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*Gila River*

PROPOSED  
IRRIGATION, ROADS, AND CONSERVATION PROGRAM  
For The  
GILA RIVER PROJECT  
WAR RELOCATION AUTHORITY

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PUBLIC WORKS DIVISION  
Irrigation Section  
W. A. Laflin — Chief

Prepared by:  
S. G. Anderson  
Asst. Reg. Irr. Engr.  
November, 1942



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### PROPOSED IRRIGATION, ROADS, AND CONSERVATION PROGRAM

for the

### GILA RIVER PROJECT

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WAR RELOCATION AUTHORITY  
Public Works Division

Synopsis of the  
PROPOSED IRRIGATION, ROADS, AND CONSERVATION PROGRAM

for the  
Gila River Project

November, 1942

The following program is submitted covering briefly the proposed irrigation development for 8,000 acres of new land on the Gila River Project. For more detailed data, reference is made to the main text "Proposed Irrigation, Roads, and Conservation Program for Gila River Project", which follows this synopsis.

AREA: The proposed development covers 7,840 acres of an area known as Parcel B, which lies west of the 7,000 acres of land now under irrigation known as Parcel A.

LAND PREPARATION: Clearing and grading of the land is necessary before it can be used for agriculture. Although this land has never been farmed before, the desert vegetation is typically sparse, and the configuration of the land is smooth, with a uniform transverse slope of about one percent.

WATER DUTY: Approximately 4 acre feet per acre per year will be required on the farmed land. This is available from the San Carlos Irrigation District facilities at an annual charge of \$3.60 per acre.

IRRIGATION DEVELOPMENT: The irrigation development proposed is in accordance with the designs prepared by the Indian Service - Irrigation Division. Estimates for the total development include 258,000 lineal feet of concrete pipe line varying from 16" to 36" in diameter, one large canal check dam, two canal turnouts, three lateral check dams, five lateral turnouts, and approximately 100 turnout structures to farms.

ROAD DEVELOPMENT: A good standard of paved road is required from the Project to the railroad siding over which the estimated 55,000 tons per year export and the import of food, fuel, and other necessary operation commodities may be economically hauled. The route proposed conforms with the required road construction stipulated in the Memorandum of Agreement between the Secretary of the Interior and the Director of the War Relocation Authority, and involves 20 miles of improved and paved road.



Field or service roads of low standard of construction are required for facilitating the agricultural program and operating the irrigation system.

PROGRESSIVE DEVELOPMENT: Expansion of the agricultural area will be made as rapidly as possible, commensurate with the ability of the project to expand its activities while maintaining the existing 7000 acres of irrigable area in full production. This expansion will vary from 1880 acres the first year to 1260 acres the fifth year to complete the program.

The paved trucking road from the project north will be required as soon as possible and is included in the first years' construction. Subsequent road development will follow the same schedule as the agricultural expansion program.

COSTS: The total agricultural development cost is \$349,664, of which \$83,848 is the first years' portion of the development.

The total irrigation development cost is \$287,837, of which \$71,997 is the first years' portion of the development.

The total transportation development cost is \$621,250, of which \$566,470 is the first years' portion of the development.

RECOMMENDATIONS: This proposal conforms with the requirements stipulated in the Memorandum of Agreement between the Secretary of the Interior and the Director of the War Relocation Authority, and it is recommended that this program be fulfilled insofar as the progressive schedule of construction permits completion of the work within the realm of the War Relocation Authority's existence and its need for the development dictates.

It is also recommended that the basic designs of the Indian Service - Irrigation Division be followed in every detail, except where mutual agreement is reached on revisions or substitutions made necessary by field conditions, critical materials, etc.

Full cooperation should be given the Indian Service - Irrigation Division, San Carlos Irrigation District, and the Gila River Indian Reservation on all matters pertaining to their interest in this work.



WAR RELOCATION AUTHORITY  
Public Works Division

PROPOSED IRRIGATION, ROADS AND  
CONSERVATION PROGRAM  
for  
GILA RIVER PROJECT

November, 1942

I INTRODUCTION

The Gila River War Relocation Project is situated on the Gila River Indian Reservation, in the south central section of Arizona. This Project is one of several Japanese War Relocation Project Areas selected, on the basis of the availability of good farming land, favorable climatic conditions and an adequate supply of water. There are approximately 15,000 acres of agricultural land available on this area and it is therefore one of the important agricultural projects in the relocation program.

The irrigation and agricultural development on this land is governed by a Memorandum of Agreement between the Secretary of the Interior and the Director of the War Relocation Authority, dated August 31, 1942, and the Land Use Permits for Parcels "A" and "B" and "Camp Sites" between the Gila River Pima - Maricopa Indian Community and the War Relocation Authority.

The work proposed herein is intended to perform the work stipulated in the above Memorandum of Agreement and relative Land Use Permits with regard to land subjugation, irrigation development and road construction, and such other improvements that will be of benefit to the War Relocation Authority during its use of the land.

The complete development program, outlined herein under the respective headings of Agricultural, Irrigation, and Transportation, will consume a period of several years on a schedule of progressive construction.

Due to the fact that constant and rapid changes are taking place in world and national affairs which may affect the availability of material and the agricultural needs which may be supplied by this project, and the possible changes of policy of War Relocation Authority regarding the prosecution of the Japanese Evacuee program it is not possible to establish a rigid annual schedule of development. The purposes of this proposal can better be served by outlining in general, the probable ultimate construction, and confining the detailed development to the first year's construction, which is estimated to be completed in 1943. On the basis of the experience gained during this period, and in the light of the status of the future development at that time, it is proposed to develop annual sub-proposals for each ensuing year's program.



## II FACTUAL DATA

### Location:

The Gila River Project contains approximately 16,450 acres located on the Gila River Indian Reservation in Pinal County, Arizona. It is about 45 miles SE of Phoenix and 75 miles NW of Tucson, the two largest cities in Arizona. The population of this project is 15,000, making it the fourth largest city in the state.

### Agricultural History:

Extensive irrigation along this section of the Gila River began about 1921 when the Ashurst-Hayden Diversion Dam was constructed for the Florence and Casa Grande Canals which serve the area south of Gila River. About 1924, the San Carlos Irrigation Project was authorized by the Department of the Interior Office of Indian Affairs, to provide irrigation water for 50,000 acres of Indian land and a similar acreage of private land. Since that time, irrigated agriculture has increased under the progressive construction of this Project, and the new development proposed herein is but a portion of the overall plan initiated by the Department of the Interior.

### Transportation Facilities:

Excellent state highways pass proximate to the project; however there are no highways connecting the project and its designated railroad siding. The nearest siding on the Phoenix loop of the Southern Pacific Railroad Sunset Route may be reached over thirteen miles of local road.

In general, existing roads within the project area are in poor condition. The Sweetwater Road, which is the main outlet road to the north has a graded roadbed for most of its distance, but in some sections, the foundation for surfacing is of such poor material, it will not support a pavement. An existing bridge across the main channel of the Gila River is narrow but is considered adequate for the needs of the immediate future. Several small waterway openings are required between South Side Canal and the junction of the Sweetwater Road with State Highway No. 87 at the Indian Reservation Boundary.

There is no direct route to the south at present. Traffic is required to go east to Sacaton over unimproved roads, thence southerly over Indian Service Route 7 to State Highway No. 187, but the volume of heavy traffic over this route is anticipated to be very small.

Existing roads within the project area are little better than wide trails, but except for the connecting road between Camp 1 and Camp 2, further improvement of existing roads is not considered necessary. These roads should be maintained in their present condition, however.



Climate:

The average annual temperature on the project is about 70°F., while the maximum frequently reaches 113°F. during June, July and August, and the minimum occasionally reaches 8°F. The frost free period is about 165 days, from about May 1 to October 15.

The annual precipitation is about 6" and usually occurs in scattered showers so that no agricultural value is attached to rainfall. Intense summer thunderstorms are frequent through this area, and may cause some damage to portions of crops, but they are usually localized so that any resulting damage is not of large extent.

Wind velocities are very low, averaging about 5 miles per hour, and are evenly distributed throughout the year.

Soils:

The greater part of the project soil consists of loam, grading from a sandy to a clayey texture. This is usually underlain by an earthy travertine formation, known locally as caliche, which retards the movement of soil moisture downward, thus tending to minimize the usual difference in absorptive power of such surface soils.

Cropping:

The principle crops being produced adjacent to the project and which may be expected to do equally well on the project area are alfalfa for hay, pasture, or for seed; cotton, both long and short staple; winter and spring grains; corn and maize for forage or seed; vegetables and fruits; and livestock, including beef, dairying, sheep and poultry.

Water Supply:

Irrigation water is obtained from the Gila River, under a Federal Court adjudication and by pumping from underground supplies. The gravity supply is largely from storage in the San Carlos Reservoir, although some accretions are received from tributary watersheds, notably the San Pedro, which originates in Mexico. San Carlos Reservoir is formed by Coolidge Dam, 75 miles east of the Project, and was constructed by Indian Irrigation Service, being completed in 1928. The reservoir has a capacity of 1,200,000 acre feet, but has been operating in a dry cycle during most of its existence and the reservoir has been dry many times. This drouth condition was alleviated in the spring of 1941, when the level rose from practically zero to approximately 800,000 acre feet. Spring runoff of 1942 was below normal, but the reservoir will go into 1943 with a carryover of better than 600,000 acre feet.

The reason that this high carryover is being maintained is that a considerable portion of each seasons water supply is derived from pumping. During the dry period of the last ten years, approximately 75 supplementary wells were dug and equipped with pumps. To furnish the necessary electrical energy, when cheap hydro-electric power from Coolidge failed, a diesel standby plant was built.



With ample storage existing in San Carlos Reservoir, release of irrigation water produces electrical power in excess of contract demands, and this surplus energy is utilized to operate the pumps. The San Carlos Project therefore, has a combination of reservoir storage and underground water supply, and can look forward with comparative safety for the next few years.

Gila River water is diverted at the Ashurst-Hayden Dam, approximately 35 miles upstream from the project, and reaches the War Relocation Authority area through the Pima Lateral. Water is furnished under terms of the Memorandum of Agreement, at the rate of 4 acre feet for an annual cost of \$8.60 per acre, which includes operation and maintenance. Additional water, if available, may be had at a charge of \$1.00 per acre-foot. In the event there should be a shortage in any year in the basic water supply, these lands will share equally with all other irrigated Indian lands within the San Carlos Irrigation Project on the apportionment and distribution of water, and an adjustment of rates will be made for the amounts actually furnished.

The Memorandum also provides for water to be furnished to new lands to be subjugated as required for an annual cost of \$2.10 per acre for the first two acre-feet; \$0.50 per acre for the third acre-foot; and \$1.00 per acre for each succeeding acre foot. In the event that in any year there should be a shortage in the available water supply to produce a crop on all land developed by the War Relocation Authority, then only such lands will be cropped for which there is an adequate water supply.

#### Existing Developments:

Reference is made to the attached map "Subjugation Schedule", Exhibit A, whereon are shown the various existing and proposed construction features. The storm water channel along the south edge of the project as well as the South Side Canal 6-54, have been constructed. In addition, all the Lateral Canals and the Laterals with appurtenant structures which serve the area marked Parcel A have been constructed and are in operation. Parcel A has also been subjugated and is now in crop.

Lateral 6-54-111-3 which borders the west edge of Parcel A has been constructed, but the colored area on its west side has not been subjugated.

Approximately one mile of Lateral Canal 6-54-125 has been constructed, and that portion of Lateral Canal 6-54-111 from Laterals 6-54-111-6 to 6-54-120 has been constructed but will be abandoned in favor of a turnout to 6-54-120 direct from Canal 6-54.



There are in existence approximately 23 miles of service roads and 9 miles of the Sweetwater Road. The latter is to be further improved as outlined under Section V, Transportation Facilities.

Bridges across 6-54 on the east edge of Section 20 and across 6-54-111 on the center of Section 20 have been constructed. The existing bridge across the Gila River on the Sweetwater Road is suitable for future use without further improvement.



### III PROPOSED AGRICULTURAL DEVELOPMENT

Parcel A, containing approximately 7,000 acres, has been subjugated and prior to its being leased to the War Relocation Authority, was cropped mostly to alfalfa and pasture. The proposed agricultural development on this area is to utilize that portion of the existing alfalfa which is in the best condition, and to convert the balance of the area to vegetables and other crops.

The rental rate on Parcel A is established at \$20.00 per acre per year.

Parcel B, containing approximately 8,850 acres, is all of the area west of Lateral 6-54-111-8, and is proposed for subjugation on a progressive basis. The actual rate of progression will be controlled by several indeterminate factors, such as the available labor for the current season's work, crop production demands, availability of materials and rate of construction of irrigation facilities, etc., but the anticipated subjugation schedule is established on a five year basis, with an annual development distribution as shown in Table I.

It may be necessary to crop new land in Parcel B to alfalfa, grains, or sweet potatoes for at least the first year, after which any crop may be grown.

The rental on Parcel B land is provided for by the improvements which are proposed, and no other cash rental is to be charged for a five year period, subsequent to the initial development.

#### Water Requirements:

Previous experience on adjacent cropped land indicates that four acre feet per acre per year is ample for the production of crops. Multiple cropping of vegetables may require four or more acre feet, but it is believed that the close water control and careful application proposed under the care of a Watermaster will restrain the wasteful use of water, and that four acre feet will be sufficient.

#### Land Preparation:

Parcel A will require but little work in preparing the land, other than removing the existing crop where necessary. Removal of borders and furrowing for change in direction of irrigation may be included with normal farming operations, and the ultimate return of the borders to the land when the War Relocation Authority relinquishes the lease will be a relatively minor operation.

Parcel B however, will require clearing of the desert sagebrush, and grading and floating of the land under the progressive schedule of subjugation. While the normal depth of the surface soil provides ample excellent fertility for the growing of all crops, care must be taken in land levelling so as not to excessively reduce this depth. A small



amount of cutting on local knolls will not seriously affect production. Previous experience on similar subjugation work indicates that this can be done for \$44.60 per acre.

1943 Construction:

Progressive annual development is proposed as shown on the attached colored map, "Subjugation Schedule", Exhibit A. On this basis, the farm land will be increased as shown on the following table:

Table I  
Annual Development

<u>Year</u>	<u>Acres Subjugated</u>	<u>Total Farm Land</u>
1942		6,977
1943	1880	8,857
1944	1600	10,457
1945	1400	11,857
1946	1680	13,537
1947	<u>1280</u>	<u>14,817</u>
Total	7840 Acres	14,817 Acres



#### IV PROPOSED IRRIGATION DEVELOPMENT

Irrigation development will be done in accordance with the plans prepared or approved by the Department of the Interior, Indian Service - Irrigation Division, and all work will be subject to their inspection.

It is acknowledged that designs prepared by the Indian Service Irrigation Division take no cognizance of the shortage of critical materials. Revisions in these designs or new designs may be necessary in order to make the work possible. Any changes or substitutions are to be jointly approved by the Indian Service and the War Relocation Authority.

Check and turnout structures will be as shown on the attached drawings, Exhibits B to G, inclusive, or in accordance with any approved revisions thereof. Laterals will be concrete pipe lines of 36", 30", 24", 20", 18" and 16" diameters, located as shown on the attached map "Subjugation Schedule", Exhibit A, and with turnout structures to farms located as shown thereon, in accordance with design shown on Exhibit F.

All concrete pipe for the pipe line laterals and sublaterals will be manufactured on the project, using Indian Service pipe making facilities which are available near the project.

##### 1945 Construction:

The following construction is proposed for 1945:

Construct a turnout structure in Lateral Canal 6-54-111 to Lateral 6-54-111-6 as shown on Exhibit G.

Construct an earth dam in 6-54-111, just west of the Lateral turnout, and eliminate approximately one-half mile of 6-54-111 west of this point.

Construct concrete pipe Lateral 6-54-111-6 with the following approximate quantities to grade lines established by the San Carlos Irrigation Project:

30" concrete pipe	1,575 ft.
24" concrete pipe	5,290 ft.
20" concrete pipe	5,240 ft.
16" concrete pipe	<u>5,503 ft.</u>
Total	17,608 ft.



Construct thirteen sub-laterals of 16" pipe line, 1320' long each, totaling 17,160 feet of concrete pipe line.

Install approximately thirteen farm turnout structures as shown on Exhibit F, varying in total height from about 4.5 feet to 14.5 feet in accordance with grades established by the San Carlos Irrigation Project.

Construct a turnout structure in Main Canal 6-54 to Lateral 6-54-120 as shown on Exhibit F.

Construct the following portion of concrete pipe Lateral 6-54-120 to grade lines established by the San Carlos Irrigation Project.

36" concrete pipe 5,810 ft.

30" concrete pipe 5,290 ft.

Total 11,100 ft.

Install approximately nine farm turnout structures as shown on Exhibit F varying in total height from about 7 feet to 18.5 feet. No sub-laterals are to be constructed from these turnouts this year.

Construct a canal check dam in 6-54 near the west edge of Section 31 as shown on Exhibits D and E.

Construct field ditches to serve all portions of the fields from each farm turnout structure on Laterals 6-54-111-3 and 6-54-111-6.

Construct approximately 200 small plain concrete drop structures in the new field ditches and approximately 130 similar structures to replace existing worn or rotted out timber drop structures in Parcel A as shown on Exhibit H.

The first drop structure in each series will be constructed as a weir so as to provide a means of measuring the water applied to each field and thus permit more accurate control of the water.

Construct approximately 1830 wooden flumes for use in conveying the water from field ditches into head ditches. These will be approximately 12" x 12" x 4'-0", as shown on Exhibit J.

Construct approximately 16,920 wooden spiles for furrow tubes. These will be approximately 2-3/4" x 2-3/4" x 2'-0" as shown on Exhibit J.



Maintenance:

On the basis of six years previous experience, no maintenance will be required on the pipe line laterals. The silt nuisance is particularly bad in the San Carlos Irrigation Project, and the use of pipe laterals reduces the cleaning work to the care of the field ditches, which are small surface ditches and maintenance of these is a minor factor.



## V TRANSPORTATION FACILITIES

### Roads:

In addition to large quantities of material and supplies, including food, fuel and construction materials which will need to be hauled to the project from the railroad siding, it is estimated that approximately 3600 carloads or 55,000 tons of produce and manufactured articles, such as camouflage nets, will be shipped annually from this project, and a substantial road from the project area to the designated railroad siding at Serape will be required for trucking purposes. The most feasible trucking route is north on the Sweetwater Road to its junction with State Highway No. 87, from which point the Serape siding is two miles north over existing paved road.

The selection of the railroad siding site and the use of this route is partly based on one of the requirements stipulated in the Memorandum of Agreement between the Secretary of the Interior and the Director of the War Relocation Authority: to improve this section of the Sweetwater Road and its extension south to its junction with State Highway No. 187, as well as a road along the south edge of Sections 16, 17 and 18 to serve the Camp 2 area. The total length of paved roads proposed is 20 miles.

In addition to being suitable for War Relocation Authority use in the operation of this project, these paved roads will be an ultimate permanent improvement in the road system for this section of the state. The Sweetwater Road will shorten the distance from Phoenix to Casa Grande and other points south by four miles. The State of Arizona will also accept this road as a part of its State Highway System, to shorten the distance between Phoenix and Tucson (the two largest cities in the state) by two miles over any other existing route.

The Gila River is particularly treacherous during periods of flood flow, and bridge crossings on through routes in this vicinity are limited to only two. The improvement of the Sweetwater Road will increase the flood period river crossings to a total of three, which in addition to the saving of mileage on the through routes, is of extremely important military significance. Numerous military establishments are located to the north and south of the Gila River, which would be more efficiently connected by the Sweetwater Road.

Service roads at half mile intervals to all the fields are required for transportation of workers, tools, material and produce, as well as for tending the gates on the irrigation lines. A low class of road construction will be suitable for these roads, but they should be kept in good repair by constant maintenance. A total of approximately 53 miles of service roads are required for full development.

Proposed typical road sections are shown on Exhibit D, "Typical Cross Sections".



Bridges:

The existing bridge across the Gila River on the Sweetwater Road is narrow but is considered adequate for the needs of the immediate future, and should not need replacing or improvement until after the duration. Other existing bridges are shown on the map "Road System", Exhibit K, and are included in the uses outlined in this proposal.

The bridge proposed in the original irrigation layout across the main canal 6-54 at the takeoff of 6-54-125 is not necessary at that point and will be installed instead across 6-54 at the east end of Camp 1 to provide direct access to the warehouse area of that camp. Substitution of masonry abutments for reinforced concrete are recommended. A proposed design is shown on Exhibit L, "Typical Bridge", subject to the approval of the Indian Service - Irrigation Division.

Two bridges on the Sweetwater Road across Canal 6-54 and the Storm Drain respectively, are proposed. Designs will be similar to that shown on Exhibit M, Indian Irrigation Service "Special Bridge - State Highway 187".

Five box culverts will be required on the Sweetwater Road between Gila River and the junction with State Highway No. 87. Designs will be as shown on Exhibit N, Arizona Highway Department, "Details Lumber Deck Culverts".

Progressive Development:

Good access roads are of immediate urgent necessity so as to conserve automotive equipment. Toward this end, that portion of the Sweetwater Road from the storm water channel south of Camp 1 to the junction with State Highway No. 87, and the Camp 2 connecting road, a total of 18 miles will be improved and paved in 1943. The completion of the balance of 7 miles of the Sweetwater Road is proposed for 1947, but earlier completion is reserved for such requirements as military necessity, and State or War Relocation Authority requirements.

