NEBRASKA NATURAL
RESOURCES COMMISSION

PRELIMINARY
REPORT

STATE WATER PLAN
PUBLICATION NO. 204-D

SUPPLEMENT

to

Republican River Basin Plan
Appendix D
Project Investigations

WAUNETA FLOOD CONTROL PROJECT

April, 1980

Supplement to
State Water Plan Publication No. 204-D
Wauneta Flood Control Project

Table of Contents

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SECTION 1. SUMMARY, CONCLUSIONS, AND REVISED PLAN

This supplement to State Water Plan Publication No. 204-D, Wauneta Flood Control Project, has been prepared to present a revised project plan. The original report had to be revised because detailed investigation and design revealed that the cost for constructing the three dams recommended in it would greatly exceed the benefits. The Village of Wauneta and the Upper Republican Natural Resources District (NRD) requested that the Natural Resources Commission (NRC) study other alternative measures to provide flood protection for Wauneta. The NRC agreed to perform the requested work, and the staff, with the assistance of an engineering consultant, developed the revised plan.

First, a number of alternatives, including one dam and levees, replacement of bridges, and channel clearing were considered. One dam produced very little reduction in flood flows, and replacement of the bridges with only channel clearing resulted in very little reduction in flood levels. Next, the potential for extensive channel improvement in conjunction with the replacement of the old bridges was investigated. Two alternatives with a uniform bottom slope and different widths were studied. This resulted in substantial reductions in flood levels, so six other, more economical channel alternatives with non-uniform bottom slopes, with and without levees, were then studied. The village and the NRD reviewed the alternatives and the results of the NRC investigations and accepted the most economical alternative that met their needs.

Conclusions

The revised project for reducing flood damages in Wauneta is technically, economically, and environmentally feasible under the criteria and rules of the Resources Development Fund. It would protect the business and residential sections of Wauneta from floods up to, and including, the 100-year flood. A floodplain park, if constructed in conjunction with the revised plan, would provide sufficient recreation benefits to be feasible under the same criteria and rules.

Revised Plan

The revised plan accepted by the Village and the NRD includes an improved channel with a 70-foot bottom width, new bridges on Arapahoe Avenue and Wichita Street, levees, and a flood plain park. The project features are shown on the attached revised preliminary plan. The proposed channel is 4,730 feet long with non-uniform bottom slopes and 2½ horizontal to 1 vertical side slopes. The levees are to located on the south and west side of the stream from Wichita Street to the football field, and on the east side of the stream above Wichita Street. The two bridges will be 100 feet long and 40 feet wide. The Wichita Street bridge and a portion of Wichita Street will be raised to provide the required flood capacity. The park, located east of the stream, would include a hike/bike trail, playground, an ice-skating rink and other recreation facilities that would not obstruct flood flows.

SECTION 2. INTRODUCTION

Background

State Water Plan Publication No. 204-D, Wauneta Flood Control Project was prepared by the Natural Resources Commission in August 1978. In that report, a plan including three dams and a levee was recommended to alleviate the flooding problem in Wauneta. This report has been prepared as a supplement to State Water Plan Publication No. 204-D to present a revised project plan.

The original report has to be revised because detailed ivestigation and design revealed that the cost for constructing the three dams would greatly exceed the benefits. The increased costs resulted from inflation, more critical structure site conditions than anticipated, and criteria changes related to high hazard dams.

Much of the information in Publication 204-D is still valid for the revised plan, and the reader is referred to the original report for this information. Only new and revised information is presented in this report.

Purpose of the New Study

The threat of flooding documented in Publication 204-D still exists in the Village of Wauneta. Therefore, the Village and the Upper Republican Natural Resources District requested that the NRC study other alternative measures to provide flood protection for Wauneta. The Natural Resources Commission agreed to perform the requested work, and the staff, with the assistance of an engineering consultant, developed the revised plan in the last half of 1979.

The primary purpose of this study is to determine if there is a flood control alternative, besides the three dams, with potential for development by the NRD and the Village. The investigation is also intended to determine the eligibility of the project for funding by the Resources Development Fund.

Scope of the New Study

The new study was conducted in three stages. The first stage was to investigate the feasibility of three alternatives of interest to the Village Board; one dam and a levee, channel clearing, and replacement of the old bridges on Wichita Street and Arapahoe Avenue. It was found that none of these alternatives, singly or in combinations, reduced flood levels sufficiently to justify further study.

In the second stage, the study was expanded to examine alternatives that would provide greater reductions in flood levels. A project based on changing the channel width and alignment was studied in this stage. Investigations were made of two channel alternatives, both with replacement

of the old bridges. The result of the first and second stages of study were presented to the NRD and the Village of Wauneta in a village board meeting on September 18, 1979. The sponsors indicated at the meeting they would be interested in an extensive channel improvement project.

The third stage was a study of the feasibility of channel improvement with a non-uniform slope and replacement of the old bridges. The effect of levees was also investigated for all three proposed channel widths. At a meeting held at Wauneta on November 14, 1979, the results of the third stage of investigation were presented to representatives of the NRD, the Village Board, and the public. After they approved what appeared to be the best of the alternatives, a more detailed analysis, including the investigation of technical, economic, and environmental considerations, was conducted.

Organization

The Village of Wauneta, the Upper Republican NRD, and the Natural Resources Commission have all participated in this new study as in the original study. In addition, the Nebraska Department of Roads aided in this revised project proposal. The Department of Roads assisted the Commission staff in preparation of the plan by providing typical plans for a bridge that would be suitable for this project and information on costs of such structures. The Department also provided invaluable advice to all parties on procedures involved in securing federal aid for bridge projects.

SECTION 3. REVISED INVESTIGATIONS

Hydrological Investigations

Two distinctive types of flood damage have identified in the Frenchman valley below Enders dam. One is urban damage to Wauneta and the other is rural damage, including damage to crops and pasture in the flood plain. The hydrological investigation for the revision of the plan was performed to evaluate only the urban damage at Wauneta because the revised project will not significantly affect rural damage as the original plan did.

The hydrological study investigated alternative conditions in the following stages:

Stage 1 - one dam and a levee; channel clearing; replacement of old bridges; channel clearing with replacement of old bridges.

Stage 2 - 80 and 100 foot wide channels with uniform slope and the replacement of the old bridges.

Stage 3 - 60, 70, and 80 foot wide channels with non-uniform slope, with and without levees, and the replacement of the old bridges.

First Stage Alternatives

One dam and a levee. The first alternative, studied at the request of the village officials, was one dam (dam #1) and a levee on the downtown side of Wauneta. Flood frequency analysis in the original report (page 13) was updated to study the effect of dam #1. Table A shows computed peak flows at Wauneta with and without the dam, as well as areal rainfall used to compute peak flows.

Table A

Computed Peak Flows at Wauneta and Areal Rainfall

Return Period	No Dams	1 Dam (Dam #1)	Areal Rainfall
(Years)	--(Cubic feet per second)--		--(inches)--
100	8385	7490	5.04
50	6920	6200	4.53
25	5410	4900	3.98
10	3850	3560	3.38
5	2760	2580	2.90
2	1260	1240	2.12

Water surface elevations were computed with the computed peak flows to evaluate the potential reduction of flooding at Wauneta. A computer program, WSP-2, developed by SCS, was employed to compute the water surface elevations.

It was found that the water surface elevations at Wauneta would be reduced very little with one dam and extensive levees would be needed. It was therefore concluded that this alternative was not practical.

Channel clearing. The second alternative examined in the first stage investigation was cleaning up the channel and flood plain, including removal of dead trees, trash and debris.

The main effect of channel and flood plain clearing would be to reduce the roughness coefficients. First, the roughness coefficients ("N" values) for the entire channel on page 20 of the original report were reduced by 10% to account for this clearing. Then, it was found from the aerial photos of Wauneta that only limited sections of flood plain adjacent to the channel could be cleared without extensive tree removal. Therefore, the "N" values for the flood plain at only several cross-sections were modified. All other variables used to compute the water surface profiles in Table 7 on page 20 of the original report were retained. The resulting flood levels with the modified "N" values were almost the same as those of the original runs, indicating that this alternative would not signifcantly alter the flooding sitation at Wauneta.

Replacement of old bridges. The third alternative of the first stage investigation included replacement of the old bridges on Wichita Street and Arapahoe Avenue. Throughout these investigations, it has been apparent that the two bridges have considerable effect on water surface elevations for large floods. It was proposed that the two bridges be replaced with 100-foot long bridges, similar to those on a nearby highway project. It was also proposed that Wichita Street be raised to prevent the isolation of the east part of the town. This had a significant effect on flood levels because it eliminated the flood-carrying capacity of a substantial part of the flood plain.

Water surface elevations were computed with the new bridges and the new Wichita Street elevations. It was found that this alternative, as a single measure, would not greatly reduce flood stages in Wauneta.

Channel clearing and replacement of old bridges. It was shown that neither channel clearing nor replacement of the two bridges alone would greatly reduce flood water elevations at Wauneta. Consequently, the effect of channel clearing in conjunction with bridge replacement was studied. The WSP-2 program was rerun with modified input data and the result showed that the combination also would not significantly reduce the flood levels at Wauneta.

Second Stage Alternatives - Channelization With Uniform Bottom Slope

After it was determined the simpler alternative would not produce the desired results, the potential for extensive channel improvement was investigated. A new channel alignment that would provide better flow

conditions with a minimum of bank disruption and structural complications was laid out on the topographic maps. Side slopes for the new channel configuration were selected based on the soils, flow characteristics, and width of the area available. A uniform slope was used throughout the new channel. Two alternative channel cross-sections were studied, one with a bottom width of 80 feet and the other with 100 feet. Both alternatives included replacement of the old bridges at Wichita Street and Arapahoe Avenue with 100-foot long bridges. The two alternatives were discussed together because they were evaluated by the same method, yielding different results.

Water surface elevations were computed by the WSP-2 program for the two alternatives with the different return period rainfalls given in Table A. The results showed that both alternatives would keep most of the flood water out of Wauneta.

A new field survey of the project area on November 18, 1979 revealed a rock ledge exposed in the riverbed, upstream from the power plant. Removal of this rock ledge seemed impractical in terms of cost as well as channel stability. This made the alternatives with the uniform bottom slope impractical, so other channel atlernatives were investigated.

Third Stage Alternatives - Channelization With Non-Uniform Slope

In the third stage, six different alternatives with non-uniform bottom slopes were studied. The first three considered different bottom widths of 60, 70, and 80 feet, all without levees. The second three considered the same channel widths with levees. All six alternatives included replacement of the old bridges on Wichita Street and Arapahoe Avenue and maintenance of the same side slope as for the second stage alternative channels.

Before studying the third stage alternatives, flood water elevations under the existing condition had to be reevaluated. In the original report, the channel grade between sections 5-006 and 5-007 was assumed to be uniform. The new field survey showed that the grade actually deviated significantly from this condition.

New water surface elevations were computed for the corrected existing condition at 12 cross-sections in and around Wauneta. In the computations, two estimated crosssections were added in place of cross-section 5-007 in the original study. One cross-section is located about 70 feet downstream from the old power plant and the other along the water pipe about 150 feet upstream from the old power plant. The locations of the two new estimated cross-sections are indicated by Point 5-006.1 and Point 5-006.2 respectively on Sheet 5 of the attached plan. The WSP-2 program was used again to compute the water surface profiles using initial water surface elevations at cross-section 5-002. These initial elevations were taken from the origianl hydrological investigation. The computed water surface elevations at Wauneta for the corrected exsiting condition shown in Table B are slightly different at some locations from those computed for the original study.

Table B

Computed Water Surface Elevations at Wauneta
for Corrected Existing Condition

Cross-Sections	Return Period in Years 100	50	25	10	5	2
			(feet[1])			
5-002	2932.0	2931.6	2931.3	2930.3	2930.0	2929.5
5-003	2934.1	2933.4	2932.7	2931.6	2931.0	2929.9
5-004	2935.3	2934.5	2933.7	2932.6	2931.9	2930.5
5-005	2935.6	2934.9	2934.1	2932.9	2932.1	2930.5
5-006	2935.7	2934.9	2934.1	2932.9	2932.1	2930.6
5-006.1[2]	2936.6	2935.9	2935.0	2933.9	2933.0	2931.2
5-006.2[3]	2937.5	2937.0	2936.2	2935.5	2934.4	2931.7
5-008	2940.9	2940.3	2939.4	2938.2	2936.8	2933.8
5-009	2941.3	2940.9	2939.7	2938.5	2937.1	2934.0
5-010	2941.7	2941.2	2940.1	2938.8	2937.3	2934.2
5-011	2942.9	2942.3	2941.5	2940.1	2938.5	2935.2
5-012	2944.0	2943.5	2942.7	2941.4	2939.7	2936.4

1/ Elevations refer to mean sea level datum

2/ Estimated cross-section across Pt. 5-006.1

3/ Estimated cross-section across Pt. 5-006.2

The next step was to compute the water surface elevations for the six alternatives at the 12 cross-sections. It was found that the three alternatives without levees substantially reduced flood levels at Wauneta, but a considerable area of Wauneta was still flooded with shallow water. The computations for the three alternatives with levees showed that the addition of levees would slightly increase water elevations in the channel, but they would prevent flooding within the town.

Among the three alternatives with levees, the 70 foot wide channel appears to be the best alternative. The 60-foot wide channel raised the water elevations too high at the Wichita Street bridge while the 80-foot wide channel did not provide a significant amount of additional flood protection over the 70-foot wide channel. Table C shows the computed water surface elevations at Wauneta for the proposed channel with 70-foot width and levees.

