGTH OF CURVE

- PIPE CULVERT W/FES, PRECAST MH W/SLUICE GATE, FLAP GATE (NEW)
- PIPE CULVERT W/FES (NEW)

SCALE IN FEET

100 0 100 200 300

US Army Corps of Engineers

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PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM

GENERAL MAP - LEVEE

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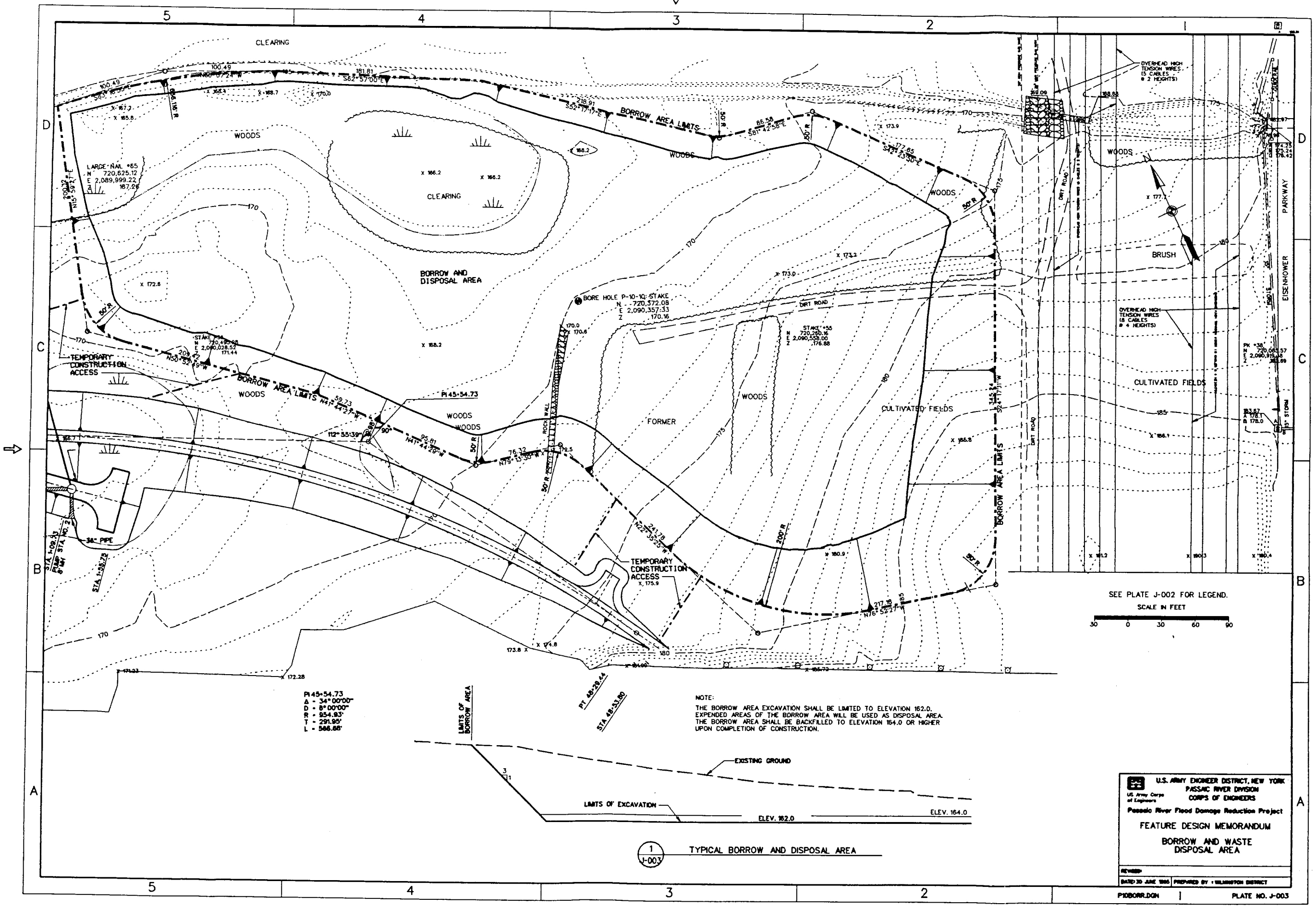
P10GENL.DGN | PLATE NO. J-002



NOTE:
THE BORROW AREA EXCAVATION SHALL BE LIMITED TO ELEVATION 162.0. EXPENDED AREAS OF THE BORROW AREA WILL BE USED AS DISPOSAL AREA. THE BORROW AREA SHALL BE BACKFILLED TO ELEVATION 164.0 OR HIGHER UPON COMPLETION OF CONSTRUCTION.

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US Army Corps of Engineers

Passaic River Flood Damage Reduction Project

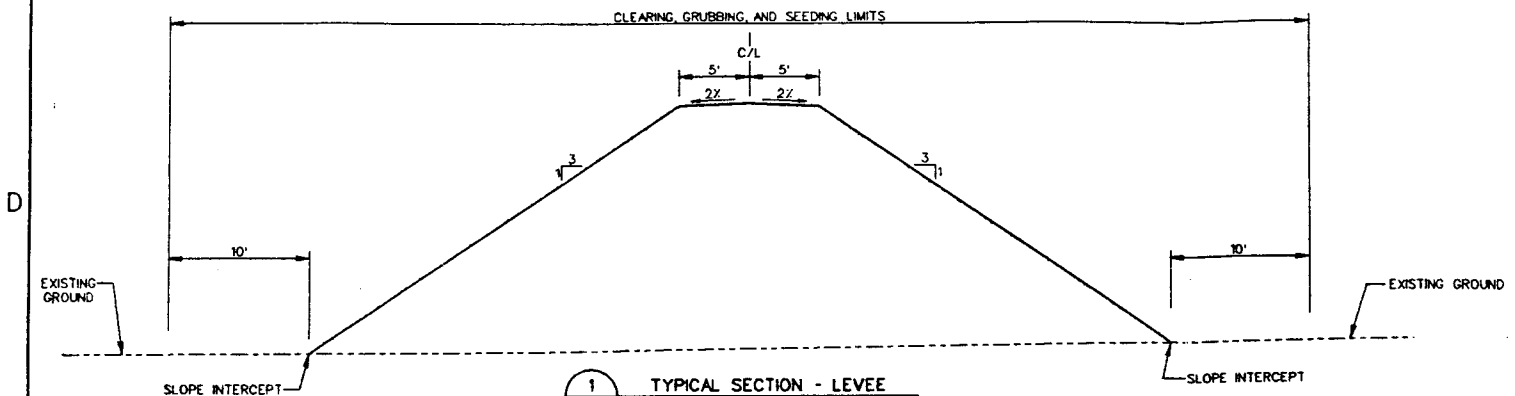
FEATURE DESIGN MEMORANDUM

BORROW AND WASTE DISPOSAL AREA

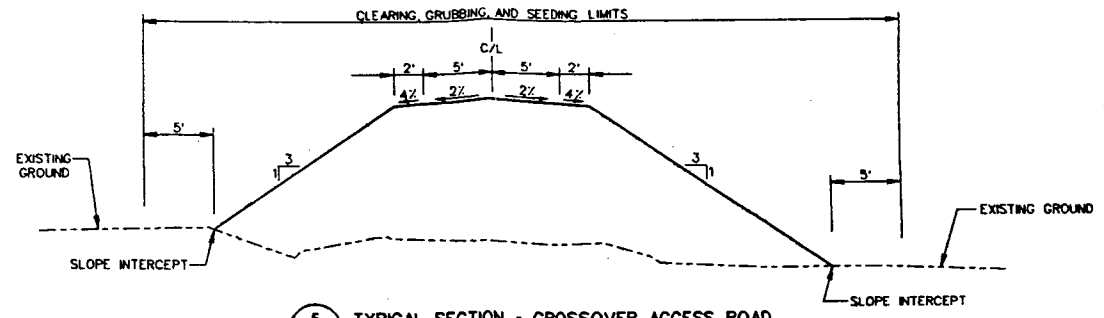
REVISED

DATED 30 JUNE 1995 | PREPARED BY : WILMINGTON DISTRICT

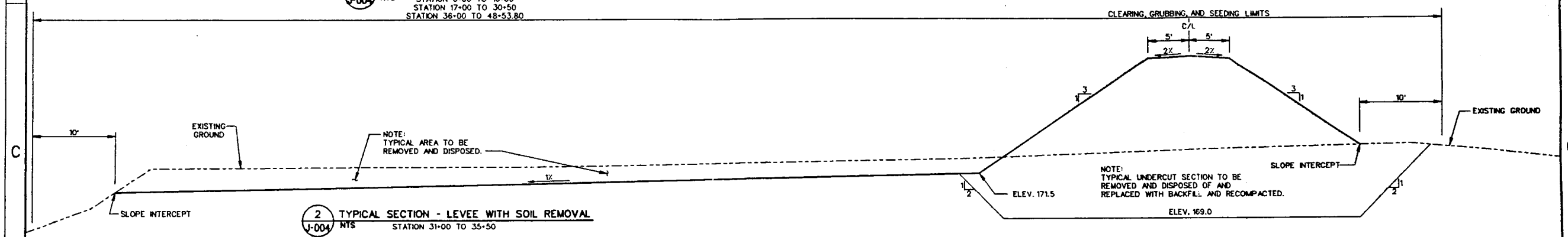
P10BORR.DGN | PLATE NO. J-003



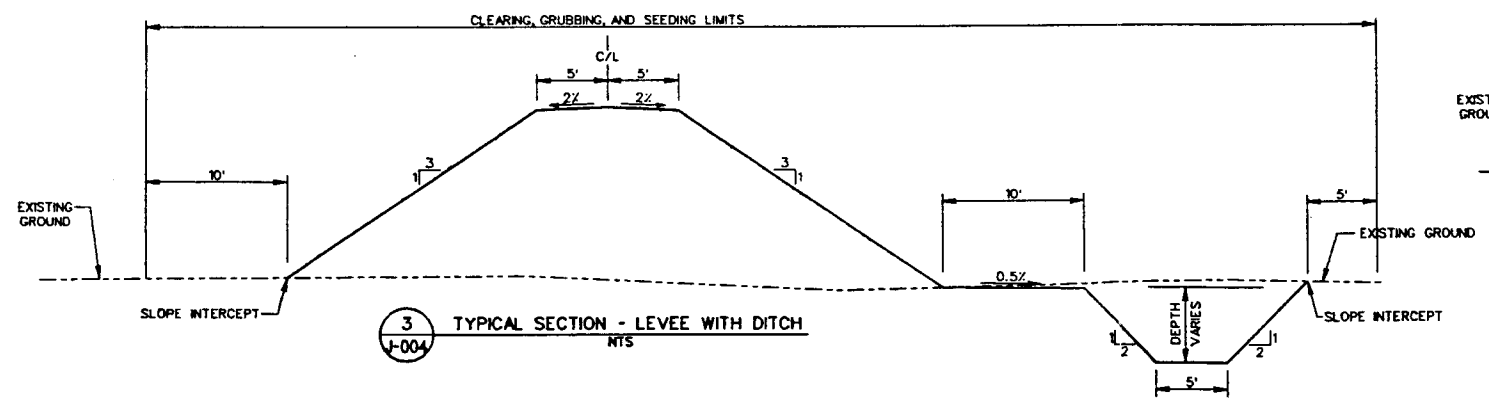
1 J-004 TYPICAL SECTION - LEVEE
NTS
STATION 0+00 TO 10+00
STATION 17+00 TO 30+50
STATION 36+00 TO 48+53.80



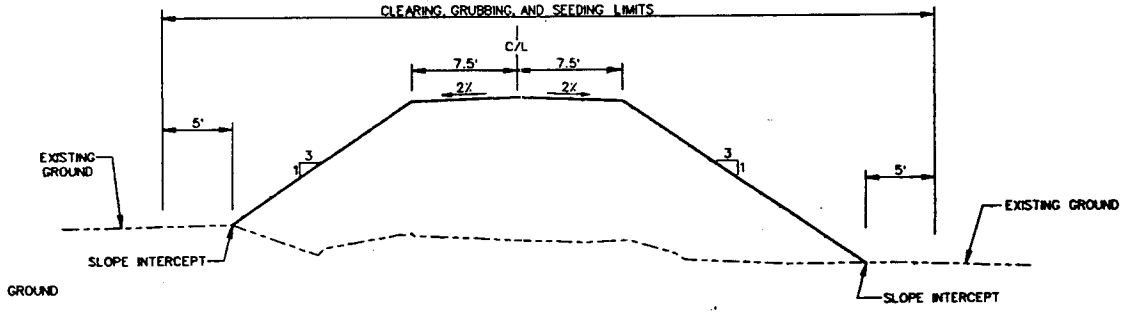
5 J-004 TYPICAL SECTION - CROSSOVER ACCESS ROAD
NTS



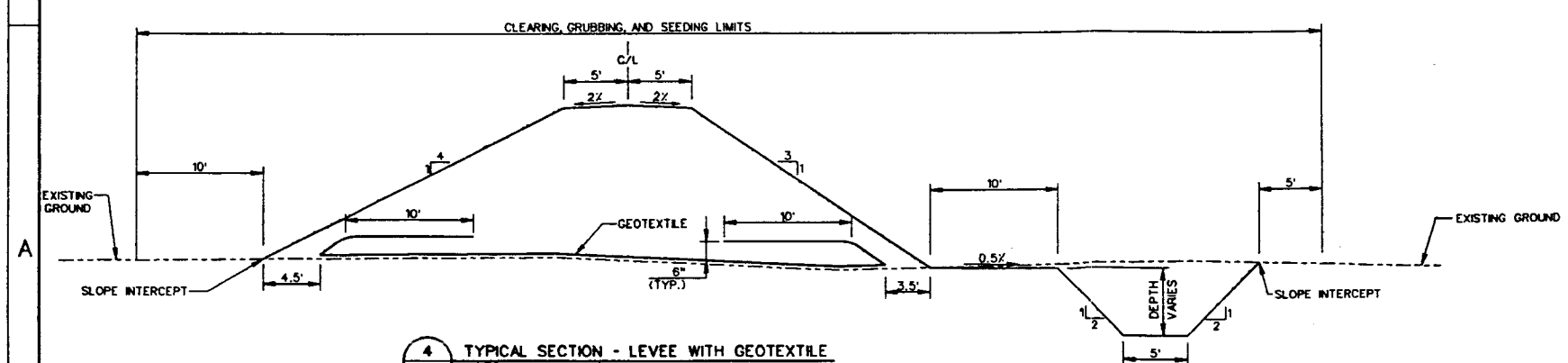
2 J-004 TYPICAL SECTION - LEVEE WITH SOIL REMOVAL
NTS
STATION 31+00 TO 35+50



3 J-004 TYPICAL SECTION - LEVEE WITH DITCH
NTS



6 J-004 TYPICAL SECTION - PUMP STATION ACCESS ROAD
NTS



4 J-004 TYPICAL SECTION - LEVEE WITH GEOTEXTILE
NTS
STATION 10+50 TO 16+50

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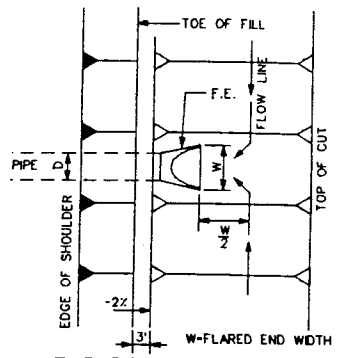
FEATURE DESIGN MEMORANDUM

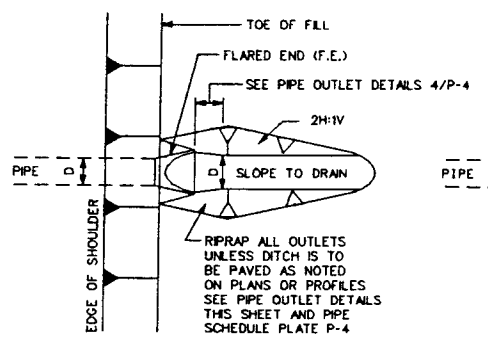
TYPICAL SECTIONS

REVISED:
DATED: 30 JUNE 1980 PREPARED BY WILMINGTON DISTRICT

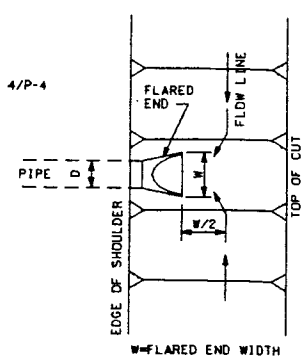
PS1DTYP.DGN | PLATE NO. J-004



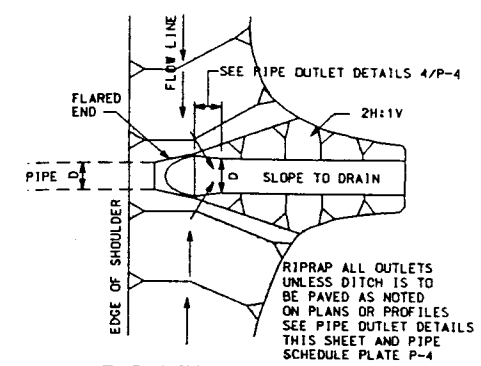
TYP. DITCH FOR PIPE IN FILL - INLET IN CUT



TYP. DITCH FOR PIPE IN FILL - OUTLET IN CUT



TYP. DITCH FOR PIPE IN CUT - INLET END



TYP. DITCH FOR PIPE IN CUT - OUTLET END

1 J-005 TYP PIPE DITCH DETAILS

NOT TO SCALE

PIPE SCHEDULE

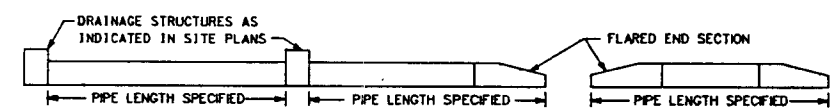
STATION	LENGTH (FT)	SIZE (IN)	END TREATMENT		INVERT ELEVATION		SKEW	OUTLET PROTECTION		
			INLET	OUTLET	INLET	OUTLET	ANGLE	THICKNESS,T	APRON LENGTH,La	STONE TYPE
15+84	50	36	FES	MH/SLG	164.85	164.81		NA	NA	NA
15+84	42	36	MH/SLG	FLG	164.81	164.78		12"	28'	CLASS A
28+36	53	24	FES	MH/SLG	165.13	164.97	74°	NA	NA	NA
28+36	28	24	MH/SLG	FLG	165.96	164.88	74°	12"	22'	CLASS A
37+50	55	24	FES	MH/SLG	165.77	165.45	122°	NA	NA	NA
37+50	29	24	MH/SLG	FLG	165.42	165.25	122°	18"	29'	CLASS B
41+18.36	72	36	FES	MH/SLG	166.58	166.24	37°43'	NA	NA	NA
41+18.36	40	36	MH/SLG	FLG	166.23	166.04	37°43'	12"	28'	CLASS A
PS. 1	58	36	FES	MH	164.96	164.93	-----	NA	NA	NA
PS. 1	102	36	MH	FES	164.92	164.86	-----	12"	28'	CLASS A
PS. 2	22	36	FES	MH	166.85	166.81	-----	NA	NA	NA
PS. 2	94	36	MH	FES	166.80	166.70	-----	12"	28'	CLASS A

MH/SLG - MANHOLE W/SLUICE GATE
FLG - FLAP GATE
FES - FLARED END SECTION
MH - MANHOLE

NOTES:

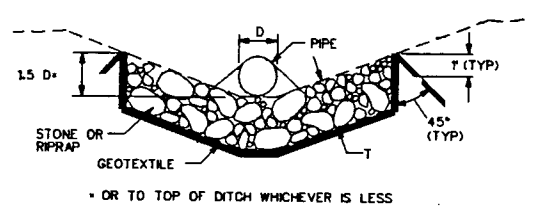
1. ALL PIPE OUTLET PROTECTION SHALL BE EROSION CONTROL STONE.
2. ALL CORRUGATED METAL PIPE SHALL BE 16 GAUGE AND ALL REINFORCED CONCRETE PIPE SHALL BE CLASS III UNLESS NOTED OTHERWISE.
3. ALL PIPES SHALL BE FIELD ADJUSTED FOR BEST FIT. CONTRACTOR SHALL, AT NO ADDITIONAL COST TO THE GOVERNMENT, FIELD ADJUST ALL PIPE LOCATIONS, LENGTHS AND INVERT ELEVATIONS (INLET AND OUTLET) FOR BEST FIT TO EXISTING FIELD CONDITIONS TO ASSURE POSITIVE DRAINAGE.
4. THE STONE FOR EROSION CONTROL SHALL BE OF A HARD, DURABLE NATURE AND SHALL RANGE IN SIZE AS FOLLOWS:

CLASS	SIZE
A	2" - 6"
B	5" - 15"

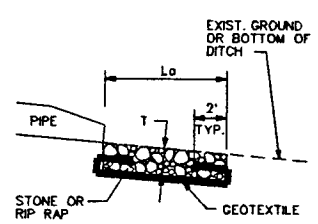


3 J-005 TYPICAL PIPE MEASUREMENTS

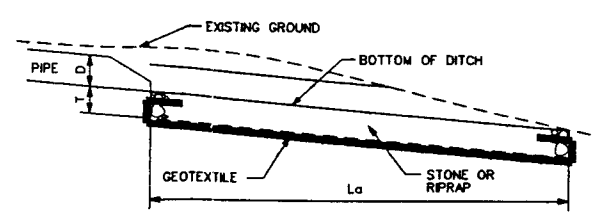
NOT TO SCALE



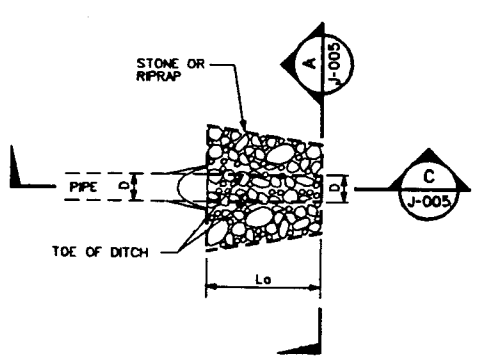
A J-005 SECTION



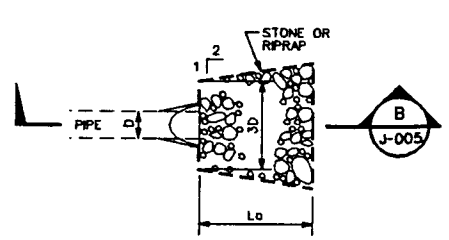
B J-005 SECTION



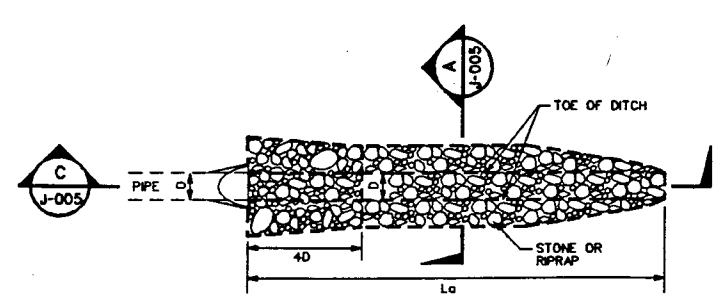
C J-005 SECTION



OUTLET WITH DITCH



OUTLET WITHOUT DITCH



OUTLET WITH EXTENDED DITCH

2 J-005 PIPE OUTLET DETAILS

NOT TO SCALE

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

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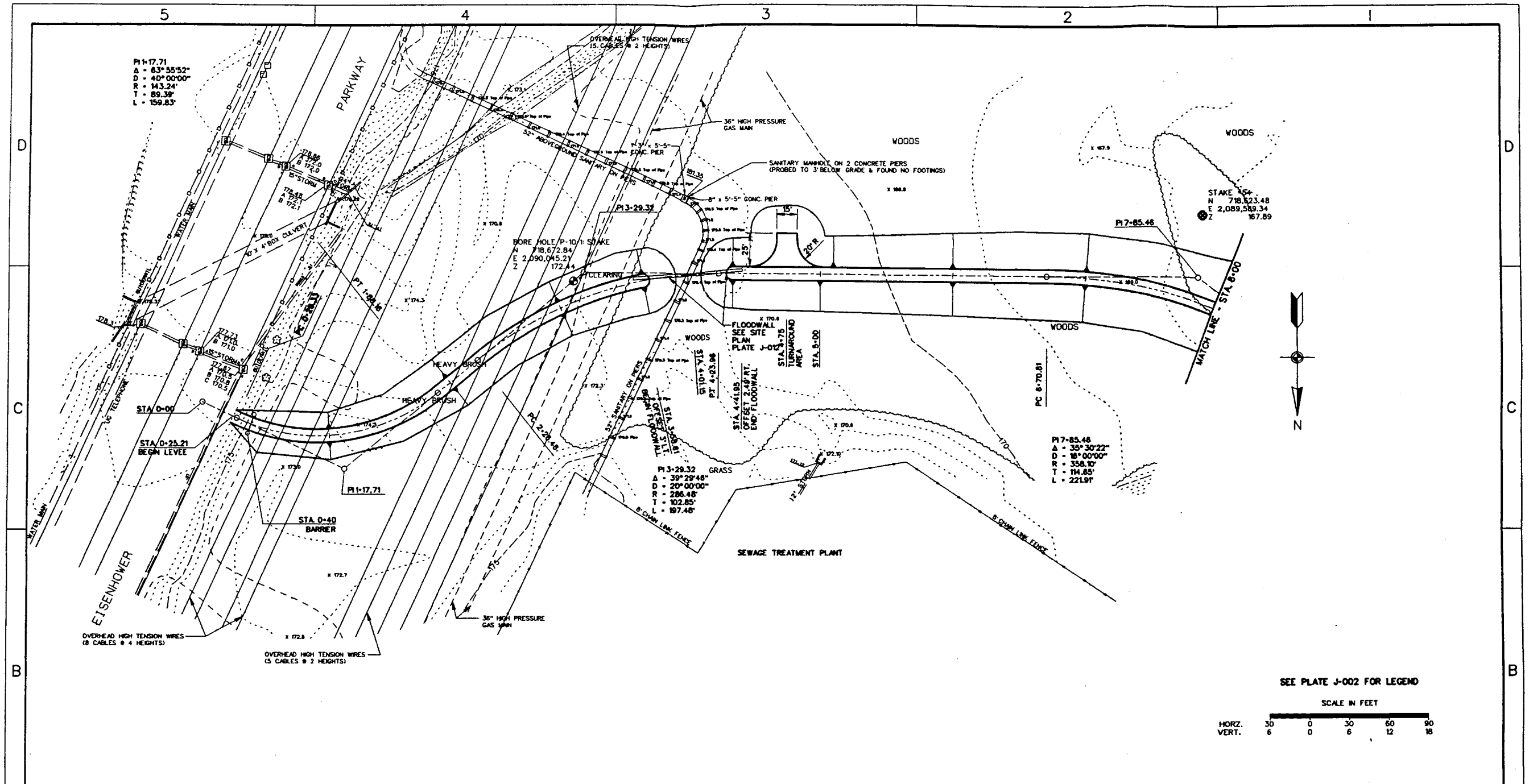
FEATURE DESIGN MEMORANDUM
DRAINAGE DETAILS

REVISED

DATED: 30 JUNE 1995 | PREPARED BY: WILMINGTON DISTRICT

PAS10DD.DGN

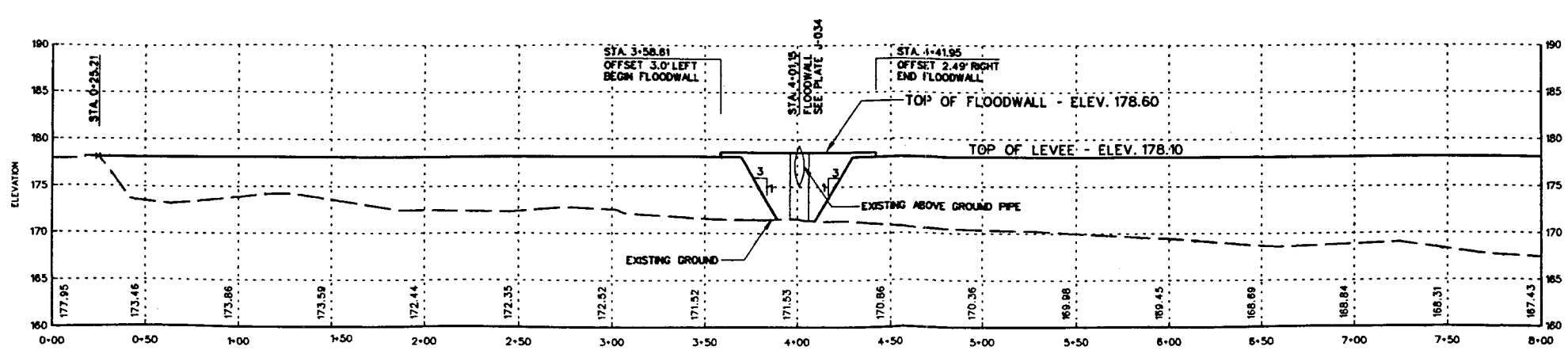
PLATE NO. J-005



SEE PLATE J-002 FOR LEGEND

SCALE IN FEET

HORZ.	30	0	30	60	90
VERT.	6	0	6	12	18



U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM

PLAN AND PROFILE
STA. 0+25.21 TO 8+00

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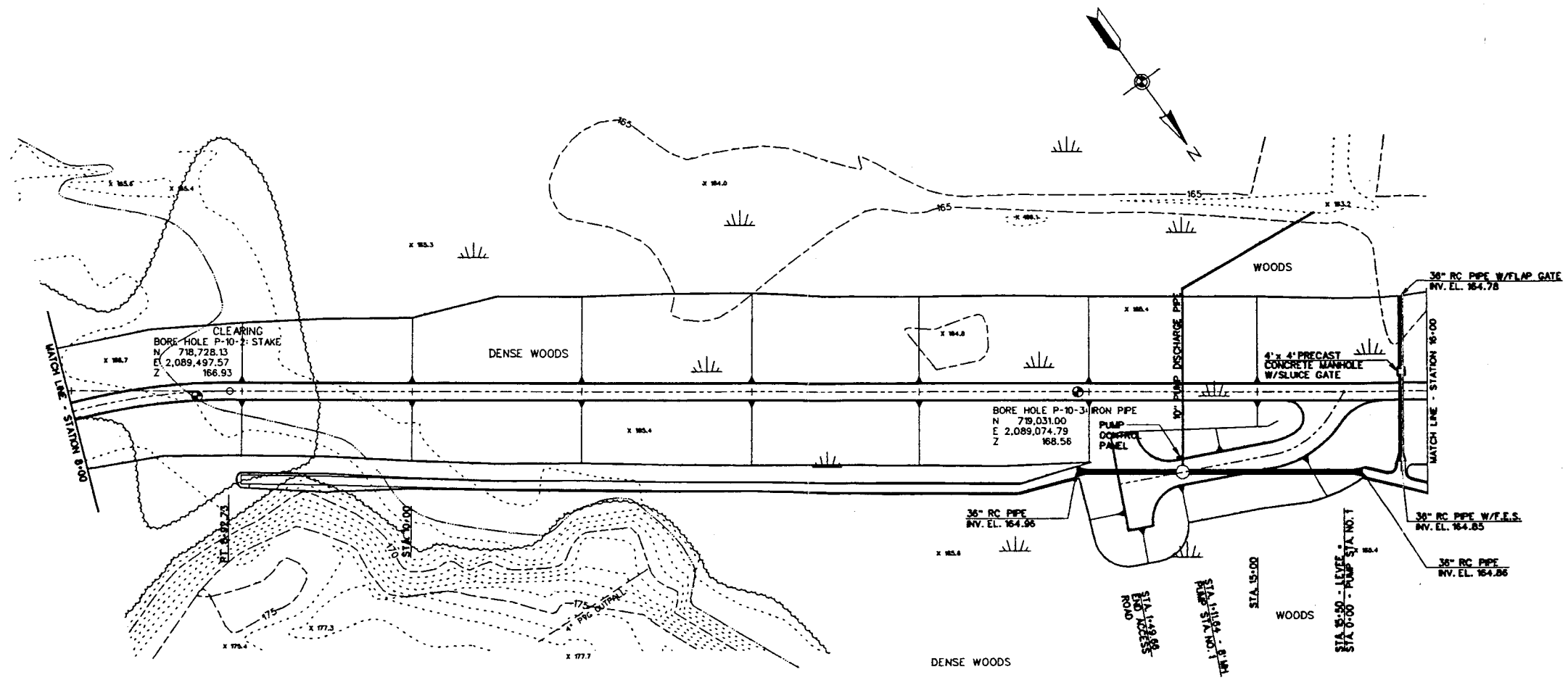
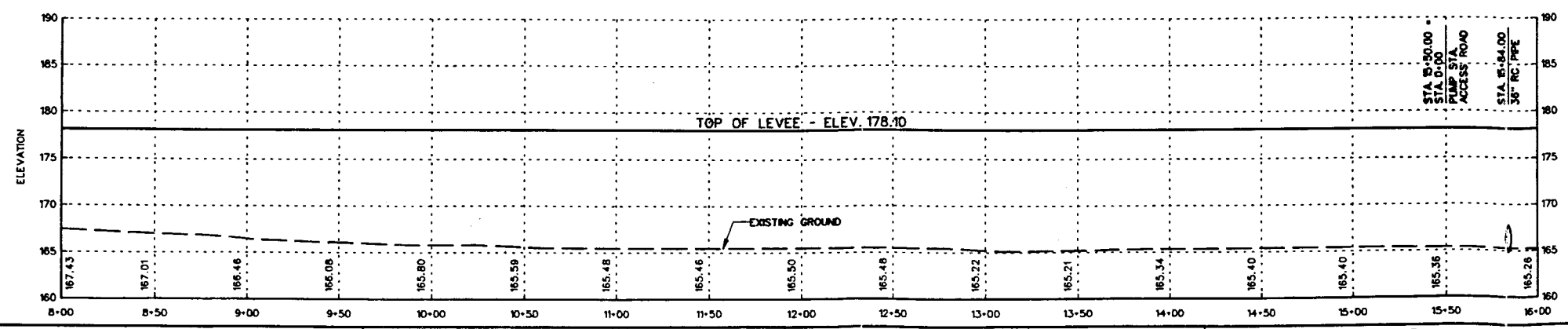
PASID-01.DGN 1 PLATE NO. J-006





U.S. Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM

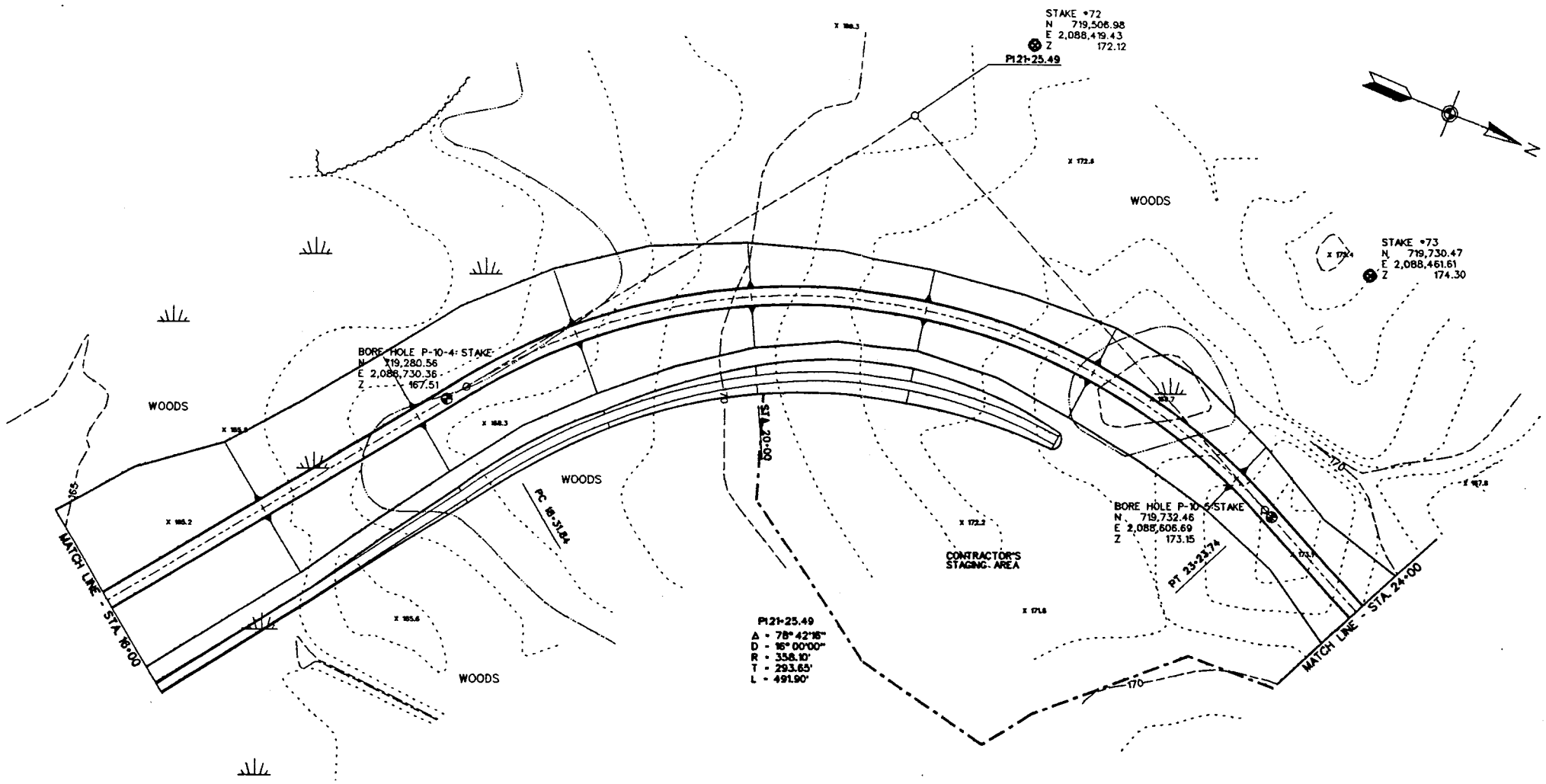
PLAN AND PROFILE
STA. 8+00 TO 16+00

REVISED:

DATE: 30 JUNE 1995 PREPARED BY WILMINGTON DISTRICT

PAS10-02.DGN

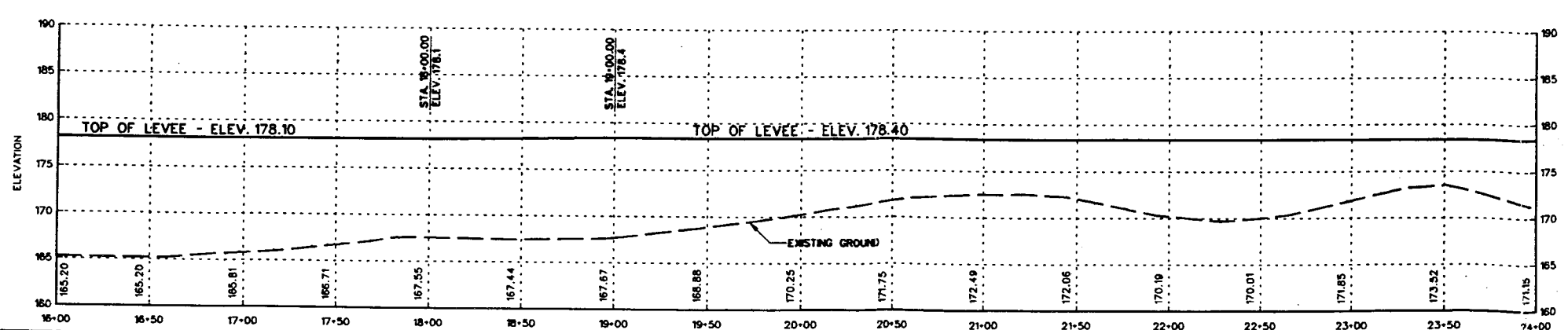
PLATE NO. J-007



SEE PLATE J-002 FOR LEGEND

SCALE IN FEET

HORZ.	30	0	30	60	90
VERT.	6	0	6	12	18



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PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

US Army Corps of Engineers

Passaic River Flood Damage Reduction Project

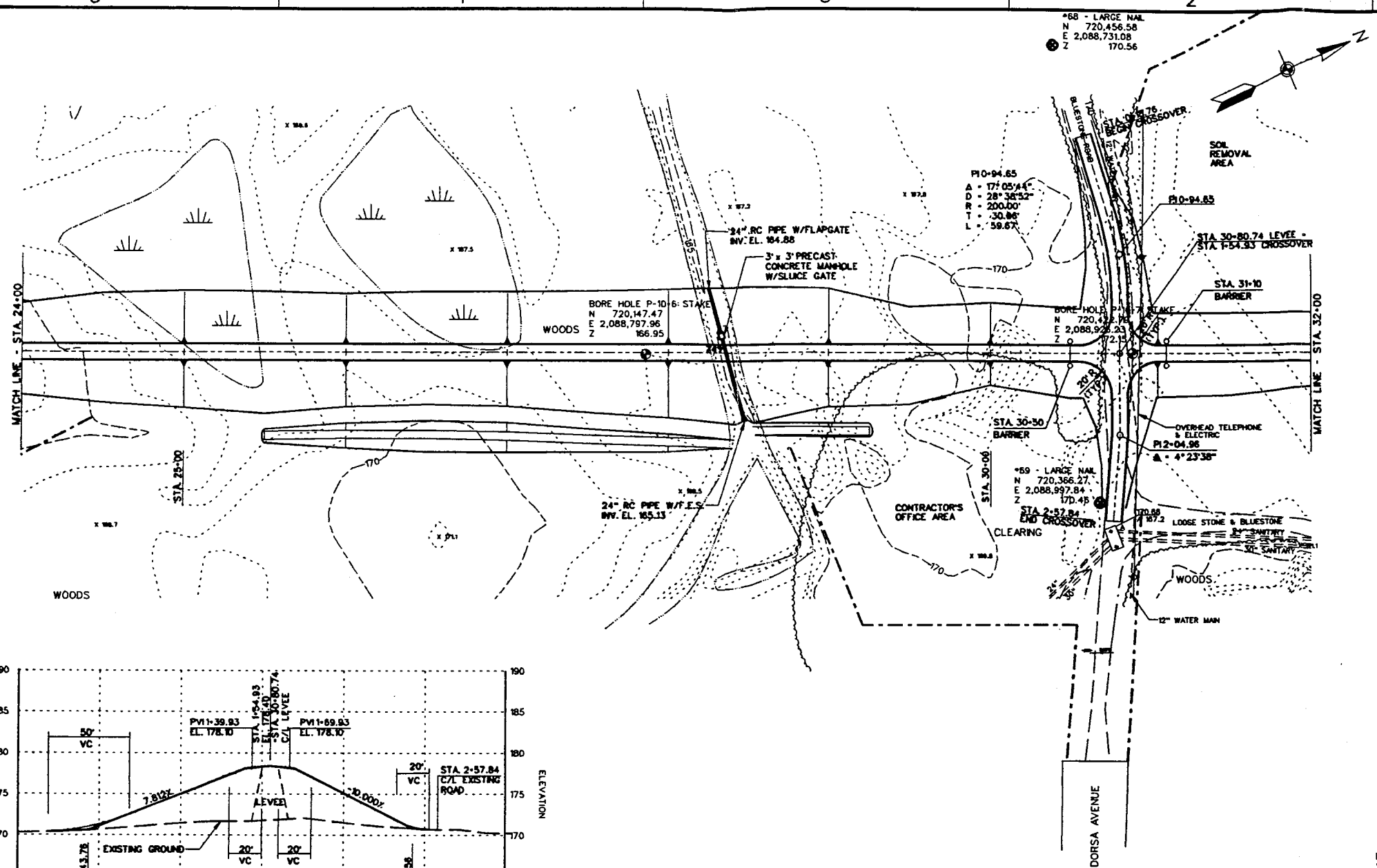
FEATURE DESIGN MEMORANDUM

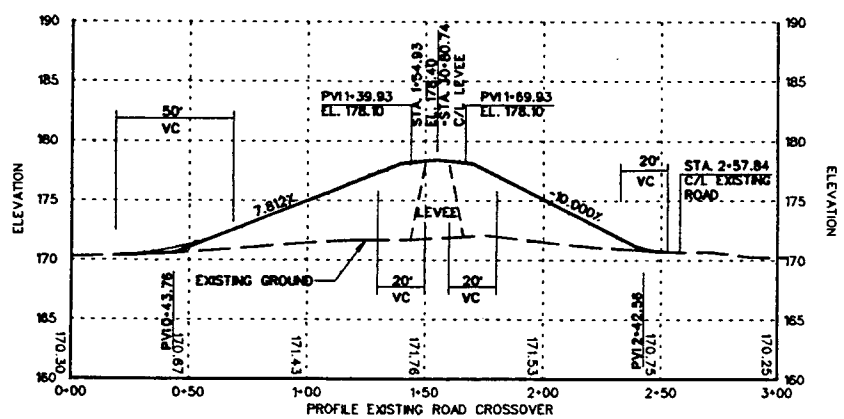
PLAN AND PROFILE
STA. 16+00 TO 24+00

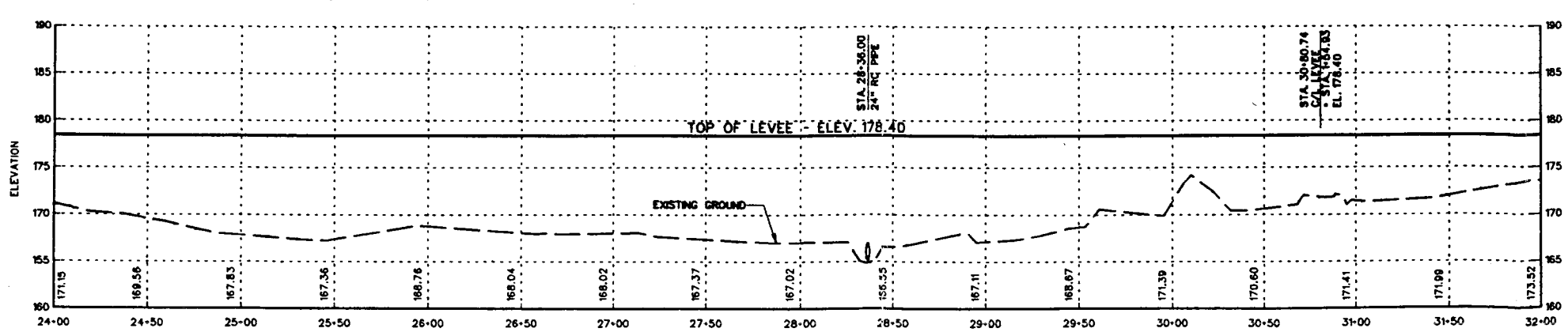
REVISED

DATE: 30 JUNE 1995 PREPARED BY : WILMINGTON DISTRICT

PASTD-03.DGN | PLATE NO. J-008







SEE PLATE J-002 FOR LEGEND

SCALE IN FEET

HORZ. 30 0 30 60 90
VERT. 6 0 6 12 18

U.S. Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

Passaic River Flood Damage Reduction Project

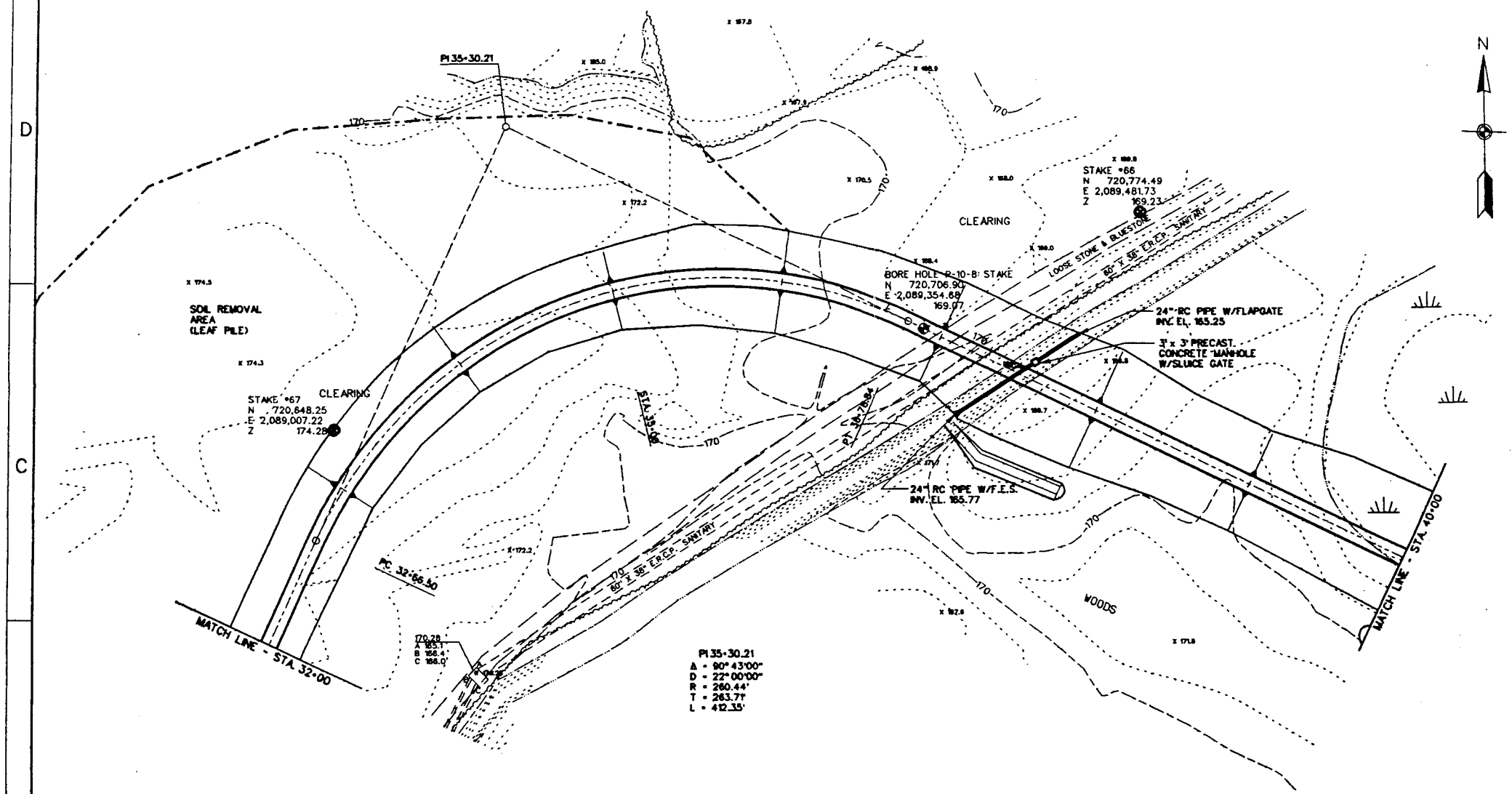
FEATURE DESIGN MEMORANDUM

PLAN AND PROFILE
STA. 24+00 TO 32+00

REVISED

DATED 30 JUNE 1995 PREPARED BY WILMINGTON DISTRICT

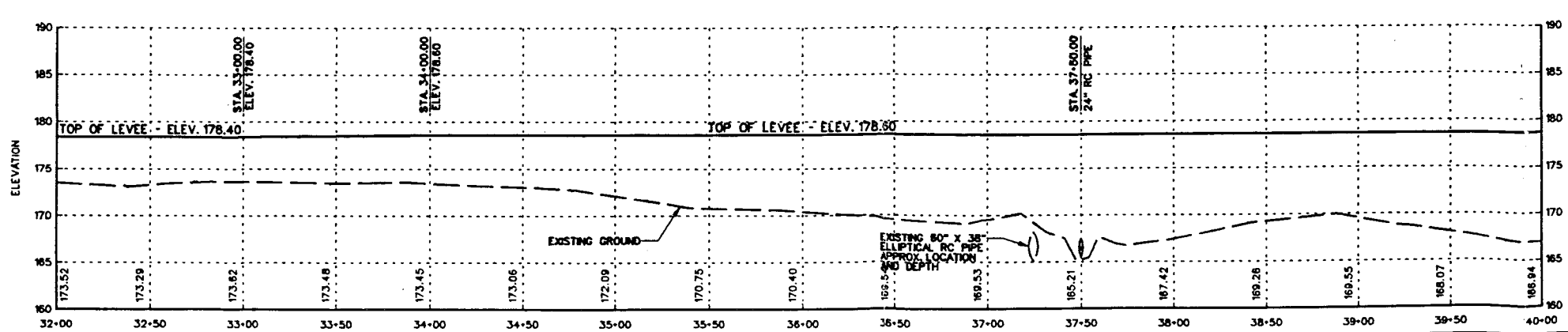
PAS10-04.DGN | PLATE NO. J-009



SEE PLATE J-002 FOR LEGEND

SCALE IN FEET

HORZ.	30	0	30	60	90
VERT.	6	0	6	12	18



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Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM

PLAN AND PROFILE
STA. 32+00 TO 40+00

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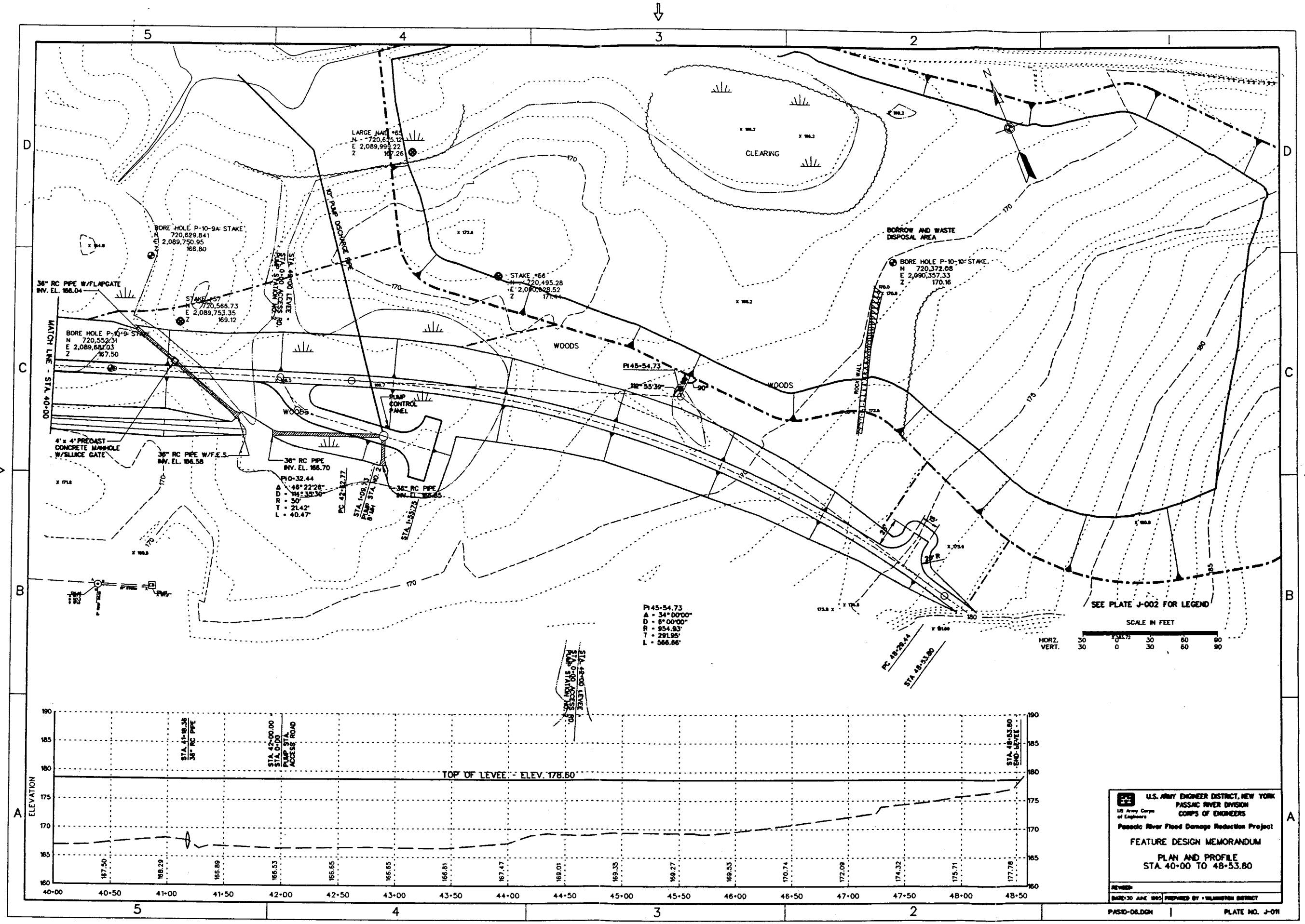
PASTD-05.DGN 1 PLATE NO. J-010


CLEARING
WOODS
BORROW AND WASTE DISPOSAL AREA
BORE HOLE P-10-10: STAKE
N 720,372.08
E 2,090,357.33
Z 170.16
BORE HOLE P-10-9A: STAKE
N 720,629.841
E 2,089,750.95
166.80
BORE HOLE P-10-9: STAKE
N 720,552.31
E 2,089,681.03
Z 167.50
STAKE #66
N 720,495.28
E 2,090,828.52
Z 171.44
STAKE #67
N 720,566.73
E 2,089,753.35
Z 169.12
LARGE NAIL #65
N 720,675.12
E 2,089,999.22
Z 167.26
10" PUMP DISCHARGE PIPE
STA. 40+00 LEVEE
STA. 0+00 ACCESS RD.
36" RC PIPE W/FLAPGATE
INV. EL. 166.04
MATCH LINE - STA. 40+00
4' x 4' PREDAST CONCRETE MANHOLE W/SLUICE GATE
36" RC PIPE W/F.E.S.
INV. EL. 166.58
36" RC PIPE
INV. EL. 166.70
PI 0+32.44
A = 46°22'26"
D = 191°39'30"
R = 50'
T = 21.42'
L = 40.47'
PC 42+82.77
STA. 1+09.34 PUMP STA. NO. 2
STA. 1+35.72
36" RC PIPE
INV. EL. 165.65
PUMP CONTROL PANEL
PI 45+54.73
192°55'39"
90°
PI 45+54.73
A = 34°00'00"
D = 8°00'00"
R = 954.93'
T = 291.95'
L = 566.86'
PC 48+28.44
STA 48+53.80
ROCK WALL
SEE PLATE J-002 FOR LEGEND
SCALE IN FEET
HORZ. 30 0 30 60 90
VERT. 30 0 30 60 90
TOP OF LEVEE - ELEV. 178.60
ELEVATION
STA. 41+18.58 36" RC PIPE
STA. 42+00.00 STA. 0+00 PUMP STA. ACCESS ROAD
STA. 48+53.80 END LEVEE
167.50 168.29 168.89 168.53 166.65 166.85 166.61 167.47 169.01 169.35 169.27 169.53 170.74 172.09 174.32 175.71 177.78
40+00 40+50 41+00 41+50 42+00 42+50 43+00 43+50 44+00 44+50 45+00 45+50 46+00 46+50 47+00 47+50 48+00 48+50
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS
US Army Corps of Engineers
Passaic River Flood Damage Reduction Project
FEATURE DESIGN MEMORANDUM
PLAN AND PROFILE
STA. 40+00 TO 48+53.80
REVISED
DATED: 30 JUNE 1995 PREPARED BY: WILMINGTON DISTRICT
PAS10-08.DGN
PLATE NO. J-011

OVERHEAD HIGH TENSION WIRES
(5 CABLES @ 2 HEIGHTS)

52" ABOVE GROUND SANITARY ON PIERS

1'-3" x 5'-5"
CONC. PIER

SANITARY MANHOLE ON 2 CONCRETE PIERS
(PROBED TO 3' BELOW GRADE & FOUND NO FOOTINGS)

8" x 5'-5" CONC. PIER

36" HIGH PRESSURE
GAS MAIN

WOODS

N

PI 3+29.32

BORE HOLE P-10-1: STAKE
N 718,672.84
E 2,090,045.21
Z 172.44

CLEARING

37'-9"

10'

35'-10"

90°

CONCRETE
FLOODWALL

STA. 4+01.15

PT 4+23.96

STA. 4+54.68

STA. 5+00

STA. 3+64.63

STA. 3+00

PI 3+29.32
Δ = 39° 29' 46"
D = 20° 00' 00"
R = 286.48'
T = 102.85'
L = 197.48'

WOODS

52" SANITARY ON PIERS

179.5 Top of Pipe
171.8
171.6
171.3
171.4
171.5
179.4 Top of Pipe
179.3 Top of Pipe
179.0 Top of Pipe
181.35
X 170.6
X 172.3

SEE PLATE J-002 FOR LEGEND

SCALE IN FEET

10 0 10 20 30

1 / J-012 SITE PLAN - FLOODWALL
SCALE: 1"=10'

US Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

Passaic River Flood Damage Reduction Project

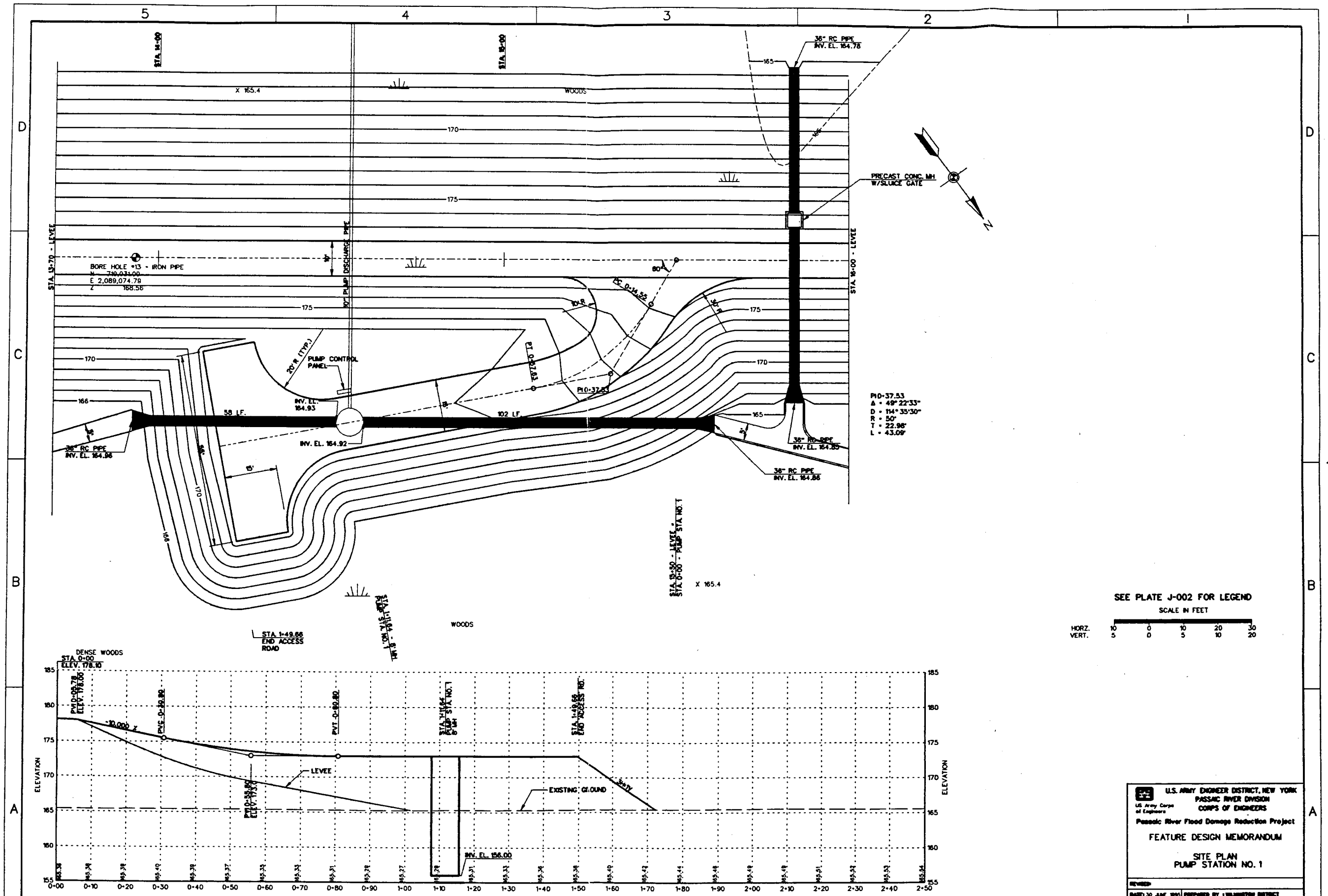
FEATURE DESIGN MEMORANDUM

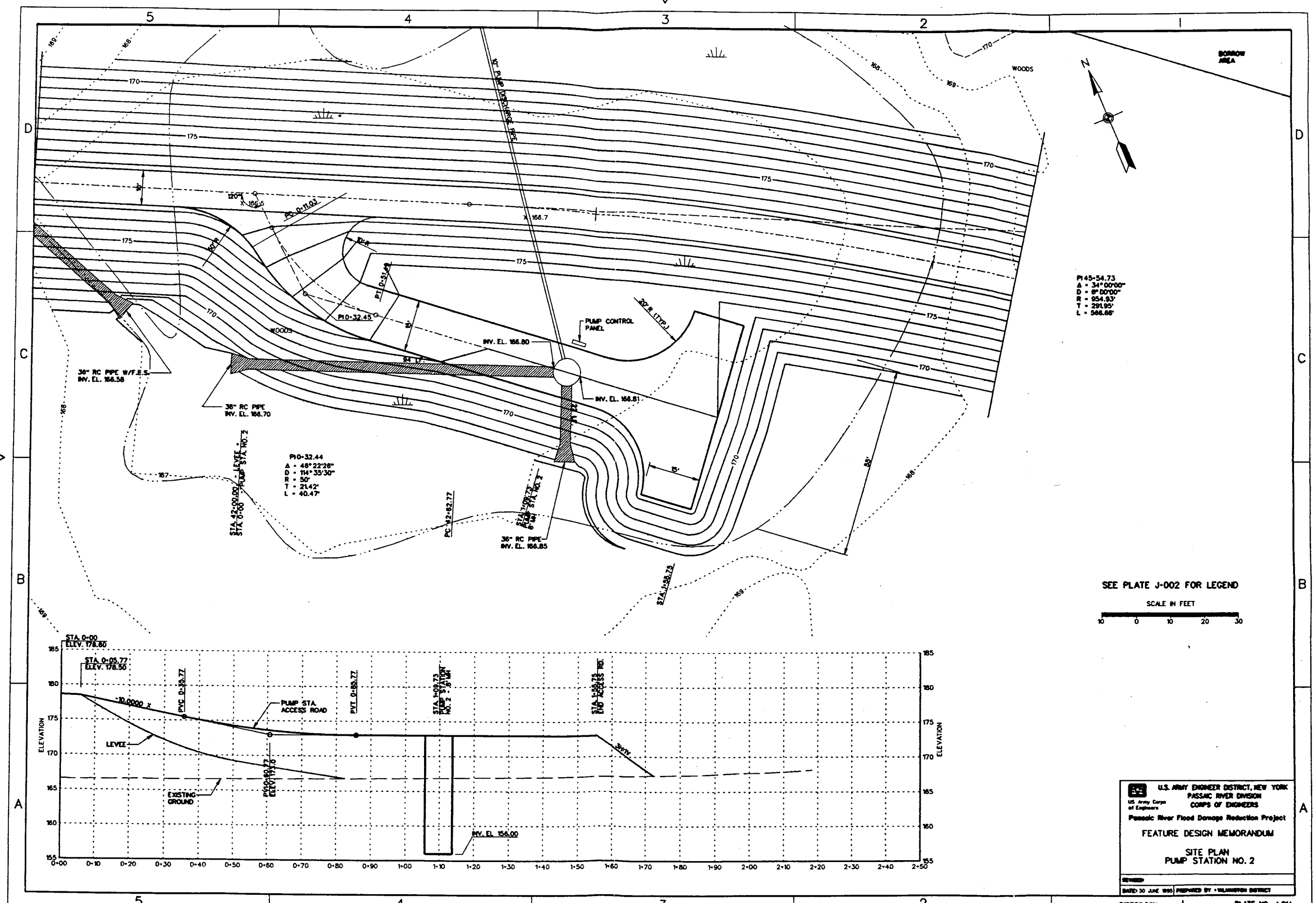
SITE PLAN
FLOODWALL

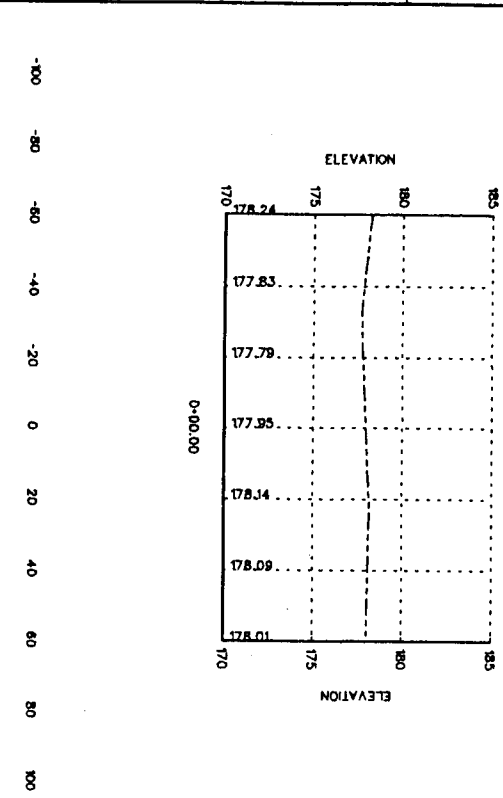
REVISED:

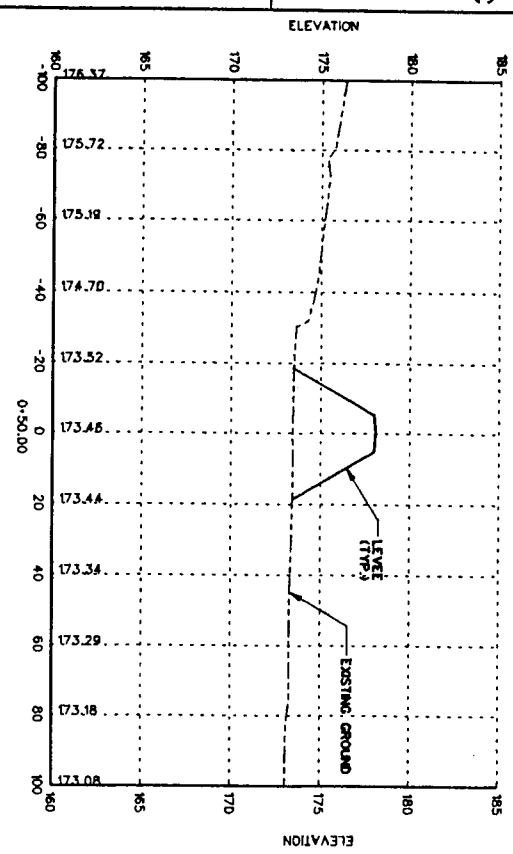
DATE: 30 JUNE 1995 | PREPARED BY: WILMINGTON DISTRICT

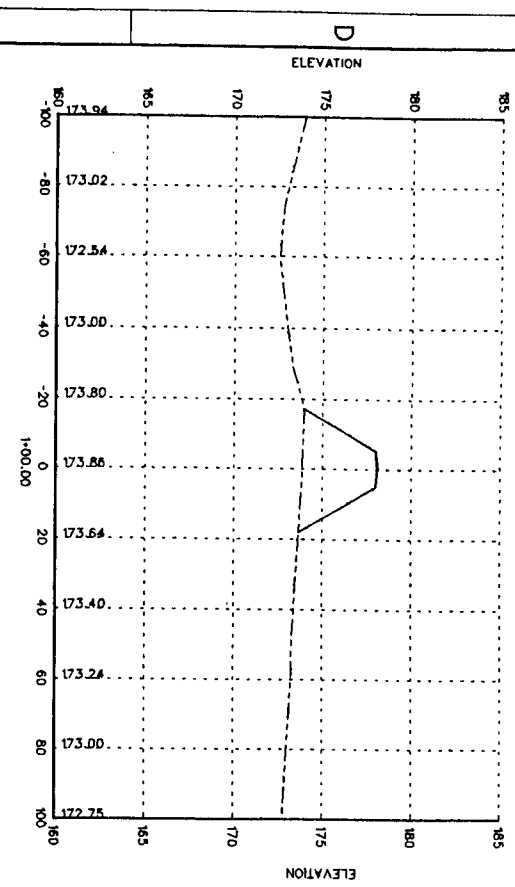
PASSDFSP.DGN 1 PLATE NO. J-012

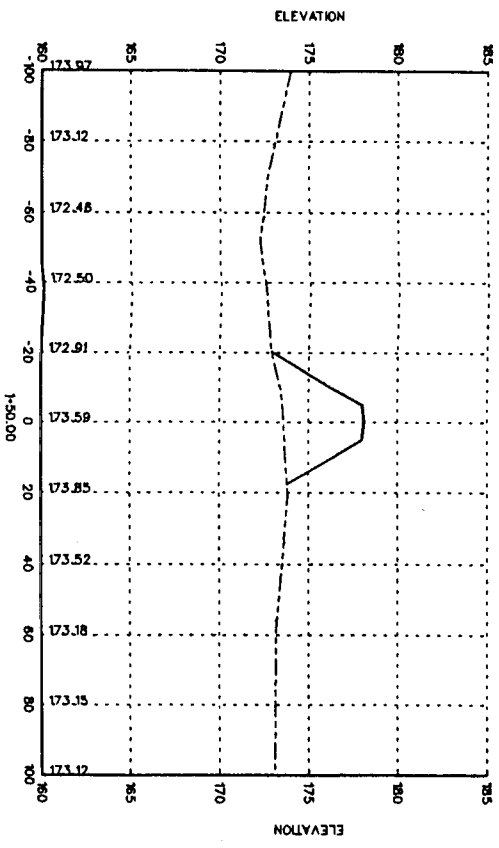

STA. 14+00
STA. 15+00
36" RC PIPE
INV. EL. 164.78
X 165.4
WOODS
PRECAST CONC. MH
W/SLUICE GATE
STA. 13+70 - LEVEE
STA. 16+00 - LEVEE
BORE HOLE #13 - IRON PIPE
N 710,031.00
E 2,089,074.79
Z 168.56
90" PUMP DISCHARGE PIPE
PC 0+14.53
PT 0+27.83
PI 0+37.53
PI 0+37.53
Δ = 49° 22'33"
D = 114° 35'30"
R = 50'
T = 22.98'
L = 43.09'
PUMP CONTROL
PANEL
INV. EL.
164.93
58 LF.
102 LF.
INV. EL. 164.92
36" RC PIPE
INV. EL. 164.96
36" RC PIPE
INV. EL. 164.89
36" RC PIPE
INV. EL. 164.86
STA. 5+50 - LEVEE
STA. 0+00 - PUMP STA. NO. 1
STA. 1+49.66
END ACCESS
ROAD
STA. 1+16.64
PUMP STA. NO. 1
WOODS
SEE PLATE J-002 FOR LEGEND
SCALE IN FEET
HORZ. 10 0 10 20 30
VERT. 5 0 5 10 20
DENSE WOODS
STA. 0+00
ELEV. 178.10
PVI 0+09.78
ELEV. 176.00
PVC -0+50.80
PVT -0+80.80
STA. 1+16.64
PUMP STA. NO. 1
STA. 1+49.66
END ACCESS RD.
-10.000 %
LEVEE
EXISTING GROUND
3:1 TY
INV. EL. 156.00
ELEVATION
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS
US Army Corps of Engineers
Passaic River Flood Damage Reduction Project
FEATURE DESIGN MEMORANDUM
SITE PLAN
PUMP STATION NO. 1
REVISED
DATE: 30 JUNE 1995
PREPARED BY: WASHINGTON DISTRICT
PIOPS1.DGN
PLATE NO. J-013

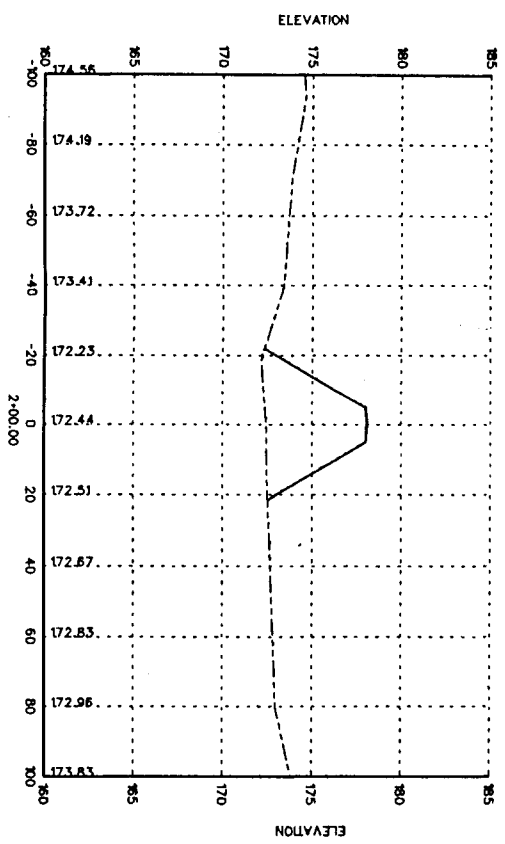

BORROW AREA
WOODS
N
10" PUMP DISCHARGE PIPE
PI 45+54.73
Δ = 34°00'00"
D = 6°00'00"
R = 954.93'
T = 291.95'
L = 566.68'
PI 0+51.49
PI 0+32.45
PUMP CONTROL PANEL
INV. EL. 166.80
INV. EL. 166.81
36" RC PIPE W/F.E.S.
INV. EL. 166.58
36" RC PIPE
INV. EL. 166.70
36" RC PIPE
INV. EL. 166.85
PI 0+32.44
Δ = 46°22'26"
D = 114°35'30"
R = 50'
T = 21.42'
L = 40.47'
STA 42+00.00 LEVEE
STA 0+00 PUMP STA. NO. 2
PC 142+62.77
STA 1+09.77 PUMP STA. NO. 2
STA 1+58.73
SEE PLATE J-002 FOR LEGEND
SCALE IN FEET
10 0 10 20 30
STA. 0+00
ELEV. 178.60
STA. 0+05.77
ELEV. 178.50
PVC 0+35.77
PVT 0+85.77
STA 1+09.73 PUMP STATION NO. 2 STATION
STA 1+58.73 END ACCESS RD.
PUMP STA. ACCESS ROAD
LEVEE
EXISTING GROUND
PVC 0+80.77
ELEV. 171.0
INV. EL. 156.00
ELEVATION
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS
Passaic River Flood Damage Reduction Project
FEATURE DESIGN MEMORANDUM
SITE PLAN
PUMP STATION NO. 2
DATE: 30 JUNE 1995
PREPARED BY: WILMINGTON DISTRICT
PIOPS2.DGN
PLATE NO. J-014

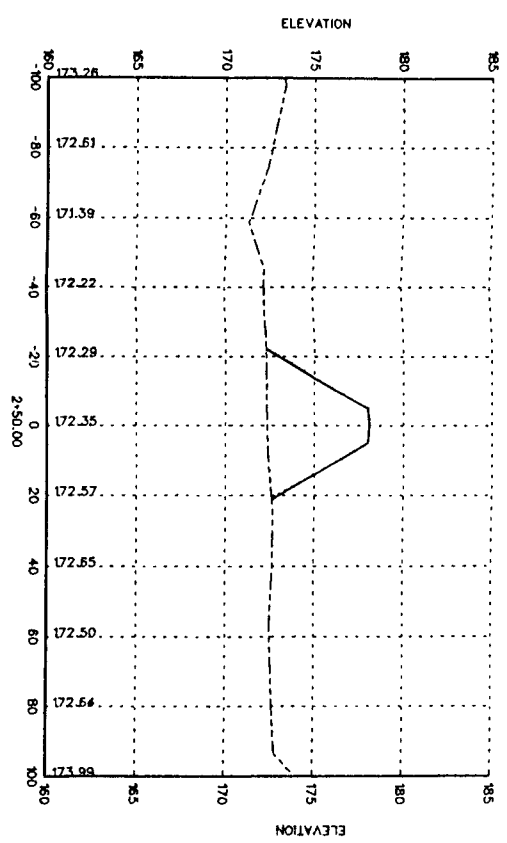


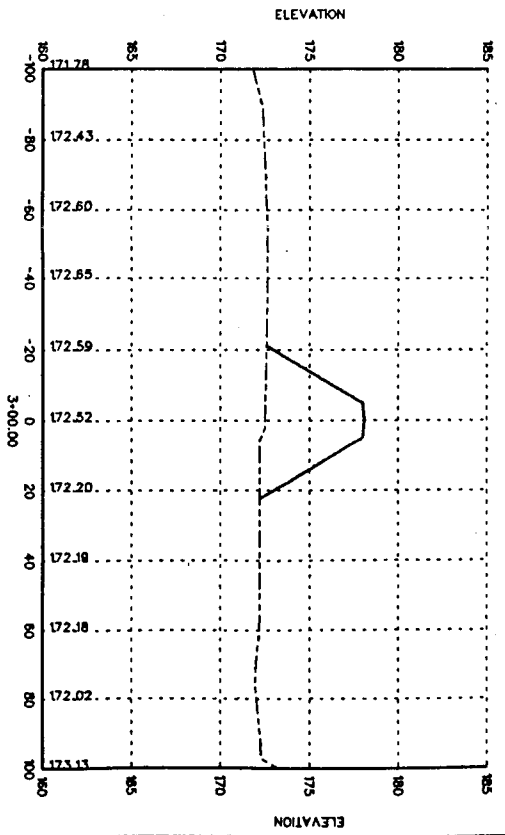


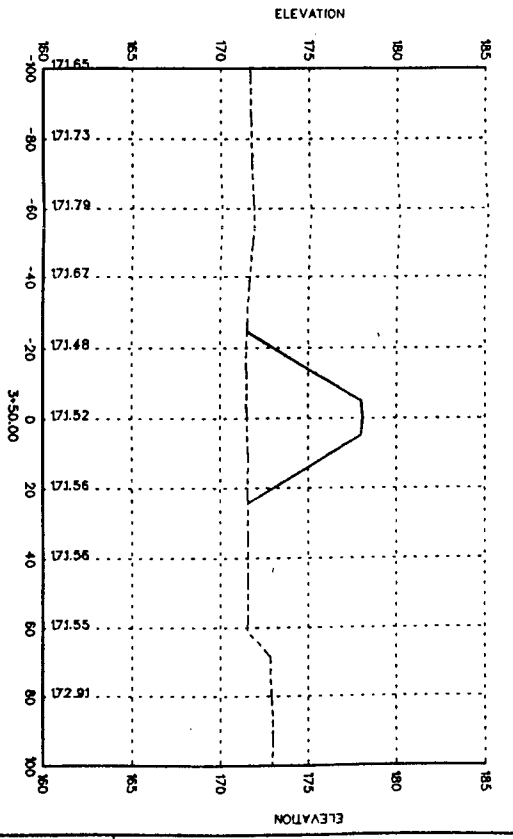












U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
US Army Corps of Engineers
CORPS OF ENGINEERS

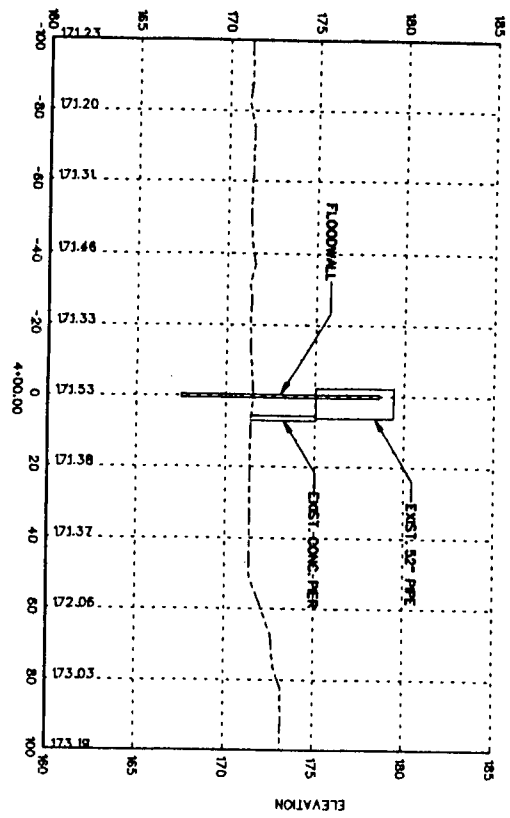
Passaic River Flood Damage Reduction Project

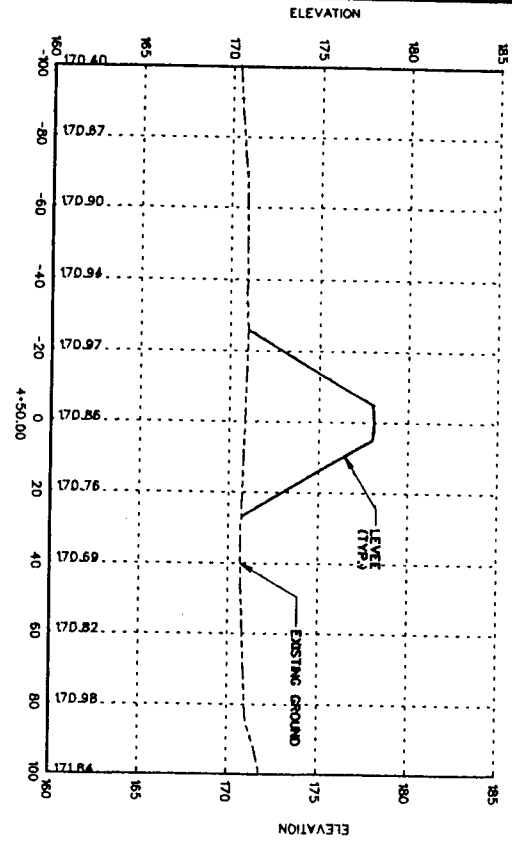
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE
STA. 0+00 TO 3+50

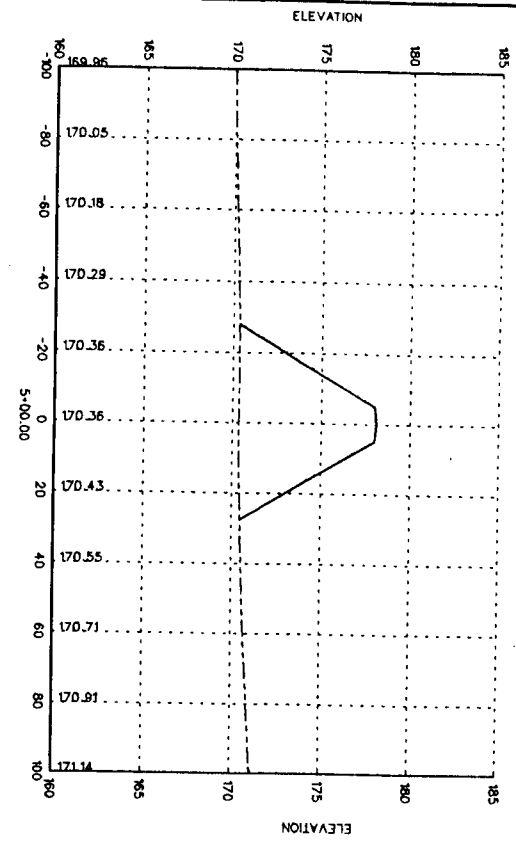
REVISED

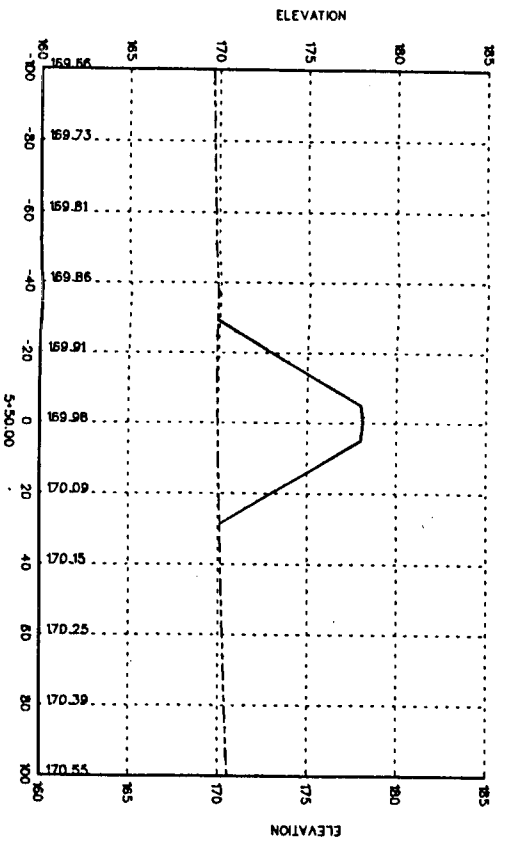
DATED: 30 JUNE 1995 | PREPARED BY: TRANSMITTAL DISTRICT

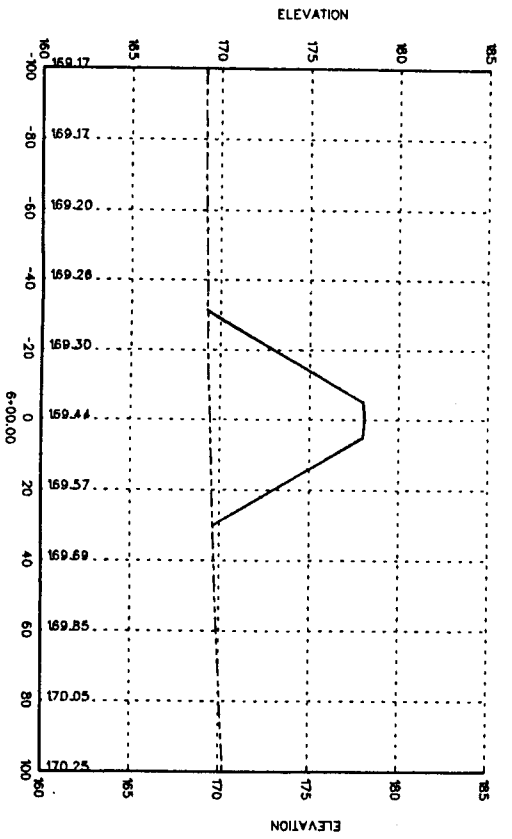
PASSDXS.DGN | PLATE NO. J-015

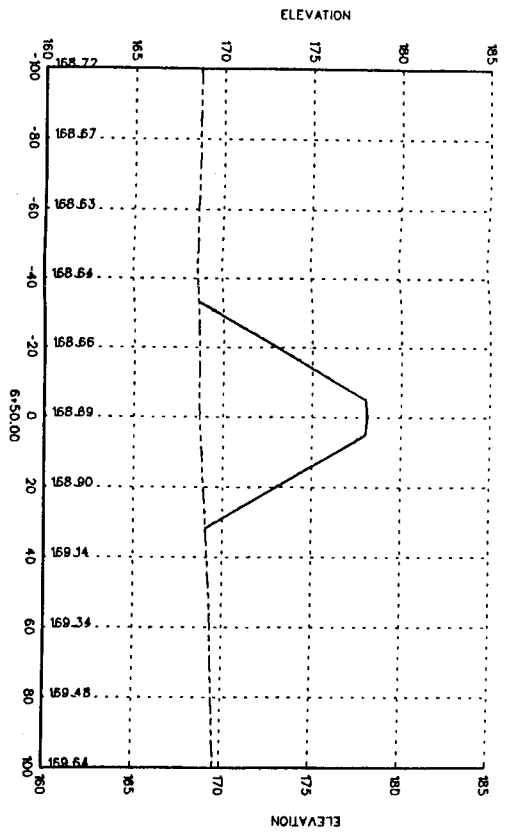


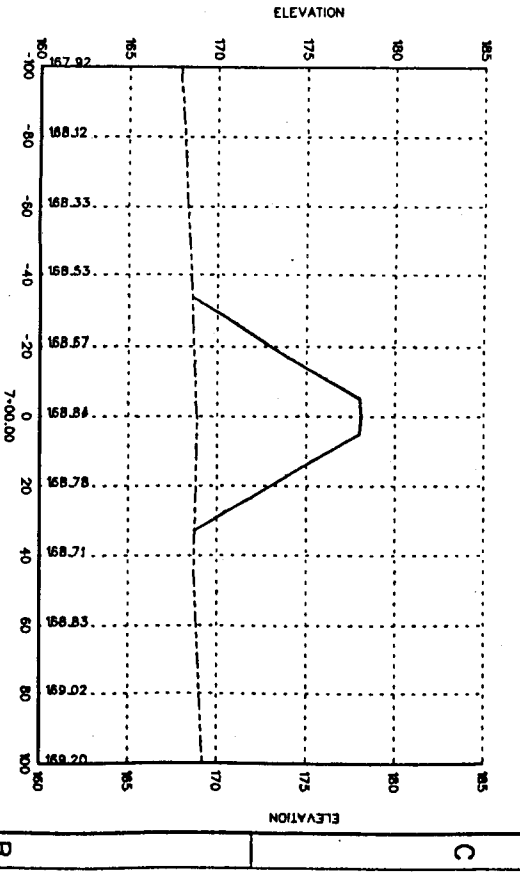


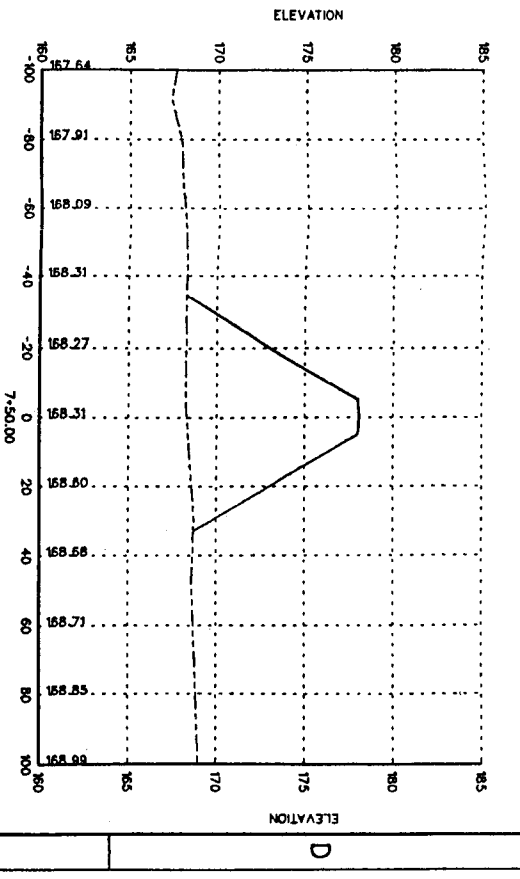












U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
U.S. Army Corps of Engineers
CORPS OF ENGINEERS

Passaic River Flood Damage Reduction Project

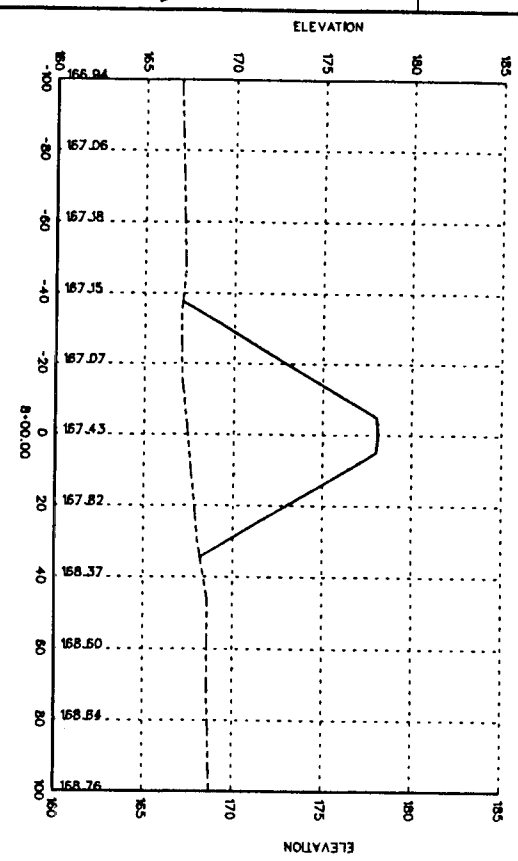
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE
STA. 4+00 TO 7+50

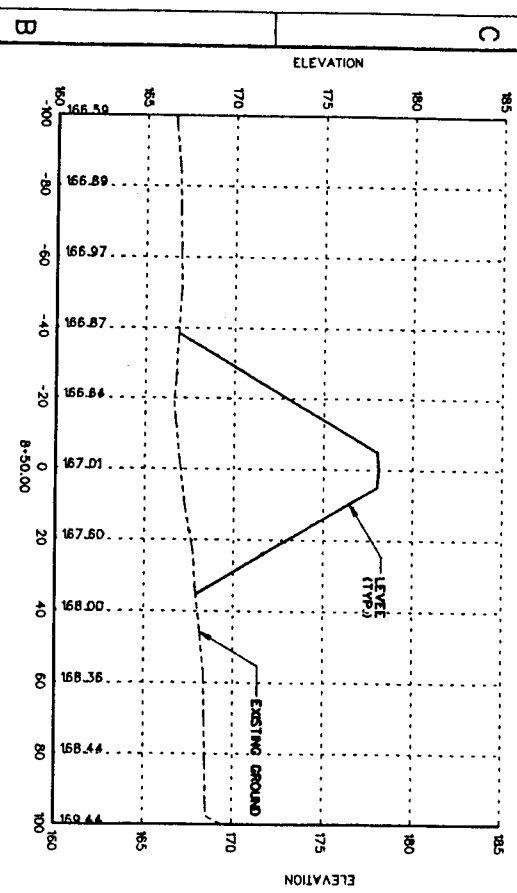
REVISIONS

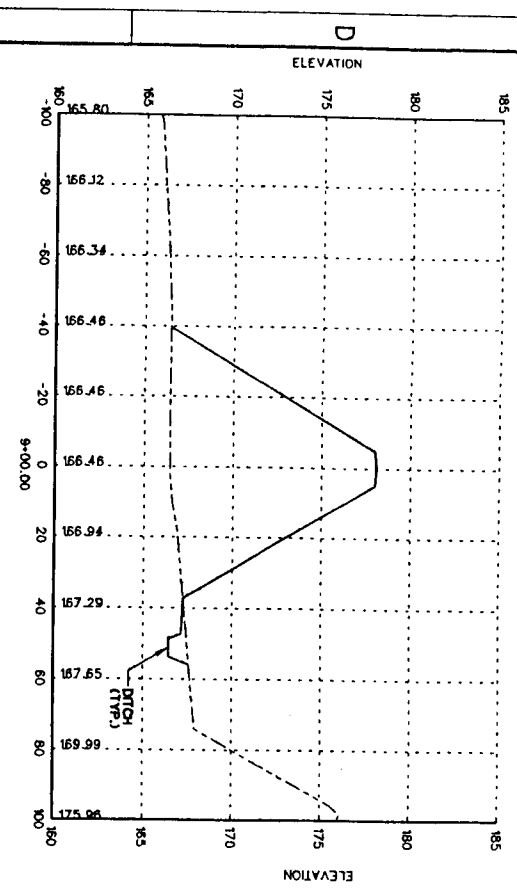
DATED 30 JUNE 1995 | PREPARED BY: WILMINGTON DISTRICT

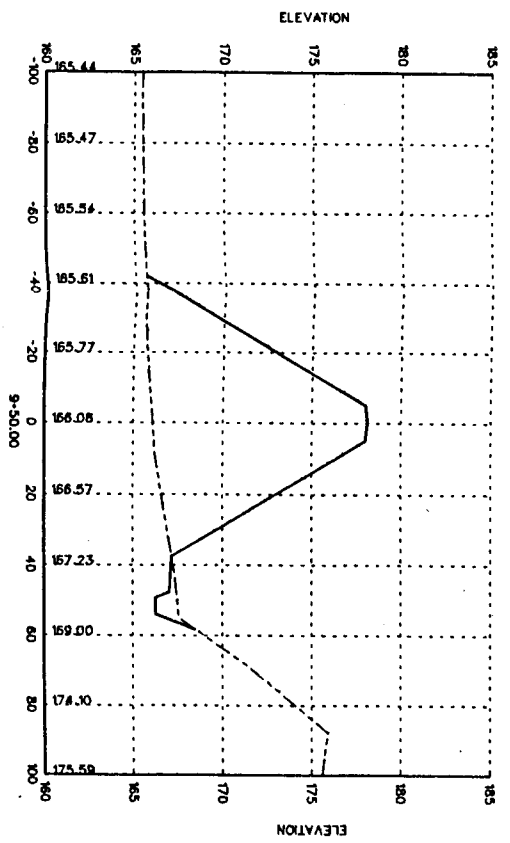
PASTOX5.DGN

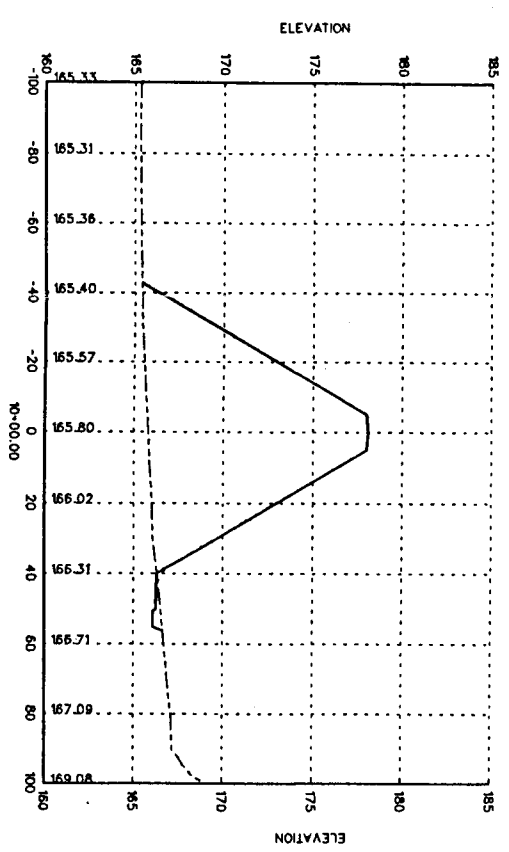
PLATE NO. J-016

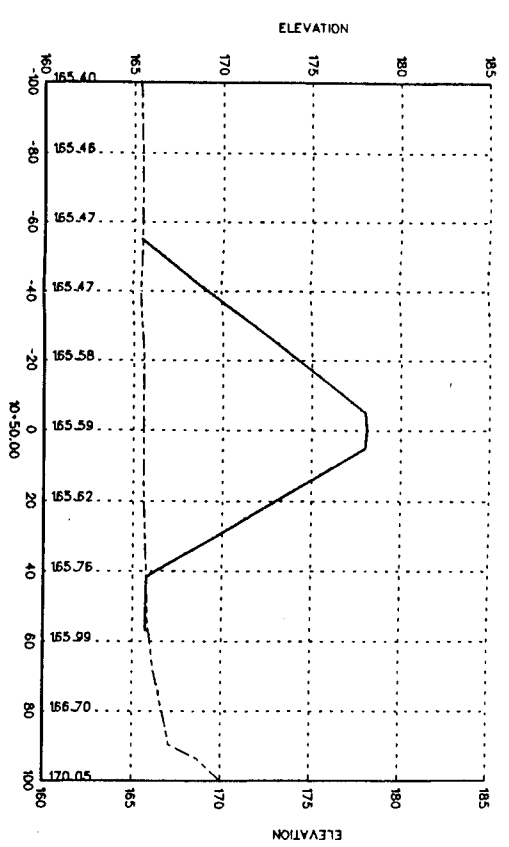


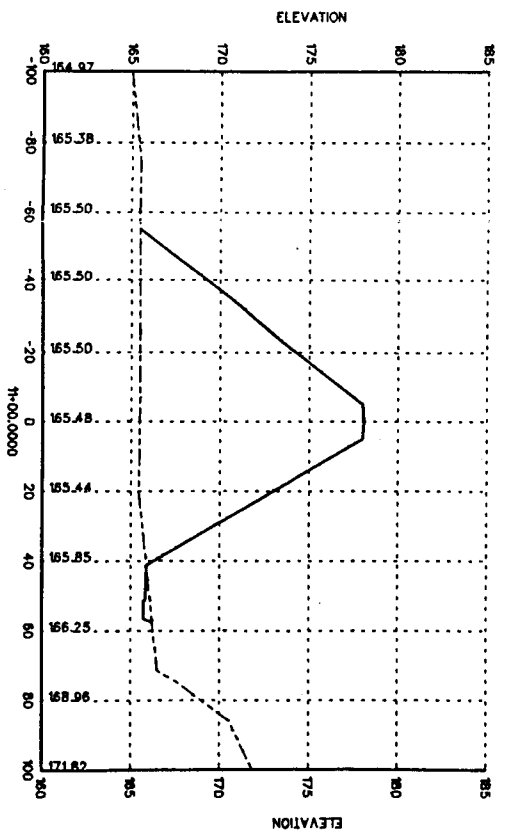


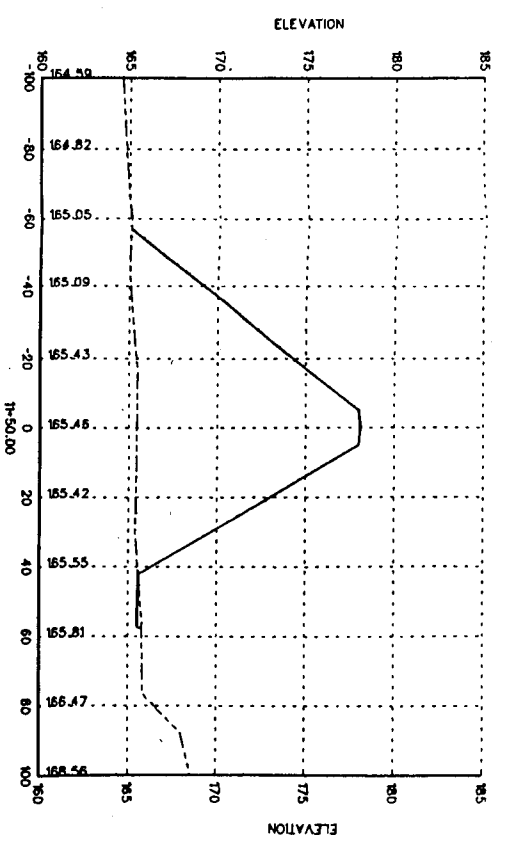












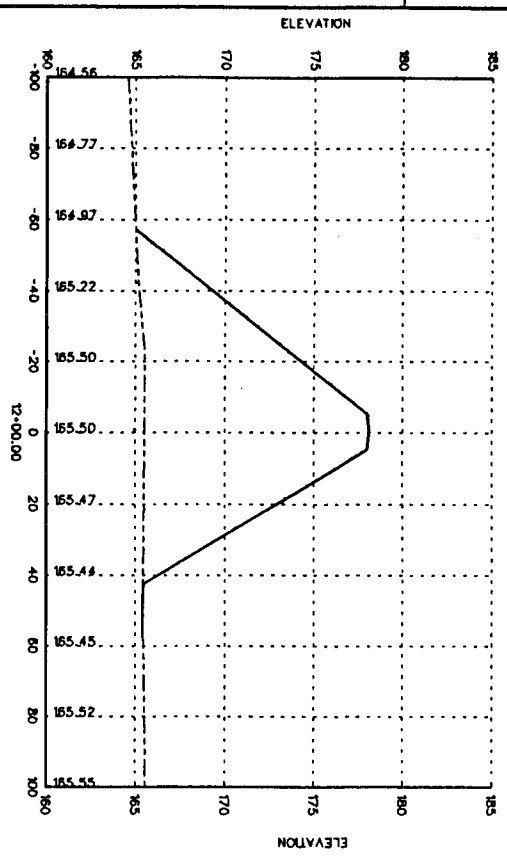
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
US Army Corps of Engineers
CORPS OF ENGINEERS

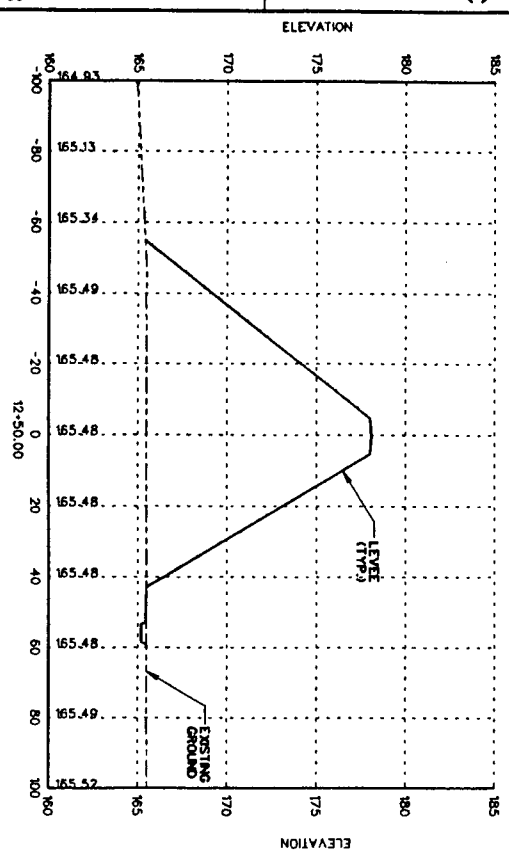
Passaic River Flood Damage Reduction Project

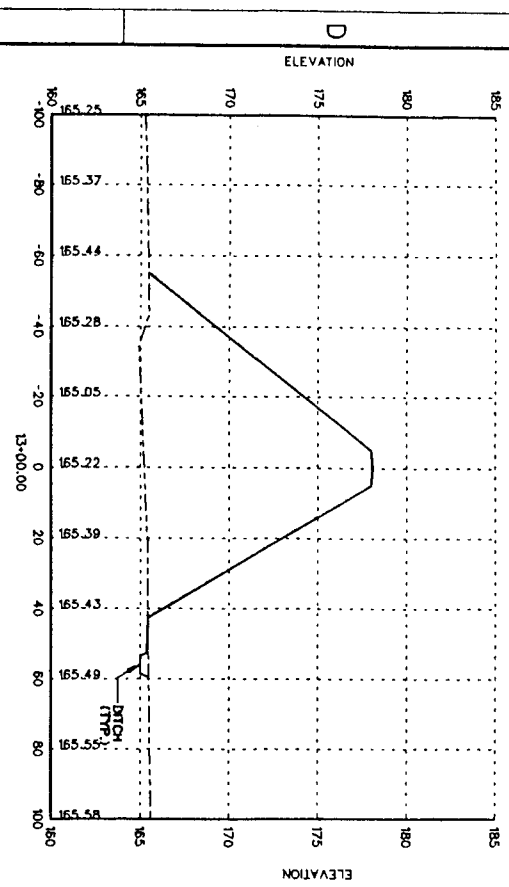
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE
STA. 8+00 TO 11+50

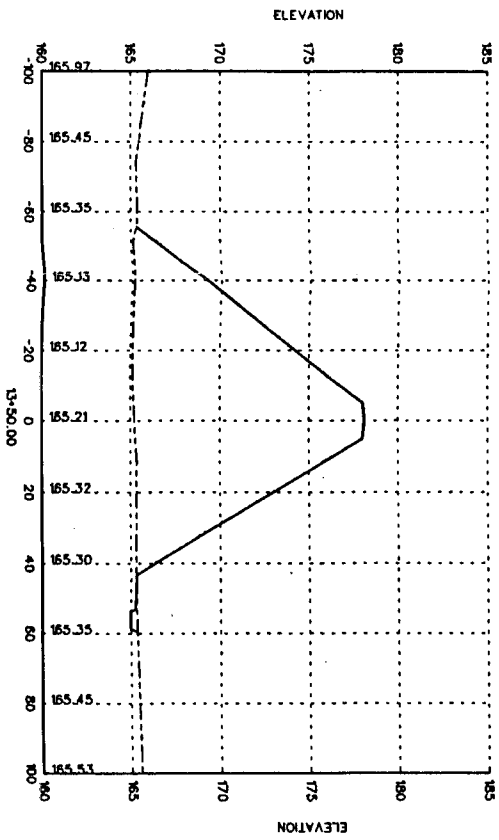
REVISED
DATED: 30 JUNE 1994 | PREPARED BY: A TALMADGE DISTRICT

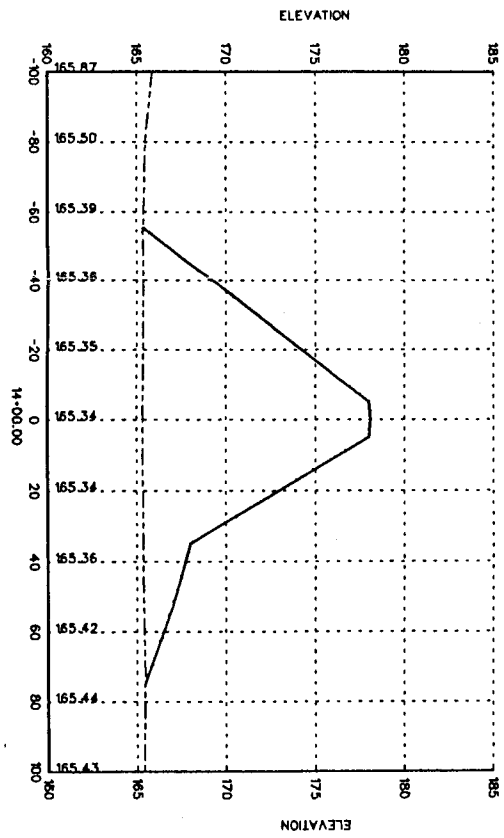
PASSDIKE.DGN | PLATE NO. J-017

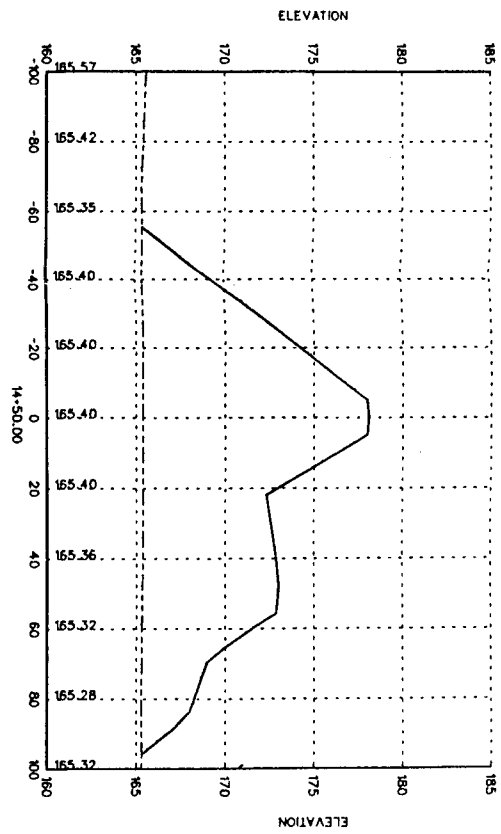


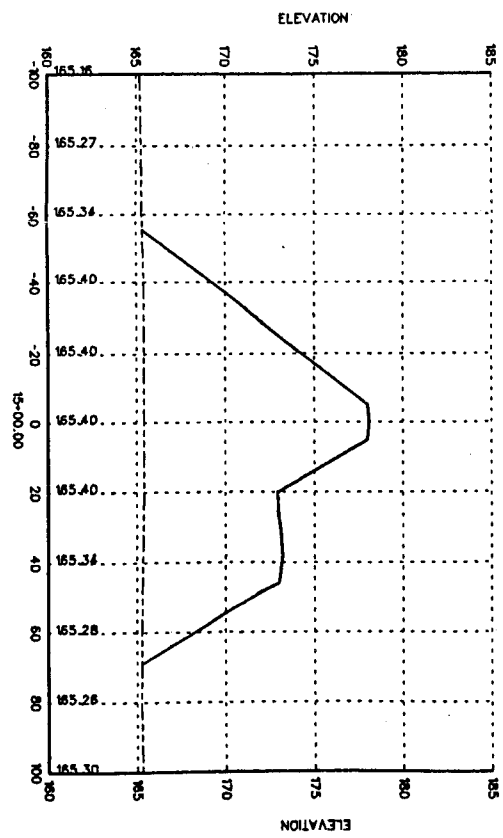


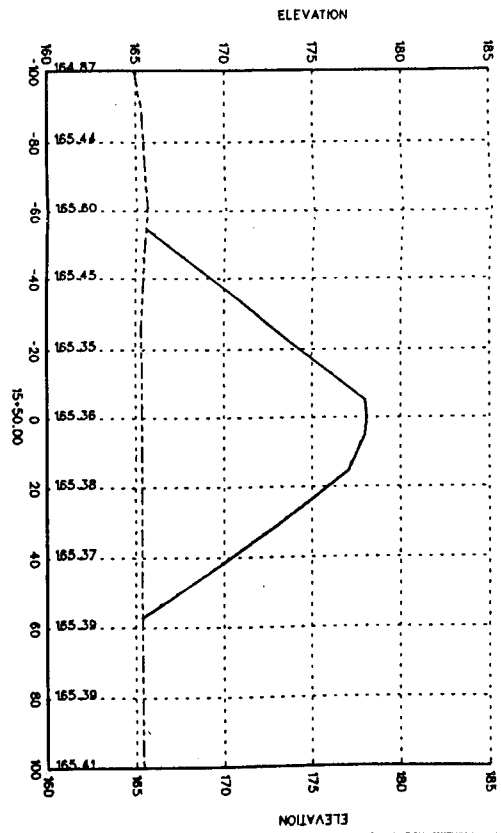










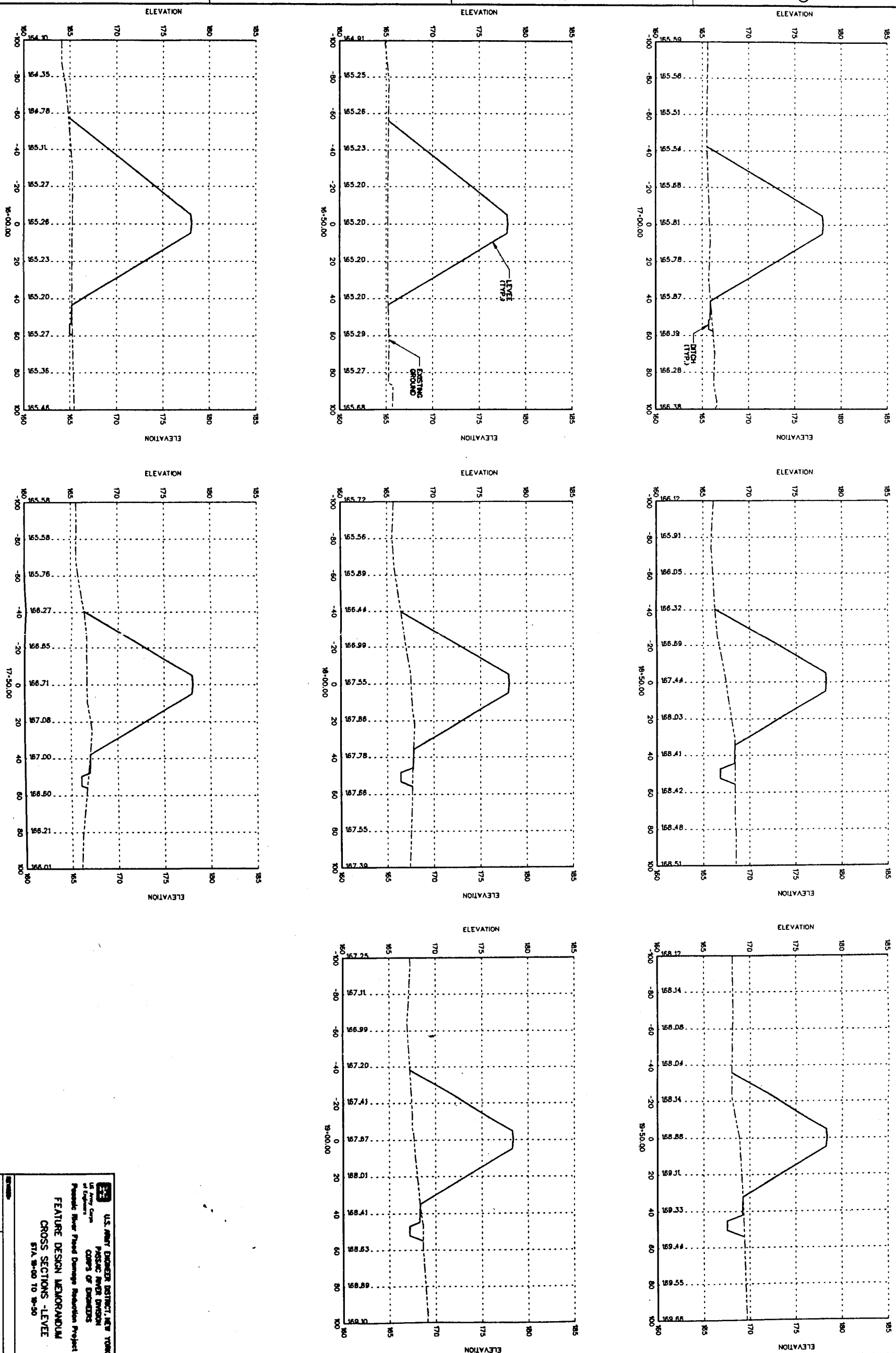


U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
US Army Corps of Engineers — CORPS OF ENGINEERS
Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE
STA. 12+00 TO 15+50

REVISED
DATED 30 JUNE 1993 | PREPARED BY NEW YORK DISTRICT

PASTOXS.DGN | PLATE NO. J-018

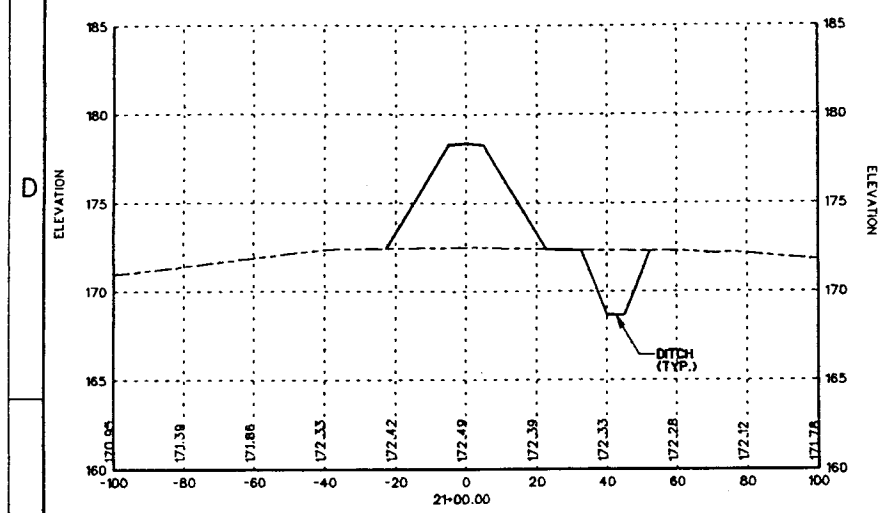


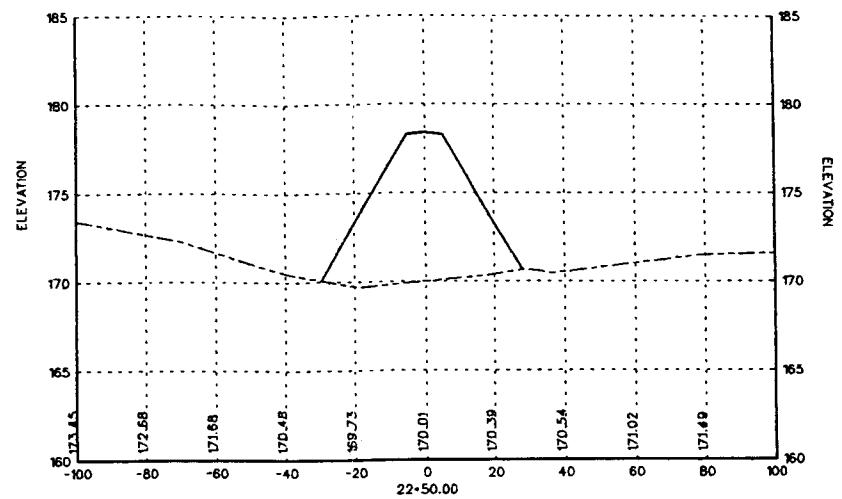
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
U.S. Army Corps of Engineers
CORPS OF ENGINEERS
Passaic River Flood Damage Reduction Project