Construction of Service Roads will be developed as required for construction of irrigation laterals and finally completed on an annual schedule shown on Exhibit K, "Road System".

Maintenance:

The usual waterway, shoulder, and pavement patching will be the only maintenance required after completion of the 20 miles of paved road.

Service roads will require more or less constant maintenance in the form of blading, dragging, and regravelling on their surface, and maintenance of side ditches for proper drainage.



VI SOIL CONSERVATION OPERATIONS

Excessive applications of irrigation water are detrimental to the future water holding capacity of the surface soil, but since in the interest of economical operation, the water applied will be held to a minimum and excessive applications will not result.

Rotation of crops will be made in order to sustain high yields.

Conservation practices of the War Relocation Authority are subject to inspection by the Department of Interior, and their approval of such practices shall be construed as fulfillment of the conservation requirements.



# VII PRELIMINARY COST ESTIMATES

## Agricultural Development:

Agricultural Development will consist of the land subjugation, which will include the clearing of light sage brush, grading and floating.

The 1943 cost is estimated as follows:

$$1880 \text{ acres} @ \$ 44.60 = \$ 85,848.00$$

The subsequent annual development cost is estimated as follows:

<u>Year</u>	<u>Amount</u>	<u>Unit Cost</u>	<u>Total Cost</u>
1944	1600 acres	\$ 44.60	\$ 71,360.00
1945	1400 acres	44.60	62,440.00
1946	1680 acres	44.60	74,928.00
1947	1280 acres	44.60	57,088.00
Total Five Year Cost			\$349,684.00

## Irrigation Development:

### Turnout in Lateral 6-54-111 to 6-54-111-6

	<u>Amount</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Concrete - 4.5 cu.yds.			
Cement	27 bags	.75	\$ 20.25
Sand	2.7 cu.yds.	1.50	4.05
Rock	3.6 cu.yds.	1.50	5.40
1/2" sq.reinforcing steel (750 lin.ft.)	640 lbs.	.06	38.40
24" slide gate 8' frame (Calco 104 or equal)	1	33.00	33.00
Form Lumber	400 bd.ft.	50.00/M	20.00
Nails 10d	15 lbs.	.06	.90
Tie Wire 16 ga.	30 lbs.	.06	1.80
Bitumuls	1/2 gal.	.07	.04
Total Materials			\$123.84
Labor			82.16
Total Cost			\$206.00



Turnout in Canal 6-54 to 6-54-120

	<u>Amount</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Concrete - 6.2 cu.yds.			
Cement	38 bags	.75	\$ 28.50
Sand	3.8 cu.yds.	1.50	5.70
Rock	5.0 cu.yds.	1.50	7.50
1/2" sq. reinforcing steel (900 lin.ft.)	765 lbs.	.06	45.90
36" slide gate 6' frame (Calco 104 or equal)	1	59.50	59.50
Form Lumber	700 bd.ft.	50.00/M	35.00
Nails 10d	20 lbs.	.06	1.20
Tie Wire 16 ga.	35 lbs.	.06	2.10
Bitumuls	5 gal.	.07	.35
Total Materials			\$185.75
Labor			122.25
Total Cost			\$308.00

Check Dam in 6-54

Concrete - 51 cu.yds.			
Cement	310 bags	.75	232.50
Sand	31 cu.yds.	1.50	46.50
Rock	42 cu.yds.	1.50	63.00
1/2" sq. reinforcing steel (4,500 lin.ft.)	3,825 lbs.	.06	229.50
30# RR rail (22 lin.ft.)	220 lbs.	.02	4.40
5" x 6.7# channel (52 lin.ft.)	350 lbs.	.06	21.00
6" x 8.2# channel (5.5 lin.ft.)	29 lbs.	.06	1.74
3" x 7.5# I beam (1 lin.ft.)	8 lbs.	.06	.48
2" x 2" x 3/16" L (22 lin.ft.)	54 lbs.	.06	3.24
3" x 3" x 1/4" L (22 lin.ft.)	108 lbs.	.06	6.48
3" x 3" x 3/8" L (1 lin.ft.)	6 lbs.	.06	.36
4" x 3" x 1/2" L (1.25 lin.ft.)	14 lbs.	.06	.84
5" x 3" x 5/16" L (2 lin.ft.)	17 lbs.	.06	1.02
3/16" x 1" x 10'-0" plate	7 lbs.	.06	.42
3/4" x 3 1/2" x 14" plate	20 lbs.	.06	1.20
5'-0" x 8'-0" corrugated metal plate 16 ga.	132 lbs.	.09	11.88
1/4" Stove Bolts (10 ea.)	1 lb.	.23	.23
1/2" x 12" Anchor Bolts	24 ea.	.10	2.40
3/4" x 8" Anchor Bolts	22 ea.	.10	2.20
3/4" x 12" Anchor Bolts	17 ea.	.17	2.89



<u>Check Dam in 6-54 (Cont'd)</u>	<u>Amount</u>	<u>Unit Cost</u>	<u>Total Cost</u>
1-15/16" cold rolled shafting (18 lin.ft.)	181 lbs.	.10	\$ 18.10
1 1/4" hand wheel shaft (2 lin.ft.)	9 lbs.	.10	.90
1-15/16" bronze bearings (7 ea.)	48 lbs.	.50	24.00
3 1/2" I.D. pipe (1 lin.ft.)	13 lbs.	.06	.78
24" diam. Handwheel	1	5.00	5.00
10" - 25 tooth gear	1	10.00	10.00
6" - worm gear	1	3.00	3.00
Double flange cast wheels	4	5.00	20.00
1/2" hoist cable	16 lin.ft.	.0975	1.56
Flat washers	11 lbs.	.13	1.43
Nails	50 lbs.	.06	3.00
Tie Wire 16 ga.	100 lbs.	.06	6.00
5" Rubber Belting	10 lin.ft.	.34	3.40
Form Lumber	1,350 bd.ft.	50.00/M	67.50
Lumber - Flashboards, walks and Fillers	548 bd.ft.	60.00/M	32.88
Bits	10 gal.	.07	.70
Total Materials			\$ 830.53
Labor			549.47
Total Cost			\$1,380.00

Field Checks (330 Required)

Concrete - 795 cu.yds.			
Cement	4,770 bags	.75	3,577.50
Sand	477 cu.yds.	1.50	715.50
Rock	636 cu.yds.	1.50	954.00
Bits	165 gal.	.07	11.55
Lumber - Use salvaged lumber from checks and T.O. for panel forms			
Total Materials			\$5,258.55
Labor			3,471.45
Total Cost			\$8,730.00



Pipe Line 6-54-111-6

	<u>Amount</u>	<u>Unit</u> <u>Cost</u>	<u>Total</u> <u>Cost</u>
Cost in Place			
Pipe - 30"	1,575 ft.	1.50	\$ 2,362.50
Pipe - 24"	5,290 ft.	.95	5,025.50
Pipe - 20"	5,240 ft.	.70	3,668.00
Pipe - 16"	5,503 ft.	.46	2,531.38
Total length	<u>17,608 ft.</u>		
Field laterals 16"	<u>17,160 ft.</u>	.46	<u>7,893.60</u>
Total pipe	34,768 ft.		\$21,480.98

Pipe manufacture and laying breakdown:

Cement (making)	11,201 bags	.75	8,400.75
Cement (laying)	1,763 bags	.75	1,322.25
Sand (making)	737 cu.yds.	1.50	1,105.50
Sand (laying)	135 cu.yds.	1.50	202.50
Rock (making)	528 cu.yds.	1.50	792.00
Lime (laying)	176 50# bags	.35	61.60
Labor - make,exc.lay. & backfill			<u>9,506.38</u>
			\$21,480.98

Pipe Line 6-54-120

Cost in Place			
Pipe - 36"	5,809 ft.	2.95	17,136.55
Pipe - 30"	<u>5,290 ft.</u>	1.50	<u>7,935.00</u>
Total length, 1943 const.	11,099 ft.		\$25,071.55

Pipe manufacture and laying breakdown:

Cement (making)	9,175 bags	.75	6,879.75
Cement (laying)	1,860 bags	.75	1,395.00
Sand (making)	666 cu.yds.	1.50	999.00
Sand (laying)	147 cu.yds.	1.50	220.50
Rock (making)	436 cu.yds.	1.50	654.00
Lime (laying)	186 50# bags	.35	65.10
Labor - make,exc.lay. & backfill			<u>14,858.20</u>
			\$25,071.55



Farm Turnout Structures 6-54-111-6 (13 Required)

	<u>Amount</u>	<u>Unit</u> <u>Cost</u>	<u>Total</u> <u>Cost</u>
Concrete - 79 cu.yds.			
Cement	475 bags	.75	\$ 356.25
Sand	48 cu.yds.	1.50	72.00
Rock	64 cu.yds.	1.50	96.00
1/2" sq. reinforcing steel (7900 lin.ft.)	6,712 lbs.	.06	402.72
5" x 11.5" channel (50 lin.ft.)	572 lbs.	.10	57.20
1/2" x 10" Anchor Bolts	78 ea.	.10	7.80
5/8" x 8" Anchor Bolts	26 ea.	.10	2.60
Flat Washers	3 lbs.	.13	.39
Nails	260 lbs.	.06	15.60
Tie Wire 16 ga.	520 lbs.	.06	31.20
Bits	8 gal.	.07	.56
Lumber - Flashboards & Covers	1,755 bd.ft.	50.00/M	87.75
Lumber - Forming	1,000 bd.ft.	50.00/M	50.00
Slide Gates (Calco 104 or equal)			
16" x 3'-0" stem	4 ea.	15.00	60.00
16" x 4'-0" stem	1 ea.	16.00	16.00
16" x 5'-0" stem	1 ea.	17.00	17.00
16" x 6'-0" stem	1 ea.	18.00	18.00
16" x 7'-0" stem	6 ea.	19.00	114.00
16" x 8'-0" stem	2 ea.	20.00	40.00
16" x 10'-0" stem	1 ea.	23.00	23.00
16" x 11'-0" stem	1 ea.	24.00	24.00
20" x 9'-0" stem	2 ea.	36.00	72.00
20" x 10'-0" stem	1 ea.	37.00	37.00
20" x 14'-0" stem	1 ea.	38.00	38.00
24" x 7'-0" stem	1 ea.	35.00	35.00
24" x 8'-0" stem	1 ea.	36.00	36.00
24" x 9'-0" stem	1 ea.	41.00	41.00
24" x 12'-0" stem	1 ea.	42.00	42.00
30" x 6'-0" stem	1 ea.	51.00	51.00
Gate Stems 1" rod (Calco 172 or equal)	13 ea.	4.39	57.07
Total Materials			\$ 1,901.14
Labor			<u>1,253.86</u>
Total Cost			\$ 3,155.00



Farm Turnout Structures (9 Required)

	<u>Amount</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Concrete - 76 cu.yds.			
Cement	456 bags	.75	\$ 342.00
Sand	46 cu.yds.	1.50	69.00
Rock	61 cu.yds.	1.50	91.50
1/2" sq. reinforcing steel (7480 lin.ft.)	6,359 lbs.	.06	381.54
5" x 11.5# channel (42 lin.ft.)	472 lbs.	.10	47.20
1/2" x 10" Anchor Bolts	54 ea.	.10	5.40
5/8" x 8" Anchor Bolts	18 ea.	.10	1.80
Flat Washers	2 lbs.	.13	.26
Nails	180 lbs.	.06	10.80
Tie Wire 16 ga.	360 lbs.	.06	21.60
Bits	5 gal.	.07	.35
Lumber - Flashboards & Covers	1,709 bd.ft.	50.00/M	85.45
Lumber - Forming	1,000 bd.ft.	50.00/M	50.00
Slide Gates (Calco 104 or equal)			
16" x 3'-0" stem	1 ea.	15.00	15.00
16" x 4'-0" stem	1 ea.	16.00	16.00
16" x 6'-0" stem	1 ea.	18.00	18.00
16" x 8'-0" stem	1 ea.	20.00	20.00
16" x 9'-0" stem	1 ea.	23.00	23.00
16" x 10'-0" stem	2 ea.	23.00	46.00
16" x 14'-0" stem	1 ea.	25.00	25.00
20" x 10'-0" stem	1 ea.	37.00	37.00
30" x 9'-0" stem	1 ea.	62.00	62.00
30" x 10'-0" stem	1 ea.	63.00	63.00
30" x 12'-0" stem	1 ea.	64.00	64.00
30" x 13'-0" stem	1 ea.	65.00	65.00
30" x 17'-0" stem	1 ea.	79.00	79.00
36" x 6'-0" stem	2 ea.	60.00	120.00
36" x 8'-0" stem	1 ea.	66.00	66.00
36" x 12'-0" stem	1 ea.	77.00	77.00
Gate Stems 1" rod (Calco 172 or equal)	9 ea.	4.39	<u>39.51</u>
Total Materials			\$ 1,942.41
Labor			<u>1,282.59</u>
Total Cost			\$ 3,225.00



Wooden Flumes (1,880 Required)

	<u>Amount</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Rwd. No. 1 Common	28,200 bd.ft.	75.00/M	\$2,115.00
Nails 8d Common	266 lbs.	.06	15.96
Total Materials			\$ 2,130.96
Labor			1,084.04
Total Cost			\$ 3,195.00

Wooden Spiles (16,920 Required)

Rwd. No. 1 Common	45,000 bd.ft.	75.00/M	3,375.00
Nails 8d Common	2,553 lbs.	.06	153.18
Total Materials			\$ 3,528.18
Labor			1,716.82
Total Cost			\$ 5,245.00

Total Estimated 1943 Cost - \$ 71,996.53

The subsequent annual development cost is estimated as follows:

1944	\$ 57,600.00
1945	50,400.00
1946	60,480.00
1947	47,560.00

Total 5-year Cost \$287,836.53

Transportation Development:

Clearing and Grubbing	80 Acres	100.00	8,000.00
Unclassified Excavation	500,000 cu.yds.	.25	125,000.00
Uncl. Excav. for Structure	5,500 cu.yds.	1.00	5,500.00
Uncl. Excav. for Borrow	100,000 cu.yds.	.25	25,000.00
Overhaul	1,000,000 sta.yds.	.01	10,000.00
Furrow Ditch	20,000 lin.ft.	.05	1,000.00
Watering	9,000 M.Gals.	2.00	18,000.00
Gravel Base Course, Cl. B	90,000 cu.yds.	1.25	112,500.00
Select, Borrow Surface Cour.	10,000 cu.yds.	1.00	10,000.00



Transportation Development (Cont'd):

	<u>Amount</u>	<u>Unit</u> <u>Cost</u>	<u>Total</u> <u>Cost</u>
Type 2 Blotter Material	1,800 cu.yds.	3.00	\$ 5,400.00
Road Oil for Seal Coat	700,000 gals.	.08	56,000.00
Cl. B-1 Pavement Rd. Mix	220,000 sq.yds.	.30	66,000.00
Case 1			
Concrete, Cl. A	345 cu.yds.	20.00	6,900.00
Reinforcing Steel	2,600 lbs.	.10	260.00
Untreated Timber	7 M.B.F.	150.00	1,050.00
Treated Timber (Creosote)	76 M.B.F.	125.00	9,500.00
Cement Rubble Masonry	810 cu.yds.	15.00	12,150.00
18" Conc. Culvert Pipe	2,600 lin.ft.	1.50	3,900.00
24" Conc. Culvert Pipe	400 lin.ft.	2.50	1,000.00
30" Conc. Culvert Pipe	200 lin.ft.	3.50	700.00
36" Conc. Culvert Pipe	200 lin.ft.	5.00	1,000.00
48" Conc. Culvert Pipe	50 lin.ft.	10.00	500.00
Treated Timber Piling	600 lin.ft.	1.00	600.00
Loose Riprap	200 cu.yds.	5.00	1,000.00
Cattle Guards	1 ea.	1,000.00	1,000.00
Barbed Wire Fence	5,000 lin.ft.	.10	500.00
Remove & Reset Exist. Fence	110,000 lin.ft.	.06	6,600.00
Remove & Reset Power Poles	Lump ea.	Lump	2,000.00
Remove & Reset Irrig. Struct.	150 ea.	10.00	1,500.00
Rough Hardware (Bolts, nails, etc.)	333 lbs.	.06	20.00
			\$ 492,580.00
Plus 15% engr. and contingencies			73,890.00
Total estimated 1943 Cost			\$ 566,470.00

The subsequent annual development cost is estimated as follows:

1944	\$ 12,540.00
1945	11,220.00
1946	5,840.00
1947	25,080.00
Total Five-year Cost	\$621,250.00



VIII SUMMARY OF DEVELOPMENT DATA

Total estimated costs for annual development are as follows:

<u>1943</u>		
	Agricultural Development	\$ 83,848.00
	Irrigation Development	71,996.53
	Transportation Development	<u>566,470.00</u>
	Total 1943 Cost	\$722,314.53
<u>1944</u>		
	Agricultural Development	\$ 71,360.00
	Irrigation Development	57,600.00
	Transportation Development	<u>12,540.00</u>
	Total 1944 Cost	\$141,500.00
<u>1945</u>		
	Agricultural Development	\$ 62,440.00
	Irrigation Development	50,400.00
	Transportation Development	<u>11,220.00</u>
	Total 1945 Cost	\$124,060.00
<u>1946</u>		
	Agricultural Development	\$ 74,928.00
	Irrigation Development	60,480.00
	Transportation Development	<u>5,940.00</u>
	Total 1946 Cost	\$141,348.00
<u>1947</u>		
	Agricultural Development	\$ 57,088.00
	Irrigation Development	47,360.00
	Transportation Development	<u>25,080.00</u>
	Total 1947 Cost	\$129,528.00
Total 5 year complete development cost		\$1,258,750.53

Justification for Development:

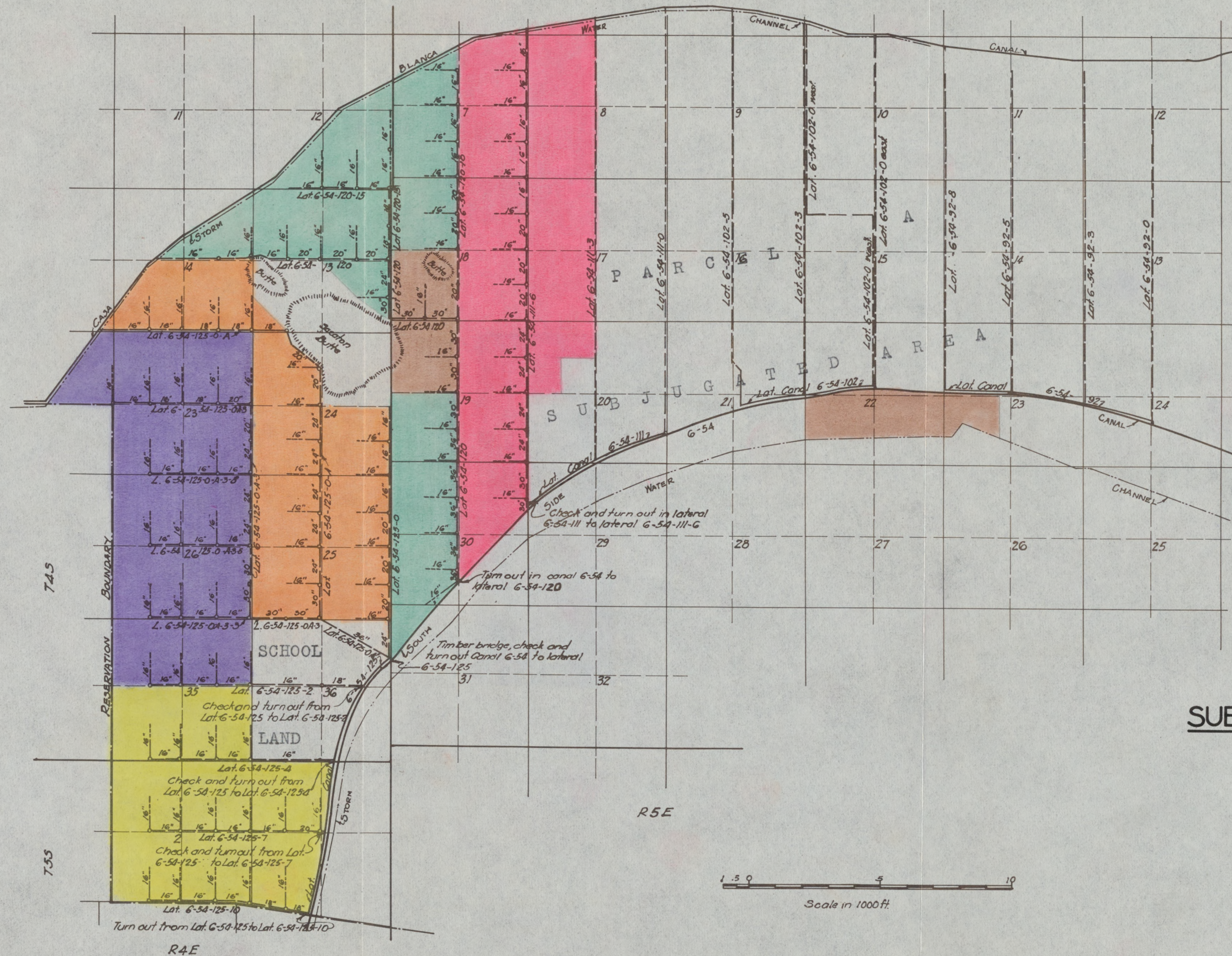
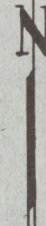
Aside from the intangible benefits to be gained from the work proposed herein, in the form of useful occupational fulfillment, development of land for posterity, and improvement of transportation facilities for military and other uses, the agricultural and irrigation development costs are compared with the annual rent reduction for the land by virtue of the improvements made thereon for justification purposes.