Table C

Computed Water Surface Elevations at Wauneta
for 70' wide channel with levees

Cross-Sections	Return Period in Years					
	100	50	25	10	5	2
			(feet[1])			
5-002	2932.0	2931.6	2931.3	2930.3	2930.0	2929.5
5-003	2933.3	2932.7	2932.1	2931.0	2930.5	2929.7
5-004	2934.1	2933.5	2932.8	2931.7	2931.0	2929.8
5-005	2934.9	2933.9	2932.9	2931.7	2931.0	2929.9
5-006	2935.0	2933.9	2933.0	2931.7	2931.0	2929.9
5-006.1[2]	2935.4	2934.4	2933.6	2932.4	2931.5	2930.1
5-006.2[3]	2935.9	2935.0	2934.1	2932.9	2932.0	2930.4
5-008	2937.7	2936.8	2935.7	2934.4	2933.3	2931.4
5-009	2938.0	2937.0	2935.9	2934.6	2933.5	2931.5
5-010	2938.2	2937.2	2936.1	2934.7	2933.6	2931.6
5-011	2939.8	2938.7	2937.5	2935.9	2934.7	2932.4
5-012	2943.0	2942.0	2940.8	2939.1	2937.8	2935.1

1/ Elevations refer to mean sea level datum

2/ Estimated cross-section across Pt. 5-006.1

3/ Estimated cross-section across Pt. 5-006.2

Description of Selected Structural Measures

After reviewing the results of the reconnaissance investigation of hydrological and economic aspects of several alternatives, the sponsors indicated their acceptance of a project including an enlarged channel with a 70-foot bottom width, levees, two new bridges, the raising of Wichita Street, and a flood plain park. The major features of these structural measures are described in the following sections, and a set of drawings of the revised preliminary plan is attached at the back of this report.

Channel Improvement

The proposed improved channel is 4,730 feet long with a 70-foot bottom width and 2½ horizontal to 1 vertical side slopes. One hundred foot long transition sections are planned at the upper and lower limits of the channel enlargement to blend with the existing channel. The proposed improvement was designed with gradual, circular curves to reduce the head loss and the erosion potential due to sharp bends. The alignment was selected to provide zero skew through the new bridges, to provide maximum clearance with the railroad, residences and levees, and to follow the present channel to the extent possible. The plans do not include curve data or horizontal control points, but the alignment should not be changed much from these drawings in final design due to the above reasons.

The side slope materials are relatively erosive and, therefore, it is imperative that a good stand of vegetation be established as soon as possible during construction and that extra care and precautions be taken with vehicle and equipment travel to minimize rilling and erosion of vehicular tracks. Critical areas may require reseeding and mulching to maintain the desired high quality vegetative cover. The plans call for seeding and mulching of all side slopes, berms, levees and spoil areas to minimize erosion and pollution during construction and the early years of aging the new channel. The 2½ horizontal to 1 vertical side slopes are considered necessary for these site conditions.

The bottom grade of the enlarged channel will follow very closely the grade which now exists. In the lower reach of the channel, the present elevations at cross-section 6-002 and at the bottom of the rock ledge are to be maintained, and a uniform channel grade will be constructed between them. The channel reach between the rock ledge and the water pipeline is very critical to channel stability. Therefore, extreme care should be taken to maintain the existing elevations and assure the continued existence of the pipeline and the rock ledge. In the reach above the pipeline, minor elevation adjustments may be necessary to obtain a uniform channel grade between the pipeline and the upper end of the improved channel.

More detailed design is necessary on the extension of the water line crossing to accommodate the widening of the channel. The attached plans show a number of other items which must be refined in final design. The responsibilities of final design include these items plus all other related features required for successful completion and functioning of the project. Surface drainage problems should be resolved in final design to the extent practical, recognizing that some modifications may be expected during construction.

Select trees should be saved to the extent possible, but it is recognized that most of the trees within the construction limits will be affected. The cost estimate provides an allowance of over $12,000 for new landscape plantings to replace visual resources values altered in construction. Plantings of select species are needed in areas of high visual contact. The landscape plan needs to replace quantity with quality on the basis of the project life.

In addition to the revegetation on the side slopes, maintenance of the channel will include silt and debris removal following major storms and the control of tree growth within the flow area of the channel.

The estimated construction cost for the proposed channel and levees, including cost for spoil placement and 15% contingencies, is $259,500.

Levees and Spoil Placement

Low levees are to be constructed to prevent flooding at several low points along the stream. The levees are to be located on the south and west side of the stream from Wichita Street to the football field, and on the east side of the stream above Wichita Street. The top elevations specified were selected to meet or exceed the estimated water elevations for the design storm, the 100 year frequency storm. The construction of the levees is considered incidental to the placement of spoil since they are low.

A level service area, or berm, for construction and maintenance has been proposed along the levees and channel. In some reaches the top of the levees will serve as the access road for construction and mainteance. Where adequate space is available the width of the berm will be 30 feet, normally at the flood plain level. A minor amount of cut or fill may be required to provide a relatively uniform grade in a longitudinal direction and a positive grade toward the channel to the extent possible. The function of this berm is to provide working area during construction and the life of the project.

The approximate limits of spoil placement are shown on the drawings. The required excavated material could be disposed of in these areas with an average depth of 2 to 3 feet. It may be desirable to direct spoil placement to greater average depths in specific reaches during final design or construction. Final disposition of the material should be controlled by the need to provide drainage and revegetation, and to avoid mounds which would be undesirable from the visual or maintenance standpoint. The additional cost of spreading spoil is considered incidental when related to the benefit of doing so in this urban environment.

New Bridges

The exsiting bridges on Wichita Street and Arapahoe Avenue are to be replaced as a part of the flood control project. The two bridges impede flood flows in the stream and need to be replaced in order to obtain the full benefit of the proposed channel improvement. In addition, the two bridges have served their 50-year service life, according to the Nebraska Department of Roads, and should be replaced. Both new bridges will be 100 feet long and 40 feet wide. In order to provide the required flood capacity, the Wichita Street bridge must be raised to the elevation of the pavement at the intersection of Arikaree Avenue and Wichita Street. Raising the rest of the street to the same elevation will allow travel during floods and prevent the isolation of the eastern part of town from fire protection, schools and other services.

The seven sheets of plans for the new bridges were furnished by the Department of Roads, Bridge Design Section. Members of that department agreed that this type and size of bridge could be used for cost estimating purposes and would likely be approved for use on this project. Additional geologic investigations and testing must be expected in final design to verify the suitability of this standard design for the construction contract.

The plans call for rip rap placement on the side slopes 75 feet upstream and downstream from the centerline of the bridges. This was included to reduce the maintenance requirements and for added protection to the bridge abutments.

The estimated construction costs for the two bridges and the associated rip rap, including contingencies, is $452,500.

Park and Recreation Plan

This preliminary design is sufficiently detailed to determine its costs and benefits, and need only be used as a broad guideline in the development of the park, as long as the constraints of economic feasibility are observed. The areas shown for the activities are considered the most suitable location for that activity within the given area.

The proposed park is to be located along the east side of the stream from approximately 400 feet north of Wichita Street to about 300 feet south of it. The main area, south of Wichita Street, consists of approximately 4.6 acres. Within this area, plans call for the construction of a hike/bike trail, playground equipment, parking lot, and picnic areas with tables, fire grates, and trash cans. The area is to have an ice-skating rink which should be constructed or formed during the clearing and grading process. Consideration should be given to providing a shelter in the ice-skating area in the future so skaters might warm themselves and rest. Lighting of the area should also be given some consideration. The other area, north of Wichita Street, is approximately 2.0 acres in size and is to be cleared, shaped, and seeded only.

The total area is to be cleared of all trash including dead and small treees. All large, healthy trees should be retained if possible. Special care should be given to this process. Once the area is cleared and graded, it should be seeded as soon as possible.

The total recreation installation cost has been estimated to be $40,500.

Economic Evaluations

The analysis of benefits and costs for flood control was based on a project consisting of an improved 70-foot wide channel, levees, two new bridges, and the raising of Wichita Street. Flood control benefits were determined by comparing flood damages with and without the project. Flood control costs are the construction costs and associated costs. Benefits and costs for recreation are not changed from the original report.

Flood Control Benefits

The SCS Urban - 1 computer program was used to determine urban benefits resulting from the project. Field trips were made to update the input data for the computer program.

Residential Data Update. A survey of the flood plain was made to determine the number of houses added or removed since the previous investigations. The change in real estate values over the two year period between investigations was also taken into consideration.

Business Data Update. The change in business establishments and the change in business values were also taken into consideration while revising the input data for the analysis. Depth-damage factors were developed or revised where necessary.

Average Annual Damages and Benefits. The SCS Urban - 1 program computes the average annual flood damages to urban property with and without the project. The results are shown in Table D.

Table D

Average Annual Urban Damages and Benefits

Cross-Section	Buildings Damaged By 100-Year Flood		Average Annual Damages		Benefits
	Without Project	With Project	Without Project	With Project	
	(No.)	(No.)	($)	($)	($)
5-003	3	2	662	206	456
5-004	2	1	395	351	44
5-006.1	3	0	3,110	0	3,110
5-006.2	49	0	18,800	0	18,800
5-008	36	0	10,025	0	10,025
5-011					
TOTALS	93	3	32,992	557	32,435

Flood Control Costs

The flood control costs are the costs of improving the channel, raising Wichita Street, cost of land, cost of bridges, and operation and maintenance costs. Bridge costs were included even though the bridges are at the end, or near the end, of their useful life. However, the bridge costs, or a portion of the cost based on the remaining useful life, was reclaimed as benefits on the year their replacement was due. This is shown on Table E.

Installation Costs. The total estimated installation costs of $1,012,540, as shown on Table E of this report, were spread over a 4-year construction period. Assuming Engineering Services at 15% of cost, following is a more detailed breakdown of the Total Installation Costs:

Estimated Construction Cost =	$ 712,000
Engineering Services =	$ 106,800
Project Administration =	$ 85,440
Estimated Land Rights Cost =	$ 67,800
Total Installation Cost, (excluding recreation) =	$ 927,040
Total Recreation Installation Costs =	$ 40,500
Grand Total =	$1,012,540

Table E

PROJECT COSTS, BENEFITS, CASH FLOW, AND RATE OF RETURN

YEAR	PROJECT COSTS			PROJECT BENEFITS	CASH FLOW	
	INSTALL. COSTS	O & M COSTS	TOTAL COST		INCRE-MENTAL	ACCUMU-LATIVE
1980	200,000	0	200,000	0	-200,000	-200,000
1981	386,020	0	386,020	0	-386,020	-586,020
1982	386,020	7,120	393,140	258,775[1/]	-134,365	-720,385
1983	40,500	7,520[2/]	48,020	33,728[3/]	-14,292	-734,677
1984	0	7,520	7,520	33,728	26,208	-708,469
1985	0	7,520	7,520	246,488[4/]	238,968	-469,501
1986	0	7,520	7,520	33,728	26,208	-443,293
1987	0	7,520	7,520	33,728	26,208	-417,085
1988 THRU 2002	0	112,800	112,800	505,920	393,120	-23,965
2003	0	7,520	7,520	33,728	26,208	2,243
2004	0	7,520	7,520	33,728	26,208	28,451
2005 THRU 2029	0	188,000	188,000	843,200	655,200	683,651
TOTALS	1,012,540	360,560	1,373,100	2,056,751	683,651	

RATE OF RETURN = 3.54%

1/ REPLACEMENT COSTS OF 1 BRIDGE (BUILT IN 1925) PLUS ANNUAL DAMAGES PREVENTED BY PROJECT.

2/ 1% OF CONSTRUCTION COSTS PLUS $400 FOR RECREATION.

3/ FLOOD DAMAGE PREVENTED BY PROJECT [$32,992 DAMAGE W/O PROJECT AND $557 DAMAGE WITH PROJECT = $32,435 REDUCTION (98%)] PLUS $1,293 RECREATION BENEFITS.

4/ 47/50 OF REPLACEMENT COSTS OF 1 BRIDGE (BUILT IN 1935) PLUS ANNUAL FLOOD DAMAGE PREVENTED BY PROJECT AND RECREATION BENEFITS.

Operation and Maintenance Costs. Annual operation and maintenance costs were estimated as a percentage of construction costs. These costs are $7,120 per year.

Cash Flow and Rate of Return

The relationship between costs and benefits considered over the economic life of the project is expressed as the rate of return on investment. This is shown on Table E. The rate of return on this project is 3.54 percent.

Environmental Investigations

Few changes are necessary in this portion of the revised report. The description of the environmental features and the impacts associated with the project generally remain the same except that specific references to the three dam sites are no longer relevant. The information regarding the levee is still useful as it concerns the same basic area as the currently proposed channel. A field review of the proposed channel alignment was conducted on November 14, 1979. A greater amount of woody vegetation and associated wildlife habitat will be removed in this alternative as it requires greater right-of-way than the levee alone. Habitat losses associated with the proposal are still considered to be minimal, however.

Number (2) under Compensation Measures on page 56 of the original report is revised to state that approximately $12,000 will be included in the project costs for proper landscaping of the channel, spoil areas, and floodplain park. Adapted and native grasses, shrubs, and trees will be planted.

The stability of the altered channel is a potential problem that might have an environmental impact. Channel stability is not expected to be a serious problem under normal conditions due to the relatively small degree (approximately 11%) of channel length reduction and the similarity of the proposed grade to the existing grade. Significant erosion could occur, however, if heavy runoff events are experienced before vegetation is well established on the channel banks.