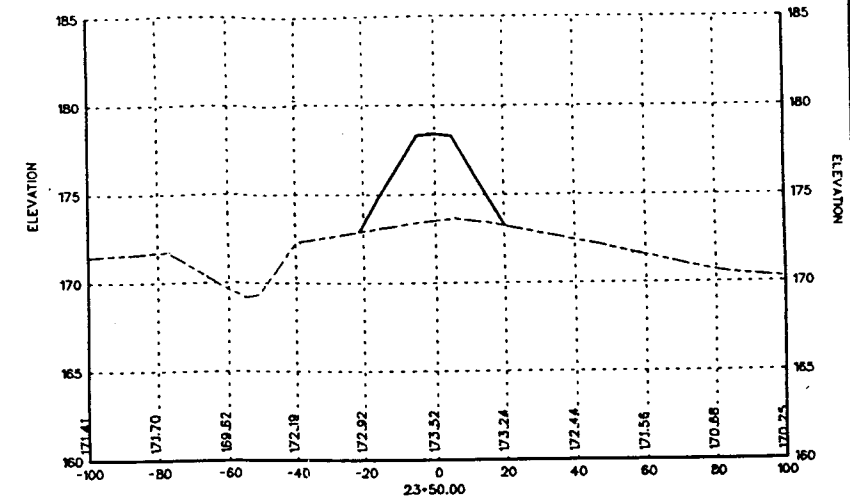
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE
STA. 16+00 TO 19+50

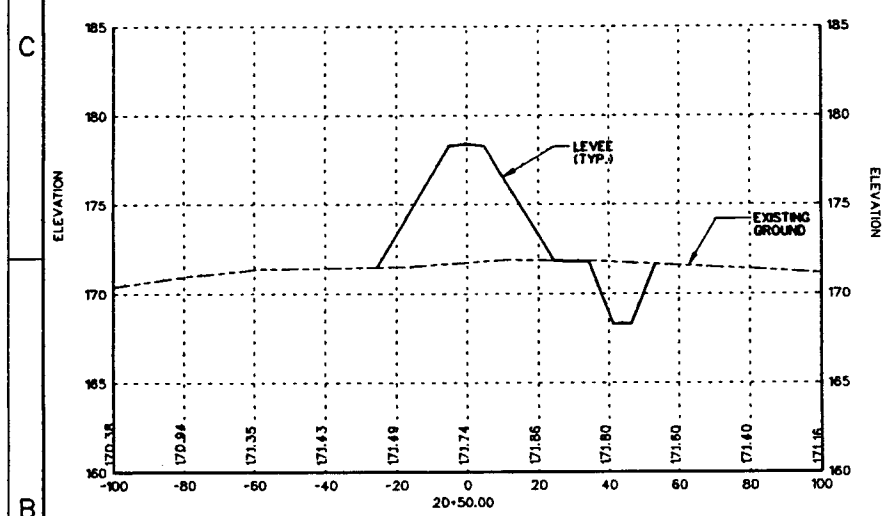
DATE: 30 JUNE 1995 | PREPARED BY: WILMINGTON DISTRICT

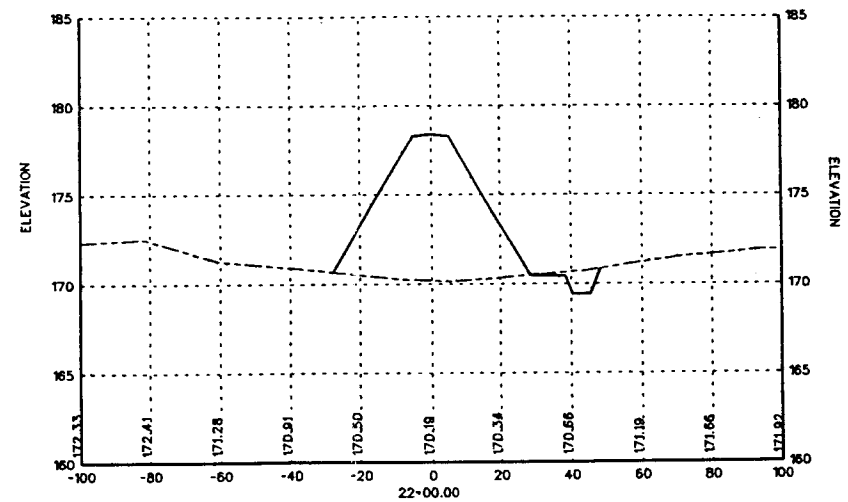
PASSDCS.DGN | PLATE NO. J-019

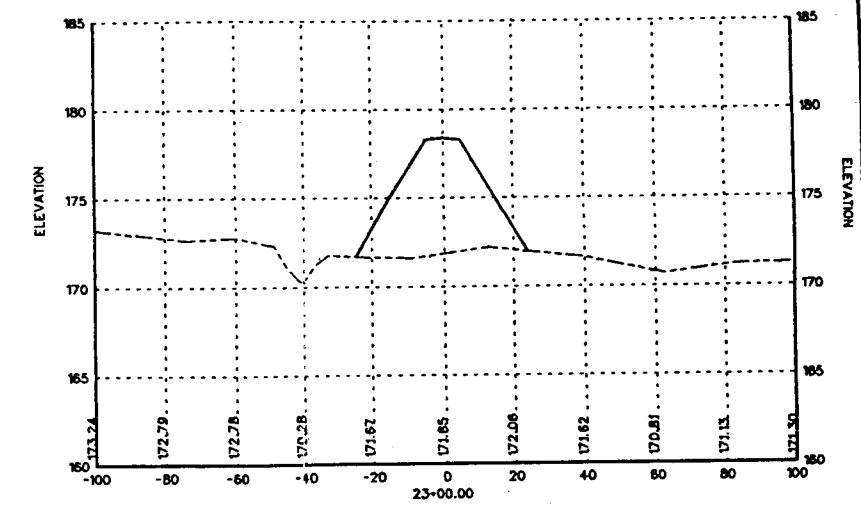


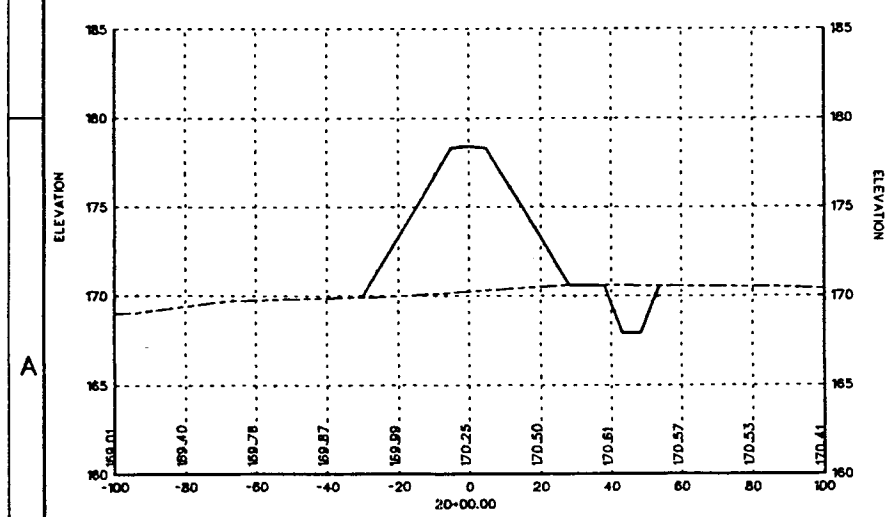


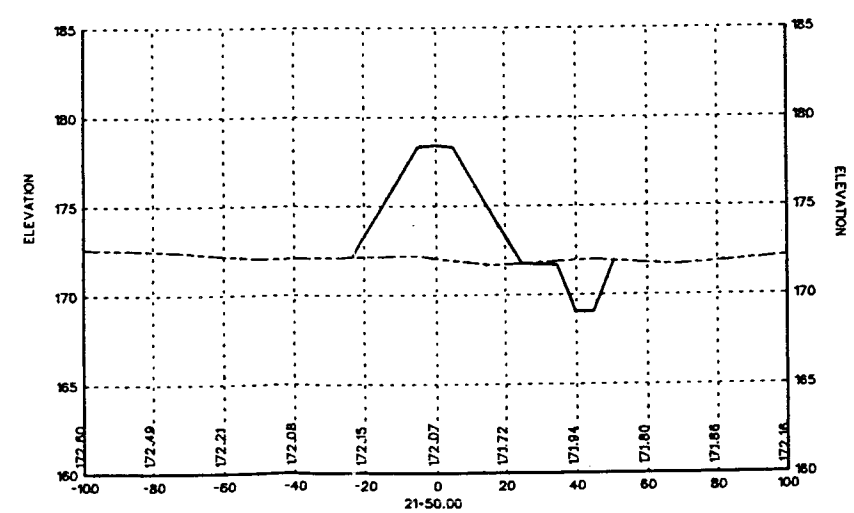












US Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

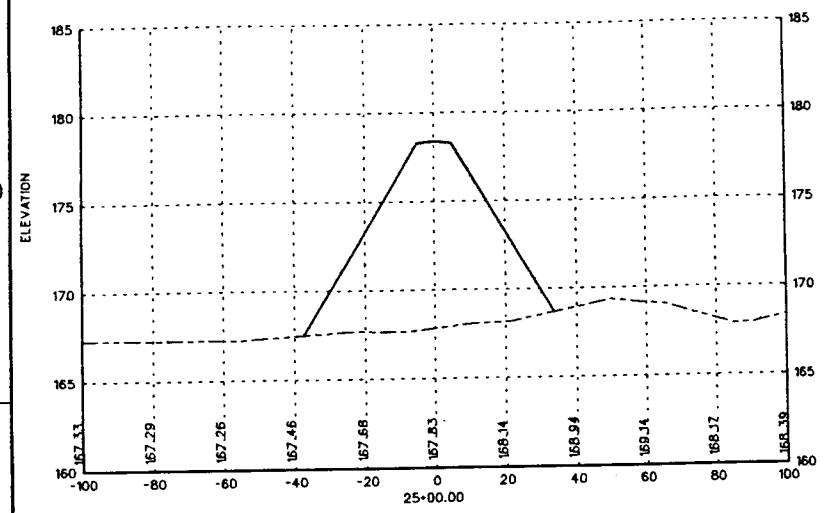
Passaic River Flood Damage Reduction Project

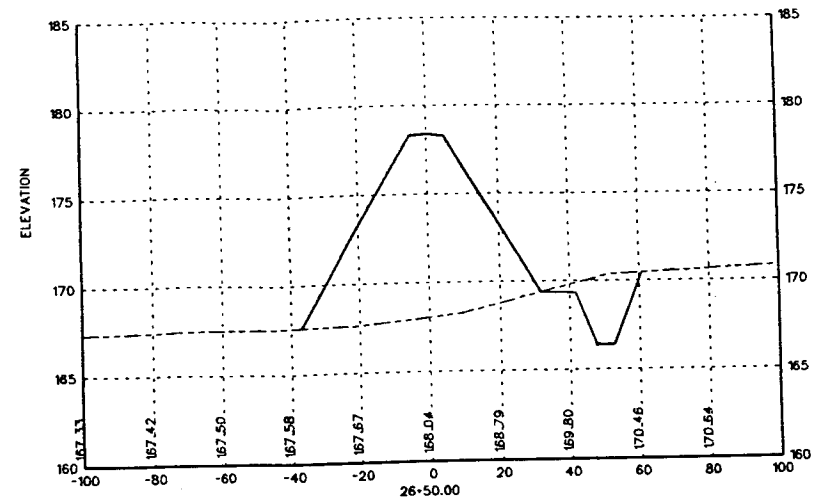
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE
STA. 20+00 TO 23+50

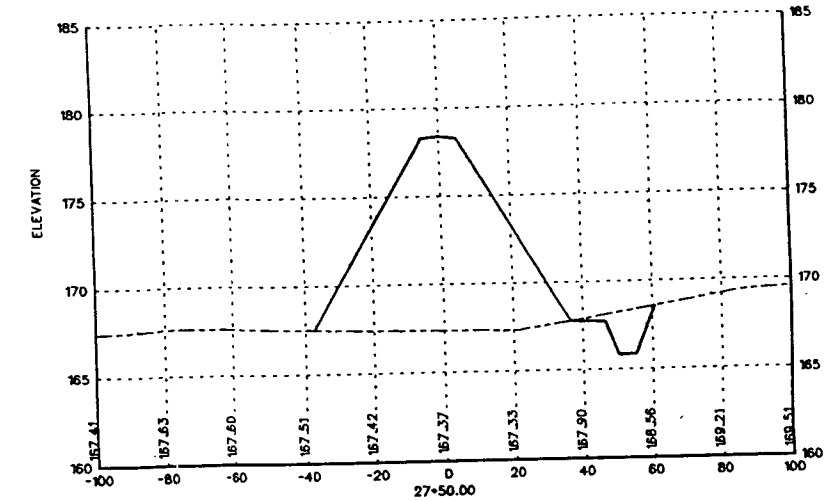
REVISION

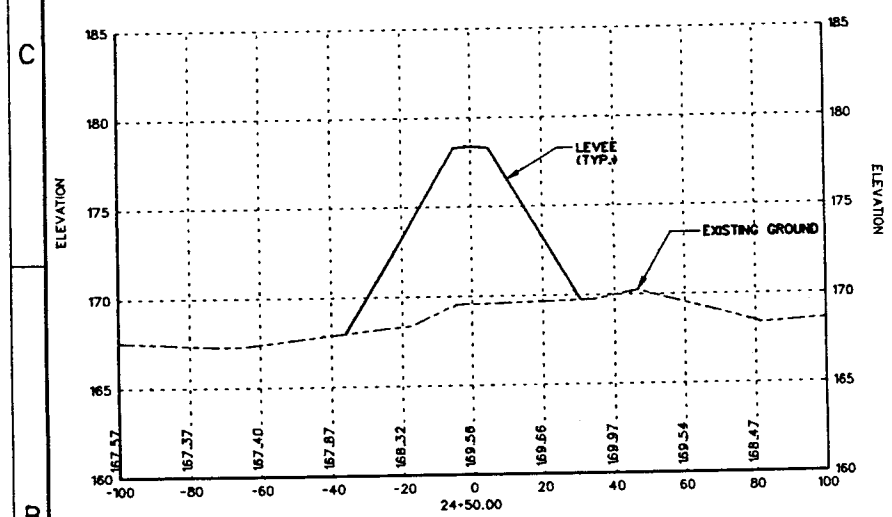
DATED 30 JUNE 1989 PREPARED BY WILMINGTON DISTRICT

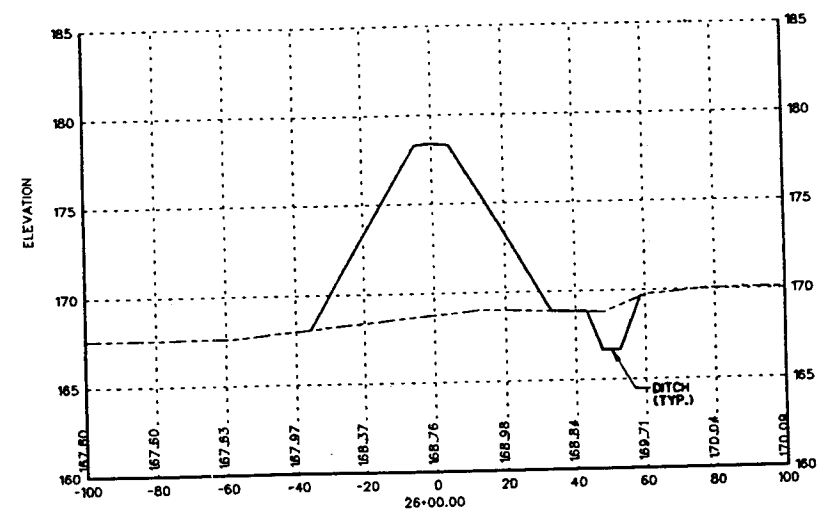
PASIDXS.DGN 1 PLATE NO. J-020

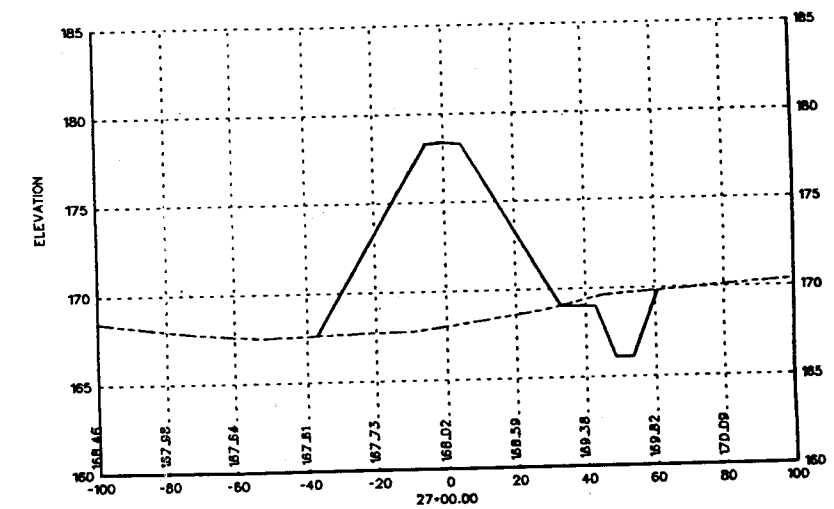


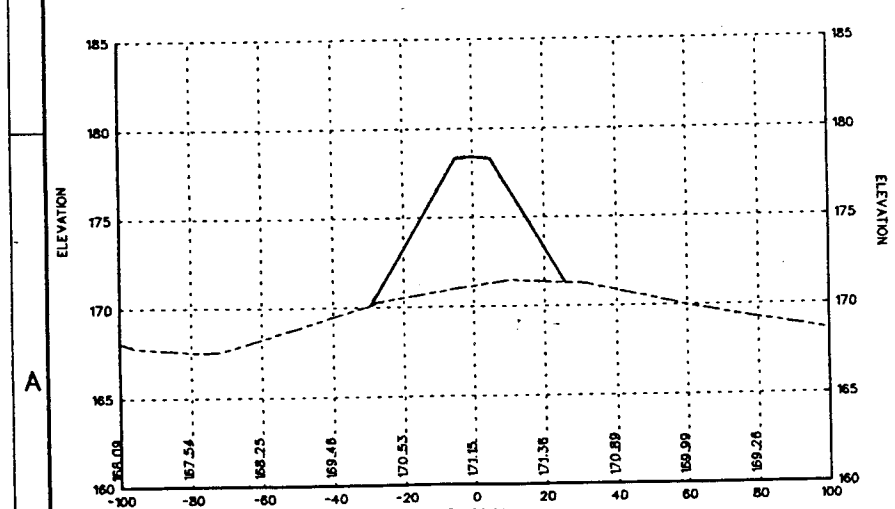


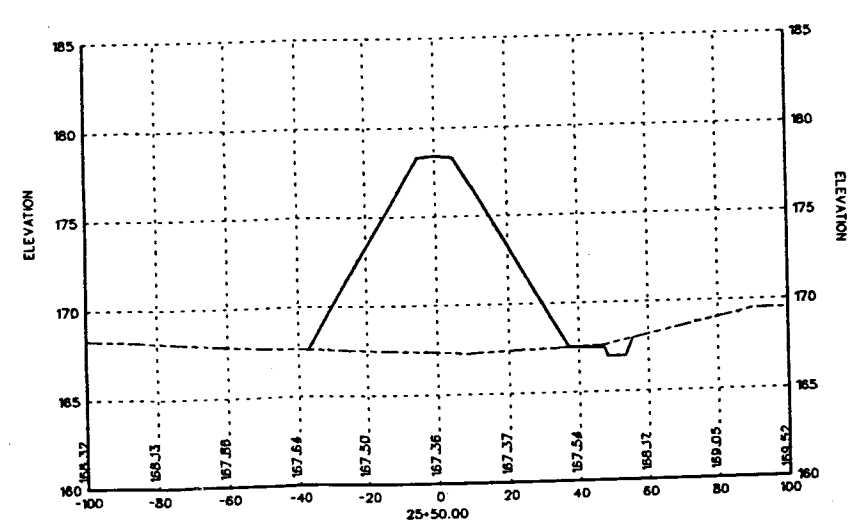












US Army Corps of Engineers

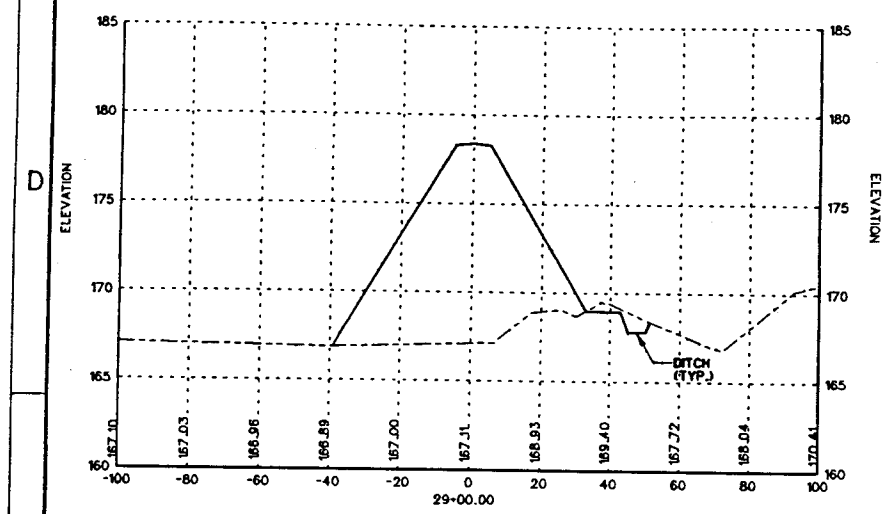
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

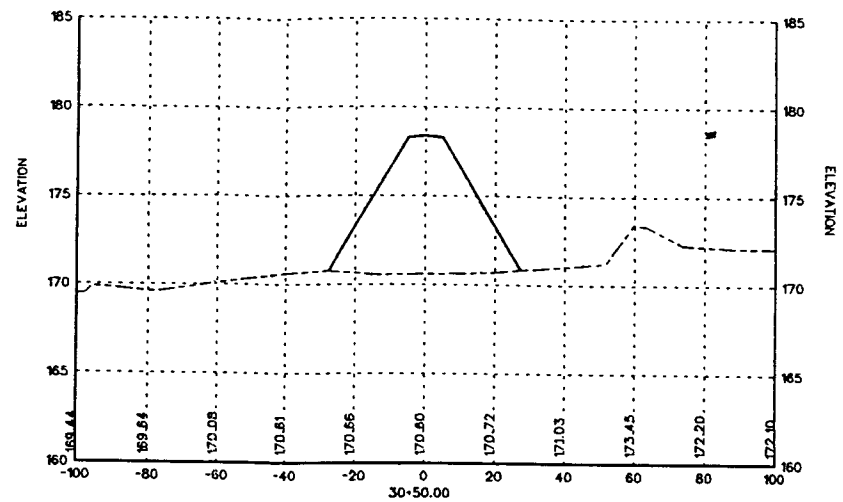
Passaic River Flood Damage Reduction Project

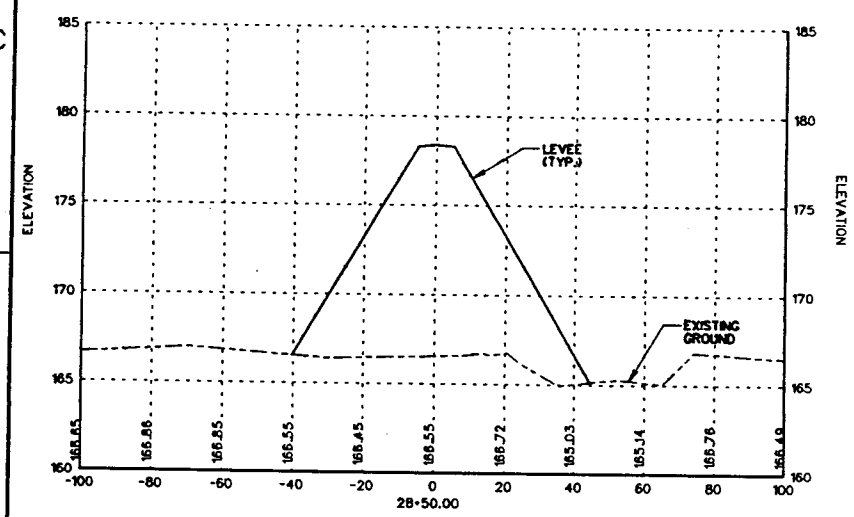
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE
STA. 24+00 TO 27+50

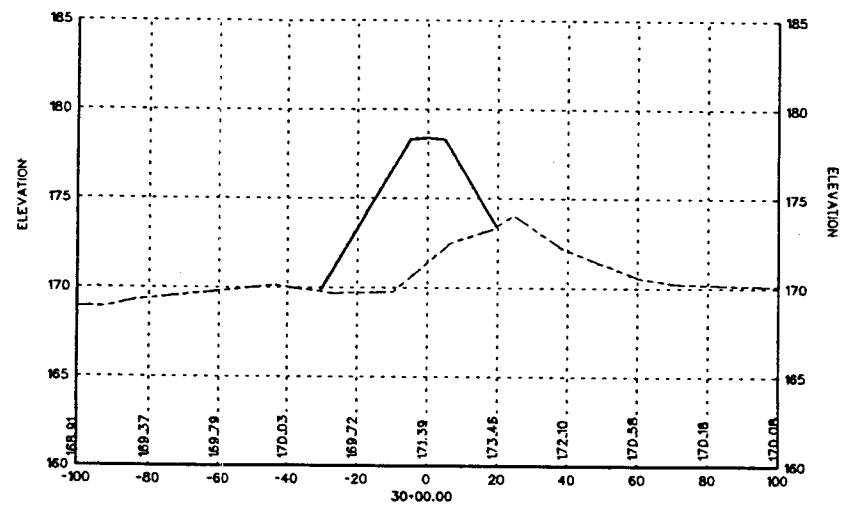
REVISED
DATED 30 JUNE 1986 | PREPARED BY WILMINGTON DISTRICT

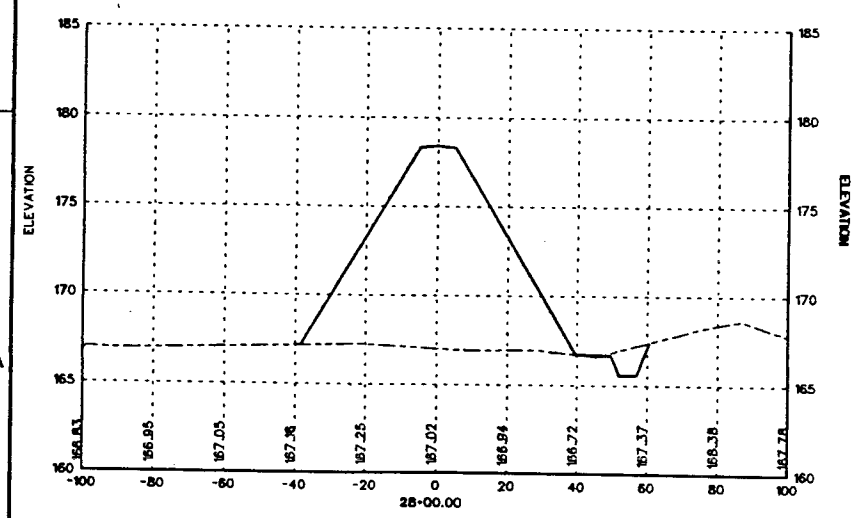
PAS100XS.DGN 1 PLATE NO. J-021

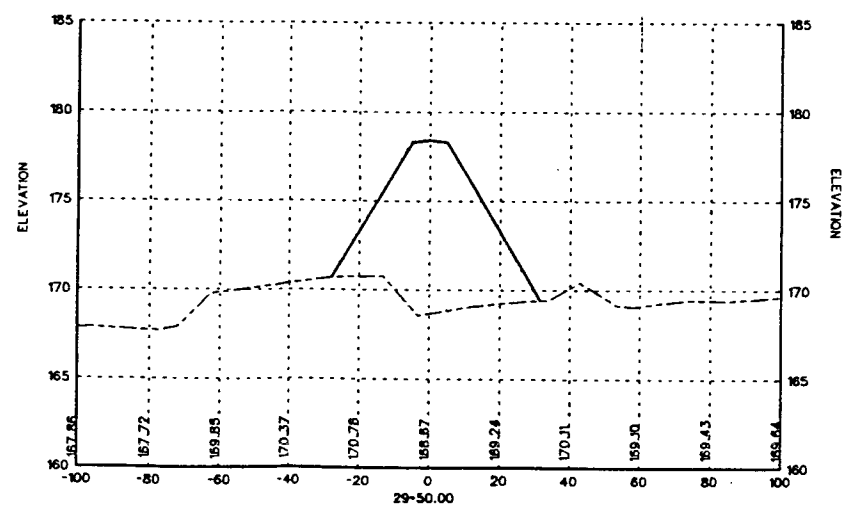












U.S. Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

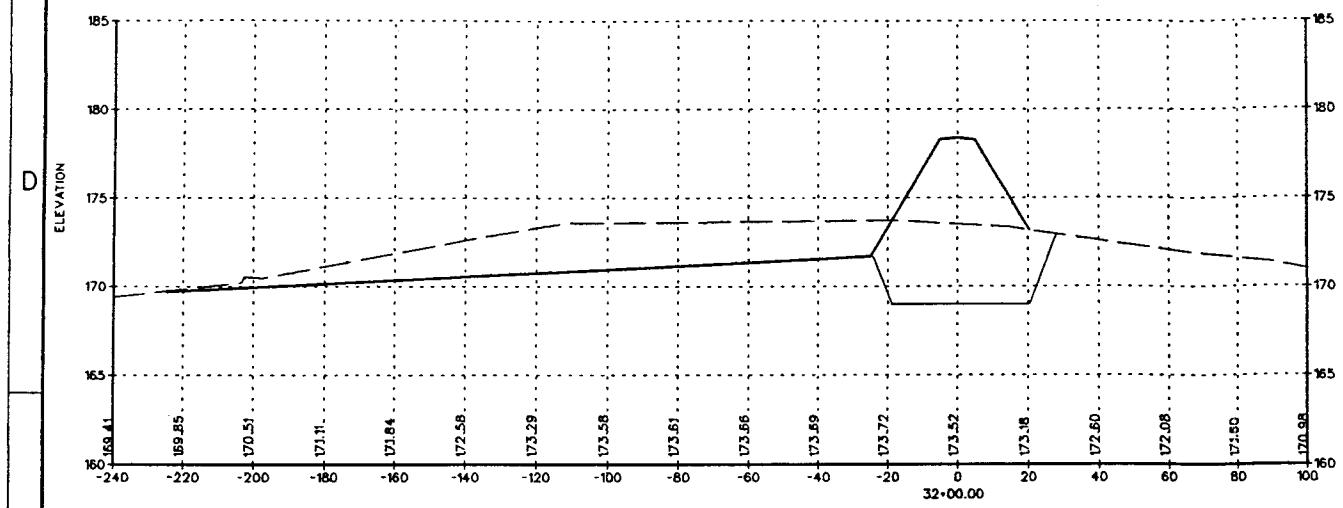
Passaic River Flood Damage Reduction Project

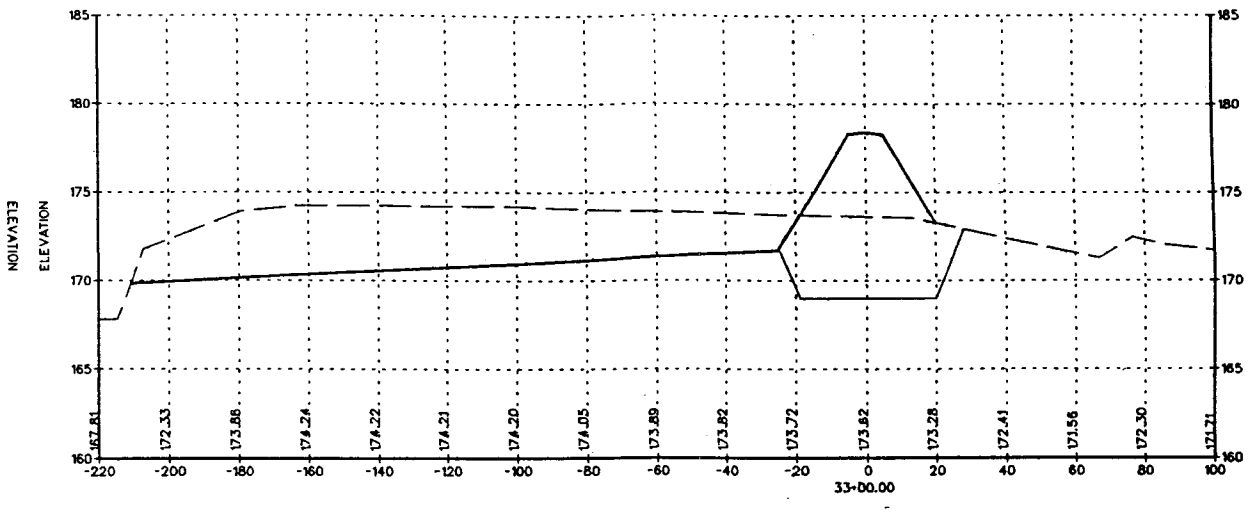
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE
STA. 28+00 TO 30+50

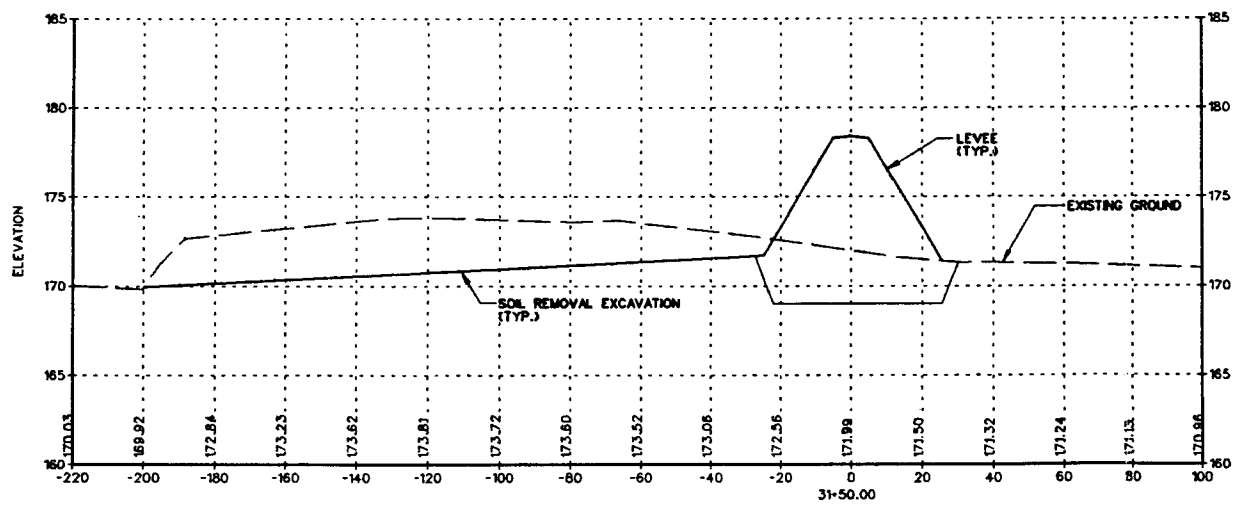
REVISED:

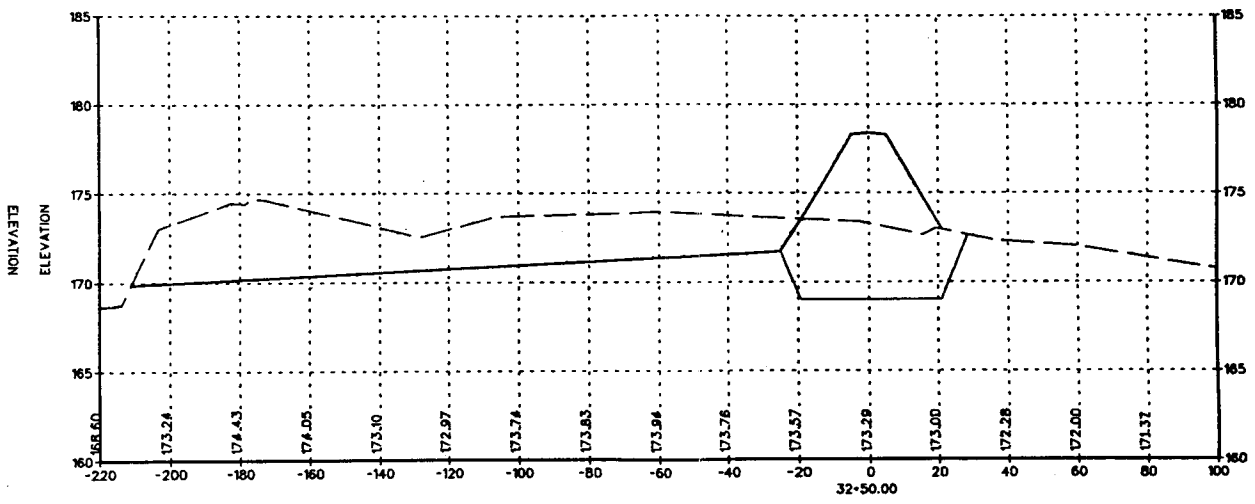
DATED: 20 JUNE 1995 | PREPARED BY: WILMINGTON DISTRICT

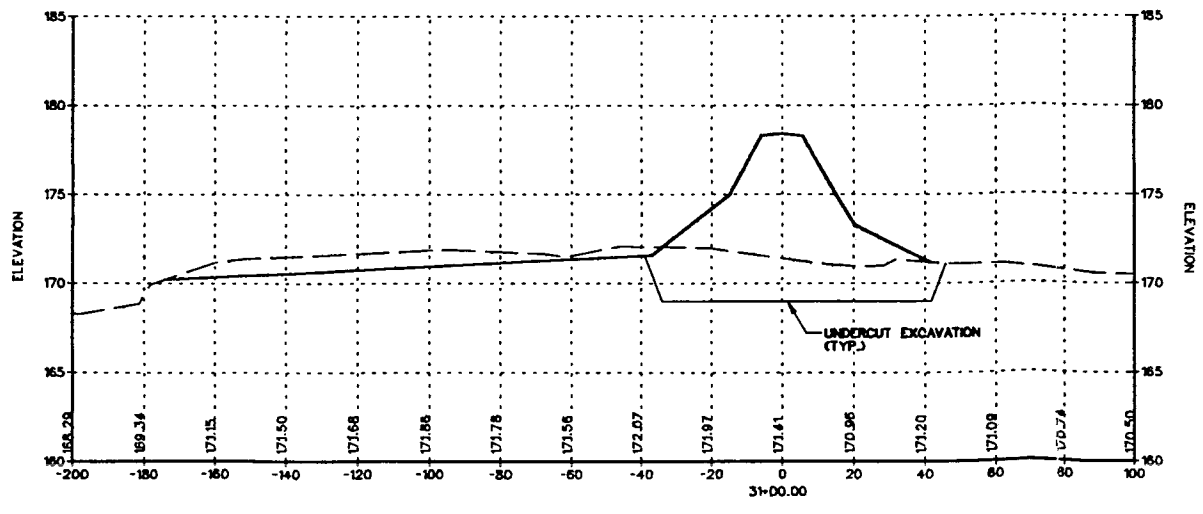
PAS10XS.DGN | PLATE NO. J-022











U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS
US Army Corps of Engineers

Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM

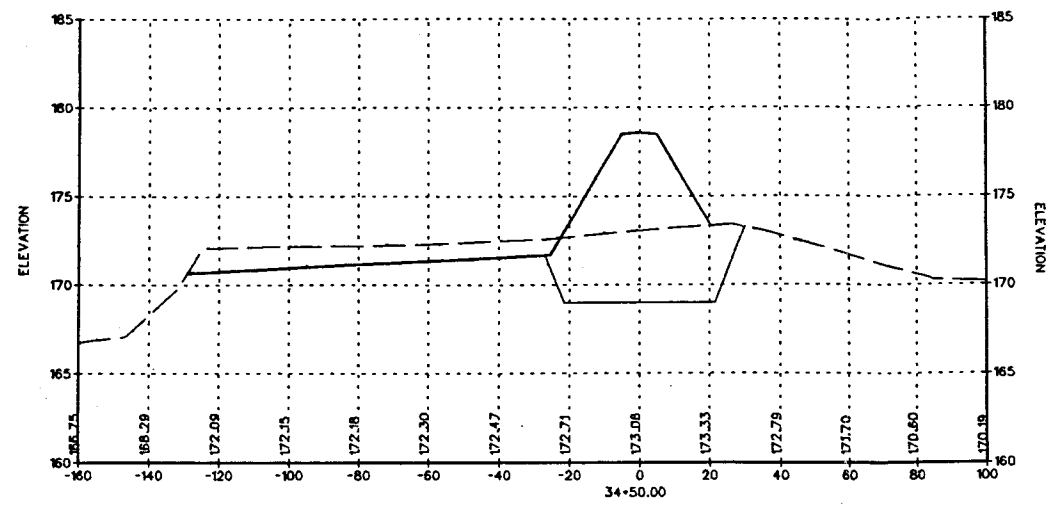
CROSS SECTIONS -LEVEE

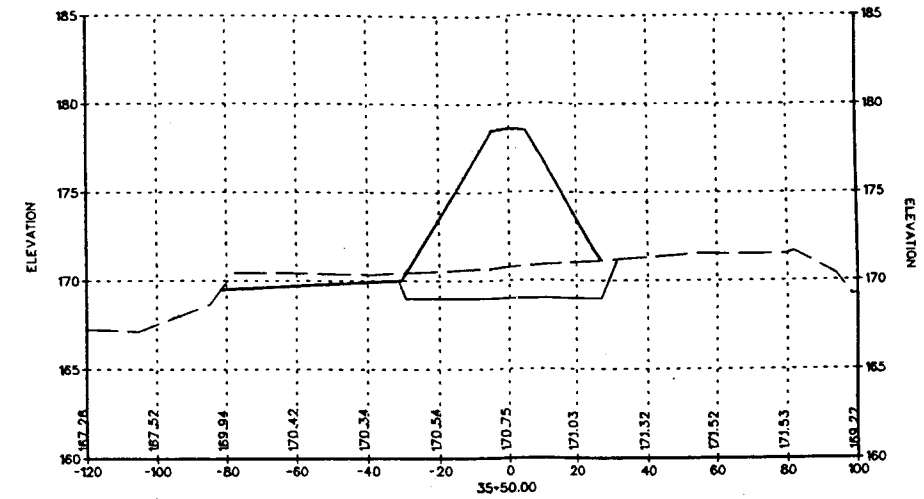
STA. 31+00 TO 33+00

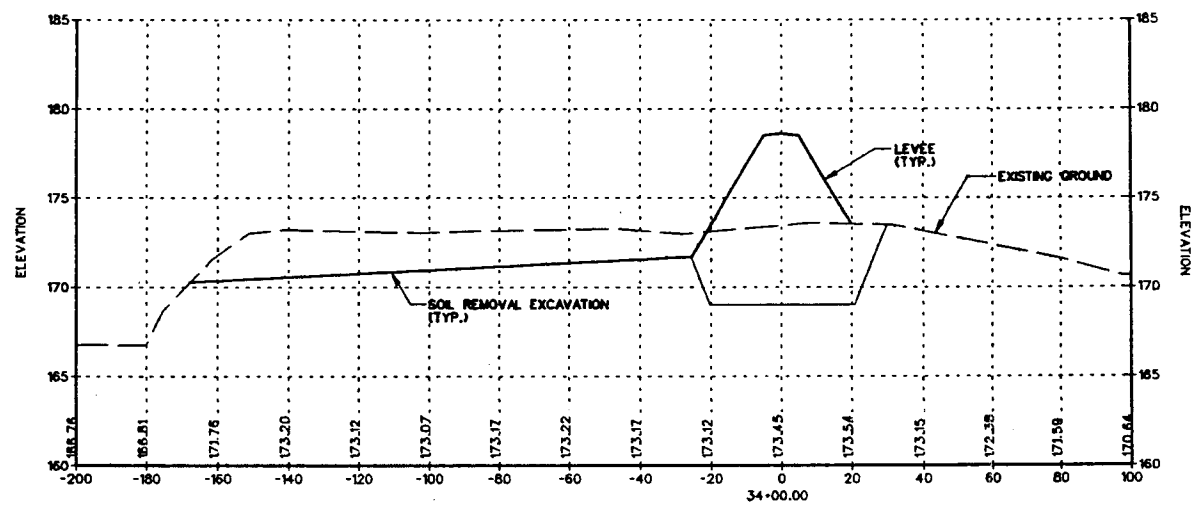
REVISED

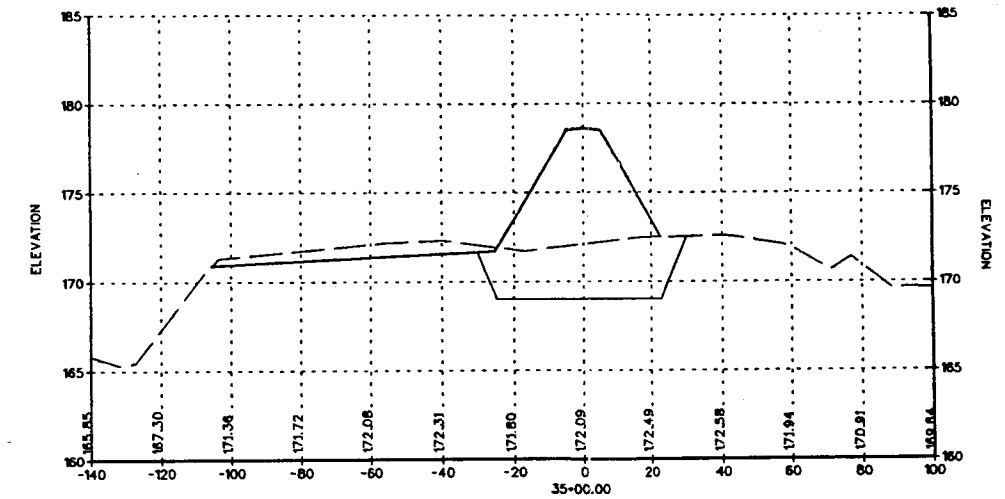
DATED 30 JUNE 1988 | PREPARED BY : WALLINGFORD DISTRICT

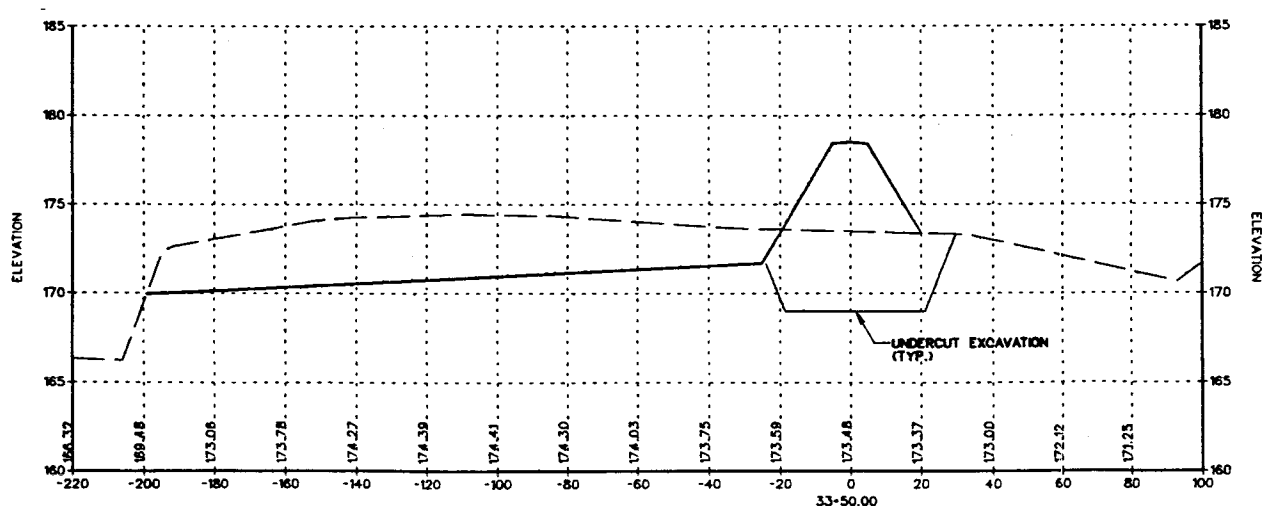
PAS10XS.DGN | PLATE NO. J-023









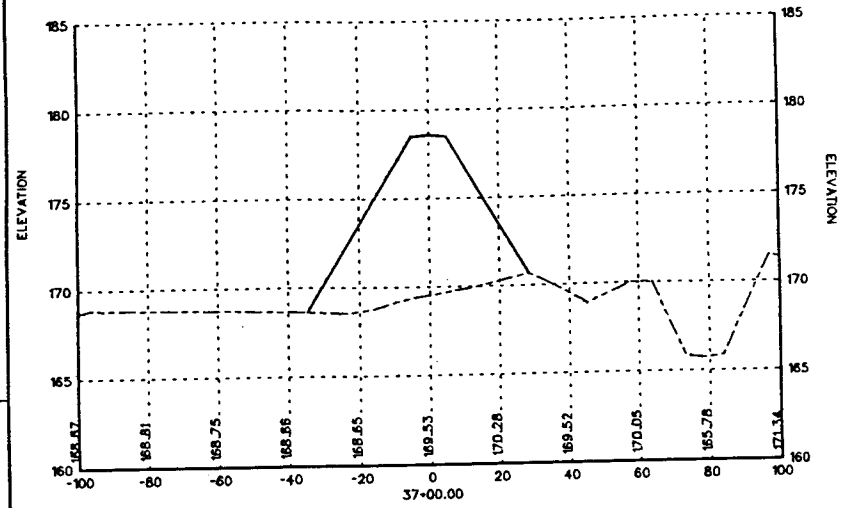


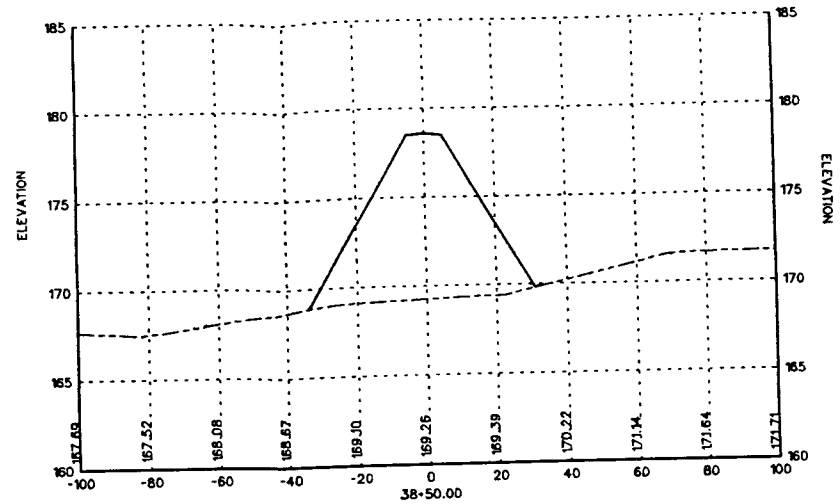
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS
US Army Corps of Engineers
Passaic River Flood Damage Reduction Project

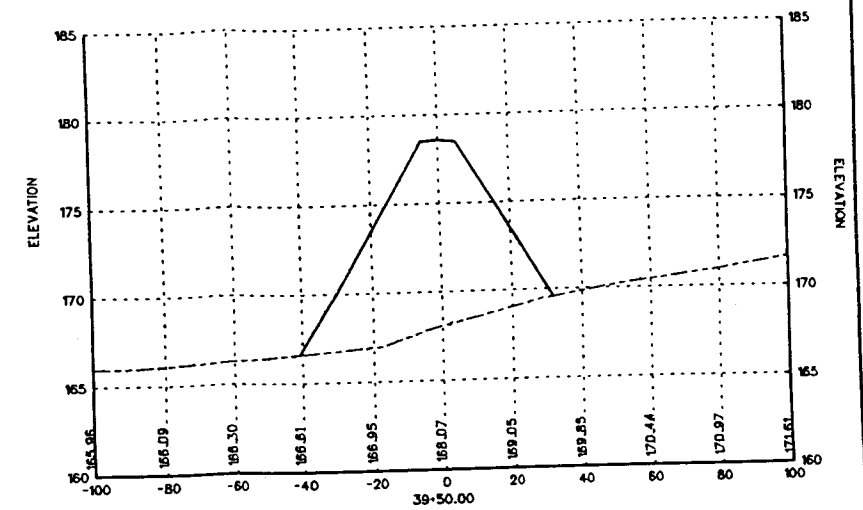
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE

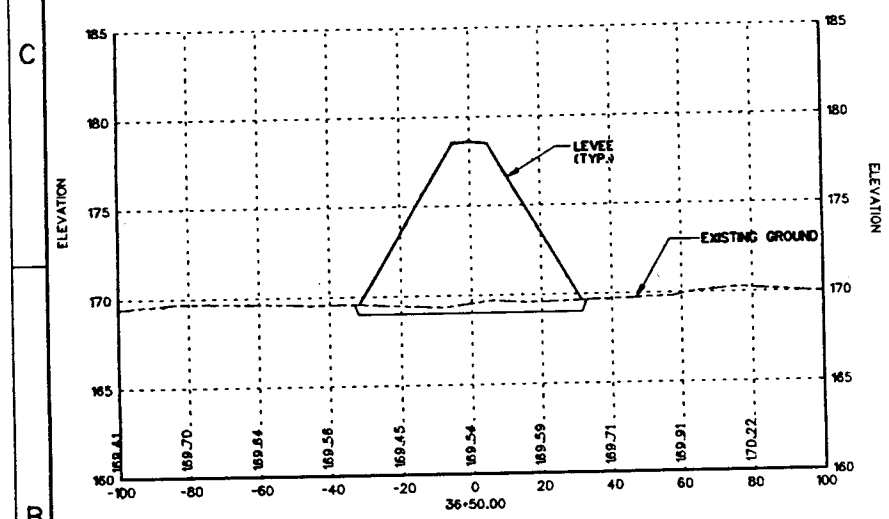
REVISED:
DATE: 30 JUNE 1988 PREPARED BY WILMINGTON DISTRICT

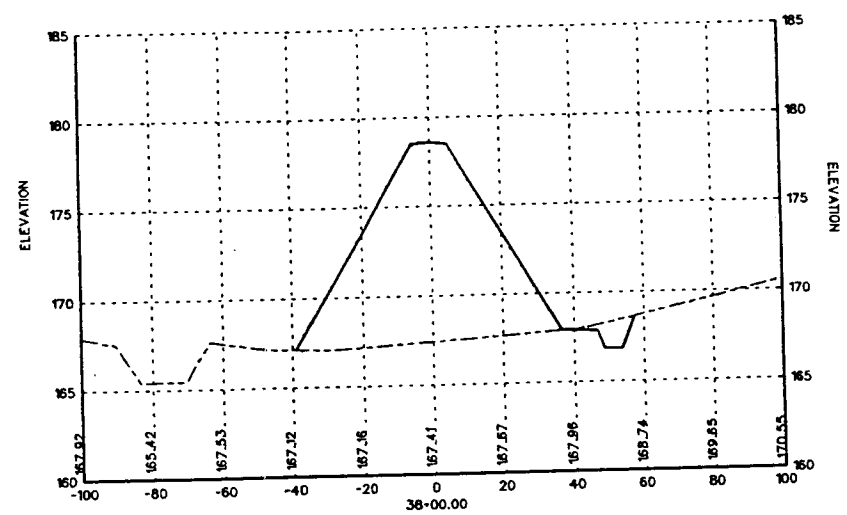
PAS10XS.DGN | PLATE NO. J-024

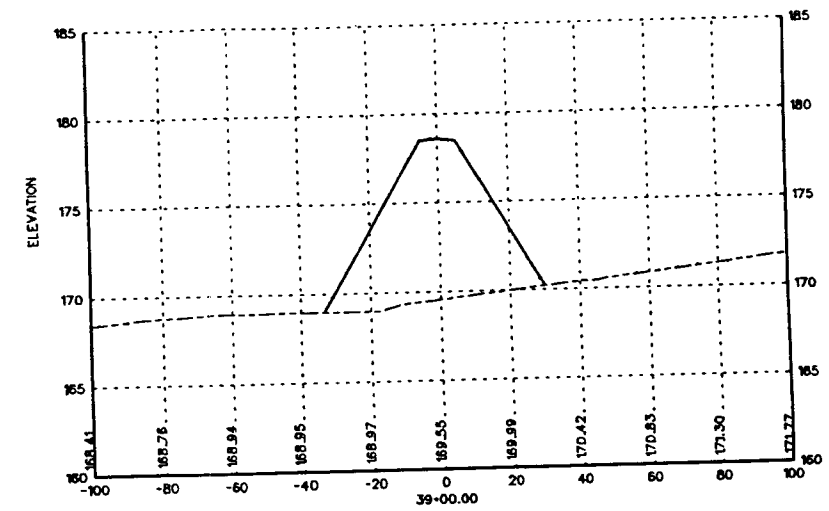


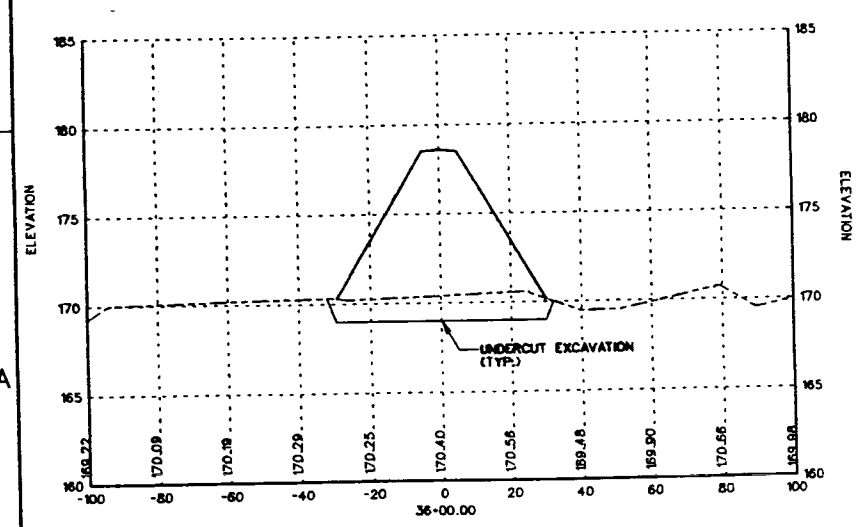


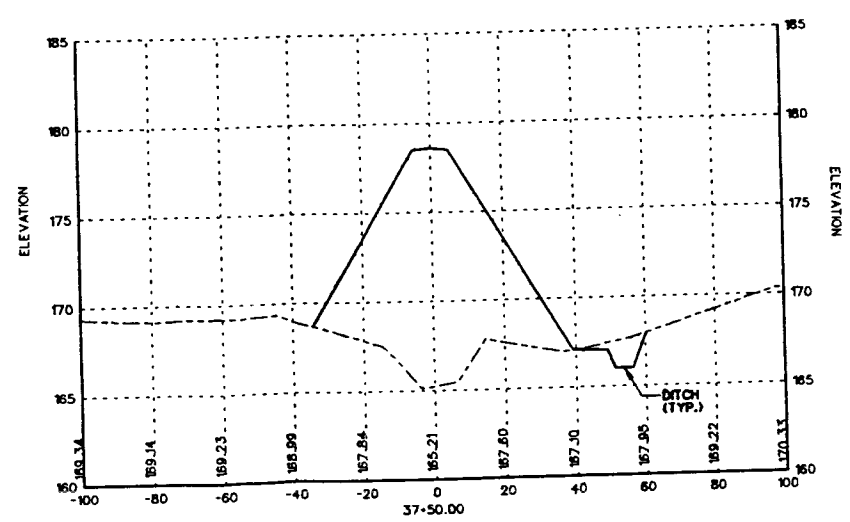












U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS
US Army Corps of Engineers

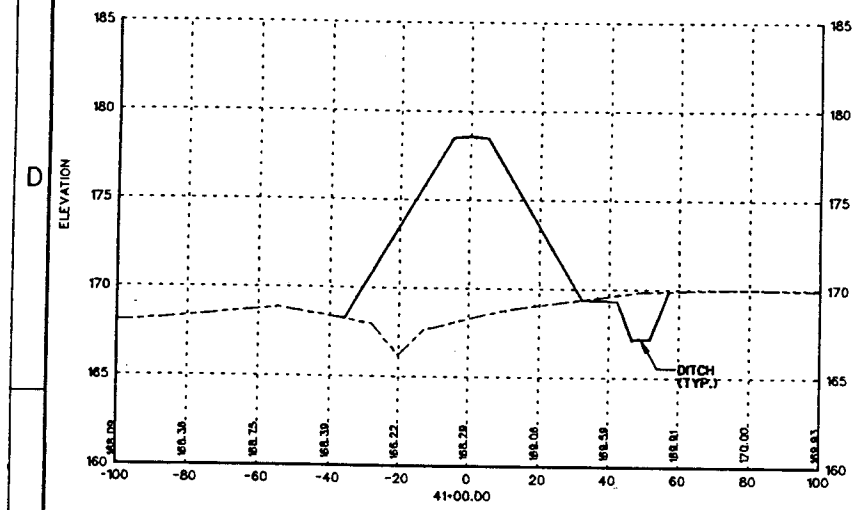
Passaic River Flood Damage Reduction Project

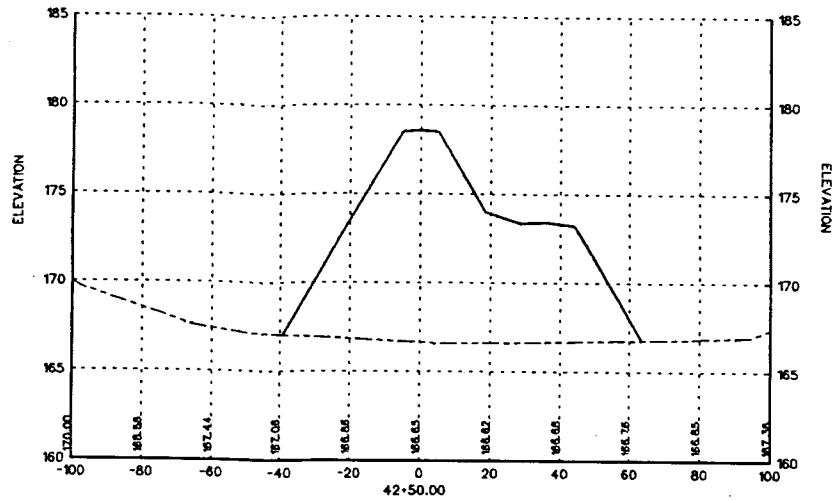
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS -LEVEE
STA. 36+00 TO 39+50

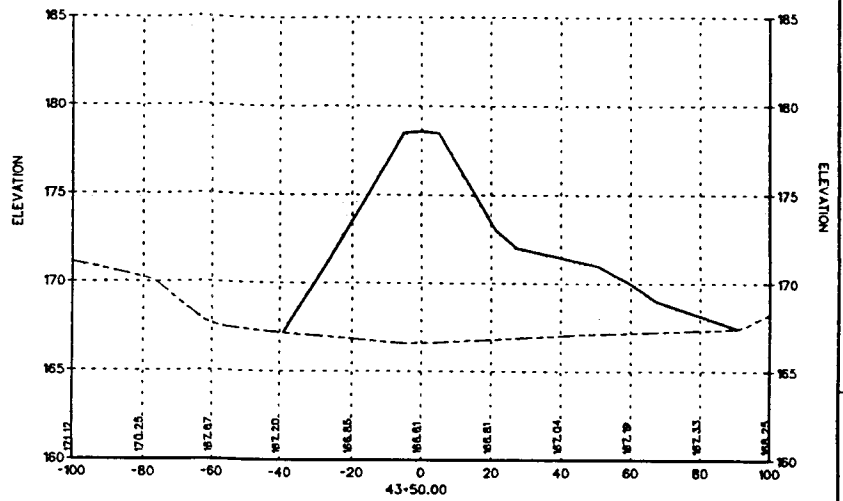
REVISED

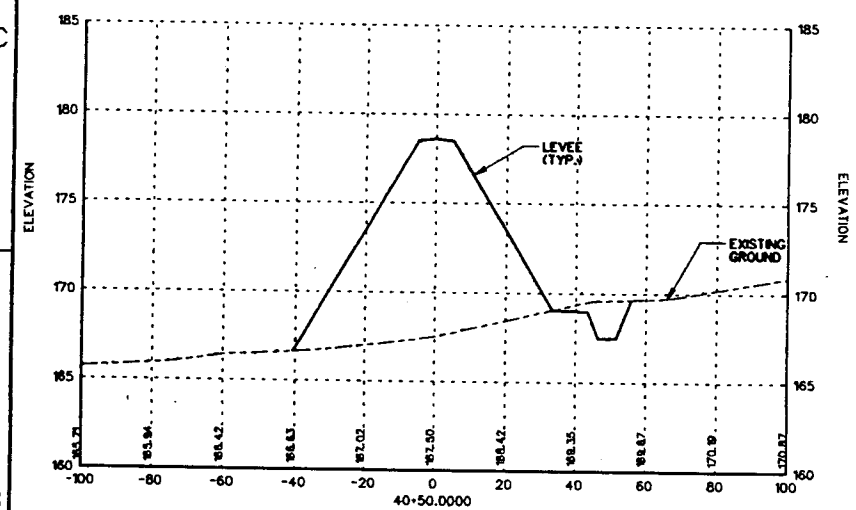
DATED 30 JUNE 1995 | PREPARED BY WILMINGTON DISTRICT

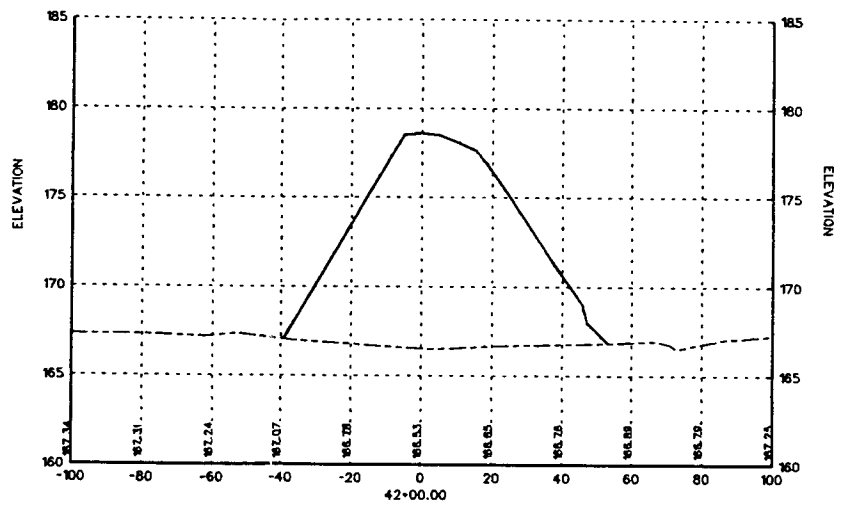
PAS10XS.DGN | PLATE NO. J-025

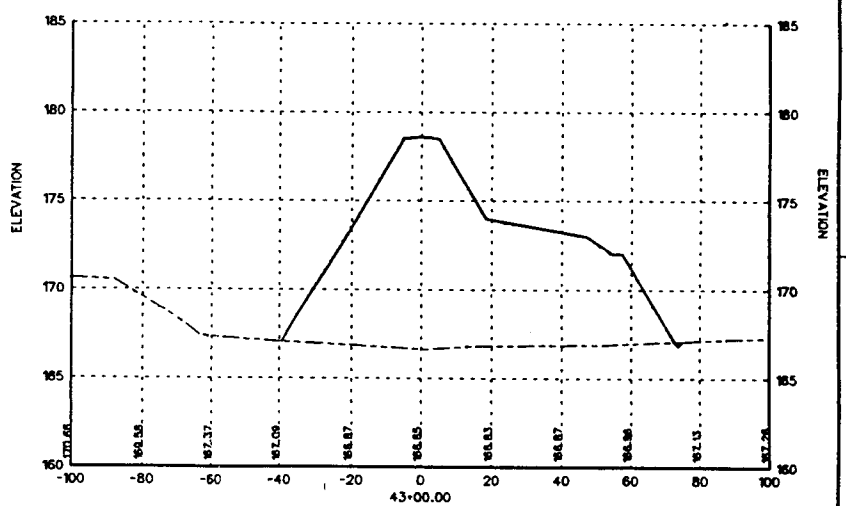


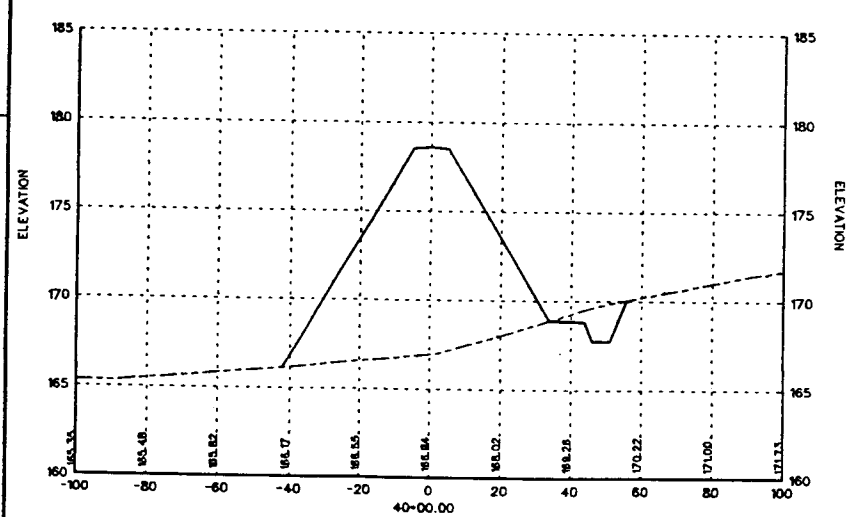


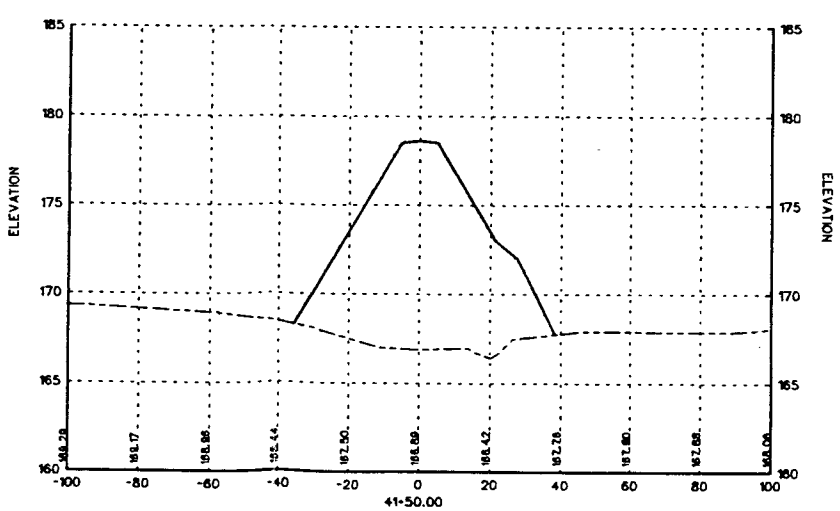












U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

US Army Corps of Engineers

Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM

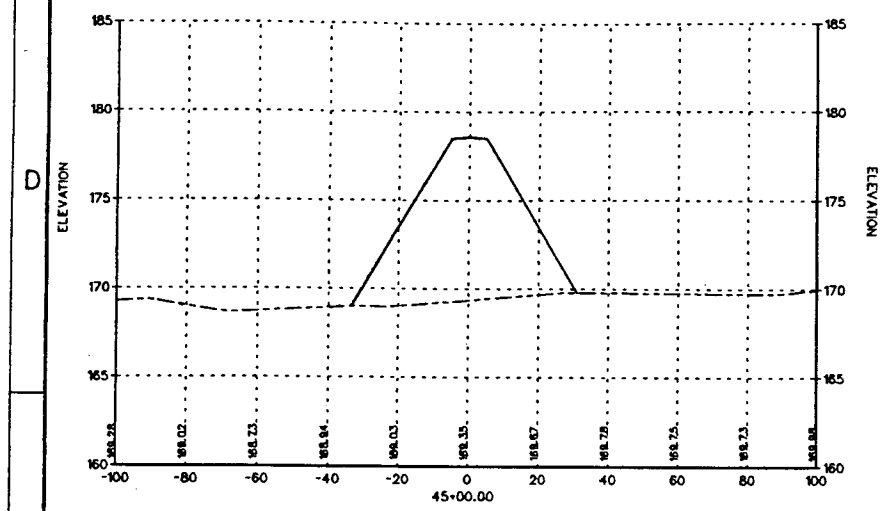
CROSS SECTIONS -LEVEE

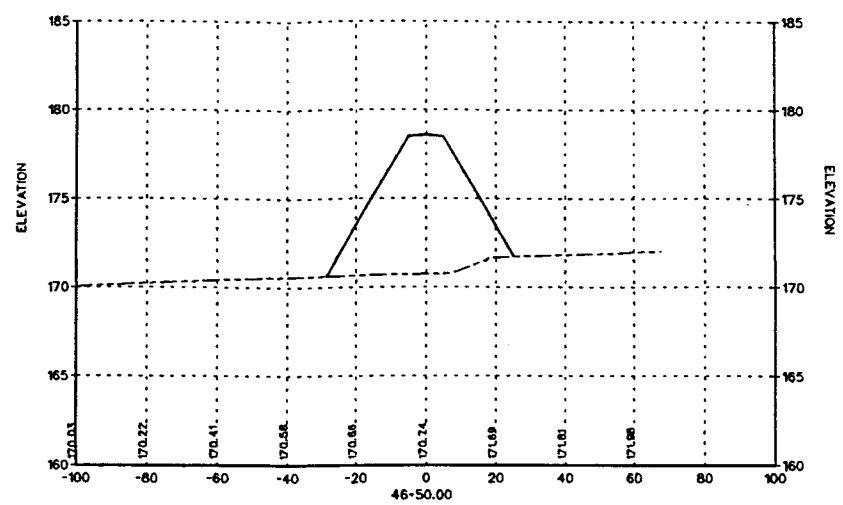
STA. 40+00 TO 43+50

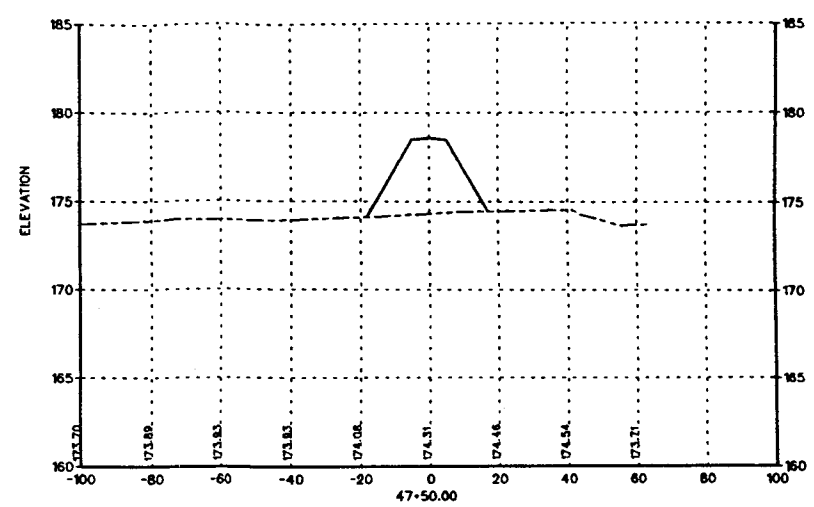
REVISED

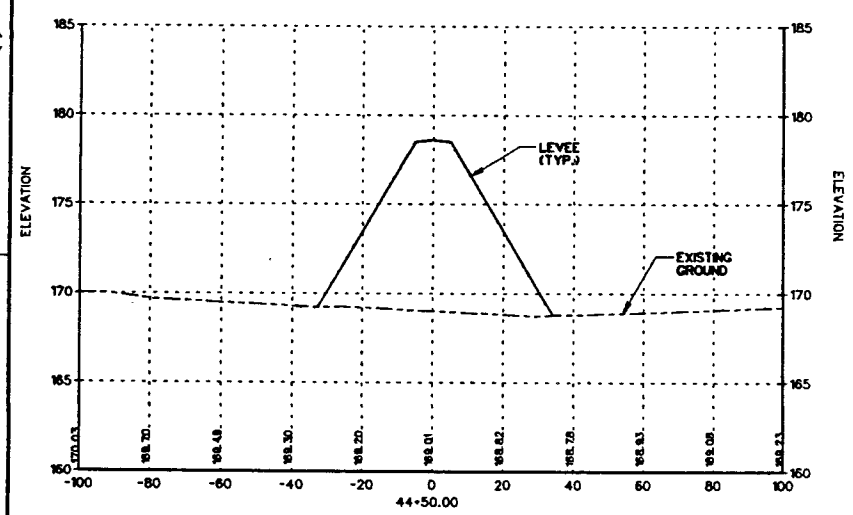
DATED 30 JUNE 1986 | PREPARED BY WASHINGTON DISTRICT

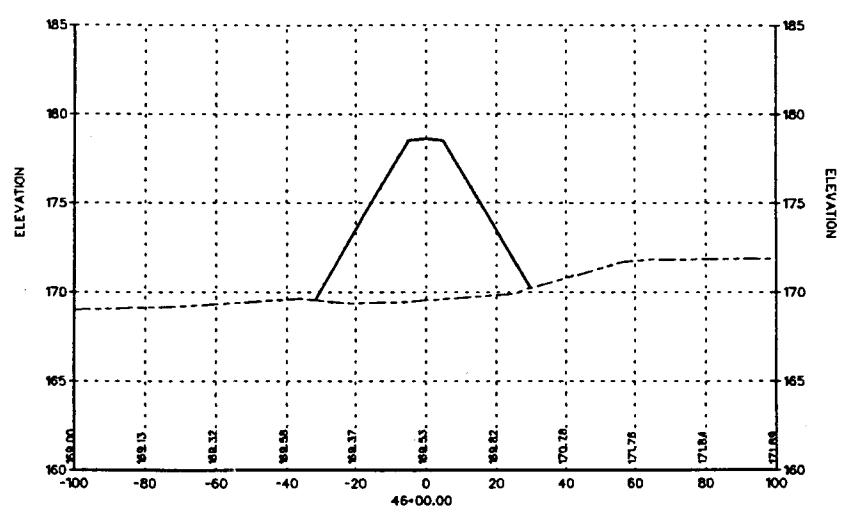
PAS10XS.DGN | PLATE NO. J-026

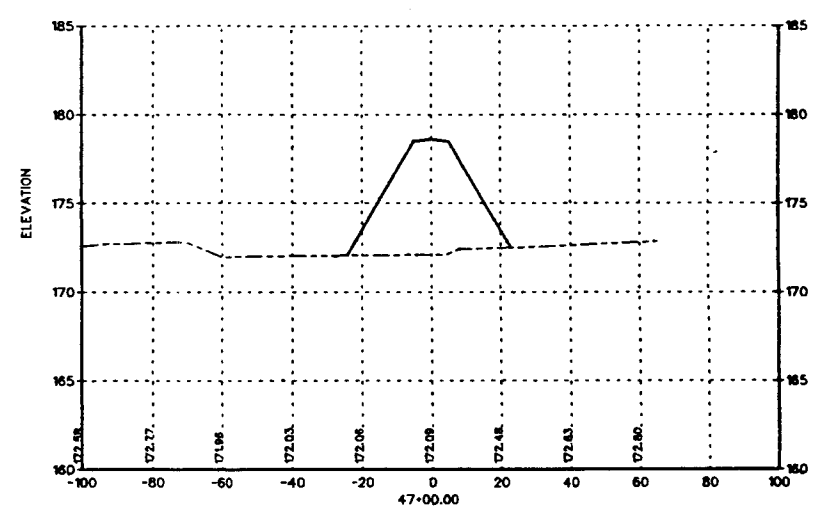


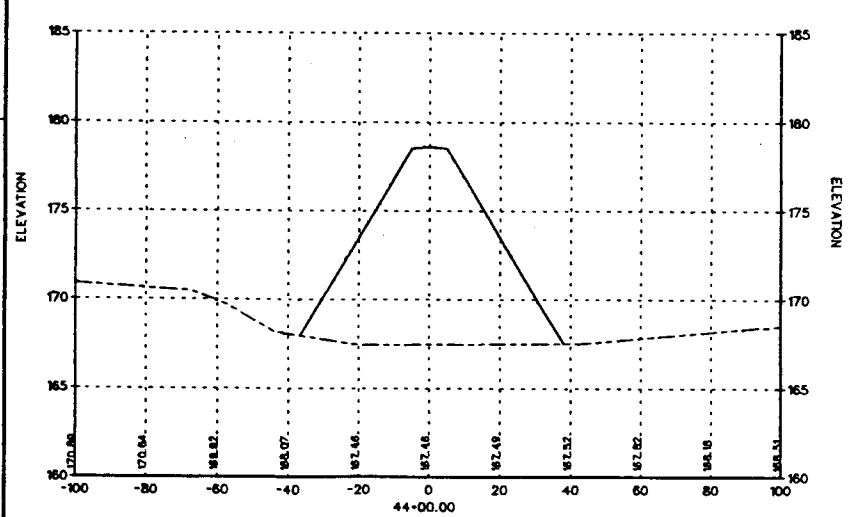


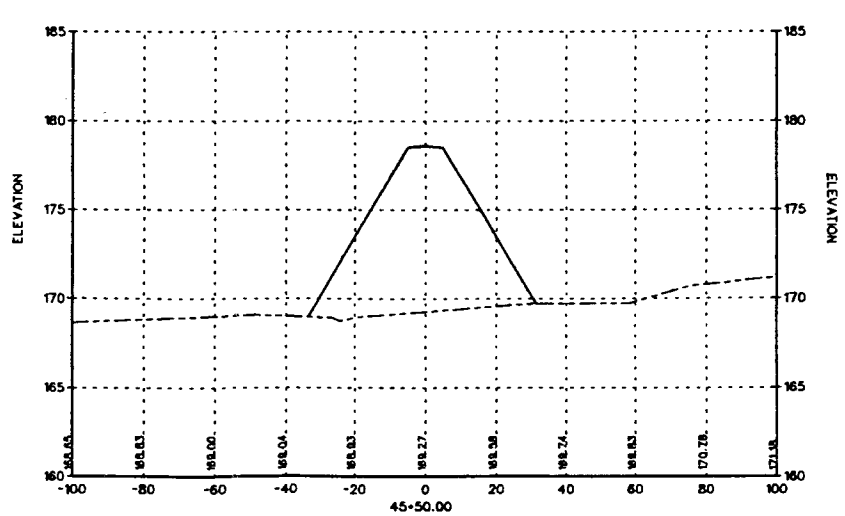












US Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM

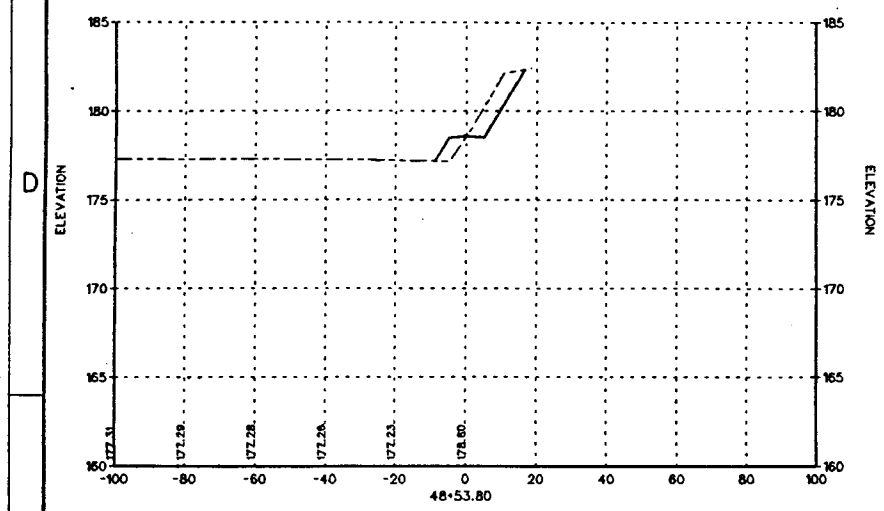
CROSS SECTIONS -LEVEE

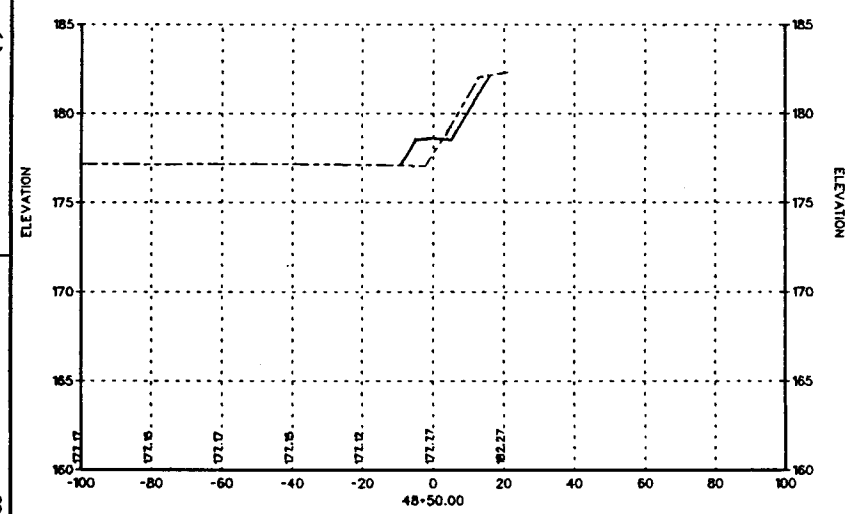
STA. 44+00 TO 47+50

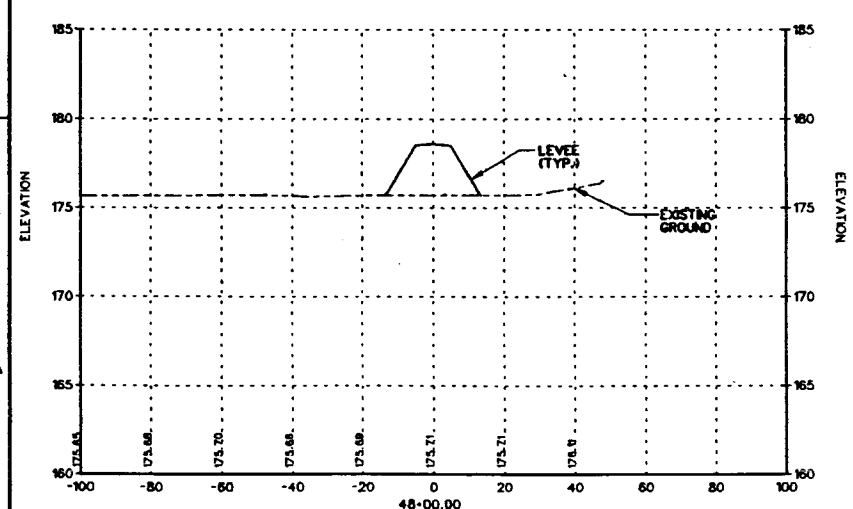
REVISED

DATE: 30 JUNE 1995 | PREPARED BY: NEW YORK DISTRICT

PASXSXS.DGN | PLATE NO. J-027







U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

US Army Corps of Engineers

Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM

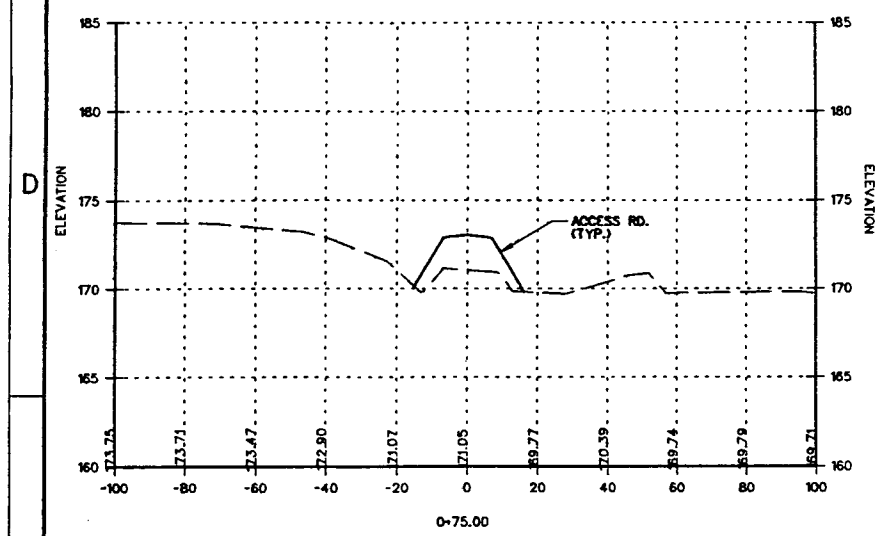
CROSS SECTIONS -LEVEE

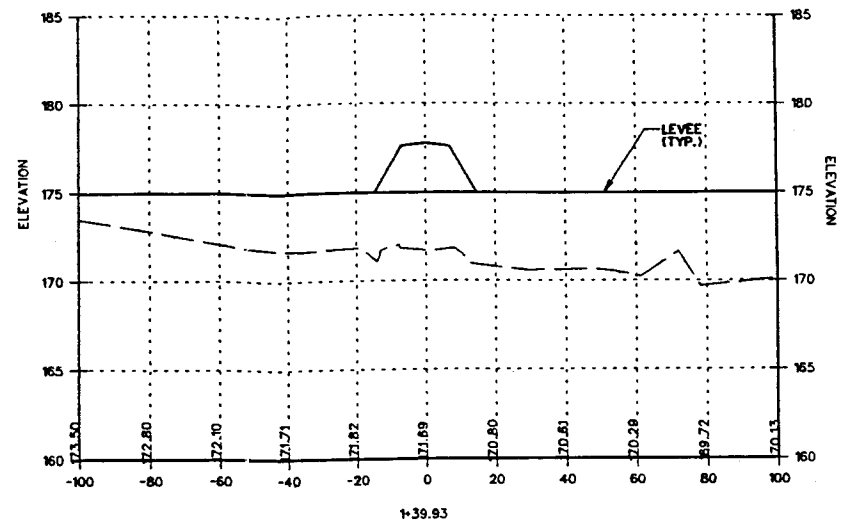
STA. 48+00 TO 48+53.80

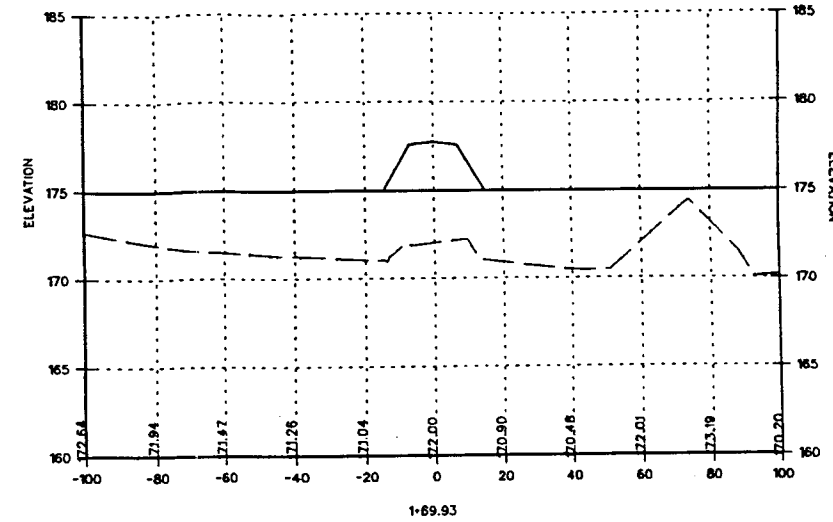
REVISED

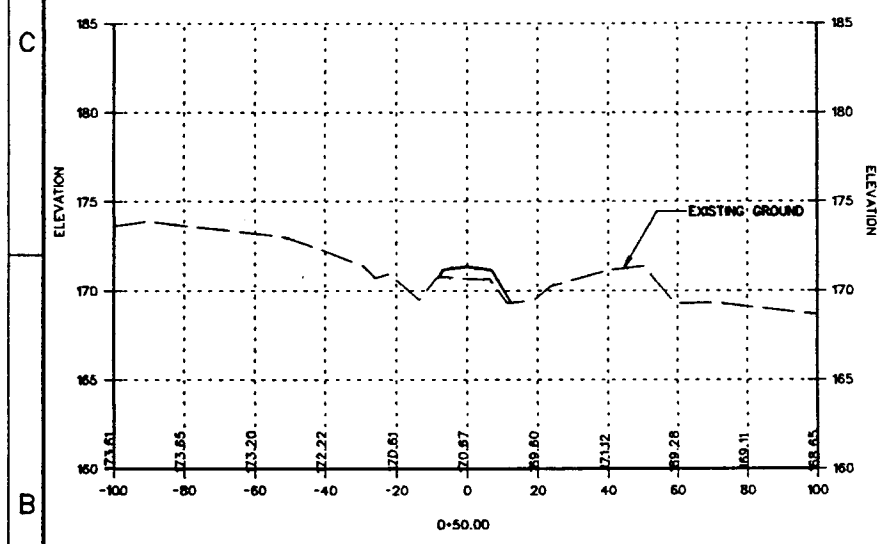
DATE: 30 JUNE 1995 | PREPARED BY : WILMINGTON DISTRICT

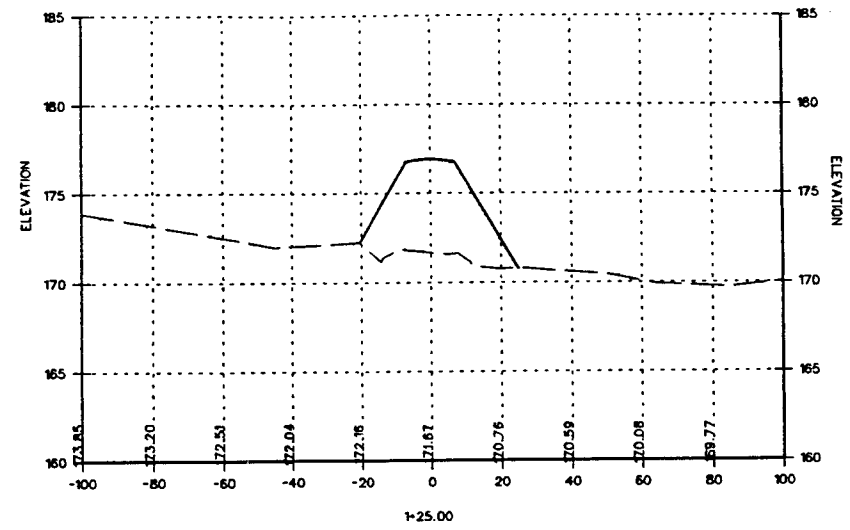
PAS10XS.DGN | PLATE NO. J-028

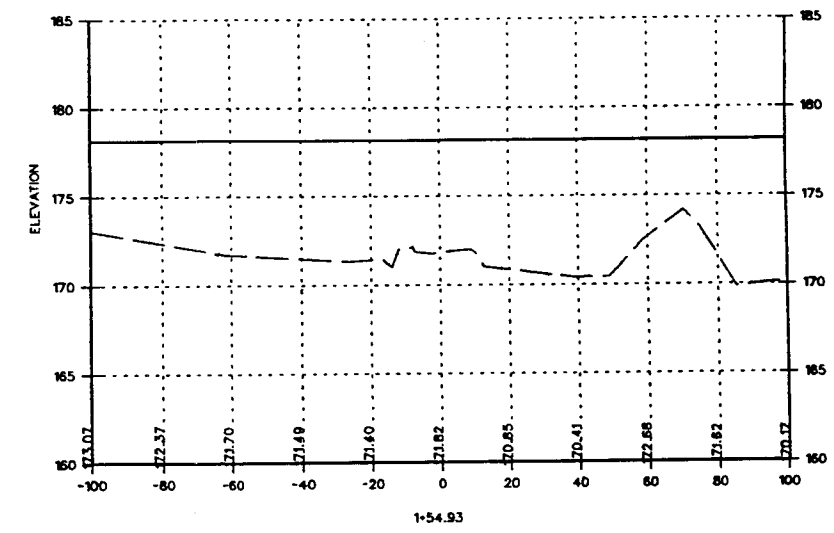


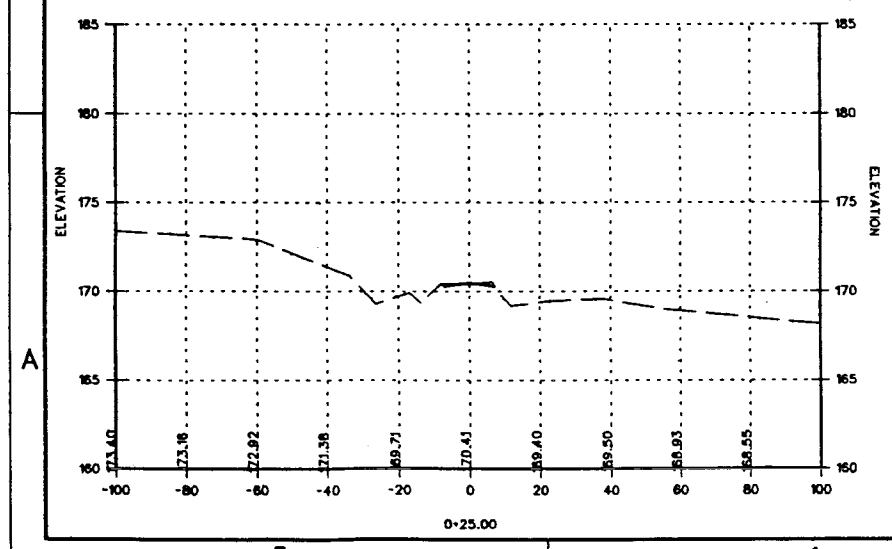


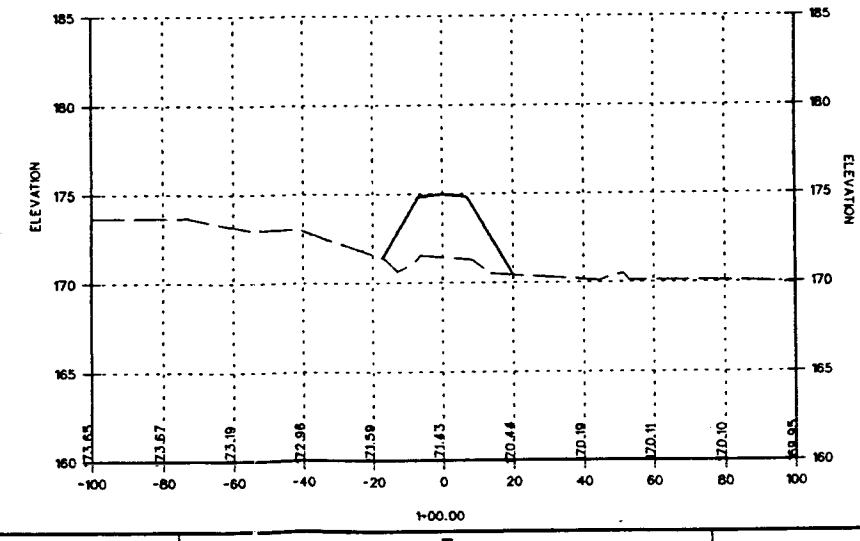












US Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

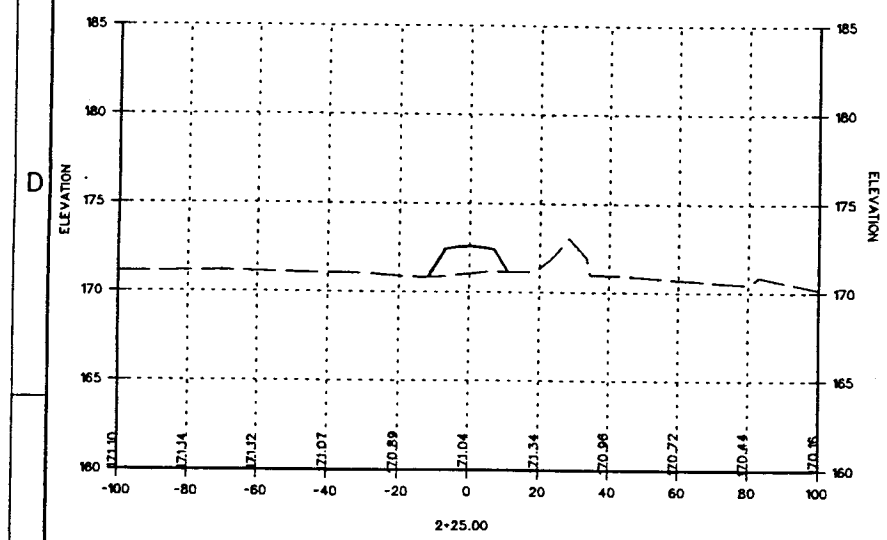
Passaic River Flood Damage Reduction Project

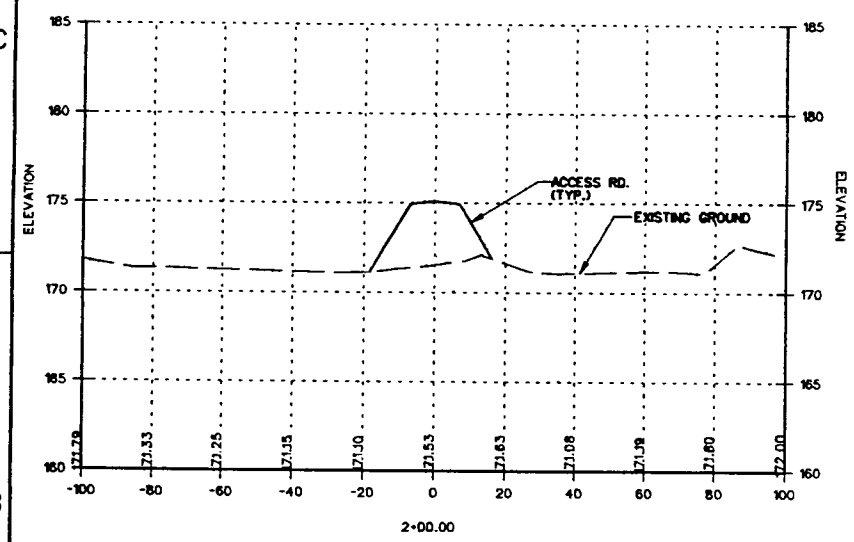
FEATURE DESIGN MEMORANDUM
CROSS SECTIONS
ROAD CROSSOVER
STA. 0+25 TO 1+69.93

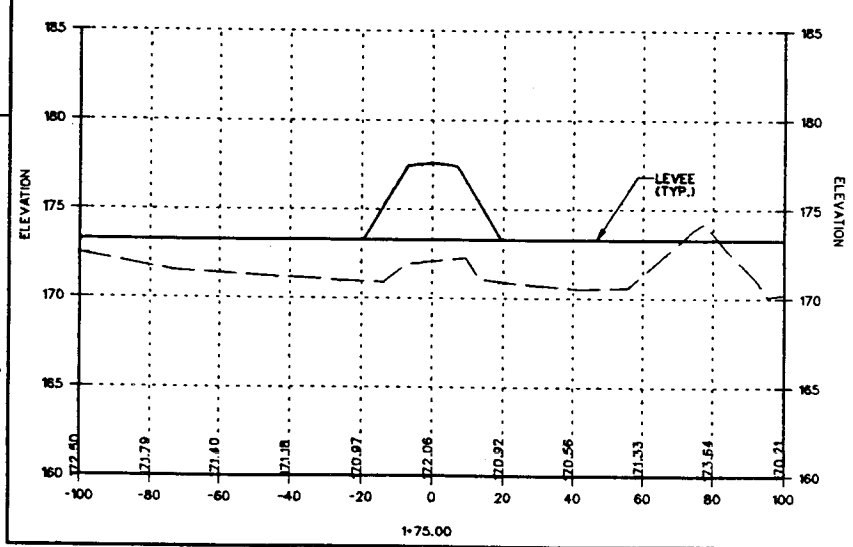
REVISED:

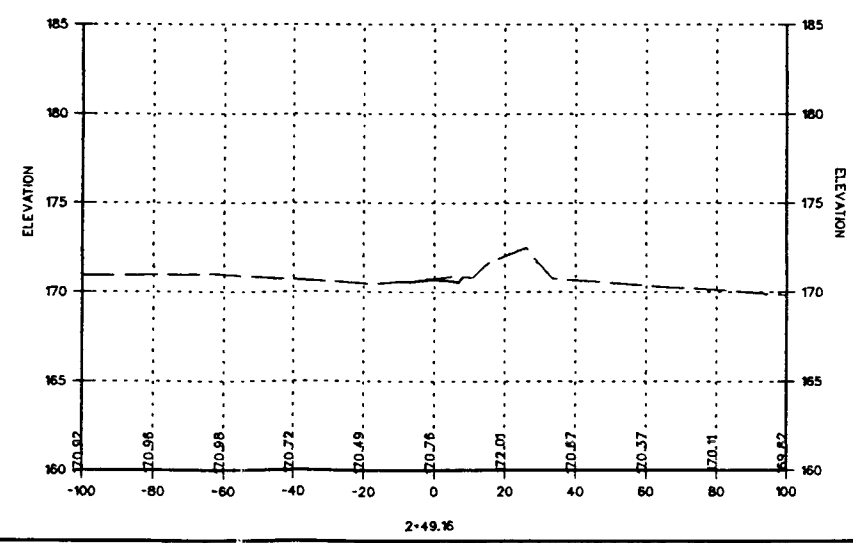
DATE: 30 JUNE 1995 PREPARED BY: WILMINGTON DISTRICT

PAS10XS.DGN | PLATE NO. J-029









U.S. Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

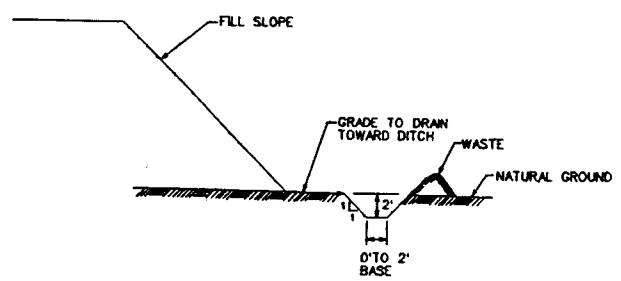
Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM
CROSS SECTIONS
ROAD CROSSOVER
STA. 1+75 TO 2+49.16

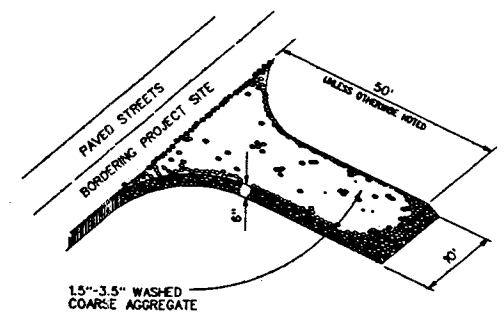
REVISION

DATE: 20 JUNE 1995 PREPARED BY: WILMINGTON DISTRICT

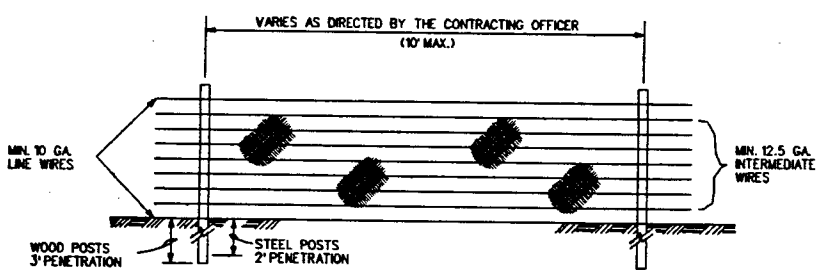
PASXXS.DGN | PLATE NO. J-030



1 / J-031 TEMPORARY SILT DITCH (TSD)
NTS



3 / J-031 CRUSHED STONE CONSTRUCTION ENTRANCE/EXIT
NOT TO SCALE



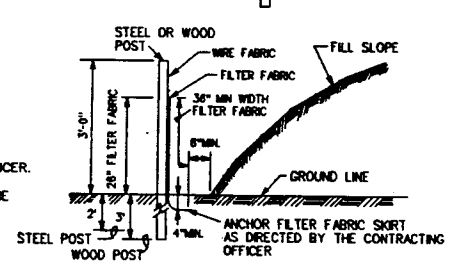
NOTES:

1.FENCE FABRIC SHALL BE A MINIMUM OF 32" IN WIDTH AND SHALL HAVE A MINIMUM OF 6 LINE WIRES WITH 12" STAY SPACING.

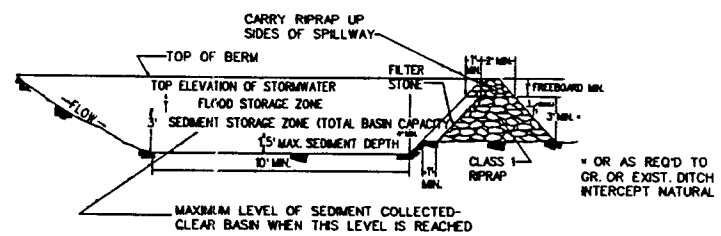
2.FILTER FABRIC SHALL HAVE A MINIMUM OF 36" WIDTH. FILTER FABRIC SHALL BE FASTENED ADEQUATELY TO THE FENCE FABRIC AS DIRECTED BY THE CONTRACTING OFFICER.

3.STEEL POSTS SHALL BE 5 FEET IN HEIGHT AND BE OF THE SELF-FASTENER ANGLE STEEL TYPE.

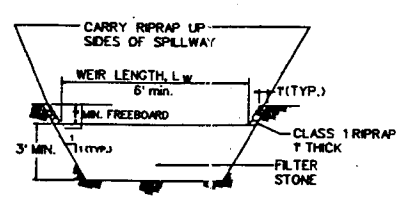
4.WOOD POSTS SHALL BE 6 FEET IN HEIGHT AND 3 TO 4 INCHES IN DIAMETER. WIRE FABRIC SHALL BE FASTENED TO WOODEN POSTS WITH NOT LESS THAN No. 9 WIRE STAPLES 1½ INCHES LONG.



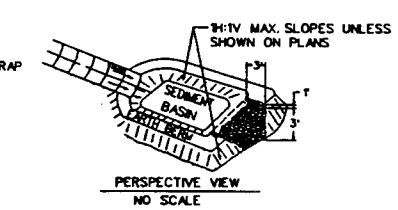
2 / J-031 DETAIL OF TEMPORARY SILT FENCE (TSF)
NTS



SECTION THRU BASIN & FILTER NO SCALE



SECTION THRU BERM & FILTER
NO SCALE



PERSPECTIVE VIEW
NO SCALE

NOTES:

1. THE CONTRACTOR SHALL BE REQUIRED TO CONSTRUCT SEDIMENT BASINS WITH THE GRAVEL & RIPRAP FILTER AT GENERAL LOCATIONS AS DIRECTED BY THE C.O.R. TO CONTAIN SEDIMENT RUNOFF FROM CONSTRUCTION OPERATIONS.
2. THE CONTRACTOR SHALL CONSTRUCT THE GRAVEL FILTER BASINS TO A SIZE SUFFUCIENT TO CONTAIN VOLUMES OF SEDIMENT RUNOFF FOR EACH SITE.
3. THE CONTRACTOR SHALL BE REQUIRED TO CLEAN OUT THE GRAVEL FILTER BASINS BEFORE THE SEDIMENT ACCUMULATES TO THE MAXIMUM SEDIMENT STORAGE LEVEL AS SHOWN ABOVE.
4. SEE GENERAL NOTES 1& 2 FOR CLASS IRIP RAP AND FILTER STONE GRADATIONS.

4 / J-031 GRAVEL FILTER BASIN (GFB)
NTS

GENERAL NOTES:

1. STONE FOR CLASS IRIP RAP SHALL VARY IN WEIGHT FROM 5 TO 200 POUNDS. AT LEAST 30 PERCENT OF THE TOTAL WEIGHT OF THE RIP RAP SHALL BE IN INDIVIDUAL PIECES WEIGHING A MINIMUM OF 60 POUNDS EACH. NOT MORE THAN 10 PERCENT OF THE TOTAL WEIGHT OF THE RIPRAP MAY BE IN IDIVIDUAL PIECES WEIGHING 15 POUNDS EACH.
2. THE FILTER STONE FOR THE GRAVEL FILTER BASIN SHALL HAVE THE FOLLOWING GRADATION:

SIEVE SIZE	PERCENTAGE OF TOTAL BY WEIGHT PASSING
1½"	100
1"	90-100
¾"	20-55
½"	0-10
⅜"	0-5

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS
US Army Corps of Engineers

Passaic River Flood Damage Reduction Project

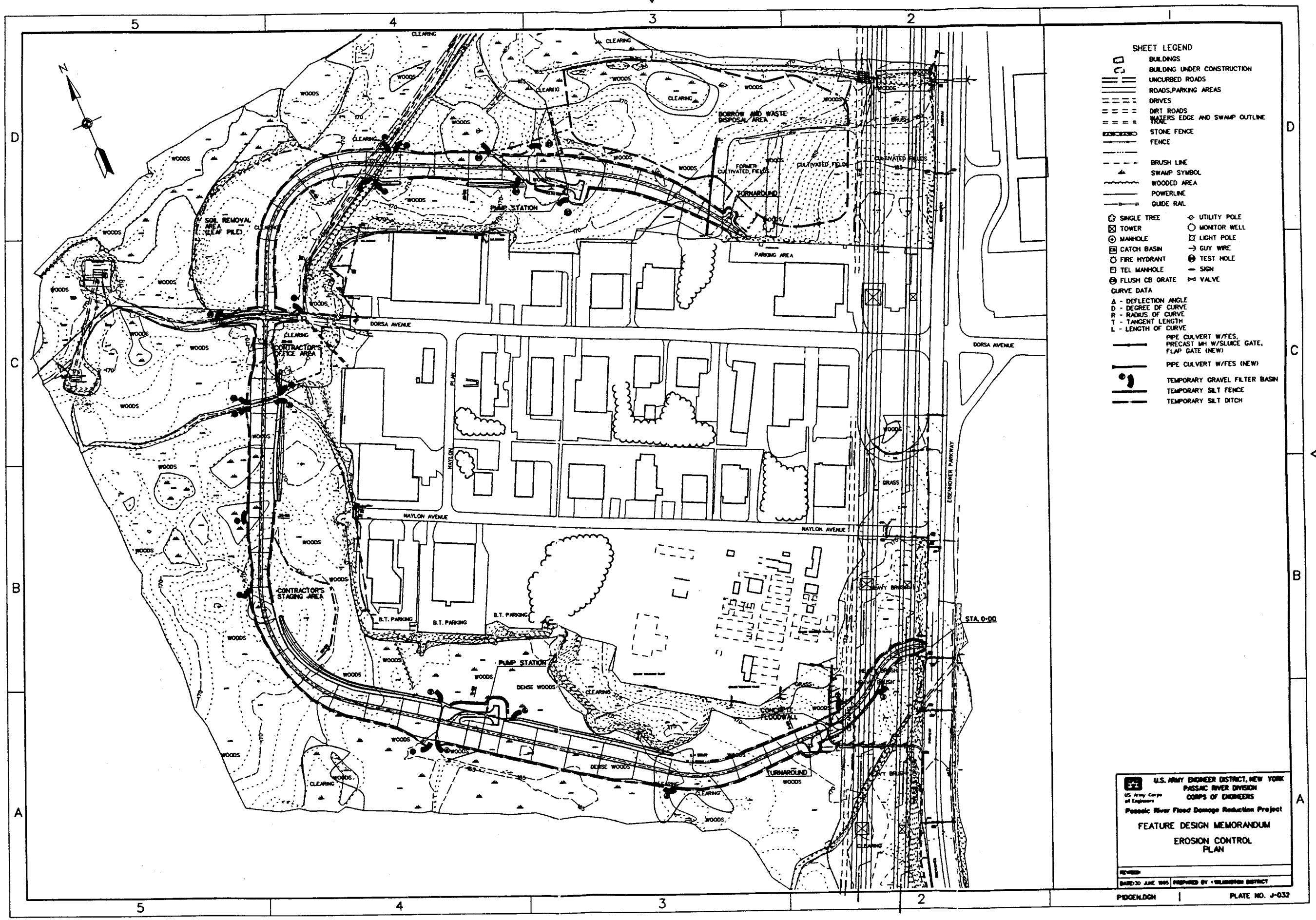
FEATURE DESIGN MEMORANDUM

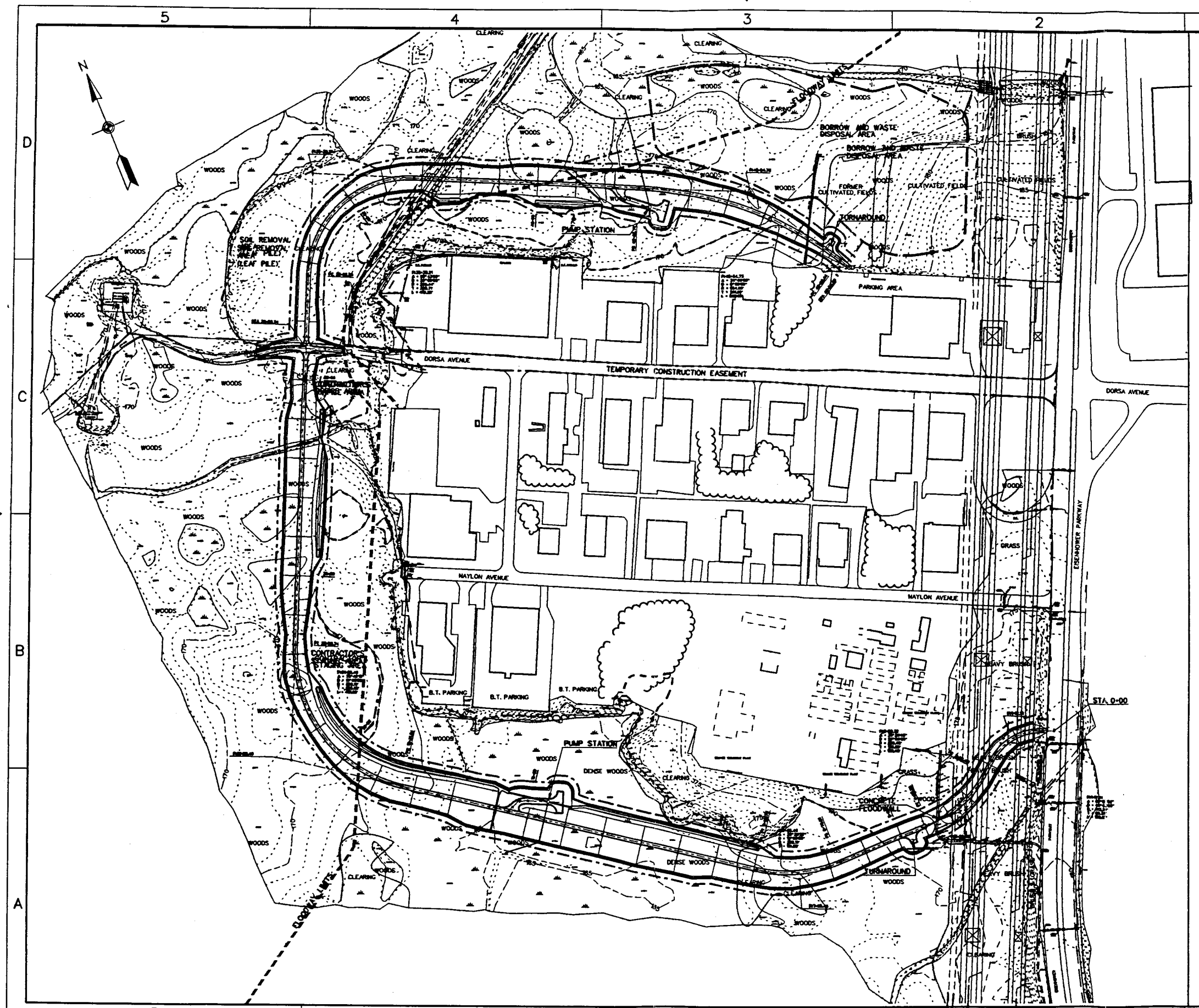
TEMPORARY EROSION CONTROL DETAILS

REVISED

DATED 30 JUNE 1990 | PREPARED BY WILMINGTON DISTRICT

P10ECRD.DGN | PLATE NO. J-031


SHEET LEGEND
BUILDINGS
BUILDING UNDER CONSTRUCTION
UNCURBED ROADS
ROADS, PARKING AREAS
DRIVES
DIRT ROADS
WATERS EDGE AND SWAMP OUTLINE
TRAIL
STONE FENCE
FENCE
BRUSH LINE
SWAMP SYMBOL
WOODED AREA
POWERLINE
GUIDE RAIL
SINGLE TREE
UTILITY POLE
TOWER
MONITOR WELL
MANHOLE
LIGHT POLE
CATCH BASIN
GUY WIRE
FIRE HYDRANT
TEST HOLE
TEL MANHOLE
SIGN
FLUSH CB GRATE
VALVE
CURVE DATA
Δ - DEFLECTION ANGLE
D - DEGREE OF CURVE
R - RADIUS OF CURVE
T - TANGENT LENGTH
L - LENGTH OF CURVE
PIPE, CULVERT W/FES, PRECAST MH W/SLUICE GATE, FLAP GATE (NEW)
PIPE CULVERT W/FES (NEW)
TEMPORARY GRAVEL FILTER BASIN
TEMPORARY SILT FENCE
TEMPORARY SILT DITCH
N
BORROW AND WASTE DISPOSAL AREA
FORMER CULTIVATED FIELDS
CULTIVATED FIELDS
TURNAROUND
PUMP STATION
PARKING AREA
SOIL REMOVAL AREA (LEAF PILE)
CONTRACTOR'S OFFICE AREA
CONTRACTOR'S STAGING AREA
DORSA AVENUE
MAYLON AVENUE
EISENHOWER PARKWAY
B.T. PARKING
DENSE WOODS
CONCRETE FLOODWALL
HEAVY BRUSH
STA. 0+00
WOODS
CLEARING
GRASS
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS
US Army Corps of Engineers
Passaic River Flood Damage Reduction Project
FEATURE DESIGN MEMORANDUM
EROSION CONTROL PLAN
REVISED
DATED: 30 JUNE 1995
PREPARED BY WILMINGTON DISTRICT
P1DGENLDGN
PLATE NO. J-032



SHEET LEGEND

- BUILDINGS
- BUILDING UNDER CONSTRUCTION
- UNCURBED ROADS
- ROADS, PARKING AREAS
- DRIVES
- DIRT ROADS
- WATERS EDGE AND SWAMP OUTLINE
- STONE FENCE
- FENCE
- BRUSH LINE
- SWAMP SYMBOL
- WOODED AREA
- POWERLINE
- GUIDE RAIL

SINGLE TREE	UTILITY POLE
TOWER	MONITOR WELL
MANHOLE	LIGHT POLE
CATCH BASIN	GUY WIRE
FIRE HYDRANT	TEST HOLE
TEL MANHOLE	SIGN
FLUSH CB GRATE	VALVE

CURVE DATA

Δ - DEFLECTION ANGLE
D - DEGREE OF CURVE
R - RADIUS OF CURVE
T - TANGENT LENGTH
L - LENGTH OF CURVE

- PIPE CULVERT W/FES, PRECAST MH W/SLUICE GATE, FLAP GATE (NEW)
- PIPE CULVERT W/FES (NEW)
- PERMANENT CONSTRUCTION EASEMENTS
- TEMPORARY CONSTRUCTION EASEMENTS
- BORROW AREA LIMITS
- FLOODWAY LIMITS (APPROX.)
- INTERIOR STORAGE (ELEV. 170)

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

US Army Corps of Engineers

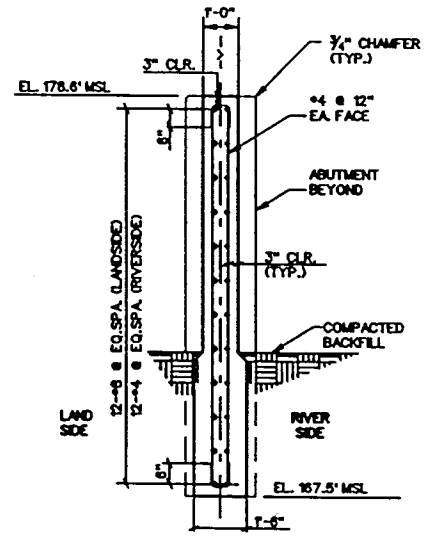
Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM
REAL ESTATE REQUIREMENTS

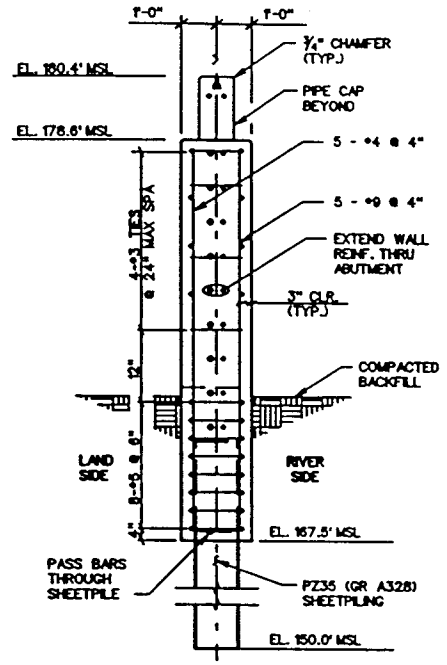
REVISED

DATED 30 JUNE 1995 | PREPARED BY WASHINGTON DISTRICT

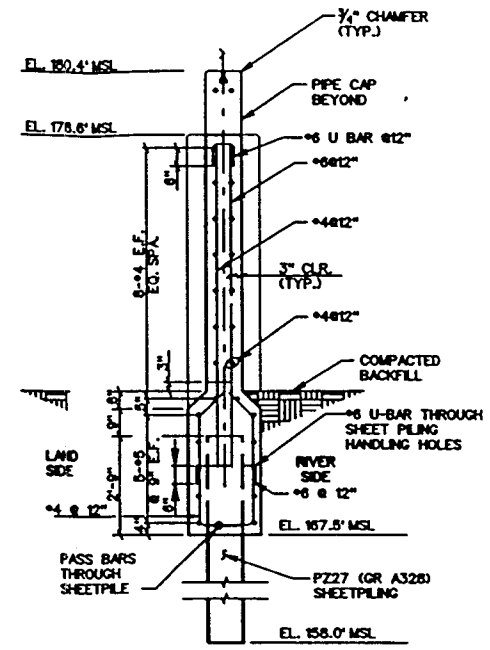
P10GENLDGN 1 PLATE NO. J-033



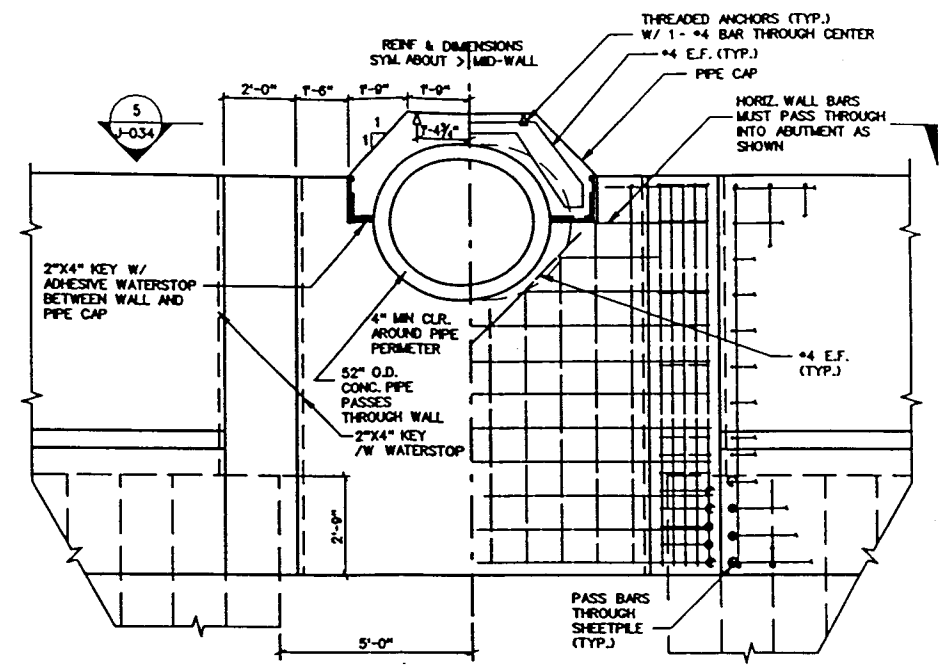
2 J-034 SECTION
SCALE: 1/2" = 1'-0"



3 J-034 SECTION
SCALE: 1/2" = 1'-0"



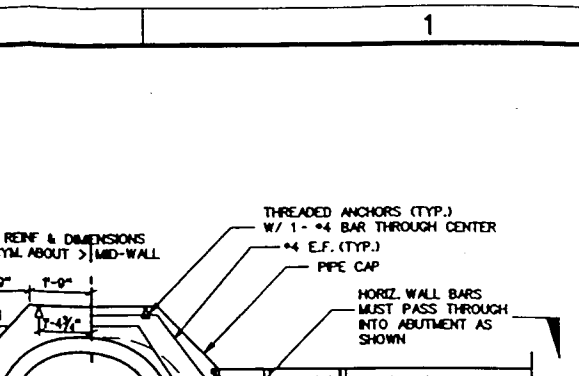
4 J-034 SECTION
SCALE: 1/2" = 1'-0"



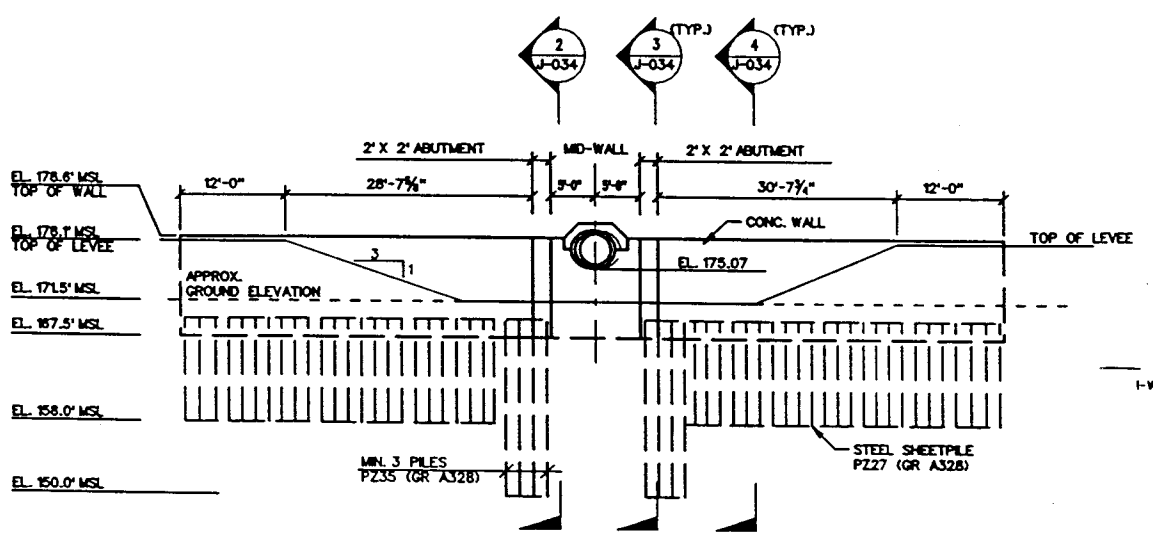
6 J-034 WALL LAYOUT
1/2" = 1'-0"

NOTES:

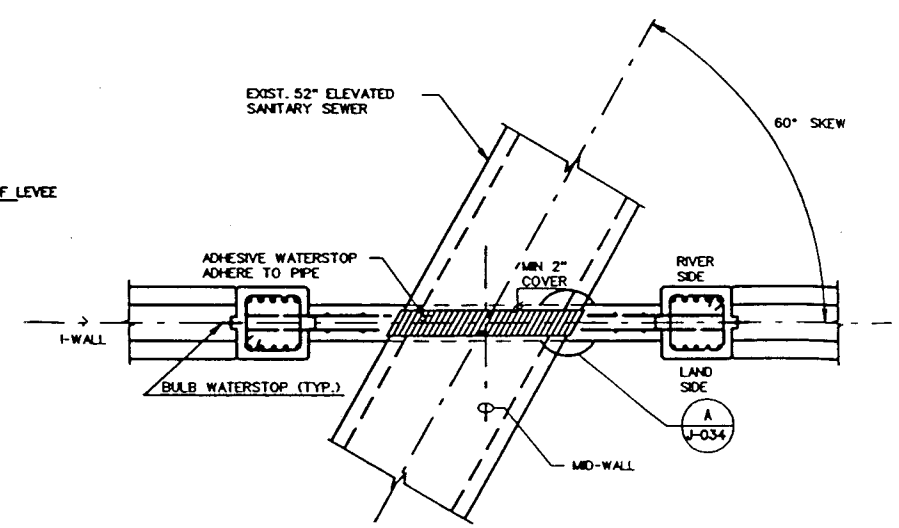
1. CONCRETE COMPRESSIVE STRENGTH fc' = 3000 PSI
2. YIELD STRENGTH OF REINFORCEMENT = 48,000 PSI
3. STEEL SHEET PILE YEILD STRENGTH fy = 38,500 PSI



A J-034 DETAIL
N.T.S.



