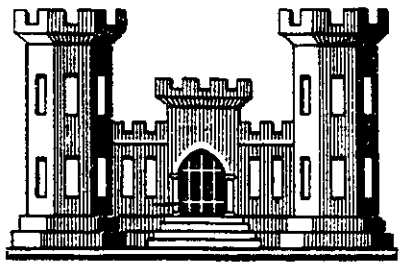
CONNECTICUT RIVER FLOOD CONTROL

CHICOPEE FALLS
LOCAL PROTECTION PROJECT

CHICOPEE RIVER, MASSACHUSETTS

DESIGN MEMORANDUM NO. 2

GENERAL DESIGN, HYDROLOGY, HYDRAULICS & GEOLOGY



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.

DECEMBER 1962

ENGCW-EZ (21 Dec 62) 3rd Ind
SUBJECT: Chicopee Falls Local Protection Project, Chicopee River, Massachusetts - Design Memorandum No. 2 - General Design, Hydrology, Hydraulics and Geology

Office, Chief of Engineers, Washington, D.C. 20315, 7 August 1963

TO: Division Engineer, U. S. Army Engineer Division, New England

The action is satisfactory concerning comments contained in the 1st indorsement approval for Design Memorandum No. 2.

FOR THE CHIEF OF ENGINEERS:

1 Incl
as

WENDELL E. JOHNSON
Chief, Engineering Division
Civil Works

Mr. Coffin

Mr. Coffin/lc/515

NEDGS (21 Dec 62) 2nd Ind
SUBJECT: Chicopee Falls Local Protection Project, Chicopee River, Massachusetts - Design Memorandum No. 2 - General Design, Hydrology, Hydraulics and Geology

U.S. Army Engineer Division, New England, Waltham, Mass. 26 July 1963

TO: Chief of Engineers, ATTN: ENGCW-EZ, Washington, D. C.

Submitted below are comments referenced to the paragraph numbers of the 1st Indorsement.

Par. a. Plate 2. Consideration was given to providing a counterforted concrete transition between the vertical flood wall and sloping dike section near Station 9+00. The transition was provided through the use of rockfill and slope protection because this solution to the problem is less costly and is considered to provide adequate flow conditions.

Par. b. Plate 3. Consideration was given to providing a reinforced concrete junction box at the outfall from Building K near Station 7+00. The drainage trench from Building K has been in existence since the construction of this building prior to 1900. Because of its location, the irregular topography and the lack of utilization of this portion of the factory land, the open drainage pit presents no serious hazard. Because of the size of the drainage pit, the cost of constructing a reinforced concrete junction box would be disproportionate to the benefits to be derived.

Par. c. Plate 8. The 15-foot brick outfall at Dike Station 29+00 and the penstocks at Stations 30+60 and 33+00 are no longer in use. The treatment for these and other similar abandoned outfalls is indicated in general note 4 on Plate 3 which states: "Abandoned portions of utilities, penstocks, conduits, etc., shall be removed at least between points 5 feet beyond the extreme foundation limits of the earth sections of dikes; the remaining ends of utilities shall be plugged in an approved manner".

Par. d. Outlet gates are not required on the Downstream Pressure Drain (Sta. 52+50) or Upstream Pressure Drain (Sta. 36+00) because the existing ground at these locations is higher than the top of dike and no damage would result from rupture of the conduits. The cooling water intake for the U.S. Rubber Company plant and the discharge conduit for the Oak Street Pumping Station were gated on the river side of the dike as requested. The discharges of the remaining penstocks and drains are collected in interceptor drains and conveyed to the pumping stations.

NEDGE (21 Dec 62) 2nd Ind 26 July 1963
SUBJECT: Chicopee Falls Local Protection Project, Chicopee River, Massachusetts - Design Memorandum No. 2 - General Design, Hydrology, Hydraulics and Geology

Par. e. The cost of the temporary water connection to the U.S. Rubber Company will be included in the project construction cost as a Federal responsibility. This item is necessary because the construction activities would cause turbity in the river water which cannot be tolerated by the U.S. Rubber Company's cooling water condensers. The cost estimate for this item will include contingencies, design, supervision, and inspection costs.

Par. f. The selection of a method of pumping was presented in Design Memorandum No. 6, "Pumping Stations". The various methods of pumping were compared and presented in that document.

Par. g. It is not the intention of the design to provide riprap between Stations 22+20± and 25+10± where rock outcrops occur. However, inasmuch as the rock outcrops are irregular in character, it will be necessary to provide riprap in some areas. This intent is indicated on Plates 6 and 7 in which the note occurs as follows: "Omit riprap at ledge outcrops".

Par. h. Plates 2 and 3. The remains of the existing rubble dam in the area of Station 6+75 will be removed. The retaining wall on the right bank however, cannot be removed because it would result in costly damages to the real estate and structures which it protects.

Par. i. Plates 2, 6 and 7. Consideration has been given to the practicability of realigning the flood wall between Stations 20 to 25. The cost for damages to the existing Mill Building would be in excess of $300,000. If this course of action were to be followed the cost of these damages would be entirely a local responsibility, and facilities would be removed which the project is designed to protect. The velocities have been taken into consideration together with the undulating water surface. The flood wall at this point of turbulence provides a freeboard of approximately six feet for the standard project flood to compensate for the turbulence. Protection stone of sufficient mass to withstand the indicated velocities has been specified.

FOR THE DIVISION ENGINEER:

1 Incl
1 wd

JOHN M. LESLIE
Chief, Engineering Division

cc: Mr. Leslie
Mr. Groden
Mr. Coffin
Eng. Div. File

ENGCW-EZ (21 Dec 62) 1st Ind
SUBJECT: Chicopee Falls Local Protection Project, Chicopee River, Massachusetts - Design Memorandum No. 2 - General Design, Hydrology, Hydraulics and Geology

Office, Chief of Engineers, Washington 25, D. C., 22 January 1963

TO: Division Engineer, U. S. Army Engineer Division, New England

Design Memorandum No. 2, entitled "General Design, Hydrology, Hydraulics and Geology" is approved as a basis of further detailed design subject to the following comments:

a. Plate 2. Consideration should be given to providing a counterforted concrete transition between the vertical flood wall and the sloping levee section near Station 9+00 to reduce hydraulic turbulence and erosion at this abrupt restriction along the convex side of the river bend.

b. Plate 3. Consideration should be given to providing a reinforced concrete junction box or manhole at the outfall from Building K near Station 7+00 to eliminate the hazard and nuisance of the large open drainage pit. Catch basins or grated inlets should be provided to collect adjacent surface runoff.

c. Plate 8. The proposed treatment for the 15-foot brick outfall at Levee Station 29+00 from the Chicopee Manufacturing Company and the penstocks at Stations 30+00 and 33+00 should be indicated. Minimum treatment should provide for tightly plugging and filling the portions within limits of levee construction.

d. Gate structures should be provided at the outlets of all operating penstocks and drains extending through the protection facilities.

e. It is not clear why the temporary water connection to U. S. Rubber Company is not included in the project construction cost since this item is required because of impurities introduced by construction activities. The cost estimate for this item should included contingencies, design and supervision costs.

f. A diesel engine drive is a satisfactory type of drive for pumps pumping from pondage where the engine is started and runs continuously for long periods of time; but, where pumps are required to cycle on and off every four to six minutes, as in the instant case, diesel engines are not a satisfactory type of drive particularly as the pumps have fixed blade propellers. If the pumps are equipped with a variable pitch propeller, diesel engines could be used as the blades could be

placed in the flat position, making it unnecessary to stop the engine during those short intervals when pumping is not required. Electric motors could be used to drive the pumps and a standby diesel generator set provided for each station to furnish emergency power, or one diesel generator set could be provided and used as the source of power for both stations. A study should be made to determine which of the above three schemes will give the station having the lowest overall cost and the results of the study should be included in the feature design memorandum covering the pumping stations.

g. Since rock outcrops occur on the existing channel bottom in the reach of the river between Stations 22+20± and 25+10±, the need for riprap should be reviewed.

h. Plates 2 and 3. In the area of Station 7+50, consideration should be given to the practicability of removing the existing rubble dam across the river and a portion or all of the retaining wall on the right bank.

i. Plates 2, 6 and 7. In the area between Station 20 to about Station 25, consideration should be given to the practicability of realigning the flood wall landward in the approximate location shown in red pencil superimposed on Plate 2, since it is desirable to develop a channel section of sufficient width and with the necessary roughness characteristics to insure that flow above critical depth will obtain. Plate A-2 and paragraph 40 indicate that under design conditions, velocities of 20 feet per second with varying critical and sub-critical flow conditions will exist in this reach. Undulating water surface and excessive turbulence could cause overtopping of the wall. Further, if the computed mean velocity is 20 feet per second, there is no assurance that velocities on the outside of the curve would not be great enough to move the protection stone.

FOR THE CHIEF OF ENGINEERS:

for WENDELL E. JOHNSON
Chief, Engineering Division
Civil Works

[redacted] (dup)
Plate #2 mrkd in red
(DMs w/d)

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

RESS REPLY TO:
ISION ENGINEER

ER TO FILE NO.

NEDGW

21 December 1962

SUBJECT: Chicopee Falls Local Protection Project, Chicopee River, Massachusetts - Design Memorandum No. 2 - General Design, Hydrology, Hydraulics and Geology

TO: Chief of Engineers
ATTENTION: ENGCW-E
Department of the Army
Washington 25, D. C.

62

There is submitted for review and approval Design Memorandum No. 2 - General Design, Hydrology, Hydraulics and Geology, for the Chicopee Falls Local Protection Project, Chicopee River, Massachusetts, in accordance with EM 1110-2-1150. The contract award for construction of this project is scheduled for April, 1963, and an early receipt of your review comments will be appreciated in order that the plans and specifications may be completed on schedule.

FOR THE DIVISION ENGINEER:

John Wm. Leslie

JOHN WM. LESLIE
Chief, Engineering Division

Incl (10 cys)
Des Memo No. 2

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FLOOD PROTECTION
CHICOPEE FALLS
LOCAL PROTECTION PROJECT
CHICOPEE RIVER, MASSACHUSETTS
DESIGN MEMORANDUM NO. 2
GENERAL DESIGN, HYDROLOGY, HYDRAULICS AND GEOLOGY

DECEMBER 1962

A. PERTINENT DATA

1.	Purpose	Flood Protection
2.	Location of Structures	On left bank of Chicopee River, Chicopee Falls, City of Chicopee, Hampden County, Mass., between Dwight Mfg. Co. Dam and City of Chicopee Dam, about 2 miles above confluence with the Connecticut River.
3.	Type of Improvement	Dikes, flood walls, channel improvements and relocation, pressure drains and pumping stations.
4.	Stream Flow Data	
	Drainage Area (Basin to mouth)	721 sq. mi.
	August 1955 Flood	41,400 c.f.s.
	Maximum Flood of Record (1938)	44,700 c.f.s.
	Natural Standard Project Flood	78,000 c.f.s.
	Modified Standard Project Flood	70,000 c.f.s.
5.	River Flood Elevations (Station 40+00)	
	Normal Flow	79.0 ± M.S.L.
	August 1955	93.8 M.S.L.

5. River Flood Elevations (Cont'd)

Modified Standard Project Flood - Natural Channel	99.0 M.S.L.
Modified Standard Project Flood - Improved Channel	98.3 M.S.L.

6. Dikes

Type	Earth-filled with stone slope protection on river side, top-soil and seed on landward side.
Length	740 feet and 2,880 feet
Top Elevation	Varies - 99.6 to 108.5
Top Width	10' (exclusive of rockfill and gravel bedding)
Maximum Height	28 feet - (taken at center line) 31 feet - (taken at river side slope)
Slopes	1 on 2.5 - Riverside 1 on 2 - Landside 1 on 2 - Channel cuts, below elev. 81.0 1 on 2.5 - Channel cuts, above elev. 81.0

7. Walls

Length	560 feet and 840 feet
Top Elevation	Varies - 102.7 to 111.5
Maximum Height	39 feet, approximately

8. Pressure Drains

Type	Reinforced Concrete, combined sewage
Number	2
Length	2470', 300'

8. Pressure Drains (Cont'd)

Sizes	1 - 24" to 48" 1 - 24" to 30"
Gates	1 - 48" sluice gate 1 - No gates required

9. Pumping Stations

Structure	Reinforced concrete with brick and steel superstructure	
Number	2 - Main Street	-- Oak Street
Size	16' x 30'	22' x 31'
Pumps	2 - 20" discharge, axial flow	3 - 16" discharge, axial flow
Pumps, capacity, each	9,000 g.p.m. @ 24' head 10,000 g.p.m. @ 11' head	6,900 g.p.m. @ 24' head 8,700 g.p.m. @ 11' head
Engines (Diesel)	75 HP continuous	60 HP continuous
Sluice Gates	2 - 36"	3 - 48"

10. Principal Quantities

Excavation	300,000 c.y.
Embankment	197,000 c.y.
Borrow	50,000 c.y.
Gravel	16,000 c.y.
Riprap and Stone Slope Protection	30,300 c.y.
Reinforced Concrete	9,300 c.y.
Plain Concrete	500 c.y.
Upstream Pressure Drain 12" to 48" R.C.P.	5,590 l.f.
Downstream Pressure Drain 24" to 30" R.C.P.	274 l.f.

10. Principal Quantities (Cont'd)

Interceptor Drains 12" to 36" R.C.P.	4,250 l.f.
Temporary Pressure Pipe for Process Water Supply 24"	1,070 l.f.
Topsoil and seed	40,000 s.y.
Pumping Stations	2

11. Cost Estimates

Federal	$1,791,000
Non-Federal	395,000
Total	$2,186,000

12. Benefits

Average Annual Benefits	$127,300
Benefit - Cost Ratio	1.92 to 1

B. PROJECT AUTHORIZATION

Authority. - The Chicopee Falls Local Protection Project was authorized by the Flood Control Act of 14 July 1960 (Public Law 86-645, 86th Congress). This reads in part: "The plan for flood protection on the Chicopee River, Massachusetts, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 434, Eighty-sixth Congress, at an estimated cost of $5,180,000." (Of this amount, $1,860,000 applies to the Chicopee Falls Local Protection Project.) "No obligation shall be incurred for the cost of this project where the flood control benefits are exclusively for local flood control, as determined by the Secretary of the Army (except costs of planning, design, and acquisition of water rights), unless the State or one or more other non-Federal entities shall have entered into an agreement in advance to assume at least 20 per centum of the cost (except costs of planning, design, and acquisition of water rights) of the completed project allocated to the production of local flood control benefits, payable either as construction proceeds or pursuant to a contract providing for repayment with interest within 50 years. The actual cost, or fair market value of lands, easements, rights-of-way, and work performed or services rendered prior to completion of construction of the project, which are furnished by a non-Federal entity, shall be included in the share of the cost to be borne by the non-Federal entity."

C. SCOPE OF DESIGN MEMORANDUM

1. Scope. - This design memorandum provides information concerning the local protection project on the Chicopee River at Chicopee Falls, Massachusetts. It submits the General, Hydrology and Hydraulics, and Geology sections of the definite project report for control of flood waters by construction of dikes, flood walls, pumping stations and appurtenant structures as a basis for preparing plans and specifications. This report includes a description of the project plan, data on climatology, hydrology, hydraulics, geology and costs.

2. Topographic Survey. - A plane table survey has been made on a scale of 1"-20' with a contour interval of 1 foot in the area of the proposed local protection.

3. Hydrographic Survey. - A hydrographic survey was made along the Chicopee River within the area of the proposed local protection in conjunction with and concurrent with the plane table survey.

4. Subsurface Explorations. - Geologic reconnaissance has been made in the project area in connection with site studies and for this study. Subsurface explorations consisting of 10 test borings completed in 1939, 10 test borings and 8 test pits completed in 1958, and 42 test borings and 35 test pits and trenches completed in 1962 have been made to determine the nature and characteristics of underlying material.

5. Flood Damage Survey. - Damage surveys were conducted in the Chicopee Falls area after the floods of 1936, 1938 and 1955. These surveys included personal interviews with municipal and State officials, officers of industrial concerns, and private individuals who suffered damage.

6. Real Estate Studies. - Field reconnaissance and determinations of recent sales in the area were used as the basis for estimates of real estate costs. Detailed information is presented in Section Q, Real Estate Requirements, and will be furnished in a separate Real Estate Design Memorandum to follow.

7. Coordination. - Frequent meetings have been held with municipal and local interests throughout the detailed planning of the work. Meetings relative to this project have also been held with State, City and Town officials and with commissions and other agencies appointed or chartered by the State legislature. The work has been coordinated and discussed with all appropriate Federal Agencies. The views of local interests were considered; a public hearing was held in October, 1959 for projects in the basin to enable interested parties to become familiar with the local protection plans and to present their views and comments thereon. Coordination with other agencies is discussed further in Section V.

D. PRIOR REPORTS

8. Interim Report - Chicopee River Basin. - An Interim Report on Review of Survey, Chicopee River Basin, Massachusetts was prepared by the New England Division and submitted

to the Chief of Engineers on 8 September 1959. The report recommended, in part, that a plan for local protection be authorized for Chicopee Falls, Massachusetts. The report, authorized by Public Law 406, 75th Congress, was printed as House Document 434, 86th Congress, 2nd Session. It served as the basis for authorization of this project.

9. Connecticut River Survey Reports.

a. House Document No. 412, 74th Congress, second session, 1936.

b. House Document No. 455, 75th Congress, second session, 1937.

10. Connecticut River Interim Reports.

a. House Document No. 653, 76th Congress, third session, 1940.

b. House Document No. 724, 76th Congress, third session, 1940.

11. Nenyiac Report. - Senate Document No. 14, 85th Congress, first session, 1957. Part Two, Chapter XXI considers flood control on the Chicopee River. This report, titled "The Resources of the New England-New York Region" was prepared by the New England-New York Inter-Agency Committee.

E. LOCAL COOPERATION

12. Local Cooperation. - The proposed project is located entirely within the limits of the City of Chicopee, Massachusetts. On 20 March 1959, the Board of Aldermen of the City of Chicopee passed a resolution which provided that the City would furnish certain items of local responsibility without cost to the United States. These items were estimated at that time to have a project first cost of $60,000. However, the authorizing legislation which was approved on 14 July 1960 provided that local interests contribute at least 20 percent of the cost, an amount estimated at that time to equal $354,000.

Local interests were advised of the increased cost of local participation due to the requirements of the authorizing legislation. On 22 March 1962, a resolution was passed

by the City of Chicopee in which assurance was given to the United States and the Commonwealth of Massachusetts that the City was willing to participate in the project and to contribute its share of expenses and liabilities.

In an Act approved on 11 June 1962, (Chapter 552, Acts of 1962, Commonwealth of Massachusetts) the Water Resources Commission of the Commonwealth of Massachusetts was authorized to pay sums not exceeding $400,000 for the non-Federal cost of the project.

F. DESCRIPTION

13. Location and Extent of Project Area. - Chicopee Falls is located on the Chicopee River in the City of Chicopee, Hampden County, Massachusetts. The Chicopee River joins the Connecticut about two miles west of the project. The proposed local protection project extends from the Deady Memorial Bridge westerly to a point downstream of the United States Rubber Company plant. Along the left bank, the project protects a highly industrialized flood plain, including, from the Deady Bridge, buildings formerly occupied by the Savage Arms Corporation, the plants of the Chicopee Manufacturing Corporation, and the United States Rubber Co. The right bank is high with no improvements near the river.

14. Topography. - In the project area, the river describes a sweeping curve, from a westerly to a southerly heading, with the project dikes and floodwalls on a narrow filled flood plain area on the left bank, inside the bend, and with high banks on the outside of the bend. Immediately downstream of the project, the river bends sharply to the right, and resumes its westerly heading. At this bend, there is a flood plain on the right bank, again inside the bend, with a single small hill rising from the flood plain at the upstream end of the bend.

15. Chicopee River Basin. - The entire Chicopee River Basin is fan-shaped and its topography in the western part of the basin is less rugged than to the north and northeast. The general conformation is low, with rolling hills and several upland plains. The hills and streams of the basin contain outcrops of rock. The banks and beds of the streams are lined with stone and the valleys and hills are dotted with boulders. From the confluence of the Ware and Quaboag Rivers

to its confluence with the Connecticut River, a distance of about 18 miles, the Chicopee River flows through well-developed manufacturing centers.

Above Three Rivers, Mass., where the Swift, Quaboag and Ware Rivers join to form Chicopee River, the terrain is hilly and exhibits the surface characteristics and irregular drainage pattern typical of glaciated areas of southern New England. Hills are prominent and valleys are steep and narrow. Most of the tributary streams are oriented in a north-south direction and flow almost due southerly to where the preglacial valleys enter the Ware River. The Ware River valley is devoted to manufacturing and agriculture.

On the Quaboag River, from Three Rivers, Mass., to its origin, the valleys are broad with gentle slopes. Except in the dairy country of the Brookfields and Spencer and in parts of Monson, the land in the Quaboag Basin is generally sandy and contains large boulders, making it unfavorable for agriculture.

The Chicopee River watershed contains many natural lakes and ponds, supplemented by numerous artificial ponds developed by local power and manufacturing plants. The largest of the natural ponds is Quaboag Pond with an area of about 512 acres, while the Quabbin Reservoir is the largest man-made lake in the State, with a surface area of approximately 19 square miles.

The relief of the basin varies from elevation 40 feet, mean sea level, at the mouth of the Chicopee River, to elevation 1,720 feet, mean sea level, at Wachusett Mountain in Princeton, Mass., in the northeast end of the East Branch Ware River watershed. Elevations at the project area vary roughly from 80 to 120 feet. Although a very large percentage of the Chicopee River Basin has some sort of tree growth, very little is under heavy woodland cover. Gray birch, pitch pine, and other scrub trees are the principal varieties found in the valley.

16. General Geology. - The Chicopee River and its tributaries drain an area comprising portions of two distinct geologic and physiographic regions, the New England Upland and the Connecticut Valley Lowland. The major, eastern part of the area lies within the Upland Section, a rough, maturely dissected

region underlain by crystalline rocks. Westerly of Ludlow, the area extends into the Connecticut Valley Lowland, a low, broad, structural basin underlain by sedimentary rocks and igneous "trap rock."

The Upland region is one of moderate to high relief characterized by relatively deep, steep-sided, poorly drained valleys and broad, rough-sided hills. The bottom of many of the valleys have been given an appearance of widening by partial filling with outwash sands and gravels. Above the outwash deposits, the upland surface is blanketed by glacial till consisting of a compact, heterogeneous mixture of materials ranging in grain size from clay to boulders. Bedrock protrudes through the thin till mantle on the upper slopes and tops of many of the hills, and is also exposed in and along the bottom of some of the valleys.

The Lowland region is generally flat to gently rolling and, except where resistant trap rock ridges rise above the general lowland surface, is underlain by sandstone, shale and conglomerate. In general, the lowland surface is represented in the eroded surfaces of glacial lake sediments and delta outwash plains, comprising varved clays, silts, and poorly sorted sands and gravels, deposited in and around the margins of glacial lakes, and post-glacial flood plain and terrace deposits composed of roughly stratified sands and gravels.

Detailed site geology is discussed in Paragraph P, Site Geology.

17. Area Maps. - The Chicopee River and its watershed are shown on standard quadrangle sheets of the U. S. Geological Survey (scale 1:31,680) and on standard quadrangle sheets of the Army Map Service (Scale 1:25,000).

G. PROJECT DOCUMENT PLAN

General. - The Survey Report plan of protection consisted of a dike and wall system about 4,800 feet long, anchored at the upstream end to the left abutment of the Deady Memorial Bridge and at the downstream end to high ground on the left bank downstream of the U. S. Rubber Co. Included in the plan were the following features:

a. About 3,370 feet of earth dike with a top elevation 3.0 feet above the Modified Standard Project Flood, top width of 10.0 feet, exclusive of stone slope protection and gravel bedding, 1 on 2.5 riverside slope and 1 on 2 landside slope. Top and landside slope were to be loamed and seeded; riverside slope to be rock-faced.

b. About 1,430 feet of concrete floodwall to a top elevation 3.0 feet above the Modified Standard Project Flood.

c. Two pumping stations, capacities of 30 and 35 c.f.s. at high river stage.

d. Two pressure drains, 250 feet and 3,150 feet long, both 60-inch pipe at the outlets. An interceptor wall was used with the longer drain to collect overland flow.

e. Extension of the pressure drain to the City dam upstream of the project, to provide a silt-free source of process water for the U. S. Rubber Co., during construction. The pressure drain and pumping station interceptor drains were to be used to carry this water.

f. Construction of the dike in the river area along the U. S. Rubber Company required an excavation on the right bank area to relocate the channel and provide a channel width of 200 feet. The material from this excavation was to be used in the construction of the dikes to the extent feasible.

H. DEPARTURES FROM PROJECT DOCUMENT PLAN

18. Channel Improvement. - There are no major departures from the Project Document Plan. Minor changes and refinements were made as listed below.

Detailed analysis of backwater profiles showed constriction of the channel, with resultant high velocities, at the bend downstream of the channel, below Station 50+00. The right bank at the inside of this bend will be excavated to provide a 400-foot radius, to remove the constriction, and to provide an improved alignment along the right bank. The channel improvement requires approximately 40,000 cubic yards of excavation, part of which will be used in dike construction. There is sufficient spoil area available along the bank for the material to be wasted. The improvement reduces

average velocities in the bend by almost 50%, with consequent reduction in the probability of damage to the railroad embankment along the left bank. It also lowers upstream water profile elevations approximately one foot.

19. Design Grade of Structures. - The detailed backwater studies resulted in minor changes in the top grades of the protective works; notably, a lowering of approximately one foot from the vicinity of Station 20 to the downstream end of the project, and a rise of one foot, more or less, upstream of Station 20. Freeboard of 3.0 feet is maintained above the Modified Standard Project Flood.

20. Relocations at U. S. Rubber Co. - Investigation of the existing utilities in the U. S. Rubber Co. yard along the river indicated that considerable difficulty would be experienced in constructing the drains and pumping station shown on the survey plan. U. S. Rubber Co. officials pointed out that it would be very likely that disruption of existing utilities would result in loss of production which could be extremely costly. Little space is available for a pumping station in the yard, and construction would be complicated by the necessity of continuous access for both maintenance and fire-fighting vehicles. It was decided, therefore, to move the dike 10 to 20 feet away from the existing river wall to provide a level area on the riverside of the wall, and to place the interceptor drains outside the wall. The pumping station could then be located at the downstream end of the yard, at the toe of the dike, near the source of heavy flows of process water.

21. Relocation of Pressure Drain. - Study of the contours in the vicinity of Oak Street and West Main Street has indicated that overland runoff reaching this area can be diverted across the U. S. Rubber Co. parking lot and over the dike. This allows the Oak Street pressure drain to outlet just north of the U. S. Rubber Co.-Chicopee Manufacturing boundary line, and avoids a deep trench cut. Smaller pipe sizes result from the reduction in drainage area tributary to the pressure drain. The upland drainage interceptor wall shown in the survey report has been replaced by regrading of critical areas and/or construction of low bituminous mounds.

22. Process Water During Construction. - It was originally planned to by-pass river water for process use by the U. S.

Rubber Co. by using the interceptor drain line. However, since it is planned to locate the proposed drain line outside the existing river wall, and since work in this area cannot start until temporary process water is available, it will be necessary to construct a separate, temporary line from the pressure drain to the U. S. Rubber intake. The portion of this line between the pressure drain and the upstream end of the interceptor drain along the U. S. Rubber Co. will be of permanent construction, to provide a by-pass for flushing the interceptor drain after construction is completed. This is desirable due to the relatively large size and flat hydraulic gradient of the interceptor drain.

23. Wall at Old Canal Bridge. - It appears simpler and less expensive to substitute an earth dike for the wall which the survey plan shows across the old canal at the bridge adjacent to the Deady Memorial Bridge. Filling of this area for parking has provided much of the required dike.

24. Riprap at Station 24+0. - Backwater studies indicate excessively high velocities at design flow along the bend at the Chicopee Manufacturing Co. At Station 24+0 ±, the average flow becomes near critical, and, due to non-uniform velocity distribution resulting from the curved channel, pronounced instability, possibly including partial jumping, may be expected. To avoid excessive scour, and in order to introduce roughness to control and discourage supercritical local flows and jumping, the river bed is to be riprapped with heavy stone in a zone approximately 200 feet long.

25. Slopes at Channel Relocation. - Examination of the materials in the areas of excavation for channel relocation indicates that a 1 on 2 slope may be used here in lieu of the 1 on 2.5 used in the survey report for short slopes. A 15-foot berm at slightly above normal (spring) high water has been added to the slope to allow access to the toe for maintenance of erosion, to limit any slides due to erosion, and to encourage vegetation close to the high water elevation. 1 on 2 slopes are used below and 1 on 2.5 slopes above the berm. This slope will be discussed in more detail in Design Memorandum No. 5, Embankments and Foundations, for this project.

I. CLIMATOLOGY

26. General. - The Chicopee River Basin has a modified continental type of climate and it is generally warm to hot in the summer and moderately cold in the winter. Variations are more extreme in the higher regions than in the southerly lowlands, which reflect the effect of lower elevation. On the average, the precipitation is uniformly distributed throughout the year but there are frequent short periods of heavy precipitation. The basin lies in the path of the "prevailing westerlies" and of cyclonic disturbances that cross the country from the west or southwest and converge on the northeast. It is also exposed to occasional storms that travel up the Atlantic Seaboard, some of which are of tropical origin and of hurricane intensity.

27. Temperature. - The average annual temperatures in the basin vary from 50° F. in the mountainous regions to 55° F. in the valleys. Recorded temperature extremes at representative stations within or adjacent to the Chicopee River Basin have varied from a maximum of about 100° F. to a minimum of -20° F. Freezing temperatures have been experienced from the latter part of September until the early part of May.

28. Precipitation. - The mean annual precipitation of approximately 44 inches over the Chicopee River watershed is distributed uniformly throughout the year. In the headwaters of the Chicopee River Basin, at Hubbardston, Mass., the maximum and minimum annual precipitation, respectively, for 35 years of record through December 1956 was 61.3 inches in 1938 and 32.8 inches in 1949. At the climatological station at Ware #2, Mass., the maximum and minimum precipitation for 23 years of record through December 1957 was 62.8 inches in 1955 and 33.5 inches in 1935, respectively.

29. Snowfall. - The mean annual snowfall recorded at Westover Field at Chicopee Falls, Mass., for 15 years of record, is 49 inches. At Hubbardston, Mass., representative of the basin area, the annual maximum, mean, and minimum snowfall was 98 inches, 55 inches, and 37 inches, respectively, during the 18 years of record. The snow cover usually reaches a maximum depth in March and has an average water content of about 3 to 4 inches over the basin.

30. Storms.

a. Storm types. The three general types of storms which occur in the Chicopee River Basin are cyclonic storms of continental origin, hurricanes of tropical origin, and thunderstorms. Hurricane-type storms generally occur in late summer and fall and have caused devastating floods in the basin.

b. Notable Storms. The storms which caused the most destructive floods in the Chicopee River watershed occurred in March 1936 (2 floods), September 1938, and August 1955. Hurricane Diane in August 1955 produced 15 inches of rain on the Quaboag River and by far the greatest flow of record along this river. On the Ware and Chicopee Rivers, the 1955 flood was second only to that of September 1938.

J. RUNOFF AND STREAMFLOW DATA

31. Discharge Records. - The U. S. Geological Survey now has 8 gaging stations distributed throughout the Chicopee River Basin, of which 3 are of minor significance for flood control studies. Flow data from the Ware River at Coldbrook are obtained from the Water Division, Metropolitan District Commission, Boston, Mass., and published by the U. S. Geological Survey. The streamflow records of the Chicopee River Basin are generally considered good to excellent. During periods when ice effects the stage-discharge relation, the records are considered fair to good. During the 1938 flood, the gage at Bircham Bend was destroyed and later relocated upstream at Indian Orchard.

32. Streamflow Data. - The following table presents a listing of gages in the basin, with areas and periods of record.

TABLE 1

Stream Gaging Stations -- Chicopee River Basin

Location	Drainage Area (Sq.Miles)	Period of Record From:
Ware River near Barre	55.0	1946 -
Ware River at Coldbrook	96.8	1928 -
Ware River at Gibbs Crossing	199.	1912 -
Hop Brook near New Salem	3.39	1947 -
East Branch Swift River near Hardwick	43.7	1937 -
Swift River at West Ware	188.	1910 -
Quaboag River at West Brimfield	151.	1909 -
Chicopee River at Indian Orchard	688.	1939 -
Chicopee River at Bircham Bend	703.	1928 - 1938

K. FLOODS OF RECORD

33. Historic Floods. - Major historical floods in the Chicopee River Basin include those of May 1854 and October 1869. On the basis of meager and unreliable records, it would appear that those floods never approached the magnitude of the major floods which occurred in and after 1936. However, the earlier floods may have been of greater volume than has been assumed and the paucity of records may reflect the lesser importance those floods had to the inhabitants of the basin than more recent floods.

