AD-A128 085 DESIGN OF LOCKAGE WAITING AREAS AT LSAF (LOWER SAINT ANTHONY FALLS) LOCK..(U) HOWARD NEEDLES TAMMEN AND BERGENDOFF MINNEAPOLIS MN JAN 80 DACW37-77-C-0148 1/1

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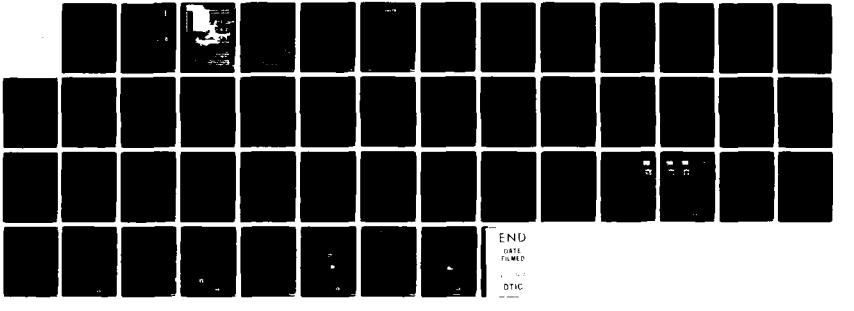

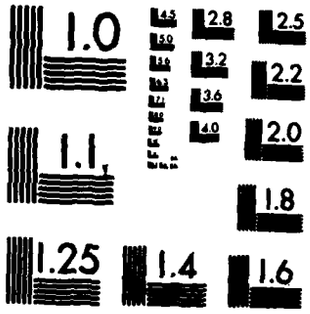

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LEVEL II

INVENTORY I

Design of Lockage Waiting Areas at L.S.A.F. Lock, Lock 2 & Lock 3, Upper Mississippi River

DOCUMENT IDENTIFICATION

Contract DACW37-77-C-0148 Jan.'80

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TIONAL CRAFT LOCKS STUDY

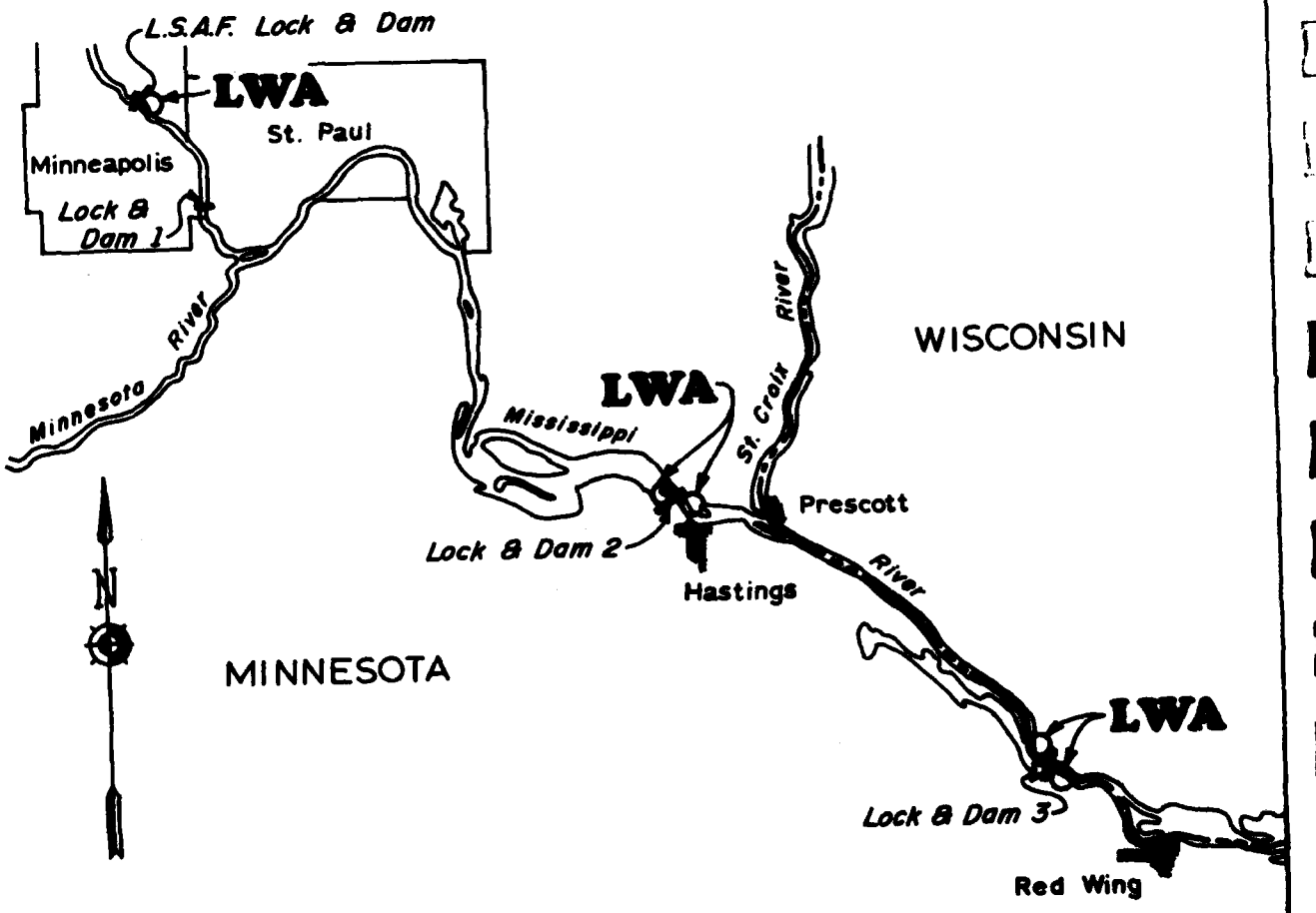
Design ... g. Areas ... Lock ...

... RIVER

for

U.S. ARMY
CORPS OF ENGINEERS
ST. PAUL DISTRICT

Howard Needles Tammen & Bergendoff
Minneapolis, Minnesota



LOCKAGE WAITING AREA (LWA) LOCATION MAP

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REPORT DOCUMENTATION PAGE

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4. TITLE (and Subtitle)	5. TYPE OF REPORT & PERIOD COVERED
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7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)
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LOCKS (WATERWAYS)
BOATS (Recreational)
MISSISSIPPI RIVER

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides site development considerations, developmental plans, and estimated costs for construction of lockage waiting area beaches and appurtenances. A procedures is developed to determine the number of recreational vessels to be accommodated and required beach length at each site.

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HNTB

HOWARD NEEDLES TAMMEN & BERGENDOFF

January 14, 1980

Mr. George W. Skene
Authorized Representative of
the Contracting Officer
Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, MN 55101

Re: Recreational Craft Locks Study
Further Design of Lockage Waiting Areas

Dear Mr. Skene:

HNTB is pleased to present herein the results of further design studies of selected lockage waiting areas at the L.S.A.F. Lock, Lock 2 and Lock 3. This work was a part of our overall study of selected means of improving the passage of recreational craft through locks on the Upper Mississippi River.

Included in this report are design assumptions, analyses, conclusions reached, reduced copies of the proposed lockage waiting area development plans and estimates of initial construction and annual maintenance costs.

This completes the work under Contract No. DACW 37-77-C-0148, and we gratefully acknowledge the assistance and cooperation of members of the staff of the St. Paul District who contributed information, guidance and consultation.

We look forward to being of further service.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard D. Beckman
Associate

RDB/KEB/det

RECREATIONAL CRAFT LOCKS STUDY

DESIGN OF LOCKAGE WAITING AREAS

AT

LOWER ST. ANTHONY FALLS LOCK, LOCK NO. 2, AND LOCK NO. 3

UPPER MISSISSIPPI RIVER

FOR

U. S. ARMY

CORPS OF ENGINEERS

ST. PAUL DISTRICT

HOWARD NEEDLES TAMMEN & BERGENDOFF

MINNEAPOLIS, MINNESOTA

January 1980

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SUMMARY

Following the completion of "Recreational Craft Locks Study, Selected Alternatives" in October 1978, the Corps of Engineers, St. Paul, directed that a detailed design study be made of the following five proposed lockage waiting areas:

a. Lower St. Anthony Falls Lock (LSAF), lower approach, mile 853.2
b. Lock 2, upper approach, mile 815.4
c. Lock 2, lower approach, mile 814.8
d. Lock 3, upper approach, mile 797.3
e. Lock 3, lower approach, mile 796.8

This report provides site development considerations, plans of development, and estimated costs for construction of lockage waiting area beaches and appurtenances. A procedure is developed to determine the number of recreational vessels to be accommodated and required beach length at each site. The determinations as found follow:

Lock	Number of boats	Beach length required (ft.)
LSAF	6	80
Lock 2	30	400
Lock 3	42	560

Estimated costs:

Lockage Waiting Area	First Costs	Annual Charges
LSAF, lower approach	$ 20,050	$ 5,910
Lock 2, upper approach	28,340	6,170
Lock 2, lower approach	71,230	16,870
Lock 3, upper approach	72,850	17,300
Lock 3, lower approach	103,270	21,340

I. INTRODUCTION

AUTHORITY

The following resolution adopted 11 April 1974 authorized the Upper Mississippi River Recreational Craft Locks Study:

> "Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the Mississippi River between the mouth of the Missouri River and Minneapolis, Minnesota, printed in House Document No. 137, 72nd Congress, 1st Session, and other pertinent reports with the view to determining whether it is advisable in the interest of navigation to modify the existing navigation project on the Upper Mississippi River to provide for separate locks or other means to permit the independent passage of recreational craft in view of the needs and safety of the present and anticipated heavy volume of small craft utilizing this waterway."

Under this authority, the following have been prepared:

(a) "Recreational Craft Locks Study, Plan of Study, Upper Mississippi River," February 1977, prepared by the St. Paul, Rock Island, and St. Louis Districts, Corps of Engineers;

(b) "Recreational Craft Locks Study, Stage II Report, Upper Mississippi River," September 1977, also prepared by the three Districts, Corps of Engineers;

(c) "Recreational Craft Locks Study, Selected Alternatives, Upper Mississippi River, Minneapolis to Guttenberg," October 1978, prepared by Howard Needles Tammen & Bergendoff for St. Paul District, Corps of Engineers.

PRIOR REPORT

In item (c) above, "Selected Alternatives," (S/A) the following were presented:

(a) A preliminary design for a mobile floating lock to be used in existing stub auxiliary locks to accommodate recreational craft.

(b) A plan for a system of informational signs to enable the recreational boater to know when the next recreational lockage is scheduled.

(c) A program for the development of lockage waiting areas (LWA) near each lock which would give the recreational boater a safe tie-up area while waiting for a scheduled lockage.

(d) A plan for the renovation of the riverward lock at Lock 2 to create a lock for the exclusive use of recreational craft.

SCOPE

Following completion of the above report, the St. Paul District Office, Corps of Engineers, determined that completion of the work under the contract with Howard Needles Tammen & Bergendoff should consist of detailed studies of five of the lockage waiting areas discussed in item (c) above as follows:

a. Lower St. Anthony Falls (LSAF) Lock, lower approach
b. Lock 2, upper approach
c. Lock 2, lower approach
d. Lock 3, upper approach
e. Lock 3, lower approach

The sites recommended for these waiting areas in the S/A report were generally approved for further study with the exception of the site for the lower approach to Lower St. Anthony Falls Lock. Local interests expressed concern over possible damage to the shoreline at site A (recommended in S/A) and therefore indicated a preference for site B over site A. In addition, upon further examination it was determined that lock operation visibility was better and the sight distance was less for site B than for site A. Following a meeting with local interests and municipal authorities it was determined that the former should be given detailed attention. As a result the following sites (identified in the S/A report) are studied in detail herein:

a. LSAF, site B, lower approach, mile 853.2
b. Lock 2, site B, upper approach, mile 815.4
c. Lock 2, site A, lower approach, mile 814.8
d. Lock 3, site C, upper approach, mile 797.3
e. Lock 3, site A, lower approach, mile 796.8

The S/A report considered a number of prospective types of locakge waiting areas. The analysis, however, led to the conclusion that the "most acceptable means of securing a boat during a waiting period appears to be that of providing a beach." The general acceptance of this conclusion has limited the considerations of the present report to detailed planning for lockage waiting areas which provide suitable beaches for temporary mooring. At the upper approach to Lock 2, it was considered necessary to supplement the available length of beach with mooring rails behind the lock guide wall.

SITE INVESTIGATIONS

Since the completion of the S/A report, topographic surveys and soundings were undertaken at the five selected sites, which resulted in maps with contour intervals of two feet. These were generally based on water levels as bench marks as estimated from gage readings on the day of the surveys. The elevations shown may therefore be in error by a maximum of 0.5 foot, which was considered an allowable error for this type of construction.

In addition, contact was made with the City of Minneapolis and University of Minnesota officials with respect to the Lower St.Anthony Falls site. No objection to the establishment of this site was stated.

Property ownerships were determined from Washington County (Minnesota) records for the lower site at Lock 2. This is the only site (other than LSAF) which is not on Federal lands.

II. SITE DEVELOPMENT CONSIDERATIONS

CAPACITY

In the preparation of the S/A report a nominal number of boats (assumed as 8 to 12 per site) was considered as a basis for selection of lockage waiting areas. For the present more detailed study, it was directed that a determination be made of lockage waiting area capacity based on anticipated lockage demand in the year 2000. Capacity is largely related to beach length and the procedure as developed herein, which utilizes projected recreational boat traffic, craft dimensions and craft distribution data, is a rational means of determining beach length requirements at the various sites.

The S/A report indicated that the number of boats per lockage has risen from about 1.3 in 1954 to 2.5 in 1976. It is considered reasonable to expect that this factor will increase about 50 percent by the year 2000 (to about 3.75). The S/A report also indicated that the number of lockages of recreational craft may be expected to increase similarly about 50 percent by the year 2000. The combination of these two factors would indicate that the number of recreation craft requiring lockage in 2000 would be about 1.5 x 1.5, or 2.25 times the number in 1976.

Since July is generally the month of maximum recreational craft lockages, the analysis is based on data which were available for July 1976. By using the number of craft locked through during that month and increasing these figures by a factor of 2.25, the number of craft in the year 2000 in a peak month is determined. It is then assumed that on an average day in a peak month about one-half of the craft approaching a lock will have to wait and that one-third of those waiting will utilize a lockage waiting area. It is considered impracticable to accommodate peak traffic fully. On these bases the number of boats to be provided beach space will be developed in table 1.