1 J-034 OVERALL ELEVATION
SCALE: 1/8" = 1'-0"



5 J-034 SECTION
SCALE: 1/2" = 1'-0"

U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

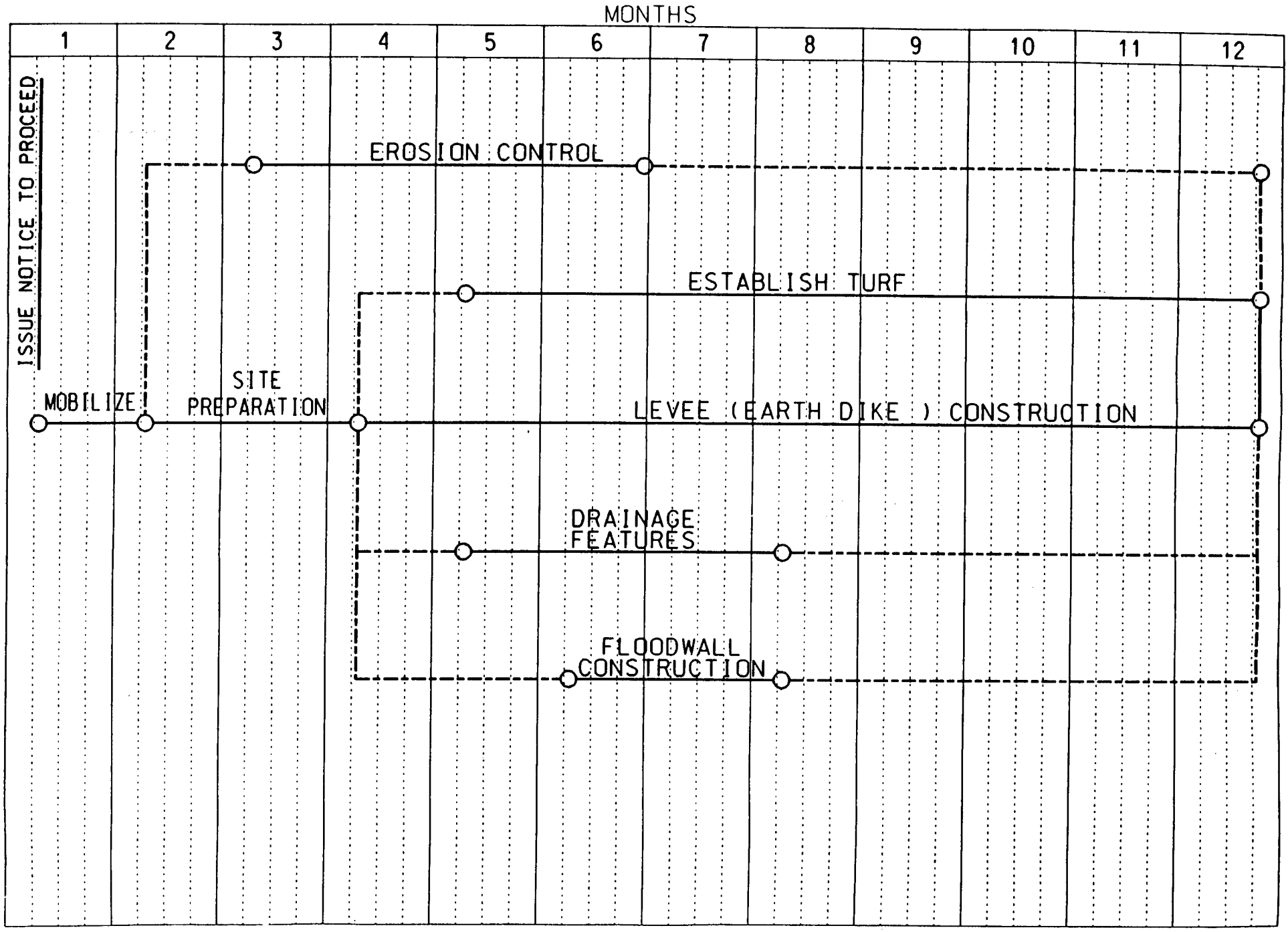
Passaic River Flood Damage Reduction Project

FEATURE DESIGN MEMORANDUM

PASSAIC 10 LEVEE SYSTEM
FLOODWALL
DETAILS

REVISED:

DATE: 12 JANUARY 1995 | PREPARED BY: WILMINGTON DISTRICT



CONSTRUCTION SCHEDULE (EXAMPLE)
PASSAIC NO. 10 LEVEE SYSTEM

ATTACHMENT A

BORING LOGS

ATTACHMENT A

BORING LOGS

Detailed Boring Logs

Boring	Page
P-10-1	JA-1 and JA-4
P-10-2	JA-3 and JA-4
P-10-3	JA-5 and JA-6
P-10-3A	JA-7
P-10-3AU	JA-8
P-10-3BU	JA-9
P-10-3CU	JA-10
P-10-4	JA-11 to JA-14
P-10-5	JA-15 and JA-16
P-10-6	JA-17 and JA-18
P-10-7	JA-19 to JA-21
P-10-8	JA-22 and JA-23
P-10-9	JA-24 to JA-27
P-10-9A	JA-28 and JA-29
P-10-10	JA-30 and JA-31

Hole No. P-10-1

DRILLING LOG	DIVISION NORTH ATLANTIC	INSTALLATION PASSAIC RIVER DIV.	SHEET 1 OF 2 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 1 3/8" ID SPLITSPOON
2. LOCATION (Coordinates or Station) N 718,672.84 E 2,090,045.21	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-1	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12 : UNDISTURBED 0
5. NAME OF DRILLER CARL MOON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
	16. DATE HOLE: STARTED 9/2/93 : COMPLETED 9/2/93
7. THICKNESS OF OVERBURDEN N/A	17. ELEVATION TOP OF HOLE 172.44 ± (TOPO)
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 18.0'	19. SIGNATURE OF INSPECTOR LESLIE (ORD) CHILD (SAW)

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	1		ML- Dark brown, non plastic, slightly organic, dry silt		1	NOTE: During drilling water level encountered at 12.0' depth. At completion of drilling water level at depth of 11.8' No 24 hour level taken.	13
	2						38
	3				2		
	4		CL-Brown, red and yellow, damp, silty lean clay		3		39
			Brown		4		
	5						49
	6				5		
						LAB. DATA W=25.6% LL-33 PL=20 PI=13	
	7				6		38
	8						28
	9				7		
			CONTINUED ON SHEET 2			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	

SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-1

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 172.44 | Hole No. P-10-1

PROJECT: PASSAIC 10 LEVEE SYSTEM | INSTALLATION: PASSAIC RIVER DIV. | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	9		ML- Brown, wet, silt with trace of sand				
	10				8		34
	11		Moist, clayey, silt		9	LAB. DATA W=25.1% LL-23 PL=19 PI=4	40
	12		SC-Brown, moist, medium to coarse grain, clayey sand.		10		
	13				11		40
	14				12		30
	15						
	16				13	NOTE: Soils were visually classified and some descriptions modified by Tom Child, Civil Engineer, CESAW.	37
	17		SM-Brown, moist, medium to coarse grain silty sand.		14	NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH OF 18.0'.	46
	18		BOTTOM OF HOLE @ 18.0'				

ENG FORM 1836-A MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: PASSAIC 10 LEVEE SYS | HOLE NO. P-10-1

Hole No. P-10-2

DRILLING LOG	DIVISION NORTH ATLANTIC	INSTALLATION PASSAIC RIVER DIV.	SHEET 1 OF 2 SHEETS
1. PROJECT PASSAIC 10 LEVEE SYSTEM		10. SIZE AND TYPE OF BIT 1⅜" ID SPLITSPOON	
2. LOCATION (Coordinates or Station) N 718,728.13 E 2,089,497.57		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY MOBILE DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL CME-75	
4. HOLE NO. (As shown on drawing title and file number) P-10-2		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 12 / UNDISTURBED 0
		14. TOTAL NUMBER CORE BOXES N/A	
5. NAME OF DRILLER CARL MOON		15. ELEVATION GROUND WATER SEE NOTE	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		16. DATE HOLE	STARTED 8/28/93 / COMPLETED 8/30/93
		17. ELEVATION TOP OF HOLE 166.93 ± (TOPO)	
7. THICKNESS OF OVERBURDEN N/A		18. TOTAL CORE RECOVERY FOR BORING N/A %	
8. DEPTH DRILLED INTO ROCK N/A		19. SIGNATURE OF INSPECTOR LESLIE (ORD) CHILD (SAW)	
9. TOTAL DEPTH OF HOLE 18.0'			

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	1		ML-Black, slightly damp organic, low plastic silt with roots.		1	NOTE: Hole was dry during and at completion of drilling. No 24 hour level taken. 9
	2		CL-Red, brown, iron stain, dry nonplastic silty clay.		2	62 LAB DATA W=9.6% LL=33 PL=15 PI=18
	3					
	4				3	75
	5		Brown, slightly silty		4	59
	6					
	7				5	63
	8				6	42
	9		CONTINUED ON SHEET 2 SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1⅜" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-2

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 166.93 | Hole No. P-10-2

PROJECT: PASSAIC 10 LEVEE SYSTEM | INSTALLATION: PASSAIC RIVER DIV. | SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	9		CL-Brown, dry, nonplastic slightly silty clay.		7		24
	10						
	11				8	LAB DATA W=22.5% LL=36 PL=19 PI=17	17
	12		Very silty, more plastic				
	13				9		21
	14				10		16
	15						
	16				11		34
	17		CH-Brown, silty, wet fat, plastic clay.		12	NOTE: Soils were visually classified and some descriptions modified by Tom Child, Civil Engineer, CESAW NOTE: Hole Terminated at Predetermined depth of 18.0'.	24
	18		BOTTOM OF HOLE @ 18.0'				

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PROJECT: PASSAIC 10 LEVEE SYS | HOLE NO. P-10-2

Hole No. P-10-3

DRILLING LOG	DIVISION NORTH ATLANTIC	INSTALLATION PASSAIC RIVER DIV.	SHEET 1 OF 2 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 1 3/8" ID SPLITSPOON
2. LOCATION (Coordinates or Station) N 719,031.00 E 2,089,074.79	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12 : UNDISTURBED 0
5. NAME OF DRILLER CARL MOON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
	16. DATE HOLE: STARTED 8/28/93 : COMPLETED 8/30/93
	17. ELEVATION TOP OF HOLE 168.56 + (TOPO)
7. THICKNESS OF OVERBURDEN N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR LESLIE (ORD) CHILD (SAW)
9. TOTAL DEPTH OF HOLE 18.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	1, 2, 3, 4		OL-Black, organic, slightly damp, silt.		1, 2, 3	NOTE: Water Level during drilling at 6.0' depth. 24 hour Water Level at 2.5' depth. 1, 1, 1
	5		OH-Black, organic, moist fat clay.		4	
	5		MH-Dark grey and brown damp plastic silt.		5	12
	6, 7		SM-Brown, fine grain silty sand, damp with trace of clay.		6, 7	8
	8				8	LAB CLASS=SM W=15.1% LL=15 PL=14 PI=1 16
	9		See next page-MH		9	
			CONTINUED ON SHEET 2 SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-3

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 16.8.5' | Hole No. P-10-3

PROJECT: PASSAIC 10 LEVEE SYSTEM | INSTALLATION: PASSAIC RIVER DIV. | SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	9		MH-Brown, grey, moist, plastic silt.			
	10				10	15
	11				11	16
	12		CH-Brown, wet, plastic, silty clay.		12	4
	13					
	14		SC-Brown, wet fine to medium grain, clayey sand		13	LAB. CLASS =SM-SC W=14.4% LL=17 PL=13 PI=4 13
	15					
	16				14	27 NOTE: Soils were visually classified and some descriptions modified by Tom Child, Civil Engineer, CESAW.
	17					
	18		CH/SC-Brown, moist, plastic clay and clayey sand		15	26 NOTE: Hole Terminated at Predetermined depth of 18.0'.
			BOTTOM OF HOLE @ 18.0'			

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PROJECT: PASSAIC 10 LEVEE SYS | HOLE NO. P-10-3

Hole No. P 10 3A

DRILLING LOG	DIVISION NORTH ATLANTIC	INSTALLATION PASSAIC RIVER DIV.	SHEET 1 OF 1 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 1 3/8" ID SPLITSPOON
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-3A	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5; UNDISTURBED 0
5. NAME OF DRILLER JAMES KNOX	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
	16. DATE HOLE: STARTED 9/11/93; COMPLETED 9/11/93
7. THICKNESS OF OVERBURDEN N/A	17. ELEVATION TOP OF HOLE 167 ± (TOPO)
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 7.5'	19. SIGNATURE OF INSPECTOR LESLIE (ORD) CHILD (SAW)

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ML/OH-Black, damp, organic silts with plant roots			NOTE: Water Level on 9/13/93 was 1.7' depth.
	1				1	1
	2		MH/OH-Black, damp, organic plastic silt.			1
	3		Moist		2	2
	4				3	
	5				4	3
	6		CH-Gray, moist, medium plastic clay		5	NOTE: Field logs transcribed into final logs by CESAW-EN-GS.
	7				6	NOTE: Hole Terminated at a depth of 7.5'. 8
	7.5		BOTTOM OF HOLE @ 7.5' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-3A

Hole No. P-10-3AU

DRILLING LOG	DIVISION NORTH ATLANTIC	INSTALLATION PASSAIC RIVER DIV.	SHEET 1 OF 1 SHEETS
1. PROJECT PASSAIC 10 LEVEE SYSTEM		10. SIZE AND TYPE OF BIT HOLLOW STEM AUGER AND SHELLBY TUBES	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY MOBILE DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL CME-75	
4. HOLE NO. (As shown on drawing title and file number) P-10-3AU		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 3 / UNDISTURBED 0
5. NAME OF DRILLER JAMES KNOX		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER SEE NOTE	
		16. DATE HOLE	STARTED 9/2/93 / COMPLETED 9/2/93
7. THICKNESS OF OVERBURDEN N/A		17. ELEVATION TOP OF HOLE 167 ± (TOPO)	
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 7.0'		19. SIGNATURE OF INSPECTOR LESLIE (ORD) CHILD (SAW)	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		OL/ML-Black, damp, low plasticity, organic silt.			NOTE: Shelby Tube 3"x 2.5'
	1					
			LAB. DATA UD-1 Depth 1.5' to 2.3' CLASS. OL - Organic Silt LOI=29.3%		TUBE 1 OF 3	Started at 0.5' Pushed 2.0' REC. 1.0' LOSS 1.0'
	2				JAR 1	
	3					
	4		LAB DATA UD-2 Depth 4.4' to 4.8' CLASS = OH Peaty muck LOI= 32.6%		TUBE 2 OF 3	Started at 3.0' Pushed 2.0' REC. 0.6' LOSS 1.4'
	5		CH-Gray, moist, highly plastic clay		JAR 2	
			LAB. DATA UD-3 CLASS. CH- Fat clay LL=60 PL=24 PI=36 W+45.8% G_s =2.66		TUBE 3 OF 3	Started at 5.0' Pushed 2.0' REC. 2.0'
	6					NOTE: Hole Terminated at a depth of 7.0'. NOTE: Field logs transcribed into final logs by CESAW-EN-GS.
	7				JAR 3	
			BOTTOM OF HOLE @ 7.0' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

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PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-3AU

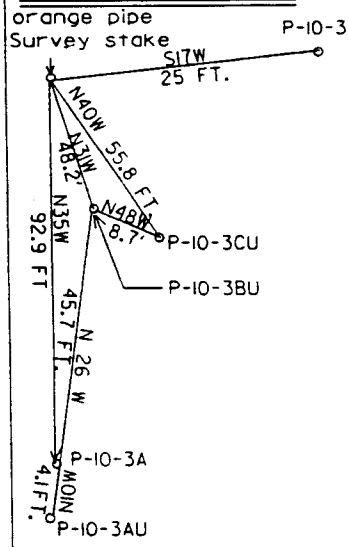
Hole No. P-10-3BU

DRILLING LOG	DIVISION NORTH ATLANTIC	INSTALLATION PASSAIC RIVER DIV.	SHEET 1 OF 1 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 3" X 2.5' SHELBY TUBE
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-3BU	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1 : UNDISTURBED 1
5. NAME OF DRILLER JAMES KNOX	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
7. THICKNESS OF OVERBURDEN N/A	16. DATE HOLE: STARTED 9/13/93 : COMPLETED 9/13/93
8. DEPTH DRILLED INTO ROCK N/A	17. ELEVATION TOP OF HOLE 167 ± (TOPO)
9. TOTAL DEPTH OF HOLE 3.2'	18. TOTAL CORE RECOVERY FOR BORING N/A %
	19. SIGNATURE OF INSPECTOR LESLIE (ORD) CHILD (SAW)

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0					Started at 0.7' Pushed 2.5' REC. 1.9' LOSS 0.6'
	1 2 3		LAB. DATA UD-1 Depth 1.3' to 3.0' CLASS. = OH LL=432 PL=194 PI=238 W=355.8% G_S =1.60		TUBE 1 OF 1	NOTE: Field logs transcribed into final logs by CESAW-EN-GS.
	3.2				JAR 1	NOTE: Hole terminated at a depth of 3.2'.
			BOTTOM OF HOLE @ 3.2' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

MAP OF P-10-3 BORINGS



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PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-3BU

Hole No. P-10-3CU

DRILLING LOG	DIVISION NORTH ATLANTIC	INSTALLATION PASSAIC RIVER DIV.	SHEET 1 OF 1 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 3" X 5.0' SHELBY TUBE
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-3CU	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED 1
5. NAME OF DRILLER JAMES KNOX	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
7. THICKNESS OF OVERBURDEN N/A	16. DATE HOLE: STARTED 9/13/93; COMPLETED 9/13/93
8. DEPTH DRILLED INTO ROCK N/A	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE 6.2'	18. TOTAL CORE RECOVERY FOR BORING N/A %
	19. SIGNATURE OF INSPECTOR LESLIE (ORD) CHILD (SAW)

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		OL/ML- Black, moist, organic silt.			
	1					
	2					
	3					
	4				TUBE 1 OF 1	Started at 1.2' Pushed 5.0' REC. 2.4' LOSS 2.6' NOTE: Field logs transcribed into finallogs by CESAW-EN-GS
	5					
	6					
	6.2		CL- Gray, damp, lean clay		JAR 1	
			BOTTOM OF HOLE @ 6.2' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-3CU

Hole No. P 10 4

DRILLING LOG	DIVISION NORTH ATLANTIC	INSTALLATION PASSAIC RIVER DIV.	SHEET 1 OF 4 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 1 3/8" ID SPLITSPOON AND HOLLOW STEM AUGER
2. LOCATION (Coordinates or Station) N 719,280.56 E 2,088,730.36	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-4	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 0
5. NAME OF DRILLER CARL MOON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
	16. DATE HOLE: STARTED 8/30/93; COMPLETED 9/1/93
7. THICKNESS OF OVERBURDEN N/A	17. ELEVATION TOP OF HOLE 167.51 + (TOPO)
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 51.5'	19. SIGNATURE OF INSPECTOR LESLIE (ORD) CHILD (SAW)

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	1		ML-Dark brown, dry, organic nonplastic silt with plant roots			NOTE: During Drilling the water level was encountered at 9.0' of depth. Water level at completion of drilling was at a depth of 28.1 feet. 24 hr Water Level at 7.3' depth. 13
			Light brown and iron stained, red, dry, low plasticity, silt with trace of clay and sand		1	
	2					42
	3				2	37
	4		Light gray and brown with clay		3	
			With sand and clay			LAB CLASS (CL-ML) W=13.3% LL=21 PL=15 PI=6
	5				4	33
	6		Reddish brown		5	40
	7					
	8		SM-Brownish, medium to fine grained, damp, silty, sand		6	32
	9		CONTINUED ON SHEET 2			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-4

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 167.51	Hole No. P-10-4
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIV.	SHEET 2 OF 4 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	9		SM-Brown, medium to coarse grained, silty sand			
	10				7	27
	11				8	29
	12				9	61
	13				10	42
	14		CH-Brown, moist, sandy, fat clay.		11	
	15		SM-Brown, medium to coarse silty sand with some clay		12	61
	16		CH-Brown, moist, sandy, fat clay.		13	31
	17					
	18		CONTINUED ON SHEET 3			

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MAR 71

PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-4

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 167.51 | Hole No. P-10-4

PROJECT: PASSAIC 10 LEVEE SYSTEM | INSTALLATION: PASSAIC RIVER DIV. | SHEET 3 OF 4 SHEETS

ELEVATION a	DEPTH	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	18		CH- Brown, moist, sandy fat clay		14	NOTE: Scale changed at 18.0' to 1" = 2' LAB CLASS W=22.6% LL=31 PL=18 PI=13	33
	20		Augered to 25.0' No sample taken				
	22						
	24						
	26		CL-Brown, moist, sandy lean clay with some plastic clay		15	NOTE: Splitspooned from 25.0' to 26.5'.	39
	28		Augered from 26.5' to 30.0' No sample taken			LAB CLASS W=31.2% LL=35 PL=20 PI=15	
	30					NOTE: Splitspooned from 30.0' to 31.5'	
			CH-Brown, moist, hard fat clay		16		54
	32		Augered from 31.5' to 35.0' No sample taken				
	34						
	36		CH-Brown, moist, hard, fat clay with black shell, coarse grained gravel, approx. 1" in diameter		17	NOTE: Splitspooned from 35.0' to 36.5'.	84
			Augered from 36.5' to 38.0'				
	38						

CONTINUED ON SHEET 4

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT: PASSAIC 10 LEVEE SYS | HOLE NO. P-10-4

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 167.51	Hole No. P-10-4
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIV.	SHEET 4 OF 4 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	38		Augered from 38.0' to 40.0'			
	40		SM-Brown, dense, moist, medium grain, silty sand		18	NOTE: Splitspooned from 40.0' to 41.5' 40
			Augered from 41.5' to 42.0' No sample taken			100/.6
	42		SC-Brown, fine grained, clayey sand, moist		19	NOTE: This interval accidently sampled because of a miscalculation
			Augered from 42.6' to 45.0' No sample taken			
	44					
	46		SC-Brown, fine, clayey, fine grained sand, moist		20	NOTE: Splitspooned from 45.8' to 46.5' 38
			Augered from 46.5' to 50.0' No sample taken			LAB CLASS W=24.3% LL=20 PL=20 PI=NP
	48					
	50		ML-Brown, gray, moist, silt with some plastic silt		21	NOTE: Hole terminated at Predetermined depth of 51.5' 28
	51.5		BOTTOM OF HOLE @ 51.5'			

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE.
MAR 71

PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-4

Hole No. P-10-5

DRILLING LOG	DIVISION NORTH ATLANTIC	INSTALLATION PASSAIC RIVER DIV.	SHEET 1 OF 2 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM.	10. SIZE AND TYPE OF BIT 1 3/8" ID SPLITSPOON
2. LOCATION (Coordinates or Station) N 719,732.46 E 2,088,606.69	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-5	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 14 : UNDISTURBED 0
5. NAME OF DRILLER CARL MOON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
	16. DATE HOLE: STARTED 9/1/93 : COMPLETED 9/2/93
7. THICKNESS OF OVERBURDEN N/A	17. ELEVATION TOP OF HOLE 173 ± (TOPO)
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 18.0'	19. SIGNATURE OF INSPECTOR LESLIE (ORD) CHILD (SAW)

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	1		ML-Brown and yellow non-plastic, dry, loose silt with plant roots		1	7
	2		No plant roots, slightly sandy		2	23
	3					
	4				3	42
	5				4	LAB CLASS W=7.8% LL=18 PL=18 PI=NP 54
	6					
	7				5	35
	7.5		CONTINUED ON SHEET 2 SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE SHEET 1 HOLE NO.

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 173	Hole No. P-10-5
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIV.	SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	7.5		SM-Brownish red, medium to fine grained silty sand with some clay.			
	8				6	29
	9					
	10				7	17
	11					37
					8	
	12		CL-Brown, damp, very stiff low plasticity, silty, lean clay.		9	
	13				10	CLASS. DATA W=18.1% LL=32 PL=19 PI=13 28
	14				11	33
	15		With some coarse gravel			
	16				12	43
	17				13	NOTE: Hole terminated at predetermined depth of 18.0'. 42
	18				14	
			BOTTOM OF HOLE @ 18.0'			

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE.
MAR 71

PROJECT PASSAIC 10 LEVEE SYS | HOLE NO. P-10-5

Hole No. P-10-6

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION PASSAIC RIVER DIVI	SHEET 1 OF 2 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 1 3/8" SPLITSPOON & HSA
2. LOCATION (Coordinates or Station) N 720,147.47 E 2,088,797.96	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-6	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 17 : UNDISTURBED 0
5. NAME OF DRILLER CARL MOON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
	16. DATE HOLE: STARTED 8-26-93 : COMPLETED 8-27-93
	17. ELEVATION TOP OF HOLE 167 ± (TOPO)
7. THICKNESS OF OVERBURDEN > 18.0'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK 0	19. SIGNATURE OF INSPECTOR LESLIE
9. TOTAL DEPTH OF HOLE 18.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		OL-Dark brown, and black non plastic organic silt plant roots, slightly damp			NOTE: Water Level at a depth of 12.6' after drilling
	1				1	16
	2				2	28
	3		CL-Grey, nonplastic, very stiff, dry, lean clay.		3	
					4	46
	4		Brown, slightly damp, medium plasticity		5	
	5				6	CLASS DATA W=19.5% LL=46 PL=24 PI=22 52
	6					
	7				7	59
	8				8	
	9				9	67
			CONTINUED ON SHEET 2			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 167 ± (TOPO)	Hole No. P-10-6
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIVISION	SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
			CL-Brown, hard, slightly damp, medium plastic, clay		10		
	10				11		50
						CLASS DATA W=19.5% LL=29 PL=18 PI=11	
	11				12		33
	12						
	13				13		28
	14		CH-Brown, very stiff, damp, plastic, silty, fat clay.		14		23
	15						
	16				15		16
	17				16		
	18				17	NOTE: Hole Terminated at predetermined depth of 18.0'	26
			BOTTOM OF HOLE @ 18.0'				

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

Hole No. P-10-7

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION PASSAIC RIVER DIVI	SHEET 1 OF 3 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 1 3/8" SPLITSPOON & HSA
2. LOCATION (Coordinates or Station) N 720,422.79 E 2,088,923.23	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-7	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 17; UNDISTURBED 0
5. NAME OF DRILLER CARL MOON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
	16. DATE HOLE: STARTED 8-25-93; COMPLETED 8-26-93
	17. ELEVATION TOP OF HOLE 172 ± (TOPO)
7. THICKNESS OF OVERBURDEN > 24.0'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK 0	19. SIGNATURE OF INSPECTOR LESLIE
9. TOTAL DEPTH OF HOLE 24.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ML-Light and dark brown, dry, sandy, slightly clayey nonplastic silt			NOTE: Water Level encountered at a depth of 4.5' during drilling
	1				1	35
	2		Tan		2	72
	3				3	
	4		Not-sampled Augered with/ 5" Diameter hollow stem.			
	5		SM-SC, Brown, fine grained, damp, silty sand and clayey sand.		4	CLASS DATA W=12.5% LL=23 PL=16 PI=7 48
	6					
	7				5	67
	8				6	28
	9		CONTINUED ON SHEET 2 SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 172 ± (TOPO)	Hole No. P-10-7
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIVISION	SHEET 2 OF 3 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	9		SM-SC, Brown, fine grained, damp, silty and clayey sand		7		26
	10		CL-Brown, damp, very stiff, medium plasticity, lean clay		8		
	11				9	CLASS DATA W=18.9% LL=31 PL=17 PI=14	41
	12						
	13		CH-Brown, damp, very stiff, fat clay with some sand		10		32
	14				11		18
	15		CL-Brown, damp, very stiff, lean clay		12	CLASS DATA W=23.9% LL=28 PL=17 PI=11	26
	16						
	17				13		26
	18		CONTINUED ON SHEET 3				

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 172 ± (TOPO)	Hole No. P-10-7
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIVISION	SHEET 3 OF 3 SHEETS

ELEVATION a	DEPTH 18	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	19		CL- Brown, damp, very stiff, lean clay		14	28
	20					CLASS DATA W=19.5% LL=29 PL=18 PI=11
					15	19
	21		CH-Brown, damp, stiff to very stiff, silty, fat clay		16	21
	22					
	23				17	14
	24		BOTTOM OF HOLE @ 24.0'			

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION PASSAIC RIVER DIVI	SHEET 1 OF 2 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 1⅜" SPLITSPOON & HSA
2. LOCATION (Coordinates or Station) N 720,706.90 E 2,089,354.68	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-8	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 0
5. NAME OF DRILLER JAMES KNOX	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER SEE NOTE
	16. DATE HOLE: STARTED 9-11-93; COMPLETED 9-13-93
7. THICKNESS OF OVERBURDEN > 18.0'	17. ELEVATION TOP OF HOLE 169 ± (TOPO)
8. DEPTH DRILLED INTO ROCK 0	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 18.0'	19. SIGNATURE OF INSPECTOR LESLIE

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ML-Black and brown, low plasticity, organic slightly damp silt with plant roots		1	NOTE: Water Level encountered at 7.5' during drilling 40
	1					
	2				2	6
	3		Tree root			
	4		SM-Brown, very loose, slightly damp, subangular fine, silty sand with wood		3	LAB CLASS DATA=SM W=34.0% LL=37 PL=28 PI=9 8
	5		No wood		4	3
	6		OL/CL-Organic, medium, plastic clay, black		5	
			ML-Brown and black, low plasticity silt with some organics		6	40
	7		CH-Grey, gravelly, sandy, fat clay (boulder)		7	
	8		SM-Grey, loose, medium grain, silty sand		8	11
	9		CH-Brown & Grey fat clay		9	
			CONTINUED ON SHEET 2			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1⅜" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 169 ± (TOP'O)	Hole No. P-10-8
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIVISION	SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			CH-Brown and grey, stiff to very stiff plastic, fat clay			
	10				10	29
	11				11	CLASS DATA W=19.9% LL=26 PL=17 PI=9 38
	12					
	13				12	32
	14				13	34
	15					
	16				14	21
	17				15	24
	18				16	NOTE: Hole Terminated at predetermined depth of 18.0'
			BOTTOM OF HOLE @ 18.0'			

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. MAR 71 | PROJECT | HOLE NO.

Hole No. P-10-9

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION PASSAIC RIVER DIVI	SHEET 1 OF 4 SHEETS
1. PROJECT PASSAIC 10 LEVEE SYSTEM		10. SIZE AND TYPE OF BIT 1 3/8" SPLITSPOON & HSA	
2. LOCATION (Coordinates or Station) N 720,552.31 E 2,089,681.03		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY MOBILE DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL CME-75	
4. HOLE NO. (As shown on drawing title and file number) P-10-9		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 21 UNDISTURBED 0	
5. NAME OF DRILLER JAMES KNOX		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER SEE NOTE	
		16. DATE HOLE STARTED 9-7-93 COMPLETED 9-11-93	
7. THICKNESS OF OVERBURDEN > 51.5'		17. ELEVATION TOP OF HOLE 167.5 + (TOPO)	
8. DEPTH DRILLED INTO ROCK 0		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 51.5'		19. SIGNATURE OF INSPECTOR LESLIE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ML-Dark brown, sandy non plastic silt with some organics and plant roots			NOTE: Water Level at completion of drilling at 29.4'; 9-10-93 on 9-11-93 W.L. 6.1'
	1				1	29
	2					41
			Yellow		2	
	3					17
	4				3	
			SM-Yellow brown, damp, medium to coarse grain subrounded, silty sand		4	
	5					23
			some clay		5	
	6					LAB CLASS DATA=SM W=14.3% LL=18 PL=15 PI=3
	7				6	24
			CL-Grey, slightly damp, medium plasticity, lean clay		7	
	8				8	34
	9					
			CONTINUED ON SHEET 2			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 15.75 ± (TOPO) | Hole No. P-10-9

PROJECT: PASSAIC 10 LEVEE SYSTEM | INSTALLATION: PASSAIC RIVER DIVISION | SHEET 2 OF 4 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	9		CL-Grey, slightly damp, medium plasticity, lean clay			
	10		CH-Grey, damp, plastic, fat clay		9	23
	11				10	35
	12					
	13				11	32
	14				12	CLASS DATA W=17.5% LL=30 PL=17 PI=13 27
	15					
	16				13	28
	17				14	46
	18					
			CONTINUED ON SHEET 3			

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. MAR 71 | PROJECT | HOLE NO.

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 167.5 ± (TOPO)	Hole No. P-10-9
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIVISION	SHEET 3 OF 4 SHEETS

ELEVATION a	DEPTH 18	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Augered from 18.0' to 20.0'.			NOTE: Scale changed at 18.0' to 1"=2'
	20		CH-Grey, slightly sandy, silty fat clay		15	14
	22		Not Sampled-Augered to 25.0'			CLASS DATA W=26.3% LL=29 PL=18 PI=11
	24					
	26		CH-Grey with brown and reddish shale gravel, fat clay.		16	23
	28		Not Sampled-Augered to 30.0'			
	30		CH-Grey with brown, fat clay		17	18
	32		Not Sampled-Augered to 35.0'			
	34					
	36		CH-Grey with brown, fat clay		18	12
			CONTINUED ON SHEET 4			

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.
MAR 71

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 167.5 ± (TOPO)	Hole No. P-10-9
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIVISION	SHEET 4 OF 4 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	36		CH-Grey with brown fat clay		18		12
	38		Not Sampled-Augered to 40.0'				
	40		CH-Grey with brown fat clay		19	CLASS DATA W=19.5% LL=29 PL=18 PI=11	25
	42		Not Sampled-Augered to 45.0'				
	44						
	46		CH-Grey, slightly sandy, fat clay		20		48
	48		Not Sampled-Augered to 50.0'				
	50		CH-Grey, slightly sandy, fat clay		21	NOTE: Hole terminated at a predetermined depth of 51.5'.	19
	51.5		BOTTOM OF HOLE @ 51.5'				

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.
MAR 71

Hole No. P 10 9A

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION PASSAIC RIVER DIVI	SHEET 1 OF 2 SHEETS
1. PROJECT PASSAIC 10 LEVEE SYSTEM		10. SIZE AND TYPE OF BIT 1⅜" SPLITSPOON & HSA	
2. LOCATION (Coordinates or Station) N 720,552.31 E 2,089,681.03		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY MOBILE DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL CME-75	
4. HOLE NO. (As shown on drawing title and file number) P-10-9A		13. TOTAL NO. OF OVER BURDEN SAMPLES TAKEN	DISTURBED 15 / UNDISTURBED 0
5. NAME OF DRILLER JAMES KNOX		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER SEE NOTE	
		16. DATE HOLE	STARTED 9-9-93 / COMPLETED 9-11-93
		17. ELEVATION TOP OF HOLE 167.5 ± (TOPO)	
7. THICKNESS OF OVERBURDEN > 18.0'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
8. DEPTH DRILLED INTO ROCK 0		19. SIGNATURE OF INSPECTOR LESLIE	
9. TOTAL DEPTH OF HOLE 18.0'			

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		OL-Black, dry, medium plastic organic silt, with roots		1	NOTE: Water Level encountered at 7.0' during drilling Water Level at end drilling at a depth of 6.1' (9-11-93). 25
	1				2	
	2		ML-Grey and brown, dry sandy silt		3	45
	3				4	33
	4		SM-Reddish brown, damp, fine to medium, silty sand		5	
	5		Medium grained, loose		6	LAB CLASS =SM W=13.7% LL=16 PL=16 PI=NP 17
	6				7	18
	7		CL-Grey, brown, damp, medium plastic clay		8	
	8				9	38
	9		CONTINUED ON SHEET 2 SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1⅜" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE [illegible]	Hole No. P-10-9A
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIVISION	SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	9		CL-Grey brown, damp, medium plastic clay				
	10				10		23
			SC-Grey, medium grain, moist to wet, clayey sand with some sand			CLASS DATA W=19.5% LL=29 PL=18 PI=11	
	11				11		27
	12		CH-Brown, damp, medium plastic fat clay				
	13				12		25
	14				13	LAB CLASS W=22.1% LL=28 PL=18 PI=10	27
	15				14		19
	16						
	17		Slightly gravelly		15	NOTE: Hole terminated at a predetermined depth of 18.0'.	23
	18		BOTTOM OF HOLE @ 18.0'				

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

HOLE NO. P 10-10

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION PASSAIC RIVER DIVI	SHEET 1 OF 2 SHEETS

1. PROJECT PASSAIC 10 LEVEE SYSTEM	10. SIZE AND TYPE OF BIT 1 3/8" SPLITSPOON & HSA
2. LOCATION (Coordinates or Station) N 720,372.08 E 2,090,357.33	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY MOBILE DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL CME-75
4. HOLE NO. (As shown on drawing title and file number) P-10-10	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 14 : UNDISTURBED 0
5. NAME OF DRILLER CARL MOON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER NOT ENCOUNTERED
	16. DATE HOLE STARTED 8-27-93 : COMPLETED 8-30-93
	17. ELEVATION TOP OF HOLE 170 + (TOPO)
7. THICKNESS OF OVERBURDEN > 18.0'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK 0	19. SIGNATURE OF INSPECTOR LESLIE
9. TOTAL DEPTH OF HOLE 18.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ML-brown and black, dry, slightly organic silt with roots and leaves			NOTE: Water Level not encountered during drilling At 48 hours (8-30-93) hole was dry.
	1				1	37
	2					63
			No organics		2	
			Tan, brown & white/w cobbles		3	
	3		CL-Yellow brown, damp, hard, clay			
	4				4	54
	5				5	CLASS DATA W=17.2% LL=52 PL=22 PI=30 87+
	6		Augered-clean out to 6.0'			
			CL-Yellow brown, damp, hard, clay			
	7				6	86
	8				7	62
	9		CONTINUED ON SHEET 2			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES

SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 170 ± (TOPO)	Hole No. P-10-10
PROJECT PASSAIC 10 LEVEE SYSTEM	INSTALLATION PASSAIC RIVER DIVISION	SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	9		CL-Yellow brown, damp hard, clay			
	10				8	44
	11					42
					9	
	12		CH-Brown, damp, very stiff, fat clay			
	13				10	22
					11	
	14		CL-Brown, moist, silty lean clay		12	CLASS DATA W=32.8% LL=34 PL=20 PI=14 16
	15					
	16				13	24
	17					
			SC-Brown, damp, fine silty, clayey sand		14	NOTE: Hole Terminated at predetermined depth of 18.0' 36
	18		BOTTOM OF HOLE @ 18.0'			

ENG FORM 1836-A PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

ATTACHMENT B

SOIL LABORATORY DATA

ATTACHMENT B

SOIL LABORATORY DATA

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Consolidation Test Data (P-10-3AU)	JB-14 and JB-15
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SOUTH ATLANTIC DIVISION LABORATORY

GENERAL TEST RESULTS

PROJECT: Passic River Levee System - Dike #10

REQN. NO: CESAW-EN-GS-94-0003
W. O. NO: 7118

Lab No.	Hole No.	Sample Number	Depth(Ft)	Loss on Ignition %	Visual Classification
264/554	P-10-3AU	1	1.5-2.3	29.3	Black very organic Silt (OL)
/555	P-10-3AU	2	4.4-4.8	32.6	Black Peaty Muck (OH) w/hair roots

SOUTH ATLANTIC DIVISION LABORATORY
U.S. ARMY CORPS OF ENGINEERS
611 SOUTH COBB DRIVE
MARIETTA, GEORGIA

Project: PASSIAC RIVER

Location: FLOOD CONTROL "Passaic 10"

Description: JAR SAMPLES

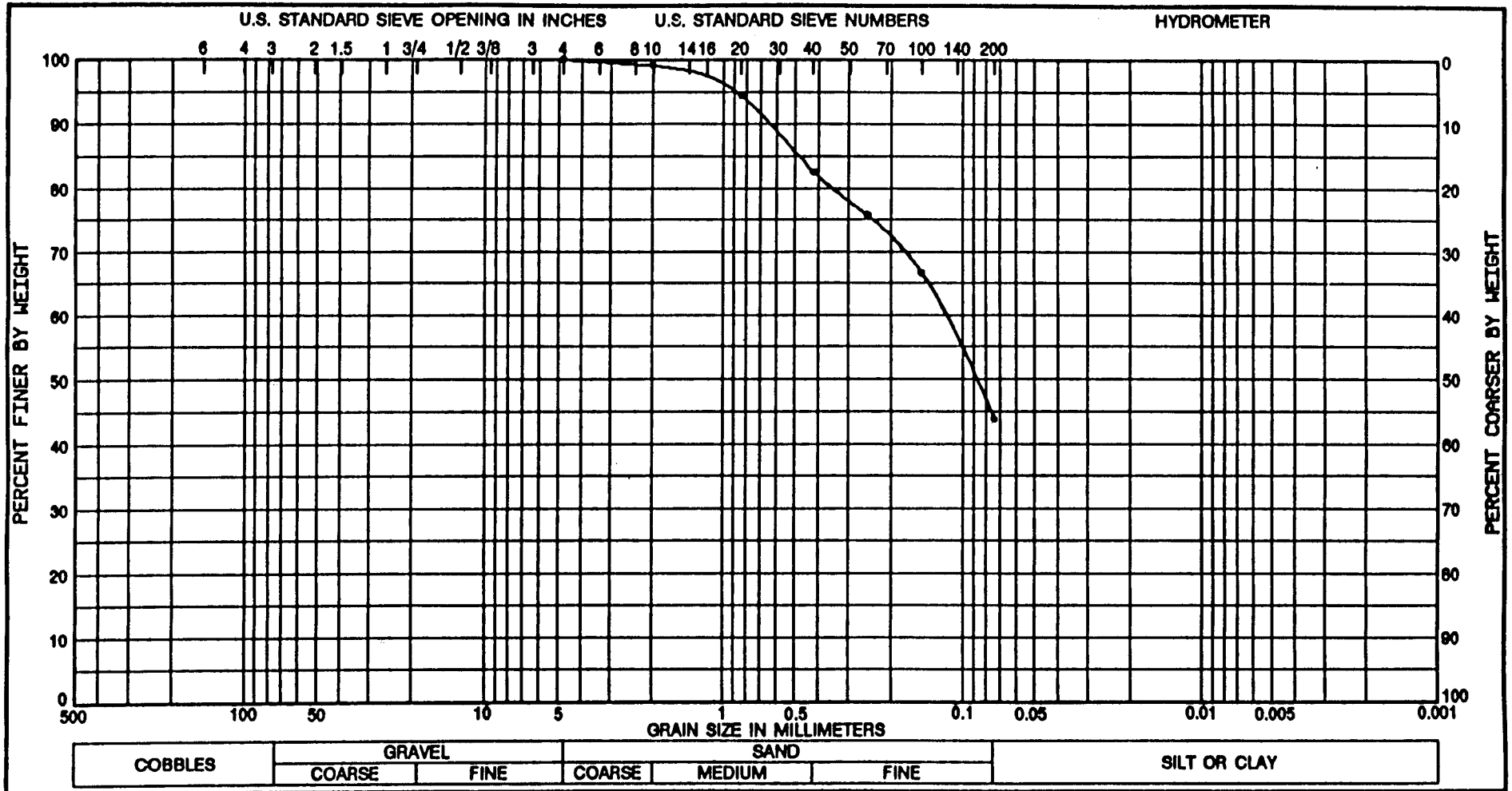
District: Wilmington
W. O. No: 7118
Req'n No: CESAW-EN-GS-94-0003

Date Rec'd 27 OCT 93
Date Rpt'd 13 JAN 94

Lab No.	Hole No.	Sample No.	Depth (ft)	Percent Moist	Atterberg Limits ll	pl	pi
264/558	P-10-1	6	6.4 to 7.2	25.6	33	20	13
559		9	10.8 to 11.8	25.1	23	19	4
560	P-10-2	2	2.3 to 3.0	9.6	33	15	18
561		8	10.6 to 11.9	22.5	36	19	17
562	P-10-3	8	8.0 to 8.8	15.1	15	14	1
563		13	13.8 to 14.7	14.4	17	13	4
564	P-10-4	4	4.5 to 5.8	13.3	21	16	5
565		7	9.3 to 10.5	14.1	np	np	np
566		14	18.9 to 19.5	22.6	31	18	13
567		15	25.5 to 26.5	31.2	35	20	15
568		20	45.8 to 46.5	24.3	20	20	np
569	P-10-5	4	5.0 to 6.0	7.8	18	18	np
570		10	12.4 to 13.2	18.1	32	19	13
571	P-10-6	6	4.8 to 6.0	19.5	46	24	22
572		12	10.7 to 11.7	19.5	29	18	11
573	P-10-7	5	6.6 to 7.2	12.5	23	16	7
574		9	10.8 to 12.0	18.9	31	17	14
575		12	15.0 to 16.5	23.9	28	17	11
576	P-10-8	3	3.7 to 4.5	34.0	37	28	9
577		11	11.0 to 12.0	19.9	26	17	9
578	P-10-9	6	6.5 to 7.5	14.3	18	15	3
579		12	14.0 to 15.0	17.5	30	17	13
580		18	35.5 to 36.5	26.3	29	18	11
581	P-10-9A	6	5.0 to 6.0	13.7	16	16	np
582		10	9.5 to 10.5	24.3	32	19	13
583		13	14.0 to 15.0	22.1	28	18	10
584	P-10-10	5	5.2 to 5.9	17.2	52	22	30
585		12	13.5 to 14.5	32.8	34	20	14

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

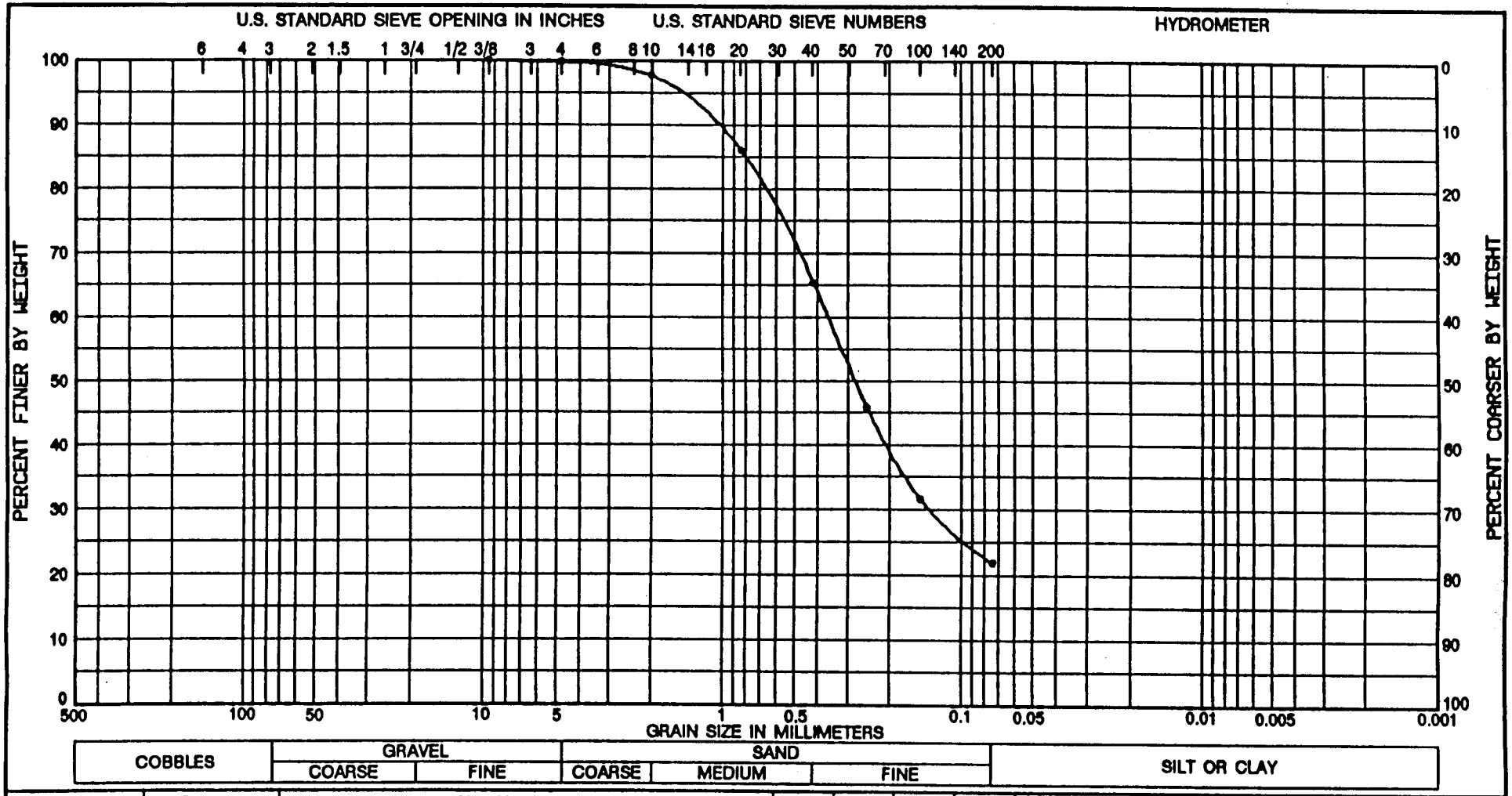
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
8	6.0-8.8'	DK. BROWN, SILTY SAND (SM).	15.1	15	14	1

Project PASSAIC RIVER
FLOOD CONTROL "Passaic 10"
Lab No. 264/562
Boring No. P-10-3
Date 01/18/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



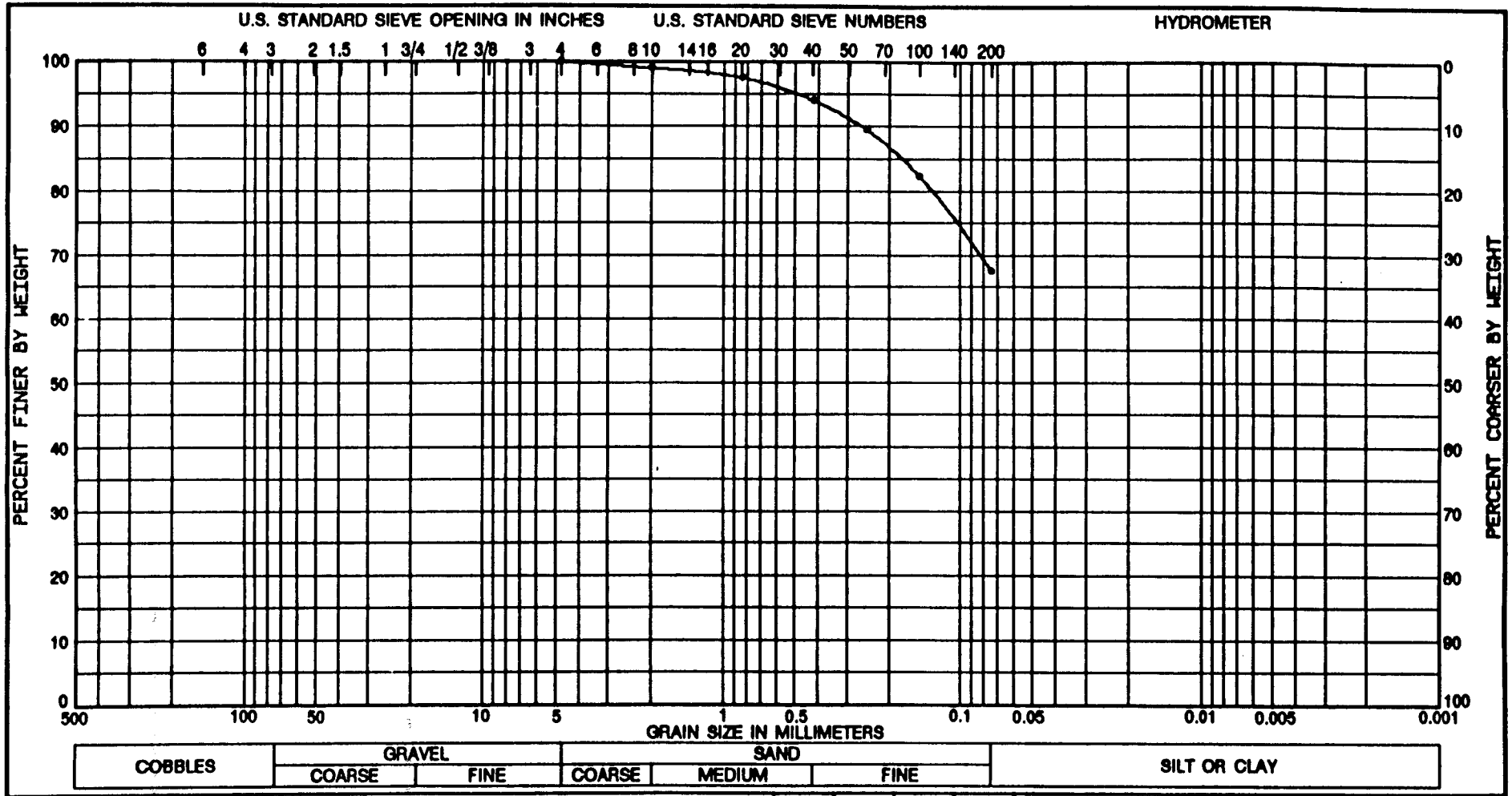
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
13	13.8-14.7'	DK. BROWN, SILTY CLAYEY SAND (SM-SC),	14.4	17	13	4
		WITH A TRACE OF GRAVEL SIZES.				

Project PASSAIC RIVER
FLOOD CONTROL "Passaic 10"
Lab No. 264/563
Boring No. P-10-3
Date 01/18/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

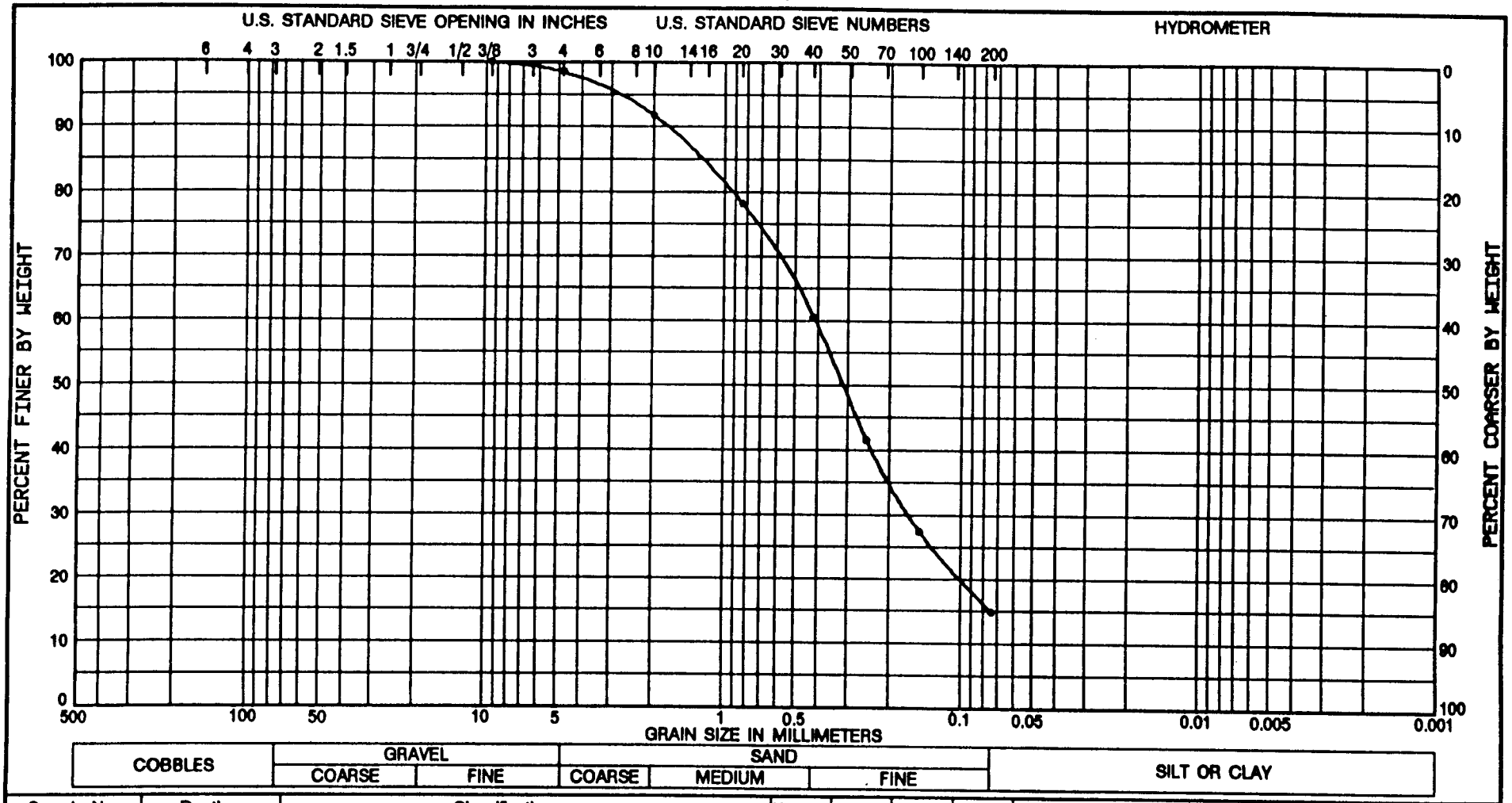
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
4	4.5-5.0'	BROWN, LEAN CLAY INORGANIC SILT LOW LL (CL-ML), WITH SOME SAND SIZES.	13.3	21	16	5

Project PASSAIC RIVER
FLOOD CONTROL "Passaic 10"
Lab No. 264/564
Boring No. P-10-4
Date 01/18/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



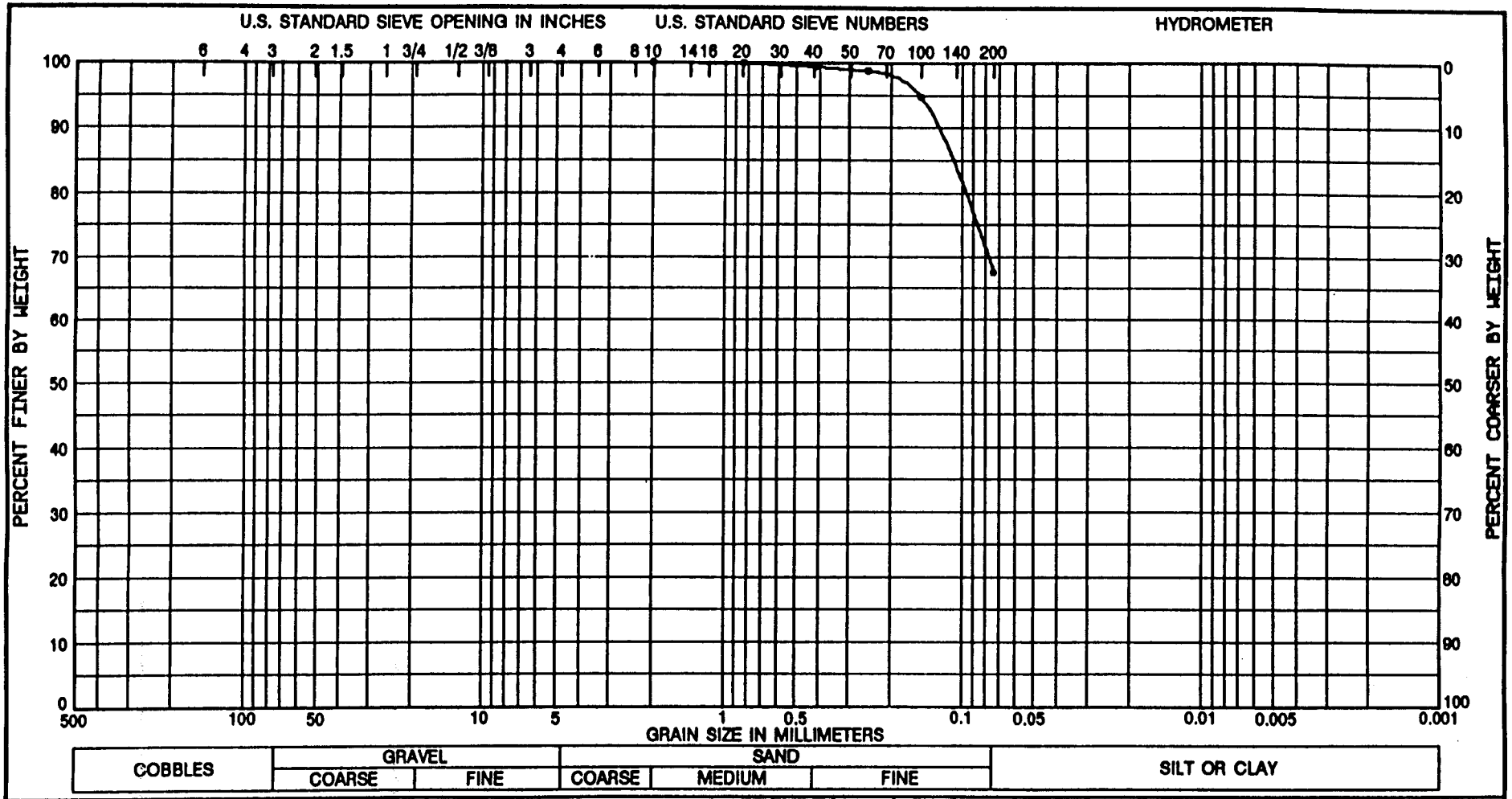
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
7	9.3-10.5'	BROWN, SILTY SAND (SM), WITH A TRACE OF GRAVEL SIZES.	14.1	NP	NP	NP

Project PASSAIC RIVER
FLOOD CONTROL "Passic 10"
Lab No. 264/565
Boring No. P-10-4
Date 01/18/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



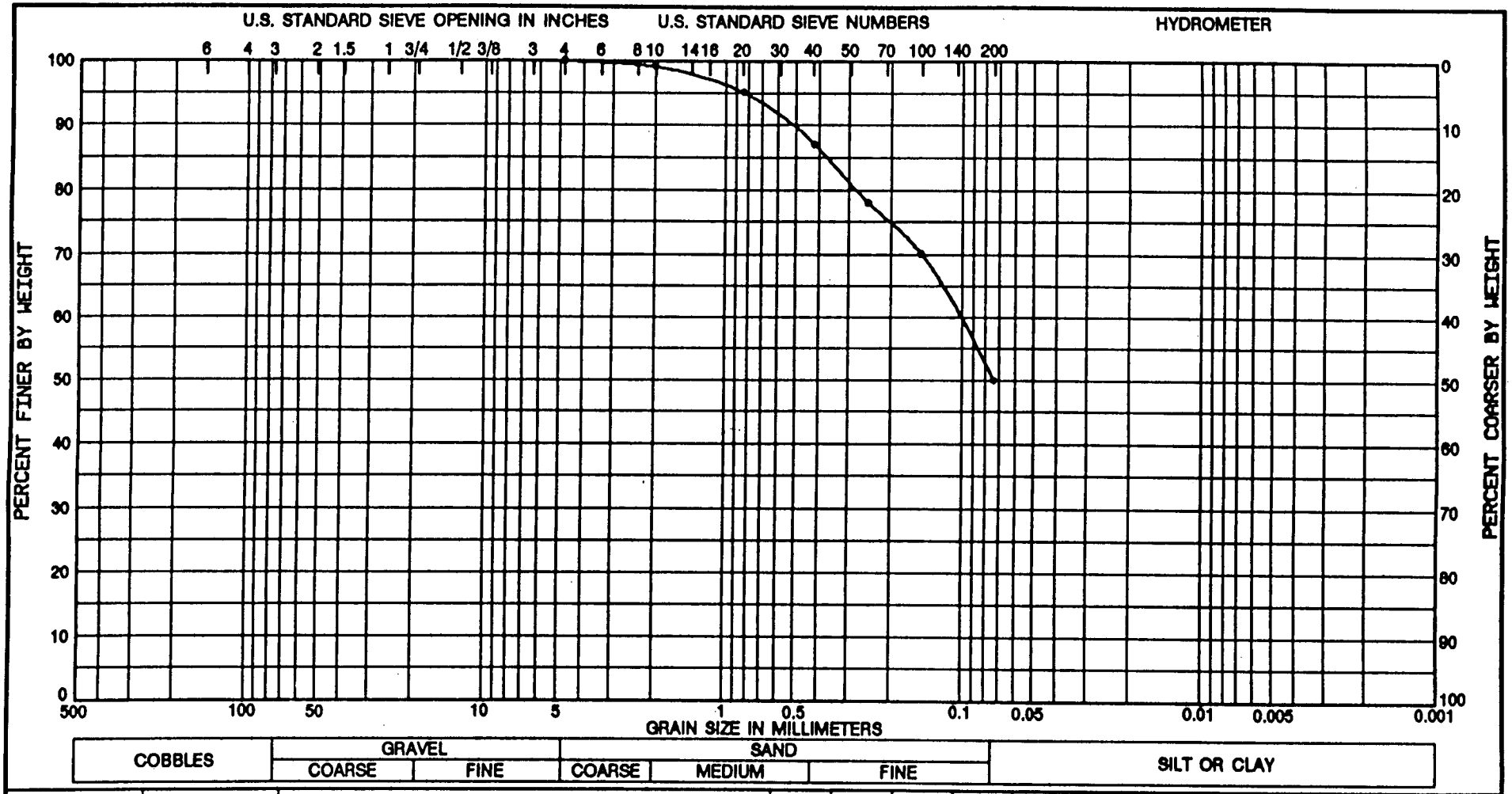
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
20	45.8-46.5'	OK. GRAY, INORGANIC SILT LOW LL (ML), WITH SOME SAND SIZES.	24.3	20	20	NP

Project PASSAIC RIVER
FLOOD CONTROL "Passic 10"
Lab No. 264/568
Boring No. P-10-4
Date 01/21/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



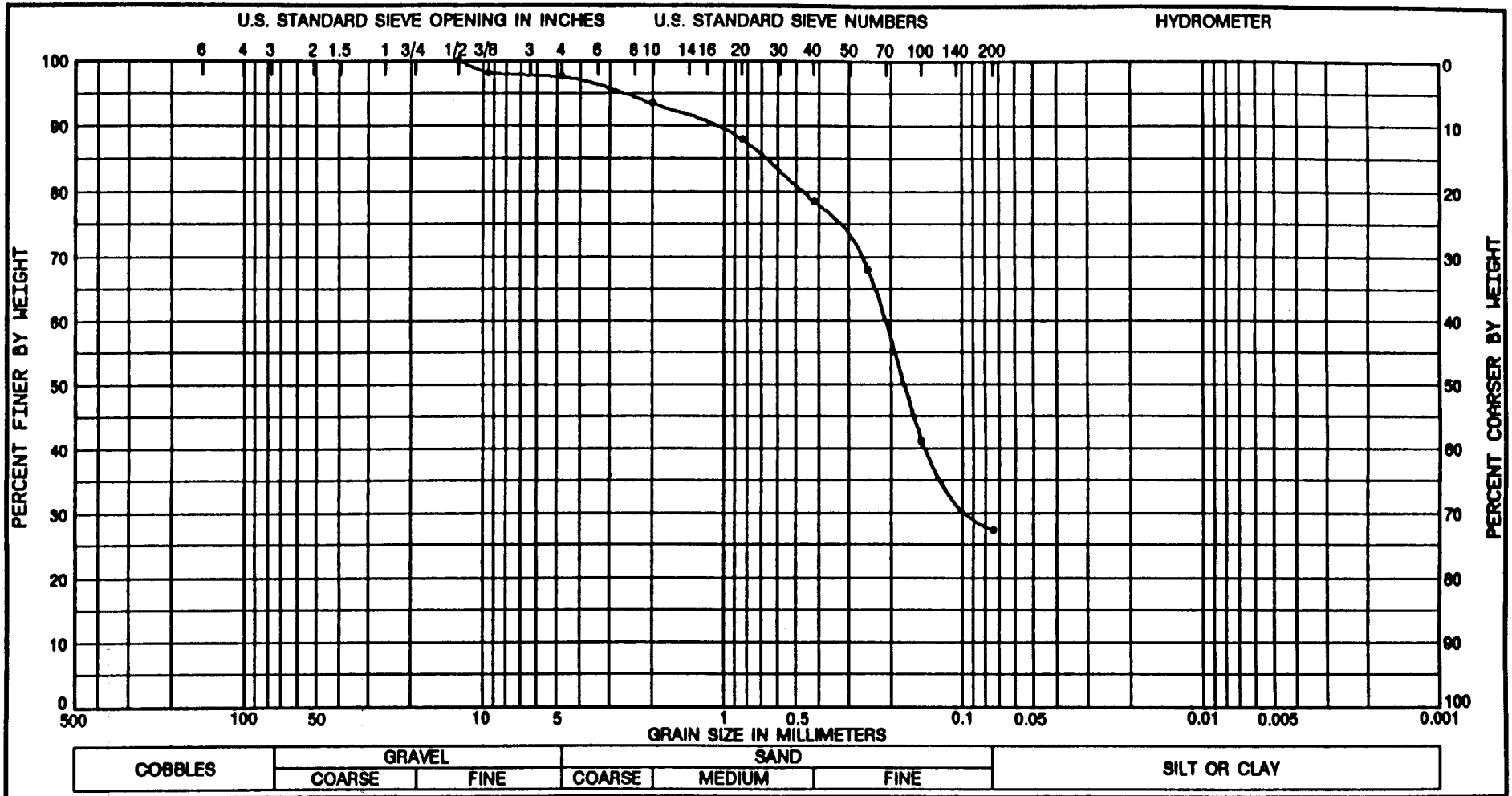
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
4	5.0-6.0'	LT. BROWN, SANDY INORGANIC SILT LOW LL (ML).	7.8	18	18	NP

Project PASSAIC RIVER
FLOOD CONTROL "Passaic 10"
Lab No. 264/589
Boring No. P-10-5
Date 01/18/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



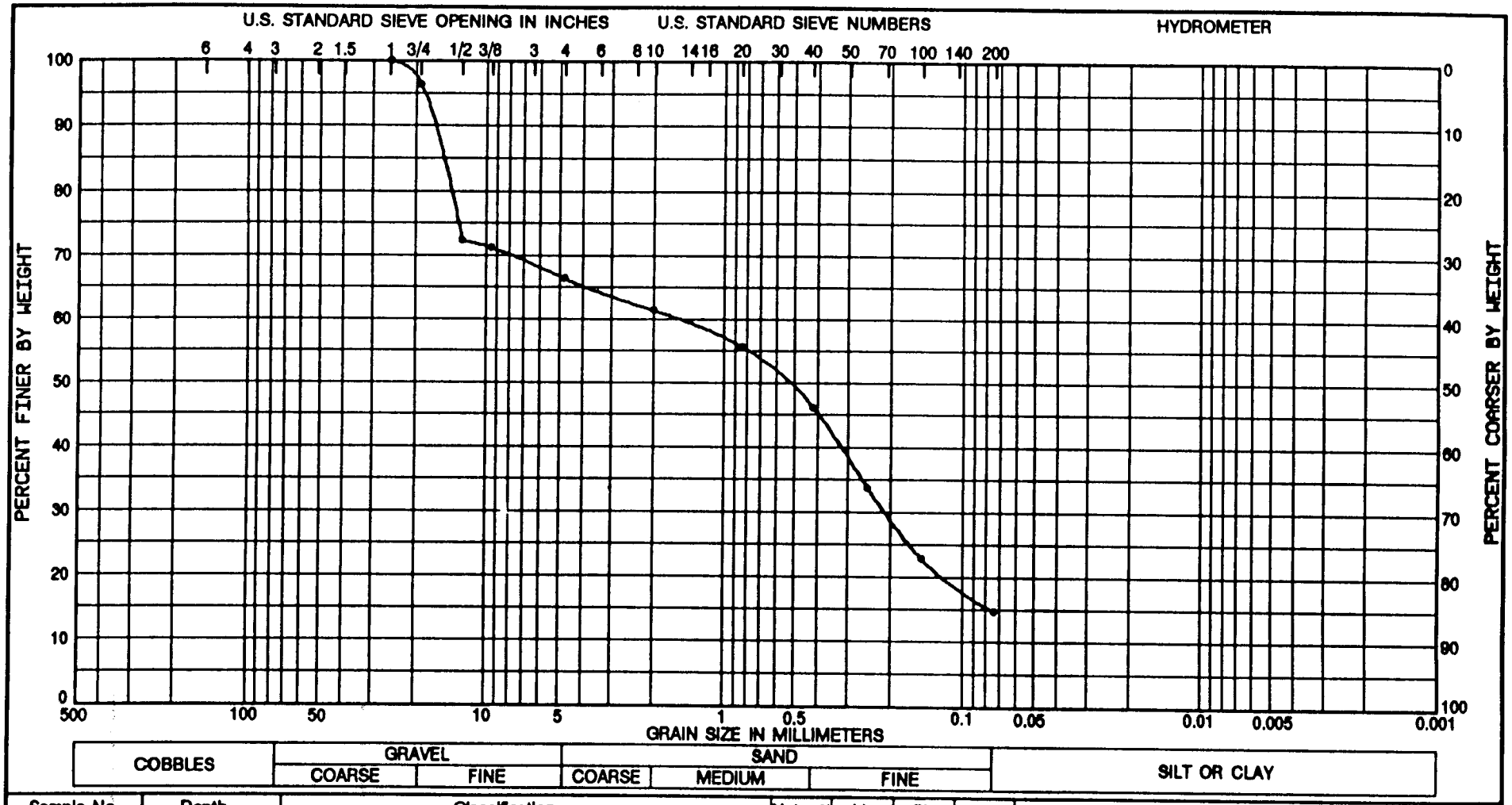
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
5	6.6-7.2'	BROWN, SILTY CLAYEY SAND (SM-SC),	12.5	23	16	7
		WITH A TRACE OF GRAVEL SIZES.				

Project PASSAIC RIVER
FLOOD CONTROL "Passaic 10"
Lab No. 264/573
Boring No. P-10-7
Date 01/18/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



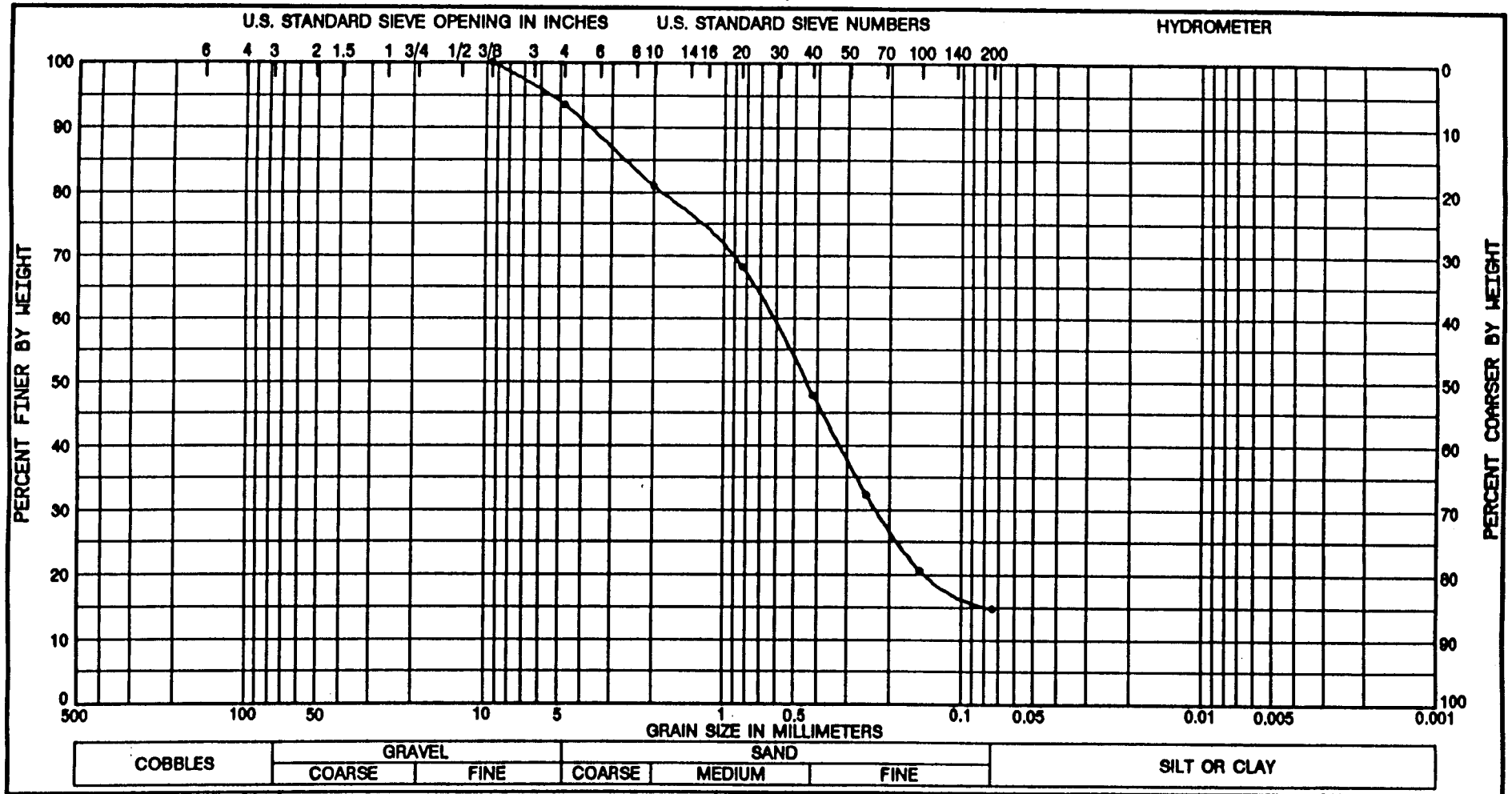
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
3	3.7-4.5'	DK. BROWN, SILTY SAND (SM), WITH SOME GRAVEL SIZE WOOD FRAGMENTS AND A TRACE OF SAND SIZE WOOD FRAGMENTS.	34.0	37	28	9

Project PASSAIC RIVER
FLOOD CONTROL "Passaic 10"
Lab No. 264/576
Boring No. P-10-8
Date 01/18/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



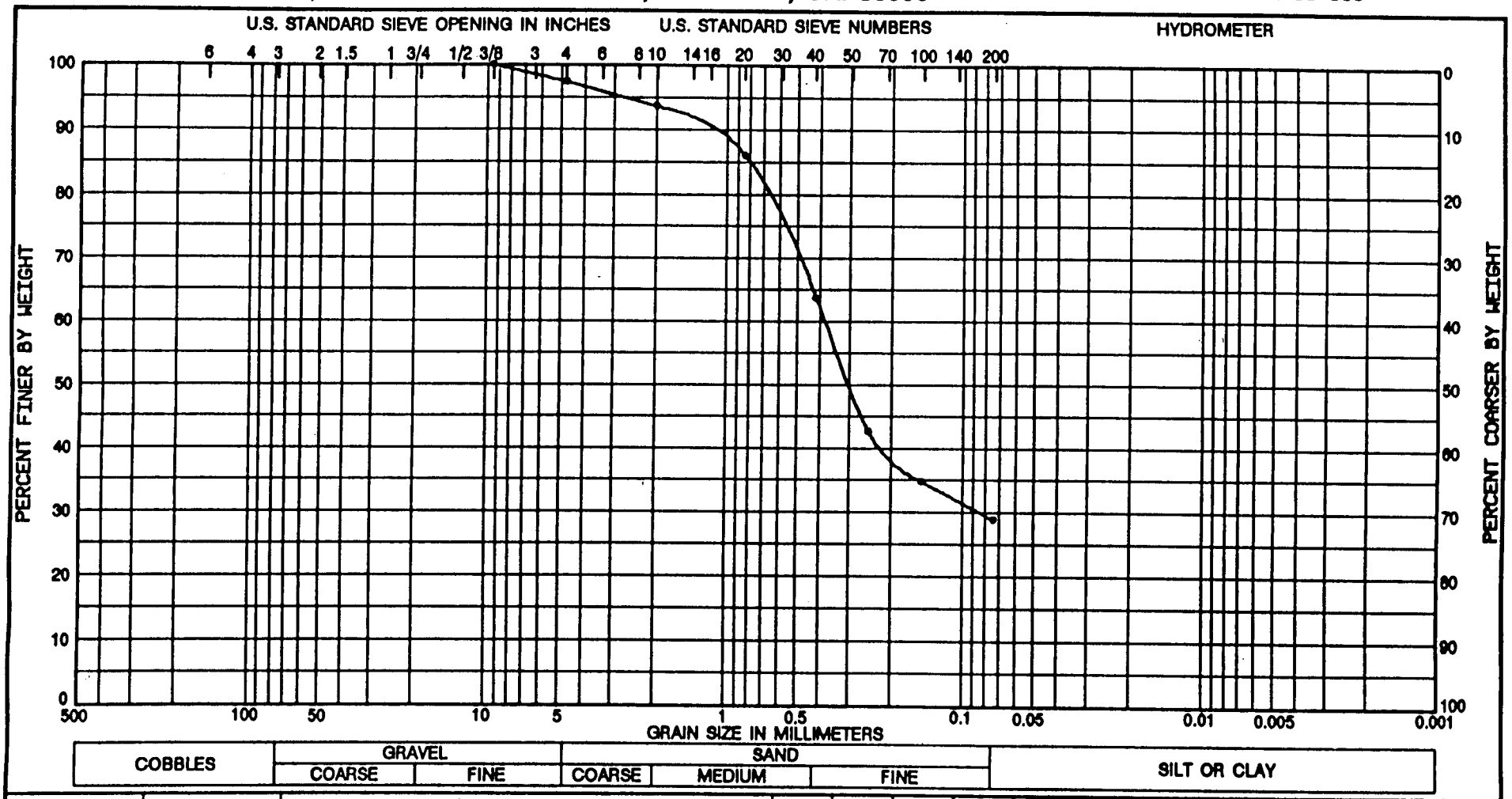
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
6	6.5-7.5'	BROWN, SILTY SAND (SM), WITH A TRACE OF GRAVEL SIZES.	14.3	18	15	3

Project PASSAIC RIVER
FLOOD CONTROL "Passaic 10"
Lab No. 264/578
Boring No. P-10-9
Date 01/18/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



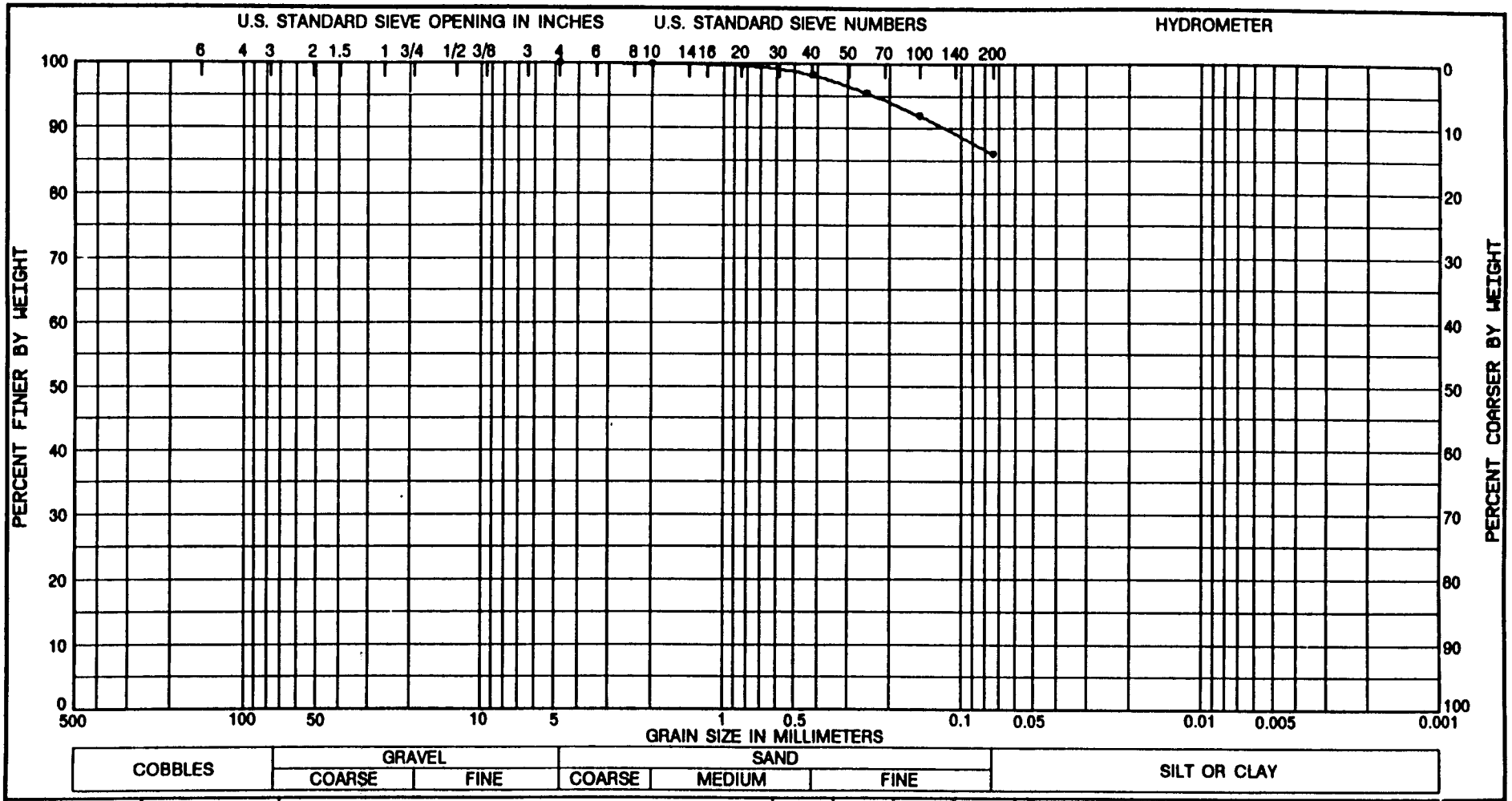
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
6	5.0-6.0'	BROWN, SILTY SAND (SM), WITH A TRACE OF GRAVEL SIZES.	13.7	16	16	NP

Project PASSAIC RIVER
FLOOD CONTROL "Passaic 10"
Lab No. 264/581
Boring No. P-10-9A
Date 01/18/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-94-0003



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

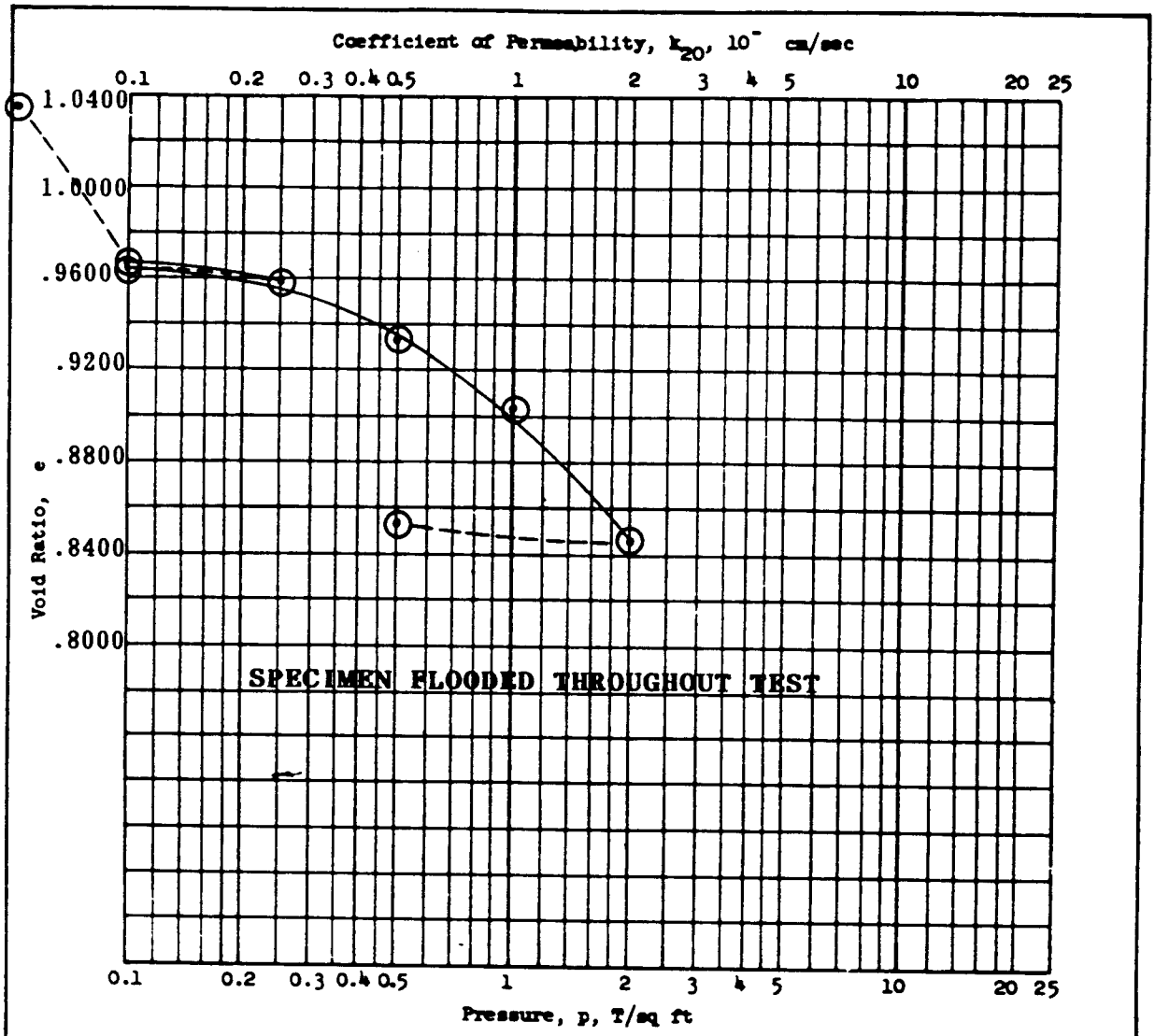
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
3	5.0-6.8'	GRAY, FAT CLAY (CH), WITH A LITTLE SAND SIZES.	45.8	60	24	36

Project PASSAIC RIVER
LEVEE SYSTEM - DIKE # 10
Lab No. 284/558
Boring No. P-10-3AU
Date 02/02/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30061

WORK ORDER NO. 7118
REQ. NO. CESAW-EN-GS-94-0003



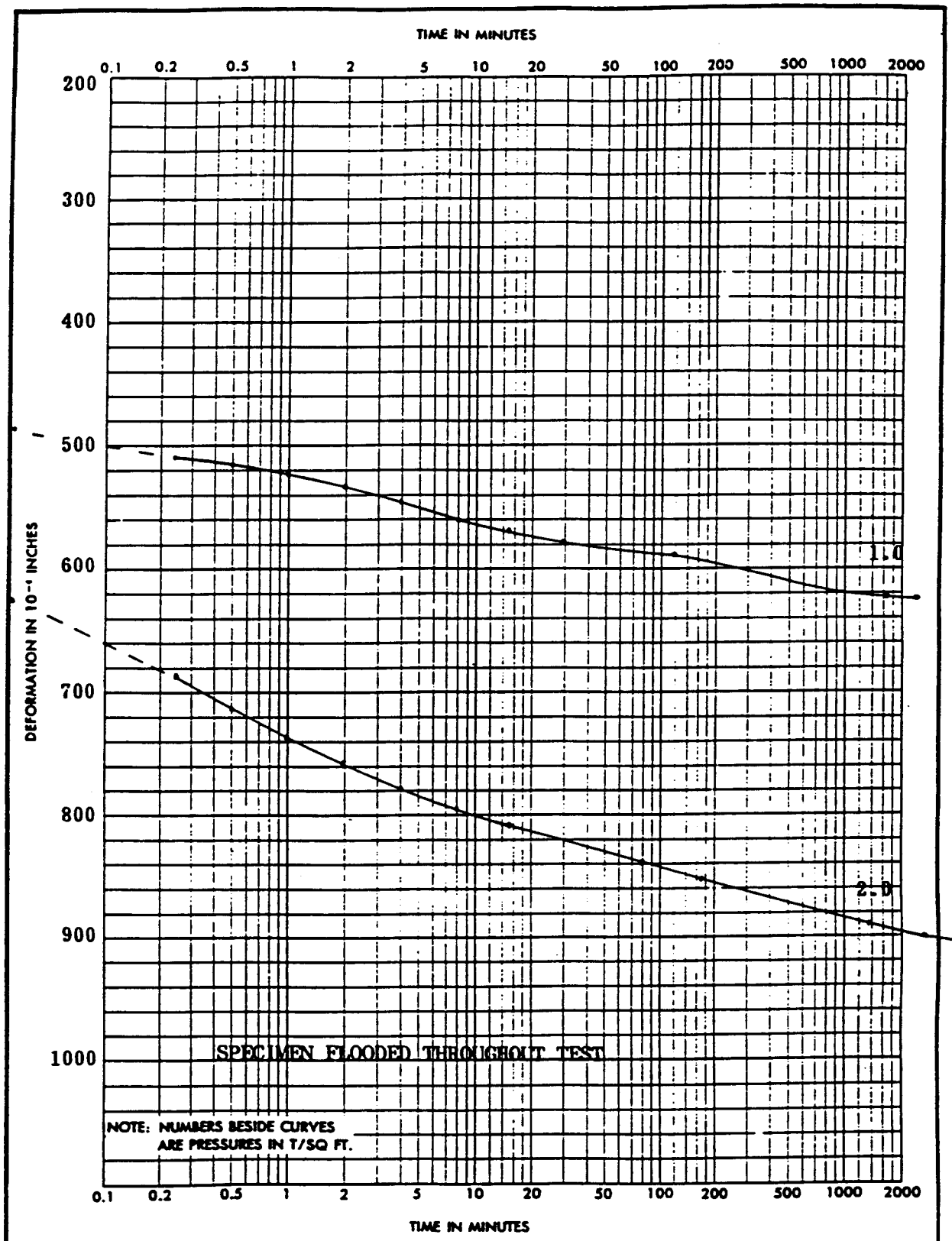
Type of Specimen Undisturbed		Before Test		After Test	
Diam 2.49 in.	Ht 1.00 in.	Water Content, w_o	38.9 %	w_f	32.1 %
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o	1.034	e_f	.853
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	100.0 %	S_f	100.0 %
Compression Index, C_c		Dry Density, γ_d	81.6 lb/ft^3		
Classification Gray, Fat Clay with/a little sand sizes		k_{20} at e_o =	x 10^{-} cm/sec		
LL 60	G_s 2.66	Project Passic River			
PL 24	D_{10} -	Lab No. 264/556			
Remarks		Area Levee System - Dike #10			
		Boring No. P-10-3AU		Sample No. 3	
		Depth El 5.0 - 6.8'		Date 8 February 1994	

CONSOLIDATION TEST REPORT

ENG FORM 1 MAY 63 2090 PREVIOUS EDITIONS ARE OBSOLETE.

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

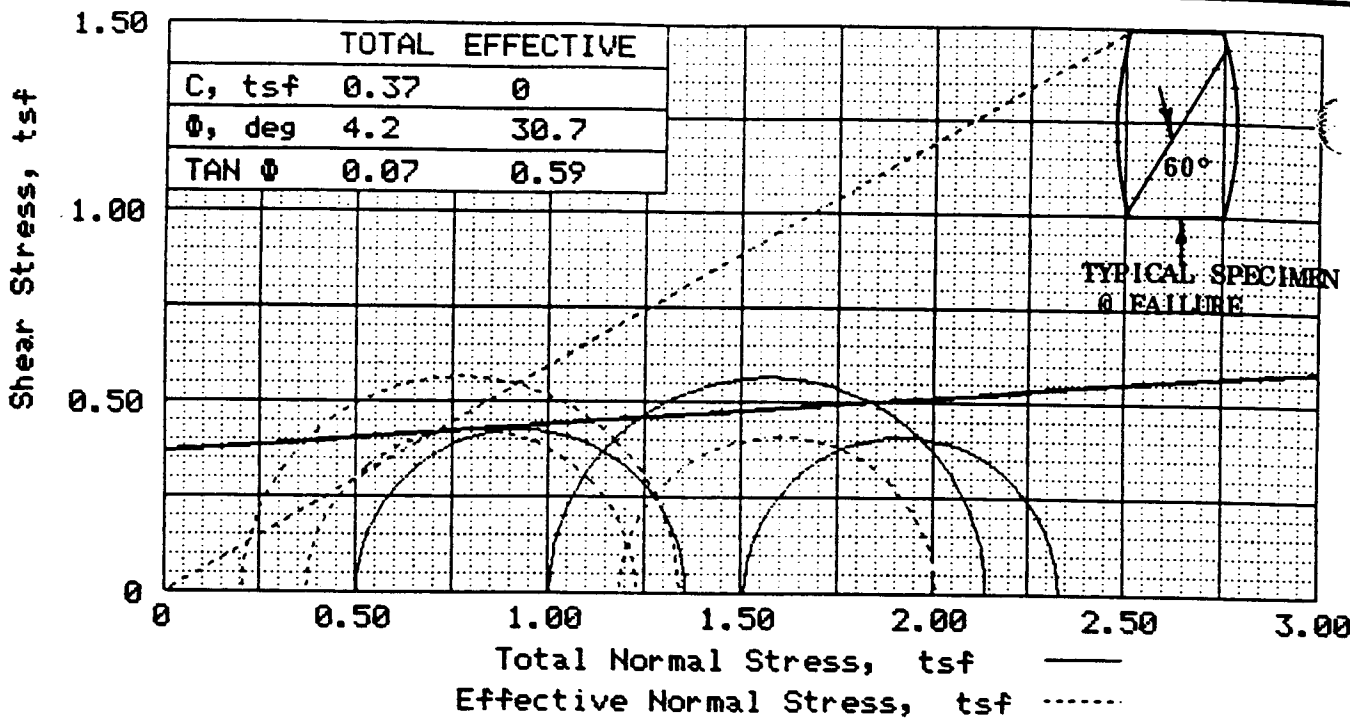
WORK ORDER NO. 7118
Req. No. CESAW-EN-GS-94-0003

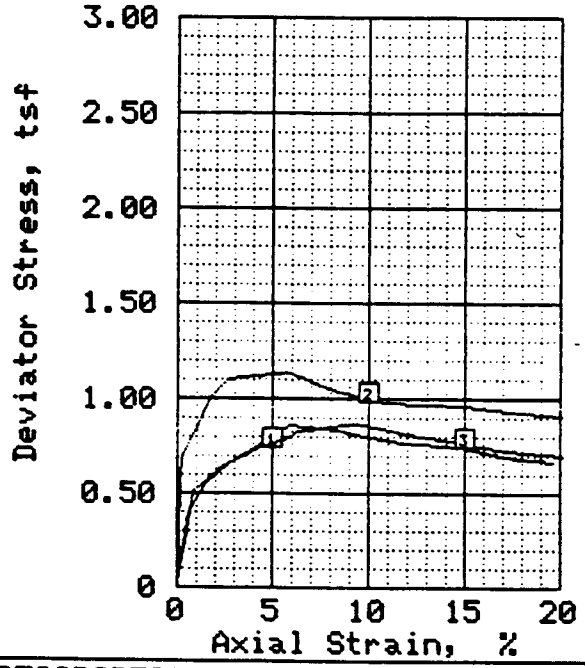


PROJECT	Passaic River			
AREA	Levee System - Dike #10		Lab No. 264/556	(CH)
BORING NO. P-10-3AU	SAMPLE NO. 3	DEPTH 5.0-6.8'	DATE 31 Mar 94	

ENG FORM 2088 1 MAY 63 PREVIOUS EDITIONS ARE OBSOLETE. **CONSOLIDATION TEST—TIME CURVES** (TRANSLUCENT)

SOUTH ATLANTIC DIVISION LABORATORY, CORPS OF ENGINEERS - MARIETTA, GEORGIA
Requisition No. CESAW-EN-GS-94-0003 Work Order No. 7117





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	47.3	47.6	42.6
	DRY DENSITY, pcf	73.5	71.8	77.8
	SATURATION, %	100.0	96.4	100.0
	VOID RATIO	1.259	1.314	1.134
	DIAMETER, in	1.38	1.38	1.38
	HEIGHT, in	3.08	3.08	3.08
@ TESTING	WATER CONTENT, %	47.3	42.1	40.2
	DRY DENSITY, pcf	73.5	78.3	80.3
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.259	1.121	1.069
	DIAMETER, in	1.39	1.34	1.36
	HEIGHT, in	3.05	2.99	3.05
BACK PRESSURE, tsf		6.05	5.04	6.05
INIT. EFF. STR., tsf		0.50	1.01	1.51
MAX. DEV. STRESS, tsf		0.86	1.13	0.82
PORE PRESSURE, tsf		0.13	0.80	0.32
TIME TO FAILURE, min.		70	60	90
RATE, %/min.		0.08	0.10	0.07
ULT. DEV. STRESS, tsf		0.74	0.96	0.76

DESCRIPTION GRAY, FAT CLAY (CH), WITH A LITTLE SAND SIZES.

LL= 60	PL= 24	PI= 36	Gs= 2.66	CONTROLLED STRAIN TEST
TYPE OF SPECIMEN UNDISTURBED				TYPE OF TEST R w/pore pressures

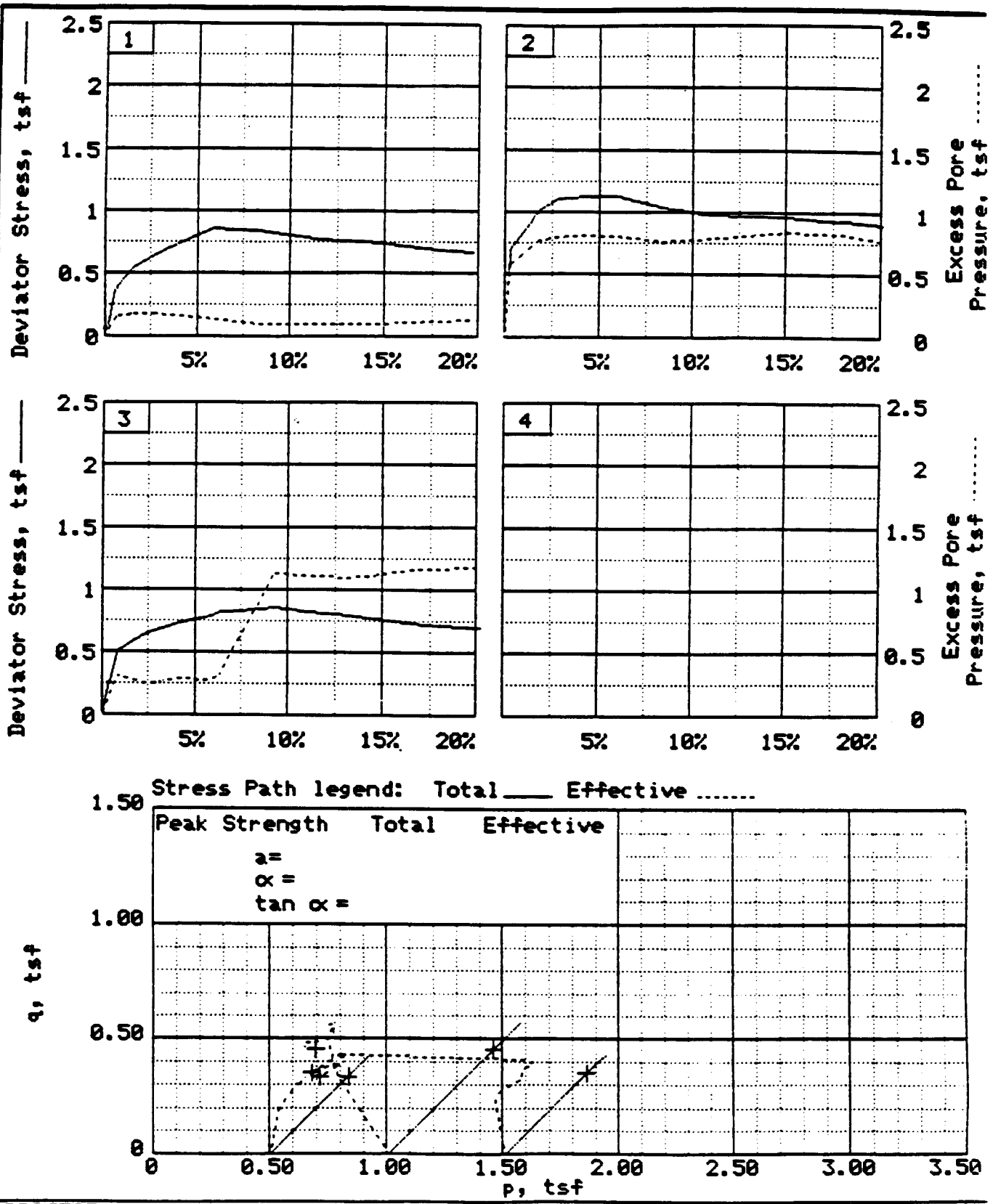
REMARKS 1. Insufficient similiar material for additional specimens.

PROJECT PASSAIC RIVER
LEVEE SYSTEM - DIKE #10
AREA

LAB NO. 264/556

BORING NO. P-10-3AU
SAMPLE NO. 3
DEPTH/ELEV 5.0 - 6.8'
LABORATORY CESAD-EN-FL DATE 8 FEB. 1994
Pg 1 of 2 TRIAXIAL COMPRESSION TEST

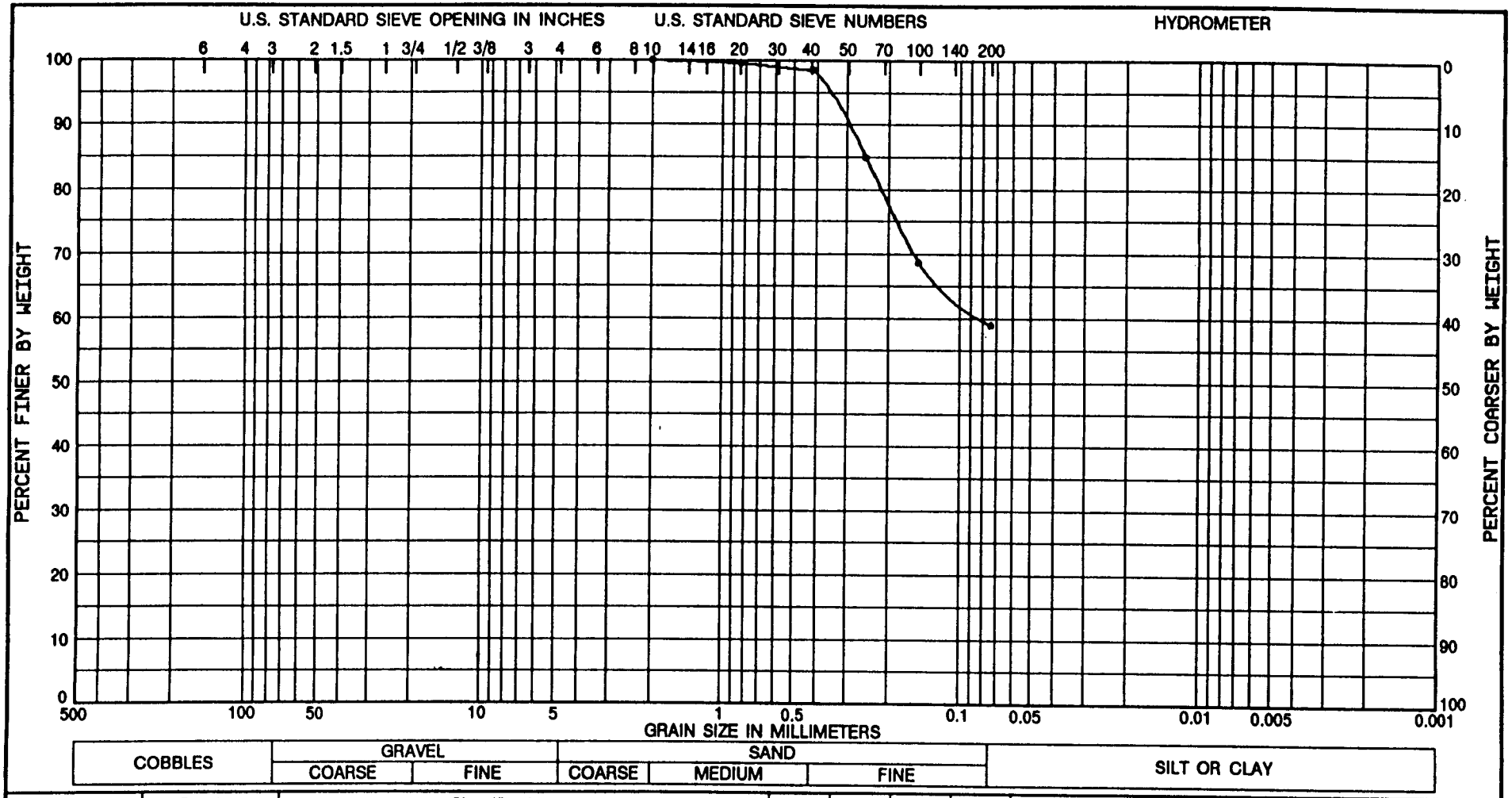
SOUTH ATLANTIC DIVISION LABORATORY, CORPS OF ENGINEERS - MARIETTA, GEORGIA
Requisition No. CESAW-EN-GS-94-0003 Work Order No. 7117



PROJECT PASSAIC RIVER LEVEE SYSTEM - DIKE #10
BORING P-10-3AU SAMPLE 3 DEPTH/ELEV 5.0 - 6.8'
TYPE OF TEST R w/pore pressures LAB NO. 264/556
LABORATORY CESAD-EN-FL PAGE 2/2 DATE 8 FEB. 1994

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER: 7118
REQUISITION: CESAW-EN-GS-003



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

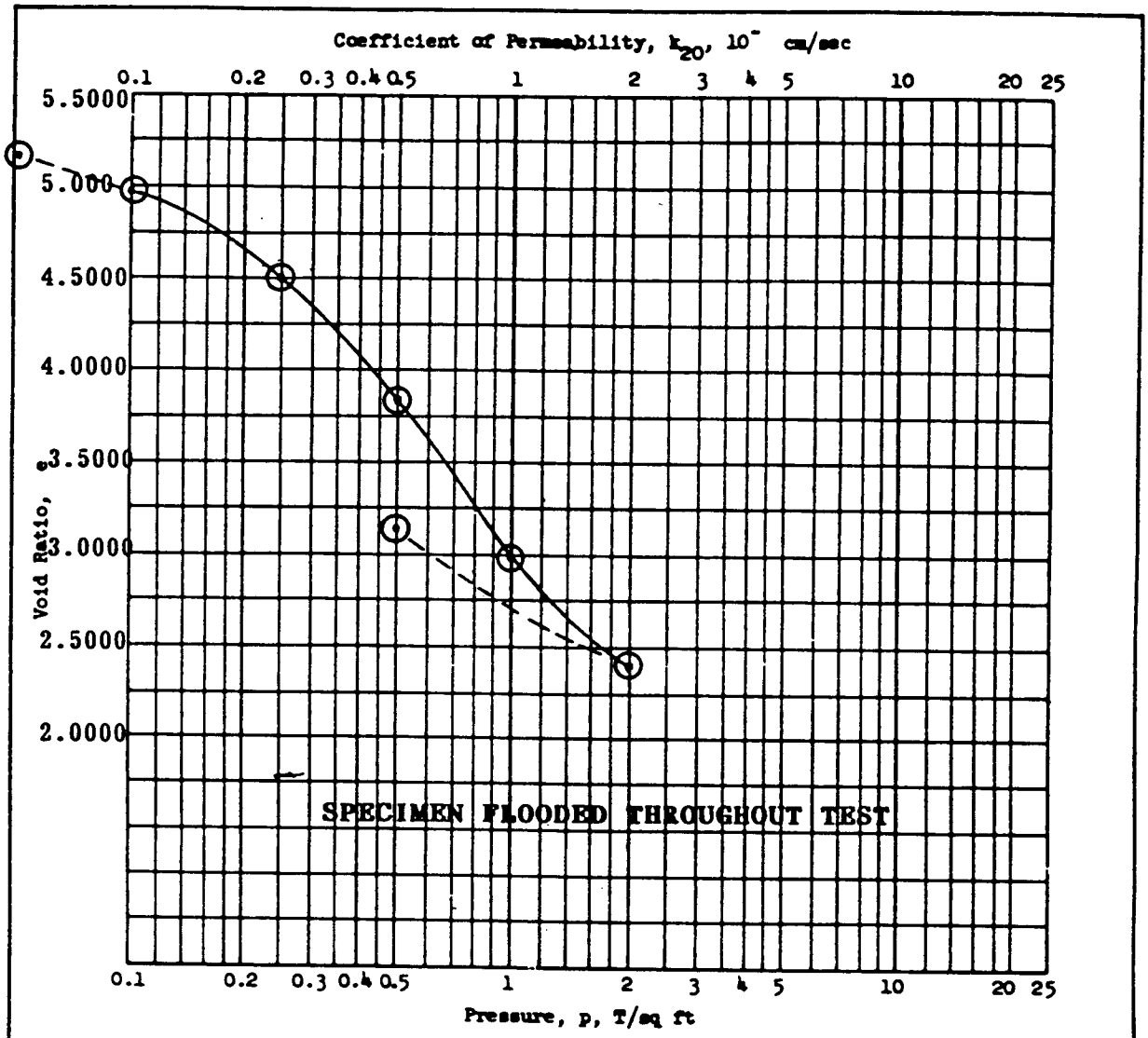
Sample No.	Depth	Classification	Nat w%	LL	PL	PI
1	1.3-3.0'	(VISUAL) BLACK ORGANIC SILT HIGH LL	355.8	432	194	238
		(OH), SANDY.				
		NOTE: THE PLUS NO. 200 SIEVE SIZES ARE				
		MOSTLY ORGANIC PARTICLES RATHER THAN				
		SAND.				