34. Floods of Record. - In the Chicopee River Basin, 4 floods of major proportions have been experienced since 1936. They occurred in March 1936 (2 floods), September 1938, and August 1955. The September 1938 flood produced the greatest flow of record along the Ware, Swift and Chicopee Rivers. The peak discharge on the Ware River at Gibbs

Crossing in September 1938 was 22,700 cubic feet per second, or nearly twice the magnitude of the August 1955 recorded peak discharge of 12,200 c.f.s. The volume of runoff in September 1938 exceeded 7 inches in most areas. However, the August 1955 flood produced by far the greatest flows of record along the Quaboag River. The peak discharge at West Brimfield in August 1955 was 12,800 cubic feet per second, or about 1½ times the magnitude of the previously recorded peak discharge of 8,500 c.f.s. The volume of runoff was 8.5 inches at West Brimfield in August 1955. An average runoff of about 7 inches was recorded for the entire Chicopee River Basin in 1938 and about 6 inches in 1955. Comparative magnitudes of the largest floods of record at the gaging stations at Indian Orchard on the Chicopee River, Gibbs Crossing on the Ware River, and West Brimfield on the Quaboag River are given in Table 2.

TABLE 2

MAJOR FLOODS OF RECORD -- CHICOPEE RIVER BASIN

	Peak Discharge In C.F.S. At		
Date of Flood	Chicopee River at Indian Orchard	Ware River at Gibbs Crossing	Quaboag River at West Brimfield
12 March 1936	----	5,210	2,040
19 March 1936	*20,400	11,200	3,620
September 1938	*45,200	22,700	8,470
August 1955	40,500	12,200	12,800

*Peak discharge taken at Bircham Bend before relocation of new U. S. Gaging Station at Indian Orchard

L. STANDARD PROJECT FLOOD

35. General. - The Standard Project Flood for the Chicopee River Basin was developed during hydrologic studies for the Interim Report on Review of Survey, dated 8 September 1959.

(Prior approval was obtained from OCE in November 1958.) The standard project storm developed from Civil Engineer Bulletin 52-8 was centered on a divide between the Ware and Quaboag Rivers. This resulted in the most critical conditions on the Chicopee River where the proposed local protection projects were located. A current review of the data indicates that the derived Standard Project Flood is still satisfactory as a basis for design.

36. Standard Project Flood. - The selected storm location combined with unit hydrographs derived from the September 1938 and August 1955 floods resulted in a peak discharge at Indian Orchard of 77,800 cfs. This discharge is nearly twice the magnitude of the August 1955 (40,500 cfs) and the September 1938 (45,200 cfs) peak discharges. The standard project flood at Chicopee as derived is 78,000 cfs. This flood modified by the existing Barre Falls Reservoir and the Conant Brook Reservoir presently under design, yields a peak discharge of 70,000 cfs at Chicopee Falls which was used as a basis for the design of this project.

M. HYDRAULIC DESIGN

37. General. - River hydraulics were investigated for three conditions: Standard Project Flood before improvement, Standard Project Flood after improvement, and a moderate flood of approximately 10-year frequency. Stage profiles and velocities were used in setting protection elevations, establishing pumping heads, and determining slope protection required. Profiles and velocities are shown on Plate A-2.

38. Channel Modifications. - Channel modifications comprise removal of a constriction at the bend downstream of the U. S. Rubber Co., moving the channel to the west to make room for the dike along the U. S. Rubber Co., and placing riprap on the channel floor in the vicinity of Station 24+0 to limit scour and raise upstream water levels above critical. Dike construction on the left bank will smooth the bank alignment, eliminate overbank flow, and result in riprapped slopes along the river.

39. River Stage Profiles. - River stage profiles are shown on Plate A-2 for the Modified Standard Project Flood before and after improvement, for the 1955 flood, and for a moderate flood (10,000 c.f.s.) of approximately 10-year frequency, used in studying low head pumping conditions.

40. Backwater Computations. - River stage profiles were computed by the Standard Step Method as outlined in EM1110-2-1409, dated 7 Dec. 1959. Manning's "n" values were determined by reconnaissance as .030 for the relocated channel, .035 for the natural channel in earth, and .040 and .045 for the irregular rocky channel at the upstream dike and wall. Overbank "n" varies from .050 in channel to .100 in wooded areas. Bend losses were computed separately by increasing the value of S by an amount of $V^3/2gR^2$, where R is the average radius of curvature. Contraction and expansion losses between sections have also been computed and included in the backwater computations. The condition of critical flow estimated to occur in the vicinity of Station 24+0 was studied with specific head diagrams up and down stream.

The backwater computations extended from the Dwight Manufacturing Co. dam approximately 3,000 feet downstream of the project. The spillway rating curve for this dam is shown on Plate A3.

41. Moderate Flow for Low Pumping Stage. - The ten-year flood, 10,000 c.f.s., was found to be useful as the low stage for pump sizing. Stages due to this flood are near the lowest which require pumping. The river stage profile for this flood is shown on Plate A2. This profile was required only as far upstream as the Main Street Pumping Station.

N. INTERIOR DRAINAGE

42. General. - Interior drainage is divided into two compartments, each with a pressure drain for flow from the uplands and a pumping station for flow originating below the top elevation of the protective works. The divide is at high ground near the U.S. Rubber Co.,-Chicopee Manufacturing Co. boundary. Some upland flow is carried across this high ground, a parking lot, to the river.

All city drains, and drains of the three plants being protected, carry combined sanitary, process and stormwater flows.

All new drains are sized for a 100-year storm coincident with normal river stage. This is considered justified at upland drains, since stormwater excess would flow to the interceptor along the line of protection. Pipes are designed for surcharge where this does not impair their function.

All major drainage divisions were assumed to have average composite runoff coefficients equal to 0.50. All areas are urban, with high concentrations of roofs and paving. Rainfall was taken from weather Bureau Technical Paper No. 40 for 100-year rates; varying from 4.30 inches per hour for short times to 2.05 inches per hour for the longest concentration times. Runoffs for pumped areas were computed for 2, 5, 10 and 25-year storms as well as for 100-year.

Peak runoffs were computed by the Rational Method, $Q = Ci A$. Concentration times were computed for the physical characteristics of each area using actual flow paths, and lengths as determined from reconnaissance, project, City and Geological Survey Maps, and profiles of proposed drains. Minimum effective concentration time used was 30 minutes.

43. Upland Drainage.

a. The upstream pressure drain runs from the Deady Memorial Bridge to the downstream end of the Chicopee Manufacturing Co. property along high ground, then skirts the protected area and outlets through the dike as a pressure conduit. A system of drain inlets, supplemented by some regrading and bituminous mound diversion structures, intercepts all surface water from the upland areas along the Savage Arms Co. and Chicopee Manufacturing Co. This drain system is designed for runoff frequencies commensurate with those used for the intercepting drains in the protected area, since any excess over the capacity of this system must be handled by the drains in the protected area.

Two old brick sewers carry the City sanitary and storm flows from the upland area. Their capacity is probably about 64 c.f.s., if a 4 f.p.s. velocity is assumed. They are intercepted by the pressure drain on high land near the point where the pressure drain turns toward the river.

The total upland drainage area is about 150 acres. Of this area, the total effective area served by the drainage system is 135 acres. The total flow is 138 c.f.s. In addition, runoff flowing overland from an area of about 27 acres is diverted directly into the river. The drainage areas are shown on Plate No. 28.

Since the upstream pressure drain will be used to carry process water for the U. S. Rubber Co. during construction as well as provide reasonable drainage capacity, it is designed to consist of two pipes; one to carry drainage and intercept the City sewers; the other to carry process water during construction and supplement the system thereafter by acting as a relief drain. This allows improved low-flow velocities in a smaller pipe than would be used for a single line. A 2-year runoff capacity is provided during construction.

This drain will be located in an abandoned, filled canal to avoid existing utilities insofar as possible. Since one of the old brick City sewers has not been found, test pitting to establish its exact location and grade will be necessary prior to constructing the sewer.

This line will be carried to the river along high ground at the U. S. Rubber Co-Chicopee Manufacturing Co. line, and no protection against pipe failure is required. A junction structure with a gated outlet will be provided near the existing City sewers to terminate the double drain line and connect the outfall and the by-pass for process water to their respective systems. These will be separated during construction; when the process water line will be no longer needed, it will be used as a relief drain and will be connected to the outfall. The gate structure will also serve as a surge tank and reservoir for the by-pass line. By manipulating gates on the outfall and by-pass lines, the by-pass may be used for flushing the Oak Street pumping station intercepting sewer after construction. Both gates will be rising stem type sluice gates.

b. The downstream pressure drain is located downstream of the U. S. Rubber Co., and carries process water from their upper buildings, plant yard drainage, and flow from an old stone City culvert which led to the spillway outlet from a pond which is now filled. This line carries runoff from approximately 23 acres plus 3 c.f.s. of process water. The estimated combined flow is 53 c.f.s.

This line will be placed under tracks of the Boston and Maine Railroad, at least partially by jacking. No gates will be required.

c. Runoff from an area in the vicinity of West Main and Oak Streets near the U. S. Rubber Co.-Chicopee Manufacturing Co. line will be diverted across the U. S. Rubber Co. parking lot by regrading, bituminous mounds, etc. The flow will be collected in ditches and carried over the dike in a pipe conduit. Consideration will be given in developing final designs to maximum use of regrading instead of bituminous mounds.

44. Drainage Below Protection Elevations.

a. The Main Street Pumping Station is located in the Chicopee Manufacturing Co. yard at Station 24+0. This pumping station serves the Chicopee Manufacturing Co. and the former Savage Arms Co. below the protection elevation. The concentration time is estimated at 30 minutes and the drainage area is 20.5 acres. At high river stage, seepage is approximately 6 c.f.s.; at the moderate flood stage, seepage is approximately 1 c.f.s. Process water and sanitary wastes are estimated at about 3.0 c.f.s. from the Chicopee Manufacturing Co. area and 1.0 c.f.s. from the Savage Arms Co. area. Table 3 presents runoff flows for various frequencies.

TABLE 3

MAIN ST. PUMPING STATION - RUNOFF-STAGE DATA

Frequency Years	Runoff C.F.S.	Total Flow, C. F. S. Moderate Stage	High Stage
100	44	----	----
25	35	40	45
10	30	35	40
5	26	31	36
2	20	25	30

b. The Oak Street Pumping Station is located at the downstream end of the U. S. Rubber Co. yard, on the river-side of the present river wall. This station serves the U. S. Rubber Co. for process water, dike underseepage, and storm runoff. The U. S. Rubber Co. buildings are on three levels; of these, the bulk of the process water originates on the intermediate level, and will require pumping only for river stages of approximately 94.0 feet (1955 stage was approximately 92.0 feet). Flows from much of the upper level are discharged through the downstream pressure drain. Flows from the lower level are not large, but will require pumping at fairly low stages.

Process water flows would be somewhat reduced, probably averaging around 15 c.f.s.; however, there is no ponding available at this pumping station, and to allow for some peaking of flows, a value of 20 c.f.s. for process water is used. At lower river stages process water to be pumped is estimated at 3.0 c.f.s.

Underseepage is estimated as 6 c.f.s. at high stages and 1 c.f.s. at moderate stages.

Concentration time of 30 minutes was used. Drainage area is 17.8 acres. Table 4 presents runoff and total flows for various frequencies.

TABLE 4

OAK ST. PUMPING STATION -- RUNOFF-STAGE DATA

Frequency Years	Runoff C.F.S.	Total Flow, C. F. S. Moderate Stage	High Stage
100	38	42	----
25	30	34	56
10	26	30	52
5	22	26	48
2	17	21	43

45. Pumping Station Design Concepts. - Stations were designed to provide protection for runoff-river stage combinations of reasonable frequency. Where greater protection can be provided without significantly increasing the size or number of pumps, this is done. Plate No. 27 shows the general features of both stations. Basic data are tabulated below. Commercial power is available at the site, but is not considered reliable in view of the probability of hurricane winds at times when pumping is required. Diesel drives are planned.

TABLE 5

PUMPING STATION DATA

River Stages	Main St. P.S.	Oak St. P.S.
Modified Standard Project Flood	97.8	96.1
Moderate Flood	86.1	82.1
Normal	79.±	77.5 ±
Sump Levels		
Maximum	83.	80.
Minimum	78.	75.

TABLE 5 (Cont'd)

PUMPING STATION DATA

Static Head	Main St. P.S.	Oak St. P.S.
Design Flood (feet)	19.8	21.1
Moderate Flood (feet)	8.1	7.1
Total Dynamic Head		
Design Flood (feet)	23	24
Moderate Flood (feet)	10.6	12
Pumping Capacity		
Design Flood	40.0 c.f.s.	46.6 c.f.s.
Moderate Flood	44.0 c.f.s.	57.0 c.f.s.
Total Operating Time For 1 Pump @ 20 c.f.s.	7.6 min.	4.9-6.1 min.
Diesel Engine Rating, Continuous	75 h.p.	60 h.p.
Number of Pumps -		
16"	---	3
20"	2	---

46. Construction Considerations.

a. There are several construction problems of a general nature. Notable are scheduling, placing the dike at the U. S. Rubber Co., and working in restricted space at Mill No. 2 of the Chicopee Manufacturing Co.

(1) Scheduling of operations must allow for continuous drainage facilities. This will require that at least gravity drains, and preferably pumping stations, be in operation prior to raising the dikes above existing drain outlets. Provision for process water supply must be completed prior to earthwork in the river.

(2) The dike at U.S. Rubber Co. poses two problems: method of unwatering and placing and method of handling high velocities in the restricted channel during construction. Since the right bank will be the source of impervious fill material, it will be necessary to leave a natural earth barrier between the excavation and the river to serve as a cofferdam during excavation operations below river level. This will constrict the river section as the dike is built. Methods of dealing with these problems will be evaluated in Design Memorandum No. 5, Embankments and Foundations.

(3) An investigation of Chicopee Manufacturing Co. Mill No. 2 shows that with normal caution there should be no ill effects from the work of this project. The river is already narrow at this point, and cofferdams will have to use a minimum of space. An access road will be required for access by fire equipment to the downstream side of the mill before the present road on the riverside of the building can be closed.

b. Process water supply for the U.S. Rubber Co. will be required during construction, since earthwork in the river will cause more turbidity than is tolerable by the processes involved. Temporary supply will be provided from the City of Chicopee dam 150 feet upstream of the Deady Memorial Bridge. A concrete pressure line will be run parallel to the upstream pressure drain; a concrete pressure pipe will be run from the gate structure on the pressure drain outlet to the U.S. Rubber Co. yard at Oak St.; and a temporary steel pressure line will be run from Oak St. to the U.S. Rubber Co. intake. This system must be in operation prior to starting earthwork in the river.

The process water pipe parallel to the upstream pressure drain will be used as a relief drain and permanent part of the upstream pressure drain system. The process water pipe between the upstream pressure drain and Oak Street will be used in the future for flushing the interceptor drain between Oak Street and the Oak Street Pumping Station.

c. A sanitary intercepting sewer under consideration by the City is expected to pass through the project area. The tentative route shows the pipe crossing the river and entering the protected area in the vicinity of the Chicopee Manufacturing Co.-Savage Arms Co. boundary line, then following the general line of the upstream pressure drain, returning to and recrossing the river in the vicinity of the U. S. Rubber Co.-Chicopee Manufacturing Co. boundary line. Plans for this are not detailed at present; should details be determined prior to construction of the local protection, coordination should include provision of sleeves at the line of protection.

O. DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

47. General. - The project plan, as shown on Plate No. 2 and in more detail on Plates Nos. 3 through 23, consists of a line of protection from the Deady Memorial Bridge abutment to high ground downstream of the U. S. Rubber Co., a channel improvement at the downstream end of the project and necessary drainage. The line of protection includes two sections of dike and two flood wall sections where there is insufficient room for dikes. Drainage includes two pressure drains for upland flow and two pumping stations for areas below the protection elevation.

48. Channel Improvements. - Channel improvements are shown on Plates 13, 14, and 15. The work consists of excavating the channel to provide approximately 400 feet radius on the right bank, and a width of between 200 and 250 feet. Suitable material from the excavation will be used in dike construction. The remainder will be placed in waste areas along the excavation limits.

49. Dikes. - Dikes will be earth-filled, with rock facing on the riverside and loam and seed on tops and landside slopes. Rock facing will vary as required for the various velocities in the channel. Detailed design of dikes, cutoffs, underdrains, etc., will be presented in Design Memorandum No. 5, Embankments and Foundations.

The upstream dike is approximately 740 feet and the downstream dike approximately 2880 feet long. Height varies from 15 to 31 feet on the riverside slope and from 0 to 17 feet on the landside slope.

Dikes are generally built on the overbank, with the riverside slope more or less coincident with the existing bank. Along the U. S. Rubber Co., the dike is built in the river, with a 10 to 20 foot filled area along the existing river wall to provide space for the new interceptor drain. Typical sections are shown on Plate No. 25.

50. Concrete Flood Walls. - Two concrete flood walls are provided in areas where space for dikes is lacking. The upstream wall extends approximately 560 feet along the Savage Arms buildings. The downstream wall runs for approximately 840 feet along the Chicopee Manufacturing Co. Wall heights vary from 24 to 39 feet approximately. Wall plans and profiles are shown on Plates Nos. 3 through 7. Typical sections are shown on Plate No. 26.

Design and details of walls will be presented in Design Memorandum No. 7, Flood Walls.

51. Interior Drainage. - Interior drainage consists of two pressure drains to intercept sewers, drains and runoff above the line of protection, and two pumping stations with interceptor drains along the landside of the dikes and walls to intercept sewage and drainage originating below the protection elevation. The City and the industries are now served by combined sewers; along the river, there are a great number of outlets of all types discharging sanitary, industrial and storm flows. Steam, hot wastes and acids are also discharged. The U. S. Rubber Co. occasionally discharges quantities of grease or latex from equipment sumps and bad batches of latex. This discharge is controlled, and would not occur during periods of pumping. The greater quantity of latex would be discharged through the downstream pressure drain.

Lowland drainage will by-pass the pumping stations during low river stages. The outlets will usually be below the river level. It is expected that the interceptor drain from Oak Street to the Oak Street pumping station will have a tendency to silt due to the small amount of available head at many river stages. A by-pass is provided to divert flow from the upstream pressure drain to flush this drain.

52. Pumping Stations. - Pumping is required at river stages of approximately 10-year flood frequency, or at somewhat lower stages for very heavy rainfalls. Pumps are powered by diesel engines to assure operation during hurricane rains.

The Oak Street station has negligible storage, and protects highly concentrated industrial property. Three 16-inch pumps are used at this station, sized to discharge a greater than 2-year storm against the river stage for the Standard Project Flood. Low stage capacity of this station is adequate for 100-year runoff, since the major portion of the process water flow is from the intermediate elevations of the plant, and can by-pass the pumping station at stages up to about 3 feet below Standard Project Flood stage.

The Main Street station protects the Savage Arms-Chicopee Manufacturing Co. area, which is more open. Some minor ponding can be tolerated here without heavy damage. This station will have two 20-inch pumps, giving adequate protection, with storage, for runoff of 10-year frequency at the Standard Project Flood stage.

53. Utilities. - The largest group of utilities affected by the work are City and industrial combined sewers which are to be cut off and intercepted at the line of protection. Both upland pressure drains intercept City sewers and factory drains above the protection elevation, and the interceptor drains leading to the pumping stations intercept a large number of small and large drains leading from factories to the river.

Several electric utility pole relocations will be required, especially in the borrow area on the right bank opposite the U. S. Rubber Co.

A low, private dam and process water intake of the U. S. Rubber Co. will be disrupted by the construction; the dam will be extended to the new right bank with steel sheet piling and dumped stone. Final top elevation of this dam has not been determined, but a height above stream bed of 2 or 3 feet appears likely. The existing dam is in poor repair, and is now 1 foot more or less above the stream bed. Its function is to provide a pool at the intake during periods of low flow.

The intake will be entirely rebuilt through the dike and extended into the new channel. A concrete conduit will be used for the new intake. An existing mechanical screen structure will be retained.

During construction, while river water is turbid or the intake is inoperative, the U.S. Rubber Co. will be supplied with water from the City of Chicopee dam upstream of the project. The upstream pressure drain, the by-pass pipe for flushing the upstream drain to the Oak Street pumping station, and the temporary pressure piping will carry this flow.

P. SITE GEOLOGY

54. Description of Project. - The Chicopee Falls Local Protection project is located on the Chicopee River in the City of Chicopee, Massachusetts, approximately 2.5 miles upstream from the confluence of the Chicopee and Connecticut Rivers.

The proposed structures are shown on Plate B-1, Plan of Foundation Explorations. The project consists of earth dikes, concrete flood walls and associated drainage structures along the east bank of the Chicopee River, beginning at the Deady Memorial Bridge and continuing for a distance of approximately 1 mile downstream.

55. Topography. - The Chicopee Falls project is located in the Connecticut Valley, a broad triangular depression with a relatively flat floor bordered on the west by the gently undulating Berkshire Hills and on the east by the more maturely dissected and lower, Worcester County Plateau.

The Connecticut River Valley occupies a broad depressed section of predominantly soft Triassic rocks overlain by glacial materials variably deposited from stagnant ice and by glacial streams and in locally dammed glacial lakes.

56. Surficial and Subsurface Investigations

a. Previous Investigations. Foundation explorations consisting of 20 drive sample borings and 8 test pits and hand augers were made prior to preparation of the 1958 Interim Report of the Chicopee River Basin. Borings BH-1

through BH-10 were made in 1938 and 1939 by intermittent sampling in overburden. Borings BH-11 through BH-20 were made in 1958 and were continuously sampled in overburden. Bedrock was core-drilled when encountered within the required depth of explorations.

b. Current Investigations. Investigations initiated in July 1962 consisted of detailed field reconnaissances and 26 additional borings and 22 test pits and trenches along the proposed project structures and associated special areas of study. Sixteen borings and thirteen test pits and trenches have been made along the right bank in areas of stream widening to delineate materials available from required excavation suitable for use in embankments.

c. Future Investigations. Foundation explorations will be made at pumping station locations and other special structures as layout and design is developed.

57. Surficial Geology. - The Chicopee River at the project flows from the west over a rock controlled bench for a distance of approximately 2000 feet downstream of the Deady Memorial Bridge where the river makes a sharp turn to the south and rock is extensively exposed along the right bank. The exposed bedrock is a thinly bedded red shale having a general northeasterly strike and a dip of from 5 to 15° to the southeast. Downstream of station 25+00, the rock dips below variably thick deposits of glacial till overlain by recent deposits of alluvial sands and gravels. The left bank of the river is formed by a low flat 10 to 15 feet above river grade generally comprised of glacial till directly overlying the rock surface and capped by recent alluvial and fill materials. Glacial deposition in the form of ice contact features along the glacial Chicopee River has resulted in the occurrence of interbedded deposits of sands and silts or clays within the till along high terrace-like features at the downstream limits of the project. The general mode of deposition of these features would suggest a relatively continuous strata of silts, clays and sands of variable thicknesses. Surficial fills of highly variable composition exist throughout the higher areas on the left bank.

The right bank of the river consists of high bluffs 40 to 60 feet high comprised of till and thick sand deposits capped by deltaic sands in the upstream portion of the project. In the lower portion of the project, the bluffs are till, surficially indurated and capped by sands and gravels. At the downstream limits of the project, the valley widens with an abandoned drainage channel following the base of the till bluff on the right bank separated from the main river channel by a dissected flood plain deposit.

58. Foundation Conditions

a. Overburden. A generalized stratigraphic sequence of subsurface conditions within the limits of the project structures is shown on Plate B-2. The left bank between approximately Stations 7+00 to 18+50 and 22+50 to 35+00 is comprised of a variably thick, moderately compact to compact sandy to clayey till deposit overlying an irregular bedrock surface. The upper surface elevation of the till is relatively uniform, beginning at approximately 80 feet M.S.L. at Station 7+00 and sloping with the river gradient to Station 35+00. This uniform gradient is broken at the old penstock discharge in vicinity of Station 27+50. A thin gravel stratum from 1 to 3 feet thick overlies the till or bedrock surface and is consistent with the present river gradient between station 7+00 and 25+00 except where removed during more recent artifical filling. The composition of the fill is highly variable but is generally comprised of granular material, and averages from 8 to 15 feet in thickness. Downstream of station 35+00, the proposed structures enter the present river channel. The rock surface becomes deeply buried by a thicker, compact, clayey basal till deposit containing extensive zones of laminated silts and clays within the till. The till which maintains a relatively uniform upper surface having a slope consistent with the river gradient is overlain by a fairly uniform 2 to 10 foot thickness of recent alluvial gravel. A deeper deposit of gravel and a conformable discontinuity in the till and rock surfaces occurs between station 37+00 and 41+00. This discontinuity is consistent with a physical feature on the east bank and a stream re-entrant on the west bank.

At higher elevations above the river grade along the left bank at the downstream limits of the project, an upper zone of clayey till occurs as a depositional feature overlying an apparently continuous 5 to 15 foot thick stratum of stratified silt, clay, and sand. The upper till is also overlain by a silt and clay deposit which varies in thickness due to excavations. Shallow explorations to the east along the proposed gravity drain indicates a continuation of this downstream stratigraphic sequence with a silt deposit overlying a relatively uniform upper till surface. The thickness of the silt varies due to recent excavations for the present manufacturing complex. Highly variable subsurface water levels encountered in explorations along the proposed drainage structures are believed to reflect the presence of man-made structures. The upper deposits of silts and till at the downstream limits of the project are relatively unconsolidated and are considered to have been deposited as an ice contact feature in a glacial lake. Based on this assumption, it is considered that the interstratified deposits would be relatively continuous and have a gentle dip toward the northwest and along the river gradient.

The right bank of the river throughout the upstream portion of the project presents a steep cut bank feature, 40 to 60 feet high with a natural slope of 40 to 45 degrees, comprised primarily of thick sand deposits displaying upper deltaic forset beds overlying till and bedrock. Downstream of station 30+00 in the area of stream widening, the bank face and samples from exploratory borings reveal a thick, very compact, reddish brown, sandy till, indurated at exposed surfaces and overlain by a variable deposit of sand and gravel 5 to 10 feet thick. A stream re-entrant dissecting the bank face indicates this deposit to be quite continuous throughout the depth of required excavation. Downstream of the steep bluff at approximately Sta. 40+00, the right bank flattens to a broad flat valley. An abandoned stream channel parallels the till controlled right abutment and is separated from the present stream channel by a triangular shaped steep sloped silt feature formed by earlier stream deposition. The stratigraphic sequence in this feature is indicated to be a silty sand and gravel overlying a sandy till at a depth of 8 to 20 feet. Interstratified thin zones of clay occur within the upper till which is separated from the underlying till by

a variably thick deposit of sand and gravel. This stratigraphic sequence is generally conformable with the continuity established in the left bank and river section.

b. Bedrock. The bedrock formation in the vicinity of the project is a thinly bedded calcareous shale having a gentle southeasterly dip which averages from 5 to 15°. Bedrock is extensively exposed at low water in the river bed west of Deady Memorial Bridge to the first bend in the river at approximately Sta. 24+00. The shale, as encountered in borings, is relatively sound where not leached and altered by chemical and mechanical processes. Weathering and alteration of the rock is highly variable but generally does not exceed depths of 12 feet below the rock surface with the deepest weathering and leaching occurring in areas where the rock has not been protected by an overburden of impervious materials. Pressure tests indicate the rock to be moderately permeable along the bedding planes in the uppermost severely weathered zones. Results of pressure tests in borings BH-22 and BH-25 indicate a measured loss of approximately 4 G.P.M. under 20 P.S.I. pressure. Below the zone of most severe alteration and weathering, it is expected that the rock will be relatively impermeable.

Physical tests conducted on selected core samples of rock below the highly weathered zones indicate an unconfined compressive strength of approximately 2200 P.S.I. at 75% saturation and an angle of sliding along natural wetted bedding planes under varying normal loads of from 5.2 to 15.9 degrees. For the purpose of design, it is considered that sliding failure would take place along bedding planes below the concrete to rock contact. Preliminary tests indicate the rock only slightly susceptible to slaking but has a swelling ratio of .7 percent when subject to saturation after drying. The shale has a unit weight of approximately 175 lb. cu. ft. and a natural water content of 1.5 percent.

59. Construction Materials.

a. Earth Fill Materials. The major portion of materials for earth fills (other than gravel and gravel bedding) will be obtained from the required excavation for the channel relocation and excavation for channel improvements. Additional earth fill materials as required or

necessary, will be obtained from a borrow area adjoining the excavation area of the channel relocation.

b. Gravel Fill and Gravel Bedding Materials. Materials for gravel fill and gravel bedding will be furnished by the contractor from off site sources. Suitable sources of gravel materials exist within 10 miles of the project.

c. Riprap and Stone Slope Protection. Bedrock in the project and adjacent areas is not generally suitable for use as riprap or stone slope protection. Suitable rock may be otained from the East Mountain traprock area located approximately five miles west of the project. Several existing quarries and at least one producer of commercial stone are in this area.

d. Concrete Aggregate. In view of the relatively small volume of concrete required for construction of walls on this project, it is considered that aggregates will be obtained from a commercial source, or sources. There are a number of such established producers within a 5 to 10 mile haul distance of the project. Details are presented in Design Memorandum No. 4, Concrete Materials.

60. Conclusions and Recommendations.

a. Full consideration is being given to geologic data developed for design of project structures. Further explorations will be made to detail foundation conditions for pumping stations or other special areas of study.

b. It is anticipated that the major portion of earth materials will be available for construction of embankment structures from required excavations. Rock from required excavations is not suitable for use as stone protection because of its slaty breakage and poor resistance to weathering.

c. A generally weathered and leached condition in the upper rock surface will require removal of 1 to 8 feet of weathered rock where a reasonably sound rock foundation is required to satisfy design criteria. The irregularity of the sound rock surface will require that the assumed footing grade for concrete structures on rock allow for extreme variations in relatively short distances.

d. Based on the results of physical testing of selected samples of sound rock cores, the following values are recommended for design.

Unconfined Compression Test (75% Sat)	2200 p.s.i.
Coefficient of Friction	f = 0.2
Percent Swell (after drying)	1.0%
Unit Weight	170 p.c.f.

e. Where stability analyses determine the need for rock anchors it is recommended that vertical anchors be utilized assuming a free plane at the base of the anchors. Dip of bedding planes in the rock is generally to the southeast at a slope of 5° to 15°. Rock excavation will tend to parallel these planes resulting in a slightly inclined base of footing.

f. Consolidation grouting to improve the bearing capacity of weathered rock zones is not recommended. Based on results of pressure testing, it is considered that a grout curtain would be only partially effective in reducing seepage beneath the structures.

g. To reduce under-seepage beneath structures, cutoffs should penetrate till or where the till deposit is thin, they should be carried into sound rock.

h. Seepage quantities beneath structures in sound rock is estimated at 20 x 10-6 CFS/ft.

i. The assumed sequence of deposition of overburden on the southeast bank of the river would indicate that where silt and clay strata occur in or adjacent to the glacial till deposit, these strata, although variable in thickness, are relatively continuous throughout the project limits.

j. Surfaces of rock prepared for foundations of structures should be protected from prolonged exposure in order to prevent possible leaching and spalling of the rock.

k. Previous experience and field observation of exposed cuts indicated that the reddish-brown till will tend to harden with loss of natural water content and precautions may be necessary during construction to eliminate placing of hardened chunks in the embankment fills which may not break down during compaction.

Q. REAL ESTATE

61. General. - Land requirements and appurtenant property rights will be acquired by local authorities.

62. Land Requirements. - It is assumed that required land interests will be acquired under permanent easement wherever this estate is adequate to serve project requirements. In one instance where it is anticipated that a residential improvement will require removal, fee acquisition will be taken.

The project area along the southerly bank of the river is densely built up with older industrial mill buildings primarily of masonry multi-story construction. The frontage along the river is divided between the former Savage Arms Co. plant at the east end, the Chicopee Manufacturing Co. near the center, and the U. S. Rubber Co. plant at the west end. Along the easterly end, the river parallels Main Street. There is a strip of commercial property backing to the former headrace canal of the Chicopee Manufacturing Co.

On this side, the protective dikes and land walls will be along the bank of the river with adequate clearance for access and other purposes so that the strip required for construction will not adversely affect the utility of the remainders. It is assumed that adequate provision will be made for necessary utility lines and utilization of water from the river during and after construction.

Utility and drainage easements will be required along the general alignment of the former canal. This area has been broken up and parts of it are used for parking in conjunction with commercial establishments. Easement encumbrance and limitation of use imposed on these ownerships will cause relatively minor property value loss.

On the northerly side of the river, the bank is quite steep and there is no necessity for protective construction. Restriction of the river due to the encroachment of the dikes on the south side will require some cutting into existing bank and reduction of slope on the north side. Most of the area is unimproved rear land lying well behind residential subdivisions. Along the east end, the rear portion of several deep lots improved with medium value residences will be acquired with minor value loss to about six ownerships and substantial loss to four unimproved low value lots.