Table 1. Number of Boats to be Accommodated at Lockage Waiting Areas

Lock	July 1976 craft	July 2000 craft (1)	Mean daily craft (2)	No. of boat spaces at LWA (3)
LSAF	478	1076	35	6
2	2496	5615	182	30
3	3458	7781	251	42

(1) July 1976 x 2.25
(2) July 2000 craft ÷ 31
(3) Mean daily craft x 1/6

The space required for various types of river recreational craft was determined from lengths given in "Architectural Graphic Standards" and from figure 4 of the S/A report which gives the relation between vessel length and beam. Having determined boat beams it was assumed that these should be increased 50 percent to allow for maneuvering and clearance at and near the lockage waiting area beach. This determination is given in table 2.

At a time when the number of boats at a given beach may approach the beach design capacity some concern may be felt regarding the clearance provided by 50 percent of the beam width. To provide greater clearance would materially increase costs. Further it is believed the design determinations are adequate if the boaters use a cooperative procedure in beaching. If the end boats have lines to the shore, boats can beach close together with little hazard. An acceptable procedure could be devised and promulgated to boaters through their boat clubs.

Table 1 of the S/A report gives the proportion of various types of recreational craft using the locks in the St. Paul District as obtained in a recreation boating survey made in the summer of 1977. To determine the beach length required at each lockage waiting area, these proportions were applied to the number of boats and the beach length required for each boat as found in table 2 to obtain the total beach length required at each site. Table 3 indicates the procedure for Lock 2.

Table 2. Beach Lengths
Required for Various Boat Sizes

Boat Type	Avg. boat length (ft.) (1)	Beam (ft.) (2)	Beach length reqd. per boat (ft.) (3)
Runabout	15	6.6	9.9
Cruiser (under 40')	28	10.7	16.0
Cruiser (over 40')	45	13.5	20.3
Houseboat	35	12.4	18.6
Fishing Dory	14	6.4	9.6
Other (including sailboats)	14	6.4	9.6

(1) "Architectural Graphic Standards"
(2) Figure 4, S/A report
(3) Beam x 1.5

Table 3. Beach Length
Determination, 30 Boats (Lock 2)

Boat type	Beach reqd. per boat (ft.)	Prop. of craft using locks (1)	No. of type (2)	Reqd. beach (ft.) (3)
Runabout	9.9	0.469	14.1	140
Cruiser (under 40')	16.0	0.313	9.4	150
Cruiser (over 40')	20.3	0.039	1.2	24
Houseboat	18.6	0.141	4.2	78
Fishing dory	9.6	0.033	1.0	10
Other	9.6	0.005	.1	1
			30.0	403
			say 400 feet	

(1) Table 1, S/A report
(2) (Number of boats for the LWA)
x (proportion of craft using locks)
(3) (Number of type of boat)
x (feet of beach required per boat)

Required lengths for LSAF and Lock 3 (6 and 42 boats, respectively) are proportional and thus it is determined that minimums of 80, 400 and 560 feet of beach should be provided for the lockage waiting areas at Lower St. Anthony Falls, Lock 2 and Lock 3, respectively.

FACILITIES

General Except as noted, the following facilities (as determined in the S/A report) will be provided at the selected sites.

Lower approach, LSAF:	Beach Lockage waiting area sign Navigation aids Stairway to access road Trash receptacles Concrete walk (1)
Upper approach, Lock 2:	Beach and mooring rails behind upper guide wall Lockage waiting area sign Navigation aids Picnic tables Trash receptacles Trail
Lower approach, Lock 2:	Beach Lockage waiting area sign Navigation aids Comfort station Picnic tables Trash receptacles Access road (2)
Upper approach, Lock 3:	Beach Lockage waiting area sign Navigation aids Comfort station Picnic tables Trash receptacles
Lower approach, Lock 3:	Beach Lockage waiting area sign Navigation aids Comfort station Picnic tables Trash receptacles Modification of lock traffic signal Stairways (2)

(1) Replaced by bituminous walkway in this study
(2) Eliminated in this study

There exists a danger that the provision of these facilities may result in encouragement of boaters to use the lockage waiting areas for general recreational uses which would result in the lack of availability of the sites for their intended use during peak traffic times. Consideration should therefore be given to undertaking the work in stages. Thus it might be desirable to construct only the beach at the outset and observe use patterns for a time before additional facilities are provided.

Beach The minimum length for beaches at each site have been established under "capacity" above. Where feasible, the beach slopes below flat pool will utilize the existing stream bed with no dredging. Where necessary, dredging will be employed to provide underwater slopes of between 1:8 and 1:5 (vertical to horizontal). The underwater slope should preferably be continued to at least 5 feet above flat pool. Above that elevation, slopes will vary from 1:2 at LSAF to 1:20 at Lock 2, depending on existing conditions. Beach surfacing above and below water line will generally be native granular material. In the event that dredged material is considered unsuitable by State or Federal authorities, quarry sources may have to be substituted. Prior to construction a study of velocities at the sites should be made to assure that placing of sand on the beaches will not require excessively frequent replacement. If these studies were to reveal strong currents which would prove hazardous to boaters in beaching, other sites should be investigated. Such an eventuality appears remote.

A minimum approach navigable depth of five feet will be provided below lowest controlled pool (LCP) at upper sites and below flat pool at lower sites. This depth will be adequate to accommodate current recreational craft drafts.

The possibility of providing a row of tie-on posts was considered. That feature is not recommended, however, for multiple reasons including the difficulty of selecting an elevation/location that would make the posts convenient to use at various stages of river flow, the increased initial cost, and the expected increased maintenance costs for replacement following ice flows.

Mooring rails In one instance (upper approach, Lock 2) the beach length available is inadequate to accommodate the requisite number of vessels. To supplement the beach length, mooring rails will be mounted on the back face of the guide wall. The upstream ends of the rails will be fastened to the downstream face of the gagewell house. Other than the well house itself there will be no hazardous projection in the area.

Lockage waiting area sign The sign will be 4 feet by 8 feet and will be visible from a distance of about 450 feet. Lettering will be reflective material 3 to 9 inches high. Details of the sign are given on plate 1.

Navigation aids Buoys or suitable on-land signs to provide direction to the waiting area and to indicate navigational hazards will be provided.

Comfort stations Of importance in the provision of toilets are the requirements of the Minnesota and Wisconsin Departments of Natural Resources and the Pollution Control Agency of Minnesota. All sites are in areas designated as floodways, and in each instance there is no practical way of relocating the sites out of the floodway and still be adjacent to the channel for access by boaters. Regulations of the two states are generally similar and permits are necessary before construction.

Minnesota requires that a privy constructed in the flood plain must be a vault type. Flooding of the vault is not considered serious as long as the vault is cleaned out at the end of the navigation season. Slab construction one foot above the 10-year flood elevation is recommended where feasible. The structure must be set back from the ordinary high water (OHW) line a distance of 75 feet. Wisconsin regulations are similarly restrictive with respect to construction in the flood plain and minimum set back is 75 feet from ordinary high water line. Structures in floodways are required to be two feet above the flood of record.(1) Since the OHW line is a level which was established prior to construction of the 9-foot channel dams and has reference to natural conditions, the set back in the upper approach sites may be related to flat pool elevation. The lower approach sites, however, must be related to OHW. These elevations are shown on plate 1. To construct comfort stations above the flood of record would require the creation of mounds of substantial height. In view of the isolation of the structures and their position in a broad flood plain, it is considered that compliance with the Wisconsin requirements cannot be justified and base elevations one foot above the 10-year flood have been adopted. It is suggested that detailed study of current state regulations and their application to Federal lands be made immediately prior to construction.

As recommended in the S/A report, vault type toilets will be provided. The S/A report indicates the following numbers of recreational lockages to be expected in the year 2000:

Lock 2, 5371
Lock 3, 6766

(1) At Locks 2 and 3 the 1965 flood (frequency about once in 100 years) is the highest on record.

The number of boats per lockage has increased to about 2.5 in recent years and it is expected to increase by 50 percent by 2000 (to about 3.75). To determine the number of users of the toilets the following assumptions have been made:

1/2 of boats locked through would have a period of waiting;

1/3 of those waiting would use the lockage waiting area;

1/2 of those using the lockage waiting area would use the comfort stations;

4 persons per boat (1977 boating survey, Corps of Engineers).

Using these assumptions a factor of 1.25 (1) may be applied to the expected numbers of lockages. This will result in the following number of toilet users in the year 2000:

Lock 2, 6714

Lock 3, 8458

If it is assumed that each toilet visit produces 1/4 gallon of wastes, the vault required capacities will be:

Lock 2, 1678 gallons

Lock 3, 2114 gallons

Because the assumptions used in the above determinations are not well founded (nothing else available), a size of vault toilet constructed by the Corps of Engineers at the Mississippi River Headwater Reservoir recreational areas will be employed. See plate 1. This structure provides a volume of 3517 gallons which affords a reasonable factor of safety over the theoretical requirements. It is considered that two cleanouts per year will be required. At one site (Lock 3, lower approach), where the comfort station is visible at some distance, privacy fences will be provided. The lower rail of the fence would be above the 100-year flood level and thus little damage from floating ice or debris need be anticipated.

(1) $3.75 \times 1/2 \times 1/3 \times 1/2 \times 4 = 1.25$

Although the sites for the comfort stations are generally in areas where soils are predominantly sand, it will be essential that the precise nature of the foundation condition be known at the time of construction. Appropriate borings and possibly testing should be accomplished at that time.

Picnic Tables At those sites where heavy usage is expected, picnic tables of the type illustrated in figure 9 of the S/A report and detailed on plate 1 will be provided. These should be regarded as a waiting period convenience and the number provided should only be sufficient to satisfy this need. In other words, the number of tables should not be so great that the area would tend to be utilized by boaters other than those waiting for the lockage. It is considered that one table for about 150 feet of minimum required beach length would be adequate. On this basis, the sites at Lock 2 will be furnished three tables and the sites at Lock 3, four tables.

Trash receptacles These would be similar to the illustration on figure 9 of the S/A report and as detailed on plate 1. One receptacle for each 100 feet of beach provided will be supplied, with a minimum of two receptacles at any one site. On this basis the numbers of receptacles will be:

LSAF site, 2 receptacles
Lock 2 sites, 4 receptacles
Lock 3 sites, 5 receptacles

Stairway At the Lower St. Anthony Falls lower approach site a steep bank would preclude boaters, who might wish to take a short walk, from gaining access to a walkway and road. A stairway will therefore be provided.

Trail At the Lock 2 upper approach site a trail will be provided to enable boaters to gain access to the lock esplanade and the public comfort station.

III. PLANS OF DEVELOPMENT

LOWER ST. ANTHONY FALLS LOCK, LOWER APPROACH (left bank, mile 853.2)

This site (see plate 2) has a total beach length of about 160 feet which is substantially greater than the requisite 80 feet as determined earlier. However, the site is restricted by the presence of an upstream protective rock wall, by the piers of the Minneapolis Tenth Avenue (Cedar Avenue) bridge, by one of the barge mooring cells for the University heating plant dock, and by the existence of limestone slabs on the shore.

The property on which this site is located is owned by the University of Minnesota and the City of Minneapolis. Initial contacts made with these two entities have revealed no major objection to such a development. Purchase of, or easements on, the property will have to be effected prior to construction.

There is at present along the shore an appreciable amount of Platteville limestone which was deposited in the river bed following the ancient recession of St. Anthony Falls. Some of this material will have to be removed by rock splitter or similar means to a depth of two feet below the beach slope. There is some concern that sand placed on the beach will be removed by erosion during periods of flood, and therefore it is planned that portions of two limestone slabs now projecting a few feet into the channel be left as retention groins. There is also an accumulation of limestone along the downstream 50 feet of the site which may be difficult to remove and it is planned that this would not be removed until it was warranted by traffic. These modifications would reduce the beach length to slightly less than 100 feet which is still greater than the theoretical requirement (80 feet).

The existing beach material other than the limestone slabs is mostly broken up concrete with a maximum diameter of about 1.5 inches. This will be graded to a uniform slope and one foot of sand or fine gravel (maximum diameter, 0.25 inch) will be placed thereon. Observations during high water indicate that the existing beach, protected as it is by an upstream massive rock wall, is not subject to serious erosive action. However, in view of the uncertainty as to whether this material may be removed by high water, a replacement annual cost has been included in the estimate. The slope of the beach will vary from 1:7 to 1:5 between elevations 720 and 730. Below elevation 720 the slope will be steeper, and above elevation 730 the bank will be dressed to a 1:2 slope and surfaced with 12 inches of riprap over a 6-inch filter blanket to the elevation (about 742) of the access road which serves the University heating plant. As a cap for the riprap a blacktop walkway 6 feet wide will be provided at about the 742 elevation. This can be considered a segment of the continuous river front walkway projected for long term development by local interests.

To permit boaters to gain access to the roadway level a 6-foot wide concrete stairway with handrail will be provided adjacent to the downstream face of the downstream Cedar Avenue bridge pier column. At present there are three 10-inch storm drains located between the pier columns, which collect storm water from the bridge floor above and discharge through the LWA site. Two flumes will be provided to conduct the stormwater across the beach to the river channel and thus prevent erosion. The other facilities provided will be navigation buoys, a lockage waiting area sign, and two trash receptacles.

LOCK 2, UPPER APPROACH (right bank, mile 815.4)

The capacity analysis above indicates a beach length of 400 feet should be provided at this lock. See plate 3. As noted earlier, the mooring will be accomplished by a combination of beach and mooring rails behind the upper guide wall.

The beach length (300 feet) as shown on plate 3 will accommodate about 23 recreational craft which leaves about seven craft to be accommodated along the mooring rail behind the guide wall. With 130 feet of mooring rail provided, seven average length craft could easily be accommodated in tandem, and thus adequate space is available for the anticipated total of 30 craft.

The property on which the site is located is considered part of the lock and dam site and is owned by the Federal government under the jurisdiction of the Corps of Engineers. No acquisition is necessary.

The area will have beach approach depths and depths behind the guide wall at or below elevation 680 which will provide about 7 feet below lowest controlled pool. This is considered adequate. The existing beach underwater slope will be modified by dredging to a uniform 1:8. Existing ground elevation at the site is about elevation 688, or, about 1 to 2 feet above flat pool. Consequently, to provide a dry area for boat occupants who wish to "stretch their legs", sand fill, probably from dredging, will be placed to an elevation of about 692 (approximately 5 feet above flat pool). This will provide an adequate area for the facilities to be installed at the site and for a dry trail to the comfort station on the lock esplanade.