State of Nebraska
NATURAL RESOURCES COMMISSION
Planning Division

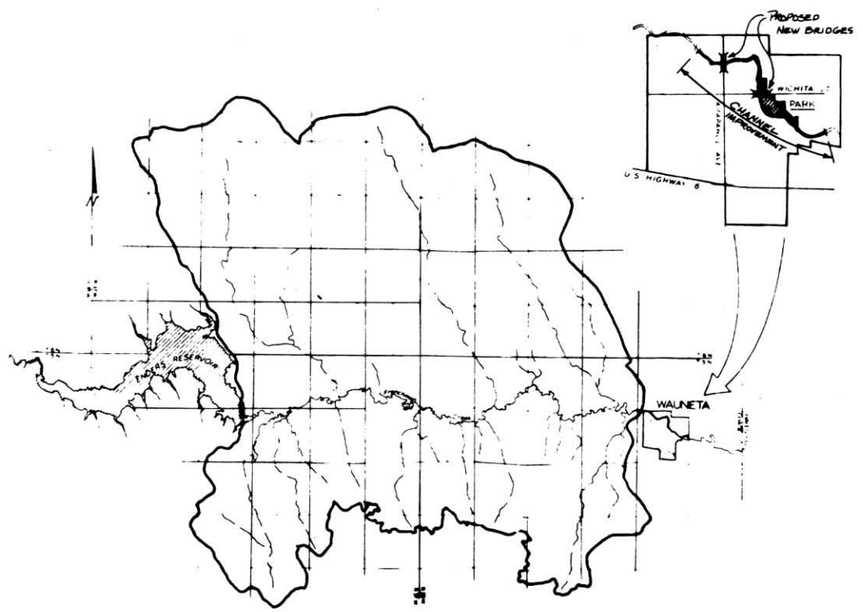
WAUNETA FLOOD CONTROL PROJECT

REV. 12/79

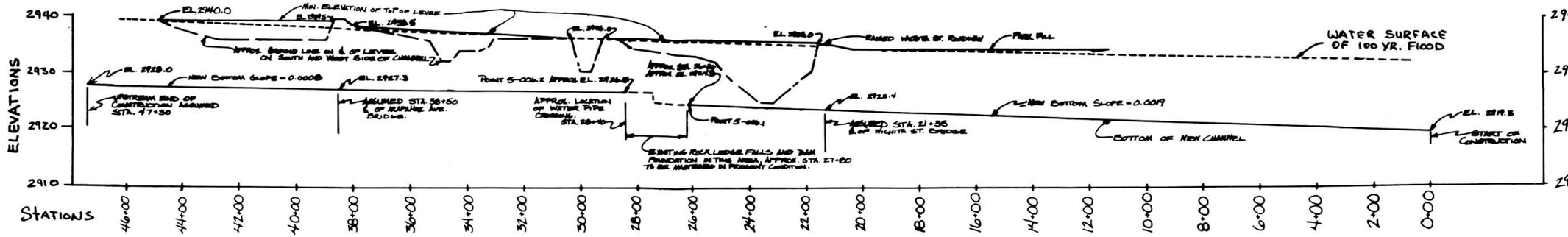
SHEET 1

WAUNETA FLOOD CONTROL PROJECT

REVISED PRELIMINARY PLAN



INDEX TO DRAWINGS



PROFILE OF NEW CHANNEL AND LEVEE

SCALE: HORIZONTAL- 1"=200', VERTICAL- 1"=10'

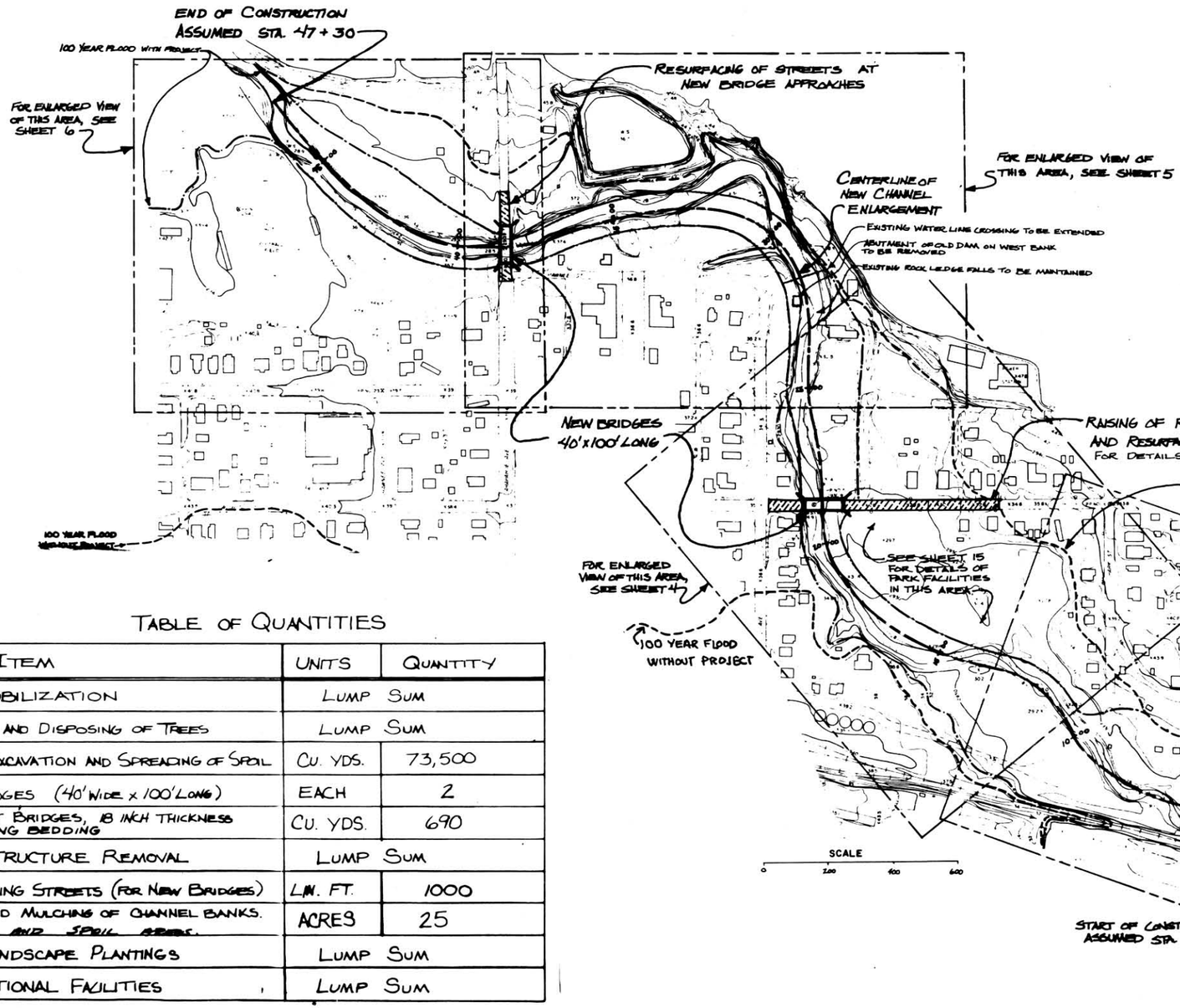


TABLE OF QUANTITIES

ITEM	UNITS	QUANTITY
MOBILIZATION	LUMP SUM	
CLEARING AND DISPOSING OF TREES	LUMP SUM	
COMMON EXCAVATION AND SPREADING OF SPOIL	CU. YDS.	73,500
NEW BRIDGES (40' WIDE x 100' LONG)	EACH	2
RIP RAP AT BRIDGES, 18 INCH THICKNESS INCLUDING BEDDING	CU. YDS.	690
STRUCTURE REMOVAL	LUMP SUM	
RESURFACING STREETS (FOR NEW BRIDGES)	LIN. FT.	1000
SEEDING AND MULCHING OF CHANNEL BANKS, BERMS AND SPOIL AREAS.	ACRES	25
LANDSCAPE PLANTINGS	LUMP SUM	
RECREATIONAL FACILITIES	LUMP SUM	

State of Nebraska
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WAUNETA FLOOD CONTROL PROJECT

State of Nebra
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WAUNETA FLOOD C
PROJECT

REV. 12/79

SHEET 3

PARK ST.

WILLOW

PONCA ST.

VALLEY ST.

X40.8

X39.2

X43.9

X38.5

X37.9

X35.9

⊗P.P. NO. 9
2932.2

X33.1

W.S.
23.0

X29.0

29.2 X

ASSUMED
STA. 10+15

APPROX. LOCATION OF SEWER MAIN NOT TO BE DISTURBED.

DETAILS OF WORK ON OLD PUMPING PLANT AND MANHOLE TO BE INCLUDED IN FINAL DESIGN.

APPROX. LIMIT OF SPOIL AREA. PROVIDE POSITIVE DRAINAGE

30' WIDE CONSTRUCTION & MAINTENANCE BERM

EXCAVATE NEW CHANNEL TO 2½:1 SIDE SLOPES

X-SECT 003

70' BOTTOM WIDTH

X28.7

X29.4

X-SECT 002

FILL OLD CHANNEL USING 2½:1 SIDE SLOPES TO FLOODPLAIN LEVEL

START OF CONSTRUCTION ASSUMED STA 0+00

100' LONG TRANSITION SECTION BLEND WITH NATURAL CHANNEL BOTTOM AND SIDE SLOPES.

APPROX. LIMIT OF SPOIL AREA

X19.5

26.2 X

26.3 X

X26.5

X25.4

X26.7

X27.8

2930

2940

0 50 100

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WAUNETA FLOOD CONTRO
PROJECT

REV. 12/78

SHEET 4

PROVIDE DRIVEWAY IN FINAL DESIGN.

APPROX. LIMITS OF SPOIL. PROVIDE POSITIVE DRAINAGE

GRADED RAMP TO MAINTENANCE BERM.

30' WIDTH MIN., UNLESS ROAD & SPOIL LEVEE SLOPE FROM EXIST. SITE TO EXIST. SITE (SIDE SLOPES 3:1 OR FLATTER)

STRUCTURES TO BE REMOVED

FINAL DESIGN TO PROVIDE FOR CULVERT WITH FLAP GATE IF REQUESTED.

ROADWAY AND DRIVEWAYS TO BE RAISED AND RESURFACED. LAYOUT AND DESIGN OF DRIVEWAYS TO BE COMPLETED IN FINAL DESIGN.

APPROX. LIMITS OF SPOIL PROVIDE POSITIVE DRAINAGE

APPROX. LOCATION OF GRASSED WATERWAY

PARK PLAN FEATURES IN THIS AREA NOT SHOWN. FOR DETAILS SEE SHEET 15.

CONSTRUCT NEW I BRIDGES 40' x 100' LONG. RIP RAP SIDE SLOPES 75' UPSTREAM AND 75' DOWNSTREAM

30' WIDE CONSTRUCTION AND MAINTENANCE BERM

ASSUMED STA. 10+15

70' BOTTOM WIDTH CHANNEL WITH 2½:1 SIDE SLOPES

APPROX. LIMITS OF SPOIL. PROVIDE POSITIVE DRAINAGE

MIN. 30' WIDE COMBINATION LEVEE AND CONSTRUCTION MAINTENANCE BERM

TOE OF LEVEE FILL. SIDE SLOPES 2½:1

PROVIDE POSITIVE DRAINAGE TO PIPE OUTLET AT ROAD DITCH

GRADED MIN. TOP EL. 2936.0 AT STA. 29+80 TO EL 2935.0 AT STA. 21+55.

18" DIA. DRAIN PIPE, FLAP GATE ON OUTLET, END CONTROL RIPRAP.

RIP RAP

FILL OLD CHANNEL USING 2½:1 SIDE SLOPES TO FLOODPLAIN

X SECT 000

X SECT 004

X SECT 005

State of Nebraska
NATURAL RESOURCES COMMISSION
Planning Division

WAUNETA FLOOD CONTROL PROJECT

REV. 12/79

SHEET 6

46
44
42
45.8
38
2950
48
46
2940
44
45.2
44
42
46
W.S. 36.7
46.3
2950
FILL OLD CHANNEL USING 2½:1 SIDE SLOPES ADJACENT TO NEW CHANNEL. PROVIDE POSITIVE DRAINAGE.
X SECT 009
X SECT 008
X SECT 010
2940
37.2
FILL OLD CHANNEL USING 2½:1 SIDE SLOPES
X 36.1
34
ROADWAY RESURFACING
RIPRAP
28
2930
32+00
31+00
37.4
W.S. 28.5
MINIMUM 30' WIDE COMBINATION LEVEE AND SPOIL CONSTRUCTION - MAINTENANCE BERM. MINIMUM TOP ELEVATION SHOWN ON SHEET 2
36
38.3
LOCATION OF WATER PIPE. TO BE MAINTAINED AND EXTENDED
STORM SEWER OUTLET
APPROX. LIMITS OF SPOIL. PROVIDE POSITIVE DRAINAGE
APPROX LOCATION OF OLD DAM FOUNDATION AND ROCK LEDGE TO BE MAINTAINED AT EXISTING ELEVATION AND EXTENDED TO FULL CHANNEL WIDTH.
ASSUMED STA. 39+50
PAWNEE CT
STRUCTURE TO BE REMOVED
FILL TO INVERT OF SEWER PIPE
TRANSITION SECTION FOR BERM GRADE TO CURB LEVEL
CONSTRUCT NEW 40'x100' LONG SLOPES 75' UP 75' DOWNSTREAM
BRIDGES RIP RAP SIDE STREAM AND
POINT 5-006.2
MINIMUM 30' WIDE COMBINATION LEVEE AND CONSTRUCTION - MAINTENANCE BERM TOP ELEVATION SHOWN ON SHEET 2
MODIFICATION OF THIS STRUCTURE IS NOT PLANNED. TRANSITION AS REQUIRED.
ABUTMENT OF OLD DAM TO BE REMOVED
35.2
POINT 5-006.1
CHANNEL WITH 70' BOTTOM WIDTH AND 2½:1 SIDE SLOPES
X 38.5
X 39.3
X 39.
0 50 100 150 200
SCALE IN FEET

