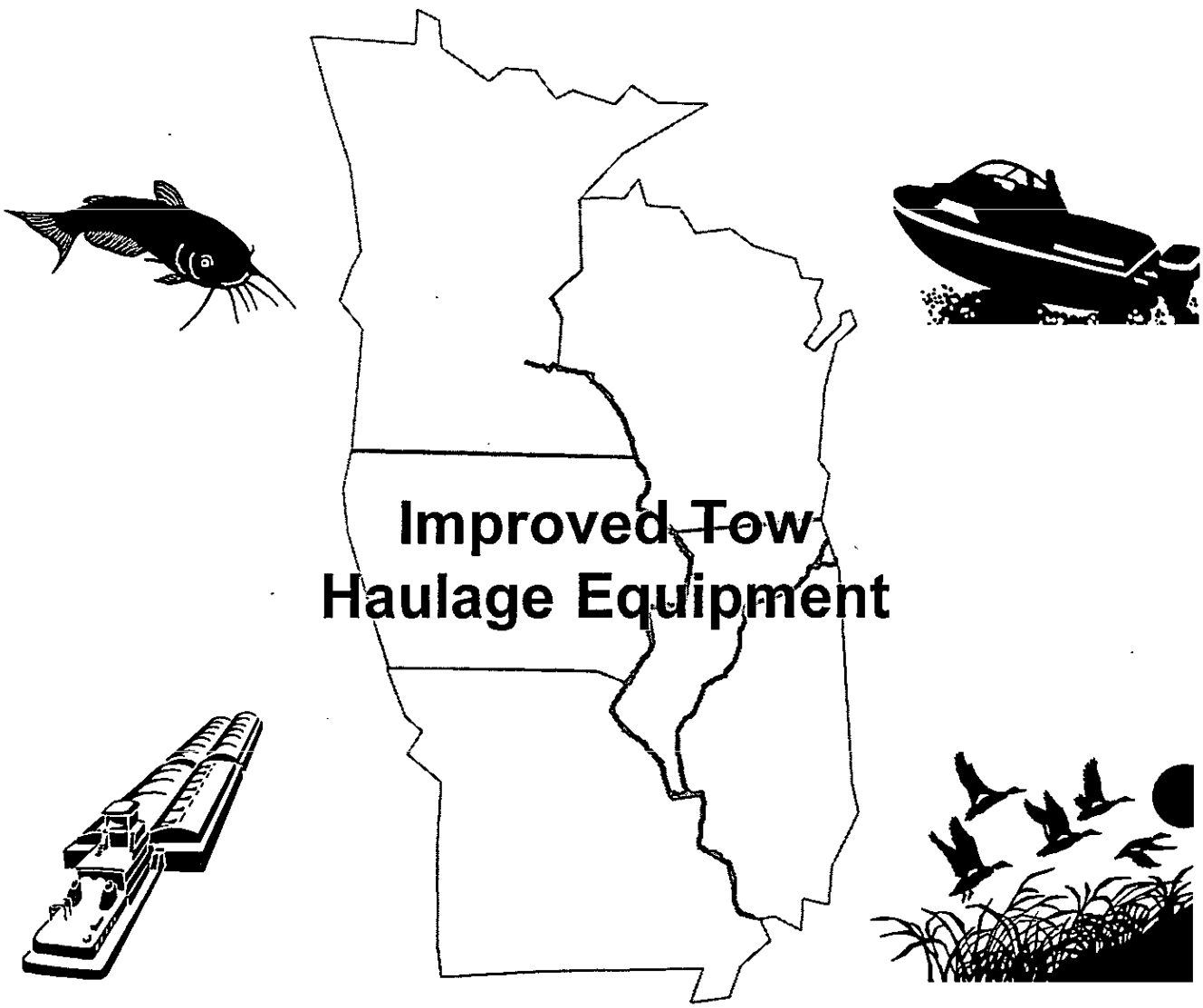
Interim Report For The Upper Mississippi River - Illinois Waterway System Navigation Study



September 1995

US Army Corps
of Engineers

St. Paul District
Rock Island District
St. Louis District

FOREWORD

This report has been submitted in fulfillment of Contract DACW25-93-D-0003 between Sverdrup Corporation of Maryland Heights, Missouri and the U.S. Army Corps of Engineers, Rock Island District, in cooperation with the U.S. Army Corps of Engineers, St. Louis and St. Paul Districts.

The purpose of this report is to assess the technical feasibility of improvements to tow haulage equipment and the resulting impacts to transit times in the locking process on the Upper Mississippi River and Illinois Waterway. This effort included (1) visits to other locks with various different types of tow haulage units, (2) the collection of timing data, (3) the development of alternative configurations, and (4) the evaluation of these configurations with respect to selected locks in the study area. This study is in support of the Upper Mississippi River - Illinois Waterway System Navigation Study (NAV Study), a system feasibility study of potential navigation improvements for locks during the period 2000-2050.

SUMMARY

This assessment is part of the Upper Mississippi River and Illinois Waterway System Navigation Study efforts to identify small-scale measures to reduce delays or congestion that commercial barge traffic experiences when transiting locks on the Upper Mississippi River and Illinois Waterway. The overall assessment process included a historical records review, visits to two locks (one on each waterway), meetings with industry, environmental, and regulatory agency representatives, identification of potential small-scale measures, and recommendations for further study of a screened list of small scale measures.

One of the measures selected for further study was "Improved Tow Haulage Equipment". This report reviews the current practices regarding hardware, procedures, and personnel related to utilization of tow haulage equipments to extract unpowered cuts from the lock chamber. It assesses the impact that these practices have on the efficiency by which the unpowered cuts are removed from the the lock chamber and tied off on the guidewalls. Finally, the report discusses the opportunities that exist for improving this process through changes in hardware and operations in current practice. With the assumption that guidewalls would be extended to 1200', alternative configurations and motive power solutions were developed and then evaluated using the following four criteria; completeness, effectiveness, efficiency, and acceptability. The two alternatives that required the tow haulage equipment to cross the miter gates were eliminated due to safety and operational concerns and the potential for system down time due to failure. The two remaining alternatives and motive power solutions were further evaluated for implementation in the study area. Time savings and sytem costs were also developed and presented.

The improved tow haulage equipment recommended will generate significant time savings in the locking process, with or without guidewall extensions. The fact that the tow haulage system configuration can apply a "restraining force" to the barges generates the time savings. The addional time saving provided by the extended guidewalls is in two components:

1. No "braking" of the unpowered cut required (to stay on 600' guidewall - can continue to end of 1200' wall and gate closure can commence)

2. The remake of the double cut can be performed without blocking the miter gate for closure for a turnback for the next tow.

The economic benefits of time savings versus cost for these recommended alternative configurations, including the guidewall extentions, will be developed and presented in another report.

Table of Contents

TABLE OF CONTENTS

	Foreword	i
	Summary	ii
	Table of Contents	iii
I	Introduction	I-1
II	Existing Systems	II-1
III	Timing Data and Observations	III-1
	A. Approach	III-1
	B. Extraction of 1st Cut	III-2
	C. Remake with 2nd Cut	III-4
IV	Configurations and Motive Power	IV-1
V	Structural Parameters	V-1
VI	Structural Modification Issues	VI-1
VII	Selected Alternatives	VII-1
	A. Powered Traveling Kevel Configurations	VII-1
	B. Power Units For Traveling Kevel	VII-2
	C. Conclusions	VII-3
VIII	Feasibility of Implementation in Study Area	VIII-1
	A. Site Visits	VIII-1
	B. Evaluation of Each Site	VIII-2
Appendix I	Plates 1 through 10 - Tow Haulage System Plans and Details	
Appendix II	Cost Estimates	
Appendix III	Structural Calculations	
Appendix IV	Timing Data	

Section I

SECTION I

INTRODUCTION

The purpose of this study effort is to assess the technical feasibility of improvements to tow haulage equipment on locks of the Upper Mississippi River and Illinois Waterway. This study is made in support of the Corps of Engineers' 6-year Upper Mississippi River and Illinois Waterway System Navigation Study (NAV Study). Sverdrup Corporation was retained to develop this report, with technical coordination and review by the St. Paul, Rock Island, and St. Louis Districts.

This study is one of several "Small Scale Improvement" studies by the Corps of Engineers in an effort to identify ways to decrease lock congestion in the study area. Small Scale Improvements are those that reduce transit time through existing locks, but do not include building new lock facilities (i.e. 600' or 1200' chambers). A separate Corps of Engineers effort is evaluating these large scale improvements.

The basis of this study is to determine the impacts to transit time with improved tow haulage equipment assuming the presence of extended (1200') guidewalls at each of the locks in the study area. Whereas the guidewall extension would provide time savings related to improved approach conditions to the chamber as well as entry time savings, this study will only address time savings associated with the improved tow haulage equipment.

It should also be noted that time savings can be achieved in the processing a double lockage by utilizing a switch boat or "self-help" policy to extract the unpowered cuts from the lock chamber. However, these two small scale improvements measures will be evaluated under a separate small-scale improvements evaluation under the NAV Study.

For purposes of this report, the study area will consist of Locks 20, 21, 22, 24, and 25 on the Upper Mississippi River and LaGrange Lock on the Illinois Waterway. These locks were chosen

because they have the 600' chambers (as opposed to 1200') and are the furthest downstream (therefore receiving more commercial traffic than those locks upstream in the study area). Many of the tows now seen on these waterways require a 1200' chamber to lock through in a single stage. A 600' chamber requires them to lock through in two stages, called a "double lockage."

Double lockages are time consuming, difficult, and pose safety concerns to lock operations staff and the towing industry deck hands. A double lockage is any tow and barge combination whose size is greater than the capacity of the lock chamber. Therefore the tow/barges must be "broken" in two segments; an unpowered segment (the group of barges that must lock through without the tow), and the powered segment (the tow and remaining barges). This process requires more than twice the time needed for a single lockage because of the two stage process. Double lockages are difficult because they require more coordination between the towboat's crew and the lock operators. They pose safety concerns because the unpowered cut must be stopped with the aid of lines checked on the lock wall. This process has several time consuming elements as listed below:

a. Disconnecting the wires between the barges of the unpowered and powered cut
b. Backing the tow out clear of the gates
c. Filling or emptying the chamber
d. Extracting the unpowered cut
e. Stopping the unpowered cut
f. Tieing the unpowered cut to the guide wall
g. Emptying or filling the chamber again
h. Locking through the powered cut and
i. Reconnecting the two segments

There is an "operational philosophy" difference at the locks in this study area as opposed to other waterways. The lock operators on the upper Mississippi River "handle" the lines; deck hands throw lines to the lock operators to tie off the unpowered cuts. This is not done at most locks in the Ohio River Division operations area. This is another time element issue and a safety issue.

This study will include review of different types of existing tow haulage systems used on other inland waterways of the United States. These systems will be used as background material in developing solutions for the study area. Each lock is different and the configurations of tow haulage systems must be adjusted after careful site surveys. This study will also include estimates of transit time improvements and cost estimates.

Section II

SECTION II
EXISTING SYSTEMS

Current practices utilizing tow haulage equipment on the Upper Mississippi River and Illinois Waterway vary from lock to lock but as a general rule were not designed for the efficient regular handling of unpowered cuts of river barges. The most common system consists of a single line winch, one each located just above the upstream miter gate recess and just below the lower miter gate. Once the first (unpowered) cut of the tow has been brought to the new pool level, the cable from the winch is passed to the deckhand on the cut. The deckhand secured the cable to a deck fitting near the stern of the first barge or the bow of the second barge in the cut. After the line is snugged the winch is brought up to speed (generally about 50 feet per minute). The winch, in effect, whips the cut out of the lock chamber. This is due to the fact that once the point of connection passes the winch station, the winch can no longer exert a pulling force on the cut unless the point of connection is moved further aft. Normally the momentum of the cut of barges is sufficient to cause the entire cut to drift out of the lock chamber.

Most of the winches observed in operation as part of a barge haulage system on the inland waterways system are rated at a top speed of 100 feet per minute. In practice these systems are operated at 50 feet per minute because of the inability of the systems to apply a restraining force to the barges.

To investigate alternative tow haulage systems, five lock & dam sites were visited within the Ohio River and Lower Mississippi River Division. These sites were selected due to the fact that they utilized improved and different tow haulage systems. Each site's system and configuration are described below.

A. PICKWICK LOCKS, TENNESSEE RIVER

On February 16-17, 1995, Dave Diestelkamp and Mary Spence visited Pickwick Locks on the Tennessee River. The visit was hosted by the Lockmaster, Mr. Donnie Damron.

1. THE SITE

The locks are located about 100 miles east of Memphis, TN and 14 miles south of Savannah, TN, near the junction of the states of Tennessee, Alabama, and Mississippi. The locks are situated at mile 206.7 on the left descending bank of the Tennessee River. Pickwick Landing is one of nine mainstream lock and dam facilities that provide a 650-mile navigation channel on the Tennessee River from Knoxville, TN, to Paducah, KY. The pool created by Pickwick Landing Dam impounds a body of water located primarily in northwest Alabama and a small portion in northeast Mississippi. The next lock upstream is Wilson (53 river miles) and the next lock downstream is Kentucky (184 river miles). The facility was named after the community that once occupied the area.

The Tennessee Valley Authority (TVA) began construction of Pickwick Landing Dam in December of 1934 and completed the project in 1938. The dam in 113' high and 7,715' long. The generating plant at Pickwick Dam is one of the largest hydroelectric installations in the TVA system. It has a capacity of 232,160 kilowatt in six units and generates as much as 2 billion kilowatt-hours of electricity a year. TVA owns the lock, dam, and surrounding property. TVA operates and maintains the dam and the powerplant, while the Corps of Engineers operates and maintains the locks.

The original lock facility was a single 110' x 600' chamber. (Figure II-1) Although a second lock was planned, construction of the new chamber did not begin until 1978. The new chamber is 110' x 1000' and was completed in 1984. (Figure II-2) The original lock is maintained as an auxiliary facility. The normal headwater elevation is 414 and the normal tailwater elevation is 359, giving the locks an average lift of 55 feet, although they are capable of a maximum lift of 63 feet.

	UPPER APPROACH WALL ELEV.	UPPER SILL ELEV.	LOWER APPROACH WALL ELEV.	LOWER SILL ELEV.
MAIN CHAMBER	424.0	395.0	402.0	342.0
AUX. CHAMBER	422.0	398.0	400.0	342.2

The main chamber is closest to the left descending bank, next to the control building and visitor's center. It has a 1,400' upper (landside) guidewall and a 1,000' lower (landside) guidewall, with shorter intermediate (river) walls. The auxiliary chamber has 600' (river) guidewalls on either end, a 110' intermediate (landside) wall upstream and a 600' intermediate (landside) wall downstream. Both locks are equipped with miter gates and floating mooring bits.