The mooring rails (see plate 3) will consist of three horizontal 3" x 6" timbers. These will be chemically treated to resist the effects of intermittent exposure to water inundation and will be mounted on steel framing suspended from the lock guide wall. The rails will be placed above the step "tread" which is at elevation 687. The outer face of the timbers will be flush with the face ("riser") of the step corner. The rails will be placed with top elevations at 692.2, 690.7 and 689.2.

It will be noted that no comfort station is to be provided at this site although recreational craft usage would indicate the need for this convenience. However, a public toilet has already been established on the lock esplanade in the vicinity of the central control system (about 1700 feet downstream from the LWA). With the provision of a dry trail, it is considered that the needs at this site will be adequately satisfied. This will be constructed by clearing a lane six feet wide and creating a six-foot wide walkway by replacing the top three inches of turf with four inches of lime stabilized aggregate.

The site will be provided with three picnic tables, four trash receptacles, a lockage waiting area sign, and appropriate buoys and navigation directional signs.

LOCK 2, LOWER APPROACH (left bank, mile 814.8)

The entire requisite beach length of 400 feet will easily be provided at this site. See plate 4. To accommodate adequately the facilities to be provided, a minimum property depth of about 200 feet should be provided. The site is situated partly in the City of Hastings and partly in Denmark Township, both in Minnesota, and is in private ownership. Acquisition of about 2.6 acres will be necessary.

In the S/A report, land access for the maintenance and operation of the site was proposed. However, a detailed site survey analysis indicated this would be undesirable and is not recommended for the following reasons:

a. The cost would be prohibitive. Two large culverts and a filled and graded roadway of over 1000 feet in length would be necessary.

b. The existence of such a road, even though barricaded and locked, would encourage substantial recreational use. This would require additional policing and maintenance of the area.

c. Maintenance by water from the lock would not be difficult though somewhat less convenient than by land.

The beach approach depth will be generally below elevation 670 (5 feet below flat pool) without dredging. The existing underwater slope is about 1:10 which is slightly flatter than the optimum, but it is considered that dredging to modify this slope is unwarranted at the outset. If this slope proves unnecessarily restrictive, a relatively small amount of dredging will accomplish the slight steepening which may be necessary. At one time a rock and brush wing dam existed at the site, but recent soundings have failed to reveal its continued presence.

Above flat pool the existing slope varies from about 1:5 to 1:15. The latter is somewhat flatter than may prove desirable but it is considered that fill placement to modify the slope is not warranted at the outset.

A comfort station is considered essential at this site. About 5000 feet downstream from the lock esplanade on the right bank a public park is planned for development on the shores of Lake Rebecca by the City of Hastings and the Corps of Engineers. Included in this development is the provision of a toilet. Although this is across the river channel (3500 feet downstream from the lockage waiting area and about 800 feet from shore), it might be considered that this facility would also serve waiting boaters. However, the main barge channel is close to the right bank in this area which would mean that recreational boaters would risk encounter with barge traffic. This safety hazard is considered sufficiently serious to require a toilet at the waiting area site.

As indicated on plate 4, the site most suitable for the comfort station is sheltered in a small opening in the wooded area and is about 2 feet below the 10-year flood elevation of 688.2. To accommodate the Minnesota requirements, a fill would be provided to bring the ground elevation to 689.2, one foot above the 10-year elevation. Fill could be either native granular material from the river bottom or could be provided from other land sources acceptable to Minnesota authorities. The comfort station will have a minimum setback of 125 feet from the flat pool shoreline and about 120 feet from the ordinary high water shoreline.

The site will be provided with three picnic tables, four trash receptacles, a lockage waiting area sign, and appropriate buoys and navigation directional signs. Some clearing and grubbing will be required along the top of the beach area in the wooded area for the placement of picnic tables and trash receptacles.

LOCK 3, UPPER APPROACH (left bank, mile 797.3)

This site will easily accommodate the requisite 560 feet of beach length. See plate 5. The existing site has a depth of about 250 feet which is adequate to accommodate the facilities contemplated. The property is part of the Federally-owned lock and dam site administered by the Corps of Engineers and no land transfer need therefore be effected.

The beach approach depth will have to be increased and the existing beach slope steepened to provide adequate mooring for all boats. The existing slope below lowest controlled pool elevation (674.0) is about 1:30 while above that elevation it is about 1:10. The latter slope persists above the lowest controlled pool to about elevation 677.0. The Corps of Engineers is currently planning an improvement in the upper approach channel to Dam 3. Two alternates are under consideration which include a rubble mound training dike extending

upstream from the right end of the movable gate section of the dam a distance of 1300 feet and a guard wall extending upstream from the intermediate lock chamber wall a distance of 1200 feet. The channel between the mound dike or guard wall and the left bank on which the lockage waiting area site is to be located will then be deepened and widened to provide adequate depths and beach slopes. To assist boaters in the lockage procedure a traffic signal light would be placed on the upstream end of the upper approach channel improvement structure.

A comfort station will be provided at this site. In order to comply partly with Wisconsin regulations a small level area will be created by filling to an elevation of 683.3 which is one foot above the 10-year flood elevation. The comfort station will be a minimum of 75 feet back from flat pool shoreline and about 180 feet from the shoreline of ordinary high water. The side slopes of the fill for the comfort station site will be protected by 12 inches of riprap over 6 inches of gravel. Two ramps on a 1:8 slope will be provided as shown on plate 5. The riprap will be covered with native organic soil and seeded to promote vegetative growth and to create a natural appearance to the landscape. The erosive forces of flood waters on the fill for the site as planned are considered minimal. The site is on the inside of a bend where velocities are normally slight. Further, since the site is immediately upstream from the dam, elevations for smaller floods will tend to be at or slightly above flat pool (675) and with the existing site ground line above elevation 676 little erosion need be anticipated.

The waiting area site will be provided with four picnic tables, five trash receptacles, a lockage waiting area sign, and appropriate buoys and navigation directional signs. Some trimming of trees will be necessary to provide adequate visibility.

LOCK 3, LOWER APPROACH (left side of channel, mile 796.8)

This site, which is along the riprapped island bank, will easily accommodate the requisite 560 feet of beach. See plate 6. The

property has adequate lateral extent to accommodate the facilities to be provided. It is part of the Federally-owned lock and dam site administered by the Corps of Engineers and therefore no land acquisition need be effected.

The existing slope of the riprap shoreline is 1:3, and is far too steep and rocky for successful boat beaching. To provide a satisfactory beach, sand fill will be placed on the face of the riprap at a slope of from 1:8 to 1:6, to an elevation of 683. It was intended in the concept development stage to provide two concrete stairs on the riprap to permit ascent from the sand fill area to the top of the riprapped bank. Sand fill on the riprap will be used in place of the stairways for the following reasons:

a. Sand fill placed on the face of the riprap will provide safe pedestrian ascent and descent.
b. Sand fill will allow greater flexibility of pedestrian movement from beach to facilities or conversely.
c. Eliminates ascending and descending on slopes greater than 1:6.
d. Reduces structural maintenance, structural cost and potential hazardous feature.

An underwater slope of 1:5 will be provided for beaching. Approach depths in the vicinity are ample for recreational craft. Maintenance at this site will include the mowing of weeds in the area to be maintained for LWA facilities.

A comfort station will be provided at this site. Since the general elevation is 687 (5½ feet above the 10-year flood elevation), no fill for this purpose will be necessary. The structure will be placed a minimum of 140 feet back from the ordinary high water shoreline and 160 feet from the shoreline of flat pool. At this site privacy fences will be provided because of the exposed nature of the comfort station location.

The waiting area site will be provided with four picnic tables, five trash receptacles, a lockage waiting area sign, and appropriate buoys and navigation directional signs. The existing lower lock traffic light is now faced directly downstream and thus would not be visible to the LWA across the channel. An additional set of lights would therefore be provided on the same light standard which would be visible across the channel (see plate 6).

IV. ESTIMATED FIRST COSTS AND ANNUAL CHARGES

The cost estimates which follow are based on surveys and investigations made since the preparation of the S/A report. Where appropriate, unit costs which appeared in the S/A report have been updated to the July 1979 cost level.

LOWER ST. ANTHONY FALLS LOCK

LOWER APPROACH (SITE B), MILE 853.2

FIRST COSTS

Item	Quantity	Unit	Unit Price	Estimated Amount
Mobilization and demobilization	Sum	Job		$ 2,000
Waiting area identification sign	1	Each	$460	460
Trash receptacles	2	Each	330	660
Beach sand and gravel (12" depth)	150	C.Y.	7	1,050
Rock excavation and grading	50	C.Y.	10	500
Bituminous walk and granular base	120	L.F.	2.50	300
Concrete stairway	6.8	C.Y.	500	3,400
Handrail	27	L.F.	10	270
Excavation (stairway, flumes, walkway)	17	C.Y.	10	170
Riprap	138	C.Y.	18	2,500
Filter stone	69	C.Y.	12	830
Outlet flumes	2	Each	950	1,900
SUBTOTAL				$ 14,040
CONTINGENCIES 20%				2,810
TOTAL CONSTRUCTION COST				16,850
Engineering and design				2,000
Supervision and administration				1,200
TOTAL FIRST COST				$ 20,050

ANNUAL CHARGES

Operation and maintenance	$ 1,500
Annual replacement, beach sand	1,600
Interest, 6.875% of $20,050	1,380
Amortization, 50 years, 7.132% of $20,050	1,430
TOTAL ANNUAL CHARGES	$ 5,910

LOCK 2

UPPER APPROACH (SITE B), MILE 815.4

FIRST COSTS

Item	Quantity	Unit	Unit Price	Estimated Amount
Mobilization and demobilization	Sum	Job		$ 2,000
Waiting area identification sign	1	Each	$ 460	460
Trash receptacles	4	Each	330	1,320
Picnic tables (precast concrete)	3	Each	1620	4,860
Dredging - sand excavation(1)	3,125	C.Y.	1.62	5,060
Mooring rail	Sum	Job		5,000
Stabilized aggregate trail	48	C.Y.	13.00	620
Clearing and grubbing	0.10	Acre	5000	500
SUBTOTAL				$ 19,820
CONTINGENCIES 20%				3,960
TOTAL CONSTRUCTION COST				23,780
Engineering and design				2,850
Supervision and administration				1,710
TOTAL FIRST COST				$ 28,340

ANNUAL CHARGES

Operation and maintenance	2,200
Interest, 6.875% of $28,340	1,950
Amortization, 50 years, 7.132% of $28,340	2,020
TOTAL ANNUAL CHARGES	$ 6,170

(1) It is assumed that dredged material can be placed to raise land level.

LOCK 2

LOWER APPROACH (SITE A), MILE 814.8

FIRST COSTS

Item	Quantity	Unit	Unit Price	Estimated Amount
Mobilization and demobilization	Sum	Job		$ 9,000
Waiting area identification sign	1	Each	$ 460	460
Trash receptacles	4	Each	330	1,320
Picnic tables (precast conrete)	3	Each	1,620	4,860
Comfort station	1	Each	20,000	20,000
Dredging (sand borrow)	170	C.Y.	1.62	280
Excavation (vault)	30	C.Y.	10	300
Clearing and grubbing	0.06	Acre	5,000	300
Land acquisition	2.64	Acre	5,000	13,200
Crushed rock aggregate	6	C.Y.	13	80
SUBTOTAL				$49,800
CONTINGENCIES 20%				9,960
TOTAL CONSTRUCTION COST				$59,760
Engineering and design				7,170
Supervision and administration				4,300
TOTAL FIRST COST				$71,230

ANNUAL CHARGES

Operation and maintenance	$ 6,900
Interest, 6.875% of $71,230	4,890
Amortization, 50 years, 7.132% of $71,230	5,080
TOTAL ANNUAL CHARGES	$16,870

LOCK 3

UPPER APPROACH (SITE C), MILE 797.3

FIRST COSTS

Item	Quantity	Unit	Unit Price	Estimated Amount
Mobilization and demobilization	Sum	Job		$ 13,000
Waiting area identification sign	1	Each	$ 460	460
Trash receptacles	5	Each	330	1,650
Picnic tables (precast concrete)	4	Each	1,620	6,480
Comfort station	1	Each	20,000	20,000
Riprap	169	C.Y.	18	3,040
Filter stone	85	C.Y.	12	1,020
Sand borrow (dredge material)	391	C.Y.	1.62	640
Crushed rock aggregate	12	C.Y.	13	160
Topsoil borrow	140	C.Y.	7	980
Tree trimming		L.S.		3,500
SUBTOTAL				$ 50,930
CONTINGENCIES 20%				10,190
TOTAL CONSTRUCTION COST				61,120
Engineering and design				7,330
Supervision and administration				4,400
TOTAL PROJECT COST				$ 72,850

ANNUAL CHARGES

Operation and maintenance	$ 7,095
Interest, 6.875% of $72,850	5,010
Amortization, 50 years, 7.132% of $72,850	5,195
TOTAL ANNUAL CHARGES	$ 17,300

NOTE: It will be assumed that the underwater beach slope improvement cost will be included in the channel dredging cost for the rubble mound dike proposal.