State of Nebraska
NATURAL RESOURCES COMMISSION
Planning Division

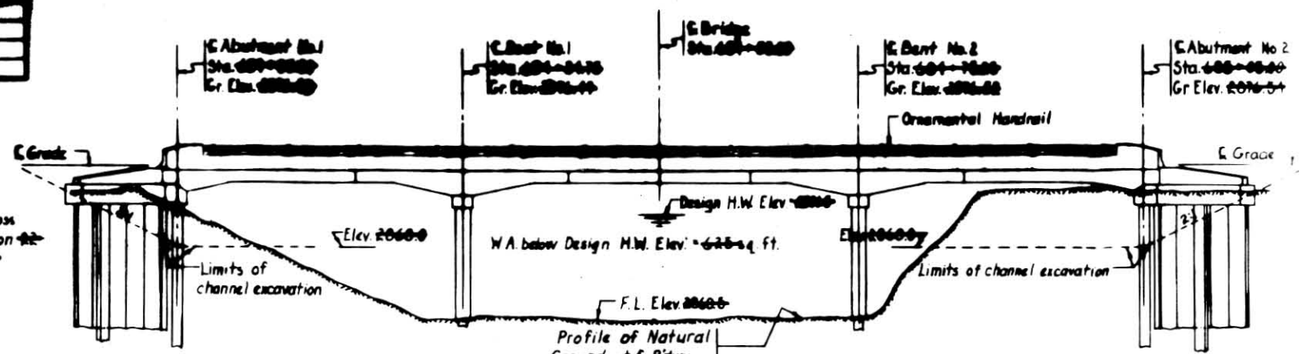
WAUNETA FLOOD CONTROL PROJECT

REV. 12/70

SHEET 6

39.7 X
X 39.7
X39.3
END OF CONSTRUCTION ASSUMED 47+30
APPROX. LIMITS OF SPOIL PROVIDE POSITIVE DRAINAGE
100' LONG TRANSITION SECTION, BLEND TO NATURAL CHANNEL WIDTH AND SIDE SLOPES
ASSUMED STA 46+30
W.S. 28.9
40.8 X
NEW CHANNEL WITH 70' BOTTOM WIDTH AND 2:1 SIDE SLOPES.
X SECT. 011
X SECT. 010
X SECT. 009
46
44
42
40
38
36
34
32
2940
2930
X 37.5
APPROX. LOCATION OF LEVEE FINAL LOCATION TO AVOID TREES TO BE SAVED (SIDE SLOPES 2:1 OR FLATTER)
PROVIDE A CONTINUOUS SPOIL BERM IN THIS WASTE AREA OF NOT LESS THAN 30' TOP WIDTH, AT ELEVATION SHOWN ON SHEET 2.
ASSUMED STA. 39+50
38.5 X
W.S. 28.5
X39.7
P.P. NO. 1
X39.4
X42.7
P.P. NO. 22
2942.1
X 42.3
FOOTBALL FIELD
42
2940
2.5X
42
APPROX. LIMITS OF SPOIL PROVIDE POSITIVE DRAINAGE
18" DIA PIPE OUTLET WITH FLAP GATE ON OUTLET PLACED ON RIPRAP SECTION
NEW BRIDGE AND RIPRAP NOT SHOWN. SEE SHEET 5 FOR LAYOUT OF ARAPAHOE STREET BRIDGE.
38.6 X
X39.2
X39.9
X40.9
40.1
X40.9
X39.3
X41.8
X40.8
X39.8
P.P. NO. 23 2939.7
X39.1
X39.1

0 50 100 150 200
SCALE IN FEET



GENERAL ELEVATION

SCALE: 1" = 1'-0"

NOTE: Channel Excavation shall be Classified as Roadway Excavation.

This Structure is located across the Frenchman River in Section [illegible] T5N-R30W in Hayes County.

DESIGN PILE BEARING

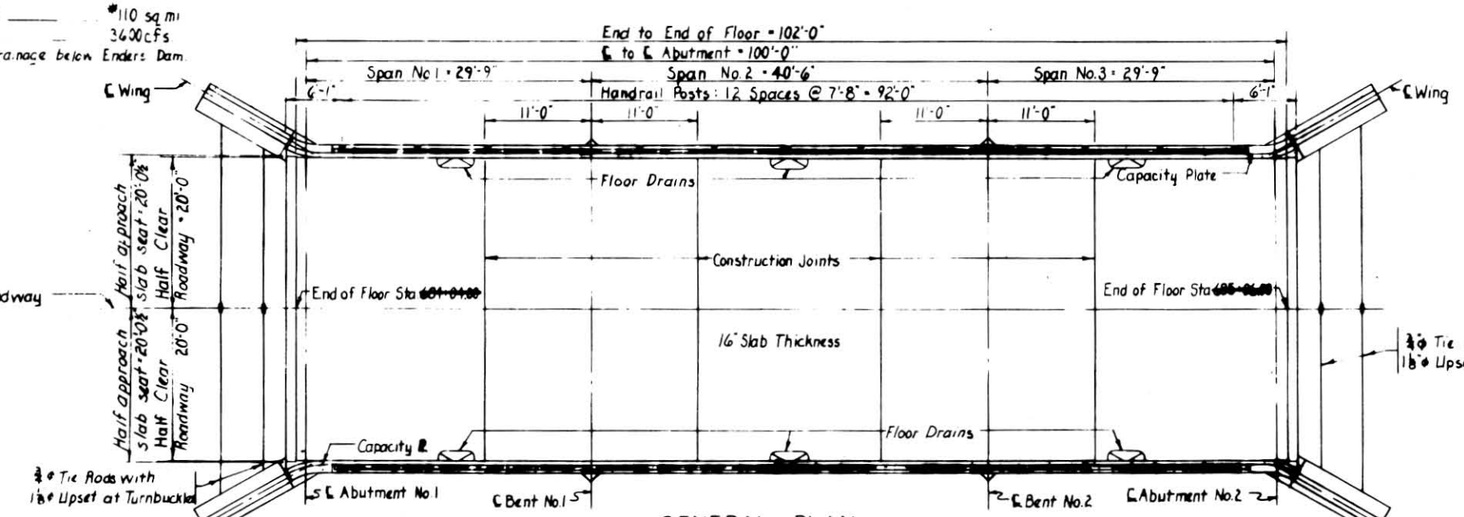
Abutment	25 Tons/Pile
Bent	32 Tons/Pile
Wing	10 Tons/Pile

Drainage Area _____ *110 sq mi

Qsc _____ 3400 cfs

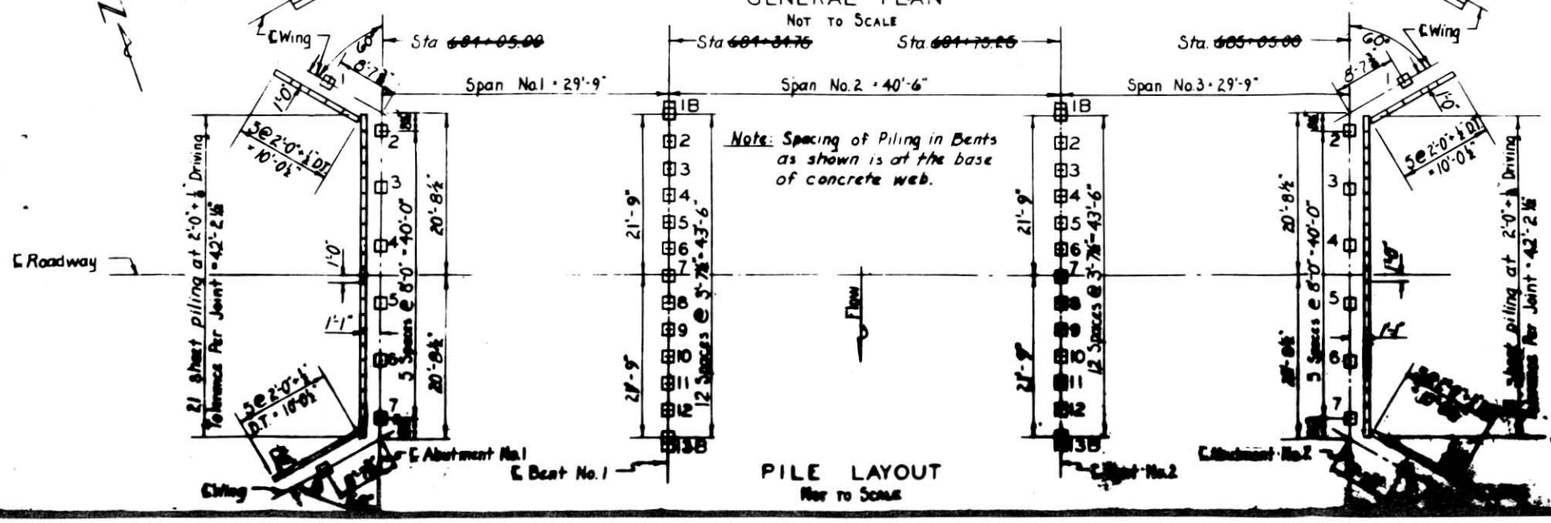
*contributing drainage below Enders Dam.

TRAFFIC DATA		
DESIGN YEAR	ADT	DHV
1972	800	110
1992	1200	160



GENERAL PLAN

NOT TO SCALE



PILE LAYOUT

NOT TO SCALE

Sheet Pile Order Length = 16'-0"

NOTE

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NOTES

Material for tie rods shall be in accordance with the requirements of A.S.T.M. - A575 Grade 1020.
Working stress for tie rods shall be 18,000 p.s.i.
All tie rods shall be galvanized.

All Cast-in-Place Concrete shall be Class "47A-S", "47B" or "47C-S".

All exposed edges of concrete shall be chamfered.

Concrete in floor shall be poured in accordance with the specifications and in accordance with the pouring diagram.

Class "47A-S" concrete shall not be used for bridge floor.

The ornamental handrail shall be set to transit line and grade and shall conform to the vertical curves. Handrail posts shall be set normal to top of curb.

All reinforcing steel shall conform to the requirements of A.S.T.M. designation A615, or A617, grade 40 or grade 60.

The minimum cover, measured from the face of the concrete to the surface of any reinforcing bar, shall be 2" except as shown.

The working stress of the reinforcing steel is 20,000 p.s.i.

The working stress for Class "47A-S", "47B" or "47C-S" concrete is 1200 p.s.i.

This Structure is designed in accordance with the 10th edition of the A.A.S.H.O. Standard Specifications for Highway Bridges.

"Concrete Piling" shall be Prestressed Concrete, Type I or Cast-in-Place concrete piling.

The alternate precast prestressed concrete sheet piling (6" thick) may be substituted for original design precast concrete sheet piling (6" thick) in accordance with Standard Plan No. 1720-E.

The contractor may substitute the alternate design for the original design as shown on these plans. Quantities are based on the original design. No additions or deductions will be allowed for use of the alternate designs.

QUANTITIES

Excavation for Bridges	5 Cu Yds.
Class "47A-S", "47B" or "47C-S" Concrete	365.8 Cu Yds.
Slab and Curbs	272.8 Cu. Yds.
Abutments	30.5 Cu. Yds.
Bents	61.5 Cu Yds
Reinforcing Steel	58,135 Lbs.
Slab and Curbs	48,465 Lbs.
Abutments	5,145 Lbs.
Bents	4,525 Lbs.
Structural Steel for Substructure	985 Lbs.
Concrete Piling	2,350 Lin. Ft.
Concrete Sheet Piling	1,984 Sq. Ft.
Ornamental Handrail	184.0 Lin. Ft.
Floor Drains	6 Each
* TEMPORARY BARRIER RAIL	75 L.F.

* For Bidding Purposes Only.

For Details of Concrete Finish see Standard 1562-C.
For Details of Handrail, except as shown, see Standard 1755-C or 1758.
For Details of Capacity Plates, except as otherwise shown, see Standard 1747-R
For Details of Prestressed Concrete Piling, Type I, see Standard 1720-C-R-2
For Details of Precast Concrete Sheet Piling, 6" thick, see Std. 1720-E.

Hwy US No. 6, Reference Post 47.78

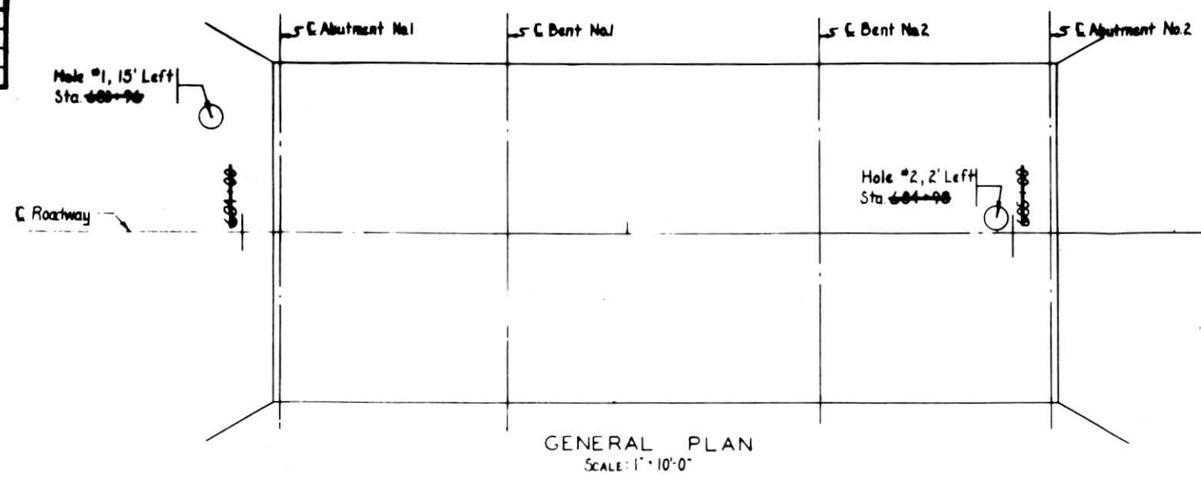
STATE OF NEBRASKA
DEPARTMENT OF ROADS

1-40'-6" AND 2-29'-9" SPANS CONTINUOUS CONCRETE SLAB BRIDGE

STATE ROAD WAUNETA - HAMLET

PROJ. [illegible]

PILE DATA



GENERAL PLAN
SCALE: 1" = 10'-0"

