

MAD RIVER AT BLUE LAKE LOCAL FLOOD PROTECTION PROJECT

OPERATION AND MAINTENANCE MANUAL

JULY 1964



U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

MAD RIVER LOCAL FLOOD PROTECTION PROJECT
OPERATION AND MAINTENANCE MANUAL

FOREWORD

This manual has been prepared by the District Engineer, U.S. Army Engineer District, San Francisco, Corps of Engineers, to acquaint responsible local interests with the requirements of maintaining the levee system, including riprap protection, drainage culverts and miscellaneous structures completed by the Corps of Engineers in November 1963. Timely effective maintenance is required to assure the continuation of beneficial results from the work. This manual supersedes the previous manual dated June 1956.

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EXHIBITS

- Exhibit A - Code of Federal Regulations, Title 33, Section 208.10
Exhibit B - Resolution of Humboldt County Board of Supervisors -
17 April 1962.
Exhibit C - Inspection Check List
Exhibit D - Suggested methods of emergency protection - 5 plates

APPENDIX

Drawings File 102-39-19 Sheets 1, 2, 3, 4, 5, 6, 7, 10, 11 and 12

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INTRODUCTION

1. AUTHORIZATION

The original Mad River Project was authorized by the Chief of Engineers on 9 March 1954 under Section 212 of the Flood Control Act of 1950. Modification of the existing Federal levee project on the North Fork of the Mad River near Blue Lake pursuant to Section 205 of the 1948 Flood Control Act, as amended, was authorized by the Chief of Engineers on 19 February 1963 for construction with funds made available under the Public Works Acceleration Act of 1962.

2. PROJECT DESCRIPTION

The project is located near Blue Lake, Humboldt County, California. The original project, completed on 12 October 1955, consisted of two isolated reaches of levee, tying into a then existing levee constructed by local interests, with riprap on the lower reach only. After the flood of 1955 additional riprap was installed under the provisions of Public Law 99 to protect the portion of the levee system previously constructed by local interests. The project accomplished pursuant to the Public Works Acceleration Act of 1962 was limited to modifying the existing levee project as indicated on Sheet 1 of the appended plans. This consisted of raising the two existing levees from three feet on the downstream reach to four feet higher on the upper reach, and constructing approximately 2,400 feet of new levee of comparable height to form one continuous levee. Riprap was placed on the streamside slope of both new and reworked levees from Station 64+00 to 73+00. A concrete wingwall closure structure was constructed at the railroad crossing at the upper end of the project for the installation of stoplogs during periods of high water. A storage facility for the stoplogs was provided. Access ramps and drainage culverts were installed as indicated on Sheet 1 of the appended plans. All work was accomplished by contract.

ACCOMPLISHMENT OF WORK

3. COMPLETION

The modified project was completed in November 1963 and was formally transferred to the County of Humboldt for maintenance and operation 3 December 1963.

LOCAL COOPERATION

4. REQUIRED COOPERATION

As contained in Detailed Project Report, local interests will be required to:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the project, including all necessary alterations and relocations of highways, utilities and other structures.

b. Hold and save the United States free from damages due to the construction works.

c. Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army.

d. Prevent any encroachment on the constructed works which might interfere with the proper functioning of the improvements for flood control.

e. Contribute in cash, prior to initiation of construction, an amount necessary to prevent Federal expenditures for the project exceeding the \$400,000 statutory limitation under Public Law 685, 84th Congress, 2d Session; or, in lieu thereof, perform designated project construction equivalent to the amount necessary to prevent Federal expenditures exceeding the statutory limitation.

The Board of Supervisors of Humboldt County passed a resolution stating they would provide the required cooperation. This resolution is attached as Exhibit B.

MAINTENANCE AND OPERATION

5. PURPOSE

The purpose of this manual is to assist the responsible local authorities in carrying out their obligations through provision of information and advice as to the operation and maintenance requirements of the project. The appended construction plans are included as an aid in proper maintenance and should be adhered to.

6. REGULATIONS

Section 208.10, Title 33 of the Code of Federal Regulations contains rules for the maintenance and operation of local flood protection works approved by the Secretary of the Army in accordance with authority contained in Section 3 of the Flood Control Act of 22 June 1936, as amended and supplemented. A copy of the complete regulations will be found in Exhibit A.

Compliance with these regulations is one of the requirements of local co-operation. Applicable portions of the regulations are as follows:

"General

(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of the Army, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent", who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation of construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army, or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

FORM 51-100

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The Department of the Army will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations."

7. DUTIES OF SUPERINTENDENT

In line with the provisions covered by the regulations, the general duties of the Superintendent should include the following:

a. Training of key personnel. Key personnel should be trained in order that regular maintenance work may be performed efficiently and to insure that unexpected problems related to flood control may be handled in an expeditious and orderly manner. The Superintendent should have available the names, addresses and telephone numbers of all his key men and a reasonable number of substitutes. These key men should in turn have similar data on all of the men that will be necessary for assistance in the discharge of their duties. The organization of key men should include the following:

(1) An assistant to act in the place of the Superintendent in case of his absence or indisposition.

(2) Sector foremen in sufficient number to lead maintenance patrol work of the entire levee during flood fights. High qualities of leadership and responsibility are necessary for these positions.

b. Streamflow stages. Permanent arrangements should be made by the Superintendent with the United States Weather Bureau at Eureka, California, to secure streamflow stages and forecasts of streamflow stages and weather conditions on effective streams and drainage areas to plan adequate measures of protection.

c. Semi-annual report. The semi-annual reports required under the regulations should be submitted within a ten-day period prior to 1 June and 1 December of each year and should include all dated copies of reports of inspections made during the period of report. Also, the nature, date of construction, and date of removal of all temporary repairs and the dates of permanent repairs should be included in this report. Other items and

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suggestions relative to public cooperation, public sentiment on the protection obtained, and other allied subjects are considered pertinent and desirable data for inclusion in the report, but are not required. A suggested form for submission of the semi-annual report covering the major features of maintenance, inspection and operation is furnished as Exhibit C for the convenience of the Superintendent. The organization responsible for the maintenance and operation of the project is required to provide their own forms in accordance with the sample.

d. Check lists. The check lists shown in Exhibit C should be used in each inspection to insure that no features of the protective system are overlooked. Items requiring maintenance should be noted thereon; if items are satisfactory they should be so indicated by a check.

e. Proposed improvements or alterations. Drawings or prints of proposed improvements or alterations to the existing Flood Control Works must be submitted for approval to the District Engineer, U.S. Army Engineer District, San Francisco, Corps of Engineers, San Francisco, California, sufficiently in advance of the proposed construction to permit adequate study and consideration of the work. Drawings or prints, in duplicate, showing any improvements or alterations as finally constructed should be furnished to the District Engineer, U.S. Army Engineer District, Corps of Engineers, after completion of the work.

8. LEVEES

Inspection and maintenance of levees shall be in accordance with paragraph 208.10 (a) General, (see paragraph 6 of this manual) and 208.10 (b) which states:

"Levees

(1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

- (iii) No seepage, saturated areas, or sand boils are occurring;
- (iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;
- (v) Drains through the levees and gates on said drains are in good working condition;
- (vi) No revetment work or riprap has been displaced, washed out, or removed;
- (vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;
- (viii) Access roads to and on the levee are being properly maintained;
- (ix) Cattle guards and gates are in good condition;
- (x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;
- (xi) There is no unauthorized grazing or vehicular traffic on the levees;
- (xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high-water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

- (i) There are no indications of slides or sloughs developing;
- (ii) Wave wash or scouring action is not occurring;
- (iii) No low reaches of levee exist which may be overtopped;
- (iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section."

Compliance with the provisions prescribed is essential for the efficient maintenance of the levee system and the successful operation of the project. Check lists suggested under Exhibit C should be used in each inspection to insure that no feature of the protective works is overlooked. Items requiring maintenance should be noted thereon; if items are found satisfactory they should be so indicated by a check.

9. DRAINAGE STRUCTURES

Inspection and maintenance of drainage structures shall be in accordance with paragraph 208.10 (a) General, (see paragraph 6 of this manual) and 208.10 (d) which states:

"Drainage structures

(1) Maintenance. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) Operation. Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed.

Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition."

Levee failures caused by neglected drainage structures are of common occurrence; it is therefore of utmost importance that these structures always be kept in perfect working condition in accordance with the regulations.

10. CLOSURE STRUCTURES

Inspection, maintenance and operation of closure structures shall be in accordance with paragraph 208.10 (a) General, (see paragraph 6 of this manual) and paragraph 208.10 (e) which states:

"Closure structures -- (1) Maintenance. Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

- (i) No parts are missing;
- (ii) Metal parts are adequately covered with paint;
- (iii) All movable parts are in satisfactory working order;
- (iv) Proper closure can be made promptly when necessary;
- (v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) Operation. Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of

the structure sill. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them."

11. CHANNELS AND FLOODWAYS

Inspection and maintenance of channels and floodways shall be in accordance with paragraph 208.10 (a) General, (see paragraph 6 of this manual) and 208.10 (g) which states:

"Channel and floodways

(1) Maintenance. Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes.

(2) Operation. The bank of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams or debris. Large objects which become lodged against the bank shall be removed. The improved channel shall be thoroughly inspected immediately following each major high water period.

As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, drainage outlets, or other flood control structures repaired."

12. MISCELLANEOUS FACILITIES

Inspection, maintenance and operation of miscellaneous facilities shall be in accordance with paragraph 208.10 (a) General, (see paragraph 6 of this manual) and 208.10 (h) which states:

"Miscellaneous facilities

(1) Maintenance. Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) Operation. Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor."