LOCK 3

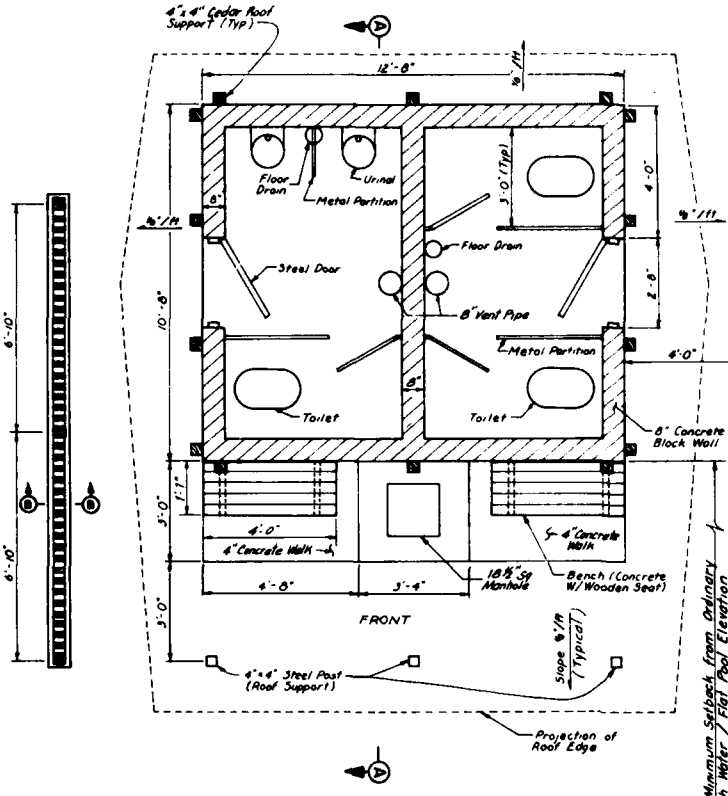
LOWER APPROACH (SITE A), MILE 796.8

FIRST COSTS

Item	Quantity	Unit	Unit Price	Estimated Amount
Mobilization and demobilization	Sum	Job		$ 10,000
Waiting area identification sign	1	Each	$ 460	460
Trash receptacles	5	Each	330	1,650
Picnic tables (precast concrete)	4	Each	1,620	6,480
Comfort station (with privacy fence)	1	Each	21,000	21,000
Sand borrow (dredge material)	18,400	C.Y.	1.62	29,810
Excavation (vault)	51	C.Y.	10	510
Crushed rock aggregate	6	C.Y.	13	80
Auxiliary traffic signals	1	Each	700	700
Clearing and grubbing	.30	Acre	5,000	1,500
SUBTOTAL				$ 72,190
CONTINGENCIES 20%				14,440
TOTAL CONSTRUCTION COST				86,630
Engineering and design				10,400
Supervision and administration				6,240
TOTAL FIRST COST				$103,270

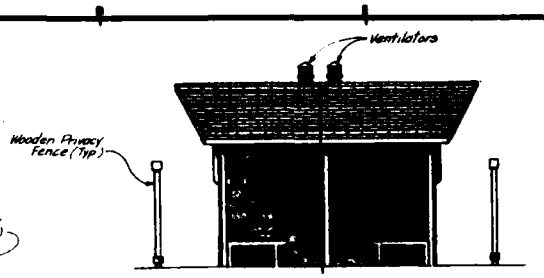
ANNUAL CHARGES

Operation and maintenance	$ 6,870
Interest, 6.875% of $103,270	7,100
Amortization, 50 years, 7.132% of $103,270	7,370
TOTAL ANNUAL CHARGES	$ 21,340

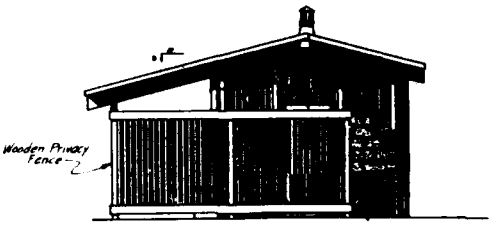


FLOOR PLAN

SCALE IN FEET 0 1 2 3 4 5



Front Elevation



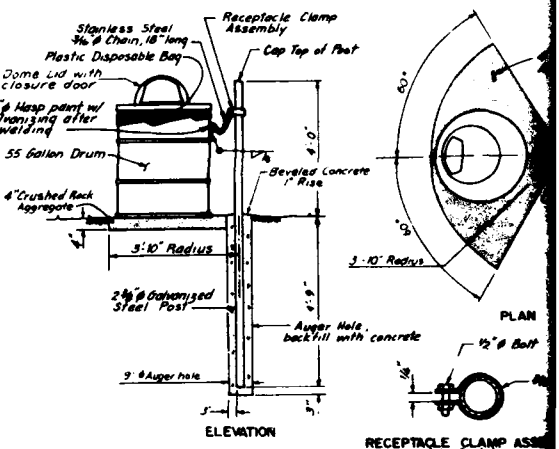
Side Elevation
WITH PRIVACY FENCE
(@ Loch 3, Lower Approach site

COMFORT STATIO

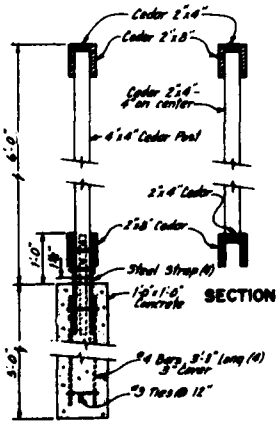
SCALE IN FEET 0 2 4

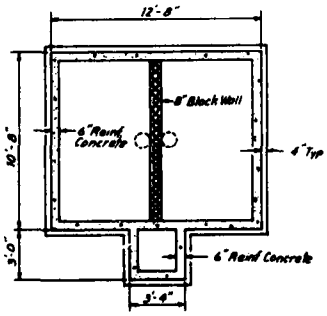
COMFORT STATION - PERTINENT ELEVATIONS					
Location	O.H.W. / F.P.	10 year Flood	100 year Flood	1965 high Water	Access Floor
L/D 2 Lower Approach	675.75 / 670	668.2	695.2	696.05	689.2
L/D 3 Upper Approach	690.85 / 670	682.3	687.5	688.22	683.3
L/D 3 Lower Approach	690.85 / 670	681.6	687.1	687.93	687.0

O.H.W. - Ordinary High Water
F.P. - Flat Pool
① Governing elevation for minimum setback requirements for Comfort Station.



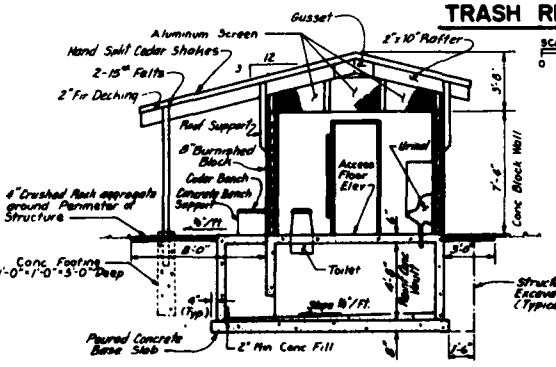
TRASH RECEPTACLE





VAULT PLAN

SCALE IN FEET 0 1 2 3 4 5



SECTION A-A

SCALE IN FEET 0 2 4 6 8

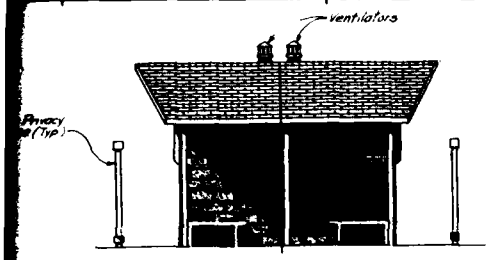
COMFORT STATION - PLAN & SECTION

NOTE: For Specification References and details of materials for Comfort Station, except as noted on Plate 1, see Department of the Army, St. Paul District Corps of Engineers drawings number M-PA-S/2, M-PA-S/3 and M-PA-S/4 titled Mississippi River Headwater Reservoirs, Recreation, Area Sanitary Facilities (Plan, Elevations and Details, Misc Details and Reinforcing).

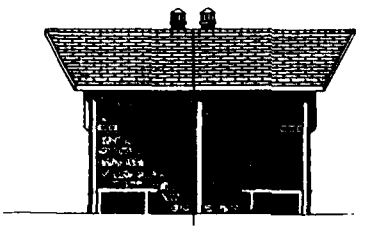
POST DETAIL

PRIVACY FENCE

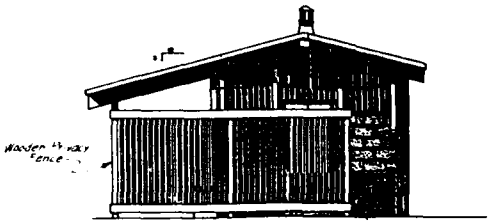
SCALE IN FEET 0 1 2 3



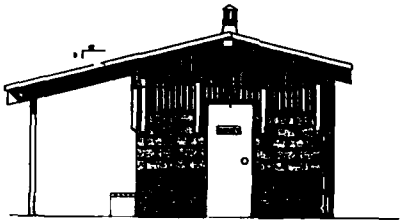
Front Elevation



Front Elevation



Side Elevation
WITH PRIVACY FENCE

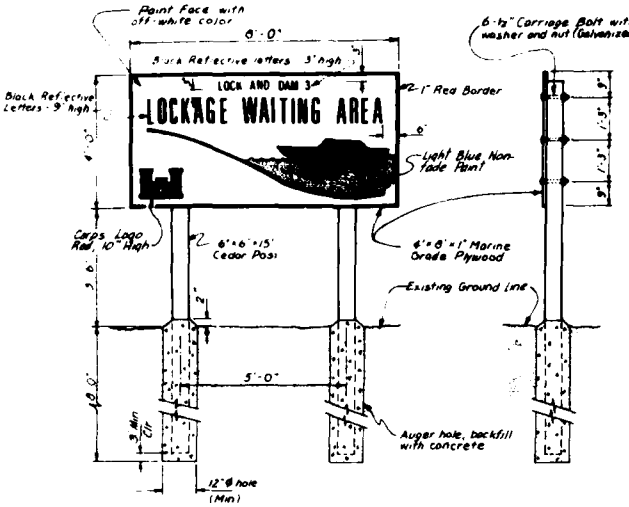


Side Elevation
WITHOUT PRIVACY FENCE

@ Lock 3 Lower Approach site

COMFORT STATION - ELEVATION

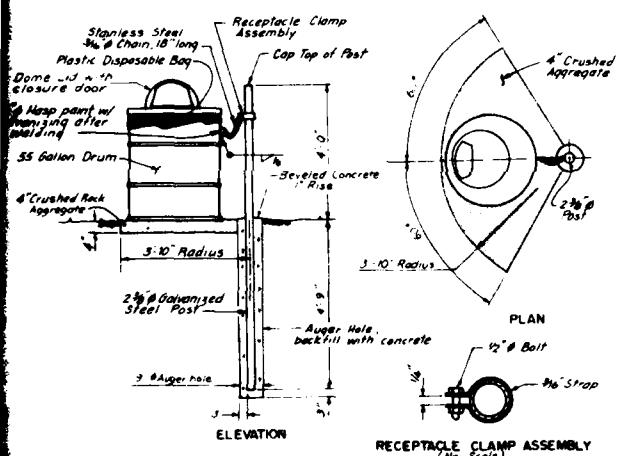
@ Lock 2 Lower Approach site
@ Lock 3 Upper Approach site



Front View

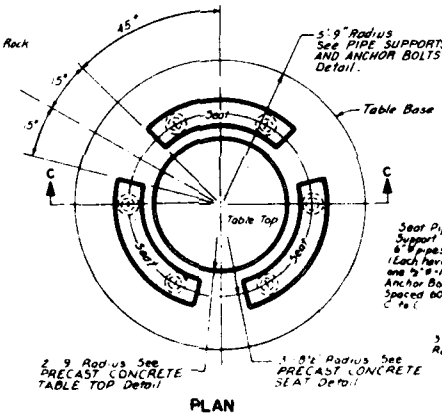
Side View

LOCKAGE WAITING AREA SIGN

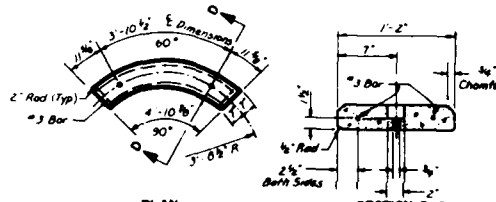


ELEVATION

RECEPTACLE CLAMP ASSEMBLY (No Scale)



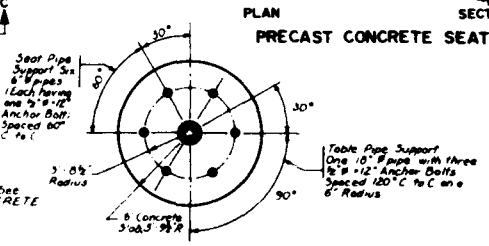
PLAN



PLAN

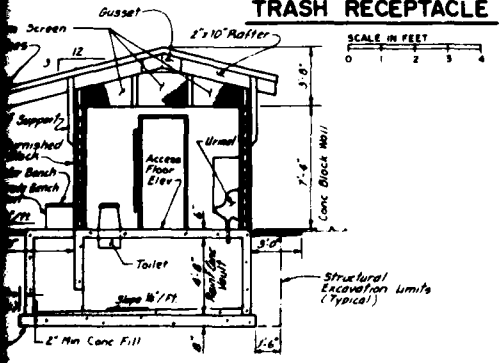
SECTION D-D (No Scale)

PRECAST CONCRETE SEAT



PIPE SUPPORTS & ANCHOR BOLTS (No Scale)

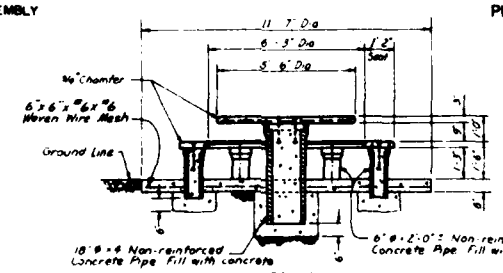
TRASH RECEPTACLE



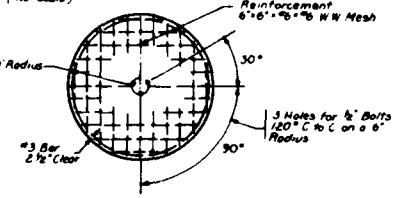
SCALE IN FEET
0 1 2 3 4

SECTION A-A

SCALE IN FEET
0 1 2 3 4



SECTION C-C



PRECAST CONCRETE TABLE TOP

PRECAST PICNIC TABLE

Note: For General Notes and Specification References see MN/DOT Standard Plate No. 9400B