NOTE

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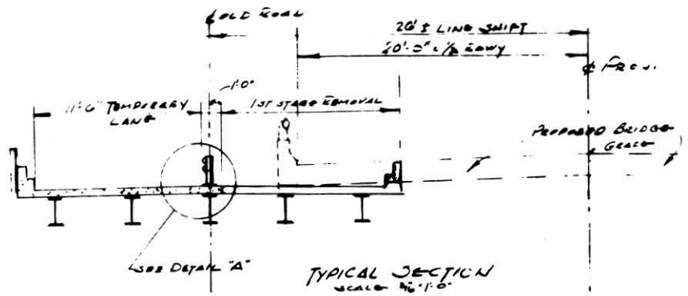
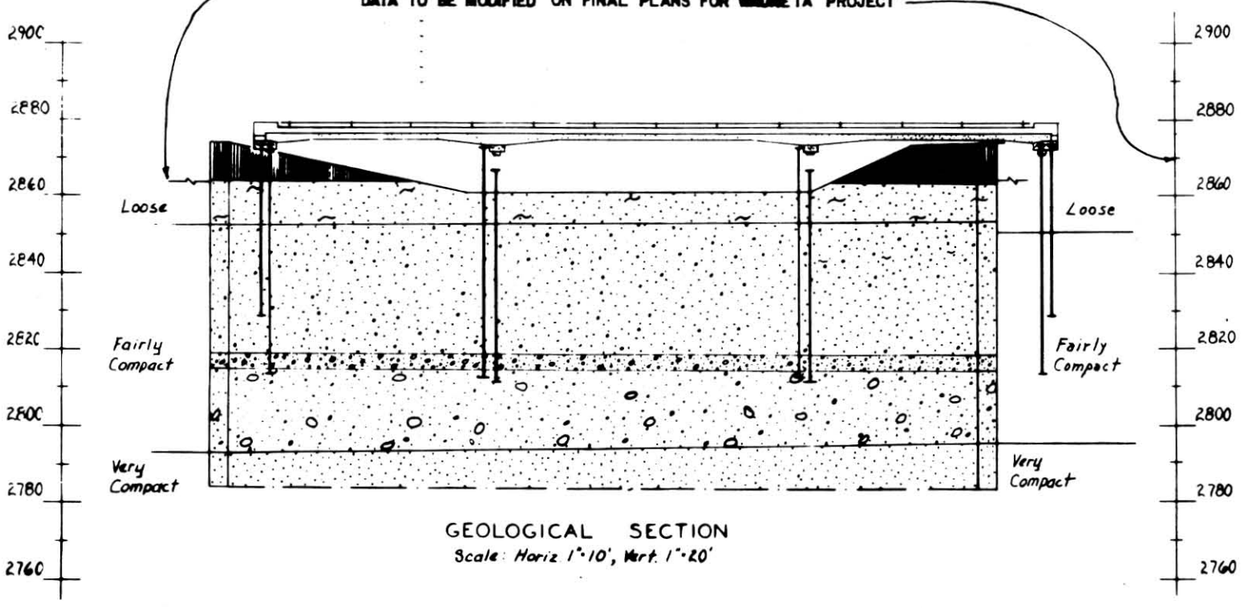
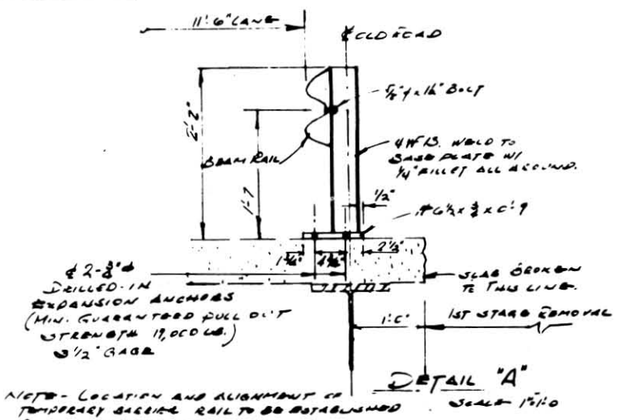


TYPICAL SECTION
SCALE ¼"=1'-0"

ALL REFERENCE TO STATIONING, ELEVATIONS AND GEOLOGIC DATA TO BE MODIFIED ON FINAL PLANS FOR WAUNETA PROJECT



GEOLOGICAL SECTION
Scale: Horiz 1"=10', Vert 1"=20'



NOTE- LOCATION AND ALIGNMENT OF TEMPORARY BARRIER RAIL TO BE ESTABLISHED BY THE ENGINEER.

TEMPORARY BARRIER RAIL

Roadway Fill

Sand, very fine to medium coarse, slightly silty, loose.

Sand, very fine to very coarse, clean; contains little pebbles and gravel grains, fairly compact.

Sand and gravel, fine sand to very coarse gravel; contains little pebbles and small stones, fairly compact.

[redacted]

Test Boring

Water Level

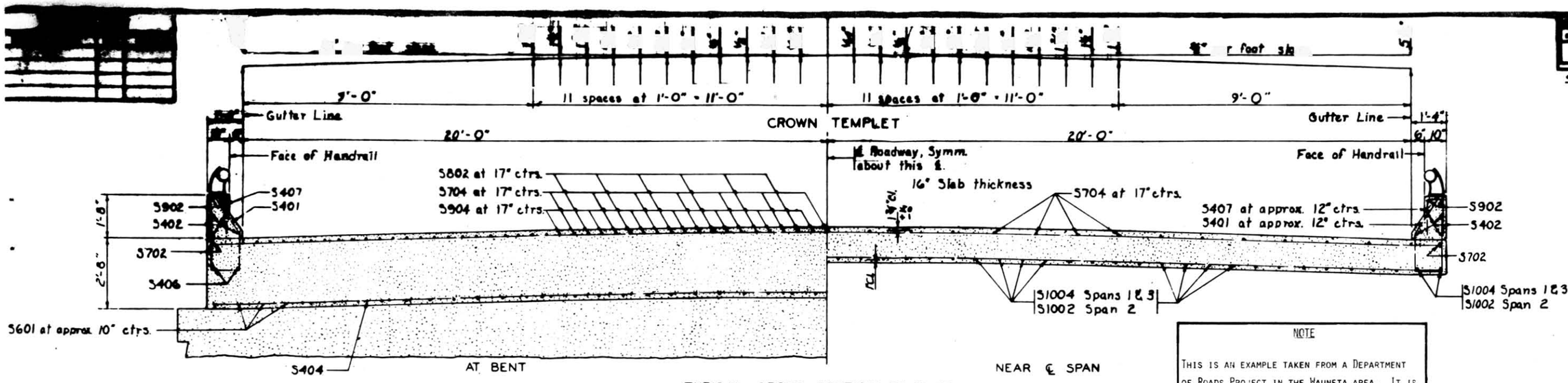
June 1967 Date of Tests

Note: [redacted]

[redacted]

STATE OF NEBR[redacted]
DEPARTMENT OF [redacted]
1-40'-6" AND 2-28'-6" [redacted]
CONCRETE [redacted]
[redacted]

TO BE ADAPTED FOR WAUNETA FLOOD CONTROL PROJECT



TYPICAL CROSS SECTION OF SLAB
Not to Scale

NOTE

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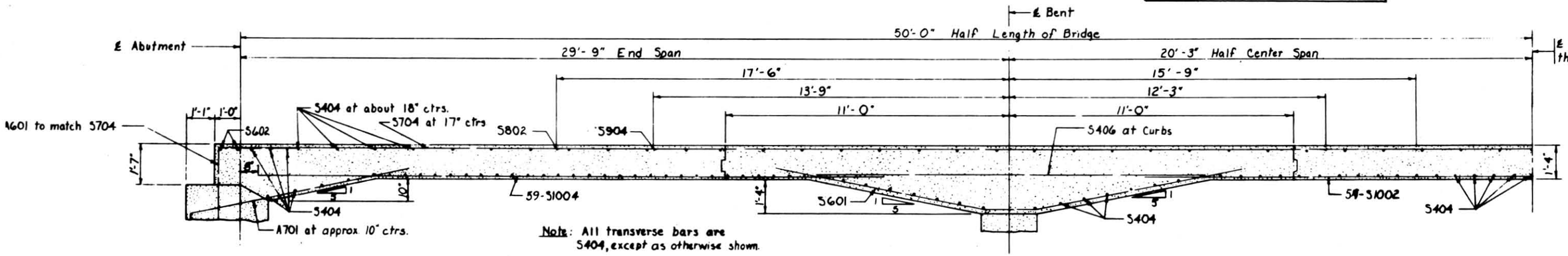
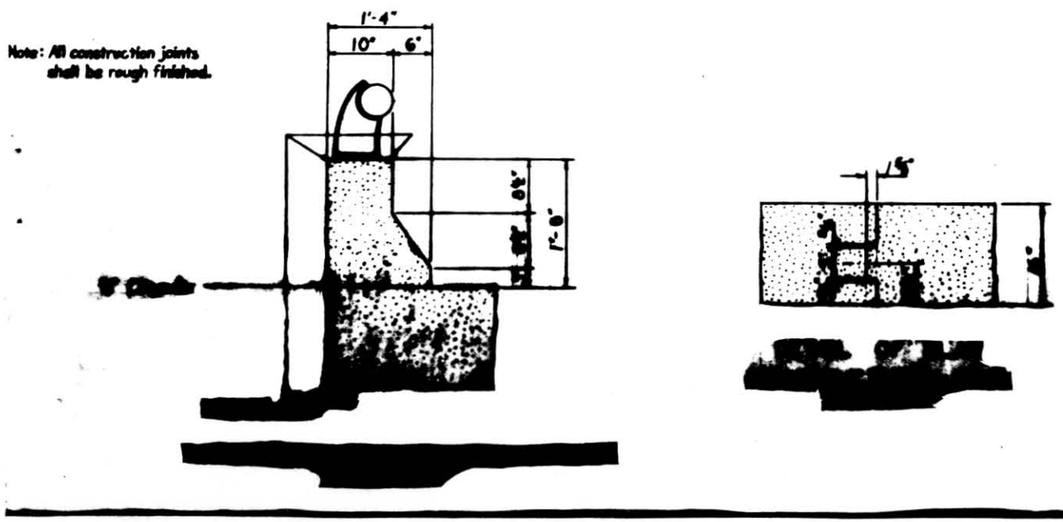
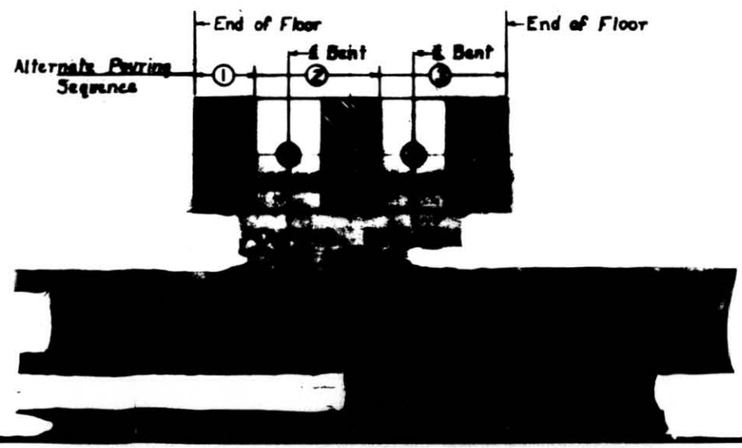
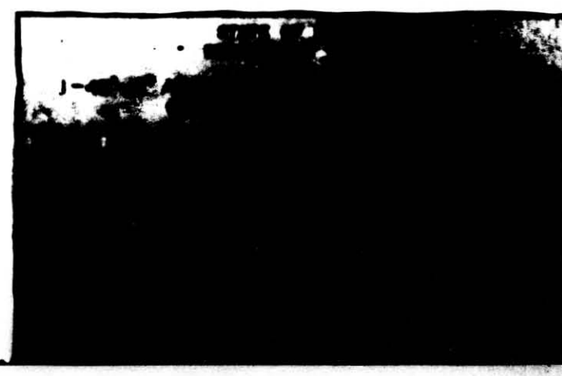


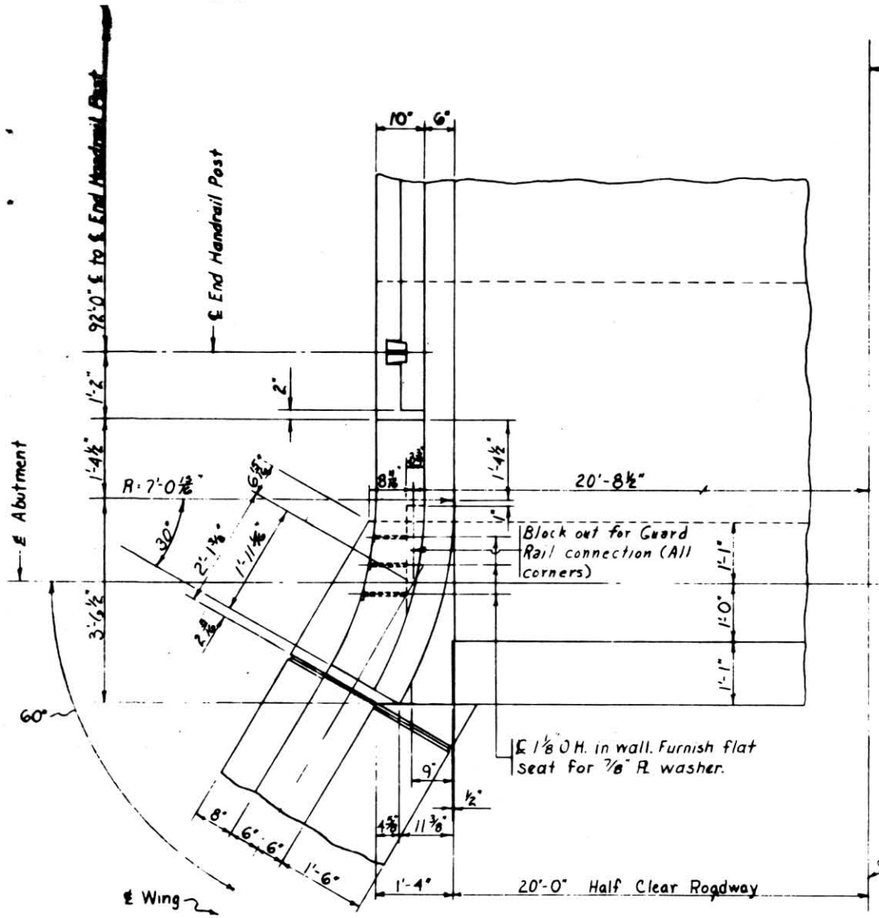
Note: All transverse bars are S404, except as otherwise shown.