2. TOW HAULAGE EQUIPMENT

a. Main Lock

The main lock has three powered kevels and one unpowered traveling checkpost. The chamber wall was designed with a powered traveling kevel built into the top armor plating. (Figure II-3) The kevel runs along the top of the wall and automatically releases its line just before the miter gates. It is powered by a single drum winch system that is recessed beneath the main chamber wall work area. The drum has two cables on it and it takes up slack from one end while it pays it out from the other. Each cable is fastened on one end of the drum with the other end attached to either side of the mule (kevel). The system also has a dynamic tensioning device at one end of the chamber to remove slack from the cable when it is under load.

The line from a cut of barges to the kevel is usually attached from the stern of the cut. The automatic line release is a mechanical device that trips the line off the top post of the mule after the

operator overrides the electrical limit switches at the end of travel. The release keeps the lock operators from having to handle the lines during a lockage. The release from the downstream side (55' drop) is fairly dramatic. The cable is 3/4" diameter and the winch is 60 hp.

About 100' outside the gates (both upstream and down) are two "secondary" tow haulage units. These systems also use a recessed single drum winch with a tensioning device, but the rails are exposed on the top of the guidewalls. The rail runs out to about 750' from the gates. (Figure II-4) These secondary systems are used (1) to pull an unpowered cut out of the chamber if the main unit fails to provide enough momentum for the cut to clear the gates, or (2) to pull the cut the full length of the guidewall when locking through doubles (so the second cut of the first tow does not occupy the chamber during remake). The cable is 5/8" diameter and the winches are 15 hp each.

The remaining 750' of the upstream wall is covered by another rail/kevel system that is used as a traveling checkpost. (This rail is not continuous with the secondary tow haulage system.) This kevel also travels on an exposed 140 lb rail mounted to the top of the guidewall. It is used only to keep the head of an upbound tow in close to the guidewall during exit. (Figure II-5) A single line winch system is of low horsepower and is used only to retrieve the checkpost from the end of the wall. The winch was not designed to pull the unpowered cut. It supplies power by turning a narrow drum that has several wraps of wire around it. This friction system is also spring loaded so that it can take up the slack in the cable. (Figure II-6) The cable is 3/8" in diameter and the winch is 5 hp.

The controls for the chamber system are located inside each of the control stands on the main chamber. The controls for the secondary units and the checkpost retriever are located nearby. The system is easy to operate and reportedly very reliable. Cuts can be removed at 50 to 100 feet per minute (fpm) depending on the conditions. The checkposts were raised above the level of the rail in order for them to be effective.

b. Auxiliary Lock

The 600' long auxiliary chamber was retro-fitted with tow haulage equipment. It has a single kevel that runs on exposed 140 lb rail on the riverside of the chamber. This system is fairly unique in that it traverses the miter gates on rail at both ends. The rails that allow it to move across the gates were added to the top edge of both riverside miter gate leaves (Figure II-7). When the gates open, the rail on the top of the miter gate aligns with the rail on the guidewall. The rails are cut at an angle to allow the mule to make a smooth transition from the chamber wall to the gate and then to the guidewall. Since the guidewall elevation on the lower end is 22' below the chamber wall elevation, the rail outside the miter gate on the downstream side is very short. The rail on the upstream guidewall continues about 100' past the gate recess (Figure II-8). The advantage to having the mule track past the gates (especially upstream) is that the lock operator doesn't have to worry about getting the momentum of the cut high enough that it will overcome the wind/current to move out past the gates. As long as the lead line on the stern of the cut is no longer than the length of additional rail (outside the gate), then the cut can be pulled out of the chamber without the assistance of a "secondary" tow haulage system.

The cable that hauls the mule up and down the wall moves along the path of the rail. When the gates are moving, then the cable becomes an obstacle. To overcome this problem, two hoists were installed at each gate. The hoists raise the cable before the gates move, and lower the cable when the gates get into their recesses (Figure II-9). Rollers were added at transition points and the gate handrails were modified to allow the cable to be lowered when the gates are closed (although the cable is normally left up in this case so as not to present a tripping hazard). The 5/8" cable is pulled from two opposing winches (25 hp each), one on each end of the chamber. (Figure II-10)

All of the controls for the tow haulage system are located on consoles at each of the control booths. The system is very easy to operate and is reportedly very reliable. Cuts can be removed at about 50 fpm depending on the conditions.

Due to (1) the difference in wall elevation (22') at the downstream end, (2) the short length of rail past the past the downstream gate, and (3) the longer length of line (which stretches under load) used when pulling a cut out of the lower end from the high chamber wall, there is a need for a pneumatic winch, an "air tugger," on the lower guidewall. This air tugger is used to give an unpowered cut a "second tug" to get it past the gates. This is especially critical for pulling empties (with a high freeboard) out of the chamber against a head wind. The deckhands from the towboat operate this winch if it is necessary to give the cut another pull. The lock operators maintain, but do not operate this machinery.

Each of the gates equipped with rails were back-fitted with latches that set when the gates move into it their recesses. This prevents the gates from swinging out of their recesses when the mule moves across them under load.

3. OPERATIONS

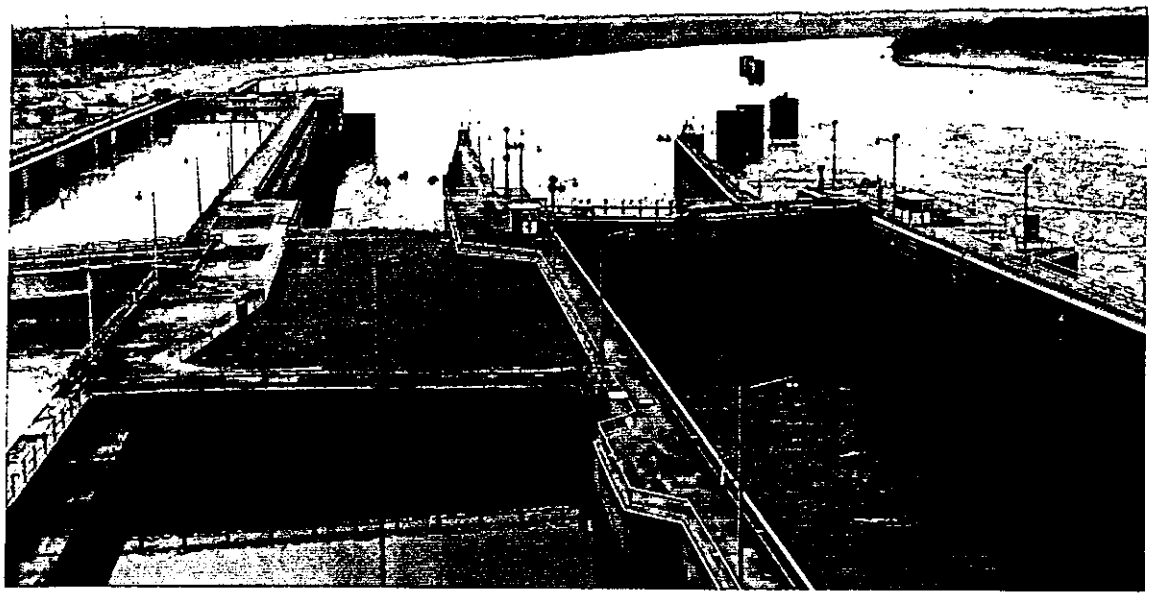
Pickwick Locks had originally planned for a new lock of 1200'. However, the size of the new lock was reduced to save costs that would be incurred upstream through construction staging, and downstream through land acquisition. The lock therefore, became 1000' long. Towboats may push as many as 22 barges on this river, but 12-15 barges is more common. If a towboat requires a double lockage with 15 barges, they will often lock the 15 barges through the main chamber and the towboat only in the auxiliary chamber. Queues occur, but reportedly not to the extent that they occur on the Upper Mississippi River and Illinois Waterway.

4. RESULTS

The Lockmaster and his staff were extremely helpful and were willing to operate the tow haulage equipment as many times as necessary. They provided all the necessary "as-built" drawings each day for our use. The trip to Pickwick Locks was a success due in large part to the cooperation of the operations staff. Photographs and video were taken each day to record the findings of day and

night lockages. Copies were made of some of the plans of the tow haulage system. Additional drawings of the tow haulage systems on the Cumberland River were provided by TVA (the owners of the lock at Pickwick).

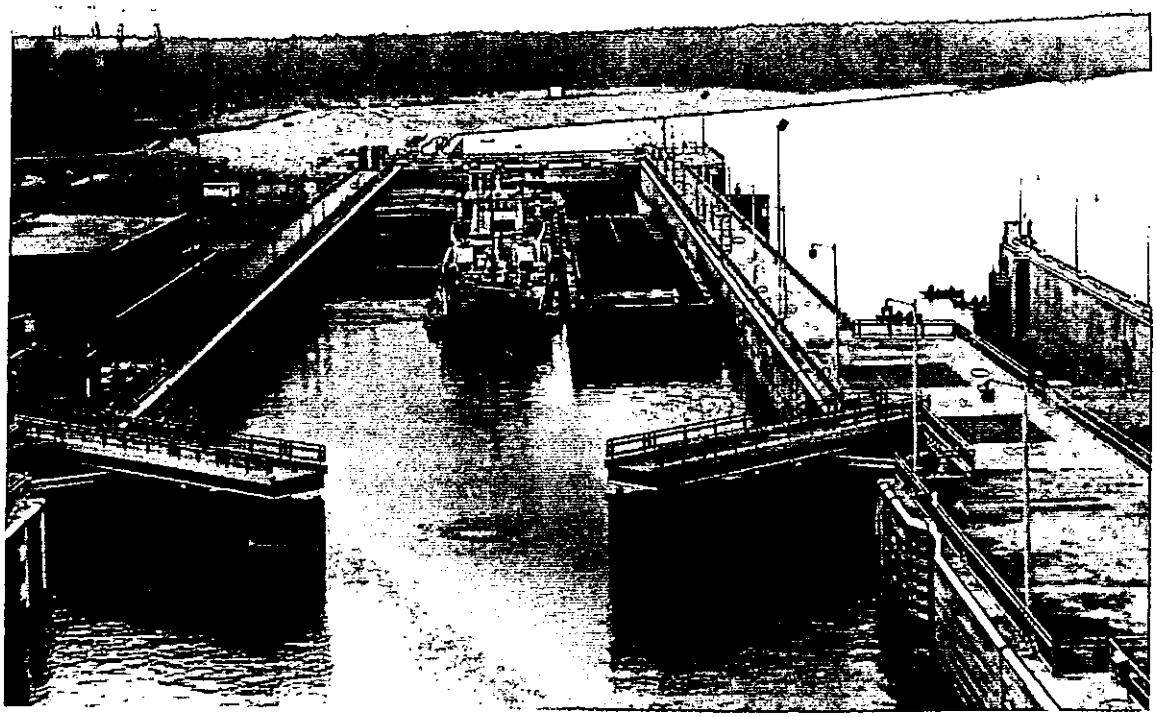
This site visit identified that the miter gate interference problem could be overcome. It also provided ideas for running powered, traveling kevels on extended guidewalls on the Upper Mississippi River and Illinois Waterway.



Pickwick Locks, Tennessee River

Looking downstream. Original 600' chamber is on right and the additional 1000' chamber is on left.

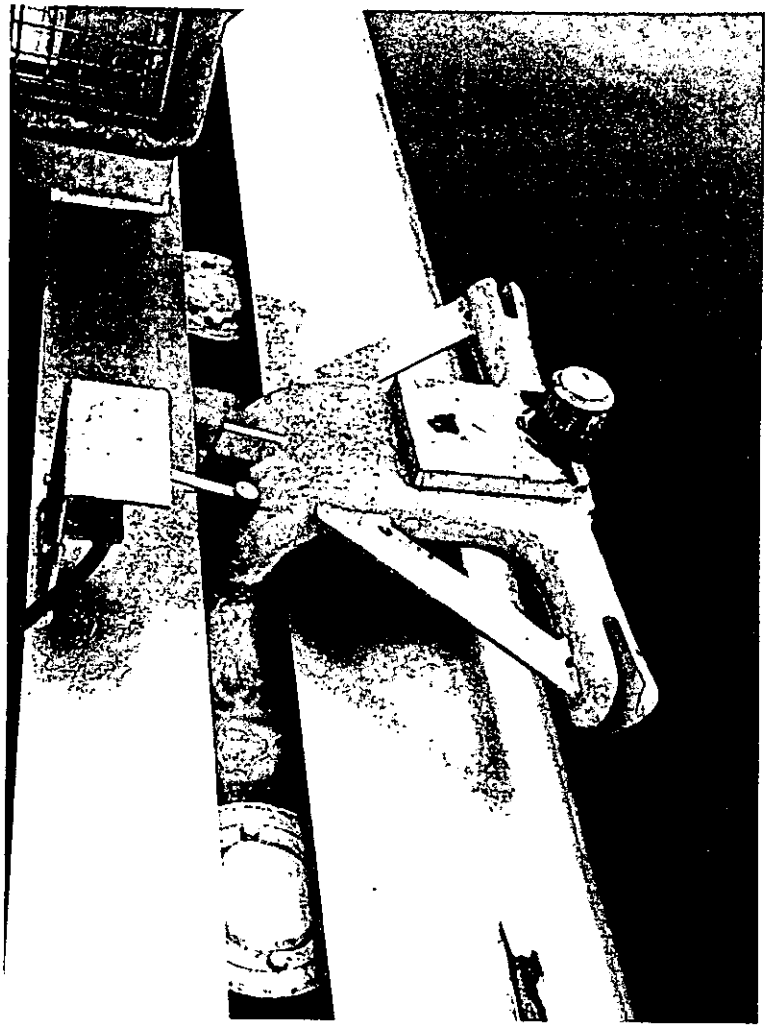
Figure II-1



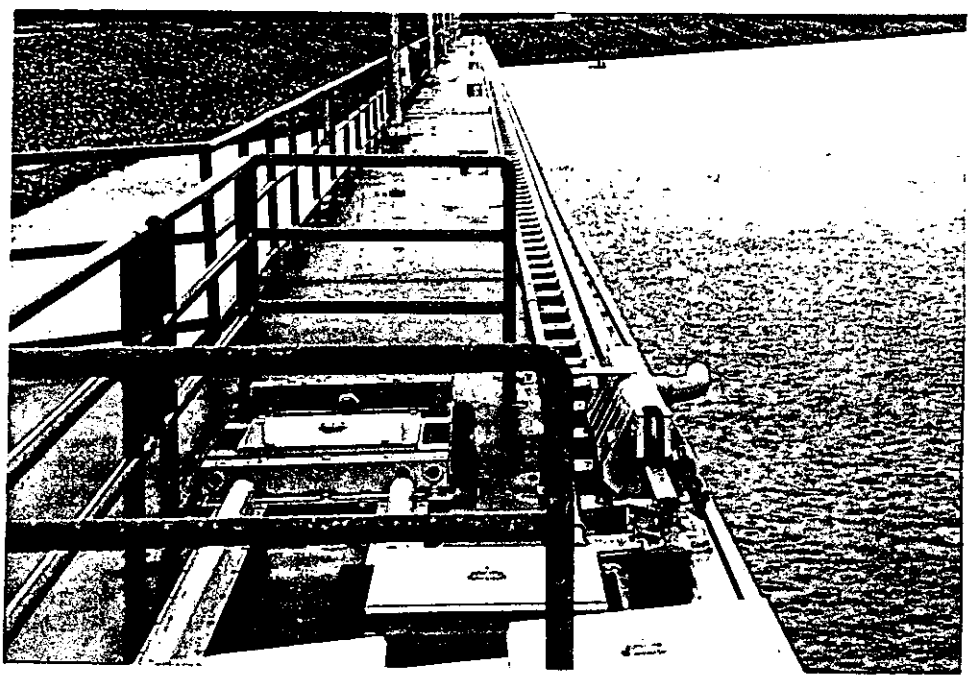
Pickwick Locks

Looking downstream. Main (1000') lock chamber.