METHODS OF COMBATTING FLOOD CONDITIONS

13. SUGGESTED METHODS

Most of the methods described herein have been developed during years of experience with the various problems that often come up during periods of high water, and they are not intended to restrict the Superintendent, or others concerned, to a rigid set of rules for every condition that may arise. The remarks are primarily concerned with the earthen portions of the levee system. If problems not covered by these suggestions arise, where the Superintendent is in doubt as to the procedure to be taken, he will be expected to consult the District Engineer, U.S. Army Engineer District, San Francisco, Corps of Engineers, San Francisco, California, and follow standard engineering practices in meeting the situation. It should be noted that it is much better to be over-prepared for a "flood fight" than to find at the last moment that preparations were incomplete or unsatisfactory. Confidence of the protected persons and firms is a valuable asset that should not be carelessly lost through inefficient operation of the protection system in time of emergency.

REF ID: A66666

a. Earthen levees. An earthen levee is in possible danger whenever there is water against it. This danger varies with the height of the water, the duration of the flood stage, and the intensity of either the current or wave action. A well-constructed levee of proper section should, if maintained and not overtopped, hold throughout any major flood. However, a serious accident may result in a break. Foundation troubles result in sand boils or a sinking levee, and the local use of unsatisfactory materials causes slides and sloughs. However, such threatened failures can be met if prompt action is taken and proper methods of treatment are used. Wave wash is to be expected whenever the levee is exposed to a wide stretch of open water and is serious if permitted to continue over a considerable length of time. Exhibit D, Plates 1 - 5 are attached to aid in flood emergency construction.

b. Premeditated damage. The Superintendent should continually guard against premeditated damage to the levee.

c. Security. Personnel of the Corps of Engineers, U.S. Army, whether military or civilian, are not vested with any civil police authority in the performance of their engineering duties, and they will not attempt to exercise any such authority. The responsibility for protecting flood control works against sabotage, acts of depredation, or other unlawful acts rests with the local interests through local and State Governmental agencies. In the event local law enforcement agencies prove inadequate, local interests can request the aid of State forces, and if additional support becomes necessary, Federal troops can be requested as provided by law.

d. Human element. Panic does not directly endanger the levee, but psychological fear due to ignorance of actual conditions may seriously affect the high-water fight during a critical moment. This fact may be considered in organization for emergency work. Confidence, engendered by an efficient organization, free from local jealousies, is the best guard against panic.

e. Inspection of Flood Control Works. Immediately upon receipt of information that a high water is imminent, the Superintendent should form a skeleton organization, capable of quick expansion, and assign individuals (Sector Foremen) to have charge of definite sections of levees. As his initial activity, each Sector Foreman should go over his entire sector and parts of adjacent sectors, making a detailed inspection, particularly with reference to the following matters:

- (1) Sector limits; ascertain that the dividing line between sectors is plainly determined and, if necessary, marked.
- (2) Condition of new levees and recent repairs.
- (3) Condition of culverts, flap gates, and sluice gates.
- (4) Transportation facilities; roads and rail.

(5) Material supply; quantity, location and condition.

(6) Communications; locate and check all necessary telephones in the sector.

f. Preliminary repair work. After the initial inspection has been made, each Sector Foreman should recruit a labor crew and provide it with tools such as shovels, axes, wheelbarrows, etc. In addition, bulldozers, scrapers, trucks, etc., should be located and made ready for use in case of emergency. Then immediate action should be taken to perform the following work:

(1) Fill up holes or washes in the levee crown and slopes. Where new construction has been completed during the year, rain washes and deep gullies may have developed. While the levee is new, preparations should be made in advance to combat wave wash along the exposed reaches.

(2) Repair gaps where road crossings have been worn down and the levee is below grade. In filling the road crossings, it may be necessary to obtain material from landside borrow pits, in which case excavation for the material should be kept at least 50 feet from the toe of levee. Any filling done in this connection should be tamped in place and, if in an exposed reach, subject to wave wash, the new section should be faced with bags of sand.

(3) Repair and close all flap gates on culverts and see that they are seated properly before they are covered with flood waters.

(4) Ascertain that all roads to and along the levee are in a good state of repair. The Superintendent should obtain assistance from the county road forces to have all roads put in first-class condition.

(5) Locate necessary tools and materials (sacks, sandbags, brush, lumber, lights, etc.) and distribute and store the same at points where active maintenance is anticipated.

(6) Check and obtain repair of all telephone lines necessary for operation, obtain lists of all team forces, motorboats, motorcars, and truck transportation that can be made available.

(7) Make thorough arrangements with reliable citizens of the community for the supply, transportation, subsistence, and shelter for the necessary labor.

(8) Communicate directly with owners of all stock pastured on the levee and direct that all stock be removed from the levee right-of-way. Cut all fences crossing the levee that do not have gates provided.

(9) Investigate all drainage ditches on the landside of the levee and open these drains when obstructions exist. Prepare to cut the necessary seep drainage ditches; however, no attempt should be made to drain the levee slope until actual seepage takes place.

(10) Remove all dynamite and explosives of any kind from the vicinity of the levee.

g. Disaster relief. It is the responsibility of local, State and municipal authorities, supported by and/or working in connection with the American Red Cross to adopt measures for the relief of flood disaster victims. Relief measures can be undertaken by the Department of the Army through its Army Area Commander under existing Army Regulations, but such measures will be undertaken only as a last resort, in extreme cases and under compelling circumstances where local resources are clearly inadequate to cope with the situation.

h. Flood fight. After the above preliminary organization and precautions have been completed, the "flood fight" itself commences. The methods of combating various defects in the earthen levee described in the following paragraphs have been proved effective during many years of use by the Department of the Army

(1) Drainage of slopes. This work can be done economically while awaiting developments and will serve to make the levees more efficient. Crews should be organized to cut seep drains at all places on the levee when seepage appears. The drains should be V-shaped, no deeper than necessary, and never more than 6" deep. Care must be taken not to cut the sod unnecessarily. In all instances, drains should be cut straight down the levee slope or nearly so. Near the toe of the slope the small drains should be Y'd together and led into larger drains which, in general, should lead straight across the landside berm into the landside pits or nearer natural or artificial drain.

(2) Sandboils. These danger spots are serious if discharging material. The common method of controlling sand boils consists of walling up a watertight sack ring around the boil up to a height necessary to reduce the velocity of flow to a point at which material is no longer discharged from the boil. See Exhibit D, Plate 1. The sack ring around the boil should be large enough to protect the defective area immediately surrounding the boil. If several boils of sufficient force to displace sand are observed a sack sublevee may be built around the entire nest of boils, rising to such a height that none of the boils will discharge with enough force to displace sand.

(3) Wave wash. The Superintendent and Sector Foreman should study the levee beforehand to determine the possibility of wave wash. All such reaches will be located well in advance and for use in emergency, a reserve supply of filled sacks and rolls of cotton bagging will be kept on board flats.

If the slope is well sodded, a storm of an hour's duration should cause very little damage. During periods of high wind and high water, ample labor should stand by and experienced personnel should observe where the washouts are beginning. Sections of cotton bagging should be placed over the washed areas, as shown on Exhibit D, Plate 3. As an alternative, filled sacks should be placed in the cut in an effective manner and as soon as possible. The filled sacks should be laid in sections of sufficient length to give protection well above the anticipated rise. Bagging so laid must be thoroughly weighted down to be effective. Plate 2, Exhibit D, shows the movable type of wave wash protection, also used with good results. Its advantage is that it can rapidly be built at any convenient place and easily set in place on the job.

(4) Scours. A careful observation should be made of the riverside of the levee at all localities where high current velocities are observed. Trouble may be looked for at road-crossing ramps and places where pipes, sewers and other structures penetrate the levee. The approved method of construction to check scour on the slopes is to construct deflection dikes, using brush, treetops, or lumber, driving stakes and wiring together, and filling in between with brush and filled sacks or stone.

i. Topping. Immediate consideration should be given the grade line of each levee section by comparison of existing grades with those shown on the appended drawings. If any reaches show a grade below the previous highest water, emergency topping should be undertaken at once to such a grade as may be established by the District Engineer, U.S. Army Engineer District, San Francisco, Corps of Engineers, San Francisco, California, as follows:

(1) Sack topping. Sack topping may be used to raise the crown of the levee about three feet. The sacks should generally be laid stretcher-wise or along the levee for the first layer, crosswise for the second layer, and so on. Sacks should be lapped at least 1/4 either way and well mauled into place. When properly sacked and tamped, one sack will give about three to four inches of topping. See Exhibit D, Plate 4.

(2) Lumber and sack topping. This is the most commonly used method of raising low reaches in emergencies. In putting on this topping, as well as other topping, a careful line of levels should be run and grade stakes set in advance; 2" x 4" x 6' stakes should then be driven on the riverside of the crown six feet apart, and 1" x 12" boards nailed to the landside of the stakes. This wall, backed with a single tier of sacks, will hold out at least one foot of water. If a second foot is necessary, the layers of sacks will have to be increased in number and reinforced. The stakes should be driven three feet in the ground, and should project out three feet, thus providing, in extreme cases, a three-foot topping if properly braced behind with sacks and earth. In some instances, it may be practicable to back up the planking with tamped earth obtained in the vicinity in lieu of the sacks shown in the drawing, Exhibit D, Plate 5.

j. Transportation. In instances where it is necessary to send equipment over roads that are impassible due to mud or sand, their passage may be provided by the use of a plank road or by means of steel or wire mats.

k. Check lists. The inspection list in Exhibit C is furnished for reproduction and use by the local interests as a check list for inspections and also for use in making the required semi-annual reports. This list should be used in each inspection to insure that no feature of the protective system is overlooked. Items requiring repairs should be noted thereon; if items are satisfactory, they should be indicated as such.

l. Use of Government Plant. The District Engineer, U.S. Army Engineer District, San Francisco, Corps of Engineers, is authorized to use or loan Government property and plant in cases of emergency where life is in danger and there is no opportunity to secure prior authority for such use. The authority also extends to saving of property where no suitable private equipment is available, provided that such use is without detriment to the Government.

m. Flood Emergency Manual. The most recent "Flood Emergency Manual" published by the San Francisco District Corps of Engineers should be used to supplement the information furnished in this Operation and Maintenance Manual.