Near the center, a strip of land along the bank is occupied by an electric power transmission line that will require relocation. One older residential unit will require removal due to proximity to the river bank and the need to relocate the electric transmission line through the remainder.

At the west end, the land is lower and a tract of vacant rough land will have to be cut along the river to avoid excessive impedance of flow. This area is owned by the U. S. Rubber Co. and will suffer little loss in value.

Total land requirements are estimated at 25 acres in fee and permanent easement of which about 10 acres are in the river and 5 acres under temporary easement for access during construction. Severance damages should be relatively light.

63. Special Benefits. - The three large industrial plants on the southerly side of the river along which project components will be constructed will each be benefited substantially by the protection from flood damage provided by the proposed project. The enhancement of value to each property will considerably exceed the relatively minor value loss attributable to the small land areas required and the minimum severance damage which will occur from the permanent easement estate. For this reason, no net loss in value to these ownerships is estimated.

Estimates of real estate requirements and costs are subject to refinement when adequate tract data and final design data are available. Details of the proposed real

estate acquisition program will be set forth in the forthcoming Design Memorandum for Real Estate No. 3.

64. Valuation.

Total Estimated Land Costs	$20,000
Severance Damage	2,000
Contingency: 15% of above	3,300
Acquisition & Administrative Expense (Estimated 21 Ownerships @ $800)	16,800
Total	$42,100
Rounded to:	$42,000

R. RELOCATIONS

65. Relocations. - The construction of protection structures for this project will not require relocation of any cemeteries, highways or railroads. An electric transmission line in the borrow area will require relocation of two or three poles, and one or two poles in the Chicopee Manufacturing Co. area will be affected. No water lines or gas lines will be relocated.

Sewers and drains will be cut off and intercepted along the line of protection and at the upland drains, but no actual relocations are required.

Approximately 300 feet of gravel road will be relocated in the Chicopee Manufacturing Co. yard along the dike at Station 15+00.

S. COST ESTIMATES

66. General. - The following estimates are based on 1962 price levels.

Item	Quantity	Unit	Unit Price $	Amount $	Total $
Construction Cost					
Channel Improvement & Relocation					
Excavation, unclassified	236,000	c.y.	.80	188,800	
Riprap	5,300	c.y.	6.00	31,800	
Topsoil and Seeding	22,000	s.y.	.90	19,800	
Contingencies				35,600	
Total Channel Improvement Cost					$ 276,000
Earth Dikes					
Excavation, unclassified	44,000	c.y.	.80	35,200	
Stream Control	1	job	L.S.	40,000	
Earth Excavation, (Borrow)	50,000	c.y.	.80	40,000	
Stone Slope Protection	25,000	c.y.	6.00	150,000	
Earth Fill	197,000	c.y.	.30	59,100	
Gravel Bedding	16,000	c.y.	2.50	40,000	
Topsoil & Seeding	18,000	s.y.	.90	16,200	
Contingencies				57,500	
Total Earth Dike Cost					$ 438,000
Flood Walls					
Stream Control	1	job	L.S.	21,500	
Excavation, unclassified	20,000	c.y.	1.25	25,000	
Excavation, Rock	6,000	c.y.	5.00	30,000	
Backfill	30,000	c.y.	1.25	37,500	
Concrete, Reinforced	9,000	c.y.	50.00	450,000	
Concrete, Plain	500	c.y.	25.00	12,500	
Rock Anchors	3,500	l.f.	4.30	15,000	
Contingencies				88,500	
Total Flood Walls Cost					$ 680,000

Item	Quantity	Unit	Unit Price $	Amount $	Total $
Drainage					
Drainage System (Excluding Pumping Stations)	1 job	L.S.		201,000	
Contingencies				30,00	
Total Drainage Cost					$ 231,000
Pumping Stations					
Pumping Stations (2)	1 job	L.S.		101,000	
Contingencies				15,000	
Total Pumping Stations Cost					$116,000
Sub-Total, Construction Cost					$1,741,000
Engineering and Design				174,000	
Supervision & Administration				153,000	
Preauthorization Studies				20,000	
Total					$ 347,000
Total Construction First Cost					$2,088,000
Land, Damages and Relocations					
Lands and Damages				22,000	
Contingencies				3,200	
Acquisition Cost				16,800	
Temporary Water Connection to U.S, Rubber				13,000	
Water Intake and Dam at U.S. Rubber				30,000	
Total Lands & Damages Cost					$ 85,000

Item	Quantity	Unit	Unit Price $	Amount $	Total $
Relocations					
Roads				4,200	
Existing Utilities				4,500	
Electric Poles				4,300	
Total Relocations Cost					$ 13,000
Total Lands, Damages and Relocations First Cost					$ 98,000
TOTAL PROJECT FIRST COST. . .					$2,186,000

APPORTIONMENT OF FIRST COSTS

BETWEEN FEDERAL AND NON-FEDERAL INTERESTS

TOTAL PROJECT COST		$2,186,000
Less Federal Liabilities to be Excluded in Computing Local Share. . .		
Engineering and Design	$174,000	
S & A during Design	16,000	
Preauthorization Studies	20,000	
		210,000
NET PROJECT COST TO DETERMINE LOCAL SHARE		$1,976,000
Minimum Non-Federal Share (20% of line above)		$ 395,000
Less Non-Federal Liabilities for L,D & R. . .		
Lands and Damages	$ 85,000	
Relocations	13,000	
		$ 98,000
NET NON-FEDERAL CASH CONTRIBUTION		$ 297,000
RECAPITULATION:		
Federal Costs		$1,791,000
Non-Federal Costs		395,000
TOTAL PROJECT COST		$2,186,000

T. SCHEDULES FOR DESIGN AND CONSTRUCTION

67. Design. - Contract plans and specifications are scheduled for completion in February 1963.

68. Construction. - Construction of the project will require 18 months. All construction will be accomplished under a single continuing contract scheduled for award in April 1963.

U. OPERATION AND MAINTENANCE

69. Operation. - Operation will be the responsibility of the local interests.

70. Maintenance. - Maintenance of the project will be the responsibility of local interests. Periodic inspections will be made to insure that adequate maintenance is performed in accordance with regulations prescribed by the Secretary of the Army. Pump drives will be started and run periodically to insure their readiness. It is estimated that maintenance of the project will cost local interests about $3,800 annually, as shown on Table 6. An operations and maintenance manual will be provided to the City of Chicopee upon completion of the project.

TABLE 6

MAINTENANCE AND OPERATION ANNUAL CHARGES

Maintenance and Operation	$2,800
Major replacements	1,000
	$3,800

V. COORDINATION WITH OTHER AGENCIES

71. General. - Appropriate Federal, State and local agencies have been consulted concerning project features which may affect them.

72. Fish and Wildlife Provisions. - The Massachusetts Department of Natural Resources, Fish and Game Division and the regional office of the U. S. Fish and Wildlife Service have been consulted, and have expressed no interest in this project.

W. ECONOMICS

73. Benefits. -

a. General. The lower reaches of the Chicopee River have long been the site of concentrated industrial activity as a part of the Springfield, Holyoke, Chicopee industrial complex which is a vital part of the economy of Western Massachusetts and the parent Connecticut River Valley. Chicopee Falls, located upstream from the effects of Connecticut River flood stages, has experienced serious flooding from the Chicopee River on several occasions with the flood of record occurring in September 1938 and slightly lower flood stages being experienced in August 1955.

Losses experienced in the City of Chicopee in August 1955 exceeded $10,000,000. The subsequently completed Barre Falls Reservoir and the authorized Conant Brook Reservoir would prevent approximately 40% of this loss in a recurring flood of similar magnitude. The local protection project in the Chicopee Falls section of the community will provide protection for 3 industrial plants producing tires, textiles, sporting goods and hardware which employ 4,000 people. After reduction of flood stages by upstream reservoirs, the Chicopee Falls local protection project would prevent damages in the amount of $2,700,000 in a recurrence of the 1955 flood.

b. Annual Benefits. - Annual benefits have been derived by determining the annual losses remaining in the project area after reduction of flood flows and stages by completed and authorized upstream reservoirs. The residual annual losses remaining after reservoirs are separated into benefits for the local protective works and unprotected residual losses. The protective works are designed to be effective against a standard project flood flow and all losses attributable to flows with a chance of occurrence less than that of the standard project flood are credited as benefits to the local works. The annual benefits to the local protection works at Chicopee Falls, adjusted to reflect growth

estimated to occur in the project area during the life of the project, are estimated at $127,300.

74. Annual Cost. - Total annual charges amounting to $66,400 are summarized below:

a.	Federal Investment	
	Federal Appropriation Requirements	$2,088,000*
b.	Annual Federal Charges	
	Interest on Federal Investment (2.625% x $2,088,000)	$ 54,800
	Amortization (100 years) (.213% x $2,088,000)	4,400
	Total Federal Annual Charges	$ 59,200
c.	Non-Federal Investment	
	Net Non-Federal First Cost	$ 98,000
d.	Annual Non-Federal Charges	
	Interest on Non-Federal Investment (3.25% x $98,000)	$ 3,200
	Amortization (100 years) (.138% x $98,000)	100
	Estimated Tax Losses	100
	Maintenance and Operation	3,800
	Total Non-Federal Annual Charges	$ 7,200
	Total Annual Charges	$ 66,400

*Includes $297,000 to be contributed by Non-Federal interests.

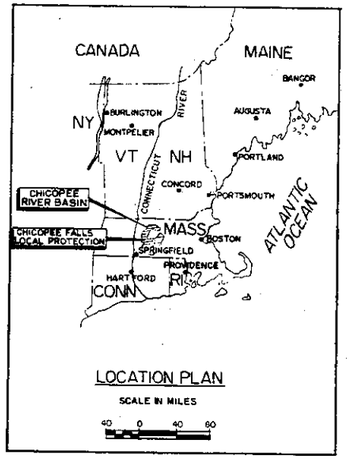
75. Benefit-Cost Ratio. - The ratio of benefits to Costs is 1.92 to 1.

X. RECOMMENDATIONS

It is recommended that the project plan submitted in this report be approved as the basis for the preparation of contract plans for the Chicopee Falls Local Protection Project.

CORPS OF ENGINEERS

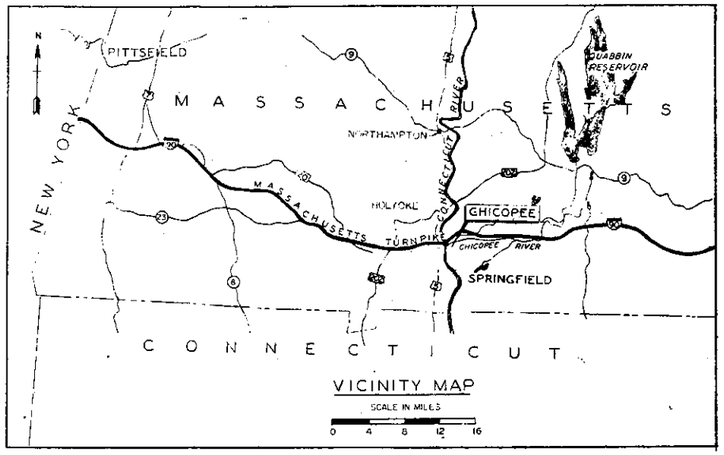
U.S. ARMY



LOCATION PLAN

SCALE IN MILES

40 0 40 80



VICINITY MAP

SCALE IN MILES

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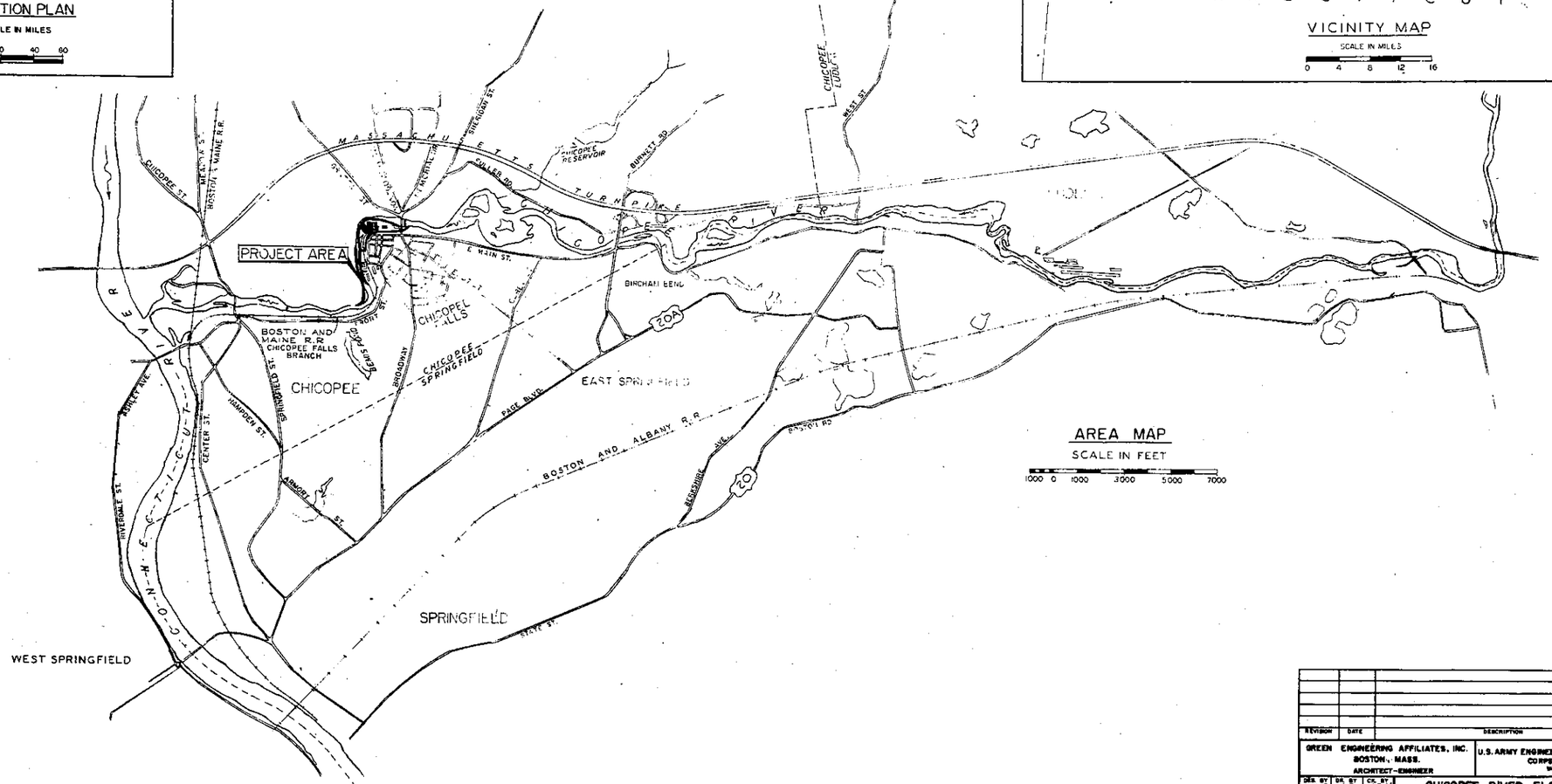


AREA MAP

SCALE IN FEET

1000 0 1000 3000 5000 7000

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
G.V.T.	E.D.	H.O.H.

SUBMITTED

ARCHITECT-ENGINEER

PROJECT ENGINEER

APPROVAL RECOMMENDED

CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED

CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS

LOCATION PLAN

CHICOPEE RIVER MASSACHUSETTS

APPROVED DATE DEC., 1962

CHIEF, ENGINEERING DIVISION

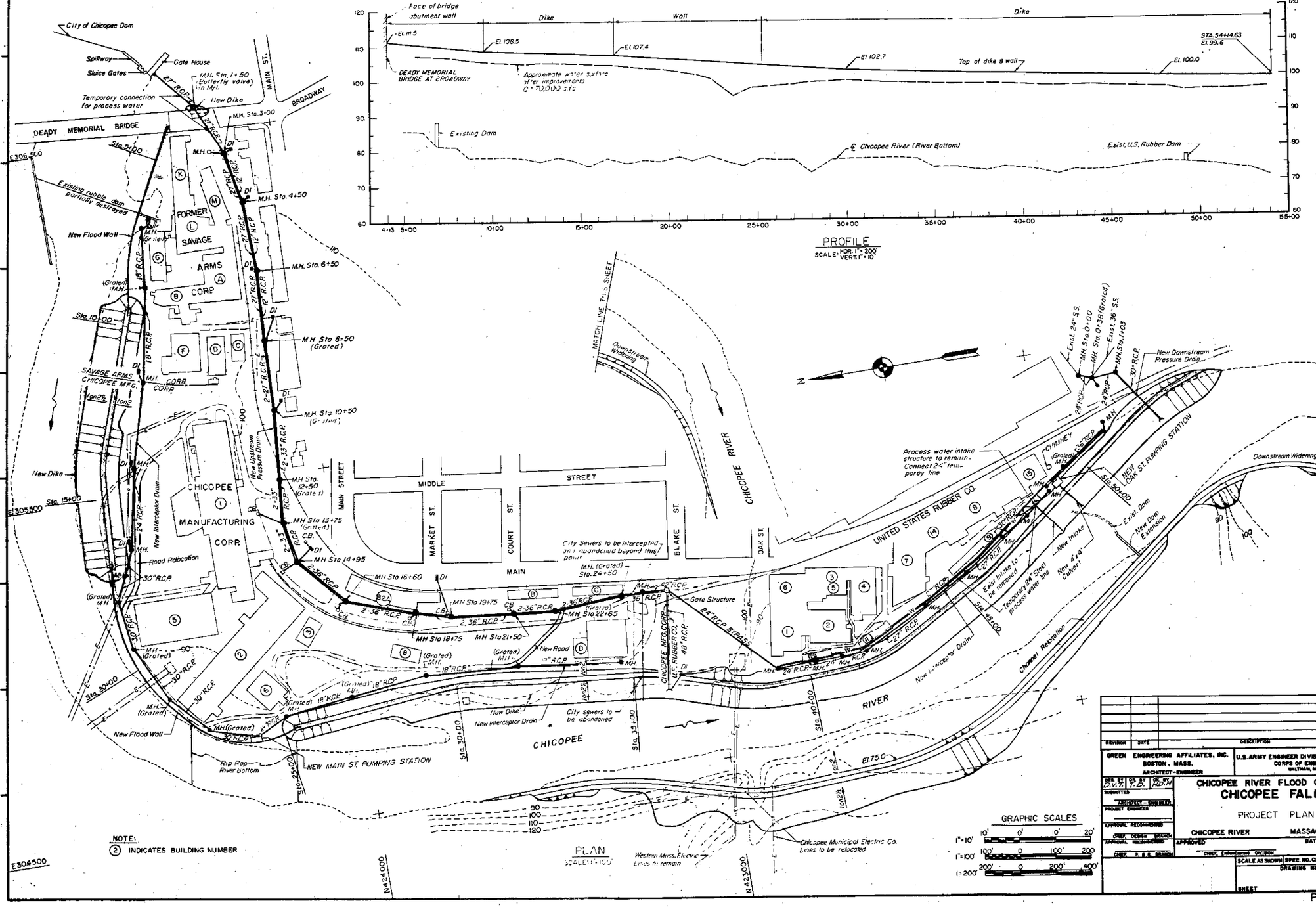
SCALE AS SHOWN; SPEC. NO. CIV. ENG.-19-CHI-

DRAWING NUMBER

SHEET

PLATE NO. 1

CORPS OF ENGINEERS — U.S. ARMY



REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY D.V.T. | DR. BY T.B. | CH. BY H.D.M.

SUBMITTED — ARCHITECT-ENGINEER — PROJECT ENGINEER

APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH — CHIEF, P. & R. BRANCH

APPROVED — CHIEF, ENGINEERING DIVISION

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS

PROJECT PLAN

CHICOPEE RIVER MASSACHUSETTS

DATE DEC., 1962

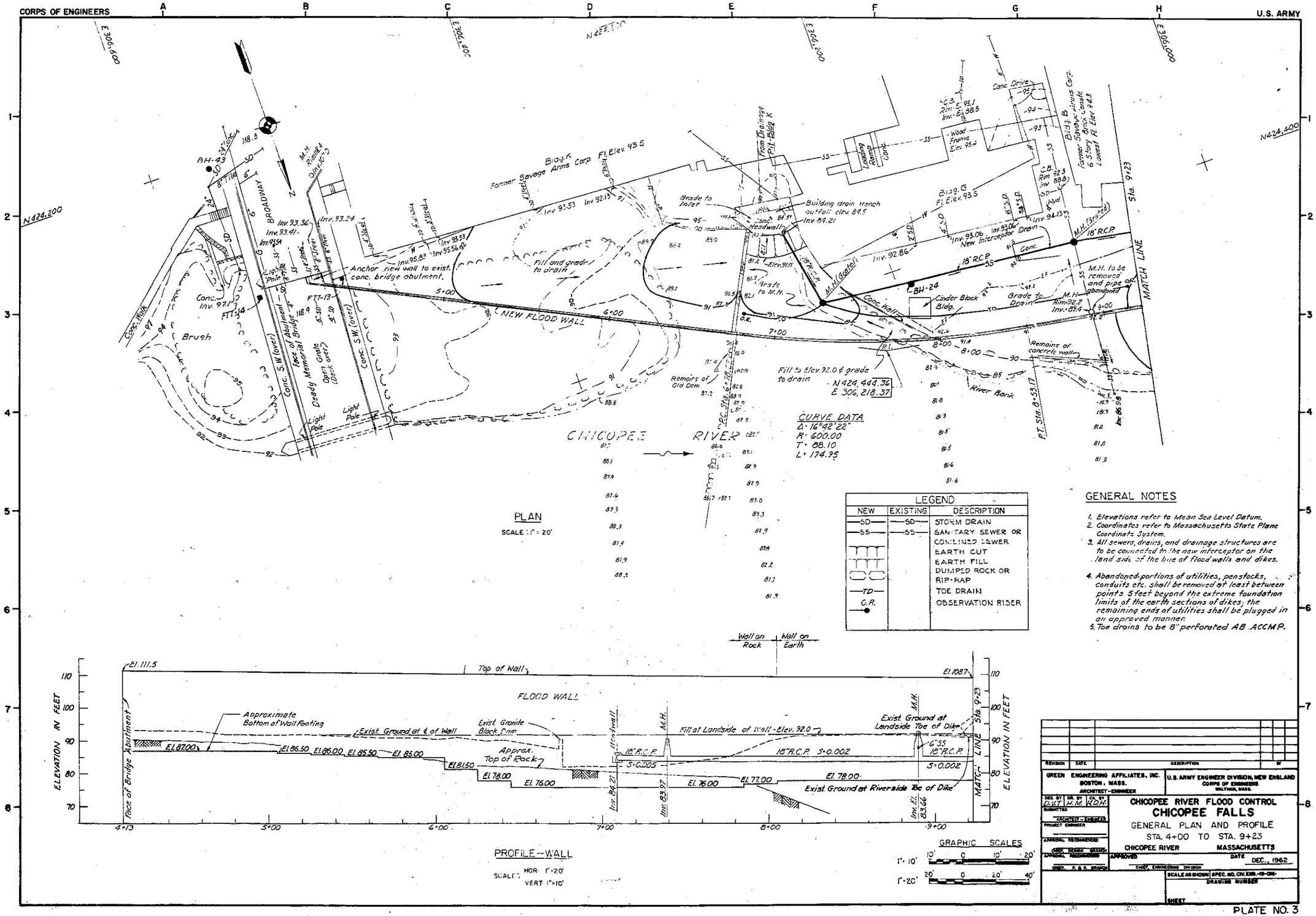
SCALE AS SHOWN | SPEC. NO. CIV. ENG.-111-ONE-

DRAWING NUMBER

SHEET

PLATE NO. 2

CORPS OF ENGINEERS — U.S. ARMY



PLAN

SCALE: 1" = 20'

LEGEND		
NEW	EXISTING	DESCRIPTION
—SD—	—SD—	STORM DRAIN
—SS—	—SS—	SANITARY SEWER OR COMBINED SEWER
		EARTH CUT
		EARTH FILL
		DUMPED ROCK OR RIP-RAP
—TD—		TOE DRAIN
C.P.		OBSERVATION RISER

GENERAL NOTES

1. Elevations refer to Mean Sea Level Datum.
2. Coordinates refer to Massachusetts State Plane Coordinate System.
3. All sewers, drains, and drainage structures are to be connected to the new interceptor on the land side of the line of flood walls and dikes.
4. Abandoned portions of utilities, penstocks, conduits etc. shall be removed at least between points 5 feet beyond the extreme foundation limits of the earth sections of dikes; the remaining ends of utilities shall be plugged in an approved manner.
5. Toe drains to be 8" perforated AB .ACCMP.

PROFILE—WALL

SCALE: HOR. 1" = 20'
VERT 1" = 10'

GRAPHIC SCALES

1" = 10': 10' 0 10' 20'

1" = 20': 20' 0 20' 40'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY D.V.T. | DR. BY H.M. | CK. BY W.D.H.

SUBMITTED — ARCHITECT-ENGINEER — PROJECT ENGINEER — APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH — APPROVAL RECOMMENDED — CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN AND PROFILE
STA. 4+00 TO STA. 9+23

CHICOPEE RIVER MASSACHUSETTS

APPROVED — DATE DEC., 1962

CHIEF, ENGINEERING DIVISION

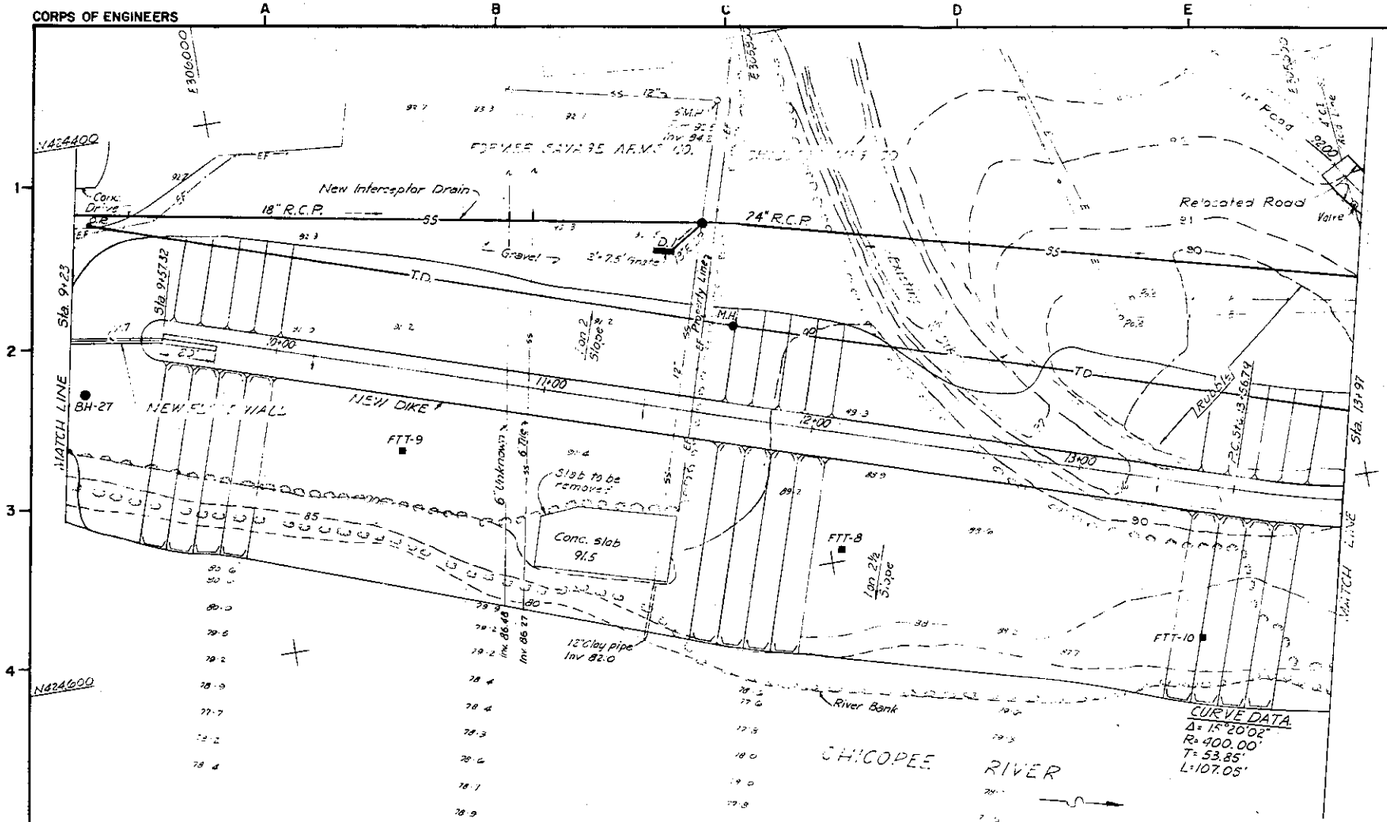
SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-065-

DRAWING NUMBER

SHEET

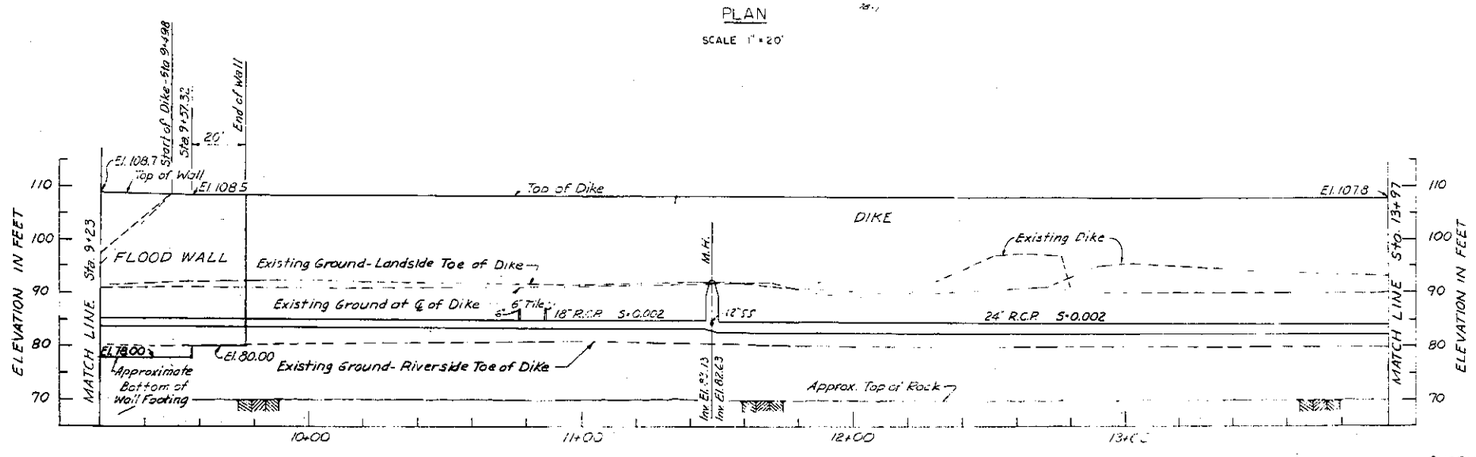
PLATE NO. 3

CORPS OF ENGINEERS — U.S. ARMY



PLAN

SCALE 1" = 20'



PROFILE—WALL AND DIKE

SCALES HOR 1"=20'
VERT 1"=10'

GRAPHIC SCALES

1"=10' 0 10' 20'

1"=20' 40' 0 20' 40'

NOTES:

1. For General Notes and Legend see Plate No. 3.

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY G.V.T. | DR. BY H.M. | CK. BY H.D.P.