The total five year cost for agricultural and irrigation development for 7840 acres of new land is \$637,500, totaled from the previous cost data. The free rent allowance for the 7840 acres at \$20 per acre for five years is \$784,000. This indicates a gain to the War Relocation Authority of \$146,500 at the end of a five year period, should it be necessary to operate the project for this length of time.

The total cost of the five year road construction program is \$621,250, totaled from the previous cost data. It has been determined that an average cost of \$2.40 per ton on a 45% load factor performance will be an equitable value for the haul from the project to the railhead, which will amount to \$132,000 per year or \$660,000 for the 55,000 tons of export estimated annually. This dollar volume of trucking alone is considered to be adequate justification for an improved road system, without giving consideration to the intangible benefits derived therefrom.





#### LEGEND

- Canals
- Pipe laterals to be constructed
- Pipe laterals constructed prior to June 1942
- Turn out structures to forms and/or sub laterals
- Sub laterals to 40 ac. subdivision
- Inside diameter of concrete pipes
- Storm water channels
- Reservation boundary

#### Camp Areas

1943 Subjugation

1944 Subjugation

1945 Subjugation

1946 Subjugation

1947 Subjugation

## EXHIBIT A SUBJUGATION SCHEDULE

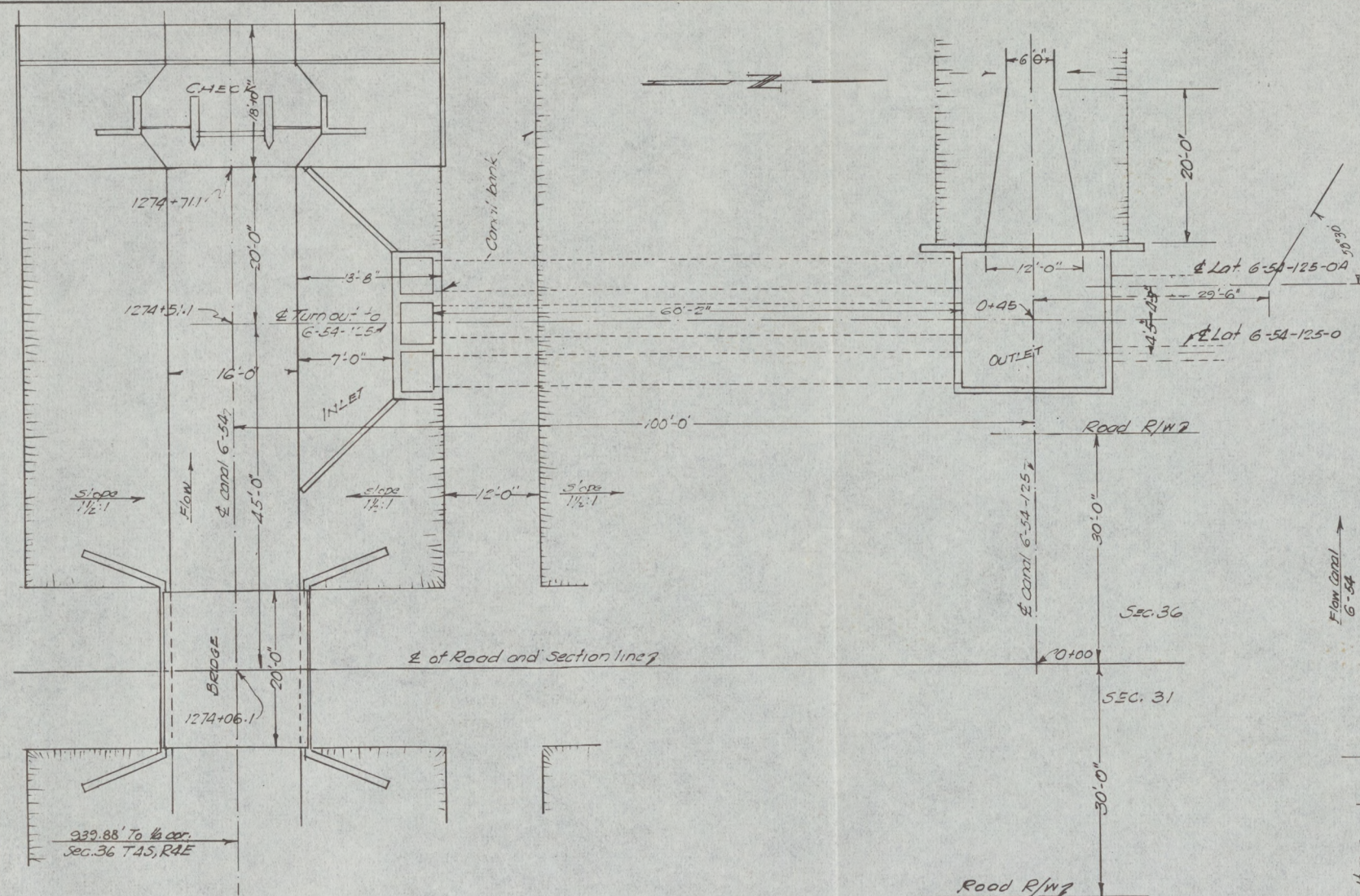
DEPARTMENT OF THE INTERIOR  
**INDIAN SERVICE - IRRIGATION DIVISION**  
A.L. WATHEN - ACTING CH. ENG. C.H. SOUTHWORTH, ACT. DIR.  
HERBERT V. CLOTTIS, ASST. DIR.  
**WAR RELOCATION AUTHORITY**  
**GILA RIVER AREA**

E.R. SMITH - PROJECT DIRECTOR

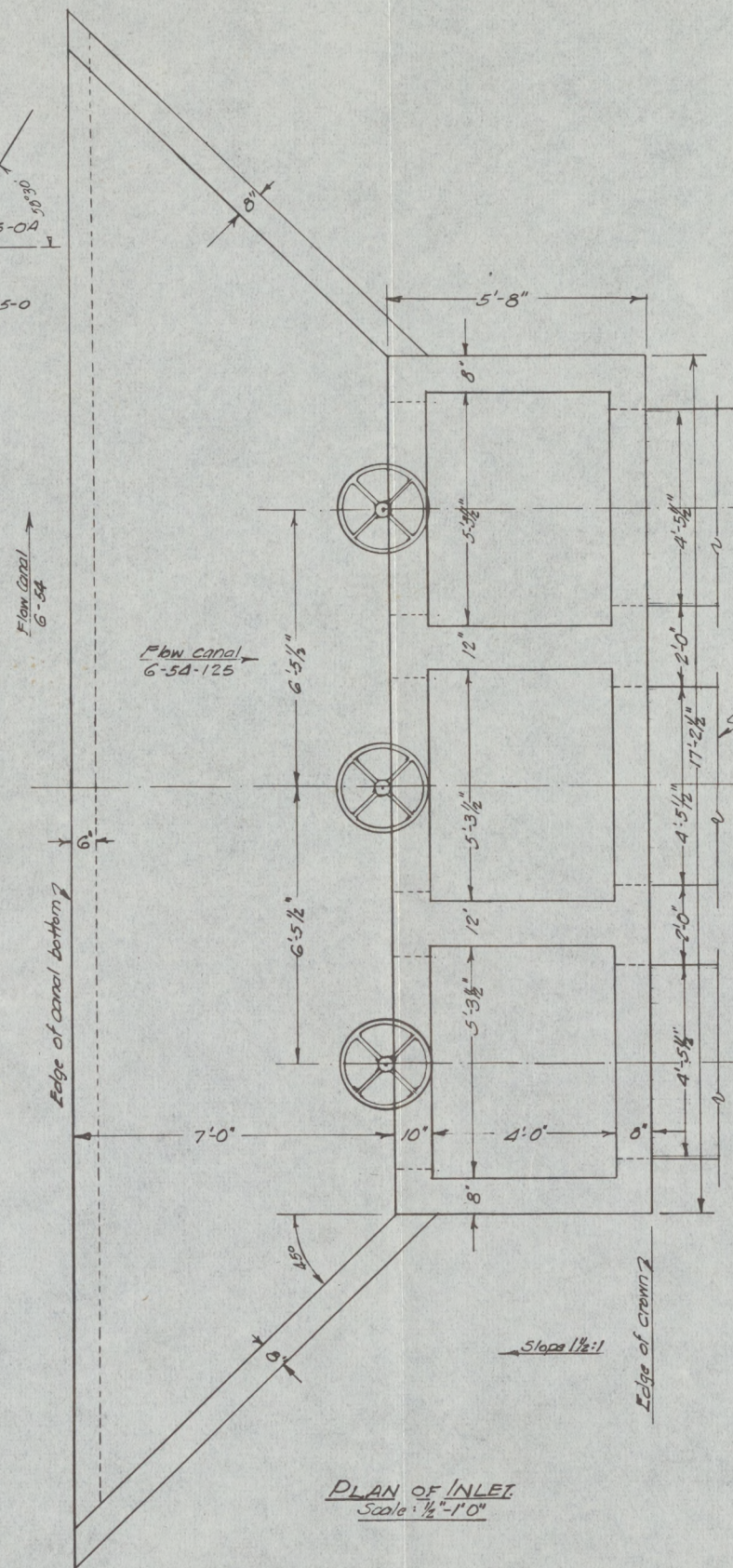
MAP OF AREA LEASED TO  
WAR RELOCATION AUTHORITY

SHOWING LOCATION OF  
CANALS - STORM WATER CHANNELS - PIPE  
LATERALS CONSTRUCTED & TO BE CONSTRUCTED  
June 20, 1942 G.B.K.

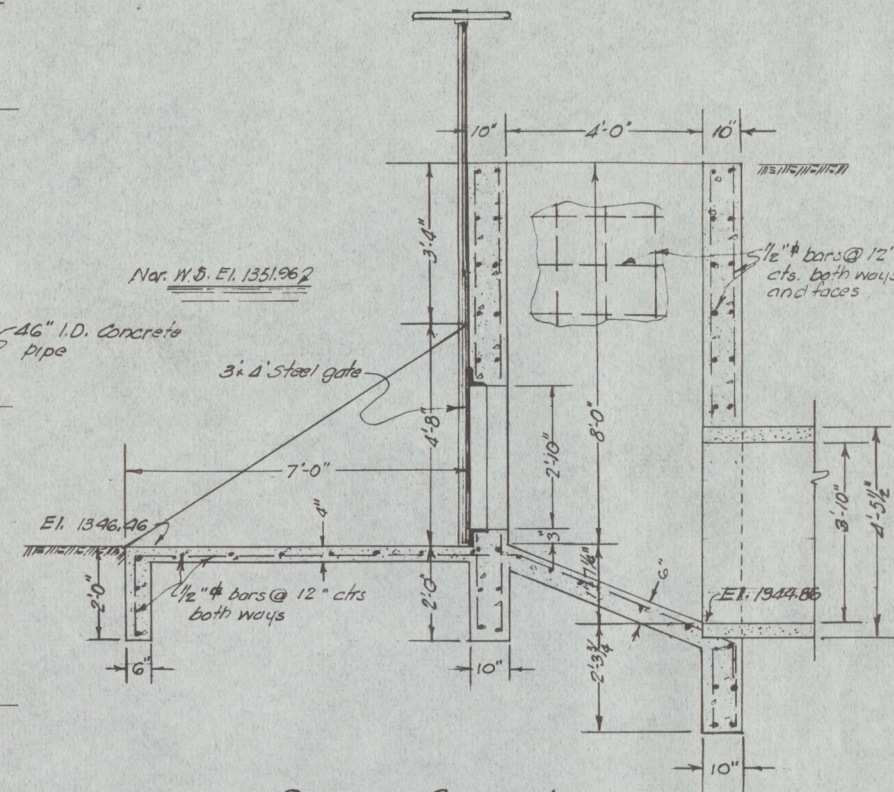




GENERAL LAYOUT PLAN OF  
BRIDGE CHECK AND TURNOUT  
Scale: 1"=10'-0"



PLAN OF INLET  
Scale: 1/2"=1'-0"



SECTION CENTER LINE  
Scale: 1/2"=1'-0"

## EXHIBIT B

DEPARTMENT OF INTERIOR  
INDIAN SERVICE - IRRIG. DIV.  
A.L. WATHEN, AC. CH. ENGR. - C.H. SOUTHWORTH, AC. DIR.  
H.V. CLOTTIS, ASST. DIR.  
SAN CARLOS PROJECT - ARIZ.

WAR RELOCATION AUTHORITY  
GILA RIVER AREA  
E.M. SMITH, PROJ. DIR.

LAYOUT AND PLAN  
OF T.O. TO LAT. 6-54-125

DRAWN G.B.K.  
TRACED G.B.L.  
JUNE 18, 1942

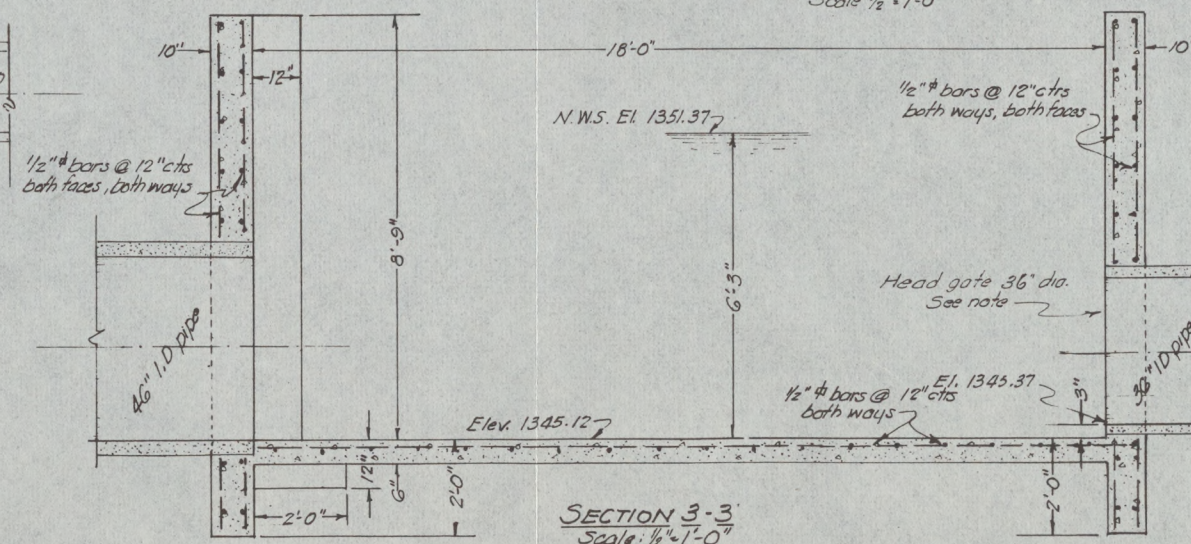
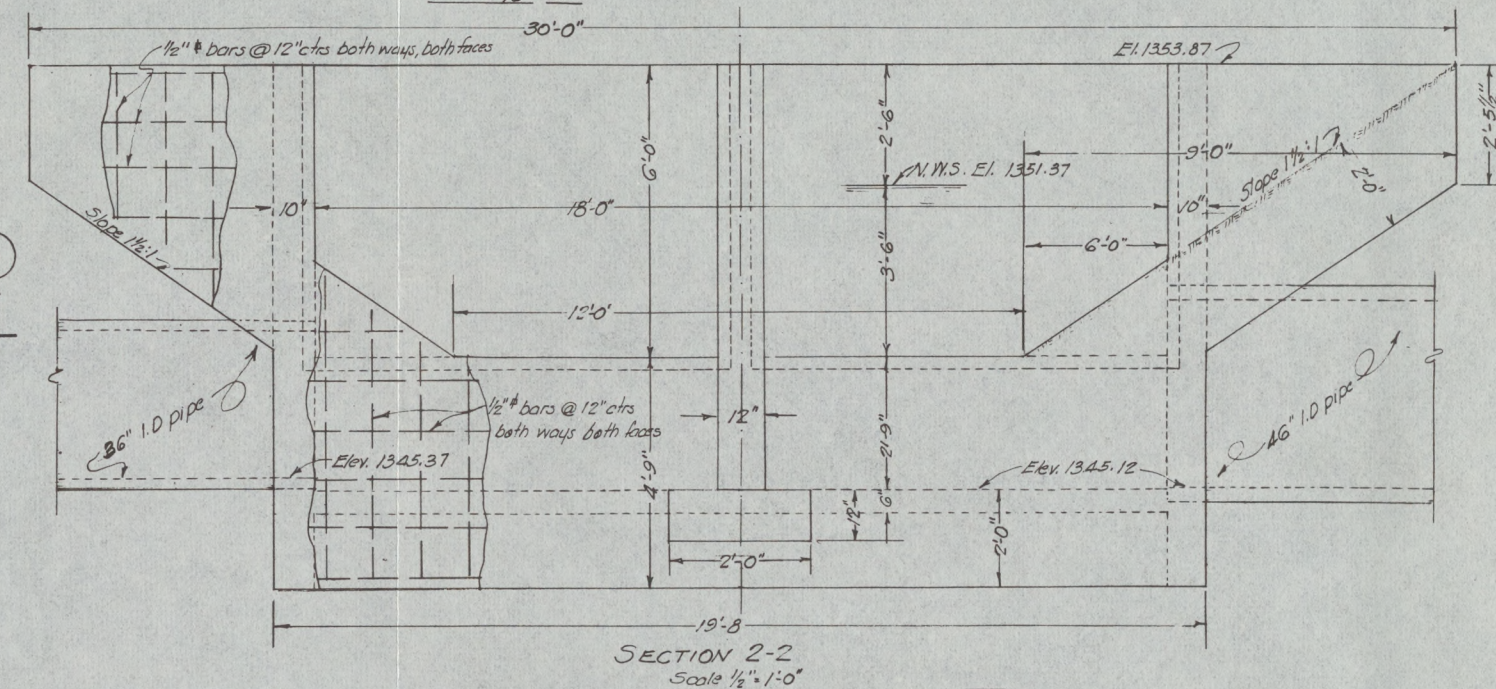
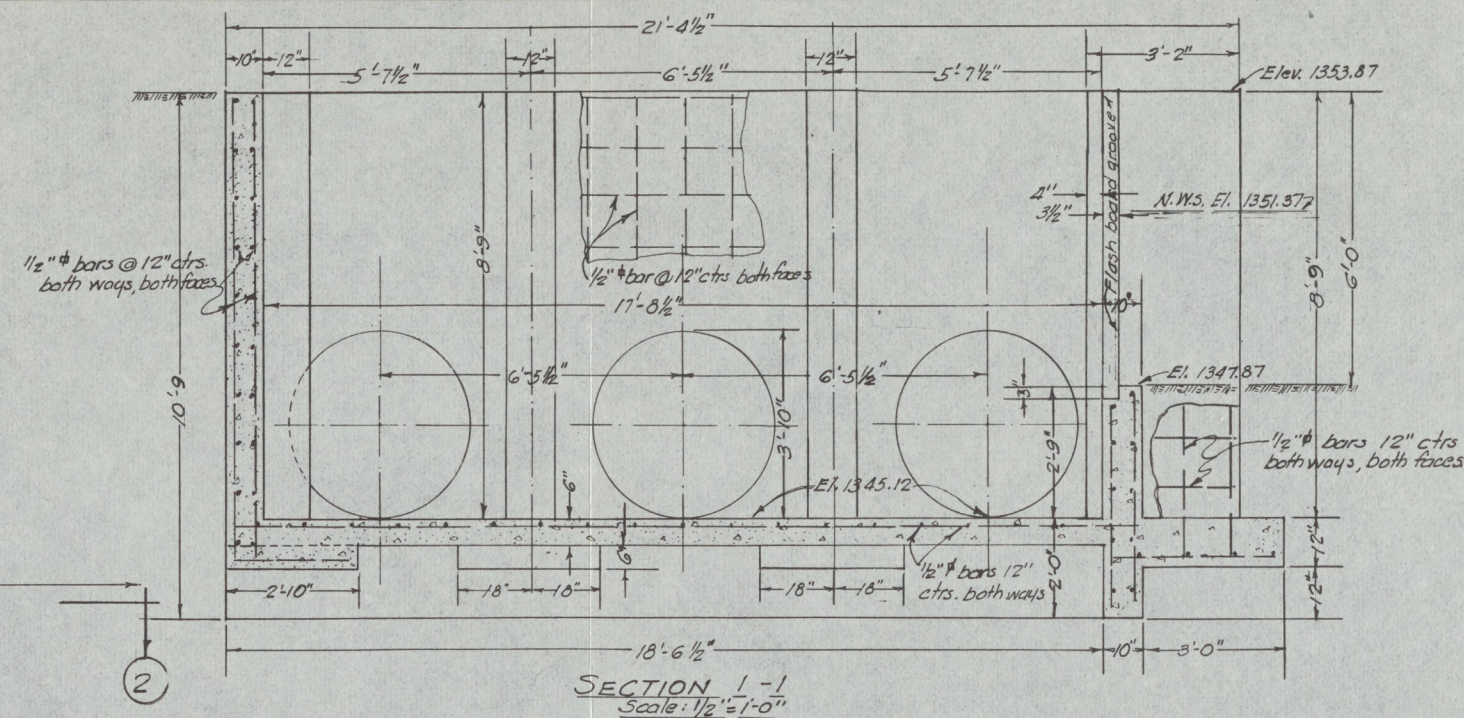
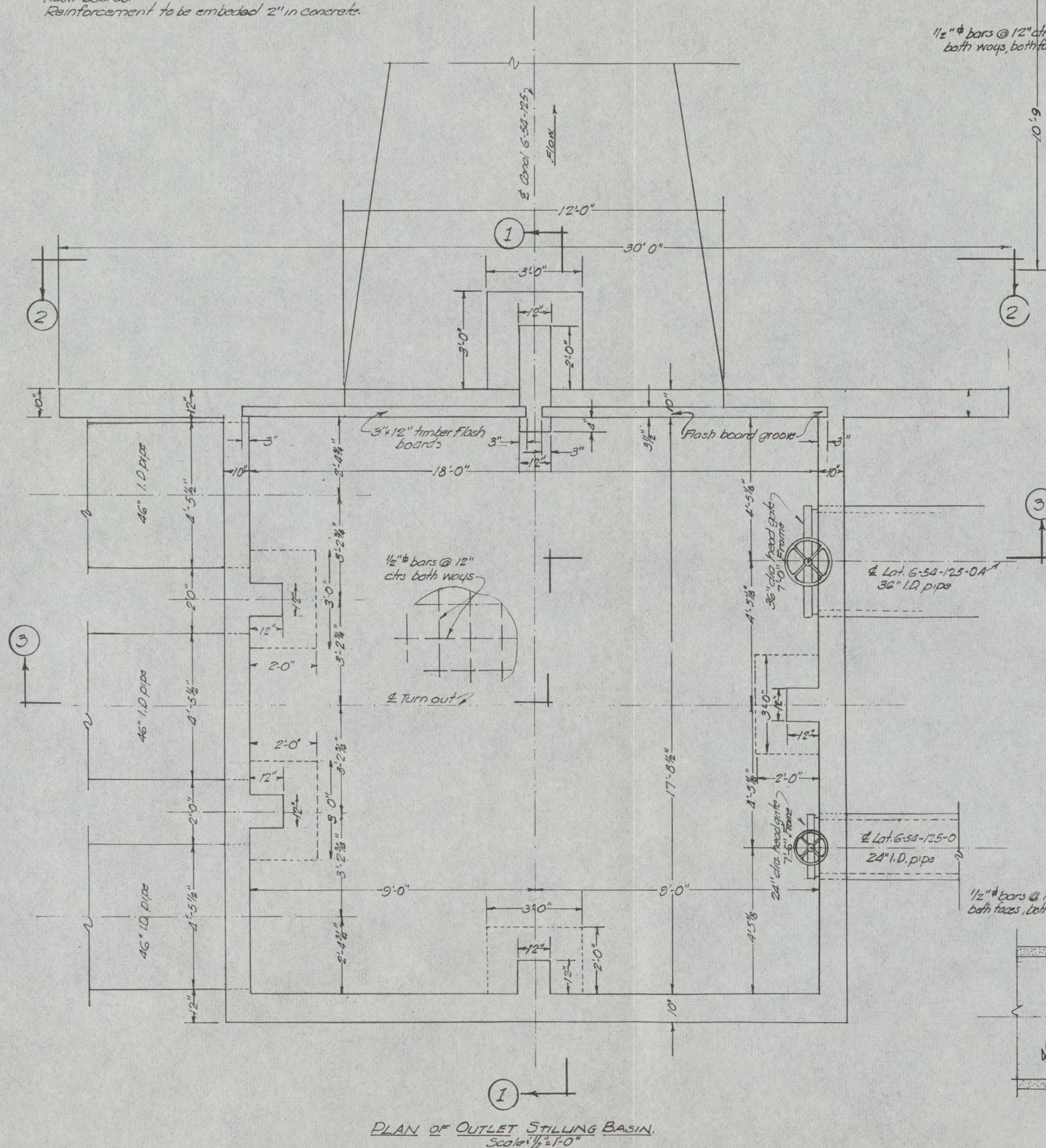
SCALE  
AS SHOWN