LONGITUDINAL SECTION AT ℄ ROADWAY
Scale: ½" = 1'-0"

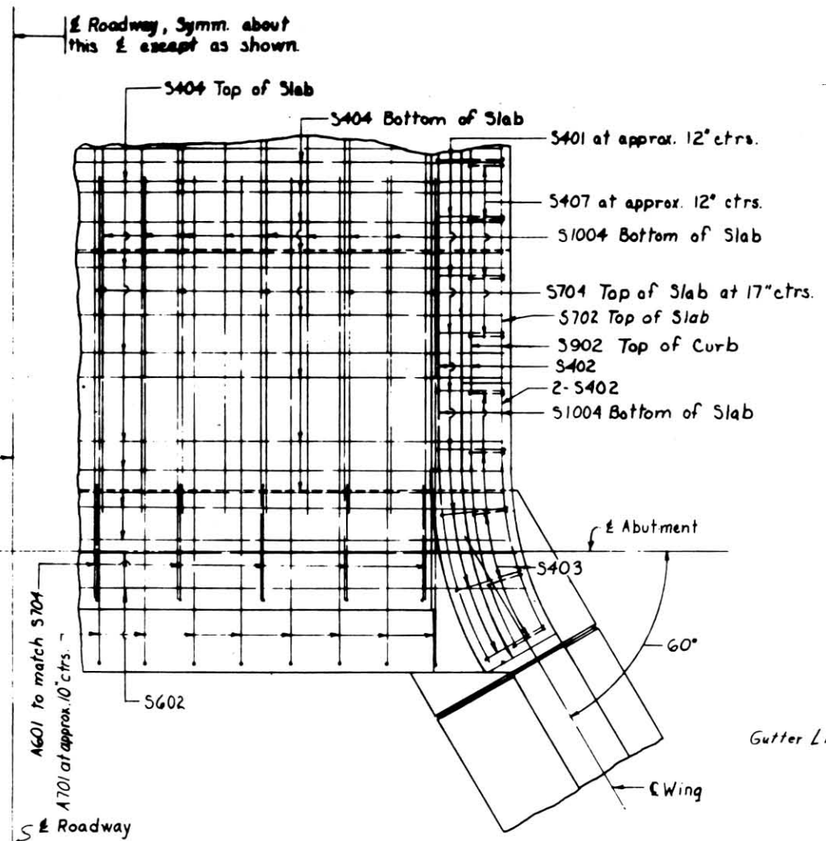






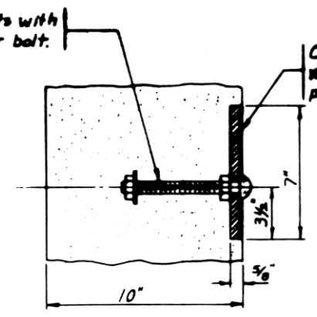


SHOWING DIMENSIONS

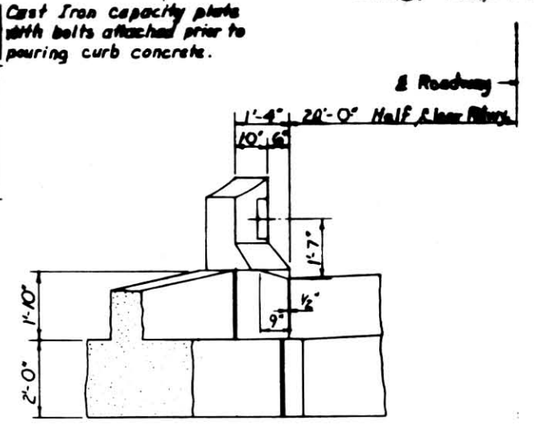


SHOWING REINFORCING

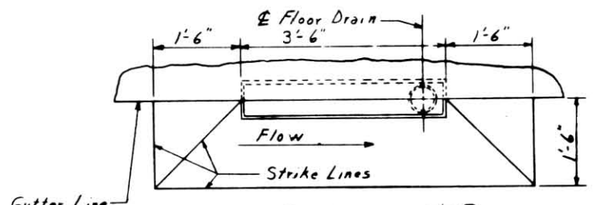
PART PLAN AT END OF FLOOR
Scale: ¾" = 1'-0"



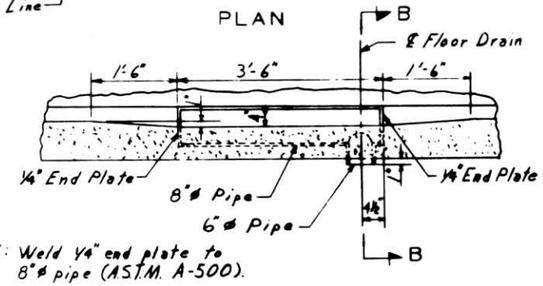
SECTION C-C
Scale: 3" = 1'-0"



ELEVATION AT END OF FLOOR
Scale: ½" = 1'-0"



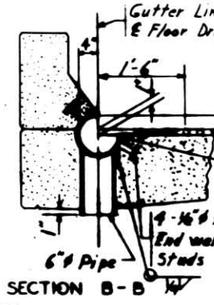
PLAN



NOTE: Weld ¼" end plate to 8"ø pipe (A.S.T.M. A-500).

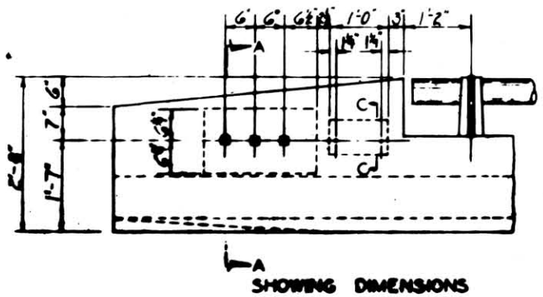
ELEVATION

Note: Bend reinforcing steel to clear drain minimum of 1 inch.
Floor drains shall be galvanized after fabrication.

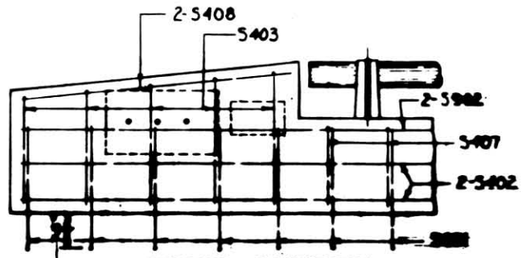


SECTION B-B

FLOOR DRAIN DETAILS
Scale: ¾" = 1'-0"

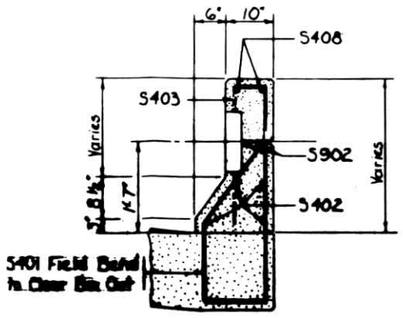


SHOWING DIMENSIONS



SHOWING REINFORCING

DETAILS OF CURB ENDS
Scale: ¾" = 1'-0"



SECTION A-A

NOTE

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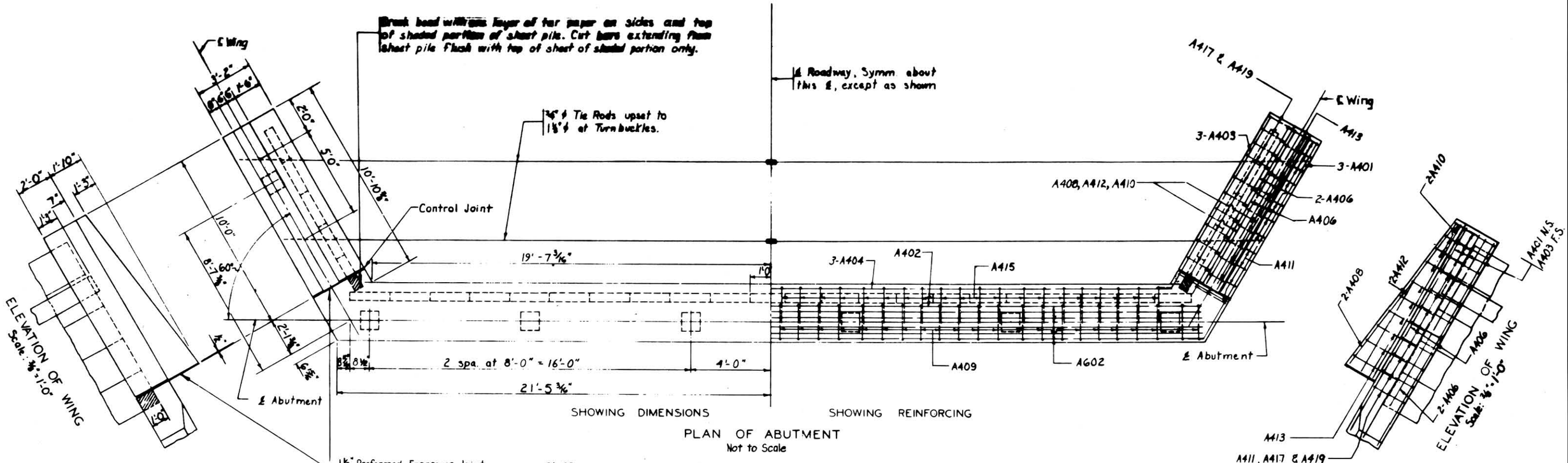
STATE OF NEBRASKA
DEPARTMENT OF ROADS

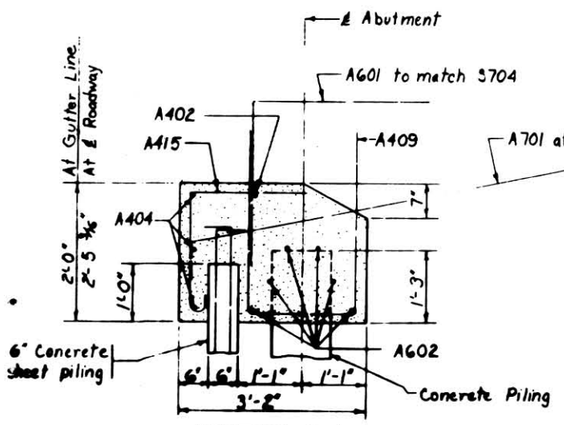
1-40'-6" AND 2-29'-9" SPANS CONTINUOUS CONCRETE SLAB [illegible]

STATE ROAD WAUNETA — [illegible]

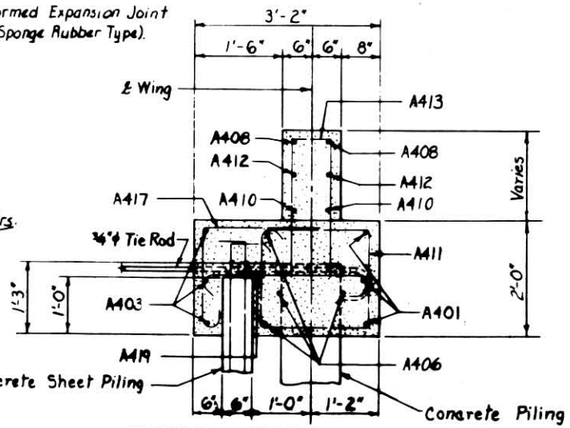


PLAN OF ABUTMENT
Not to Scale

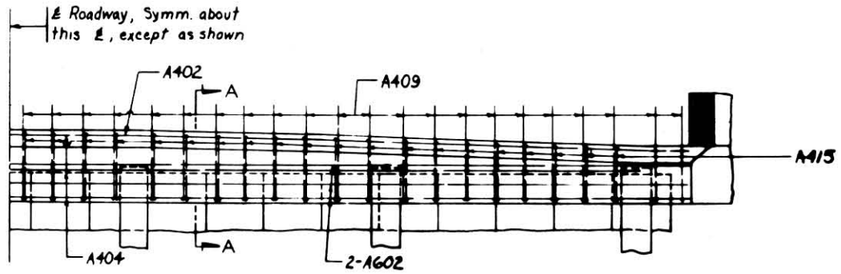
½" Preformed Expansion Joint Filler (Sponge Rubber Type).



SECTION A-A
Scale: ¾"=1'-0"



TYPICAL SECTION OF WING
Scale: ¾"=1'-0"



HALF ELEVATION OF ABUTMENT
Not to Scale

NOTE

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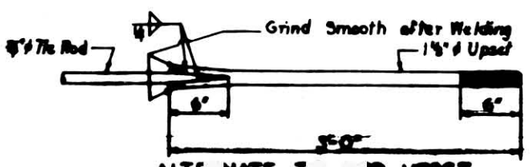
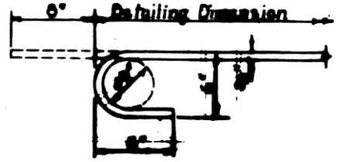
53'-10"

I [illegible] LE [illegible] STHS



ALTE NATE T [illegible] ID UPSET



T [illegible]

Note: Tie rods shall conform to the requirements of A.S.T.M. designation A 575 grade 1020.