Title 33—Navigation and Navigable Waters

Chapter II—Corps of Engineers

Part 208—Flood Control Regulations

Sec.
208.10 Local flood protection works; maintenance and operation of structures and facilities.

§ 208.10 *Local flood protection works; maintenance and operation of structures and facilities*—(a) *General.* (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of the Army, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The Department of the Army will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under this part.

(b) *Levees*—(1) *Maintenance.* The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod; exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance

repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation.* During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls*—(1) *Maintenance.* Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) *Operation.* Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures*—(1) *Maintenance.* Adequate measures shall be taken to insure that inlet and outlet channels

are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(c) *Closure structures*—(1) *Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order;

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient

time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the *Operation and Maintenance Manual* which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants*—(1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways* — (1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities* — (1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor.

(Sec. 3, 49 Stat. 1571, as amended; 33 U. S. C. 701c) [9 F. R. 9999, 10203]

BOARD OF SUPERVISORS, COUNTY OF HUMBOLDT, STATE OF CALIFORNIA

Certified copy of portion of proceedings, Meetings of April 17, 1962

**IN THE MATTER OF APPROVING PROPOSED PLAN OF
U.S. ARMY CORPS OF ENGINEERS CONCERNING FLOOD
PROTECTION ON NORTH FORK OF MAD RIVER NEAR
BLUE LAKE.**

WHEREAS, the Director of the Department of Public Works reported that he had received a communication dated April 12, 1962 from the U.S. Army Engineer District, San Francisco, advising that studies for flood protection on the North Fork of the Mad River near Blue Lake had been completed; and

WHEREAS, drawings showing the proposed plan of improvement were forwarded with said communication, with a request that this Board of Supervisors take formal action concerning said plan; and

WHEREAS, the Director of the Department of Public Works recommended that said plan be approved, and that this Board of Supervisors express a willingness on behalf of the County of Humboldt to fulfill the requirements of local cooperation as cited within the aforesaid communication;

NOW, THEREFORE, upon the motion of Supervisor Robertson, seconded by Supervisor Bareilles, the preliminary map of the proposed plan of the U.S. Army Corps of Engineers, being their file No. 102-39-16 is hereby approved by this Board of Supervisors.

IT IS FURTHER ORDERED that the requirements of local cooperation as listed following are accepted by the County of Humboldt:

- a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the project, including all necessary alterations and relocations of highways, utilities and other structures.
- b. Hold and save the United States free from damages due to the construction works.
- c. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army.

BOARD OF SUPERVISORS, COUNTY OF HUMBOLDT, STATE OF CALIFORNIA

Certified copy of portion of proceedings, Meetings of April 17, 1962

d. Prevent any encroachment on the constructed works which might interfere with the proper functioning of the improvements for flood control.

e. Contribute in cash, prior to initiation of construction, an amount necessary to prevent Federal expenditures for the project exceeding the \$400,000 statutory limitation under Public Law 685, 84th Congress, 2d Session; or in lieu thereof, perform designated project construction equivalent to the amount necessary to prevent Federal expenditures exceeding the statutory limitation.

AYES: Supervisors— Lindley, Bareilles, Robertson, Pettersen, Merryman
NOES: Supervisors— None
ABSENT: Supervisors— None

STATE OF CALIFORNIA, }
County of Humboldt } ss.

I, FRED J. MOORE, JR., County Clerk of the County of Humboldt, State of California, and ex-officio Clerk of the Board of Supervisors of the County of Humboldt, do hereby certify the foregoing to be full, true and correct copies of the original orders made in the above entitled matters by said Board of Supervisors, at a meeting held in Eureka, California, on April 17, 1962 and as the same now appears of record in my office.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the Seal of said Board of Supervisors this 18th day of April, 1962

FRED J. MOORE, JR.
County Clerk and ex-officio Clerk of the Board of Supervisors of the County of Humboldt, State of California
By Fannie Sessila Deputy Clerk.

SEMI-ANNUAL REPORT FOR
INSPECTION, MAINTENANCE, AND OPERATION OF
FLOOD CONTROL PROJECT
MAD RIVER AT BLUE LAKE

Period from _____
to _____

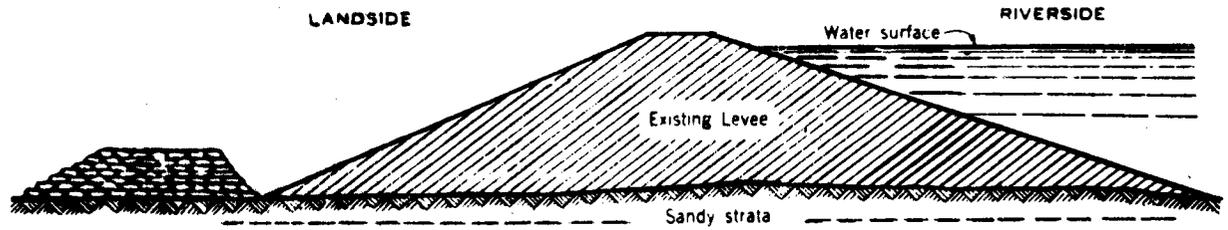
Submitted by _____
Date _____

INSPECTION

ITEM NO. :	FEATURE :	LOCATION AND EXTENT OF MAINTENANCE REQUIRED :
1	Settlement, sloughing, or loss of grade	
2	Graveled roadway on crown of levee	
3	Access road ramps	
4	Fences and gates	
5	Erosion of levee slopes	
6	Riprap	
7	Toe drainage system	
8	Seepage	
9	Sod on levee slopes	
10	Weeds or undesirable vegetation	
11	Accumulation of drift, trash, or debris	
12	Animal burrows	
13	Inappropriate burning	
14	Unauthorized grazing or traffic	
15	Unauthorized encroachment on rights-of-way	
16	Unauthorized excavation and loose backfill	
17	Drainage culverts	
18	Channel	
19	Railroad closure	
20	Stoplog storage structure	

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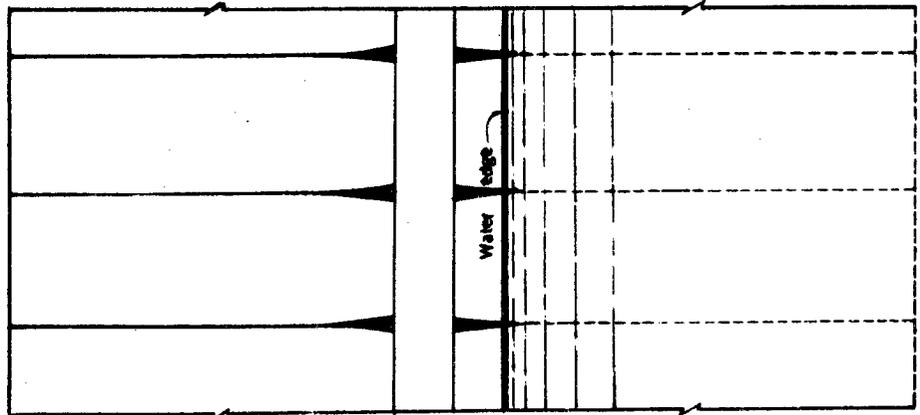
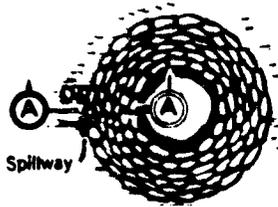


Note.
 Bottom width to be no less than 1 1/2 times height.
 Be sure to clear sand discharge
 Tie into levee if boil is near toe.

ELEVATION



SECTION A-A



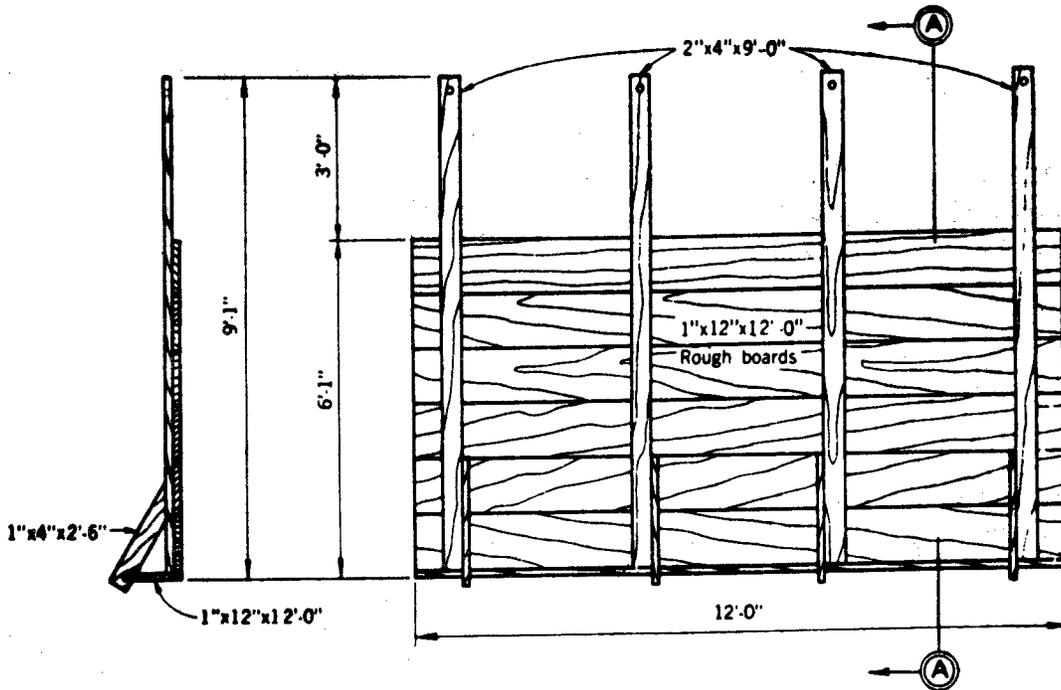
PLAN

Note:
 Do not sack boil which does not put
 out material.
 Height of sack loop or ring should be only
 sufficient to create enough head to slow
 down flow through boil so that no more
 material is displaced and boil runs clear.
 Never attempt to completely stop flow
 through boil.