SUBMITTED B.B. Russell  
RECOMMENDED J.B. Brown  
APPROVED G.D. Smith



# NOTES

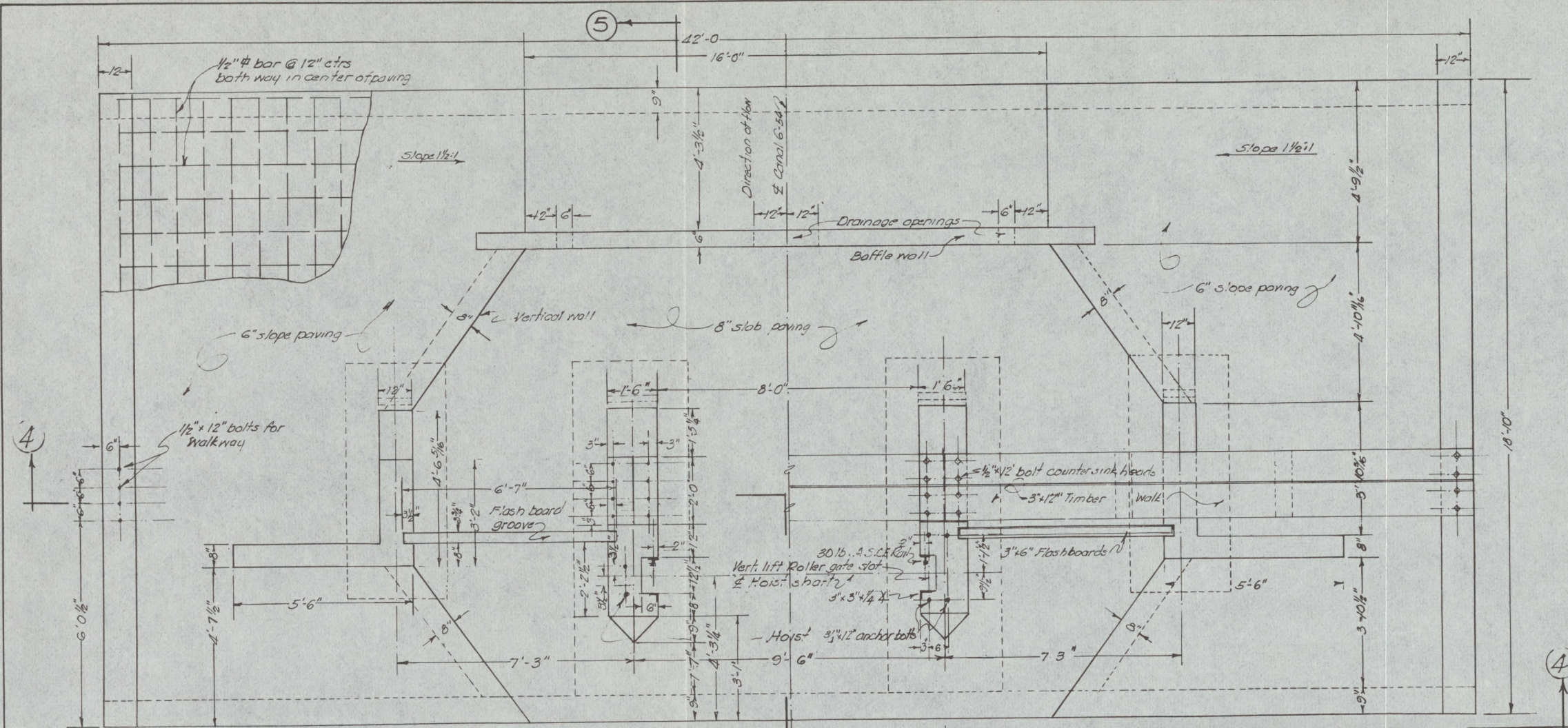
The location of outlet gates are shown in plan only. The details of connecting bolts shall conform with the manufacturer's drawing.  
 Stilling basin to be equipped with 3"x12" timber flash boards.  
 Reinforcement to be embedded 2" in concrete.



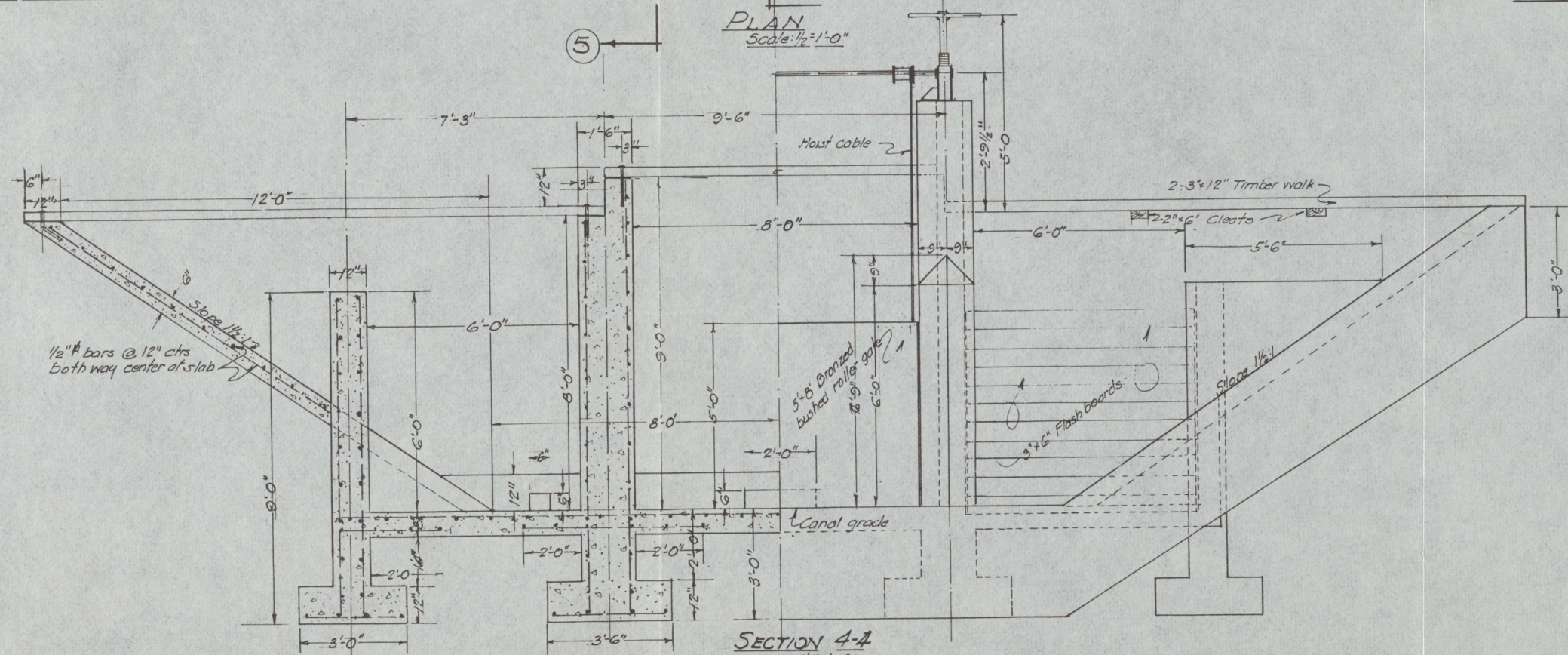
## EXHIBIT C

DEPARTMENT OF INTERIOR INDIAN SERVICE IRRIG. DIV. A.L. WATSON, AG. CH. ENGR. - C.H. SOUTHWORTH, AG. DIR. H.V. CLOTTE, ASST. DIR.		
SAN CARLOS PROJECT- ARIZONA		
WAR RELOCATION AUTHORITY GILA RIVER AREA E.R. SMITH, PROJ. DIR.		
DETAIL OF T.O. TO LAT. 6-54-125		
DRAWING BY TRACED BY JUNE 18, 1942	SCALE AS SHOWN	SUBMITTED BY RECOMMENDED BY APPROVED BY

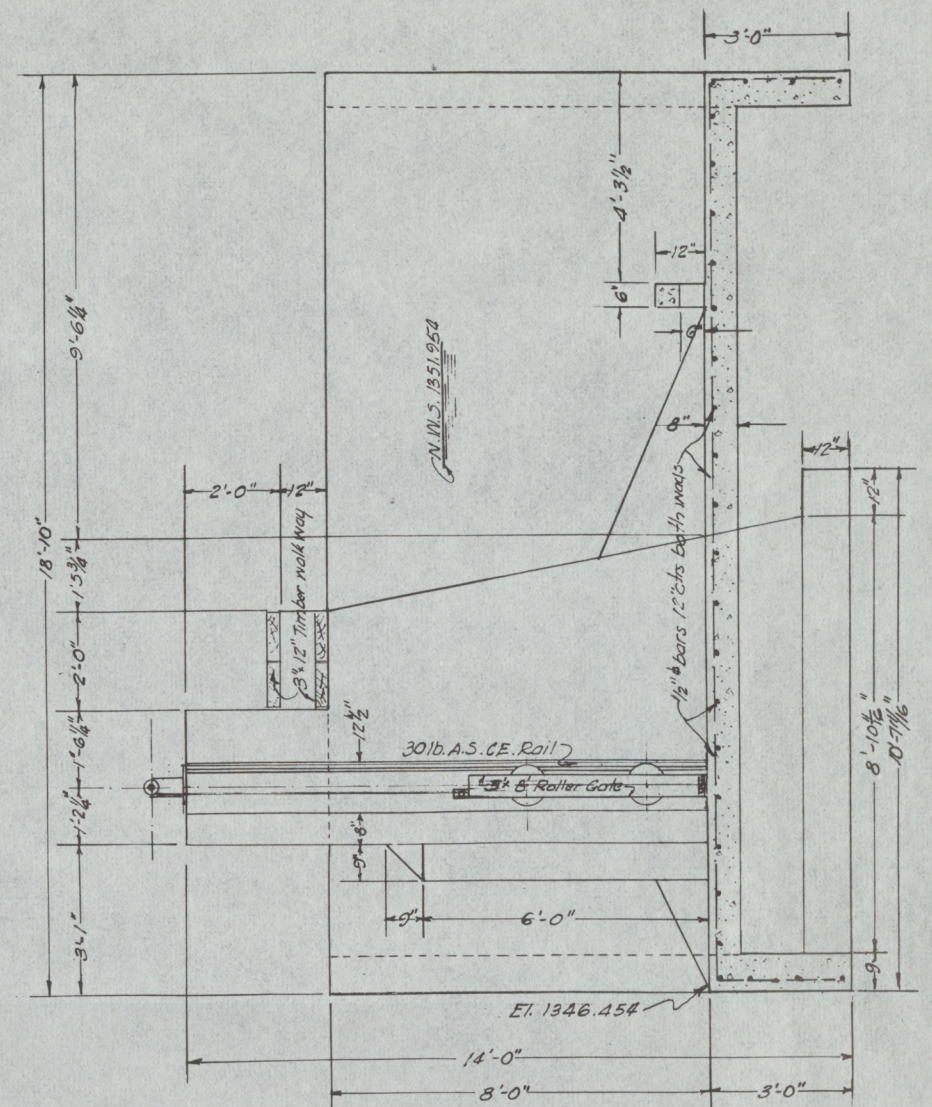




PLAN  
Scale: 1/2" = 1'-0"



SECTION 4-4  
Scale: 1/2" = 1'-0"



SECTION 5-5  
Scale: 1/2" = 1'-0"

## EXHIBIT D

DEPARTMENT OF INTERIOR  
INDIAN SERVICE - IRRIG. DIV.  
A.L. WATSON, AC. CH. ENGR. - C.H. SOUTHWORTH, AC. DIR.  
H.V. CLOTT, ASST. DIR.

SAN CARLOS PROJECT - ARIZ.

CHECK - LATERAL T.O.

6-54-125

WAR RELOCATION AUTHORITY  
GILA RIVER AREA

E.R. SMITH, PROJ. DIR.