Project PASSAIC RIVER
LEVEE SYSTEM - DIKE # 10
Lab No. 264/557
Boring No. P-10-3BU
Date 01/31/94

GRADATION CURVES

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30061

WORK ORDER NO. 7118
REQ. NO. CESAW-EN-GS-94-0003



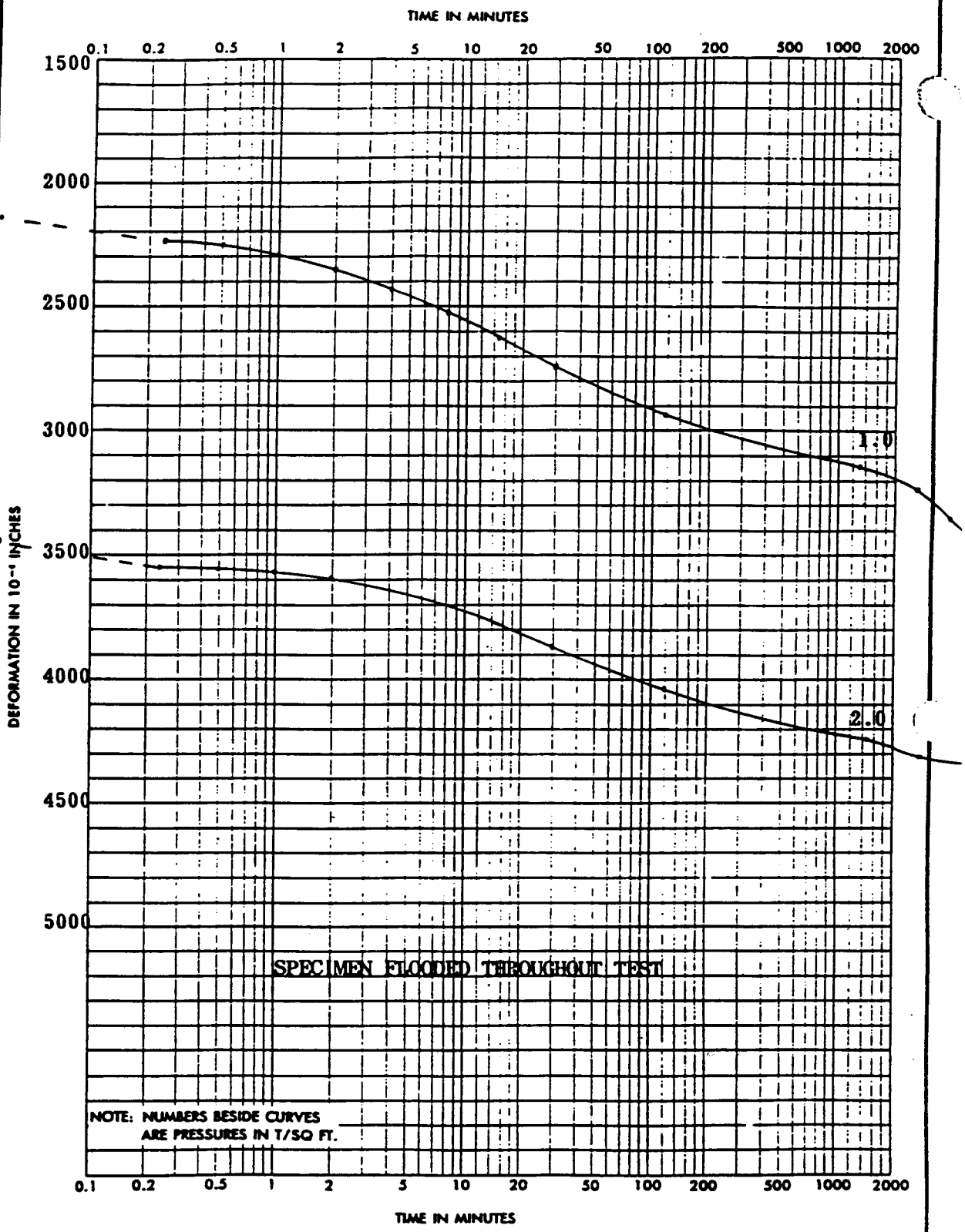
Type of Specimen Undisturbed		Before Test		After Test	
Diam 2.47 in.	Ht 1.00 in.	Water Content, w_o	321.3 %	w_f	197.6 %
Overburden Pressure, p_o	T/sq ft	Void Ratio, e_o	5.141	e_f	3.161
Preconsol. Pressure, p_c	T/sq ft	Saturation, S_o	100.0 %	S_f	100.0 %
Compression Index, C_c		Dry Density, γ_d	16.3 lb/ft^3		
Classification (Visual) Black Organic Silt High LL (OH), Sandy. NOTE: The plus 200 sieve sizes are mostly organic particles rather than sand		Sieve e_o =	× 10^{-} cm/sec		
LL 432	G_s 1.60	Project Passic River			
PL 194	D_{10} -	Lab. No. 264/557			
Remarks		Area Levee System - Dike #10			
		Boring No. P-10-3BU		Sample No. 1	
		Depth El 1.3 - 3.0'		Date 8 Feb. 94	

CONSOLIDATION TEST REPORT

ENG FORM 1 MAY 63 2090 PREVIOUS EDITIONS ARE OBSOLETE.

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER NO. 7118
Req. No. CESAW-EN-GS-0003



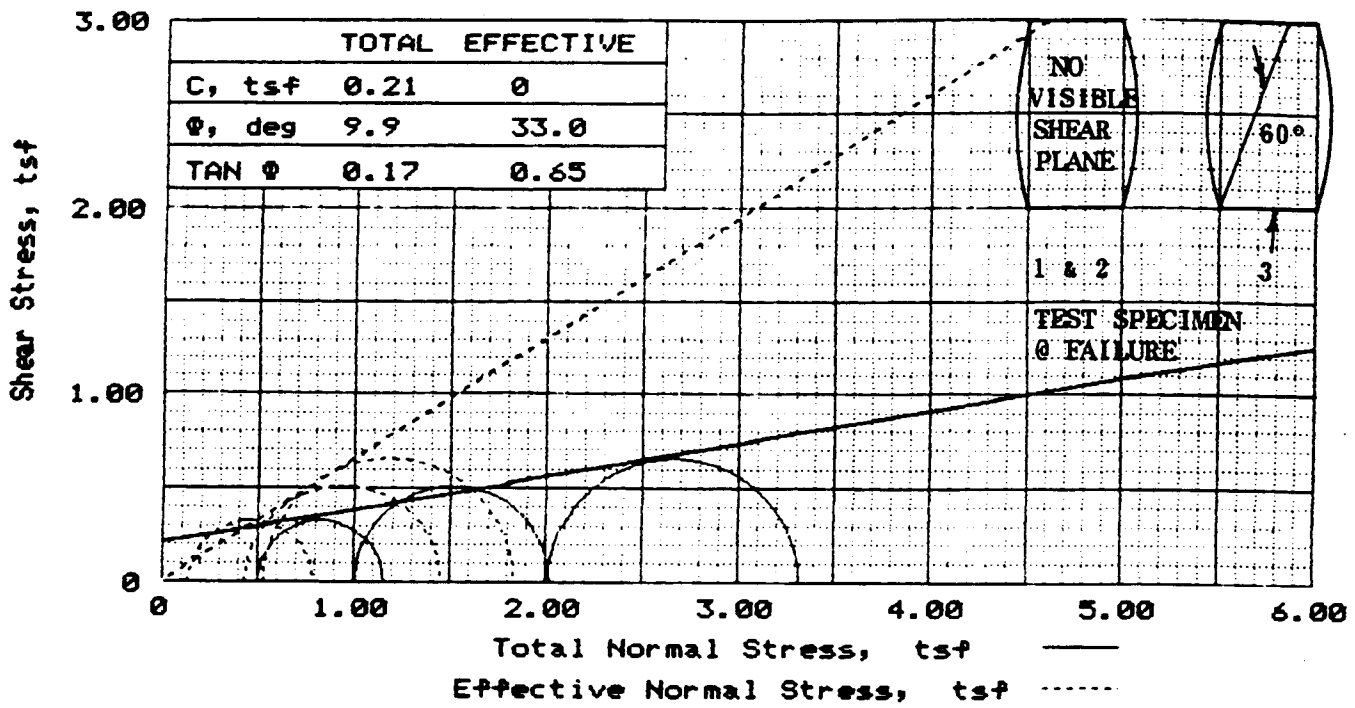
PROJECT Passaic River

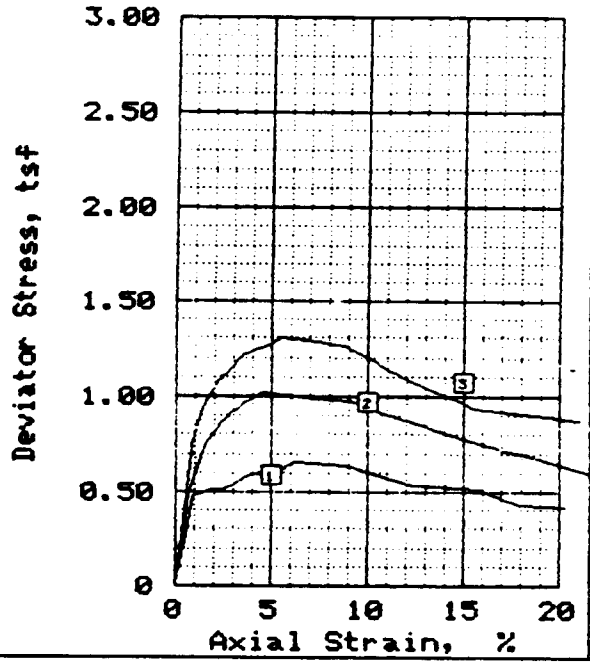
AREA Levee System Dike #10 Lab No. 264/557 (OH)

BORING NO. P-10-3BU | SAMPLE NO. 1 | DEPTH K 1.3-3.0' | DATE 31 Mar 94

ENG FORM 2088 1 MAY 63 PREVIOUS EDITIONS ARE OBSOLETE. **CONSOLIDATION TEST—TIME CURVES** (TRANSLUCENT)

SOUTH ATLANTIC DIVISION LABORATORY, CORPS OF ENGINEERS - MARIETTA, GEORGIA
Requisition No. CESAW-EN-GS-94-0003 Work Order No. 7118





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	389.4	396.7	315.6
	DRY DENSITY, pcf	12.5	12.5	16.5
	SATURATION, %	89.3	91.0	100.0
	VOID RATIO	6.973	6.973	5.050
	DIAMETER, in	1.38	1.38	1.38
	HEIGHT, in	3.08	3.08	3.08
@ TESTING	WATER CONTENT, %	309.9	294.8	258.3
	DRY DENSITY, pcf	16.8	17.5	19.5
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	4.957	4.717	4.134
	DIAMETER, in	1.25	1.23	1.30
	HEIGHT, in	2.80	2.77	2.92
BACK PRESSURE, tsf		5.04	5.04	5.04
INIT. EFF. STR., tsf		0.50	1.01	2.02
MAX. DEV. STRESS, tsf		0.65	1.02	1.31
PORE PRESSURE, tsf		0.37	0.57	1.48
TIME TO FAILURE, min.		85	60	70
RATE, %/min.		0.07	0.08	0.08
ULT. DEV. STRESS, tsf		0.52	0.78	0.96

DESCRIPTION (VISUAL) BLACK ORGANIC SILT HIGH 11 (OH), SANDY.

LL= 432	PL= 194	PI= 238	Gs= 1.60	CONTROLLED STRAIN TEST
TYPE OF SPECIMEN UNDISTURBED				TYPE OF TEST R w/pore pressures

REMARKS SEE ADDITIONAL INFO. ON GRADATION TEST REPORT

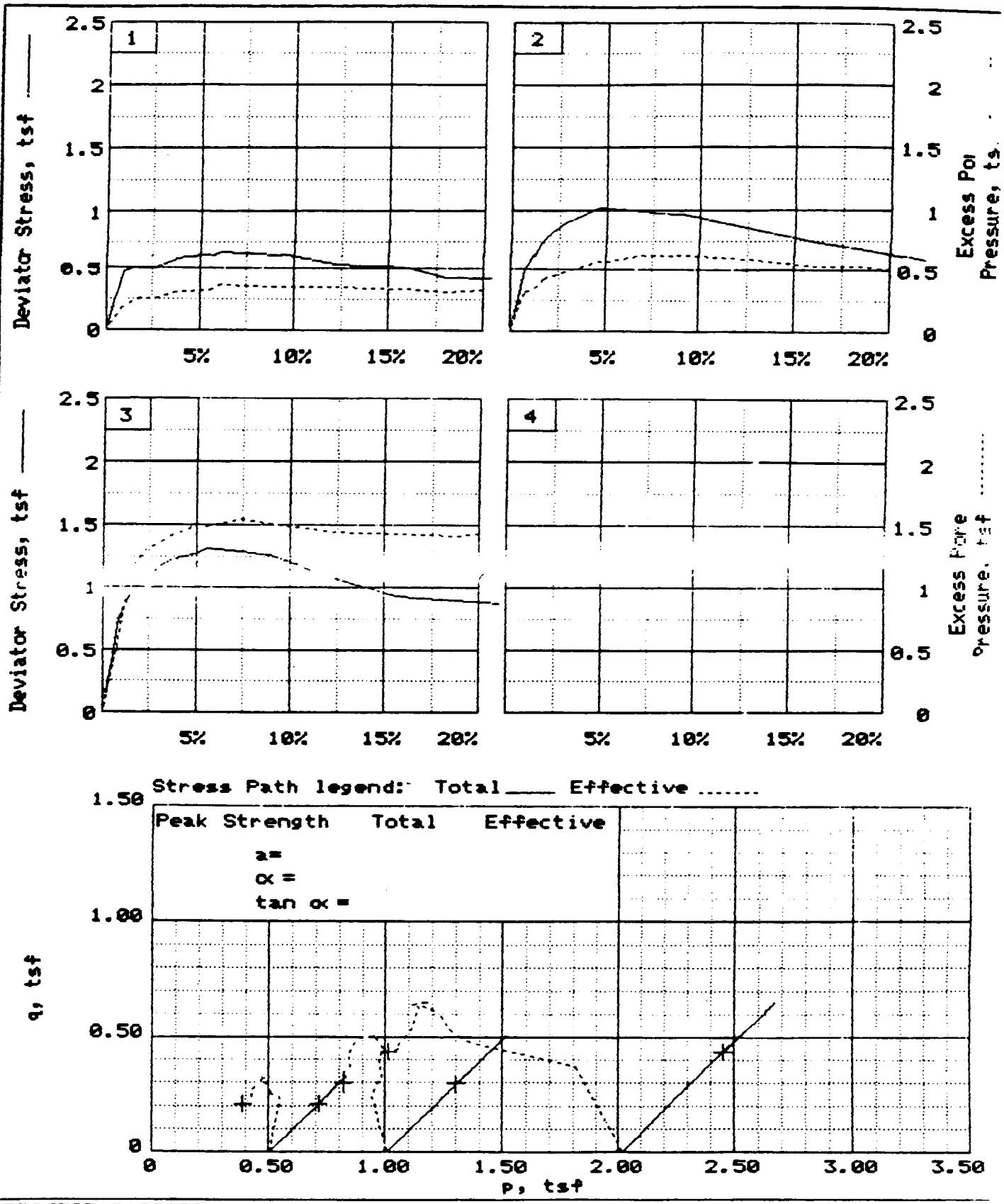
PROJECT PASSAIC RIVER
LEVEE SYSTEM - DIKE #10
AREA

LAB NO. 264/557

BORING NO. P-10-3BU
SAMPLE NO. 1
DEPTH/ELEV 1.3 - 3.0'
LABORATORY CESAD-EN-FL DATE 31 JAN 94

TRIAXIAL COMPRESSION TEST

SOUTH ATLANTIC DIVISION LABORATORY, CORPS OF ENGINEERS - MARIETTA, GEORGIA
Requisition No. CESAW-EN-GS-94-0003 Work Order No. 7118



PROJECT PASSAIC RIVER LEVEE SYSTEM - DIKE #10
BORING P-10-3BU SAMPLE 1 DEPTH/ELEV 1.3 - 3.0'
TYPE OF TEST R w/pore pressures LAB NO. 264/557
LABORATORY CESAD-EN-FL PAGE 2/2 DATE 31 JAN 94

ATTACHMENT C

GEOTECHNICAL ANALYSIS

APPENDIX J

ATTACHMENT C

GEOTECHNICAL ANALYSIS

Table of Contents

Text	Page
Text	JC-1 to JC-4
Organic Layer Location Map	Plate JC-1
Soil Profile	Plate JG-1
Levee Stability Analysis	Plate JG-2 to JG-9
Settlement Analysis	Figures JC-1 to JC-17

GEOTECHNICAL ANALYSIS

GENERAL. This attachment presents the geotechnical aspects of the Passaic 10 Levee Project, as accomplished by Wilmington District, U.S. Army Corps of Engineers. The work presented is the result of a team effort consisting of personnel from Passaic River Division, Mobile District, Nashville District, and the South Atlantic Division Laboratory, as well as the Wilmington District. Passaic River Division provided local support and guidance, Mobile provided the drill crews and equipment, Nashville provided the drill inspector, and SAD Lab provided the laboratory information. Wilmington provided criteria and guidance during sampling and testing and has been responsible for the work contained in this appendix.

SUBSURFACE INVESTIGATIONS

DRILLING PROCEDURE. Ten holes along the levee alignment were drilled using a Failing drill rig and the Standard Penetration Test (SPT) procedure. All holes were continuously sampled to a predetermined depth of 180 feet. Two holes, P-10-4 and P10-9, were then continued on five foot centers to a depth of 51.5 feet. Hole P-10-9A was drilled to 18.0 feet, but at a different location than P-10-9, on an alternate levee alignment. Hole P-10-3 has some companion holes that were drilled to obtain undisturbed samples. Also in the area of P-10-3, Passaic River Division personnel drilled several holes with a hand auger in order to define the extent of the soft organic layer which lies at the top of ground in the area. No boring logs for these hand augers exist, but a location map with the depth of the organics is included herein.

SOIL TYPES. The soils encountered are typical of an area which has undergone glaciation, i.e. a mix of fined-grained silts and clays with some sand deposits and some gravel. After the glacier loaded the area and melted, Lake Passaic was formed from the melting glacier. More fine-grained soils (clay and silts) were then deposited and in one area, near P-10-3 (the soft area) a kettle or basin was formed. This kettle had organic deposited in it and as can be seen from the boring logs this is the only soil type along the alignment which is drastically different than the soils in other holes. A theoretical soil profile is included as

Plate G-1. Visual observations revealed an area of surface debris, mostly leaves and small limbs, in the western foundation area between holes P-10-3, P-10-7, and P-10-8. An HTRW investigation of the entire area is presented in the HTRW section.

GROUNDWATER. Groundwater was encountered in most holes during drilling. This water level and a 24 hour water level are shown on the boring logs. The depth to water, when encountered, range from 4.5 feet to 11.8 feet. Water levels are not expected to have any affect on the levee construction. However, the levee does traverse some low lying areas and surface ponding has been seen and can be expected in those areas during rainy weather.

LEVEE DESIGN

GENERAL. The typical levee cross-section is 6 to 11 feet high with a 10 foot wide crest, and 3H:1V side slopes. The levee fill was assumed to be a homogeneous silt-clay material. The strengths used for the levee were assumed, but are typical of a glacial silt-clay soil. The strength of the underlying organic and clay layers were determined from the undisturbed sample testing. The sand layer strength was assumed using a correlation between the blow counts and strength. One levee section was analyzed with a stiff foundation while another levee section was analyzed over a soft foundation.

SLOPE STABILITY. Slope stability was analyzed using the computer program, UTEXAS3, by Dr. Stephen Wright, as packaged by the Corps. Three loading conditions were analyzed for slope stability. They were end of construction, steady seepage, and sudden drawdown. All stability results are presented on plates G-2 thru G-9, in this appendix. There were two drawdown conditions analyzed. One was a full height drawdown of 10 feet in which the upstream water elevation drops from 178 to the toe, while the downstream water elevations drops form 170 to the toe. The second condition was a partial drawdown of 6 feet from elevation 178, while the downstream water elevation remains constant at 170. The difference in these two conditions is the interior drainage capability of the interior drainage structures. All conditions analyzed with stiff foundation met the slope stability criteria in the Corps EM 1110-2-1913, Design and Construction of Levees. In the area around P-10-3, known as the soft area, the design changes slightly. In order to meet the EM criteria for sudden drawdown, the riverside slope was flattened

to 4H:1V for 600 feet of levee. The downstream slope remains as a 3H:1V. A geotextile was added at the interface between the levee and the foundation to provide additional strength to the levee and a stable working platform to facilitate construction. For the steady seepage condition this reinforcement allows the 3H:1V slope on the downstream to meet to meet the EM criteria. The sudden drawdown condition was not analyzed with this reinforcement because of the sudden drawdown analysis procedure. The geotextile may add strength for this condition, but land space is not a factor upstream, therefor it is best to have a stable slope without the reinforcement.

SETTLEMENT. Settlement within the levee was not calculated because the type of fill material is unknown at this time. Typically a settlement of 2-6 inches can be expected for a silt-clay levee. Settlement along most of the levee alignment (stiff foundation) was not calculated because of the stiff materials encountered as indicated by the blow counts during drilling. The materials have been previously loaded and preconsolidated by glaciation. Some foundation settlement will occur, but it should be less than one inch. In the soft area two undisturbed samples underwent consolidation testing. The organics and the underlying soft clay layer were tested. The clay layer is the basis for the statements above concerning settlement on the stiff foundation. The clay tested had the lowest blow counts of any clay encountered, yet yielded very little settlement due to consolidation because of glacial preconsolidation and the small load of the levee. The organics were slightly preloaded, but showed the largest amount of consolidation. The settlement calculations are presented in this appendix. References used include the Corps Settlement Analysis, EM 1110-1-1904, particularly chapter 3, and Soil Mechanics, by Perloff and Baron, Wiley & Sons, chapter 4, section 4.5 and Appendix A, Figure A-12. This figure was used to determine the load distribution in the soil layers due to the levee.

SEEPAGE. Seepage through the levee was not calculated because the assumed material to be used as fill is relatively impermeable. The silt-clay mixture assumed for stability analyses yields a levee with very low permeabilities. For underseepage, information from the consolidation tests was used to calculate the permeability of the organic layer and clay layer. A formula relating the coefficient of consolidation (C_v) to permeability (k) is a part of Terzaghi's consolidation theory. This formula can be found in Principles of Foundation Engineering, by Braja Das, First Edition, page 37, equation 1.65. The calculation sheet is included in this appendix. The permeability for the organics was calculated as 0.9 x 10(-4)

feet/day and for the clay layer as 1.6 x 10(-3) feet/day. These permeabilities are typical of impermeable materials. For this reason underseepage is not considered to be a problem and no flow net was constructed. Since the materials involved are relatively impermeable no toe drain was designed.

CONSTRUCTION CONSIDERATIONS

GENERAL. A Construction Materials document exists which lists available sources of stone, gravel, and other materials such as soil fill and fly ash. This document, prepared under contract by a local (NJ) A-E firm, should be consulted for sources.

LEVEE. The area beneath the entire levee footprint will be cleared of trees and stripped to a minimum depth of 6 inches to remove all vegetation and other objectionable materials. Then the area will be grubbed to a depth of 3 ft to remove all large trees roots and other debris. In addition, an inspection trench with a maximum depth of 6 ft. will be excavated and backfilled prior to fill placement.

PASSAIC #10 LEVEE
ORGANIC LAYER LOCATION

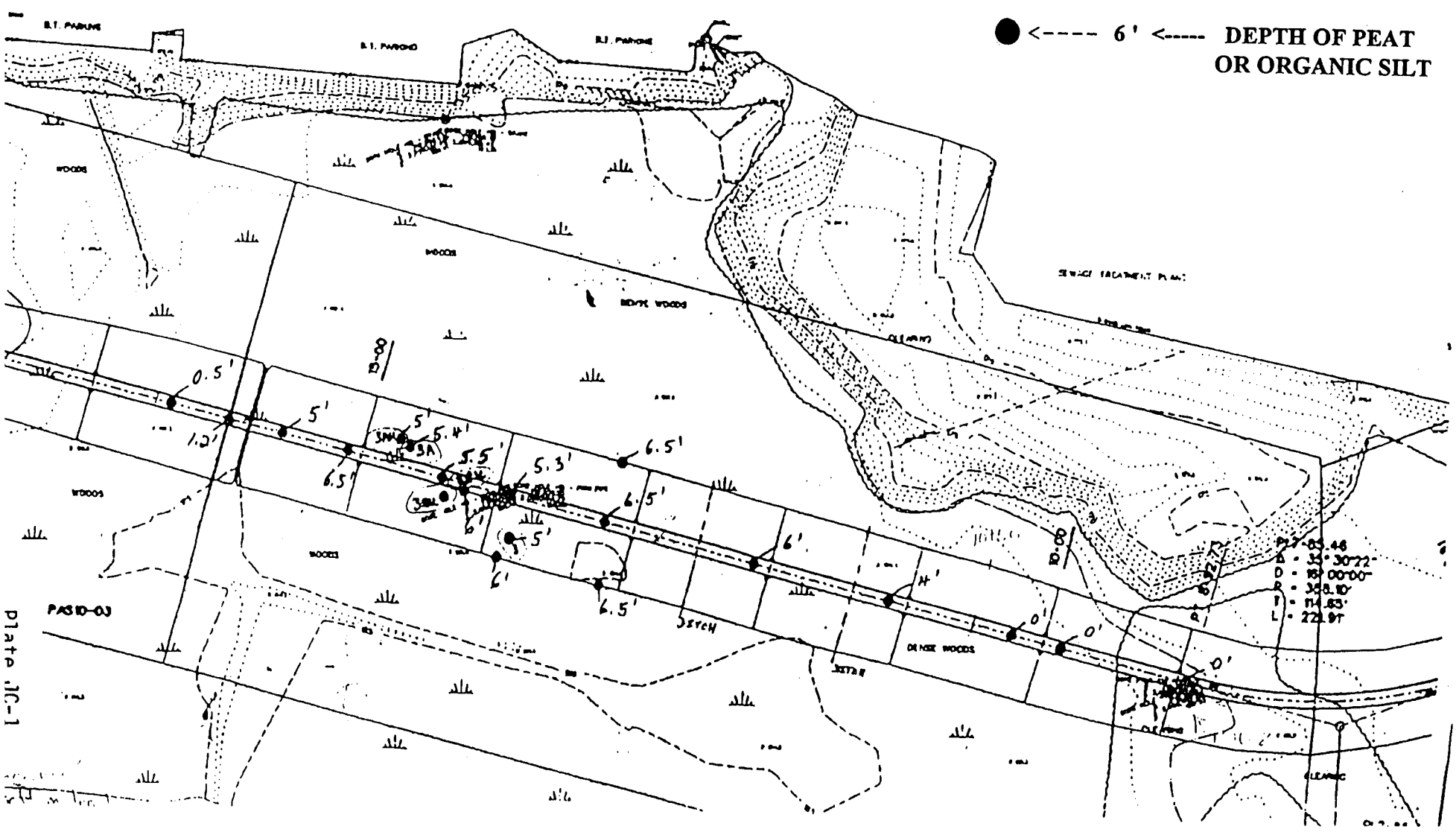
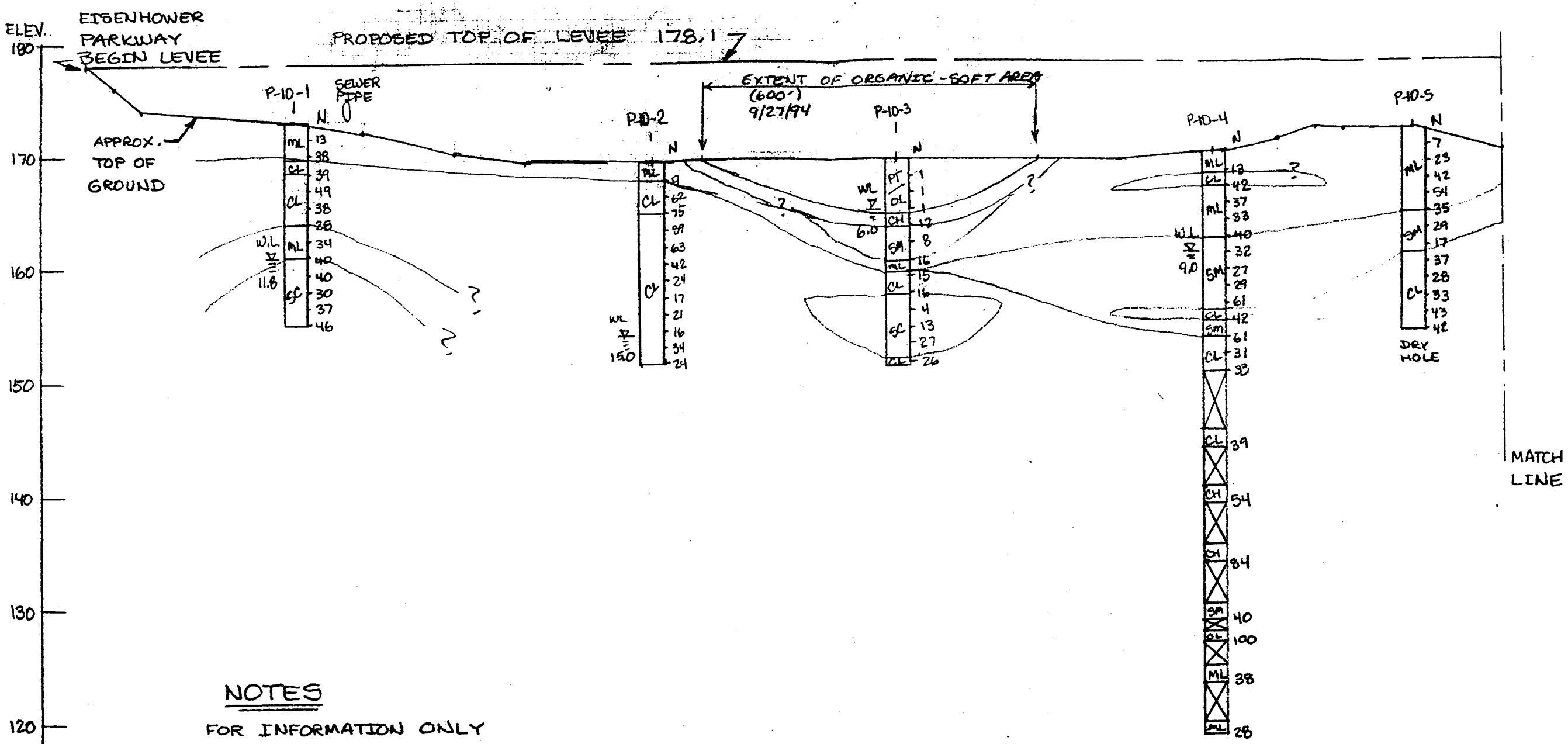


Plate JC-1



NOTES

FOR INFORMATION ONLY

HOLES ELEVATION AND LOCATION ARE APPROXIMATE

TOP OF GROUND CONTOUR IS APPROXIMATE

WATER LEVEL (W.L) IS DURING DRILLING

SOILS DATA FROM 9/9/93 BORINGS.

X - INTERVAL - AUGER CLEAN OUT

SCALE

VERT. 1" = 10'

HORIZ. 1" = 200'

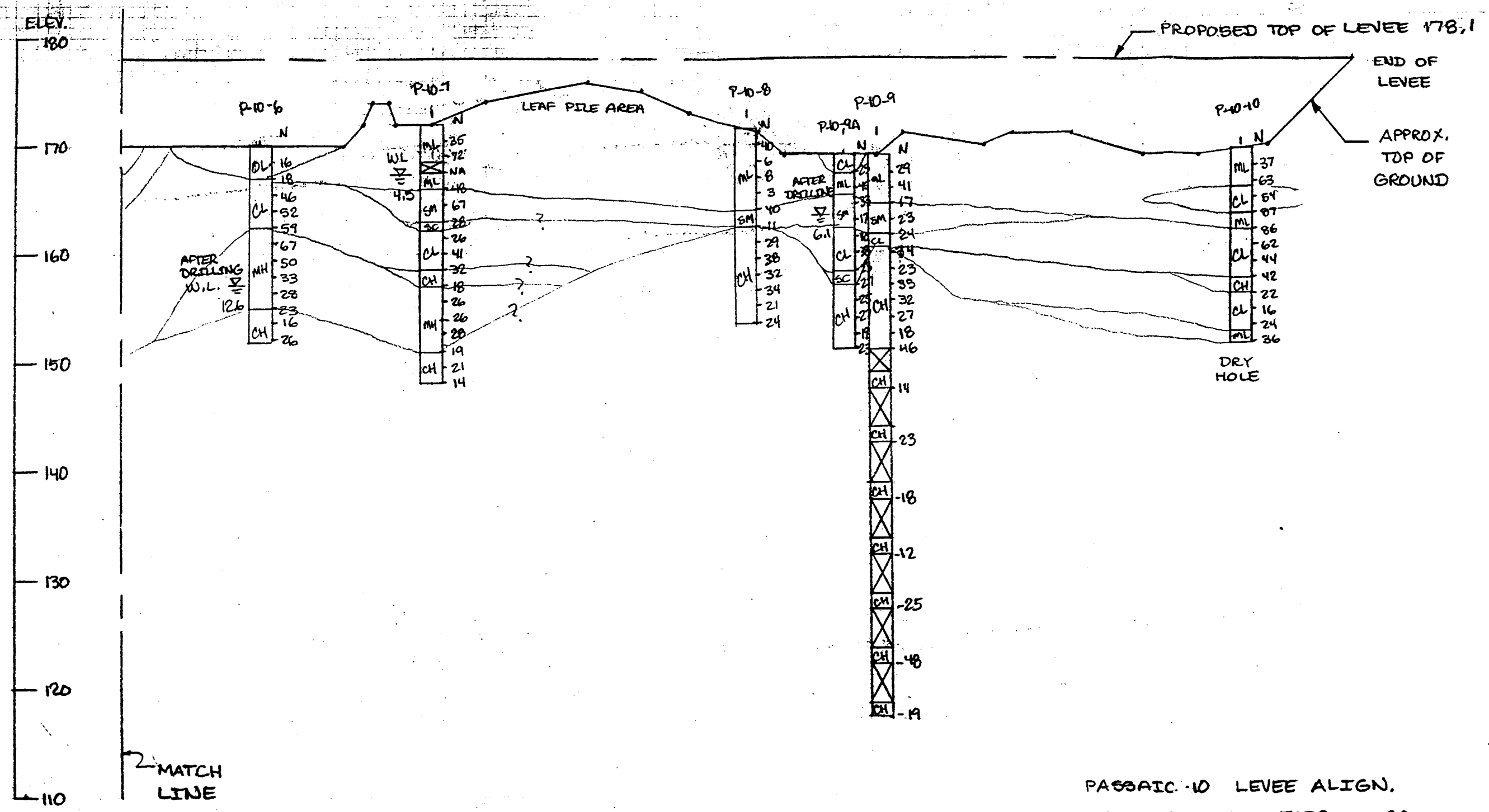
PASSAIC - 10 LEVEE ALIGN.

SOIL PROFILE - THEORETICAL

WILMINGTON DISTRICT

TOM CHILD 5/94

PLATE G-1 1 OF 2



SCALE
VERT. 1" = 10'
HORIZ. 1" = 200'

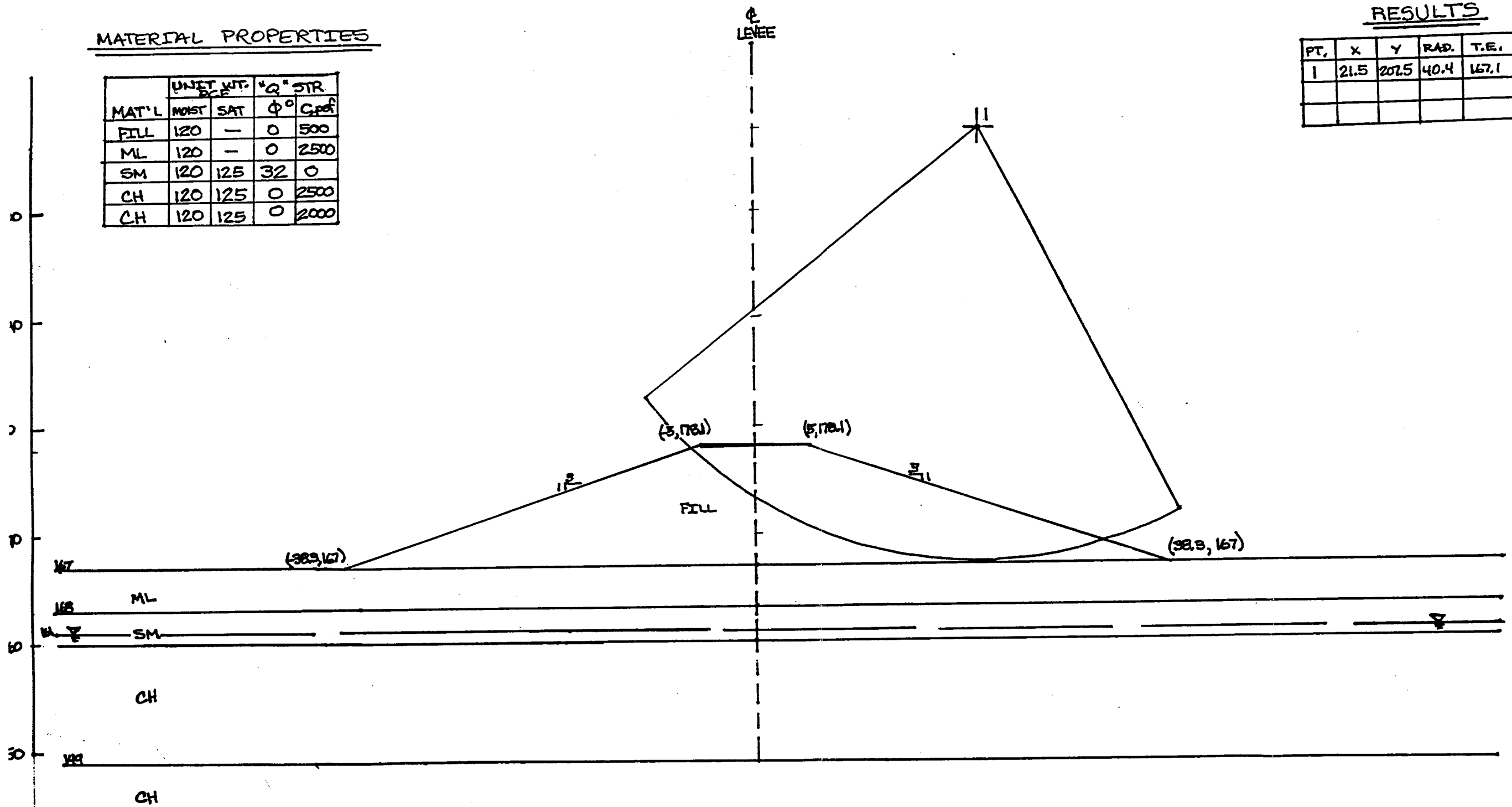
PASSAIC-10 LEVEE ALIGN.
SOIL PROFILE - THEORETICAL
WILMINGTON DISTRICT
TOM CHILD 5/94
PLATE G-1 2 OF 2

MATERIAL PROPERTIES

MAT'L	UNIT WT. PCF MOIST	SAT	"Q" STR. $\phi°$	C psf
FILL	120	—	0	500
ML	120	—	0	2500
SM	120	125	32	0
CH	120	125	0	2500
CH	120	125	0	2000

RESULTS

PT.	X	Y	RAD.	T.E.	F.S.
1	21.5	207.5	40.4	167.1	4.02



PASSAIC RIVER PROJECT
PASSAIC "10" LEVEE SYSTEM
SLOPE STABILITY
END OF CONSTRUCTION
APPROX. STATION 41+00

SCALE: 1" = 10'

PLATE G-2

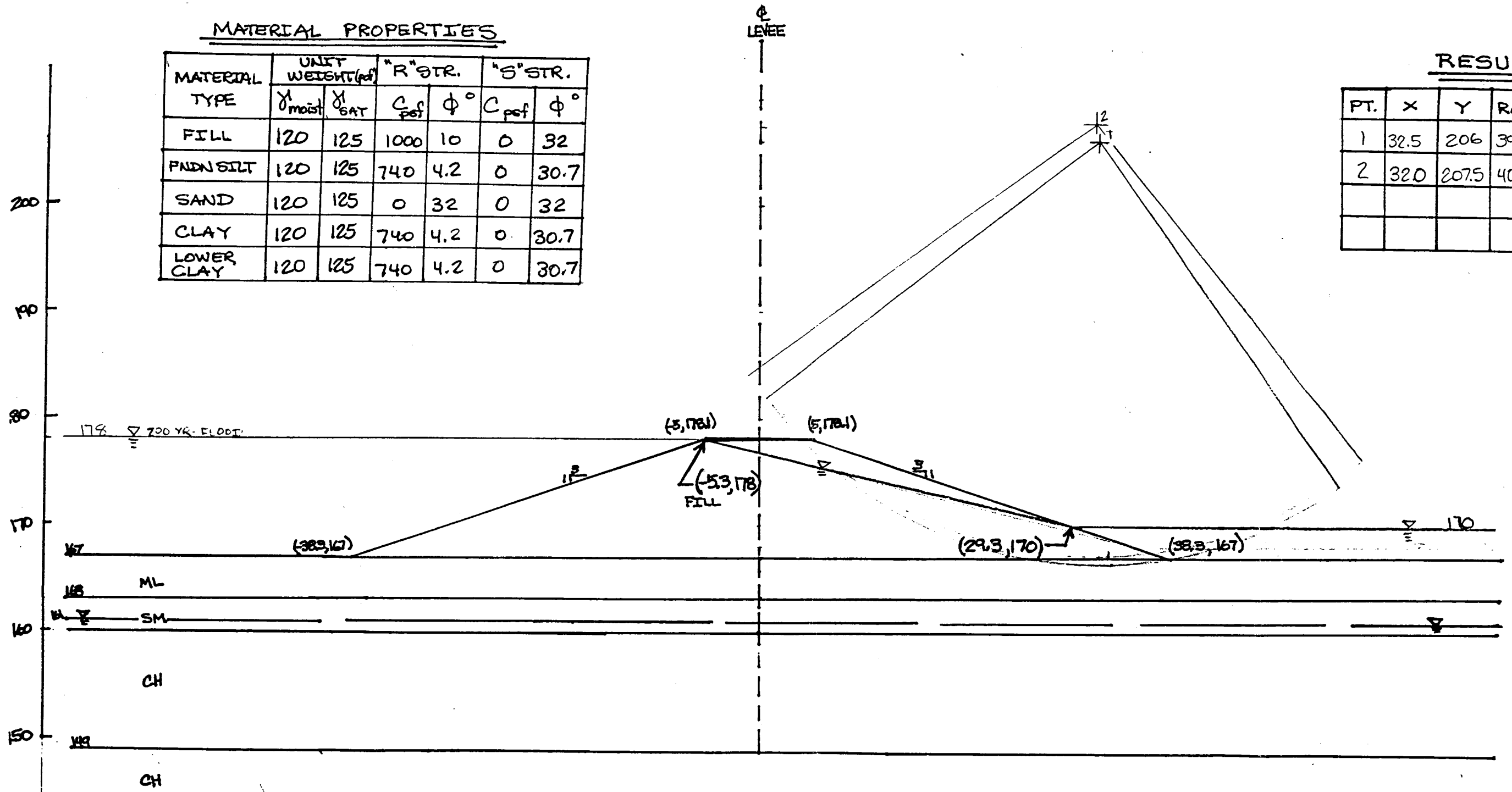
TOM CHILD
CESAW-EN-GS
MAY 1994

MATERIAL PROPERTIES

MATERIAL TYPE	UNIT WEIGHT (pcf)		"R" STR.		"S" STR.	
	γ_{moist}	γ_{SAT}	C_{psf}	$\phi°$	C_{psf}	$\phi°$
FILL	120	125	1000	10	0	32
PNDN SILT	120	125	740	4.2	0	30.7
SAND	120	125	0	32	0	32
CLAY	120	125	740	4.2	0	30.7
LOWER CLAY	120	125	740	4.2	0	30.7

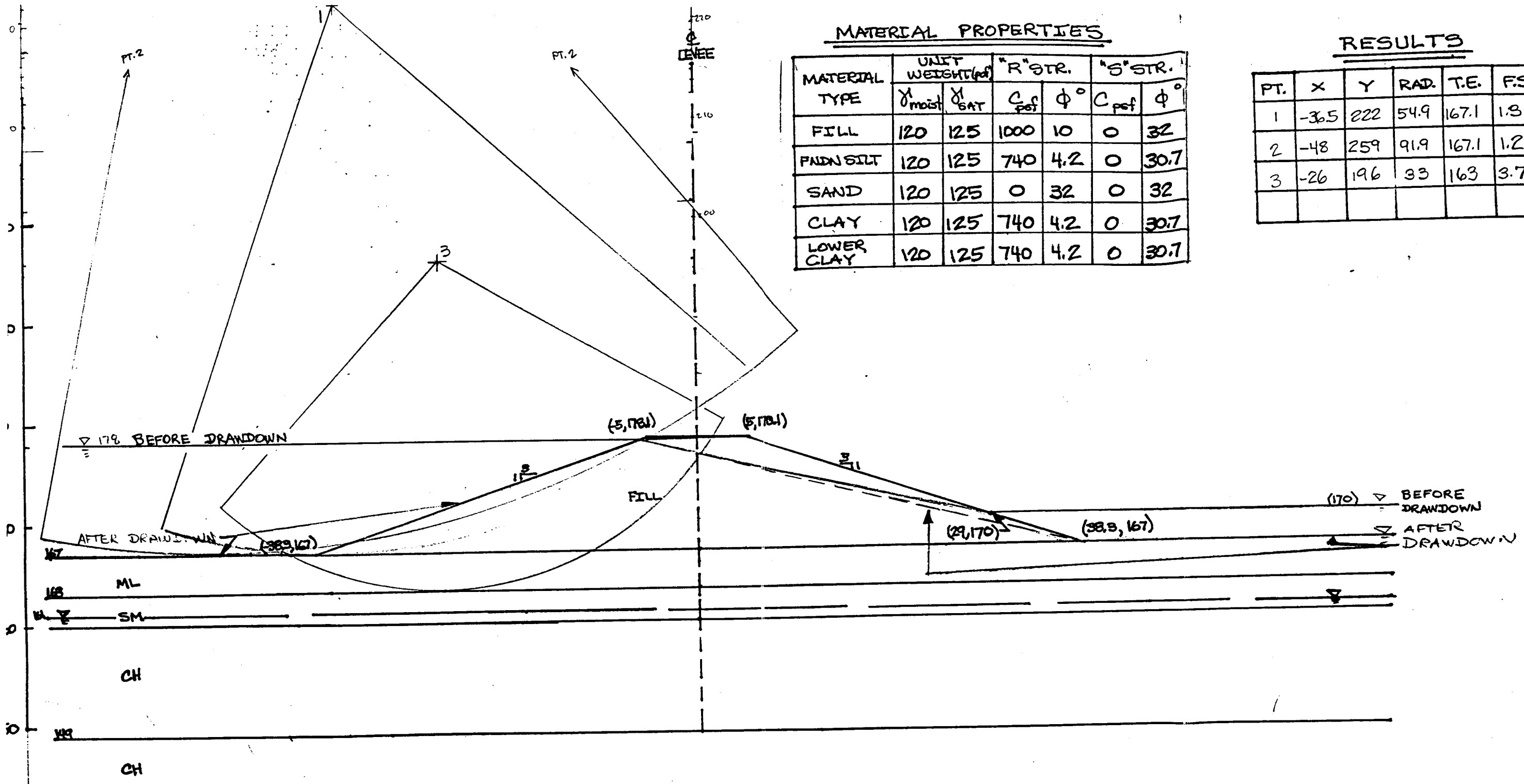
RESULTS

PT.	X	Y	RAD.	T.E.	F.S.
1	32.5	206	39.5	166.5	1.40
2	32.0	207.5	40.4	167.1	1.40



PASSAIC RIVER PROJECT
PASSAIC "10" LEVEE SYSTEM
SLOPE STABILITY
APPROX. STATION 41+00
STEADY SEEPAGE
SCALE 1" = 10'
PLATE: G-3

TOM CHILD
CESAW-EN-GS
MAY 1994



MATERIAL PROPERTIES

MATERIAL TYPE	UNIT WEIGHT (pcf)		"R" STR.		"S" STR.	
	γ_{moist}	γ_{SAT}	C_{psf}	$\phi°$	C_{psf}	$\phi°$
FILL	120	125	1000	10	0	32
PADIN SILT	120	125	740	4.2	0	30.7
SAND	120	125	0	32	0	32
CLAY	120	125	740	4.2	0	30.7
LOWER CLAY	120	125	740	4.2	0	30.7

RESULTS

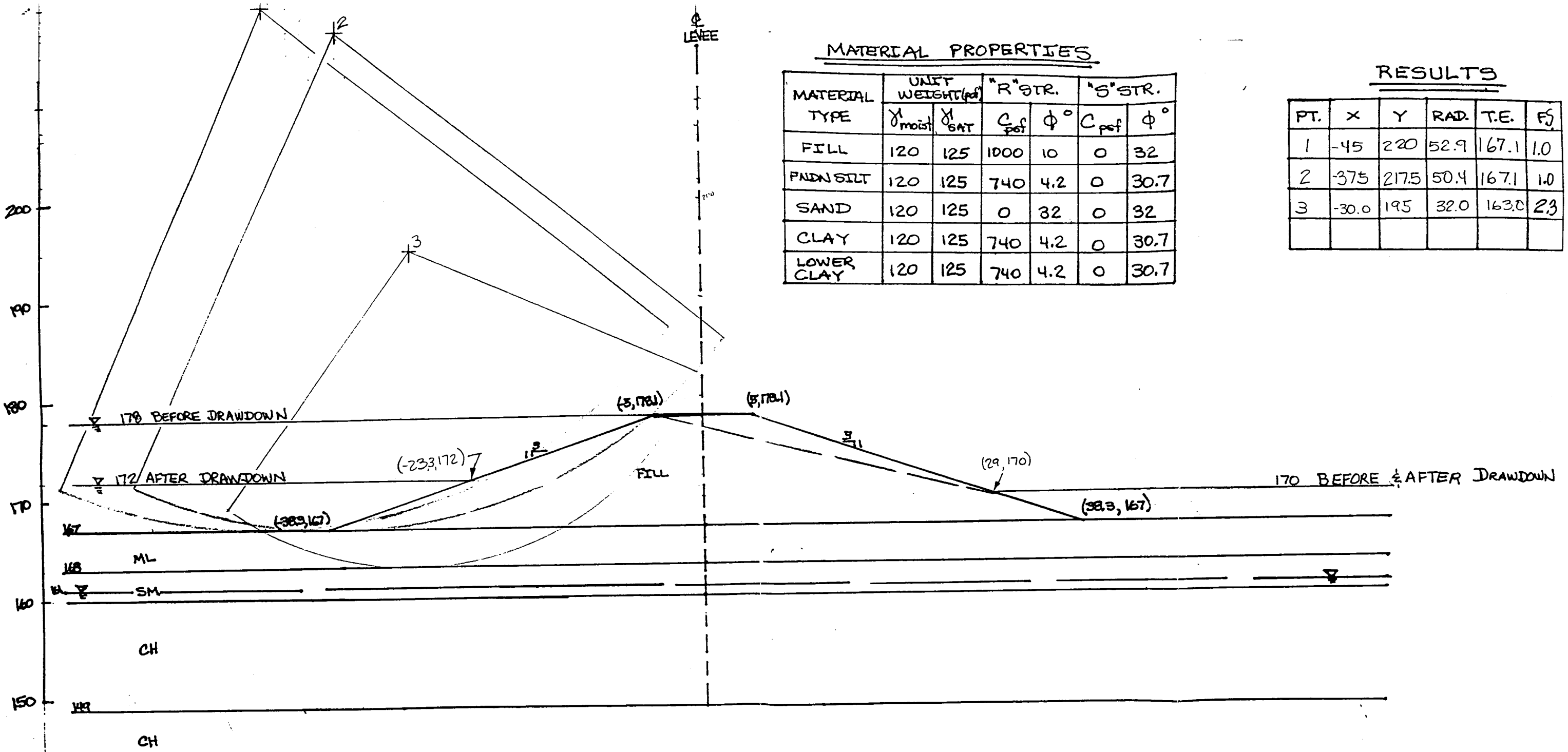
PT.	X	Y	RAD.	T.E.	F.S.
1	-36.5	222	54.9	167.1	1.8
2	-48	259	91.9	167.1	1.2
3	-26	196	33	163	3.7

PASSAIC RIVER PROJECT
PASSAIC "10" LEVEE SYSTEM
SLOPE STABILITY
SUDDEN DRAWDOWN (11' DRAWDOWN)
STA. 41+00

SCALE: 1" = 10'

PLATE G-4

TOM CHILD
CESAW-EN-GS
MAY 1994



MATERIAL PROPERTIES

MATERIAL TYPE	UNIT WEIGHT (pcf)		"R" STR.		"S" STR.	
	γ_{moist}	γ_{SAT}	C_{psf}	$\phi°$	C_{psf}	$\phi°$
FILL	120	125	1000	10	0	32
FNDN SILT	120	125	740	4.2	0	30.7
SAND	120	125	0	32	0	32
CLAY	120	125	740	4.2	0	30.7
LOWER CLAY	120	125	740	4.2	0	30.7

RESULTS

PT.	X	Y	RAD.	T.E.	FS
1	-45	220	52.9	167.1	1.0
2	-37.5	217.5	50.4	167.1	1.0
3	-30.0	195	32.0	163.0	2.3

PASSAIC RIVER PROJECT
PASSAIC "10" LEVEE SYSTEM
SLOPE STABILITY
SUDDEN DRAWDOWN (6' DRAWDOWN)
STA. 41+00

SCALE: 1" = 10'

PLATE G-5

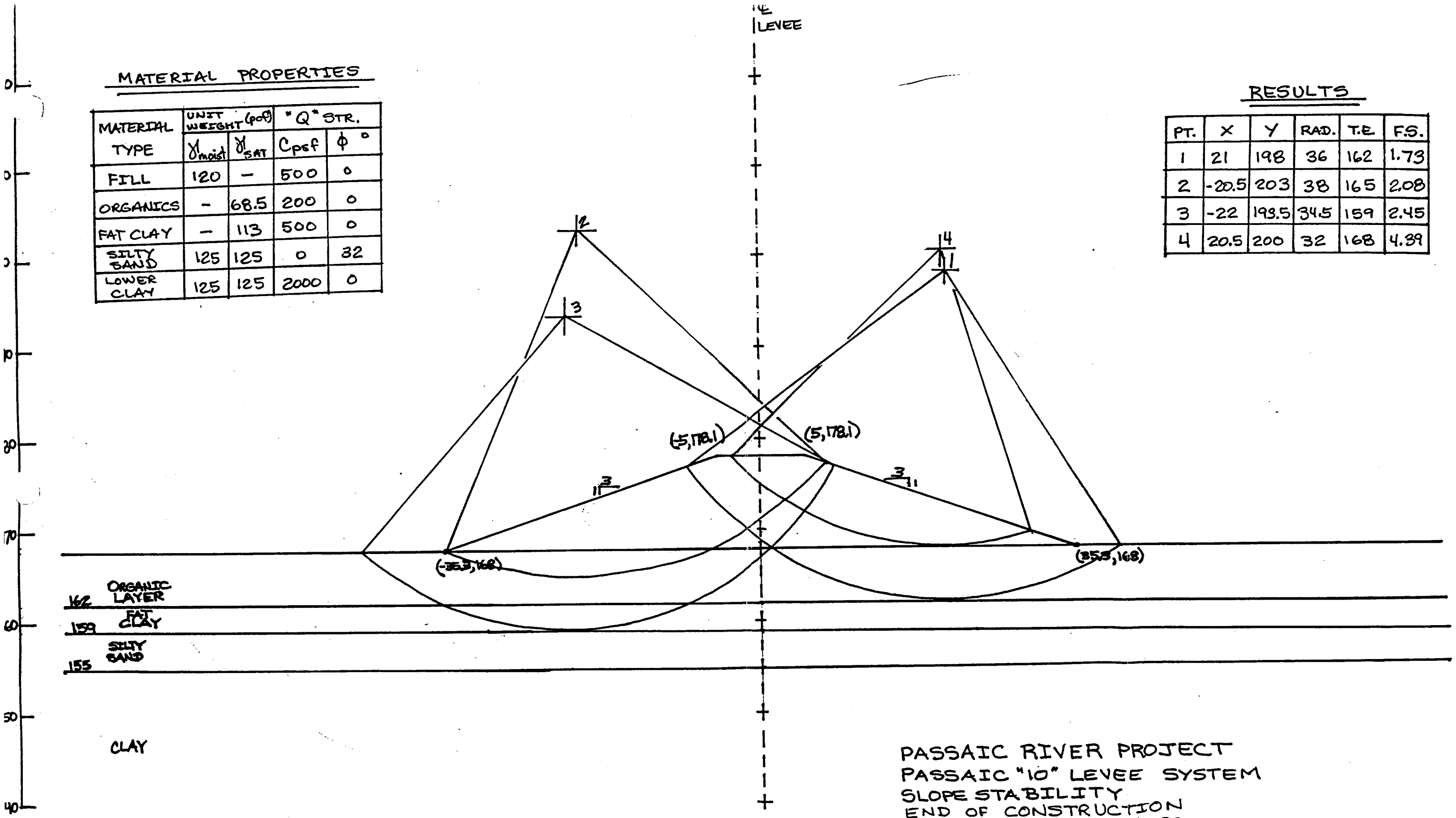
TOM CHILD
CESAW-EN-GS
MAY 1994

MATERIAL PROPERTIES

MATERIAL TYPE	UNIT WEIGHT (pcf) γ_{moist}	γ_{SAT}	"Q" STR. C_{psf}	ϕ °
FILL	120	–	500	0
ORGANICS	–	68.5	200	0
FAT CLAY	–	113	500	0
SILTY SAND	125	125	0	32
LOWER CLAY	125	125	2000	0

RESULTS

PT.	X	Y	RAD.	T.E.	F.S.
1	21	198	36	162	1.73
2	-20.5	203	38	165	2.08
3	-22	193.5	34.5	159	2.45
4	20.5	200	32	168	4.39



PASSAIC RIVER PROJECT
PASSAIC "10" LEVEE SYSTEM
SLOPE STABILITY
END OF CONSTRUCTION
STATION (APPROX.) 14+00
SCALE 1" = 10'
PLATE G-6

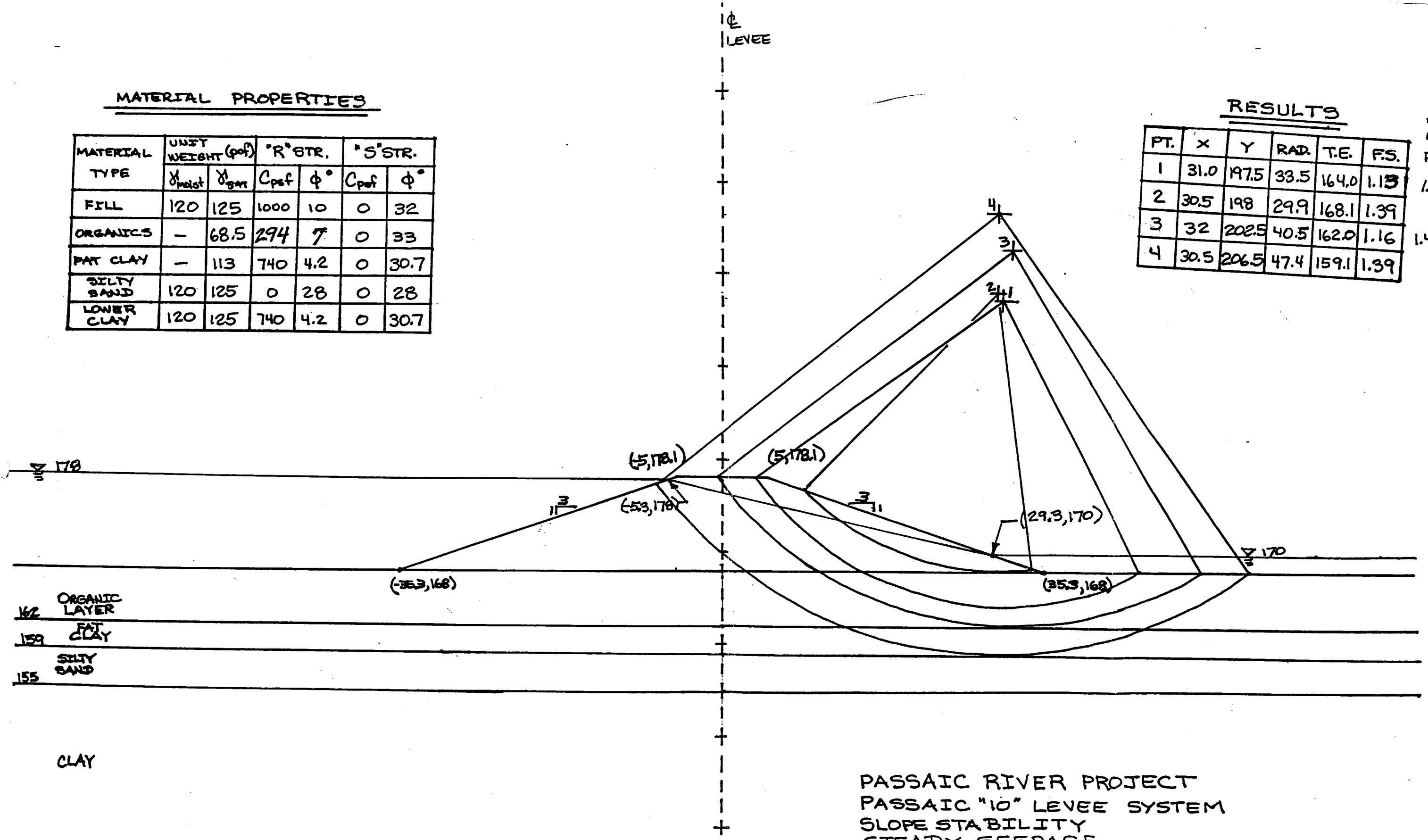
TOM CHILD
CESAW-EN-GS
MAY 1994

MATERIAL PROPERTIES

MATERIAL TYPE	UNIT WEIGHT (pcf)		"R" STR.		"S" STR.	
	γ_{moist}	γ_{sat}	C_{psf}	$\phi°$	C_{psf}	$\phi°$
FILL	120	125	1000	10	0	32
ORGANICS	–	68.5	294	7	0	33
FAT CLAY	–	113	740	4.2	0	30.7
SILTY SAND	120	125	0	28	0	28
LOWER CLAY	120	125	740	4.2	0	30.7

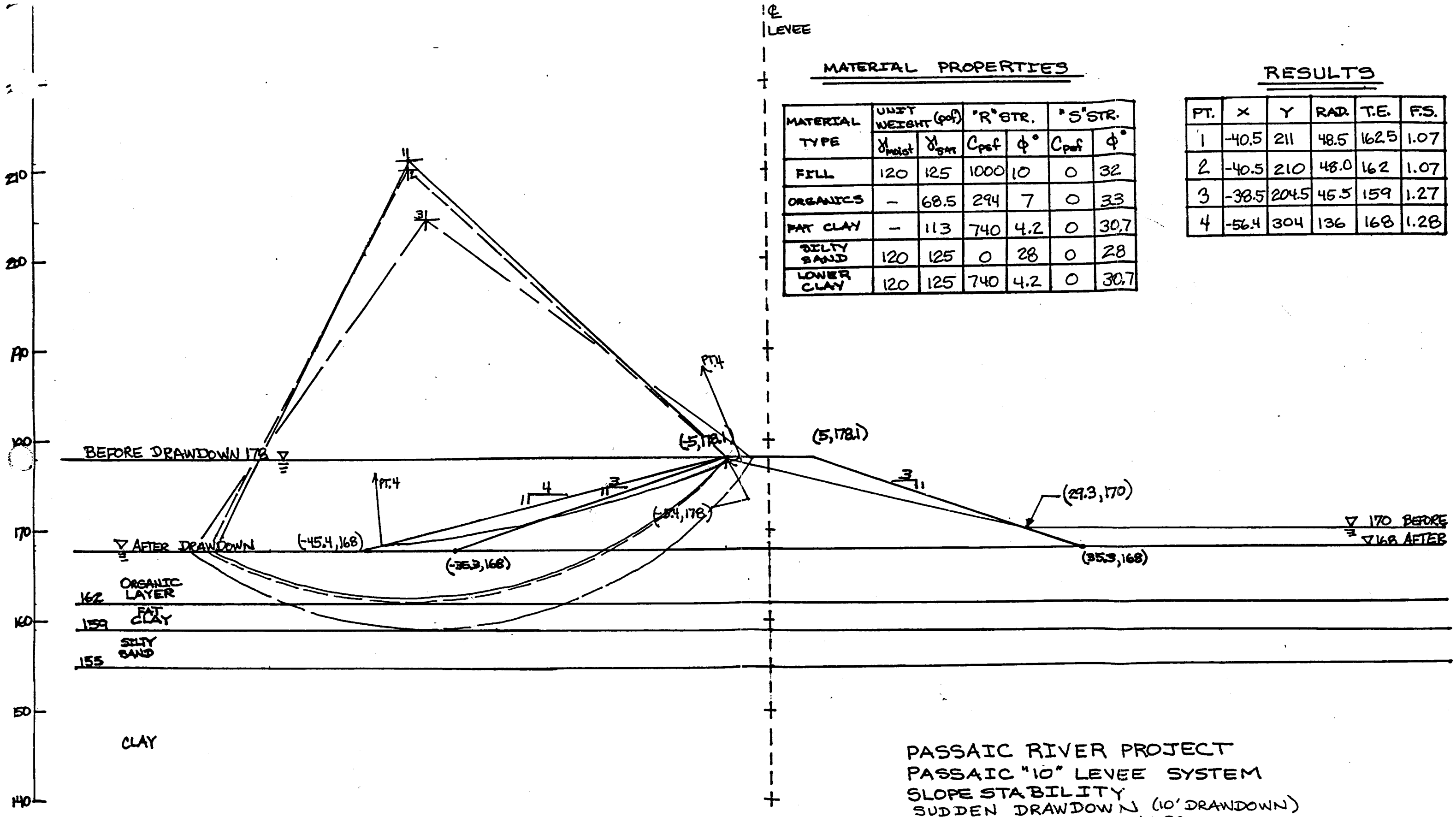
RESULTS

PT.	X	Y	RAD.	T.E.	F.S.	WITH REINF. F.S.
1	31.0	197.5	33.5	164.0	1.13	1.52
2	30.5	198	29.9	168.1	1.39	
3	32	202.5	40.5	162.0	1.16	1.40
4	30.5	206.5	47.4	159.1	1.39	



PASSAIC RIVER PROJECT
PASSAIC "10" LEVEE SYSTEM
SLOPE STABILITY
STEADY SEEPAGE
STATION (APPROX.) 14+00
SCALE 1" = 10'
PLATE G-7

TOM CHILD
CESAW-EN-GS
MAY 1994



MATERIAL PROPERTIES

MATERIAL TYPE	UNIT WEIGHT (pcf)		"R" STR.		"S" STR.	
	γ_{moist}	γ_{sat}	C_{psf}	$\phi°$	C_{psf}	$\phi°$
FILL	120	125	1000	10	0	32
ORGANICS	–	68.5	294	7	0	33
FAT CLAY	–	113	740	4.2	0	30.7
SILTY SAND	120	125	0	28	0	28
LOWER CLAY	120	125	740	4.2	0	30.7

RESULTS

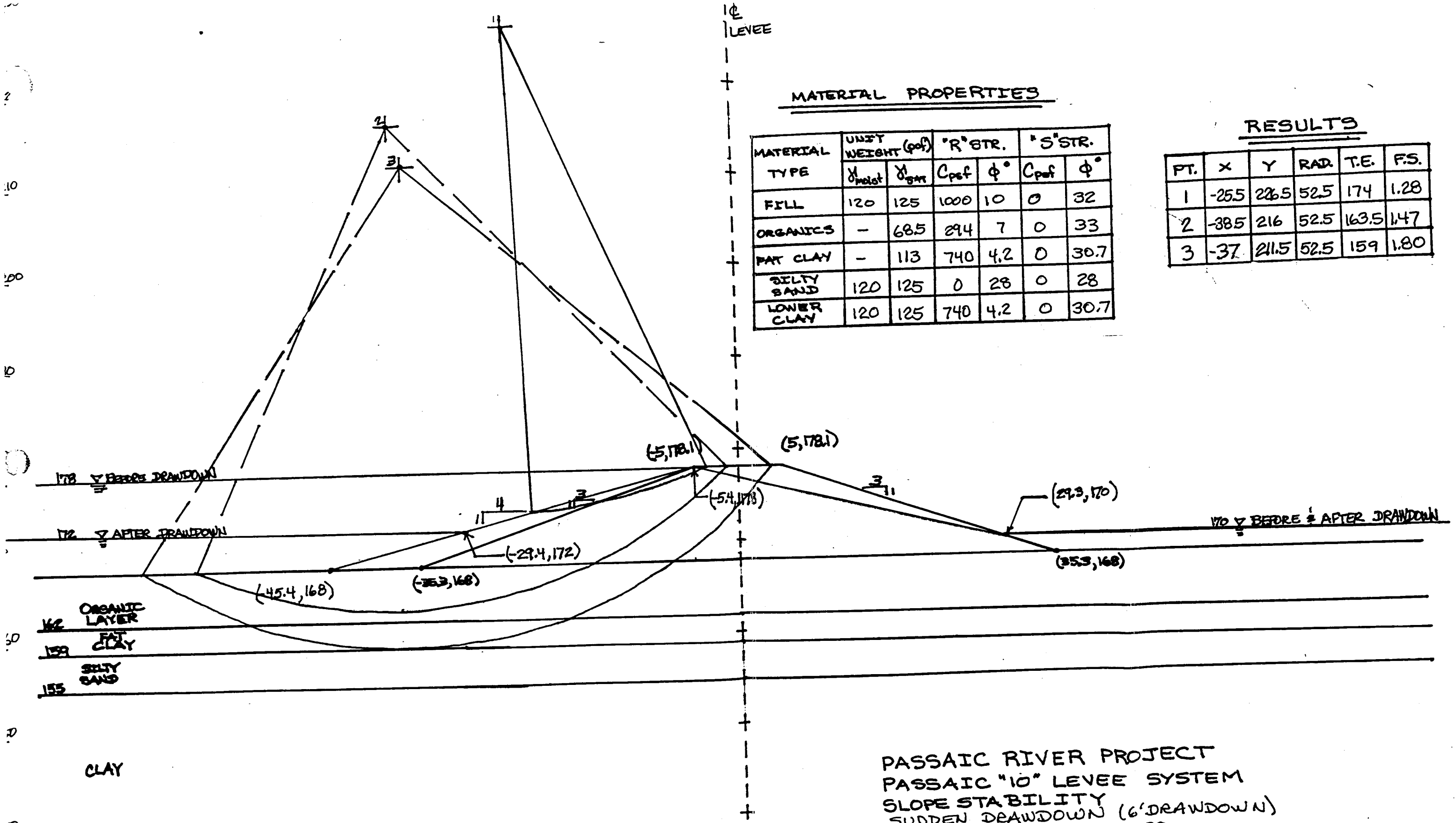
PT.	X	Y	RAD.	T.E.	F.S.
1	-40.5	211	48.5	162.5	1.07
2	-40.5	210	48.0	162	1.07
3	-38.5	204.5	45.5	159	1.27
4	-56.4	304	136	168	1.28

PASSAIC RIVER PROJECT
PASSAIC "10" LEVEE SYSTEM
SLOPE STABILITY
SUDDEN DRAWDOWN (10' DRAWDOWN)
STATION (APPROX.) 14+00
SCALE 1" = 10'

UPSTREAM SLOPE 1V:4H

PLATE G-8

TOM CHILD
CESAW-EN-GS
MAY 1994



MATERIAL PROPERTIES

MATERIAL TYPE	UNIT WEIGHT (pcf)		"R" STR.		"S" STR.	
	γ_{moist}	γ_{sat}	C_{psf}	$\phi°$	C_{psf}	$\phi°$
FILL	120	125	1000	10	0	32
ORGANICS	–	68.5	294	7	0	33
FAT CLAY	–	113	740	4.2	0	30.7
SILTY SAND	120	125	0	28	0	28
LOWER CLAY	120	125	740	4.2	0	30.7

RESULTS

PT.	X	Y	RAD.	T.E.	F.S.
1	-25.5	226.5	52.5	174	1.28
2	-38.5	216	52.5	163.5	1.47
3	-37	211.5	52.5	159	1.80

PASSAIC RIVER PROJECT
PASSAIC "10" LEVEE SYSTEM
SLOPE STABILITY
SUDDEN DRAWDOWN (6' DRAWDOWN)
STATION (APPROX.) 14+00
SCALE 1" = 10'

UPSTREAM SLOPE 1:V 4:H
PLATE G-9

TOM CHILD
CESAW-EN-GS
MAY 1994

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

DESIGN ANALYSIS

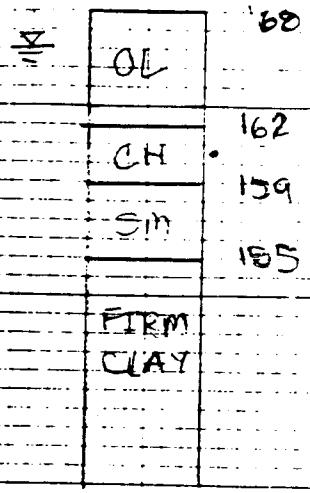
DATE [illegible] SHEET No. 1 OF

COMPUTED BY: Tom [illegible] CHECKED BY: [illegible]

PROJECT: PASSAIC "C"

FEATURE: [illegible]

SOIL MODEL



Present overburden over top of clay
AT BOTTOM OF LAYER

$P_{oc} = 30'(50.6\ pcf) + 6'(68.5 - 62.4\ pcf) =$
$= 151.8 + 36.6 = 188.4\ psf$
$= 0.0942\ tsf$

CL $\gamma_{SAT} = 68.5\ pcf$

CH $\gamma_{SAT} = 113\ pcf$

overburden in bottom of organics

$P_{oc} = 6'(6.1\ pcf) = 36.6\ psf = 0.0183\ tsf$
(37)

Overburden due to dike $\gamma = 120\ pcf$ height $= 10.1'$

$P_{cd} = 10.1'(120\ pcf) = 1{,}212\ psf = 0.606\ tsf$

$P_{cc} - P_{cd} = 0.6243\ tsf = 1{,}249\ psf$ (ORGANIC)

$P_{cd} + P_{cc} = 0.7002\ tsf = 1{,}400\ psf$ (CLAY)

BOTH SOILS APPEAR TO BE PRECONSOLIDATED

FOR CH: $\gamma_{SAT} = 113\ pcf$ FOR OH/OL: $\gamma_{SAT} = 68.5\ pcf$
FROM LAB DATA.

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FIG. JC-1

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

DESIGN ANALYSIS

DATE [illegible] SHEET No. 2 OF

COMPUTED BY: Tom Child CHECKED BY: [illegible]

PROJECT: [illegible]

FEATURE: [illegible]

Preconsolidation of clay

MAXIMUM CURVATURE ASSUMED AT PT. A.

$\alpha = 23^\circ$ $\alpha/2 = 11.5^\circ$

From plot $P_p = 0.67$ tsf $= 1,340$ psf $p_{oc} = 188$ psf

MEANS CLAY IS PRECONSOLIDATED

Preconsolidation of organics

Pt. A = max. curvature

$\alpha = 32^\circ$ $\alpha/2 = 16^\circ$

FROM PLOT: $P_p = 0.22$ tsf $= 440$ psf $p_{oo} = 37$ psf

MEANS ORGANICS ARE PRECONSOLIDATED

THE OVERBURDEN AT THE BOTTOM OF ORGANICS DUE TO LEVEE IS $p_{OL} = 1249$ psf $= 0.6243$ tsf

consolidation occurs along both preconsolidation curve and the virgin curve.

THE OVERBURDEN AT THE BOTTOM OF THE CLAY DUE TO THE LEVEE IS: $p_{CL} = 1,400$ psf $= 0.7002$ tsf

WHICH MEANS THE MAJORITY OF THE CLAY CONSOLIDATION TAKES PLACE ALONG THE PRECONSOL. CURVE AND JUST BARELY SOME VIRGIN COMPRESSION.

FOR SETTLEMENT THE STRESS INCREASE IS USED.

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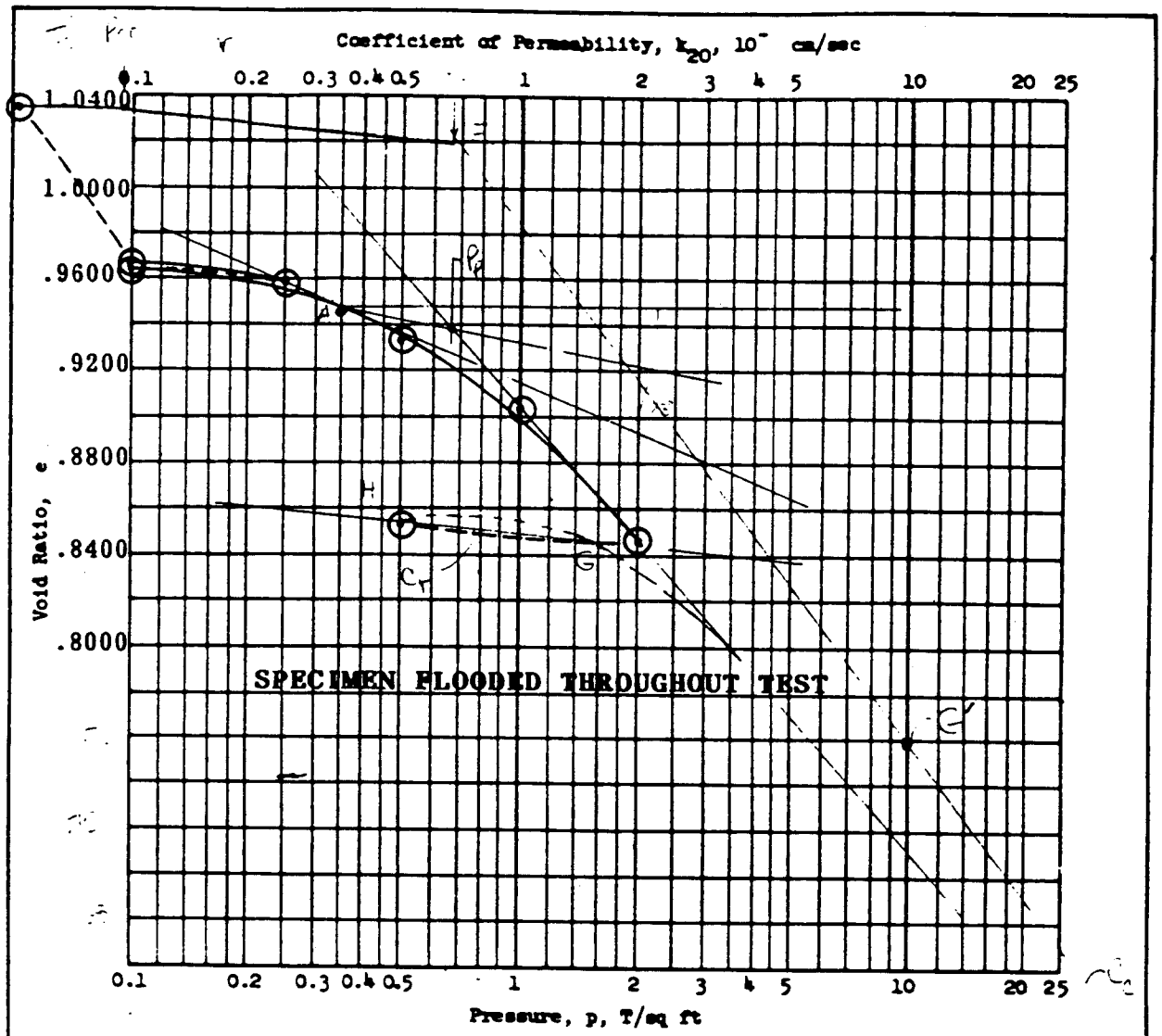
FIG. JC-2

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30061

WORK ORDER NO. 7118
REQ. NO. CESAW-EN-GS-94-0003



Type of Specimen Undisturbed		Before Test		After Test	
Diam 2.49 in.	Ht 1.00 in.	Water Content, w_o	38.9 %	w_f	32.1 %
Overburden Pressure, p_o	T/sq ft	Void Ratio, e_o	1.034	e_f	.853
Preconsol. Pressure, p_c	T/sq ft	Saturation, S_o	100.0 %	S_f	100.0 %
Compression Index, C_c		Dry Density, γ_d	81.6 lb/ft^3		
Classification Gray, Fat Clay with/a little sand sizes		k_{20} at e_o =	x 10^{-} cm/sec		
LL 60	G_s 2.66	Project Passic River			
PL 24	D_{10} -	Lab No. 264/556			
Remarks		Area Levee System - Dike #10			
		Boring No. P-10-3AU		Sample No. 3	
		Depth El 5.0 - 6.8'		Date 8 February 1994	

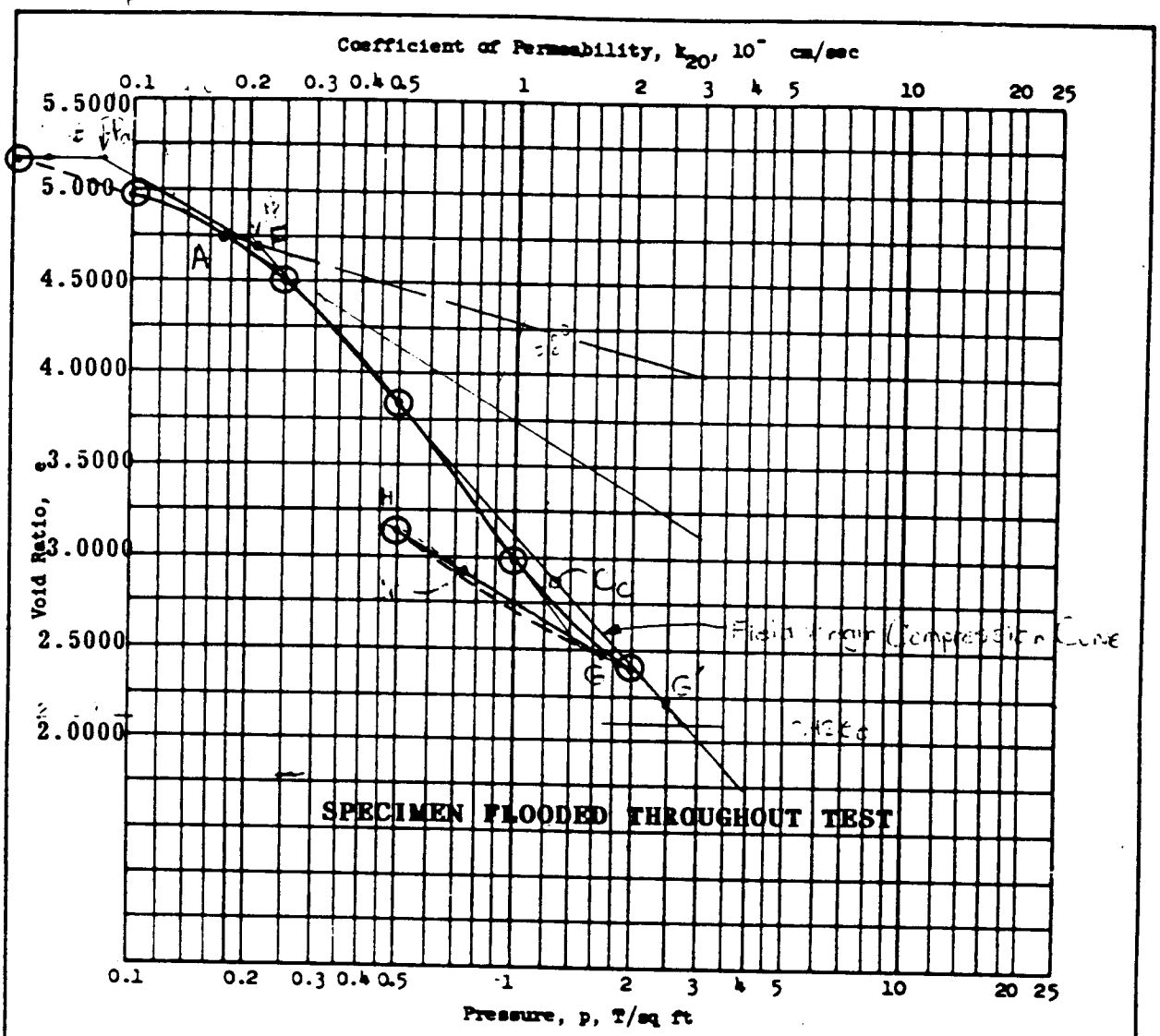
CONSOLIDATION TEST REPORT

ENG FORM 1 MAY 63 2090 PREVIOUS EDITIONS ARE OBSOLETE.

FIG.JC-3

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30061

WORK ORDER NO. 7118
REQ. NO. CESAW-EN-GS-94-0003



Type of Specimen Undisturbed		Before Test		After Test	
Diam 2.47 in.	Ht 1.00 in.	Water Content, w_o	321.3 %	w_f	197.6 %
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o	5.141	e_f	3.161
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	100.0 %	S_f	100.0 %
Compression Index, C_c		Dry Density, γ_d	16.3 lb/ft^3		
Classification (Visual) Black Organic Silt High LL (OH) Sandy. NOTE: The plus 200 sieve sizes are mostly organic particles rather than sand.		Sigma e_o =	x 10^{-} cm/sec		
LL 432	G_s 1.60	Project Passic River			
PL 194	D_{10} -	Lab. No. 264/557			
Remarks		Area Levee System - Dike #10			
		Boring No. P-10-3BU		Sample No. 1	
		Depth El 1.3 - 3.0'		Date 8 Feb 94	

CONSOLIDATION TEST REPORT

ENG FORM 1 MAY 63 2090 PREVIOUS EDITIONS ARE OBSOLETE.

FIG. JC-4

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE [illegible] SHEET No. 3 OF

COMPUTED BY: [illegible] CHECKED BY: [illegible]

PROJECT: [illegible]

FEATURE: CONSOLIDATION

RECONSTRUCT VIRGIN CURVE FOR OVERCONSOLIDATED CLAY

EM 1110-1-1904 30 SEP 90 Table 3-6

$e = 0.42 e_o = 0.42(1.034) = 0.434$

$$C_r = \frac{e_H - e_G}{\log_{10} \frac{\sigma_G}{\sigma_H}} = \frac{0.853 - 0.848}{\log_{10} \frac{1.5}{0.5}} = \frac{0.005}{0.5E} = 0.0099 = C_r$$

$$C_c = \frac{e_F - e_G}{\log_{10} \frac{\sigma_G}{\sigma_F}} = \frac{1.020 - 0.760}{\log_{10} \frac{10}{0.67}} = \frac{0.260}{1.174} = 0.222 = C_c$$

FOR ORGANICS:

$e = 0.42 e_o = 0.42(5.141) = 2.159$

$$C_r = \frac{e_H - e_G}{\log_{10} \frac{\sigma_G}{\sigma_H}} = \frac{3.14 - 2.47}{\log_{10} \frac{1.7}{0.5}} = \frac{0.65}{0.532} = 1.223 = C_r$$

$$C_c = \frac{e_F - e_G}{\log_{10} \frac{\sigma_G}{\sigma_F}} = \frac{4.71 - 2.249}{\log_{10} \frac{2.5}{0.21}} = \frac{2.46}{1.076} = 2.288 = C_c$$

The settlement will be the consolidation or the settlement of the subsoil layers, ie:

$$\rho_c' = \sum_{i=1}^{n} \frac{H_i}{1+e_o} \left[C_r \log \frac{\sigma_p'}{\sigma_o'} + C_c \log \frac{\sigma_o' + \Delta\sigma'}{\sigma_p'} \right] \text{ for } \Delta\sigma_i' \geq (\sigma_p' - \sigma_o')_i$$

$$\text{and } \rho_c'' = \sum_{i=1}^{m} \frac{H_o}{1+e_o} C_r \log \frac{\sigma_o' + \Delta\sigma'}{\sigma_o'} \text{ for } \sigma_i' < (\sigma_p' - \sigma_o')_i$$

$$\rho_c = \rho_c' + \rho_c''$$

$\Delta\sigma'$ = EFFECTIVE STRESS INCREASE

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FIG. IC-5

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

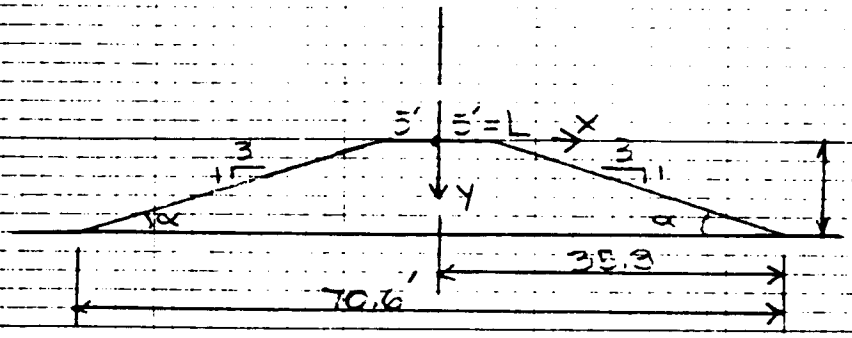
DATE 8/30/84 SHEET No. 4 OF

COMPUTED BY: Tom Child CHECKED BY:

PROJECT: PASSAIC

FEATURE: CONSOLIDATION

TO DETERMINE THE SETTLEMENT OF THE ORGANIC AND CLAY LAYERS, THE EFFECT OF THE LEVEE ON THE UNDERLYING SOIL MUST BE DETERMINED.



$\gamma_L = 120$ pcf

$\alpha = 18.4°$

$H = 10.1'$

ASSUME $\mu = 0.3$

USING "SOIL MECHANICS" BY PERLOFF AND BARON JOHN WILEY & SONS COPYRIGHT 1976. REFERENCE CHAPTER 4, SEC 4.5 AND APPENDIX A, FIG. A.12.

ASSUME POISSON'S RATIO $= \mu = 0.3$ USE FIG WITH $\alpha = 15$, CLOSELY APPROXIMATES $\alpha = 18.4°$.

$L = 5'$ $H = 10.1'$ $L/H = 5/10.1 = 0.5$ ASSUME MAX. STRESS AT ℄. $\frac{X}{H} = 0$

$\gamma H = 120(10.1) = 1212$ psf

AT BASE $Y = 10.1$ $Y/H = 10/10.1 = 1$ $\sigma_Y/\gamma H = 0.86$

$\sigma_Y = .86(1212) = 1042$ psf

AT $Y = 13.1$ (MIDDLE ORGANICS) $Y/H = 13.1/10.1 = 1.31$

$\sigma_Y/\gamma H = 0.84$ $\sigma_Y = 1018$ psf

AT $Y = 16.1$ $Y/H = 16.1/10.1 = 1.59$ $\sigma_Y/\gamma H = 0.81$

$\sigma_Y = 982$ psf

AT $Y = 17.6$ $Y/H = 17.6/10.1 = 1.74$ $\sigma_Y/\gamma H = 0.8$

$\sigma_Y = 970$ psf

AT $Y = 19.1$ $Y/H = 19.1/10.1 = 1.89$ $\sigma_Y/\gamma H = 0.77$

$\sigma_Y = 933$ psf

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FIG. JC-6

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

DESIGN ANALYSIS

DATE 8/30/94 SHEET No. 5 OF

COMPUTED BY: Tom Child CHECKED BY: [illegible]

PROJECT: PASSAIC "IC"

FEATURE: CONSOLIDATION

AT Y = 23.1 Y/H = 23.1/10.1 = 2.23 $\sigma_y/\gamma H = 0.74$
$\sigma_y = 897$ psf

AT Y = 28.1 Y/H = 28.1/10.1 = 2.78 $\sigma_y/\gamma H = 0.68$
$\sigma_y = 824$ psf

AT Y = 38.1 Y/H = 38.1/10.1 = 3.77 $\sigma_y/\gamma H = 0.6$
$\sigma_y = 727$ psf

AT Y = 48.1 Y/H = 48.1/10.1 = 4.76 $\sigma_y/\gamma H = 0.5$
$\sigma_y = 606$ psf

AT THE EDGE OF THE EMBANKMENT: (35.3/H)

AT Y = 10.1 Y/H = 1 $\sigma_y/\gamma H = 0$ $\sigma_y = 0$

AT Y = 13.1 Y/H = 1.31 $\sigma_y/\gamma H = 0.05$ $\sigma_y = 61$ psf

AT Y = 16.1 Y/H = 1.59 $\sigma_y/\gamma H = 0.07$ $\sigma_y = 85$ psf

AT Y = 17.6 Y/H = 1.74 $\sigma_y/\gamma H = 0.09$ $\sigma_y = 109$ psf

AT Y = 19.1 Y/H = 1.89 $\sigma_y/\gamma H = 0.1$ $\sigma_y = 121$ psf

AT Y = 23.1 Y/H = 2.23 $\sigma_y/\gamma H = 0.13$ $\sigma_y = 158$ psf

AT Y = 28.1 Y/H = 2.78 $\sigma_y/\gamma H = 0.15$ $\sigma_y = 182$ psf

AT Y = 38.1 Y/H = 3.77 $\sigma_y/\gamma H = 0.17$ $\sigma_y = 230$ psf

AT Y = 48.1 Y/H = 4.76 $\sigma_y/\gamma H = 0.21$ $\sigma_y = 255$ psf

HALFWAY FROM ℄ TO TOE X = 17.65'

AT Y = 10.1 Y/H = 1 $\sigma_y/\gamma H = 0.65$ $\sigma_y = 788$ psf

AT Y = 16.1 Y/H = 1.59 $\sigma_y/\gamma H = 0.605$ $\sigma_y = 733$ psf

AT Y = 17.6 Y/H = 1.74 $\sigma_y/\gamma H = 0.60$ $\sigma_y = 727$ psf

AT Y = 19.1 Y/H = 1.89 $\sigma_y/\gamma H = 0.59$ $\sigma_y = 715$ psf

AT Y = 23.1 Y/H = 2.23 $\sigma_y/\gamma H = 0.57$ $\sigma_y = 691$ psf

AT Y = 28.1 Y/H = 2.78 $\sigma_y/\gamma H = 0.53$ $\sigma_y = 642$ psf

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

DESIGN ANALYSIS

DATE 3/30/94 SHEET No. 6 OF

COMPUTED BY: Tom Child CHECKED BY:

PROJECT: PASSAIC 10"

FEATURE: CONSOLIDATION

AT Y = 38.1 Y/H = 3.77 $\sigma_y/\gamma H$ = 0.47 σ_y = 570 psf

AT Y = 48.1 Y/H = 4.76 $\sigma_y/\gamma H$ = 0.42 σ_y = 500 psf

AT Y = 13.1 Y/H = 1.31 $\sigma_y/\gamma H$ = 0.62 σ_y = 751 psf

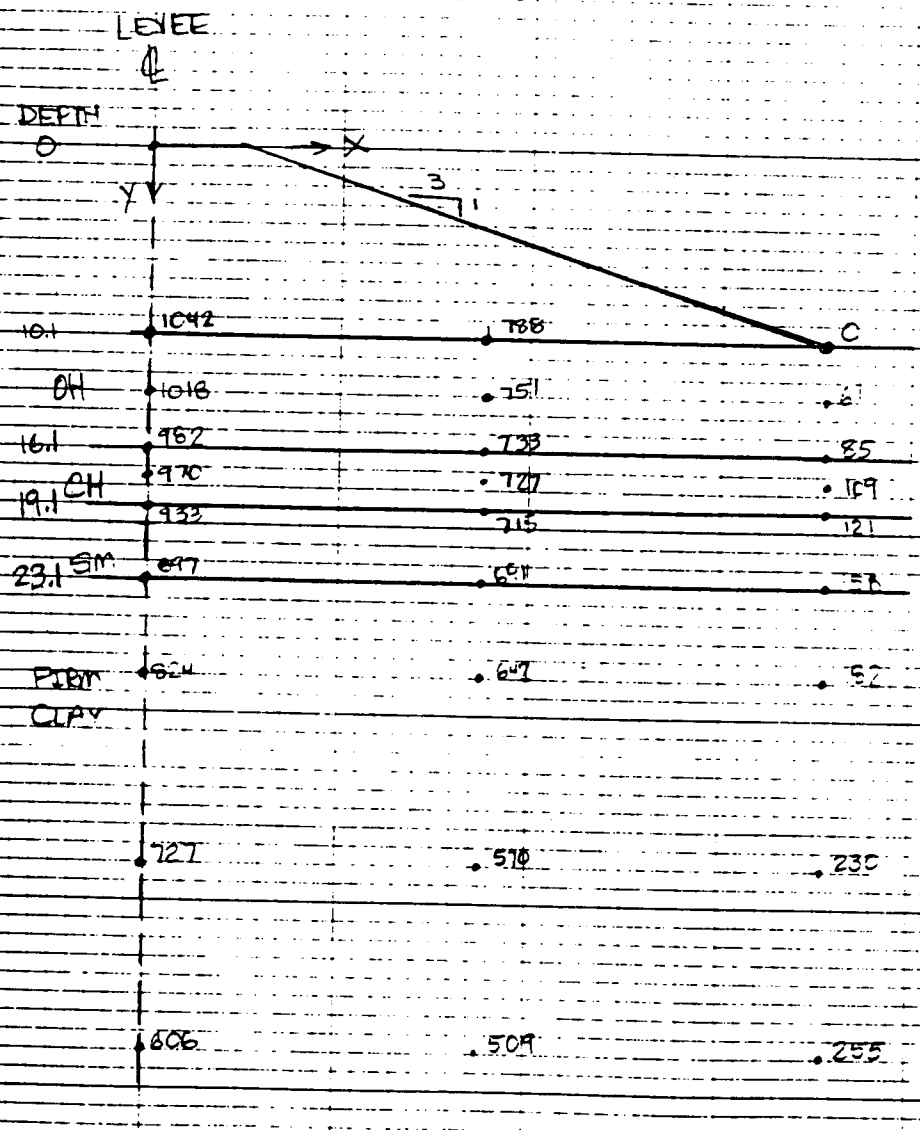

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FIG. JC-8

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 8-30-74 SHEET No. 7 OF

COMPUTED BY: Tom Child CHECKED BY:

PROJECT: PASSAIC "C"

FEATURE: CONSOLIDATION

SETTLEMENT UNDER CENTER OF LEVEE

USE JUST THE TWO LAYERS BECAUSE THEY ARE NOT VERY THICK. THEREFORE DETERMINE SETTLEMENT AT BOTTOM OF OH AND CH LAYERS.

IN ORGANIC LAYER $\Delta\sigma'$ at bottom = 982 psf = 0.49 ksf

$\sigma_p' - \sigma_o' = 440\text{ psf} - 37\text{ psf} = 403\text{ psf}$ $\therefore \Delta\sigma' > \sigma_p' - \sigma_o'$

$$\rho' = \frac{H}{1+e_o}\left[C_r \log\frac{\sigma_p'}{\sigma_o'} + C_c \log\frac{\sigma_o' + \Delta\sigma'}{\sigma_p}\right] \qquad H = 6' \quad e_o = 5.141$$

$C_r = 1.223$ $C_c = 2.288$ $\sigma_p' = 440\text{ psf}$ $\sigma_o' = 37\text{ psf}$ $\Delta\sigma' = 982\text{ psf}$

$$\rho' = \frac{6}{6.141}\left[1.223 \log\frac{440}{37} + 2.288 \log\frac{37+982}{440}\right]$$

$$= 0.977\left[1.223(1.075) + 2.288(0.365)\right] = 0.977\left[1.315 + 0.835\right]$$

$$= 0.977\left[2.150\right] = 2.1' = 25.2''$$

FOR CH LAYER $\Delta\sigma'$ AT BOTTOM = 933 psf

$\sigma_p' - \sigma_o' = 1340\text{ psf} - 188\text{ psf} = 1152\text{ psf}$ $\therefore \sigma' < \sigma_p' - \sigma_o'$

$$\rho'' = \frac{H}{1+e_o} C_r \log\frac{\sigma_o' + \Delta\sigma'}{\sigma_o'} \qquad H = 3' \quad e_o = 1.034$$

$\sigma_o' = 188\text{ psf}$ $\Delta\sigma' = 933\text{ psf}$

$C_r = .0099$

$$\rho'' = \frac{3}{2.034}(0.0099)\log\frac{188+933}{188}$$

$$\rho'' = 1.475(0.0099)(0.775) = 0.0113' = 0.14''$$

TOTAL SETTLEMENT AT CENTER IS $\rho' + \rho''$

$\Delta S_c = 25.2'' + .1'' = 25.3''$ – Mostly in Organics

SAW FORM 472 REV 17 APR 1980

FIG. JC-9

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

DESIGN ANALYSIS

DATE 2 30 9 SHEET No. 8 OF

COMPUTED BY: Tom Chr CHECKED BY:

PROJECT: PASSAIC

FEATURE: CONSOLIDATION

SETTLEMENT, HALF-WAY TO TOE FROM ℄ AT BOTTOM OF EACH OH & CH LAYER.

ORGANIC LAYER: $\Delta\sigma' = 733$ psf $\sigma_p' - \sigma_o' = 403$ psf $\therefore \Delta\sigma' > \sigma_p' - \sigma_o'$

$\rho' = 0.977\left[1.223 \log \frac{440}{37} + 2.288 \log \frac{37+733}{440}\right]$

$= 0.977\left[1.315 + 2.288(0.243)\right] = 0.977\left[1.315 + 0.556\right]$

$= 0.977[1.87] = 1.83' = 21.9''$

FOR CLAY: $\Delta\sigma' = 715$ psf $\sigma_p' - \sigma_o' = 1152 > \Delta\sigma'$

$\rho'' = \frac{3}{2.034}(0.0099)\log\frac{188+715}{188} = 1.475(0.0099)(0.662) = 0.01' = 0.12''$

$\Delta S_H = 21.9'' + 0.1'' = 22.0''$ Mostly in Organics

$\Delta S_c - \Delta S_H = 25.3' - 22.0'' = 3.3'$ DIFFERENTIAL

Under toe ΔS_T

~~FOR ORGANICS: $\Delta\sigma = 85$ psf $\sigma_p - \sigma_o = 403$ psf $\therefore \Delta\sigma' < \sigma_p' - \sigma_o'$~~

$\rho' = \frac{6}{6.141}(1.223)\log\frac{37+85}{37} = 0.977(1.223)(0.5182)$

$\rho' = 0.619' = 7.43''$

FOR CLAY $\Delta\sigma'' = 121$ psf $\sigma_p - \sigma_o' = 1152$ psf $\therefore \Delta\sigma' < \sigma_p' - \sigma_o'$

$\rho'' = \frac{3}{2.034}(0.0099)\log\frac{188+121}{188} = 1.475(0.0099)(0.2158)$

$= 0.0032' = 0.04''$ negligible

$\Delta S_T = 7.43'' + 0.04'' = 7.47''$

$\Delta S_c - \Delta S_T = 25.3' - 7.5'' = \underline{\underline{17.8'}}$ DIFFERENTIAL.

SAW FORM 472 REV 17 APR 1980

FIG. JC-10

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 8/30/91 SHEET No. 9 OF

COMPUTED BY: Tom Child CHECKED BY:

PROJECT: PASSAIC "C"

FEATURE: CONSOLIDATION

THIS ANALYSIS ASSUMES THAT THE UNDERLYING SAND AND CLAY SAMPLES CONSOLIDATE NEGLIGIBLY UNDER THE IMPOSED LOAD OF THE LEVEE. THIS SEEMS TO BE VERIFIED BY THE CH LAYER WHICH HAS MINIMAL CONSOLIDATION. THE UNDERLYING LAYERS HAVE LARGER BLOW COUNTS AND A LARGER PRESENT OVERBURDEN, WHICH MAY MEAN A LARGER PRECONSOLIDATION LOAD, AND THAT THEY WILL CONSOLIDATE LESS THAN THE CLAY LAYER ANALYSED.

NOW THAT SETTLEMENT DUE TO CONSOLIDATION HAS BEEN DETERMINED, NOW THE TIME RELATIONSHIP NEEDS TO BE DETERMINED.

FOR ORGANICS $T_{cc} = 300\,min$ GRAPHICAL

$D_{100} = 4130$ $D_0 = 3500$ GRAPHICAL (t_1, $4t_1$ method)

NOTE: FOR SAMPLE IN FIELD THERE IS ONE WAY DRAINAGE

FOR LAB SAMPLE THERE IS TWO-WAY $\therefore H_e = H/2$

FOR LAB SAMPLE $H = 1.0''$ $H_e = 0.5''$

$$D_{50} = \frac{D_{100} + D_0}{2} = \frac{4130 + 3500}{2} = 3815 \Rightarrow t_{50} = 39\,min$$

$$C_v = \frac{T_{50} H_e^2}{t_{50}} = \frac{0.197(0.5'')^2}{39\,min} = \frac{0.0493''}{39\,min} = 1.263 \times 10^{-3}\ in/min$$

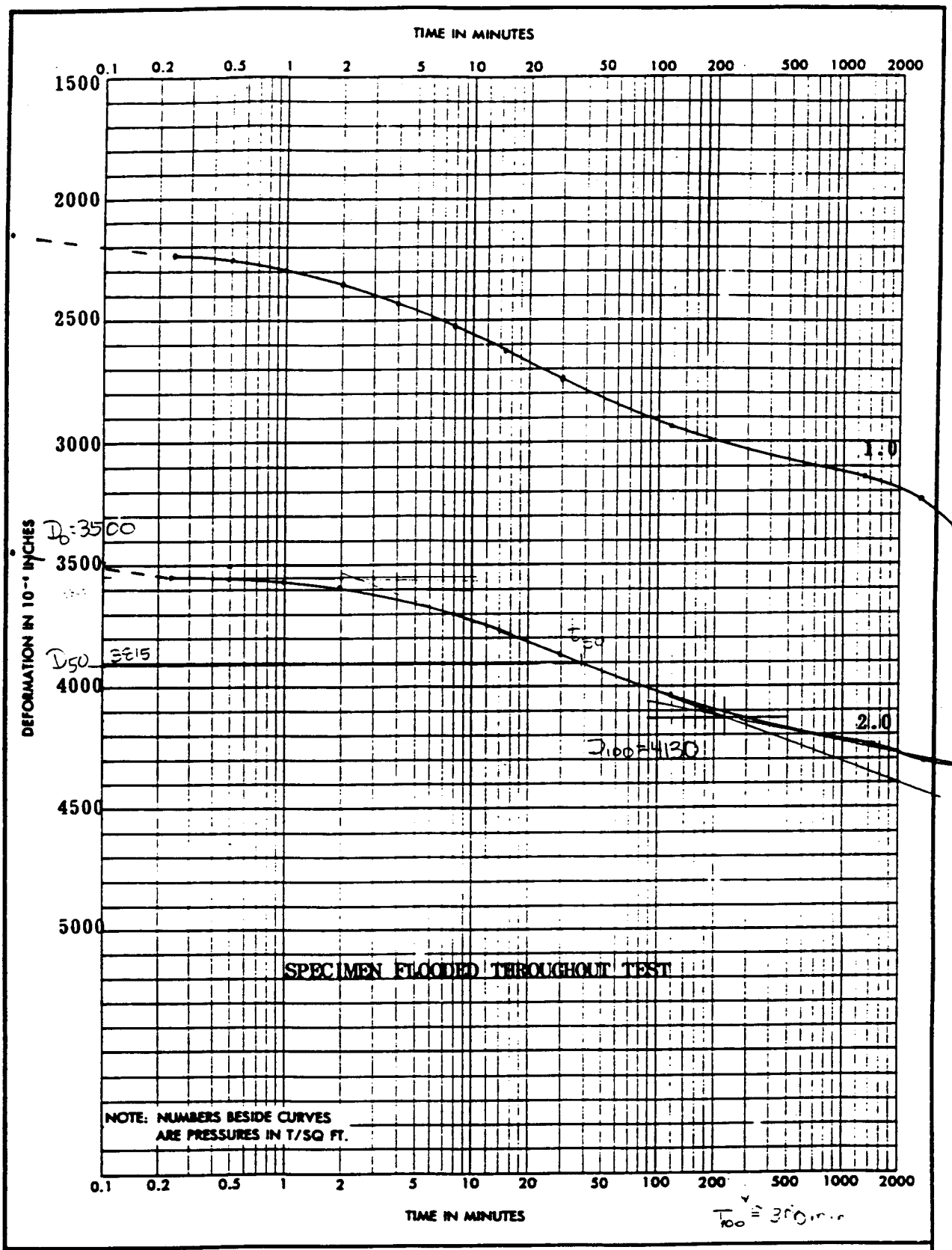
$$C_v = 1.263 \times 10^{-3}\ in/min = 1.263 \times 10^{-2}\ ft^2/day$$

$$\frac{in}{min} \times \left(\frac{1\,ft}{12\,in}\right)^2 \times \frac{60\,min}{hr} \times \frac{24\,hr}{day} = 10\ \frac{ft^2}{day}$$

SAW FORM 472 REV 17 APR 1980

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER NO. 7118
Req. No. CESAW-EN-GS-0003



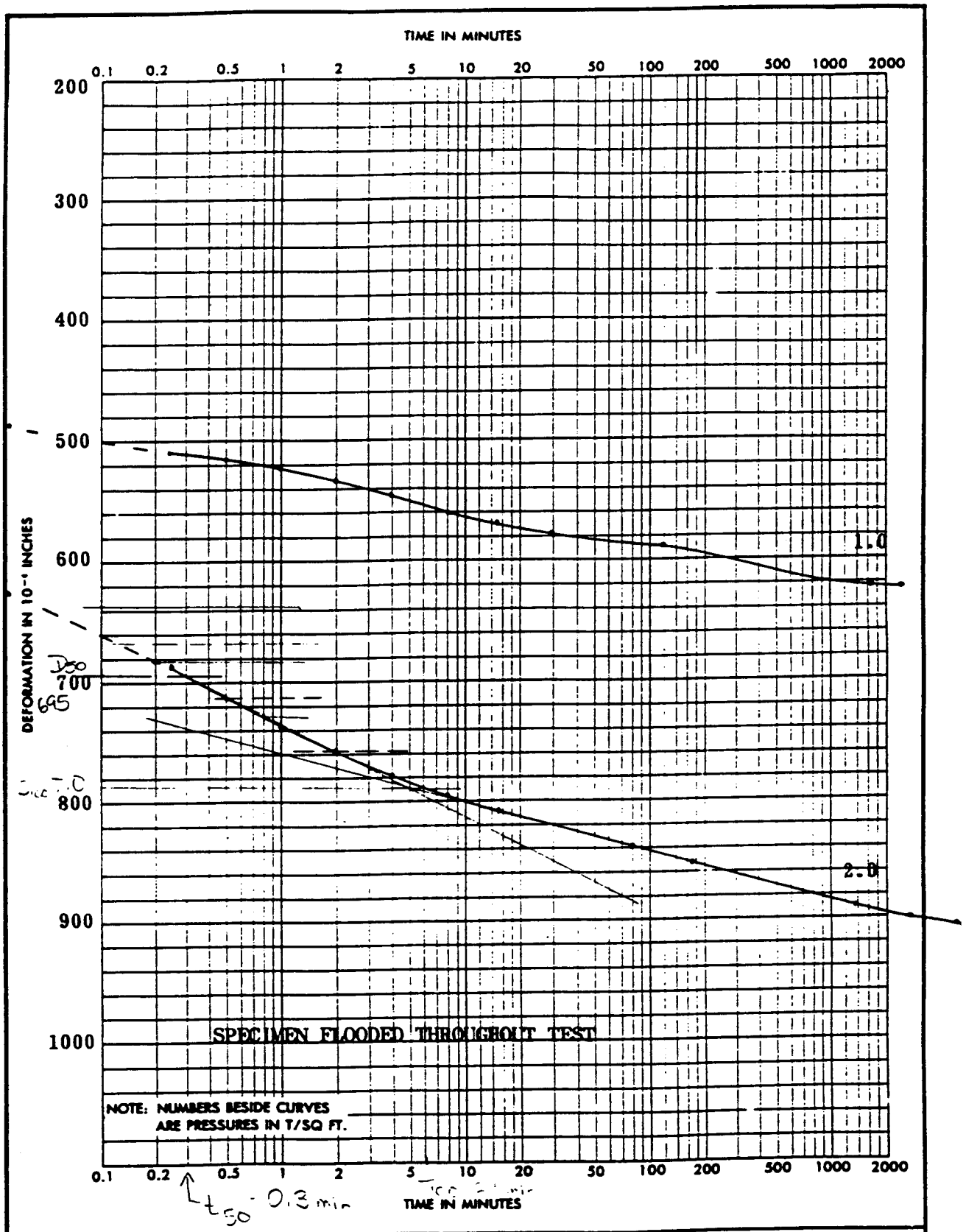
PROJECT Passaic River			
AREA Levee System Dike #10		Lab No. 264/557	(OH)
BORING NO. P-10-3BU	SAMPLE NO. 1	DEPTH 1.3-3.0'	DATE 31 Mar 94

ENG FORM 2088 1 MAY 63 PREVIOUS EDITIONS ARE OBSOLETE. **CONSOLIDATION TEST—TIME CURVES** (TRANSLUCENT)

FIG. JC-12

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30060

WORK ORDER NO. 7118
Req. No. CESAW-EN-GS-94-0003



PROJECT	Passaic River			
AREA	Levee System - Dike #10		Lab No. 264/556	(CH)
BORING NO. P-10-3AU	SAMPLE NO. 3	DEPTH 5.0-6.8'	DATE 31 Mar 94	

ENG FORM 2088 1 MAY 63 PREVIOUS EDITIONS ARE OBSOLETE. **CONSOLIDATION TEST—TIME CURVES** (TRANSLUCENT)

FIG.JC-13

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

DESIGN ANALYSIS

DATE 8/30/[illegible] SHEET No. 10 OF

COMPUTED BY: Tom Child CHECKED BY: [illegible]

PROJECT: PASSAIC 10

FEATURE: CONSOLIDATION

FOR ORGANICS

$t_{95} = \frac{T_{95} H^2}{C_v}$ FOR 95% CONSOLIDATION $T = 1.127$

$C_v = 0.304$ ft/day

Assume H is single drainage ∴ $H = 6'$

$t_{95} = \frac{1.129(6)ft^2}{0.01263\ ft/day} = 3{,}218$ day = ~~≈ 8.8 yrs.~~

$\Delta S_o = 25.3''$

95% $\Delta S_o = 24.0''$ AT ℄ OF LEVEE

FOR CH $T_{100} = 6.1$ min $D_{100} = 770$ (GRAPHICAL)

ASSUME $D_0 = 620$

$D_{50} = \frac{D_{100} + D_0}{2} = \frac{770+620}{2} = 695 \Rightarrow t_{50} = 0.3$ min

$C_v = \frac{T_{50} H_e^2}{t_{50}} = \frac{0.197(0.5'')^2}{0.3\ min} = 0.1642\ ''^2/min = 1.642\ ft^2/day$

$t_{95} = \frac{T_{95} H^2}{C_v} = \frac{1.129(3')^2}{1.642\ ft^2/day} = 6.19$ day $H = 3'$ for one way drainage

CLAY WILL CONSOLIDATE ALMOST IMMEDIATELY

FOR ORGANICS AT ℄ LEVEE $\Delta S_o = 25.2''$

$U_{50} = .5\Delta S_o = .5(25.2) = 12.6''$ $T_{50} = .197$ $H = 6'$

$t_{50} = \frac{T_{95} H^2}{C_v} = \frac{.197(6')^2}{1.263 \cdot 10^{-2} ft^2/day} = 562$ days $= 1.54$ yrs.

$U_{10} = .1\Delta S_o = .1(25.2) = 2.5''$ $T_{10} = .0078$ $H = 6'$

$t_{10} = \frac{.0078(6')^2}{1.263 \times 10^{-2}\ ft/d} = 22.2$ days

12" of settlement $= \frac{12}{25.2} = 47.6\% = U$ $T_{47.6} = 0.180$

$t_{47.6} = \frac{0.180(6')^2}{1.263 \times 10^{-2} ft/d} = 513$ days ~~≈ 1.4 yrs for 1' of settlement.~~

$U_{80} = .8(25.2) = 20.2''$ $T_{80} = 0.567$

$t_{80} = \frac{.567(6')^2}{1.263 \times 10^{-2} ft^2/d} = 1{,}616$ day $= 4.4$ yrs.

SAW FORM 472 REV 17 APR 1980

FIG. JC-14

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

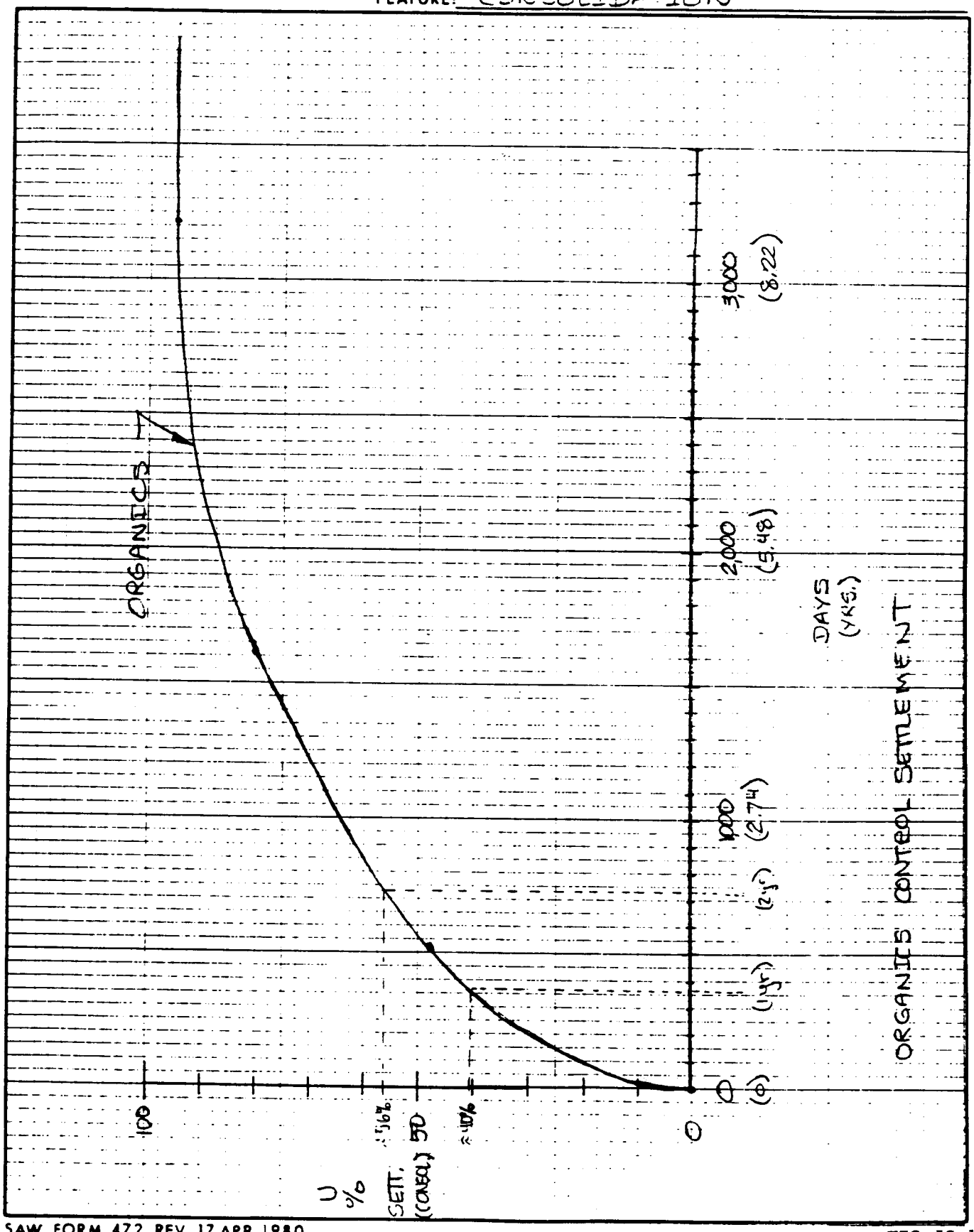
DESIGN ANALYSIS

DATE 8.30.94 SHEET No. 11 OF

COMPUTED BY: Tom Child CHECKED BY:

PROJECT: PASSAIC "10"

FEATURE: CONSOLIDATION



SAW FORM 472 REV 17 APR 1980

FIG. JC-15

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

DESIGN ANALYSIS

DATE 12/22/94 SHEET No. ___ OF ___

COMPUTED BY: Tom Child CHECKED BY: [illegible]

PROJECT: PASSAIC 10 LEEVEES

FEATURE: UNDERSEEPAGE

FROM "PRINCIPLES OF FOUNDATION ENGINEERING" BY BRAJA DAS; © 1984 1st EDITION: PG 37 EQN 1.65

$$C_v = \frac{\frac{K}{\Delta e}}{\Delta p(1+e_{av})}\gamma_w$$

C_v = coefficient of consolidation
K = permeability
Δe = total change in void ratio caused by stress increase = Δp
e_{av} = avg. void ratio during cons.

FOR OH LAYER:

FROM SETTLEMENT CALCULATIONS & LAB TEST (CONSOL.)

$C_v = 1.263 \times 10^{-2} \frac{ft^2}{day}$ $\Delta e = 3.80 - 2.40 = 1.4$ $e_{av} = 3.1$

$\Delta p = 2 - 0.5 = 1.5\ T/ft^2 = 3000\ \#/ft^2$

$$K = \frac{C_v \Delta e \gamma_w}{\Delta p(1+e_{av})} = \frac{1.263\times10^{-2}\ ft^2/day\ (1.4)\ 62.4\ \#/ft^3}{3000\ \frac{\#}{ft^2}\ (4.1)} = \frac{ft}{day}$$

$$= \frac{1.103}{12{,}300} = 0.897\times10^{-4}\ \frac{ft}{d} \text{ say } 0.9\times10^{-4}\ \frac{ft}{d}$$

$$2.54\frac{cm}{in}\times 12\frac{in}{ft}\times\frac{1d}{24hr}\times\frac{1hr}{60min}\times\frac{1min}{60sec} = 3.53\times10^{-4}\ \frac{cm}{sec}\cdot\frac{d}{ft}$$

$$K = 0.9\times10^{-4}\ ft/d \times 3.53(10^{-4})\ \frac{cm}{sec}\cdot\frac{d}{ft} = 3.18\times10^{-8}\ cm/sec$$

very poor permeability - clay like.

FOR CH LAYER

$C_v = 1.642\ ft^2/d$ $\Delta e = 0.059$ (.904 - .845) $\Delta p = 2000\ \#/ft^2$ $e_{av} = 0.8745$

$$K = \frac{1.642(0.059)62.4}{2000(1.8745)} = \frac{6.045}{3749} = 1.613\times10^{-3}\ ft/d$$

$$K = (1.613\times10^{-3})\times(3.53\times10^{-4}) = 5.69\times10^{-7}\ cm/sec$$

a typical clay permeability.

SAW FORM 472 REV 17 APR 1980

FIG. JC-16

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 12/23/94 SHEET No. ____ OF ____

COMPUTED BY: Tom Child CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEES

FEATURE: UNDERSEEPAGE

FROM LOOKING AT THE PERMEABILITIES CALCULATED IT IS REASONED THAT THE BOTH THE ORGANIC LAYER AND THE CLAY LAYER CAN BE CONSIDERED AS IMPERVIOUS. THIS LEADS TO THE CONCLUSION THAT NO UNDERSEEPAGE ANALYSIS IS NECESSARY. FOR THROUGH SEEPAGE, OR SEEPAGE THROUGH THE EMBANKMENT, A FLOW NET OR OTHER TYPE OF ANALYSIS IS NOT HELPFUL AT THIS TIME. IF THE EMBANKMENT IS A CLAY TYPE MATERIAL, OR A SAND WITH ENOUGH FINES IT COULD BE CONSIDERED AS IMPERMEABLE. HENCE, NO SEEPAGE WOULD OCCUR AND NO ANALYSIS IS NECESSARY. IF THE LEVEE IS COMPOSED OF A DIFFERENT MAT'L A DECISION ON AN ANALYSIS WOULD BE MADE AT THE TIME THE TYPE OF MATERIAL IS DECIDED UPON.

SAW FORM 472 REV 17 APR 1980

ATTACHMENT D
EROSION AND SEDIMENT CONTROL ANALYSIS AND PUMP CALCULATIONS

ATTACHEMENT D
EROSION AND SEDIMENT CONTROL ANALYSIS
AND PUMP CALCULATIONS

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ATTACHMENT D

EROSION AND SEDIMENT CONTROL ANALYSIS

INTRODUCTION: The levee system will surround an industrialized area consisting of office buildings and various industries. The present plan consist of an earthen levee approximately 4853 feet long with a 10-foot wide top width and 3H:1V side slopes except between stations 9+50 and 15+50 where 4H:1V side slopes will be used on the exterior slopes. The top of the levee will be constructed to elevation 178.1 from station 0+00 to 18+00, elevation 178.4 from station 19+00 to 33+00, elevation 178.6 from station 34+00 to end. Two pump stations with vertical turbine submersible pumps will included as part of the project.

PURPOSE. The purpose of this project is to provide flood damage reduction protection to the industrialized area consisting of office buildings and various industries in the Livingston Township.

PROJECT LOCATION: The Passaic 10 levee system is located within the Central Basin on the right bank of the Passaic River in the Livingston Township in Essex County, New Jersey.

PROJECT SCOPE. Proposed plan consists of the following:

(a) Earth embankment with 10' wide crown and 3H:1V side slopes.
(b) Interior drainage ditch.
(b) Concrete floodwall.
(c) Two pump station locations
(d) One cross over ramp
(e) 4 pipe outlets with sluice gates and flapgates.
(f) Soil (Leaf Pile) Removal Area.

SITE DEVELOPMENT.

a. General. The current plan and existing site conditions are shown on the drawings. The new proposed elevation for the top of the levee was established and set to elevation 178.1 which coincides with the elevation of the existing shoulders along Eisenhower Parkway. The profile of the levee will be raised slightly to elevation 178.6 along the northern end of the levee.