**FLOOD EMERGENCY
 CONSTRUCTION**

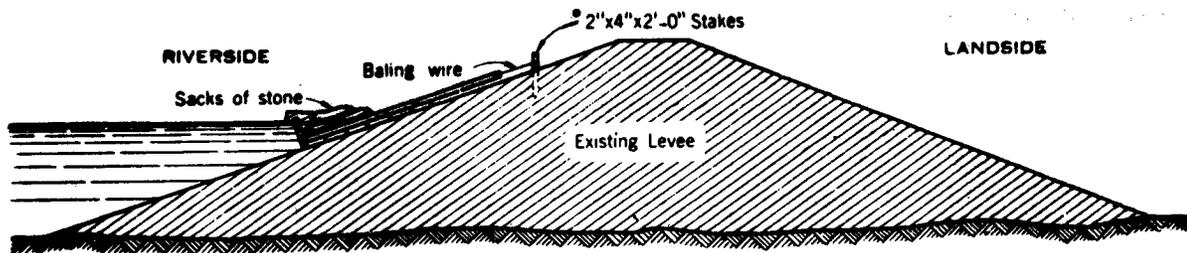
CONTROL OF SAND BOILS

U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
 CORPS OF ENGINEERS
 SAN FRANCISCO, CALIFORNIA



SECTION A-A

PLAN



SECTION

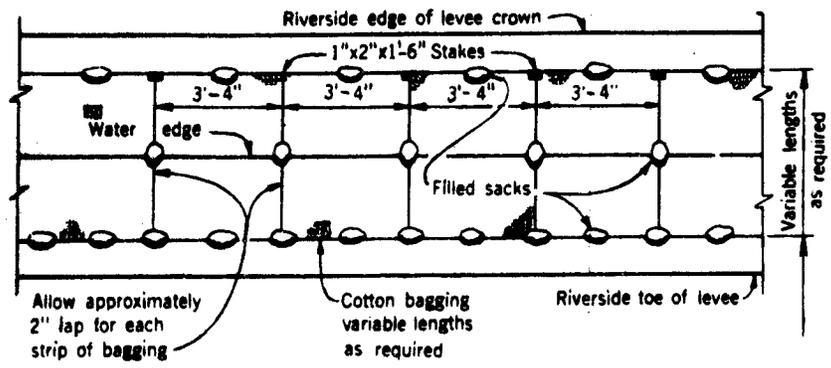
BILL OF MATERIAL FOR 100 FEET	
LUMBER	
56 pieces	1"x12"x12'-0"
32 pieces	1"x4"x2'-6"
32 pieces	2"x4"x9'-0"
• 32 pieces	2"x4"x2'-0"
•	(Sharpened)
WIRE	
200'	baling wire
NAILS	
4½ lbs.	8d nails

**FLOOD EMERGENCY
CONSTRUCTION**

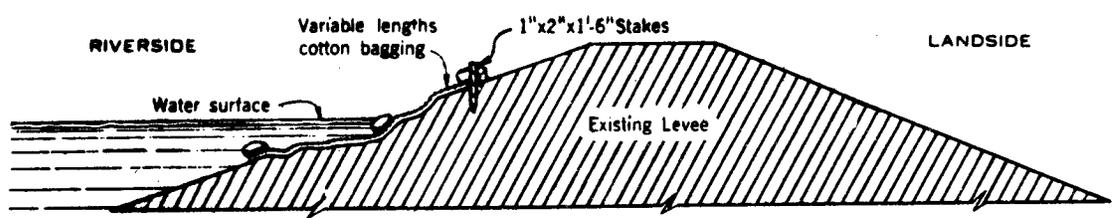
**MOVABLE
WAVE WASH PROTECTION**

 U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
 CORPS OF ENGINEERS
 SAN FRANCISCO, CALIFORNIA

M
R
1400



PLAN



SECTION

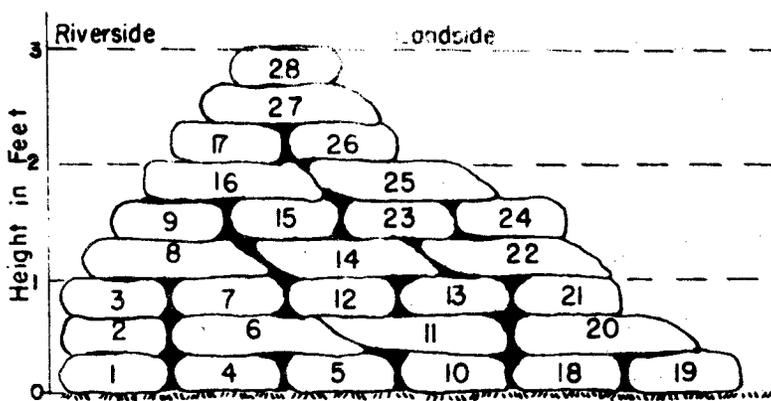
Note:
 Lay lengths as required of cotton bagging approximately parallel with levee slope and across damaged section. Weight top and edges of bagging with filled sacks as shown above. The filled sacks should be wired or tied to each strip before laying in place. Stake the corners of each strip above water surface. Where cotton bagging is not available burlap sacking may be substituted.

MATERIAL REQUIRED FOR 100 LINEAR FEET OF LEVEE
LUMBER
<ul style="list-style-type: none"> • 30 Stakes 1"x2"x1'-6" • (Sharpened)
SANDBAGS
<ul style="list-style-type: none"> 120 sand bags Cotton bagging as required

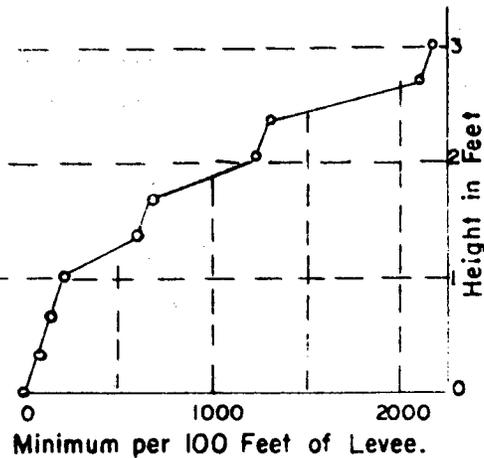
**FLOOD EMERGENCY
 CONSTRUCTION**

WAVE WASH PROTECTION

 U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
 CORPS OF ENGINEERS
 SAN FRANCISCO, CALIFORNIA



SANDBAG LEVEE CROSS SECTION



NUMBER OF SANDBAGS

Notes:

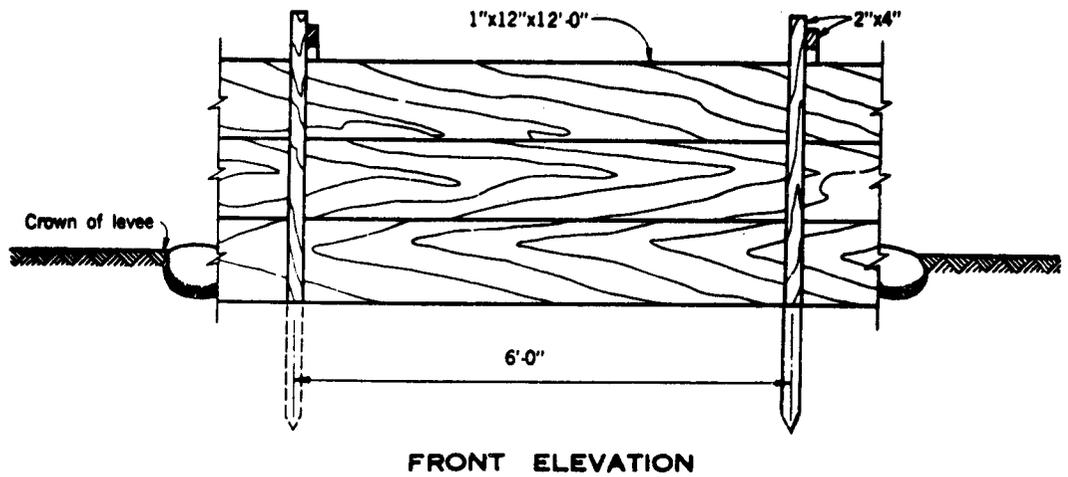
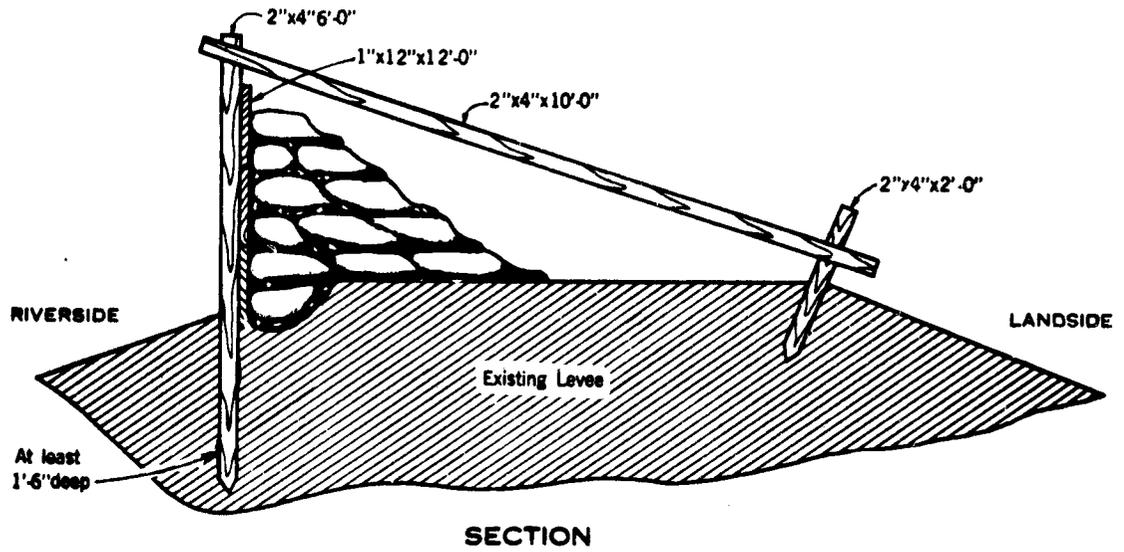
1. Entire base to be cleared and scarified.
2. Best material for filling sandbags is a fine sand or coarse silt. Avoid, as much as possible, the use of coarse gravel and heavy clays.
3. Fill sandbags 1/2 to 2/3 full, 50 to 60 pounds, and leave enough flap to turn under. Do not tie.
4. Numbers shown on the sandbags are for the general order of placing the sandbags to give the highest protection with the minimum number of sandbags.
5. When bags are placed, flatten out and fill voids by mashing bags with feet and vigorously tramping each course of the levee section. Provide a levee section as impervious to water as possible. Alternate direction of sacks and stagger joints wherever practical.
6. The above section is based upon an average in place sandbag section of 4" x 12" x 18".

**FLOOD EMERGENCY
CONSTRUCTION**

SACK TOPPING

 U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
 CORPS OF ENGINEERS
 SAN FRANCISCO CALIFORNIA

10400
 10400

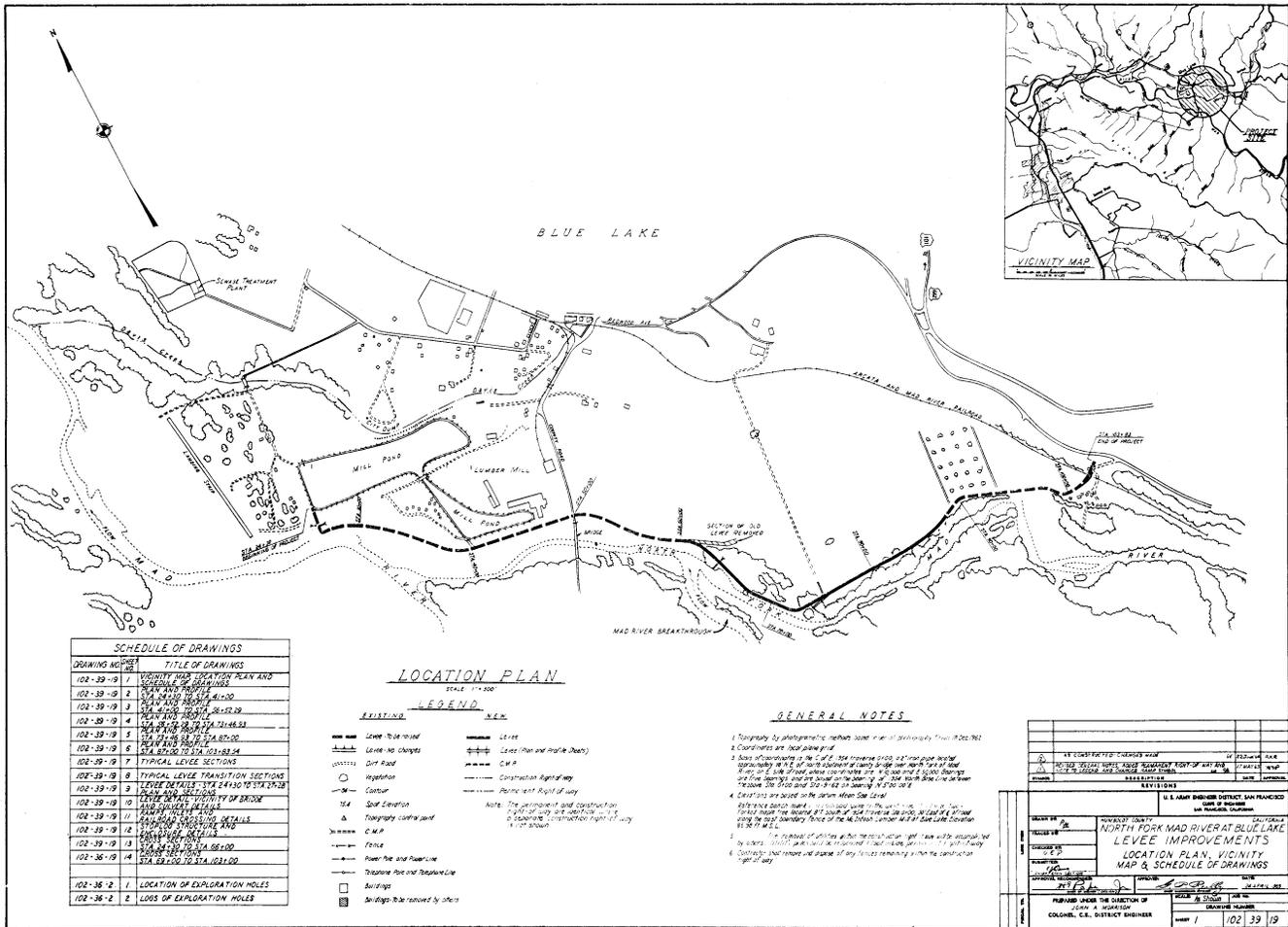


BILL OF MATERIAL FOR 100 LINEAR FEET OF LEVEE	
LUMBER	
25 pieces	1"x12"x12'-0"
17 pieces	2"x4"x10'-0"
* 17 pieces	2"x4"x6'-0"
* 17 pieces	2"x4"x2'-0"
* (Sharpened)	
NAILS	
1 lb.	8d nails
2 lbs.	16d nails
SANDBAGS	
1100	bags

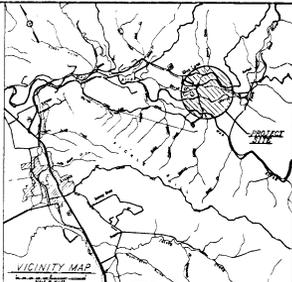
**FLOOD EMERGENCY
 CONSTRUCTION**

LUMBER AND SACK TOPPING

 U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
 CORPS OF ENGINEERS
 SAN FRANCISCO, CALIFORNIA

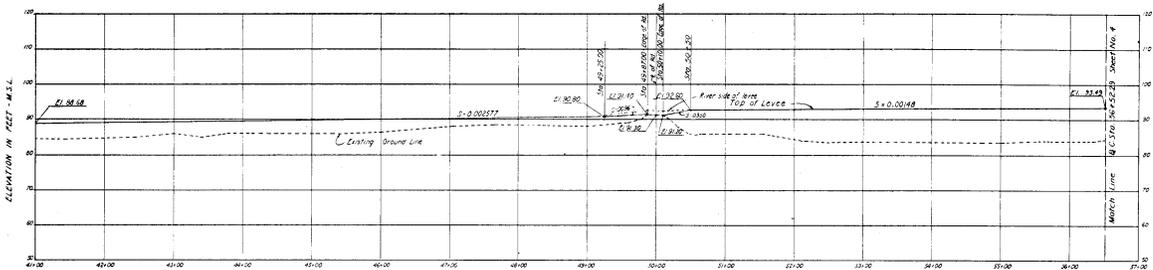


SCHEDULE OF DRAWINGS	
DRAWING NUMBER	TITLE OF DRAWINGS
102-39-19 1	VICINITY MAP, NORTH FORK MAD RIVER AT BLUE LAKE
102-39-19 2	LOCATION PLAN, NORTH FORK MAD RIVER AT BLUE LAKE
102-39-19 3	PLAN AND PROFILE, NORTH FORK MAD RIVER AT BLUE LAKE
102-39-19 4	PLAN AND PROFILE, NORTH FORK MAD RIVER AT BLUE LAKE
102-39-19 5	PLAN AND PROFILE, NORTH FORK MAD RIVER AT BLUE LAKE
102-39-19 6	PLAN AND PROFILE, NORTH FORK MAD RIVER AT BLUE LAKE
102-39-19 7	TYPICAL LEVEL SECTIONS
102-39-19 8	TYPICAL LEVEL TRANSITION SECTIONS
102-39-19 9	TYPICAL LEVEL TRANSITION SECTIONS
102-39-19 10	TYPICAL LEVEL TRANSITION SECTIONS
102-39-19 11	TYPICAL LEVEL TRANSITION SECTIONS
102-39-19 12	TYPICAL LEVEL TRANSITION SECTIONS
102-39-19 13	TYPICAL LEVEL TRANSITION SECTIONS
102-39-19 14	TYPICAL LEVEL TRANSITION SECTIONS
102-36-2 1	LOCATION OF EXPLORATION HOLES
102-36-2 2	LOSS OF EXPLORATION HOLES