DRAWN G. B. K.  
TRACED G. B. K.  
JUNE 18, 1942

SCALE  
AS SHOWN

SUBMITTED  
RECOMMEND  
APPROVED



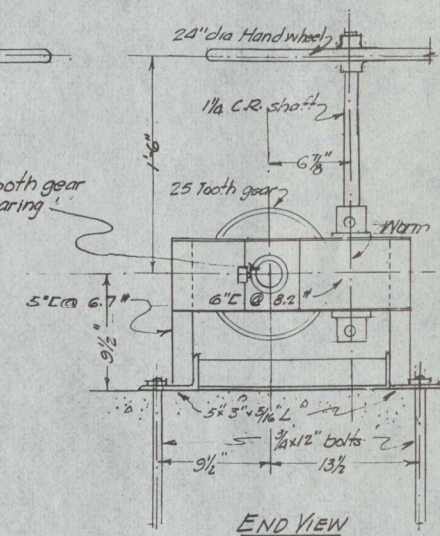
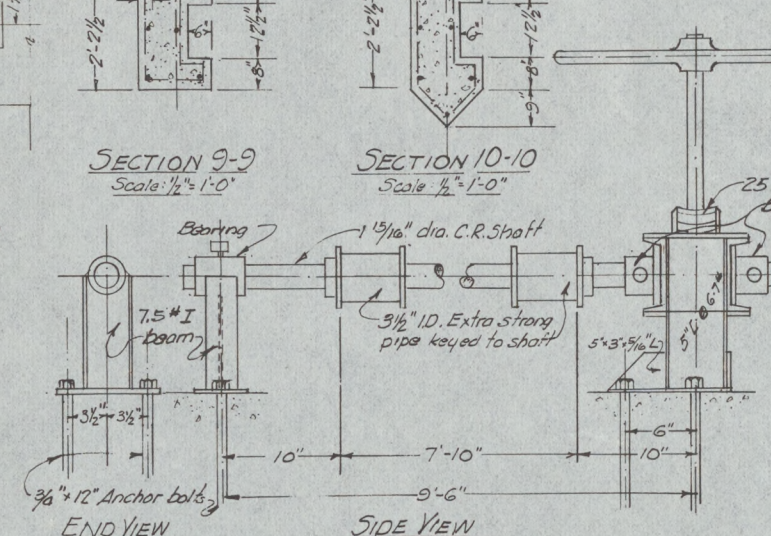
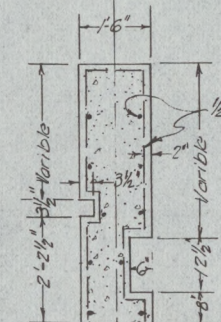
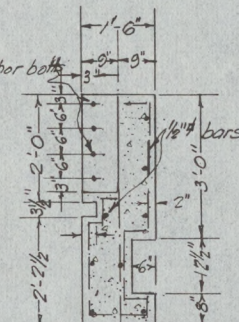
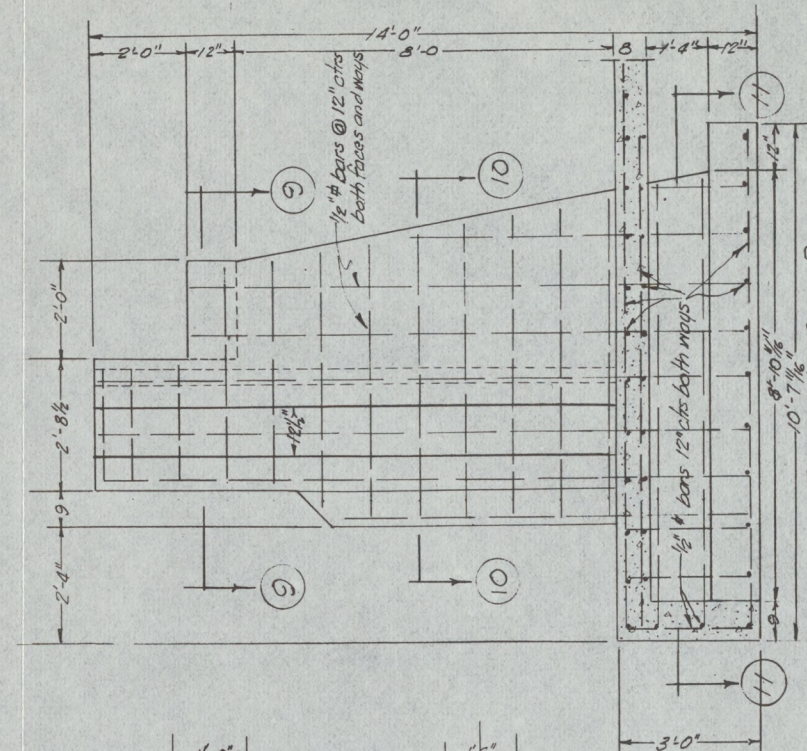
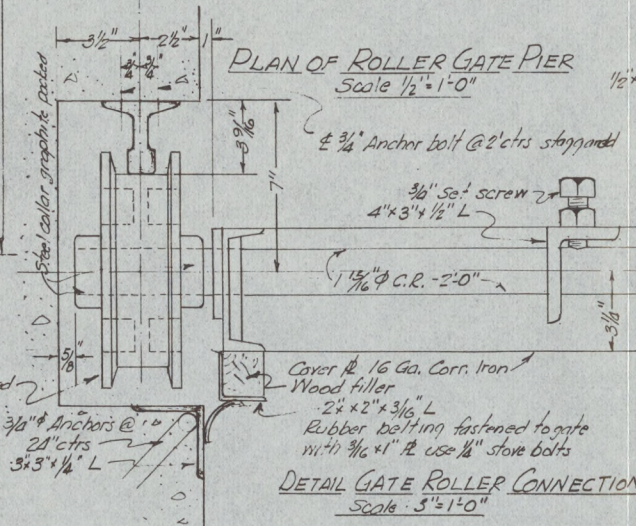
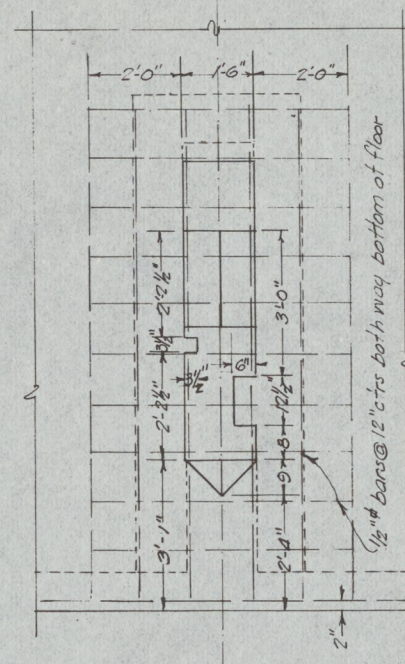
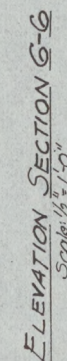
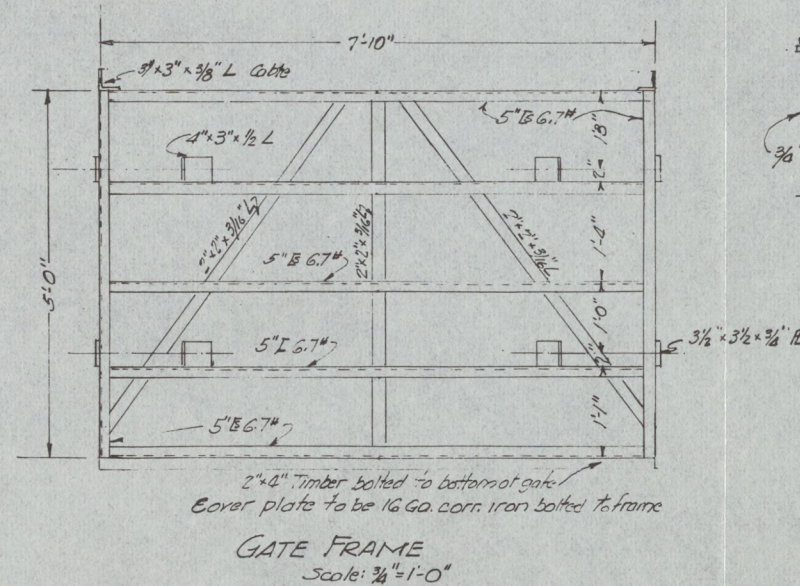
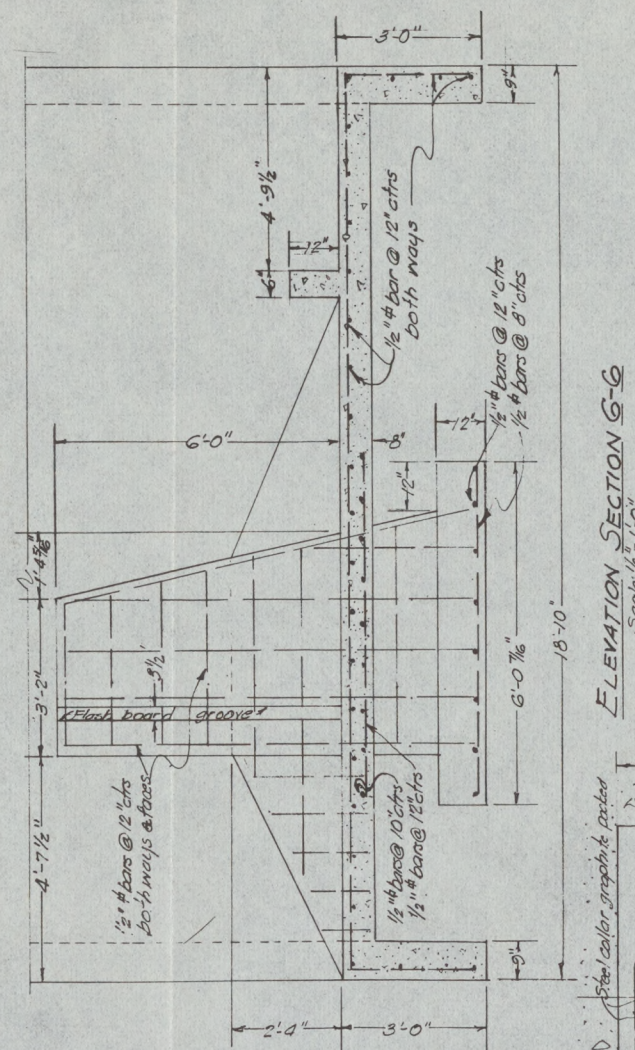
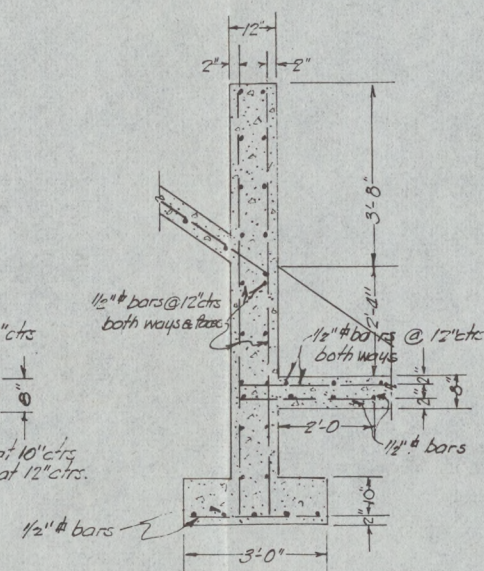
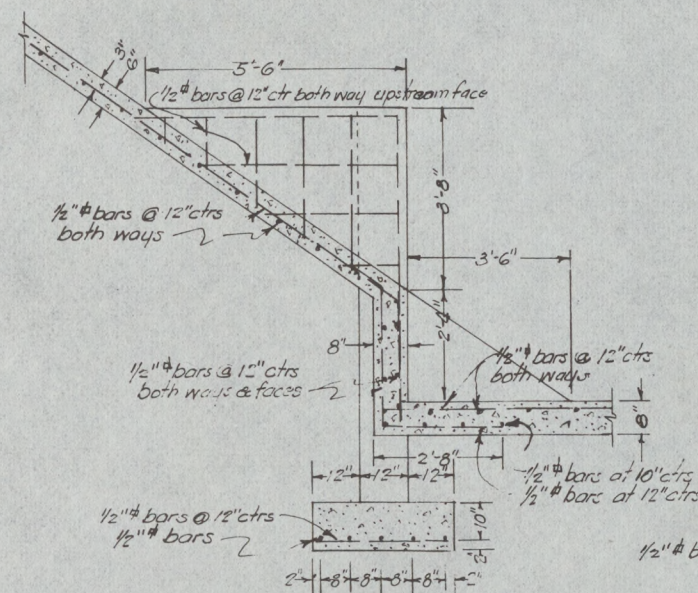
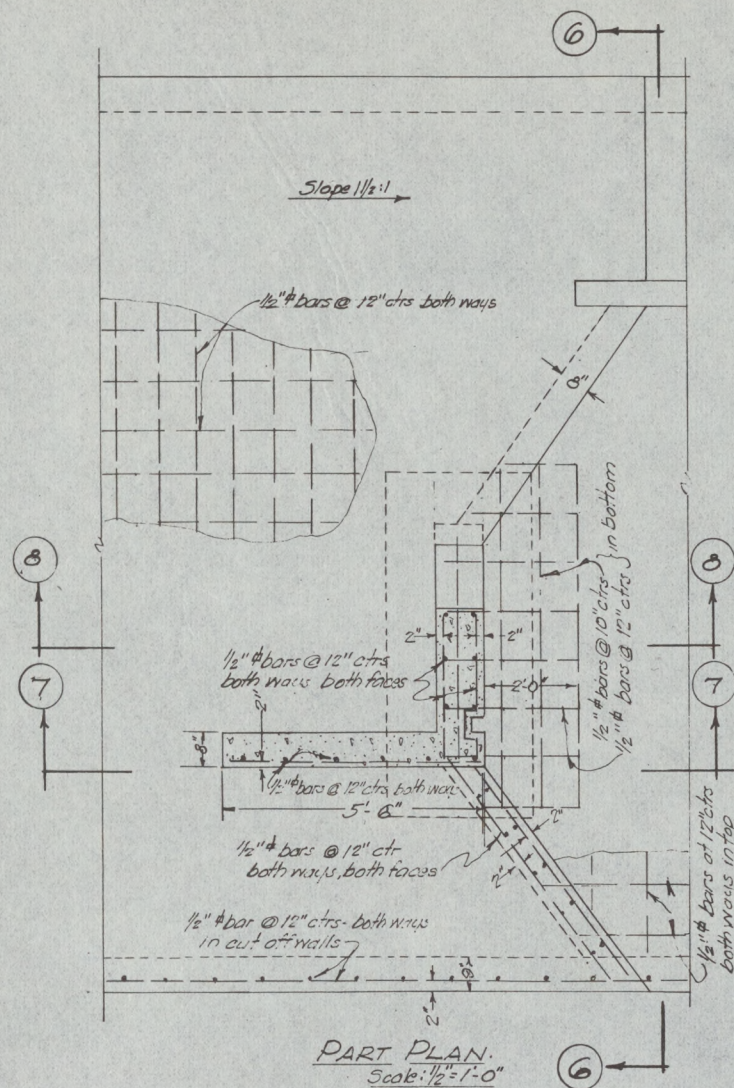


EXHIBIT E

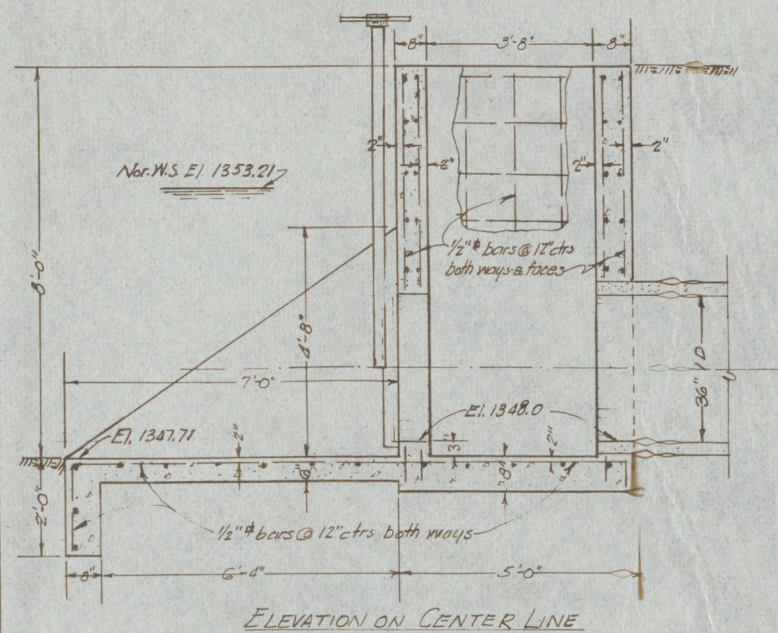
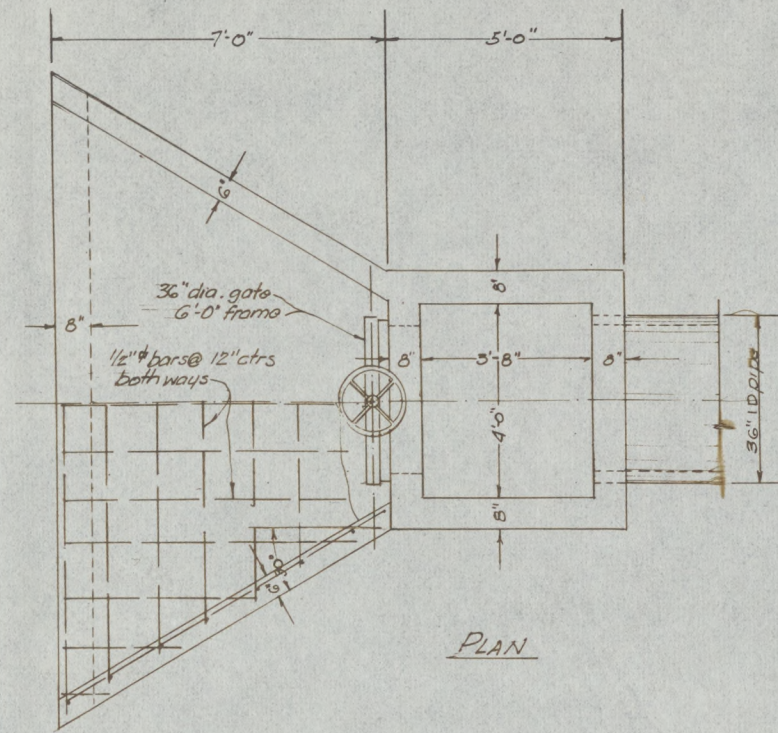
DEPARTMENT OF INTERIOR  
INDIAN SERVICE-IRRIG. DIV.  
A.L. WATKEN, AC. CH. ENGR.-C.H. SOUTHWORTH, AC. DIR.  
H.V. CLOTTIS, ASST. DIR.  
SAN CARLOS PROJECT---ARIZONA

WAR RELOCATION AUTHORITY  
GILA RIVER AREA  
E. R. SMITH, PROJ. DIR.

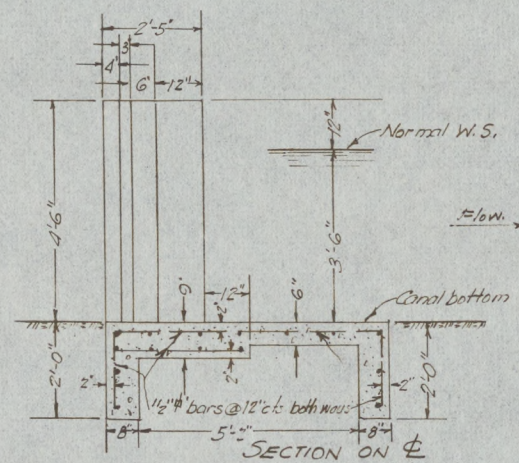
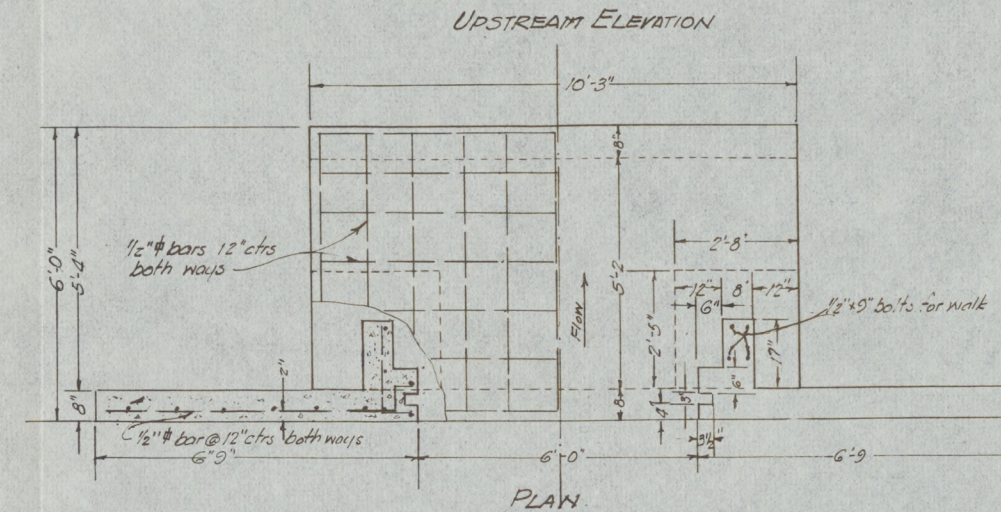
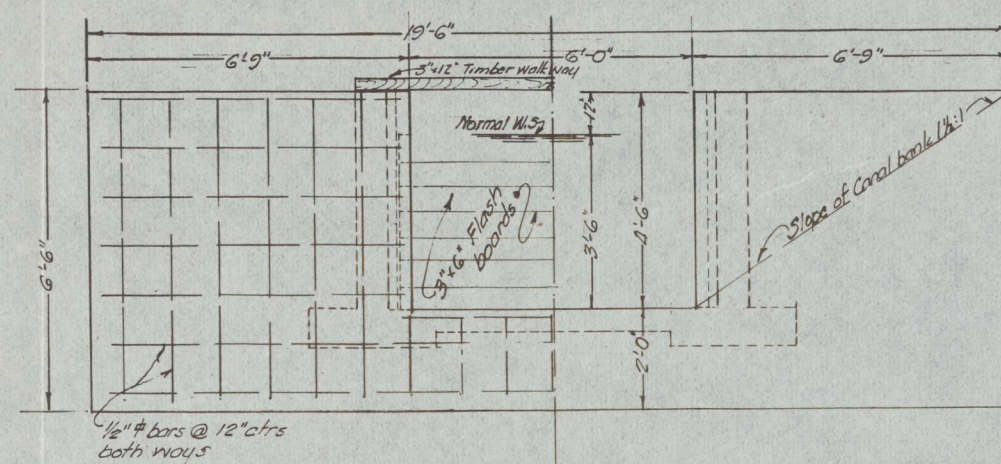
DETAIL CHECK LAT. T.O.  
6-54-125

DRAWN <u>G.B.K.</u> TRACED <u>G.B.K.</u> JUNE 18, 1942	SCALE AS SHOWN	SUBMITTED <u>E.P. Kiesel</u> RECOMMEND <u>Forney, J.P. 1942</u> APPROVED <u>E.R. Smith</u>
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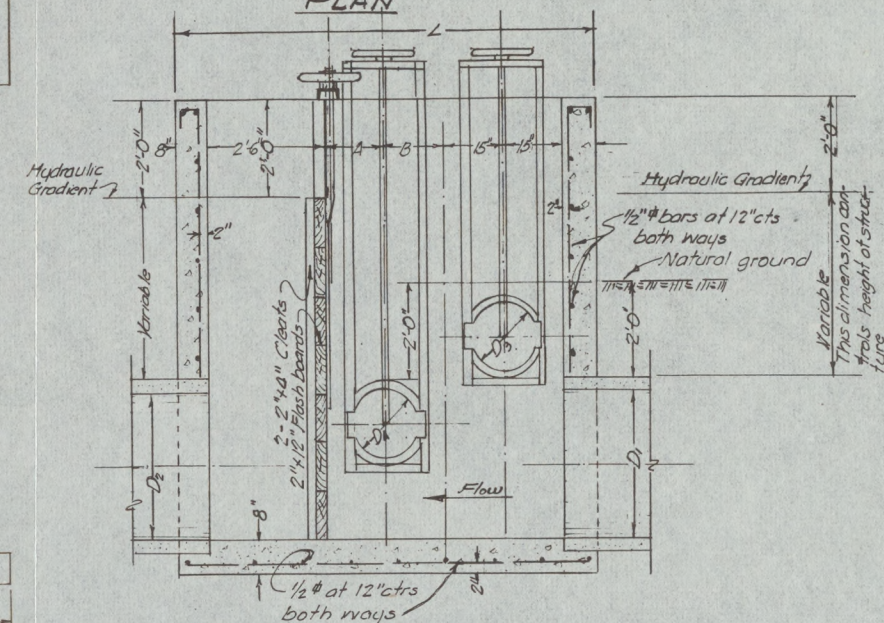
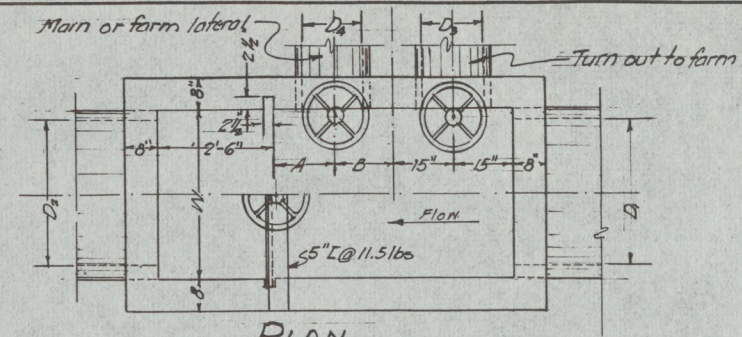




DETAILS TURN OUT TO LAT. G-54-120 AT STA 1206+72.83 CANAL G-54  
Scale:  $\frac{1}{2}$ " = 1'-0"



DETAILS OF CHECK FOR LAT. 6-54-125  
Scale: 1/2"=1'-0"



DIMENSIONS								
D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	A	B	W	L	
36"	36"	16"	36"	25"	25"	3'-6"	10'-6"	
	30"	16"	30"	22"	22"	3'-6"	10'-0"	
	24"	16"	24"	19"	19"	3'-6"	9'-6"	
	20"	16"	20"	17"	17"	3'-6"	9'-2"	
	16"	16"	16"	15"	15"	3'-6"	8'-10"	
30"	30"	16"	30"	22"	22"	2'-10 1/2"	10'-0"	
	24"	16"	24"	19"	19"	2'-0 1/2"	9'-6"	
	20"	16"	20"	17"	17"	2'-10 1/2"	9'-2"	
	18"	16"	18"	16"	16"	2'-10 1/2"	9'-0"	
	16"	16"	16"	15"	15"	2'-10 1/2"	8'-10"	
24"	24"	16"	24"	19"	19"	2'-5"	9'-6"	
	20"	16"	20"	17"	17"	2'-5"	9'-2"	
	18"	16"	18"	16"	16"	2'-5"	9'-0"	
	16"	16"	16"	15"	15"	2'-5"	8'-10"	
	20"	16"	20"	17"	17"	2'-5"	9'-2"	
20"	18"	16"	18"	16"	16"	2'-5"	9'-0"	
	16"	16"	16"	15"	15"	2'-5"	8'-10"	
	18"	16"	18"	16"	16"	2'-5"	9'-0"	
18"	16"	16"	16"	15"	15"	2'-5"	8'-10"	
	16"	16"	16"	15"	15"	2'-5"	8'-10"	

NOTES -  
Standard irrigation gates similar to the type manu-  
factured by the Snow Irrigation Supply Co shall be  
placed on all firm and lateral turn outs.  
Movable Flash Board shall be made into a gate as  
shown and shall be operated by a hand wheel  
fastened to a 4" diameter "Y" shaped steel

### STANDARD TURN OUT TO FARM AND LATERAL

## EXHIBIT F

DEPARTMENT OF INTERIOR  
INDIAN SERVICE - IRRIG. DIV.  
A.L. WATHEN, Ac. Ch. Engr. - C.H. Southworth, Acting Dir.  
H.V. Clotts, Asst. Dir.