SUBMITTED
ARCHITECT - ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P. B. & R. BRANCH

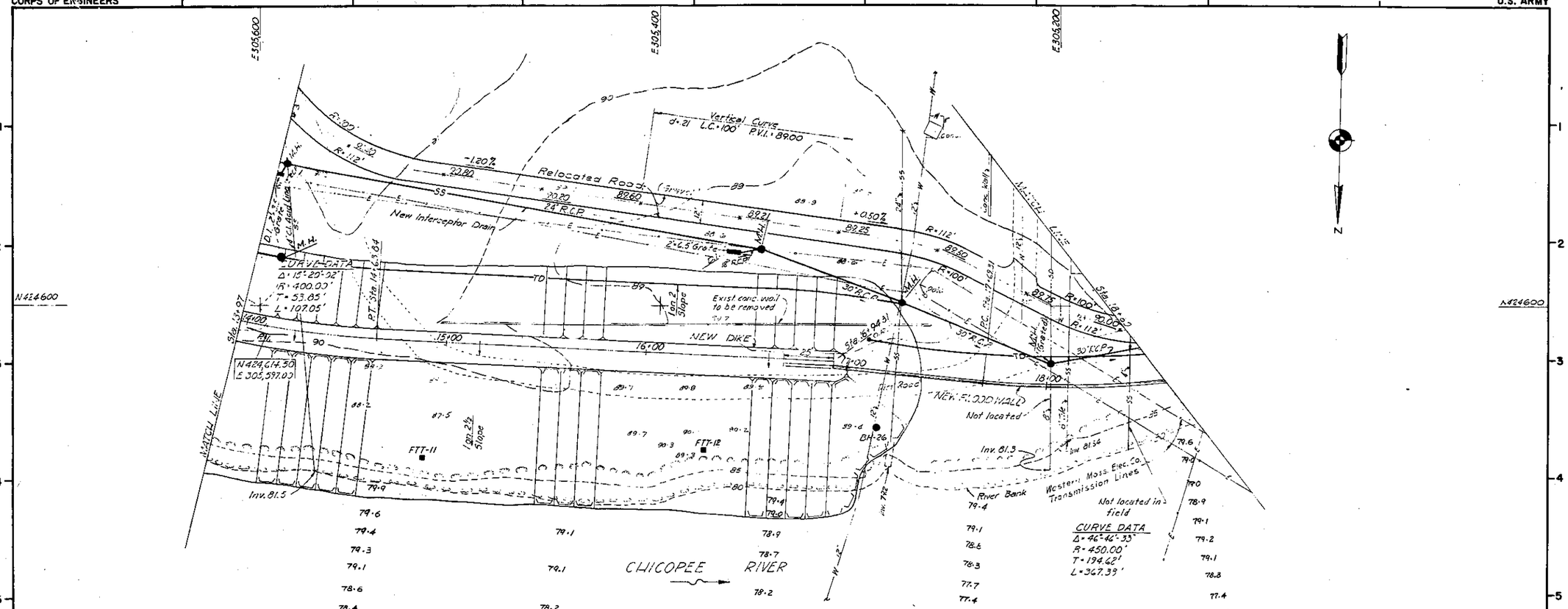
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN AND PROFILE
STA. 9+23 TO STA 13+97
CHICOPEE RIVER — MASSACHUSETTS

APPROVED
CHIEF, ENGINEERING DIVISION
DATE DEC., 1962

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-ONE-
DRAWING NUMBER
SHEET

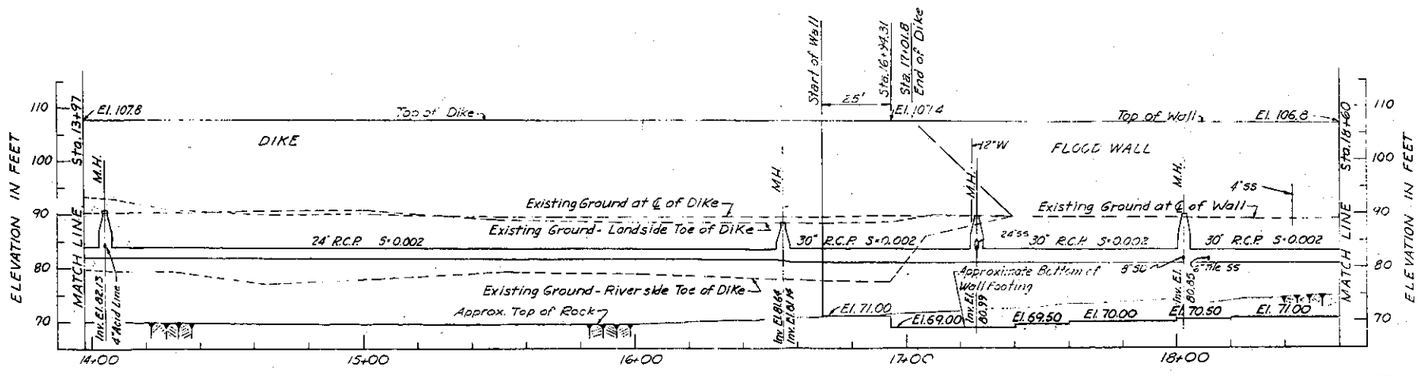
PLATE NO. 4

CORPS OF ENGINEERS — U.S. ARMY



PLAN

SCALE : 1" = 20'



PROFILE—WALL AND DIKE

SCALES: HOR. 1" = 20'
VERT. 1" = 10'

GRAPHIC SCALES

1" = 10'

1" = 20'

NOTES:

1. For General Notes and Legend see Plate No. 3

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. — ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY	DR. BY	CH. BY
C.V.T.	H.A.H.	H.J.H.

SUBMITTED — ARCHITECT – ENGINEER — PROJECT ENGINEER — APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH — APPROVAL RECOMMENDED — CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN AND PROFILE
STA. 13+97 TO STA. 18+60

CHICOPEE RIVER — MASSACHUSETTS

APPROVED — DATE DEC., 1962

CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-060

DRAWING NUMBER

SHEET

PLATE NO. 5

CORPS OF ENGINEERS — U.S. ARMY

Bldg. #5 Chicopee Mfg. Co. Floor El. 86.7 Drain P.I. El. 82.5

Platform El. 94.9

Road Relocation

30"R.C.P.

Elev. of Wires & Poles El. 125 ±

E.F. Transformers

Lowest Floor El. 84.74

Bldg. #2 Chicopee Mfg. Co. (Brick Constr.) Basement Floor El. 86.82

CURVE DATA
Δ = 139°18'39"
R = 253.00'
T = 78.17'
L = 221.33'

New Interceptor Drain

Dirt Road

30"R.C.P. S=0.002

"NEW" FLOOD WALL

BH-22 El. 88.9

BH-23 El. 77.3

BH-24 El. 88.0

M.H. (Grated)

Inv. 81.54

Linv. 78.33

Chicopee Mfg. Co. Signal circuit to water tanks

River Bank

CURVE DATA
Δ = 46°46'33"
R = 450.00'
T = 194.62'
L = 367.38'

P.I.
N 424,659.00
E 305,045.00

MATCH LINE 18+60

MATCH LINE 23+40

3' Blanket 1 to 2 ton riprap full width of stream below Sta. 24+00. Omit riprap at bridge outcrops.

CHICOPEE RIVER

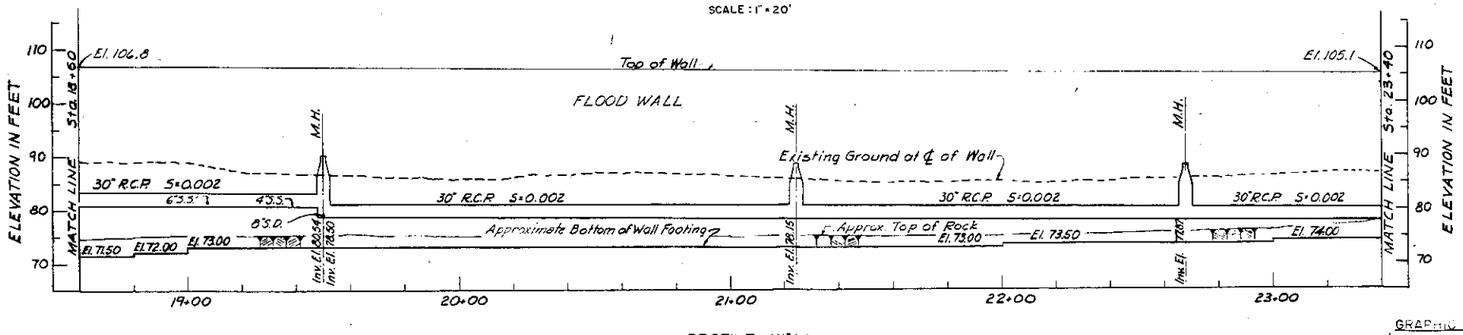
River Bank

E 305,100 · E 305,000 · E 304,900 · E 304,800 · E 304,600 · E 305,200

N 424,600 · N 424,800 · N 424,400

NOTES:
1. For General Notes and Legend see Plate No. 3

PLAN
SCALE: 1" = 20'



PROFILE—WALL
SCALES: HOR. 1"=20'
VERT. 1"=10'

GRAPHIC SCALES
1" = 10'
1" = 20'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY DJF | DR. BY | CK. BY M.D.H.

SUBMITTED — ARCHITECT-ENGINEER

PROJECT ENGINEER

APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED — CHIEF, P. & R. BRANCH

APPROVED — CHIEF, ENGINEERING DIVISION — DATE DEC., 1962

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN AND PROFILE
STA. 18+60 TO STA. 23+40
CHICOPEE RIVER MASSACHUSETTS

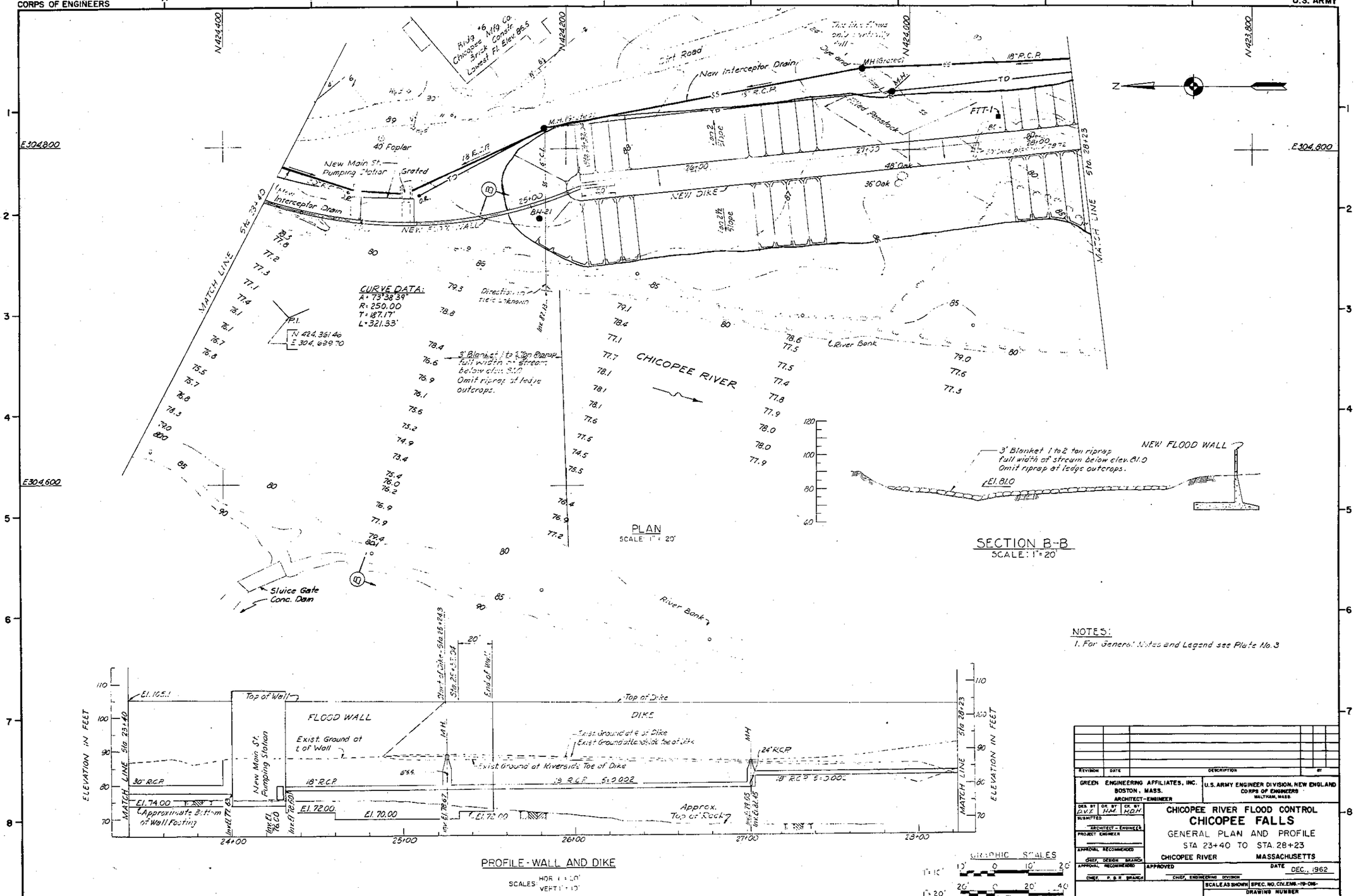
SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-ON-

DRAWING NUMBER

SHEET

PLATE NO.

CORPS OF ENGINEERS — U.S. ARMY



NOTES:

1. For General Notes and Legend see Plate No. 3

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. — ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND — CORPS OF ENGINEERS — WALTHAM, MASS.

DES. BY	CK. BY	CK. BY
D.V.I.	H.M.	M.M.

SUBMITTED — ARCHITECT - ENGINEER — PROJECT ENGINEER — APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH — APPROVAL RECOMMENDED — CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN AND PROFILE
STA 23+40 TO STA. 28+23

CHICOPEE RIVER — MASSACHUSETTS

APPROVED — DATE DEC., 1962

CHIEF, ENGINEERING DIVISION

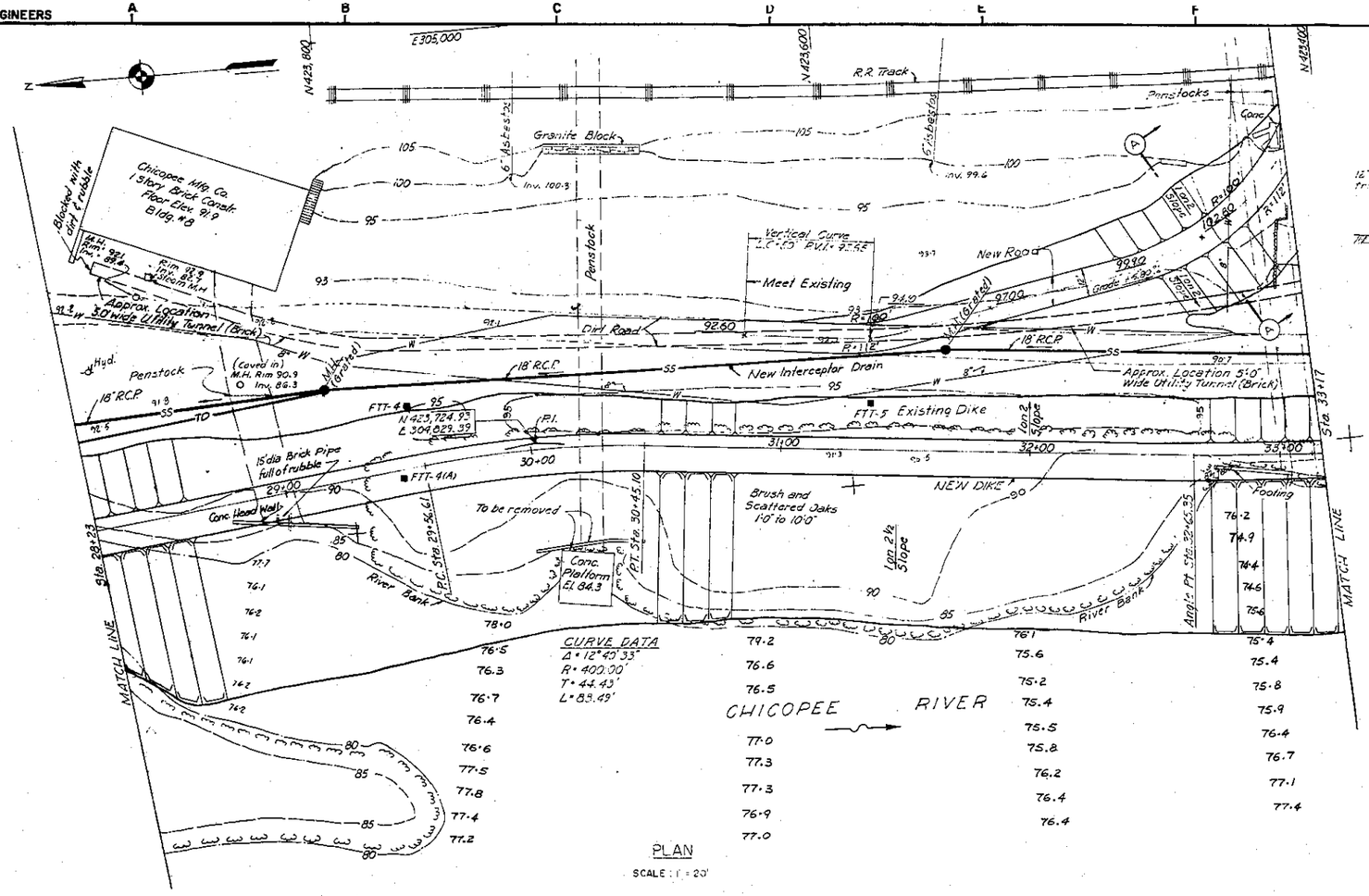
SCALE AS SHOWN — SPEC. NO. CIV. ENG.-19-096

DRAWING NUMBER

SHEET

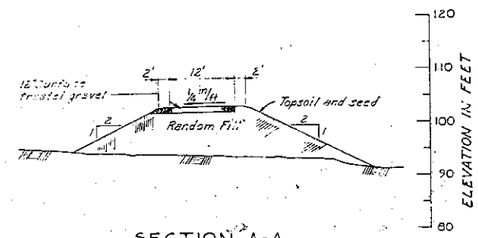
PLATE NO. 7

CORPS OF ENGINEERS — U.S. ARMY



PLAN

SCALE 1" = 20'

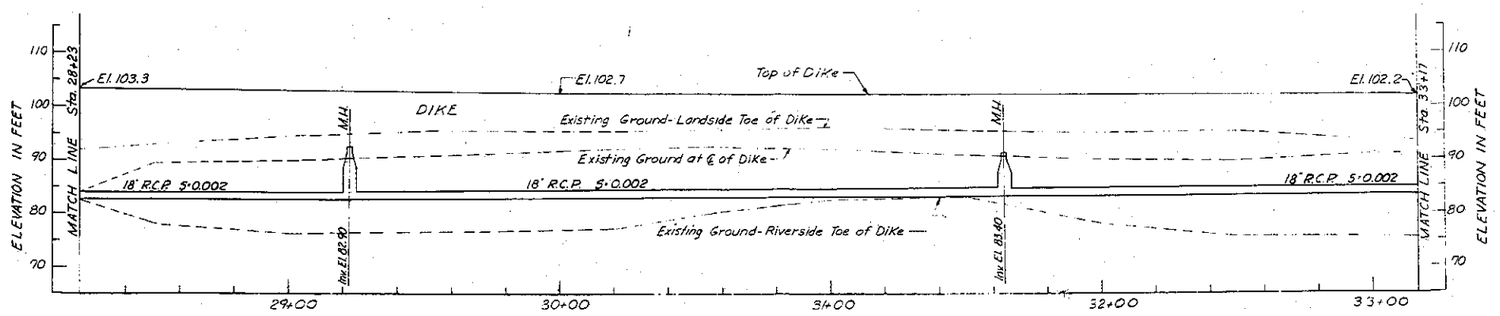


SECTION A-A

Scale: 1" = 10'

NOTES:

1. For General Notes and Legend see Plate No. 3



PROFILE — DIKE

SCALES: HOR 1"=20'
VERT 1"=10'

GRAPHIC SCALES

1"=10' 10' 0 10' 20'

1"=20' 20' 0 20' 40'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER	U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
DES. BY G.V.T. DR. BY M.M. CK. BY J.D.H. SUBMITTED ARCHITECT-ENGINEER PROJECT ENGINEER APPROVAL RECOMMENDED CHIEF, DESIGN BRANCH APPROVAL RECOMMENDED CHIEF, P. B. R. BRANCH	CHICOPEE RIVER FLOOD CONTROL CHICOPEE FALLS GENERAL PLAN AND PROFILE STA. 28+23 TO STA. 33+17 CHICOPEE RIVER MASSACHUSETTS APPROVED DATE DEC., 1962 CHIEF, ENGINEERING DIVISION SCALE AS SHOWN SPEC. NO. CIV. ENG.-19-ONE- DRAWING NUMBER SHEET

PLATE NO. 8

CORPS OF ENGINEERS — U.S. ARMY

CHICOPEE RIVER

CHANNEL RELOCATION

MATCH LINE Sta 33+17

MATCH LINE Sta. 37+21

N423,400

N423,200

N423,000

E304,600

E304,800

E305,000

Wood Frame Barn

Conc. Pad

2 Story Wood Frame House

Porch

Pole

Toe of Slope El 75.0

River Bank

Channel Relocation Sta. 33+17

Chicopee Municipal Electric Co. Distribution Line to be Relocated

Western Mass. Elec. Co. Transmission Lines to Remain

Excavate to El 75.0 at Toe Slope to River

CURVE DATA
Δ = 17°36'46"
R = 1000.00
T = 154.92
L = 307.40

CURVE DATA
Δ = 12°27'24"
R = 400.00
T = 43.65
L = 86.96

BD-14

BD-15

BD-37

BH-37

Bldg. D

Cotton House
Chicopee Mfg. Co. (Brick Constr.)
Ground Floor El. 90.0

NEW DIKE

Existing Dike

Approx. Location 50' wide Utility Tunnel (Brick)

18" R.C.P. New Interceptor Drain

Inv. 83.52

C.B. Rim El. 88.62

1on2 Slope

FTT-6

FTT-7

P.C. Sta. 35+14.96

P.T. Sta. 36+01.82

Inv. City Sewer 76.52 Broken Buried

City Sewers to be Abandoned

30°-45'-55" origin unknown

N423,170.00
E304,773.00

CHICOPEE MFG. CO.

Property Line

U.S. RUBBER CO.

10'-30" Bituminous Mound

48" R.C.P.

D.I. 2'x10' Grate

River Bank

NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of dike and drain see Plate No. 16

PLAN

GRAPHIC SCALE
1"=20'
20 0 20' 40'

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY CWZ | DR. BY PAM | CK. BY MEH

SUBMITTED — ARCHITECT-ENGINEER — PROJECT ENGINEER

APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED — CHIEF, P. & R. BRANCH

APPROVED — CHIEF, ENGINEERING DIVISION

DATE DEC., 1962

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA. 33+17 TO STA. 37+21
CHICOPEE RIVER MASSACHUSETTS

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-ONE-

DRAWING NUMBER

SHEET

PLATE NO. 9

CORPS OF ENGINEERS — U.S. ARMY

A B C D E F G H

E 304,200 E 304,400 E 304,600 E 304,800

N 422,800 N 422,600 N 423,000 N 422,800

N 422,931.48
E 304,395.86

N 422,888.50
E 304,604.00

MATCH LINE Sta 37+21

MATCH LINE Sta 41+25

CURVE DATA
Δ = 18°55'49"
R = 400.00'
T = 66.69'
L = 132.16'

CURVE DATA
Δ = 20°14'07"
R = 400.00'
T = 71.38'
L = 141.27'

Chicopee Municipal Electric Co. distribution lines to be relocated

1on 2½ Slope

1on 2 Slope

15' Berm

Berm Elev. 81.0

P.C. Toe of Slope Elev. 78.0

CHANNEL RELOCATION

Excavate to El. 75.0 at Toe Slope to River

210'± 200' Minimum

CHICOPEE RIVER

River Bank

NEW DIKE

Begin 16" temporary steel pressure pipe for press. water Exact location to be determined in field

24" R.C.P. Bypass

U.S. Rubber Co. Parking Area

10'-30" Bituminous Mound

Concrete Platform

Transformer

3'x3' Conc. Piers

Conc. Wall

10" Conc. W.W.

Hose House

10" Mill Ditch

U.S. Rubber Co.
4 Story Brick Constr.
Floor Elev 85.85
Basement Elev. 78.55

Bldg #1

Bldg #2

Bldg #6

see Note Plate No. 16

M.H. Rim 84.2 Inv. 80.1

24" RCP

New Collector Box

Inv. 81.73

Inv. 81.72

PC. Sta. 40+94.13

Inv. 81.34 See Note Plate No. 16

PT. Sta. 39+23.25

Inv. 81.17 15" CMP

Inv. 81.85

M.H. Rim 87.4 Bot. 84.0

Conc. Driveway

Const. Elev. 84.7

NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of dike and drain see Plate No. 14

PLAN
SCALE 1" = 20'

GRAPHIC SCALE
1" = 20'
0 20' 40'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY D.V.T. | DR. BY H.M. | CK. BY H.O.H.

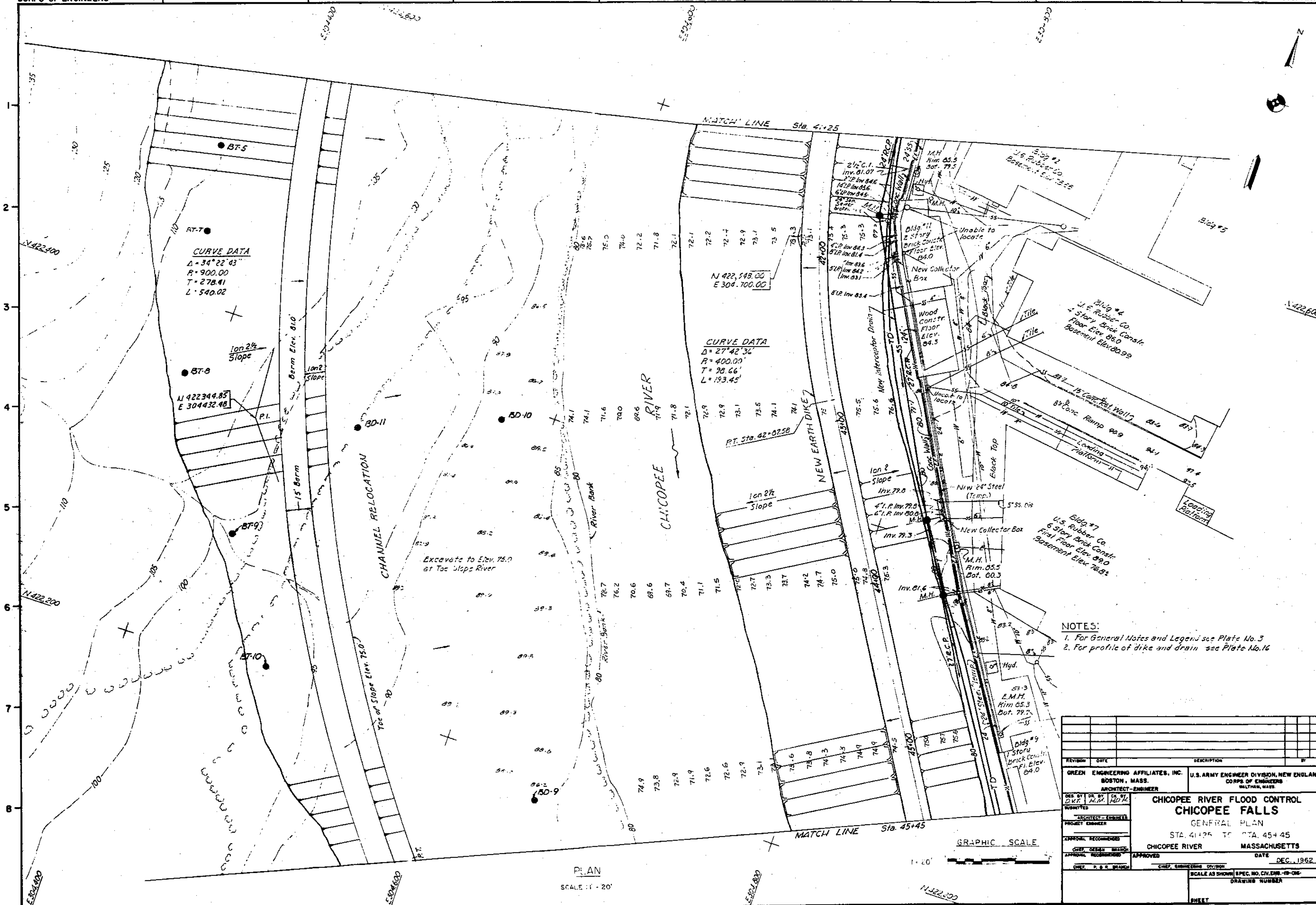
SUBMITTED
ARCHITECT-ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA. 37+21 TO STA. 41+25
CHICOPEE RIVER MASSACHUSETTS

APPROVED
DATE DEC., 1962
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC. NO. CIV. ENG. -19-ONE-
DRAWING NUMBER
SHEET

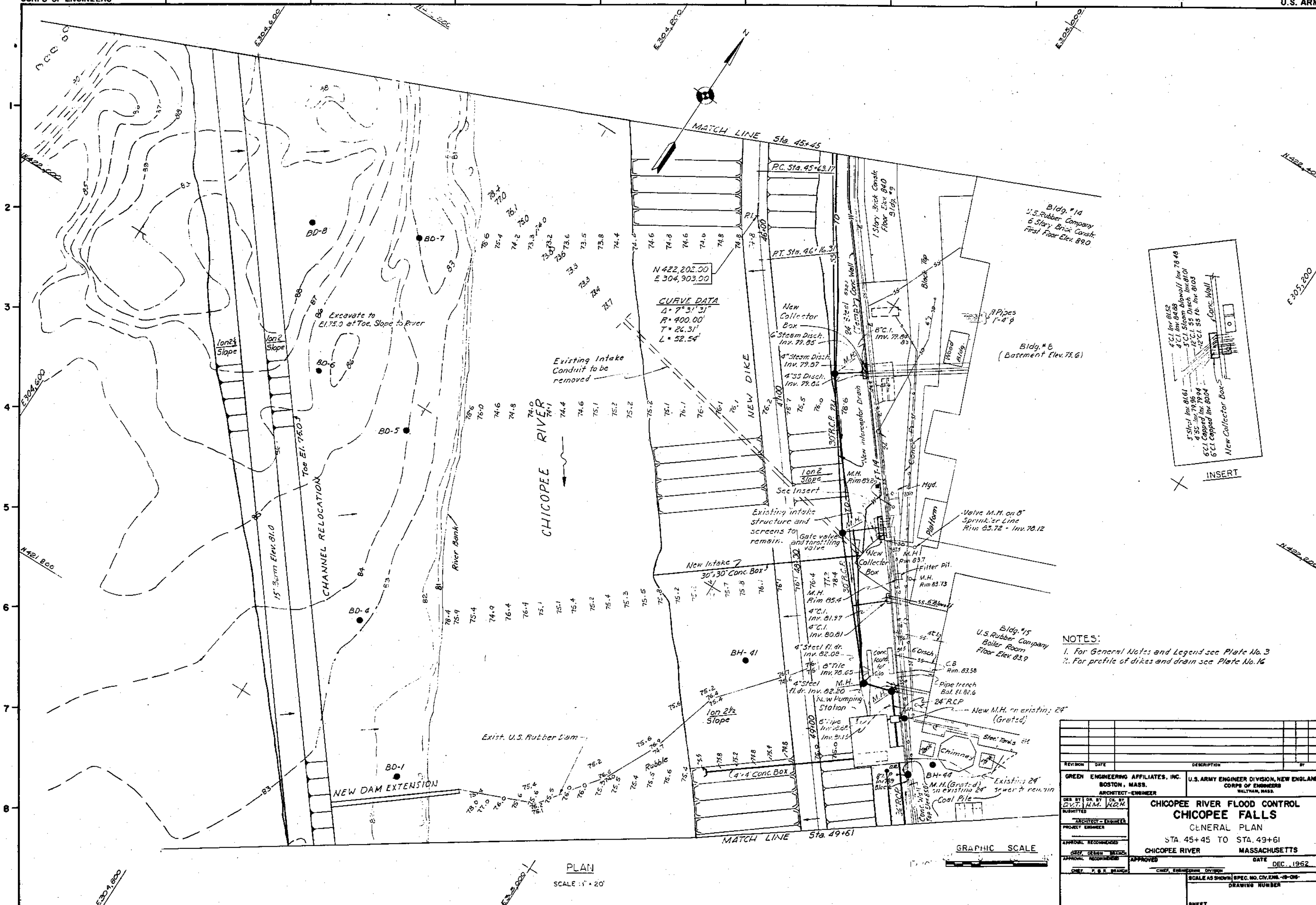
PLATE NO. 10



CORPS OF ENGINEERS
U.S. ARMY
MATCH LINE Sta. 41+25
MATCH LINE Sta. 45+45
CURVE DATA
Δ = 34°22'43"
R = 900.00
T = 278.41
L = 540.02
CURVE DATA
Δ = 27°42'36"
R = 400.00'
T = 98.66'
L = 193.45'
N 422344.85
E 304432.48
N 422,548.00
E 304,700.00
P.T. Sta. 42+07.58
BT-5
BT-7
BT-8
BT-9
BT-10
BD-9
BD-10
BD-11
1 on 2½ Slope
1 on 2 Slope
Berm Elev. 81.0'
15' Berm
CHANNEL RELOCATION
Toe of Slope Elev. 75.0
Excavate to Elev. 75.0 at Toe Slope River
River Bank
CHICOPEE RIVER
NEW EARTH DIKE
New Interceptor Drain
New Collector Box
Unable to locate
Bldg #11 2 Story Brick Constr. Floor Elev. 84.0
Wood Constr. Floor Elev. 84.3
Bldg #4 U.S. Rubber Co. 4 Story Brick Constr. Floor Elev. 86.0 Basement Elev. 80.99
Bldg #5
Bldg #7 U.S. Rubber Co. 6 Story Brick Constr. First Floor Elev. 89.0 Basement Elev. 78.8±
Bldg #9 Story Brick Constr. Fl. Elev. 84.0
15" Conc. Ret. Wall
Conc. Ramp
Loading Platform
Black Top
New 24" Steel (Temp.)
M.H. Rim 85.5 Bot. 80.5
E.M.H. Rim 85.3 Bot. 79.7
Hyd.
NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of dike and drain see Plate No. 16
PLAN
SCALE 1" = 20'
GRAPHIC SCALE
N 422,400
N 422,200
N 422,600
E 304,400
E 304,600
E 304,800
GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA. 41+25 TO STA. 45+45
CHICOPEE RIVER
MASSACHUSETTS
DATE DEC. 1962

PLATE NO. 11

CORPS OF ENGINEERS U.S. ARMY



MATCH LINE Sta. 45+45
MATCH LINE Sta. 49+61
CHICOPEE RIVER
CHANNEL RELOCATION
NEW DIKE
NEW DAM EXTENSION
Exist. U.S. Rubber Dam
Excavate to El.75.0 at Toe. Slope to River
Toe El. 75.0
15' Berm Elev. 81.0
River Bank
Existing Intake Conduit to be removed
CURVE DATA
Δ = 7°31'31"
R = 400.00'
T = 26.31'
L = 52.54'
N 422,202.00
E 304,903.00
P.C. Sta. 45+63.17
P.T. Sta. 46+16.31
New Collector Box
New Intake 30"x30" Conc. Box
New Pumping Station
4'x4' Conc. Box
Existing intake structure and screens to remain.
Gate valve and throttling valve
See Insert
INSERT
New Collector Box
Bldg. #14 U.S. Rubber Company 6 Story Brick Constr. First Floor Elev. 89.0
Bldg. #8 (Basement Elev. 75.6)
Bldg. #15 U.S. Rubber Company Boiler Room Floor Elev. 83.9
1 Story Brick Constr. Floor Elev. 84.0 Bldg. #9
Valve M.H. on 8" Sprinkler Line Rim 83.72 - Inv. 78.12
New M.H. on existing 24" (Grated)
Existing 24" sewer to remain
Coal Pile
Chimney
Steel Tanks
Platform
Filter Pit
BD-1
BD-4
BD-5
BD-6
BD-7
BD-8
BH-41
BH-44
GRAPHIC SCALE
PLAN
SCALE 1" = 20'

NOTES:

1. For General Notes and Legend see Plate No. 3
2. For profile of dikes and drain see Plate No. 16

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY D.V.T. DR. BY H.M. CK. BY H.D.H.