HNTB

DEPARTMENT OF THE ARMY
ST PAUL DISTRICT CORPS OF ENGINEERS
ST PAUL, MINNESOTA

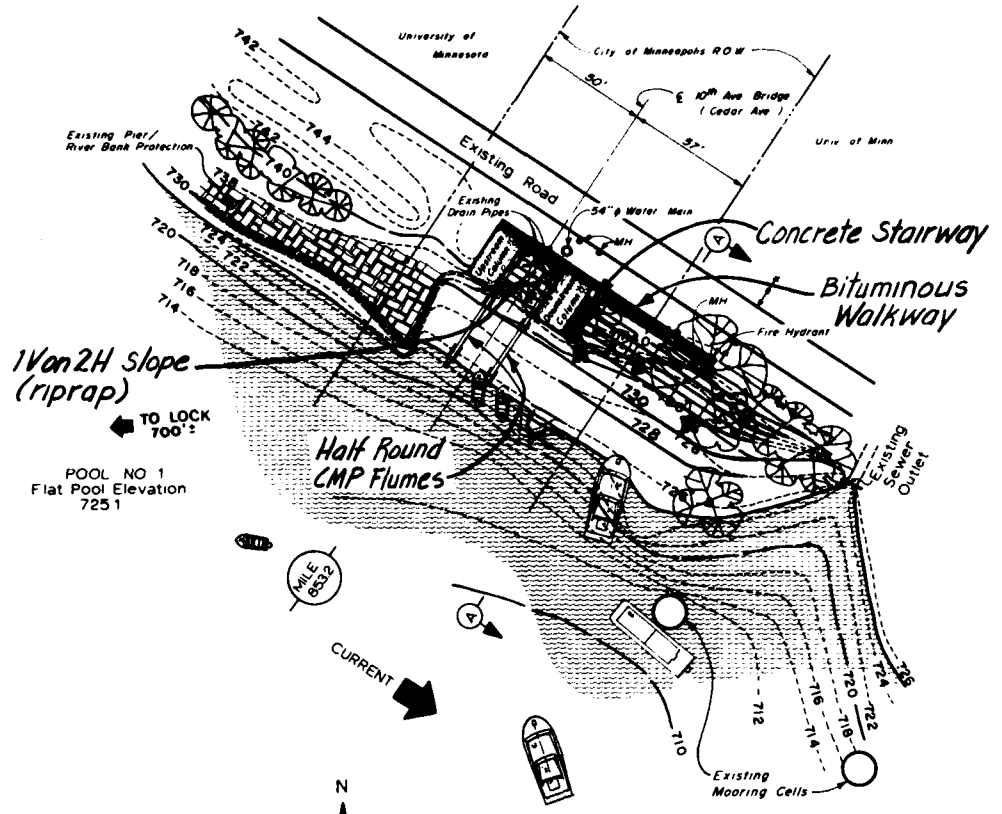
UPPER MISSISSIPPI RIVER
RECREATIONAL CRAFT LOCKS STUDY
LOCKAGE WAITING AREA FACILITIES
PLAN, ELEVATION & DETAILS

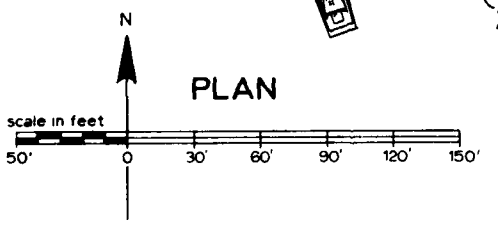
DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
DATE:
APPROVED:

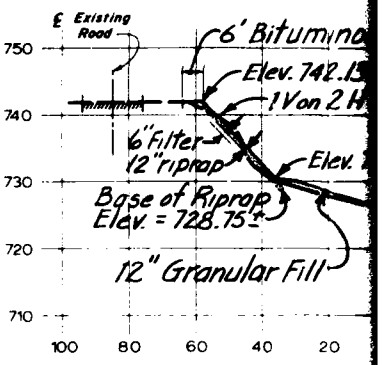
DRAWING NUMBER
PLATE 1

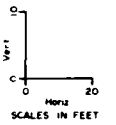
SAFETY PAYS

2

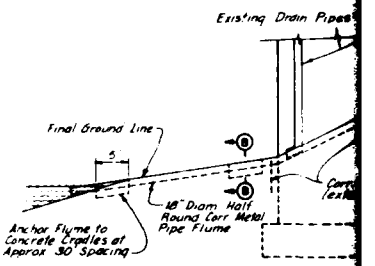




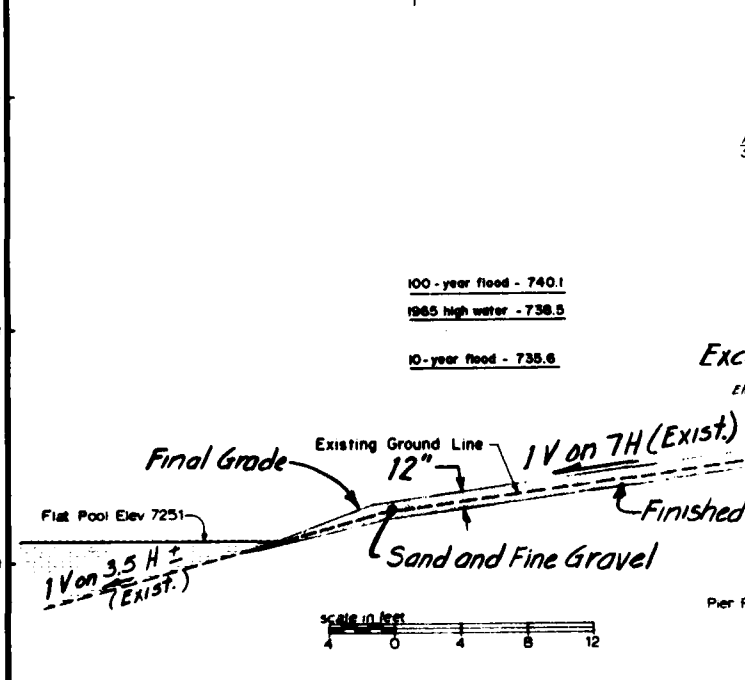


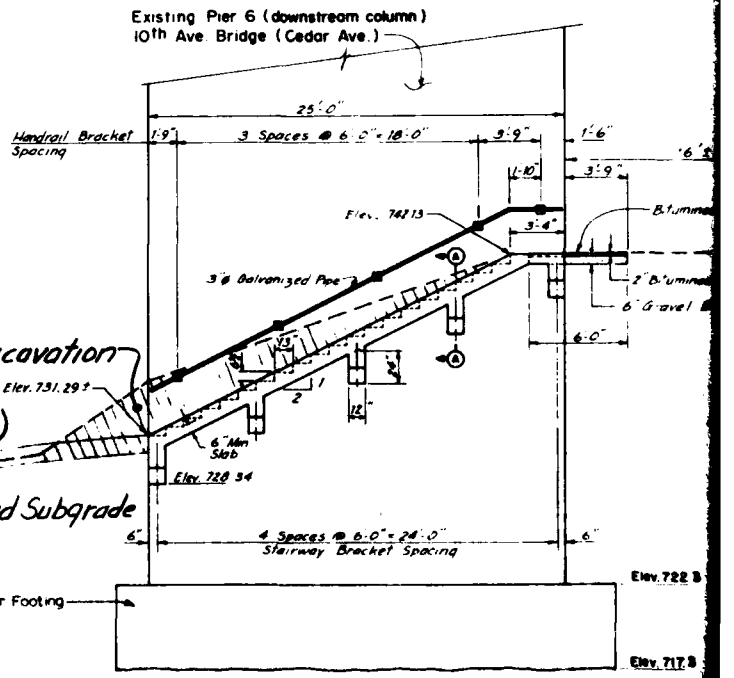


CROSS
Scale : Horiz



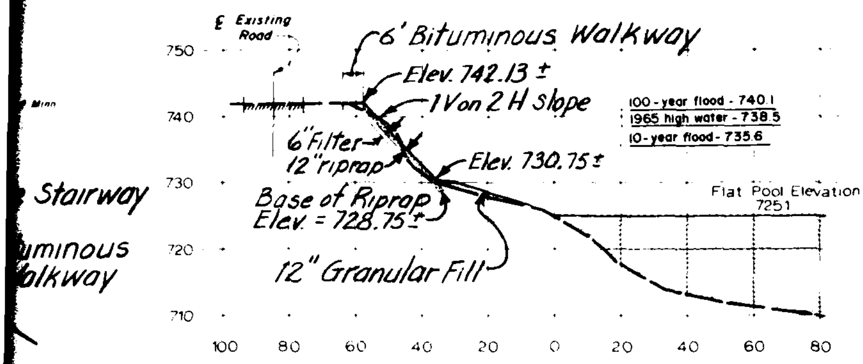
OUTLET FLUME for BRIDG
SYSTEM - DOWNSTREAM E
UPSTREAM COLU
(NO SCALE)





STAIRWAY @ PIER 6 - Downstream Column

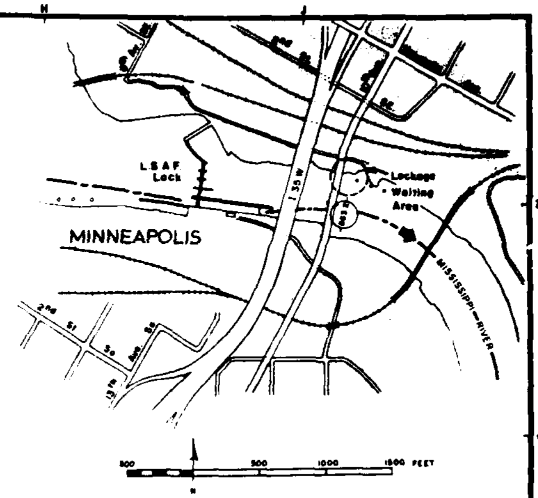
(Looking Upstream)



CROSS SECTION A-A

Scale Horiz 1" = 20', Vert 1" = 10'

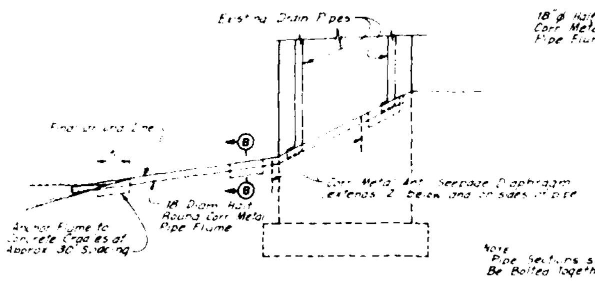
SCALE IN FEET

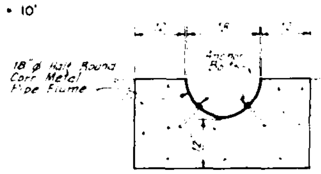


LOCATION MAP – LOCKAGE WAITING AREA, LOWER APPROACH

LEGEND.

	Existing	Proposed
Contour		
Tree Cover (Overstory Canopy)		
Tree Cover (Single or Small Group)		
Lockage Waiting Area Sign		S
Trash Receptacle		R



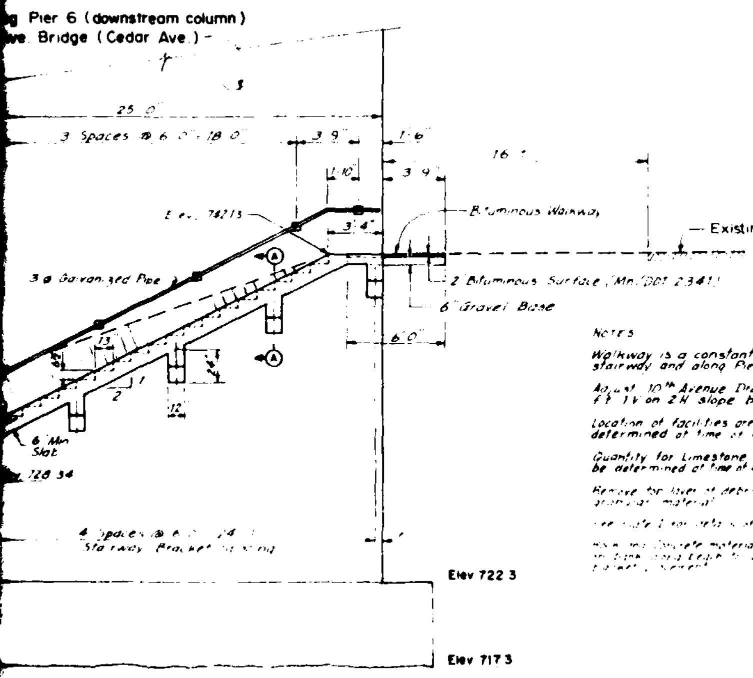


SECTION B-B

SCALE IN FEET

OUTLET FLUME for BRIDGE DRAINAGE SYSTEM – DOWNSTREAM ELEVATION of UPSTREAM COLUMN

(NO SCALE)



PIER 6 - Downstream Column

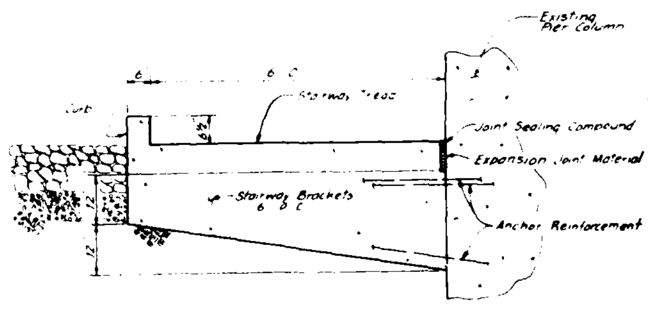
NOTES

Walkway is a constant 6' width except at stairway and along Pier columns where width is 3' 9".

Adjust 10th Avenue Drainage Pipes (3) in field to fit 1 V on 2 H slope between Pier 6 Columns.

Location of facilities are approximate. Exact location to be determined at time of construction.

Quantity for Limestone slab removal along shoreline is approximate and shall be determined at time of construction. This is included in the Rock Excavation quantity.