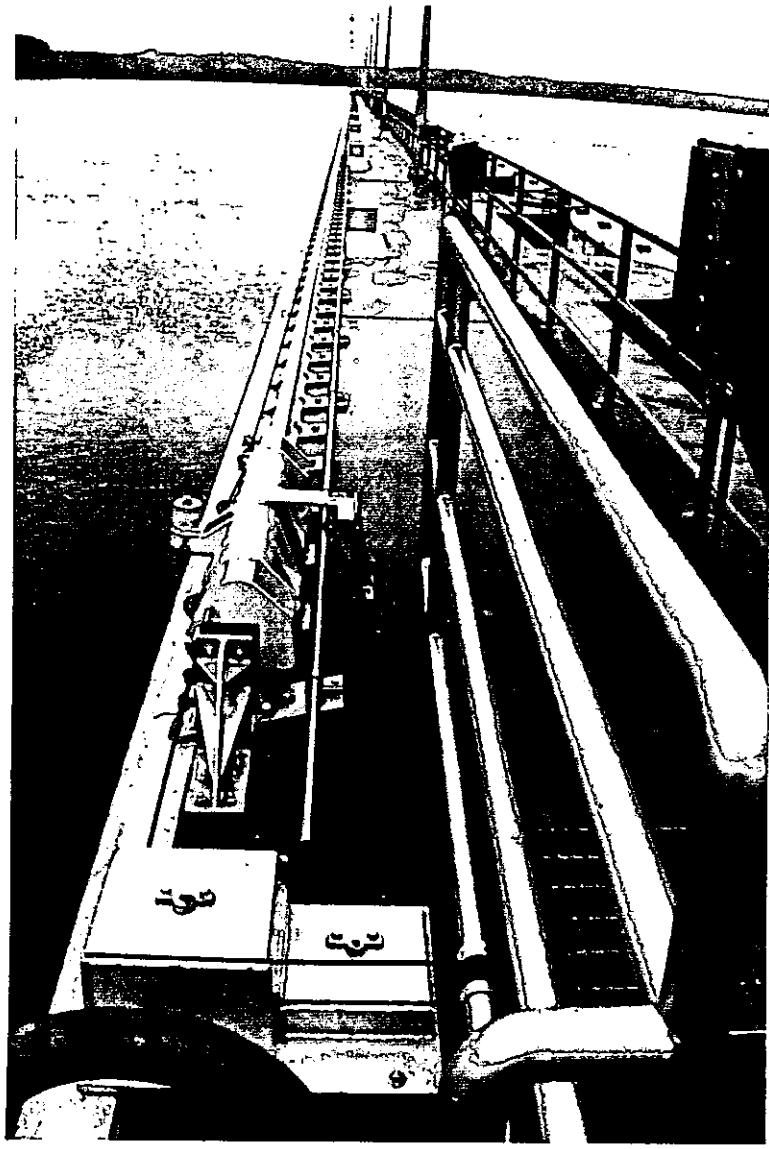
Figure II-2



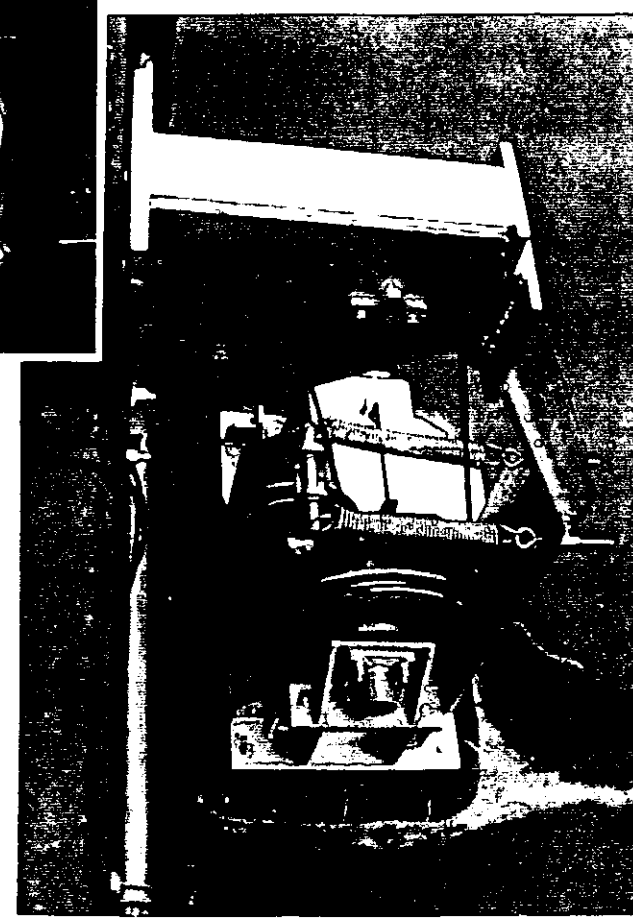
Pickwick Locks, Main Chamber
Powered traveling kevel recessed into armor plating.
Figure II-3



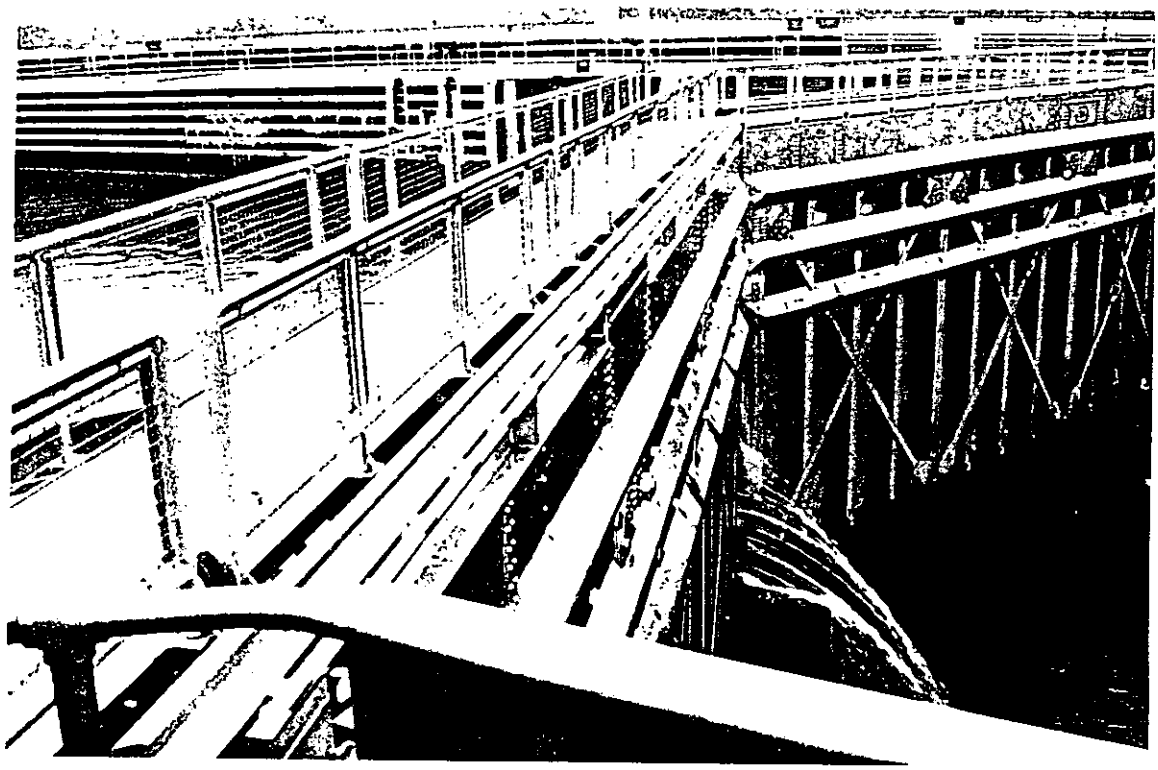
Pickwick Locks, Main Lock
Secondary tow haulage system on lower guidewall (also one on upstream guidewall).
Figure II-4



Pickwick Locks, Main Lock
Traveling checkpost on upstream guidewall only.
Figure II-5



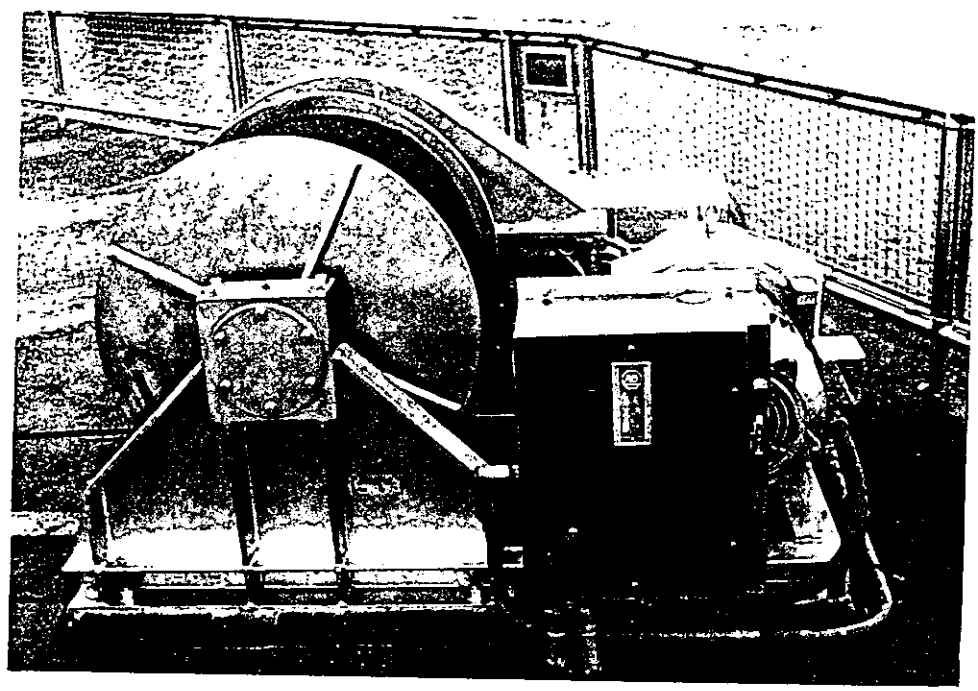
Pickwick Locks, Main Lock Guidewall
Traveling checkpost winch and tensioning device.
Figure II-6



Pickwick Locks, Auxiliary Chamber
Rail mounted on inside of upper gate.
Figure II-7

Pickwick Locks, Auxiliary Chamber
Rail extends above upper gate, cable is held up by hoists when not in use.
Figure II-8

Pickwick Locks, Auxiliary Chamber
Cable hoist at miter gate recess.
Figure II-9



Pickwick Locks, Auxiliary Chamber
Pull/retard winch at upstream end.
Figure II-10

B. DAVID D. TERRY LOCK, ARKANSAS RIVER

1. THE SITE

On February 23-24, 1995, Mary Spence visited David D. Terry Lock on the Arkansas River. The visit was hosted by Mr. Don Bratton, of the Navigation and Maintenance Branch of the Little Rock District. Others who provided assistance during the trip were Ms. Sheila Ellis (Statistical Assistant, Navigation and Maintenance Branch), Mr. Wendell Gray (Lockmaster, David D. Terry Lock & Dam), Mr. Bill Gray (Mechanical Engineer), Mr. Jeff Stiles (Mechanical Engineer), and Mr. Mark Dixson (Electrical Engineer). David D. Terry Lock, formerly known as Lock Number 6, is located about 10 miles east of Little Rock, Arkansas on the left descending bank of the Arkansas River at Navigation Mile Marker 108.1. It is one of 17 locks on the McClelland-Kerr Navigation System, a navigable waterway that spans three rivers and a canal; the White River, the Arkansas Post Canal, the Arkansas River, and the Verdigris River. The McClelland-Kerr Navigation system allows for river navigation between the Mississippi River and Tulsa, Oklahoma. This waterway is 445 miles long and has a vertical drop of 420 feet.

Construction of David D. Terry Lock began in January of 1965 and was completed in October of 1968 at a cost of 55 million dollars. The chamber is 600' long and 110' wide. (Figure II-11) The guidewalls are 600' long and are on the river side of the lock. The normal lift of the lock is 18 feet. There is no change in the elevation of the top of the wall along the entire length of the lock and its approach walls. The elevation of the top of the lock wall is 243 MSL and the elevation of the chamber floor is 196 MSL. The normal pool elevation is 231 MSL. The adjacent dam has 17 - 60'x27' gates and can be operated from the central control facility.

2. TOW HAULAGE EQUIPMENT

The lock has three powered kevels; one in the chamber, and one on each guidewall. All three systems are mounted on pre-existing parapet walls on the river side of the lock. The tow haulage system in the main chamber is powered by a single 50 hp winch (SLM Model CPE 7). (Figure II-12) This friction system uses a closed loop of 7/8" wire and has a weight/pulley system to take up the stretch/slack in the cables when they are placed under load. The kevel is mounted on 140 lb rail and has a quick release that is mechanically operated at each end to release the hawser. (Figure II-13) Limit switches at each end cause the kevel to stop before reaching the quick releases. This process allows slack to develop in the line before it is cast off.

The controls for the main chamber system are located in each of the control booths. Lock operators have an excellent view of tow haulage operations because the booths are on the opposite side of the lock from the rail. They can be set to any speed up to 100 feet per minute (fpm) and requires a few minutes to "ramp up" and "ramp down" after a new speed is selected and entered. For this reason, the speed is usually left at the default setting (50 fpm) and is only changed when necessary to push the barges against a strong headwind. The location of the controls (opposite the long walls) also means that the lock operators do not handle lines; the deckhands are responsible for this. (Figure II-14)

The systems on the upstream and downstream 600' guidewalls are identical. Each one has a 140 lb rail with a traveling kevel that carries a single 1/4" retrieving line. (Figure II-15) The 3 hp winches (SLM Model 25) that retrieve the kevels are just outside the miter gates. (Figure II-16) They can only pull the kevel back towards the gate after it has been pulled to the end of the wall (as a traveling checkpost) at the head of an unpowered cut.