SUBMITTED — ARCHITECT - ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED — CHIEF, F. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA. 45+45 TO STA. 49+61
CHICOPEE RIVER MASSACHUSETTS

APPROVED — CHIEF, ENGINEERING DIVISION DATE DEC., 1962

SCALE AS SHOWN SPEC. NO. CIV.ENG.-19-016-
DRAWING NUMBER
SHEET

PLATE NO. 12

CORPS OF ENGINEERS

U.S. ARMY

MATCH LINE Sta 49+61

Light Brush

Mixed Woods 1" to 36"

BORROW AREA
Excavate to 21.0 at Toe
Slope to River

DOWNSTREAM WIDENING

15' Berm Elev. 81.0

BA-1

1on 2½ Slope

1on 2 Slope

Toe El. 75.0

P.C.

River Bank

CHICOPEE RIVER

CURVE DATA
Δ = 124°15'49"
R = 900.00'
T = 756.48'
L = 867.52'

CURVE DATA
Δ = 18°23'20"
R = 600.00'
T = 97.12'
L = 192.57'

NEW DIKE

1on 2½ Slope

P.C. Sta. 51+87.60

P.T. Sta. 53+66.17

Sta. 54+14.62

MATCH LINE

New Interceptor Drain
24" to be removed

Wood Trestle

Conc. Piers

Coal Conveyor

Coal Chute

Coal Storage Area

Tool Shed

1on 2 Slope

M.H. (Pressure)
Inv. 74.8

40" Conc. Culvert
Inv. 78.9

M.H.

Junction Box

M.H.
Rim = 99.0
Inv. = 87.8

Slope Transition

Slope to River

New Downstream Pressure Drain

30" R.C.P.

M.H. Sta 53+03

BH-31

BH-46

N 421,654.00
E 305,330.00

Pump House

B & M R.R.

CHICOPEE FALLS BRANCH

N 421,600

E 305,800

N 422,000

E 305,400

N 421,800

E 305,200

E 305,120

PLAN
SCALE : 1" = 20'

GRAPHIC SCALE
0 20 40

NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of drain and dike see Plate No. 16
3. For downstream pressure drain see Plate No. 23

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY D.V.T. | DR. BY H.M. | CK. BY H.D.H.
SUBMITTED
ARCHITECT - ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P & S BRANCH

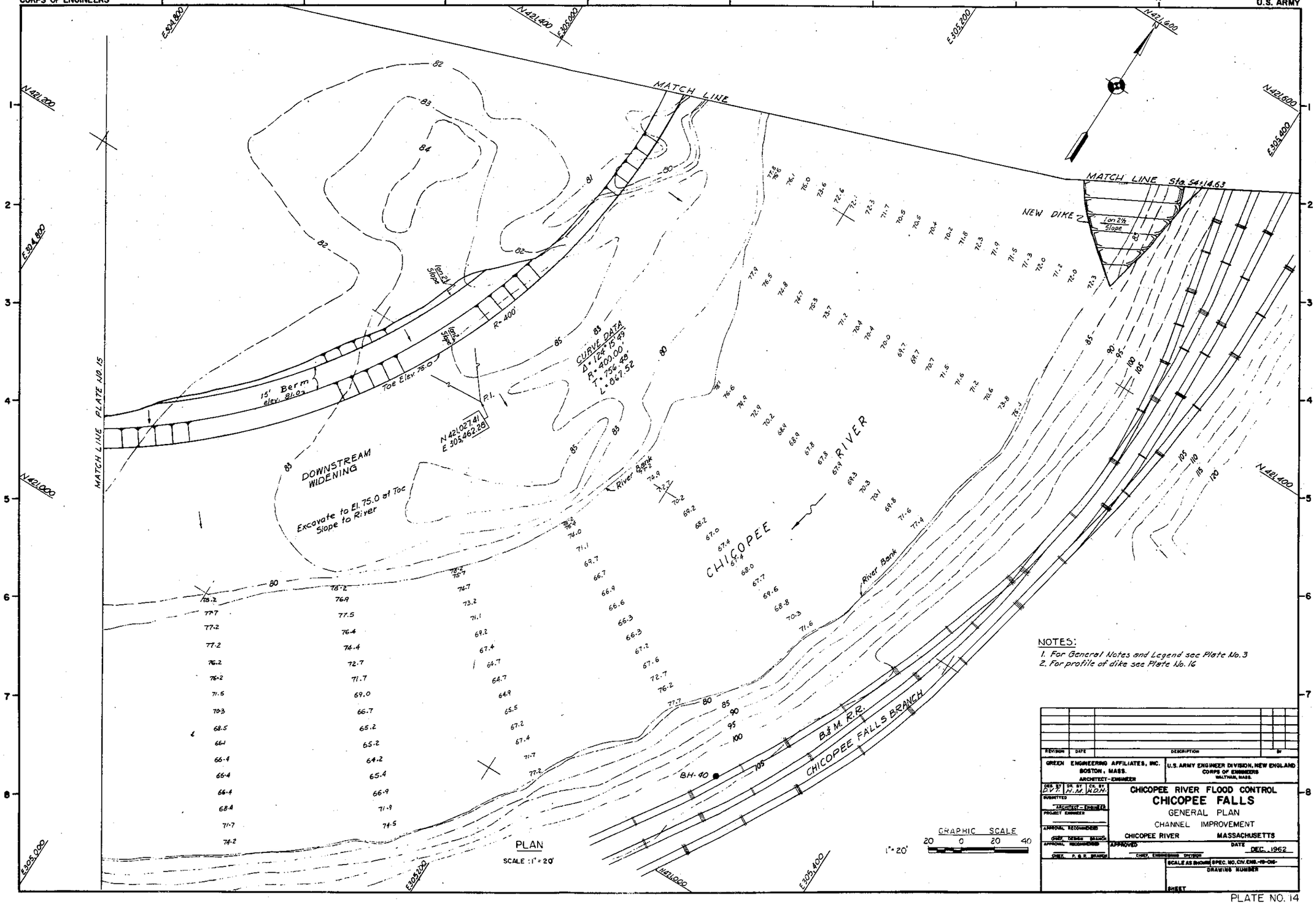
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA. 49+61 TO STA. 54+14
CHICOPEE RIVER MASSACHUSETTS

APPROVED
CHIEF, ENGINEERING DIVISION
DATE DEC., 1962

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-016-
DRAWING NUMBER
SHEET

PLATE NO. 13

CORPS OF ENGINEERS — U.S. ARMY



NOTES:

1. For General Notes and Legend see Plate No. 3
2. For profile of dike see Plate No. 16

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY D.V.T. | DR. BY P.M. | CK. BY N.D.N.

SUBMITTED "ARCHITECT-ENGINEER"

PROJECT ENGINEER

APPROVAL RECOMMENDED CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED CHIEF, P. & R. BRANCH

APPROVED CHIEF, ENGINEERING DIVISION

DATE DEC. 1962

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
CHANNEL IMPROVEMENT
CHICOPEE RIVER MASSACHUSETTS

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-ONE-

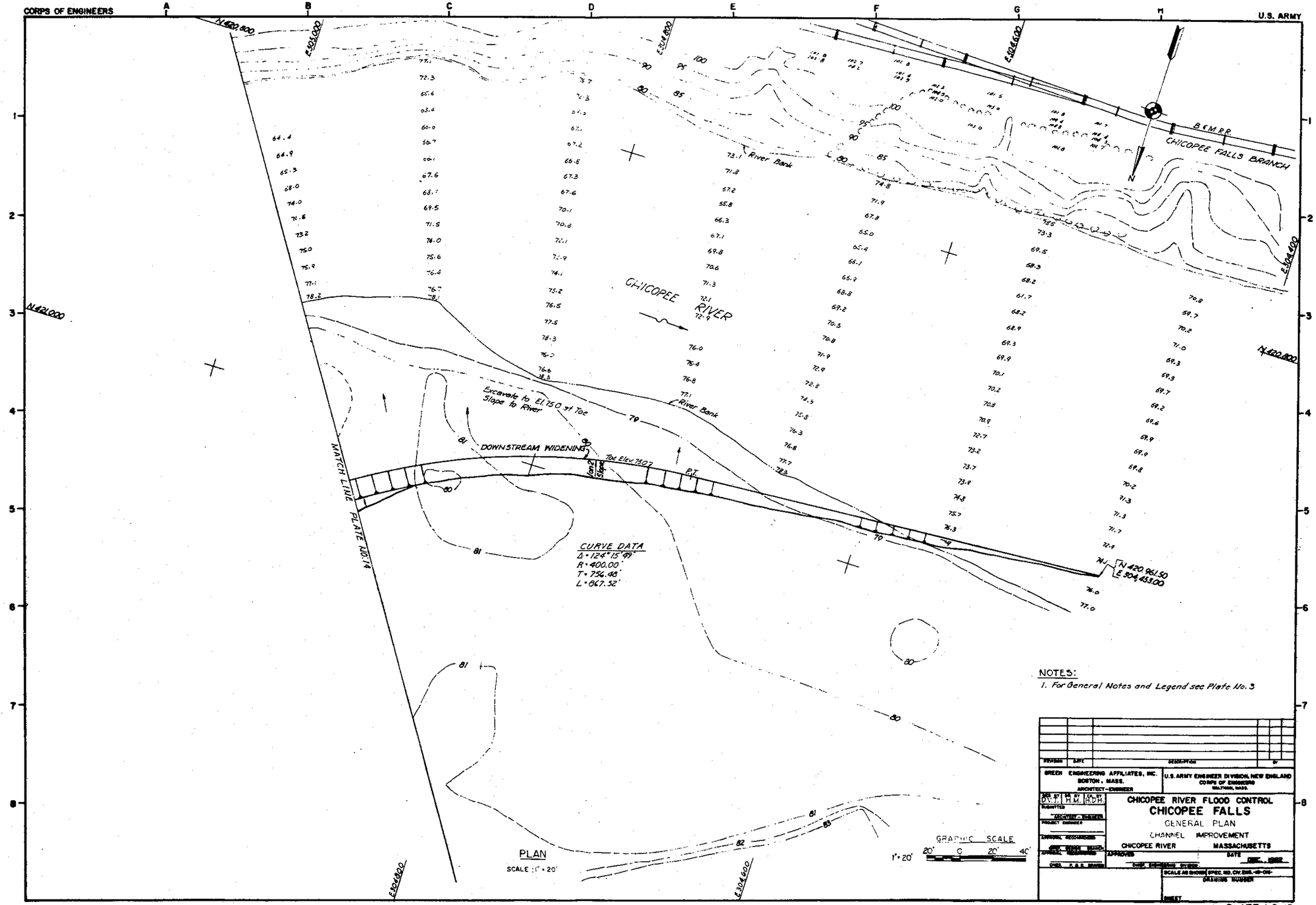
DRAWING NUMBER

SHEET

PLATE NO. 14

CORPS OF ENGINEERS

U.S. ARMY



NOTES:

1. For General Notes and Legend see Plate No. 3

REVISED	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
D.V.T.	H.M.	H.D.H.

SUBMITTED

ARCHITECT-ENGINEER

PROJECT ENGINEER

CHIEF, DESIGN BRANCH

APPROVED

CHIEF, P. & D. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
CHANNEL IMPROVEMENT
CHICOPEE RIVER MASSACHUSETTS

APPROVED DATE

CHIEF, ENGR. DIVISION

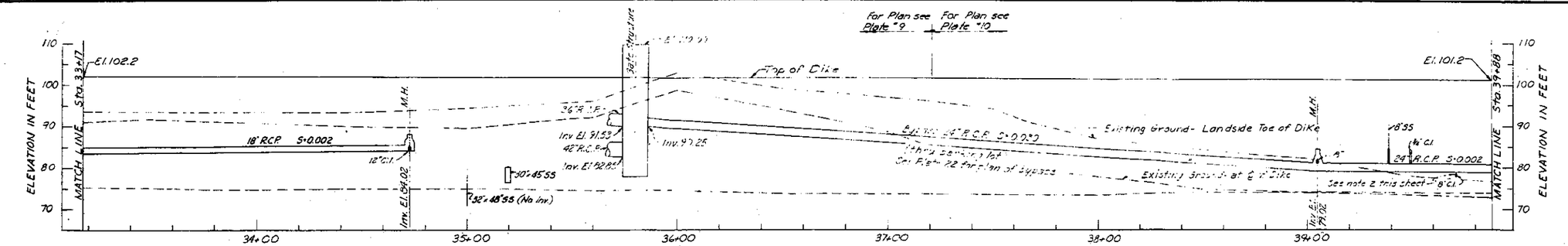
SCALE AS SHOWN SPEC. NO. CIV. ENG.-48-010-

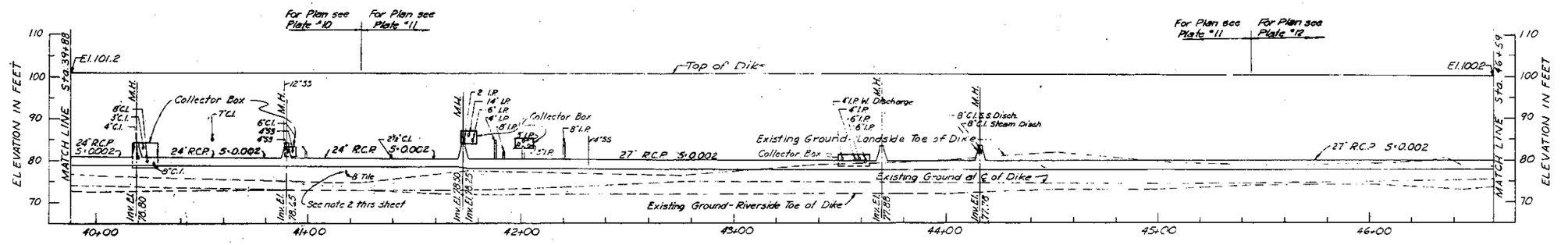
DRAWING NUMBER

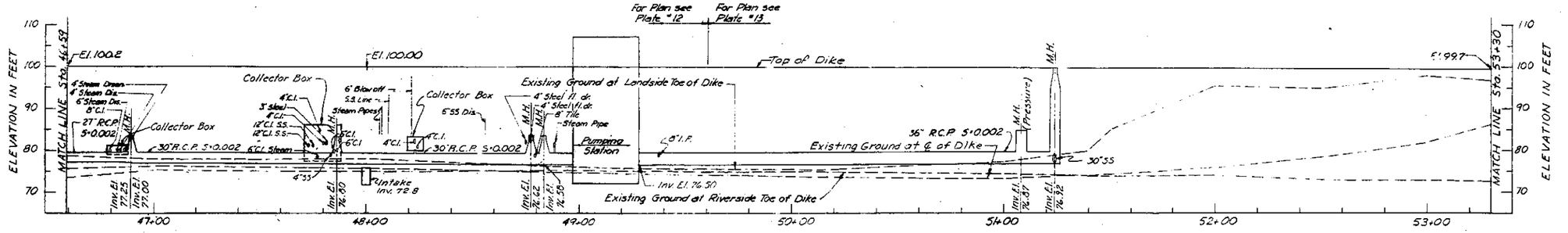
SHEET

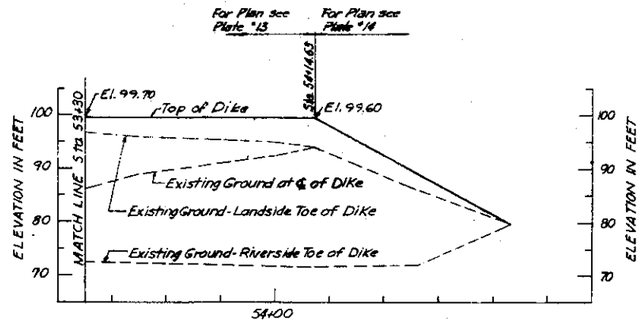
PLATE NO. 15

CORPS OF ENGINEERS — U.S. ARMY









NOTES:

1. For Plans see Plates Nos 9, 10, 11, 12 and 13
2. Rework roofleader piping for gravity connections
   Install sump pumps for basement pits at U. S. Rubber Bldgs

PROFILE — DIKE

SCALES HOR. 1"=20'
VERT. 1"=10'

GRAPHIC SCALES

1"=10' 10' 0 10' 20'

1"=20' 40' 20' 0 20' 40'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
D.V.T.	H.M.	H.D.H.

SUBMITTED
ARCHITECT-ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P. & C. BRANCH

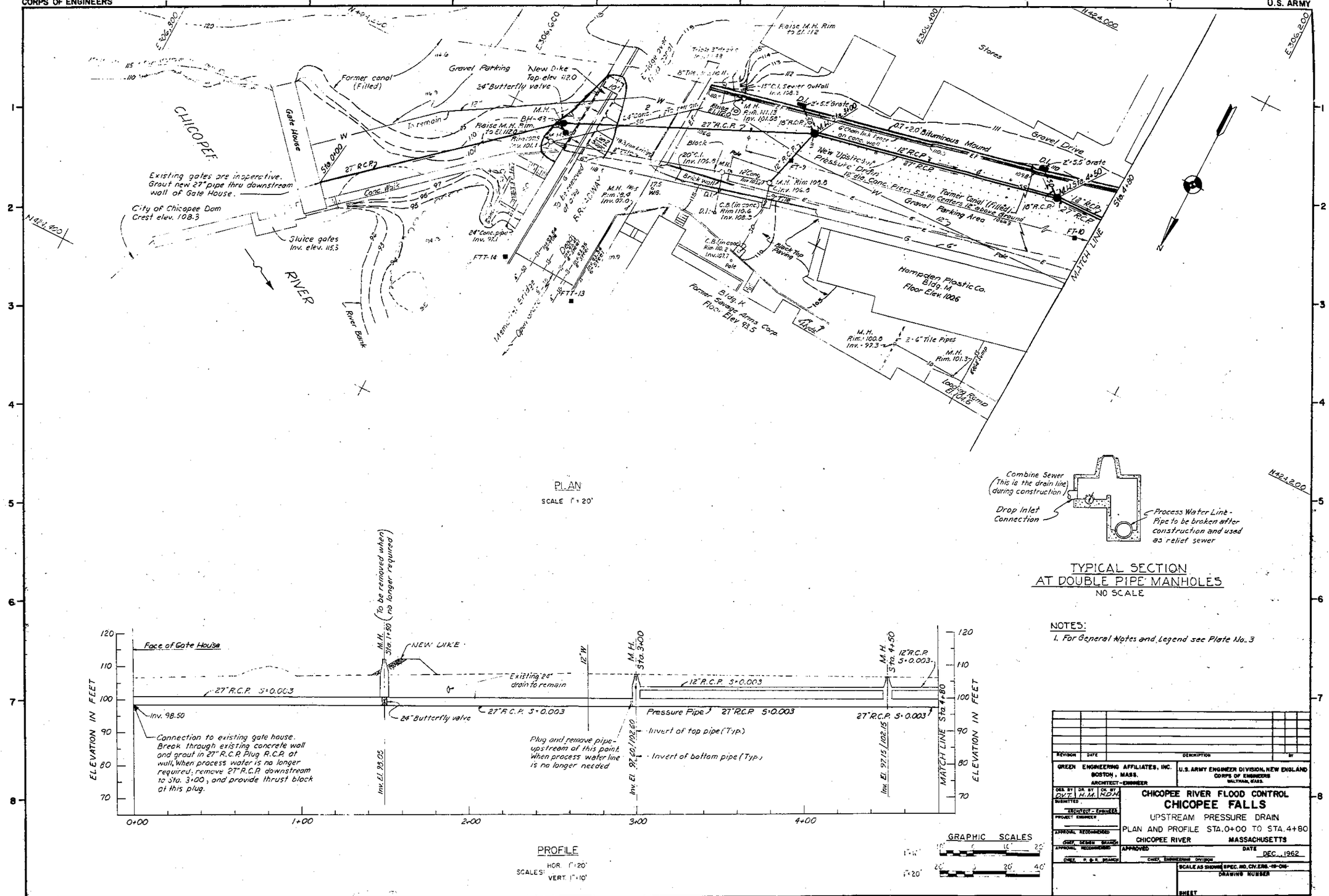
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PROFILE
STA. 33+17 TO STA. 54+14.63
CHICOPEE RIVER MASSACHUSETTS

APPROVED
CHIEF, ENGINEERING DIVISION
DATE DEC. 1962

SCALE AS SHOWN ON ORIGINAL DRAWING
DRAWING NUMBER
PROJECT

PLATE NO. 8

CORPS OF ENGINEERS — U.S. ARMY



PLAN

SCALE 1" = 20'

PROFILE

SCALES: HOR. 1"=20'
VERT. 1"=10'

TYPICAL SECTION
AT DOUBLE PIPE MANHOLES

NO SCALE

NOTES:

1. For General Notes and Legend see Plate No. 3

GRAPHIC SCALES

1"=10' 0 10' 20'

1"=20' 20' 0 20' 40'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY DWT | DR. BY H.M. | CK. BY M.D.M.

SUBMITTED: ARCHITECT-ENGINEER

PROJECT ENGINEER

APPROVAL RECOMMENDED: CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED: CHIEF, P. & R. BRANCH

APPROVED: CHIEF, ENGINEERING DIVISION

DATE: DEC., 1962

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
UPSTREAM PRESSURE DRAIN
PLAN AND PROFILE STA. 0+00 TO STA. 4+80

CHICOPEE RIVER MASSACHUSETTS

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-016

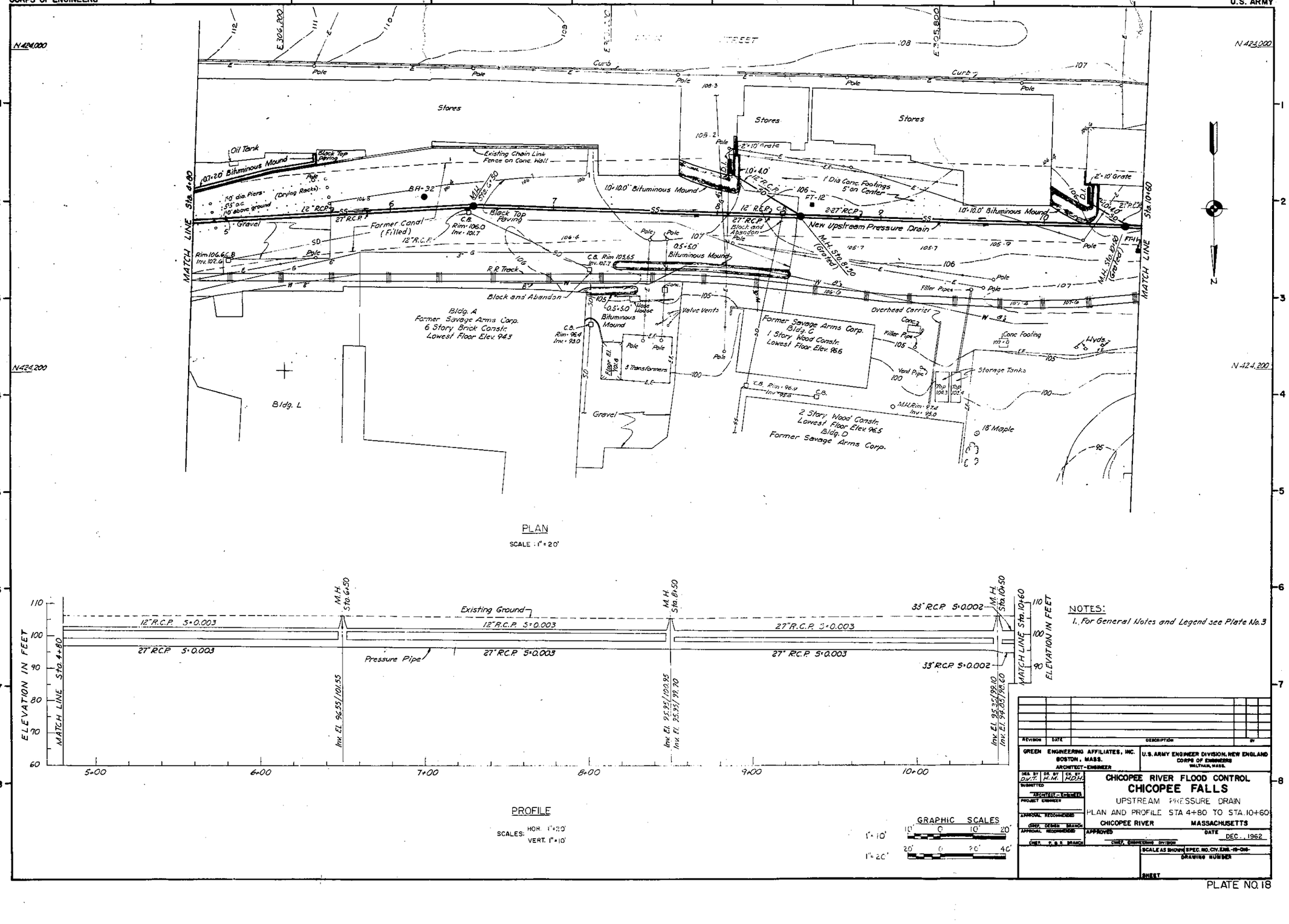
DRAWING NUMBER

SHEET

PLATE NO. 17

CORPS OF ENGINEERS

U.S. ARMY



PLAN

SCALE : 1" = 20'

PROFILE

SCALES: HOR. 1" = 20'
VERT. 1" = 10'

GRAPHIC SCALES

1" = 10'

1" = 20'

NOTES:

1. For General Notes and Legend see Plate No. 3

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY D.V.T. | DR. BY H.M. | CK. BY M.D.H.

SUBMITTED
ARCHITECT-ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
UPSTREAM PRESSURE DRAIN
PLAN AND PROFILE STA 4+80 TO STA 10+60
CHICOPEE RIVER MASSACHUSETTS

APPROVED
CHIEF, ENGINEERING DIVISION

DATE DEC., 1962

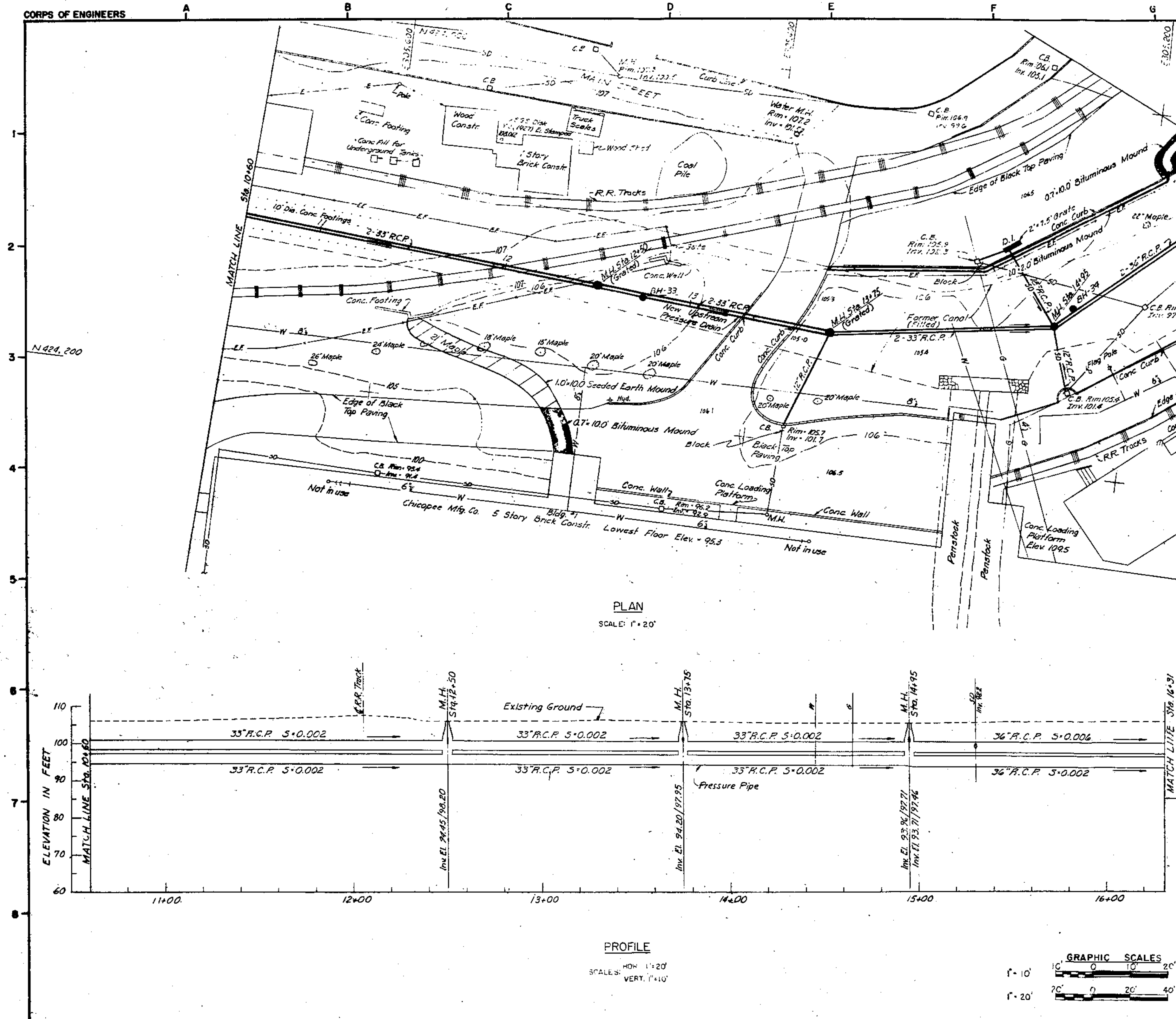
SCALE AS SHOWN SPEC. NO. CIV. ENG.-19-060

DRAWING NUMBER

SHEET

PLATE NO. 18

CORPS OF ENGINEERS　　　　U.S. ARMY



NOTES:

1. For General Notes and Legend see Plate No. 3.

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY D.V.T. | DR. BY H.M. | CK. BY H.O.M.