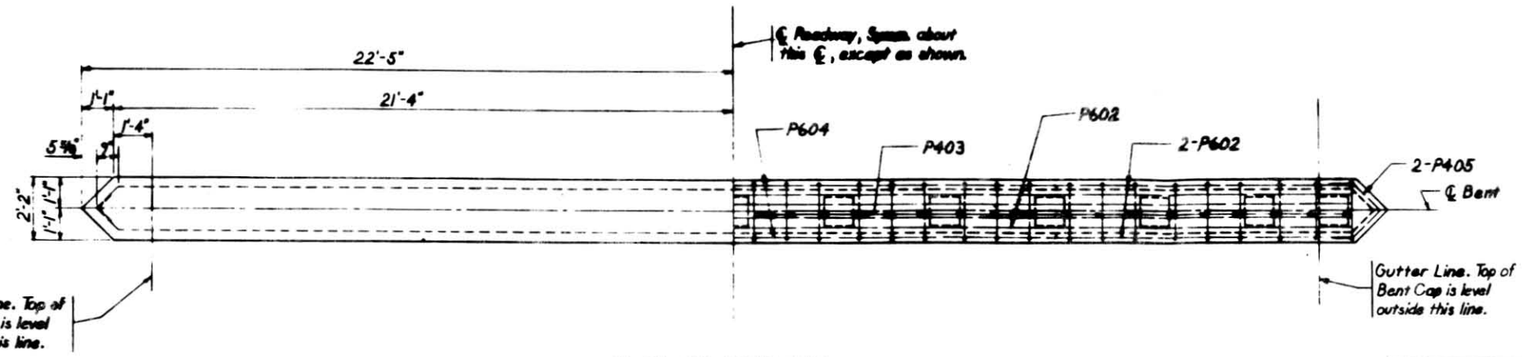
*Note: Fill joint with "Kobi's Elastic Caulking And Painting Composition" as manufactured by H.& R. Kobi Brooklyn, New York or [illegible]

I [illegible]

STATE OF [illegible]
DEPARTMENT OF [illegible]

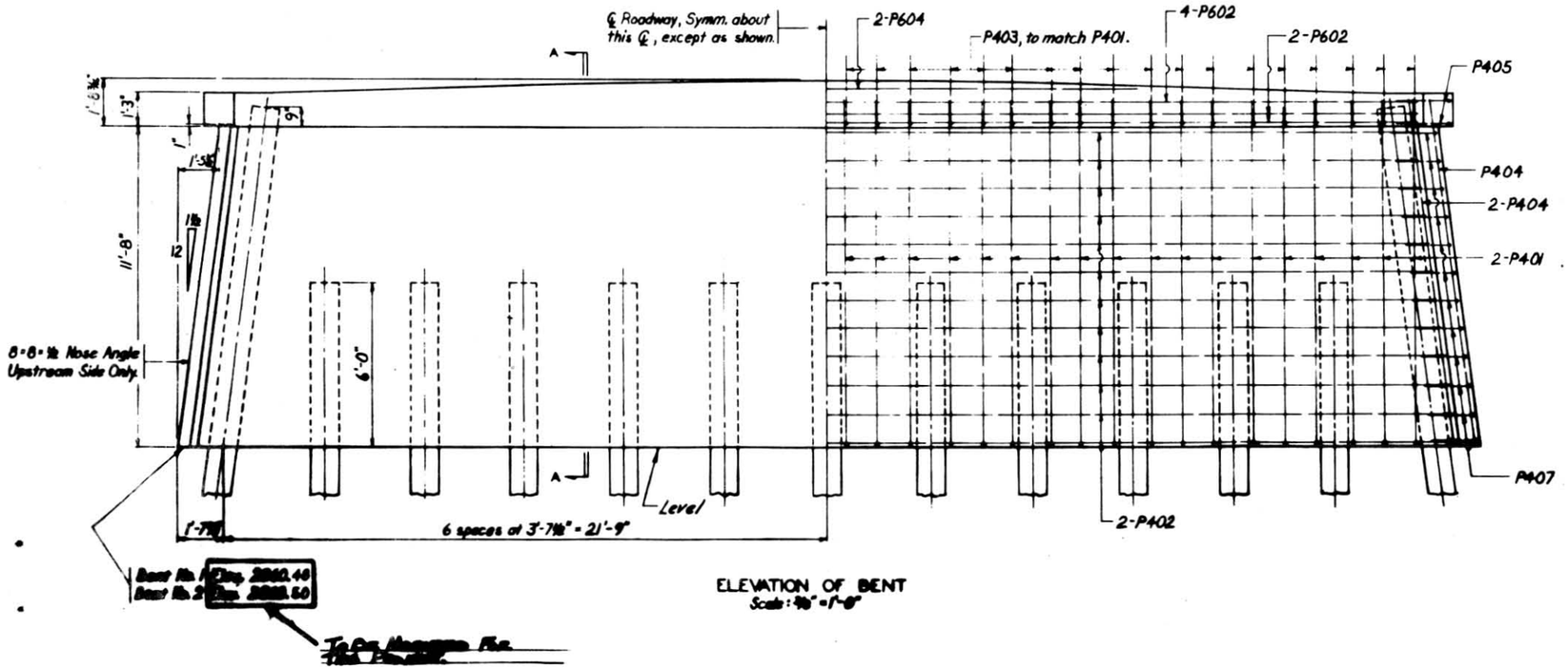
1-40'-6" AND 2-29'-9" S[illegible]
CONCRETE SL[illegible]

STATE ROAD WAUNETA [illegible]



PLAN OF BENT CAP
Scale: 3/16"=1'-0"

Note: Make top of Bent Cap conform with bottom of slab.



ELEVATION OF BENT
Scale: 3/16"=1'-0"

To Bridge Manager File

NOTE

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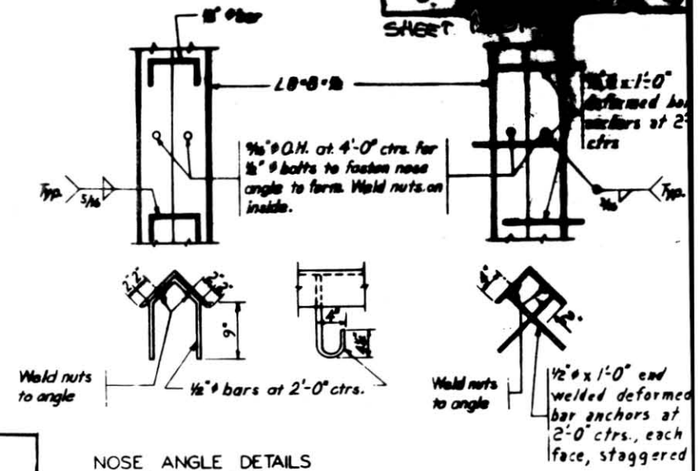
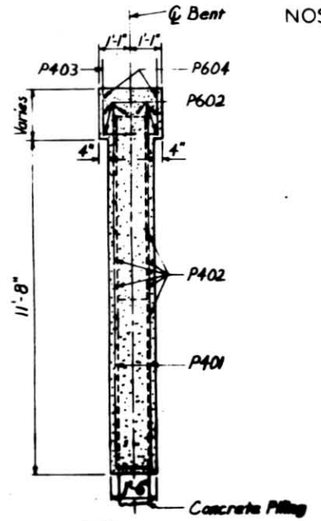


NOSE ANGLE DETAILS
Scale: 1" = 1'-0"

ALTERNATE
NOSE ANGLE DETAILS
SCALE: 1"=1'-0"



SECTION A-A
Scale: 3/16"=1'-0"

NOTE

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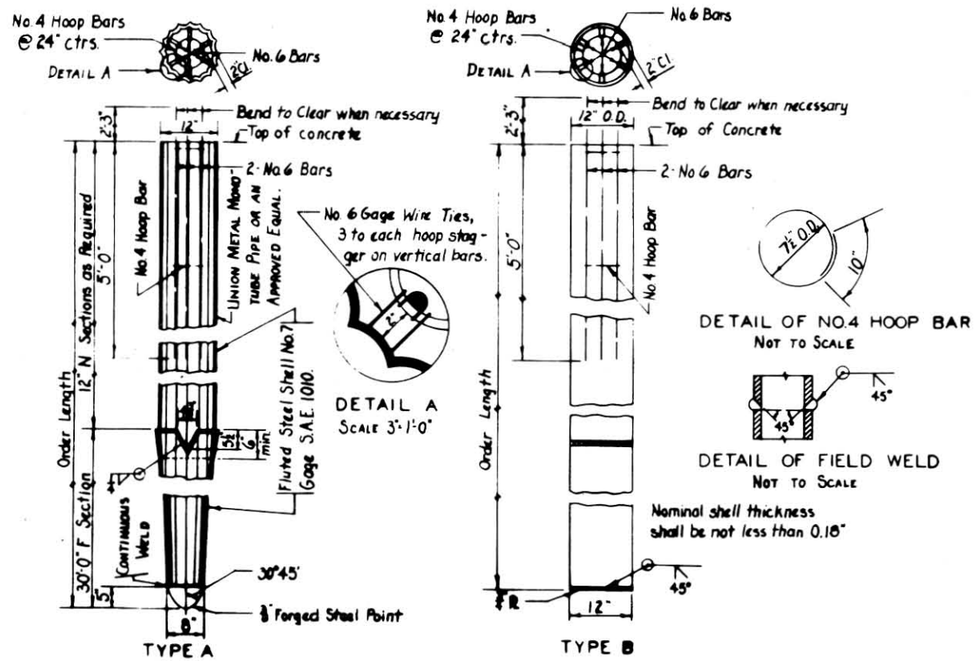


CAST IN PLACE PILING

NOT TO SCALE

NOTE: Pipe for pipe piles shall conform to the Requirements of A.S.T.M. Serial Designation A-252, "Welded and Seamless Steel Pipe Piles" - Grade 2.

BILL OF BARS

SLAB AND CURBS

STRAIGHT			BENT		
MARK	No.	LENGTH	MARK	No.	LENGTH
S1002	54	30'-0"	S401	208	6'-4"
S1004	118	24'-3"	S403	20	4'-9"
S902	4	109'-2"	S407	188	3'-4"
S904	56	26'-0"			
			S601	104	18'-4"
S802	56	33'-3"			
S702	2	*108'-0"			
S704	29	*106'-2"			
S602	4	*43'-7"			
S402	8	*106'-6"			
S404	202	*43'-2"			
S406	8	15'-6"			
S408	8	4'-6"			

ABUTMENTS

STRAIGHT			BENT		
MARK	No.	LENGTH	MARK	No.	LENGTH
A402	12	*44'-1"	A701	98	9'-4"
A404	2	*43'-8"	A601	88	5'-10"
A406	6	39'-6"			
A408	16	9'-8"	A401	12	18'-2"
A405	8	9'-9"	A403	12	111'-8"
A410	8	9'-8"			
A412	8	6'-0"			
			A409	88	8'-2"
			A411	44	7'-10"
			A413	40	4'-9"
			A415	80	4'-7"
			A417	44	4'-4"
			A419	44	3'-8"

BENTS

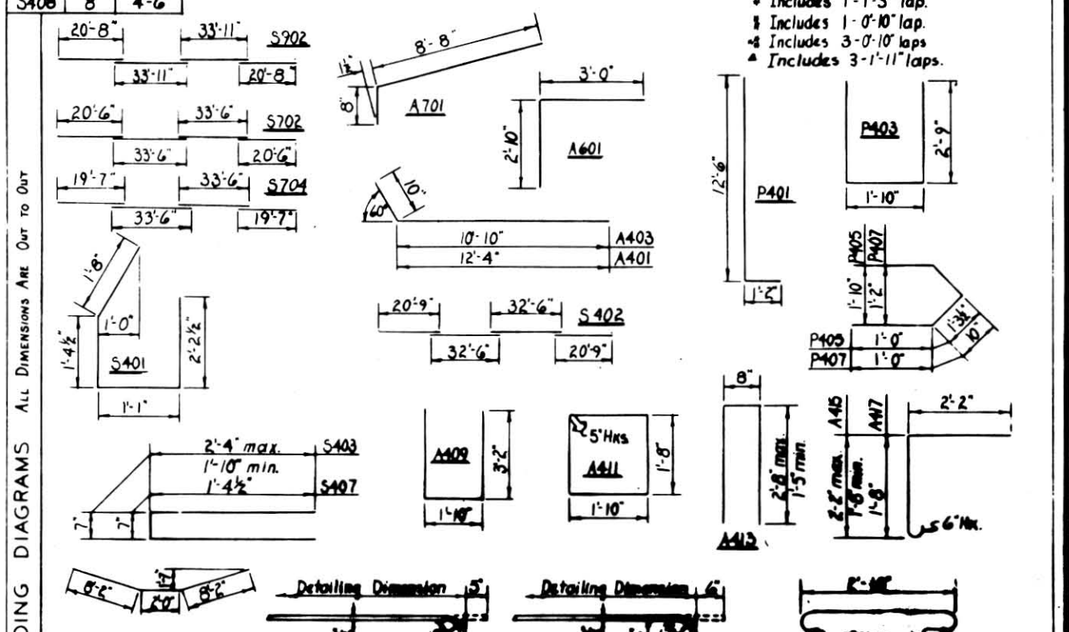
STRAIGHT			BENT		
MARK	No.	LENGTH	MARK	No.	LENGTH
P602	16	*43'-8"	P401	184	13'-8"
P604	4	22'-8"	P403	72	7'-4"
			P405	8	4'-7"
P402	48	*44'-7"	P407	48	3'-8"
P404	12	12'-6"			

BAR SETS

MARK	MAXIMUM	MINIMUM	SETS
A413	6'-0"	3'-6"	4 of 10
A415	4'-10"	4'-4"	4 of 20
P402	*46'-0"	*43'-6"	4 of 12
S403	5'-3"	4'-3"	4 of 5

* Includes 3-1'-6" laps.
+ Includes 1-1'-3" lap.
‡ Includes 1-0'-10" lap.
*‡ Includes 3-0'-10" laps
▲ Includes 3-1'-11" laps.

BENDING DIAGRAMS ALL DIMENSIONS ARE OUT TO OUT



MAP OF APPROXIMATE TREE CLEARING AREAS.