BORROW AREA. It is anticipated that approximately 92,000 cubic yards of borrow material will be required for construction of the levee. A borrow area located adjacent to the north end of the

levee has been identified as a potential source for levee fill. This borrow area will be excavated to elevation 162. Additional borrow material needed for the levee fill will be obtained from a borrow area located at the Hatfield Swamp site approximately four (4) miles from the site. The borrow area located on site will be backfilled with waste material from the construction operations and the material excavated from the soil removal area identified on the plans. The borrow area will be brought back up to elevation 164 or higher.

STORM DRAINAGE. Storm water runoff within the immediate site area is handle by interior drainage ditches and several pipe outlets. The design of the culverts are discussed in the Hydrology and Hydraulics Analysis Attachment F.

EROSION CONTROL MEASURES. Permanent measures to consist of seeding and grassing. A detailed erosion and sedimentation control plan is shown on plates P-31 and P-32. Erosion and Sediment control measures will be developed in accordance with requirements as established by the New Jersey State Soil Conservation Committee. Temporary control measures consisting of silt fences, silt ditches, gravel filter basins, stabilized construction entrance, and temporary seeding will be implemented and maintained during the construction at each site. These temporary measures will be located within the site to contain sediment runoff expected from construction operations. Implementation of temporary control measures will require adjustments and/or additions by field personnel to the initial proposed sediment control plan for construction. All temporary control measures will be maintained until permanent measures have been established.

Applicable standards for temporary erosion control measures will be in accordance with the Structural Standards Section 4 of the Standards for Soil Erosion and Sediment Control in New Jersey as identified below.

<u>Sediment Barriers.</u> Sediment barriers consist of temporary silt fences in accordance with Standard 4.13. As a variation to the standards, temporary silt ditches have incorporated into the erosion control plan as a means to contain sediment along the toe of the levee while directing surface runoff toward a gravel filter basin. The temporary silt ditches have been used effectively as an erosion control measure in North Carolina.

<u>Sediment and Detention Basins.</u> As a variation to standards 4.4 Sediment Basin and 4.7 Detention Basin, a gravel filter basin designed and sized in accordance with the requirements of

standards 4.4 and 4.7 and standard engineering practices has been incorporated as part of the erosion and sediment control measures. These basins are sized for a 10 year 1-hour design storm. With proper clean-out and maintenance , these gravel filter basins can be effectively used as an erosion control measure.

Stabilized Construction Entrance. All construction entrance onto a paved surface will be constructed in accordance with Structural Standards Section 4.15 of the Standards for Soil Erosion and Sediment Control in New Jersey.

Permanent erosion control measures will include establishment of proper ground cover within 30 days of completion of construction in any area, and placing mulching, erosion control matting, and/or rip rap protection where necessary to reduce erosion. All pipe outlets will be rip rapped. During construction, contractor will be required to accomplish his temporary and/or permanent seeding operations within seven (7) days following the completion and/or suspension of any grading operations for any particular area.

Stone Protection for pipe outlets. No riprap or stone protection has been designed for the levee except at drainage outlets and for temporary erosion control measures. Water flows are not expected to reach magnitudes great enough to cause serious erosive damage. Stone protection for pipe outlets was designed in accordance with Structural Standards Section 4.12 and 4.14 of the Standards for Soil Erosion and Sediment Control in New Jersey. A 25-year 1-hour design storm was used in the calculations for determining stone thickness and dimensions for the stone aprons at the pipe outlets. Stone protection for pipe outlets will be either Class A for a rip rap thickness of 1 foot or Class B for a rip rap thickness of 1.5 foot. These stone protection Classes have been used successfully in construction projects in another state for the range of anticipated velocities. A stone class which is specified by the New Jersey Department of Transportation (NJDOT) for use as erosion control stone may be utilized for stone at pipe outlets. The stone for erosion control shall be of a hard, durable nature and shall range in size as follows:

Class	Size
A	2" - 6"
B	5" - 15"

While no specific gradation is required, the various size of stone shall be equally distributed within the required size range.

Riprap and Filter Stone for Temporary Erosion Control. The riprap and filter stone used in conjunction with the gravel filter basins are similar to the requirements for the temporary stone outlets structure as contained in the Structural Standards Section 4.2.4 and shown on page 4.2.6 and 4.27 of the Standards for Soil Erosion and Sediment Control in New Jersey. Rip rap as required for the temporary gravel filter basins shall be graded to meet the following requirements:

Class I Rip Rap. Stone shall vary in weight from 5 to 200 pounds. At least 30 percent of the total weight of the rip rap shall be in individual pieces weighing a minimum 60 pounds each. Not more than 10 percent of the total weight of the rip rap may be in individual pieces weighing less than 15 pounds each.

The filter stone for the temporary gravel filter basins shall be graded to meet the following requirements:

Sieve Size	Percentage of Total, by Weight Passing
1.5"	100
1.0"	90-100
0.75"	20-55
0.5"	0-10
0.375"	0-5

SOIL REMOVAL AREA. An adjacent exterior area approximately between levee stations 31+00 and 35+50 is known to contain leaf piles and possibly other low level contaminants which will be excavated and removed and disposed of in the borrow pit near the completion of the levee construction and upon the depletion of the borrow material.

STORM WATER MANAGEMENT. The alterations to existing storm water runoff in the general area is discussed in Attachment F as part of the hydraulic analysis for the levee protection project. No impervious areas will be added as part of this project.

FLOODWAY LIMITS. Portions of the Passaic 10 site are located within floodway limits.

CONSTRUCTION PERIOD. The anticipated construction period is 365 calendar days.

EROSION AND SEDIMENT CONTROL ANALYSIS

Gravel Filter Basins

References:
1. TM-5-820-1
2. TM-5-820-4
3. Introduction to Hydrometeorology, J.P. Bruce and R.H. Clark
4. New Jersey Standards for Soil Erosion and Sediment Control Manual

Design Storm - 10 year, 1 hour frequency

Formulas:

$T_c^{2.14} = 2Ln/3S^{.5}$
T_c = Time of Concentration, minutes
L = Farthest point in Drainage area, feet
n = Roughness coefficient, weighed value
S = Average Slope of drainage area, ft/ft

Q = cIA
Q = Flow, cubic feet per second
c = Runoff coefficient, weighted value
I = Rainfall intensity for T_c
A = Drainage area, acres

$Q = CL_wH^{1.5}$
Q = Flow, cubic feet per second
C = Weir coefficient
L_w = Weir length, feet
H = Flow depth across weir, feet

Stone Protection - Pipe outlets
Design Storm - 25 year, 1 hour frequency

Formulas:
$T_c^{2.14} = 2Ln/3S^{.5}$
Tc = Time of Concentration, minutes
L = Farthest point in Drainage area, feet
n = Roughness coefficient, weighted value
S = Average Slope of drainage area, ft/ft

Q = cIA
Q = Flow, cubic feet per second
c = Runoff coefficient, weighted value
I = Rainfall intensity for Tc
A = Drainage area, acres

Interior Drainage Ditches

Formulas:

$V = 1.486R^{.667}S^{.5}/N$

V = Velocity, feet per second

N = Manning coefficient

R = Hydraulic Radius, feet

S = Slope, ft/ft

Assumptions:

Coefficients

Surface Area	Roughness Coefficient n	Runoff Coefficient c
Disturbed Area	.10	.25
Open area	.30	.30
Levee	.35	.25
Wooded area	.70	.20
Impervious surface		
Pavement	.02	.95
Building roofs	.02	.95

Pump Selection:

Q = 1350 gpm Coeficient, C = 100 Pipe Length = 300'

Size	Velocity (fps)	Pipe Loss per 100' (Feet)	Total Elev. Loss(x3) (Feet)	Total Head (Feet)
6"	15.9	22.6	67.3	22	89.8
8"	8.95	5.5	16.5	22	38.5
10"	5.71	1.87	5.6	22	27.6

Assume fitting loss equivalent to 2.5' head loss.

Select Fairbanks Morse Vertical Turbine Pump, Single Stage Model No. 13H7000, 15 Hp Motor, 1350 gpm at 30 feet TDH.

Pump is to be mounted in 8' dia. by 10' Concrete overflow sump and discharge through 10" pipe which passes over the levee and down to low point of discharge.

EROSION AND SEDIMENT CONTROL CALCULATIONS

PASSAIC 10 LEVEE

Gravel Filter Basins

DRAINAGE AREAS

GFB No.	Disturbed Area SF	P'vmt Area SF	Building Area SF	Wooded Area SF	Open Area SF	Total Area SF	Basin Size CF	Weir length Lw Feet
1	5,195	0	0	0	12,635	17,830	624	6.0
2	7,998	0	0	15,598	65,173	88,769	3,107	18.0
3	17,623	0	0	1,521		19,144	670	6.0
4	33,017	0	0	445		33,462	1,171	6.0
5	64,194	0	30,781	156,813	405,698	657,487	11,506	20.0
6	21,822	0	0	348		22,170	776	6.0
7	28,227	41,323	0	86,687	31,697	187,934	6,578	20.0
8	5,427	0	0	266		5,692	199	6.0
9	15,895	0	0	56		15,952	558	6.0
10	5,028	0	0	3,602		8,630	302	6.0
11	31,537	153,060	97,142	159,851	156,292	597,881	10,463	20.0
12	6,911	0	0	4,180		11,091	388	6.0
13	8,529	0	0	24,447	14,219	47,195	1,652	12.0
14	5,468	0	0	0	20,197	25,665	898	6.0
15	3,676	0	0	0	6,735	10,410	364	6.0
16	15,656	160,779	60,259	75,655	197,922	510,271	8,930	20.0
17	13,607	0	0	0	13,287	26,894	941	6.0
18	6,891	42,853	59,922	34,637	38,288	182,591	6,391	20.0
19	5,585	0	0	0		5,585	195	6.0
20	9,448	0	0	0		9,448	331	6.0
21	9,174	0	0	23,202		32,376	1,133	6.0
22	13,523.78	0	0	0	0	13,524	237	6.0
23	22,725.24	0	0	18,710		41,435	1,450	6.0

Assumptions :

1. Basin size computed from New Jersey Soil Erosion and Sediment Control Manual at a rate of .07 acre feet per acre of total drainage area. It was assumed that the basins would be cleaned out twice during the year.

2. The gravel weir length for the basins were determined as follows:

Drainage Area Acres	Weir Length
0-1	6'
1 - 2	12'
2 - 3	18'
over 3	20'

These weir length are considered adequate to handle the flows for the 10-year, 1 hour design storm as computed for each gravel filter basins drainage area. Computing the weir length from a weir formula equation resulted in a lower weir length.

EROSION AND SEDIMENT CONTROL CALCULATIONS

PASSAIC 10 LEVEE

Gravel Filter Basins

DRAINAGE AREAS CHARACTERISTICS

GFB No.	H.P.	L.P.	Length Feet	Slope Ft./Ft.	n	Tc	i in/hr.	c	A Acre	Q CFS
1	178.1	172.0	194	0.0314	0.24	11.2	5.2	0.29	0.41	0.61
2	178.1	172.0	517	0.0118	0.35	26.6	3.6	0.28	2.04	2.04
3	178.1	166.5	512	0.0227	0.15	15.1	4.6	0.25	0.44	0.50
4	178.1	165.0	714	0.0183	0.11	16.0	4.5	0.25	0.77	0.86
5	178.2	166.8	1840	0.0062	0.36	56.7	2.2	0.30	15.09	10.02
6	178.1	165.0	561	0.0234	0.11	13.6	4.8	0.25	0.51	0.61
7	178.1	164.8	925	0.0144	0.39	35.0	3.0	0.39	4.31	5.04
8	178.1	170.5	228	0.0333	0.13	8.9	5.8	0.25	0.13	0.19
9	178.1	167.5	250	0.0424	0.10	7.9	6.0	0.25	0.37	0.55
10	178.1	166.0	128	0.0945	0.35	8.5	5.8	0.23	0.20	0.26
11	188.1	166.0	2140	0.0103	0.28	47.8	2.6	0.54	13.73	19.36
12	178.1	166.0	209	0.0579	0.33	11.6	5.2	0.23	0.25	0.31
13	174.0	167.0	260	0.0269	0.47	18.2	4.3	0.24	1.08	1.11
14	174.0	169.5	357	0.0126	0.26	19.0	4.2	0.29	0.59	0.72
15	178.1	170.5	192	0.0396	0.23	10.3	5.5	0.28	0.24	0.37
16	189.5	166.0	1900	0.0124	0.23	39.7	2.8	0.57	11.71	18.54
17	174.0	168.0	490	0.0122	0.20	19.7	4.1	0.27	0.62	0.70
18	171.0	166.0	259	0.0193	0.21	13.5	4.8	0.65	4.19	12.98
19	178.1	166.0	137	0.0883	0.10	5.0	6.5	0.25	0.13	0.21
20	178.1	166.0	193	0.0627	0.10	6.3	6.3	0.25	0.22	0.34
21	172.0	168.0	288	0.0139	0.53	23.6	3.8	0.21	0.74	0.60
22	178.6	166	220	0.0573	0.10	6.8	2.9	0.25	0.31	0.23
23	178.1	167	653	0.0170	0.37	27.9	6	0.23	0.95	1.30

EROSION AND SEDIMENT CONTROL CALCULATIONS

PASSAIC 10 LEVEE

Pipe Culverts

DRAINAGE AREAS

Drainage Area	Location Station	Levee Area Acre	Building Area Acre	P'vmt Area Acre	Wooded Area Acre	Open Area Acre	Total Area Acre
I	15+84	2.27	0.71	0.95	6.14	11.84	21.90
II	28+36	0.73	2.23	3.51	3.86	4.02	14.35
III	37+50	0.57	2.76	4.67	2.51	5.63	16.15
IV	41+18.36	0.75	1.11	1.78	2.10	2.48	8.21

DRAINAGE AREAS CHARACTERISTICS

Location Station	H.P.	L.P.	Length Feet	Slope Ft./Ft.	n	Tc	i in/hr.	c	A Acre	Q CFS
15+84	178.20	166.80	1840	0.0062	0.40	59.1	2.4	0.32	21.90	16.61
28+36	188.10	166.00	2140	0.0103	0.30	49.2	2.9	0.53	14.35	22.09
37+50	189.50	166.00	1900	0.0124	0.24	40.0	3.1	0.58	16.15	29.13
41+18.36	188.50	166.00	1400	0.0161	0.31	37.0	3.1	0.50	8.21	12.69

PIPE DIMENSIONS AND DATA

Location Station	Pipe Dia. Inches	Invert in	Invert out	Length Feet	Slope Ft./Ft.	Q CFS	Qfull CFS
15+84	36	164.85	164.78	88	0.0008	16.61	20.38
28+36	24	165.13	164.88	86	0.0029	22.09	13.21
37+50	24	165.77	165.25	96	0.0054	29.13	18.04
41+18.36	36	166.58	166.04	112	0.0048	12.69	50.17
PS No. 1	36	164.96	164.93	58	0.0005	16.58	16.43
PS No. 1	36	164.92	164.86	102	0.0006	16.58	17.52
PS No. 2	36	166.85	166.81	22	0.0018	16.78	30.81
PS No. 2	36	166.80	166.70	94	0.0011	16.78	23.57

Assumption: The flow through the pipes for the pump stations was considered equal to the flow for the adjacent outlet pipe for the general area.

PIPE OUTLET - STONE PROTECTION

Location Station	Q/Qfull	Vfull Fps	V/Vfull	V Fps	Apron Length, La Feet	Riprap d50, Size Inches	Riprap Thickness Inches
15+84	0.81	2.88	1.11	3.20	28	4	8
28+36	1.67	4.21	1.13	4.75	22	6	12
37+50	1.62	5.74	1.13	6.49	29	9	17
41+18.36	0.25	7.10	0.85	6.03	26	3	5
PS No. 1	1.01	2.32	1.13	2.63	N/A		
PS No. 1	0.95	2.48	1.13	2.80	28	4	8
PS No. 2	0.54	4.36	1.13	4.93	N/A		
PS No. 2	0.71	3.33	1.13	3.77	28	4	8

Assumption: The flow for the outlet pipe at the pump stations was considered equal to the flow for the adjacent outlet pipe for the general area for purpose of determining riprap thickness.

INTERIOR DRAINAGE DITCHES

Ditch Location Station From	To	Ditch Slope	Fore-Slope	Back-Slope	Flow, Q CFS	Flow Depth	Velocity Fps
950	1600	0.00734	2H:1V	2H:1V	10.02	0.48	3.47
1700	2200	0.00744	2H:1V	2H:1V	5.04	0.32	2.76
2550	2850	0.00752	2H:1V	2H:1V	19.36	0.70	4.33
3750	3800	0.01698	2H:1V	2H:1V	12.98	0.44	5.00
4000	4100	0.00567	2H:1V	2H:1V	0.6	0.10	1.17

Assumptions:

1. For purpose of calculating velocities, the flow for adjacent gravel filter basin was used in conjunction with the steepest slope for the particular ditch. This was considered the worst case.

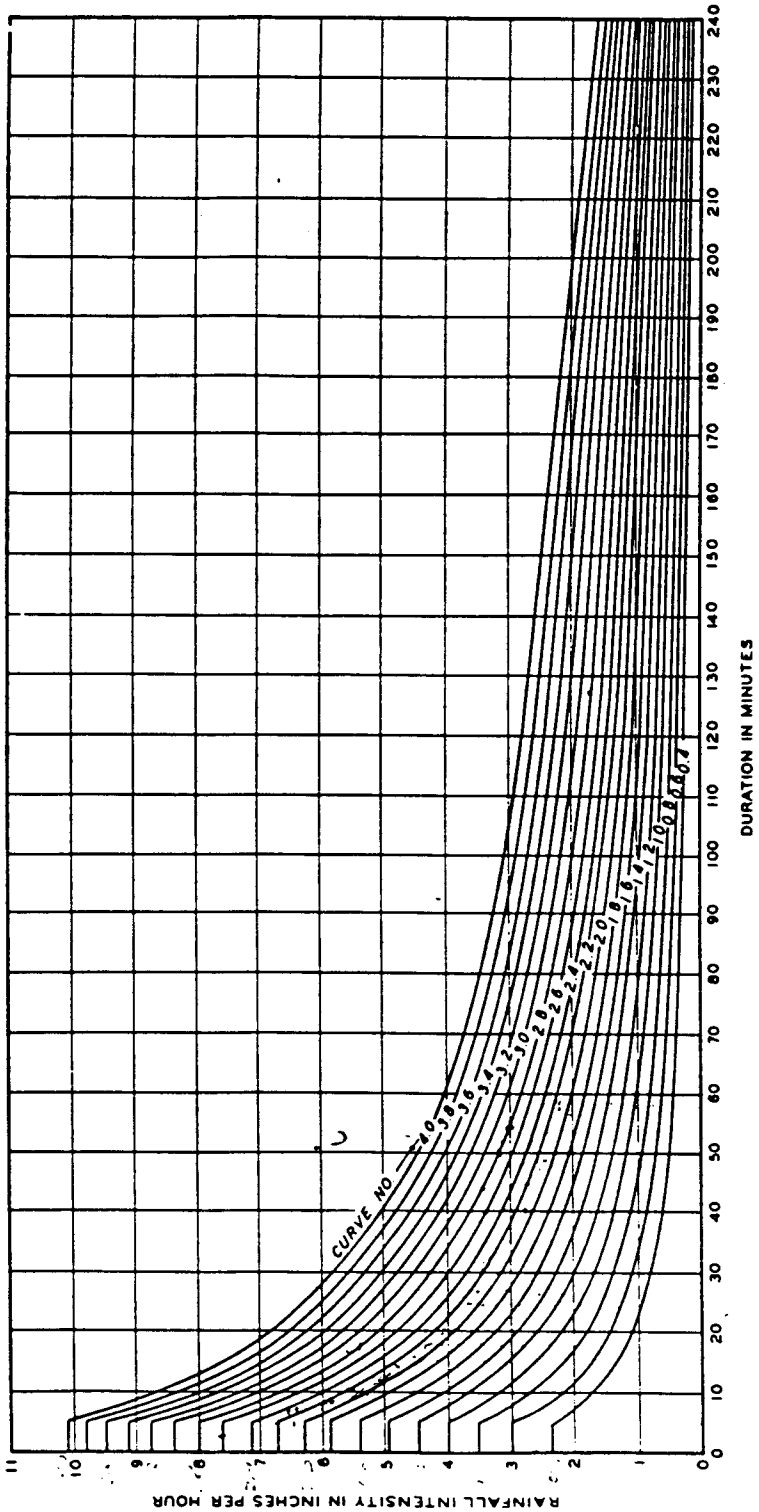
2. A vegetative cover should be sufficient in most cases. Erosion Control Matting may be used where the velocities exceed 4 feet per second.

TABLE 10.4. VALUES OF RUNOFF COEFFICIENT c
(after Frevert, Schwab, Edminster and Barnes)[19] (Courtesy John Wiley)

Topography and vegetation	Open sandy loam	Clay and silt loam	Tight clay
Woodland			
Flat (0–5 per cent slope)	0·10	0·30	0·40
Rolling (5–10 per cent slope)	0·25	0·35	0·50
Hilly (10–30 per cent slope)	0·30	0·50	0·60
Pasture			
Flat	0·10	0·30	0·40
Rolling	0·16	0·36	0·55
Hilly	0·22	0·42	0·60
Cultivated			
Flat	0·30	0·50	0·60
Rolling	0·40	0·60	0·70
Hilly	0·52	0·72	0·82
Urban areas	**30 per cent impervious**	**50 per cent impervious**	**70 per cent impervious**
Flat	0·40	0·55	0·75
Rolling	0·50	0·65	0·80

TABLE 10.5. VALUES OF n IN EQN. (10.8)

Type of surface	Value of n
Smooth impervious	0·02
Smooth bare packed soil	0·10
Poor grass, row crops or moderately rough bare soil	0·20
Pasture	0·40
Deciduous timber land	0·60
Coniferous timber land, or deciduous timber land with deep litter or grass	0·80

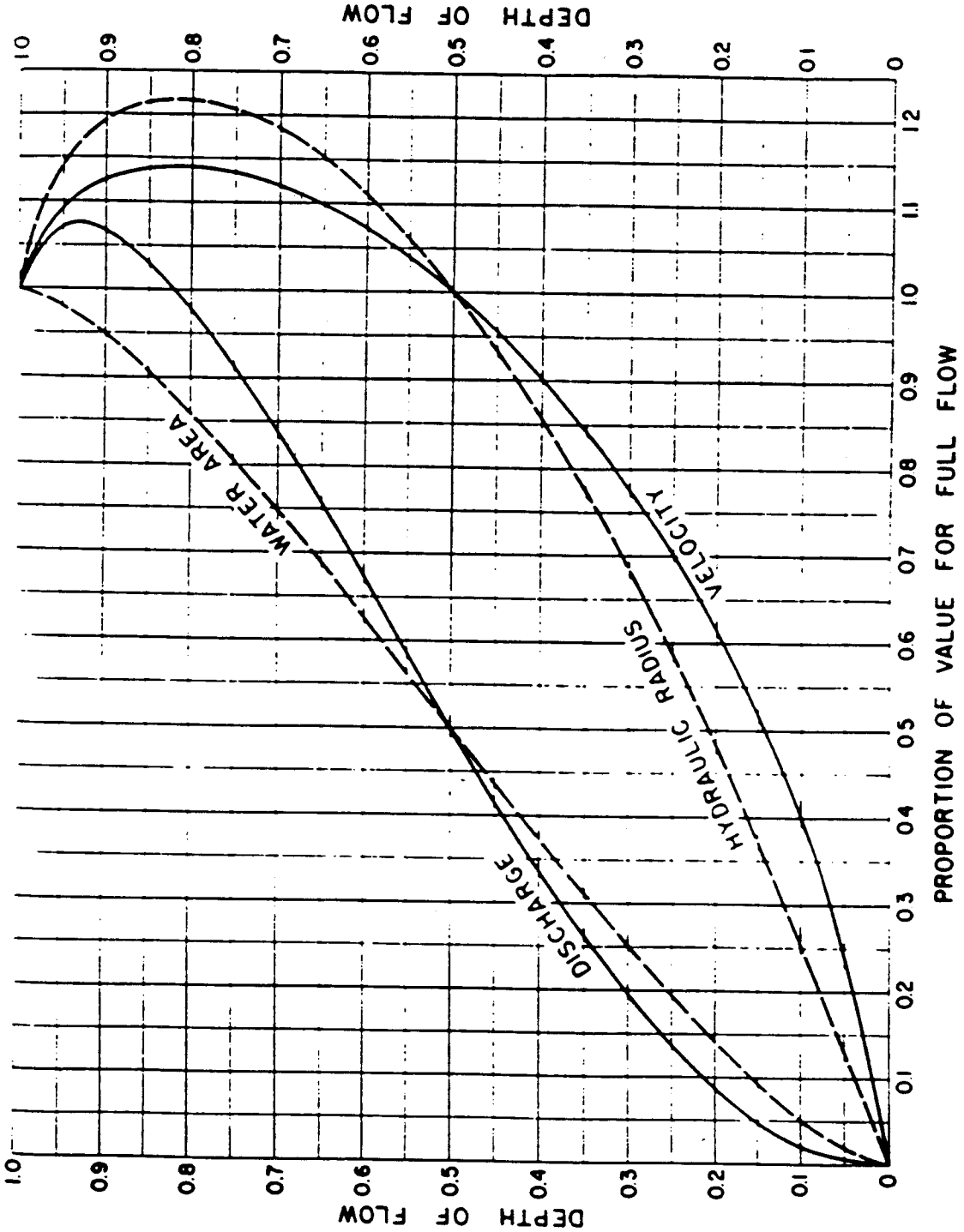


STANDARD RAINFALL INTENSITY-DURATION CURVES
OR
STANDARD SUPPLY CURVES

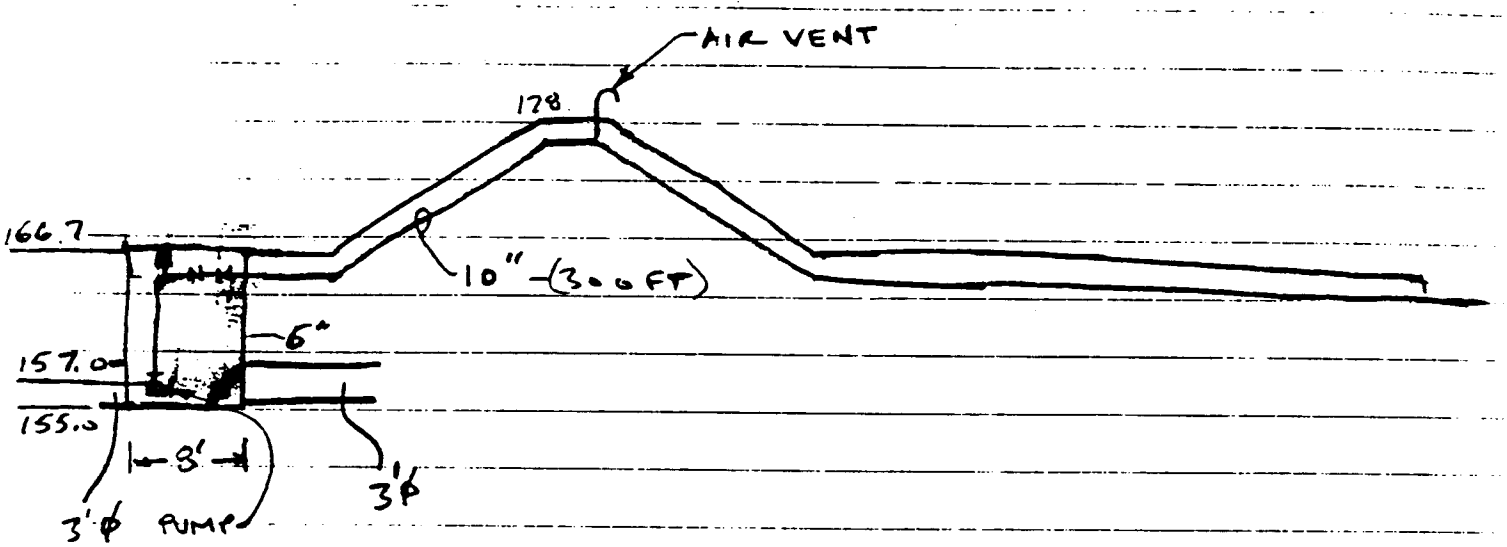
NOTE: CURVE NUMBERS CORRESPOND TO 1-HOUR VALUES OF RAINFALL OR SUPPLY INDICATED BY RESPECTIVE CURVES. ALL POINTS ON THE SAME CURVE ARE ASSUMED TO HAVE THE SAME AVERAGE FREQUENCY OF OCCURRENCE.

Figure 2

RELATIVE VELOCITY AND DISCHARGE IN PIPE FOR ANY DEPTH OF FLOW



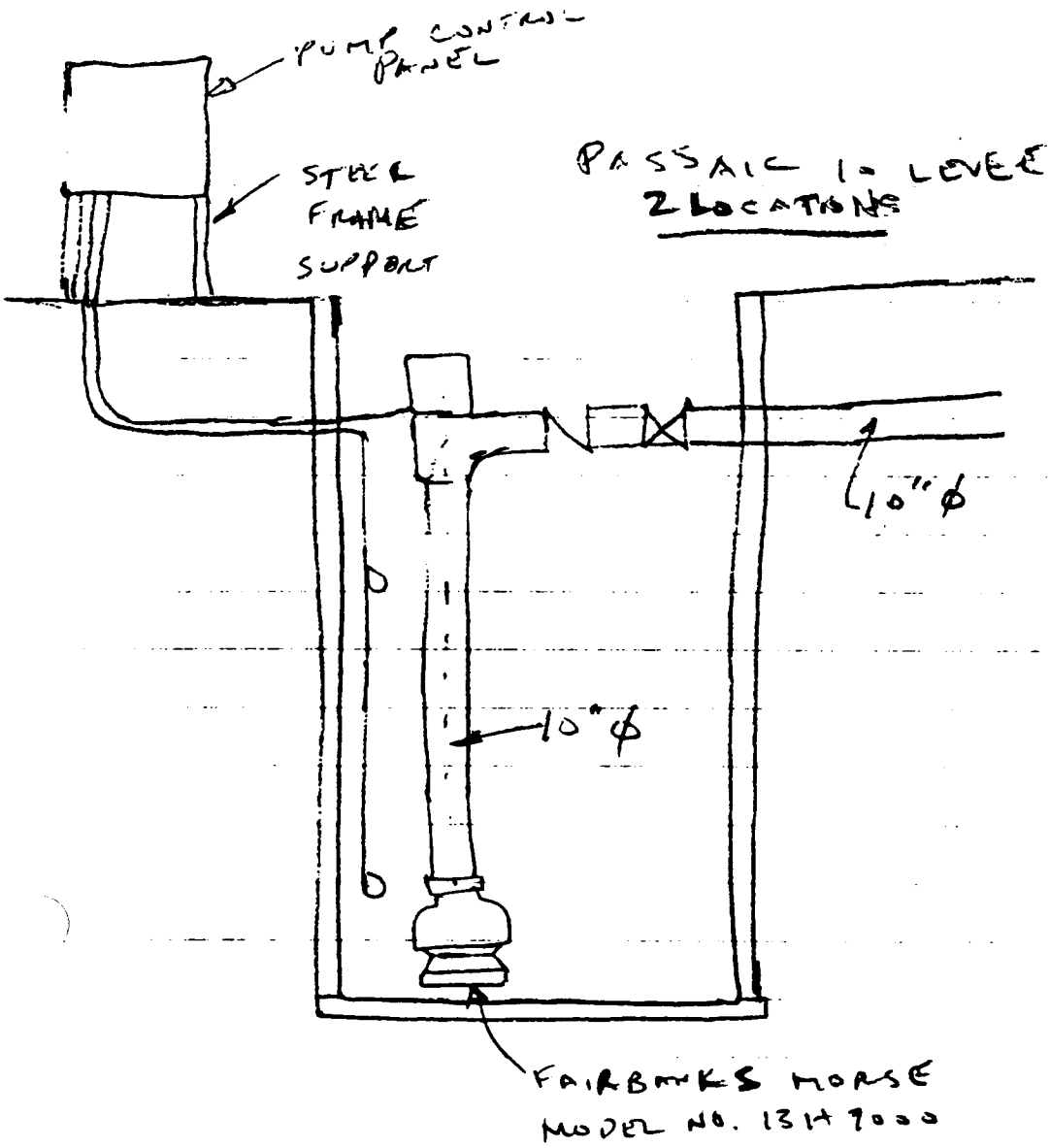
PASSAIC RIVER, NEW JERSEY & NEW YORK 1/24/95
PASSAIC 10 LEVEE D. Livingst

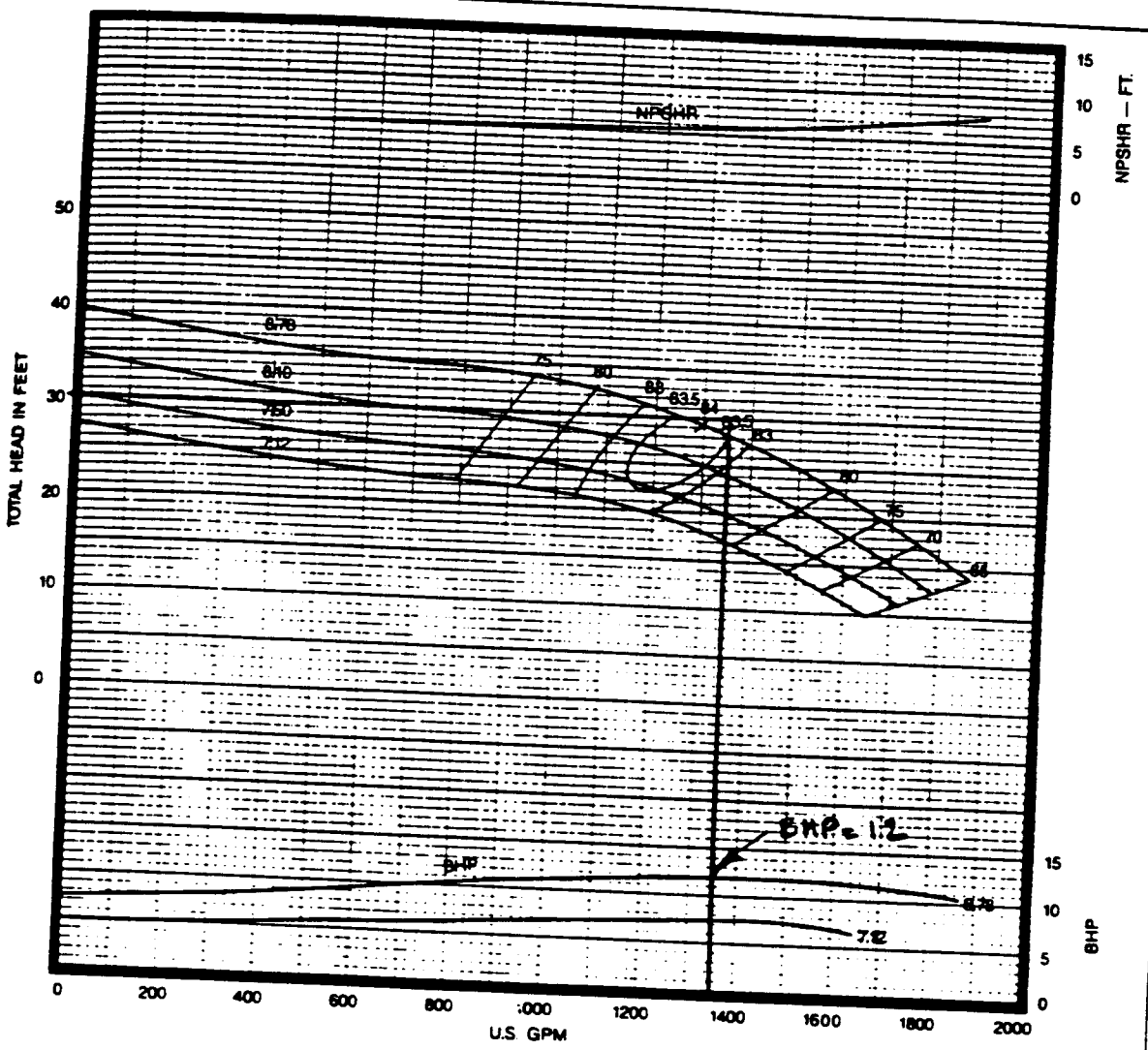


SEE P. 9-21, PUMP HANDBOOK

PASSAIC 10 LEVEE
2 LOCATIONS

1/25/95
Drawings.





13H 7000

1170 RPM

ENCLOSED IMPELLER T7EKA99

EFFICIENCY CORRECTIONS[1]

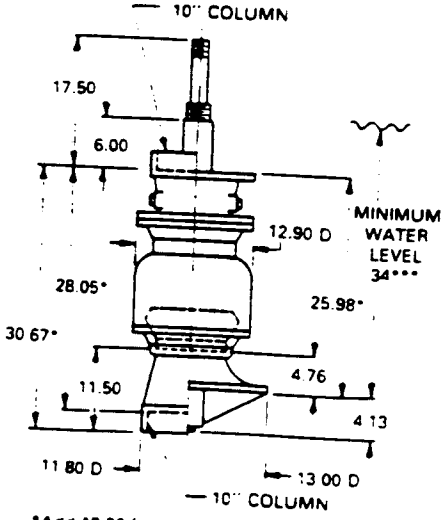
NUMBER OF STAGES	EFFICIENCY CHANGE
1	-3.0 POINTS
2	-2.0 POINTS
3	-1.0 POINTS
4	NO CHANGE
5	NO CHANGE
6 OR MORE	NO CHANGE

BOWL MATERIAL	EFFICIENCY CHANGE
AST IRON	-2.0 POINTS
AMELED C I	NO CHANGE

IMPELLER MATERIAL	EFFICIENCY CHANGE
AST IRON	-1.0 POINTS
ONZE	NO CHANGE
AMELED C I	- 1.0 POINTS

efer to "Application and Reference ata" for head correction

DIMENSIONS (Inches)



*Add 13.06 for each additional stage

TECHNICAL DATA

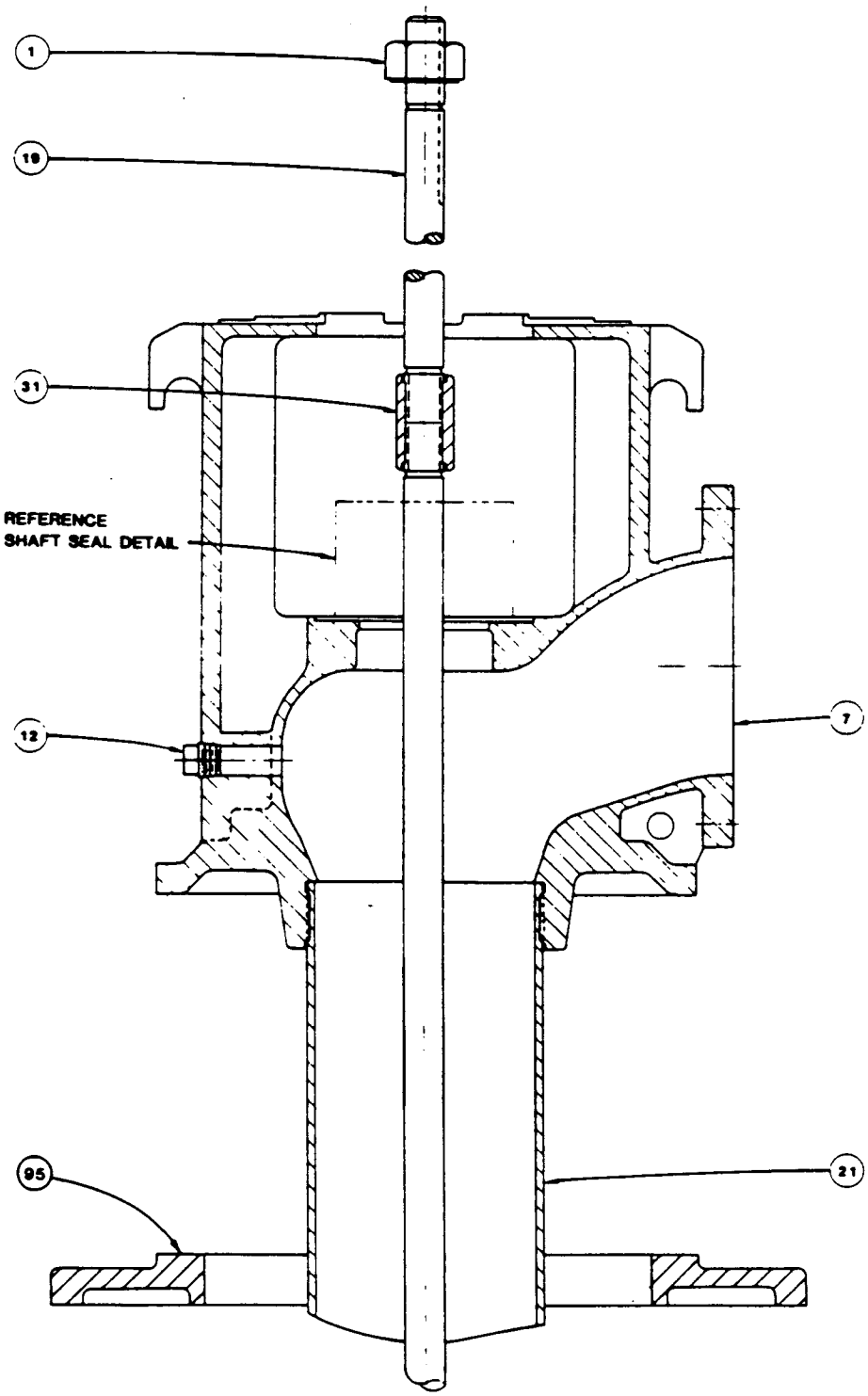
DATA	VALUE
MAXIMUM OPERATING SPEED	2300 RPM
MAXIMUM NUMBER OF STAGES	15**
PUMP SHAFT DIAMETER	1 11/16 IN.
IMPELLER EYE AREA	28.40 SQ. IN.
MAXIMUM SPHERE SIZE	1.00 IN.
K_t (THRUST FACTOR)	12.02 LBS./FT.
K_w (ROTOR WT. PER STAGE)	43.30 LBS.
BOWL WT. (FIRST STAGE)	327 LBS.
BOWL WT. (EACH ADD'L. STAGE)	157 LBS.
ALLOWABLE SHAFT STRETCH	.80 IN.**
WK^2 (FIRST STAGE)	3.11 LBS.-FT.^{2}
WK^2 (EACH ADD'L. STAGE)	3.05 LBS.-FT.^{2}
BOWL RING CLEARANCE	.014/.018 IN.

** These are nominal values. Refer to "Application and Reference Data" for information further limiting or extending these values.

*** This value is the minimum submergence required to prevent vortexing only. This value may need to be increased to provide adequate NPSHA.

PASS LEVEE

233



ER2-12164

DRAWN BY	DATE	CHECKED BY	DATE	ENGINEERING APPROVAL	DATE	MARKETING APPROVAL	DATE	DRAWING NUMBER
								24LYA2363BN

REV.	DATE	ECN NO.

Fairbanks Morse Pump Corporation

ASSEMBLY
CT STYLE
DISCHARGE HEAD

SIZE C | DWG. NO. 24LYA2363BN

FAIRBANKS MORSE PUMPS

ATTACHMENT E

STRUCTURAL ANALYSIS

ATTACHMENT E

STRUCTURAL ANALYSIS

Table of Contents

Section	Page
Design Criteria	E-1
Design Parameters	E-1
Assumptions	E-1
Computations Sheets	E-3 E-5 1

ATTACHMENT E

STRUCTURAL ATTACHMENT

DESIGN CRITERIA

EM 1110-2-2502, Retaining and flood walls.
CWALSHT, Sheetpile wall design program.
ACI 381-89, Building Code Requirements for Reinforced Concrete.
Kenneth Leet, Reinforced Concrete Design, copyright 1982.
Drill Hole P-10-1, Soil profile and design parameters.
Existing sanitary sewer field data.

DESIGN PARAMETERS

Loading:	(1.9 x LL) + (1.5 x DL)
Strength Reduction: (Phi Angle)	ϕ = 0.90 for bending ϕ = 0.85 for shear
Sheetpile Design:	A328 steel f_y = 36 ksi A572 steel f_y = 50 ksi
Concrete:	f'c = 3,000 psi E_c = 3,125,000 psi
Reinforcement:	f_y = 48,000 psi E_s = 29,125,000 psi

ASSUMPTIONS

Wt of water = 62.4 pcf
Wt of concrete = 150.0 pcf

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

DESIGN ANALYSIS

DATE 12-19-94 SHEET No. ___ OF ___

COMPUTED BY: MLB CHECKED BY: ___

PROJECT: PASSAIC 10 LEVEE

FEATURE: CHECK I-WALL MOMENT + DEFLECTION

@ 165.64' MSL (IN STEEL) M_u = 17.3 K-FT

$\phi M_N = \phi f_y(S) =$

$= \frac{0.9(36ksi)(30.2 in^3)}{(12 in/ft)}$

ϕM_N = 81.54 K-FT

$\phi M_N > M_u$ ✓

SF = 4.71

CHECK $\phi M_N > M_u$ @ 171.5' ASL

M_u = 3 K-FT

ϕM_N = 12.3 K-FT

$\phi M_N > M_u$ ✓

SF = 4.1

DEFLECTION: Δ @ TOP OF WALL = 0.55 IN ✓

SAW FORM 472 REV 17 APR 1980

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 94/12/29 TIME: 11.38.19

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É¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶»
º  SUMMARY OF RESULTS FOR  º
º CANTILEVER WALL ANALYSIS º
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```

I.--HEADING
'PASSAIC 10 LEVEE
'SHEETPILE DESIGN_PENETRATION FOR I-WALL

II.--SUMMARY
RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.
LEFTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

FACTOR OF SAFETY	:	3.60
MAX. BEND. MOMENT (LB-FT)	:	17289.
AT ELEVATION (FT)	:	165.64
MAXIMUM DEFLECTION (IN)	:	5.5468E-01
AT ELEVATION (FT)	:	178.10

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 94/12/29 TIME: 11.38.19

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É¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡»
º   COMPLETE RESULTS FOR   º
º CANTILEVER WALL ANALYSIS º
È¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¼
```

I.--HEADING

'PASSAIC 10 LEVEE

'SHEETPICE DESIGN_PENETRATION FOR I-WALL

II.--RESULTS

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	DEFLECTION (IN)	NET PRESSURE (PSF)
178.10	0.	0.	5.5468E-01	.00
177.10	10.	31.	5.0940E-01	62.40
176.10	83.	125.	4.6413E-01	124.80
175.10	281.	281.	4.1889E-01	187.20
174.10	666.	499.	3.7375E-01	249.60
173.10	1300.	780.	3.2883E-01	312.00
172.10	2246.	1123.	2.8434E-01	374.40
171.50	2990.	1359.	2.5797E-01	411.84
171.50	2990.	1359.	2.5797E-01	-143.72
171.10	3671.	2416.	2.4058E-01	5429.51
170.59	5354.	3738.	2.1881E-01	-222.07
170.50	5698.	3717.	2.1488E-01	-232.52
170.10	7165.	3614.	1.9810E-01	-278.28
169.10	10622.	3281.	1.5793E-01	-387.93
168.10	13659.	2742.	1.2118E-01	-689.94
167.90	14193.	2593.	1.1433E-01	-809.55
167.10	15968.	1795.	8.8830E-02	-1184.51
167.00	16142.	1676.	8.5868E-02	-1198.19
166.10	17158.	575.	6.1616E-02	-1248.62
165.10	17098.	-705.	3.9919E-02	-1310.74
164.42	16320.	-1604.	2.8397E-02	-1352.32
164.10	15730.	-2017.	2.3718E-02	-1191.38
163.10	13200.	-2961.	1.2573E-02	-695.99
162.50	11316.	-3289.	7.9892E-03	-398.75
162.10	9974.	-3409.	5.6792E-03	-200.59
161.10	6547.	-3362.	2.0066E-03	294.81
160.10	3415.	-2820.	4.5983E-04	790.20
159.70	2356.	-2464.	2.0552E-04	988.36
159.10	1073.	-1782.	3.9030E-05	1285.60
158.10	17.	-248.	7.8877E-09	1781.00
157.96	0.	0.	0.0000E+00	1848.78

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 94/12/29 TIME: 11.37.57

É!!!!!!!!!!!!!!!»
º INPUT DATA º
È!!!!!!!!!!!!!!!¼

I.--HEADING:
'PASSAIC 10 LEVEE
'SHEETPILE DESIGN_PENETRATION FOR I-WALL

II.--CONTROL
CANTILEVER WALL ANALYSIS
SAME FACTOR OF SAFETY APPLIED TO ACTIVE AND PASSIVE PRESSURES.

III.--WALL DATA
ELEVATION AT TOP OF WALL = 178.10 (FT)
ELEVATION AT BOTTOM OF WALL = 158.00 (FT)
WALL MODULUS OF ELASTICITY = 2.90E+07 (PSI)
WALL MOMENT OF INERTIA = 184.20 (IN**4/FT)

IV.--SURFACE POINT DATA
IV.A--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	171.50
500.00	171.50

IV.B-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	171.50
500.00	171.50

V.--SOIL LAYER DATA
V.A.--RIGHTSIDE LAYER DATA

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	115.00	.00	1000.0	.00	.0	167.90	.00		
126.00	120.00	.00	2000.0	.00	.0	162.50	.00		
126.00	120.00	.00	2000.0	.00	.0	159.70	.00		
126.00	120.00	36.00	.0	.00	.0	155.00	.00		
126.00	120.00	37.00	.0	.00	.0				

V.B.-- LEFTSIDE LAYER DATA

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	115.00	.00	1000.0	.00	.0	167.90	.00		
126.00	120.00	.00	2000.0	.00	.0	162.50	.00		
126.00	120.00	.00	2000.0	.00	.0	159.70	.00		
126.00	120.00	36.00	.0	.00	.0	155.00	.00		
126.00	120.00	37.00	.0	.00	.0				

VI.--WATER DATA
UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 178.10 (FT)
LEFTSIDE ELEVATION = 167.00 (FT)
NO SEEPAGE

VII.--SURFACE LOADS
VII.A.--RIGHTSIDE SURFACE LOADS
VII.A.1.--SURFACE LINE LOADS

DIST. FROM WALL (FT)	LINE LOAD (PLF)
.00	3650.00

VII.A.2.--SURFACE DISTRIBUTED LOADS
NONE
VII.B.--.LEFTSIDE SURFACE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

```
1000 'PASSAIC 10 LEVEE
1010 'SHEETPILE DESIGN_PENETRATION FOR I-WALL
1020 CONTROL  C  A
1030 WALL     178.10    158.00   2.900E+07    184.20
1040 SURFACE RIGHTSIDE   2
1050       .00    171.50    500.00    171.50
1060 SURFACE  LEFTSIDE   2
1070       .00    171.50    500.00    171.50
1080 SOIL RIGHTSIDE  STRENGTH    5     .00
1090  120.00  115.00   .00 1000.00    .00      .00   167.90    .00
1100  126.00  120.00   .00 2000.00    .00      .00   162.50    .00
1110  126.00  120.00   .00 2000.00    .00      .00   159.70    .00
1120  126.00  120.00 36.00     .00    .00      .00   155.00    .00
1130  126.00  120.00 37.00     .00    .00      .00
1140 SOIL  LEFTSIDE  STRENGTH    5     .00
1150  120.00  115.00   .00 1000.00    .00      .00   167.90    .00
1160  126.00  120.00   .00 2000.00    .00      .00   162.50    .00
1170  126.00  120.00   .00 2000.00    .00      .00   159.70    .00
1180  126.00  120.00 36.00     .00    .00      .00   155.00    .00
1190  126.00  120.00 37.00     .00    .00      .00
1200 WATER ELEVATIONS    62.40  178.10  167.00
1210 VERTICAL LINE  RIGHTSIDE    1
1220       .00   3650.00
1230 FINISH
```

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 12-29-94 SHEET No. ___ OF ___

COMPUTED BY: MLB CHECKED BY: ___

PROJECT: PASSAIC 10 LEVEE

FEATURE: ___

WALL PENETRATION IS VERY SHALLOW

EXTEND BOTTOM OF WALL TO A SET ELEVATION & WITH PZ 27

MOMENT OF INERTIA

$I = 184.20 \ in^4/ft$

SET BOTTOM @ EL 158.00' MSL

SAW FORM 472 REV 17 APR 1980

III.--SOIL PRESSURES

ELEVATION (FT)	< LEFTSIDE PRESSURE (PSF)> PASSIVE	ACTIVE	<RIGHTSIDE PRESSURE (PSF)> ACTIVE	PASSIVE
178.10	0.	0.	0.	0.
177.10	0.	0.	0.	0.
176.10	0.	0.	0.	0.
175.10	0.	0.	0.	0.
174.10	0.	0.	0.	0.
173.10	0.	0.	0.	0.
172.10	0.	0.	0.	0.
171.50+	0.	0.	0.	0.
171.50-	1333.	0.	0.	1333.
171.10	1379.	0.	4816.	7483.
170.66	1430.	0.	0.	2667.
170.50	1448.	0.	0.	870.
170.10	1494.	0.	0.	1414.
169.10	1597.	0.	0.	1459.
168.10	2162.	0.	0.	1967.
167.90	2417.	0.	0.	2210.
167.23	3062.	0.	0.	2819.
167.10	3188.	0.	0.	2938.
167.00	3209.	0.	0.	2957.
166.10	3246.	0.	0.	2989.
165.10	3310.	0.	0.	3052.
164.39	3373.	0.	0.	3116.
163.10	3437.	0.	0.	3179.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 94/12/29 TIME: 10.22.17

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É¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡»
º  SUMMARY OF RESULTS FOR  º
º  CANTILEVER WALL DESIGN  º
È¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¼
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I.--HEADING
'PASSAIC 10 LEVEE
'SHEETPILE DESIGN_PENETRATION FOR I-WALL

II.--SUMMARY
RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.
LEFTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

WALL BOTTOM ELEV. (FT)	:	164.39
PENETRATION (FT)	:	7.11
MAX. BEND. MOMENT (LB-FT)	:	7925.
AT ELEVATION (FT)	:	168.28
MAX. SCALED DEFL. (LB-IN3)	:	6.4201E+08
AT ELEVATION (FT)	:	178.10

(NOTE: DIVIDE SCALED DEFLECTION BY MODULUS OF ELASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN**4 TO OBTAIN DEFLECTION IN INCHES.)

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 94/12/29 TIME: 10.22.17

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É¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡»
º   COMPLETE RESULTS FOR   º
º  CANTILEVER WALL DESIGN  º
È¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¼
```

I.--HEADING

'PASSAIC 10 LEVEE
'SHEETPILE DESIGN_PENETRATION FOR I-WALL

II.--RESULTS

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN3)	NET PRESSURE (PSF)
178.10	0.	0.	6.4201E+08	.00
177.10	10.	31.	5.7158E+08	62.40
176.10	83.	125.	5.0117E+08	124.80
175.10	281.	281.	4.3093E+08	187.20
174.10	666.	499.	3.6120E+08	249.60
173.10	1300.	780.	2.9266E+08	312.00
172.10	2246.	1123.	2.2640E+08	374.40
171.50	2990.	1359.	1.8841E+08	411.84
171.50	2990.	1359.	1.8841E+08	-921.49
171.10	3588.	1950.	1.6408E+08	3873.96
170.66	4655.	2585.	1.3867E+08	-965.52
170.50	5064.	2427.	1.2956E+08	-974.09
170.10	5956.	2033.	1.0823E+08	-995.13
169.10	7485.	1018.	6.2519E+07	-1035.60
168.10	7901.	-269.	2.9591E+07	-1537.69
167.90	7815.	-601.	2.4638E+07	-1780.57
167.23	6969.	-1994.	1.1915E+07	-2383.62
167.10	6689.	-2287.	1.0086E+07	-2099.24
167.00	6450.	-2486.	8.8204E+06	-1881.63
166.10	3715.	-3299.	1.8592E+06	76.84
165.10	817.	-2134.	6.2357E+04	2252.92
164.39	0.	0.	0.0000E+00	3789.66

(NOTE: DIVIDE SCALED DEFLECTION BY MODULUS OF ELASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN**4 TO OBTAIN DEFLECTION IN INCHES.)

PASS B OUT

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 94/12/29 TIME: 10.22.01

É!!!!!!!!!!!!!!!»
º INPUT DATA º
È!!!!!!!!!!!!!!!¼

I.--HEADING:
'PASSAIC 10 LEVEE
'SHEETPILE DESIGN_PENETRATION FOR I-WALL

II.--CONTROL
CANTILEVER WALL DESIGN
LEVEL 1 FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.50
LEVEL 1 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.50

III.--WALL DATA
ELEVATION AT TOP OF WALL = 178.10 (FT)

IV.--SURFACE POINT DATA
IV.A--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	171.50
500.00	171.50

IV.B-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	171.50
500.00	171.50

V.--SOIL LAYER DATA
V.A.--RIGHTSIDE LAYER DATA
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	115.00	.00	1000.0	.00	.0	167.90	.00	DEF	DEF
126.00	120.00	.00	2000.0	.00	.0	162.50	.00	DEF	DEF
126.00	120.00	.00	2000.0	.00	.0	159.70	.00	DEF	DEF
126.00	120.00	36.00	.0	.00	.0	155.00	.00	DEF	DEF
126.00	120.00	37.00	.0	.00	.0			DEF	DEF

V.B.-- LEFTSIDE LAYER DATA
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	115.00	.00	1000.0	.00	.0	167.90	.00	DEF	DEF
126.00	120.00	.00	2000.0	.00	.0	162.50	.00	DEF	DEF
126.00	120.00	.00	2000.0	.00	.0	159.70	.00	DEF	DEF
126.00	120.00	36.00	.0	.00	.0	155.00	.00	DEF	DEF
126.00	120.00	37.00	.0	.00	.0			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 178.10 (FT)
LEFTSIDE ELEVATION = 167.00 (FT)
NO SEEPAGE

VII.--SURFACE LOADS
VII.A.--RIGHTSIDE SURFACE LOADS
VII.A.1.--SURFACE LINE LOADS

DIST. FROM WALL (FT)	LINE LOAD (PLF)
.00	3650.00

VII.A.2.--SURFACE DISTRIBUTED LOADS
NONE
VII.B.-- LEFTSIDE SURFACE LOADS
NONE
VIII.--HORIZONTAL LOADS
NONE

PASSB.IN

```
1000 'PASSAIC 10 LEVEE
1010 'SHEETPILE DESIGN_PENETRATION FOR I-WALL
1020 CONTROL  C  D    1.50    1.50
1030 WALL     178.10
1040 SURFACE RIGHTSIDE   2
1050       .00    171.50    500.00    171.50
1060 SURFACE  LEFTSIDE   2
1070       .00    171.50    500.00    171.50
1080 SOIL RIGHTSIDE  STRENGTH    5     .00     .00
1090  120.00  115.00    .00 1000.00    .00     .00   167.90    .00  .00  .00
1100  126.00  120.00    .00 2000.00    .00     .00   162.50    .00  .00  .00
1110  126.00  120.00    .00 2000.00    .00     .00   159.70    .00  .00  .00
1120  126.00  120.00 36.00      .00    .00     .00   155.00    .00  .00  .00
1130  126.00  120.00 37.00      .00    .00     .00      .00    .00
1140 SOIL  LEFTSIDE  STRENGTH    5     .00     .00
1150  120.00  115.00    .00 1000.00    .00     .00   167.90    .00  .00  .00
1160  126.00  120.00    .00 2000.00    .00     .00   162.50    .00  .00  .00
1170  126.00  120.00    .00 2000.00    .00     .00   159.70    .00  .00  .00
1180  126.00  120.00 36.00      .00    .00     .00   155.00    .00  .00  .00
1190  126.00  120.00 37.00      .00    .00     .00      .00    .00
1200 WATER ELEVATIONS    62.40  178.10  167.00
1210 VERTICAL LINE  RIGHTSIDE    1
1220       .00   3650.00
1230 FINISH
```

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

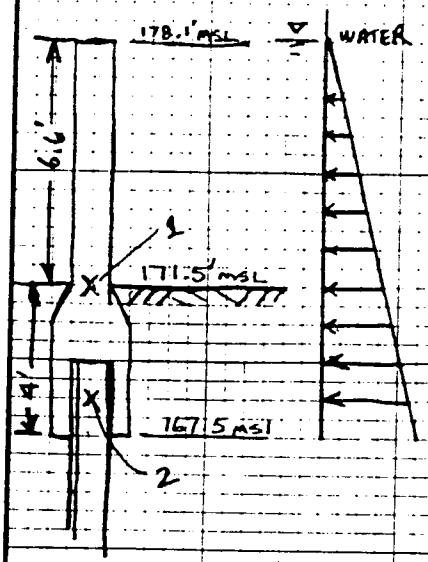
DESIGN ANALYSIS

DATE 12-14-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 Levee

FEATURE: Determine Reinforcement in I-WALL



DETERMINE THE STEEL NEEDED AT THE I-WALL SECTIONS.

SECTION 1: $M_L = 62.4\frac{lb}{FT^3} \times \frac{6.6FT^2}{2} \times 1' \times \frac{6.6FT}{3}$

$M_L = 2.99$ KFT

$M_{UL} = 1.9 \times 2.99 = 5.68$ K·FT

SECTION 2: $M_L = 62.4\frac{lb}{FT^3} \times \frac{10.6FT^2}{2} \times 1' \times \frac{10.6'}{3}$

$M_L = 12.38$ KFT

$M_{UL} = 1.9 \times 12.38 = 23.53$ KFT

CHECK 1' SECTION FIRST:

ESTIMATE $d = 8$ IN TARGET $\rho = 0.15\rho_b = 0.15 \times 0.0291$

$\rho = 0.0044$

TARGET $A_s = \rho bd = 0.0044(12")(8") = 0.42 IN^2$

USE #6 BAR @ 1' $= 0.44 IN^2$

$d = 12 - 3 - .5 - \frac{.75}{2} = 8.125$

$T = C$

$(48000)(0.44) = 0.85(12IN)(C_{IN})(3000)$

$c = 0.69$ IN

$\phi M_N = \frac{0.90(0.44 \times 48000)\left(8.125" - \frac{0.69"}{2}\right)}{12 IN/FT} = 12.3$ K·FT

$\phi M_N \geq M_U$?

$12.3 \geq 5.68$ KFT ✓

SHRINKAGE STEEL $= 0.0018 A_c = 0.1755 IN^2 =$ 1-#4 bar @ 12"

SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 12-14-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 Levee

FEATURE: ____

Using the #6 bars down in the lower 2' section, will they be o.k.? $M_u = 23.53$ K·FT

$$C = \frac{f_y A_s}{0.85(b)(f'_c)} = \frac{(48000\,psi)(0.44\,in^2)}{0.85(12\,in)(3000\,psi)} = 0.69\,in$$

$$d = 24\,in - 3\,in\ cover - 0.5 - \frac{0.75}{2} = 20.125\,in$$

$$\phi M_N = \frac{0.9(0.44)(48000)}{12\,in/ft}\left(20.125 - \frac{0.69}{2}\right) = 31.33\,K\text{-}FT$$

$$\phi M_N > M_u \overset{??}{}$$

$$\underline{31.33 > 23.53\,K\,FT}\quad OK\ \checkmark$$

SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

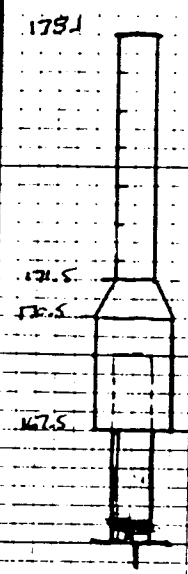
DESIGN ANALYSIS

DATE 12-16-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: Compute I-WALL weight per FOOT



WEIGHT: AREA: $(178.1 - 171.5) \times 1' = 6.6$

$1' \times 1.5' = 1.5$

$4' \times 2' = 8.0$

$\Sigma \; 16.1 \; FT^2 \times 1' \times 150^{\#}/FT^3$

$\frac{WT}{FT \text{ OF WALL}} = 2.42 \; K$

INPUT INTO SHEET PILE PROGRAM.

$W_u = 1.5 \times 2.42 \frac{K}{FT} = \boxed{3.63 \; K/FT}$

COMPUTATION SHEET
U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

DESIGN ANALYSIS

DATE 12-14-94 SHEET No. ___ OF ___

COMPUTED BY: MLB CHECKED BY: ___

PROJECT: PASSAIC 10 LEVEE

FEATURE: DEFLECTION Check @ ABUTMENT

DEFLECTION Check ASSUMPTION THAT A572 PZ 27 WILL NOT WORK.

FROM COMPUTER PRINTOUT:

DEFLECTION

$$\Delta = \frac{3.0392 \times 10^{10}}{EI}$$

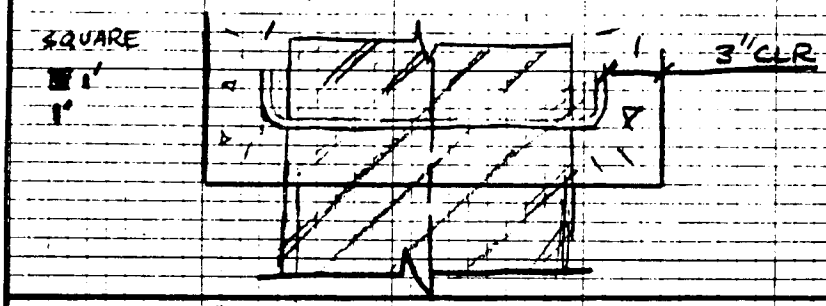
$$I = \frac{bh^3}{12} \qquad S = \frac{bh^2}{6}$$

$$I = S \times \frac{h}{2}$$

$$\Delta = \frac{3.0392 \times 10^{10} \times 2}{29{,}000{,}000\ (30.2\ in^2)(12\ in)}$$

$$\Delta = 5.78\ IN$$ TOO HIGH

CAN PZ35 FIT INSIDE 2' DIA? YES



CHECK Δ: WITH A328 PZ35

$$\Delta = \frac{3.0392 \times 10^{10} \times 2}{(29{,}000{,}000)(48.5)(14.9)} = 2.9\ IN.$$

$$\boxed{\Delta = 2.9\ IN}$$ MUCH BETTER

SAW FORM 472 REV 17 APR 1980

III.--SOIL PRESSURES

ELEVATION (FT)	< LEFTSIDE PRESSURE (PSF)> PASSIVE	ACTIVE	<RIGHTSIDE PRESSURE (PSF)> ACTIVE	PASSIVE
178.10	0.	0.	0.	0.
177.10	0.	0.	0.	0.
176.10	0.	0.	0.	0.
175.10	0.	0.	0.	0.
174.10	0.	0.	0.	0.
173.10	0.	0.	0.	0.
172.10	0.	0.	0.	0.
171.50+	0.	0.	0.	0.
171.50-	1333.	0.	0.	1333.
171.10	1379.	0.	0.	257.
171.03	1387.	0.	0.	27.
170.50	1448.	0.	0.	1391.
170.10	1494.	0.	0.	1414.
169.10	1597.	0.	0.	1459.
168.10	2162.	0.	0.	1967.
167.90	2417.	0.	0.	2210.
167.10	3188.	0.	0.	2938.
167.00	3209.	0.	0.	2957.
166.10	3246.	0.	0.	2989.
165.10	3310.	0.	0.	3052.
164.10	3373.	0.	0.	3116.
163.10	3437.	0.	0.	3179.
162.50	3475.	0.	0.	3217.
162.10	3500.	0.	0.	3243.
161.10	3578.	0.	0.	3058.
160.10	3390.	0.	0.	8403.
159.70	3092.	0.	0.	10344.
159.10	2739.	0.	0.	6670.
159.07	2740.	0.	0.	6514.
158.10	2756.	0.	0.	1726.
157.10	2932.	0.	0.	2276.
156.10	3093.	0.	0.	2434.
155.10	3300.	0.	0.	2936.
155.00	3326.	0.	0.	2991.
154.10	3527.	0.	0.	3004.
153.10	3697.	0.	0.	2999.
152.10	3864.	0.	0.	3187.
151.10	4031.	0.	0.	3354.
150.48	4198.	0.	0.	3522.
149.10	4366.	0.	0.	3689.

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 12-14-94 SHEET No. ___ OF ___

COMPUTED BY: MLB CHECKED BY: ___

PROJECT: PASSAIC 10 Levee

FEATURE: DETERMINE SHEET PILE SECTION

PENETRATION @ ABUTMENT = 150.48 FT MSL

MAX BEND MOMENT CONC @ 167.90' MSL = 53.3 K-FT PER FOOT

STEEL @ 162.45' MSL = 92.9 K PER FOOT

Concrete Abut. $M_u = 53.3 \frac{K\ FT}{FT} \times 2 FT = 106.6$ FT K

$\phi M_n = 316$ FT K OK

SHEETPILE STEEL 92.9 K·FT/FT LRFD

$\sigma = \frac{M}{S}$

LIMITING STRESS IN LRFD

ASSUME 0.9 F_y

0.9 × 36 KSI = 32.4 KSI A328

0.9 × 50 KSI = 45.0 KSI A572

THEREFORE,

THE REQUIRED SECTION MODULUS

for A572:

$S = \frac{M}{\sigma} = \frac{92.9 \text{ K·FT} \times 12 \text{ IN/FT}}{45 \text{ KSI}} = 24.8 \text{ IN}^3$ per FT OF WALL

GRADE 572

for A328:

$S = \frac{M}{\sigma} = \frac{92.4 \text{ K·FT} \times 12 \text{ IN/FT}}{32.4 \text{ PSI}} = 34.2 \text{ IN}^3$ per FOOT

BETHLEHEM STEEL SHEET PILING © 1988

USE	A328	PZ35	AT ABUTMENT
USE	A328	PZ27	ELSEWHERE

SAW FORM 472 REV 17 APR 1980

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 94/12/16 TIME: 10.37.05

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É¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶»
º  SUMMARY OF RESULTS FOR  º
º  CANTILEVER WALL DESIGN  º
È¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¶¼
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I.--HEADING
'PASSAIC 10 LEVEE
'SHEETPILE DESIGN_PENETRATION FOR WALL-COLUMN

II.--SUMMARY
RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.
LEFTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

WALL BOTTOM ELEV. (FT)	:	150.48
PENETRATION (FT)	:	21.02
MAX. BEND. MOMENT (LB-FT)	:	92918.
AT ELEVATION (FT)	:	162.45
MAX. SCALED DEFL. (LB-IN3)	:	3.0392E+10
AT ELEVATION (FT)	:	178.10

(NOTE: DIVIDE SCALED DEFLECTION BY MODULUS OF ELASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN**4 TO OBTAIN DEFLECTION IN INCHES.)

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 94/12/16 TIME: 10.37.05

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É¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡»
º   COMPLETE RESULTS FOR   º
º  CANTILEVER WALL DESIGN  º
È¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¡¼
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I.--HEADING
'PASSAIC 10 LEVEE
'SHEETPILE DESIGN_PENETRATION FOR WALL-COLUMN

II.--RESULTS

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN3)	NET PRESSURE (PSF)
178.10	0.	0.	3.0392E+10	.00
177.10	10.	31.	2.8486E+10	62.40
176.10	83.	125.	2.6580E+10	124.80
175.10	281.	281.	2.4674E+10	187.20
174.10	666.	499.	2.2768E+10	249.60
173.10	1300.	780.	2.0864E+10	312.00
172.10	2246.	1123.	1.8963E+10	374.40
171.50	2990.	1359.	1.7823E+10	411.84
171.50	2990.	1359.	1.7823E+10	-921.49
171.10	3459.	986.	1.7065E+10	-942.53
171.03	3526.	920.	1.6932E+10	-946.22
171.03	3526.	17520.	1.6932E+10	-946.22
170.50	12678.	17011.	1.5929E+10	-974.09
170.10	19404.	16617.	1.5176E+10	-995.13
169.10	35517.	15602.	1.3322E+10	-1035.60
168.10	50517.	14315.	1.1528E+10	-1537.69
167.90	53348. CONC	13984.	1.1179E+10	-1780.57
167.10	63888.	12271.	9.8214E+09	-2501.36
167.00	65103.	12020.	9.6565E+09	-2516.60
166.10	74896.	9738.	8.2249E+09	-2553.34
165.10	83348.	7153.	6.7575E+09	-2616.87
164.10	89182.	4505.	5.4337E+09	-2680.47
163.10	92336.	1792.	4.2636E+09	-2744.07
162.50	92915. STEEL	135.	3.6378E+09	-2782.23
162.10	92746.	-983.	3.2527E+09	-2807.67
161.10	90345.	-3830.	2.4016E+09	-2885.36
160.10	85104.	-6621.	1.7063E+09	-2697.53
159.70	82248.	-7641.	1.4699E+09	-2399.61
159.10	77252.	-8975.	1.1576E+09	-2046.67
159.07	76968.	-9039.	1.1425E+09	-2047.21
158.10	67363.	-10684.	7.4215E+08	-1348.58
157.10	56125.	-11672.	4.4289E+08	-627.17
156.10	44261.	-11938.	2.4053E+08	94.25
155.10	32490.	-11483.	1.1466E+08	815.67
155.00	31346.	-11398.	1.0549E+08	887.81
154.10	21535.	-10307.	4.5048E+07	1537.08
153.10	12117.	-8409.	1.2873E+07	2258.50
152.10	4958.	-5790.	1.9603E+06	2979.91
151.10	778.	-2449.	4.4241E+04	3701.33
150.48	0.	0.	0.0000E+00	4151.31

(NOTE: DIVIDE SCALED DEFLECTION BY MODULUS OF ELASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN**4 TO OBTAIN DEFLECTION IN INCHES.)

PASSA.OUT

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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                          BY CLASSICAL METHODS
DATE: 94/12/16                                                  TIME: 10.36.50
                          É¡¡¡¡¡¡¡¡¡¡¡¡¡¡»
                          º  INPUT DATA  º
                          È¡¡¡¡¡¡¡¡¡¡¡¡¡¡¼

I.--HEADING:
  'PASSAIC 10 LEVEE
  'SHEETPILE DESIGN_PENETRATION FOR WALL-COLUMN

II.--CONTROL
  CANTILEVER WALL DESIGN
  LEVEL 1 FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.50
  LEVEL 1 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.50

III.--WALL DATA
  ELEVATION AT TOP OF WALL    =   178.10 (FT)

IV.--SURFACE POINT DATA
  IV.A--RIGHTSIDE
     DIST. FROM     ELEVATION
     WALL (FT)        (FT)
            .00       171.50
         500.00       171.50

  IV.B-- LEFTSIDE
     DIST. FROM     ELEVATION
     WALL (FT)        (FT)
            .00       171.50
         500.00       171.50


V.--SOIL LAYER DATA
  V.A.--RIGHTSIDE LAYER DATA
     LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES  =. DEFAULT
     LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES =  DEFAULT
```

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	115.00	.00	1000.0	.00	.0	167.90	.00	DEF	DEF
126.00	120.00	.00	2000.0	.00	.0	162.50	.00	DEF	DEF
126.00	120.00	.00	2000.0	.00	.0	159.70	.00	DEF	DEF
126.00	120.00	36.00	.0	.00	.0	155.00	.00	DEF	DEF
126.00	120.00	37.00	.0	.00	.0			DEF	DEF

```
  V.B.-- LEFTSIDE LAYER DATA
     LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES  =  DEFAULT
     LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES =  DEFAULT
```

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	115.00	.00	1000.0	.00	.0	167.90	.00	DEF	DEF
126.00	120.00	.00	2000.0	.00	.0	162.50	.00	DEF	DEF
126.00	120.00	.00	2000.0	.00	.0	159.70	.00	DEF	DEF
126.00	120.00	36.00	.0	.00	.0	155.00	.00	DEF	DEF
126.00	120.00	37.00	.0	.00	.0			DEF	DEF

```
VI.--WATER DATA
     UNIT WEIGHT          =    62.40 (PCF)
     RIGHTSIDE ELEVATION =   178.10 (FT)
      LEFTSIDE ELEVATION =   167.00 (FT)
     NO SEEPAGE
```

VII.--SURFACE LOADS

VII.A.--RIGHTSIDE SURFACE LOADS

VII.A.1.--SURFACE LINE LOADS

DIST. FROM WALL (FT)	LINE LOAD (PLF)	
.00	10800.00	10.8K

VII.A.2.--SURFACE DISTRIBUTED LOADS

NONE

VII.B.-- LEFTSIDE SURFACE LOADS

NONE

VIII.--HORIZONTAL LOADS

VIII.A.--EARTHQUAKE ACCELERATION = .00 (G'S)

VIII.B.--HORIZONTAL LINE LOADS

ELEVATION (FT)	LINE LOAD (PLF)	
171.03	16600.00	16.6K

VIII.B.--HORIZONTAL DISTRIBUTED LOADS

NONE

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

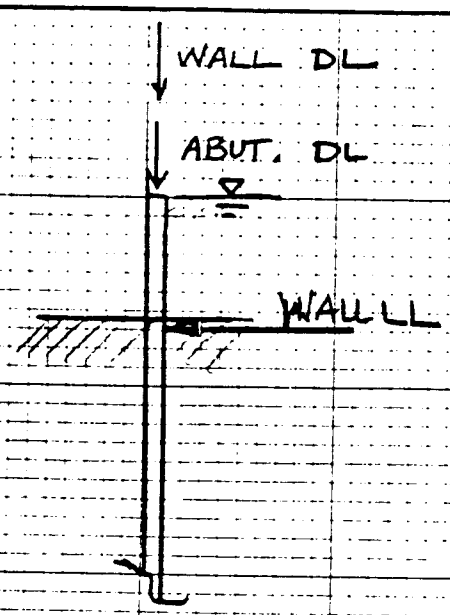
DESIGN ANALYSIS

DATE 12-14-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: APPLIED LOADS TO ABUTMENT



FACTORED WALL DL =
FACTORED ABUT DL = } R_v = 21.6 K

$WALL_{LL}$ = F_v = 33.3 K

DIVIDE ALL LOADS by 2 TO INPUT INTO CWALSHT PROGRAM

WALL DL
ABUT DL = } = 10.8 K
WALL LL = 16.7 K @ 771.03' msl

RUN CWALSHT

SAW FORM 472 REV 17 APR 1980

PASSA.IN