SUBMITTED

PROJECT ENGINEER

APPROVAL RECOMMENDED

APPROVAL RECOMMENDED

CHICOPEE RIVER FLOOD CONTROL

CHICOPEE FALLS

UPSTREAM PRESSURE DRAIN

PLAN AND PROFILE STA.10+60 TO STA.16+35

CHICOPEE RIVER　　MASSACHUSETTS

APPROVED

DATE DEC. 1962

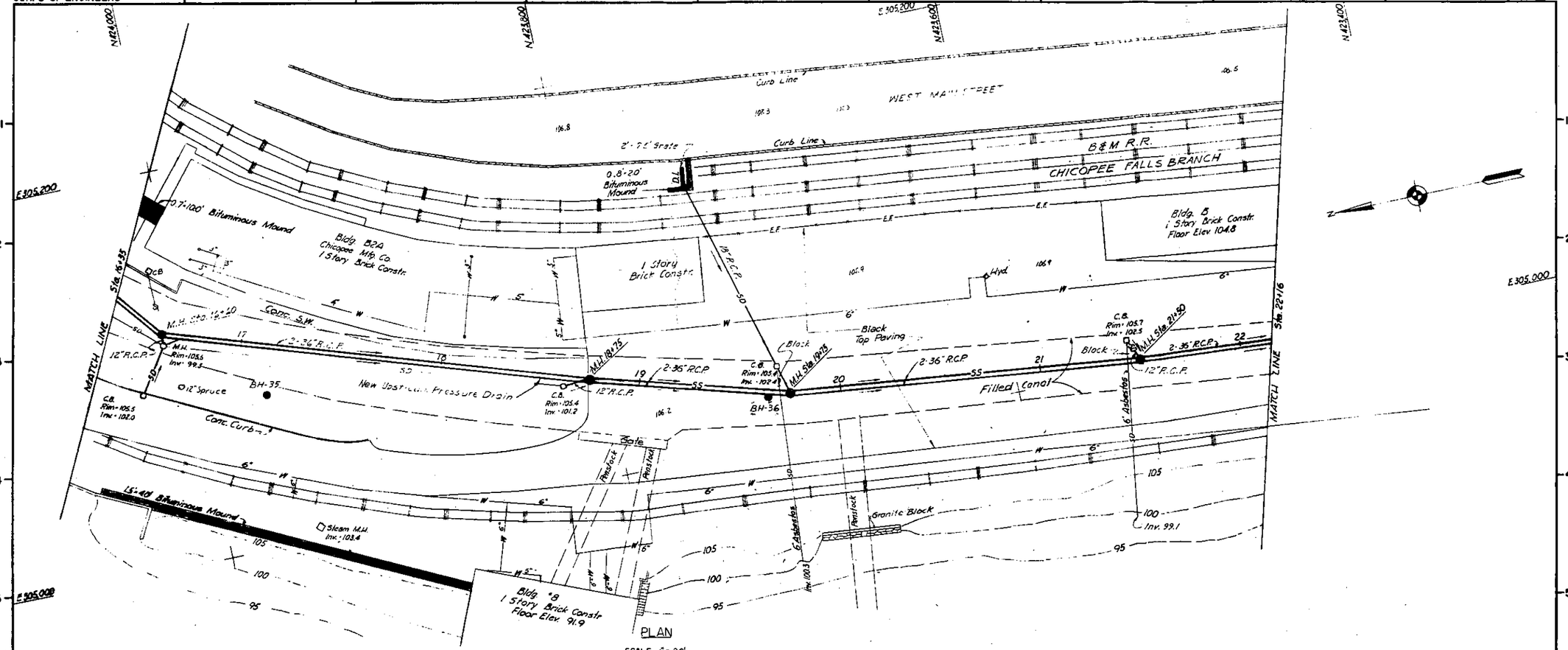
SCALE AS SHOWN | SPEC. NO. CIV. ENG.

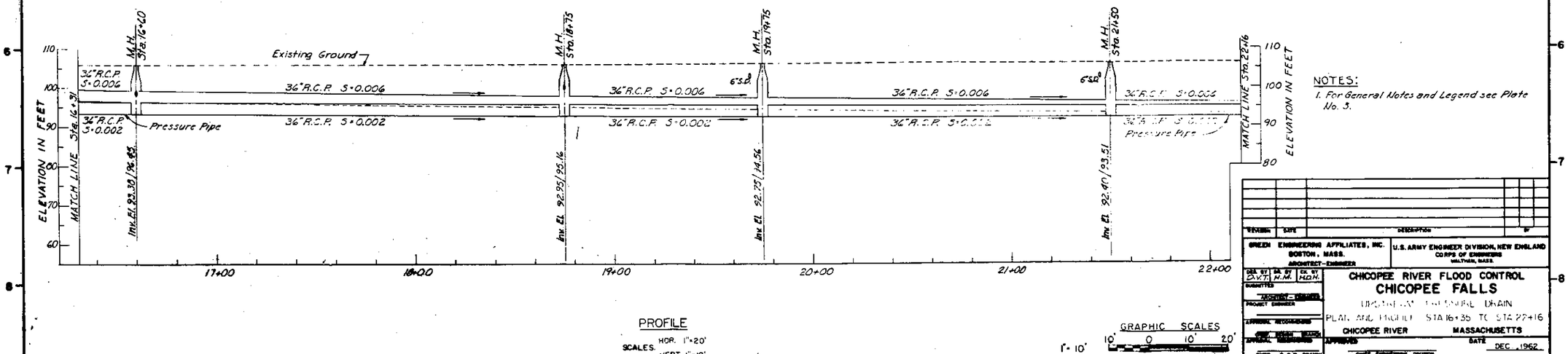
DRAWING NUMBER

SHEET

PLATE NO. 19

CORPS OF ENGINEERS — U.S. ARMY





NOTES:

1. For General Notes and Legend see Plate No. 3.

GRAPHIC SCALES

1" = 10'

1" = 20'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
D.V.T.	N.M.	H.D.M.

SUBMITTED — ARCHITECT-ENGINEER — PROJECT ENGINEER — APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH — CHIEF, E & D BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
UPSTREAM PRESSURE DRAIN

PLAN AND PROFILE STA 16+35 TO STA 22+16

CHICOPEE RIVER MASSACHUSETTS

APPROVED — CHIEF, ENGINEERING DIVISION

DATE DEC. 1962

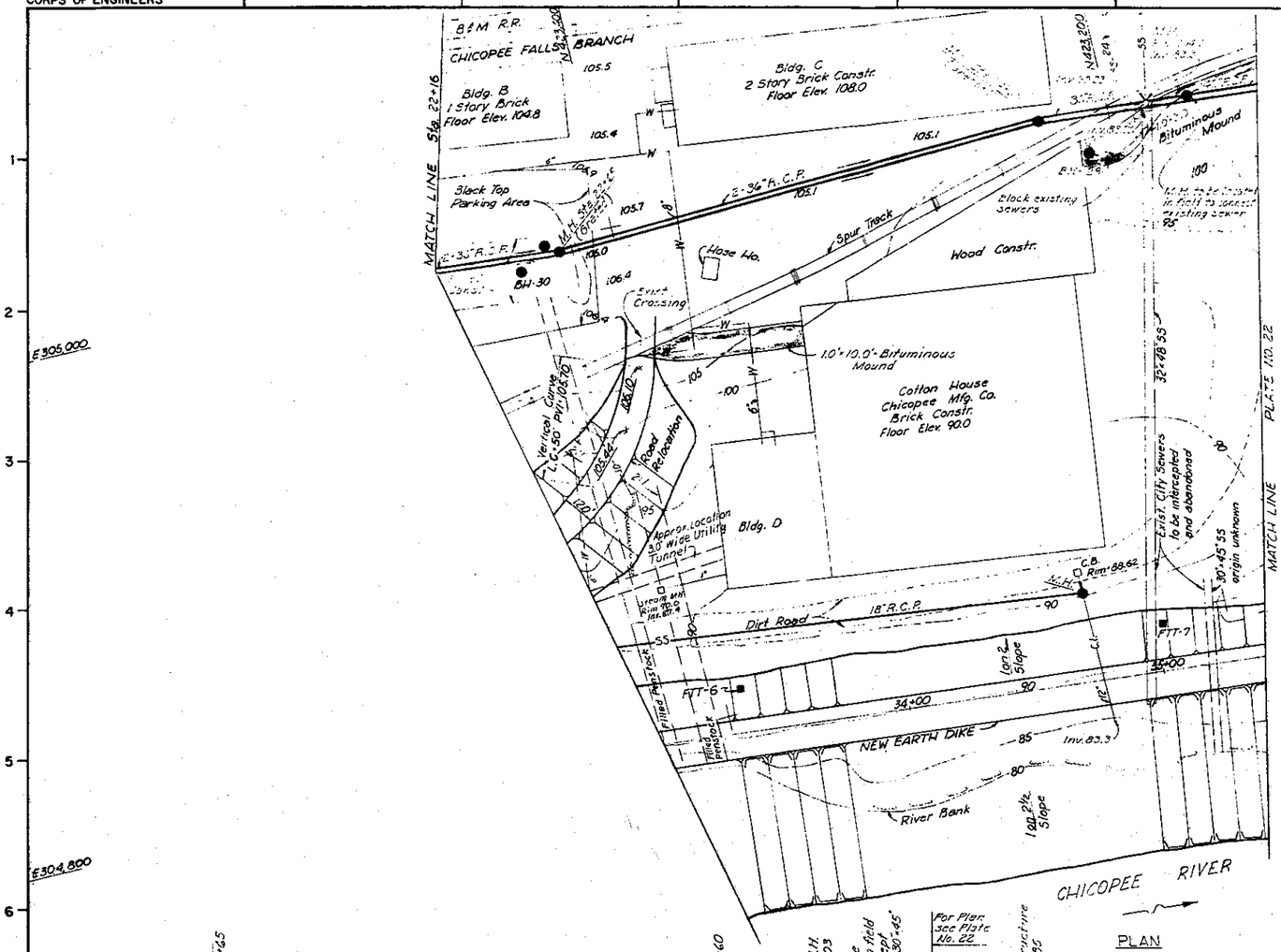
SCALE AS SHOWN — SPEC. NO. CIV. ENG.-19-ONE-

DRAWING NUMBER

SHEET

PLATE NO. 20

CORPS OF ENGINEERS — U.S. ARMY

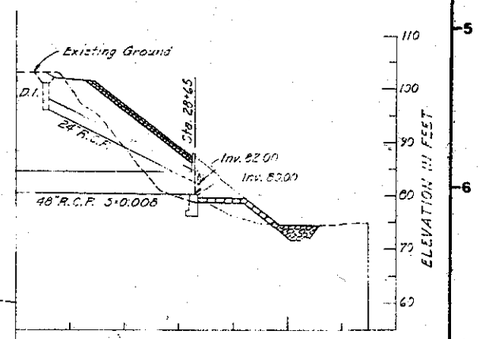


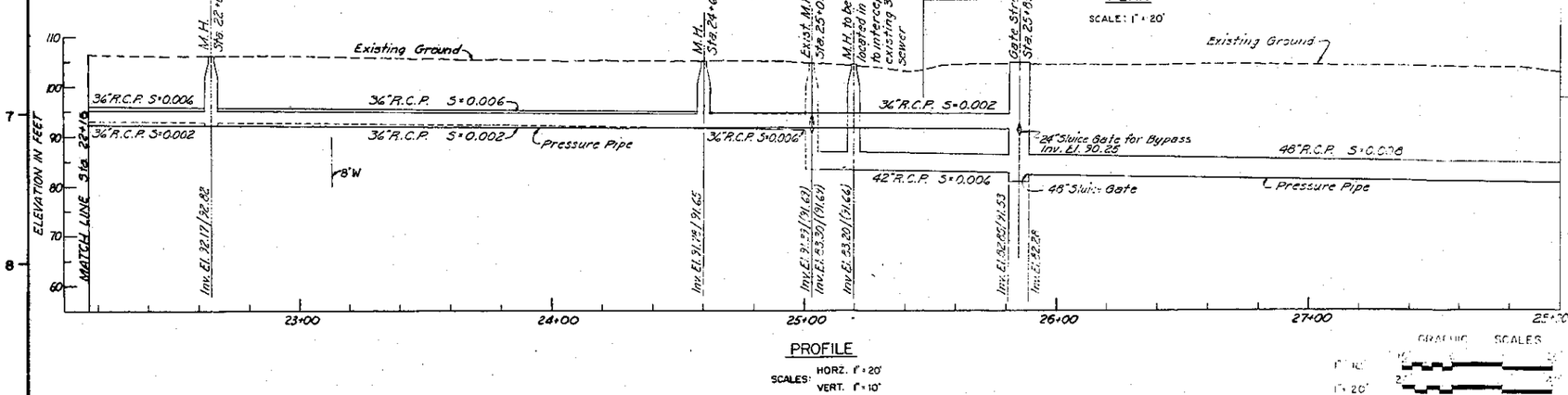
PLAN

SCALE: 1" = 20'

NOTES:

1. For General Plan and Legend see Plate No. 3
2. Invert elevations shown in parentheses where new drain passes outside the manholes.
3. Existing sewers to be located by trenching before 2 new 36" R.C.P. are constructed.





PROFILE

SCALES: HORZ. 1" = 20'
VERT. 1" = 10'

GRAPHIC SCALES

1" = 10'

1" = 20'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES BY D.V.T. | DR BY H.M. | CH BY H.D.M.

SUBMITTED
ARCHITECT-ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, [illegible] BRANCH
APPROVAL RECOMMENDED
CHIEF, P.D.R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
UPSTREAM PRESSURE DRAIN
PLAN AND PROFILE STA. 22+16 TO OUTLET
CHICOPEE RIVER MASSACHUSETTS

APPROVED
DATE DEC., 1962
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-ONE-
DRAWING NUMBER
SHEET

PLATE NO. 21

CORPS OF ENGINEERS — U.S. ARMY

A B C D E F G H

1 2 3 4 5 6 7 8

N 423,530

N 423,000

E 305,000

E 304,800

WEST MAIN STREET

Curb Line

Curb Line

10.5'x30.0' Bituminous Mound

Sewer M.H. Rim - 105.1 Bot. - 99.1

M.H. Rim-105.1 Bot. - 100.9

Valve M.H. Rim - 105.3 Bot. - 98.3

C.B. Rim 104.5 Bot. 101.7

1.0'x10.0' Bituminous Mound

B & M R.R. CHICOPEE FALLS BRANCH

Spur Track

1'-6" Trench

BH-38

Wood Guard Shack

C.B.

C.B. Conc. Wall

C.B.

S.D.

S.D.

Side inlet

Gate Structure

42" R.C.P.

36" R.C.P.

26'-00

104.6 104.5 104.4 104.6 104.6 104.5 104.6 104.4 104.3 104.2 104.2 104.6 104.2 104.2 104.2 104.0 104.3 104.3 104.1 104.2

U.S. Rubber Co. Parking Area

Wave Pit 87.0 Bot.

Conc. Ret. Wall

O.WG. 92.3

Bldg #6

U.S. Rubber Company 4 Story Brick Constr. Floor Elev. 86.0

Conc. Ditch

18" C.M.P. Inv. 87.8

Elec. M.H. Rim - 90.1 Bot. - 82.4

24" R.C.P. Bypass

1.0'x3.0' Bituminous Mound

MATCH LINE PLATE 21

Property Line

48" R.C.P. 27'-00

1.0'x3.0' Bituminous Mound

CHICOPEE MFG. CO.

U.S. RUBBER CO.

104.1 104.1 104.1 103.6 103.7 104.3 103.9 103.8 103.7 103.2 103.3 103.8 103.9 103.7

C.B. Rim 103.5 Inv. 101.5

D.I. 2'x10' Grate

Block and abandon

Conc. Platform Elev 96.7 Transformer Pan

Conc. Wall

Elec. M.H. Rim. 85.1 Bot. 79.3

Conc. Wall

Hyd

10" Mill Drain

Driveway

Bldg #1

M.H. Rim-87.4 Bott-84.0

Bldg 13 2 Story Brick Constr.

1.0d Steel (Temp.)

Existing Link Fence on Conc. Wall

M.H.

FT-15

M.H.

24" R.C.P. New Interceptor Drain

8" C.I. Inv. 78.92

8" C.I. Inv. 79.32

4" C.I. Inv. 80.42

3" C.I. Inv. 82.78

24" C.I. Inv. 83.89

Inv. 97.6

Inv. 81.1

1on 2 Slope

1on 2 Slope

1on 2 Slope

1on 2 Slope

30+00

39+20

40+00

NEW DIKE

Begin 24" temporary steel pressure pipe for process water. Exact location to be determined in the field.

P.C. Sta. 30+01.82

P.T. Sta. 30+83.02

P.T. Sta. 39+23.22

River Bank

BH-37

78.8 77.6 76.2 74.8 74.4 74.7 74.8 74.7 74.3 74.0 74.0 74.0 74.0 74.0

CHICOPEE RIVER

PLAN

SCALE 1"=20'

GRAPHIC SCALE 1"=20' 20' 0' 20' 40'

NOTES:

1. For General Notes and Legend see Plate No. 3
2. For Upstream Pressure Drain Profile see Plate No. 21
3. For Bypass and Interceptor Drain Profile see Plate No. 16

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY L.V.T. | DR. BY R.T. | CK. BY R.O.H.

SUBMITTED — ARCHITECT - ENGINEER — PROJECT ENGINEER

APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED — CHIEF, P & R BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
DRAINAGE PLAN

CHICOPEE RIVER MASSACHUSETTS

APPROVED DATE DEC., 1962

CHIEF, ENGINEERING DIVISION

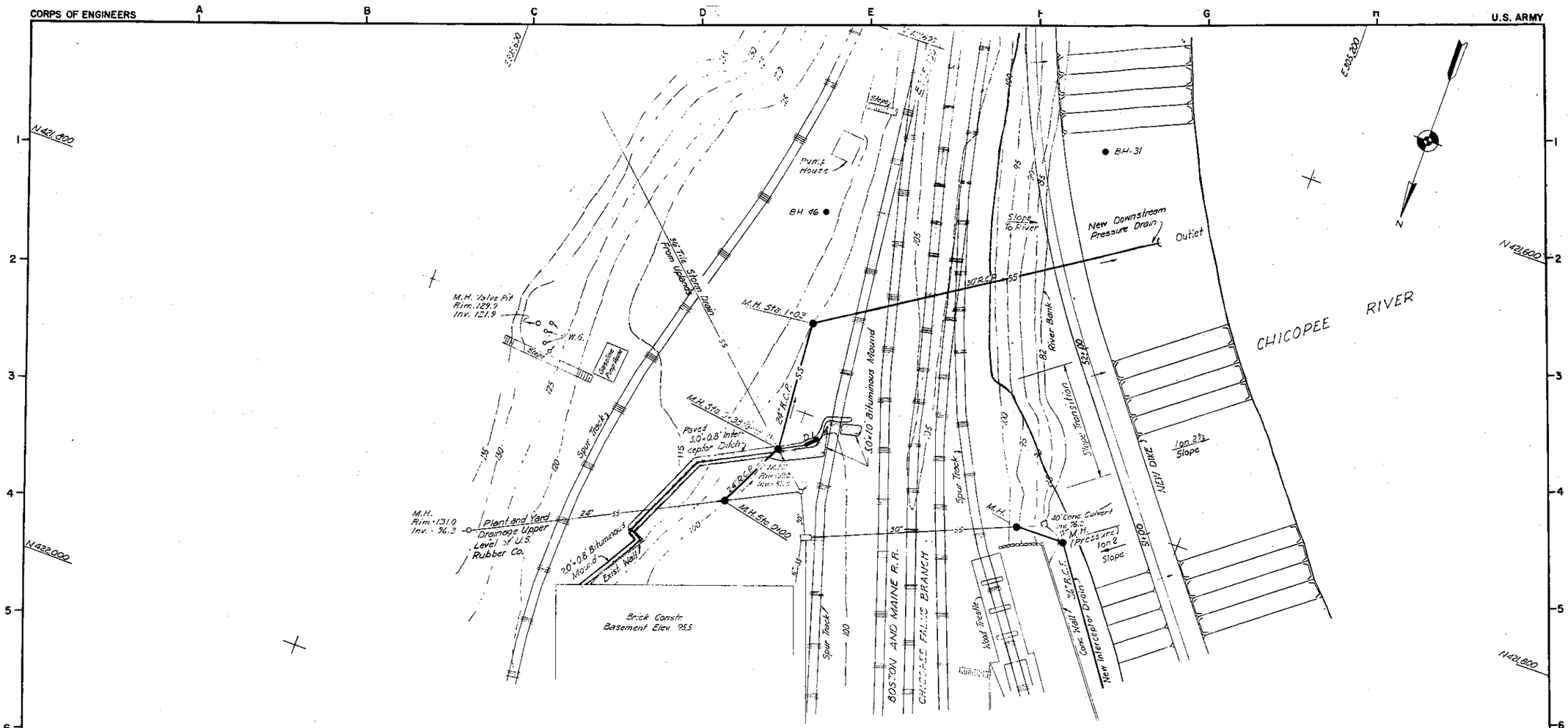
SCALE AS SHOWN SPEC. NO. CIV. ENG.-19-016-

DRAWING NUMBER

SHEET

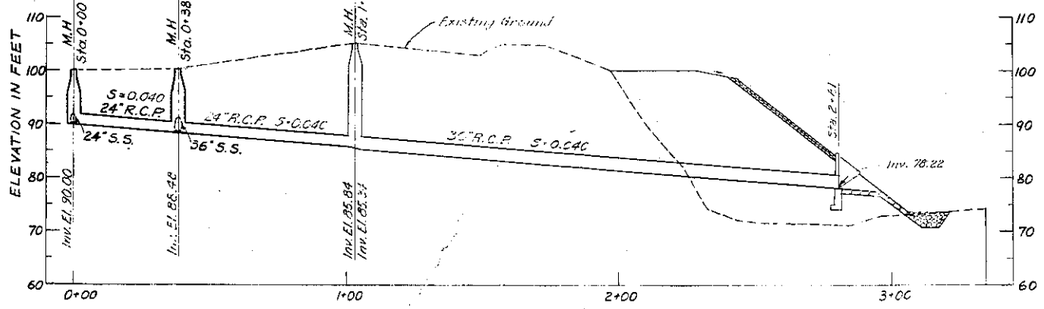
PLATE NO. 22

CORPS OF ENGINEERS — U.S. ARMY



PLAN

SCALE: 1" = 20'



PROFILE -

SCALES: HOR. 1"=20'
VERT. 1"=10'

GRAPHIC SCALES

1" = 20'

NOTES:

1. For General Notes and Legend see Plate No. 3

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
D.V.T.	H.M.	H.L.H.

SUBMITTED — ARCHITECT - ENGINEER

PROJECT ENGINEER

APPROVAL RECOMMENDED — SPEC. DESIGN BRANCH

APPROVAL RECOMMENDED — CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
DOWNSTREAM PRESSURE DRAIN
PLAN AND PROFILE STA. 0+00 TO OUTLET
CHICOPEE RIVER MASSACHUSETTS

APPROVED — CHIEF, ENGINEERING DIVISION

DATE DEC., 1962

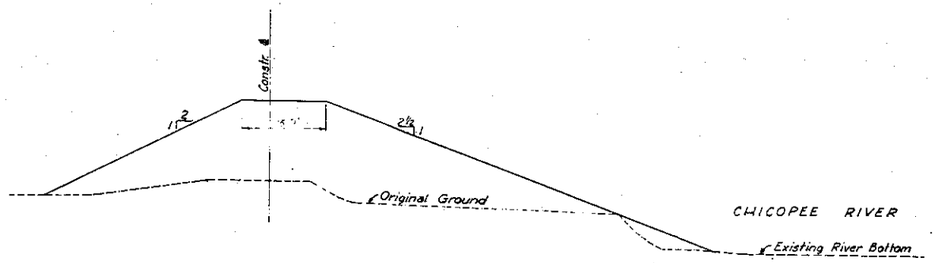
SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-DIG-

DRAWING NUMBER

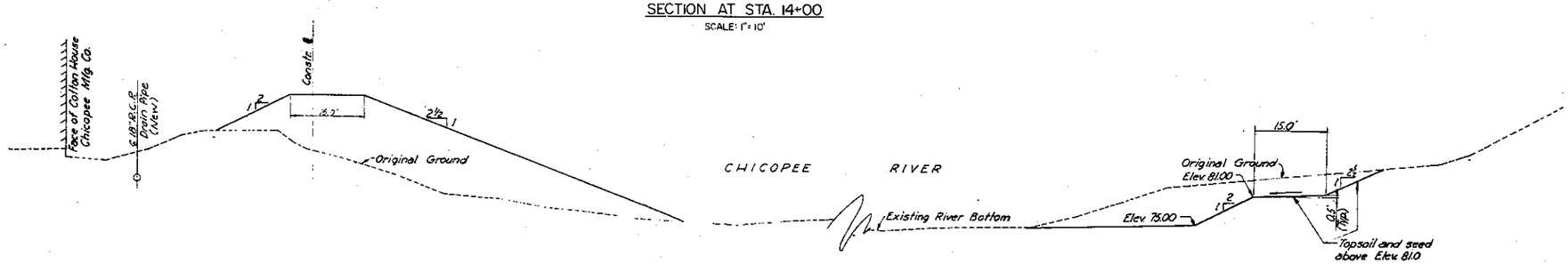
SHEET

PLATE NO. 23

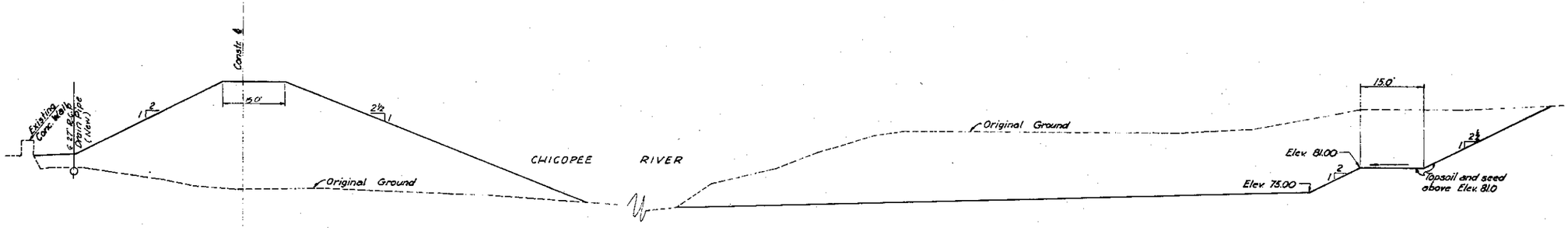
CORPS OF ENGINEERS — U.S. ARMY



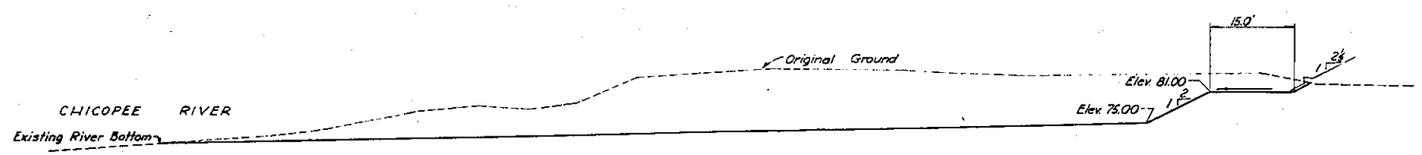
SECTION AT STA. 14+00
SCALE: 1" = 10'



SECTION AT STA. 34+50
SCALE: 1" = 10'



SECTION AT STA. 44+00
SCALE: 1" = 10'



SECTION AT DOWNSTREAM WIDENING
SCALE: 1" = 10'

GRAPHIC SCALE
1" = 10'
10' 0 10' 20'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY EJL | DR. BY H.M. | CK. BY HDH

SUBMITTED — ARCHITECT-ENGINEER — PROJECT ENGINEER — APPROVAL RECOMMENDED — CHIEF, ENGINEERING BRANCH — APPROVAL RECOMMENDED — CHIEF, P. & R. BRANCH

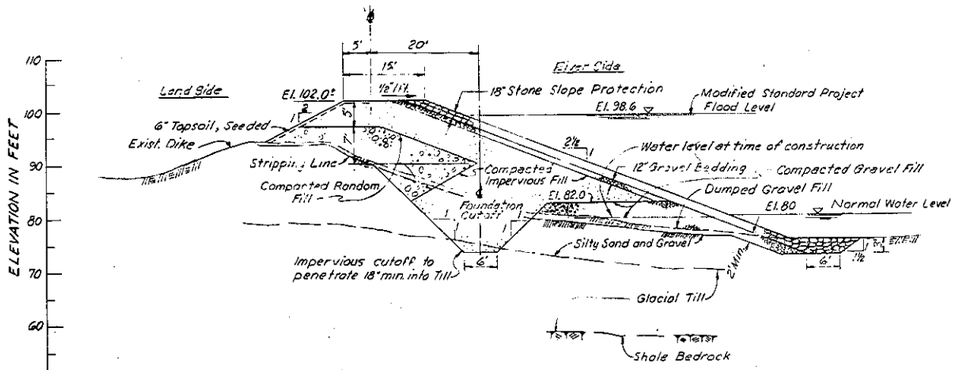
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
TYPICAL SECTIONS
CHANNEL
CHICOPEE RIVER MASSACHUSETTS

APPROVED — DATE DEC., 1962
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-10-006-
DRAWING NUMBER
SHEET

PLATE NO. 24

CORPS OF ENGINEERS — U.S. ARMY

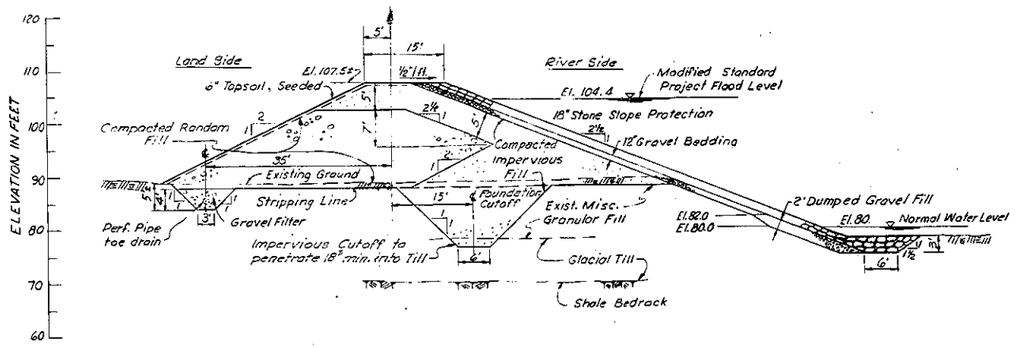


AT RIVER SECTION # 34

TYPICAL FOR EARTH DIKE FROM

STA 30+00 TO STA 37+50

SCALE: 1" = 10'



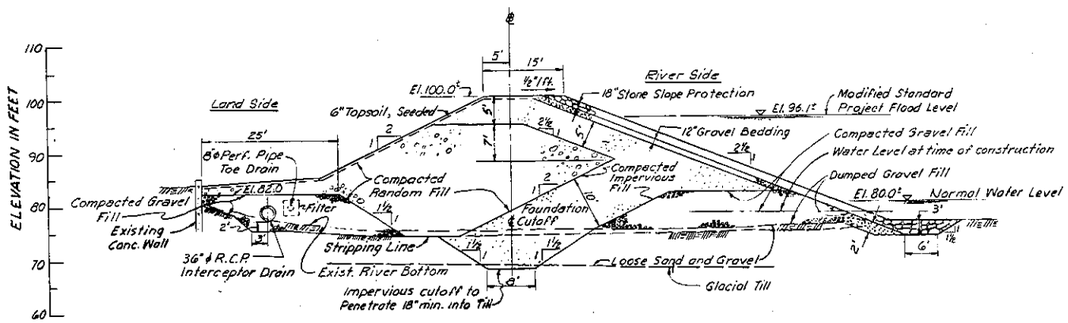
AT RIVER SECTION # 16

TYPICAL FOR EARTH DIKE FROM

STA 9+57 TO STA 16+94

STA 25+32 TO STA 30+00

SCALE: 1" = 10'



AT RIVER SECTION # 49

TYPICAL FOR EARTH DIKE FROM

STA. 37+50 TO STA. 54+15

SCALE: 1" = 10'

GRAPHIC SCALE

1" = 10'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
C.V.	A.P.	H.D.H.