U. S. ARMY DISTRICT, SAN FRANCISCO	
SAN FRANCISCO OFFICE	
PROJECT NUMBER: NORTH FORK MAD RIVER AT BLUE LAKE	
DRAWING NUMBER: LOCATION PLAN, VICINITY MAP & SCHEDULE OF DRAWINGS	
DATE: 1952	
DRAWN BY: [Name]	
CHECKED BY: [Name]	
APPROVED BY: [Name]	
PURCHASED UNDER THE DIRECTION OF [Name]	
DRAWN BY: [Name]	
CHECKED BY: [Name]	
APPROVED BY: [Name]	
DATE: 1952	
DRAWING NUMBER: 102 39 19	
APPENDIX	

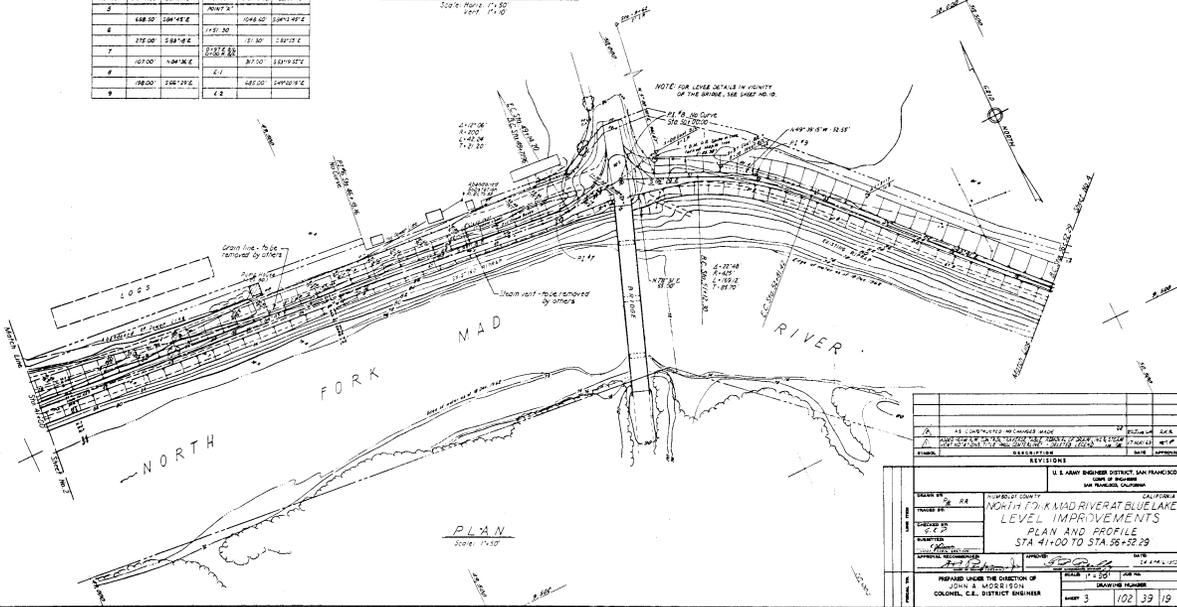
10500 10500 10500



PROJECT CENTERLINE		CONTROL TRANSVERSE	
PT. NO.	STATION	POINT	BEARING
3	548.00	548.00	548+0.00 E
6	576.00	576.00	576+0.00 E
7	604.00	604.00	604+0.00 E
8	632.00	632.00	632+0.00 E
9	660.00	660.00	660+0.00 E

CENTERLINE PROFILE

Scale: Horiz. 1"=50'
Vert. 1"=10'

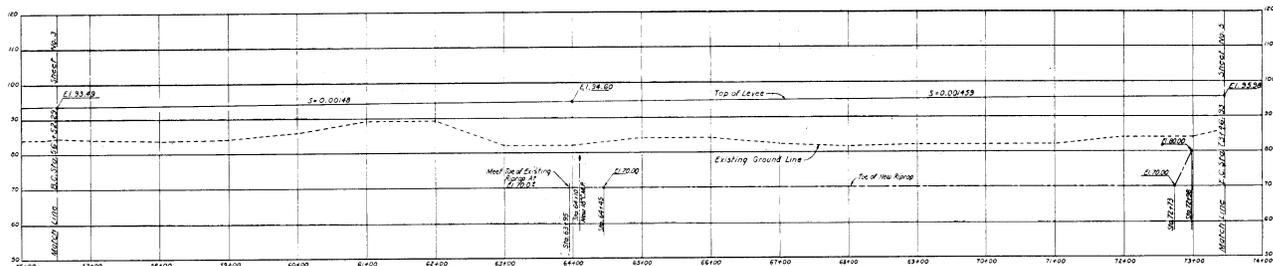


PLAN

Scale: 1"=50'

DESIGNED BY	PROJECT ENGINEER	DATE	24 APR 1951
DRAWN BY	PROJECT ENGINEER	SCALE	1"=50'
CHECKED BY	PROJECT ENGINEER	SHEET NUMBER	3
APPROVED BY	PROJECT ENGINEER	TOTAL SHEETS	19

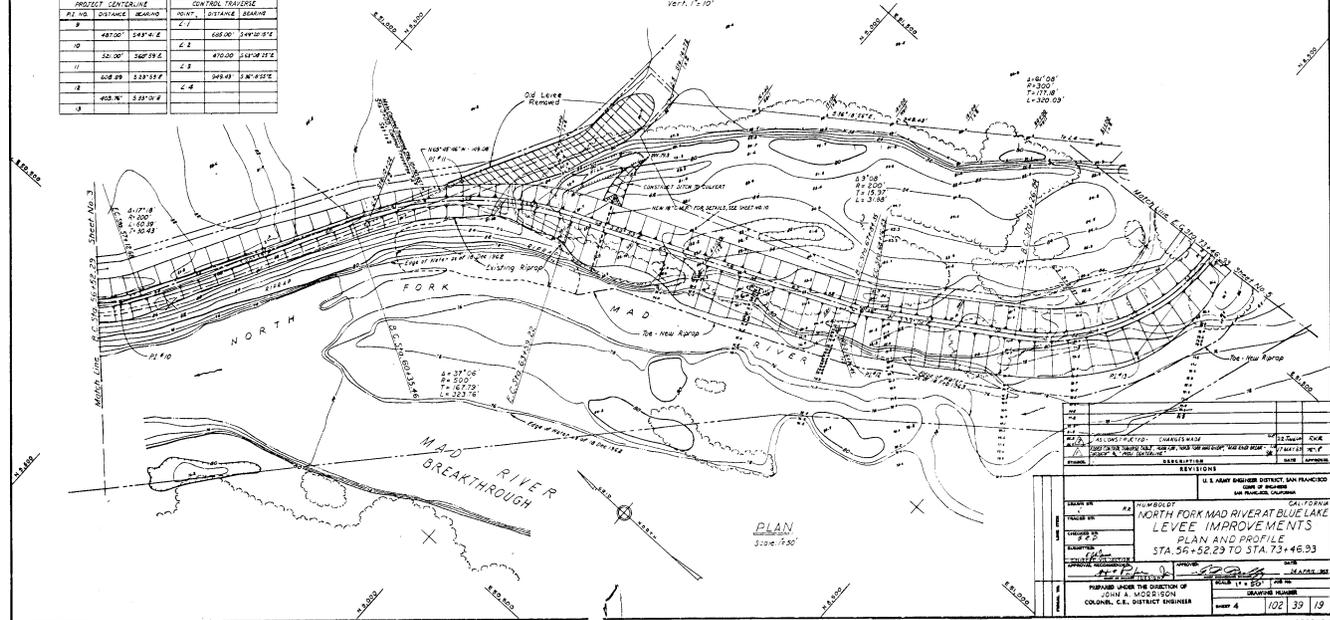
U. S. ARMY DISTRICT, SAN FRANCISCO
 DISTRICT ENGINEER
 COLONEL C. E. DISTRICT ENGINEER



CENTERLINE PROFILE

Scale: HORIZ. 1" = 50'
VERT. 1" = 5'

PROJECT CENTERLINE	CENTRAL TRAVERSE		
P.V. NO.	POINT	STATION	BEARING
9	487+00'	144° 41' E	585.00' 1/4" P.S. 1/2"
10	501+00'	286° 29' E	470.00' 1/4" P.S. 1/2"
11	508+89'	233° 33' E	349.43' 1/4" P.S. 1/2"
12	492+74'	339° 33' W	349.43' 1/4" P.S. 1/2"



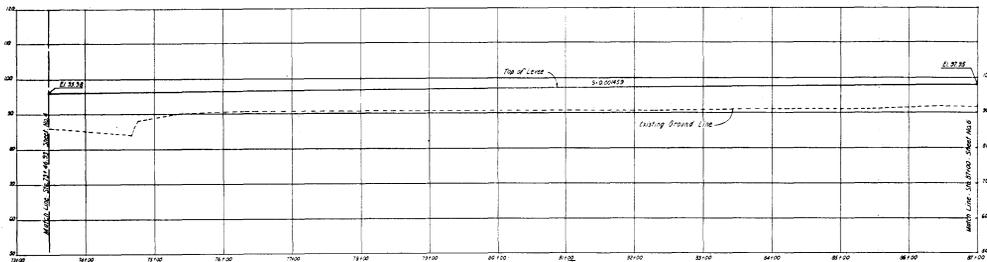
PLAN

Scale: 1" = 50'

DATE	10/23/59	SCALE	AS SHOWN
DESIGNED BY	W. J. BROWN	CHECKED BY	W. J. BROWN
DRAWN BY	W. J. BROWN	APPROVED BY	W. J. BROWN
PROJECT NO.	1023919	DATE	10/23/59
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO OFFICE OF CHIEF OF DISTRICT SAN FRANCISCO, CALIFORNIA			
TITLE: NORTH FORK MAD RIVER AT BLUE LAKE LEVEE IMPROVEMENTS PLAN AND PROFILE STA. 56+82.83 TO STA. 75+46.33			
PREPARED UNDER THE SUPERVISION OF COLONEL C. E. DISTRICT ENGINEER		DRAWING NUMBER 1023919	

DRAWING NO. 102 39 119

ELEVATION IN FEET-M.S.L.