Each of the guidewall traveling checkposts can also be used as powered traveling kevels. Each guidewall has a 10 hp winch system (SLM Model 60) on the bullnose and a 3/4" cable that lays along the full length of the base of the rail when it is not in use. (Figures II-17 and II-18) If it is

necessary to haul an unpowered cut using this secondary cable, then the kevel has to be retrieved (if it traveled too far from the miter gate), the cable attached, and the motor operated (from the end of the guidewall). Since the wall is only 600' long, the powered kevel aspect of this system is rarely used, except to give the barges a "second tug" if the main chamber system fails to get the cut clear of the gates. This may be necessary when the main chamber system is pulling empty barges against a strong headwind. As was observed on the visit, the lock operators avoid using this cumbersome secondary powered kevel by increasing the speed of the main chamber kevel. If the main chamber kevel pulls the cut fast enough, then the barges will have enough momentum to clear the gate. If they do not, then the lock operators may try the main system a second time before resorting to the guidewall kevel for power.

The guidewall kevels also had a release system that used a plunger to activate the release mechanism. However, a "cow catcher" (similar to one on a locomotive) was added to each of the upstream and downstream wheels to prevent people from getting fingers caught in the kevel. Thus, when the kevel reaches the end of its travel, the protective covering (the cow catcher) strikes the end plate first, and the plunger, which no longer protrudes far enough, is rendered useless. Since the guidewalls are only 600' long, the cuts usually make-up with the head of the first barge at the end of the guidewall and the stern of the tow still in the chamber. Therefore, the tow haulage aspect and the plunger release system of guidewall kevels is rarely needed.

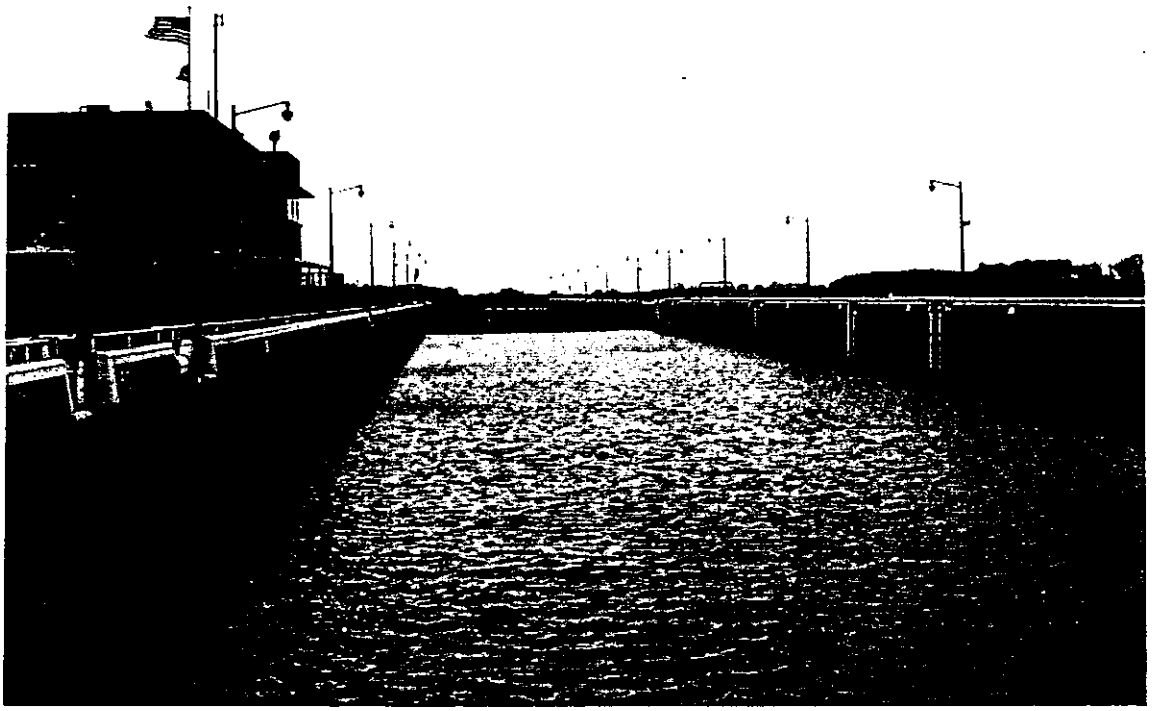
3. OPERATIONS

Tows on the McClellan-Kerr Navigation System are typically no larger than 12 barges. Although tows could push as many as 17 barges through a double lockage at David D. Terry, there are no tow haulage systems above this lock. By limiting themselves to 12 barges, towboats can break their cuts into two groups of 6 and push each cut through themselves. This requires a secure place to tie off the 6 barge units on each end and it also requires the towboat itself to lock back through to retrieve its second load.

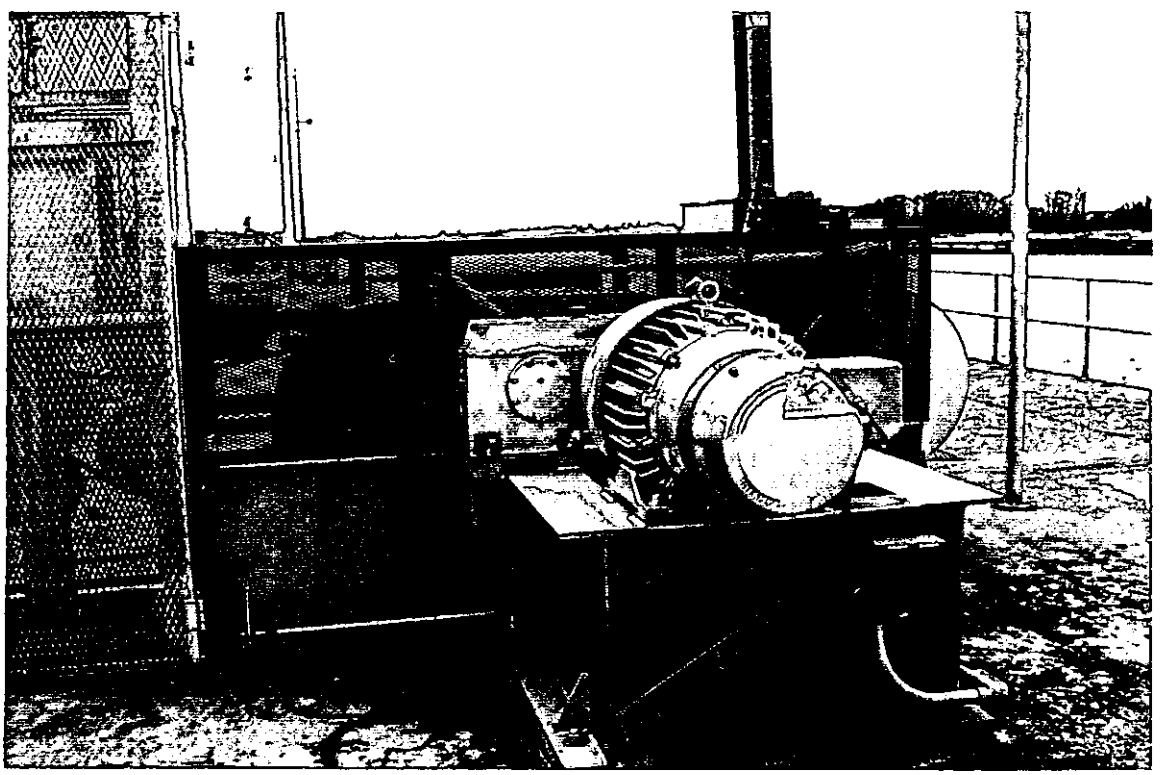
The District and the lock operators are not satisfied with their current system at David D. Terry Lock. Although the mechanical systems work well (once they retro-fitted the slack take-up/tensioning device), the electrical systems require a great deal of care. Lightning strikes frequently put the main chamber system out of operation, and service representatives are not close-by. They also had several installation problems. The electrical send and receive units on the main chamber system were confused by the "rubber band" action of the line used to secure the barge to the traveling kevel; the system could not maintain a given speed because the inputs were changing too rapidly. This problem has since been corrected, but many of the operators still do not like the main chamber system. The secondary system, as described above, is also difficult to operate because it requires so much effort for very little gain. The lock operator has to leave the booth, travel to the other end of the chamber, cross the gate, travel back up to the other end of the wall, retrieve the kevel, attach the secondary tow haulage cable, go out to the end of the guidewall, engage the clutch (which was difficult to engage), and operate the electric motor from underneath an awning. This secondary system is only used as a last resort.

4. RESULTS

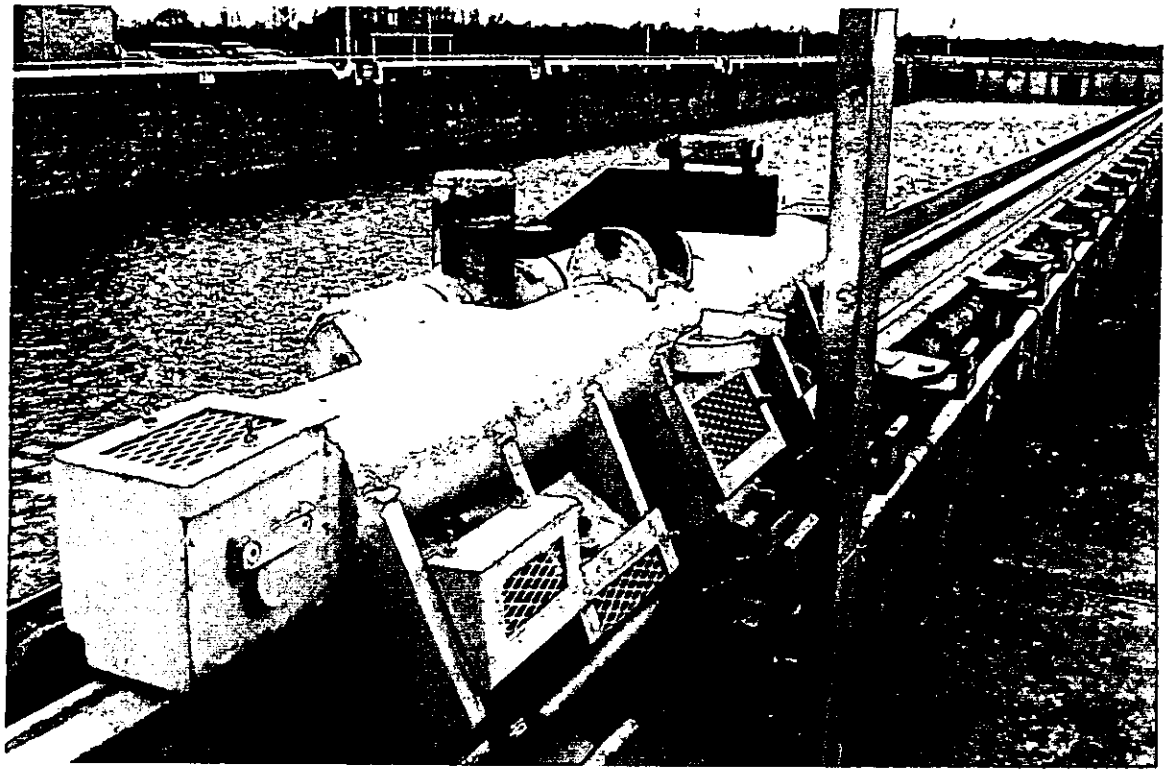
The District Staff and the Lockmaster were extremely helpful during the visit. The Maintenance and Navigation staff provided a great deal of background information and Engineering staff provided plans and drawings. The Little Rock District is currently designing tow haulage systems for Locks 1 and 2 on the McClellan-Kerr Navigation System and is using the Pittsburgh District's designs as a model. A trip to Locks 4 and 7 on the Monongahela River, and Montgomery Lock on the Ohio River was recommended. The trip to David D. Terry lock identified many of the problems associated with a system of this type.



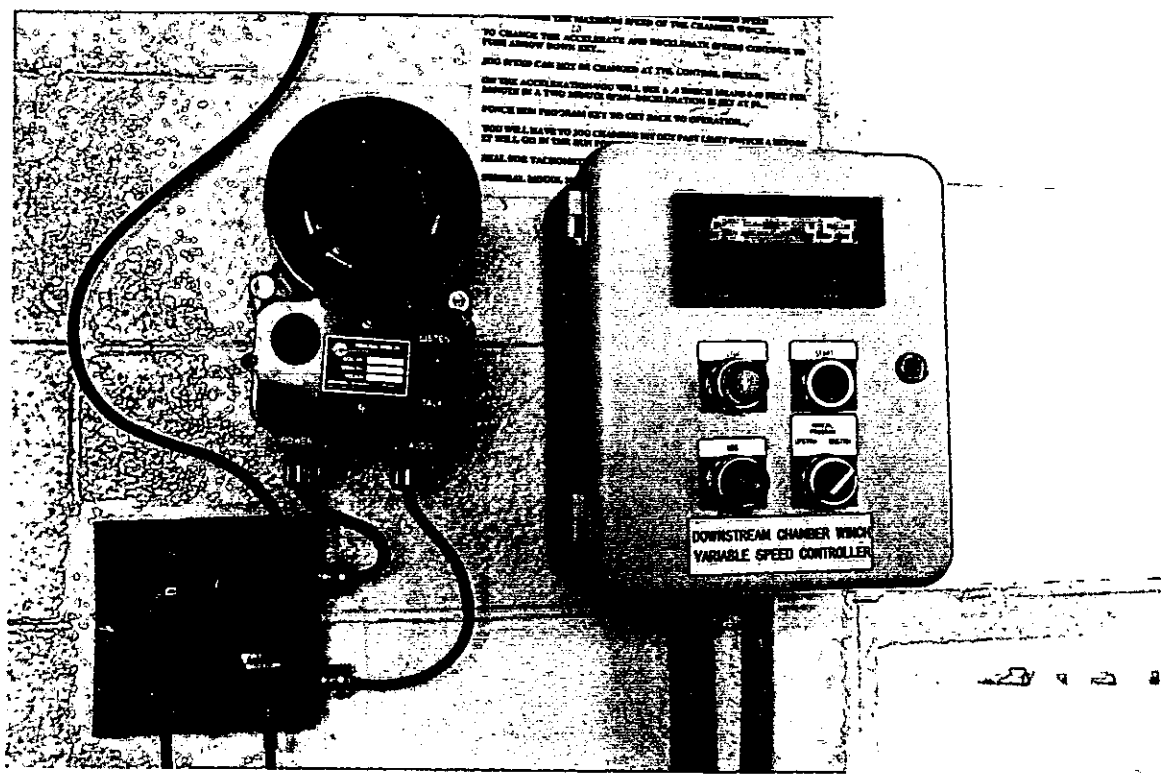
David D. Terry Lock, Arkansas
Looking downstream.
Figure II-11