SAN CARLOS PROJECT- ARIZ.

WAR RELOCATION AUTHORITY  
GILA RIVER AREA  
E. R. SMITH, PROJ. DIR.

MISC. STRUCTURES

DRAWN GBR  
TRACED GBR  
JUNE 18, 1942

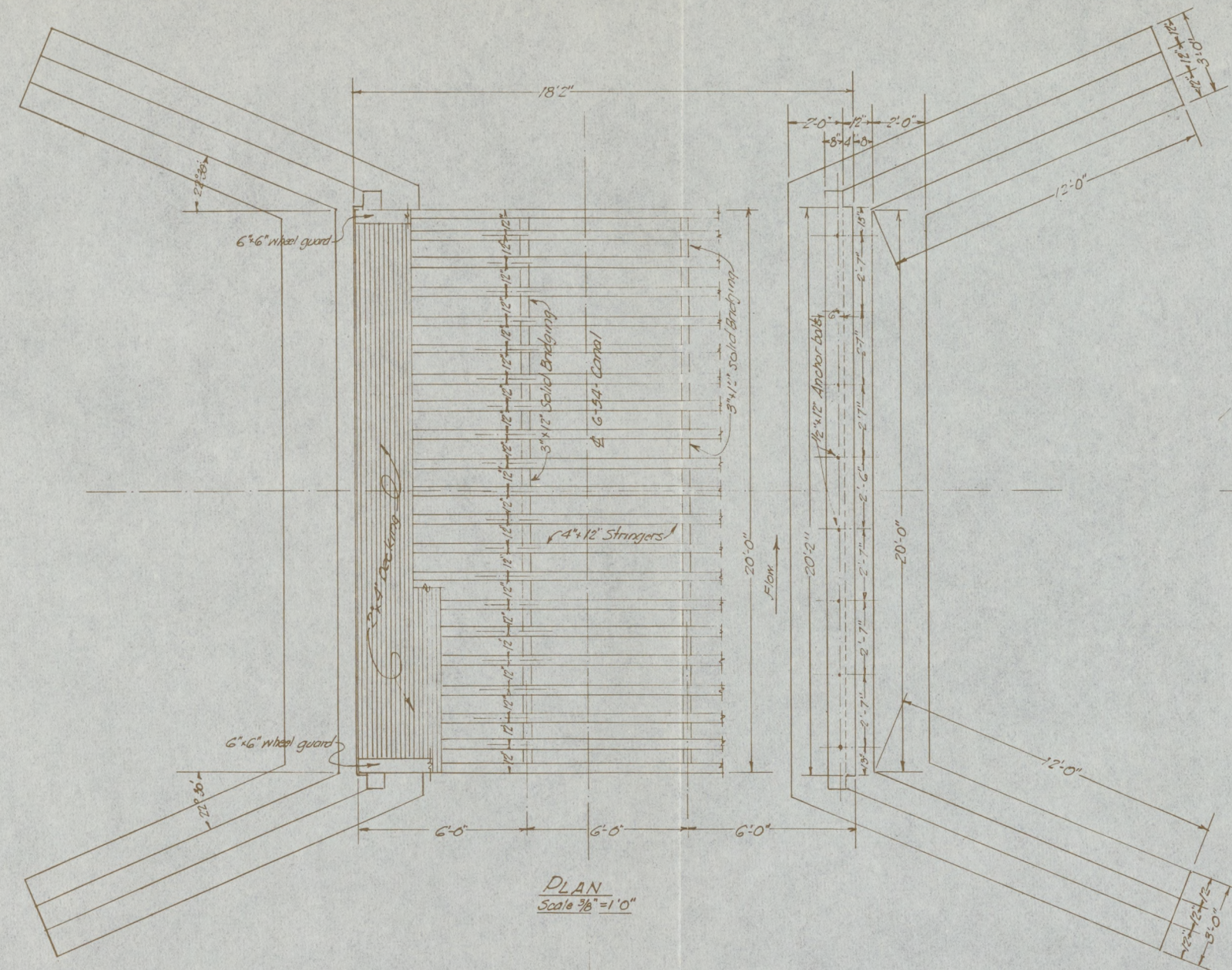
SCALE  
AS SHOWN

SUBMITTED B. B. Keene  
RECOMMEND William H. Brown  
APPROVED E. J. Smith

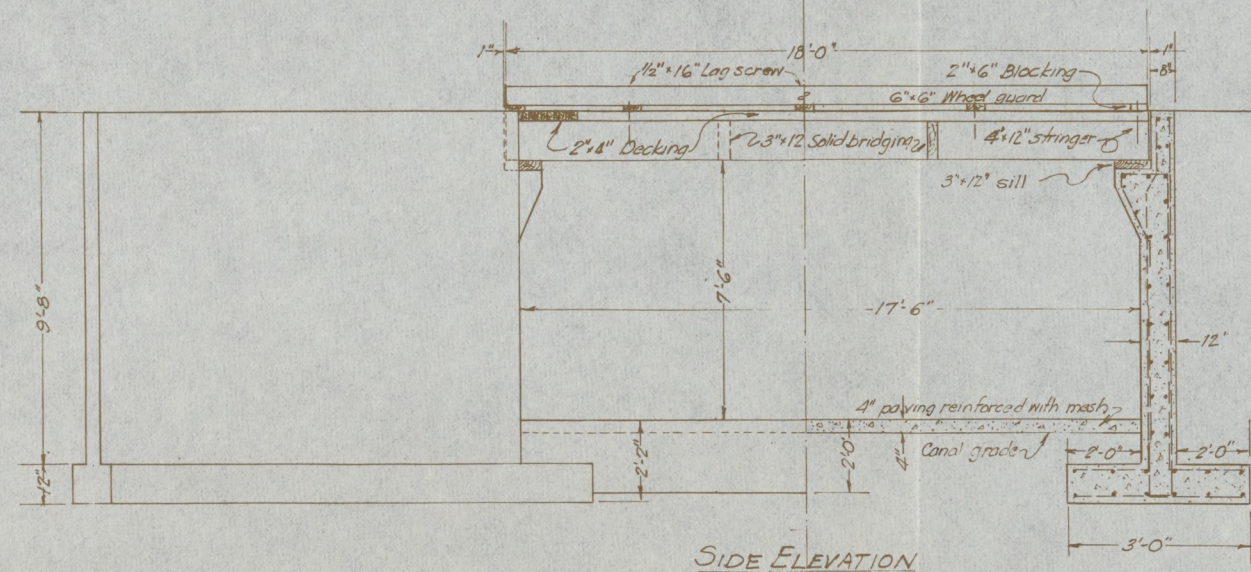
RECOMMEND *RECOMMENDATION*  
APPROVED *E. R. Smith*

RECOMMEND *RECOMMENDATION*  
APPROVED *E. R. Smith*

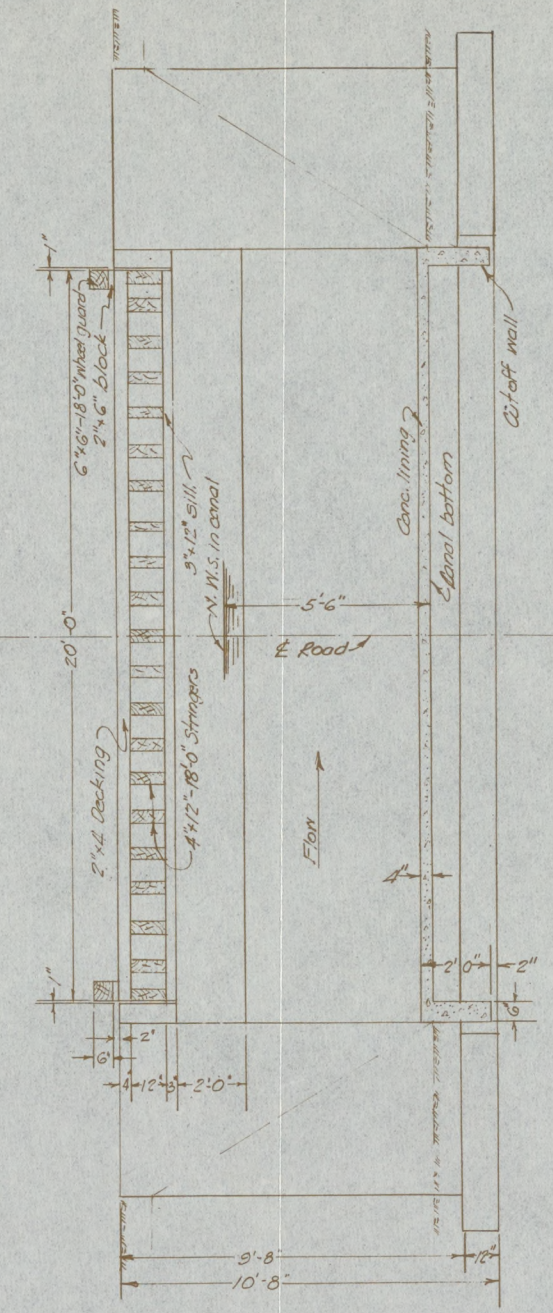




PLAN  
Scale 3/8" = 1'-0"



SIDE ELEVATION  
Scale 3/8" = 1'-0"



SECTION ON E CANAL  
Scale 1/8" = 1'-0"

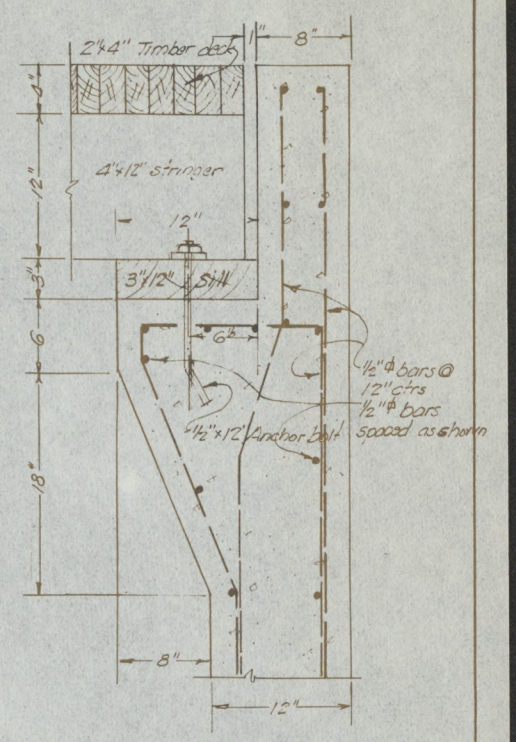
BILL OF MATERIAL FOR BRIDGE			
Description	N <sup>o</sup>	Size	Quantity
Timber-Plates	2	3"x12"x20	120 B.M.
" Stringers	21	4"x12"x18	1512 "
" Deck	109	2"x4"x20	1454 "
" Wheel guard	2	6"x6"x18	120 "
" Bridging	3	3"x12"x16	144 "
Bolts - Anchor	16	1/2"x12"	
Lag screws	16	1/2"x16"	51.6 C4.
Concrete			5020 lbs.
Reinforcing bars		1/2" #	497 "
Wire mesh			

-NOTES-

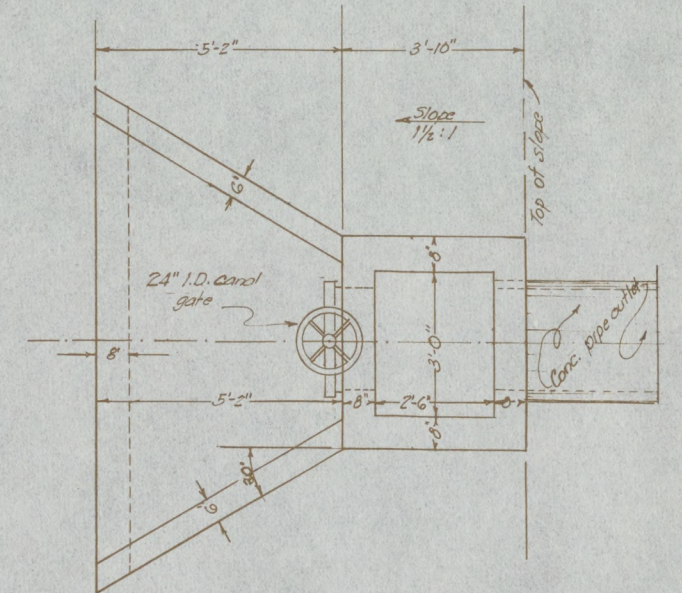
All timber shall be creosoted treated in.

Loading: Live load assumed as distributed over all stringers. Allowable stress 1200 lbs per sq. in. bending. Safe concentrated load on one half width of bridge 8.9 tons.

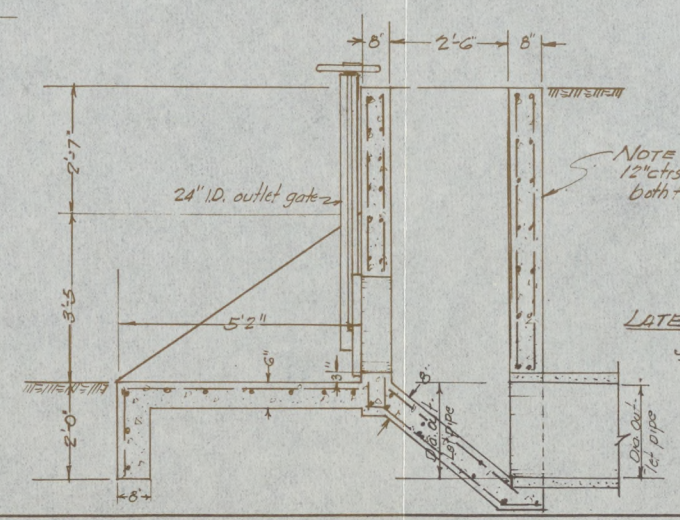
Reinforcement: Abutments and wing walls shall be reinforced with 1/2" # bars spaced 12" ctrs both ways, both faces. Placed 2" from face of concrete.



DETAIL OF BRIDGE SEAT  
Scale 1/2" = 1'-0"



PLAN-OUTLET FROM LATERAL CANALS  
6-52-125 & 6-54-111 TO PIPE LATERALS  
Scale 1/2" = 1'-0"

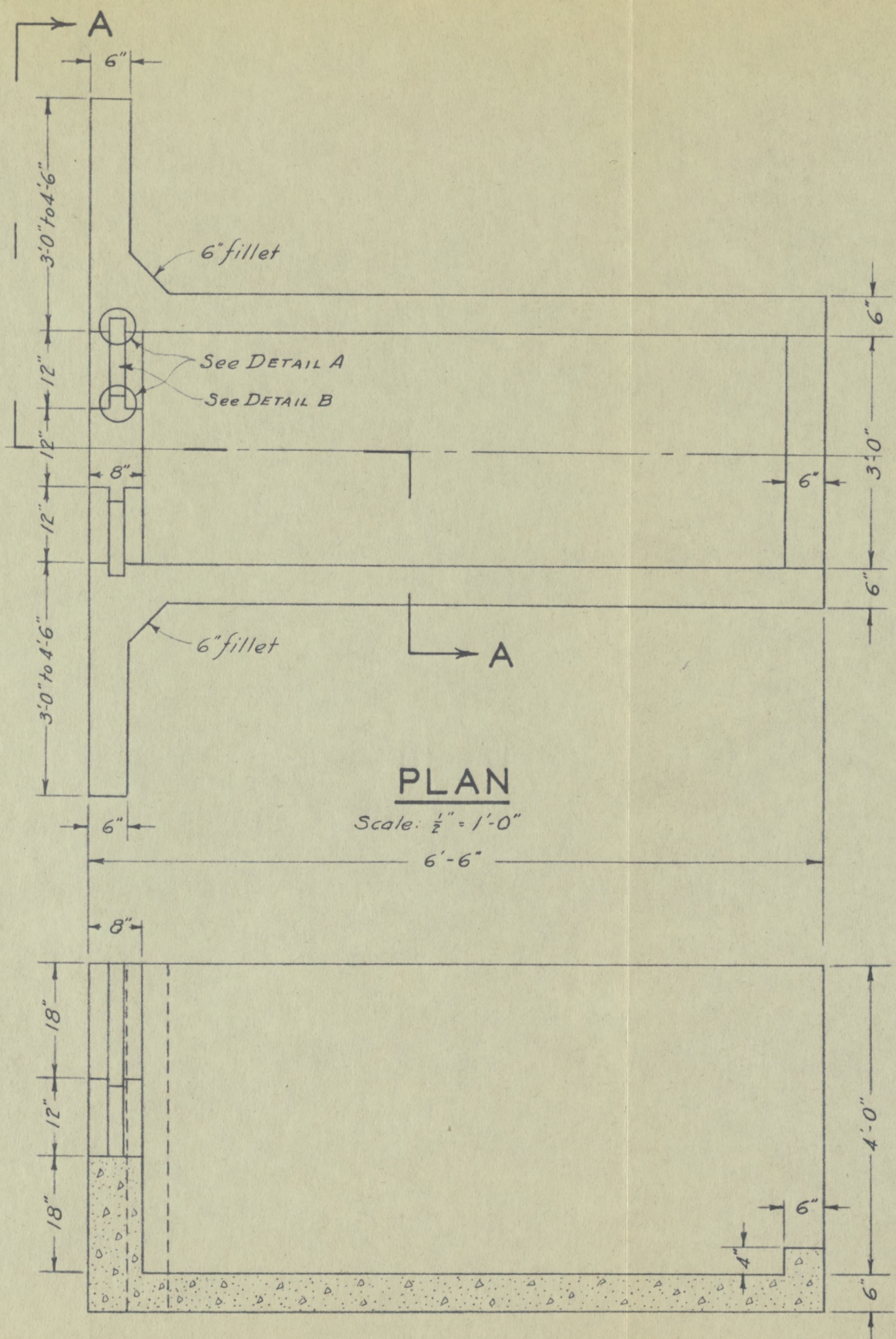


LATERAL CANAL OUTLET  
SECTION ON E  
Scale 1/2" = 1'-0"