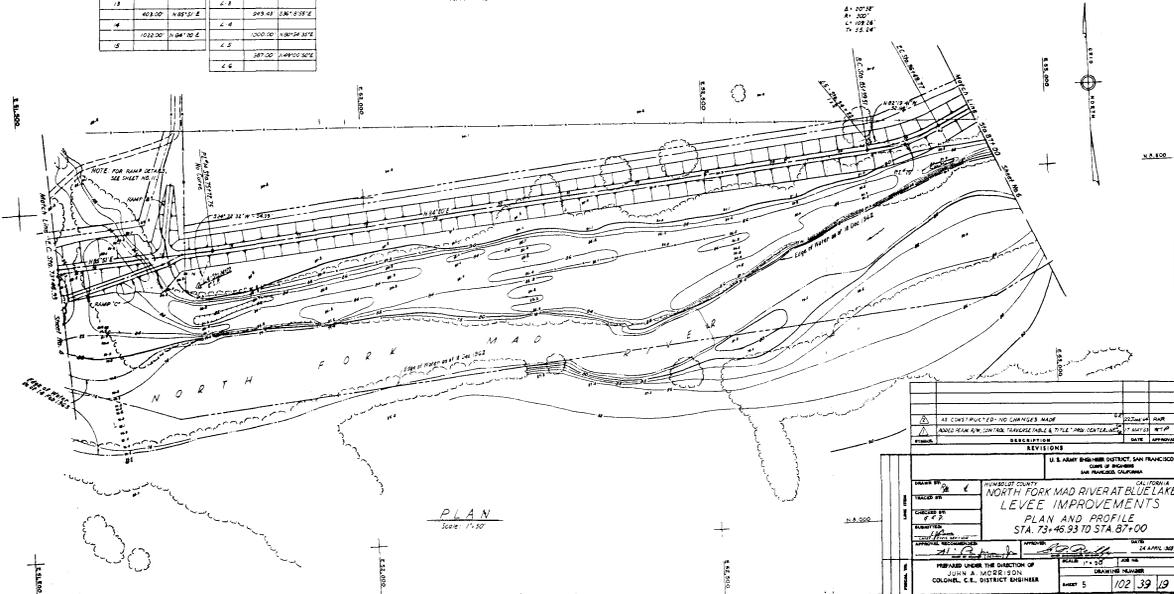


PROJECT CENTERLINE		CONTROL TRAVERSE	
PI NO.	DISTANCE BEAK-NS	POINT	DISTANCE BEAK-NS
13		2.9	
14	103.00 N 89° 52' E	2.8	399.41 S 87° 53' E
15	152.00 S 84° 10' E	2.7	120.10 S 87° 58' W
16		2.6	187.00 S 89° 50' W
17		2.5	
18		2.4	

CENTERLINE PROFILE

200' HORIZ. 1" = 50'

VERT. 1" = 10'

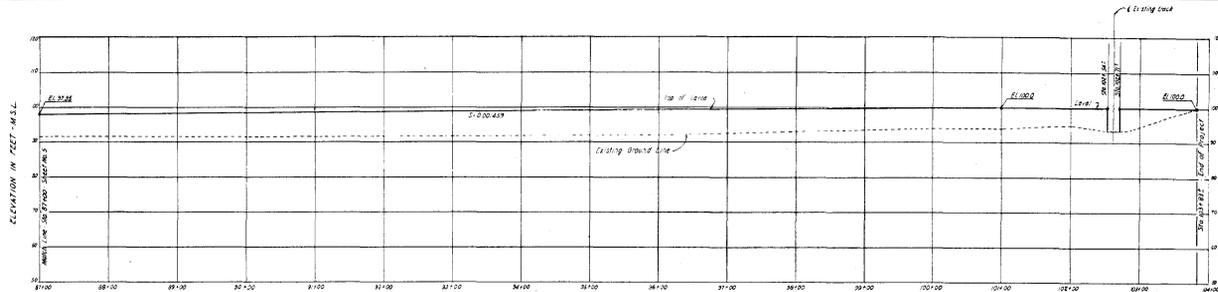


PLAN

SCALE 1" = 50'

U. S. ARMY DISTRICT SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
PROJECT NO. 102 39 119 DRAWING NO. 102 39 119 SHEET NO. 5	
TITLE: NORTH FORK MAD RIVER AT BLUE LAKE LEVEE IMPROVEMENTS PLAN AND PROFILE STA. 72+45.38 TO STA. 81+00	
DESIGNED BY: J. A. MOORE CHECKED BY: J. A. MOORE APPROVED BY: J. A. MOORE	DATE: 10 APR 50 SCALE: AS SHOWN SHEET NO.: 5

GROUND PROFILE

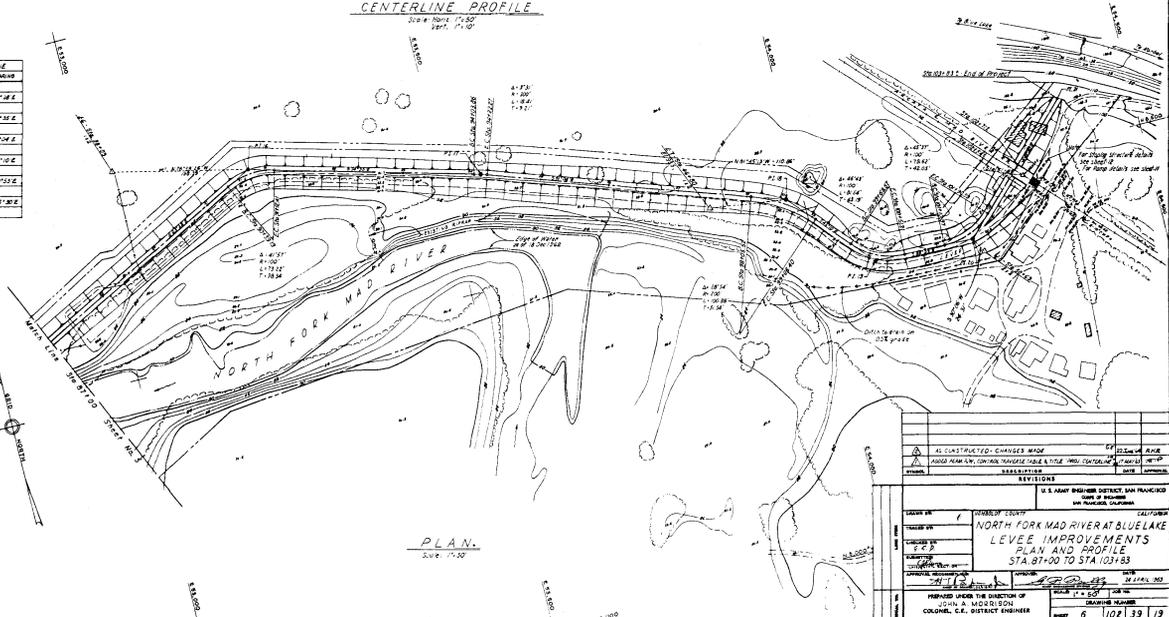


CENTERLINE PROFILE

DATE: 12-50
VERT. 11-50

PROJECT CENTERLINE		
P.T. NO.	DISTANCE	BEARING
1	484.00'	S 45° 30' E
2	339.00'	S 20° 30' E
3	444.00'	S 20° 30' E
4	108.00'	S 45° 30' E
5	148.00'	S 45° 30' E
6	252.00'	S 45° 30' E
7	252.00'	S 45° 30' E

CONTROL TRAVERSE		
POINT	DISTANCE	BEARING
A-1	287.00'	S 45° 30' E
A-2	87.00'	S 10° 30' E
A-3	404.50'	S 70° 30' E
A-4	121.00'	S 45° 30' E
A-5	212.00'	S 45° 30' E

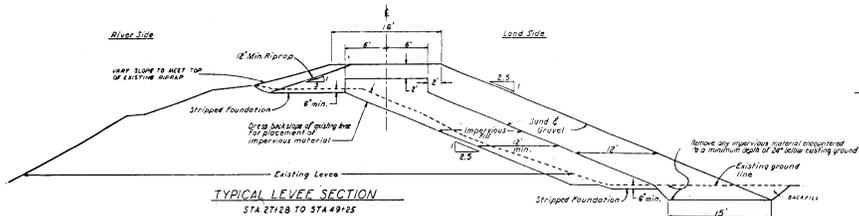


PLAN.