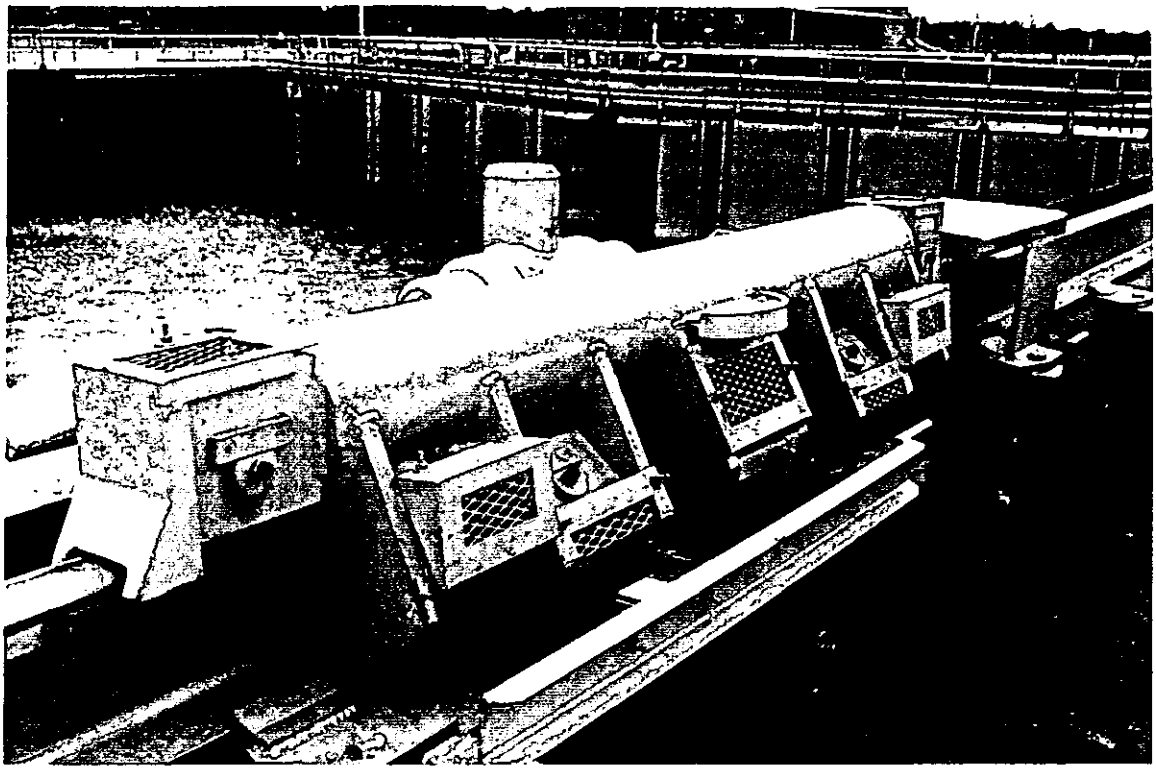
David D. Terry Lock
Power unit for chamber kevel.
Figure II-12



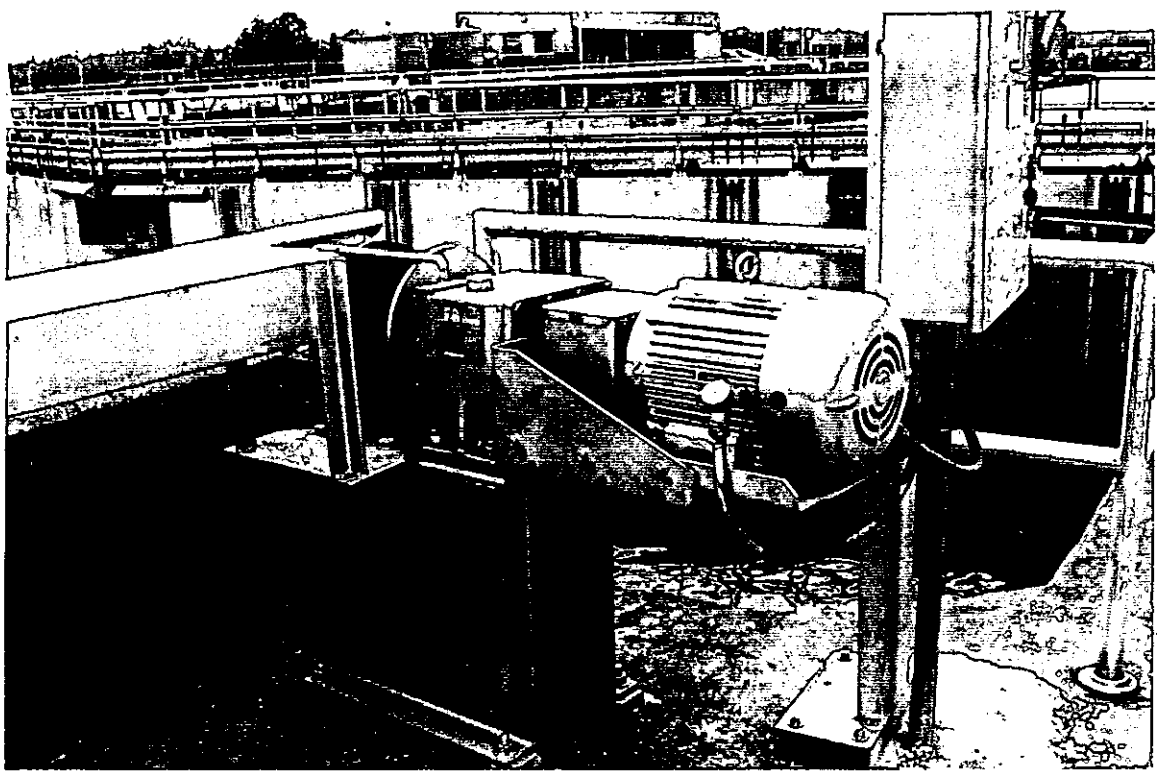
David D. Terry Lock
Chamber kevel with mechanical release.
Figure II-13



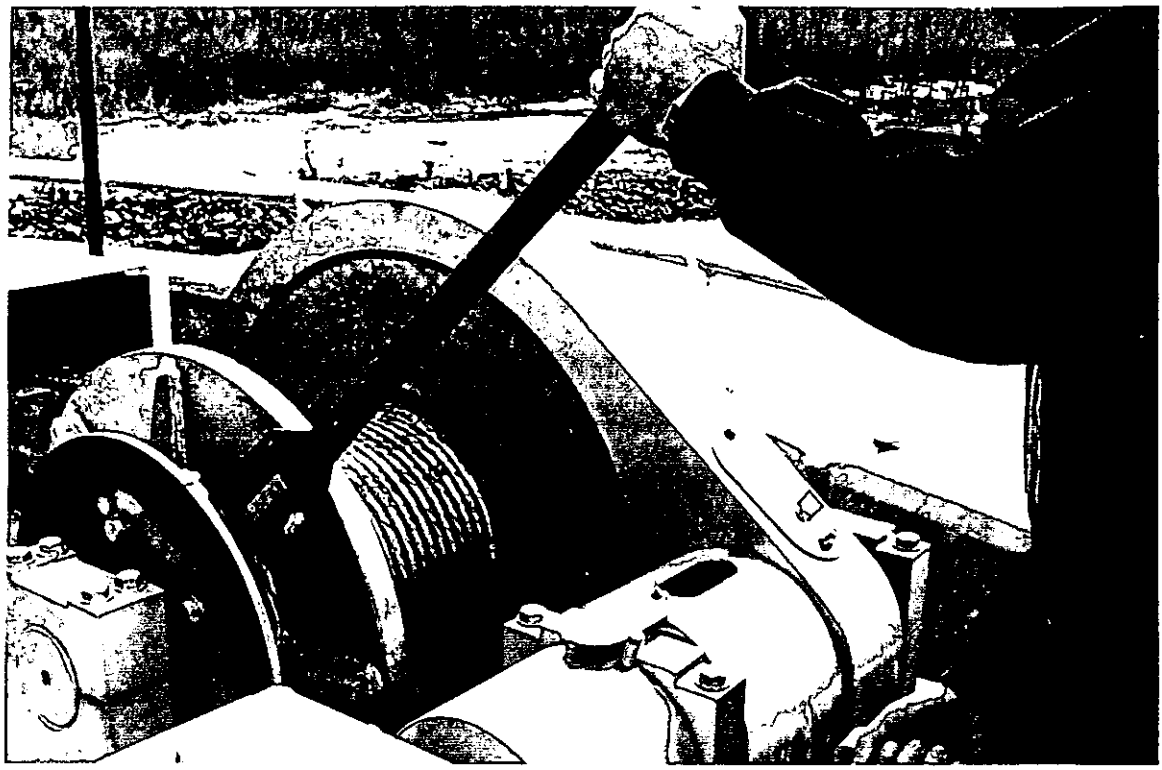
David D. Terry Lock
Chamber winch controls in control booth.
Figure II-14



David D. Terry Lock
Guidewall kevel.
Figure II-15



David D. Terry Lock
Retriever winch for guidewall kevel.
Figure II-16



David D. Terry Lock
Engaging clutch on guidewall winch.
Figure II-17

David D. Terry Lock
Control panel for guidewall winch (located at end of guidewall).
Figure II-18

C. PITTSBURGH DISTRICT LOCKS, ALLEGHENY AND OHIO RIVERS

1. OVERVIEW OF TRIP

On March 23-24, 1995, Dave Diestelkamp and Mary Spence visited the Pittsburgh District to observe tow haulage systems at several locks. The trip was hosted by the Mr. Dave Buccini, a Mechanical Engineer in the Design Branch. Mr. Buccini has been a key player in the design of tow haulage systems in the Pittsburgh District. He hosted a similar tour for engineers from the Little Rock District last December. Our two-day trip involved visits to Allegheny Lock 7, Allegheny Lock 4, and Montgomery Locks on the Ohio River. The Allegheny River runs for 325 miles from an area along the Pennsylvania-New York border to Pittsburgh, PA. Only the lower 72 miles of the Allegheny are commercially navigable due to the 8 locks and dams along this stretch of the river. The Ohio River's 981 miles span from Pittsburgh, PA to Cairo, IL. The Pittsburgh District is responsible for the upper six lock and dam facilities on the Ohio (from Mile Marker 0 to 127.2).

The Lock Operators were very enthusiastic about the tow haulage systems at the locks we visited. Their needs, concerns, and desires seem to have been met throughout the installation and testing of these systems. Dave Buccini was extremely helpful and made the trip very worthwhile.

2. ALLEGHENY LOCK 7

Lock 7 is located in West Kittanning, Pennsylvania at Mile Marker 45.7 on the right descending bank of the Allegheny River. (Figure II-19) The lock and dam facility was built from 1928 to 1931 at a cost of 1.46 million dollars. The lock officially opened in 1930. The dam is a 916' fixed crest dam that provides a 9-foot navigation channel in the river. The lock is 56' wide and 360' long with a lift of 22.0 feet. The lock services an average of two commercial tows daily throughout the year and 200 recreational boats a month during the summer season (May through November). The primary commodities carried in this area are fuel oil, sand, gravel, fertilizer, farm products, waste, scrap, and manufactured materials.

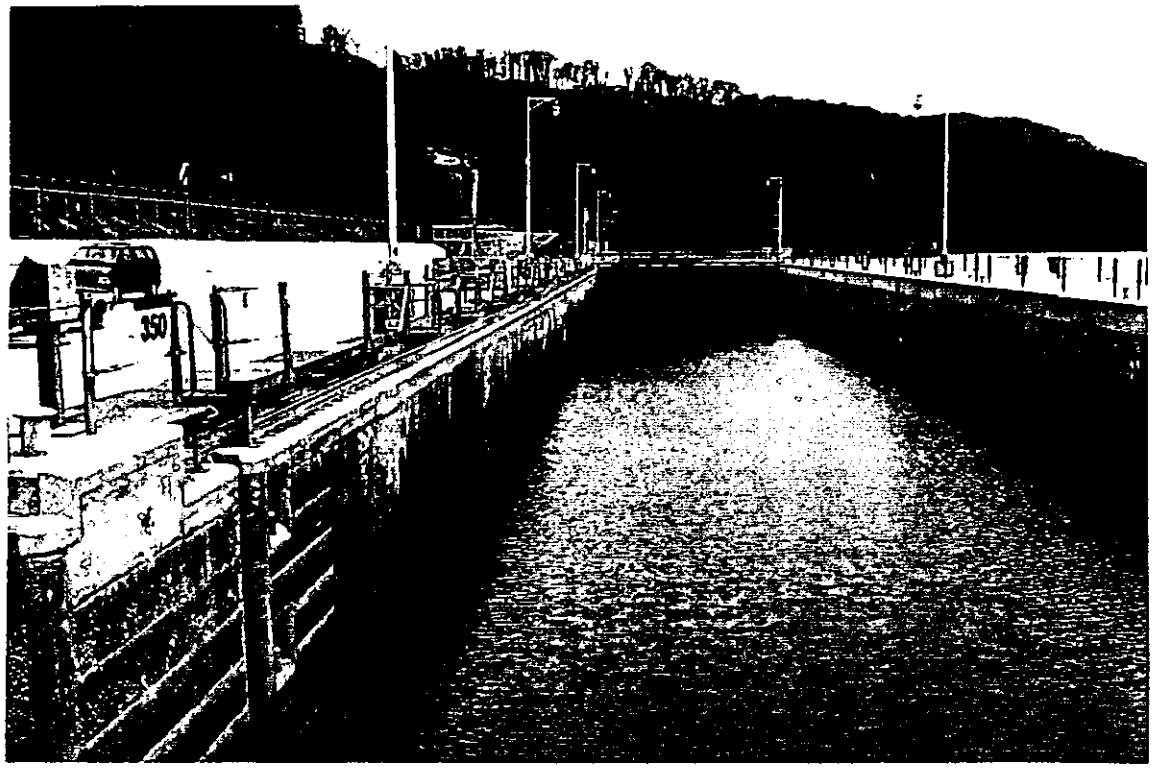
The tow haulage system consists of two opposing 40 hp Superior-Lingerwood-Mundy (SLM) hydraulic winches which are supplied with Falk controls and motors. (Figures II-20 to 22) The winches are attached to each end of a rail-mounted traveling kevel with 3/4" wire rope fed from 24" diameter sheaves. One winch pulls against the other at a reduced torque so as to maintain a constant tension in the line. The pulling winch pulls at about 10,000 lbs, and the opposing winch at about 2,000 lbs for a net force of about 8,000 lbs. Since there are no control booths at this lock, the winch control panels are mounted on pedestals at each end of the chamber. (Figures II-23 and II-24)