EXHIBIT G

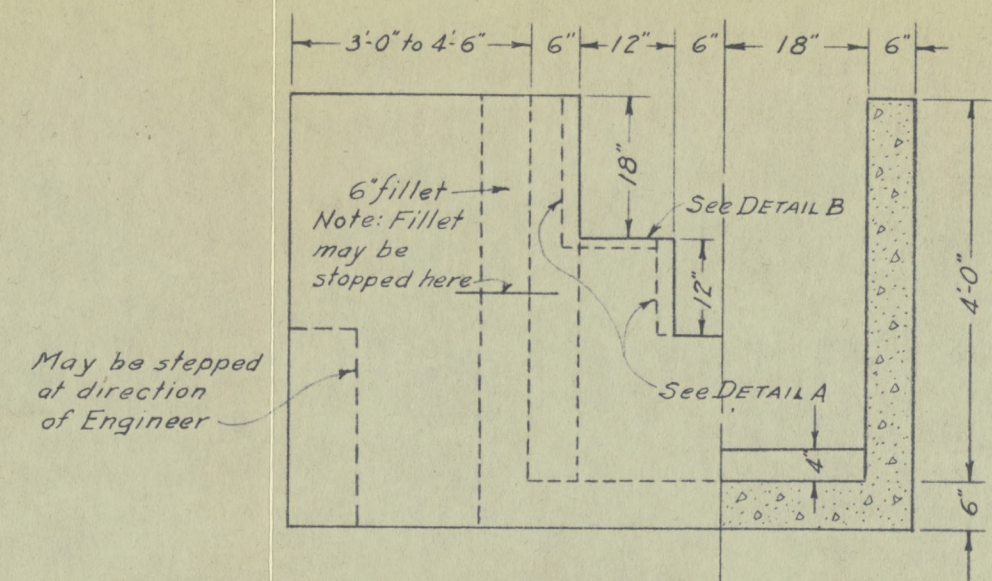
DEPARTMENT OF INTERIOR INDIAN SERVICE -- IRRIG. DIV. A.L. WATSON, AC. CH. ENGR. - C.H. SOUTHWORTH, AC. DIR. H.V. CLOTT, ASST. DIR. SAN CARLOS PROJECT -- ARIZ.		
WAR RELOCATION AUTHORITY GILA RIVER AREA E.R. SMITH, PROJ. DIR.		
TYPICAL BRIDGE		
DRAWN 6.8K TRACED 6.8K JUNE 18, 1942	SCALE AS SHOWN	SUBMITTED 6.8K RECOMMENDED 6.8K APPROVED 6.8K



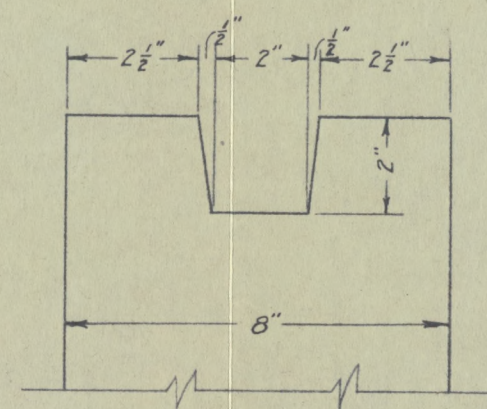


**PLAN**  
Scale:  $\frac{1}{2}'' = 1'-0''$

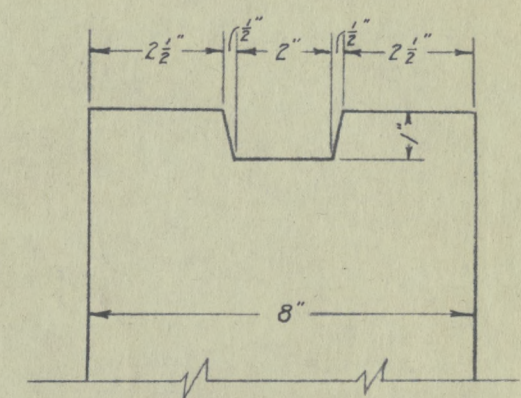
**SECTION ON A**  
Scale:  $\frac{1}{2}'' = 1'-0''$



**SECTION A-A**  
Scale:  $\frac{1}{2}'' = 1'-0''$



**DETAIL A**  
Scale:  $3'' = 1'-0''$



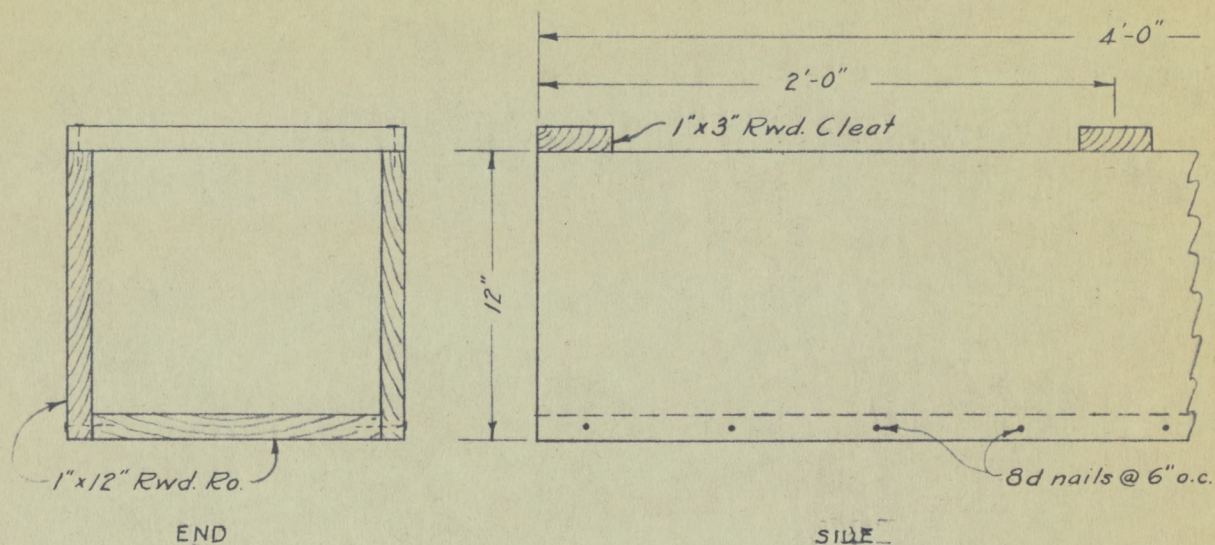
**DETAIL B**  
Scale:  $3'' = 1'-0''$

Concrete to be 2000 lb., poured against undisturbed earth where possible.

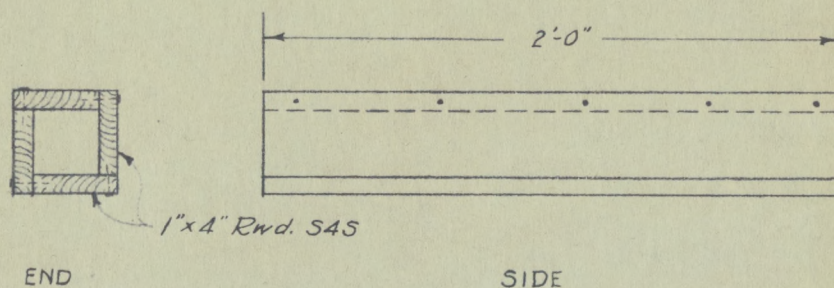
**EXHIBIT H**

<b>IRRIGATION FIELD CHECK STRUCTURE</b>			
WAR RELOCATION AUTHORITY			
DILLON S. MYER DIRECTOR			
SAN FRANCISCO REGIONAL OFFICE			
E. R. FRYER REGIONAL DIRECTOR			
PUBLIC WORKS DIVISION			
SEC. CHIEF		ASST. REG. DR.	
DIV. CHIEF		REG. DR.	
DR. SGA	TR. SGA	CH. SGA	DATE 11-14-42
			<b>X - 34</b>

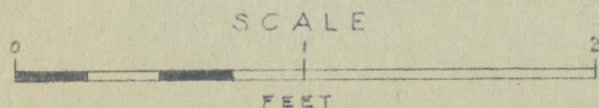




## WOODEN FLUME



## FURROW TUBE



## EXHIBIT J

### IRRIGATION FACILITIES FLUME & FURROW TUBE

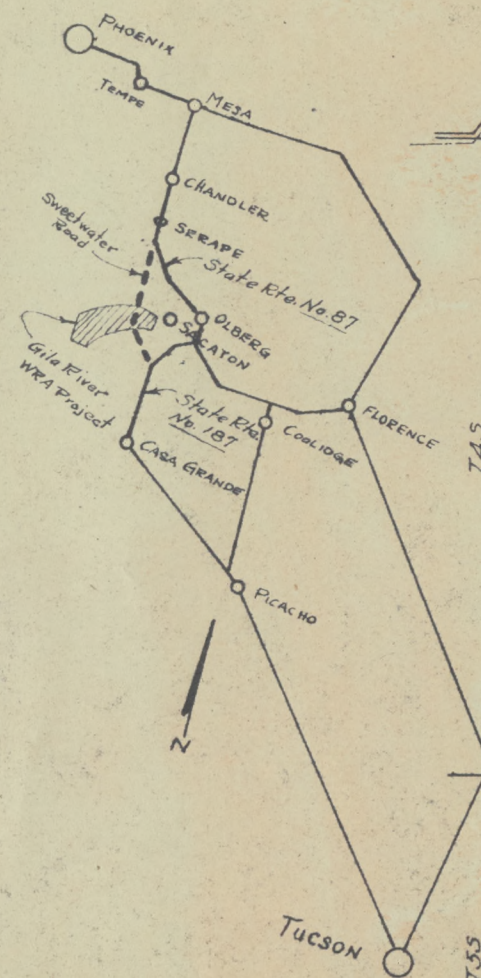
WAR RELOCATION AUTHORITY  
DILLON S. MYER DIRECTOR

SAN FRANCISCO REGIONAL OFFICE  
E. R. FRYER REGIONAL DIRECTOR

PUBLIC WORKS DIVISION

SEC. CHIEF		ASST. REG. DIR.	
DIV. CHIEF		REG. DIR.	
DR. S.G.A.	TR. S.G.A.	CH. <i>[Signature]</i>	DATE 11-14-42
			X-33



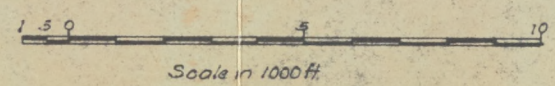


- LEGEND**
- Canals
  - Pipe laterals to be constructed
  - Pipe laterals constructed prior to June 1942
  - Turn out structures to forms and/or sub laterals
  - Sub laterals to 48 ac. subdivision
  - Inside diameter of concrete pipes
  - Storm water channels
  - Reservation boundary

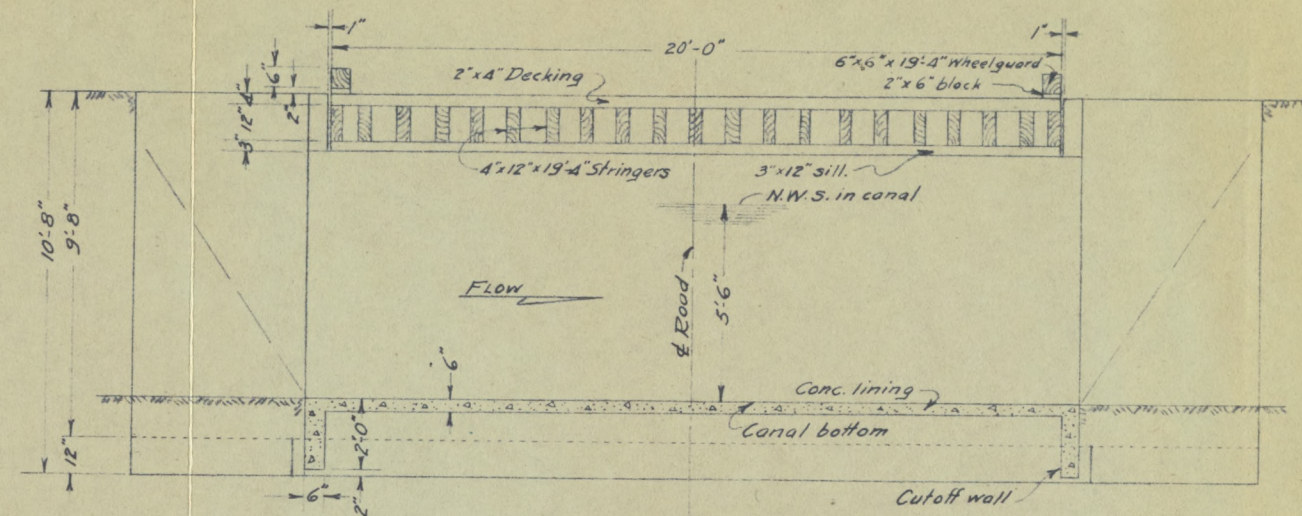
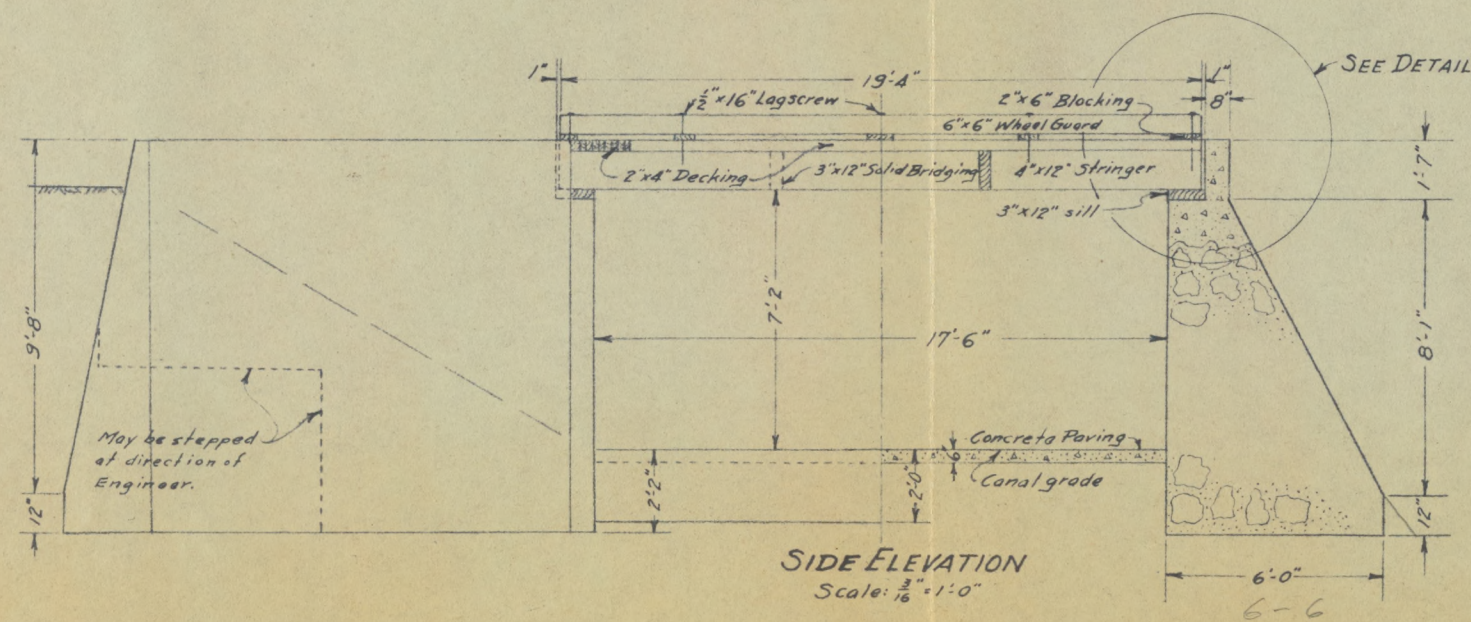
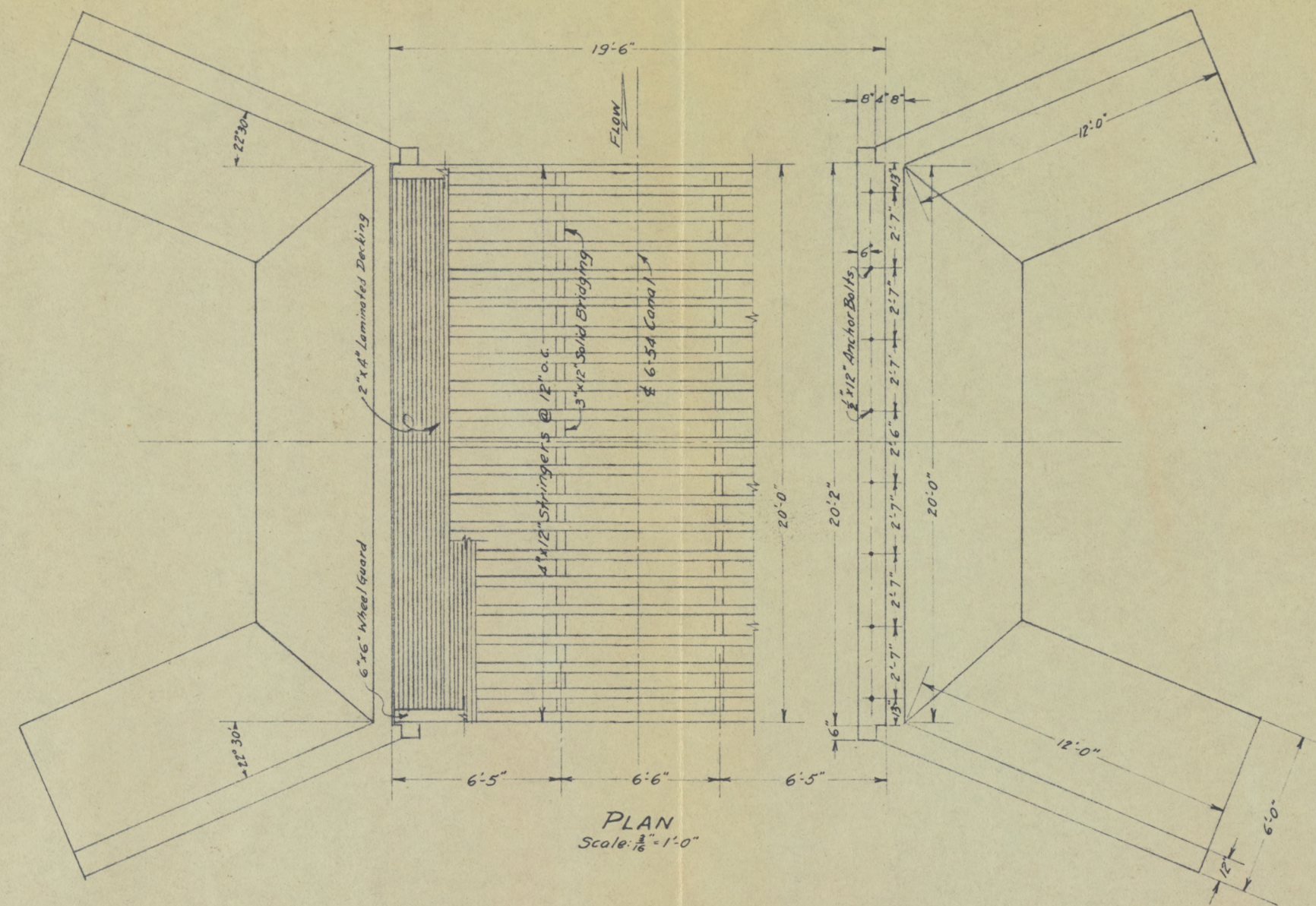
- Construction Schedule**
- Existing
  - 1943 Paving
  - 1943 Grading
  - 1944 "
  - 1945 "
  - 1946 "
  - 1947 "
  - 1947 Paving

**EXHIBIT K**  
**ROAD SYSTEM**

DEPARTMENT OF THE INTERIOR  
**INDIAN SERVICE - IRRIGATION DIVISION**  
A.L. WATHEN - ACTING CH. ENG. C.M. SOUTHWORTH - ACT. DIR.  
HERBERT V. CLUTTS - ASST. DIR.  
**WAR RELOCATION AUTHORITY**  
**GILA RIVER AREA**  
E.R. SMITH - PROJECT DIRECTOR  
**MAP OF AREA LEASED TO**  
**WAR RELOCATION AUTHORITY**  
**SHOWING LOCATION OF**  
**CANALS - STORM WATER CHANNELS - PIPE**  
**LATERALS CONSTRUCTED & TO BE CONSTRUCTED**  
June 20, 1942 G.B.K.







MATERIAL LIST			
Description	No. Pcs.	Size	Amt.
Timber-Plates	2	3"x12"x20'	120 FBM
" Stringers	21	4"x12"x20'	1680 FBM
" Deck.	2400 l.f.	2"x4"x Ran.	1608 FBM
" Wheel Guard	2	6"x6"x20'	120 FBM
" Bridging	30 l.f.	3"x12"x Ran.	90 FBM
" Spacers	6 l.f.	2"x6"x Ran.	6 FBM
Anchor Bolts	16	$\frac{1}{2}$ " x 12"	11 lbs.
Lag Screws	12	$\frac{1}{2}$ " x 16"	16 lbs.
M.I. Washers	28	$\frac{1}{2}$ "	6 lbs.
Reinf. Steel	1250 l.f.	$\frac{1}{2}$ " #	1100 lbs.
Reinf. Concrete			15 C.Y.
Masonry			60 C.Y.
Nails		60 d	300 lbs.
Tie Wire			20 lbs.