```
1000 'PASSAIC 10 LEVEE
1010 'SHEETPILE DESIGN PENETRATION FOR WALL-COLUMN
1020 CONTROL  C  D    1.50    1.50
1030 WALL     178.10
1040 SURFACE RIGHTSIDE   2
1050       .00    171.50    500.00    171.50
1060 SURFACE  LEFTSIDE   2
1070       .00    171.50    500.00    171.50
1080 SOIL RIGHTSIDE  STRENGTH    5     .00     .00
1090  120.00  115.00   .00 1000.00    .00     .00   167.90    .00  .00  .00
1100  126.00  120.00   .00 2000.00    .00     .00   162.50    .00  .00  .00
1110  126.00  120.00   .00 2000.00    .00     .00   159.70    .00  .00  .00
1120  126.00  120.00 36.00     .00    .00     .00   155.00    .00  .00  .00
1130  126.00  120.00 37.00     .00    .00     .00      .00    .00
1140 SOIL  LEFTSIDE  STRENGTH    5     .00     .00
1150  120.00  115.00   .00 1000.00    .00     .00   167.90    .00  .00  .00
1160  126.00  120.00   .00 2000.00    .00     .00   162.50    .00  .00  .00
1170  126.00  120.00   .00 2000.00    .00     .00   159.70    .00  .00  .00
1180  126.00  120.00 36.00     .00    .00     .00   155.00    .00  .00  .00
1190  126.00  120.00 37.00     .00    .00     .00      .00    .00
1200 WATER ELEVATIONS    62.40  178.10  167.00
1210 VERTICAL LINE  RIGHTSIDE    1
1220       .00  10800.00
1230 HORIZONTAL LINE    1
1240    171.03  16600.00
1250 FINISH
```

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

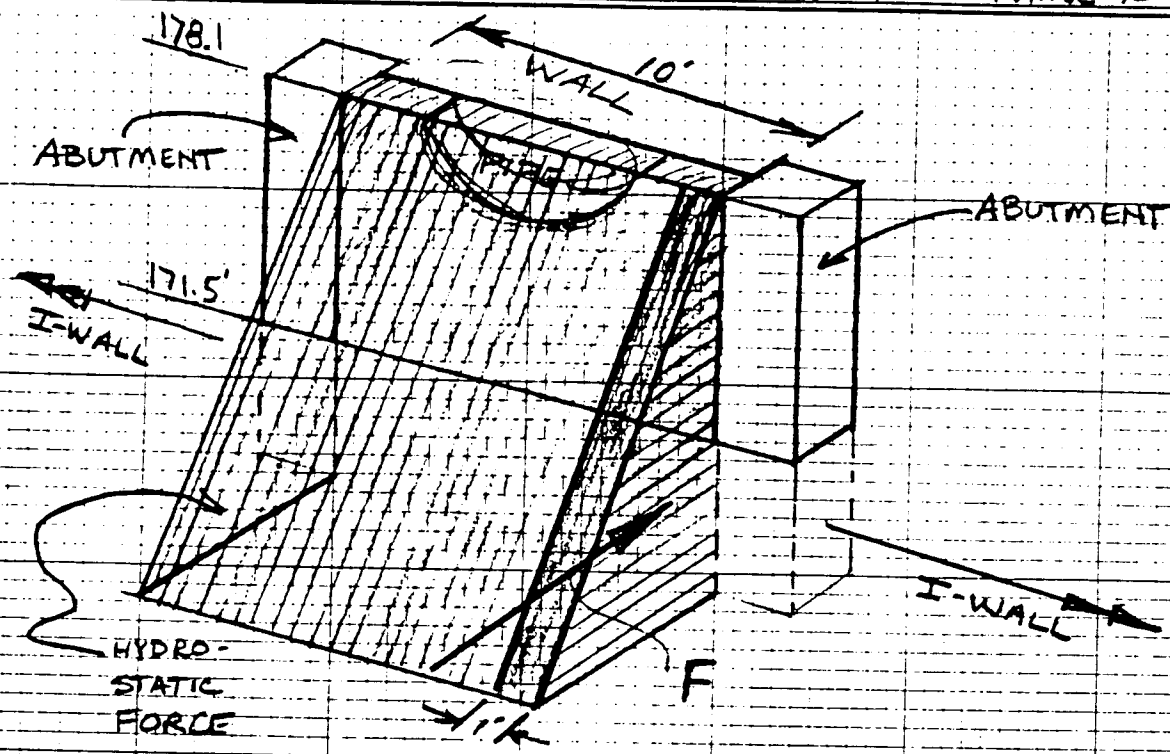
DESIGN ANALYSIS

DATE 12-14-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: LOAD TRANSFER FROM WALL TO ABUTMENTS



PER FOOT LOADING (ON WALL ONLY)

(COMPUTER WILL FIGURE FORCES ON THE ABUTMENT)

$$F = \frac{62.4\,lb}{FT^3} \times 10.6' \times \frac{10.6'}{2} = 3.5\,\frac{K}{FT}$$

EACH ABUTMENT RECEIVES 5' WORTH AND A 1.9 LOAD FACTOR FOR LIVE LOAD.

$$F_u = 1.9\,(5')(3.5\,K/FT) = \underline{33.3\,K}$$ (LIVE)

MOMENT ARM IS 1/3 OF HEIGHT OR,

$$167.5'\,MSL + \frac{10.6'}{3} = \underline{171.03'\,MSL}$$ (LOCATION)

CWALSHT ANALYZES SHEETPILE ON A PER-FOOT BASIS, THEREFORE ANY LOADS APPLIED TO THE 2 FOOT ABUTMENT WILL BE HALVED.

SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

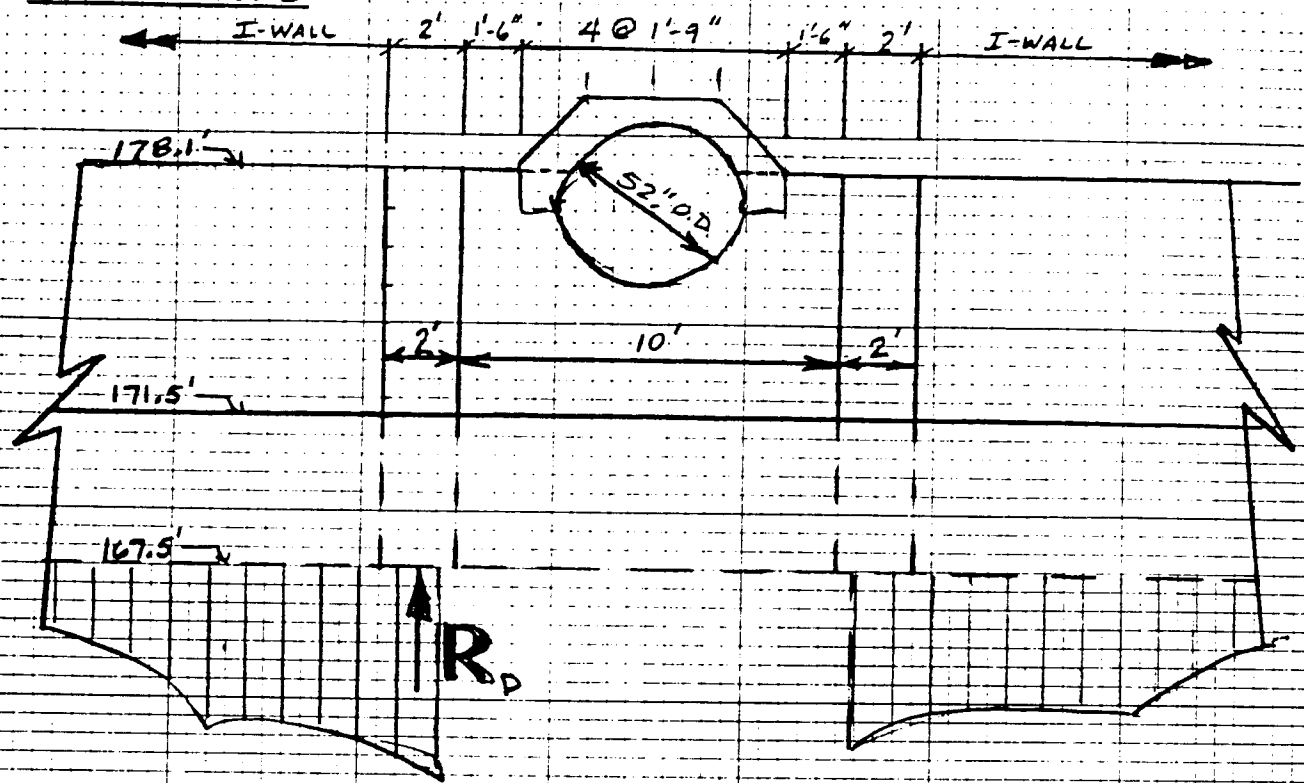
DATE 12-14-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: WEIGHT TRANSFER FROM WALL TO ABUTMENTS

DEAD LOADS



ASSUMPTIONS: PIPE WILL NOT CONTRIBUTE TO WALL LOADS. THE EXTRA WEIGHT OF CAP WILL BE ASSUMED TO FILL AREA WHERE PIPE IS. (LEVEL TOP)

CALCULATIONS: WALL: 1' THICK = 1' (WID) x 10' (LENG) x 10.6' high x 150 pcf = 15.9K

(1) ABUTMENT = 2' x 2' x 10.6' x 150 pcf = 6.4K

$$R_D = \frac{15.9K}{2} + 6.4 = 14.4K$$

$$R_U = 1.5 \times R_D = 1.5 \times 14.4 = 21.6K$$ (ON 2' ABUTMENT)

SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 12-14-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: ABUTMENT DESIGN

SHRINKAGE/TEMP STEEL

USE ACI MIN
ACI 7.12.2.1

$A_s = 0.0018\ b_w d$

$A_s = 0.0018\ (24_{IN})(20_{IN})$

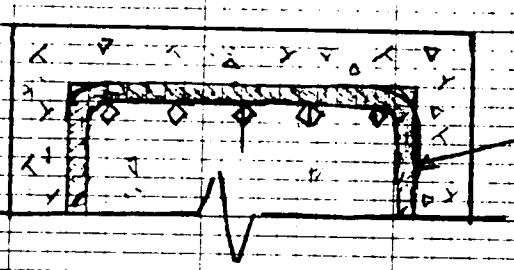
$A_s = 0.864\ IN^2$

#4's are $0.20\ in^2$
#5's are 0.31

5#4's or
3#5's

USE 5 #4 BARS FOR SHRINKAGE
IN ABUTMENT

5#4 BARS @ 3.5 IN SPA



SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

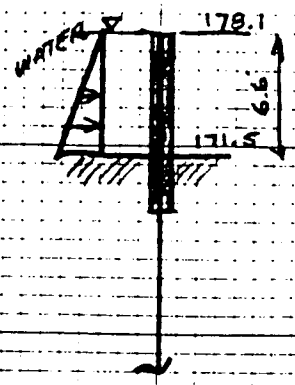
DESIGN ANALYSIS

DATE 12-14-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: SHEAR DESIGN FOR ABUTMENT



$V_L = 62.4 \frac{lb}{FT^3} \times 6.6\,FT \times \frac{6.6\,FT}{2} = 1.36\,K/FT$

$= 1.36 \frac{K}{FT} \times 7' = 9.5\,K$

$V_U = 1.9 \times V_L = 9.5 \times 1.9 = 18.0\,K$

$V_C = 2\sqrt{3000} \times 24' \times 20\,in = 52.6\,K$ (LEET p151 eq 4.8)

$\phi V_C = 0.85 \times 52.6\,K = 44.7\,K$

DOES $V_U < \frac{\phi V_C}{2}$?

$18\,K < \frac{44.7}{2} = 22.3$ YES ✓

NO SHEAR STEEL REQUIRED

USE MIN 2' #3 TIES to hold BARS together

SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

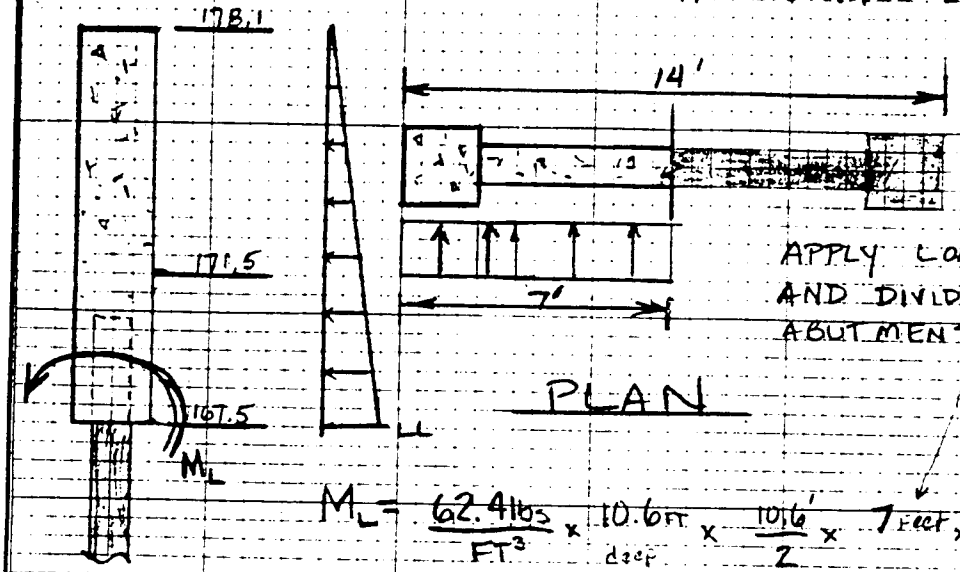
DATE 12-14-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: ABUTMENT DESIGN

ABUTMENT DESIGN: TRANSFER WALL LOADS TO ABUTMENT



APPLY LOADS FROM 14' WALL AND DIVIDE IN HALF FOR ABUTMENTS.

$$M_L = \underbrace{\frac{62.4\,lbs}{FT^3} \times 10.6\,FT_{deep} \times \frac{10.6'}{2} \times 7\,Feet}_{FORCE} \times \underbrace{\frac{10.6\,FT}{3}}_{MOMENT\ ARM} =$$

$$M_L = 24.54\,K \cdot 3.53\,FT = 86.71\,K \cdot FT$$

$$M_U = 1.9\,M_{LL} = 1.9 \times 86.7\,KFT = 164.7\,KFT$$

ρ_{TARGET} is still 0.00728

$b = 24\,IN$

$d = 24 - 3 - 0.5 - \frac{1.00}{2} = 20\,IN$

$A_s = 0.00728 \times 24 \times 20 = 3.49\,IN^2$ ✓

$f'_c = 3000$

$f_y = 48000$

USE 4 - #9 BARS $A_s = 4\,IN^2$

$$T = C$$

$$(4.00\,IN^2)(48000\,PSI) = (0.85)(3000)(24)(c)$$

$$c = 3.137\,IN$$

$$d = 24 - 3 - 0.5 - \frac{1.128}{2} =$$

$$d = 19.936\,IN$$

$$\phi M_N = \frac{0.90\,(4\,IN^2)(48000\,PSI)}{12\,IN/FT \quad 1000\,lbs/K}\left(19.936 - \frac{3.137}{2}\right) = 264.5\,KFT$$

$$\phi M_N > M_U$$

$$264.5 > 164.7\,KFT$$

USE 4#9 BARS FOR FLEXURE

SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 12-13-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: WALL BETWEEN ABUTMENTS

MINIMUM STEEL IN OTHER LOCATIONS / POSITIONS

ACI 318 MIN STEEL: $A_s = 0.0018\ b_w d$

ACI 7.12.2.1

$A_s = 0.0018\ (12\text{in})(8\text{in})$

$A_{s\,MIN} = 0.1728\ \text{in}^2/\text{FT}$

#4 = 0.20

USE #4 BARS @ 12" O.C.

COMPUTATION SHEET
U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

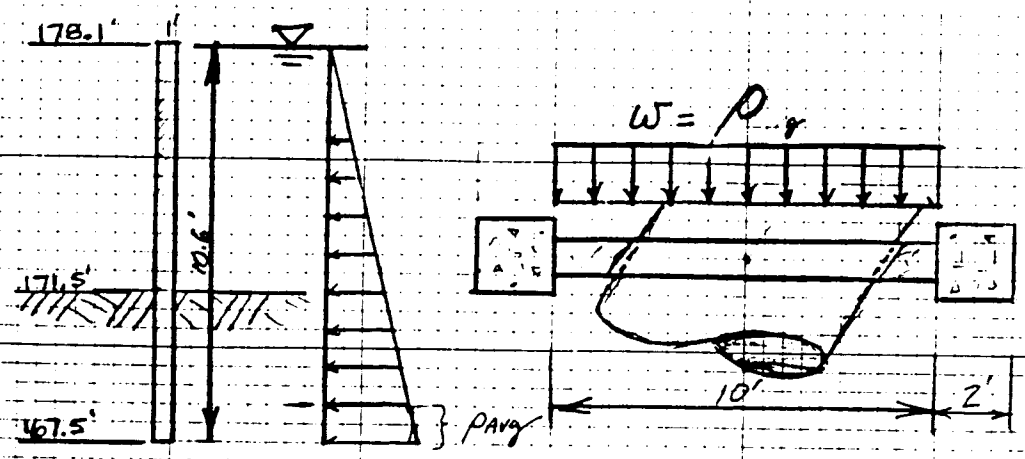
DESIGN ANALYSIS

DATE 12-13-94 SHEET No. ___ OF ___

COMPUTED BY: MLB CHECKED BY: ___

PROJECT: PASSAIC 10 Levee

FEATURE: Wall Between Abutments - DESIGN



ELEVATION PLAN

$p_{AVG} = 62.4\ lb/ft^3 \times \frac{(10.6 + 9.6)}{2} = 630\ lb/ft^2$

$w_u = 1.9 w_L + 1.5 w_D = 1.9(630) = 1200\ lb/ft^2$ (EM eq. 9-7)

$M_u = \frac{w_u L^2}{8} = \frac{(1200\ lb/ft)(10\ ft)^2}{8} = 15000\ lb\text{-}ft = \underline{15.0\ k\text{-}ft}$

$b = 12''$
$d = 8''$
$f'_c = 3000\ psi$
$f_y = 48000\ psi$
EM SAYS USE THIS FOR 60K STEEL.

$\rho_B = \frac{0.85(3000)0.85}{48000} \times \frac{87000}{87000 + 48000} = 0.0291$

$\rho_{TARGET} = 0.25\ \rho_B = 0.25 \times 0.0291 = 0.00728$

$A_s = \rho b d = (.00728)(12)(8) = 0.70\ in^2$ STEEL

$\underline{1 - \#8\ BAR} = 0.79\ in^2 > 0.70\ in^2$ ✓

$T = C$

$(0.79\ in^2)(48000\ psi) = 0.85(3000\ psi)(12\ in)(c\ in)$

$c = 1.24\ in$

cover #4 TIE 1/2 #8

check $d = 12'' - 3'' - 0.5'' - \frac{1.0''}{2}$

$d = 8\ in$

$\phi M_N = \frac{0.90}{12\ in/ft}(0.79\ in^2)(48000\ psi)\left(8\ in - \frac{1.24\ in}{2}\right) = \underline{21.0\ k\text{-}ft}$

CHECK $\phi M_N > M_U$: $21.0\ kft > 15.0\ kft$ ✓ OK

FOR FLEXURAL REINFORCEMENT:
USE #8 BARS @ 12" O.C. HORIZONTALLY ON DRY SIDE

SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

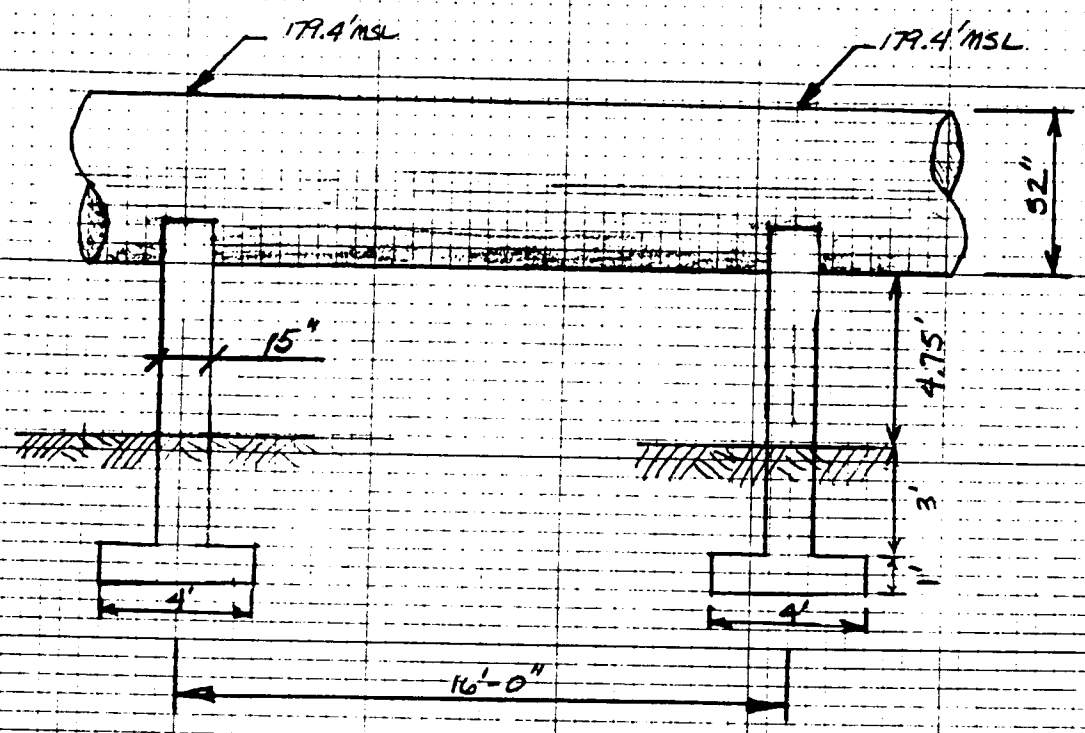
DESIGN ANALYSIS

DATE 12-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: PROFILE - ELEVATED SEWER



TYPICAL PROFILE OF SEWER LINE AT LEVEE CROSSING

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COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

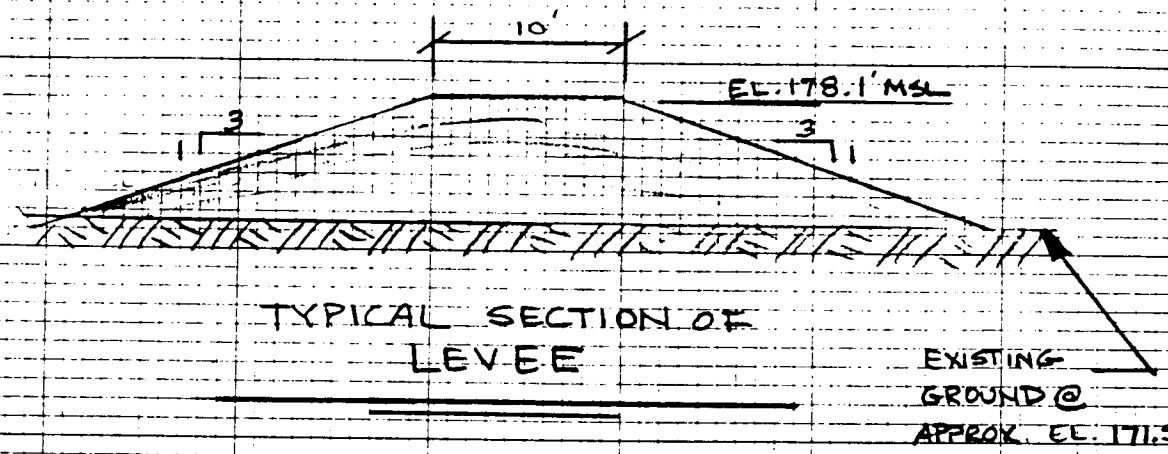
DESIGN ANALYSIS

DATE 12-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: TYPICAL LEVEE SECTION



TYPICAL SECTION OF LEVEE

SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

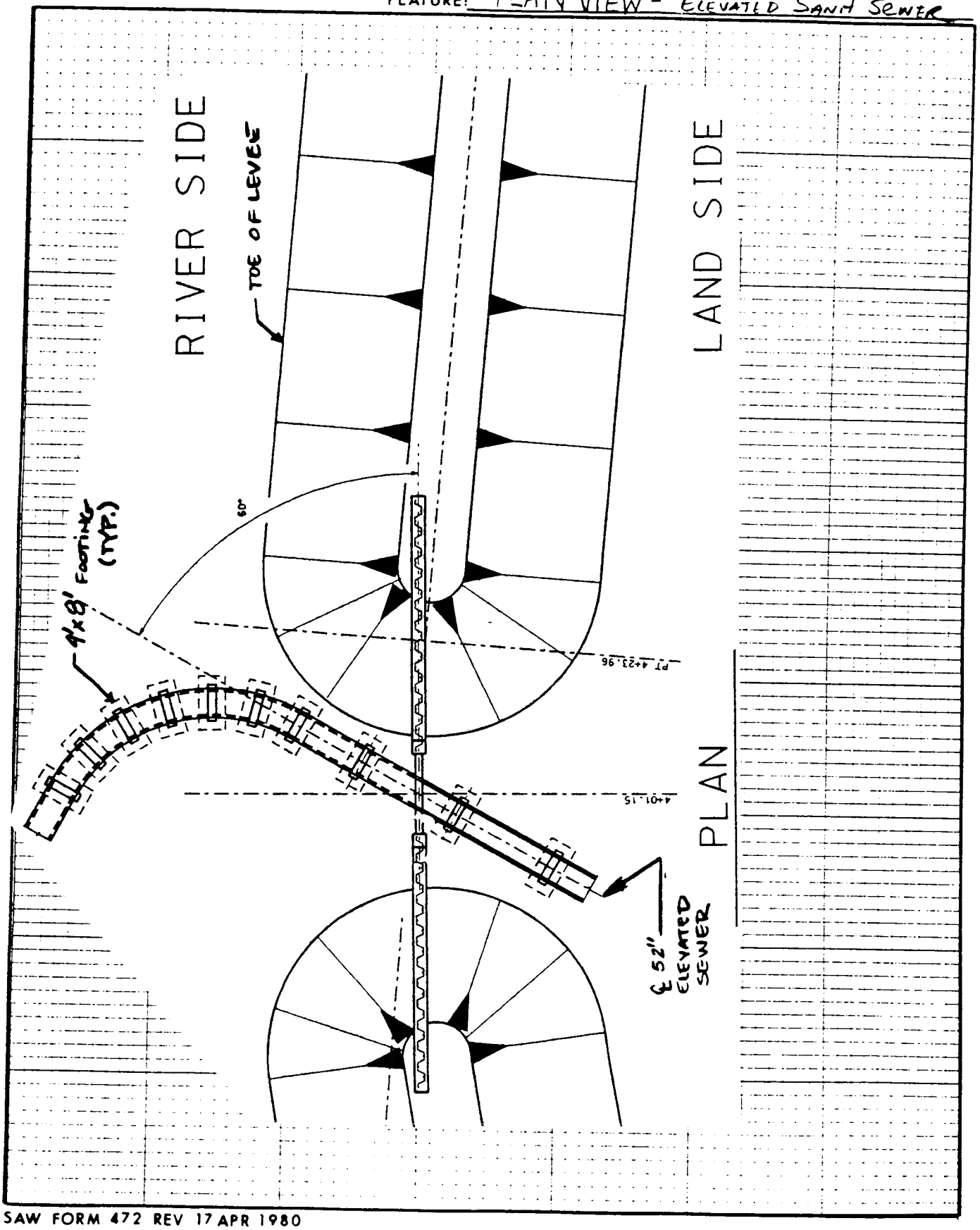
DESIGN ANALYSIS

DATE 12-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: PLAN VIEW - ELEVATED SANIT SEWER



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COMPUTATION SHEET
U.S. ARMY ENGINEER DISTRICT
WILMINGTON, N C

STRUCTURAL DESIGN ANALYSIS

DATE 12-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE

FEATURE: SOIL PARAMETERS

GEOTECH SOIL PROFILE FOR DESIGN

FROM DRILL HOLE P-10-1

TOP OF GROUND

0.0' (ASSUME 171.5' MSL)

SILT (ML) $\phi = 0°$, $C = 1000$ psf, $\gamma_{moist} = 115$ pcf

-3.6' 167.9' MSL

CLAY (CL) $\phi = 0°$, $C = 2000$ psf, $\gamma_{moist} = 120$ pcf

-9.0' 162.5' MSL

SILT (ML) $\phi = 0°$, $C = 2000$ psf, $\gamma_{moist} = 120$ pcf, $\gamma_{SAT} = 126$ pcf

-11.8' 159.7' MSL

-12.8' ▽

SAND (SC) $\phi = 36°$, $C = 0$, $\gamma_{moist} = 120$ pcf, $\gamma_{SAT} = 126$ pcf

-16.5' 155.0' MSL

SAND (SM) $\phi = 37°$, $C = 0$, $\gamma_{SAT} = 126$ pcf

-18.0' 153.5' MSL

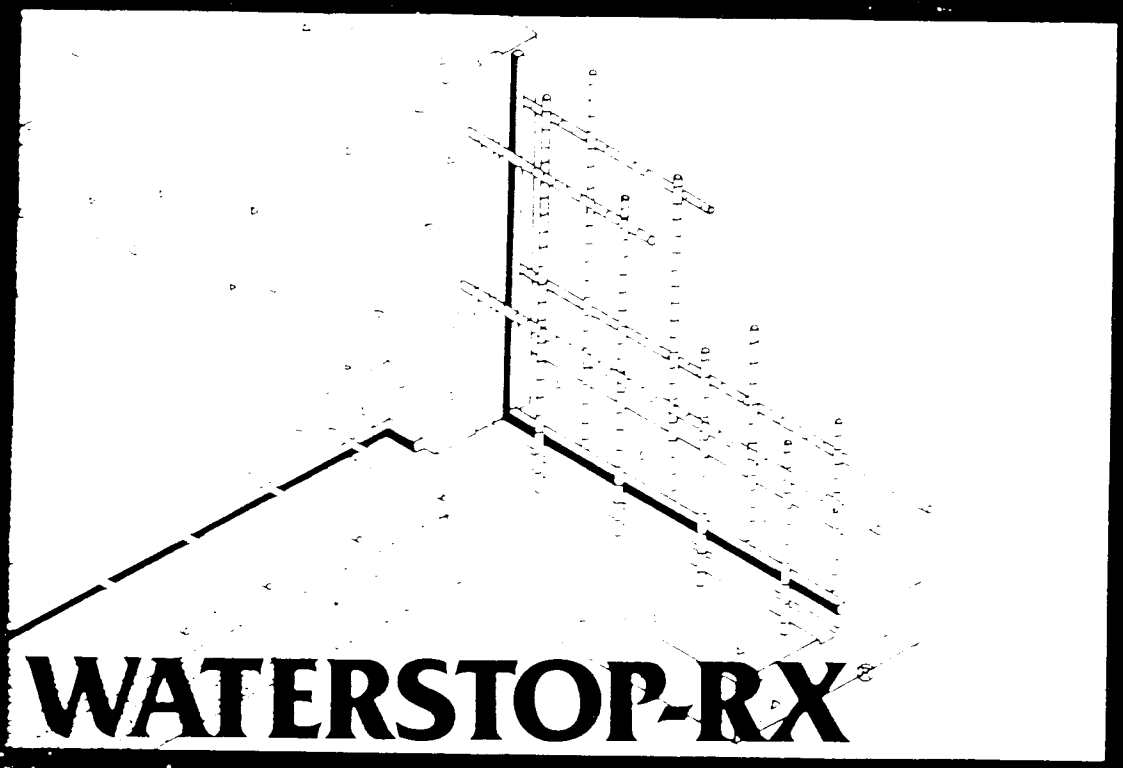
BOTTOM OF HOLE

BEARING CAPACITY = 3.50 KSF

SAW FORM 472 REV 17 APR 1980

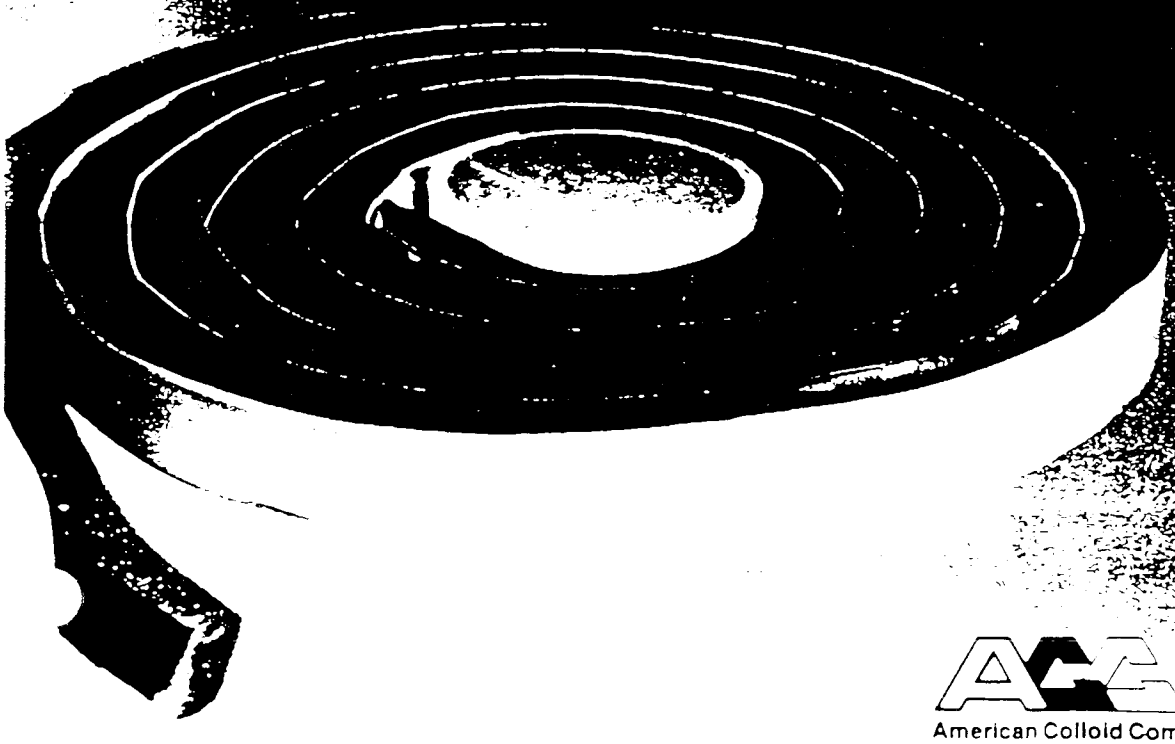
03250/AME
BuyLine 3563

VOLCLAY®



WATERSTOP-RX

fa
fo



American Colloid Company

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 12-19-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

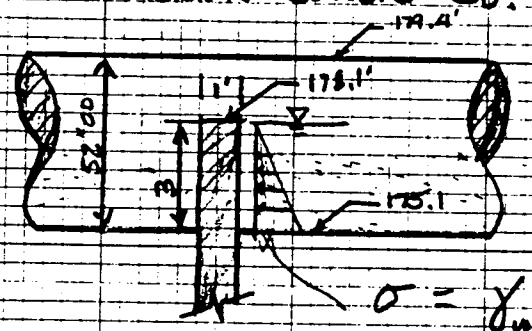
PROJECT: PASSAIC 10 LEVEE

FEATURE: ____

WATER STOP COLLAR AROUND PIPE.

A NEOPRENE WATERSTOP CANNOT BE USED ON THE PIPE. A COLLAR TYPE WATERSTOP will not work since the Pipe is so large. MOST COLLAR TYPES ARE 4 to 6 inches AND AT 90° with the wall. OUR pipe is 52" O.D. AND at A 60° SKEW. A Flexible, malleable adhesive TYPE WATERSTOP WAY Allow movement and adhere to THE PIPE AS WELL.

I LOOKED IN THE 1993 SWEET'S CATALOG AND FOUND A COLLOID TYPE WATERSTOP. SEE SWEET'S CATALOG Volume 2, SECTION 03250/AME, BUYLINE 3563 AMERICAN Colloid Co. (good to 100 psi)



$$\sigma = \gamma_w \times d = \frac{62.4\ lb.}{FT} \times 3'\ deep =$$

$$\sigma = \frac{187.2\ lb.}{FT^2} \times \left(\frac{1\ FT}{12\ in}\right)^2 = 1.3\ psi$$

$1.3\ psi << 100\ psi$ O.K.

SAW FORM 472 REV 17 APR 1980

Waterstop-RX helps save time, money... and concrete structures.

Installing conventional waterstops in concrete joints is an important (but normally time-consuming) part of concrete construction. It can also be very labor-intensive, reducing the profitability of the job. Most important, conventional waterstops offer only a partial solution to water infiltration, leaving architects, engineers, and contractors open to liability problems.

Volclay® Waterstop-RX® solves water infiltration problems. It's easy to apply even by a single, inexperienced laborer, cutting installation time in half. It eliminates split-forming and splicing. And, its self-healing properties assure that concrete joints remain protected permanently.

How Waterstop-RX works

The key to Waterstop-RX is its western sodium bentonite base. Specified for more than 20 years for foundation waterproofing, bentonite swells in contact with water, forming an impenetrable gel. This property also allows bentonite products to fill in small cracks in concrete.

Waterstop-RX comes in a coil. It is applied by adhering the material to the **butt end of the concrete** with RX Adhesive or concrete cut nails—an operation that requires a single laborer. Then pour or place the next section of concrete to complete the joint. No split forming, splicing, or bonding is required as with conventional waterstops.

Upon hydration, Waterstop-RX swells to form a self-healing compression seal that completely locks out water. This action also prevents water migration along the waterstop and in keyways as an extra protection against penetration.

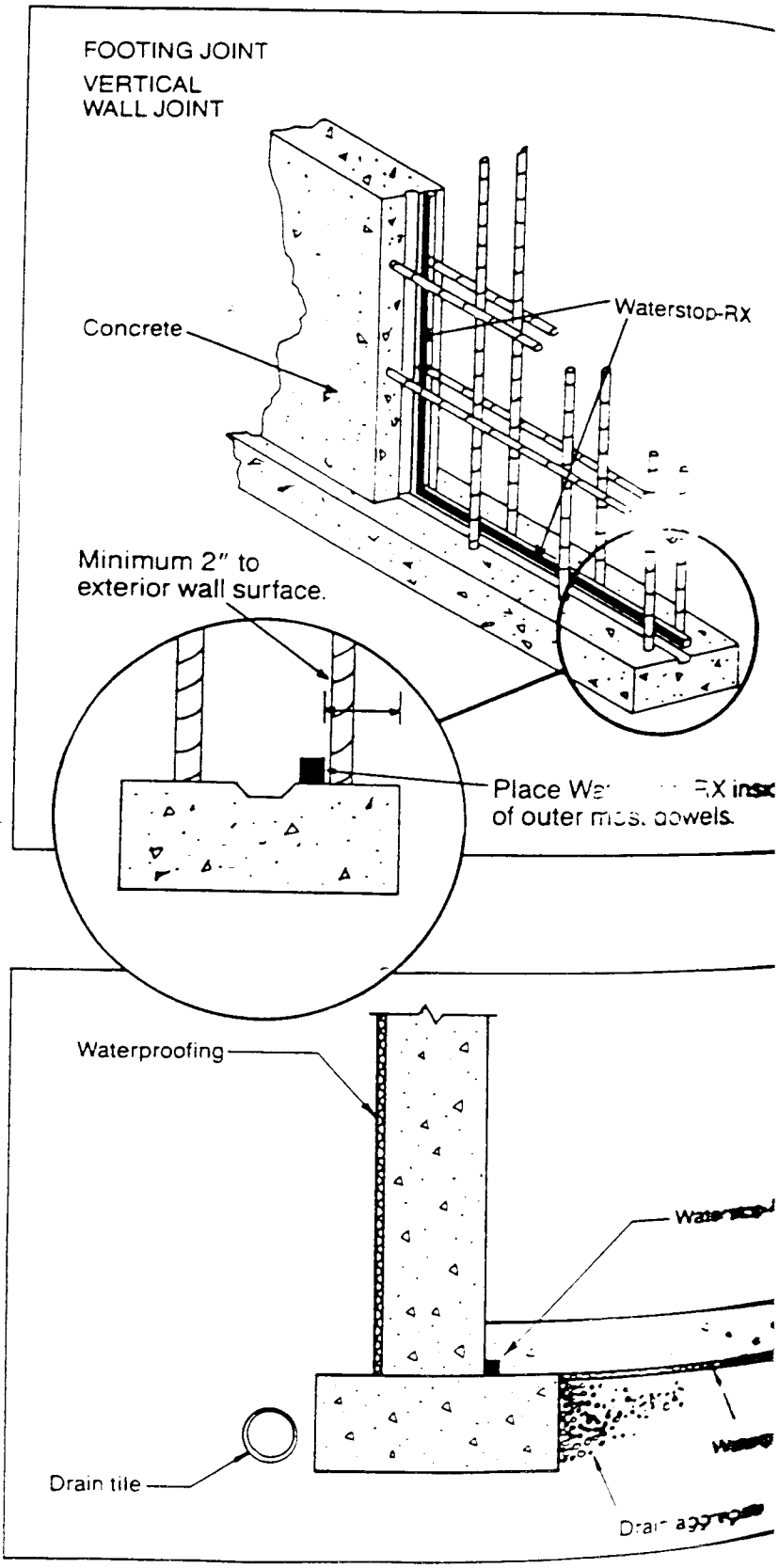
All-temperature application

Waterstop-RX has been engineered for use under virtually all temperature conditions. Unlike other popular joint sealants, Waterstop-RX does not become stiff and brittle in cold weather nor spongy and difficult to work with in hot weather. As a result, Waterstop-RX does not have to be heated in cold weather, saving time and money. It also remains totally flexible without shrinking, hardening, or oxidizing.

Safe to use

Because Waterstop-RX is non-toxic, no special handling equipment is required. It is clean to the touch, and does not contain any material which can discolor or irritate the skin, helping eliminate lost man-hours.

Note: Waterstop-RX is not an expansion joint material and should not be used as such. Expansion joints are the responsibility of OTHERS.



Placement of Waterstop-RX where slab rests on top of foo

lation procedures

ce preparation

ces should be clean and dry. For Waterstop-RX Adhesive should be to the joint surface prior to adhering p-RX especially on vertical joints. sive creates a tacky surface which excellent adhesion to the concrete.

oning

p-RX is adhered to the butt end ous concrete pour and should ned a minimum of 2" from the joint surface. Concrete cut nails, p-RX Adhesive, or both must be cure Waterstop-RX in place to placement of the material during

p-RX may also be installed in a ce recess at the exterior side of In this situation, precautions must to protect Waterstop-RX from pro to backfilling and backfill compacted to 85% modified proctor adjacent to the joint. The the exterior of the joint should dimension of Waterstop-RX.

of individual Waterstop-RX uld be butted together—never d

cations

p-RX is ideal for use on many poured in place and below grade concrete applications. There should mum of 2" of concrete cover sep- e exterior face of the Waterstop- the exterior side of the joint.

cases of lightweight concrete cient coverage, consult the urer.

concrete wall panel systems

nks and sewage treatment plants

and storm sewer manholes

nd, oval, flatbase, elliptical, and s)

s in foundation slabs or walls de

lts Utility vaults

Box culverts

er treatment plants

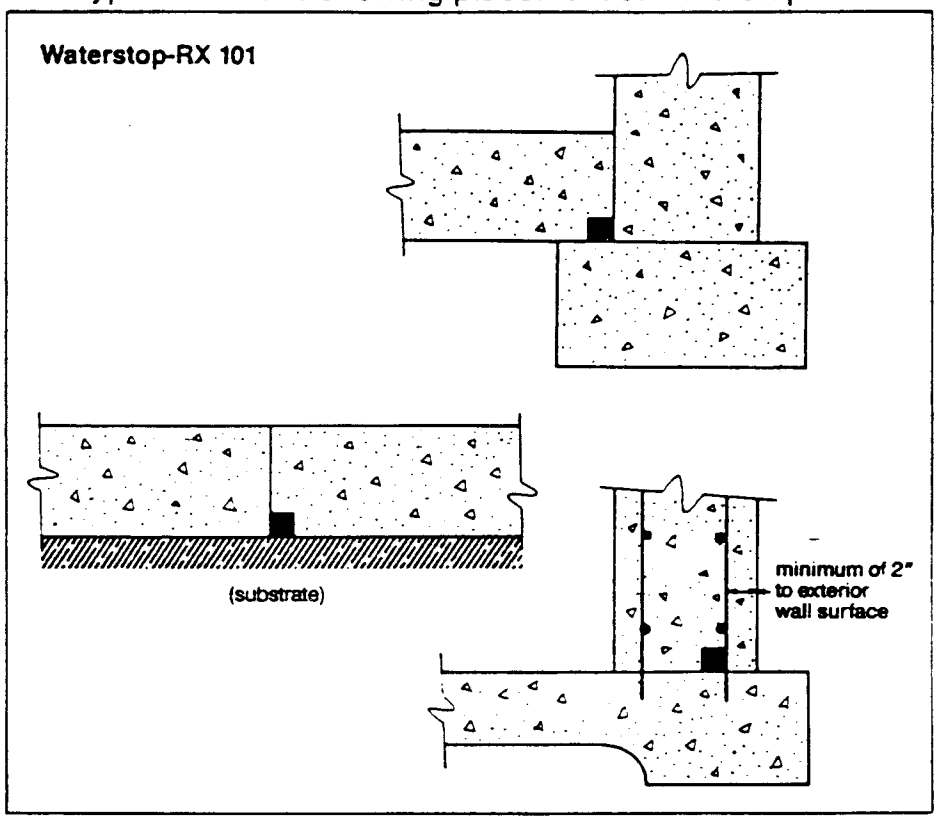
water tanks

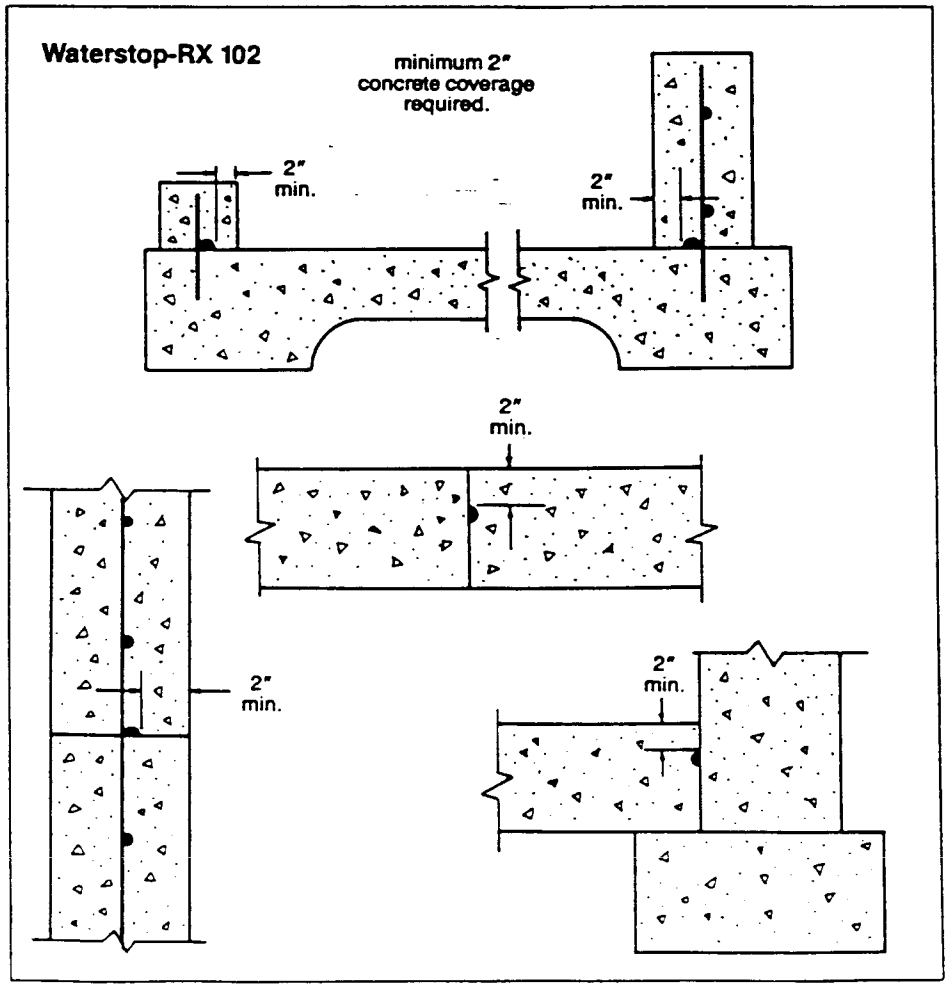
rstop is available in two sizes as wn the technical information on page. The smaller size (RX 102) is used in smaller joints.

which size RX Waterstop is used, re a minimum concrete coverage the exterior wall surface.

erstop-RX is not an expansion nal and should not be used as pansion joints are the responsibility RS.

Typical sections showing placement of Waterstop-RX





Waterstop-RX Technical Information

Volclay Waterstop-RX® is a flexible strip of bentonite waterproofing compound, coiled in two sizes. Dimensions and other specifications are as follows:

	RX 101	RX 102
Dimensions	1" x ¾" x 16'6"	¾" x ⅜" x 25'0"
Weight	.50 lbs./ft. minimum	.165 lbs./ft. minimum
Carton Contents	100 L/F	150 L/F
Carton Weight	50 lbs.	25 lbs.
Carton Size	10" x 14" x 10"	8" x 14" x 10"
Pallet Size	4' x 4'	4' x 4'

Chemical Composition

Material	Test Method	Waterstop-RX Results
Butyl Rubber-Hydrocarbon (% by weight)	ASTM D-297	24.9%
Bentonite	SS-S-210-A	75.0%
Volatile matter	ASTM D-6	Below 1%

NOTE: Contains no asbestos fibers or asphaltics

Physical Properties

Property	Test Method	Waterstop-RX Results
Specific gravity at 77°F	ASTM D-71	1.57
Softening point	ASTM D-30	N/A
Penetration	ASTM D-217 150 GTL 300 GTL	 58 85
Flash point	ASTM D93-97	365
Min. head pressure	Hydrostatic pressure test	231 ft. (100 psi)
Accelerated aging	(Mechanical oven 4 hrs. @ 212° F)	Maintained 99% solids
Flow resistance	(¾" overhead joint exposed to 135° F for 7 days)	No flow
Storage life		Indefinite
Adhesion to clean, dry concrete		Excellent
Application temperature range		5° to 125°F
Service temperature range		−40° to 212°F

Notice: The information presented here is believed to be correct. However, since it is provided without charge and without specific knowledge of the intended use or application of its product, American Colloid Company assumes no obligation or liability with respect to such use or application, and makes no warranty, either expressed or implied, as to the application or use of such product, or to the use or infringement of any patent or other proprietary rights of American Colloid Company or others with respect to such application or use.

Seal concrete joints quickly and permanently with the waterstop that heals itself—Waterstop-RX. For more information, contact your American Colloid Company distributor, or contact us direct.

Limitations

In conditions w[illegible] contaminatio[illegible] the manufacturer [illegible] mation. Waterstop-RX should [illegible] within a concrete joint with a [illegible] concrete cover to the exterior of the [illegible] surface. Waterstop-RX may also be [illegible] in a cast-in-place recess at the [illegible] side of the joint. In this situation [illegible] tions must be taken to protect Waterstop-RX from hydration prior to backfill [illegible] backfill must be compacted [illegible] modified procto[illegible] the joint. The [illegible] match the dime[illegible] being used.

An exposed length of coil should not be submerged for extended periods [illegible] If Waterstop-RX exhibits considerable swelling prior to confinement [illegible] it must be replaced with new [illegible] avoid displacement of Waterstop-RX [illegible] or prior to concrete placement [illegible] and/or Waterstop-RX Adhesive [illegible] used to hold the material [illegible] care should be [illegible] ment to avoid [illegible] strip. Waterstop-RX is an expansion joint product and should not be used as such.

NOTE: In cases of lightweight concrete or insufficient coverage, consult the manufacturer.

Warranty

American Colloid Company warrants its [illegible] rials to be of good quality and will replace material proven to be defective. In no event will American Colloid Company be liable [illegible] labor costs or [illegible] damage [illegible] with the use of this product, unless [illegible] in a warranty for a specific project.

Document

This brochure contains information to supplement information service available from American Colloid Company's Building Materials Division and from local distributors.

Application Assistance

Local distributors of Waterstop-RX are qualified to a[illegible] of this product. In the event that you are special or you have an unusual situation, your local Waterstop-RX distributor will arrange to have a factory representative contact you for personal assistance.

Protected under patent no[illegible]

Distributed by:

WARRANTY

The information and data contained herein are believed to be accurate and reliable. Specifications and other information contained herein supersede all previously printed material and are subject to change without notice.

Manufacturer warranty of installed system is available. Contact seller for terms and sample document including all limitations.

All goods sold by seller are warranted to be free from defects in material and workmanship.

The foregoing warranty is in lieu of and exclude all other warranties not expressly set forth herein, whether express or implied by operation of law or otherwise including but not limited to any implied warranties of merchantability or fitness.

Seller shall not be liable for incidental or consequential losses, damages or expenses, directly or indirectly arising from the sale, handling or use of the goods, or from any other cause relating thereto, and seller's liability hereunder in any case is expressly limited to the replacement (in the form originally shipped) of goods not complying with this agreement or at seller's election, to the repayment of, or crediting buyer with, an amount equal to the purchase price of such goods, whether such claims are for breach of warranty or negligence.

Any claim by buyer with reference to the goods sold hereunder for any cause shall be deemed waived by buyer unless submitted to seller in writing within thirty (30) days from the date buyer discovered or should have discovered any claim; provided that

Materials should be inspected and tested by purchaser prior to their use. Product quality is subject to verification upon shipment. Performance guarantees are normally supplied by the applicator.

NOTE: Expansion joints shall be the responsibility of OTHERS.

American Colloid Company
Building Materials Division
1500 W. South Drive
Arlington Heights, Illinois
[illegible]

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

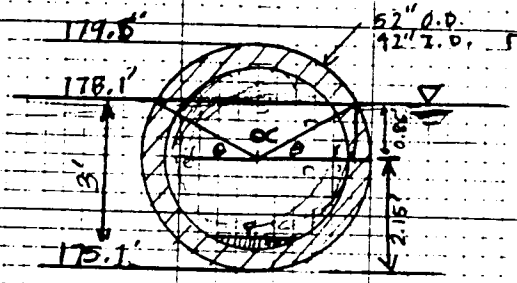
DATE 12-19-94 SHEET No. ____ OF ____

COMPUTED BY: MLB CHECKED BY: ____

PROJECT: PASSAIC 10 Levee

FEATURE: ____

Check AND SEE IF THE Pipe will 50 Bouyant During A Flood.



$$\theta = \sin^{-1} \frac{0.85'}{2.1667} = 23.10°$$

1. CONCRETE WEIGHT : $A_{OD} - A_{ID} =$

$$\frac{\pi (52''/12'')^2}{4} - \frac{\pi (42''/12'')^2}{4} = 5.1269 \text{ ft}^2$$

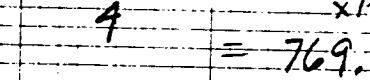
$\times 1'$ long

$= 769.0$ lbs.

2. DISPLACED VOL WEIGHT

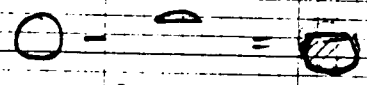
$$\alpha = 180° - 2(23.10°) = 133.8°$$

a. Area to Remove from Circle

Wedge − Triangle = 

$$\frac{\pi (52/12)^2}{4} \times \frac{133.8°}{360°} - \frac{(52/12)^2}{8} \sin 133.8° =$$

$$5.481 - 1.694 = 3.787 \text{ ft}^2$$

b. Displace wt 

$$\frac{\pi (52/12)^2}{4} - 3.787 =$$

$$14.748 - 3.787 = 10.961 \text{ ft}^2 \times 1 \text{ ft} \times 62.4 \text{ lb/ft}^3$$

684.0 lbs

3. Conc. wt − Disp. wt = FLOAT OR SINK.

$769.0 - 684 = +85$ lbs sink ✓ OK.

SAW FORM 472 REV 17 APR 1980

PASSAIC 10
LEVEE
CONCRETE CAP
WEIGHT
CALCULATIONS

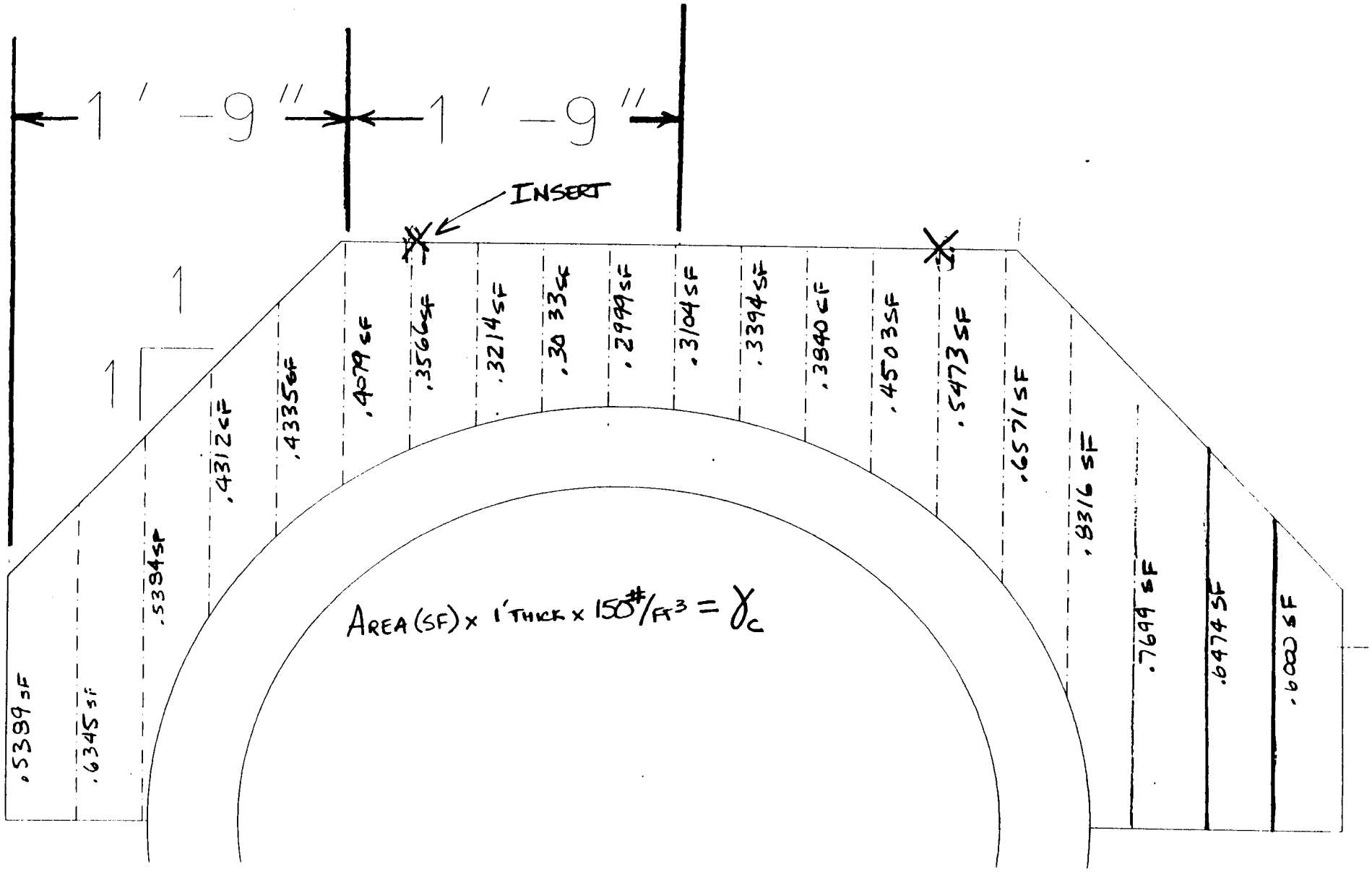
Total Length =		7	ft			
Segment Lengths =		0.35	ft			
Segment	Area	Weight	Opp Wt	Avg Wt	Shear	Moment
Num	(ft2)	(lbs)	(lbs)	(lbs)	(lbs)	(ft-lbs)
1	0.5389	80.835	90	85.4175	85.4175	14.9
2	0.6345	95.175	97.11	96.1425	181.560	63.5
3	0.5384	80.76	115.485	98.1225	279.68	146.8
4	0.4312	64.68	124.74	94.71	373.78	241.6
5	0.4335	65.025	98.565	81.795	455.59	348
6	0.4079	61.185	82.095	71.64	527.23	553.6
7	0.3566	53.49	67.545	60.5175	-147.49	
8	0.3214	48.21	57.6	52.905	-94.585	
9	0.3033	45.495	50.91	48.2025	46.3825	
10	0.2999	44.985	46.56	45.7725		
11	0.3104	46.56	44.985	45.7725		
12	0.3394	50.91	45.495	48.2025		
13	0.384	57.6	48.21	52.905		
14	0.4503	67.545	53.49	60.5175		
15	0.5473	82.095	61.185	71.64		
16	0.6571	98.565	65.025	81.795		
17	0.8316	124.74	64.68	94.71		
18	0.7699	115.485	80.76	98.1225		
19	0.6474	97.11	95.175	96.1425		
20	0.6	90	80.835	85.4175		
				1470.45 lbs		

R_{xx} = 735.225 lbs

× 2.0 overload

1500 lbs

AREA/WEIGHT CALCULATIONS FOR DESIGN OF THREADED INSERTS.



COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

DESIGN ANALYSIS

DATE 12-20-94 SHEET No. ___ OF ___

COMPUTED BY: MLB CHECKED BY: ___

PROJECT: PASSAIC 10 LEVEE

FEATURE: ___

Check $M = 1110$ lb-ft

$$\sigma_B = \frac{\left(1110\ \text{lb-ft} \times \frac{12\ \text{in}}{\text{ft}}\right)\left(\frac{13\ \text{in}}{2}\right) \times 12}{(12\ \text{in})(13\ \text{in})^3} = 78.8\ \text{psi} \ll 0.9 \times 410\ \text{psi}$$

σ_B

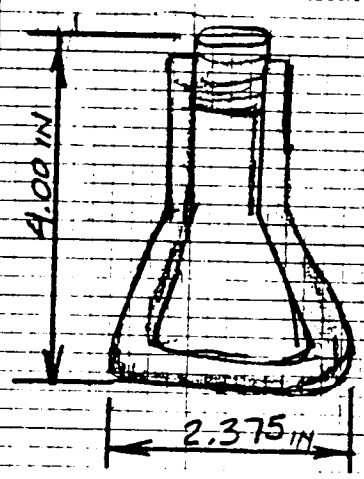
OK

TENS / RXN = 1500 lbs

Reference:

RICHMOND PRODUCTS FOR CONCRETE CONSTRUCTION USE DATED 1990. PAGE 9.

3/8" DIA TYPE LE ANCHOR

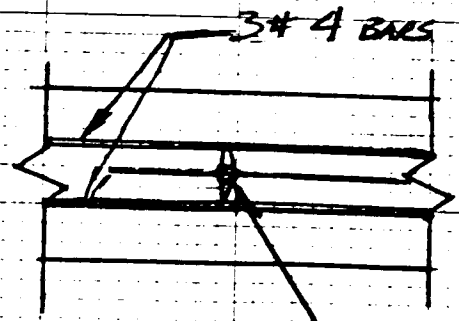


ALLOWABLE SHEAR	APPLIED SHEAR
1280 LBS	1060 LBS
ALLOWABLE TENSION	2.0 x REACTION
1920 LBS	1500 LBS

MIN STEEL = $0.0018 A_c$ = $0.0018 \times 12 \times 18 = 0.3888\ \text{in}^2/\text{ft}$

$2\#4^2 = 0.40\ \text{in}^2$

USE 3 #4 BARS



POSITION ANCHOR ON CENTER BAR

SAW FORM 472 REV 17 APR 1980

COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT

WILMINGTON, N C

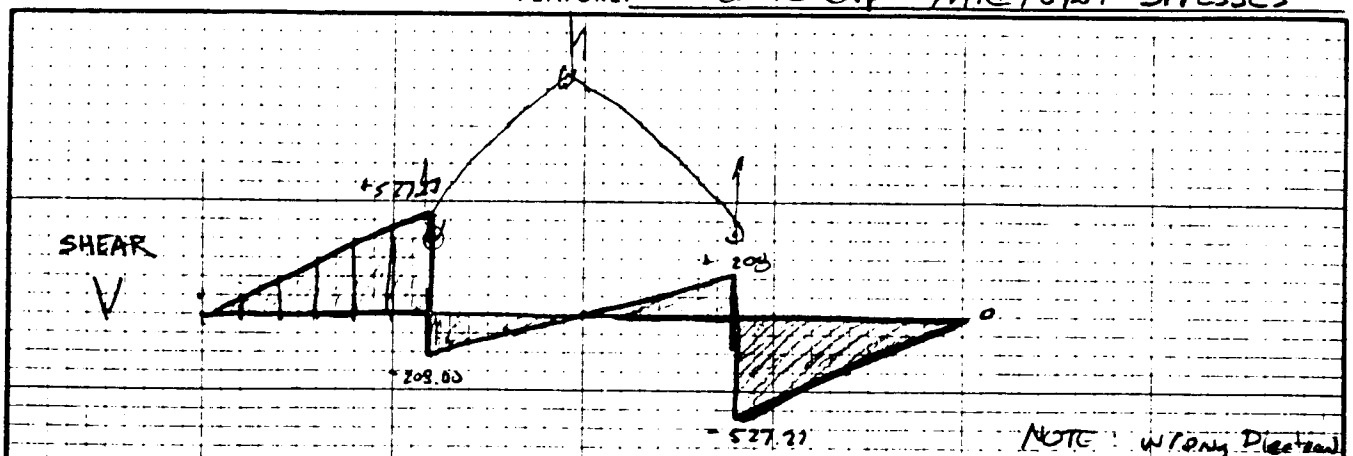
DESIGN ANALYSIS

DATE 12-20-94 SHEET No. ____ OF ____

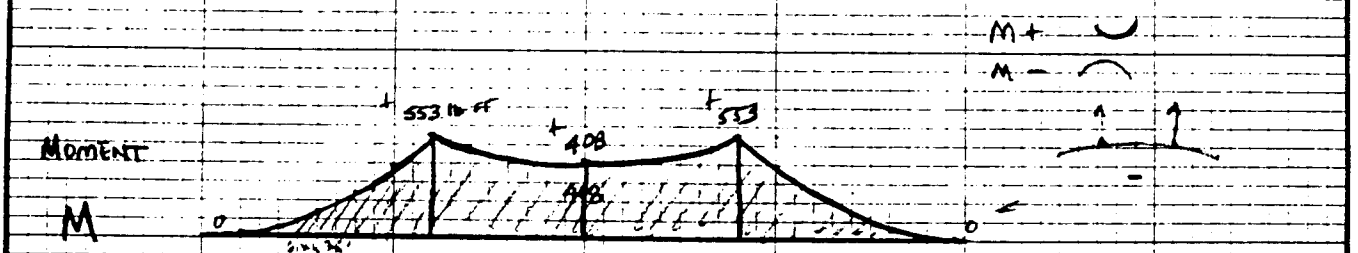
COMPUTED BY: MLB CHECKED BY: ____

PROJECT: Passaic No Levee

FEATURE: Concrete Cap - Mid Point stresses



NOTE: wrong Direction for shear + moment



	UNFACT	2.0x FACT
Shear @ support	527 lbs	1060 lb
Moment @ support	553 lb-ft	1110 lb
Moment @ center	408 lb-ft	820 lb-ft

15" - 2" = 13"
12 - 2" cover

SECTION @ center = 12 x 8 $A = b_w d = 96 in^2$

SECTION @ support = 12 x 13 in $A = b_w d = 156 in^2$

eq 4.6 ACI

$V_c = 2\sqrt{f'_c} = 109.5 psi$

$V_{@support} = \frac{V}{b_w d} = \frac{1060 lb}{156 in^2} = 6.79 psi$ O.K.

$\sigma_{Bunit} = 7.5\sqrt{f'_c} = 410 psi$

$M = 820 lb\,ft$

$\sigma_B = \frac{My}{I} = \frac{820 (lb\,ft)(4 in)\, 12 in/ft}{12 (8)^3} = 77 psi < 410$ ✓

SAW FORM 472 REV 17 APR 1980

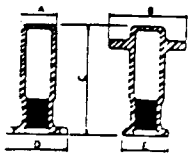
CONCRETE INSERTS (Cont.)

KOHLER THREADED INSERT

Richmond "Kohler" Threaded Insert

The original grey cast iron threaded insert for supporting pipes, conduits, etc. in tension.

Not applicable to precast concrete members for lifting; or for heavy structural use; or when dynamic loads exist.



NUMBER	BOLT DIAM.	PHYSICAL DIMENSIONS					WORKING LOAD
		A	B	C	D	E	
UST 614	¼"	⅝	2 1/16	2⅛	1⅛	⅝	762 lbs.
UST 638	⅜"	⅝	2 1/16	2⅛	1⅛	⅝	1,118 lbs.
UST 612	½"	⅝	2⅝	2⅛	1⅛	1 3/16	2,080 lbs.
UST 658	⅝"	1 7/32	3 1/16	3⅛	1 27/32	1 5/16	2,100 lbs.
UST 634	¾"	1 5/16	3⅛	3	2	1⅜	3,100 lbs.
UST 678	⅞"	1 5/16	3⅛	3⅛	2 11/16	1 11/16	3,300 lbs.
UST 688	1"	1 5/16	3⅛	3⅛	2 11/16	1 11/16	3,500 lbs.

Safe working loads shown reflect an approx. 4:1 safety factor (ult.:appl. working load) for concrete compressive strength of 3,200 psi.

PLAIN FERRULE INSERT

IPF

The Richmond Plain Ferrule Insert is an economical steel insert designed to take machine thread studs or bolts. Manufactured in 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1" and 1¼" diameters.

BOLT DIA.	MIN CONC THICKNESS	WORKING LOAD*	
		SHEAR	TENSION
¼"	3"	300 lbs.	150 lbs.
⅜"	3"	800 lbs.	700 lbs.
½"	3"	1,000 lbs.	650 lbs.
⅝"	3"	1,250 lbs.	700 lbs.
¾"	4"	1,600 lbs.	850 lbs.
⅞"	6"	2,000 lbs.	1,150 lbs.
1"	6"	2,300 lbs.	1,250 lbs.
1¼"	6"	3,000 lbs.	1,700 lbs.

Approx. 3:1 safety factor.

*Safe working load in 3000 psi concrete.

THIN SLAB FERRULE INSERT

ITSF

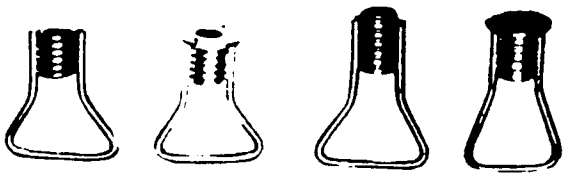
The Richmond Thin Slab Ferrule Insert is a special insert designed to develop better working loads in very thin slabs. Manufactured in 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1" and 1¼" diameters.

LOOP LENGTH	MIN. CONC. THICKNESS	WORKING LOAD*	
		SHEAR	TENSION
3¼"	3"	500 lbs.	700 lbs.
4"	3"	1,350 lbs.	800 lbs.
4"	3"	2,150 lbs.	1,200 lbs.
6"	3"	3,600 lbs.	1,250 lbs.
6"	3"	3,800 lbs.	1,350 lbs.

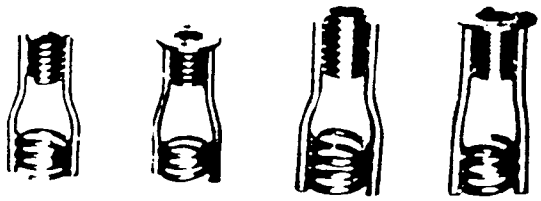
Note: When concrete is thicker than 3" min. shown above (i.e., 4½" min. for ½" dia. inserts and 5" min. for ⅝" dia. and ¾" dia. inserts), then use Type L or LF Structural Concrete Inserts for greater safe working loads.

Approx. 5:1 safety factor.

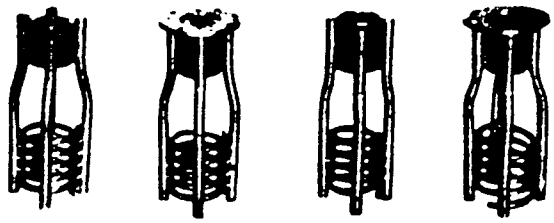
STRUCTURAL CONNECTION INSERTS



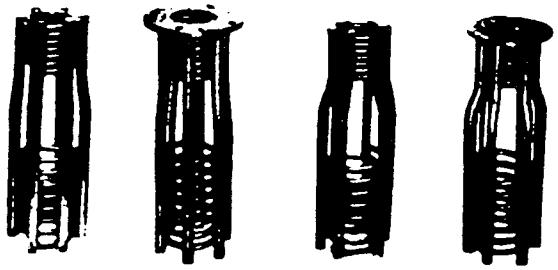
Type L — Type LW — Type LF — Type LF-W



Type EC-2 — Type EC-2W* — Type EC-2F — Type EC-2FW



Type EC-4 — Type EC-4W* — Type EC-4F — Type EC-4FW



Type EC-6 — Type EC-6W* — Type EC-6F — Type EC-6FW

*U.S. Patent 2,880,608

Richmond Structural Connection Inserts are prefabricated from a special design which distributes the bolt loads into the concrete for greater strength than any previously known device. Available in standard or stainless steel.

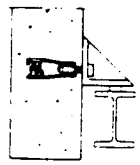
Type L Inserts 1/2" and 3/4" dia. designed to take contour threaded bolts, can be furnished to take machine bolts. LF units 3/8", 1/2", 5/8" and 3/4" dia. are furnished with closed machine thread ferrules. Open ferrules available on special order. LW or LF-W units similar to above with the addition of a flat washer for attaching to the formwork.

Type EC Inserts in 3/4" and 1" dia. designed to take contour threaded bolts, can also, be furnished to take machine bolts. EC-2F units in 3/4", 7/8" and 1" dia. are furnished with closed machine threaded ferrules. Open ferrules available on special order. EC-2W or EC-2FW units similar to above with the addition of a flat washer.

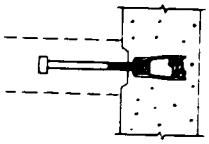
Type EC-4, EC-4F, EC-4W and EC-4FW Inserts in 1¼" dia. are four strut inserts similar to EC-2 Inserts described above.

Type EC-6, EC-6W, EC-6F and EC-6FW Inserts in 1½" dia. are six strut inserts similar to the EC-2 Inserts described above.

APPLICATIONS



Precast anchoring to steel



Bond Dowels

Sealed for future use

SIZE AND STRENGTH DATA

BOLT DIAMETER AND SYMBOL	MIN. CONC. THICKNESS	INSERT LENGTH L	INSERT WIDTH O	WASHER THICKNESS T	WORKING LOAD	
					SHEAR	TENSION
⅜" Dia. Type LF	6"	4"	2⅜"	3/32"	1,280 lbs.*	1,920 lbs.
½" Dia. Type L	6"	4"	2⅜"	3/32"	2,200 lbs.	2,820 lbs.
⅝" Dia. Type LF	6"	4"	3⅜"	3/32"	3,000 lbs.*	3,620 lbs.
¾" Dia. Type L	6"	4"	3⅜"	3/32"	3,100 lbs.*	3,660 lbs.
¾" Dia. - 2 Strut Type EC-2	6"	4½"	2"	⅛"	5,100 lbs.	5,800 lbs.
⅞" Dia. - 2 Strut Type EC-2F	6"	5½"	2⅝"	3/16"	6,000 lbs.*	8,000 lbs.
1" Dia. - 2 Strut Type EC-2	6"	5½"	2⅝"	3/16"	8,000 lbs.*	8,270 lbs.
1¼" Dia. - 4 Strut Type EC-4	8"	7½"	3⅛"	7/32"	13,200 lbs.	16,300 lbs.
1½" Dia. - 6 Strut Type EC-6	12"	9½"	3¼"	7/32"	18,000 lbs.*	21,670 lbs.

*Estimated

Shear and Tensile values shown are for comparatively large blocks. For specific conditions or certified test data consult our Technical Department. All the above Inserts are available in Stainless Steel.

Safe working loads shown are for approx. 3:1 safety factor (ult.:working load).

PLASTIC INCLUDED
SAMPLE ANCHORS 3.6/Ri

RICHMOND

PRODUCTS FOR CONCRETE CONSTRUCTION

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COMPUTATION SHEET

U.S. ARMY ENGINEER DISTRICT
WILMINGTON, NC

DESIGN ANALYSIS

DATE 1-17-95 SHEET No. ____ OF ____

COMPUTED BY: M.E CHECKED BY: ____

PROJECT: PASSAIC 10 LEVEE - FLOODWALL

FEATURE: MATERIALS ESTIMATE

CONCRETE:

A. I-WALL: 3.5' x 2.0' = 7.00 FT² Length = 83.28'
1.5' x 0.5' = 0.75 FT²
7.1' x 1.0' = 7.10 FT²
14.85 FT² x 83.28' = 1236 FT³

B. ABUTMENTS: (170.6 - 167.5) x 2' x 2' =
11.1' x 4 FT² = 44.4 FT³

C. PIPE WALL: (ESTIMATE VOL) 11.1' x 1' x 10' long = 111 FT³

TOTAL CONCRETE = 1392.108 FT³ = 52 CY

REINFORCING STEEL:

ASSUME 1% CONC VOLUME
1392.108 FT³ x 0.01 x 490#/FT³ = 6.82K

SHEET PILE:
20.25' x 6' = 121.5 SF OF PZ 35 (A328)
12.25' x 83.28' = 1020.2 SF OF PZ 27 (A328)

WATERSTOPS:

A: COLLOID TYPE
$\frac{2\pi(12)}{2} \times 8$ passes = 1306.90 in
4 x (1'-6") = 72.00 in
115 LINEAR FEET

B: 6" BULB TYPE
4 x 11.1' = 45 LINEAR FEET

Threaded Pickup Anchors:

2 -

SAW FORM 472 REV 17 APR 1980

ATTACHMENT F

HYDROLOGY AND HYDRAULIC ANALYSIS

ATTACHMENT F

HYDROLOGY AND HYDRAULIC ANALYSIS

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INTERIOR DRAINAGE ANALYSIS

GENERAL. The Wilmington District was tasked with performing a feature design memorandum level interior drainage analysis of the Passaic #10 levee for the Passaic River Project. With exterior stage input from UNET analysis by Savannah District and economic input from Passaic River Division, the Wilmington District evaluated minimum facilities at the site as well as addressed the need for additional facilities. All analysis was performed for future with project conditions and a 42-foot main tunnel (with spur tunnel) in place.

SITE DESCRIPTION. The Passaic #10 levee site is located in the township of Livingston, NJ. The interior area is bound by the proposed levee on the north, west and south, with Eisenhower Parkway forming the eastern boundary. Total length of the levee is 4,830 feet. The interior area is divided into two subareas (designated as northern and southern) for runoff computations and then combined as one total inflow runoff into a common ponding area. The northern area and southern area have drainage areas of 0.051 square miles (32.7 acres) and 0.065 square miles (41.5 acres), respectively. The total interior drainage area is 0.116 square miles (74.2 acres). The receiving stream for the line of protection outlets is the Passaic River with a drainage area of 133.0 square miles at the receiving point. Line of protection outlets for the northern and southern area are located about 500 feet and 1400 feet from the Passaic River, respectively. Well defined natural drainage conveys flows from the outlet to the Passaic River. Development within the study area is commercial and light industry except for the Livingston, NJ sewage disposal plant. The primary interior roads are Dorsa Avenue and Naylon Avenue which branch off Eisenhower Parkway toward the Passaic River to the west. Plate F-1 presents a plan view of the Passaic #10 study site, showing drainage divides and pertinent features.

SEWAGE DISPOSAL PLANT. The sewage plant has a total capacity of 4.2 MGD but is currently (August 1993) only operating at 2.6 MGD. Plant operation would not be impacted by the proposed levee project. Conversely, the plant operation would not impact on the levee interior drainage analysis since the plant discharge point is outside the line of protection and, according to the plant superintendent, positive gravity flow would be maintained for exterior river stages up to the 500-year flood level.

LEVEE FEATURES. For the established levee alignment, the top of levee elevation was established at 178.1 feet, m.s.l., which is the maximum allowed at the south end tie-in at Eisenhower Parkway since anything higher would tie-in on top of the parkway. The

water surface profile for the 200-year flood is effectively flat from the south to the north end of the levee; therefore, levee superiority has been applied to the levee to control the location of overtopping. Overtopping at the sewage plant (near the south tie-in) would be a desirable location from a safety viewpoint since plant staff on duty could provide good warning time. Although the selected overtopping location is at the upstream end of the levee, this location is acceptable because of the sluggish nature of overbank flow (<1.0 fps), the slow rate of rise for the days near the peak (<0.5 foot per day), the buffer (storage area) between the levee and the developed areas, and the fact that there would not be an immediate threat to life by overtopping at this location. The levee height will be slightly raised from elevation 178.1 at the south tie-in to elevation 178.6 at the north tie-in point with the inclusion of 0.5 feet of levee superiority.

METHODOLOGY. The interior analysis was performed in accordance with EM 1110-2-1413 dated 15 January 1987, entitled "Hydrologic Analysis of Interior Areas". In order to preserve the integrity of the existing interior storm runoff system, minimum facilities were sized to provide the same level of protection as currently exists. Minimum facilities were then made an integral part of the line of protection for analysis of additional facilities. Minimum facilities were first sized for low exterior Passaic River stages and then operated with exterior flood conditions to establish a base economic condition for evaluating the need for additional facilities at the line of protection. The economic effectiveness of each additional facility alternative was based on its ability to reduce residual damages remaining after minimum facilities.

ANALYSIS CONDITIONS. Hypothetical floods for seven(7) flood frequency events (2-, 5-, 10-, 25-, 50-, 100-, and 500-year) were developed for both exterior and interior flood conditions. UNET modeling by Savannah District produced hypothetical floods for exterior conditions. Plots of the hypothetical flood hydrographs at Passaic River station 261880 are shown on plate F-2. Hypothetical floods were then developed by the Wilmington District for the 8interior area at Passaic #10. The resulting hypothetical flood frequency events, both exterior and interior, were assumed totally coincident in evaluating peak interior ponding elevations. Storm rainfall was taken from the August 1992 report for the Passaic River project entitled "Existing and Future Unimproved Conditions Hydrology and Hydraulics". Hypothetical storm rainfall data utilized up to a 96-hour duration is shown in table F-1. A 24-hour storm duration for the interior area was used for sizing minimum facilities with free

outflow conditions. A 96-hour storm duration was then applied to the total basin (including the interior area) above the point where the minimum facility outlet empties into the receiving stream to determine the performance of the minimum facilities with exterior river flood conditions. Adjustments were made to the rainfalls based on the total drainage area (133 square miles) of the Passaic River at the receiving point of the interior outlets. Natural ponding (without clearing or excavation) was utilized during the analysis.

Table F-1
Hypothetical Storm Rainfall
(inches)

	Rainfall Frequency						
Duration	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
5 min	0.43	0.50	0.56	0.64	0.71	0.77	0.83
15 min	0.80	1.00	1.14	1.34	1.49	1.65	1.81
1 hr	1.15	1.75	2.10	2.40	2.70	3.00	3.65
2 hr	1.45	2.20	2.60	3.00	3.35	3.75	4.55
3 hr	1.65	2.50	2.95	3.40	3.75	4.25	5.15
6 hr	2.00	3.05	3.60	4.15	4.55	5.20	6.30
12 hr	2.40	3.60	4.30	5.00	5.45	6.25	7.60
24 hr	2.90	4.30	5.10	5.95	6.60	7.45	9.00
48 hr	3.50	5.10	6.00	7.10	7.80	9.00	10.70
96 hr	4.20	6.10	7.20	8.50	9.40	10.70	12.70

EXISTING STORM DRAINAGE. During a field reconnaissance of the study site in August 1993, the interior area was canvassed for existing storm drainage. Existing street drainage is limited to the lower ends of Dorsa and Naylon Avenues where storm drains transport flows to ditches outside the developed area, which then carry flows away from development toward the river. These existing ditches would be intercepted by the proposed line of protection; therefore, a gravity outlet would be provided at each of the 2 crossings to maintain the integrity of the existing system. The remainder of the interior area is surface drainage except for surface inlets in parking areas that drain directly to the perimeter of the developed area and into the designated ponding area. Surface drainage will also drain directly into the designated ponding except for the areas at the lower end of Dorsa and Naylon Avenues where these areas will be hydraulically connected to the ponding sites as well as provided with 2 gravity outlets (as mentioned earlier) to keep the existing storm drainage system functioning properly. From field observations and storm drainage maps provided by Essex County Engineering, it

is apparent that no storm water, either by surface flow or storm water piping, crosses Eisenhower Parkway into the interior area. All storm water runoff east of Eisenhower Parkway is intercepted by a storm water drainage system along Eisenhower Parkway and carried around the interior area and into the Passaic River by way of two unnamed tributaries, one just to the north and one just to the south of the interior area.

INTERIOR RUNOFF PARAMETERS. For the Passaic #10 interior area, Soil Conservation Service methods were used to define both the infiltration losses and the inflow unit hydrograph. Basin slope, SCS curve number, SCS lag time, and basin imperviousness are the key variables in the analysis. For the north interior subbasin, a basin slope of 3.0 percent, a SCS curve number of 89, a lag time of 0.13 hours, and a percent imperviousness of 64 percent was used. For the south interior subbasin, a basin slope of 1.4 percent, a SCS curve number of 89, a lag time of 0.33 hours, and a percent imperviousness of 64 percent was used. The percent imperviousness used in this analysis was taken from HEC-IFH, Interior Flood Hydrology Package-Users Manual, table 4.3 on page 63, entitled "Values of SCS Curve Number for Urban and Suburban Areas". In our analysis, values are higher than in the August 1992 report entitled "Passaic River Flood Protection Project, Existing and Future Unimproved Conditions Hydrology and Hydraulics". These higher values are appropriate because the detail and refinement for the smaller interior areas of Passaic #10 is greater than for the generally larger and less developed areas of the August 1992 report.

INTERIOR FLOOD HYDROGRAPHS. Interior inflow hydrographs from surface runoff were developed from hypothetical storm rainfall and computed SCS inflow hydrographs. Base flow was added to interior storm runoff to form the total inflow hydrograph. An initial base flow of 1 cfs/sq.mi. (or 1 cfs) was added at the beginning of storm runoff. When flows on the recession side of the inflow hydrograph fell to 1 cfs, a groundwater discharge of 1 cfs was assumed to continue for a 24-hour period. This is a very important assumption in light of the fact that the outlet through the line of protection could be blocked for periods up to 2 weeks during flood recession. For certain conditions, a blocked outlet with continuous groundwater discharge for a lengthy period after surface runoff ceases could produce a secondary peak considerably higher than that produced by the inflow flood hydrograph.

INTERIOR INFLOW PEAK FREQUENCY. Table F-2 summarizes flood peak inflows to Passaic #10 for both a 24-hour and 96-hour storm duration.

Table F-2
Peak Interior Inflows

Flood Frequency	24-Hour Peak Inflow	96-Hour Peak Inflow
	(c.f.s.)	(c.f.s.)
500-yr	460	276
100-yr	404	243
50-yr	363	219
25-yr	324	195
10-yr	276	168
5-yr	237	144
2-yr	175	107

INTERIOR PONDAGE. Existing natural pondage between the levee alignment and the developed area was used for floodwater retention. No excavation or clearing of the ponding area was allowed. Table F-3 summarizes surface area and storage volumes for the interior ponding area. A plot of surface area and storage volume is presented on plate F-3.

Table F-3
Existing Natural Pondage

Pond Elevation	Surface Area	Storage Volume
(feet,msl)	(acres)	(acre-feet)
165	0.0	0.0
166	2.8	1.4
168	5.8	10.0
170	10.0	25.8
171	12.2	36.9
172	19.3	52.7
174	34.2	106.2
176	47.8	188.1
178	54.1	290.0

LEVEE EMBANKMENT SEEPAGE. Seepage estimates for the Central Basin Levees are based on calculations performed for the Hurricane Levees and Floodwalls. Table F-4 summarizes seepage estimates used at Passaic #10 to compute seepage into the interior area through the 5,120-foot long earthen levee embankment.

Table F-4
Levee Embankment Seepage

Differential Head	Seepage per Lin. Ft.	Total Seepage
(feet)	(c.f.s. per foot)	(c.f.s.)
0	0.0×10^{-4}	0.00
2	0.6×10^{-4}	0.31
4	1.1×10^{-4}	0.56
6	1.7×10^{-4}	0.87
8	2.2×10^{-4}	1.13
10	2.8×10^{-4}	1.43
12	3.3×10^{-4}	1.69

MINIMUM FACILITIES. The objective of minimum facilities is to provide the same level of interior flood protection as provided by the existing storm water system. Assuming street flooding for the lower end of Dorsa and Naylon Avenues begins at the 15-year level, the target is to keep the 15-year ponding elevation off the streets which flood at about elevation 171. The elevation of beginning damage for the interior area is 170.5.

Minimum Facilities Requirements. For minimum facility design, the Wilmington District and Passaic River Division jointly established minimum gravity outlet sizes of 36-inch for primary outlets and 24-inch for secondary outlets for maintenance purposes. To adequately drain the ponding storage on the north and south sides of the interior area, a 36" primary outlet would be required for each area. To maintain the existing storm drainage capacity at the lower ends of Dorsa and Naylon Avenues, a 24" secondary outlet would be required for each of the two existing drainage ditches crossing the line of protection. For minimum facility design, a total of 2-36" and 2-24" gravity outlets are required for maintenance, far exceeding the existing 15-year flooding target. Refer to plate F-1 for location of minimum facility outlets.

Minimum Facilities Frequency Analysis. The interior elevation frequency curve for minimum facilities with a 24-hour storm over the interior area and low exterior river stages is shown on plate F-4. It can be seen from the frequency curve that not only the 15-year pond elevation but all ponding elevations up to the 500-year frequency are well below the desired target of 171. With the minimum facilities requirements now confirmed, these minimum facilities are treated as an integral part of the line of protection. The basis for additional facility analysis is then established by computing the interior elevation frequency

curve for minimum facilities with a 96-hour storm over the total area for the receiving stream and coincident exterior river stages from UNET analysis. This curve is presented on plate F-4 along with the minimum facility curve with a 24-hour storm and low exterior stages. Flood delineation for the 100-year interior peak of 171.1 with minimum facilities is shown on plate F-1.

ADDITIONAL FACILITIES. Minimum facility elevation frequency data was developed initially as the basis for determining residual damages, which in return are the basis for evaluating the need for additional facility alternatives beyond minimum facilities.

Additional Facility Alternatives. Alternatives addressed include: a) adding gravity outlet capacity, b) increasing ponding storage, and c) providing pumping capacity.

Additional Facility Objectives. The primary objectives of each alternative are to: a) reduce the 100-year interior peak elevation below the beginning damage elevation 170.5 and b) evacuate the ponded waters as quickly as possible to reduce prolonged standing water and to recover ponding storage quickly in the unlikely event that a secondary interior flood event would occur with blocked outlet conditions.

Additional Facility Analysis. Analysis was performed for each additional facility alternative defined and the relative merits of each was evaluated.

Adding Gravity Outlet Capacity. Adding gravity outlet capacity has minimal impact on reducing interior peak elevations as shown by the curves on plate F-5 comparing peak elevation with minimum facilities and with unlimited gravity outlet capacity. This should be eliminated as a feasible alternative.

Increasing Ponding Storage. Increasing ponding storage appears to be an effective, but limited, alternative. An increase in ponding storage of about 30 percent would lower the 100-year peak below 170.5 but would not help evacuate ponded flood waters quickly. Also, the levee alignment would have to be moved outward, creating a need for more log borings since borings of the current levee centerline have been completed. Lastly, increased storage would entail increased mitigation requirements since additional lands would be subject to interior flooding. This is a viable alternative for eliminating damages below the

100-year level; however, the inability to evacuate stored floodwaters and the need to move the levee centerline to increase storage are obvious drawbacks and should preclude it from further consideration.

Providing Pumping Capacity. Providing pumping is a very effective way of reducing interior peak stages with the current levee alignment and natural ponding storage. Several pump flow rates (1 cfs, 2 cfs, 3 cfs, and 6 cfs) were evaluated assuming a constant pumping rate over the full range of expected pumping heads. The pumps were started at elevation 168 of the rising interior pond and stopped at elevation 166 of the receding pond. The start elevation of 168 corresponds to the initial blocked outlet condition for the 10-year interior flood. The stop elevation of 166 corresponds to a drawdown to minimal ponding. A pumping rate of 1 cfs would lower the 100-year interior peak to 170.3 with a maximum pumping head of about 5.5 feet. As pump rates increase the maximum pumping head increases due to the timing of the interior drawdown and the rise of the exterior river stages. For the 2, 3, and 6 cfs pumps, the maximum pumping head would be 6.5, 10.0, and 10.0 feet, respectively. Total pump operating time during the 100-year flood for 1, 2, 3, and 6 cfs pumps would be >14, 10.5, 6.5, and 3.0 days, respectively. The larger pumps achieve lower interior peaks, but their main advantage is a much quicker evacuation of the ponded flood waters. Plate F-6 shows a comparison of elevation frequency curves for the minimum facility plan versus plans for a range of pump sizes from 1 to 6 cfs. Plates F-7 through F-11 show interior-exterior stage hydrographs for the minimum facility plan and plans with various pump sizes for the 100-year flood. Plates F-12 through F-15 show the differential (pumping) head for each pump size analyzed. Table F-5 compares surface area flooded, peak interior ponding elevations, and drawdown for various pump sizes versus minimum facilities. Drawdown is defined as the time in days from the cessation of storm runoff (end of day 4) to elevation 166.

Table F-5
Minimum Facility vs Pumping Alternatives

Flood Frequency	Interior Feature	Minimum Facilities	1 CFS Pump	2 CFS Pump	3 CFS Pump	6 CFS Pump
500-yr	Pond Peak	171.8	171.1	170.8	170.5	169.9
	Pond Area	17.9	13.1	11.8	11.1	9.8
	Drawdown	>14.0	>14.0	13.0	6.5	2.0
100-yr	Pond Peak	171.1	170.3	170.0	169.7	169.6
	Pond Area	13.0	10.7	10.0	9.3	9.1
	Drawdown	>14.0	>14.0	8.5	4.5	1.0
50-yr	Pond Peak	170.8	170.0	169.6	169.4	169.4
	Pond Area	11.6	9.9	9.1	8.8	8.7
	Drawdown	>14.0	>14.0	7.0	3.5	0.5
25-yr	Pond Peak	170.3	169.5	169.3	169.3	169.2
	Pond Area	10.6	8.9	8.5	8.5	8.4
	Drawdown	>14.0	>14.0	5.5	2.5	0.5
10-yr	Pond Peak	169.7	169.1	169.1	169.1	169.0
	Pond Area	9.5	8.1	8.0	8.0	7.9
	Drawdown	>14.0	11.0	4.0	1.5	0.0
5-yr	Pond Peak	169.3	168.8	168.8	168.8	168.8
	Pond Area	8.6	7.6	7.5	7.5	7.5
	Drawdown	>14.0	9.0	3.0	1.0	0.0
2-yr	Pond Peak	168.7	168.3	168.3	168.2	168.2
	Pond Area	7.2	6.3	6.3	6.3	6.3
	Drawdown	13.5	5.5	1.5	0.5	0.0

Note:
"Pond Peak" refers to peak interior ponding elevation (ft,msl).
"Pond Area" refers to pond surface area (acres) at pond peak.
"Drawdown" refers to drawdown time (days), storm end to EL 166.

SECONDARY FLOOD PERFORMANCE. To assist in the selection of the best alternative, analysis of the possibility of a secondary flood was performed. This, in addition to the drawdown analysis performed for pumping evaluations, provides a good sound basis for plan selection. With the ponding pool drawn down by pumping to elevation 166 after the initial storm, a secondary 24-hour storm was assumed to occur over the interior area with a 6 cfs pumping capacity and gravity outlets still blocked by high exterior river stages. In a comparison with the minimum facilities plan with gravity outlets only, a 10-year peak pool elevation 169.7 was assumed prior to the secondary flood and routings were repeated for the same blocked gravity outlet conditions. The results of this comparative analysis shown in table F-6 illustrate much greater positive control over interior flooding with pumps.

Table F-6
Secondary Flood Peaks
(w/blocked outlet)

Flood Frequency	Gravity Outlets W/Pond at 169.7 (ft,msl)	Grav Outlets & Pumps W/Pond at 166.0 (ft,msl)
500-yr	173.1	171.8
100-yr	172.7	171.2
50-yr	172.5	170.8
25-yr	172.3	170.5
10-yr	172.0	170.0
5-yr	171.8	169.5
2-yr	171.2	168.6

RECOMMENDED FACILITIES. The recommended plan for Passaic #10 is to provide minimum facilities consisting of 2-36" and 2-24" gravity outlets for unblocked conditions and provide pumping facilities consisting of 2-3cfs pumps for environmental mitigation measures. The pumps will also provide some additional interior flood protection as noted in tables F-5 and F-6, providing positive control for evacuating stored floodwaters and also providing the flexibility to deal with secondary floods and other unforeseen conditions. Interior ponding areas will be maintained in a natural state. Environmental mitigation management with pumps will be closely coordinated with flood control measures to insure proper use of the interior storage areas. Mitigation measures are discussed elsewhere in the report.

OPERATION OF RECOMMENDED FACILITIES. A range of normal operation is illustrated on plates F-16 through F-19 for the 2-, 10-, 50-, and 100-year floods for both minimum facilities only and minimum facilities plus the 2-3cfs pumps. For a given flood, interior routings with the two aforementioned outlet works schemes would represent the normal upper and lower boundaries to be expected. The true operation should lie somewhere in between these boundaries in order to satisfy mitigation requirements.

EXTERIOR LEVEE SLOPE PROTECTION

GENERAL. An analysis was made to determine the need for protection of the exterior slope of the Passaic #10 levee. Velocity data required for the analysis was taken from UNET analysis of the Passaic River by Savannah District.

LEVEE DATA. Along the centerline, the levee is about 4830 feet in length and generally about 6 to 10 feet in height. The levee is located along the Passaic River, setback about 500-600 feet along the north face of the levee, 1100-1200 feet along the west face of the levee, and 1400 feet plus along the south face of the levee. Only the north and west faces are parallel to the river and would expect flows along the sloped surface. The south face would primarily expect water ponding along the slope with very low velocity flows washing up the sloped bank.

FLOODING DATA. Velocity and stage data for the 2-year, 10-year, and 100-year has been extracted from the UNET analysis. Plates F-20 through F-22 show the average, channel, and overbank velocities for the 2-, 10-, and 100-year floods at Passaic River station 261880, located near the midpoint of the west face of the levee. As can be seen, channel velocities range from 1.3 fps for the 2-year flood to 2.0 fps for the 100-year flood. For overbank velocities, a value of only about 0.2 fps is common to all floods. Maximum flood depths of 2, 4, and 6 feet would be expected for the 2-, 10-, and 100-year floods, respectively, with lesser depths occurring coincident with the maximum overbank velocities.

LEVEE SLOPE STABILITY. As a minimum the levee slopes will be stabilized by grassing. Allowable velocities for grass have been taken from table 2-5, "Suggested Maximum Permissible Mean Channel Velocities" contained in EM 1110-2-1601, Hydraulic Design of Flood Control Channel. As seen in the table, grass can withstand a minimum of 5 fps without scour taking place. Kentucky Blue Grass and Bermuda Grass on sandy silt and silt clay soils can withstand velocities of 5 to 8 fps with stream energy slopes less than 5 percent as occurs along the Passaic River.

CONCLUSION. The remoteness of the levee to the river combined with the low velocities predicted by UNET analysis indicate that a grass lined levee slope would be more than adequate to provide slope stability. No additional analysis is needed at this time.

RISK & UNCERTAINTY ANALYSIS

GENERAL. A risk based analysis was performed for the Passaic #10 levee so that the decision making process can incorporate considerations of risk and uncertainty. EC 1105-2-105, "Risk-Based Analysis for Evaluation of Hydrology/Hydraulics and Economics in Flood Damage Reduction Studies", was used as guidance for the analysis performed herein. The @Risk model by Palisade Corporation was used as the computer tool for performing the risk and uncertainty analysis. Since the top of levee has already been established at elevation 178.1 feet above mean sea level(ft.,msl), a project sizing analysis was not required. For the project performance and reliability analysis performed, only hydrology and hydraulic input is needed.

HYDROLOGY AND HYDRAULICS INPUT. The key parameters included in this study are a peak discharge frequency relationship and a stage discharge rating relationship at the levee site. There is uncertainty in each of these parameters that has been described by a probability distribution. For the computed peak discharge frequency curve, the confidence limits as computed by WRC Bulletin #17B defines the distribution. For the stage discharge rating curve, the distribution is described by the variance about the computed 100-year water surface due to adjustments to key modeling parameters. All analysis was performed for future with project conditions and a 42-foot main tunnel (with spur tunnel) in place.

PEAK-DISCHARGE FREQUENCY UNCERTAINTY. Peak-discharge frequency data was taken from the results of UNET modeling of the Passaic River Basin performed by the Savannah District. A best fit curve for the UNET output frequency discharges was described using a log-pearson III distribution. The resulting computed mean (3.145), standard deviation (0.225), and skew (0.0) are input to the @Risk program which automatically develops a distribution using bulletin #17B procedures.