pull restraint

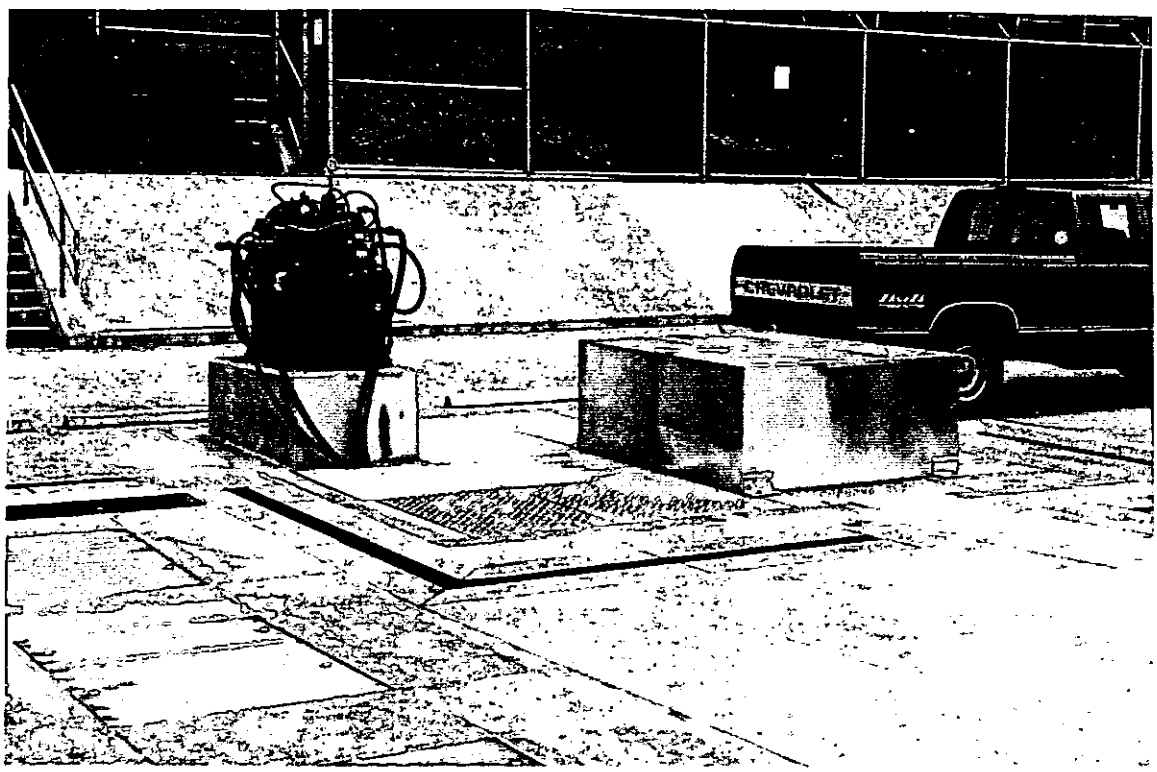
The rail is mounted on the original lock wall, but the entire esplanade was raised 2 feet. (Figures II-25 and II-26) This allowed the working area to be cantilevered out over the top of the rail. Therefore, the rail appears to sit in a recess. The buttons on the wall were raised, and the extended (cantilevered) walkway allows lock operator to see and handle lines for recreational boats. All of the sheaves and wire rope are hidden beneath deck plates. The winch sits at the same level as the kevel, and is therefore below the grade of the parking lot surrounding it. The pump and its motor are placed nearby, but several feet higher in elevation so as to avoid flood damage.

There are no floating mooring bits at this lock and the ladder recesses were easily accommodated. The cable is attached to the kevel with a swivel to keep the wire rope from binding. All rail is 132 RE. The lock also has a traveling checkpost on the upstream landside guidewall with a low horsepower retriever winch to pull the kevel back to its starting position. (Figure II-27 and II-28)

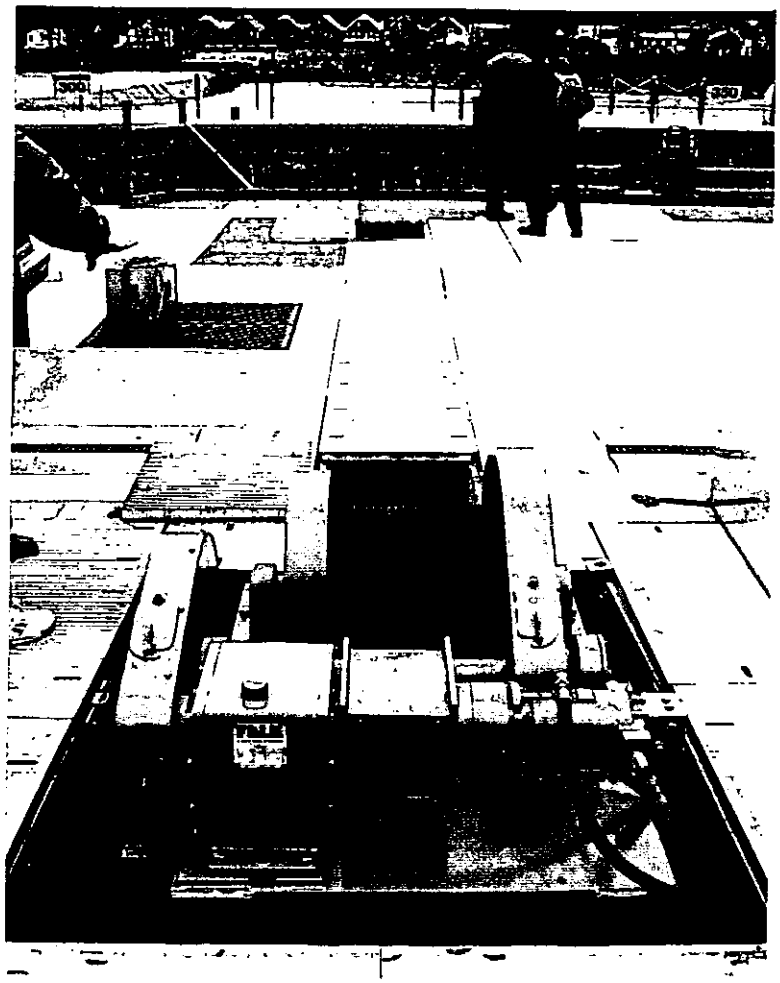
The tow haulage system runs within the limits of the chamber; it does not extend past the miter gates. If a tow is unable to clear the gates, then the lock operator will bring it back into the chamber and give it a second try. If is still fails to clear the gate, then the tow must wait until the headwinds die down in order to get out of the lock chamber.



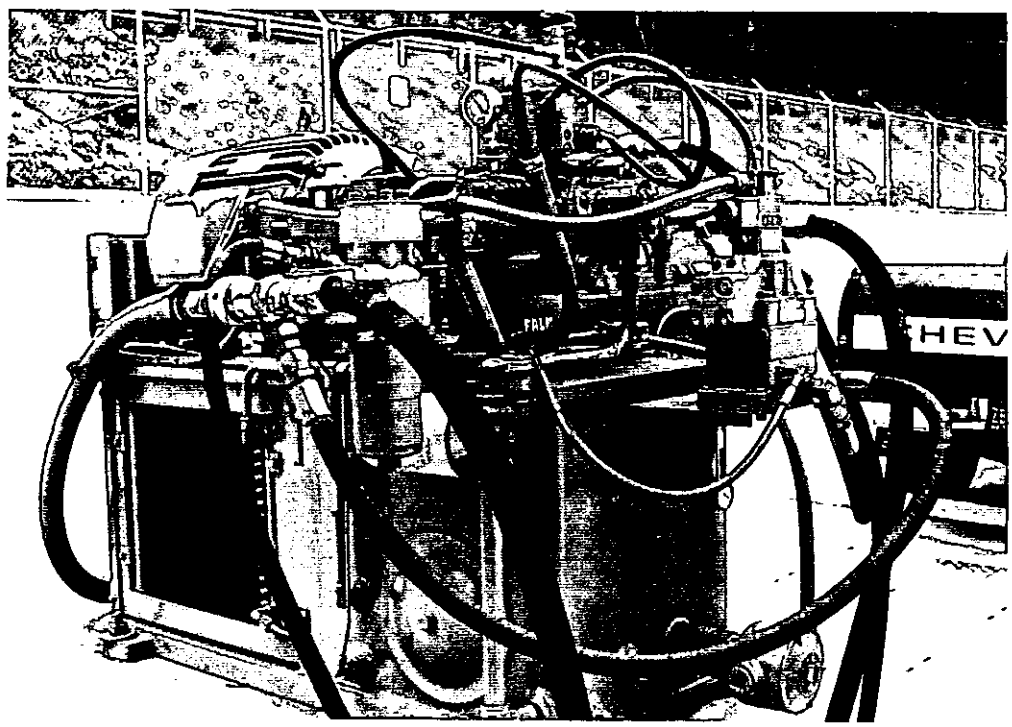
Allegheny Lock 7
Looking upstream.
Figure II-19



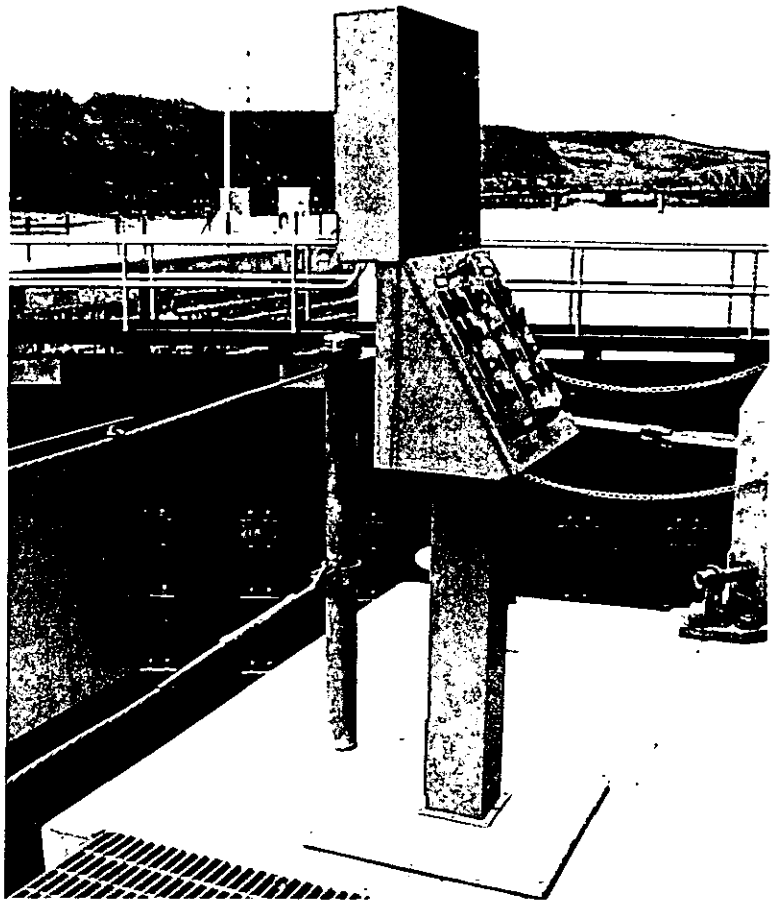
Allegheny Lock 7
Pull/retard winch (under aluminum cover) and motor (on concrete pedestal).
Figure II-20



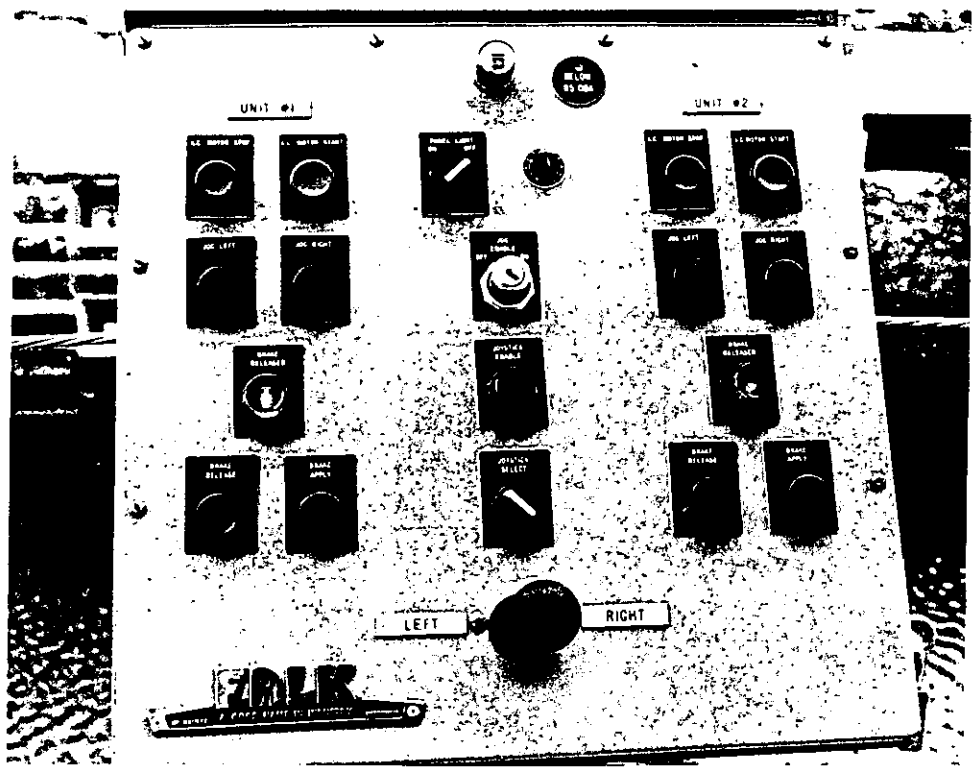
Allegheny Lock 7
Winch with cover removed (one of two).
Figure II-21



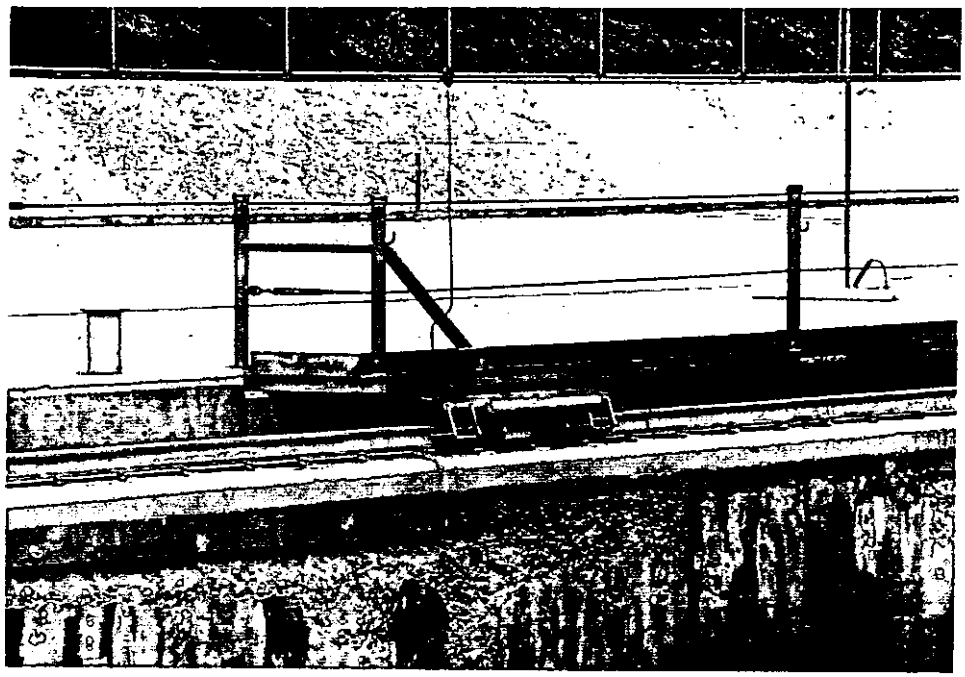
Allegheny Lock 7
Motor for powered kevel (one of two).
Figure II-22