SUBMITTED
ARCHITECT-ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P. & R. BRANCH

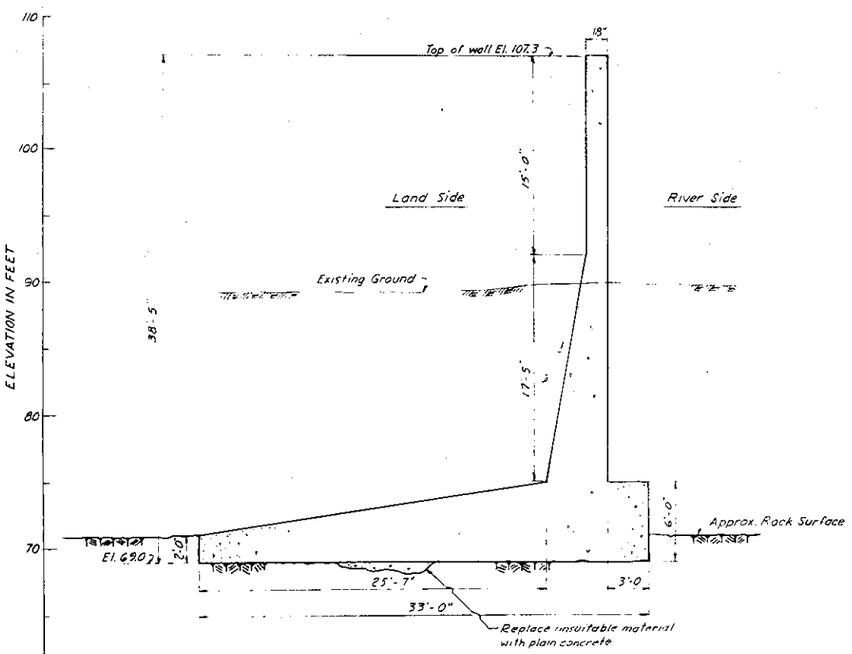
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
TYPICAL SECTIONS
DIKE
CHICOPEE RIVER — MASSACHUSETTS

APPROVED
DATE DEC., 1962
CHIEF, ENGINEERING DIVISION

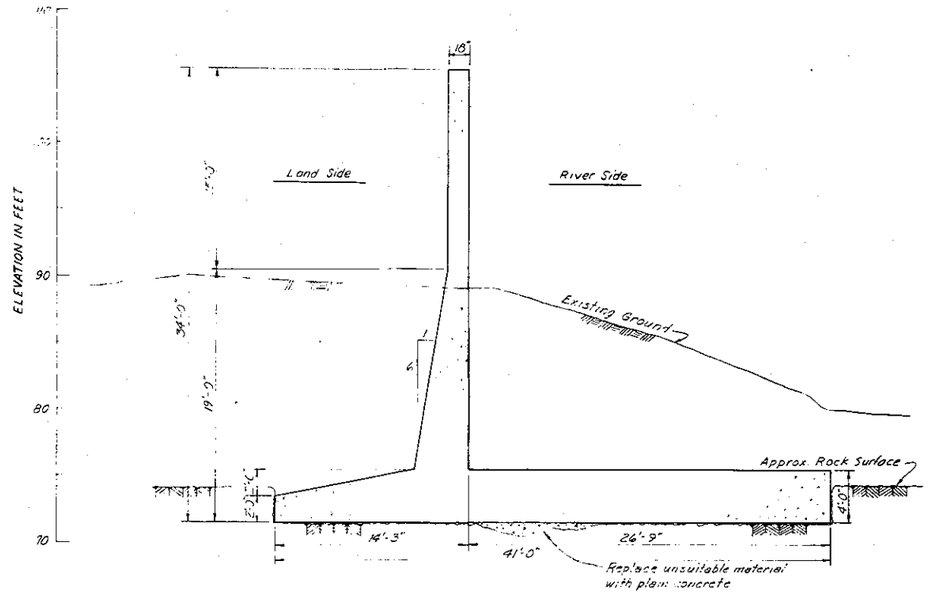
SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-060
DRAWING NUMBER
SHEET

PLATE NO. 25

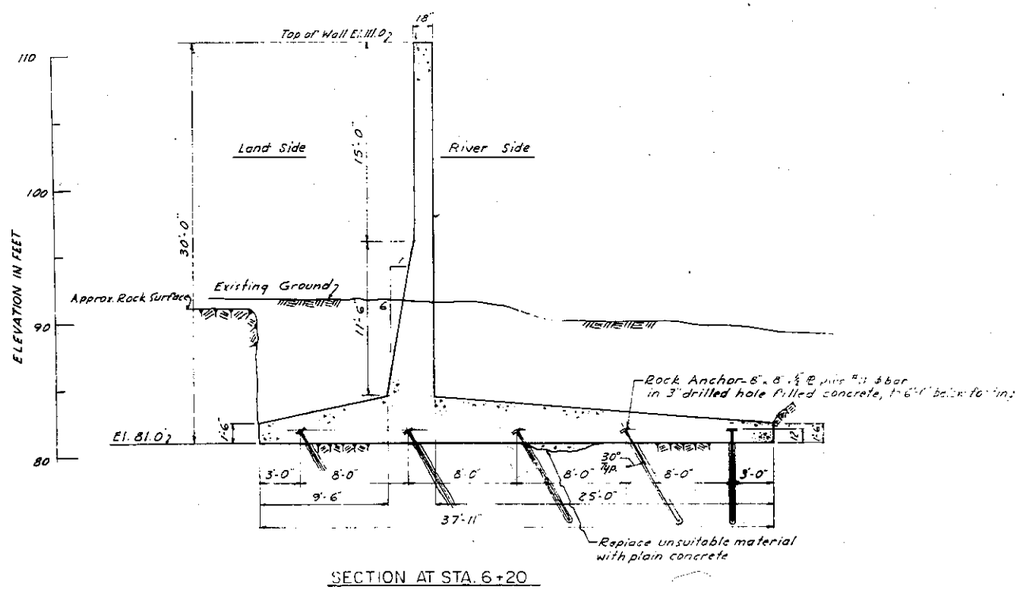
CORPS OF ENGINEERS — U.S. ARMY



SECTION AT STA. 17+30
TYPICAL STA 16+94.31 TO STA 18+60
SCALE 1/4"=1'-0"



SECTION AT STA. 18+60
TYPICAL - STA. 6+20 TO STA. 9+57.32
STA. 18+60 TO STA. 21+40
STA. 22+50 TO STA. 25+32.04
SCALE 1/4"=1'-0"



SECTION AT STA. 6+20
TYPICAL - STA 4+13 TO STA 6+20
STA 21+40 TO STA 22+50
SCALE 1/4"=1'-0"

NOTE

See General Plans and Profiles for footing elevation.

ORIGINAL SCALE
1"=4'-0" 4' 0' 4' 8'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY F.M.N. | DR. BY W.H. | CK. BY M.D.M.
SUBMITTED
ARCHITECT - ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P & R BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
TYPICAL SECTIONS
FLOOD WALL
CHICOPEE RIVER MASSACHUSETTS

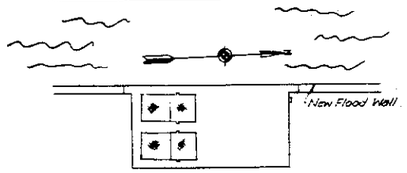
APPROVED
DATE DEC., 1962
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-090-
DRAWING NUMBER
SHEET

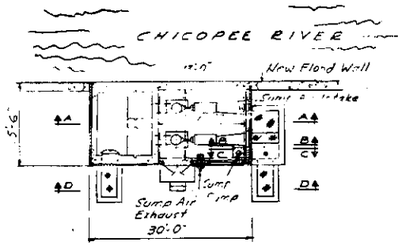
PLATE NO. 26

CORPS OF ENGINEERS

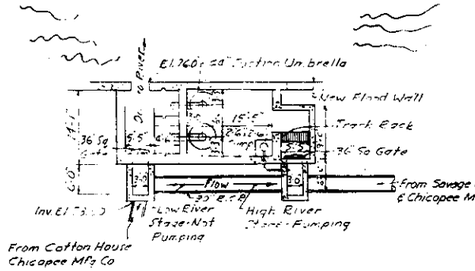
U.S. ARMY



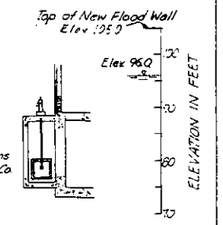
ROOF PLAN



FLOOR PLAN



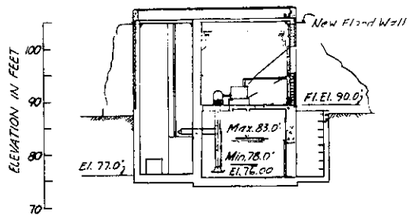
SUMP PLAN



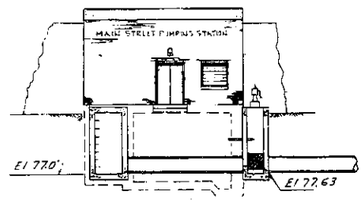
SECTION C-C

MAIN STREET PUMPING STATION

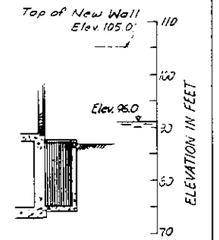
SCALE: 1/10" = 1'-0"



SECTION A-A



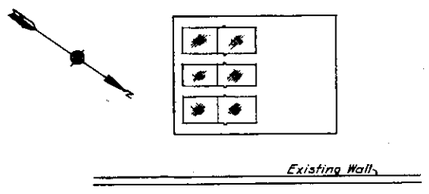
SECTION D-D



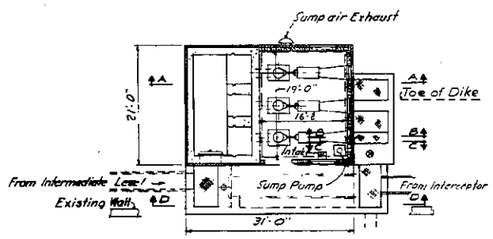
SECTION B-B

NOTES:

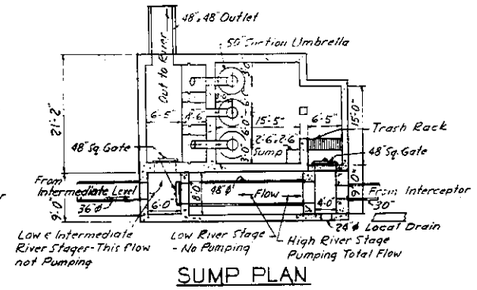
1. All sluice gates to have electrically operated floorstands with auxiliary handwheels.
2. Drives to be diesel.
3. All floodwater pumps are axial flow pumps.



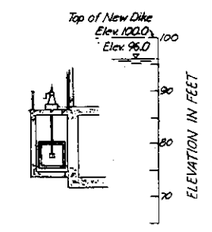
ROOF PLAN



FLOOR PLAN



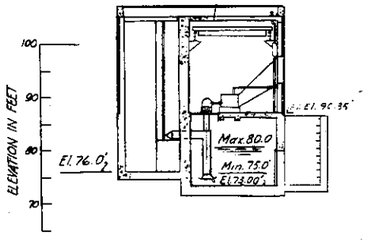
SUMP PLAN



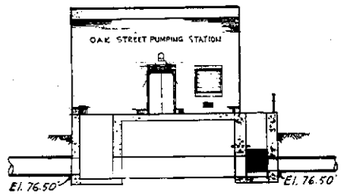
SECTION C-C

OAK STREET PUMPING STATION

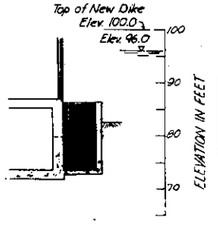
SCALE: 1/10" = 1'-0"



SECTION A-A



SECTION D-D



SECTION B-B

LEGEND

Elev. 96.0 Modified standard project flood Elev. 96.0.

GRAPHIC SCALE 1/10" = 1'-0"

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING APPLIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY A.A.V. | DR. BY E.D. | CK. BY H.O.H.

SUBMITTED ARCHITECT-ENGINEER

PROJECT ENGINEER

APPROVAL RECOMMENDED

CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED

CHIEF, P. & O. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
PUMPING STATIONS

CHICOPEE RIVER MASSACHUSETTS

APPROVED DATE DEC., 1962

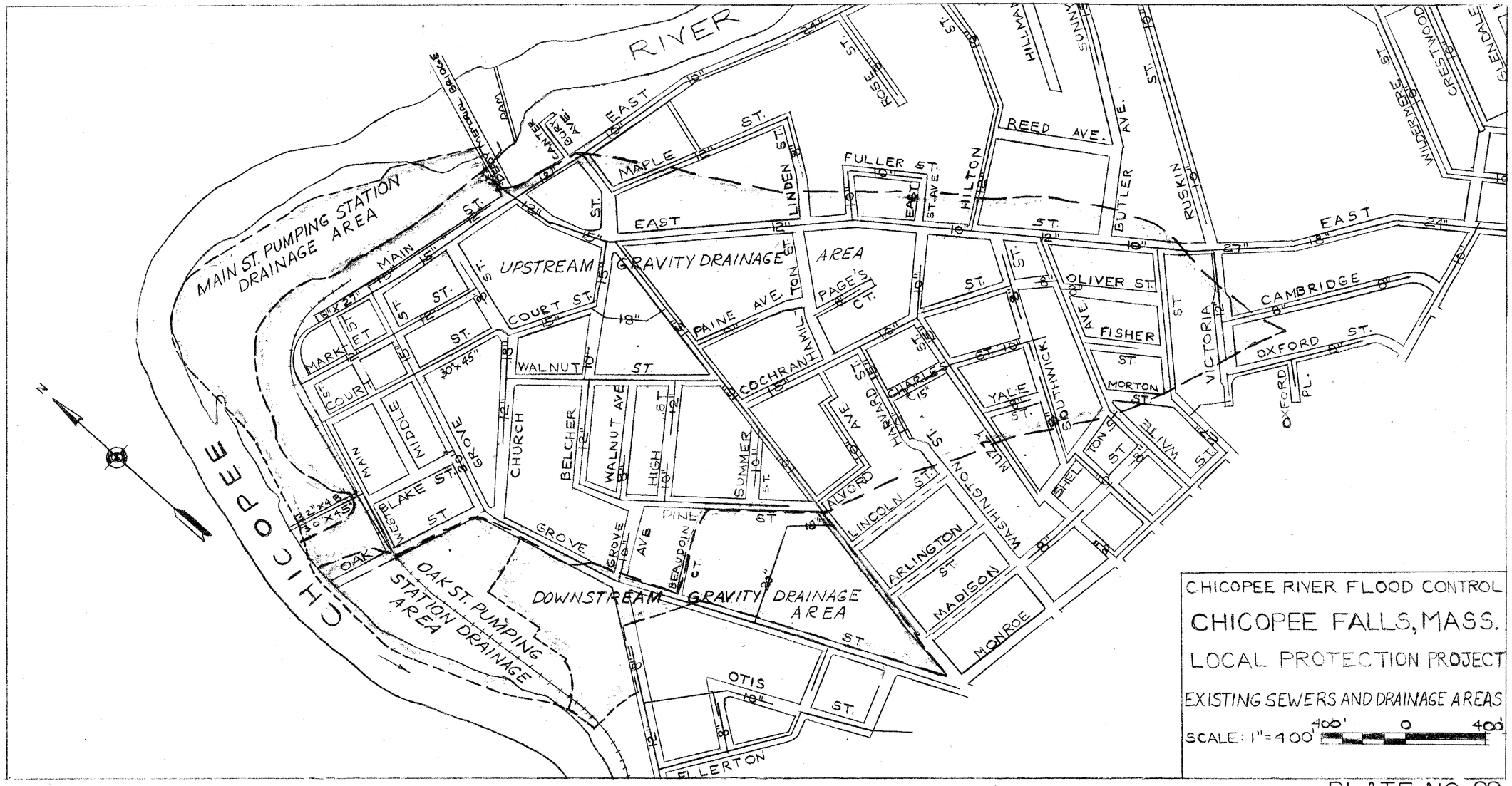
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN SPEC. NO. CW-ENG-19-020-

BIDDING NUMBER

SHEET

PLATE NO. 27



CHICOPEE RIVER FLOOD CONTROL

CHICOPEE FALLS, MASS.

LOCAL PROTECTION PROJECT

EXISTING SEWERS AND DRAINAGE AREAS

SCALE: 1"=400' 400' 0 400'

PLATE NO 28

CORPS OF ENGINEERS — U.S. ARMY

NOTE: City of Chicopee Dam Spillway elev. 108.5

DEADY MEMORIAL BRIDGE

Sta 5+00

Existing Rubble Dam Partially Destroyed

FORMER SAVAGE ARMS CORP

SAVAGE ARMS CORP
CHICOPEE MANUFACTURING CORP

Sta 10+00

Sta 15+00

Sta 20+00

Rip Rap River Bottom

CHICOPEE MANUFACTURING CORP

Sta 25+00

Sta 30+00

Sta 35+00

Sta 40+00

Sta 45+00

CHICOPEE RIVER

MATCH LINE "A"

MATCH LINE "B"

MATCH LINE "C"

MATCH LINE "D"

ASSUMED AT DWIGHT DAM

MIDDLE STREET

MAIN STREET

MARK ST.

COURT ST.

LAKE ST.

OAK ST.

WEST MAIN STREET

UNITED STATES RUBBER CO.

CHICOPEE MFG. CORP

Exist. Dam

New Dam Extension

E305500

E304500

N424000

N423000

PLAN
SCALE 1"= 100'

GRAPHIC SCALE
1"=100' 100' 0 100' 200'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES BY D.V.T. DR BY H.M. CH BY RGH

SUBMITTED
ARCHITECT - ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P. & R. BRANCH

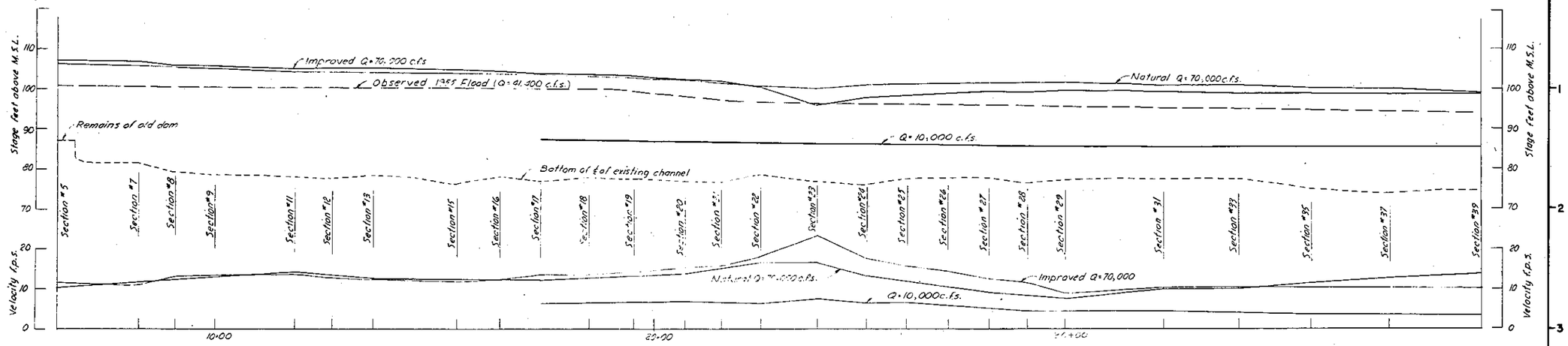
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
LOCATION OF CROSS SECTIONS
CHICOPEE RIVER MASSACHUSETTS

APPROVED
DATE DEC., 1962
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-065-
DRAWING NUMBER
SHEET

PLATE NO A-1

CORPS OF ENGINEERS — U.S. ARMY



PROFILE

SCALES HOR 1"=100'
VERT 1"=10'

GRAPHIC SCALES

1"=10' 10' 0 10' 20'

1"=100' 100' 0 100' 200'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES BY	DR. BY	CK. BY
A.A.V.	A.P.	H.D.H.

SUBMITTED
ARCHITECT-ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS

HYDRAULIC PROFILES

CHICOPEE RIVER — MASSACHUSETTS

APPROVED
CHIEF, ENGINEERING DIVISION

DATE DEC., 1962

SCALE AS SHOWN
SPEC. NO. CIV. ENG.-TD-ONE-
DRAWING NUMBER
SHEET

PLATE NO. A-2

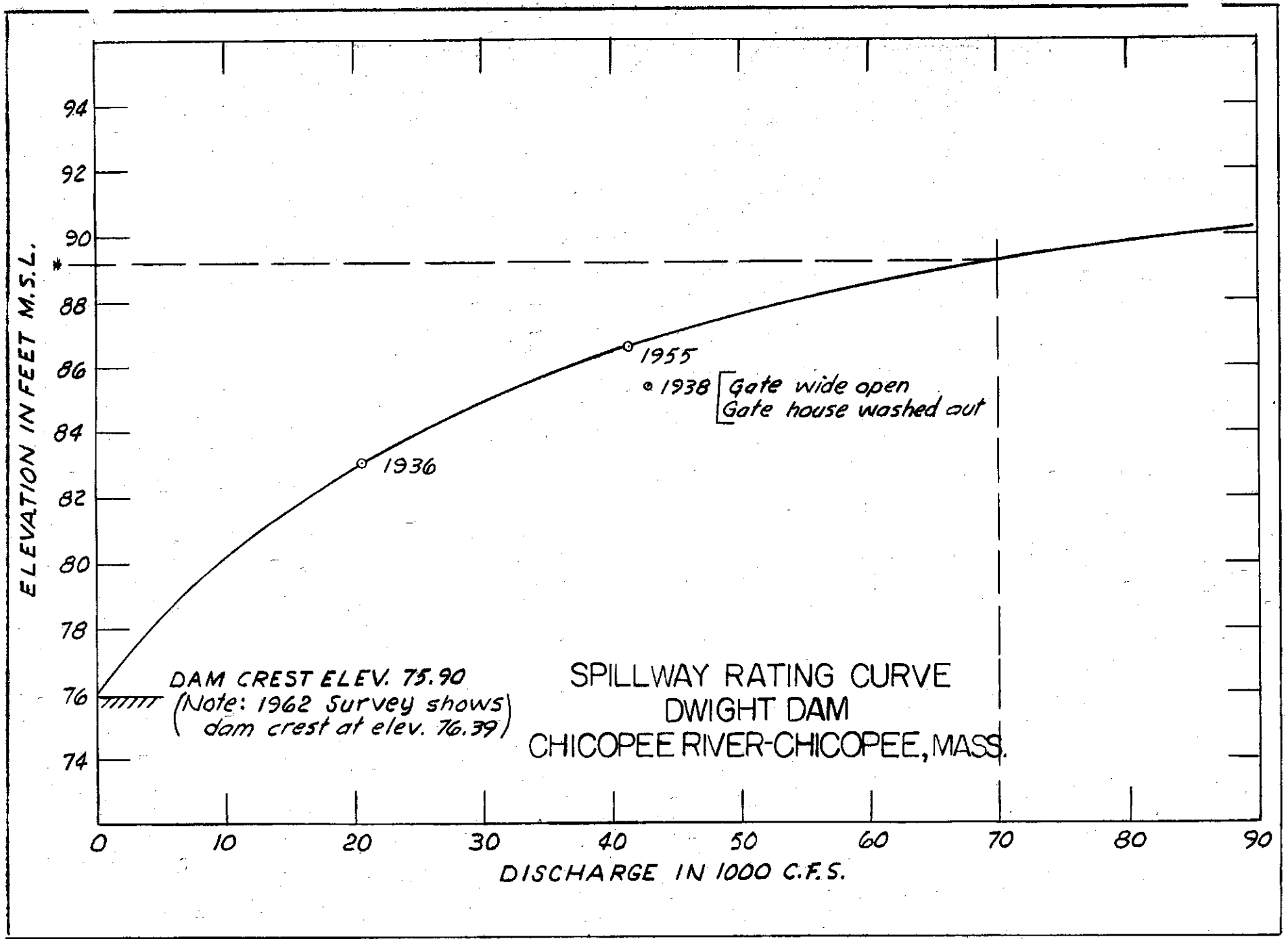
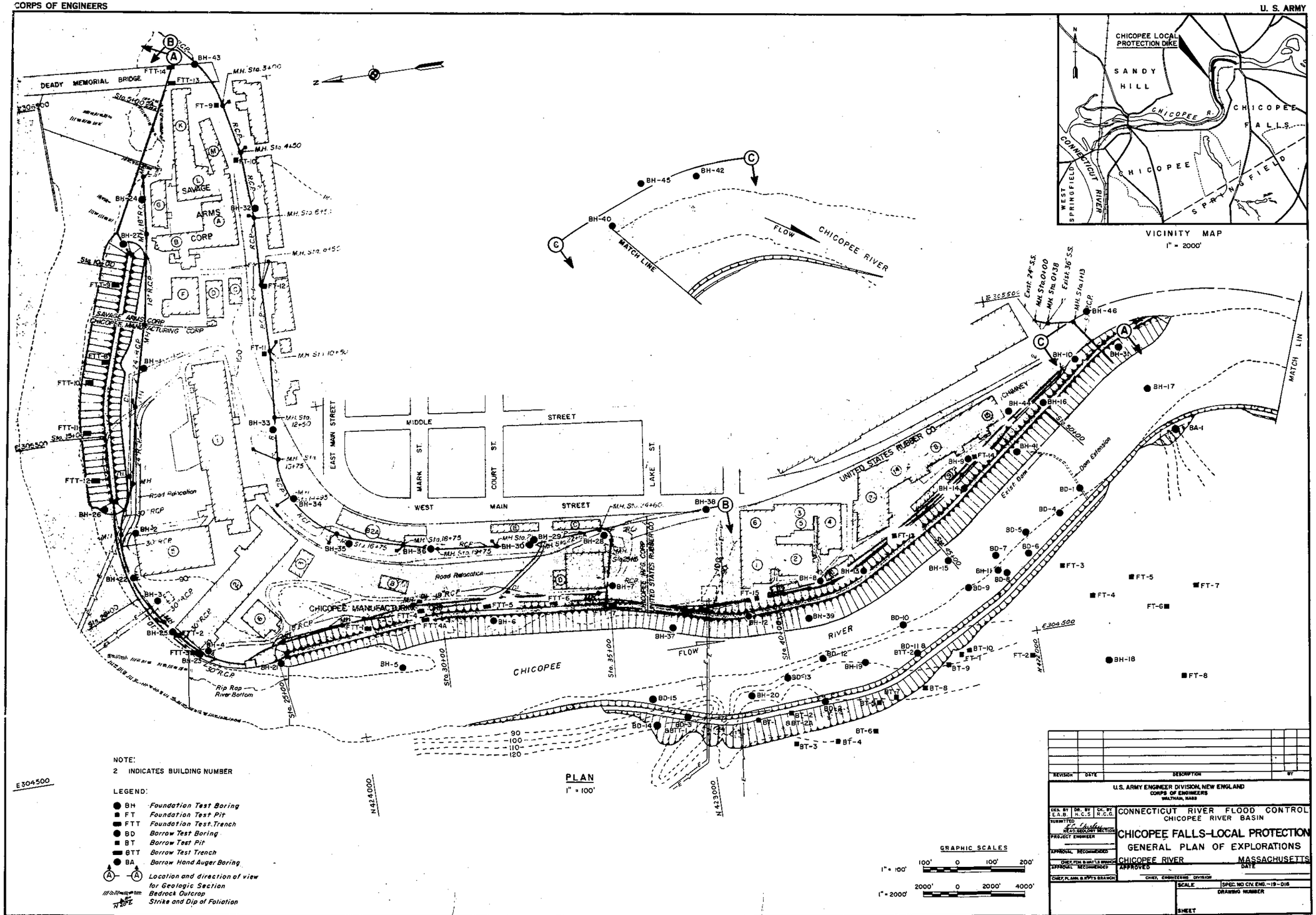

ELEVATION IN FEET M.S.L.
94
92
90
*
88
86
84
82
80
78
76
74
1955
1938
Gate wide open
Gate house washed out
1936
DAM CREST ELEV. 75.90
(Note: 1962 Survey shows
dam crest at elev. 76.39)
SPILLWAY RATING CURVE
DWIGHT DAM
CHICOPEE RIVER-CHICOPEE, MASS.
0
10
20
30
40
50
60
70
80
90
DISCHARGE IN 1000 C.F.S.

PLATE NO A-3

CORPS OF ENGINEERS

U. S. ARMY



VICINITY MAP
1" = 2000'

NOTE:
2 INDICATES BUILDING NUMBER

LEGEND:

- BH Foundation Test Boring
- FT Foundation Test Pit
- FTT Foundation Test Trench
- BD Borrow Test Boring
- BT Borrow Test Pit
- BTT Borrow Test Trench
- BA Borrow Hand Auger Boring
- (A)—(A) Location and direction of view for Geologic Section
- Bedrock Outcrop
- Strike and Dip of Foliation

PLAN
1" = 100'

GRAPHIC SCALES
1" = 100' 100' 0 100' 200'
1" = 2000' 2000' 0 2000' 4000'

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

DES. BY E.A.B.	DR. BY H.C.S	CK. BY R.C.G.