STAGE-DISCHARGE RATING UNCERTAINTY. The stage-discharge relationship for the Passaic River at the levee site is totally dependent on the input parameters to the UNET modeling effort. A sensitivity analysis of the key parameters were defined to establish the reasonable upper and lower water surface profile limits for the 100-year flood, which is the defining flood for input to the @Risk model. These limits were taken as enveloping 98 percent of the variance for the 100-year flood, or a variance of 4 standard deviations. With the UNET model used for defining water surface profiles, the key parameters used to define variance were changes in flow and conveyance, as well as

potential for debris blockage. A conveyance increase of 20%, plus a flow increase of 20%, combined with debris blocked resulted in a 100-year stage increase of 2.2 feet. Assuming that the lower profile limit is 2.2 feet below the mean, the total band would be 4.4 feet. The 4.4 feet band equates to 4 standard deviations, or 1 standard deviation of 1.1 feet, which is input to the @Risk model to describe the distribution function for stage uncertainty for the 100-year flood.

@RISK MODELING. With the discharge and stage uncertainty defined as input to the @Risk model, project reliability analysis is performed by the model to illustrate how the levee will function with various magnitude floods. A total of 5000 iterations was selected for the analysis because the model parameters for discharge frequency became stable with this number. Table F-7 shows how the levee will perform given the occurrence of the 10%, 2%, 1%, 0.5%, or the 0.2% chance floods.

Table F-7
Project Reliability

	Percent Chance of Non-Exceedance				
Elevation	10-YR	50-YR	100-YR	200-YR	500-YR
(ft,msl)	(10%)	(2%)	(1%)	(0.5%)	(0.2%)
172.0	10.3	0.3	0.2	0.1	0.0
173.0	50.0	3.1	1.0	0.4	0.2
174.0	87.2	18.9	8.0	2.8	0.6
175.0	98.1	50.1	27.3	12.8	3.3
176.0	99.6	78.4	54.0	31.4	12.0
177.0	99.8	92.5	77.6	54.9	28.1
178.0	99.9	97.7	90.8	76.5	48.8
178.1	99.9	98.0	91.8	78.1	51.1
179.0	100.0	99.3	96.5	89.4	70.5
180.0	100.0	99.8	98.7	95.7	84.8

Project Performance. As shown in table F-7, a levee elevation of 178.1 feet, m.s.l. (which equates to about a 0.2% chance flood level with the 42-foot tunnel in place) has a 99.9% chance of containing a 10% chance flood, a 98.0% chance of containing a 2% chance flood, a 91.8% chance of containing a 1% chance flood, a 78.1% chance of containing a 0.5% chance flood, and a 51.1% chance of containing a 0.2% chance flood. An increase in levee elevation to 180 feet, m.s.l. would not significantly improve reliability except for the 0.2% chance flood. Limitations imposed by Eisenhower Parkway (which restricts the levee height to a maximum of 178.1 unless the parkway is modified) and the insignificant improvement in reliability created by raising the

levee, makes elevation 178.1 the practical upper levee limit. Lowering the levee should be considered very cautiously since the percent chance of containing the large floods would drop dramatically. Any decision on the final levee elevation should be a joint effort of the local groups, agencies and government, as well as the Federal government.

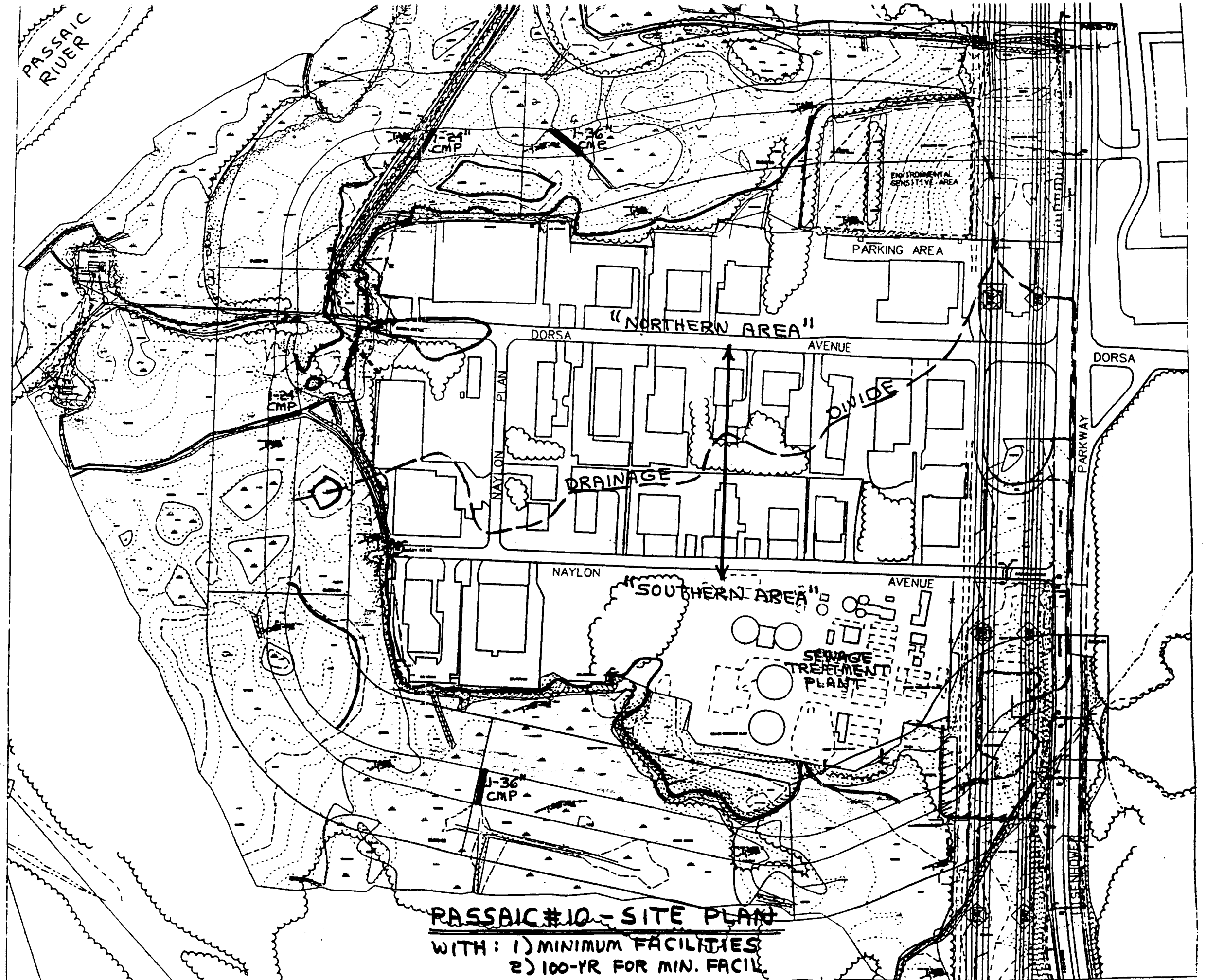

PASSAIC RIVER
I-24" CMP
I-36" CMP
ENVIRONMENTAL SENSITIVE AREA
PARKING AREA
"NORTHERN AREA"
DORSA
AVENUE
DORSA
PARKWAY
NAYLON
PLAN
DIVIDE
DRAINAGE
NAYLON
AVENUE
"SOUTHERN AREA"
SEWAGE TREATMENT PLANT
I-24" CMP
J-36" CMP
PASSAIC #10 - SITE PLAN
WITH: 1) MINIMUM FACILITIES
2) 100-YR FOR MIN. FACIL.

PLATE F-1

EXTERIOR STAGE

PASSIC10

PASSAIC RIVER
P261880

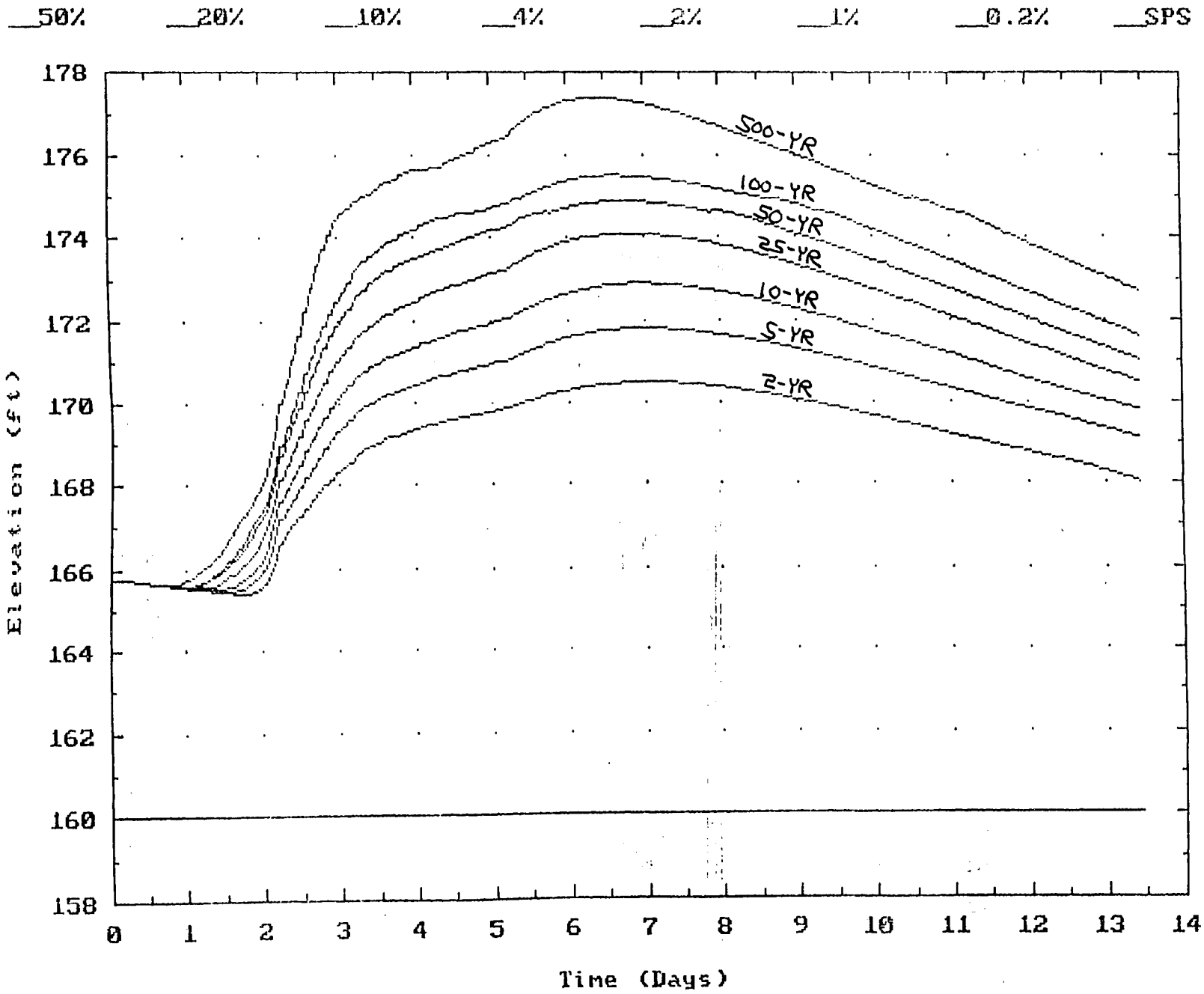


PLATE F-2

POND SURFACE AREA AND STORAGE VOLUME

PASSIC10 POND-P10

____VOLUME ____AREA

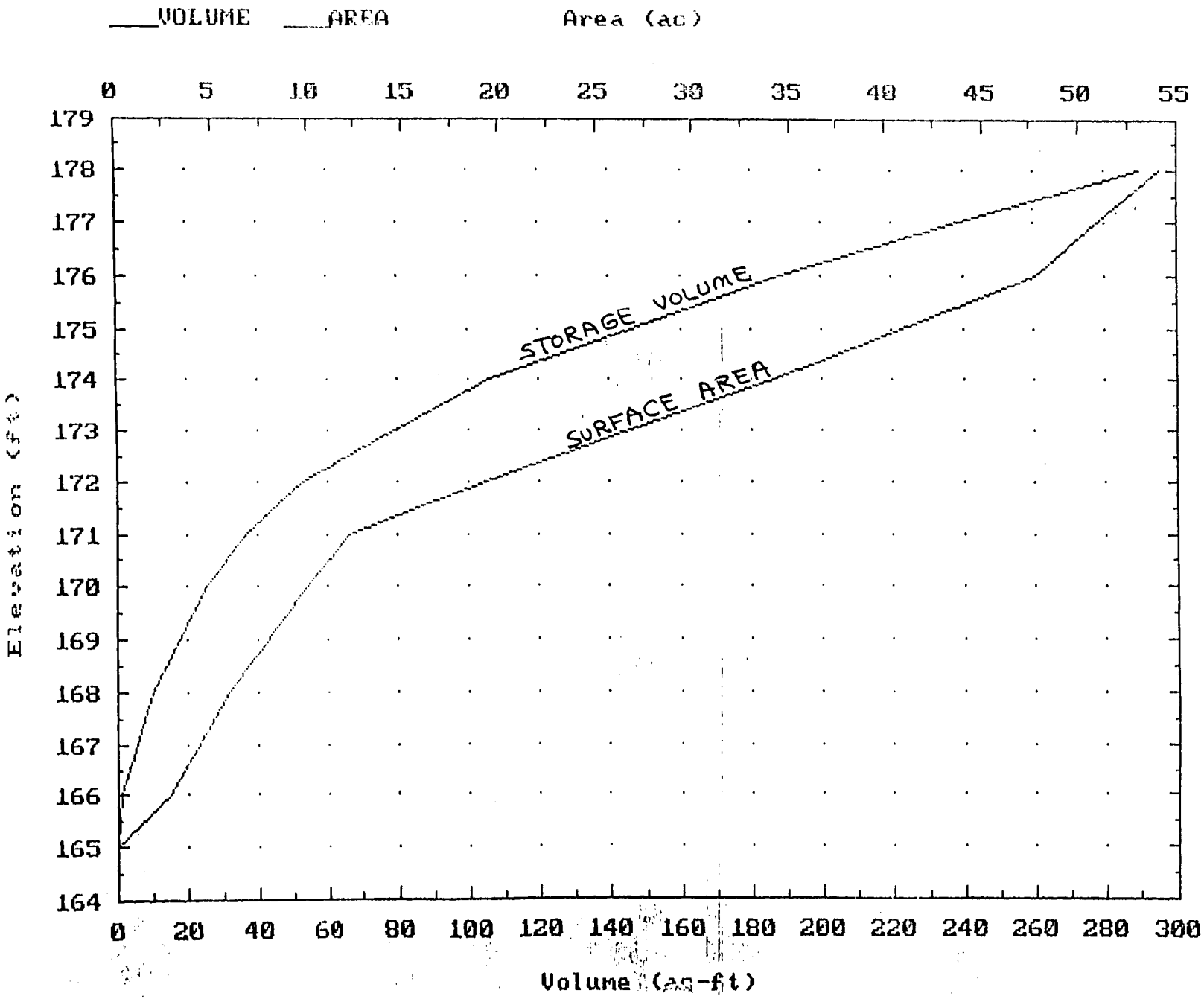


PLATE F-3

MAXIMUM INTERIOR ELEVATION

POSSIBLE

___PIO-NIC ___PIO-RPGS

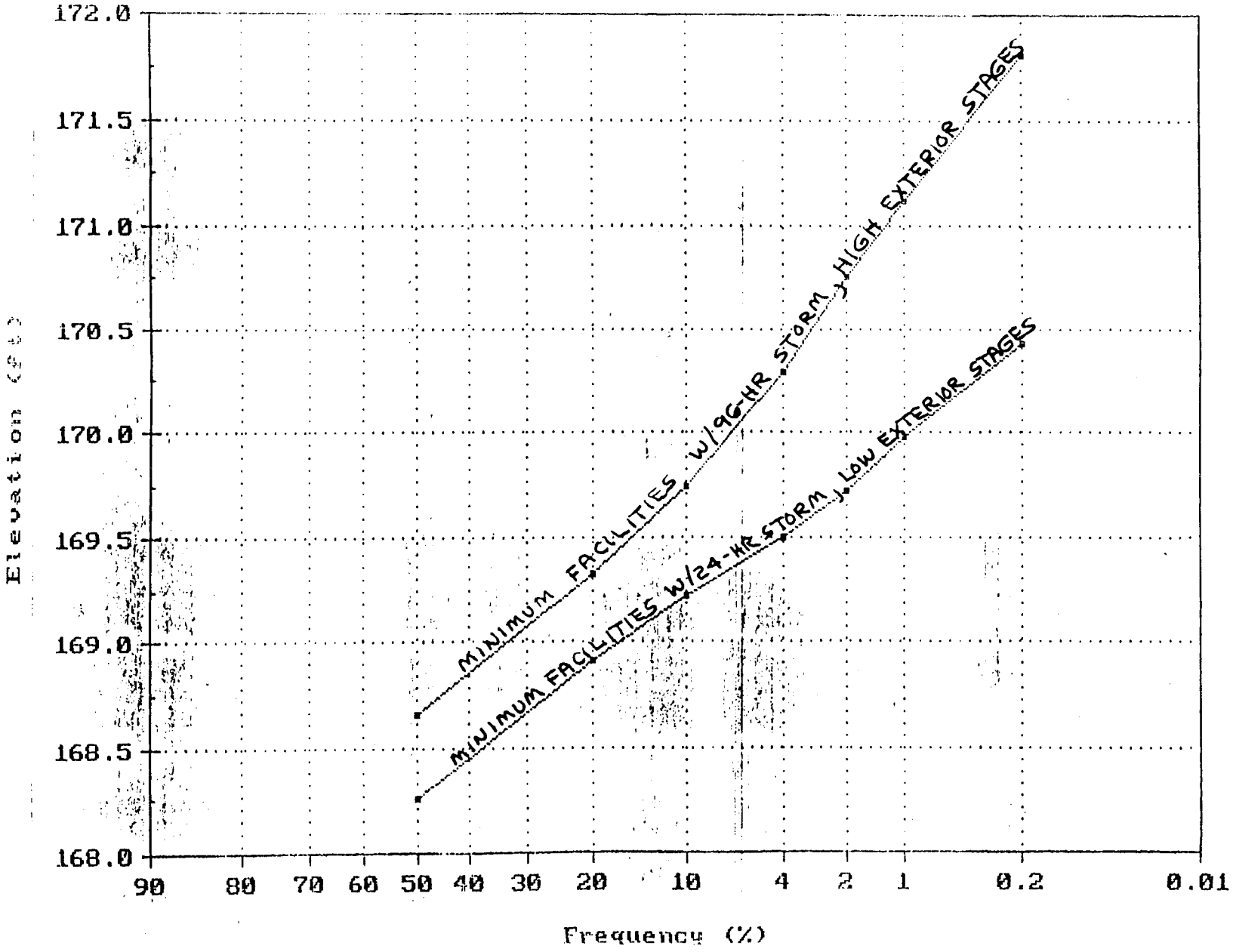


PLATE F-4

MAXIMUM INTERIOR ELEVATION

PASSIC10

P10 R96 P10-QMAX

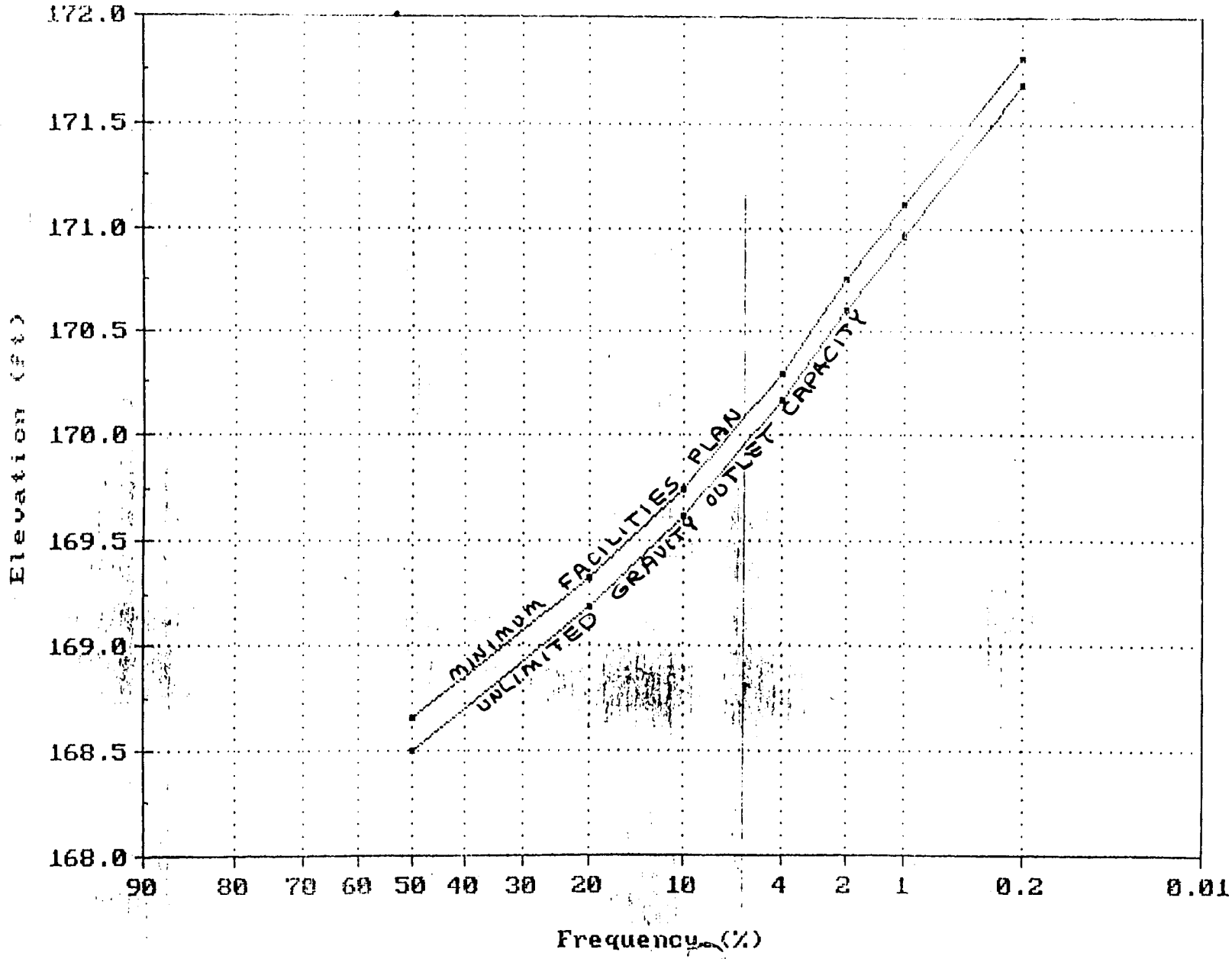


PLATE F-5

MAXIMUM INTERIOR ELEVATION

PASSIC10

P10-N06S P10-P01S P10-P02S P10-P03S P10-P06S

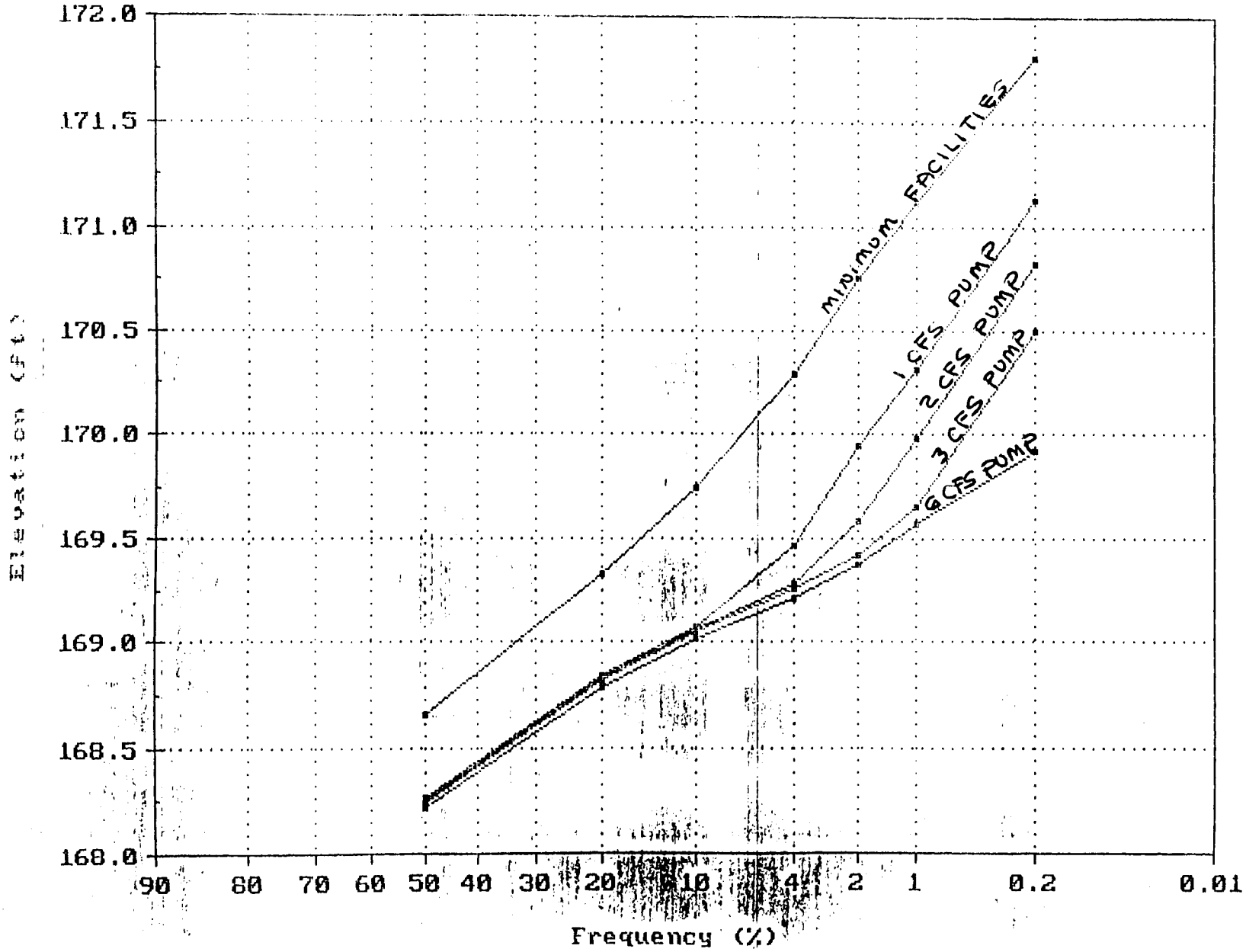


PLATE F-6

ELEVATIONS

PASSIC10 1% P10-M96S

(100-YEAR)

____INTERIOR ____EXTERIOR

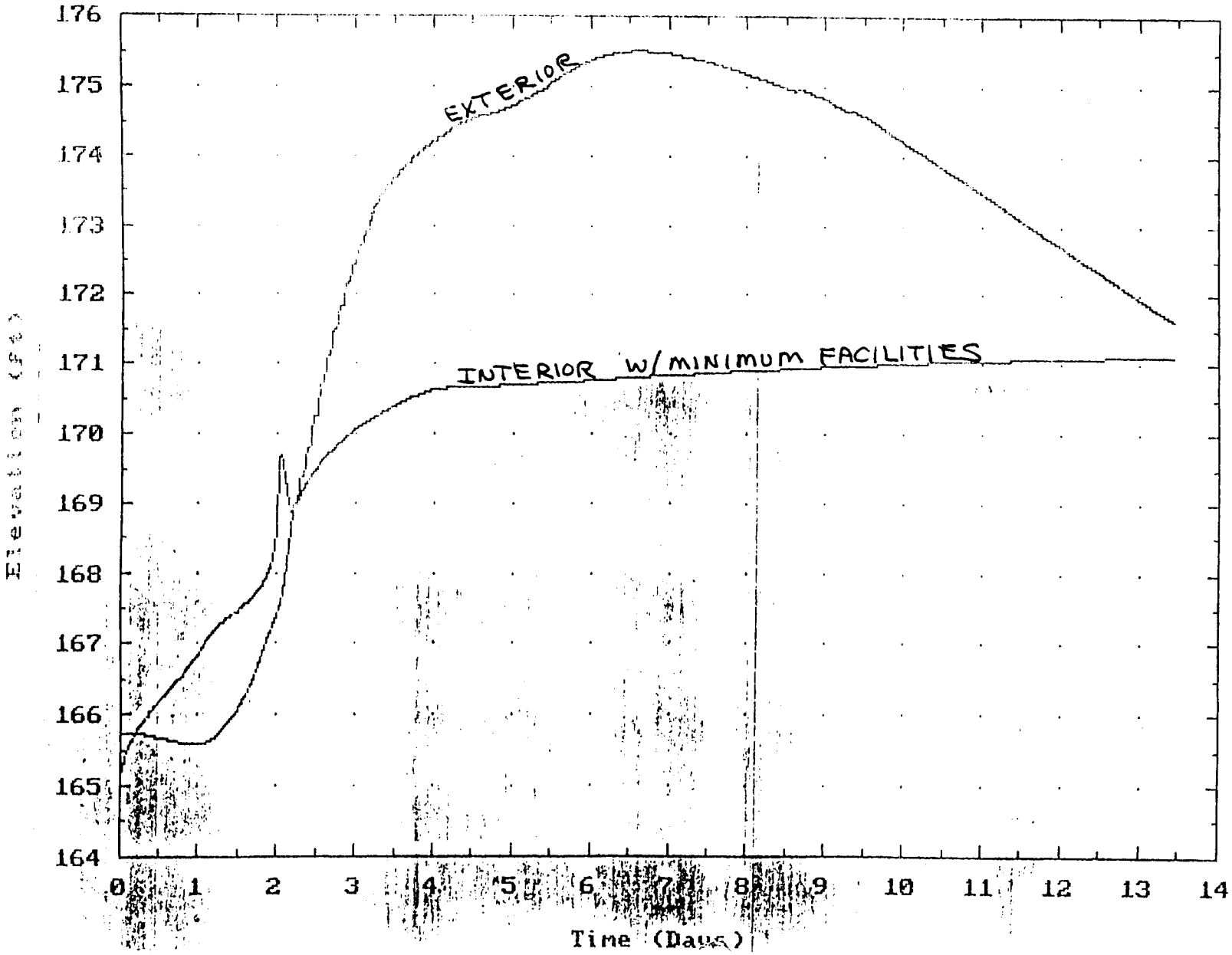


PLATE F-7

ELEVATIONS

PASSIC10 1% (100-YEAR) P10-P01S

____INTERIOR____EXTERIOR

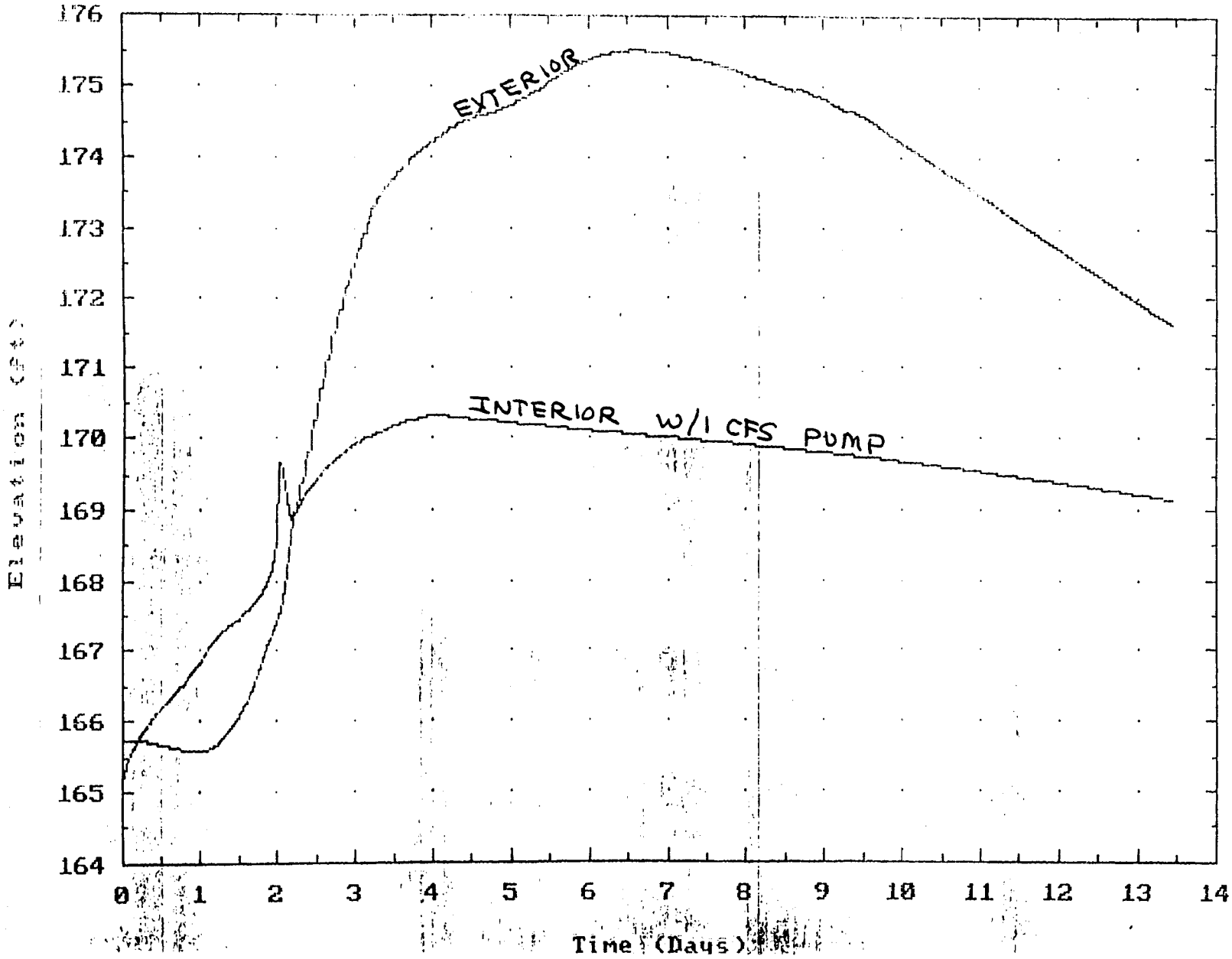


PLATE F-8

ELEVATIONS

PASSIC10

1%
(100-YEAR)

P10-P02S

____INTERIOR____EXTERIOR

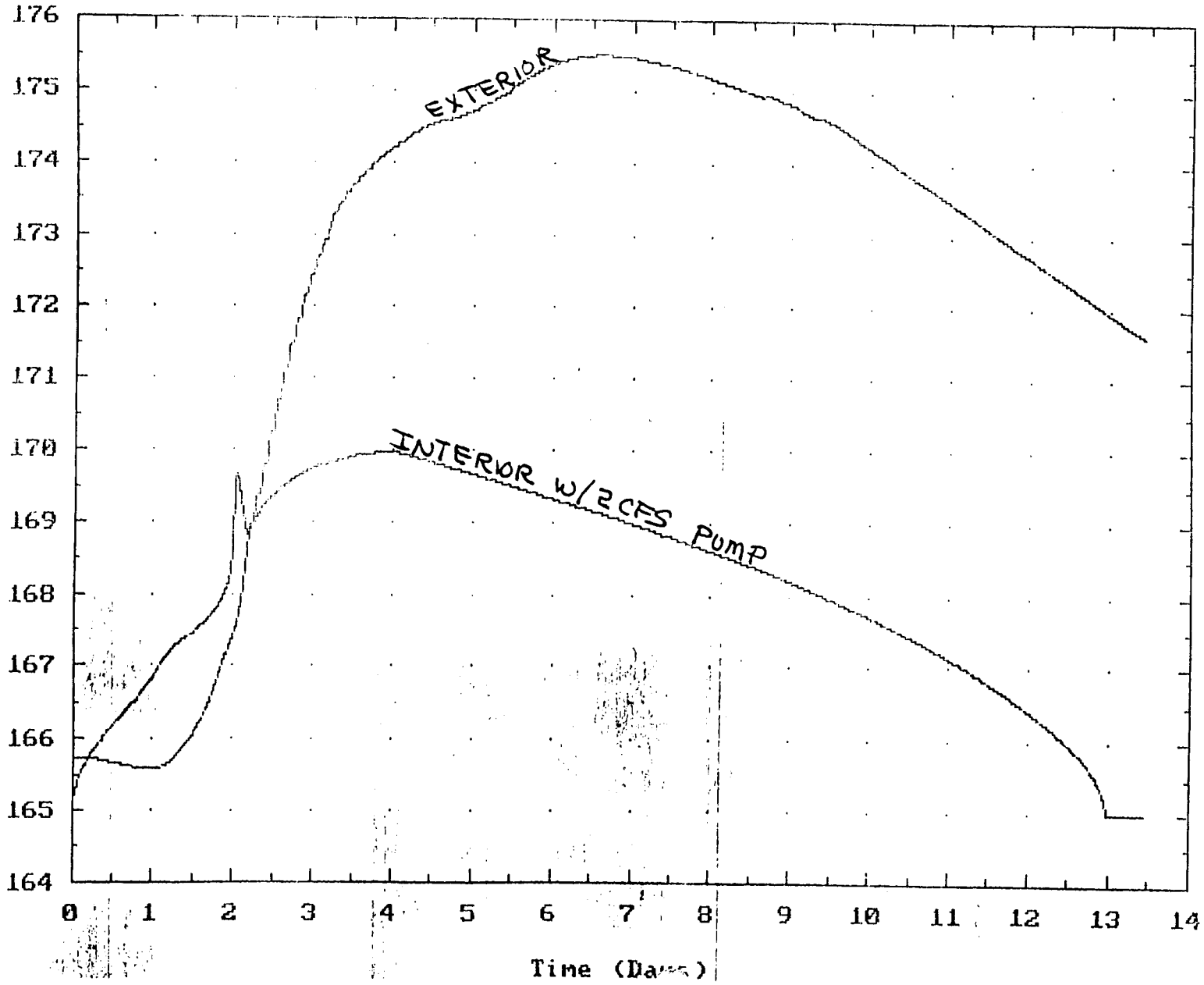


PLATE F-9

ELEVATIONS

PASSIC10 1% P10-P03S

(100-YEAR)

____INTERIOR____EXTERIOR

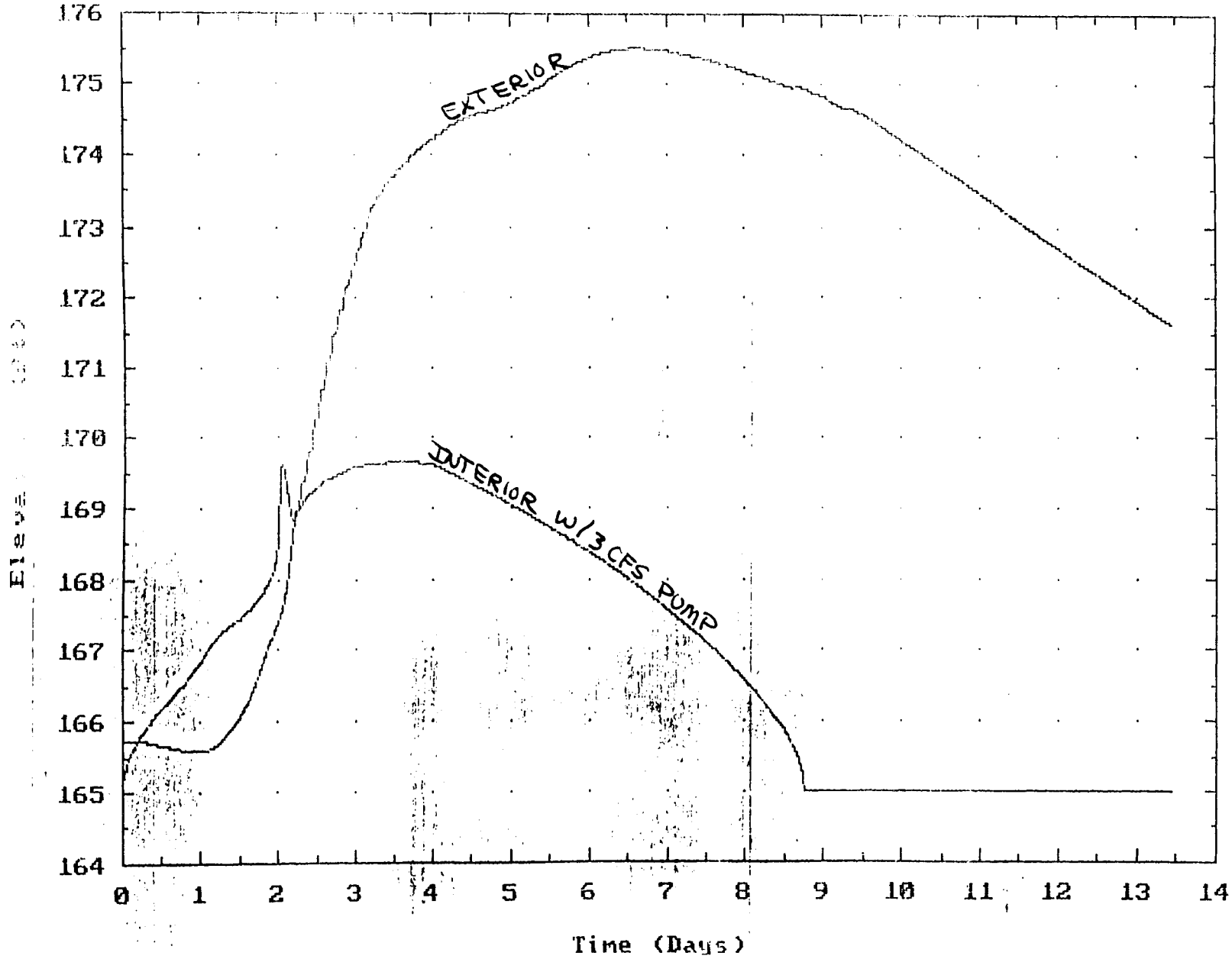


PLATE F-10

ELEVATIONS

PASSIC10 1% (100-YEAR) P10-P06S

____INTERIOR___EXTERIOR

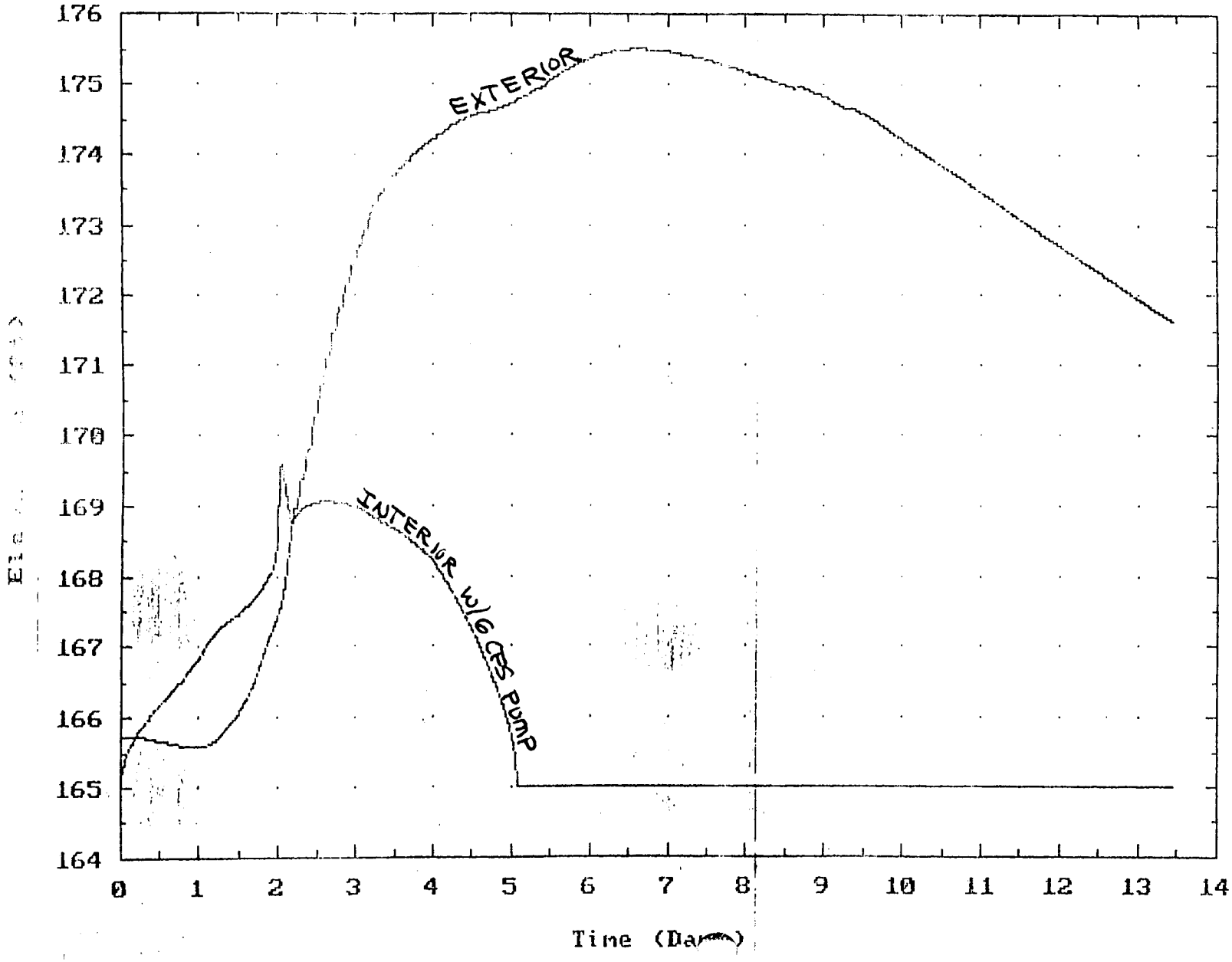


PLATE F-11

(PUMPING HEAD)
DIFFERENTIAL HEAD

PASSIC10 — HEAD

1%
(100-YEAR)

P10-P01S
(1CFS PUMP)

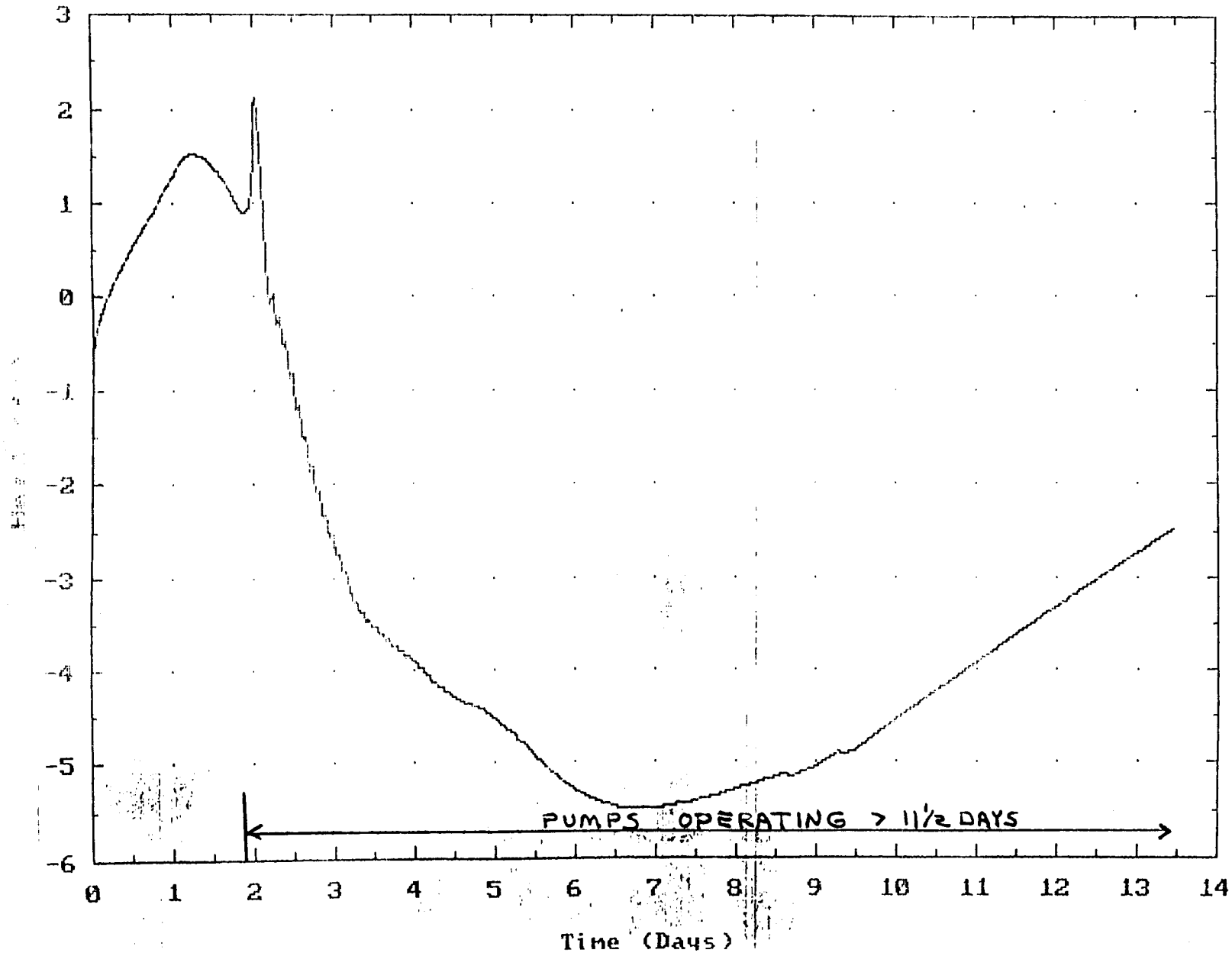


PLATE F-12

(PUMPING HEAD)
DIFFERENTIAL HEAD

PASSIC10

___HEAD

1%
(100-YEAR)

P10-P02S
(2CFS PUMP)

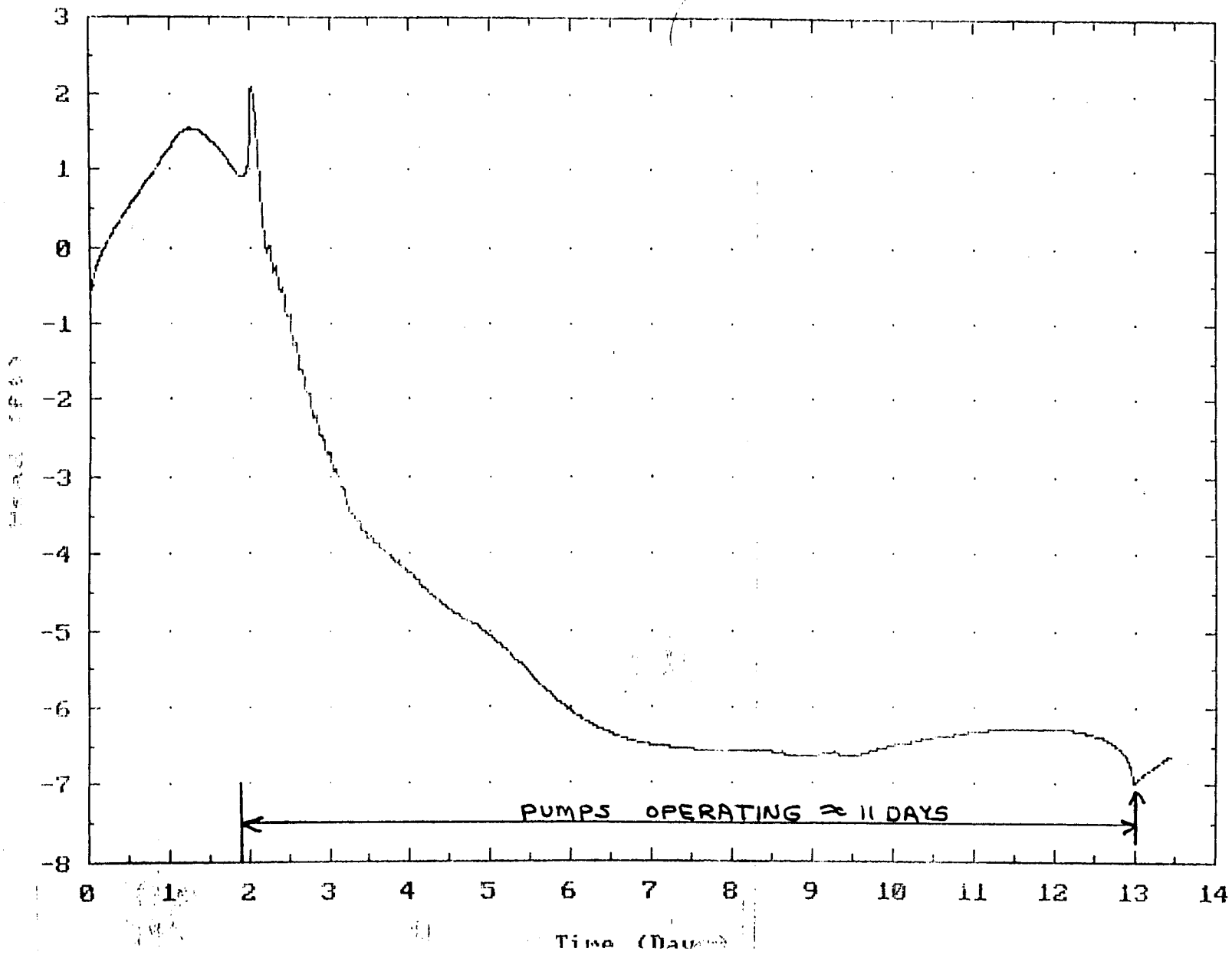


PLATE F-13

(PUMPING HEAD)
DIFFERENTIAL HEAD

PASSIC10

___HEAD

1%
(100-YEAR)

P10-P03S
(3 CFS PUMP)

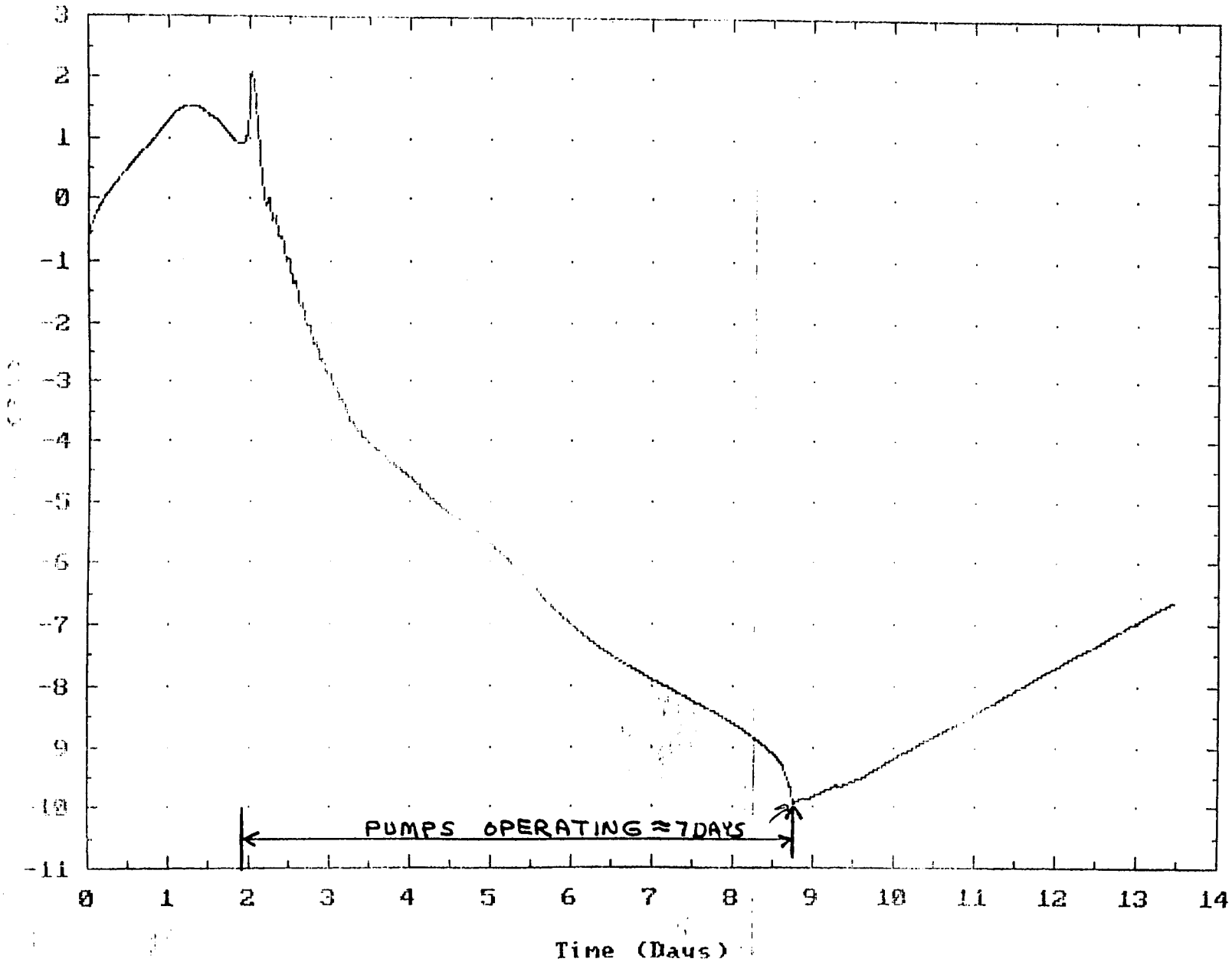


PLATE F-4

(PUMPING HEAD)
DIFFERENTIAL HEAD

PASSIC10

___HEAD

1%
(100-YEAR)

P10-P06S
(6 CFS PUMP)

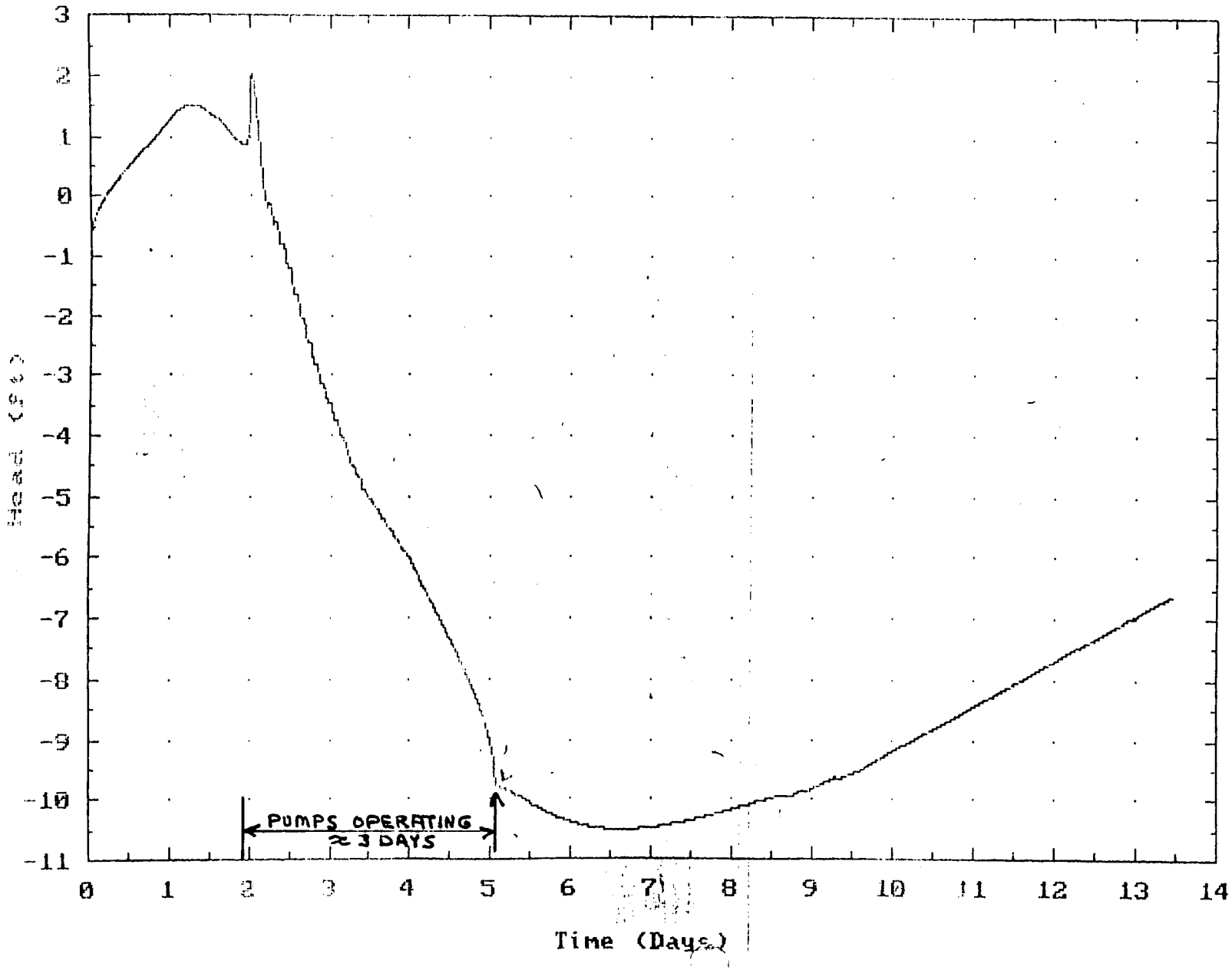
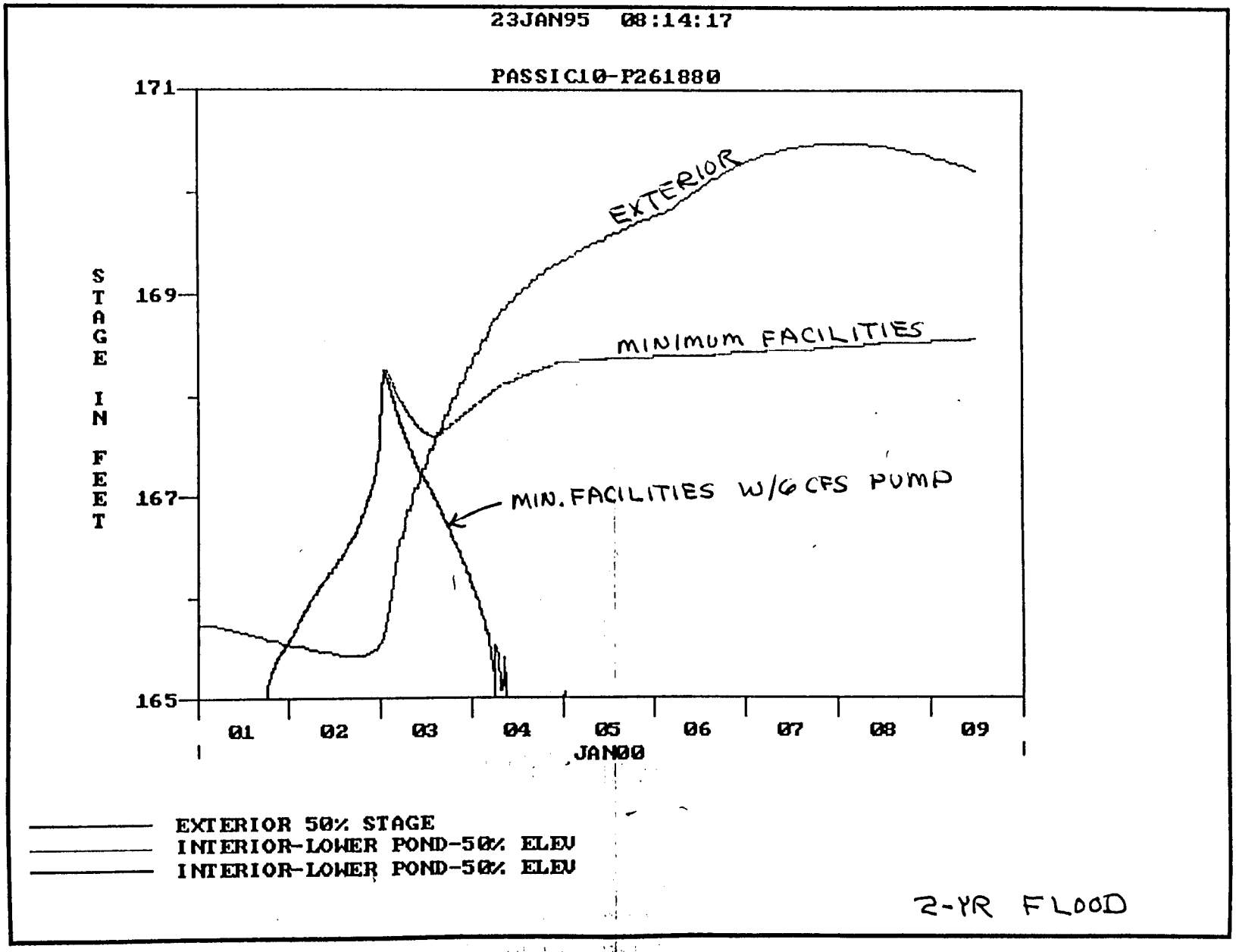


PLATE F-15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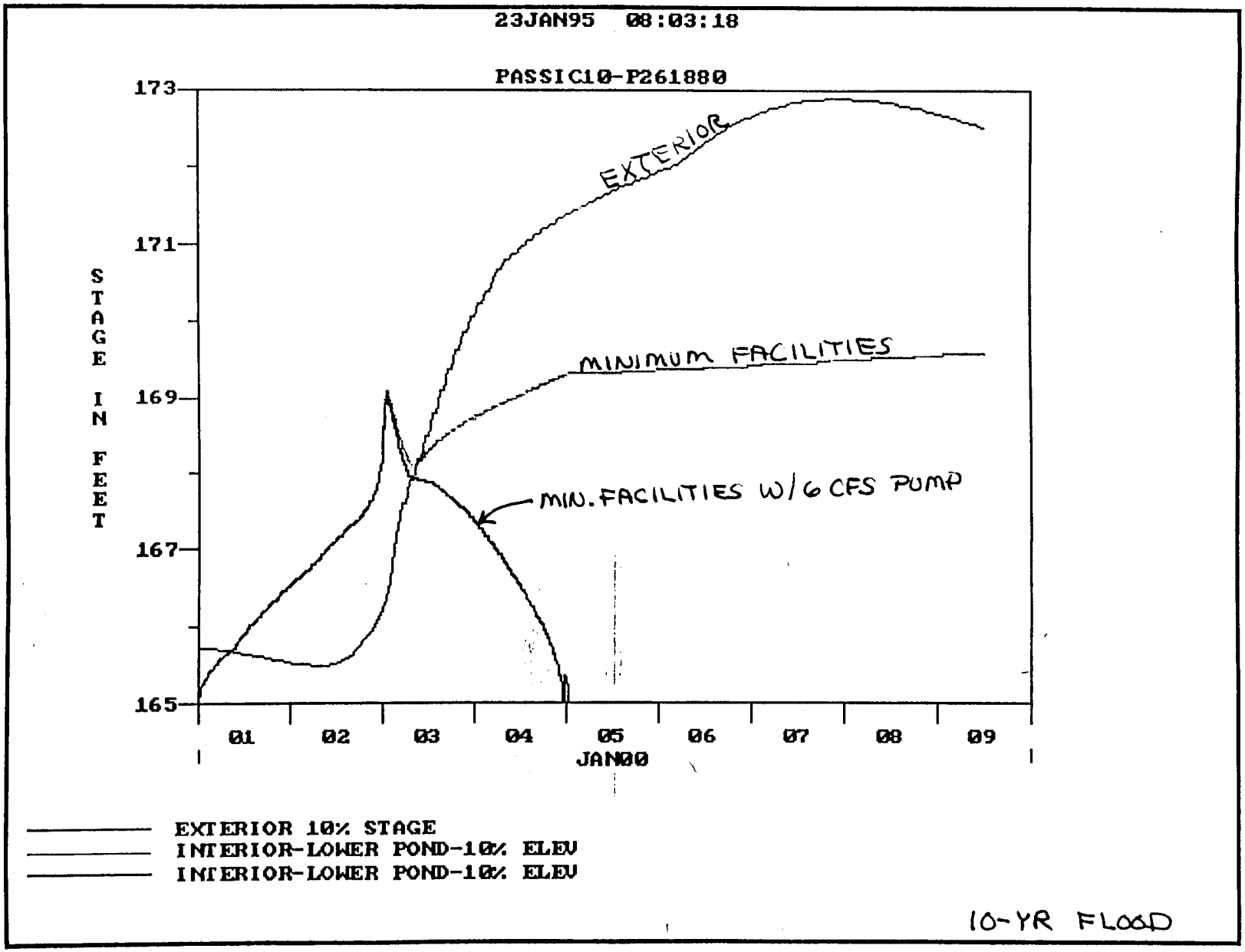
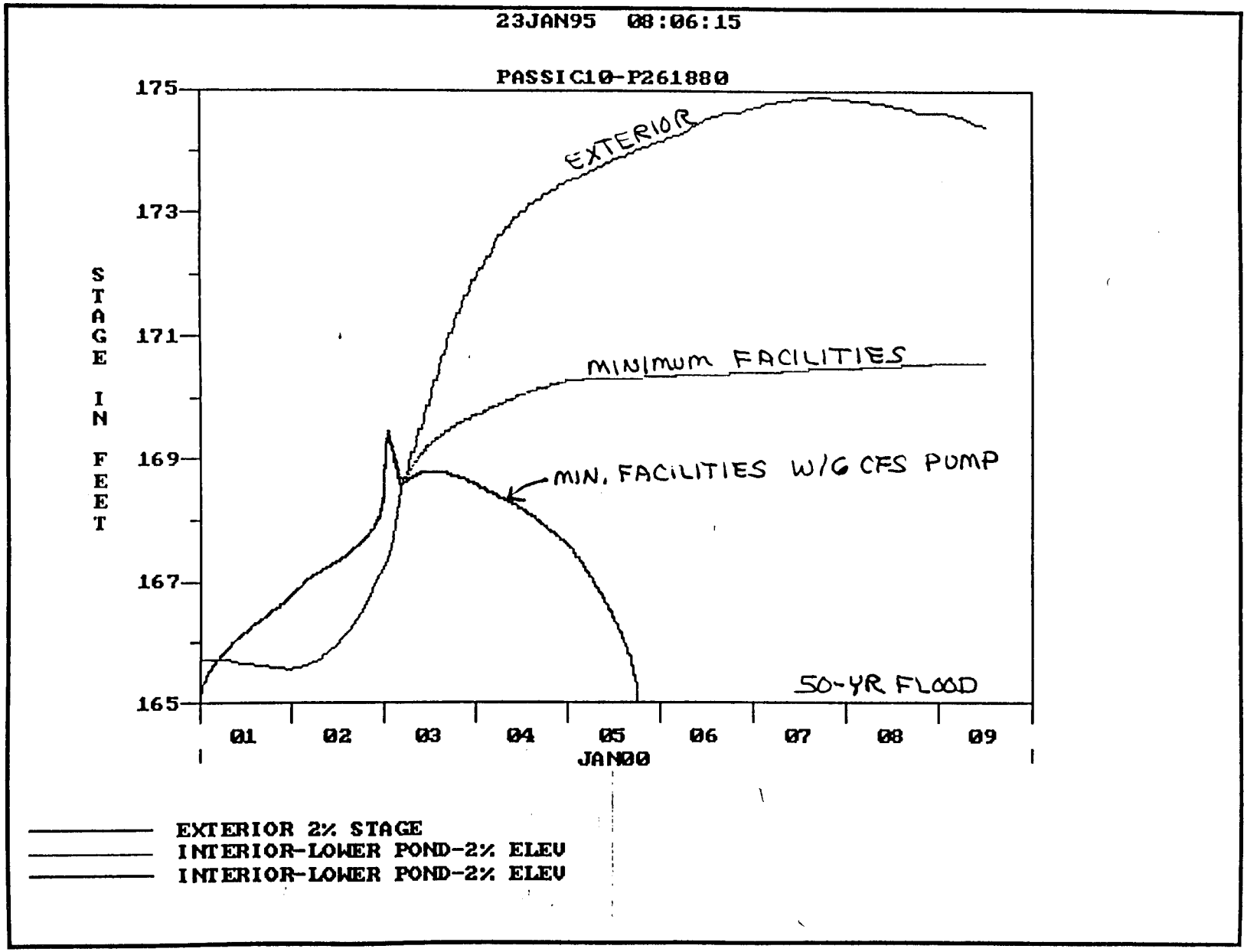
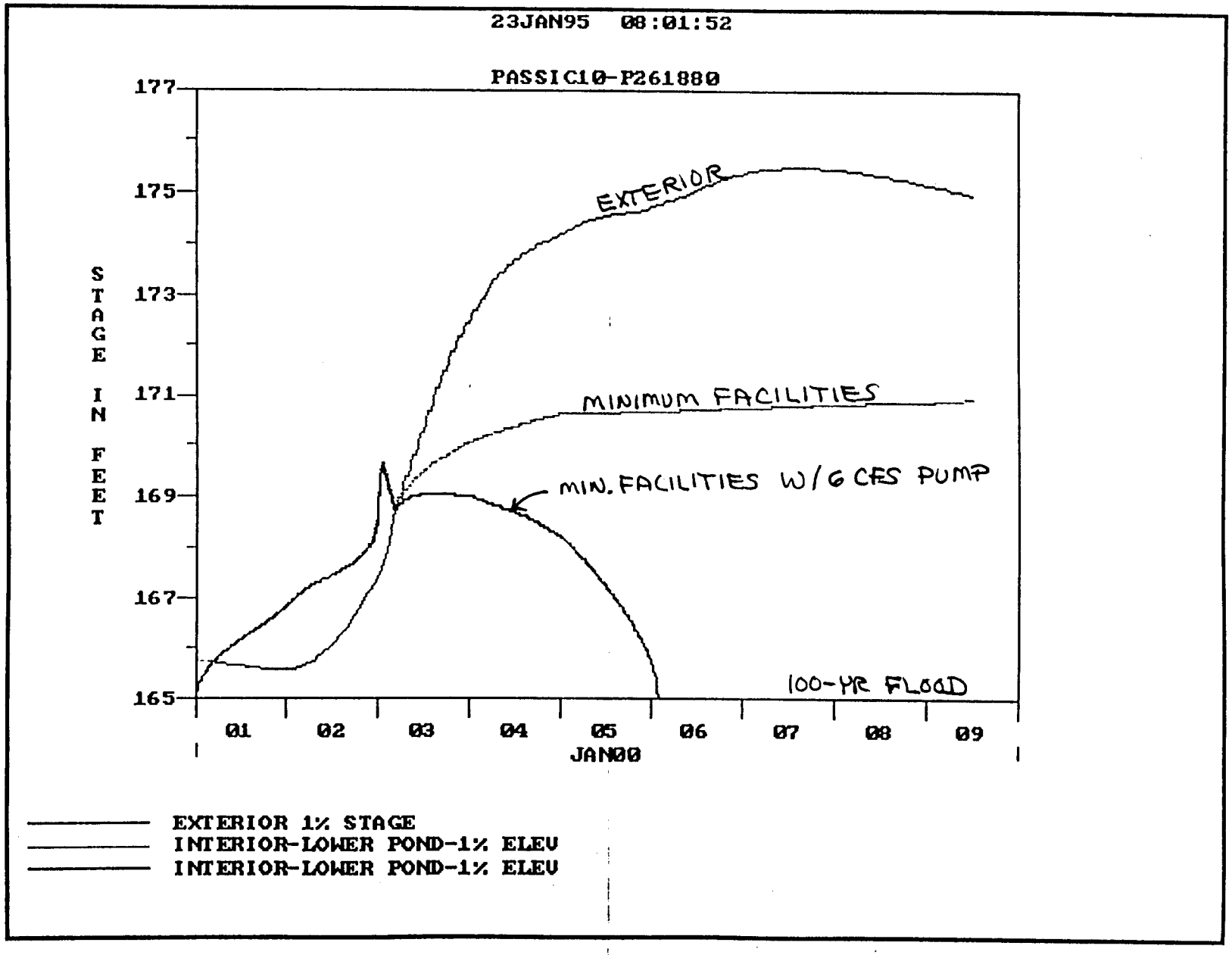
PASSIC10-P261880
171
169
167
165
STAGE IN FEET
EXTERIOR
MINIMUM FACILITIES
MIN. FACILITIES W/6 CFS PUMP
01
02
03
04
05
06
07
08
09
JAN00
EXTERIOR 50% STAGE
INTERIOR-LOWER POND-50% ELEV
INTERIOR-LOWER POND-50% ELEV
2-YR FLOOD


23JAN95 08:03:18
PASSIC10-P261880
173
171
169
167
165
STAGE IN FEET
EXTERIOR
MINIMUM FACILITIES
MIN. FACILITIES W/6 CFS PUMP
01
02
03
04
05
06
07
08
09
JAN00
EXTERIOR 10% STAGE
INTERIOR-LOWER POND-10% ELEV
INTERIOR-LOWER POND-10% ELEV
10-YR FLOOD


23JAN95 08:06:15
PASSIC10-P261880
175
173
171
169
167
165
STAGE IN FEET
EXTERIOR
MINIMUM FACILITIES
MIN. FACILITIES W/6 CFS PUMP
50-YR FLOOD
01
02
03
04
05
06
07
08
09
JAN00
EXTERIOR 2% STAGE
INTERIOR-LOWER POND-2% ELEV
INTERIOR-LOWER POND-2% ELEV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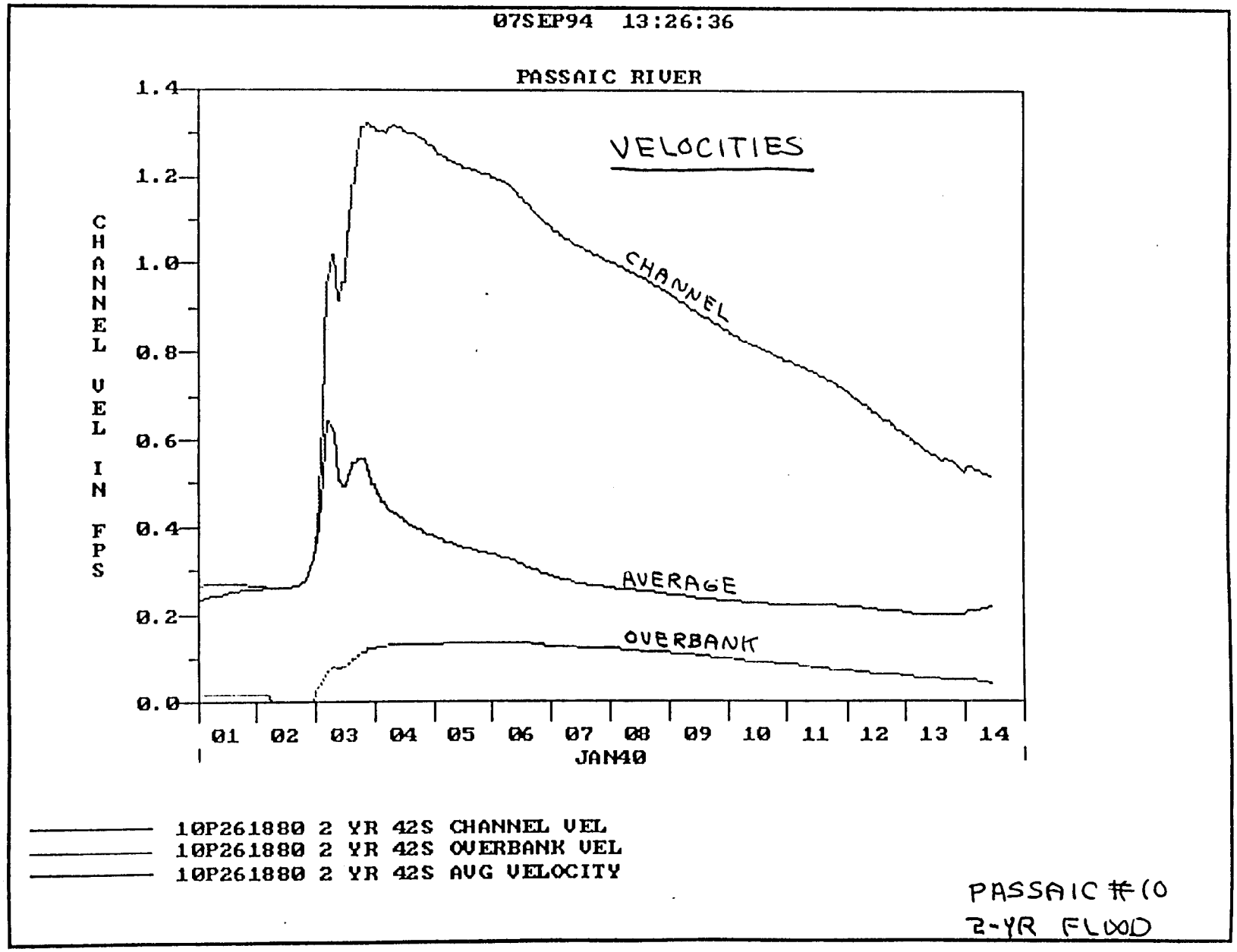
PASSIC10-P261880
STAGE IN FEET
177
175
173
171
169
167
165
EXTERIOR
MINIMUM FACILITIES
MIN. FACILITIES W/6 CFS PUMP
100-YR FLOOD
01
02
03
04
05
06
07
08
09
JAN00
EXTERIOR 1% STAGE
INTERIOR-LOWER POND-1% ELEV
INTERIOR-LOWER POND-1% ELEV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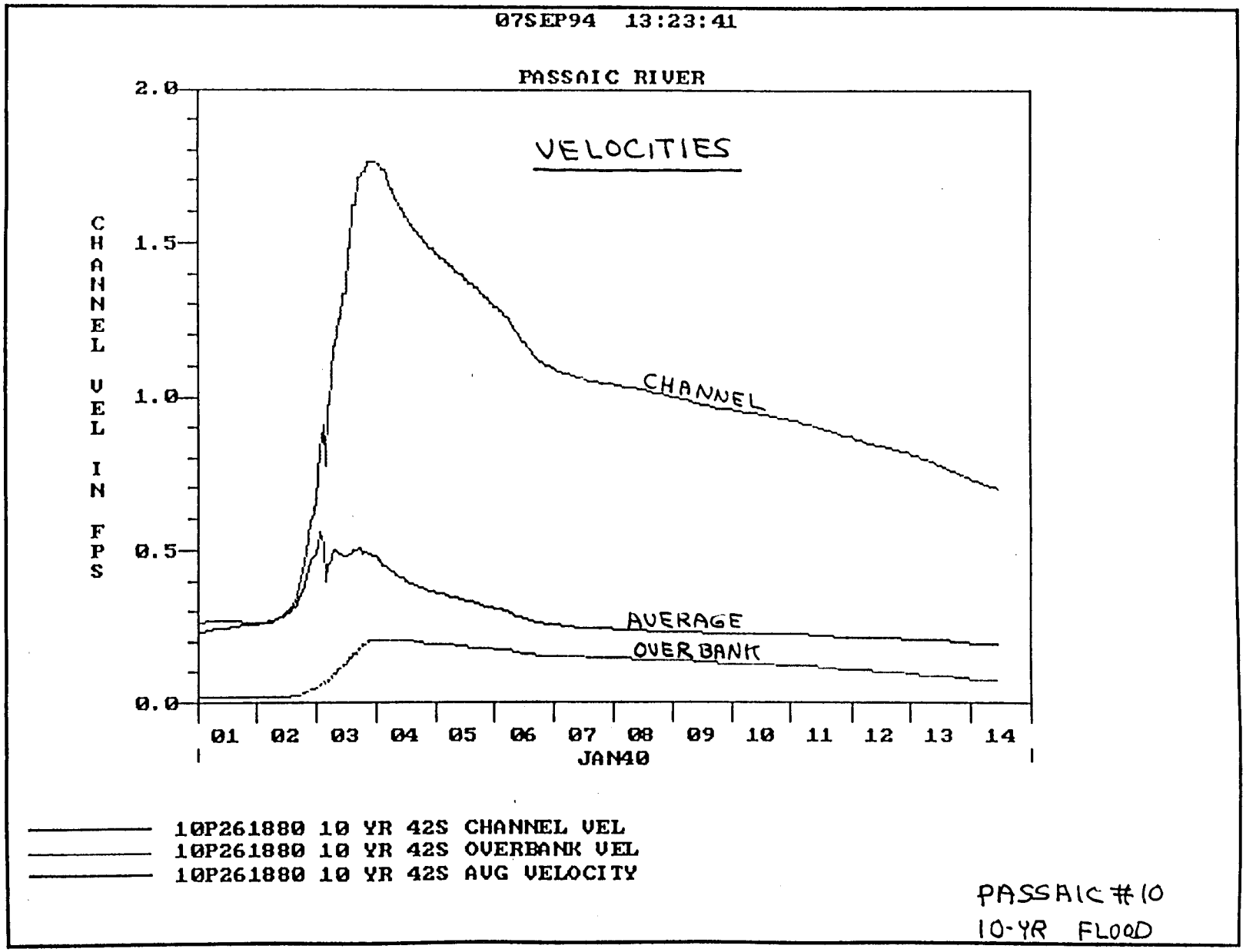
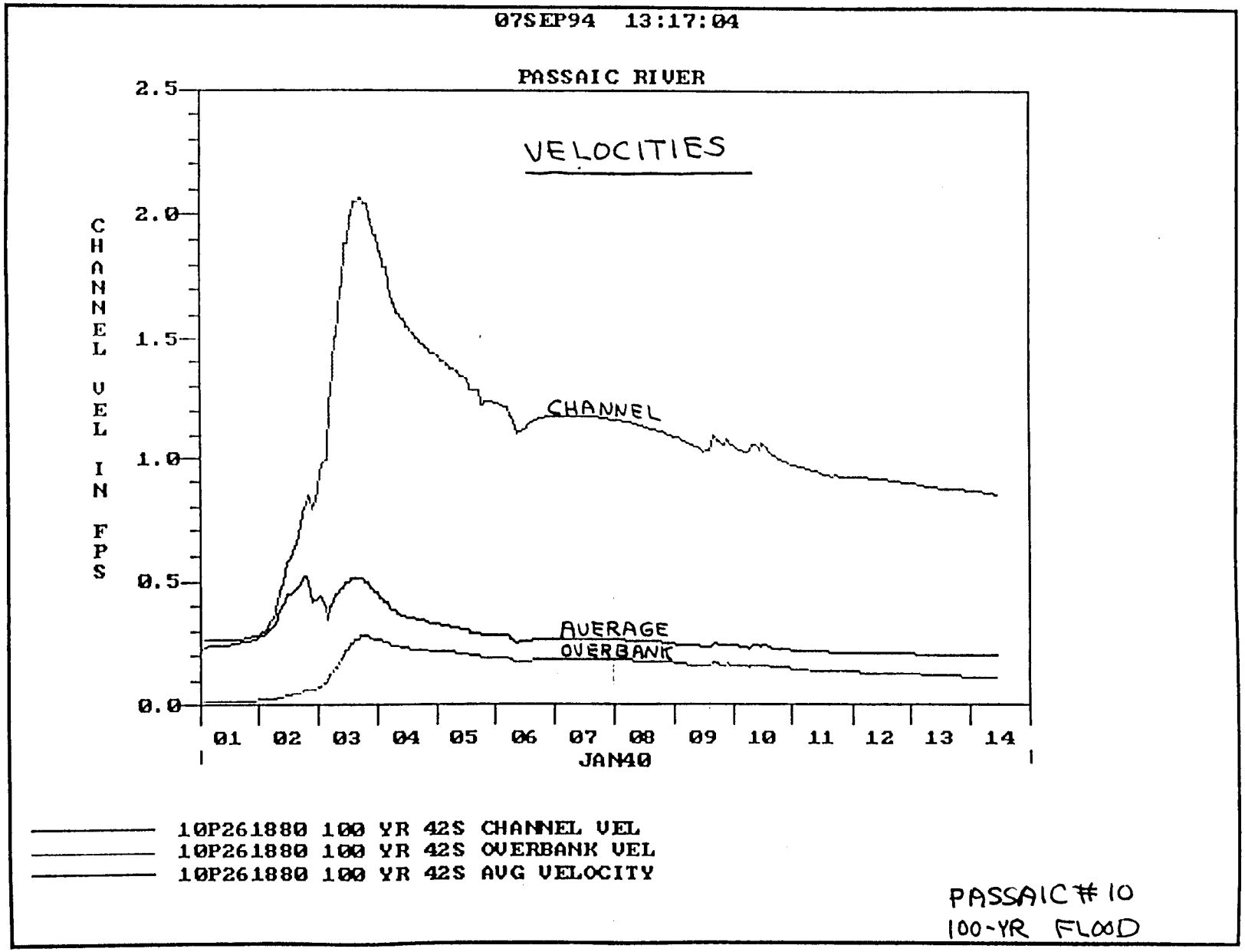
PASSAIC RIVER
VELOCITIES
CHANNEL VEL IN FPS
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
CHANNEL
AVERAGE
OVERBANK
01 02 03 04 05 06 07 08 09 10 11 12 13 14
JAN40
10P261880 2 YR 42S CHANNEL VEL
10P261880 2 YR 42S OVERBANK VEL
10P261880 2 YR 42S AVG VELOCITY
PASSAIC #10
2-YR FLOOD


07SEP94 13:23:41
PASSAIC RIVER
VELOCITIES
CHANNEL VEL IN FPS
2.0
1.5
1.0
0.5
0.0
CHANNEL
AVERAGE
OVERBANK
01 02 03 04 05 06 07 08 09 10 11 12 13 14
JAN40
10P261880 10 YR 42S CHANNEL VEL
10P261880 10 YR 42S OVERBANK VEL
10P261880 10 YR 42S AVG VELOCITY
PASSAIC #10
10-YR FLOOD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PASSAIC RIVER
VELOCITIES
CHANNEL VEL IN FPS
2.5
2.0
1.5
1.0
0.5
0.0
CHANNEL
AVERAGE
OVERBANK
01 02 03 04 05 06 07 08 09 10 11 12 13 14
JAN40
10P261880 100 YR 42S CHANNEL VEL
10P261880 100 YR 42S OVERBANK VEL
10P261880 100 YR 42S AVG VELOCITY
PASSAIC #10
100-YR FLOOD

PLATE F-22

ATTACHMENT G

COST ESTIMATE

Passaic #10 Project Cost
Passaic River
Flood Damage Reduction Project
Passaic #10
Levee System

Designed By: Wilmington District, L. Creech
Estimated By: CESAW-EN-E

Prepared By: D. W. Greene, CESAW-EN-E
H.F. (Bud) Kiefer, CENAN-PR-TC

Date: 05/30/95
Est Construction Time: 252 Days

M C A C E S G O L D E D I T I O N
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Release 5.20J

SUMMARY REPORTS SUMMARY PAGE

PROJECT OWNER SUMMARY - LEVEL 3.....1
PROJECT INDIRECT SUMMARY - LEVEL 3.....3
PROJECT DIRECT SUMMARY - LEVEL 3.....5

No Detailed Estimate...

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

Any HTRW issues are to be resolved before contruction and therefore are not included in this estimate other than for HTRW testing. Because this project is nearly in the Plans & Specs. stage, contingencies for all items are 10%.

EARTHWORK:

All earthwork quantities area shown as Loose Cubic Yards, except for Footprint Excavation which in calculated in Bank Cubic Yards . Most borrow material will come from an on site borrow pit with an average haul distance of 1 mile. Additional borrow material will come from the Hatfield Swamp project where excavation and loading will not be charged to the Passaic #10 project. Haul distance one way from Hatfield Swamp is 4 miles.

The following adjustments were made to develop costs for northern New Jersey at October 1994 price levels.

LABOR:

The 1994 Passaic River Basin Labor Rates Database was used to calculate labor costs.

EQUIPMENT:

The 1994 Region 1 Equipment Rates Database was used to calculate equipment costs.

CREWS:

The 1994 Passaic River Basin Crews Database was used to calculate crew costs.

MATERIALS:

Costs were obtained from the 1994 Region 1 (Passaic River Basin) Unit Price Book, Passaic River Basin Materials Resources Study, and direct inquiries.

		QUANTITY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT COST
01	LANDS AND DAMAGES						
01.21	Feature Design Memorandum						
01.21.03	Real Estate Analysis Documents	1.00	EA	28,215	2,822	31,037	31036.50
	Feature Design Memorandum	1.00	EA	28,215	2,822	31,037	31036.50
	LANDS AND DAMAGES	1.00	EA	28,215	2,822	31,037	31036.50
11	LEVEES AND FLOODWALLS						
11.01	Mob/Demob						
	Mob/Demob	1.00	EA	63,968	6,400	70,368	70368.41
11.02	Site Preparation						
11.02.01	Clearing	1.00	EA	58,054	5,800	63,854	63854.01
11.02.02	Erosion Control	1.00	EA	87,745	8,800	96,545	96545.11
	Site Preparation	1.00	EA	145,799	14,600	160,399	160399.12
11.03	Levee						
11.03.01	Earth Dike	1.00	EA	791,873	80,000	871,873	871873.05
11.03.02	Concrete Wall	1.00	EA	69,866	7,200	77,066	77065.65
	Levee	1.00	EA	861,739	87,200	948,939	948938.69
11.04	Interior Drainage						
11.04.01	Culverts and Gates	1.00	EA	47,753	5,000	52,753	52752.92
	Interior Drainage	1.00	EA	47,753	5,000	52,753	52752.92
11.05	Landscaping						
11.05.01	Establish Turf	1.00	EA	57,971	6,000	63,971	63971.35
	Landscaping	1.00	EA	57,971	6,000	63,971	63971.35
11.06	Green Acres Mitigation						

	QUANTITY UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT COST
Green Acres Mitigation	1.00 EA	185,464	27,820	213,283	213283.14
11.07 Beautification					
Beautification	1.00 EA	109,698	16,455	126,153	126153.16
LEVEES AND FLOODWALLS	1.00 EA	1,472,392	163,474	1,635,867	1635867
13 PUMPING PLANT					
13.00 Pumping Plant					
13.00.99 Associated General Items	1.00 EA	203,616	20,000	223,616	223615.61
Pumping Plant	1.00 EA	203,616	20,000	223,616	223615.61
PUMPING PLANT	1.00 EA	203,616	20,000	223,616	223615.61
30 PLANNING, ENGINEERING AND DESIGN					
30.20 General Design Memorandum					
30.20.08 Final Report Documentation	1.00 EA	769,349	1,772	771,121	771121.00
General Design Memorandum	1.00 EA	769,349	1,772	771,121	771121.00
PLANNING, ENGINEERING AND DESIGN	1.00 EA	769,349	1,772	771,121	771121.00
31 CONSTRUCTION MANAGEMENT					
31.23 Construction Contracts					
31.23.11 Supervision and Administration	1.00 EA	118,145	17,722	135,867	135867.00
Construction Contracts	1.00 EA	118,145	17,722	135,867	135867.00
CONSTRUCTION MANAGEMENT	1.00 EA	118,145	17,722	135,867	135867.00
Passaic #10 Project Cost	1.00 EA	2,591,717	205,790	2,797,507	2797507

** PROJECT INDIRECT SUMMARY - LEVEL 3 **

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
01 LANDS AND DAMAGES								
01.21 Feature Design Memorandum								
01.21.03 Real Estate Analysis Document	1.00 EA	28,215	0	0	0	0	28,215	28215.00
Feature Design Memorandum	1.00 EA	28,215	0	0	0	0	28,215	28215.00
LANDS AND DAMAGES	1.00 EA	28,215	0	0	0	0	28,215	28215.00
11 LEVEES AND FLOODWALLS								
11.01 Mob/Demob								
Mob/Demob	1.00 EA	53,268	3,196	2,259	4,707	539	63,968	63968.41
11.02 Site Preparation								
11.02.01 Clearing	1.00 EA	48,343	2,901	2,050	4,271	489	58,054	58054.01
11.02.02 Erosion Control	1.00 EA	73,067	4,384	3,098	6,456	740	87,745	87745.11
Site Preparation	1.00 EA	121,410	7,285	5,148	10,727	1,229	145,799	145799.12
11.03 Levee								
11.03.01 Earth Dike	1.00 EA	659,411	39,565	27,959	58,264	6,674	791,873	791873.05
11.03.02 Concrete Wall	1.00 EA	58,179	3,491	2,467	5,141	589	69,866	69865.65
Levee	1.00 EA	717,590	43,055	30,426	63,404	7,263	861,739	861738.69
11.04 Interior Drainage								
11.04.01 Culverts and Gates	1.00 EA	39,765	2,386	1,686	3,514	402	47,753	47752.92
Interior Drainage	1.00 EA	39,765	2,386	1,686	3,514	402	47,753	47752.92
11.05 Landscaping								
11.05.01 Establish Turf	1.00 EA	48,274	2,896	2,047	4,265	489	57,971	57971.35
Landscaping	1.00 EA	48,274	2,896	2,047	4,265	489	57,971	57971.35
11.06 Green Acres Mitigation								

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
Green Acres Mitigation	1.00 EA	185,464	0	0	0	0	185,464	185463.60
11.07 Beautification								
Beautification	1.00 EA	109,698	0	0	0	0	109,698	109698.40
LEVEES AND FLOODWALLS	1.00 EA	1,275,469	58,818	41,565	86,617	9,922	1,472,392	1472392
13 PUMPING PLANT								
13.00 Pumping Plant								
13.00.99 Associated General Items	1.00 EA	169,556	10,173	7,189	14,981	1,716	203,616	203615.61
Pumping Plant	1.00 EA	169,556	10,173	7,189	14,981	1,716	203,616	203615.61
PUMPING PLANT	1.00 EA	169,556	10,173	7,189	14,981	1,716	203,616	203615.61
30 PLANNING, ENGINEERING AND DESIGN								
30.20 General Design Memorandum								
30.20.08 Final Report Documentation	1.00 EA	769,349	0	0	0	0	769,349	769349.00
General Design Memorandum	1.00 EA	769,349	0	0	0	0	769,349	769349.00
PLANNING, ENGINEERING AND DES	1.00 EA	769,349	0	0	0	0	769,349	769349.00
31 CONSTRUCTION MANAGEMENT								
31.23 Construction Contracts								
31.23.11 Supervision and Administratio	1.00 EA	118,145	0	0	0	0	118,145	118145.00
Construction Contracts	1.00 EA	118,145	0	0	0	0	118,145	118145.00
CONSTRUCTION MANAGEMENT	1.00 EA	118,145	0	0	0	0	118,145	118145.00
Passaic #10 Project Cost	1.00 EA	2,360,734	68,992	48,754	101,599	11,638	2,591,717	2591717
Contingency							205,790	
TOTAL INCL OWNER COSTS							2,797,507	

	QUANTITY	UOM	MANHRS	LABOR	EQUIPMN	MATERIA	TOTAL COST	UNIT COST
01 LANDS AND DAMAGES								
01.21 Feature Design Memorandum								
01.21.03 Real Estate Analysis Documents	1.00	EA	0	28,215	0	0	28,215	28215.00
Feature Design Memorandum	1.00	EA	0	28,215	0	0	28,215	28215.00
LANDS AND DAMAGES	1.00	EA	0	28,215	0	0	28,215	28215.00
11 LEVEES AND FLOODWALLS								
11.01 Mob/Demob								
Mob/Demob	1.00	EA	0	20,000	20,000	13,268	53,268	53268.00
11.02 Site Preparation								
11.02.01 Clearing	1.00	EA	959	32,898	15,445	0	48,343	48342.94
11.02.02 Erosion Control	1.00	EA	1,049	39,300	27,688	6,080	73,067	73067.42
Site Preparation	1.00	EA	2,007	72,198	43,133	6,080	121,410	121410.35
11.03 Levee								
11.03.01 Earth Dike	1.00	EA	9,700	322,401	337,010	0	659,411	659411.30
11.03.02 Concrete Wall	1.00	EA	587	28,273	4,875	25,032	58,179	58178.76
Levee	1.00	EA	10,288	350,674	341,884	25,032	717,590	717590.06
11.04 Interior Drainage								
11.04.01 Culverts and Gates	1.00	EA	273	12,083	1,858	25,824	39,765	39764.98
Interior Drainage	1.00	EA	273	12,083	1,858	25,824	39,765	39764.98
11.05 Landscaping								
11.05.01 Establish Turf	1.00	EA	501	19,901	1,556	26,818	48,274	48274.10
Landscaping	1.00	EA	501	19,901	1,556	26,818	48,274	48274.10
11.06 Green Acres Mitigation								

	QUANTITY UOM	MANHRS	LABOR	EQUIPMN	MATERIA	TOTAL COST	UNIT COST
Green Acres Mitigation	1.00 EA	0	32,594	152,870	0	185,464	185463.60
11.07 Beautification							
Beautification	1.00 EA	0	25,186	84,512	0	109,698	109698.40
LEVEES AND FLOODWALLS	1.00 EA	13,070	532,635	645,813	97,021	1,275,469	1275469
13 PUMPING PLANT							
13.00 Pumping Plant							
13.00.99 Associated General Items	1.00 EA	1,082	46,390	6,832	116,334	169,556	169555.50
Pumping Plant	1.00 EA	1,082	46,390	6,832	116,334	169,556	169555.50
PUMPING PLANT	1.00 EA	1,082	46,390	6,832	116,334	169,556	169555.50
30 PLANNING, ENGINEERING AND DESIGN							
30.20 General Design Memorandum							
30.20.08 Final Report Documentation	1.00 EA	0	769,349	0	0	769,349	769349.00
General Design Memorandum	1.00 EA	0	769,349	0	0	769,349	769349.00
PLANNING, ENGINEERING AND DESIGN	1.00 EA	0	769,349	0	0	769,349	769349.00
31 CONSTRUCTION MANAGEMENT							
31.23 Construction Contracts							
31.23.11 Supervision and Administration	1.00 EA	0	118,145	0	0	118,145	118145.00
Construction Contracts	1.00 EA	0	118,145	0	0	118,145	118145.00
CONSTRUCTION MANAGEMENT	1.00 EA	0	118,145	0	0	118,145	118145.00
Passaic #10 Project Cost	1.00 EA	14,152	1494734	652,645	213,355	2,360,734	2360734
OVERHEAD						68,992	
SUBTOTAL						2,429,726	
HOME OFC						48,754	

	QUANTITY	UOM	MANHRS	LABOR	EQUIPMN	MATERIA	TOTAL COST	UNIT COST
SUBTOTAL							2,478,480	
PROFIT							101,599	
SUBTOTAL							2,580,079	
BOND							11,638	
TOTAL INCL INDIRECTS							2,591,717	
Contingency							205,790	
TOTAL INCL OWNER COSTS							2,797,507	

ATTACHMENT H

MANUFACTURERS LITERATURE

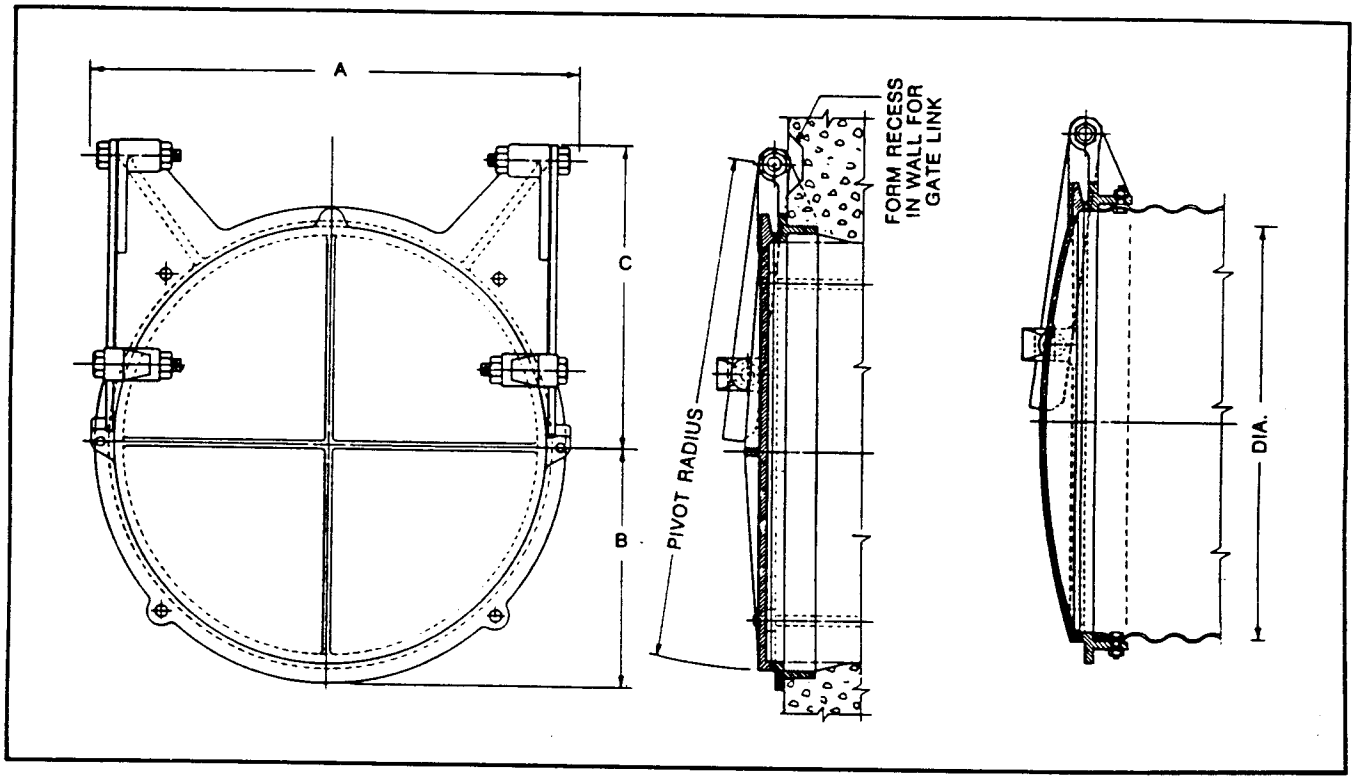
MODEL 10C FLAP GATE

- For seating heads to 10 feet
- Round opening
- Spigot back
- Cast iron seating surfaces

The Model 10C flap gate consists of the simplest possible design with double hinge action for heads to 10 feet. Pivot points are stationary. Ring and flap are of cast iron with galvanized steel hinge arms and assembly bolts and bronze bushings. Extension of the cast iron bosses of the flap over the top of the pivot arms limits the double hinge action, and prevents the bottom of the flap from folding inside the ring and wedging the gate in the open position.

This gate is made only in spigot back and normally attaches to corrugated steel pipe. The spigot back gate may be embedded in the concrete at the time it is poured; however, a flat back gate anchored and then grouted to the wall is recommended. See "Medium Duty Gates" for this application.

This gate opens under a minimum head differential, yet is positive closing under a few inches of water on the face of the gate. A lifting eye is cast integrally with the flap to permit manual operation.

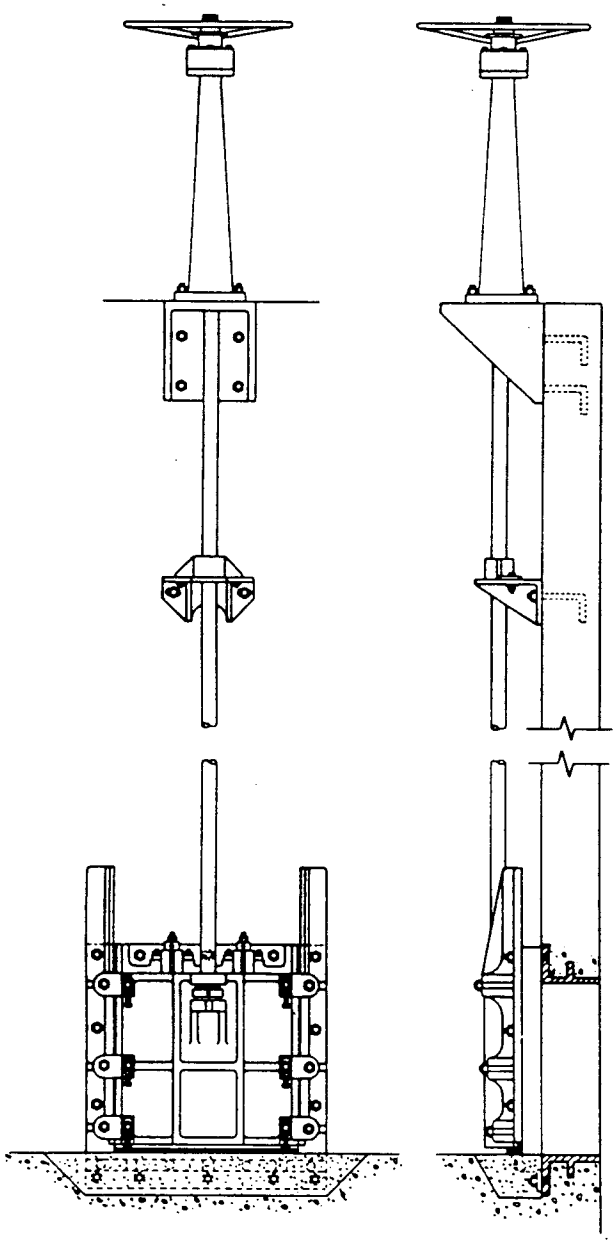


(All Dimensions in Inches)

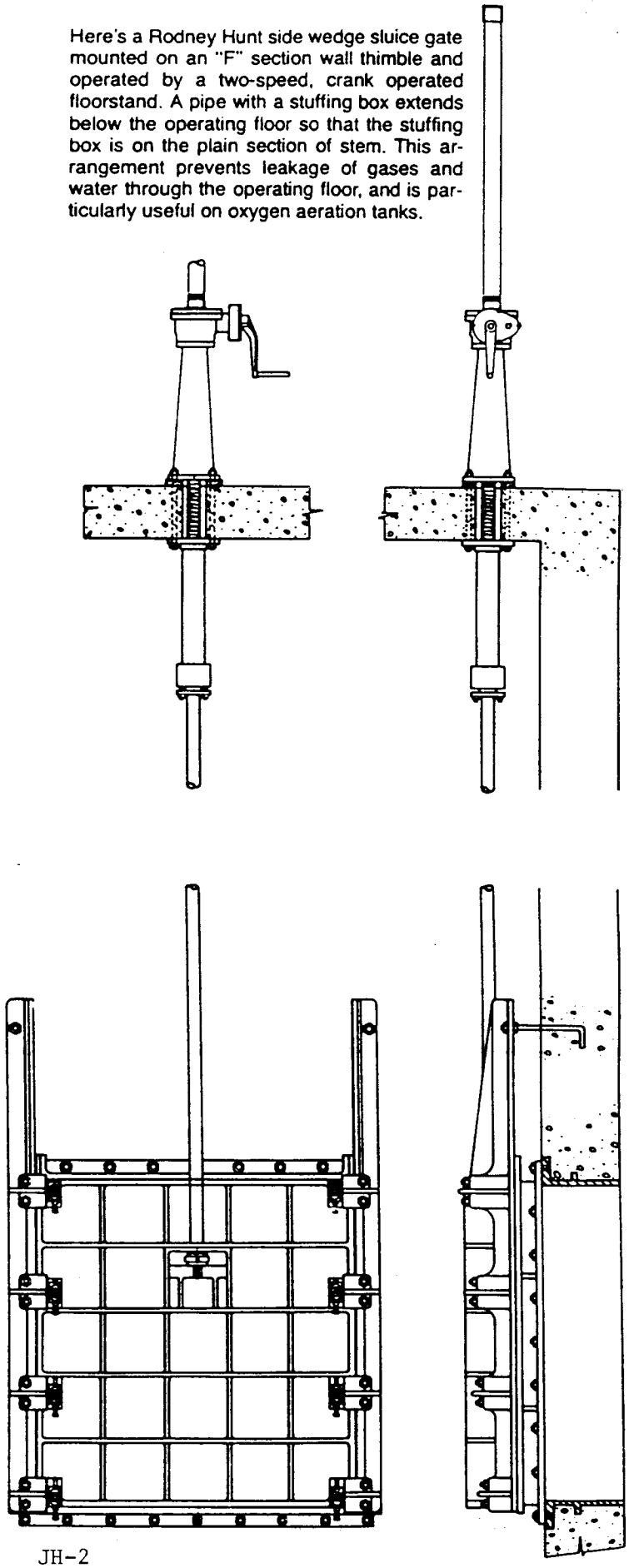
6	8.75	3.75	4.75	7.50
8	10.75	5.00	6.50	10.25
10	12.75	6.25	8.00	12.50
12	15.25	7.25	9.25	15.00
15	18.75	9.00	11.50	18.50
18	21.75	10.50	13.75	22.25
21	24.75	12.25	16.00	26.00
24	27.75	13.75	18.00	29.75
30	34.25	17.00	21.75	36.25
36	41.50	20.50	26.25	43.75
42	47.50	23.50	31.00	51.50
48	54.00	27.00	35.50	58.75

*Maximum width of gate may occur at top or on horizontal center line. "A" dimension is shown for maximum horizontal width of gate.

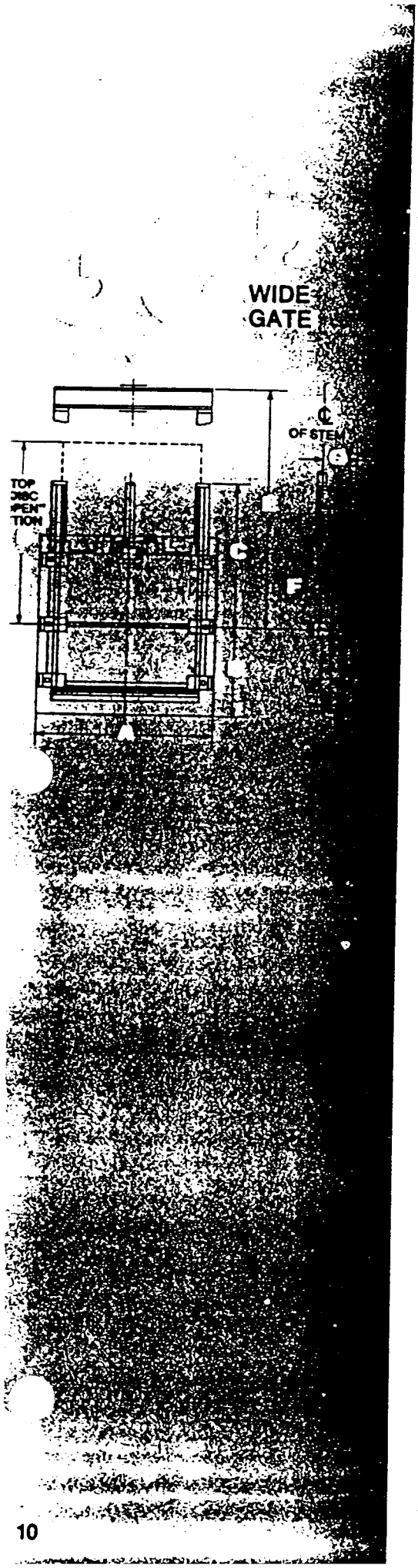
This is a Rodney Hunt sluice gate with flush-bottom closure and side and top wedges. It is mounted on a type "F" wall thimble, the most widely used. Note that the handwheel operated floorstand is mounted on a machined wall bracket. In this situation, a grout pad under the floorstand is not necessary for true alignment.



Here's a Rodney Hunt side wedge sluice gate mounted on an "F" section wall thimble and operated by a two-speed, crank operated floorstand. A pipe with a stuffing box extends below the operating floor so that the stuffing box is on the plain section of stem. This arrangement prevents leakage of gases and water through the operating floor, and is particularly useful on oxygen aeration tanks.



JH-2



The dimensions listed below are the actual dimensions, to the nearest ¼", of the size of gate listed and the head for which that gate is designed. Rodney Hunt will furnish the gate shown in the table for all applications where the head is equal to or less than the design head indicated. In some instances, several gates are listed for the same size but with different design heads. This has been done to enable Rodney Hunt to provide the most economically designed gate for the specific design head application.

SIZE	DESIGN HEAD FT.		DIMENSIONS, INCHES						
WIDTH x HEIGHT INCHES	SEAT	UNSEAT	A	B	C	D	E	F	G
36 x 18	88	40	46	14	20	33	40	8½	6
36 x 24	82	30	46	17	26	42	49	8½	6¼
36 x 30	60	36	46	20	32	51	58¼	9½	6¼
36 x 36	60	30	46	23	38	60	67¾	9½	6¼
36 x 42	76	43	47½	26	44	69	82	9½	6¼
36 x 48	65	30	47½	29	50	78	91	10	6¼
36 x 48	240	95	49½	30¾	51½	81½	93½	15¼	9½
36 x 60	213	84	49½	36¾	63½	99½	111½	16½	9½
36 x 72	244	101	49½	42¾	75½	117½	129½	16½	9½

For 36 inch diameter gates to be mounted on pipe flanges, the dimensions "F" and "G" are increased by 3½ inches.

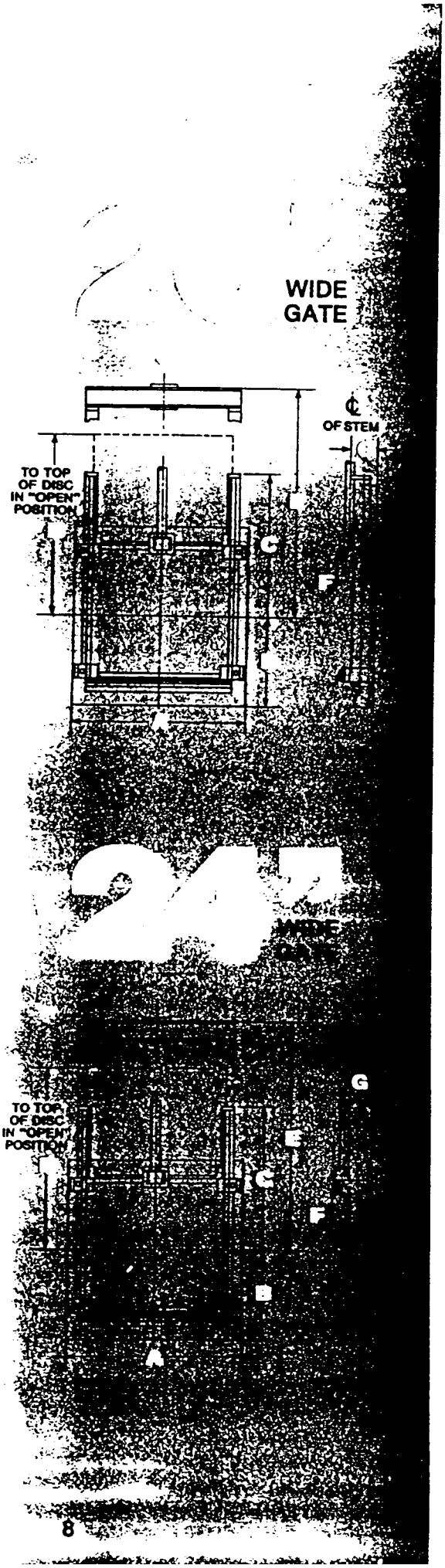
Installation Clearance

All sluice gates listed in the tables can be installed where the installation clearance along each side and along the bottom of the gate is 1". The flange of the gate is drilled so that the attaching studs extend to the front of the gate where they are easily accessible.

Where flange frame gates are required, such as where the gate must be mounted on a circular pipe flange, the recommended installation clearance is 8" on each side and beneath the bottom of the gate.

For flush-bottom closure sluice gates the dimensions for the cut-out required in the concrete floor is shown on Page 3.

For sizes of gates not shown above and for applications where the head required is greater than the design head listed, please contact Rodney Hunt Company for dimensions.



The dimensions listed below are the actual dimensions, to the nearest ¼", of the size of gate listed and the head for which that gate is designed. Rodney Hunt will furnish the gate shown in the table for all applications where the head is equal to or less than the design head indicated. In some instances, several gates are listed for the same size but with different design heads. This has been done to enable Rodney Hunt to provide the most economically designed gate for the specific design head application.

SIZE	DESIGN HEAD FT.		DIMENSIONS, INCHES						
WIDTH x HEIGHT INCHES	SEAT	UNSEAT	A	B	C	D	E	F	G
20 x 20	70	55	30	15	21	35¾	41½	8½	6

For 20 inch diameter gates to be mounted on pipe flanges, the dimensions "F" and "G" are increased by 2½ inches.

Installation Clearance

All sluice gates listed in the tables can be installed where the installation clearance along each side and along the bottom of the gate is 1". The flange of the gate is drilled so that the attaching studs extend to the front of the gate where they are easily accessible.

Where flange frame gates are required, such as where the gate must be mounted on a circular pipe flange, the recommended installation clearance is 8" on each side and beneath the bottom of the gate.

For flush-bottom closure sluice gates the dimensions for the cut-out required in the concrete floor is shown on Page 3.

SIZE	DESIGN HEAD FT.		DIMENSIONS, INCHES						
WIDTH x HEIGHT INCHES	SEAT	UNSEAT	A	B	C	D	E	F	G
24 x 12	54	41	34	11	14	24	31	8½	6
24 x 18	60	55	34	14	20	33	40	8½	6
24 x 24	60	55	34	17	26	42	49	8½	6¼
24 x 30	53	31	34	20	32	51	58¼	9¼	6¼
24 x 36	45	41	34	23	38	60	67¾	9½	6¼
24 x 42	84	47	35½	26	44	69	82	9½	6¼
24 x 48	78	56	35½	29	50	78	91	10	6¼

For 24 inch diameter gates to be mounted on pipe flanges, the dimensions "F" and "G" are increased by 2½ inches.

For sizes of gates not shown above and for applications where the head required is greater than the design head listed, please contact Rodney Hunt Company for dimensions.

Crank-Operated Floor Stands

RODNEY HUNT

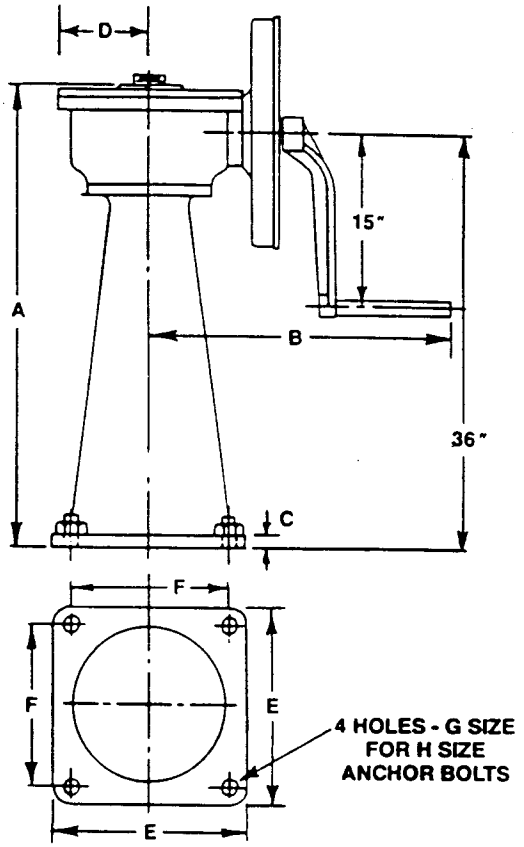
Standard Features

- BRONZE OPERATING NUTS
- TAPERED ROLLER BEARINGS THROUGHOUT
- MECHANICAL SEALS
- PRECISION-CUT GEARS
- WEATHERPROOF HOUSINGS
- CADMIUM PLATED PINION SHAFTS
- LUBRICATION FITTINGS
- SELF-LOCKING AT ANY POSITION OF STEM TRAVEL

Specifications

The geared floor stand shall have a weatherproof, cast-iron housing, with a bronze operating nut, mounted on a high strength pedestal. The operating nut shall be internally threaded with 29° acme threads corresponding to stem threading. Tapered roller bearings shall be located above and below the bronze operating nut to support the out-put thrust of the floor stand. The gearing shall be accurately cut and of proper design to support the load conditions without undue stress. The cadmium plated pinion shaft will be mounted on tapered roller bearings to provide low friction operation and to resist axial and radial thrusts. Mechanical seals shall be provided around the operating nut and the pinion shaft to prevent lubrication from leaving the unit and moisture from entering the sealed housing. The reduction gear case shall be precision machined and equipped with tapered roller or needle bearings and sealed about the reduction shafts. Lubrication fittings shall be provided for all bearings.

Crank operated floor stands will be selected so that no more than a 40 lb. effort on the crank will be required to open or close the sluice gate or slide gate.



Note: 5001, 5002 & 5003 have a 12" long crank.

TABLE OF DIMENSIONS (Inches)

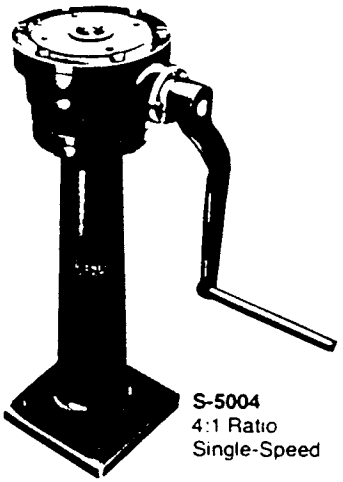
FLOORSTAND MODEL	APPROX. WEIGHT LBS.	A	B	C	D	E	F	G	H
S-5002	150	40	13	1¼	5	10	8	⅞	¾
S-5004	325	40	22	1½	6	12	9	1¼	1⅛
S-5001	175	40	15	1¼	5	10	8	⅞	¾
S-5003	175	40	15	1¼	5	10	8	⅞	¾
S-5012	380	40	25	1½	6	12	9	1¼	1⅛
S-5020	405	40	25	1½	6	12	9	1¼	1⅛
S-5036	780	40	28	1⅞	9	17	14	1⅜	1¼
S-5054	830	40	28	1⅞	9	17	14	1⅜	1¼

CRANK TURNS REQUIRED TO MOVE GATE 1 FOOT

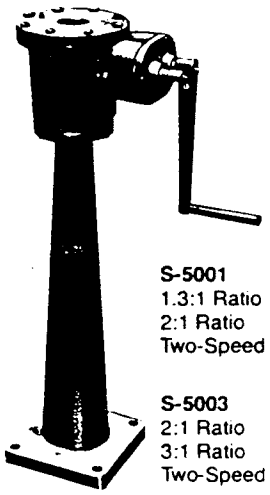
FLOORSTAND MODEL	INPUT SHAFT SPEED	NUMBER OF THREADS PER INCH 4	3½	3	2½	2
S-5002	Single	96	84	72		
S-5004	Single		168	144	120	
S-5001	High	64	56	48		
	Low	96	84	72		
S-5003	High	96	84	72		
	Low	144	126	108		
S-5012	High			144	120	
	Low			472	394	
S-5020	High			144	120	
	Low			720	600	
S-5036	High			240	200	160
	Low			1,200	1,000	800
S-5054	High			240	200	160
	Low			2,100	1,750	1,400

Crank operated floor stands are available to a ratio of 160 to 1 and a capacity of 104,000 lbs.

S-5002
2:1 Ratio
Single-Speed

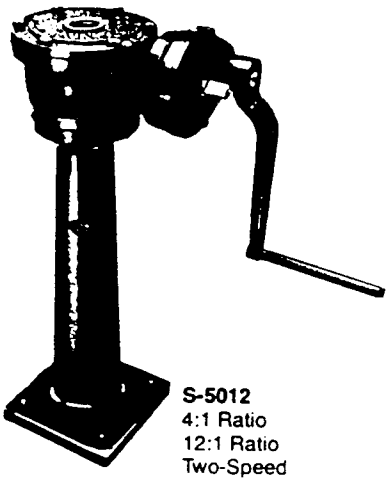


S-5004
4:1 Ratio
Single-Speed

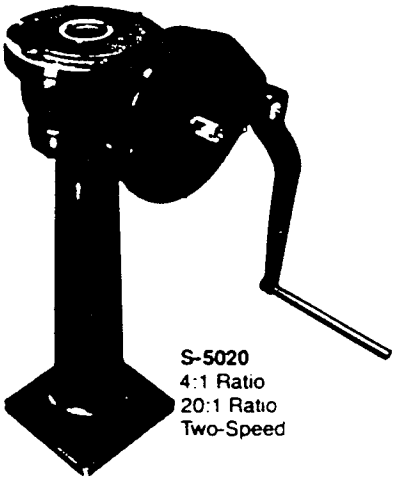


S-5001
1.3:1 Ratio
2:1 Ratio
Two-Speed

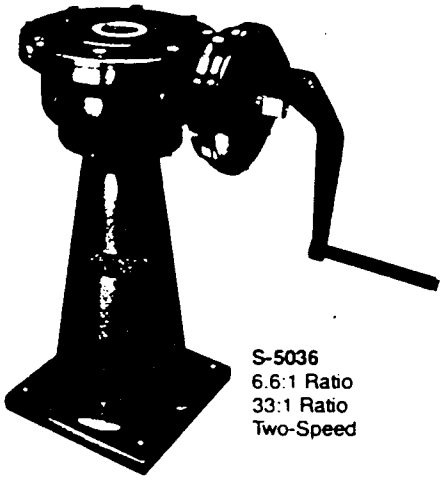
S-5003
2:1 Ratio
3:1 Ratio
Two-Speed



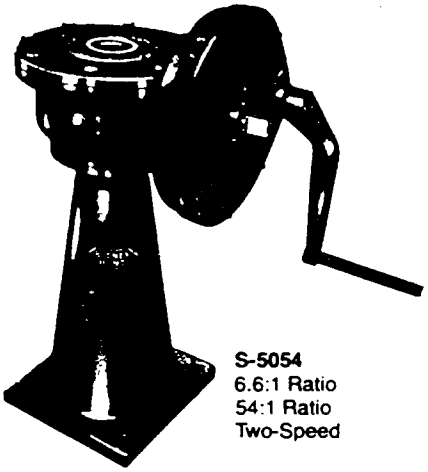
S-5012
4:1 Ratio
12:1 Ratio
Two-Speed



S-5020
4:1 Ratio
20:1 Ratio
Two-Speed



S-5036
6.6:1 Ratio
33:1 Ratio
Two-Speed



S-5054
6.6:1 Ratio
54:1 Ratio
Two-Speed

OUTPUT WITH 40 LB. EFFORT ON CRANK (Pounds)

STEM DIA.	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4
NO. THRDS PER INCH	4	3½	3½	3	3	3	2½	2½	2	2	2	2
S-5002	6,000	5,110	4,480	3,920								
S-5004			10,100	8,830	7,900	7,300	6,620	6,140	5,670			
S-5001	5,410	4,590	4,030	3,530								
S-5003	8,120	6,890	6,040	5,300								
S-5012				28,900	25,800	23,800	21,600	20,100	18,200			
S-5020					39,500	36,400	33,100	30,700	27,800			
S-5036						57,800	52,000	48,300	43,800	41,100	38,900	36,900
S-5054							85,300	79,300	72,000	68,200	63,900	60,500

ATTACHMENT I

OPERATIONS AND MAINTENANCE

ATTACHMENT I

OPERATIONS AND MAINTENANCE

Table of Contents

Section	Page
General Procedures	JI-1
Specific Maintenance and Operations	JI-1

OPERATIONS AND MAINTENANCE

I. GENERAL PROCEDURES.

A. Section 208.10, Title 33, of the Code of Federal Regulations contains regulations for the operation and maintenance of local flood-protection works approved by the Secretary of the Army in accordance with authorities contained in Section 3 of the Flood Control Act of 22 June 1936, as amended and supplemented (a copy of Section 208.10 is included).

B. The following general regulations are prescribed to govern the maintenance of the Passaic 10 Levee Project:

1. The levee shall be maintained continuously in such a manner as to obtain maximum flood-protection benefits.

2. A permanent committee, consisting of or headed by an official, hereinafter called the "Superintendent," shall be responsible for the continuing maintenance of the project.

3. No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protection facilities.

4. No improvement shall be passed over, under, or through the levee, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in the feature of the works, that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facility. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice.

5. It shall be the duty of the Superintendent to submit a semiannual report to the District Engineer covering the inspection and maintenance of the project. The report should cover such items as the number of inspections made, the condition of the levee maintenance needed, and maintenance work done since the last report.

II. SPECIFIC MAINTENANCE AND OPERATIONS INSTRUCTIONS.

A. Maintenance. The Superintendent shall provide such maintenance as may be required to insure the serviceability of the levee protection, floodwall, drainage structures, and pumping

plants during times of flood. Measures shall be taken to repair damage caused by erosion and above-normal floods, and to promote growth of the vegetative cover above the slope protection. Periodic inspections of the levee, floodwall, drainage structures, and pumping plants shall be made by the Superintendent to ascertain whether or not:

1. Any unusual movement, sloughing, or material displacement of the levee has occurred;

2. Any erosion has occurred in the open grassed areas within the project right-of-way;

3. A satisfactory stand of grass is maintained along the levee top and side slopes.

4. Levee dimensions, grade, and alignment are being maintained according to the plans.

5. Encroachments are not being made within the project rights-of-way which might hinder the efficiency of the levee protection and floodwall.

6. Rip rap sections are in good conditions.

7. No seepage, saturated areas, or sand boils are occurring around the levee, floodwall, drainage structures, and pumping plants.

8. No undue settlement has occurred which affects the stability of the floodwall or its water tightness;

9. The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the floodwall or its water tightness.

10. Pipe, gates, operating mechanism, riprap, and headwalls are in good condition.

11. Inlet and outlet channels are open.

12. All equipment, including motors and pumps shall be trial operated and checked.

Such inspections shall be made at intervals not to exceed 90 days and also periods following heavy rainfall which produce above-normal floods. Following the inspection, the Superintendent shall take immediate steps to:

1. Repair eroded grassed area within the project right-of-way limits by filling, grading, shaping, and reseeding as necessary to restore and stabilize the levee;

2. Repair damaged rip rap sections replacing stone that has been disturbed or dislodged.

3. Repair and/or replace damaged gates and operating mechanisms as necessary.

4. Repair and/or replaced damaged equipment as necessary.

5. Remove trash and debris adjacent to floodwall, drainage structures, and pumping plants intake.

B. Operations.

1. During flood periods, the levee should be monitored closely for erosion damages, bank sloughing, damages to vegetation, and stone protection displacement. Upon inspection, corrective measures should be taken to repair all damaged areas immediately after each high water period.

2. Continuous patrol of the floodwall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Immediate steps shall be taken to correct any condition which endangers the stability of the floodwall.

3. Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Manually operated gates shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

4. Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased.

TITLE 33 - NAVIGATION AND NAVIGABLE WATERS

CHAPTER II - CORPS OF ENGINEERS

PART 208 - FLOOD CONTROL REGULATIONS

208.10 Local flood protection works; maintenance and operations of structures and facilities.

(a) General.

(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of the Army, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood, emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army or his authorized representative that such improvement, excavation,

construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvement or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the Superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The Department of the Army will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under this part.

(b) Levees - (1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might effect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working conditions, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger that structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) Flood walls - (1) Maintenance. Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working conditions, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) Operation. Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) Drainage structures - (1) Maintenance. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) Operation. Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) Closure structures - (1) Maintenance. Closure structures for traffic openings shall be inspected by the Superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order;

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once

each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) Operation. Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up closure structures or to discharge passengers or cargo over them.

(f) Pumping plants - (1) Maintenance. Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and

repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) Operation. Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) Channels and floodways - (1) Maintenance. Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days.

Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on banks slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) Operation. Both banks of the channel of the flood season during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) Miscellaneous facilities - (1) Maintenance. Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) Operation. Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor.

(Sec. 3, 49 Stat. 1571, Flood Control Act of 22 June 1936, as amended; 33 U.S.C. 701c).

ATTACHMENT J

HTRW INVESTIGATION

ATTACHMENT J

HTRW INVESTIGATIONS

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HTRW INVESTIGATION

Investigation Results

A. Field Investigation

One soil boring was completed to a depth of 16 feet in the old leaf dump at the Passaic Levee No. 10 location. Organic soil with vegetative remains was encountered to a depth of 1.5 feet. The stratigraphy beneath the organic fill material consisted of mixed sand, silt, and clay to 5 feet; silty, fine-grained sand to 7 feet; saturated, medium- to coarse-grained sand to approximately 11.5 feet; and clay with some silt and trace sand to the bottom of the borehole.

Soil samples for chemical analysis were collected from the soil boring at depths of 4 to 6 feet and 12 to 14 feet. The samples were analyzed for VOCs; SVOCs; pesticides/PCBs; herbicides; metals; chromium VI; cyanide; TPH; 2,3,7,8-TCDD; and gross and . The deeper sample in the soil boring was not analyzed for herbicides or 2,3,7,8-TCDD. The locations of the soil boring and the surface soil samples are depicted in Figure IV-17A. Detected compounds and applicable screening criteria are presented in Table IV-E-4-1.

Several metals and a few organics were detected in the borehole soil samples. Gross and were not detected at levels significantly above background. Cyanide, chromium VI, TPH, and 2,3,7,8-TCDD were not detected in the samples.

In addition to the borehole soil samples, eight surface soil samples were collected from the wing areas of the levee footprint: four samples were collected in a former sludge disposal area near the WWTP and four samples were collected near the old railroad ties dump. Several metals were detected in the surface soil samples. The reported concentrations of beryllium and cadmium in soil samples PL2-S-HA3 and PL2-S-HA4, collected near the WWTP, slightly exceed the NJDEP Residential Soil Cleanup Criteria. According to NJDEP guidance in NJAC 7:26D-3.3, the soil concentrations at a site can be averaged for compliance if: 1) no single sample exceeds the applicable criterion by a factor of more than five for a standard between 10 and 101 ppm and 2) no more than 10 percent of the samples exceed the criteria. This averaging rule cannot be applied for beryllium and cadmium at thesite because the second guideline has not been achieved (i.e.,

2 of 8 samples exceeded criteria). Therefore, the soils near the WWTP are evaluated as nonhazardous contaminated soil and must be handled as such.

B. Environmental Records Search

One Priority C HTRW site, DMI/Paper Mart, was identified in the ERS (Figure IV-17). The site is not anticipated to impact on construction of this levee feature. Summaries of findings are presented in Tables IV-E-4-2 and IV-E-4-3.

DMI/Paper Mart, a distributor of printing papers, maintains a print shop and vehicle maintenance garage. The site is within the 300 foot buffer zone surrounding the proposed levee. Low quality (1985) HTRW data for DMI/Paper Mart indicated elevated levels of benzene and TPH in both soil and groundwater. More current analytical data or regulatory status of the site was not available through the ERS. DMI/Paper Mart is not listed in the NJDEP Site Remediation Program July 1994 *Known Contaminated Sites in New Jersey* report.

The field investigation at Passaic Levee No. 10 detected low levels of several metals and persistent pesticides in surficial and deep soil. With the exception of beryllium (2.1 mg/kg) and cadmium, none of the other identified HTRW contaminant concentrations were above residential soil cleanup criteria. The field investigation provides evidence that soil HTRW contaminants within the footprint of the feature is considered to be nonhazardous contaminated soil based on the slightly elevated levels of beryllium and cadmium.

Recommendations for Additional HTRW Investigations

Additional soil investigations are not recommended for this feature. However, if groundwater is encountered, dewatering of any excavation may be required. HTRW characteristics of the water are not known and limited shallow groundwater sampling and analysis is recommended to determine if groundwater contamination exists.

Potential Impacts of HTRW

A. Impact of HTRW on Feature Construction and Operation

Occupational exposure to surficial soil at the feature location would pose negligible cancer risk and non-cancer health hazards. The soil concentrations of beryllium and cadmium detected at Levee No. 10 do not pose occupational health concerns

through dermal contact to such soil.

B. Impact of Feature Construction on HTRW

The potential for HTRW mobilization due to the construction activities to be carried out at the Passaic Levee No. 10 is expected to be very low. The primary activity is the removal of six inches of soil from the surface where the levee is to be constructed. Previous investigations indicate there is only slight beryllium and cadmium contamination of surface soil. There is little indication that excavation of the surface soils at this site will increase mobilization of HTRW. Confirmatory analysis of the soils where the metals exceeded the soil cleanup criteria will be carried out to demonstrate that they do not exceed TCLP parameters and may be reused on site as fill material for the levee.

One section of the levee will pass through an area which has been used as a leaf dump. The organic material here is up to 7 feet deep and will need to be removed prior to installation of the levee. Once the leaves have been removed, the depression will be backfilled with acceptable fill material. Groundwater at the site is present at greater than 7 feet below ground level, so it will probably not be encountered during excavation. If it is encountered, however, dewatering of the excavation may be required. As the HTRW characteristics of the water are not known, the potential for contamination exists. If the water removed from the excavation has parameters which exceed discharge limits, appropriate treatment measures will be implemented.

HTRW Response Alternatives

Sampling and analysis for TCLP of excavated soil where metals exceed the soil cleanup criteria will be required. If analysis of excavated soils demonstrates contamination above TCLP levels, transportation and disposal offsite would be required. While the concentrations of certain contaminants may be above residential standards, they are expected to be substantially below TCLP levels. Therefore, it is expected that excavated soils will be reused on site for levee construction.

Excavated soils will be stockpiled on site until analytical results indicate whether they are acceptable for reuse or must be removed from the site for disposal.

Zone control would be implemented to limit impact of the surrounding sites on the health and safety of workers. Dust control measures would, also, be implemented to minimize generation of airborne particulates.

Worker health and safety concerns would be addressed and, while the lowest level of protection is expected to be necessary, they would include such elements as PPE appropriate for the conditions.

Cost Estimates

Soil: Will require sampling and analysis. The soils are expected to be reused on site with no associated HTRW costs. However, if analysis indicates that they exceed TCLP levels, they will require special handling (e.g., containerizing), transportation and disposal.

Groundwater: Groundwater is not expected to be encountered during excavation. Therefore, no HTRW costs are associated with it during construction (Table IV-E-4-4).

Table IV-E-4-1
Comparison of Field Investigation Analytical Results to Screening Criteria
Passaic Levee No. 10

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
PL1-S-SB1-04					
Antimony	1100 B	340000	14000		
Arsenic	1400	20000	20000		
Barium	28800	47000000	700000		
Copper	13200	600000	600000		
Gross Alpha	3.8				50
Gross Beta	30				60
Lead	6500	600000	100000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	9800	2400000	250000		
Vanadium	28600	7100000	370000		
Zinc	23600	1500000	1500000		
PL1-S-SB1-12					
Acetone	41	1000000	1000000	100000	
Antimony	1100 B	340000	14000		
Arsenic	3600	20000	20000		
Barium	68800	47000000	700000		
Copper	24300	600000	600000		
Gross Alpha	6.4				50
Gross Beta	44				60
Lead	10500	600000	100000		
Methylene chloride	1 BJ	210000	49000	1000	
Nickel	20700	2400000	250000		
Vanadium	40300	7100000	370000		
Zinc	46100	1500000	1500000		
PL2-S-HA01					
4,4prime-DDE	11	9000	2000	50000	
4,4prime-DDT	5.6	9000	2000	500000	
Antimony	1200 B	340000	14000		
Arsenic	1700	20000	20000		
Barium	76600	47000000	700000		

All units are in ppb

1

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
Beryllium	640	1000	1000		
Bis(2-ethylhexyl) phthalate	440	210000	49000	100000	
Cadmium	870	100000	1000		
Copper	9300	600000	600000		
Gross Alpha	9.7				50
Gross Beta	29				60
Lead	26400	600000	100000		
Mercury	120	270000	14000		
Nickel	9600	2400000	250000		
Selenium	590 B	3100000	63000		
Vanadium	39400	7100000	370000		
Zinc	43700	1500000	1500000		
PL2-S-HA02					
4,4prime-DDE	26	9000	2000	50000	
4,4prime-DDT	8	9000	2000	500000	
Antimony	1100 B	340000	14000		
Arsenic	1600	20000	20000		
Barium	66800	47000000	700000		
Beryllium	690	1000	1000		
Bis(2-ethylhexyl) phthalate	1100	210000	49000	100000	
Cadmium	740	100000	1000		
Copper	10500	600000	600000		
Gross Alpha	9.1				50
Gross Beta	29				60
Lead	33900	600000	100000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	12000	2400000	250000		
Selenium	550 B	3100000	63000		
Vanadium	35900	7100000	370000		
Zinc	34900	1500000	1500000		
PL2-S-HA03					
4,4prime-DDD	30	12000	3000	50000	
4,4prime-DDE	260	9000	2000	50000	
4,4prime-DDT	290	9000	2000	500000	
Antimony	1600 B	340000	14000		

All units are in ppb

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
Arsenic	4100	20000	20000		
Barium	133000	47000000	700000		
Beryllium	1300	1000	1000		
Bis(2-ethylhexyl) phthalate	1700	210000	49000	100000	
Cadmium	1300	100000	1000		
Copper	54200	600000	600000		
Gross Alpha	4.6				50
Gross Beta	31				60
Lead	47600	600000	100000		
Mercury	300	270000	14000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	26800	2400000	250000		
Selenium	1100 B	3100000	63000		
Vanadium	52200	7100000	370000		
Zinc	69900	1500000	1500000		
PL2-S-HA04					
4,4prime-DDE	17	9000	2000	50000	
4,4prime-DDT	10	9000	2000	500000	
Acetone	28	1000000	1000000	100000	
Antimony	1900 B	340000	14000		
Arsenic	3100	20000	20000		
Barium	164000	47000000	700000		
Beryllium	2100	1000	1000		
Cadmium	1700	100000	1000		
Copper	56200	600000	600000		
Gross Alpha	20				50
Gross Beta	34				60
Lead	27500	600000	100000		
Mercury	360	270000	14000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	23500	2400000	250000		
Selenium	1600 B	3100000	63000		
Vanadium	60500	7100000	370000		
Zinc	69500	1500000	1500000		
PL3-S-HA05					

All units are in ppb

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
4,4prime-DDE	29	9000	2000	50000	
4,4prime-DDT	15	9000	2000	500000	
Antimony	1100 B	340000	14000		
Arsenic	4200	20000	20000		
Barium	74900	47000000	700000		
Cadmium	790	100000	1000		
Copper	16600	600000	600000		
Gross Alpha	7				50
Gross Beta	37				60
Lead	32700	600000	100000		
Mercury	230	270000	14000		
Nickel	13300	2400000	250000		
Selenium	570 B	3100000	63000		
Vanadium	51500	7100000	370000		
Zinc	70300	1500000	1500000		
PL3-S-HA06					
1,1,1,2-Tetrachloroethane	4 J	310000	170000	1000	
1,1,2-Trichloroethane	1 J	420000	22000	1000	
1,1-Dichloroethene	2 J	150000	8000	10000	
4,4prime-DDE	85	9000	2000	50000	
4,4prime-DDT	30	9000	2000	500000	
Acetone	18	1000000	1000000	100000	
Acrylonitrile	2 J	5000	1000	1000	
Antimony	1200 B	340000	14000		
Arsenic	3600	20000	20000		
Barium	70600	47000000	700000		
Benzene	5 J	13000	3000	1000	
Bromodichloromethane	2 J	46000	11000	1000	
Cadmium	750	100000	1000		
Chlorobenzene	9	680000	37000	1000	
Chlorodibromomethane	1 J	1000000	110000	1000	
Chloroform	6 J	28000	19000	1000	
Copper	16300	600000	600000		
Ethylbenzene	4 J	1000000	1000000	100000	
Gross Alpha	13				50

All units are in ppb

4

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
Gross Beta	42				60
Lead	40100	600000	100000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	13600	2400000	250000		
Selenium	620 B	3100000	63000		
Styrene	2 J	97000	23000	100000	
Tetrachloroethylene	6 J	6000	4000	1000	
Toluene	5 J	1000000	1000000	500000	
Trichloroethene	2 J	54000	23000	1000	
Vanadium	55100	7100000	370000		
Xylenes (total)	4 J	1000000	410000	10000	
Zinc	51700	1500000	1500000		
PL3-S-HA07					
4,4prime-DDE	73	9000	2000	50000	
4,4prime-DDT	32	9000	2000	500000	
Acetone	21	1000000	1000000	100000	
Antimony	1200 B	340000	14000		
Arsenic	3900	20000	20000		
Barium	49600	47000000	700000		
Cadmium	620	100000	1000		
Chloroform	2 J	28000	19000	1000	
Copper	15800	600000	600000		
Gross Alpha	9.1				50
Gross Beta	37				60
Lead	49500	600000	100000		
Mercury	140	270000	14000		
Methylene chloride	1 BJ	210000	49000	1000	
Nickel	10500	2400000	250000		
Selenium	610 B	3100000	63000		
Vanadium	47500	7100000	370000		
Zinc	47700	1500000	1500000		
PL3-S-HA08					
4,4prime-DDE	43	9000	2000	50000	
4,4prime-DDT	16	9000	2000	500000	
Antimony	1100 B	340000	14000		

All units are in ppb

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
Arsenic	2200	20000	20000		
Barium	29000	47000000	700000		
Chloroform	2 J	28000	19000	1000	
Copper	8700	600000	600000		
Gross Alpha	3.8				50
Gross Beta	30				60
Lead	23400	600000	100000		
Methylene chloride	1 BJ	210000	49000	1000	
Nickel	7000	2400000	250000		
Selenium	530 B	3100000	63000		
Vanadium	38900	7100000	370000		
Zinc	26800	1500000	1500000		

All units are in ppb

Key to Criteria Cited in Field Investigation and Historical Data Tables

Criteria	Description
Freshwater (a)	USEPA Surface Water Criteria (Acute), November 1991
Freshwater (c)	USEPA Surface Water Criteria (Chronic), November 1991
FW-2 Effluent Daily Max.	NJDEP Soil Cleanup Criteria, February 3, 1994
FW-2 Effluent Monthly Avg	NJDEP Soil Cleanup Criteria, February 3, 1994
FW2-NT (a)	NJDEP Surface Water Criteria, (Acute), November 1991.
FW2-NT (c)	NJDEP Surface Water Criteria, (Chronic), November 1991.
FW2-NT (hc)	NJDEP Surface Water Criteria, (Human Carcinogenic), November 1991.
Haz Waste Classification	NJDEP Guidance Document for Remediation of Contaminated Soils, June 1994.
Non Res Soil	NJDEP Soil Cleanup Criteria, February 3, 1994
Res Soil	NJDEP Soil Cleanup Criteria, February 3, 1994
SE (a)	NJDEP Surface Water Quality Standards (Acute), April 1994.
SE (c)	NJDEP Surface Water Quality Standards (Chronic), April 1994.
SE (h)	NJDEP Surface Water Quality Standards (Human Health), April 1994.
SE (hc)	NJDEP Surface Water Quality Standards (Human Carcinogenic), April 1994.
SE Effluent Daily Max.	NJDEP Guidance Document for Remediation of Contaminated Soils, June 1994.
SE Effluent Monthly Avg	NJDEP Guidance Document for Remediation of Contaminated Soils, June 1994.
Soil Impact to GW	NJDEP Soil Cleanup Criteria, February 3, 1994
Soil Misc	Miscellaneous Soil Criteria (Used to produce Gross Alpha, Gross Beta, and 2,3,7,8-TCDD reports)
Water Misc	Miscellaneous Water Criteria (Used to produce Gross Alpha, Gross Beta, and 2,3,7,8-TCDD reports)

Table IV - E - 4 - 2

INVESTIGATION AND RESPONSE SUMMARY
PASSAIC LEVEE 10

Passaic River Local Flood Protection Project

FEATURE NAME	SITE NAME	ERS	FI	CONSTITUENT OF CONCERN	SELECTED RESPONSE	COST	WORKER H&S CONCERN
Passaic Levee 10				Inorganics	Field Investigation, Mitigation	$44,000	Low
	Passaic Levee 10 Field Investigation	Yes	Yes				
	DMI / Paper Mart	Yes	No				

Table IV - E - 4 - 3

LIST OF HTRW SITES
PASSAIC LEVEE 10

Passaic River Local Flood Protection Project

SITE NAME	RANK	REASONS FOR DELETION	ADDRESS	TOWNSHIP	AGENCY ID	DESIGNATION	SOURCE
Passaic Levee 10 Field Investigation	A		Dorsa Ave.	Livingston	-	-	IT
DMI / Paper Mart	C		120 Dorsa Ave.	Livingston	-	ISRA	D&M, IT

Notes :

Criteria and Rationale Used to Delete Priority E HTRW Sites :

1. The site is not within the tunnel alignment database corridor search or within 300 feet of a levee feature if outside the corridor.
2. The site has been recommended "No Further Action" by the USEPA or NJDEP.
3. HTRW contaminant concentrations are less than the proposed New Jersey non-residential soil cleanup criteria.
4. The identified petroleum product spill or leak was less than 100 gallons and does not impact groundwater.
5. The site-related HTRW contaminants are limited to metals with no impact to groundwater and the site is not within 500 feet of a workshaft.
6. The site is a listed SPL Hudson County Chromate site and HTRW contaminants are limited only to the chromate ore slag fill on the property.
7. The NPL/SPL site is a secured radioactive materials storage facility with no soil or groundwater HTRW contamination.
8. The site is located on the east bank of the Hackensack River.
9. The site is only identified as a RCRA small or large quantity generator of hazardous waste materials.

HTRW SITE INFORMATION
Passaic River Local Flood Protection Project

1. Name :	Passaic Levee 10 Field Investigation	**5. Rank :**	A
2. Address :	Dorsa Ave.	**6. Facility ID Number :**	-
3. Town/Township :	Livingston	**7. Designation :**	-
4. Feature :	Passaic Levee 10	**8. Source :**	IT

9. Site Description and History :
Passaic Levee No. 10 lies in the northwestern portion of Livingston Township, NJ. The site lies between the Passaic River to the north and west, the Eisenhower Parkway to the east, and surrounds an industrial park at Dorsa Avenue, Naylon Place, and Naylon

10. Physical and Geologic Description of the Site :
The Passaic Levee 10 site is underlain by at least 15 feet of unconsolidated deposits cocsisting of glacial till and stratified drift deposits. Groundwater occurs approximately 7 feet beneath the land surface. The depth to bedrock is unknown.

11. Quality of Information Reviewed :

MEDIA	SCORE	COMMENT
Soil	16	MEDIUM - Available analytical data indicate HTRW present in soils.
Groundwater	0	LOW - Available analytical data is limited and not sufficient to assess if site-related HTRW has impacted groundwater.

12. Occupational Risk and Hazard Analysis :

MEDIA	TOTAL RISK	TOTAL HAZARD
Surficial Soil	6.49E-08	5.73E-03
Deep Soil	2.20E-08	6.67E-03
Shallow Groundwater	NA	NA
Deep Groundwater	NA	NA

13. HTRW Constituents of Concern :

Free Product : NA
Product Thickness*(ft)* : NA
Depth to Groundwater*(ft)* : NA

MEDIA	CONSTITUENT	CAS No.	MAX CONC.	UNIT	SAMPLING DATE	REPORTED DATE
Deep Soil	Acetone	67-64-1	41.00	µg/kg	06/06/94	
Deep Soil	Arsenic	7440-38-2	3,600.00	µg/kg	06/06/94	
Deep Soil	Barium	7440-39-3	68,800.00	µg/kg	06/06/94	
Deep Soil	Chromium	18540-29-9	22,600.00	µg/kg	06/06/94	
Deep Soil	Cobalt	7440-48-4	11,000.00	µg/kg	06/06/94	
Deep Soil	Copper	7440-50-8	24,300.00	µg/kg	06/06/94	
Deep Soil	Lead	7439-92-1	10,500.00	µg/kg	06/06/94	
Deep Soil	Manganese	7439-96-5	556,000.00	µg/kg	06/06/94	
Deep Soil	Nickel	7440-02-0	20,700.00	µg/kg	06/06/94	
Deep Soil	Vanadium	7440-62-2	40,300.00	µg/kg	06/06/94	
Deep Soil	Zinc	7440-66-6	46,100.00	µg/kg	06/06/94	
Surficial Soil	Acetone	67-64-1	28.00	µg/kg	06/06/94	
Surficial Soil	Arsenic	7440-38-2	4,200.00	µg/kg	06/06/94	
Surficial Soil	Barium	7440-39-3	164,000.00	µg/kg	06/06/94	
Surficial Soil	Beryllium	7440-41-7	2,100.00	µg/kg	06/06/94	
Surficial Soil	Bis(2-ethylhexyl)Phthalate (DEHP)	117-81-7	1,700.00	µg/kg	06/06/94	
Surficial Soil	Cadmium	7440-43-9	1,700.00	µg/kg	06/06/94	
Surficial Soil	Chlorobenzene	108-90-7	9.00	µg/kg	06/06/94	
Surficial Soil	Chromium	18540-29-9	45,900.00	µg/kg	06/06/94	
Surficial Soil	Cobalt	7440-48-4	8,400.00	µg/kg	06/06/94	
Surficial Soil	Copper	7440-50-8	56,200.00	µg/kg	06/06/94	
Surficial Soil	DDD	72-54-8	30.00	µg/kg	06/06/94	
Surficial Soil	DDE	72-55-9	260.00	µg/kg	06/06/94	
Surficial Soil	DDT	50-29-3	290.00	µg/kg	06/06/94	
Surficial Soil	Dinoseb	88-85-7	7.60	µg/kg	06/06/94	
Surficial Soil	Lead	7439-92-1	49,500.00	µg/kg	06/06/94	
Surficial Soil	Manganese	7439-96-5	341,000.00	µg/kg	06/06/94	
Surficial Soil	Mercury	7439-97-6	360.00	µg/kg	06/06/94	
Surficial Soil	Nickel	7440-02-0	26,800.00	µg/kg	06/06/94	
Surficial Soil	Vanadium	7440-62-2	60,500.00	µg/kg	06/06/94	
Surficial Soil	Zinc	7440-66-6	70,300.00	µg/kg	06/06/94	

HTRW SITE INFORMATION
Passaic River Local Flood Protection Project

1. Name :	DMI / Paper Mart	**5. Rank :**	C
2. Address :	120 Dorsa Ave.	**6. Facility ID Number :**	-
3. Town/Township :	Livingston	**7. Designation :**	ISRA
4. Feature :	Passaic Levee 10	**8. Source :**	D&M, IT

9. Site Description and History :
The site is a distributor of writing and printing papers and maintained a print shop and maint vehicle garage. In 1985 UST integrity was tested, and found the gasoline tank to leak. The facility is currently designing a groundwater recovery system due to elevated levels of contamination.

10. Physical and Geologic Description of the Site :
NA

11. Quality of Information Reviewed :

MEDIA	SCORE	COMMENT
Soil	7	LOW - Available analytical data is not sufficient to characterize the type and extent of HTRW in soil.
Groundwater	7	LOW - Available analytical data is limited and not sufficient to assess if site-related HTRW has impacted groundwater.

12. Occupational Risk and Hazard Analysis :

MEDIA	TOTAL RISK	TOTAL HAZARD
Surficial Soil	NA	NA
Deep Soil	NA	NA
Shallow Groundwater	2.87E-05	NA
Deep Groundwater	NA	NA

13. HTRW Constituents of Concern :

Free Product : NA