SECTION A-A

SCALE IN FEET

HNTB

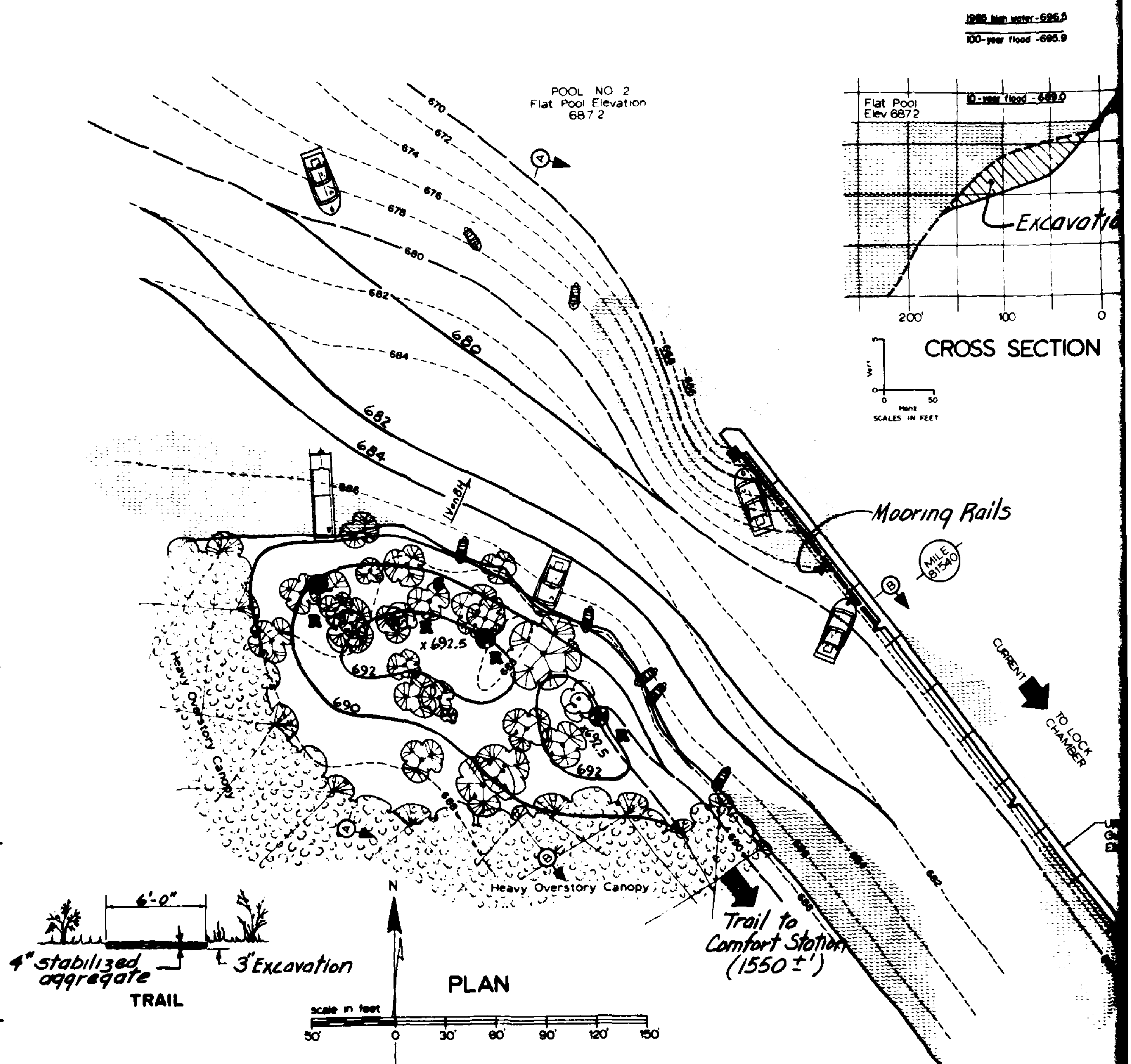
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

UPPER MISSISSIPPI RIVER
RECREATIONAL CRAFT LOCKS STUDY
LOCKAGE WAITING AREA
L.S.A.F. LOCK, LOWER APPROACH
PLAN AND SECTION

SUBMITTED BY:
APPROVED
DATE:

SAFETY PAYS

PLATE 2



LEGEND:

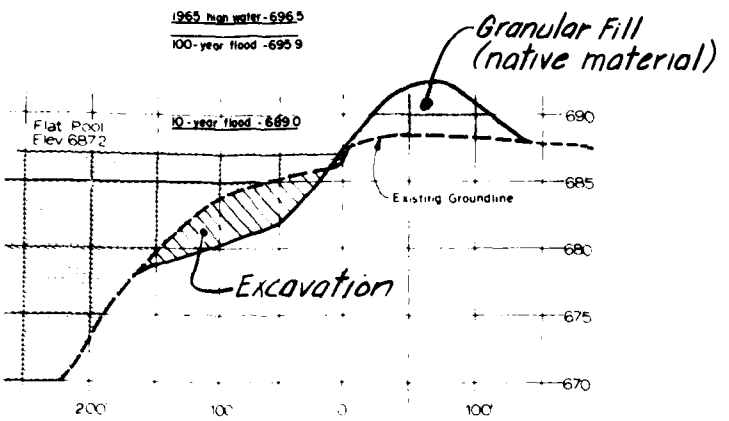
	Existing	Proposed
Contour	— — —	
Tree Cover (Overstory Canopy)		
Tree Cover (Single or Small Group)		
Lockage Waiting Area Sign		
Trash Receptacle		
Picnic Table		
Trail		

Notes

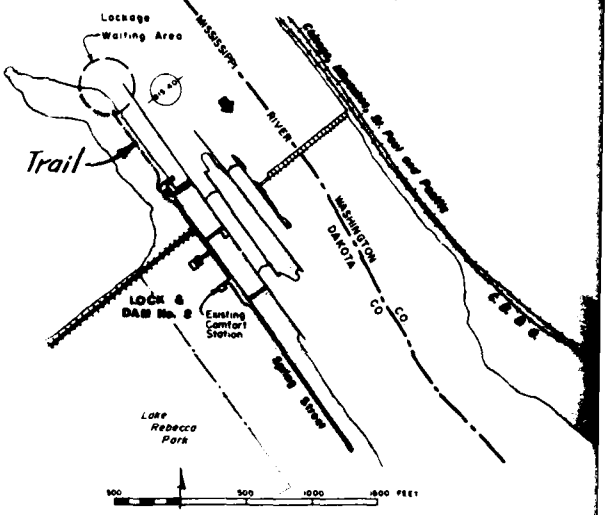
Location of facilities are approximate. Exact location to be determined at time of const.

See Plate 1 for details of Lockage Waiting Area Sign, Trash Receptacle and Picnic Table

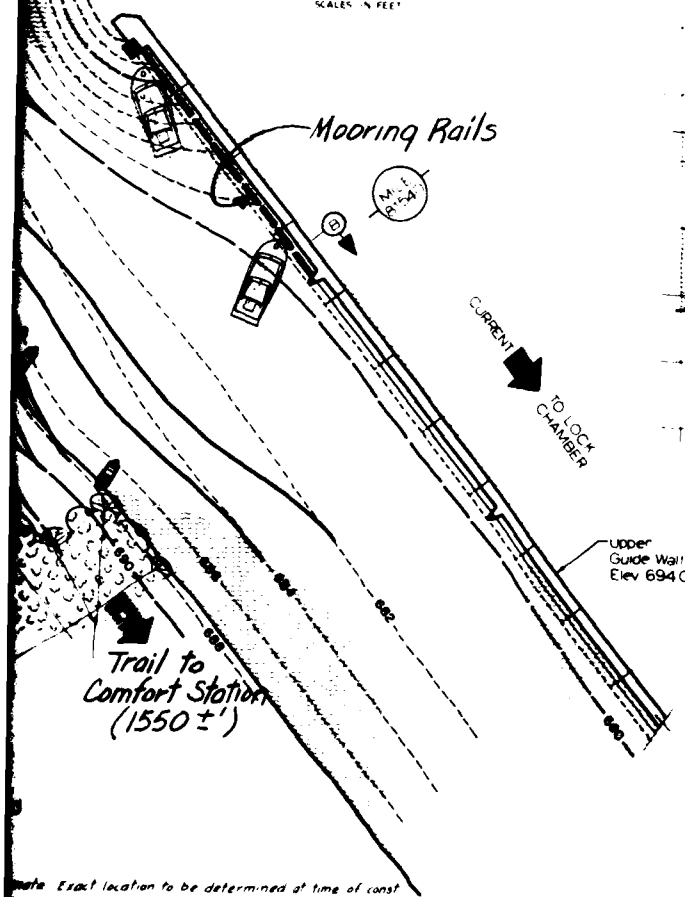
Exact location of Trail to be determined at time of construction

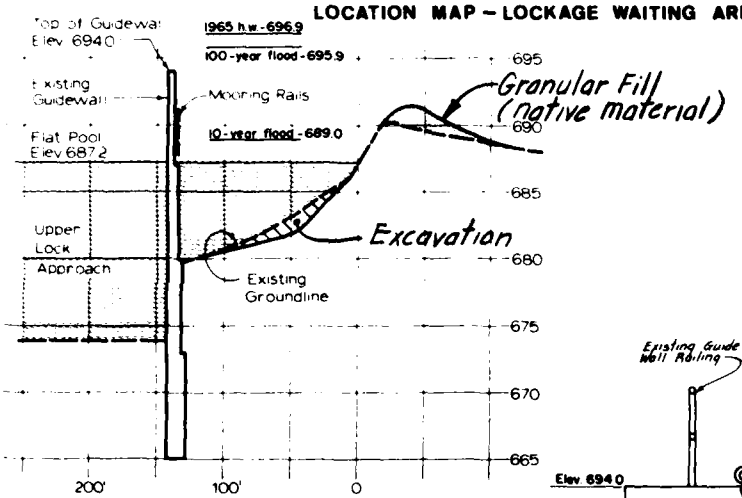


CROSS SECTION A - A

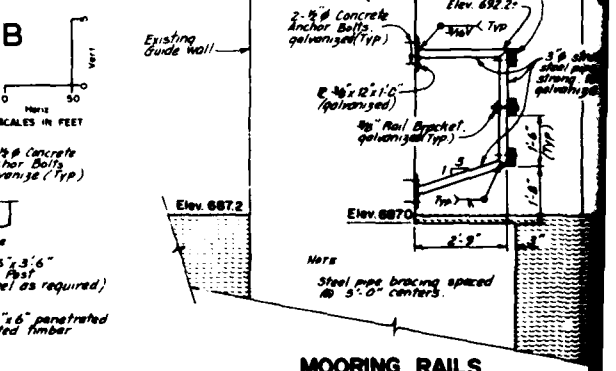


LOCATION MAP – LOCKAGE WAITING AREA, UPPER APPROACH

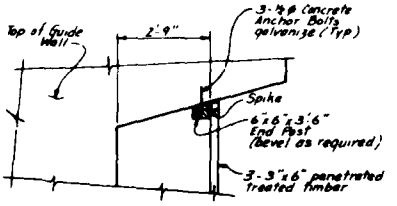




CROSS SECTION B - B



MOORING RAILS



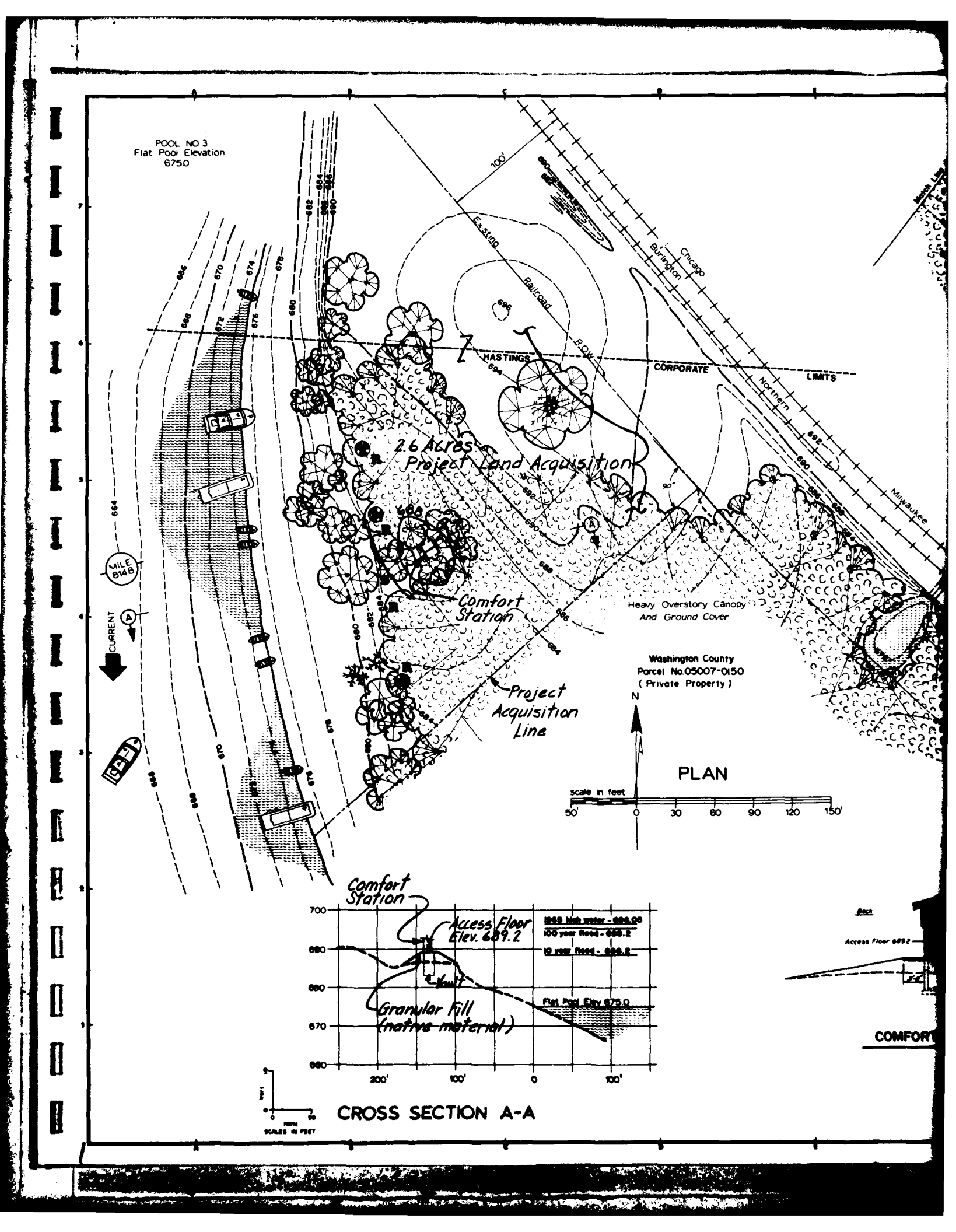
SECTION C-C
(End Rail Connection)