SUBMITTED
HEAD GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, FDN. & EARTH'S BRANCH
APPROVAL RECOMMENDED
CHIEF, PLANS & SPEC'S BRANCH

CONNECTICUT RIVER FLOOD CONTROL
CHICOPEE RIVER BASIN

CHICOPEE FALLS-LOCAL PROTECTION
GENERAL PLAN OF EXPLORATIONS
CHICOPEE RIVER MASSACHUSETTS

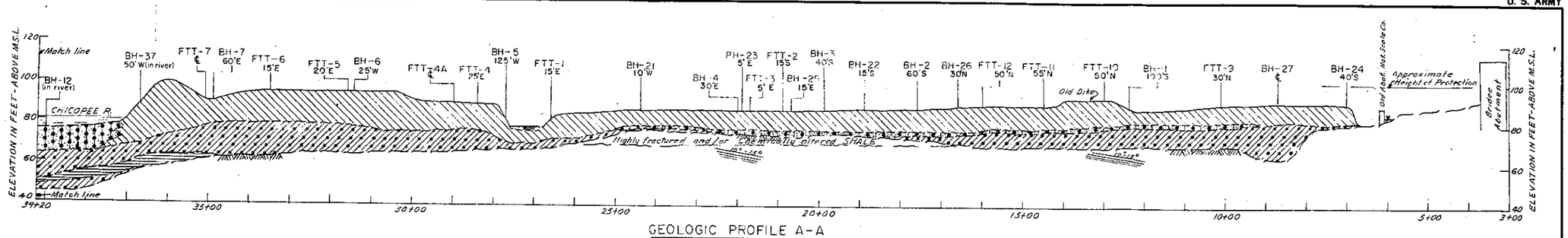
APPROVED
CHIEF, ENGINEERING DIVISION
DATE

SCALE
SPEC. NO CIV. ENG. -19-D16
DRAWING NUMBER
SHEET

PLATE NO. B-1

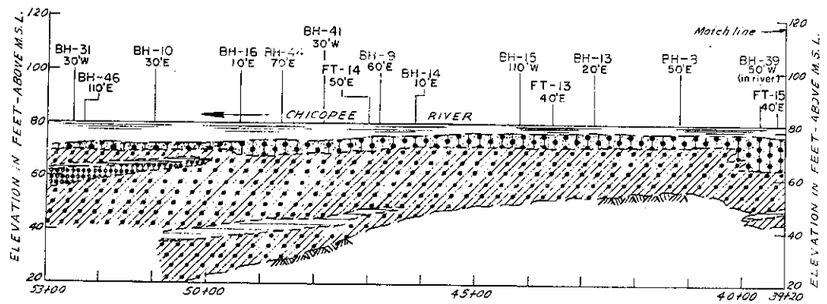
CORPS OF ENGINEERS

U. S. ARMY

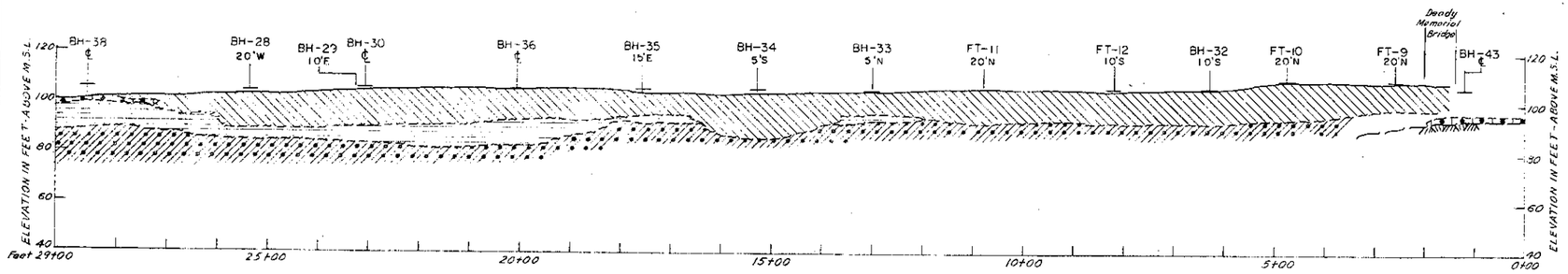


GEOLOGIC PROFILE A-A

℄ DIKE STRUCTURES (Looking Riverward)

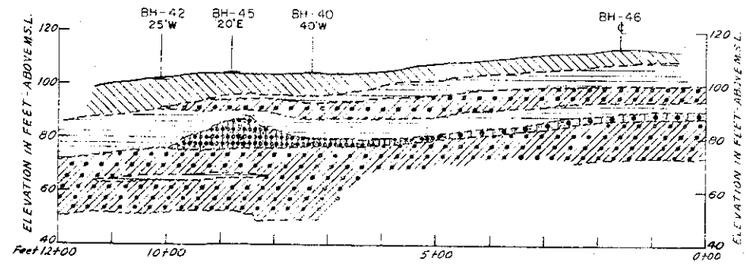


GEOLOGIC PROFILE A-A (continued)



GEOLOGIC PROFILE B-B

℄ DRAINAGE STRUCTURE (Looking Riverward)



GEOLOGIC PROFILE C-C

LEGEND

- Silty Sandy GRAVEL
- Silty SAND
- Sandy SILT and CLAY (stratified)
- Sandy CLAY and gravelly SAND: TILL)
- FILL
- Assumed Bedrock Surface Shale, red and gray, thinly bedded, calcareous. Dip of bedding 5° to 15° to Southeast.
- Approximate bedding dip

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

DES. BY E.A.B	DR. BY H.C.S.	DR. BY R.C.G.
SUBMITTED: Earl Bowden, HEAD, GEOLOGY SECTION		
PROJECT ENGINEER		
APPROVAL RECOMMENDED		
CHIEF, FOR'S SHEET'S BRANCH APPROVAL RECOMMENDED		
CHIEF, PLANS & SPEC'S BRANCH		

CONNECTICUT RIVER FLOOD CONTROL
CHICOPEE RIVER BASIN

CHICOPEE FALLS-LOCAL PROTECTION

GEOLOGIC PROFILES A-A, B-B & C-C

CHICOPEE RIVER MASSACHUSETTS

APPROVED: CHIEF, ENGINEERING DIVISION — DATE

SCALE | SPEC. NO CIV. ENG.-19-018

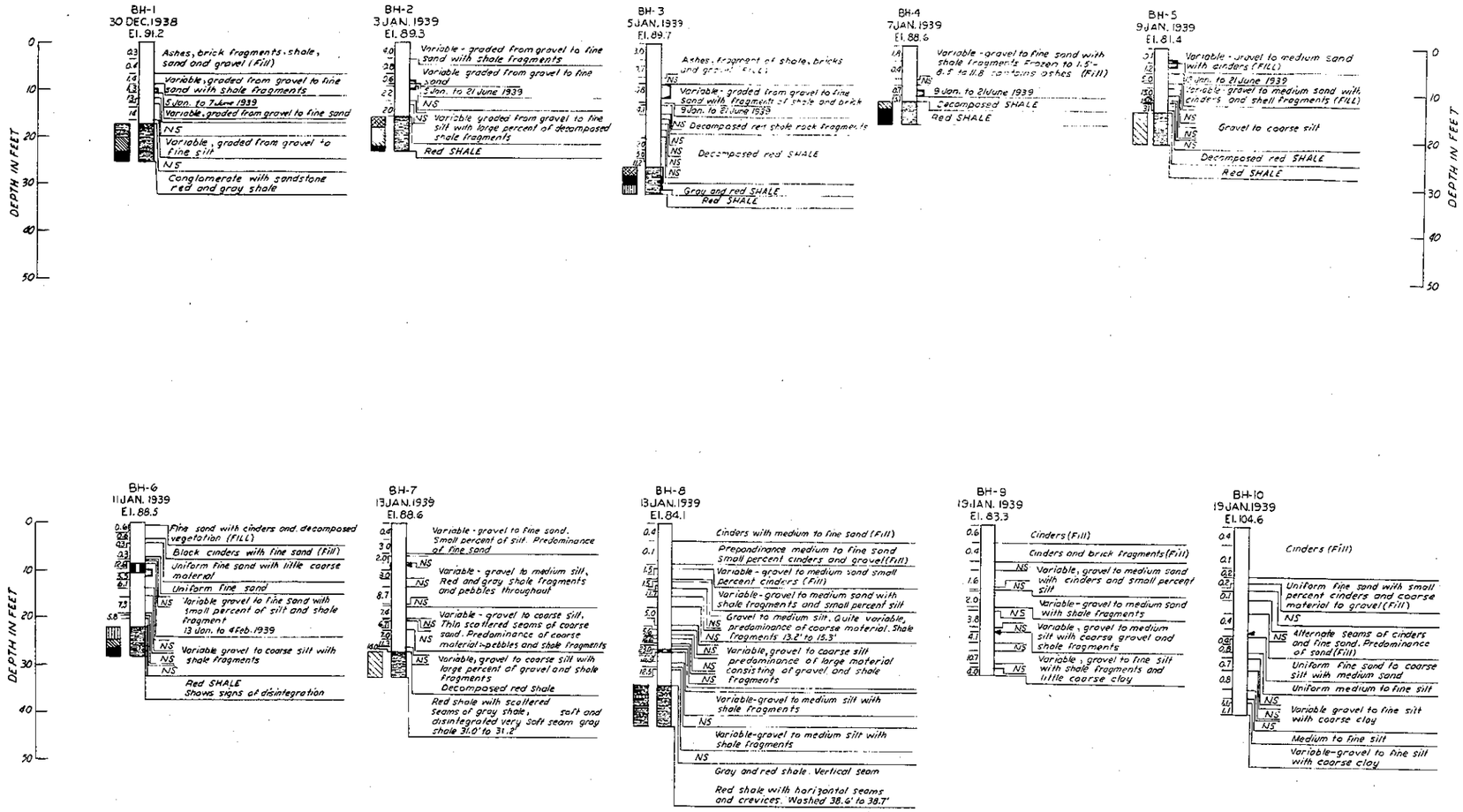
DRAWING NUMBER

SHEET

PLATE NO. B-2

CORPS OF ENGINEERS

U.S. ARMY



NOTES

For Graphic Logs appearing on this sheet Blow Count recorded as blows/inch using a 1½" or 1⅜" I.D. sample spoon. Weight of drop hammer and length of fall not given.

Soil and rock description based on field inspectors Log.

GRAPHIC SCALE

1" = 10'

10' 0 10' 20'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY E.V. | DR. BY T.C. | CH. BY M.M.

SUBMITTED

Architect-Engineer

PROJECT ENGINEER

APPROVAL RECOMMENDED

CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED

CHIEF, P. & P. BRANCH

CHICOPEE RIVER FLOOD CONTROL

CHICOPEE FALLS

RECORD OF FOUNDATION EXPLORATION

CHICOPEE RIVER MASSACHUSETTS

APPROVED DATE DEC., 1962

Chief, Engineering Division

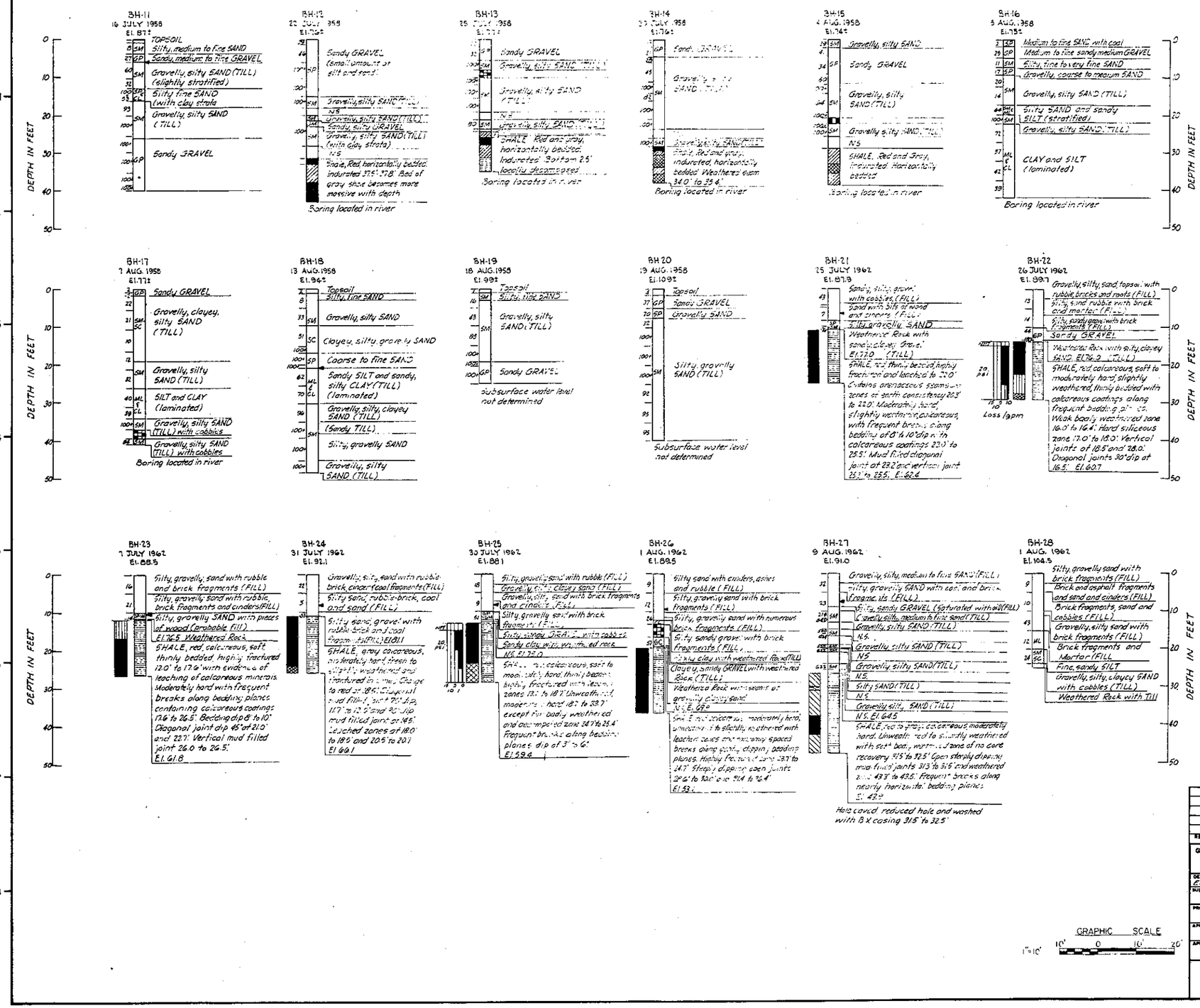
SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-060-

DRAWING NUMBER

SHEET

PLATE NO. B-3

CORPS OF ENGINEERS — U.S. ARMY



LEGEND FOR GRAPHIC LOGS

BH	Foundation Test Boring
FT	Foundation Test Pit
FTT	Foundation Test Trench
BD	Borrow Test Boring
BT	Borrow Test Pit
BTT	Borrow Test Trench
BA	Borrow Hand Auger Boring
25 JULY 1962	Date exploration completed
El. 87.9	Elevation of ground surface during time of exploration
◀	Subsurface water level in boring at time of exploration
SP	Group letter symbol according to Unified Soil Classification System
NR	No recovery or unsatisfactory soil samples recovered
NS	Not sampled. Hole advanced by Core-drilling, blasting and/or wash boring due to operational difficulty
76	Blows per foot of penetration considered most representative for each sample drive using a 300 or 350 pound hammer with a free fall of about 18" on a 1⅜" I.D. or 2" O.D.; 2"ID or 2¼"O.D.; 2½" I.D. or 3" O.D. size sample spoon equipped with a beveled and sharpened drive shoe
	Cobble or boulder (Core-drilled)
	Cobbes and boulders, continuous or nested (Core-drilled and/or blasted and chopped)
El. 80.0	Elevation of Bedrock Surface
	Rock symbol
NPT	Rock core recovery 0-25%
20 PSI	Rock core recovery 25-50%
	Rock core recovery 50-75%
30 PSI	Rock core recovery 75-90%
	Rock core recovery 90-100%
El. 65.0	Elevation of bottom of exploration

1 5 10 5 1 0
LOSS IN GPM

NPT No Pressure Test Performed

PSI Constantly maintained pressure for 1 to 5 minutes. Volume loss in gallons per minute under constant pressure, tested continuously in 5-foot sections. Scale extended from 0 gpm to 1 gpm for clarification of low pressure losses.

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY E.J. | DR. BY T.D. | CH. BY H.D.M.

SUBMITTED — ARCHITECT-ENGINEER

PROJECT ENGINEER

APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED — CHIEF, P. & E. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
RECORD OF FOUNDATION EXPLORATION
CHICOPEE RIVER — MASSACHUSETTS

APPROVED — DATE DEC., 1962

CHIEF, ENGINEERING DIVISION

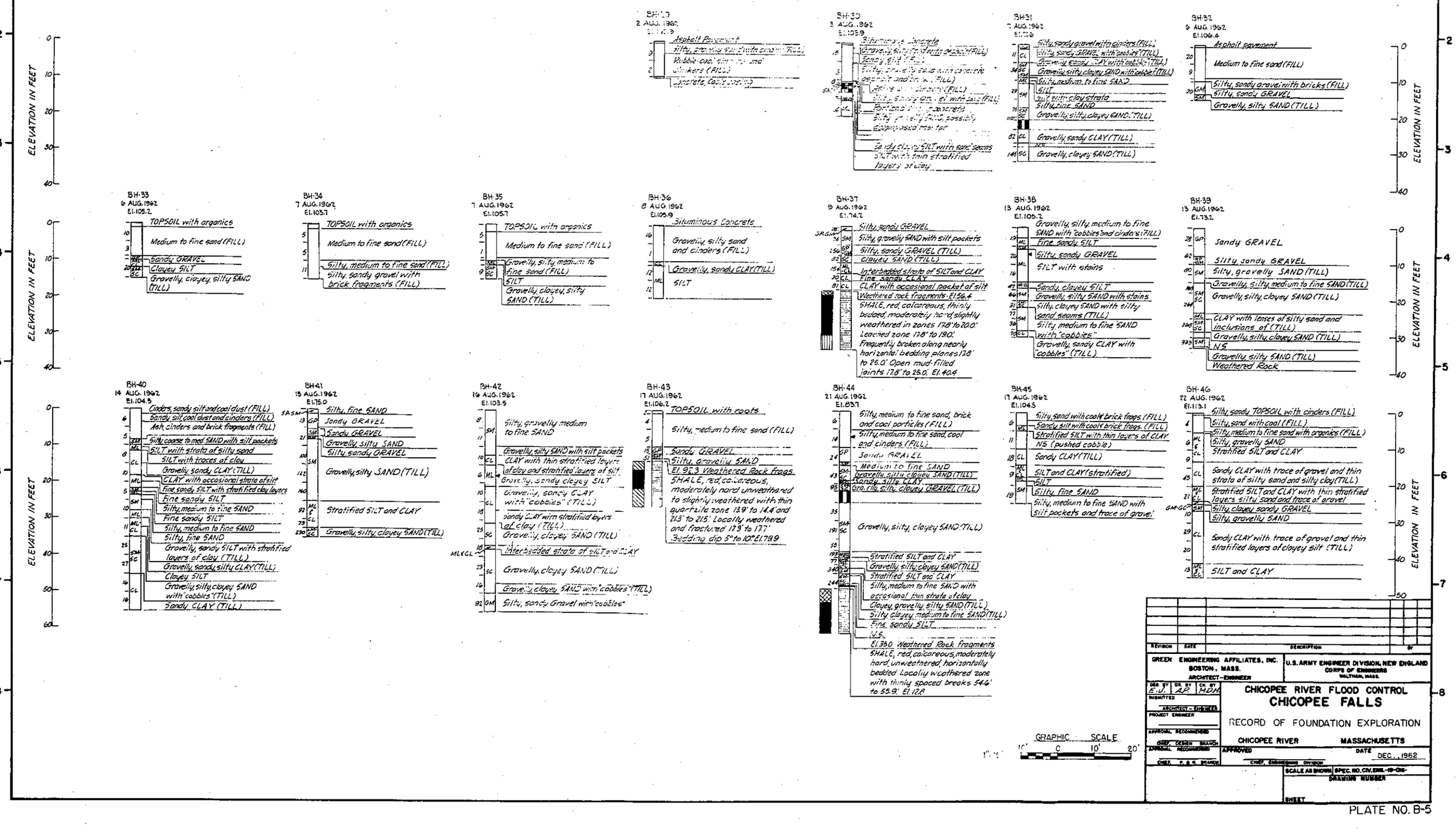
SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-CHE-

DRAWING NUMBER

SHEET

PLATE NO. B-4

CORPS OF ENGINEERS — U.S. ARMY



REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY E.V. | DR. BY A.Z. | CK. BY M.D.M.

SUBMITTED — ARCHITECT-ENGINEER — PROJECT ENGINEER

APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED — CHIEF, P. & C. BRANCH

APPROVED — CHIEF, ENGINEERING DIVISION — DATE DEC., 1962

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
RECORD OF FOUNDATION EXPLORATION
CHICOPEE RIVER MASSACHUSETTS

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-CHS- | DRAWING NUMBER

SHEET

PLATE NO. B-5

CORPS OF ENGINEERS — U.S. ARMY

BD-1
24 AUG. 1962
EL. 93.1

4	SM	TOPSOIL with roots
30	GM	Silty fine SAND with roots
14	ML	Silty sandy GRAVEL
22	SM-SC	Fine sandy SILT
		Gravelly, clayey, silty SAND
		Gravelly silty clayey SAND (TILL)

BD-2
4 SEPT. 1962
EL. 109.0

9	SM	TOPSOIL with roots
13	SM-SC	Silty fine SAND
30	GM-SC	Gravelly silty fine SAND
346	SM	Gravelly clayey silty SAND with cobbles (TILL)
198		Silty, sandy GRAVEL with cobbles (TILL)
436		Silty coarse to medium SAND with cobbles (TILL)
204	SM-SC	Gravelly silty SAND with cobbles (TILL)
207	SM	Silty SAND with cobbles, gravel and thin stratified layers of silty fine SAND (TILL)
110	CL	Gravelly, silty SAND (TILL)
		Silty SAND (TILL)
		Gravelly, silty, clayey SAND (TILL)
		Gravelly silty SAND (TILL)
		Gravelly, silty, clayey SAND with thin strata of CLAY
		Silty gravelly sandy CLAY (TILL) with thin strata of SILT and CLAY

BD-3
11 SEPT. 1962
EL. 114.5

8	ML	TOPSOIL with roots
49		Gravelly, sandy SILT with cobbles (TILL)
91	SM	Gravelly silty, medium to fine SAND with cobbles (TILL)
67		
162		
46		
258		
171		
143		
361		Silty, medium to fine SAND with cobbles and occasional clay strata
46	GC	Silty, medium to fine SAND
378	CL	Gravel, clayey GRAVEL with cobbles (TILL)
45	ML	CLAY with occasional pockets of SILT
49	SC	Stratified SILT and CLAY
		Clayey SAND with cobbles (TILL)

BD-4
24 SEPT. 1962
EL. 88.3

3	SM	TOPSOIL with roots
22		Silty fine SAND with roots
18	GM	Silty fine SAND
	SM	Silty, sandy GRAVEL with cobbles
		Silty, sandy GRAVEL
		Gravelly silty SAND (TILL)

BD-5
25 SEPT. 1962
EL. 93.9

15	SM	TOPSOIL with roots
56	SM	Silty fine SAND with roots
37		Silty, sandy GRAVEL with cobbles
		Gravelly silty SAND (TILL)

BD-6
25 SEPT. 1962
EL. 86.1

10	SM	TOPSOIL with roots
76	ML	Silty fine SAND with roots
81	SM	Gravelly silty fine SAND with roots
		Silty fine SAND
		Silty, gravelly SAND with cobbles
		Gravelly, silty SAND with numerous cobbles and sand seams (TILL)

BD-7
26 SEPT. 1962
EL. 82.8

23	SM	TOPSOIL with roots
6		Silty fine SAND with roots, cobbles, and traces of gravel
49	ML-SM	Silty gravelly fine SAND with cobbles
1		Fine sandy SILT interbedded
37	SM	with silty SAND (TILL)
		Gravelly, silty SAND with cobbles and thin layers of sand (TILL)

BD-8
26 SEPT. 1962
EL. 88.7

5		Silty, medium to fine SAND FILL
16		
37		Silty fine SAND with iron slag, wire, ashes and cinders FILL
152	SM	
		Silty SAND with a trace of gravel (TILL)

BD-9
26 SEPT. 1962
EL. 86.7

16		TOPSOIL
157		Gravelly silty fine SAND
62	SM	Silty fine SAND
158	GM	Silty gravelly SAND
22	ML-CL	Silty GRAVEL
		Gravelly, sandy, clayey SILT (TILL)

BD-10
1 OCT. 1962
EL. 86.9

5	SM	TOPSOIL
91		Silty, fine SAND with roots
102	GM	Silty, medium to fine SAND
	SM	Silty, sandy GRAVEL with cobbles (TILL)
		Silty, gravelly SAND (TILL)

BD-11
1 OCT. 1962
EL. 97.5

5	SM	TOPSOIL with roots
	ML	Silty, fine SAND with roots
	SM	Sandy SILT (TILL)
21		Silty SAND (TILL)
		Gravelly, silty SAND with cobbles (TILL)

BD-12
2 OCT. 1962
EL. 98.0

4		TOPSOIL
22	SM	Silty, fine SAND
56		
28		Gravelly, silty SAND (TILL)

BD-13
2 OCT. 1962
EL. 106.8

25	SM	TOPSOIL
47		Gravelly, silty fine SAND with roots
39	SM	Silty, sandy GRAVEL
		Silty, medium to fine SAND
		Silty, medium to fine SAND (TILL-like) with layers of laminated SILT
		Gravelly, silty SAND (TILL) with layers of laminated silt

BD-14
4 OCT. 1962
EL. 89.9

2		TOPSOIL
30		Silty, medium to fine SAND
44		Silty, sandy GRAVEL
		Gravelly, silty, medium to fine SAND (TILL)

BD-15
4 OCT. 1962
EL. 84.0

5	ML	TOPSOIL
9	SM	Fine sandy SILT
43	SM	Silty fine SAND
95		Silty, sandy GRAVEL
		Gravelly silty SAND (TILL)
		Silty medium to fine SAND (TILL)

BT-1
13 SEPT. 1962
EL. 114.0

2	SM	Loose, sandy, silty TOPSOIL with roots
9	SP	Loose, gravelly, silty SAND with roots and cobbles
6	SM-GC	Loose coarse to fine SAND with cobbles
		Medium compact, gravelly, silty SAND with cobbles
		Extremely gravelly, clayey, silty SAND (till)

PIT DIMENSIONS 4'-2.5'-5.2'
Pit extended from 5.2 to 7.2 with post hole digger

Cobbles and Boulders
4"-6" 9
6"-18" 1

BT-2
BT-2A
13 SEPT. 1962
EL. 112.8

2	SM	Loose, sandy, silty TOPSOIL with roots
6	SM-GC	Loose, silty, fine SAND with cobbles
		Medium compact, gravelly, silty SAND with cobbles
		Medium compact, gravelly, silty, clayey SAND, TILL

BT-2 PIT DIMENSIONS 4.2'-2.5'-2.6'
Pit extended from 2.4' to 4.0' with post hole digger

BT-2A PIT DIMENSIONS 4.4'-6.5'-3.0'
Pit extended from 3.0 to 4.0' with post hole digger

Cobbles and Boulders
BT-2 4"-6" 4 — BT-2A 4"-6" 7
6"-18" 2 — 6"-18" 3

BT-3
13 SEPT. 1962
EL. 120.2

2	SM	Loose, sandy, silty TOPSOIL with roots
6	ML	Compact, fine, sandy SILT with roots
4	SM	Loose, silty SAND
6		Compact SILT
6		Medium compact, silty, medium to fine SAND with cobbles (TSM)
6		Medium compact, silty, clayey SAND with cobbles (TILL) (SM-SC)

PIT DIMENSIONS 4.5'-2.5'-4.0'
Pit extended from 4.0' to 5.6' with post hole digger

Cobbles and Boulders
4"-6" 5
6"-18" 1

BT-4
14 SEPT. 1962
EL. 119.3

2	SM	Loose, sandy, silty TOPSOIL with roots
6	SM-SC	Medium compact, silty, fine SAND with roots
		Medium compact, gravelly, silty, fine SAND with cobbles
		Medium compact, gravelly, silty clayey SAND (TILL)

PIT DIMENSIONS 4.5'-2.5'-4.0'
Pit extended from 4.0' to 5.5' with post hole digger

Cobbles and Boulders
4"-6" 7
6"-18" 1

BT-5
14 SEPT. 1962
EL. 108.5

2	SM	Loose, sandy, silty TOPSOIL with roots
8		Medium compact, silty, fine SAND
10		Medium compact, silty, gravelly fine SAND with cobbles
		Medium compact, gravelly, clayey, silty SAND (TILL)

PIT DIMENSIONS 4.5'-2.5'-3.5'
Pit extended from 3.5' to 4.5' with post hole digger

Cobbles and Boulders
4"-6" 3
6"-18" 1

BT-6
17 SEPT. 1962
EL. 124.8

2	SM	Loose, silty, sandy TOPSOIL with roots
8		Loose, silty, fine SAND with roots
		Loose, silty, fine SAND

PIT DIMENSIONS 4.5'-2.5'-4.0'
Pit extended from 4.0' to 8.0' with post hole digger and from 8.0' to 12.0' with 6" auger

BT-7
17 SEPT. 1962
EL. 108.1

2	SM	Loose, silty, sandy TOPSOIL with roots
6		Medium compact, silty, fine SAND with roots
4		Medium compact, gravelly silty fine SAND "with cobbles"
6		Medium compact, silty, medium to fine SAND "with cobbles" (TILL) (slightly plastic)

PIT DIMENSIONS 4.5'-2.5'-2.8'
Pit advanced from 2.8' to 5.5' with post hole digger

Cobbles and Boulders
4"-6" 8
6"-18" 3

BT-8
17 SEPT. 1962
EL. 106.8

2	SM	Loose, silty, sandy TOPSOIL with roots
6		Medium compact, fine SAND with roots
4		Medium compact, medium to fine SAND "with cobbles"
6		Medium compact, silty, medium to fine SAND "with cobbles" slightly plastic (TILL)

PIT DIMENSIONS 4.8'-3.0'-2.5'
Pit extended from 2.5' to 5.7' with post hole digger

BT-9
19 SEPT. 1962
EL. 99.2

2	SM	Loose gravelly medium to fine SAND with glass and rubble FILL
6		Loose, silty, sandy TOPSOIL with roots
4	SC	Medium compact, silty fine SAND with cobbles and organics
6		Medium compact, silty, fine SAND with cobbles (TILL) and occasional lenses of medium sand
		Medium compact, gravelly, clayey SAND "with cobbles" (TILL)

PIT DIMENSIONS 5.5'-3.0'-4.5'
Pit extended from 4.5' to 8.4' with post hole digger

Cobbles and Boulders
4"-6" 11

BT-10
20 SEPT. 1962
EL. 98.7

2	SM	Loose silty, sandy TOPSOIL with roots
6		Medium compact, silty, fine SAND with roots
4		Medium compact, silty, gravelly SAND "with cobbles"
6		Compact, gravelly silty SAND (TILL) (slightly plastic)

PIT DIMENSIONS 6.5'-3.0'-6.2'

Cobbles and Boulders
4"-6" 14
6"-18" 7

BA-1
10 OCT. 1962
EL. 100.4

2		TOPSOIL
6	SM	Loose, gravelly SAND, with pieces of wood FILL
4		Loose silty, medium to fine SAND with pieces of wood FILL
6		Medium compact, silty, gravelly SAND with pieces of wood and large spikes FILL
4		Medium compact, gravelly, silty SAND with large spikes FILL
6		Compact, gravelly, silty, medium to fine SAND

BTT-1
4 OCT. 1962
EL. 114.5

Not sampled and classified same as BD-3

TRENCH DIMENSIONS 9.9'-8.8'-3.0'

BTT-2
8 OCT. 1962
EL. 97.5

Not sampled and classified same as BD-11

TRENCH DIMENSIONS 13.4'-10.1'-3.9'

GRAPHIC SCALE
1"=10'
0 5 10' 20'

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES BY E.D. | DR. BY A.P. | CK. BY HDH
SUBMITTED — ARCHITECT-ENGINEER
PROJECT ENGINEER
APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED — CHIEF, P. & R. BRANCH

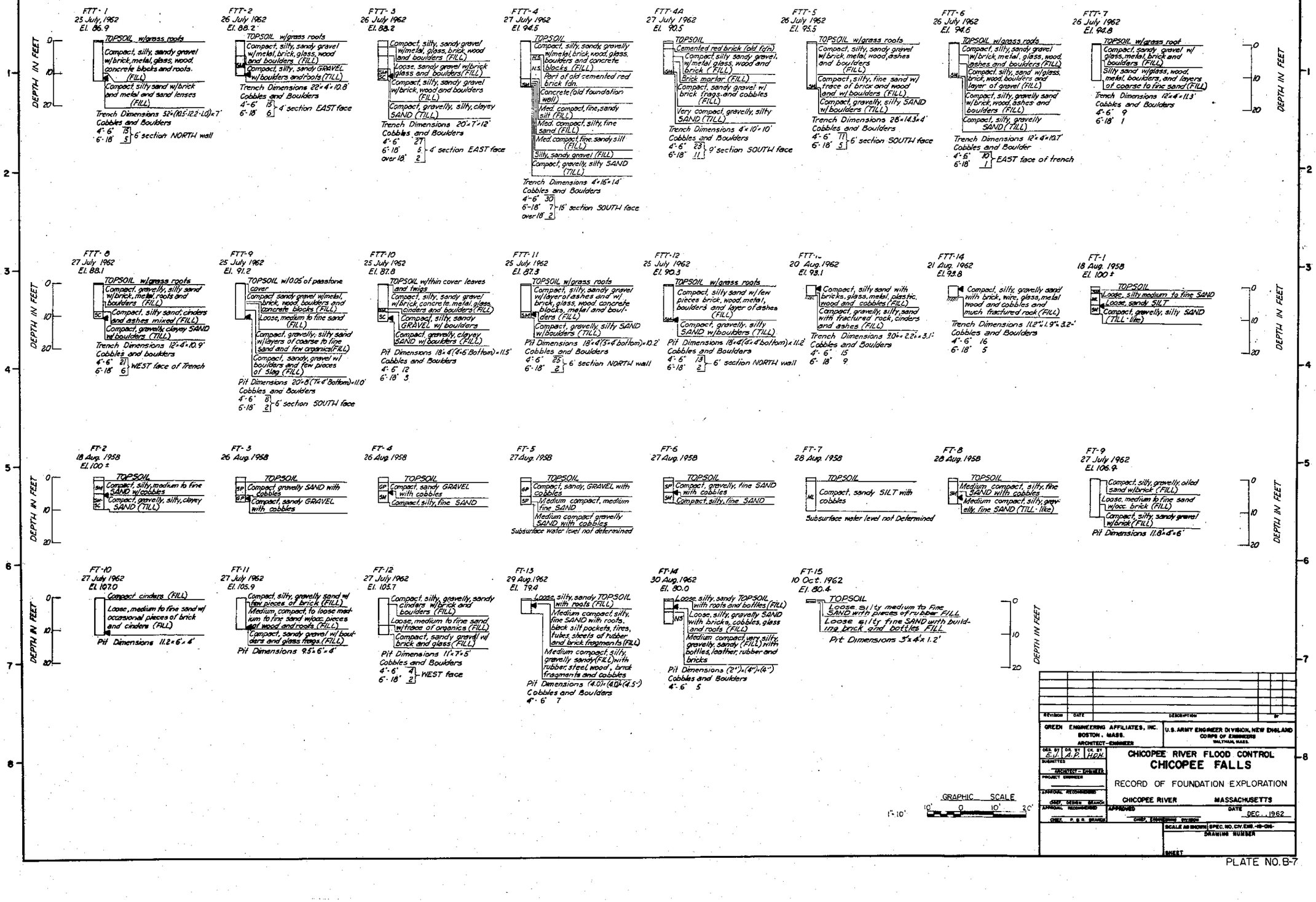
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
RECORD OF FOUNDATION EXPLORATION
CHICOPEE RIVER — MASSACHUSETTS

APPROVED — DATE DEC., 1962
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN SPEC. NO. CIV. ENG.-19-ONE-
DRAWING NUMBER
SHEET

PLATE NO. B-6

CORPS OF ENGINEERS — U.S. ARMY



REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY E.J. | DR. BY A.P. | CK. BY H.G.N.

SUBMITTED — ARCHITECT-ENGINEER — PROJECT ENGINEER — APPROVAL RECOMMENDED — CHIEF, DESIGN BRANCH — APPROVAL RECOMMENDED — CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
RECORD OF FOUNDATION EXPLORATION

CHICOPEE RIVER MASSACHUSETTS

APPROVED — CHIEF, ENGINEERING DIVISION — DATE DEC., 1962

SCALE AS SHOWN | SPEC. NO. CIV. ENG.-18-ONE-

DRAWING NUMBER

SHEET

PLATE NO. B-7