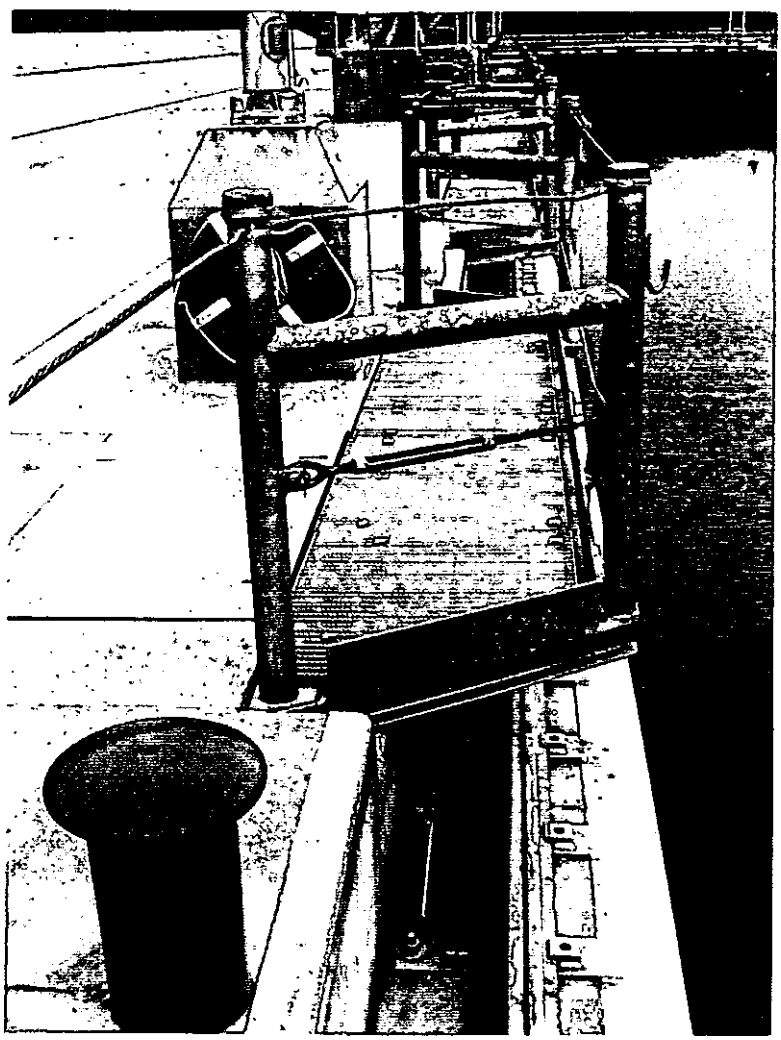
Allegheny Lock 7
Control panel (one of two) for powered kevel, with cover raised.
Figure II-23



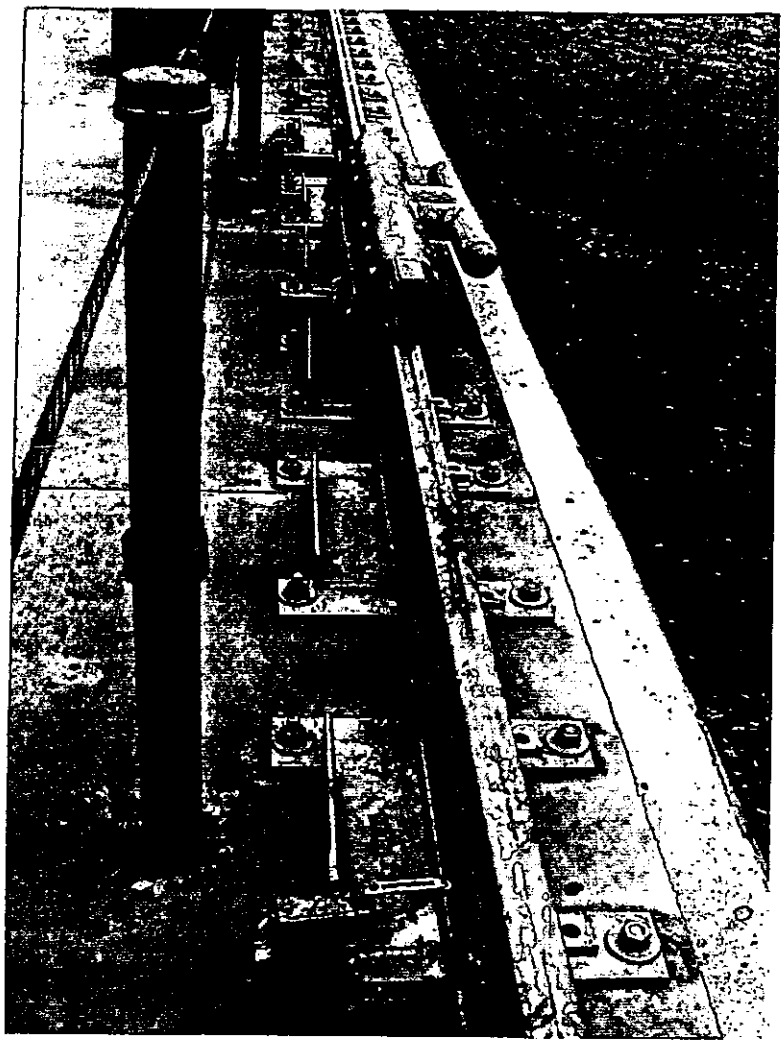
Allegheny Lock 7
Close-up of control panel (joystick at bottom).
Figure II-24



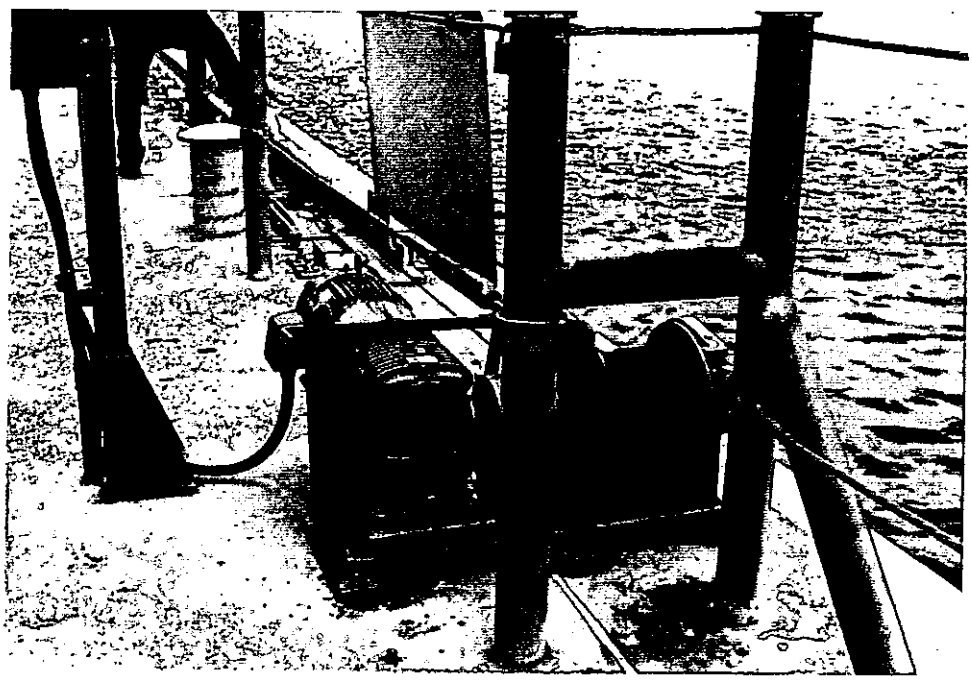
▲
Allegheny Lock 7
Kevel on original wall with raised esplanade.
Figure II-25



Allegheny Lock 7
Cantilevered walkway over powered kevel system.
Figure II-26



Allegheny Lock 7
Traveling checkpost on upstream guidewall.
Figure II-27



Allegheny Lock 7
Retriever winch for upstream guidewall traveling checkpost.
Figure II-28

3. ALLEGHENY LOCK 4

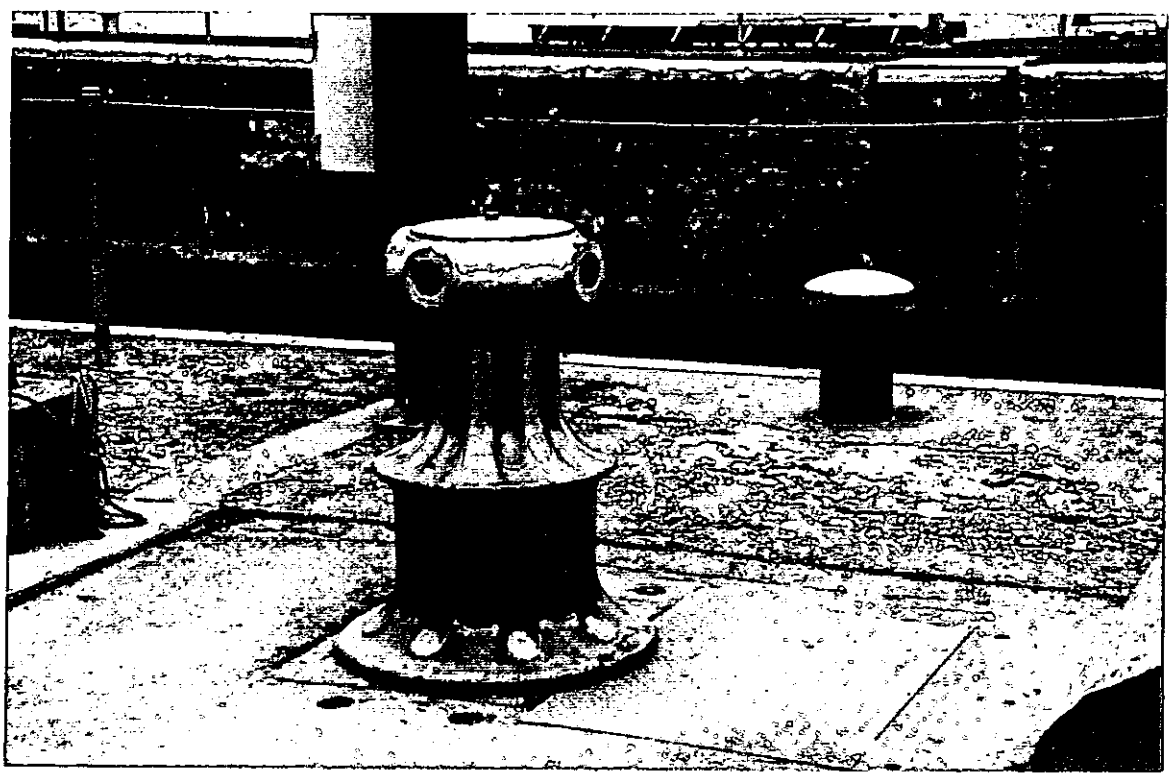
Lock 4 is located in Natrona, Pennsylvania at Mile Marker 24.2 on the right descending bank of the Allegheny River. The lock and dam facility was built from 1920 to 1927 at a cost of 1.7 million dollars. The lock officially opened in 1927. The dam is an 876' fixed crest dam that provides a 9-foot navigation channel in the river. The lock is 56' wide and 360' long with a lift of 10.5 feet. The lock services an average of seven commercial tows daily throughout the year and 300-600 recreational boats a month during the summer season (May through November). The primary commodities carried in this area are coal, petroleum, sand and gravel, ore, steel, chemicals, fertilizer, salt, flour, lime and slag.

This lock is currently undergoing a major rehabilitation effort. (Figure II-29) The lock originally used capstans for tow haulage. (Figure II-30) Winches similar to those found on the Upper Mississippi River and Illinois Waterway were installed, but rarely used (due to the operators preference for the old capstans). Although the capstans will remain in place, the old winches were removed for overhaul. They will be returned in "as-new" condition to be used in a similar manner as Lock 7 on the Allegheny. (Figure II-31)

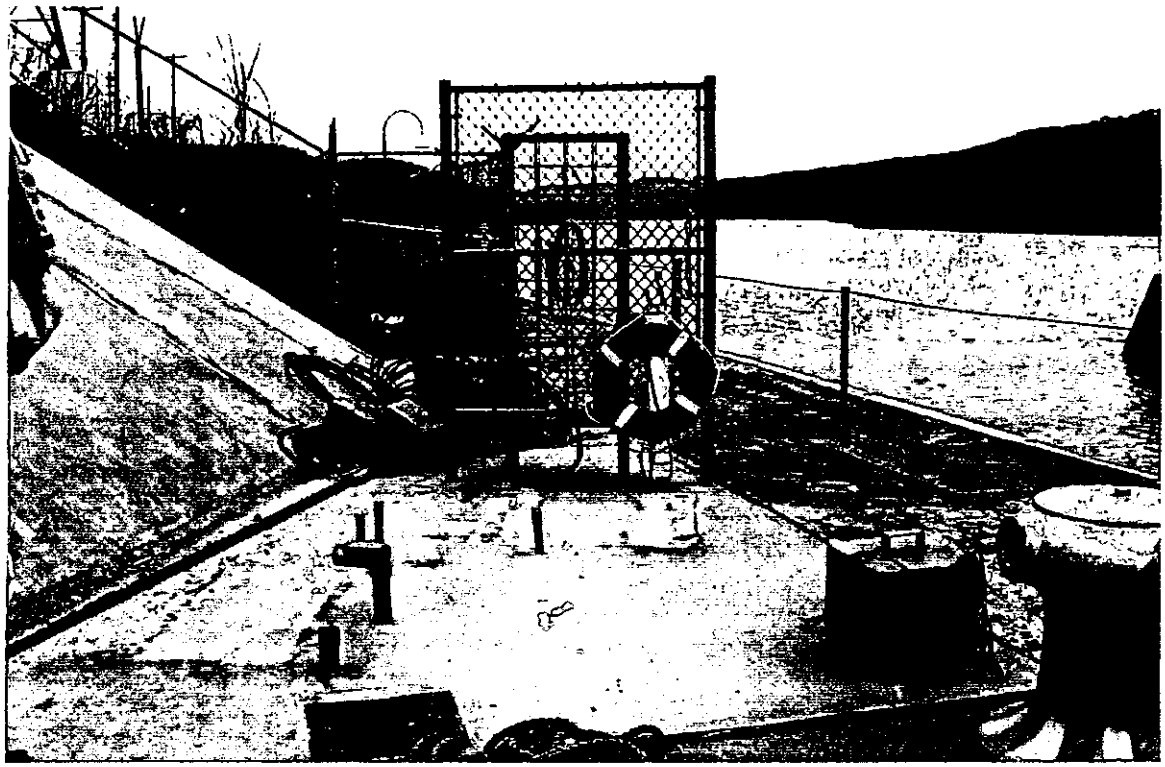
The first two feet of concrete wall face is being blasted off so that new precast concrete panels can be installed. (Figure II-32) A new rail and kevel system will be placed on the new wall section two feet below the old top of wall. The lock operators will be able to step out onto cantilevered walkways above the rail and therefore have a clear view of recreational boaters below them. There are no floating mooring bits and the ladders were easily accommodated.