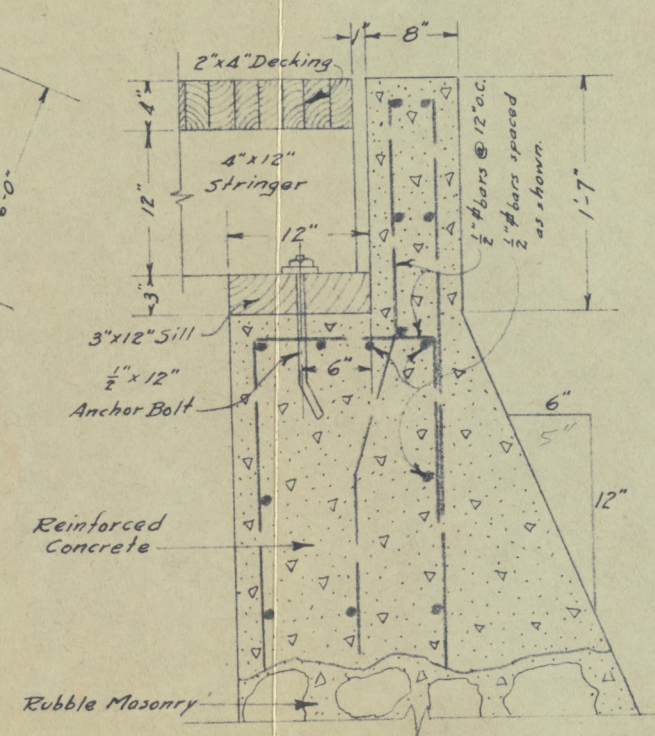


EXHIBIT L

DEPARTMENT OF INTERIOR  
INDIAN SERVICE -- IRRIG. DIV.  
A. L. WATHEN, Ac. CH. ENGR. - C. H. SOUTHWORTH, Ac. DIR.  
H. V. CLOTTIS, ASST. DIR.

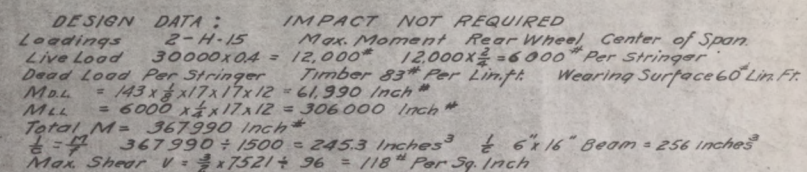
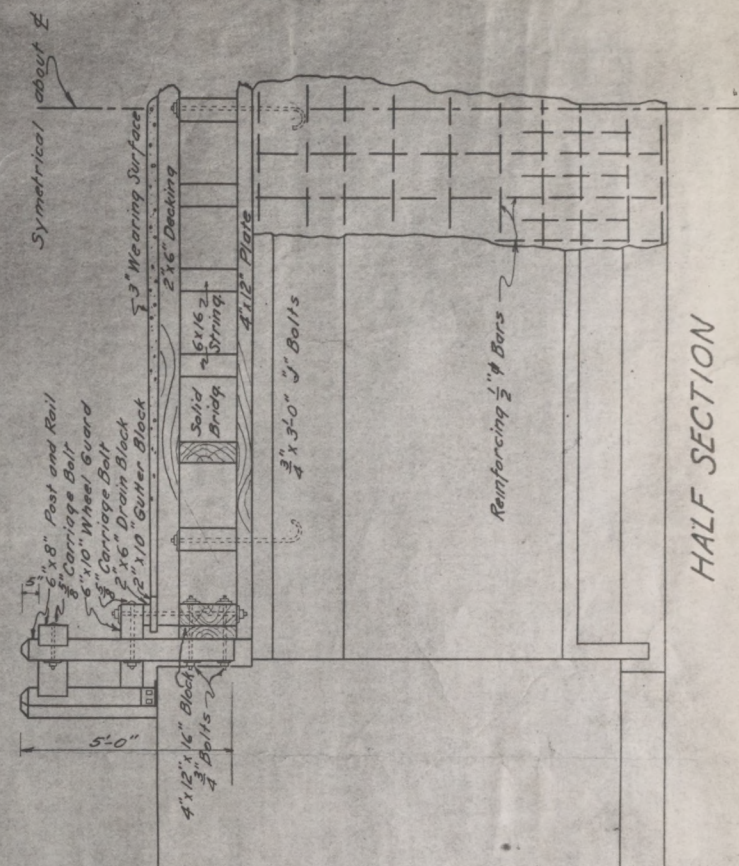
SAN CARLOS PROJECT--ARIZ.

WAR RELOCATION AUTHORITY  
GILA RIVER AREA

TYPICAL BRIDGE

DRAWN <i>[Signature]</i> TRACED Oct. 31, 1942	SCALE AS SHOWN	SUBMITTED <i>[Signature]</i> RECOMMENDED <i>[Signature]</i> APPROVED
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*All Timber, Except Rails and Posts, Rough Creosoted Douglas Fir  
Rails and Posts Dressed 4 Sides*

QUANTITIES

Concrete 59.6 CYds  
#4 Reinforcing Steel 6712'  
Timmer 6100 FT BM  
Lining Wire 600 #

## EXHIBIT M

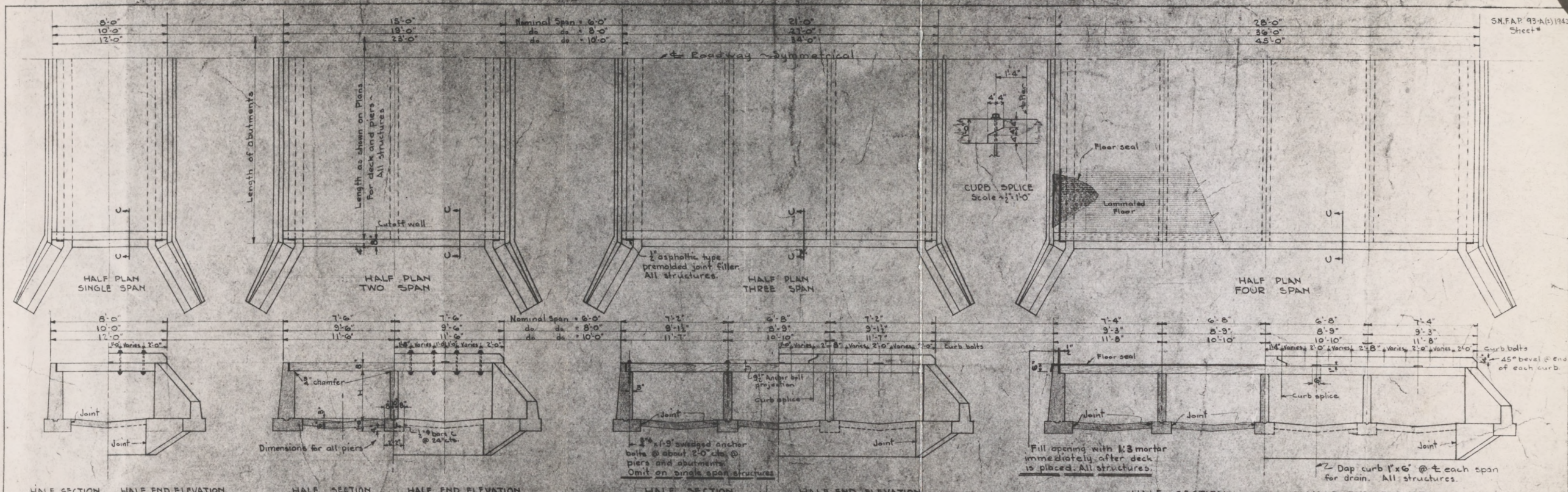
DEPARTMENT OF THE INTERIOR  
U. S. INDIAN IRRIGATION SERVICE  
A. L. WATHEN DIRECTOR OF IRRIGATION  
M. V. CLOTT'S ASST. DIRECTOR C. A. ENGLE SUPERVISING ENGR.  
C. J. MOODY ENGR.  
SAN CARLOS PROJECT ARIZONA

SPECIAL BRIDGE 24 FT. WIDE  
ON STATE HIGHWAY 187

DRAWN BY JJK 4 1934  
TRACED BY JJK  
SCALE  $\frac{1}{2}'' = 1'-0''$

SC-C22





NOTE -  
Maximum fill  
Minimum cover 0'-0"

Floor seal - On finished floor shall be placed a water seal, composed of 2 layers of cotton fabric and 3 coats of hot asphalt with the top coat sand blotted.  
Not asphalt shall be applied to cleaned floor surface at rate of 4 to 5 gals per sq. yd. followed by alternate layers of fabric and asphalt. Asphalt on each layer of fabric shall be applied at rate of 5 gals. per sq. yd. Sand blasting course shall be spread about 15# per sq. yd.  
Fabric shall be 10/10 mesh cotton fabric.  
Asphalt shall be paving grade min. penetration 100 and max. 200. At time of application it shall have a temperature of 275° min.  
Sand for bletting may be pit run material with approval of Engineer.

NOTES -  
Std. Specifications, Arizona Highway Department, Edition of 1935 and amendments thereto.  
Design Specifications A.A.S.H.O. 1941 Loading class H16  
Backfill - Flooring shall be in place and grouted (grout to set 24 hours min.) before any backfilling is done.  
Timber - All timber shall be rough-Douglas Fir (East Reg). All timber shall be treated. Either creosote or salts treatment may be used. See specifications.  
Framing may be done in field. Field treatment of cuts, daps, holes, etc., as per specifications.  
Random lengths for laminated floor may be used for multiple span structures with following requirements - Splices shall be approximately at 4 points adjacent to piers. No splice shall be closer than fourth piece of same 4 point. No two adjacent pieces shall splice in same span.  
Flooring shall be cut to length for splicing before treatment and selected for uniformity of thickness to form a tight floor before placing.  
Each floor board shall be nailed to adjacent board with 40d nails at about 12" cts. staggered. Ends of boards shall have two nails within 6" of end. If necessary, to prevent splitting holes, 1/8 less than diameter of nail, shall be bored before driving nails.  
Galvanizing of hardware and nails not required.  
Payment for hardware including anchor bolts shall be included in unit price bid for treated timber.

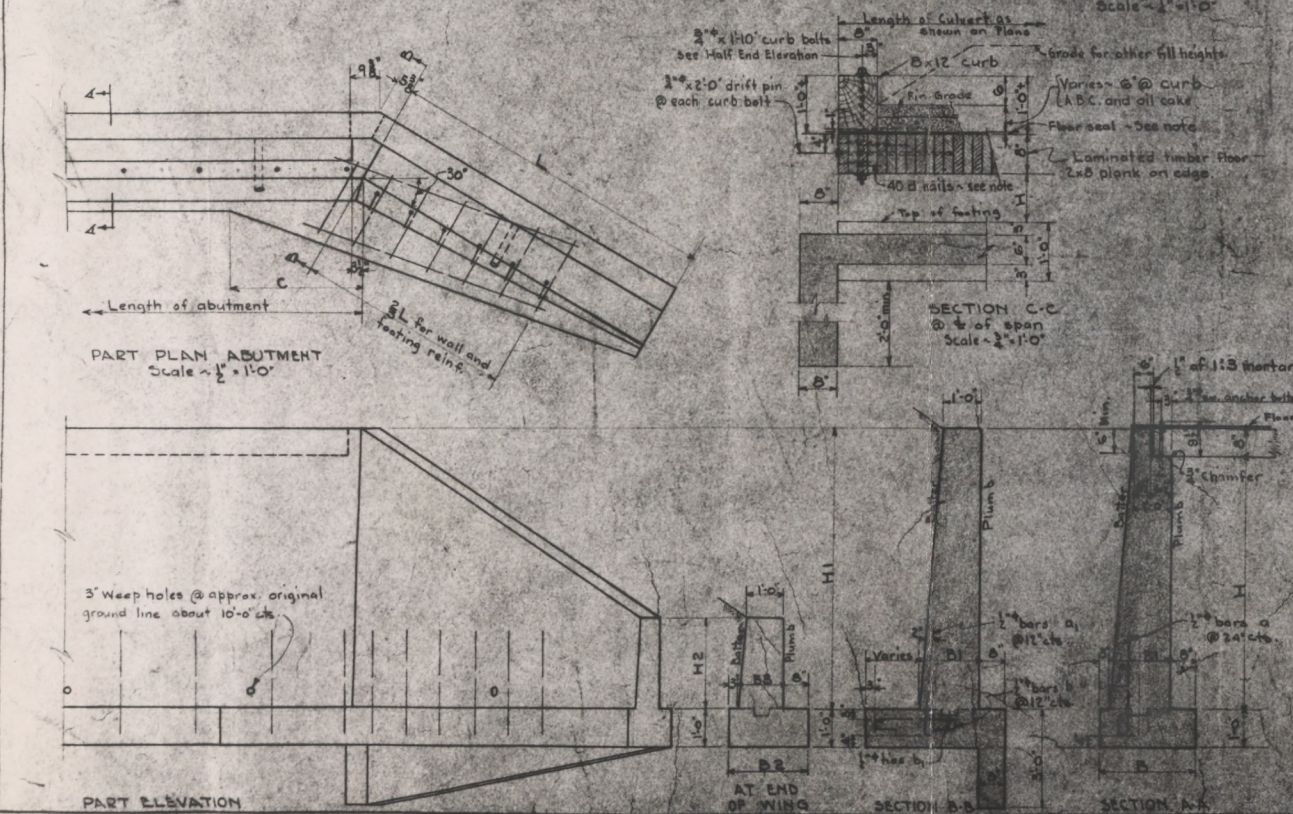
APPROXIMATE QUANTITIES  
DECK FLOOR & CUTOFF WALLS

Span Length	CURB & CUTOFF		PER LIN. FT.	
	Treated Timber M.B.M.	Class A Conc. C.Y.	Treated Timber M.B.M.	Class A Conc. C.Y.
SINGLE SPAN				
6'-0"	.15	.66	.056	.086
8'-0"	.16	.95	.072	.123
10'-0"	.19	1.23	.088	.148
TWO SPAN				
6'-0"	.24	1.56	.112	.176
8'-0"	.30	2.13	.144	.250
10'-0"	.37	2.70	.176	.324
THREE SPAN				
6'-0"	.34	2.32	.160	.247
8'-0"	.43	3.17	.208	.315
10'-0"	.54	4.17	.264	.393
FOUR SPAN				
6'-0"	.45	3.22	.216	.326
8'-0"	.58	4.35	.280	.415
10'-0"	.72	5.44	.352	.515

Dimensions and Approximate Quantities

ABUTMENT / DIMENSIONS										ONE ABUTMENT		ONE PIER	
H	H1	H2	B	B1	B2	B3	C	L		Class A Conc. C.Y.	Rein. Steel Lbs.	Class A Conc. C.Y.	Rein. Steel Lbs.
1'-6"	2'-2"	0'-2"	2'-1"	1'-2"	1'-11"	1'-0"	0'-1"	5'-6"	119	None	151	None	127
2'-0"	2'-8"	0'-3"	2'-2"	1'-3"	1'-11"	1'-0"	0'-1"	4'-0"	148	do	178	do	142
2'-6"	3'-2"	0'-6"	2'-2"	1'-3"	2'-0"	1'-1"	0'-1"	4'-0"	165	do	199	do	157
3'-0"	3'-8"	0'-11"	2'-3"	1'-4"	2'-0"	1'-1"	0'-2"	4'-9"	208	do	220	do	173
3'-6"	4'-2"	1'-2"	2'-3"	1'-4"	2'-0"	1'-1"	0'-2"	5'-3"	246	do	250	do	188
4'-0"	4'-8"	1'-5"	2'-4"	1'-5"	2'-0"	1'-1"	0'-2"	5'-9"	298	do	282	do	204
4'-6"	5'-2"	1'-7"	2'-4"	1'-5"	2'-0"	1'-1"	0'-2"	6'-3"	360	53.2	304	1.2	219
5'-0"	5'-8"	1'-8"	2'-5"	1'-6"	2'-0"	1'-1"	0'-2"	7'-0"	419	64.0	330	1.2	235
5'-6"	6'-2"	1'-11"	2'-5"	1'-6"	2'-1"	1'-2"	0'-3"	7'-6"	485	66.0	362	do	250
6'-0"	6'-6"	2'-1"	2'-6"	1'-7"	2'-1"	1'-2"	0'-3"	8'-0"	558	74.0	398	do	265
6'-6"	7'-2"	2'-4"	2'-6"	1'-7"	2'-1"	1'-2"	0'-3"	8'-6"	628	76.0	422	do	281

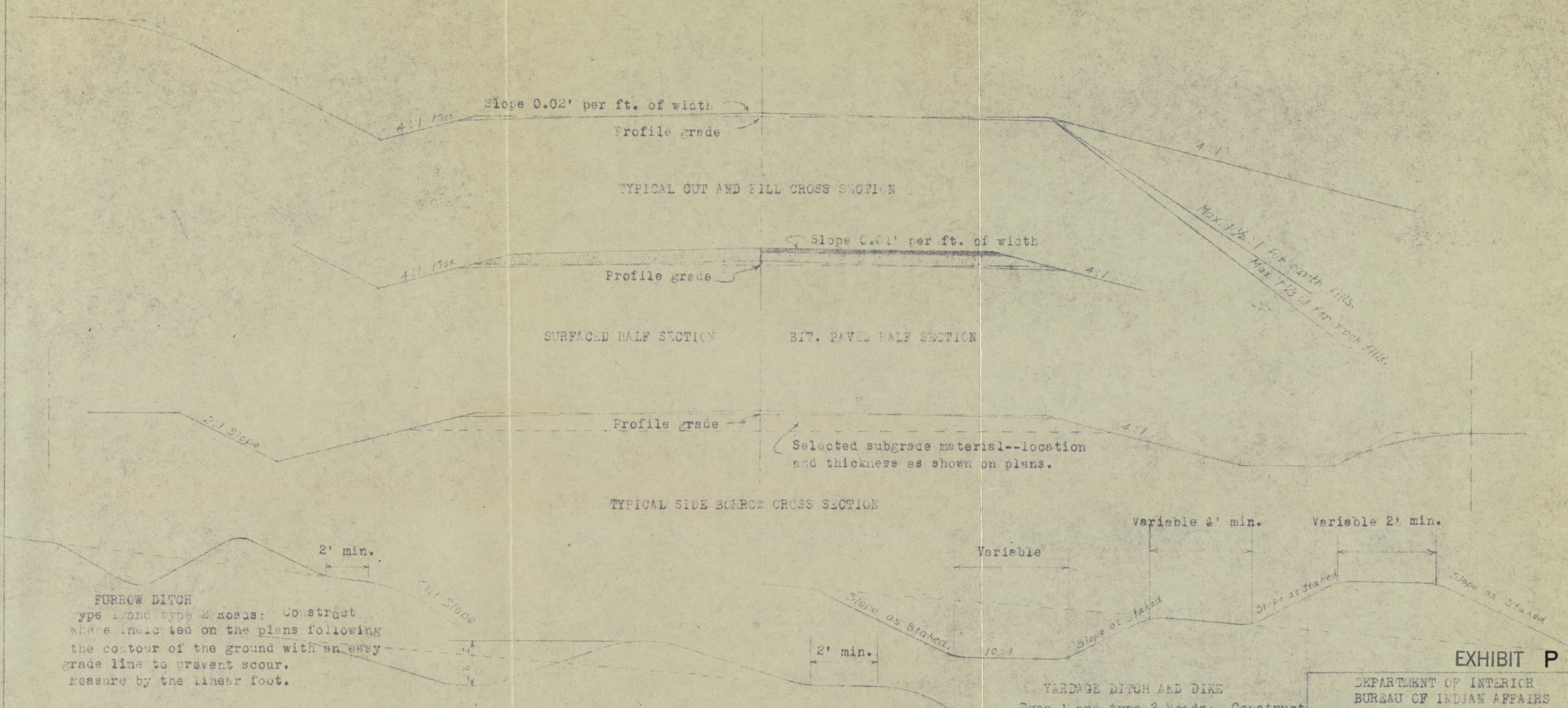
Note -  
No reinforcing steel required where H equals 1'-6" to 4'-0" inclusive.



**EXHIBIT N**  
ALL CONCRETE CLASS-A  
ARIZONA HIGHWAY DEPARTMENT  
**BRIDGE DIVISION**  
STANDARD  
DETAILS  
TIMBER DECK CULVERTS  
SPANS - 6'-0" - 5'-0" & 10'-0"  
Single, Two, Three & Four Span Culverts

Designed RAH-F April 1942  
Detailed LEM 4-7-42  
Checked [Signature]  
Approved [Signature]





**FURROW DITCH**  
 Type 1 and Type 2 Roads: Construct where indicated on the plans following the contour of the ground with an easy grade line to prevent scour. Measure by the linear foot.

**CUT SLOPE ROUNDING**  
 Type 1 Roads: Round all cut slopes in materials which behave as earth.  
 Type 2 Roads: Slope rounding optional. Include slope rounding yardage in roadway excavation.

**GRADER DITCH**  
 Type 1 and Type 2 Roads: Construct where indicated on the plans following the contour of the ground with an easy grade line to prevent scour. Measure by the linear foot.

**YARDAGE DITCH AND DIKE**  
 Type 1 and Type 2 Roads: Construct to widths, line and grade where and as shown on the plans. Include ditch and dike yardage in roadway excavation.

**EXHIBIT P**

DEPARTMENT OF INTERIOR BUREAU OF INDIAN AFFAIRS INDIAN SERVICE-ROAD DIVISION F. M. Brown, Director D. J. Rierdon, Dist. Engr. WAR RELOCATION AUTHORITY GILA RIVER PROJECT E. R. Fryer, Act. Proj. Director		
TYPICAL CROSS SECTION Roads and Road Ditches		
Drawn WBA	Scale	Submitted
Traced	As	Recommended
Oct 9, 1942	shown	Approved



WAR RELOCATION AUTHORITY

DEC 4 1942

DILA RIVER PROJECT  
ADMINISTRATIVE DIVISION