SCALE 1"=200'

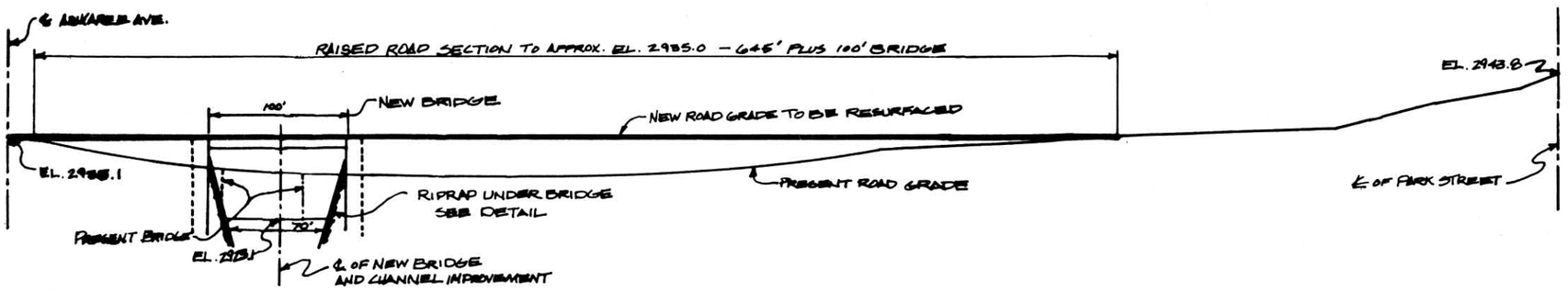
0 200 400 600

CONSTRUCTION NOTES AND ITEMS TO BE REFINED IN FINAL DESIGN

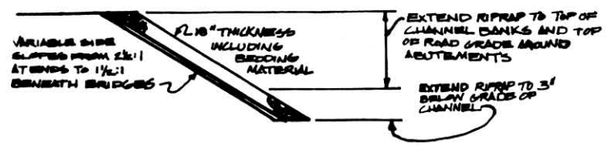
1. ONE-SIDE CONSTRUCTION WILL BE USED TO THE EXTENT POSSIBLE TO MAINTAIN QUALITY TREES AND VEGETATION.
2. SELECT TREES TO BE SAVED WILL BE MARKED PRIOR TO START OF CONSTRUCTION.
3. THE SPECIFICATIONS AND FINAL PLANS WILL ADDRESS THE PROBLEMS OF POLLUTION CONTROL MEASURES DURING CONSTRUCTION. SUCH MEASURES MAY INCLUDE A DEBRIS BASIN AT LOWER END; SEQUENCE AND PROCEDURES FOR CLEARING OF TREES AND SPOIL PLACEMENT; DIVERTING OF FLOWS; AND TIMELY SEEDING AND MULCHING OF DISTURBED AREAS.
4. FINAL PLANS WILL INCLUDE MORE DETAIL ON THE RELOCATION OF STORM SEWER AND OTHER UTILITIES.
5. THE RESULTS OF A VISUAL RESOURCE STUDY WILL NEED TO BE INCORPORATED IN THE FINAL PLANS TO REFLECT LANDSCAPE PLANTINGS AS A REPLACEMENT FOR TREE REMOVAL TO FACILITATE CONSTRUCTION.
6. ALL DRIVEWAYS AFFECTED BY THE RAISING OF WICHITA STREET AND ENTRANCES TO ANY SPECIAL USE AREAS WILL BE DESIGNED AS A PART OF THE PREPARATION OF FINAL PLANS.
7. GEOLOGIC BORINGS WILL BE MADE AT THE BRIDGE LOCATIONS ALONG WITH ANY TESTING RECOMMENDED BY THE DEPARTMENT OF ROADS.
8. THE COST OF LEVEE CONSTRUCTION IS INCIDENTAL TO THE COMMON EXCAVATION AND SPREADING OF SPOIL.

EARTHWORK ESTIMATES BY REACHES

REACH	EXCAVATION CUBIC YARDS	SPOIL VOLUME, TO AVERAGE OF 2.5 FT. DEPTH, CUBIC YARDS
LOWER END TO STA. 7+00	13,000	14,450
STA. 7+00 TO STA. 12+00	6,500	7,750
STA. 12+00 TO STA. 21+00	12,400	15,400
STA. 21+00 TO STA. 26+00	6,500	6,600
STA. 26+00 TO STA. 29+00	4,000	2,400
STA. 29+00 TO STA. 33+00	10,300	10,500
STA. 33+00 TO STA. 38+00	8,200	7,950
STA. 38+00 TO STA. 47+00	12,600	11,850
TOTALS	73,500	76,900



PROFILE ALONG ℄ OF WICHITA STREET
SCALE HOR. 1"=50' VERT. 1"=10'



TYPICAL SECTION OF RIPRAP FOR SIDE SLOPES AT NEW BRIDGES
SCALE 1"=10'

State of Nebraska
NATURAL RESOURCES COMMISSION
Planning Division

WAUNETA FLOOD CONTROL PROJECT

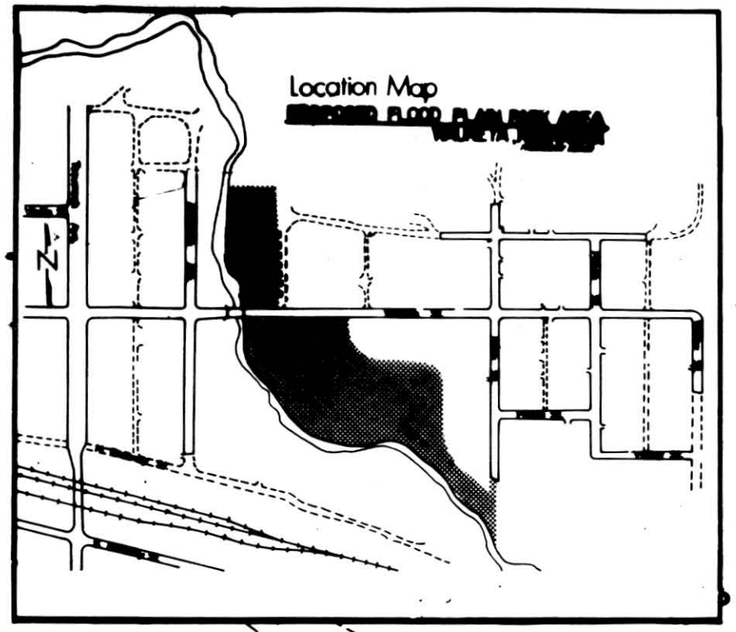
REV 12/79

State of Nebraska
NATURAL RESOURCES COMMISSION
Planning Division

WAUNETA FLOOD CONTROL PROJECT
RECOMMENDED PROJECT

REV. 12/79

SHEET 18



PARK STREET

SHAPE ON UNIFORM GRADE TO GRASSED WATERWAY 2929.0

2928.0

RIP RAP OUTLET TO RIVER

SLOPE TO PROVIDE POSITIVE DRAINAGE

ICE SKATING RINK
80'-100' DIA. EARTH RINK

2930.0

PARKING LOT A

TOP ELEVATION 34.5-35.0 (SEE NOTES)

PLAYGROUND AREA

ROAD SURFACE ELEVATION AT CENTER 2933.0

SMALL SURFACE ELEVATION 34.5

BICYCLE PARKING

WICHITA STREET

HIKE/BIKE HARD SURFACE TRAIL

30' WIDE CONSTRUCTION AND MAINTENANCE BERM

SHAPED AND SEEDED ONLY

BERM

℄ OF NEW CHANNEL

ARIKAREE AVE.

LEGEND FOR PARK

- HARD SURFACE HIKE BIKE TRAIL
- PICNIC TABLES
- FIRE GRATES
- TRASH CANS AND HOLDERS
- PLAYGROUND EQUIPMENT
- NEW VEGETATION

NOTES:

THE PRELIMINARY DESIGN FOR THE PROPOSED WAUNETA FLOOD PLAIN PARK AREA IS BASED ON AVAILABLE INFORMATION SUPPLIED TO THE NEBRASKA NATURAL RESOURCES COMMISSION. THE DESIGN SHOULD BE USED ONLY AS A BROAD GUIDELINE IN THE DEVELOPMENT OF THE AREA.

THE TOTAL AREA INVOLVED IS TO BE CLEARED OF ALL ACCUMULATIONS OF TRASH, VACANT BUILDINGS, DEAD AND SMALL TREES, AND ANY HEALTH OR SAFETY HAZARDS, ETC. . . . ALL HEALTHY, LARGE SPECIMENS SHOULD BE RETAINED AS MUCH AS POSSIBLE. THE TOTAL AREA WILL BE GRADED AND SHAPED DURING CONSTRUCTION AND IS TO BE WELL SEEDED AS SOON AS POSSIBLE; PLANTING OF NEW TREES AND SHRUBS SHOULD BE DONE AT THIS TIME, ALSO.

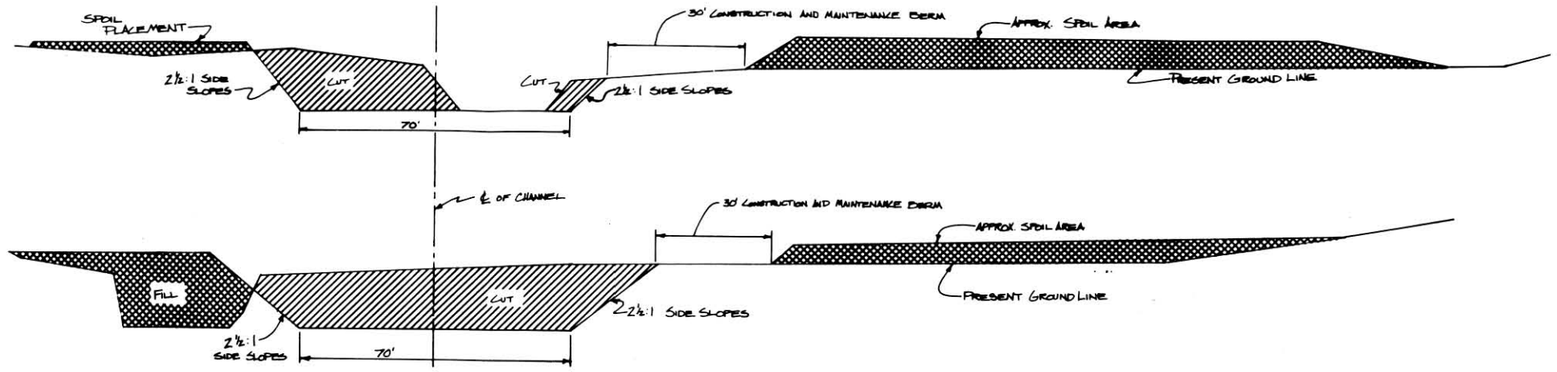
PROPOSED PLANS CALL FOR PARK ELEVATION OF 2934.0 IF FILL IS ECONOMICALLY AVAILABLE. THE TOP ELEVATION OF THE PARK WILL BE LIMITED BY THE AMOUNT OF FILL AVAILABLE WITHIN AN ECONOMIC HAULING RANGE OF THE AREA.

STATE OF NORTH DAKOTA
NATURAL RESOURCES COMMISSION
Planning Division

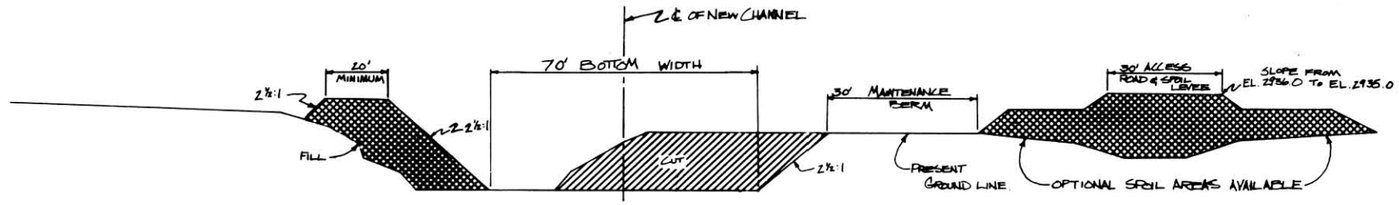
WAUNETA FLOOD CONTROL PROJECT

REV 12/79

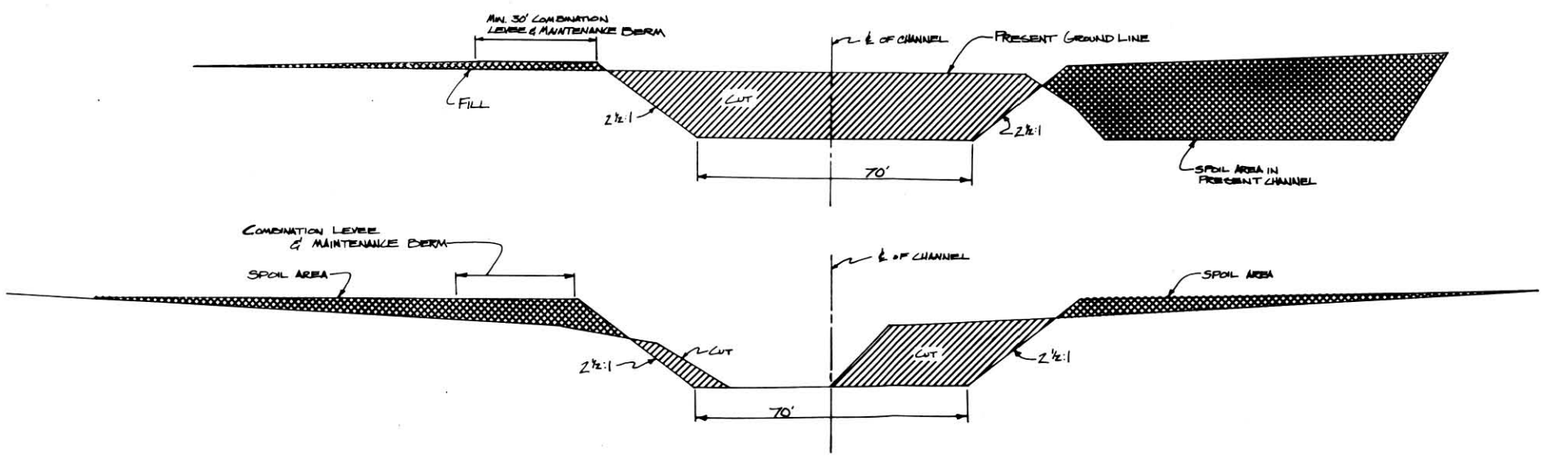
SHEET 16



TYPICAL CROSS SECTIONS FOR STATIONS 0+00 TO 21+00



TYPICAL CROSS SECTION FOR STATIONS 21+50 TO 28+90



TYPICAL CROSS SECTIONS FOR STATIONS 30+50 TO 47+00

TYPICAL CROSS SECTIONS FOR CHANNEL EXCAVATION, FILL IN CHANNEL AND LEVEE, AND SPOIL IN WASTE AREAS

SCALE: HORIZONTAL - 1"=20', VERTICAL - 1"=10'