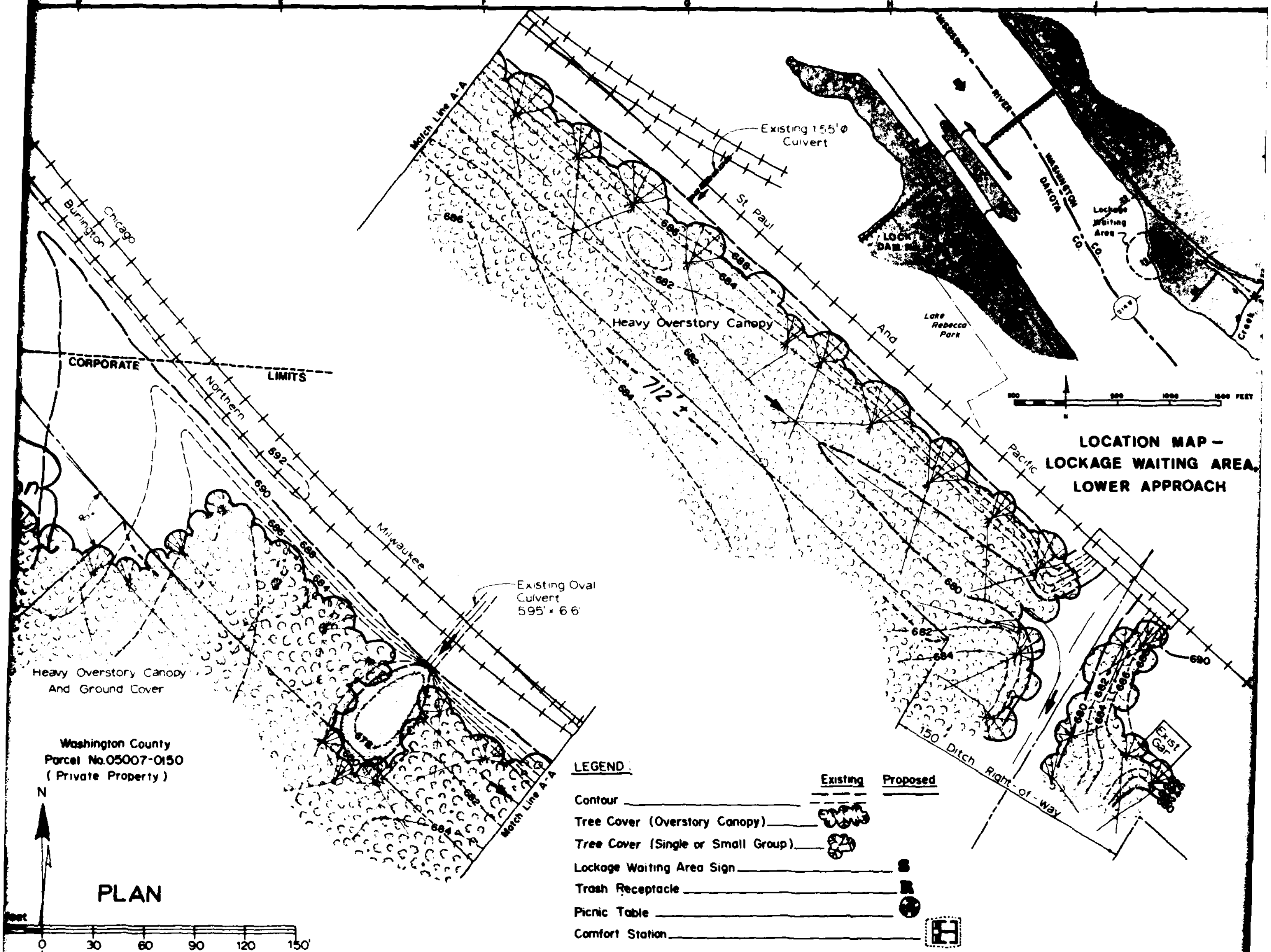
Scale in feet
2 1 0 2 4 6

Note: Exact location to be determined at time of const
Lighting Area Sign, Trash Receptacle and Picnic Table
determined at time of construction

HNTB	DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA
SUBMITTED BY:	UPPER MISSISSIPPI RIVER RECREATIONAL CRAFT LOCKS ST
APPROVED:	LOCKAGE WAITING AREA LOCK NO. 2, UPPER APPR PLAN AND SECTION
DATE:	PLATE

SAFETY PAYS


POOL NO 3
Flat Pool Elevation
675.0
100'
Existing
Railroad
R.O.W.
Chicago
Burlington
Northern
Milwaukee
HASTINGS
CORPORATE
LIMITS
2.6 Acres
Project Land Acquisition
Comfort
Station
Heavy Overstory Canopy
And Ground Cover
Washington County
Parcel No.05007-0150
(Private Property)
Project
Acquisition
Line
MILE
814.8
CURRENT
N
PLAN
scale in feet
50'
0
30
60
90
120
150'
Comfort
Station
Access Floor
Elev. 689.2
Vault
Granular Fill
(native material)
Flat Pool Elev 675.0
700
690
680
670
660
200'
100'
0
100'
CROSS SECTION A-A
Access Floor 689.2
COMFORT



LEGEND:

	Existing	Proposed
Contour		
Tree Cover (Overstory Canopy)		
Tree Cover (Single or Small Group)		
Lockage Waiting Area Sign		
Trash Receptacle		
Picnic Table		
Comfort Station		

NOTES:

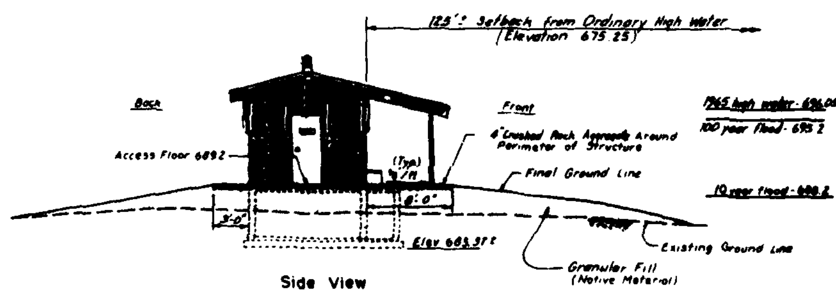
Some clearing and grubbing necessary at Comfort Station and at picnic table & trash receptacle sites.

Location of facilities are approximate. Exact location to be determined at time of const

Trees and logs located in beach area to remain, provided they are not a hazard to boaters

Four inches of crushed rock aggregate to be placed approximately three feet out from back of Comfort Station, six feet out from sides of Structure & eight feet out from front of structure.

See Plate 1 for details of Comfort Station, Lockage Waiting Area Sign, Trash Receptacle and Picnic Table



COMFORT STATION - ELEVATION

(Looking Downstream)
No Scale

HNTB

DEPARTMENT OF THE ARMY

SUBMITTED BY:

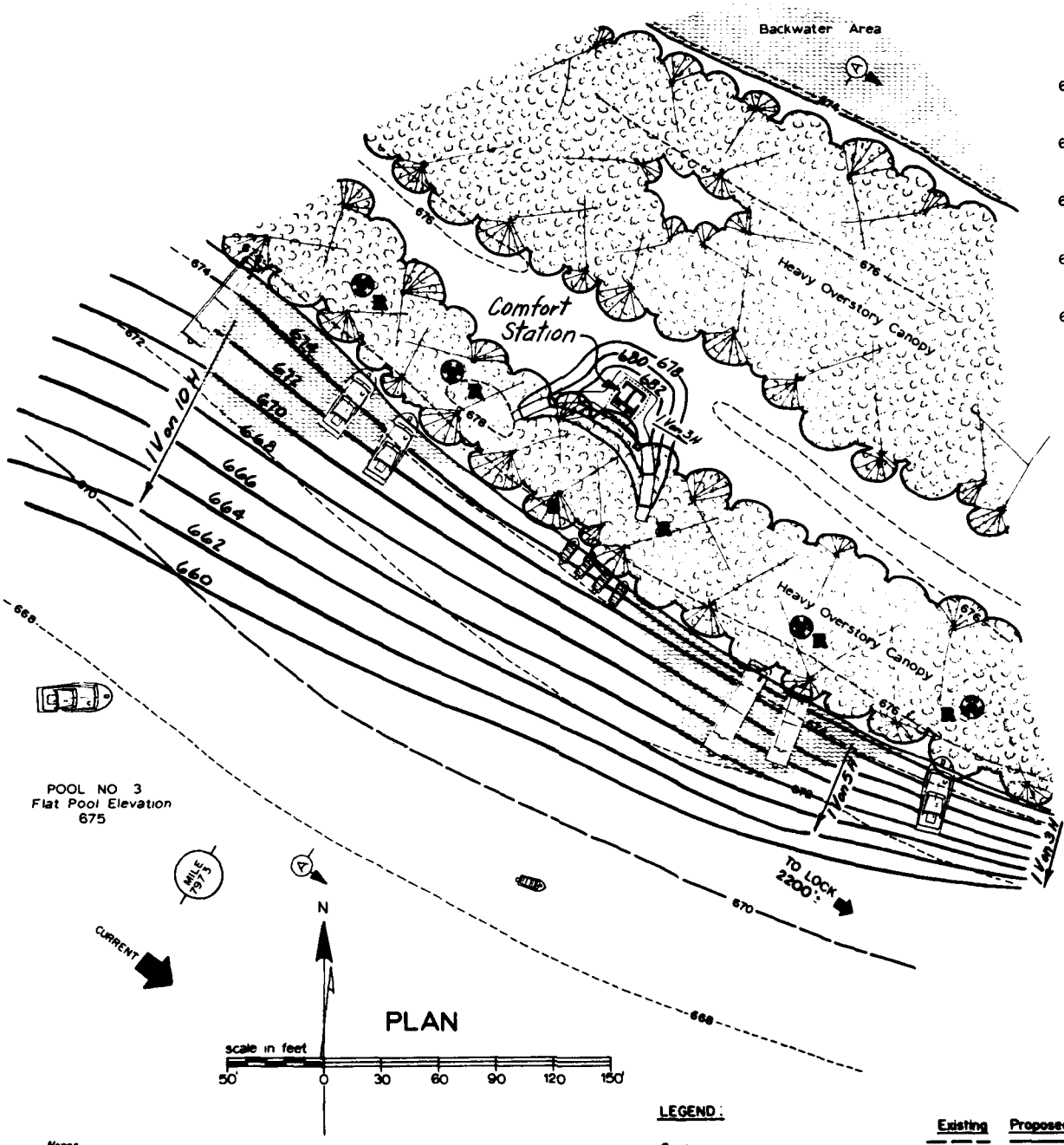
APPROVED:

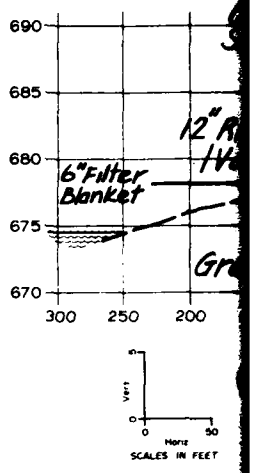
UPPER MISSISSIPPI RIVER
RECREATIONAL CRAFT LOCKS STUDY

LOCKAGE WAITING AREA
LOCK NO. 2, LOWER APPROACH
PLAN AND SECTION

DATE:

PLATE 4





POOL NO 3
Flat Pool Elevation
675

Notes :

Location of facilities are approximate. Exact location to be determined at time of construction

Four inches of Crushed Rock aggregate to be placed approximately three feet out from back of Comfort Station, six feet out from sides of structure and eight feet out from front of structure and along access ramps to structure

Riprap to be placed around the Comfort Station and along Access Ramps

Place organic soil (native) and seeds among riprap to promote vegetative growth.

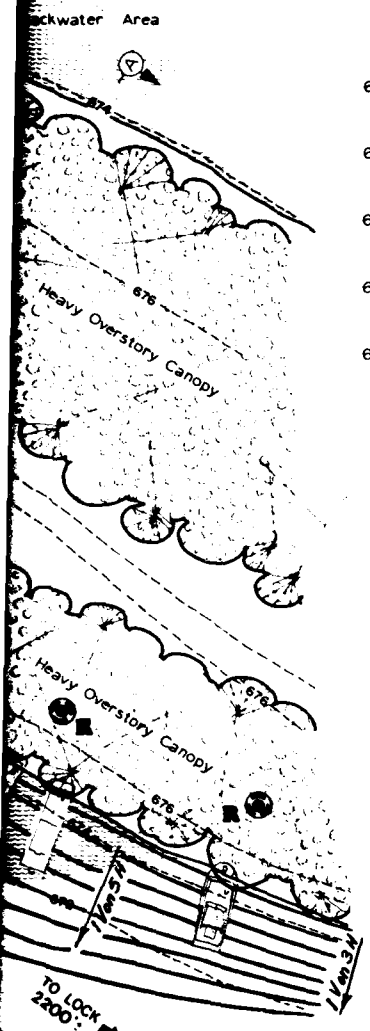
See Plate 1 for details of Comfort Station, Lockage Waiting Area Sign, Trash Receptacle and Picnic Table

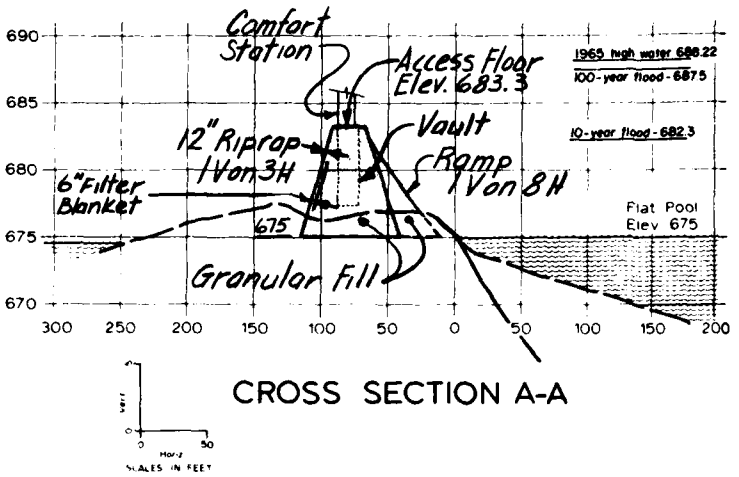
Install Traffic Signal Lights on upstream end of upper approach channel improvement structure (rubble mound dike or guard wall) for navigation purposes

Trim trees along required beach length (560') 50 feet deep and 15 feet high

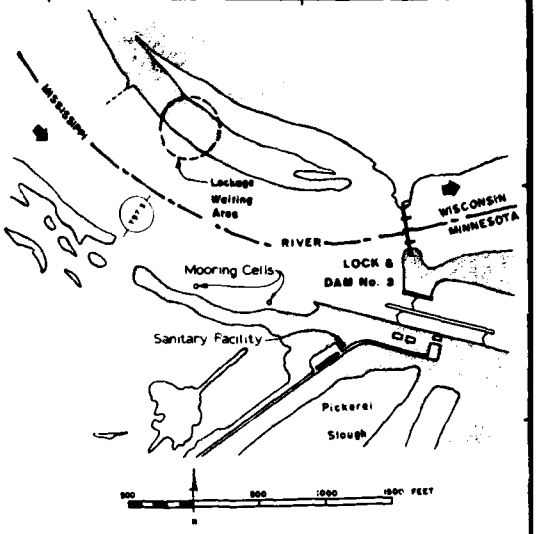
LEGEND :

	Existing	Proposed
Contour		
Tree Cover (Overstory Canopy)		
Tree Cover (Single or Small Group)		
Lockage Waiting Area Sign		
Trash Receptacle		
Picnic Table		
Comfort Station		