Product Thickness*(ft)* : NA
Depth to Groundwater*(ft)* : NA

MEDIA	CONSTITUENT	CAS No.	MAX CONC.	UNIT	SAMPLING DATE	REPORTED DATE
Shallow Groundwater	Benzene	71-43-2	6,750.00	µg/L	1985	
Shallow Groundwater	TPH	TPH	6,100,000.00	µg/L	1985	
Surficial Soil	TPH	TPH	3,100,000.00	µg/kg	1985	

TABLE IV-E-4-4
ESTIMATES OF HTRW IMPACTS ON FEATURE CONSTRUCTION COSTS
PASSAIC RIVER LOCAL FLOOD PROTECTION PROJECT

PASSAIC LEVEE 10

DESCRIPTION	NO. UNITS	UNIT MEAS.	UNIT PRICE($)	TOTAL
CONSTRUCTION COSTS:				
1. LEVEES AREAS:				
A. SOIL-CONFIRMATION TCLP ANALYT. (1 COMPOSITE SAMPLE/500 C.Y.)	17	EA.	$1,500	$25,500
TOTAL DIRECT COST				$25,500
20% CONTINGENCIES				$5,100
TOTAL COSTS:				$30,600
INVESTIGATION COSTS:				
1. LEVEES AREAS:				
A. GW-WELL AND SAMPLING INSTALLATION,SAMPLING,ANALYTICAL, AND REPORT		L.S.		$11,500
TOTAL DIRECT COST				$11,500
20% CONTINGENCIES				$2,300
TOTAL COSTS:				$13,800

NOTES: 1. TOP 6" OF SOILS REMOVED FROM LEVEE FOOTPRINT AREA, PLUS SOILS FROM LEAF DUMP
2. BASED ON RESULTS OF INVESTIGATIONS ADDITIONAL REMEDIATION MAY BE REQUIRED
3. IF TCLP FAILS THAN SOIL REMEDIATION IS REQUIRED

EXTERIOR STAGE

PASSAIC RIVER
P261880

PASSIC10

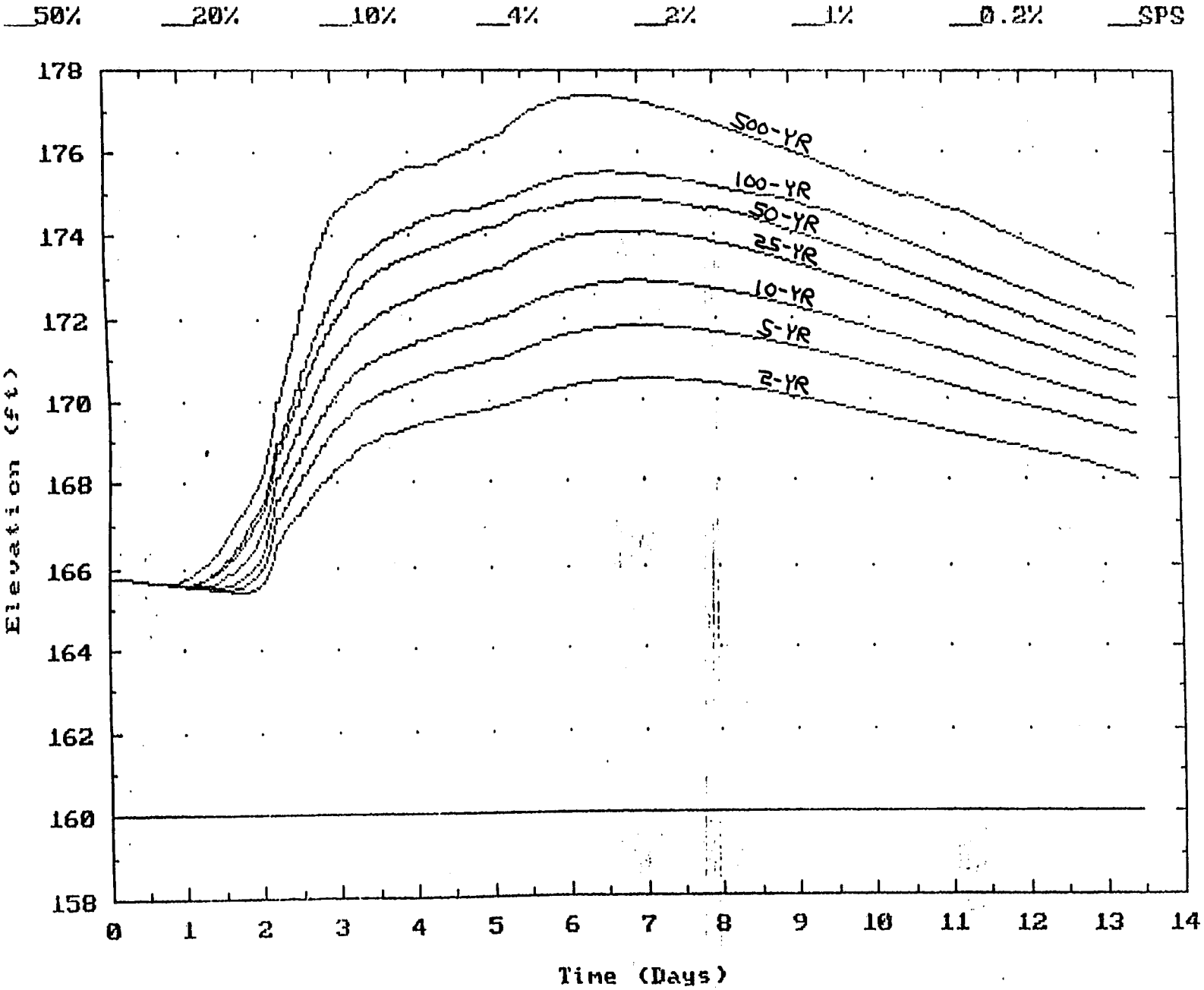


PLATE F-2

POND SURFACE AREA AND STORAGE VOLUME

PASSIC10 POND-P10

____VOLUME ____AREA

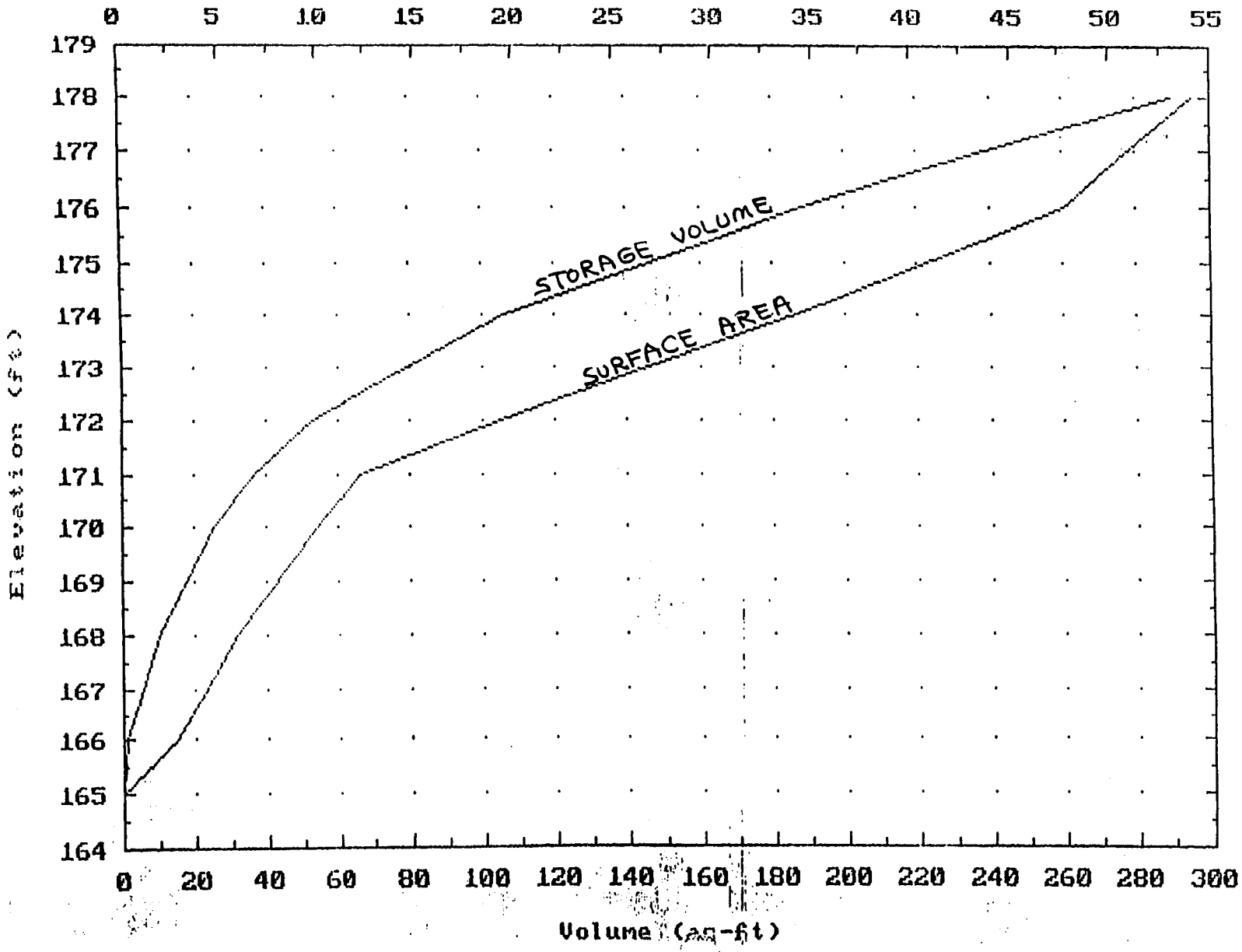


PLATE F3

MAXIMUM INTERIOR ELEVATION

POSSIBLE

P10-HIE P10-RES

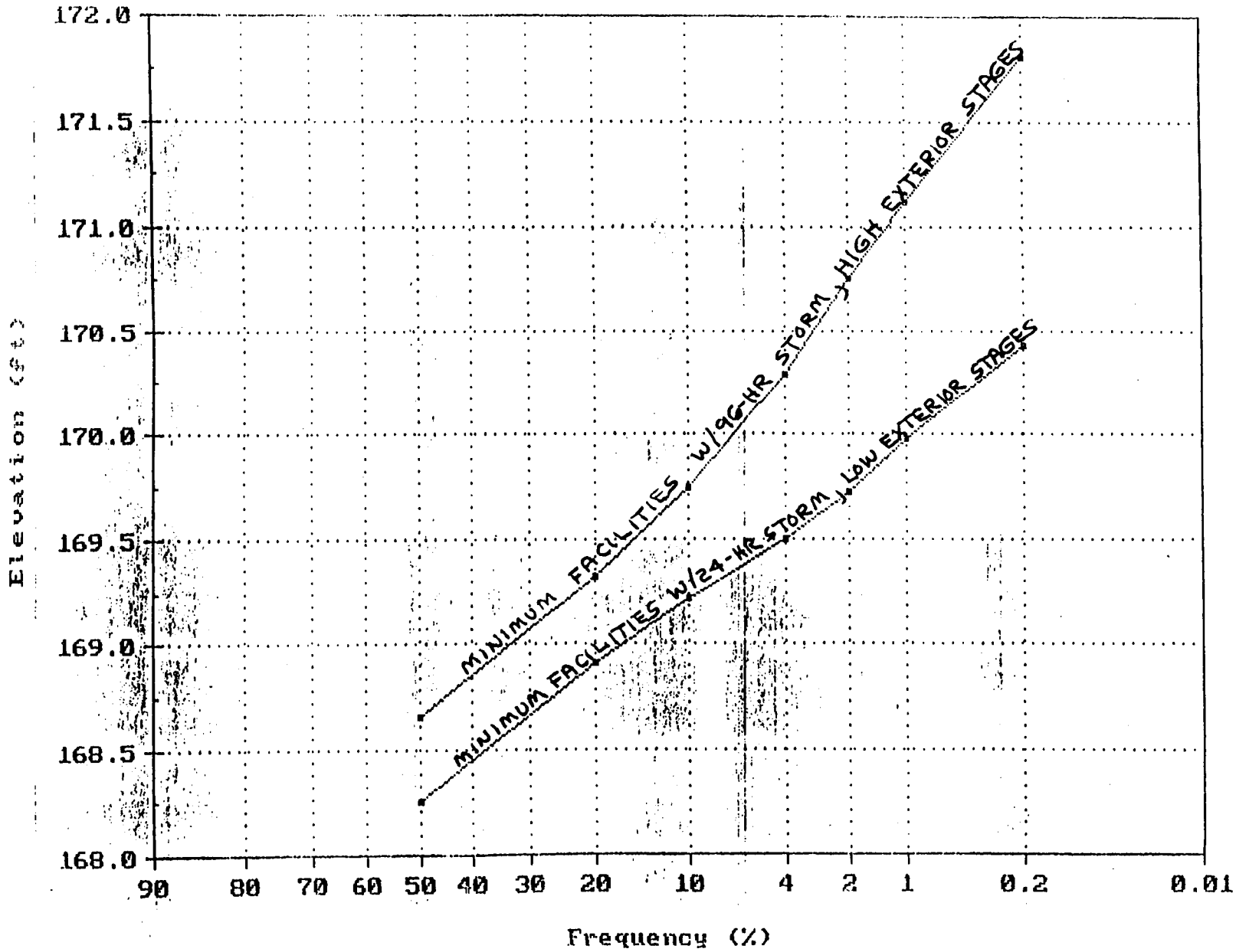


PLATE F-4

MAXIMUM INTERIOR ELEVATION

PASSIC10

P10 H96S F10-QMAX

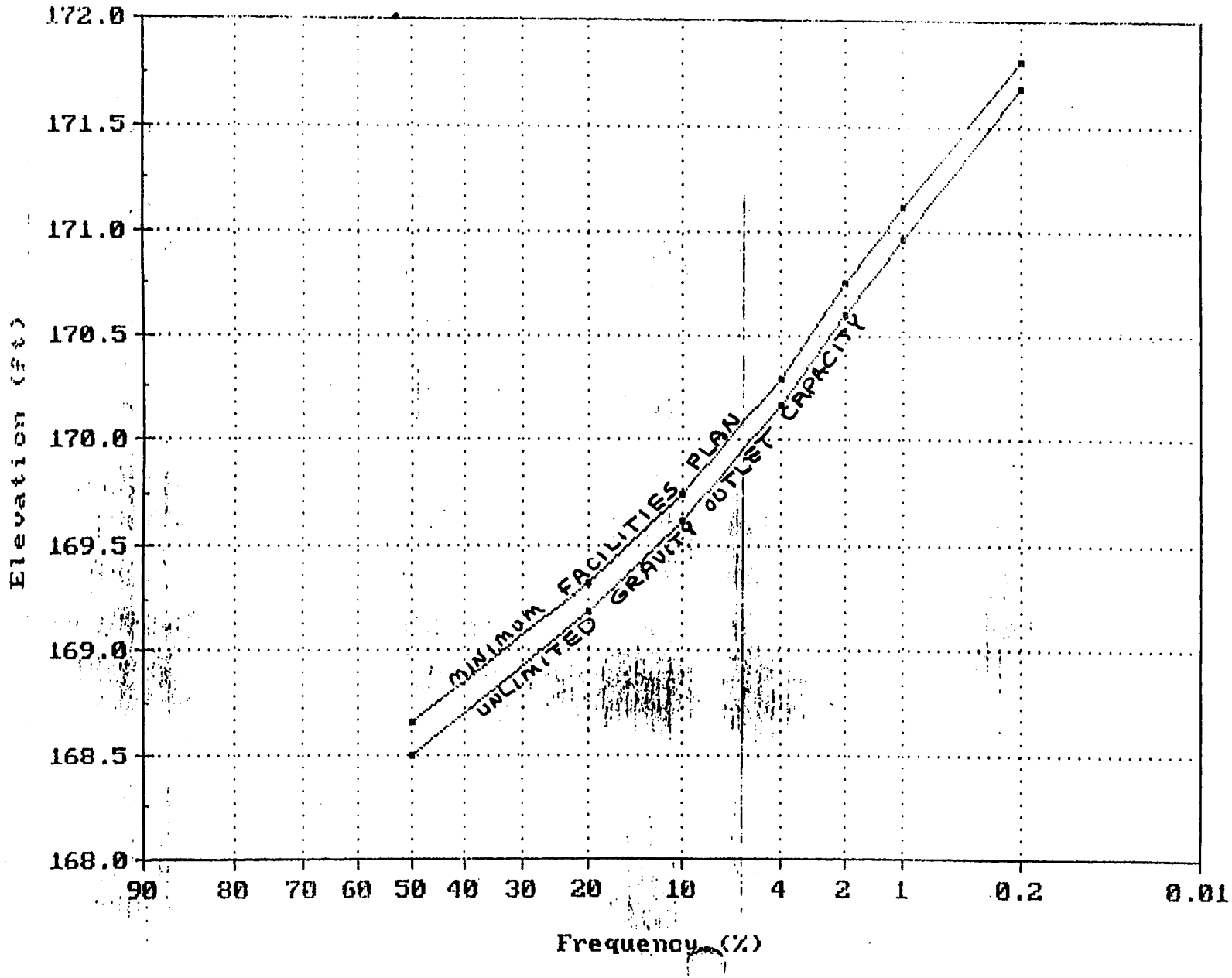


PLATE F-5

MAXIMUM INTERIOR ELEVATION

PASSIC10

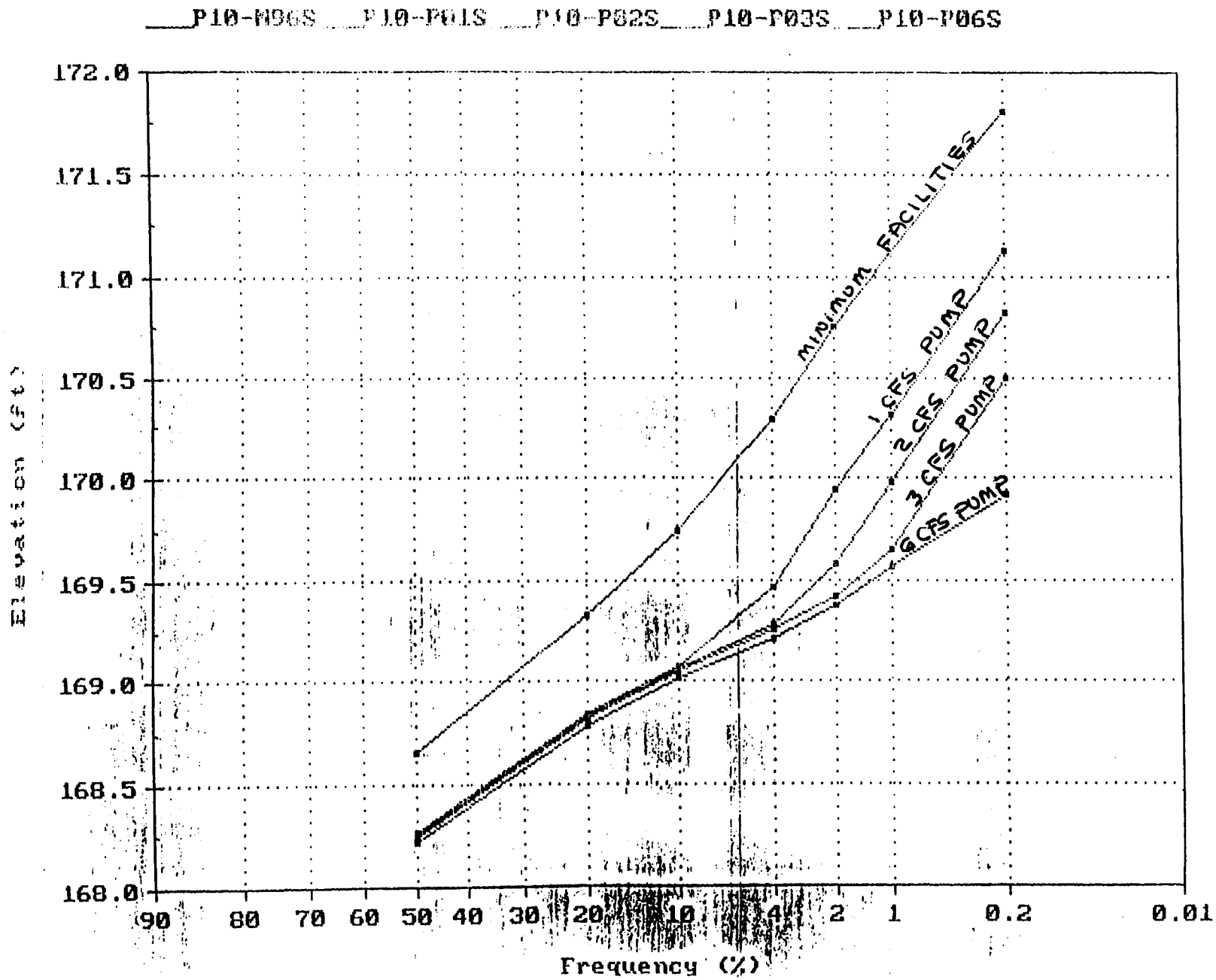


PLATE F-6

ELEVATIONS

PASSIC10 1% P10-M96S

(100-YEAR)

____INTERIOR____EXTERIOR

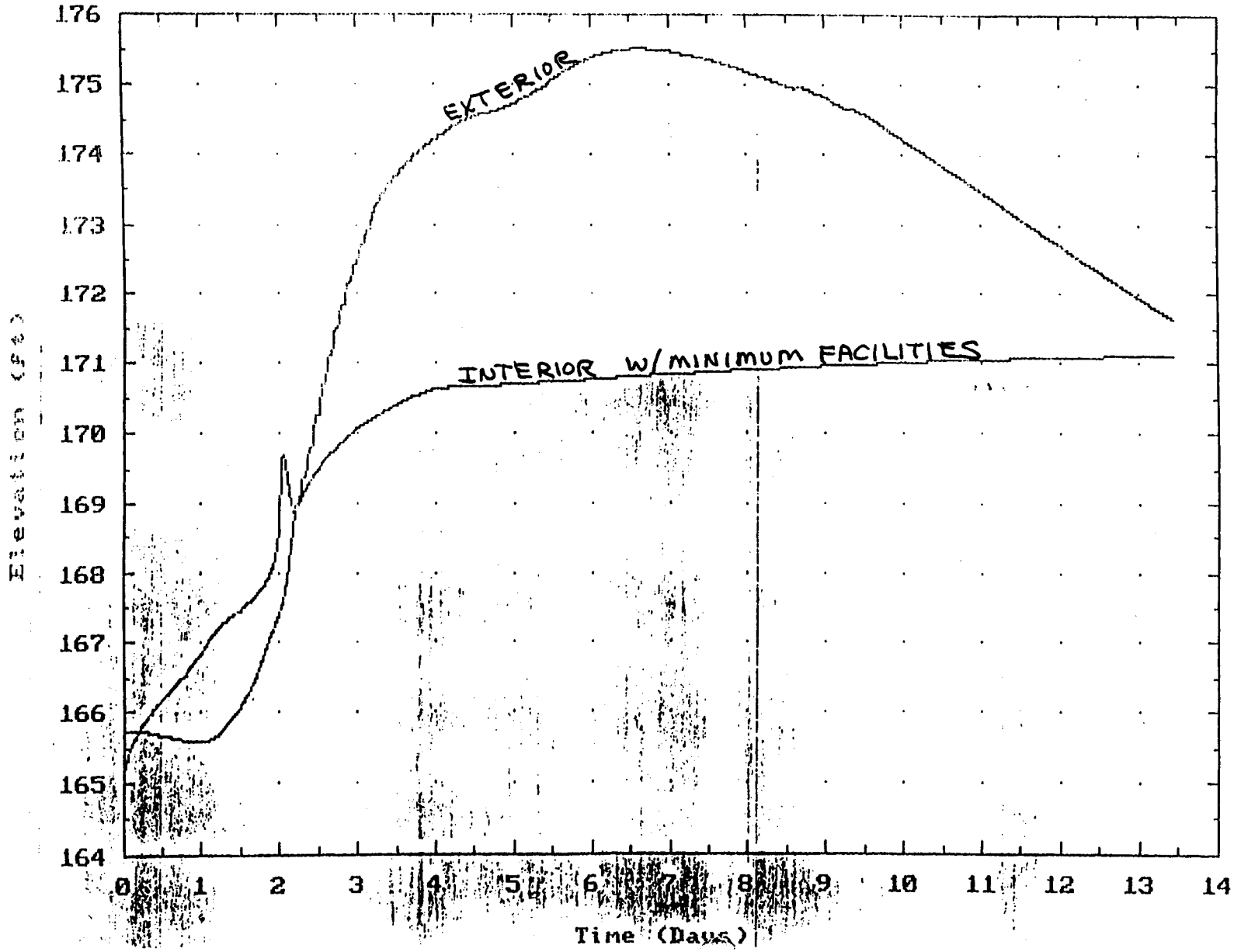


PLATE F-7

ELEVATIONS

PASSIC10 1% (100-YEAR) P10-P01S

INTERIOR EXTERIOR

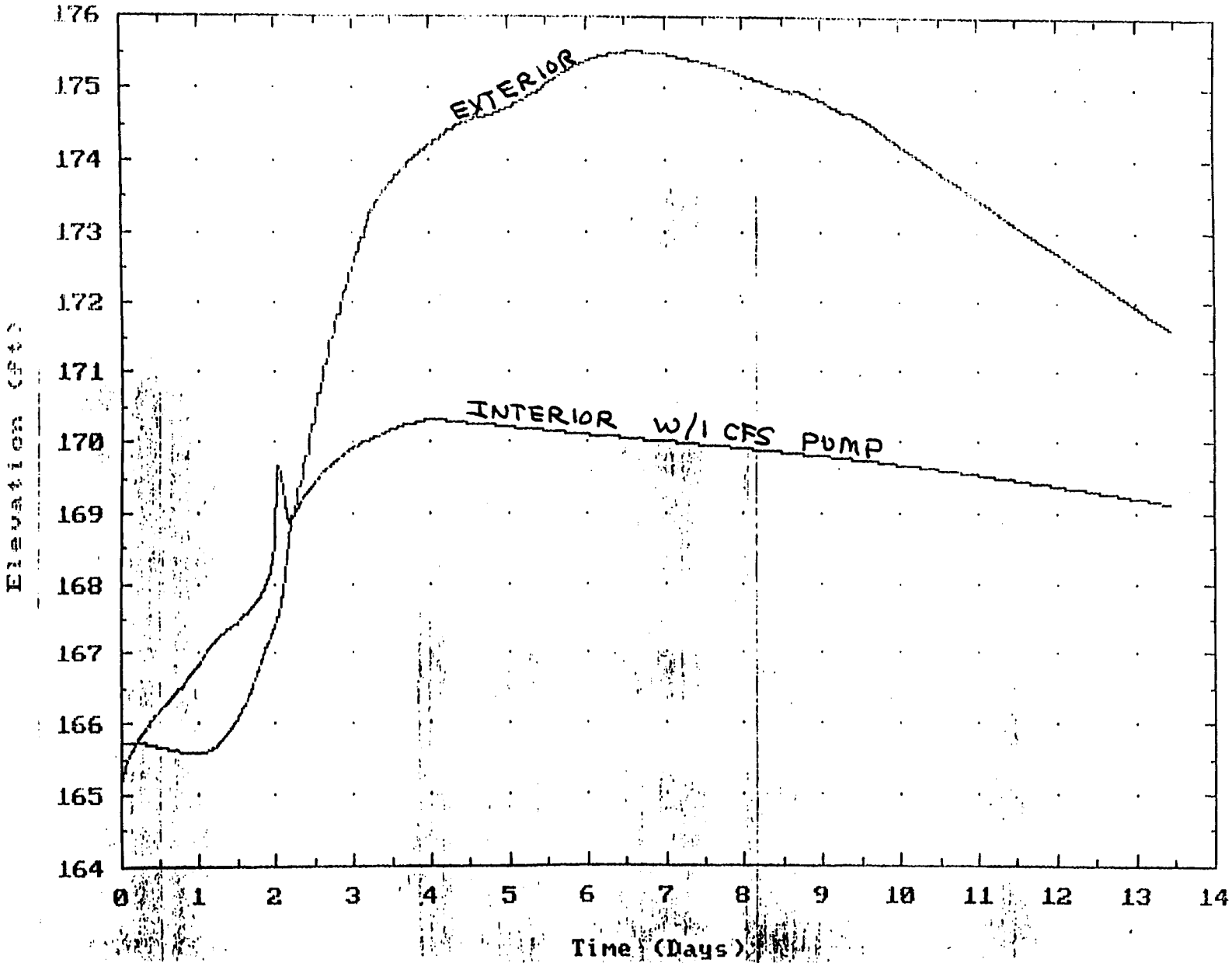


PLATE F-8

ELEVATIONS

PASSIC10 1% (100-YEAR) P10-P02S

INTERIOR EXTERIOR

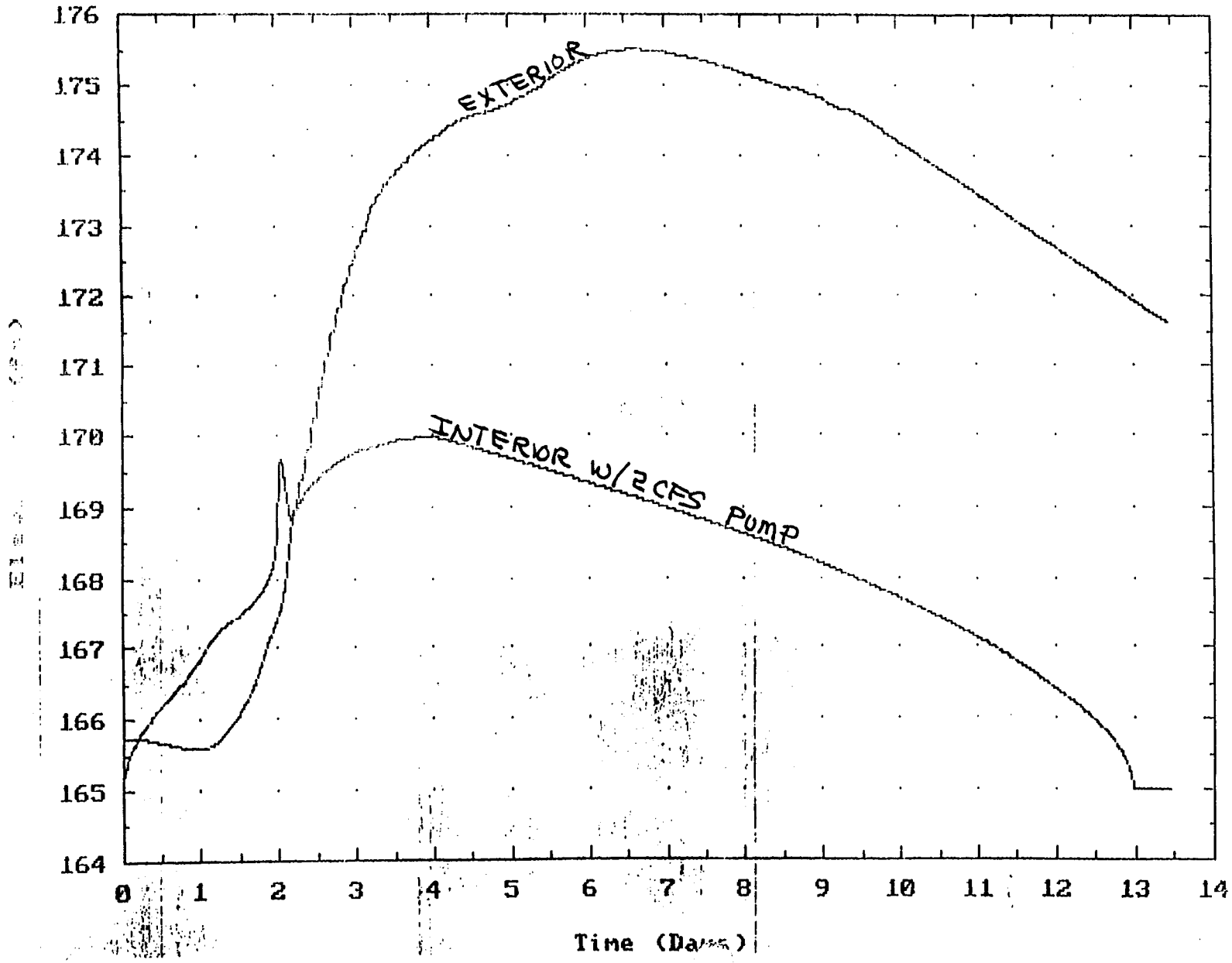


PLATE F-9

ELEVATIONS

PASSIC10 1% (100-YEAR) P10-P03S

____INTERIOR___EXTERIOR

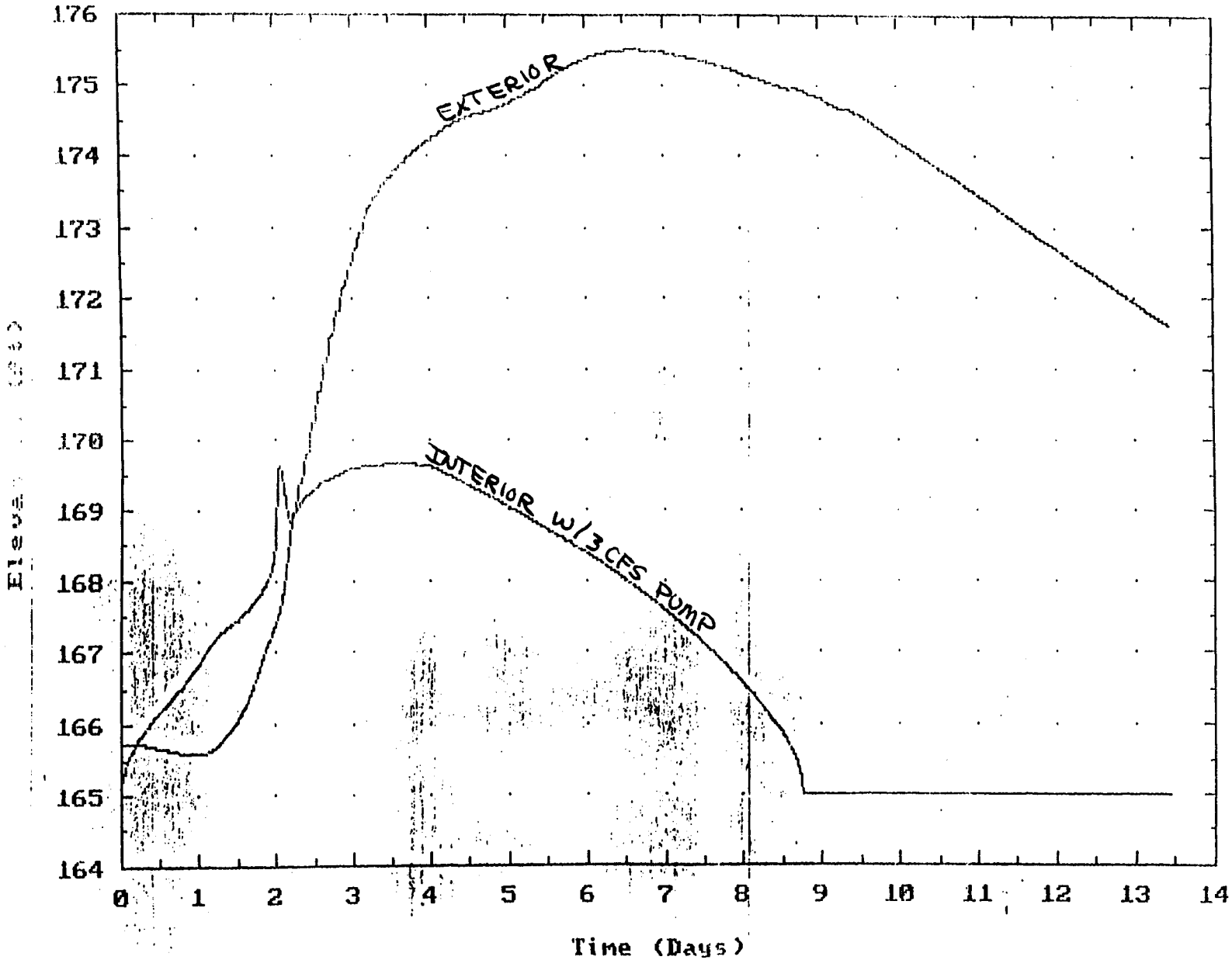


PLATE F-10

ELEVATIONS

PASSIC10 1% (100-YEAR) P10-P06S

____INTERIOR____EXTERIOR

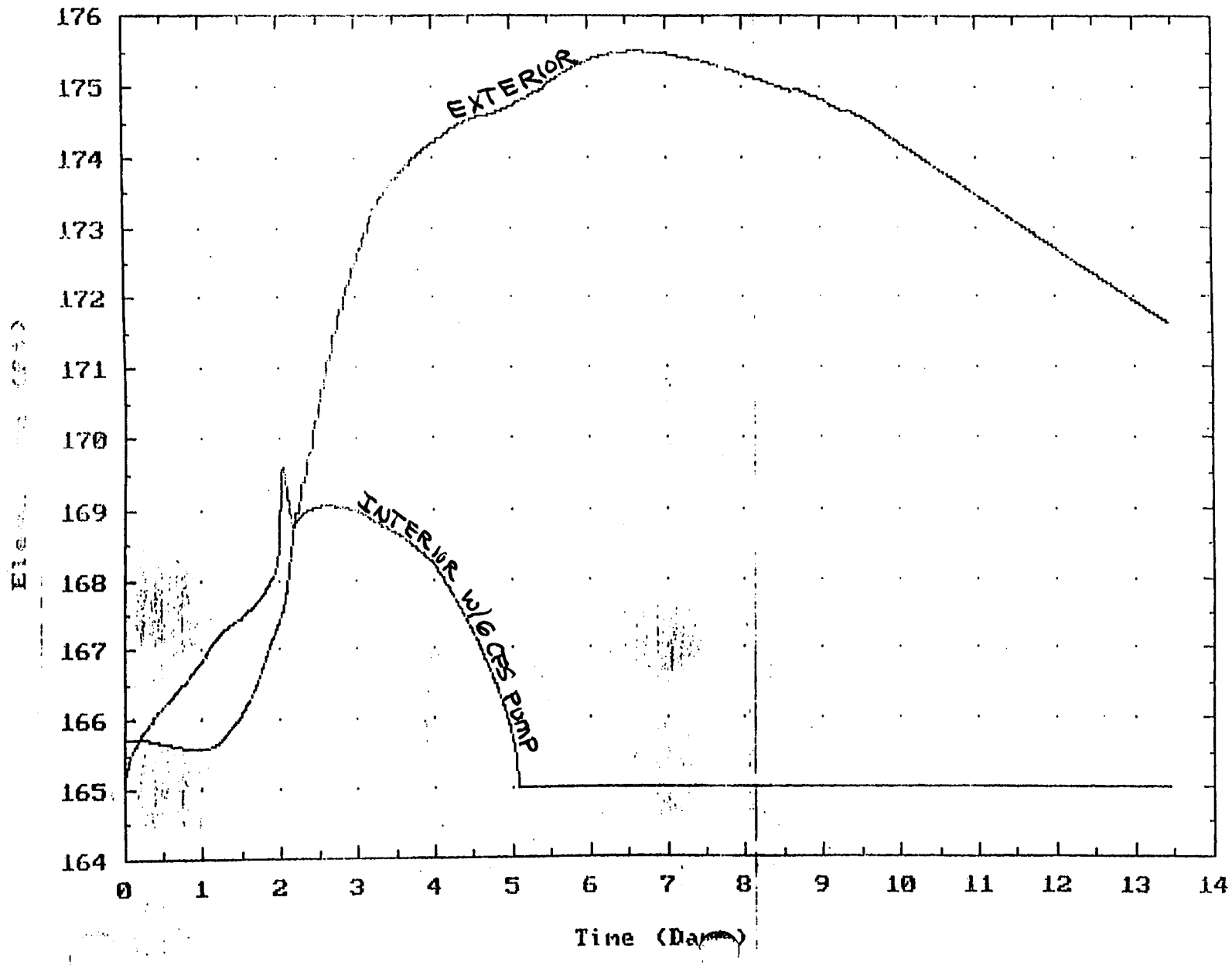


PLATE F-11

(PUMPING HEAD)
DIFFERENTIAL HEAD

PASSIC10 — HEAD

1%
(100-YEAR)

P10-P01S
(1CFS PUMP)

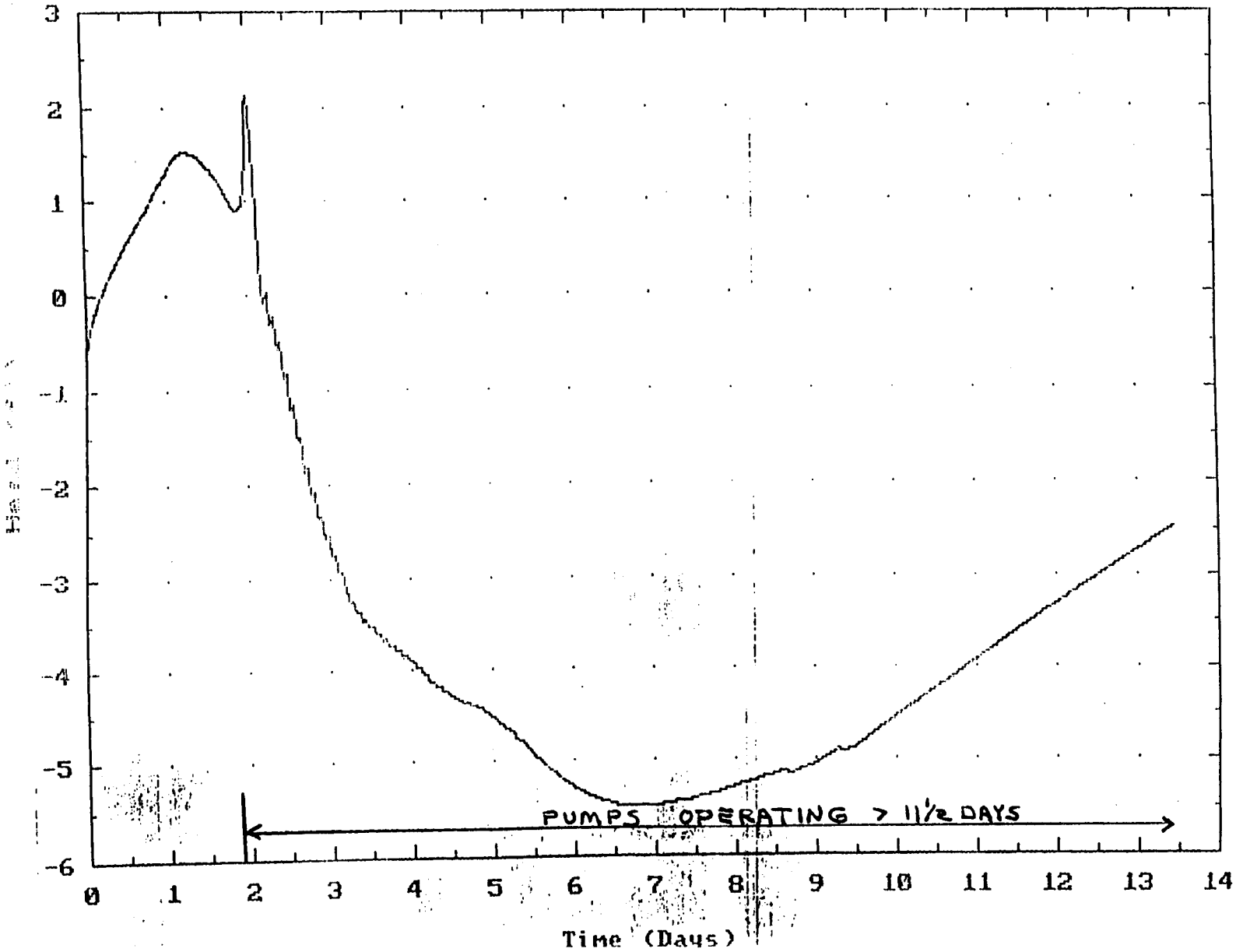


PLATE F-12

DIFFERENTIAL HEAD

PASSIC10 1% P10-P02S

___HEAD (100-YEAR) (2CFS PUMP)

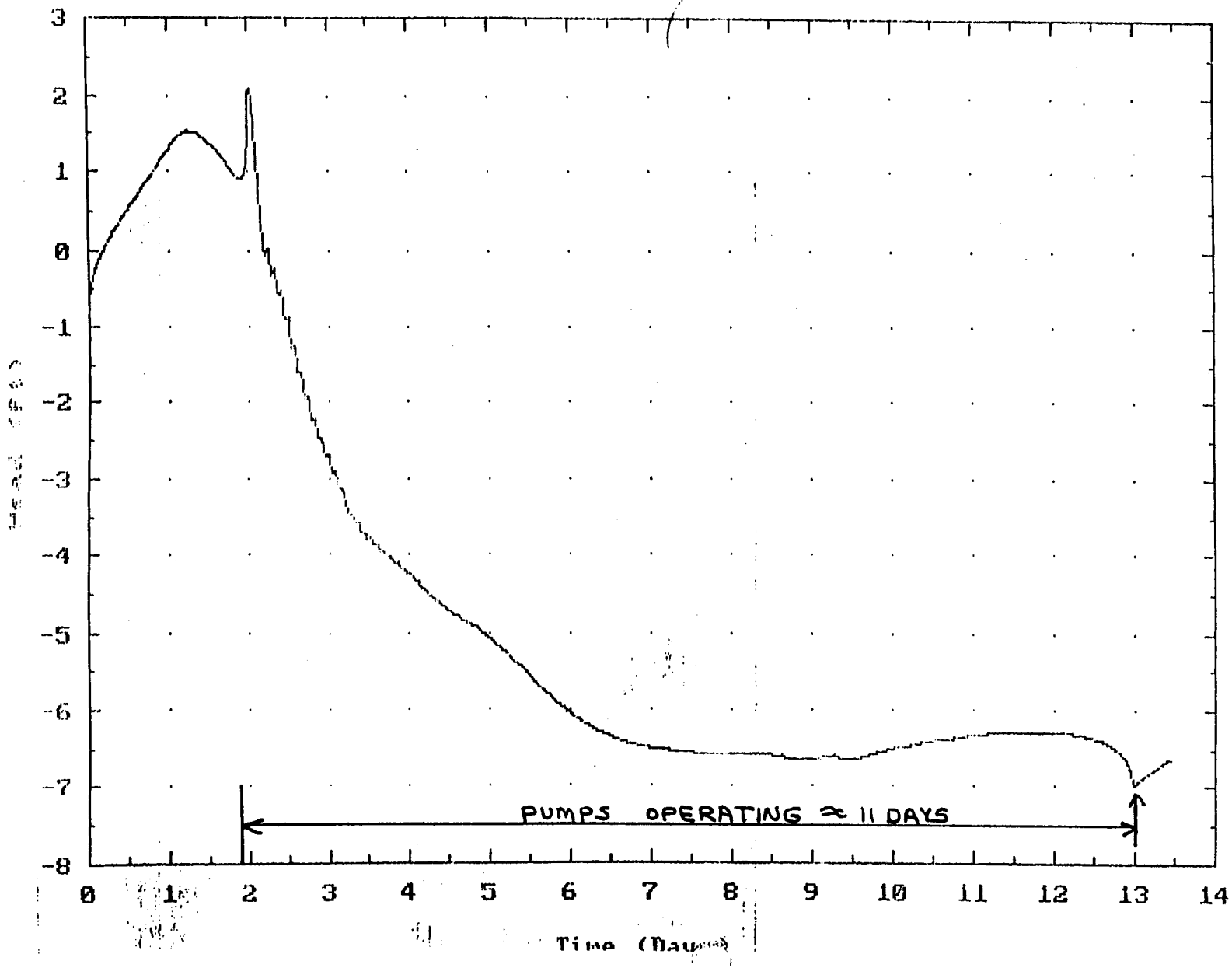


PLATE F-13

(PUMPING HEAD)
DIFFERENTIAL HEAD

PASSIC10

___HEAD

1%
(100-YEAR)

P10-P03S
(3 CFS PUMP)

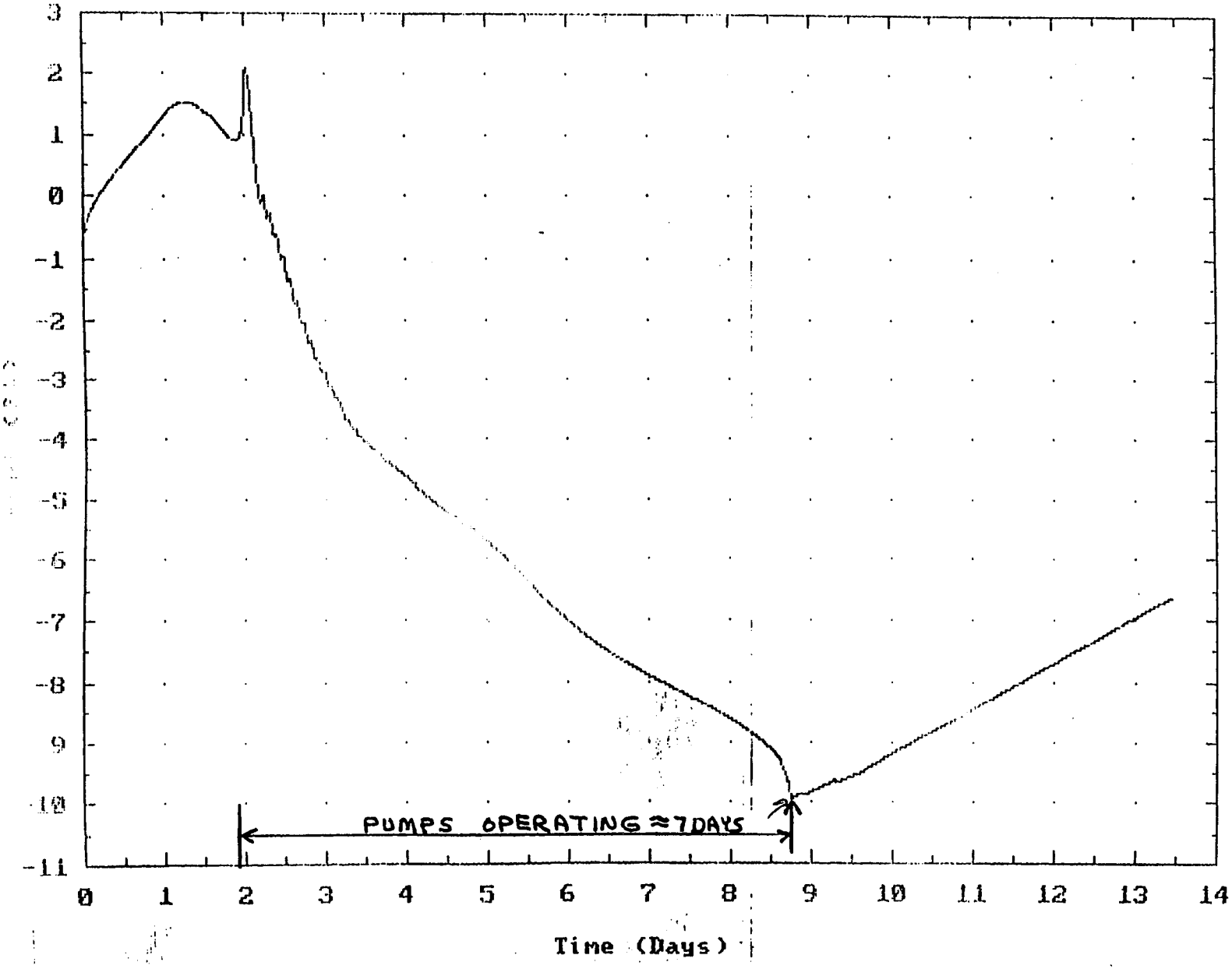


PLATE F-4

(PUMPING HEAD)
DIFFERENTIAL HEAD

PASSIC10

___HEAD

1%
(100-YEAR)

P10-P06S
(6 CFS PUMP)

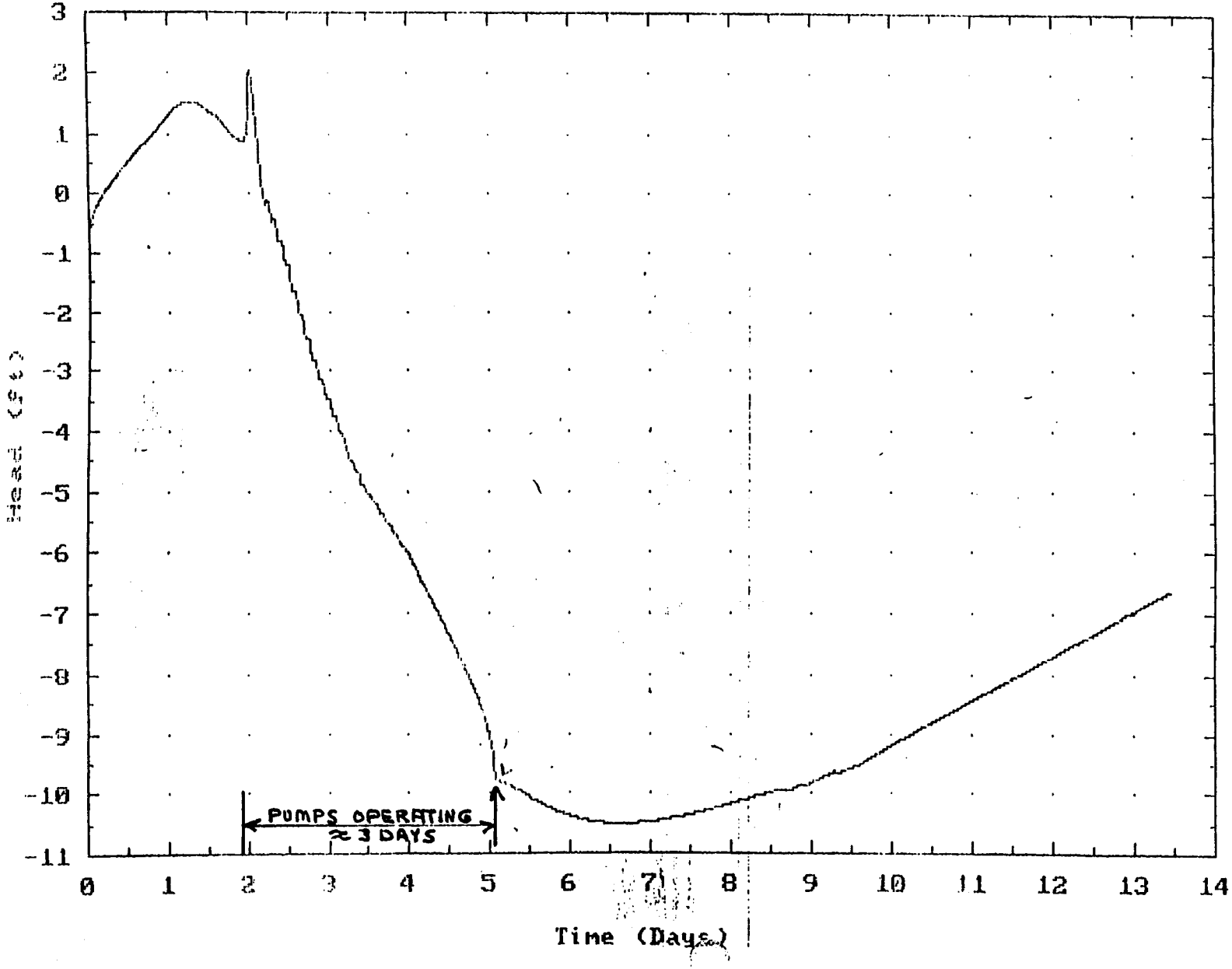
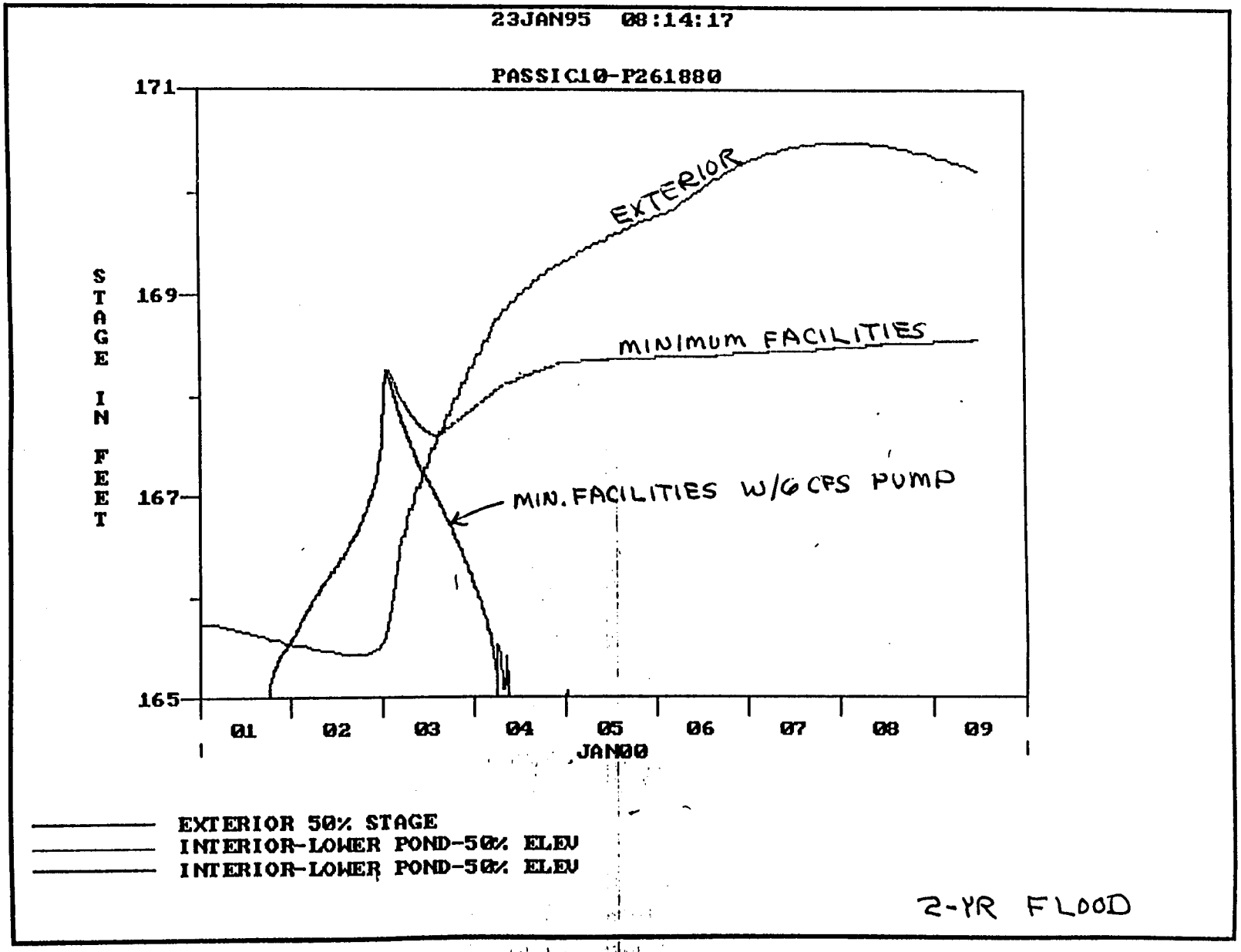
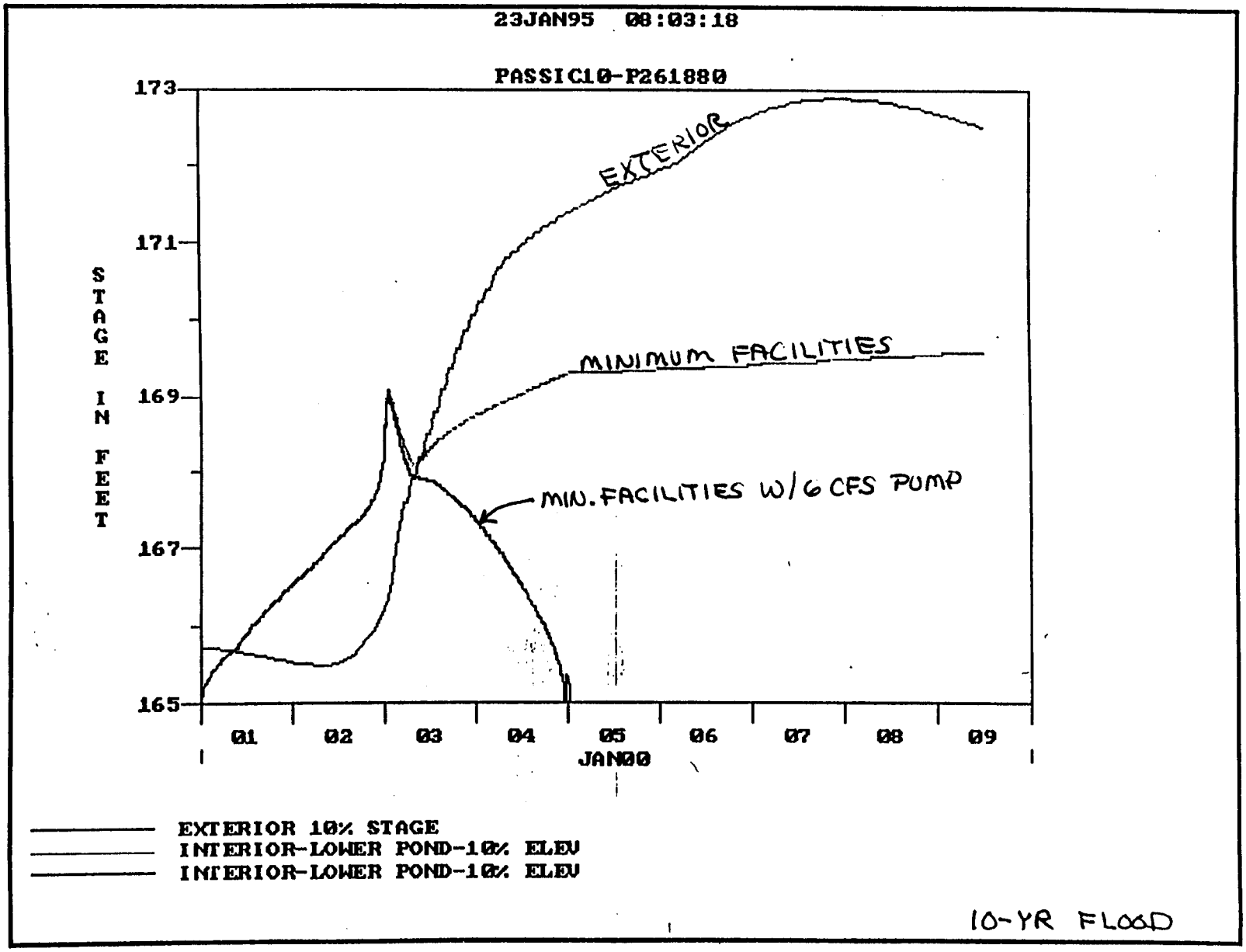


PLATE F-15


23JAN95 08:14:17
PASSIC10-P261880
171
169
167
165
STAGE IN FEET
01
02
03
04
05
06
07
08
09
JAN00
EXTERIOR
MINIMUM FACILITIES
MIN. FACILITIES W/6 CFS PUMP
EXTERIOR 50% STAGE
INTERIOR-LOWER POND-50% ELEV
INTERIOR-LOWER POND-50% ELEV
2-YR FLOOD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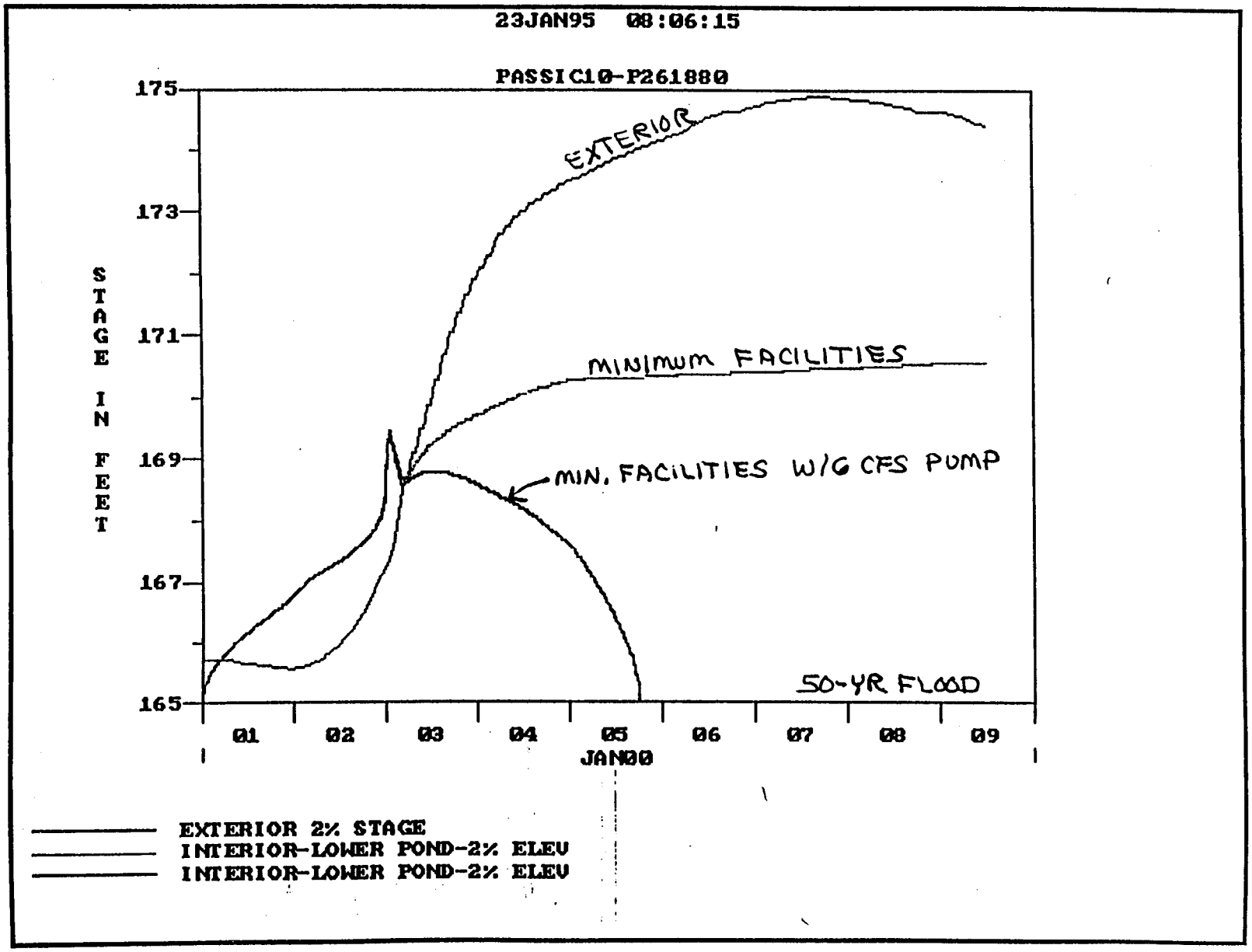
PASSIC10-P261880
173
171
169
167
165
STAGE IN FEET
EXTERIOR
MINIMUM FACILITIES
MIN. FACILITIES W/6 CFS PUMP
01
02
03
04
05
06
07
08
09
JAN00
EXTERIOR 10% STAGE
INTERIOR-LOWER POND-10% ELEV
INTERIOR-LOWER POND-10% ELEV
10-YR FLOOD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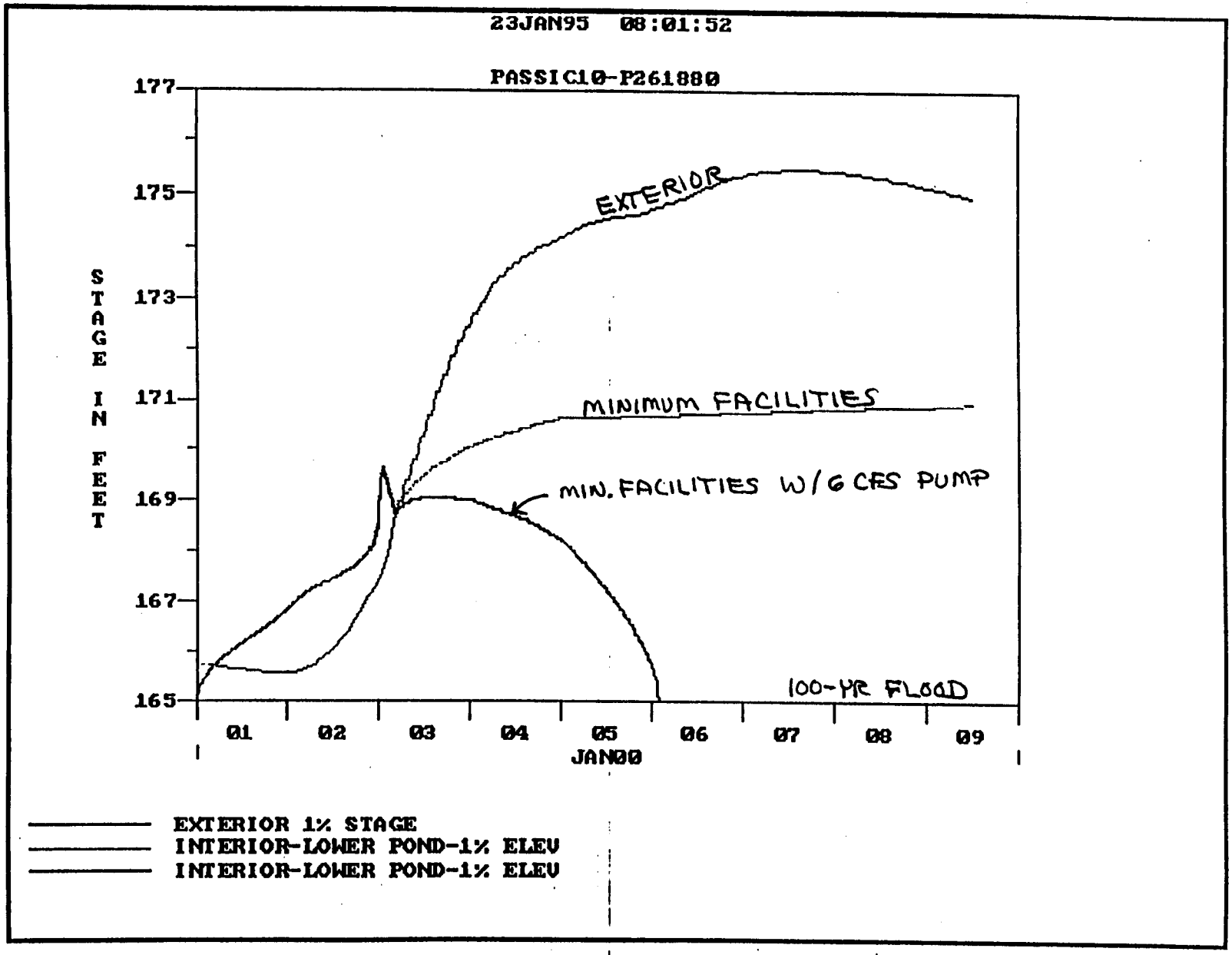
PASSIC10-P261880
175
173
171
169
167
165
STAGE IN FEET
EXTERIOR
MINIMUM FACILITIES
MIN. FACILITIES W/O CFS PUMP
50-YR FLOOD
01
02
03
04
05
06
07
08
09
JAN00
EXTERIOR 2% STAGE
INTERIOR-LOWER POND-2% ELEV
INTERIOR-LOWER POND-2% ELEV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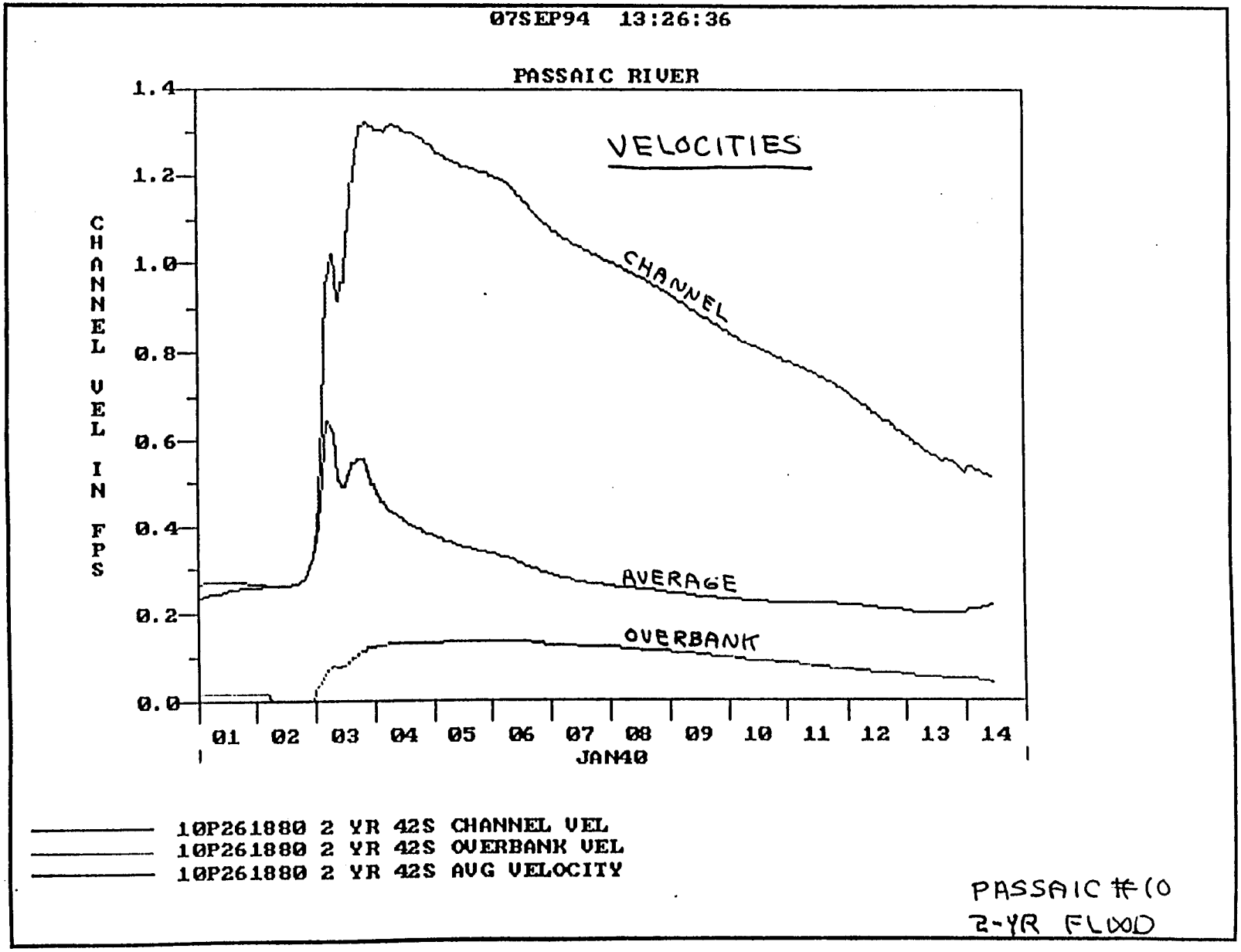
PASSIC10-P261880
STAGE IN FEET
177
175
173
171
169
167
165
01
02
03
04
05
06
07
08
09
JAN00
EXTERIOR
MINIMUM FACILITIES
MIN. FACILITIES W/6 CFS PUMP
100-YR FLOOD
EXTERIOR 1% STAGE
INTERIOR-LOWER POND-1% ELEV
INTERIOR-LOWER POND-1% ELEV

PLATE F-19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VELOCITIES
CHANNEL
AVERAGE
OVERBANK
CHANNEL VEL IN FPS
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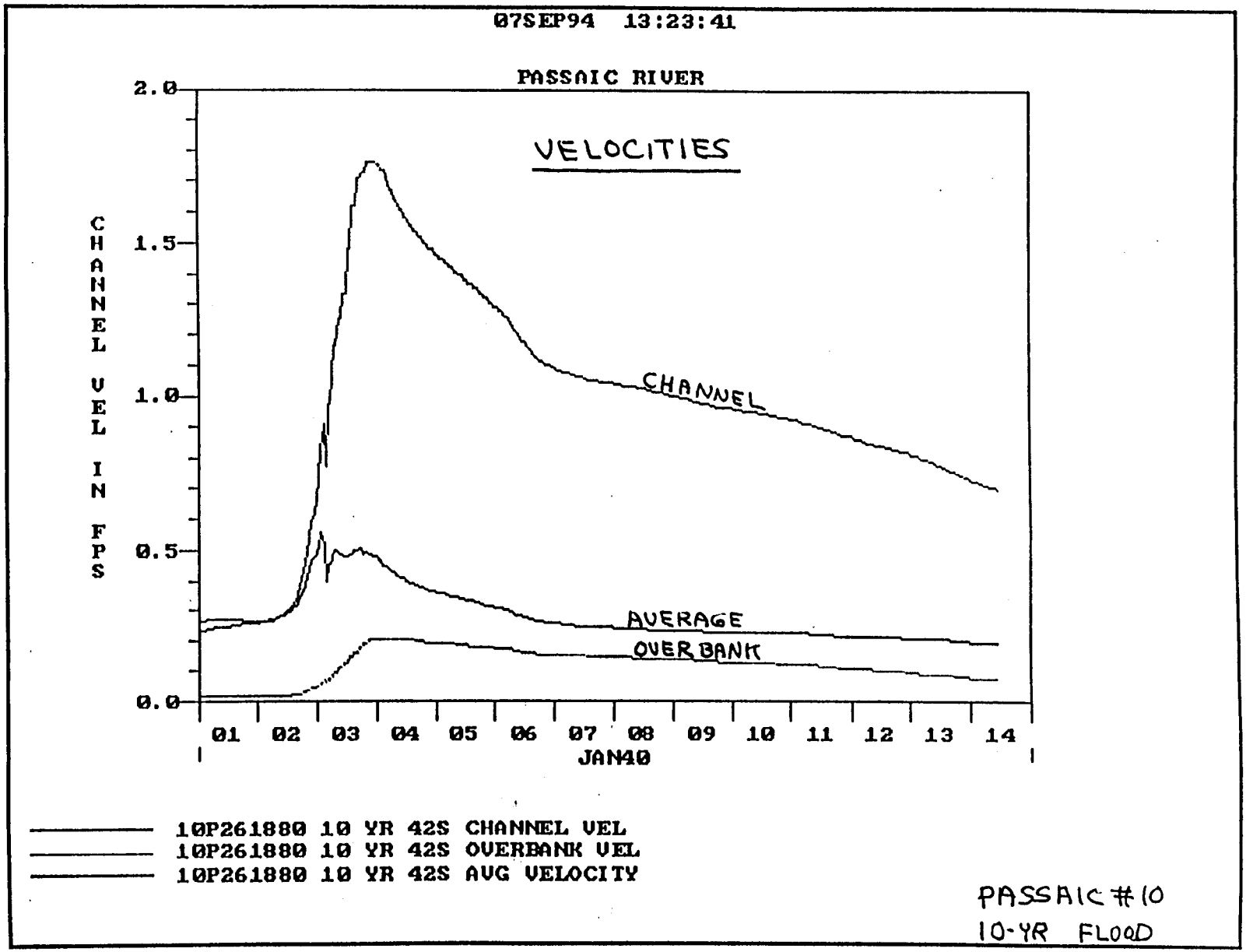
1.2
1.0
0.8
0.6
0.4
0.2
0.0
01 02 03 04 05 06 07 08 09 10 11 12 13 14
JAN40
10P261880 2 YR 42S CHANNEL VEL
10P261880 2 YR 42S OVERBANK VEL
10P261880 2 YR 42S AVG VELOCITY
PASSAIC #10
2-YR FLOOD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VELOCITIES
CHANNEL VEL IN FPS
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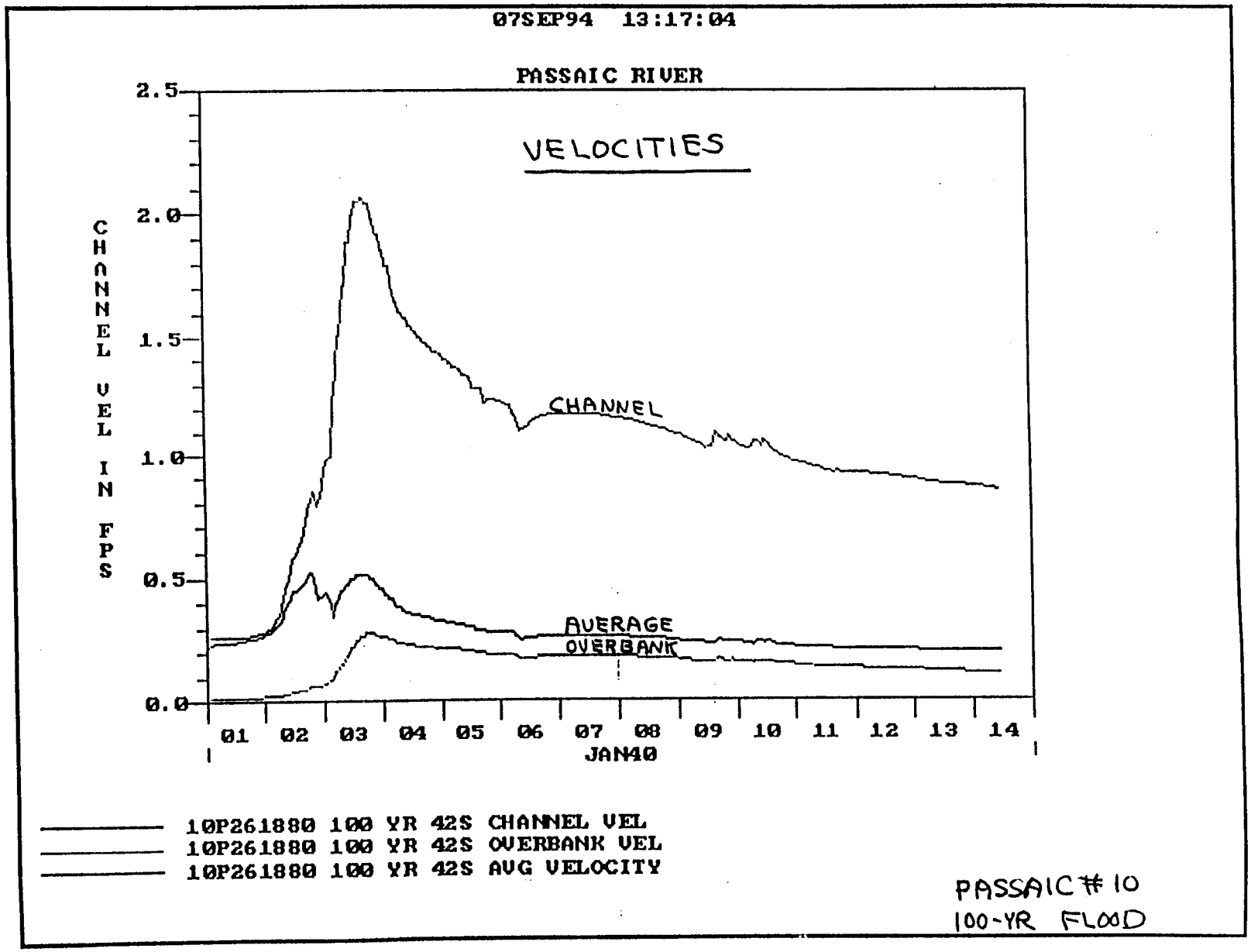
1.5
1.0
0.5
0.0
CHANNEL
AVERAGE
OVERBANK
01 02 03 04 05 06 07 08 09 10 11 12 13 14
JAN40
10P261880 10 YR 42S CHANNEL VEL
10P261880 10 YR 42S OVERBANK VEL
10P261880 10 YR 42S AVG VELOCITY
PASSAIC #10
10-YR FLOOD

PLATE F-21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VELOCITIES
CHANNEL VEL IN FPS
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2.0
1.5
1.0
0.5
0.0
CHANNEL
AVERAGE
OVERBANK
01 02 03 04 05 06 07 08 09 10 11 12 13 14
JAN40
10P261880 100 YR 42S CHANNEL VEL
10P261880 100 YR 42S OVERBANK VEL
10P261880 100 YR 42S AVG VELOCITY
PASSAIC # 10
100-YR FLOOD

PLATE F-2

ATTACHMENT G

COST ESTIMATE

Passaic #10 Project Cost
Passaic River
Flood Damage Reduction Project
Passaic #10
Levee System

Designed By: Wilmington District, L. Creech
Estimated By: CESAW-EN-E

Prepared By: D. W. Greene, CESAW-EN-E
H.F. (Bud) Kiefer, CENAN-PR-TC

Date: 05/30/95
Est Construction Time: 252 Days

M C A C E S G O L D E D I T I O N
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Release 5.20J

SUMMARY REPORTS SUMMARY PAGE

PROJECT OWNER SUMMARY - LEVEL 3.....1
PROJECT INDIRECT SUMMARY - LEVEL 3.....3
PROJECT DIRECT SUMMARY - LEVEL 3.....5

No Detailed Estimate...

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

Any HTRW issues are to be resolved before contruction and therefore are not included in this estimate other than for HTRW testing. Because this project is nearly in the Plans & Specs. stage, contingencies for all items are 10%.

EARTHWORK:

All earthwork quantities area shown as Loose Cubic Yards, except for Footprint Excavation which in calculated in Bank Cubic Yards . Most borrow material will come from an on site borrow pit with an average haul distance of 1 mile. Additional borrow material will come from the Hatfield Swamp project where excavation and loading will not be charged to the Passaic #10 project. Haul distance one way from Hatfield Swamp is 4 miles.

The following adjustments were made to develop costs for northern New Jersey at October 1994 price levels.

LABOR:

The 1994 Passaic River Basin Labor Rates Database was used to calculate labor costs.

EQUIPMENT:

The 1994 Region 1 Equipment Rates Database was used to calculate equipment costs.

CREWS:

The 1994 Passaic River Basin Crews Database was used to calculate crew costs.

MATERIALS:

Costs were obtained from the 1994 Region 1 (Passaic River Basin) Unit Price Book, Passaic River Basin Materials Resources Study, and direct inquiries.

	QUANTITY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT COST
01 LANDS AND DAMAGES						
01.21 Feature Design Memorandum						
01.21.03 Real Estate Analysis Documents	1.00	EA	28,215	2,822	31,037	31036.50
Feature Design Memorandum	1.00	EA	28,215	2,822	31,037	31036.50
LANDS AND DAMAGES	1.00	EA	28,215	2,822	31,037	31036.50
11 LEVEES AND FLOODWALLS						
11.01 Mob/Demob						
Mob/Demob	1.00	EA	63,968	6,400	70,368	70368.41
11.02 Site Preparation						
11.02.01 Clearing	1.00	EA	58,054	5,800	63,854	63854.01
11.02.02 Erosion Control	1.00	EA	87,745	8,800	96,545	96545.11
Site Preparation	1.00	EA	145,799	14,600	160,399	160399.12
11.03 Levee						
11.03.01 Earth Dike	1.00	EA	791,873	80,000	871,873	871873.05
11.03.02 Concrete Wall	1.00	EA	69,866	7,200	77,066	77065.65
Levee	1.00	EA	861,739	87,200	948,939	948938.69
11.04 Interior Drainage						
11.04.01 Culverts and Gates	1.00	EA	47,753	5,000	52,753	52752.92
Interior Drainage	1.00	EA	47,753	5,000	52,753	52752.92
11.05 Landscaping						
11.05.01 Establish Turf	1.00	EA	57,971	6,000	63,971	63971.35
Landscaping	1.00	EA	57,971	6,000	63,971	63971.35
11.06 Green Acres Mitigation						

		QUANTITY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT COST
	Green Acres Mitigation	1.00	EA	185,464	27,820	213,283	213283.14
11.07	Beautification						
	Beautification	1.00	EA	109,698	16,455	126,153	126153.16
	LEVEES AND FLOODWALLS	1.00	EA	1,472,392	163,474	1,635,867	1635867
13	PUMPING PLANT						
13.00	Pumping Plant						
13.00.99	Associated General Items	1.00	EA	203,616	20,000	223,616	223615.61
	Pumping Plant	1.00	EA	203,616	20,000	223,616	223615.61
	PUMPING PLANT	1.00	EA	203,616	20,000	223,616	223615.61
30	PLANNING, ENGINEERING AND DESIGN						
30.20	General Design Memorandum						
30.20.08	Final Report Documentation	1.00	EA	769,349	1,772	771,121	771121.00
	General Design Memorandum	1.00	EA	769,349	1,772	771,121	771121.00
	PLANNING, ENGINEERING AND DESIGN	1.00	EA	769,349	1,772	771,121	771121.00
31	CONSTRUCTION MANAGEMENT						
31.23	Construction Contracts						
31.23.11	Supervision and Administration	1.00	EA	118,145	17,722	135,867	135867.00
	Construction Contracts	1.00	EA	118,145	17,722	135,867	135867.00
	CONSTRUCTION MANAGEMENT	1.00	EA	118,145	17,722	135,867	135867.00
	Passaic #10 Project Cost	1.00	EA	2,591,717	205,790	2,797,507	2797507

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
01 LANDS AND DAMAGES								
01.21 Feature Design Memorandum								
01.21.03 Real Estate Analysis Document	1.00 EA	28,215	0	0	0	0	28,215	28215.00
Feature Design Memorandum	1.00 EA	28,215	0	0	0	0	28,215	28215.00
LANDS AND DAMAGES	1.00 EA	28,215	0	0	0	0	28,215	28215.00
11 LEVEES AND FLOODWALLS								
11.01 Mob/Demob								
Mob/Demob	1.00 EA	53,268	3,196	2,259	4,707	539	63,968	63968.41
11.02 Site Preparation								
11.02.01 Clearing	1.00 EA	48,343	2,901	2,050	4,271	489	58,054	58054.01
11.02.02 Erosion Control	1.00 EA	73,067	4,384	3,098	6,456	740	87,745	87745.11
Site Preparation	1.00 EA	121,410	7,285	5,148	10,727	1,229	145,799	145799.12
11.03 Levee								
11.03.01 Earth Dike	1.00 EA	659,411	39,565	27,959	58,264	6,674	791,873	791873.05
11.03.02 Concrete Wall	1.00 EA	58,179	3,491	2,467	5,141	589	69,866	69865.65
Levee	1.00 EA	717,590	43,055	30,426	63,404	7,263	861,739	861738.69
11.04 Interior Drainage								
11.04.01 Culverts and Gates	1.00 EA	39,765	2,386	1,686	3,514	402	47,753	47752.92
Interior Drainage	1.00 EA	39,765	2,386	1,686	3,514	402	47,753	47752.92
11.05 Landscaping								
11.05.01 Establish Turf	1.00 EA	48,274	2,896	2,047	4,265	489	57,971	57971.35
Landscaping	1.00 EA	48,274	2,896	2,047	4,265	489	57,971	57971.35
11.06 Green Acres Mitigation								

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
Green Acres Mitigation	1.00 EA	185,464	0	0	0	0	185,464	185463.60
11.07 Beautification								
Beautification	1.00 EA	109,698	0	0	0	0	109,698	109698.40
LEVEES AND FLOODWALLS	1.00 EA	1,275,469	58,818	41,565	86,617	9,922	1,472,392	1472392
13 PUMPING PLANT								
13.00 Pumping Plant								
13.00.99 Associated General Items	1.00 EA	169,556	10,173	7,189	14,981	1,716	203,616	203615.61
Pumping Plant	1.00 EA	169,556	10,173	7,189	14,981	1,716	203,616	203615.61
PUMPING PLANT	1.00 EA	169,556	10,173	7,189	14,981	1,716	203,616	203615.61
30 PLANNING, ENGINEERING AND DESIGN								
30.20 General Design Memorandum								
30.20.08 Final Report Documentation	1.00 EA	769,349	0	0	0	0	769,349	769349.00
General Design Memorandum	1.00 EA	769,349	0	0	0	0	769,349	769349.00
PLANNING, ENGINEERING AND DES	1.00 EA	769,349	0	0	0	0	769,349	769349.00
31 CONSTRUCTION MANAGEMENT								
31.23 Construction Contracts								
31.23.11 Supervision and Administratio	1.00 EA	118,145	0	0	0	0	118,145	118145.00
Construction Contracts	1.00 EA	118,145	0	0	0	0	118,145	118145.00
CONSTRUCTION MANAGEMENT	1.00 EA	118,145	0	0	0	0	118,145	118145.00
Passaic #10 Project Cost	1.00 EA	2,360,734	68,992	48,754	101,599	11,638	2,591,717	2591717
Contingency							205,790	
TOTAL INCL OWNER COSTS							2,797,507	

		QUANTITY UOM	MANHRS	LABOR	EQUIPMN	MATERIA	TOTAL COST	UNIT COST
01	LANDS AND DAMAGES							
01.21	Feature Design Memorandum							
01.21.03	Real Estate Analysis Documents	1.00 EA	0	28,215	0	0	28,215	28215.00
	Feature Design Memorandum	1.00 EA	0	28,215	0	0	28,215	28215.00
	LANDS AND DAMAGES	1.00 EA	0	28,215	0	0	28,215	28215.00
11	LEVEES AND FLOODWALLS							
11.01	Mob/Demob							
	Mob/Demob	1.00 EA	0	20,000	20,000	13,268	53,268	53268.00
11.02	Site Preparation							
11.02.01	Clearing	1.00 EA	959	32,898	15,445	0	48,343	48342.94
11.02.02	Erosion Control	1.00 EA	1,049	39,300	27,688	6,080	73,067	73067.42
	Site Preparation	1.00 EA	2,007	72,198	43,133	6,080	121,410	121410.35
11.03	Levee							
11.03.01	Earth Dike	1.00 EA	9,700	322,401	337,010	0	659,411	659411.30
11.03.02	Concrete Wall	1.00 EA	587	28,273	4,875	25,032	58,179	58178.76
	Levee	1.00 EA	10,288	350,674	341,884	25,032	717,590	717590.06
11.04	Interior Drainage							
11.04.01	Culverts and Gates	1.00 EA	273	12,083	1,858	25,824	39,765	39764.98
	Interior Drainage	1.00 EA	273	12,083	1,858	25,824	39,765	39764.98
11.05	Landscaping							
11.05.01	Establish Turf	1.00 EA	501	19,901	1,556	26,818	48,274	48274.10
	Landscaping	1.00 EA	501	19,901	1,556	26,818	48,274	48274.10
11.06	Green Acres Mitigation							

	QUANTITY	UOM	MANHRS	LABOR	EQUIPMN	MATERIA	TOTAL COST	UNIT COST
Green Acres Mitigation	1.00	EA	0	32,594	152,870	0	185,464	185463.60
11.07 Beautification								
Beautification	1.00	EA	0	25,186	84,512	0	109,698	109698.40
LEVEES AND FLOODWALLS	1.00	EA	13,070	532,635	645,813	97,021	1,275,469	1275469
13 PUMPING PLANT								
13.00 Pumping Plant								
13.00.99 Associated General Items	1.00	EA	1,082	46,390	6,832	116,334	169,556	169555.50
Pumping Plant	1.00	EA	1,082	46,390	6,832	116,334	169,556	169555.50
PUMPING PLANT	1.00	EA	1,082	46,390	6,832	116,334	169,556	169555.50
30 PLANNING, ENGINEERING AND DESIGN								
30.20 General Design Memorandum								
30.20.08 Final Report Documentation	1.00	EA	0	769,349	0	0	769,349	769349.00
General Design Memorandum	1.00	EA	0	769,349	0	0	769,349	769349.00
PLANNING, ENGINEERING AND DESIGN	1.00	EA	0	769,349	0	0	769,349	769349.00
31 CONSTRUCTION MANAGEMENT								
31.23 Construction Contracts								
31.23.11 Supervision and Administration	1.00	EA	0	118,145	0	0	118,145	118145.00
Construction Contracts	1.00	EA	0	118,145	0	0	118,145	118145.00
CONSTRUCTION MANAGEMENT	1.00	EA	0	118,145	0	0	118,145	118145.00
Passaic #10 Project Cost	1.00	EA	14,152	1494734	652,645	213,355	2,360,734	2360734
OVERHEAD							68,992	
SUBTOTAL							2,429,726	
HOME OFC							48,754	

	QUANTITY	UOM	MANHRS	LABOR	EQUIPMN	MATERIA	TOTAL COST	UNIT COST
SUBTOTAL							2,478,480	
PROFIT							101,599	
SUBTOTAL							2,580,079	
BOND							11,638	
TOTAL INCL INDIRECTS							2,591,717	
Contingency							205,790	
TOTAL INCL OWNER COSTS							2,797,507	

ATTACHMENT H

MANUFACTURERS LITERATURE

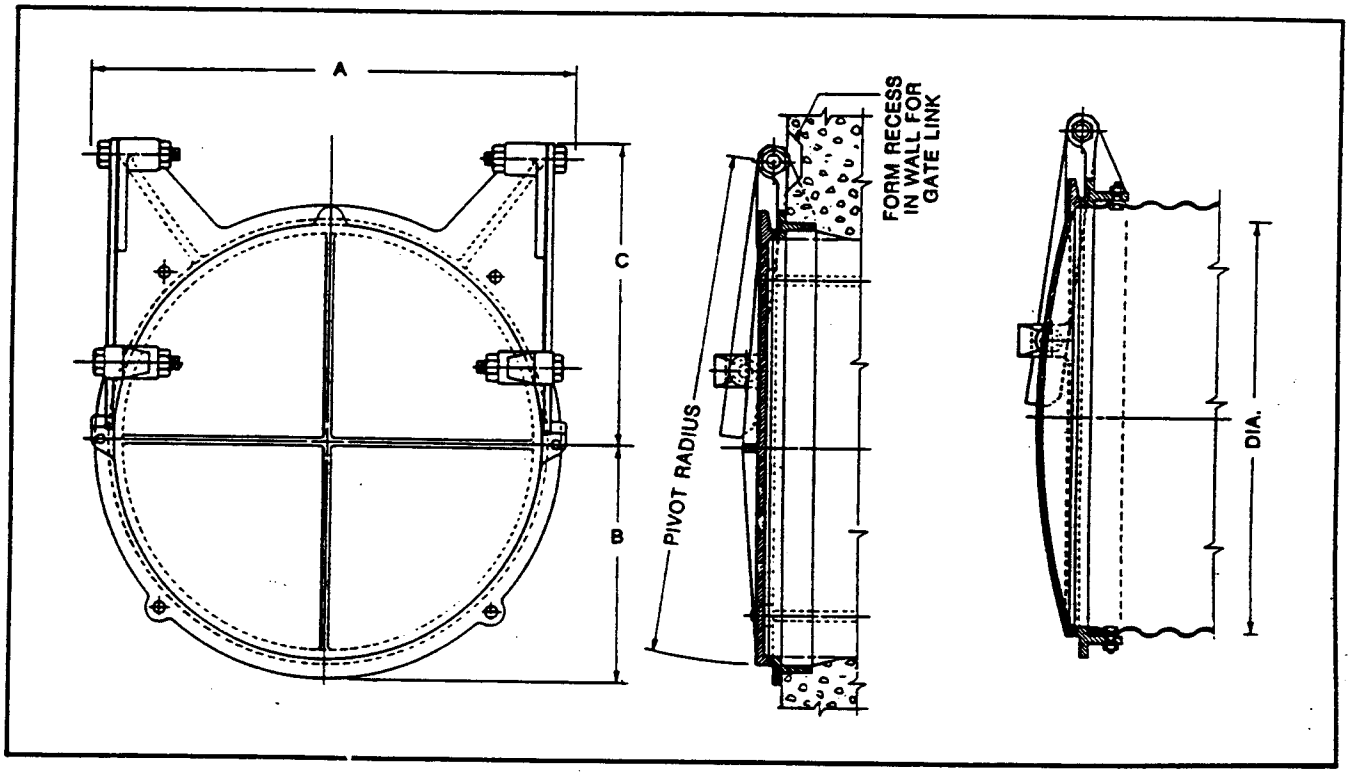
MODEL 10C FLAP GATE

- For seating heads to 10 feet
- Round opening
- Spigot back
- Cast iron seating surfaces

The Model 10C flap gate consists of the simplest possible design with double hinge action for heads to 10 feet. Pivot points are stationary. Ring and flap are of cast iron with galvanized steel hinge arms and assembly bolts and bronze bushings. Extension of the cast iron bosses of the flap over the top of the pivot arms limits the double hinge action, and prevents the bottom of the flap from folding inside the ring and wedging the gate in the open position.

This gate is made only in spigot back and normally attaches to corrugated steel pipe. The spigot back gate may be embedded in the concrete at the time it is poured; however, a flat back gate anchored and then grouted to the wall is recommended. See "Medium Duty Gates" for this application.

This gate opens under a minimum head differential, yet is positive closing under a few inches of water on the face of the gate. A lifting eye is cast integrally with the flap to permit manual operation.

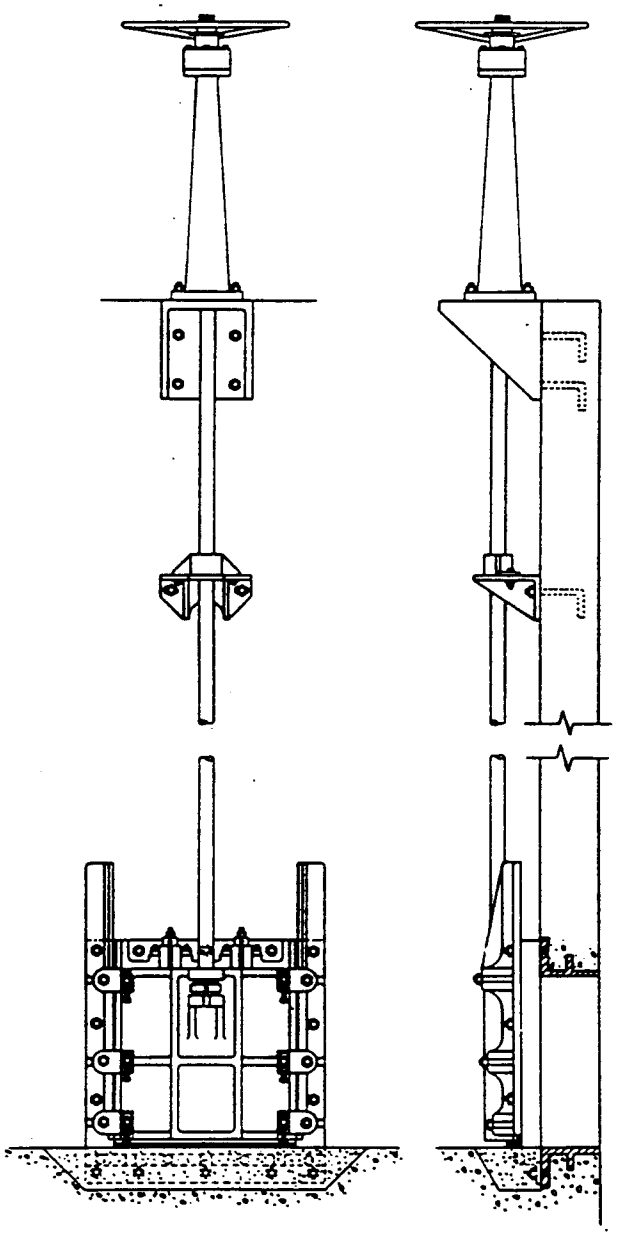


(All Dimensions in Inches)

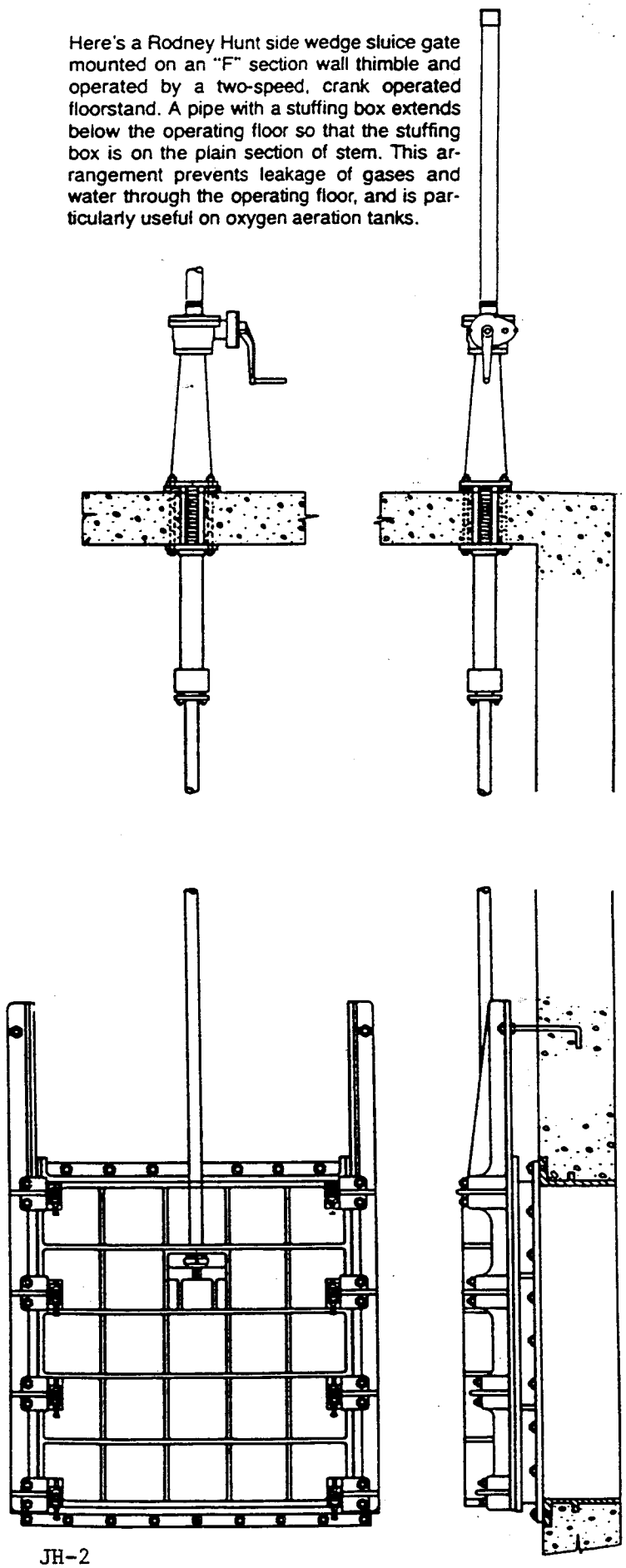
6	8.75	3.75	4.75	7.50
8	10.75	5.00	6.50	10.25
10	12.75	6.25	8.00	12.50
12	15.25	7.25	9.25	15.00
15	18.75	9.00	11.50	18.50
18	21.75	10.50	13.75	22.25
21	24.75	12.25	16.00	26.00
24	27.75	13.75	18.00	29.75
30	34.25	17.00	21.75	36.25
36	41.50	20.50	26.25	43.75
42	47.50	23.50	31.00	51.50
48	54.00	27.00	35.50	58.75

*Maximum width of gate may occur at top or on horizontal center line. "A" dimension is shown for maximum horizontal width of gate.

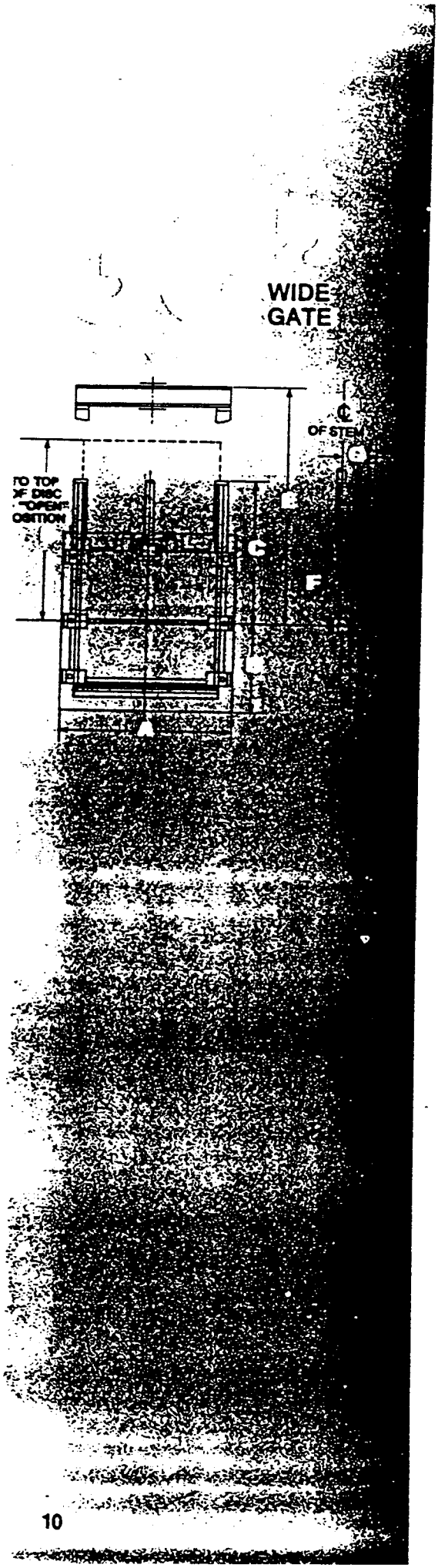
This is a Rodney Hunt sluice gate with flush-bottom closure and side and top wedges. It is mounted on a type "F" wall thimble, the most widely used. Note that the handwheel operated floorstand is mounted on a machined wall bracket. In this situation, a grout pad under the floorstand is not necessary for true alignment.



Here's a Rodney Hunt side wedge sluice gate mounted on an "F" section wall thimble and operated by a two-speed, crank operated floorstand. A pipe with a stuffing box extends below the operating floor so that the stuffing box is on the plain section of stem. This arrangement prevents leakage of gases and water through the operating floor, and is particularly useful on oxygen aeration tanks.



JH-2



The dimensions listed below are the actual dimensions, to the nearest ¼", of the size of gate listed and the head for which that gate is designed. Rodney Hunt will furnish the gate shown in the table for all applications where the head is equal to or less than the design head indicated. In some instances, several gates are listed for the same size but with different design heads. This has been done to enable Rodney Hunt to provide the most economically designed gate for the specific design head application.

SIZE	DESIGN HEAD FT.		DIMENSIONS, INCHES						
WIDTH x HEIGHT INCHES	SEAT	UNSEAT	A	B	C	D	E	F	G
36 x 18	88	40	46	14	20	33	40	8½	6
36 x 24	82	30	46	17	26	42	49	8½	6¼
36 x 30	60	36	46	20	32	51	58¼	9½	6¼
36 x 36	60	30	46	23	38	60	67¾	9½	6¼
36 x 42	76	43	47½	26	44	69	82	9½	6¼
36 x 48	65	30	47½	29	50	78	91	10	6¼
36 x 48	240	95	49½	30¾	51½	81½	93½	15¼	9½
36 x 60	213	84	49½	36¾	63½	99½	111½	16½	9½
36 x 72	244	101	49½	42¾	75½	117½	129½	16½	9½

For 36 inch diameter gates to be mounted on pipe flanges, the dimensions "F" and "G" are increased by 3½ inches.

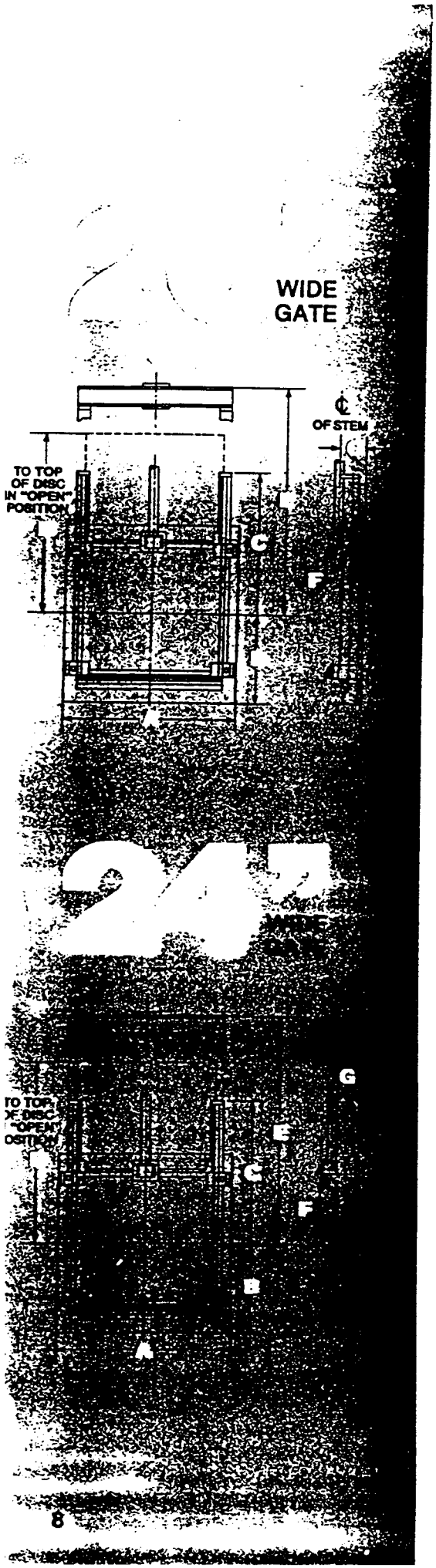
Installation Clearance

All sluice gates listed in the tables can be installed where the installation clearance along each side and along the bottom of the gate is 1". The flange of the gate is drilled so that the attaching studs extend to the front of the gate where they are easily accessible.

Where flange frame gates are required, such as where the gate must be mounted on a circular pipe flange, the recommended installation clearance is 8" on each side and beneath the bottom of the gate.

For flush-bottom closure sluice gates the dimensions for the cut-out required in the concrete floor is shown on Page 3.

For sizes of gates not shown above and for applications where the head required is greater than the design head listed, please contact Rodney Hunt Company for dimensions.



The dimensions listed below are the actual dimensions, to the nearest ¼", of the size of gate listed and the head for which that gate is designed. Rodney Hunt will furnish the gate shown in the table for all applications where the head is equal to or less than the design head indicated. In some instances, several gates are listed for the same size but with different design heads. This has been done to enable Rodney Hunt to provide the most economically designed gate for the specific design head application.

SIZE	DESIGN HEAD FT.		DIMENSIONS, INCHES						
WIDTH x HEIGHT INCHES	SEAT	UNSEAT	A	B	C	D	E	F	G
20 x 20	70	55	30	15	21	35¾	41½	8½	6

For 20 inch diameter gates to be mounted on pipe flanges, the dimensions "F" and "G" are increased by 2½ inches.

Installation Clearance

All sluice gates listed in the tables can be installed where the installation clearance along each side and along the bottom of the gate is 1". The flange of the gate is drilled so that the attaching studs extend to the front of the gate where they are easily accessible.

Where flange frame gates are required, such as where the gate must be mounted on a circular pipe flange, the recommended installation clearance is 8" on each side and beneath the bottom of the gate.

For flush-bottom closure sluice gates the dimensions for the cut-out required in the concrete floor is shown on Page 3.

SIZE	DESIGN HEAD FT.		DIMENSIONS, INCHES						
WIDTH x HEIGHT INCHES	SEAT	UNSEAT	A	B	C	D	E	F	G
24 x 12	54	41	34	11	14	24	31	8½	6
24 x 18	60	55	34	14	20	33	40	8½	6
24 x 24	60	55	34	17	26	42	49	8½	6¼
24 x 30	53	31	34	20	32	51	58¼	9¼	6¼
24 x 36	45	41	34	23	38	60	67¾	9½	6¼
24 x 42	84	47	35½	26	44	69	82	9½	6¼
24 x 48	78	56	35½	29	50	78	91	10	6¼

For 24 inch diameter gates to be mounted on pipe flanges, the dimensions "F" and "G" are increased by 2½ inches.

For sizes of gates not shown above and for applications where the head required is greater than the design head listed, please contact Rodney Hunt Company for dimensions.

Crank-Operated Floor Stands

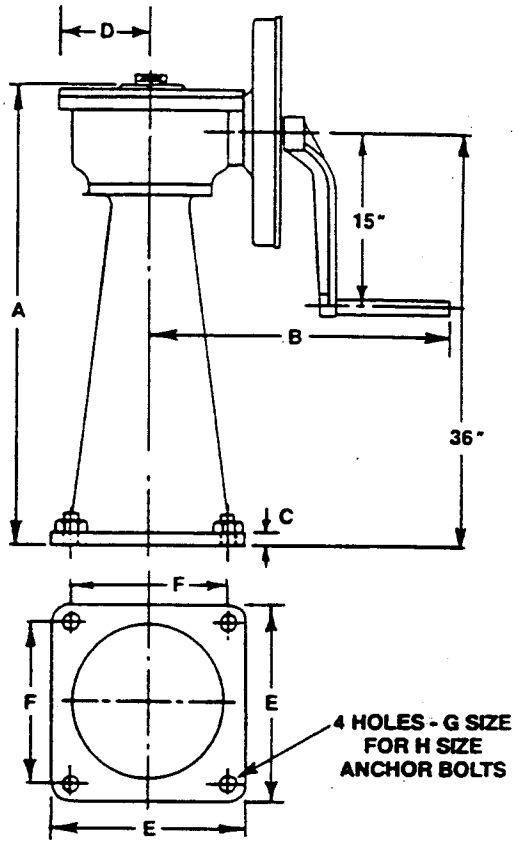
Standard Features

- BRONZE OPERATING NUTS
- TAPERED ROLLER BEARINGS THROUGHOUT
- MECHANICAL SEALS
- PRECISION-CUT GEARS
- WEATHERPROOF HOUSINGS
- CADMIUM PLATED PINION SHAFTS
- LUBRICATION FITTINGS
- SELF-LOCKING AT ANY POSITION OF STEM TRAVEL

Specifications

The geared floor stand shall have a weatherproof, cast-iron housing, with a bronze operating nut, mounted on a high strength pedestal. The operating nut shall be internally threaded with 29° acme threads corresponding to stem threading. Tapered roller bearings shall be located above and below the bronze operating nut to support the out-put thrust of the floor stand. The gearing shall be accurately cut and of proper design to support the load conditions without undue stress. The cadmium plated pinion shaft will be mounted on tapered roller bearings to provide low friction operation and to resist axial and radial thrusts. Mechanical seals shall be provided around the operating nut and the pinion shaft to prevent lubrication from leaving the unit and moisture from entering the sealed housing. The reduction gear case shall be precision machined and equipped with tapered roller or needle bearings and sealed about the reduction shafts. Lubrication fittings shall be provided for all bearings.

Crank operated floor stands will be selected so that no more than a 40 lb. effort on the crank will be required to open or close the sluice gate or slide gate.



Note: 5001. 5002 & 5003 have a 12" long crank.

TABLE OF DIMENSIONS (Inches)

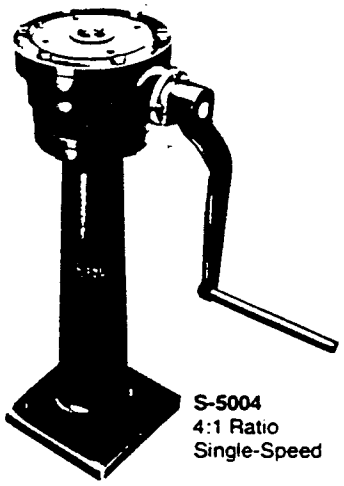
FLOORSTAND MODEL	APPROX. WEIGHT LBS.	A	B	C	D	E	F	G	H
S-5002	150	40	13	1¼	5	10	8	⅞	¾
S-5004	325	40	22	1½	6	12	9	1¼	1⅛
S-5001	175	40	15	1¼	5	10	8	⅞	¾
S-5003	175	40	15	1¼	5	10	8	⅞	¾
S-5012	380	40	25	1½	6	12	9	1¼	1⅛
S-5020	405	40	25	1½	6	12	9	1¼	1⅛
S-5036	780	40	28	1⅞	9	17	14	1⅜	1¼
S-5054	830	40	28	1⅞	9	17	14	1⅜	1¼

CRANK TURNS REQUIRED TO MOVE GATE 1 FOOT

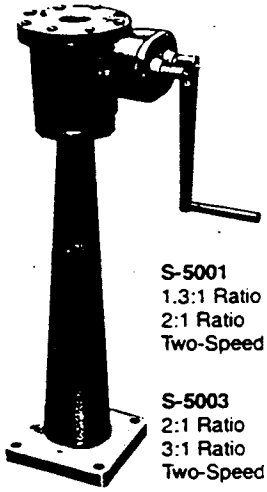
FLOORSTAND MODEL	INPUT SHAFT SPEED	NUMBER OF THREADS PER INCH 4	3½	3	2½	2
S-5002	Single	96	84	72		
S-5004	Single		168	144	120	
S-5001	High	64	56	48		
	Low	96	84	72		
S-5003	High	96	84	72		
	Low	144	126	108		
S-5012	High			144	120	
	Low			472	394	
S-5020	High			144	120	
	Low			720	600	
S-5036	High			240	200	160
	Low			1,200	1,000	800
S-5054	High			240	200	160
	Low			2,100	1,750	1,400

Crank operated floor stands are available to a ratio of 160 to 1 and a capacity of 104,000 lbs.

S-5002
2:1 Ratio
Single-Speed

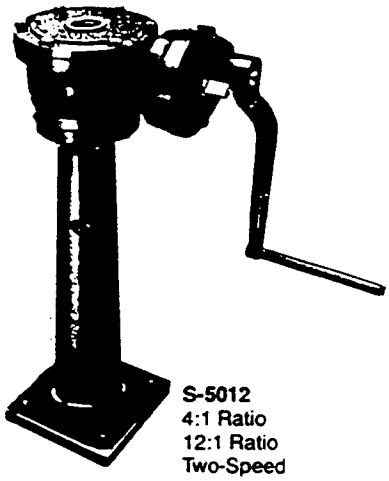


S-5004
4:1 Ratio
Single-Speed

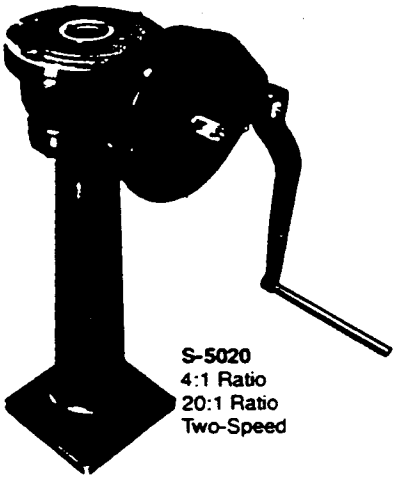


S-5001
1.3:1 Ratio
2:1 Ratio
Two-Speed

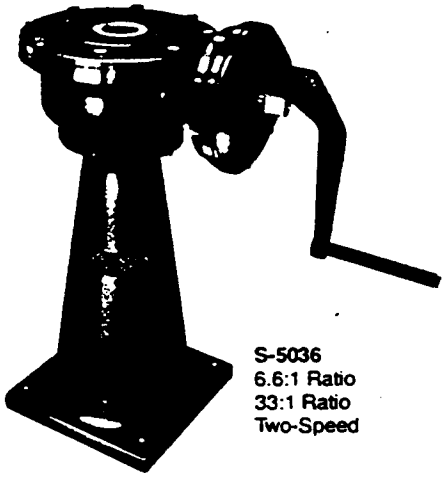
S-5003
2:1 Ratio
3:1 Ratio
Two-Speed



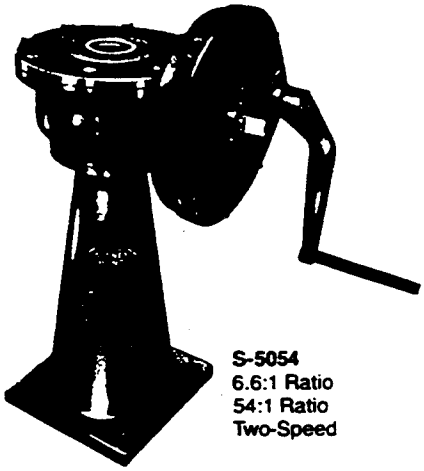
S-5012
4:1 Ratio
12:1 Ratio
Two-Speed



S-5020
4:1 Ratio
20:1 Ratio
Two-Speed



S-5036
6.6:1 Ratio
33:1 Ratio
Two-Speed



S-5054
6.6:1 Ratio
54:1 Ratio
Two-Speed

OUTPUT WITH 40 LB. EFFORT ON CRANK (Pounds)

STEM DIA.	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4
NO. THRDS PER INCH	4	3½	3½	3	3	3	2½	2½	2	2	2	2
S-5002	6.000	5.110	4.480	3.920								
S-5004			10.100	8.830	7.900	7.300	6.620	6.140	5.670			
S-5001	5.410	4.590	4.030	3.530								
S-5003	8.120	6.890	6.040	5.300								
S-5012				28.900	25.800	23.800	21.600	20.100	18.200			
S-5020					39.500	36.400	33.100	30.700	27.800			
S-5036						57.800	52.000	48.300	43.800	41.100	38.900	36.900
S-5054							85.300	79.300	72.000	68.200	63.900	60.500

ATTACHMENT I

OPERATIONS AND MAINTENANCE

ATTACHMENT I

OPERATIONS AND MAINTENANCE

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Specific Maintenance and Operations	JI-1

OPERATIONS AND MAINTENANCE

I. GENERAL PROCEDURES.

A. Section 208.10, Title 33, of the Code of Federal Regulations contains regulations for the operation and maintenance of local flood-protection works approved by the Secretary of the Army in accordance with authorities contained in Section 3 of the Flood Control Act of 22 June 1936, as amended and supplemented (a copy of Section 208.10 is included).

B. The following general regulations are prescribed to govern the maintenance of the Passaic 10 Levee Project:

1. The levee shall be maintained continuously in such a manner as to obtain maximum flood-protection benefits.

2. A permanent committee, consisting of or headed by an official, hereinafter called the "Superintendent," shall be responsible for the continuing maintenance of the project.

3. No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protection facilities.

4. No improvement shall be passed over, under, or through the levee, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in the feature of the works, that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facility. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice.

5. It shall be the duty of the Superintendent to submit a semiannual report to the District Engineer covering the inspection and maintenance of the project. The report should cover such items as the number of inspections made, the condition of the levee maintenance needed, and maintenance work done since the last report.

II. SPECIFIC MAINTENANCE AND OPERATIONS INSTRUCTIONS.

A. Maintenance. The Superintendent shall provide such maintenance as may be required to insure the serviceability of the levee protection, floodwall, drainage structures, and pumping

plants during times of flood. Measures shall be taken to repair damage caused by erosion and above-normal floods, and to promote growth of the vegetative cover above the slope protection. Periodic inspections of the levee, floodwall, drainage structures, and pumping plants shall be made by the Superintendent to ascertain whether or not:

1. Any unusual movement, sloughing, or material displacement of the levee has occurred;

2. Any erosion has occurred in the open grassed areas within the project right-of-way;

3. A satisfactory stand of grass is maintained along the levee top and side slopes.

4. Levee dimensions, grade, and alignment are being maintained according to the plans.

5. Encroachments are not being made within the project rights-of-way which might hinder the efficiency of the levee protection and floodwall.

6. Rip rap sections are in good conditions.

7. No seepage, saturated areas, or sand boils are occurring around the levee, floodwall, drainage structures, and pumping plants.

8. No undue settlement has occurred which affects the stability of the floodwall or its water tightness;

9. The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the floodwall or its water tightness.

10. Pipe, gates, operating mechanism, riprap, and headwalls are in good condition.

11. Inlet and outlet channels are open.

12. All equipment, including motors and pumps shall be trial operated and checked.

Such inspections shall be made at intervals not to exceed 90 days and also periods following heavy rainfall which produce above-normal floods. Following the inspection, the Superintendent shall take immediate steps to:

1. Repair eroded grassed area within the project right-of-way limits by filling, grading, shaping, and reseeding as necessary to restore and stabilize the levee;

2. Repair damaged rip rap sections replacing stone that has been disturbed or dislodged.

3. Repair and/or replace damaged gates and operating mechanisms as necessary.

4. Repair and/or replaced damaged equipment as necessary.

5. Remove trash and debris adjacent to floodwall, drainage structures, and pumping plants intake.

B. Operations.

1. During flood periods, the levee should be monitored closely for erosion damages, bank sloughing, damages to vegetation, and stone protection displacement. Upon inspection, corrective measures should be taken to repair all damaged areas immediately after each high water period.

2. Continuous patrol of the floodwall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Immediate steps shall be taken to correct any condition which endangers the stability of the floodwall.

3. Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Manually operated gates shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

4. Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased.

TITLE 33 - NAVIGATION AND NAVIGABLE WATERS

CHAPTER II - CORPS OF ENGINEERS

PART 208 - FLOOD CONTROL REGULATIONS

208.10 Local flood protection works; maintenance and operations of structures and facilities.

(a) General.

(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of the Army, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood, emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army or his authorized representative that such improvement, excavation,

construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvement or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the Superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The Department of the Army will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under this part.

(b) Levees - (1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might effect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working conditions, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger that structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) Flood walls - (1) Maintenance. Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working conditions, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) Operation. Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) Drainage structures - (1) Maintenance. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) Operation. Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) Closure structures - (1) Maintenance. Closure structures for traffic openings shall be inspected by the Superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order;

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once

each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) Operation. Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up closure structures or to discharge passengers or cargo over them.

(f) Pumping plants - (1) Maintenance. Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and

repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) Operation. Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) Channels and floodways - (1) Maintenance. Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days.

Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on banks slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) Operation. Both banks of the channel of the flood season during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) Miscellaneous facilities - (1) Maintenance. Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) Operation. Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor.

(Sec. 3, 49 Stat. 1571, Flood Control Act of 22 June 1936, as amended; 33 U.S.C. 701c).

ATTACHMENT J

HTRW INVESTIGATION

ATTACHMENT J

HTRW INVESTIGATIONS

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Potential Impacts Of HTRW	JJ-2
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Cost Estimates	JJ-4
Analytical Data	JJ-5 To JJ-15
Construction/Investigation Costs	JJ-16
Investigation Maps	JJ-17, JJ-18

Legend:

1 PRIORITY B, C OR D HTRW SITE

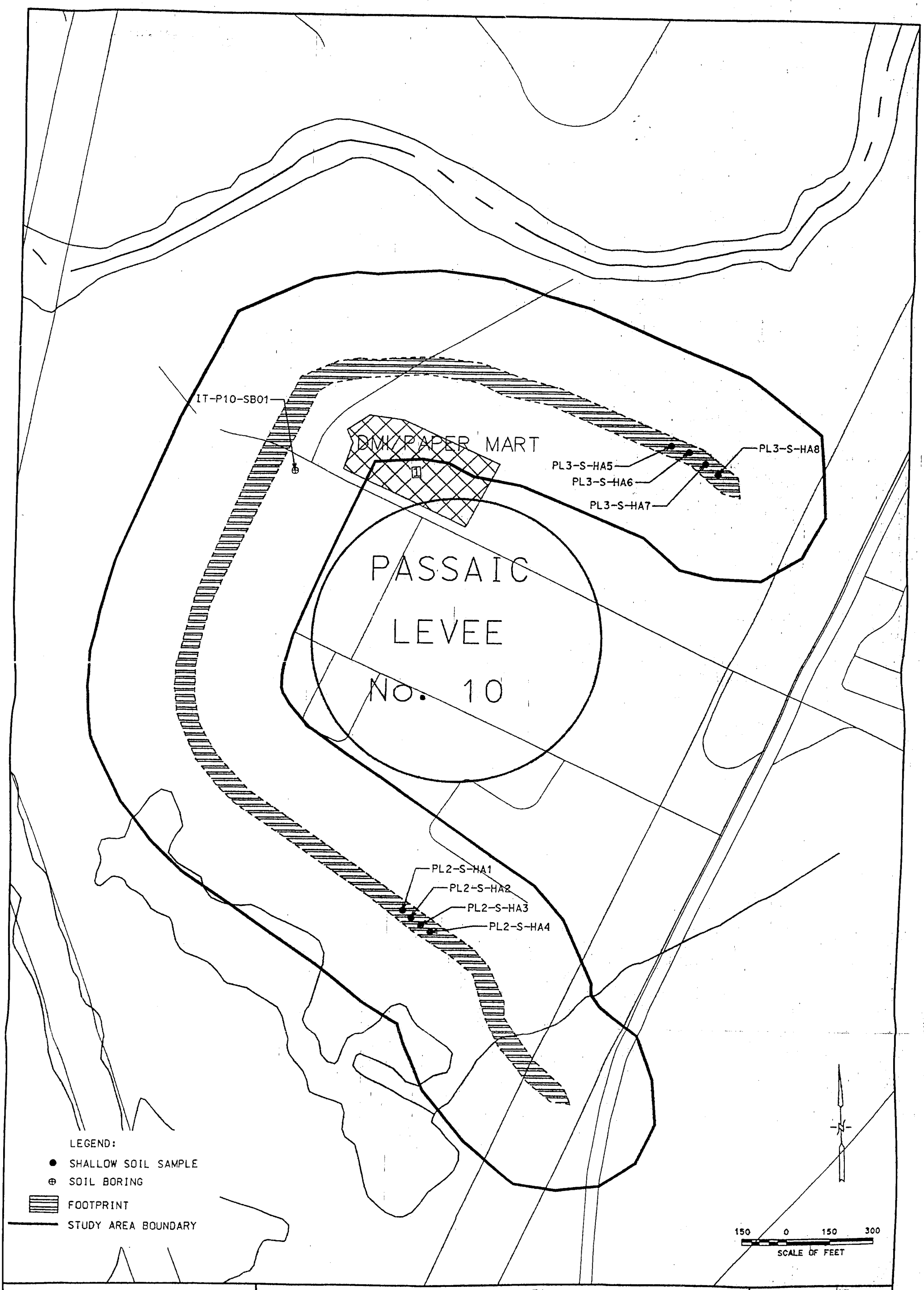
2 PRIORITY E HTRW SITE

FIGURE IV-17
PASSAIC LEVEE No. 10
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS

Passaic River Flood Damage Reduction Project
GENERAL DESIGN MEMORANDUM

DRAWN BY: D.BROOKER	DATE: 1/5/95		
CHECKED BY:	DATE:		
ENGINEER:	DATE:		
APPROVED BY:	DATE:		
SCALE: AS SHOWN	PROJECT NO. 529740		
DRAWING NO. 529740-876	REV		

REV	DESCRIPTION	DATE	BY



REV	DESCRIPTION	DATE	BY
-	-	-	-

FIGURE IV-17A
FEATURE MAP
PASSAIC LEVEE No. 10
U.S. ARMY ENGINEER DISTRICT, NEW YORK
PASSAIC RIVER DIVISION
CORPS OF ENGINEERS
Passaic River Flood Damage Reduction Project

DRAWN BY: D. BROOKER		DATE: 10/15/94	
CHECKED BY:		DATE:	
ENGINEER:		DATE:	
APPROVED BY:		DATE:	
SCALE: AS SHOWN		PROJECT No. 529740	
DRAWING No. 529740-B10			REV

Investigation Results

A. Field Investigation

One soil boring was completed to a depth of 16 feet in the old leaf dump at the Passaic Levee No. 10 location. Organic soil with vegetative remains was encountered to a depth of 1.5 feet. The stratigraphy beneath the organic fill material consisted of mixed sand, silt, and clay to 5 feet; silty, fine-grained sand to 7 feet; saturated, medium- to coarse-grained sand to approximately 11.5 feet; and clay with some silt and trace sand to the bottom of the borehole.

Soil samples for chemical analysis were collected from the soil boring at depths of 4 to 6 feet and 12 to 14 feet. The samples were analyzed for VOCs; SVOCs; pesticides/PCBs; herbicides; metals; chromium VI; cyanide; TPH; 2,3,7,8-TCDD; and gross and . The deeper sample in the soil boring was not analyzed for herbicides or 2,3,7,8-TCDD. The locations of the soil boring and the surface soil samples are depicted in Figure IV-17A. Detected compounds and applicable screening criteria are presented in Table IV-E-4-1.

Several metals and a few organics were detected in the borehole soil samples. Gross and were not detected at levels significantly above background. Cyanide, chromium VI, TPH, and 2,3,7,8-TCDD were not detected in the samples.

In addition to the borehole soil samples, eight surface soil samples were collected from the wing areas of the levee footprint: four samples were collected in a former sludge disposal area near the WWTP and four samples were collected near the old railroad ties dump. Several metals were detected in the surface soil samples. The reported concentrations of beryllium and cadmium in soil samples PL2-S-HA3 and PL2-S-HA4, collected near the WWTP, slightly exceed the NJDEP Residential Soil Cleanup Criteria. According to NJDEP guidance in NJAC 7:26D-3.3, the soil concentrations at a site can be averaged for compliance if: 1) no single sample exceeds the applicable criterion by a factor of more than five for a standard between 10 and 101 ppm and 2) no more than 10 percent of the samples exceed the criteria. This averaging rule cannot be applied for beryllium and cadmium at thesite because the second guideline has not been achieved (i.e.,

2 of 8 samples exceeded criteria). Therefore, the soils near the WWTP are evaluated as nonhazardous contaminated soil and must be handled as such.

B. Environmental Records Search

One Priority C HTRW site, DMI/Paper Mart, was identified in the ERS (Figure IV-17). The site is not anticipated to impact on construction of this levee feature. Summaries of findings are presented in Tables IV-E-4-2 and IV-E-4-3.

DMI/Paper Mart, a distributor of printing papers, maintains a print shop and vehicle maintenance garage. The site is within the 300 foot buffer zone surrounding the proposed levee. Low quality (1985) HTRW data for DMI/Paper Mart indicated elevated levels of benzene and TPH in both soil and groundwater. More current analytical data or regulatory status of the site was not available through the ERS. DMI/Paper Mart is not listed in the NJDEP Site Remediation Program July 1994 *Known Contaminated Sites in New Jersey* report.

The field investigation at Passaic Levee No. 10 detected low levels of several metals and persistent pesticides in surficial and deep soil. With the exception of beryllium (2.1 mg/kg) and cadmium, none of the other identified HTRW contaminant concentrations were above residential soil cleanup criteria. The field investigation provides evidence that soil HTRW contaminants within the footprint of the feature is considered to be nonhazardous contaminated soil based on the slightly elevated levels of beryllium and cadmium.

Recommendations for Additional HTRW Investigations

Additional soil investigations are not recommended for this feature. However, if groundwater is encountered, dewatering of any excavation may be required. HTRW characteristics of the water are not known and limited shallow groundwater sampling and analysis is recommended to determine if groundwater contamination exists.

Potential Impacts of HTRW

A. Impact of HTRW on Feature Construction and Operation

Occupational exposure to surficial soil at the feature location would pose negligible cancer risk and non-cancer health hazards. The soil concentrations of beryllium and cadmium detected at Levee No. 10 do not pose occupational health concerns

through dermal contact to such soil.

B. Impact of Feature Construction on HTRW

The potential for HTRW mobilization due to the construction activities to be carried out at the Passaic Levee No. 10 is expected to be very low. The primary activity is the removal of six inches of soil from the surface where the levee is to be constructed. Previous investigations indicate there is only slight beryllium and cadmium contamination of surface soil. There is little indication that excavation of the surface soils at this site will increase mobilization of HTRW. Confirmatory analysis of the soils where the metals exceeded the soil cleanup criteria will be carried out to demonstrate that they do not exceed TCLP parameters and may be reused on site as fill material for the levee.

One section of the levee will pass through an area which has been used as a leaf dump. The organic material here is up to 7 feet deep and will need to be removed prior to installation of the levee. Once the leaves have been removed, the depression will be backfilled with acceptable fill material. Groundwater at the site is present at greater than 7 feet below ground level, so it will probably not be encountered during excavation. If it is encountered, however, dewatering of the excavation may be required. As the HTRW characteristics of the water are not known, the potential for contamination exists. If the water removed from the excavation has parameters which exceed discharge limits, appropriate treatment measures will be implemented.

HTRW Response Alternatives

Sampling and analysis for TCLP of excavated soil where metals exceed the soil cleanup criteria will be required. If analysis of excavated soils demonstrates contamination above TCLP levels, transportation and disposal offsite would be required. While the concentrations of certain contaminants may be above residential standards, they are expected to be substantially below TCLP levels. Therefore, it is expected that excavated soils will be reused on site for levee construction.

Excavated soils will be stockpiled on site until analytical results indicate whether they are acceptable for reuse or must be removed from the site for disposal.

Zone control would be implemented to limit impact of the surrounding sites on the health and safety of workers. Dust control measures would, also, be implemented to minimize generation of airborne particulates.

Worker health and safety concerns would be addressed and, while the lowest level of protection is expected to be necessary, they would include such elements as PPE appropriate for the conditions.

Cost Estimates

Soil: Will require sampling and analysis. The soils are expected to be reused on site with no associated HTRW costs. However, if analysis indicates that they exceed TCLP levels, they will require special handling (e.g., containerizing), transportation and disposal.

Groundwater: Groundwater is not expected to be encountered during excavation. Therefore, no HTRW costs are associated with it during construction (Table IV-E-4-4).

Table IV-E-4-1
Comparison of Field Investigation Analytical Results to Screening Criteria
Passaic Levee No. 10

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
PL1-S-SB1-04					
Antimony	1100 B	340000	14000		
Arsenic	1400	20000	20000		
Barium	28800	47000000	700000		
Copper	13200	600000	600000		
Gross Alpha	3.8				50
Gross Beta	30				60
Lead	6500	600000	100000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	9800	2400000	250000		
Vanadium	28600	7100000	370000		
Zinc	23600	1500000	1500000		
PL1-S-SB1-12					
Acetone	41	1000000	1000000	100000	
Antimony	1100 B	340000	14000		
Arsenic	3600	20000	20000		
Barium	68800	47000000	700000		
Copper	24300	600000	600000		
Gross Alpha	6.4				50
Gross Beta	44				60
Lead	10500	600000	100000		
Methylene chloride	1 BJ	210000	49000	1000	
Nickel	20700	2400000	250000		
Vanadium	40300	7100000	370000		
Zinc	46100	1500000	1500000		
PL2-S-HA01					
4,4prime-DDE	11	9000	2000	50000	
4,4prime-DDT	5.6	9000	2000	500000	
Antimony	1200 B	340000	14000		
Arsenic	1700	20000	20000		
Barium	76600	47000000	700000		

All units are in ppb

1

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
Beryllium	640	1000	1000		
Bis(2-ethylhexyl) phthalate	440	210000	49000	100000	
Cadmium	870	100000	1000		
Copper	9300	600000	600000		
Gross Alpha	9.7				50
Gross Beta	29				60
Lead	26400	600000	100000		
Mercury	120	270000	14000		
Nickel	9600	2400000	250000		
Selenium	590 B	3100000	63000		
Vanadium	39400	7100000	370000		
Zinc	43700	1500000	1500000		
PL2-S-HA02					
4,4prime-DDE	26	9000	2000	50000	
4,4prime-DDT	8	9000	2000	500000	
Antimony	1100 B	340000	14000		
Arsenic	1600	20000	20000		
Barium	66800	47000000	700000		
Beryllium	690	1000	1000		
Bis(2-ethylhexyl) phthalate	1100	210000	49000	100000	
Cadmium	740	100000	1000		
Copper	10500	600000	600000		
Gross Alpha	9.1				50
Gross Beta	29				60
Lead	33900	600000	100000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	12000	2400000	250000		
Selenium	550 B	3100000	63000		
Vanadium	35900	7100000	370000		
Zinc	34900	1500000	1500000		
PL2-S-HA03					
4,4prime-DDD	30	12000	3000	50000	
4,4prime-DDE	260	9000	2000	50000	
4,4prime-DDT	290	9000	2000	500000	
Antimony	1600 B	340000	14000		

All units are in ppb

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
Arsenic	4100	20000	20000		
Barium	133000	47000000	700000		
Beryllium	1300	1000	1000		
Bis(2-ethylhexyl) phthalate	1700	210000	49000	100000	
Cadmium	1300	100000	1000		
Copper	54200	600000	600000		
Gross Alpha	4.6				50
Gross Beta	31				60
Lead	47600	600000	100000		
Mercury	300	270000	14000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	26800	2400000	250000		
Selenium	1100 B	3100000	63000		
Vanadium	52200	7100000	370000		
Zinc	69900	1500000	1500000		
PL2-S-HA04					
4,4prime-DDE	17	9000	2000	50000	
4,4prime-DDT	10	9000	2000	500000	
Acetone	28	1000000	1000000	100000	
Antimony	1900 B	340000	14000		
Arsenic	3100	20000	20000		
Barium	164000	47000000	700000		
Beryllium	2100	1000	1000		
Cadmium	1700	100000	1000		
Copper	56200	600000	600000		
Gross Alpha	20				50
Gross Beta	34				60
Lead	27500	600000	100000		
Mercury	360	270000	14000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	23500	2400000	250000		
Selenium	1600 B	3100000	63000		
Vanadium	60500	7100000	370000		
Zinc	69500	1500000	1500000		
PL3-S-HA05					

All units are in ppb

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
4,4prime-DDE	29	9000	2000	50000	
4,4prime-DDT	15	9000	2000	500000	
Antimony	1100 B	340000	14000		
Arsenic	4200	20000	20000		
Barium	74900	47000000	700000		
Cadmium	790	100000	1000		
Copper	16600	600000	600000		
Gross Alpha	7				50
Gross Beta	37				60
Lead	32700	600000	100000		
Mercury	230	270000	14000		
Nickel	13300	2400000	250000		
Selenium	570 B	3100000	63000		
Vanadium	51500	7100000	370000		
Zinc	70300	1500000	1500000		
PL3-S-HA06					
1,1,1,2-Tetrachloroethane	4 J	310000	170000	1000	
1,1,2-Trichloroethane	1 J	420000	22000	1000	
1,1-Dichloroethene	2 J	150000	8000	10000	
4,4prime-DDE	85	9000	2000	50000	
4,4prime-DDT	30	9000	2000	500000	
Acetone	18	1000000	1000000	100000	
Acrylonitrile	2 J	5000	1000	1000	
Antimony	1200 B	340000	14000		
Arsenic	3600	20000	20000		
Barium	70600	47000000	700000		
Benzene	5 J	13000	3000	1000	
Bromodichloromethane	2 J	46000	11000	1000	
Cadmium	750	100000	1000		
Chlorobenzene	9	680000	37000	1000	
Chlorodibromomethane	1 J	1000000	110000	1000	
Chloroform	6 J	28000	19000	1000	
Copper	16300	600000	600000		
Ethylbenzene	4 J	1000000	1000000	100000	
Gross Alpha	13				50

All units are in ppb

4

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
Gross Beta	42				60
Lead	40100	600000	100000		
Methylene chloride	2 BJ	210000	49000	1000	
Nickel	13600	2400000	250000		
Selenium	620 B	3100000	63000		
Styrene	2 J	97000	23000	100000	
Tetrachloroethylene	6 J	6000	4000	1000	
Toluene	5 J	1000000	1000000	500000	
Trichloroethene	2 J	54000	23000	1000	
Vanadium	55100	7100000	370000		
Xylenes (total)	4 J	1000000	410000	10000	
Zinc	51700	1500000	1500000		
PL3-S-HA07					
4,4prime-DDE	73	9000	2000	50000	
4,4prime-DDT	32	9000	2000	500000	
Acetone	21	1000000	1000000	100000	
Antimony	1200 B	340000	14000		
Arsenic	3900	20000	20000		
Barium	49600	47000000	700000		
Cadmium	620	100000	1000		
Chloroform	2 J	28000	19000	1000	
Copper	15800	600000	600000		
Gross Alpha	9.1				50
Gross Beta	37				60
Lead	49500	600000	100000		
Mercury	140	270000	14000		
Methylene chloride	1 BJ	210000	49000	1000	
Nickel	10500	2400000	250000		
Selenium	610 B	3100000	63000		
Vanadium	47500	7100000	370000		
Zinc	47700	1500000	1500000		
PL3-S-HA08					
4,4prime-DDE	43	9000	2000	50000	
4,4prime-DDT	16	9000	2000	500000	
Antimony	1100 B	340000	14000		

All units are in ppb

Analyte	Result	Non Res Soil	Res Soil	Soil Impact to GW	Soil Misc
Arsenic	2200	20000	20000		
Barium	29000	47000000	700000		
Chloroform	2 J	28000	19000	1000	
Copper	8700	600000	600000		
Gross Alpha	3.8				50
Gross Beta	30				60
Lead	23400	600000	100000		
Methylene chloride	1 BJ	210000	49000	1000	
Nickel	7000	2400000	250000		
Selenium	530 B	3100000	63000		
Vanadium	38900	7100000	370000		
Zinc	26800	1500000	1500000		

All units are in ppb

Key to Criteria Cited in Field Investigation and Historical Data Tables

Criteria	Description
Freshwater (a)	USEPA Surface Water Criteria (Acute), November 1991
Freshwater (c)	USEPA Surface Water Criteria (Chronic), November 1991
FW-2 Effluent Daily Max.	NJDEP Soil Cleanup Criteria, February 3, 1994
FW-2 Effluent Monthly Avg	NJDEP Soil Cleanup Criteria, February 3, 1994
FW2-NT (a)	NJDEP Surface Water Criteria, (Acute), November 1991.
FW2-NT (c)	NJDEP Surface Water Criteria, (Chronic), November 1991.
FW2-NT (hc)	NJDEP Surface Water Criteria, (Human Carcinogenic), November 1991.
Haz Waste Classification	NJDEP Guidance Document for Remediation of Contaminated Soils, June 1994.
Non Res Soil	NJDEP Soil Cleanup Criteria, February 3, 1994
Res Soil	NJDEP Soil Cleanup Criteria, February 3, 1994
SE (a)	NJDEP Surface Water Quality Standards (Acute), April 1994.
SE (c)	NJDEP Surface Water Quality Standards (Chronic), April 1994.
SE (h)	NJDEP Surface Water Quality Standards (Human Health), April 1994.
SE (hc)	NJDEP Surface Water Quality Standards (Human Carcinogenic), April 1994.
SE Effluent Daily Max.	NJDEP Guidance Document for Remediation of Contaminated Soils, June 1994.
SE Effluent Monthly Avg	NJDEP Guidance Document for Remediation of Contaminated Soils, June 1994.
Soil Impact to GW	NJDEP Soil Cleanup Criteria, February 3, 1994
Soil Misc	Miscellaneous Soil Criteria (Used to produce Gross Alpha, Gross Beta, and 2,3,7,8-TCDD reports)
Water Misc	Miscellaneous Water Criteria (Used to produce Gross Alpha, Gross Beta, and 2,3,7,8-TCDD reports)

Table IV - E - 4 - 2

INVESTIGATION AND RESPONSE SUMMARY
PASSAIC LEVEE 10

Passaic River Local Flood Protection Project

FEATURE NAME	SITE NAME	ERS	FI	CONSTITUENT OF CONCERN	SELECTED RESPONSE	COST	WORKER H&S CONCERN
Passaic Levee 10				Inorganics	Field Investigation, Mitigation	$44,000	Low
	Passaic Levee 10 Field Investigation	Yes	Yes				
	DMI / Paper Mart	Yes	No				

Table IV - E - 4 - 3

LIST OF HTRW SITES
PASSAIC LEVEE 10

Passaic River Local Flood Protection Project

SITE NAME	RANK	REASONS FOR DELETION	ADDRESS	TOWNSHIP	AGENCY ID	DESIGNATION	SOURCE
Passaic Levee 10 Field Investigation	A		Dorsa Ave.	Livingston	-	-	IT
DMI / Paper Mart	C		120 Dorsa Ave.	Livingston	-	ISRA	D&M, IT

Notes :

Criteria and Rationale Used to Delete Priority E HTRW Sites :

1. The site is not within the tunnel alignment database corridor search or within 300 feet of a levee feature if outside the corridor.
2. The site has been recommended "No Further Action" by the USEPA or NJDEP.
3. HTRW contaminant concentrations are less than the proposed New Jersey non-residential soil cleanup criteria.
4. The identified petroleum product spill or leak was less than 100 gallons and does not impact groundwater.
5. The site-related HTRW contaminants are limited to metals with no impact to groundwater and the site is not within 500 feet of a workshaft.
6. The site is a listed SPL Hudson County Chromate site and HTRW contaminants are limited only to the chromate ore slag fill on the property.
7. The NPL/SPL site is a secured radioactive materials storage facility with no soil or groundwater HTRW contamination.
8. The site is located on the east bank of the Hackensack River.
9. The site is only identified as a RCRA small or large quantity generator of hazardous waste materials.

HTRW SITE INFORMATION
Passaic River Local Flood Protection Project

1. Name :	Passaic Levee 10 Field Investigation	5. Rank :	A
2. Address :	Dorsa Ave.	6. Facility ID Number :	-
3. Town/Township :	Livingston	7. Designation :	-
4. Feature :	Passaic Levee 10	8. Source :	IT

9. Site Description and History :
Passaic Levee No. 10 lies in the northwestern portion of Livingston Township, NJ. The site lies between the Passaic River to the north and west, the Eisenhower Parkway to the east, and surrounds an industrial park at Dorsa Avenue, Naylon Place, and Naylon

10. Physical and Geologic Description of the Site :
The Passaic Levee 10 site is underlain by at least 15 feet of unconsolidated deposits cocsisting of glacial till and stratified drift deposits. Groundwater occurs approximately 7 feet beneath the land surface. The depth to bedrock is unknown.

11. Quality of Information Reviewed :

MEDIA	SCORE	COMMENT
Soil	16	MEDIUM - Available analytical data indicate HTRW present in soils.
Groundwater	0	LOW - Available analytical data is limited and not sufficient to assess if site-related HTRW has impacted groundwater.

12. Occupational Risk and Hazard Analysis :

MEDIA	TOTAL RISK	TOTAL HAZARD
Surficial Soil	6.49E-08	5.73E-03
Deep Soil	2.20E-08	6.67E-03
Shallow Groundwater	NA	NA
Deep Groundwater	NA	NA

13. HTRW Constituents of Concern :
Free Product : NA
Depth to Groundwater(ft) : NA
Product Thickness(ft) : NA

MEDIA	CONSTITUENT	CAS No.	MAX CONC.	UNIT	SAMPLING DATE	REPORTED DATE
Deep Soil	Acetone	67-64-1	41.00	µg/kg	06/06/94	
Deep Soil	Arsenic	7440-38-2	3,600.00	µg/kg	06/06/94	
Deep Soil	Barium	7440-39-3	68,800.00	µg/kg	06/06/94	
Deep Soil	Chromium	18540-29-9	22,600.00	µg/kg	06/06/94	
Deep Soil	Cobalt	7440-48-4	11,000.00	µg/kg	06/06/94	
Deep Soil	Copper	7440-50-8	24,300.00	µg/kg	06/06/94	
Deep Soil	Lead	7439-92-1	10,500.00	µg/kg	06/06/94	
Deep Soil	Manganese	7439-96-5	556,000.00	µg/kg	06/06/94	
Deep Soil	Nickel	7440-02-0	20,700.00	µg/kg	06/06/94	
Deep Soil	Vanadium	7440-62-2	40,300.00	µg/kg	06/06/94	
Deep Soil	Zinc	7440-66-6	46,100.00	µg/kg	06/06/94	
Surficial Soil	Acetone	67-64-1	28.00	µg/kg	06/06/94	
Surficial Soil	Arsenic	7440-38-2	4,200.00	µg/kg	06/06/94	
Surficial Soil	Barium	7440-39-3	164,000.00	µg/kg	06/06/94	
Surficial Soil	Beryllium	7440-41-7	2,100.00	µg/kg	06/06/94	
Surficial Soil	Bis(2-ethylhexyl)Phthalate (DEHP)	117-81-7	1,700.00	µg/kg	06/06/94	
Surficial Soil	Cadmium	7440-43-9	1,700.00	µg/kg	06/06/94	
Surficial Soil	Chlorobenzene	108-90-7	9.00	µg/kg	06/06/94	
Surficial Soil	Chromium	18540-29-9	45,900.00	µg/kg	06/06/94	
Surficial Soil	Cobalt	7440-48-4	8,400.00	µg/kg	06/06/94	
Surficial Soil	Copper	7440-50-8	56,200.00	µg/kg	06/06/94	
Surficial Soil	DDD	72-54-8	30.00	µg/kg	06/06/94	
Surficial Soil	DDE	72-55-9	260.00	µg/kg	06/06/94	
Surficial Soil	DDT	50-29-3	290.00	µg/kg	06/06/94	
Surficial Soil	Dinoseb	88-85-7	7.60	µg/kg	06/06/94	
Surficial Soil	Lead	7439-92-1	49,500.00	µg/kg	06/06/94	
Surficial Soil	Manganese	7439-96-5	341,000.00	µg/kg	06/06/94	
Surficial Soil	Mercury	7439-97-6	360.00	µg/kg	06/06/94	
Surficial Soil	Nickel	7440-02-0	26,800.00	µg/kg	06/06/94	
Surficial Soil	Vanadium	7440-62-2	60,500.00	µg/kg	06/06/94	
Surficial Soil	Zinc	7440-66-6	70,300.00	µg/kg	06/06/94	

HTRW SITE INFORMATION
Passaic River Local Flood Protection Project

1. Name :	DMI / Paper Mart	**5. Rank :**	C
2. Address :	120 Dorsa Ave.	**6. Facility ID Number :**	-
3. Town/Township :	Livingston	**7. Designation :**	ISRA
4. Feature :	Passaic Levee 10	**8. Source :**	D&M, IT

9. Site Description and History :
The site is a distributor of writing and printing papers and maintained a print shop and maint vehicle garage. In 1985 UST integrity was tested, and found the gasoline tank to leak. The facility is currently designing a groundwater recovery system due to elevated levels of contamination.

10. Physical and Geologic Description of the Site :
NA

11. Quality of Information Reviewed :

MEDIA	SCORE	COMMENT
Soil	7	LOW - Available analytical data is not sufficient to characterize the type and extent of HTRW in soil.
Groundwater	7	LOW - Available analytical data is limited and not sufficient to assess if site-related HTRW has impacted groundwater.

12. Occupational Risk and Hazard Analysis :

MEDIA	TOTAL RISK	TOTAL HAZARD
Surficial Soil	NA	NA
Deep Soil	NA	NA
Shallow Groundwater	2.87E-05	NA
Deep Groundwater	NA	NA

13. HTRW Constituents of Concern :

Free Product : NA
Depth to Groundwater*(ft)* : NA
Product Thickness*(ft)* : NA

MEDIA	CONSTITUENT	CAS No.	MAX CONC.	UNIT	SAMPLING DATE	REPORTED DATE
Shallow Groundwater	Benzene	71-43-2	6,750.00	µg/L	1985	
Shallow Groundwater	TPH	TPH	6,100,000.00	µg/L	1985	
Surficial Soil	TPH	TPH	3,100,000.00	µg/kg	1985	

TABLE IV-E-4-4
ESTIMATES OF HTRW IMPACTS ON FEATURE CONSTRUCTION COSTS
PASSAIC RIVER LOCAL FLOOD PROTECTION PROJECT

PASSAIC LEVEE 10

DESCRIPTION	NO. UNITS	UNIT MEAS.	UNIT PRICE($)	TOTAL
CONSTRUCTION COSTS:				
1. LEVEES AREAS:				
A. SOIL-CONFIRMATION TCLP ANALYT. (1 COMPOSITE SAMPLE/500 C.Y.)	17	EA.	$1,500	$25,500
TOTAL DIRECT COST				$25,500
20% CONTINGENCIES				$5,100
TOTAL COSTS:				$30,600
INVESTIGATION COSTS:				
1. LEVEES AREAS:				
A. GW-WELL AND SAMPLING INSTALLATION,SAMPLING,ANALYTICAL, AND REPORT		L.S.		$11,500
TOTAL DIRECT COST				$11,500
20% CONTINGENCIES				$2,300
TOTAL COSTS:				$13,800

NOTES: 1. TOP 6" OF SOILS REMOVED FROM LEVEE FOOTPRINT AREA, PLUS SOILS FROM LEAF DUMP
2. BASED ON RESULTS OF INVESTIGATIONS ADDITIONAL REMEDIATION MAY BE REQUIRED
3. IF TCLP FAILS THAN SOIL REMEDIATION IS REQUIRED