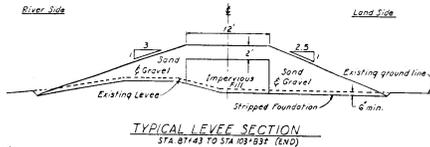
DATE: 7-50

AS CONSTRUCTED, CHANGES MADE	DATE	BY
AS DESIGNED, CHANGES MADE	DATE	BY
REVISIONS	DATE	BY
U. S. ARMY ENGINEER DISTRICT SAN FRANCISCO		
OFFICE OF DISTRICT ENGINEER		
PROJECT NO.	PROJECT OF DISTRICT	CALIFORNIA
PROJECT NAME	NORTH FORK MAD RIVER AT BLUE LAKE	
PROJECT TYPE	LEVEE IMPROVEMENTS	
PROJECT LOCATION	PLAN AND PROFILE	
PROJECT STATIONING	STA 81+00 TO STA 103+53	
PROJECT DRAWING NO.	DATE	BY
PROJECT DRAWING NO.	DATE	BY
PREPARED UNDER THE DIRECTION OF		
COLONEL C. E. DISTRICT ENGINEER		
APP. 6	102	33 13

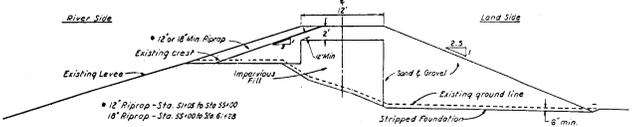
NORTH SIDE



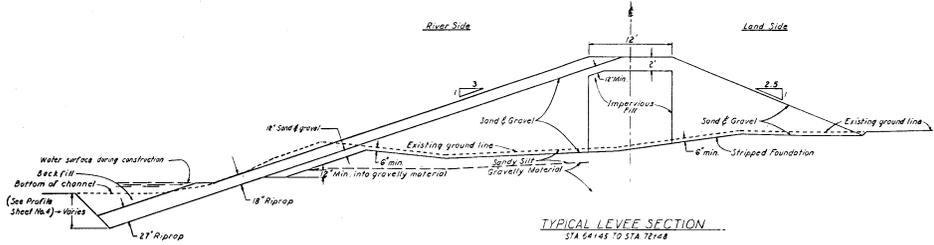
TYPICAL LEVEL SECTION
STA 27128 TO STA 49125



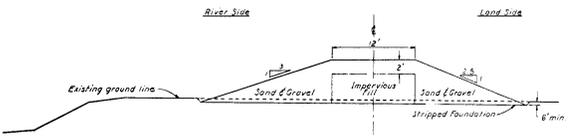
TYPICAL LEVEL SECTION
STA 87143 TO STA 1031937 (END)



TYPICAL LEVEL SECTION
STA 5105 TO STA 6125



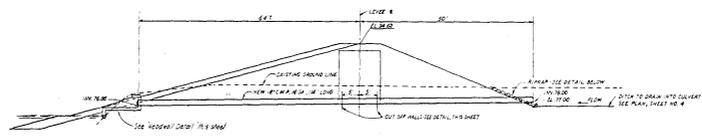
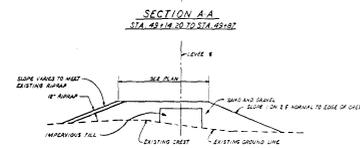
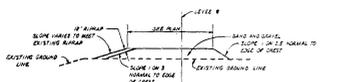
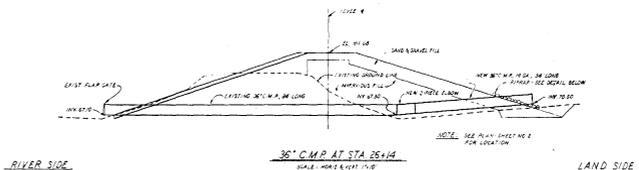
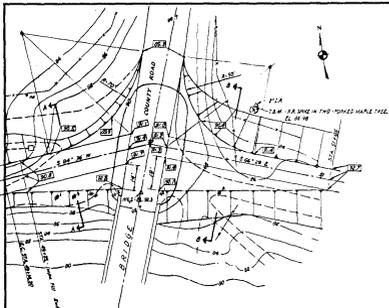
TYPICAL LEVEL SECTION
STA 64125 TO STA 72125



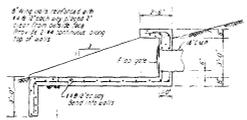
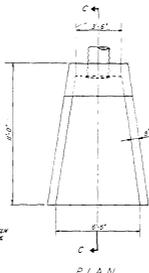
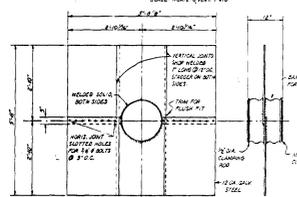
TYPICAL LEVEL SECTION
STA 72138 TO STA 87145

DESIGNED BY		CHECKED BY	
DRAWN BY		APPROVED BY	
DATE		DATE	
PROJECT		SCALE	
REVISIONS		DATE	
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO DISTRICT			
SHEET NO. PROJECT NO. DRAWING NO.	DIVISION NORTH FORK MAD RIVER AT BLUE LAKE LEVEE IMPROVEMENTS TYPICAL LEVEL SECTIONS	DRAWN BY DATE	CHECKED BY DATE
PREPARED UNDER THE DIRECTION OF COLONEL, G.S. DISTRICT ENGINEER		DRAWN BY DATE	CHECKED BY DATE

DRAWING



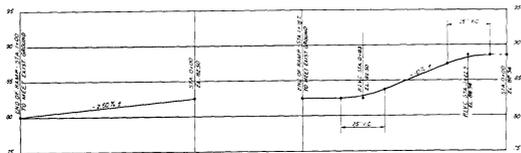
LAND SIDE ELEVATIONS
SCALE: 1" = 10'



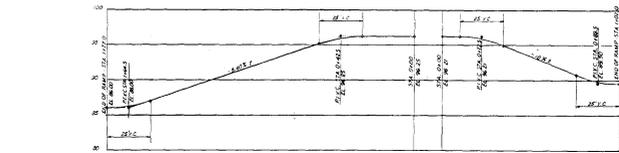
HEAD WALL DETAIL STA 64+10
SCALE: 1" = 10'

U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO DISTRICT OF CALIFORNIA DISTRICT ENGINEER	
PROJECT NO. 100-100-100-100-100-100 DRAWING NO. 100-100-100-100-100-100 SHEET NO. 100-100-100-100-100-100	DATE 10-1-1918 DRAWN BY J. W. BROWN CHECKED BY J. W. BROWN APPROVED BY J. W. BROWN
REVISIONS 1. AS SHOWN	
PROJECT TITLE NORTH FORK MAD RIVER AT BLUE LAKE LEVEE IMPROVEMENTS LEVEE DETAIL - VICINITY OF BRIDGE AND CULVERT DETAILS	DRAWING NUMBER 100-100-100-100-100-100 SHEET NO. 100-100-100-100-100-100

1-10426-100-1



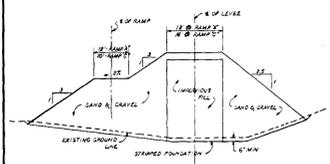
PROFILE - RAMP 'E'



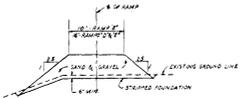
PROFILE - RAMP 'C'

PROFILE - RAMP 'V'

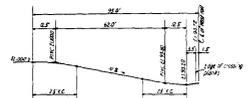
PROFILE - RAMP 'B'



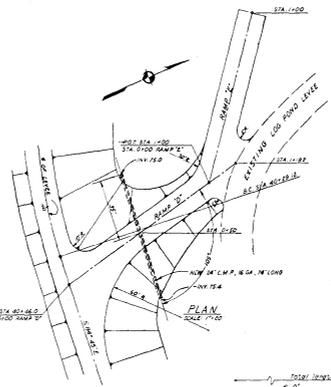
TYPICAL SECTION - RAMPS 'A', 'C', 'V'



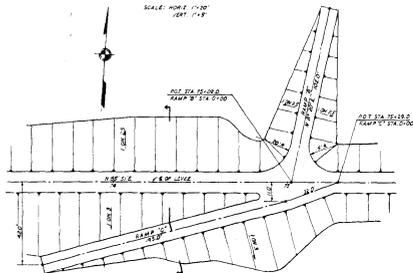
TYPICAL SECTION - RAMPS 'B', 'D', 'K'



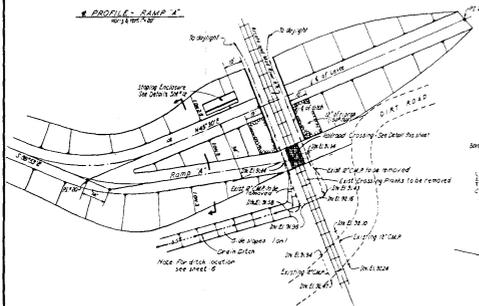
PROFILE - RAMP 'A'



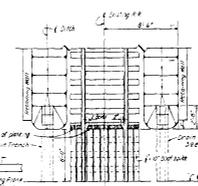
PLAN



PLAN



RAMP B RAILROAD CROSSING

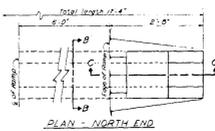


MAIN PLAN

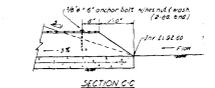


SECTION A AND B OF ACCESS RAMP

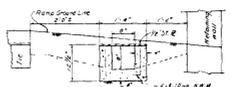
RAILROAD CROSSING DETAILS



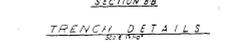
PLAN - NORTH END



SECTION C-C



SECTION B-B



TRENCH DETAILS

DATE		SCALE	
PREPARED UNDER THE DIRECTION OF COLONEL C. B. DISTRICT ENGINEER			
DRAWN BY ENGINEER		CHECKED BY DISTRICT ENGINEER	
DATE 1923		SHEET NO. 102 39 72	