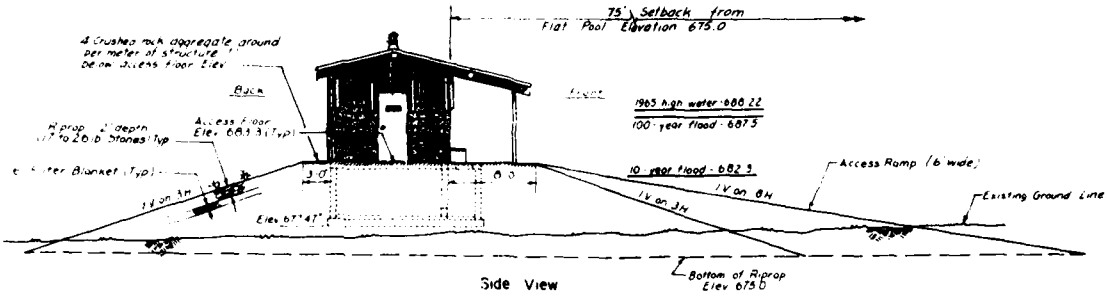




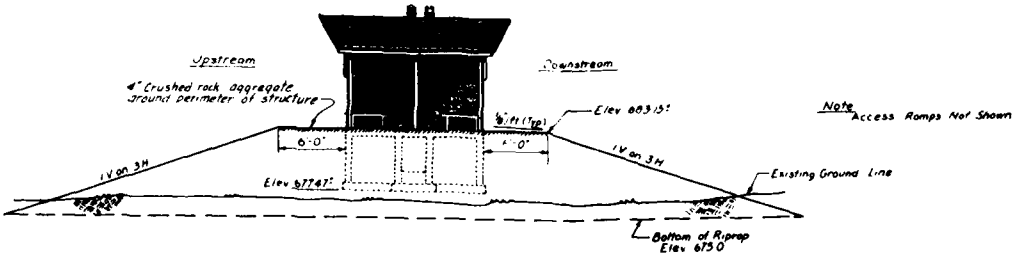
CROSS SECTION A-A



LOCATION MAP – LOCKAGE WAITING AREA, UPPER APPROACH



Side View

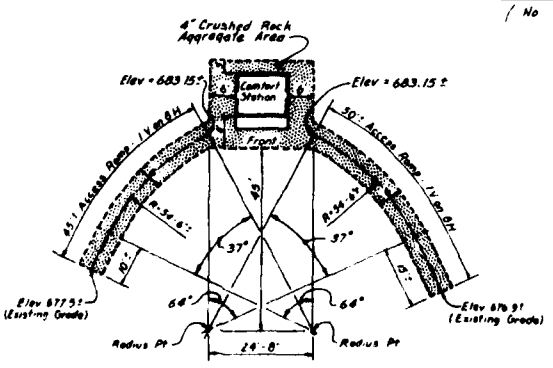


Front View

COMFORT STATION - ELEVATION

(No Scale)

	Existing	Proposed
Overstory Canopy)		
Single or Small Group)		
ting Area Sign		
cle		
n		



GEOMETRY FOR ACCESS RAMPS COMFORT STATION

(NO Scale)

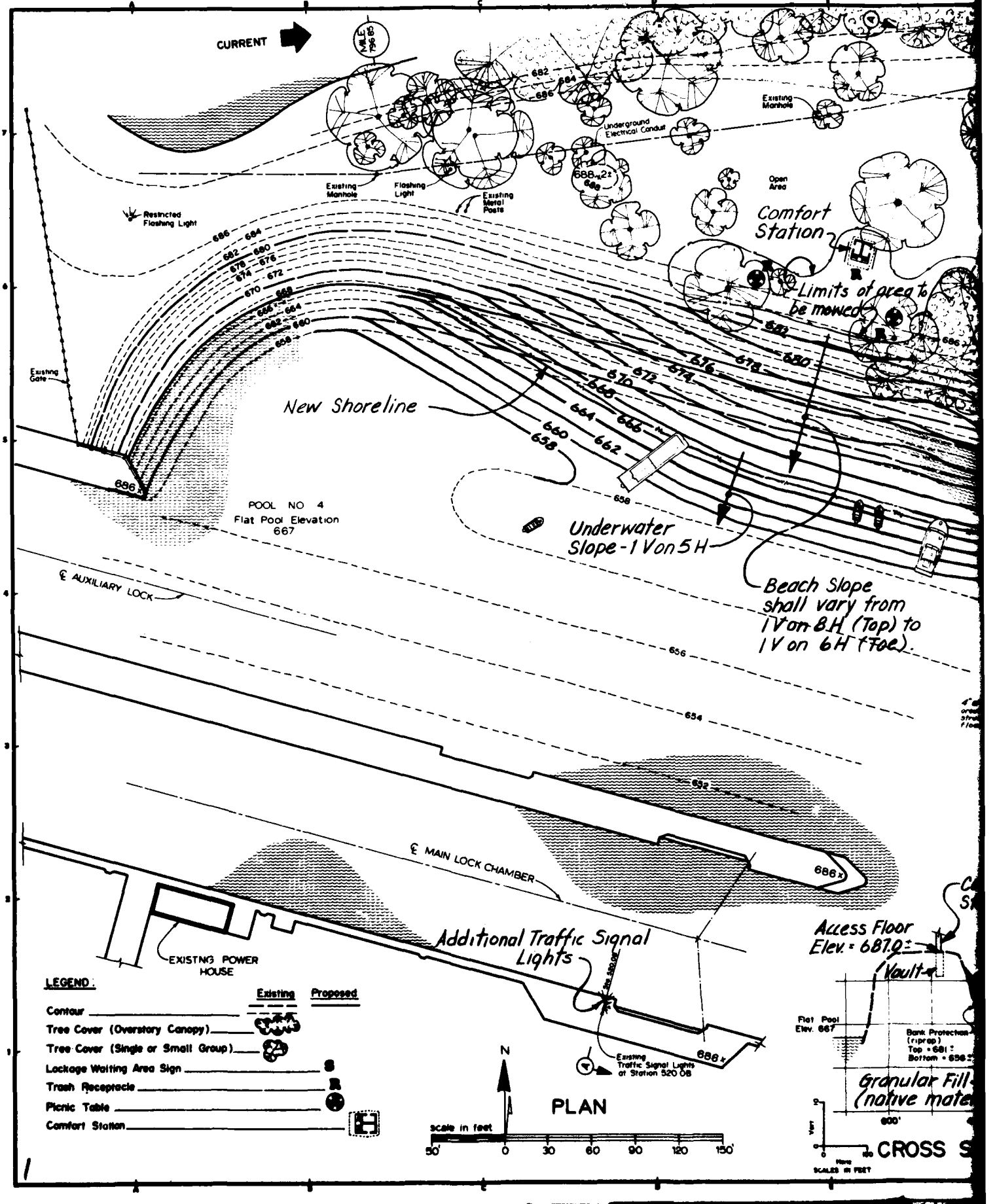
SAFETY PAYS

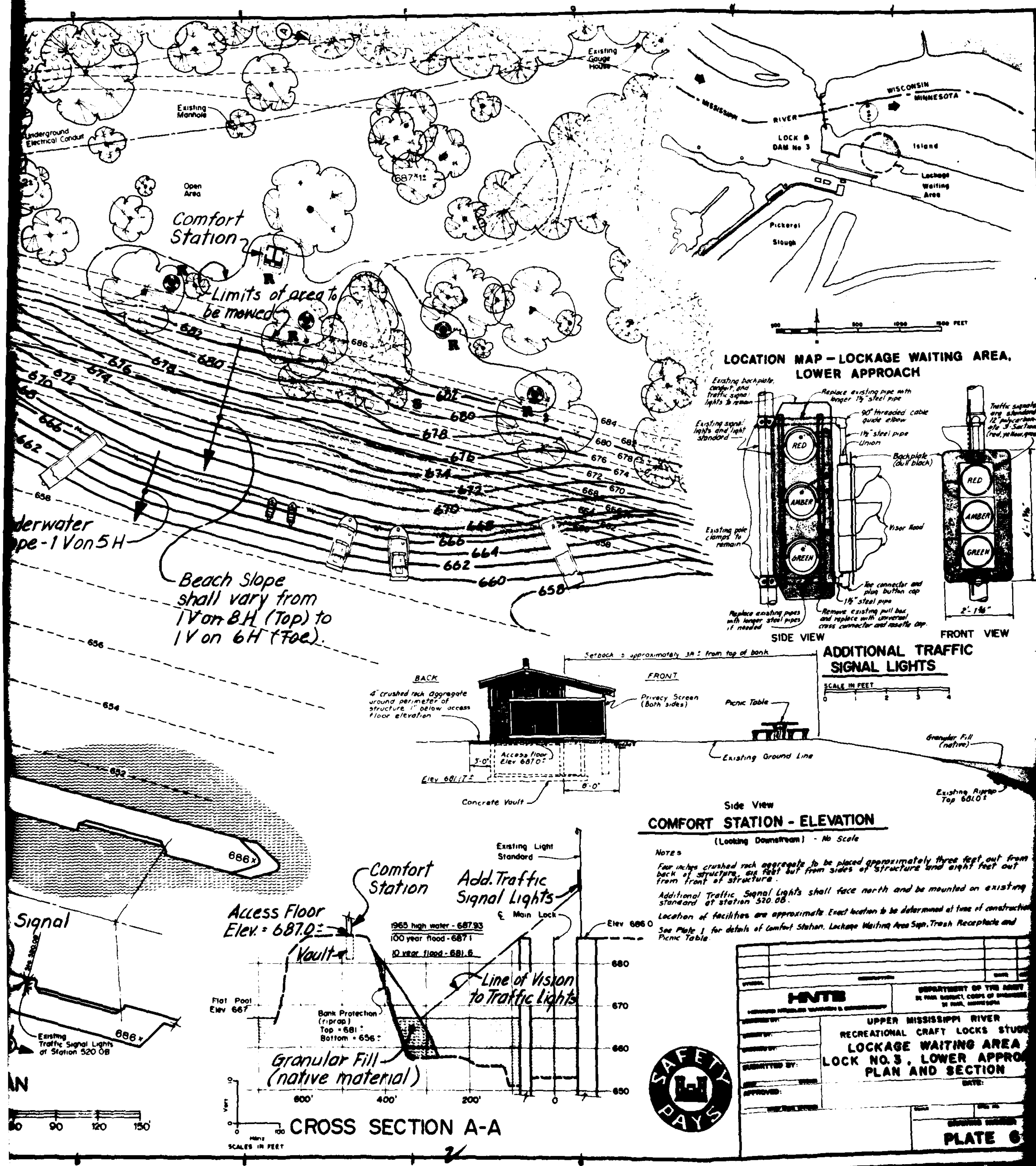
HNTB

DEPARTMENT OF THE ARMY
ST PAUL DISTRICT, CORPS OF ENGINEERS
ST PAUL, MINNESOTA

UPPER MISSISSIPPI RIVER
RECREATIONAL CRAFT LOCKS STUDY
LOCKAGE WAITING AREA
LOCK NO. 3, UPPER APPROA
PLAN AND SECTION

PLATE 8


CURRENT
MILE 68.96
Existing Manhole
Flashing Light
Existing Metal Posts
Underground Electrical Conduit
Existing Manhole
Open Area
Comfort Station
Restricted Flashing Light
Limits of area to be mowed
Existing Gate
New Shoreline
POOL NO 4
Flat Pool Elevation
667
Underwater Slope - 1 V on 5 H
Beach Slope shall vary from 1 V on 8 H (Top) to 1 V on 6 H (Toe).
℄ AUXILIARY LOCK
℄ MAIN LOCK CHAMBER
EXISTNG POWER HOUSE
Additional Traffic Signal Lights
Existing Traffic Signal Lights at Station 520 08
Access Floor Elev. = 687.0±
Vault
Flat Pool Elev. 667
Granular Fill (native mate
LEGEND:
Existing
Proposed
Contour
Tree Cover (Overstory Canopy)
Tree Cover (Single or Small Group)
Lockage Waiting Area Sign
Trash Receptacle
Picnic Table
Comfort Station
N
PLAN
scale in feet
50' 0 30 60 90 120 150'
CROSS S
SCALES IN FEET



Existing Gauge House
Existing Manhole
Underground Electrical Conduit
Open Area
687±
Comfort Station
Limits of area to be mowed
Underwater Slope - 1 V on 5 H
Beach Slope shall vary from 1V on 8H (Top) to 1V on 6H (Toe).
Signal
Existing Traffic Signal Lights at Station 520.08
MISSISSIPPI RIVER
WISCONSIN
MINNESOTA
LOCK & DAM No 3
Island
Lockage Waiting Area
Pickerel Slough
LOCATION MAP - LOCKAGE WAITING AREA, LOWER APPROACH
Existing backplate, conduit, and traffic signal lights to remain
Replace existing pipe with longer 1½" steel pipe
90° threaded cable guide elbow
1½" steel pipe
Union
Backplate (dull black)
Existing signal lights and light standard
Existing pole clamps to remain
Visor Hood
Tee connector and plug button cap
1½" steel pipe
Remove existing pull box and replace with universal cross connector and rosette cap
Replace existing pipes with longer steel pipes if needed
RED
AMBER
GREEN
SIDE VIEW
FRONT VIEW
2'-1⅛"
ADDITIONAL TRAFFIC SIGNAL LIGHTS
SCALE IN FEET
Setback = approximately 3ft ± from top of bank
BACK
FRONT
4" crushed rock aggregate around perimeter of structure 1" below access floor elevation
Privacy Screen (Both sides)
Picnic Table
Access floor Elev 687.0±
Elev 681.7±
Concrete Vault
Existing Ground Line
Granular Fill (native)
Existing Riprap Top 681.0±
Side View
COMFORT STATION - ELEVATION
(Looking Downstream) - No Scale
NOTES
Four inches crushed rock aggregate to be placed approximately three feet out from back of structure, six feet out from sides of structure and eight feet out from front of structure.
Additional Traffic Signal Lights shall face north and be mounted on existing standard at station 520.08.
Location of facilities are approximate. Exact location to be determined at time of construction.
See Plate 1 for details of Comfort Station, Lockage Waiting Area Sign, Trash Receptacle and Picnic Table.
Existing Light Standard
Comfort Station
Add. Traffic Signal Lights
Access Floor Elev. = 687.0±
Vault
1965 high water - 687.93
100 year flood - 687.1
10 year flood - 681.6
℄ Main Lock
Elev 686.0
Line of Vision to Traffic Lights
Flat Pool Elev 667
Bank Protection (riprap) Top = 681± Bottom = 656±
Granular Fill (native material)
CROSS SECTION A-A
SCALES IN FEET
HNTB
DEPARTMENT OF THE ARMY
UPPER MISSISSIPPI RIVER
RECREATIONAL CRAFT LOCKS STUDY
LOCKAGE WAITING AREA
LOCK NO. 3, LOWER APPROACH
PLAN AND SECTION
SUBMITTED BY:
APPROVED:
DATE:
PLATE 6
SAFETY PAYS