The tow haulage system runs within the limits of the chamber; it does not extend past the miter gates. If a tow is unable to clear the gates, then the lock operator will bring it back into the chamber and give it a second try. If is still fails to clear the gate, then the tow must wait until the headwinds die down in order to get out of the lock chamber.

Allegheny Lock 4
Looking downstream.
Figure II-29



Allegheny Lock 4
Tow haulage capstan.
Figure II-30



Allegheny Lock 4

Site of tow haulage winch (out to be refurbished).

Figure II-31

Allegheny Lock 4

Site of rail addition (on top of newly installed precast panels).

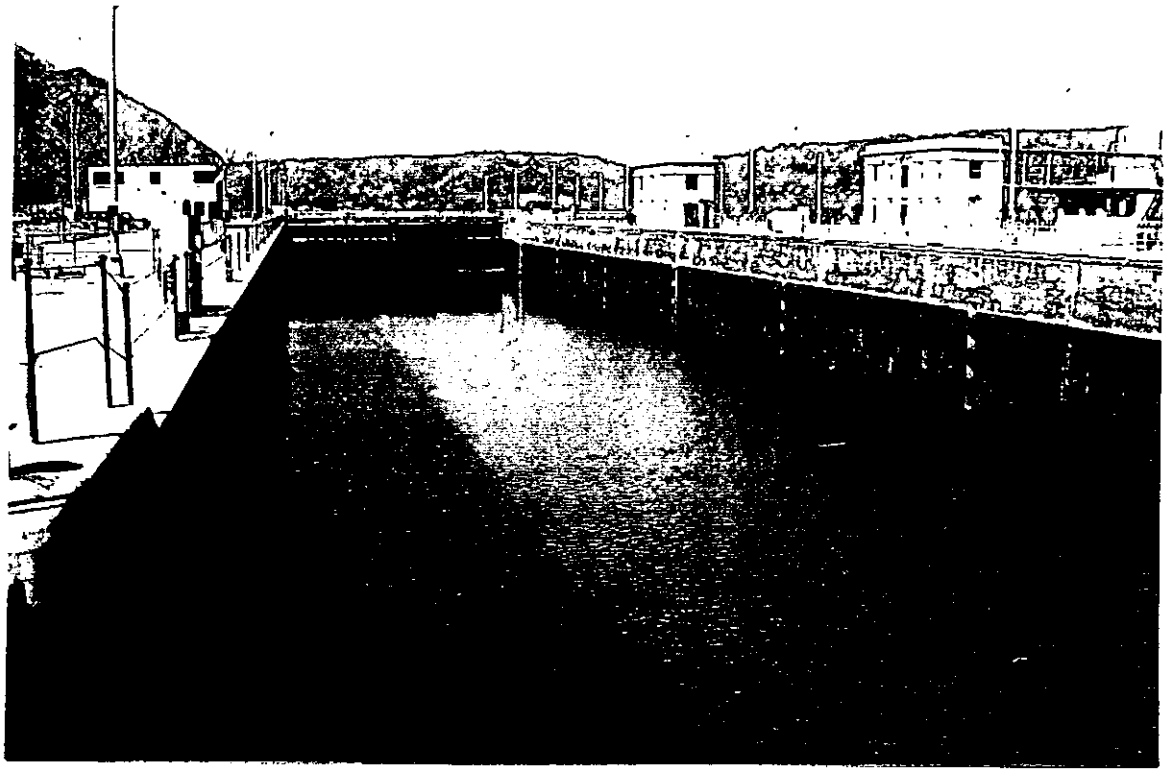
Figure II-32

4. MONTGOMERY LOCKS - OHIO RIVER

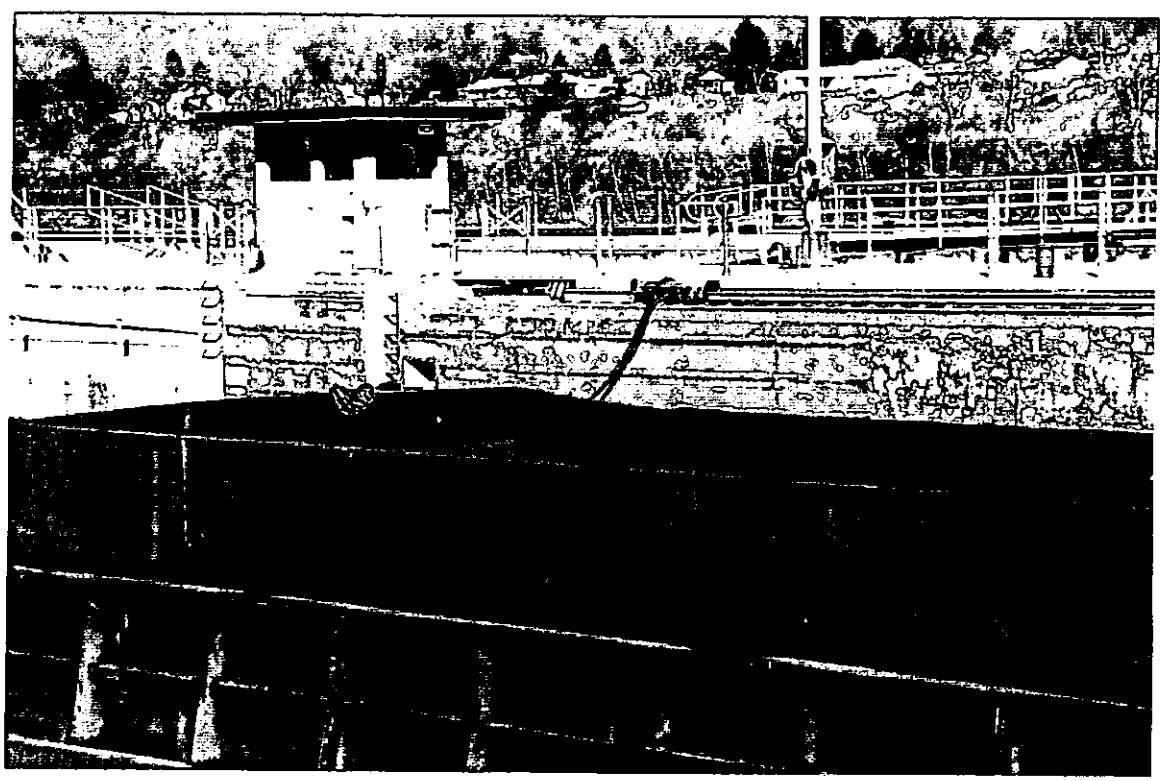
Montgomery Locks, at Mile Marker 32 on the left descending bank of the Ohio River, is located about three miles upstream from Shippingport, Pennsylvania, home of the first large scale nuclear power plant in the United States. The lock and dam facility was built from 1932 to 1936 at a cost of 5.7 million dollars. The lock officially opened in June of 1936. The dam is a 1379' gated dam that provides a 9-foot navigation channel in the river. This facility was built to eliminate the original Locks 4 (built 1898-1908), 5 (1898-1907), and 6 (1892-1904) which were wooden wicket dams used to create the first shallow navigation pool. The lock has a 110' x 600' chamber landside, and a 56' x 360' chamber riverside with a lift of 17.5 feet. (Figure II-33) The lock services an average of 550 commercial tows a month throughout the year and an additional 275 recreational boats a month during the summer season (May through November). Several industries maintain shipping docks in the pool provided by this facility; steel, slag, coal, oil, barge building, steel fabrication, construction supply companies, and industrial parks.

The tow haulage system is mounted on the existing intermediate (I) wall and the area behind the rail was raised approximately one foot. (Figure II-34) The system is similar to the pull/retard system at Lock 7 on the Allegheny, but it has 50 hp hydraulic winches, 1" diameter wire rope, and 36" diameter sheaves because of the larger size of lock. The winches are located in an existing gallery inside the I wall (Figure II-35) and the motors are mounted on top of the I wall to protect them from flooding. (Figure II-36) The floating mooring bits are located on the landside of the chamber and, when the lock is full, they extend up above the top of the lock wall. (Figure II-37) This prohibited the tow haulage system from being installed on the landside wall and the same side as the guidewalls. The advantage to having the tow haulage on the opposite side of the guidewalls is that the head of the tow is forced towards the guidewall when the kevel is pulling from the stern. However, this also means that double lockages of tows that are not wide enough to fill the chamber (such as fuel barges) can be very difficult and create safety concerns because the barges may be traversing from one side of the lock chamber to the other. According to the lock operators, this is not a common occurrence.

The tow haulage system runs within the limits of the chamber; it does not extend past the miter gates. (Figure II-38) If a tow is unable to clear the gates after two attempts with the tow haulage system, then the towboat is required to leave his remaining barges on the guidewall, lock through alone in the small chamber, extract his own unpowered cut, lock back through the small chamber, and continue with the second cut. The traveling checkpost on the upstream guidewall has a small retriever winch installed on one end. (Figure II-39) Air winches are being added to the landside wall as a back-up to the existing tow haulage system. (Figure II-40)

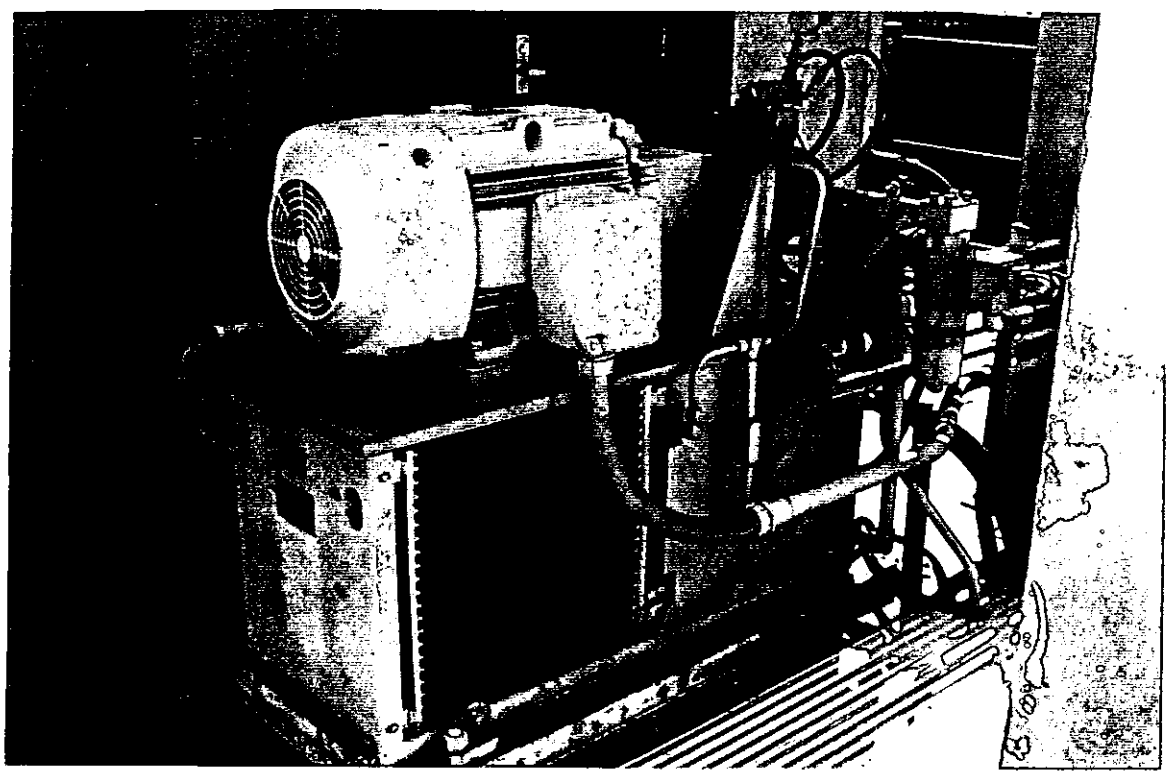


Montgomery Locks, Ohio River
Main chamber, looking downstream from land wall.
Figure II-33

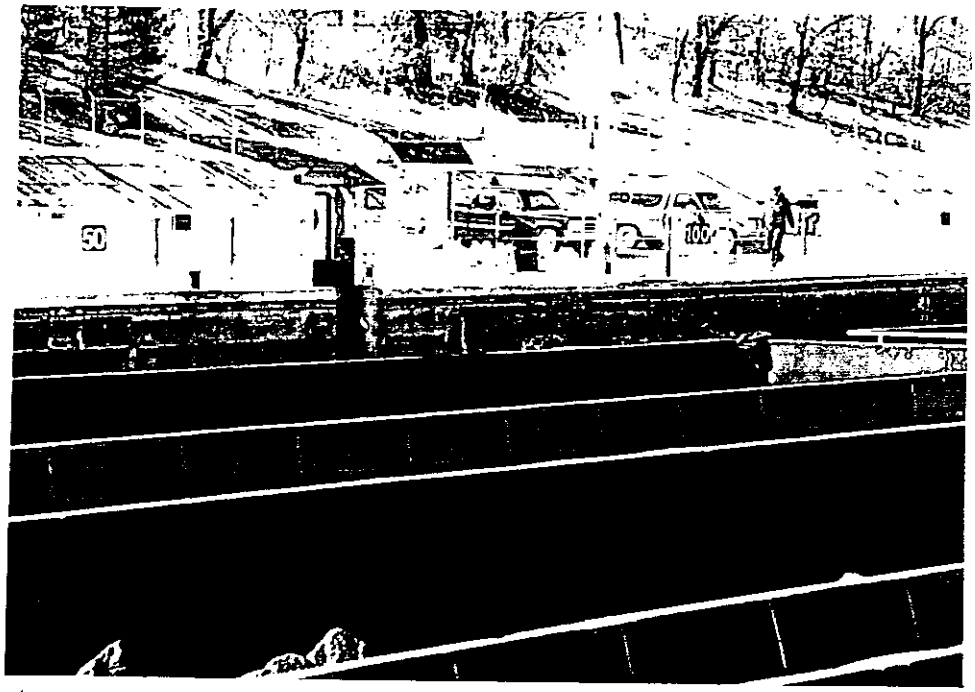


Montgomery Locks
Powered traveling kevel on I wall (1' below walking surface).
Figure II-34

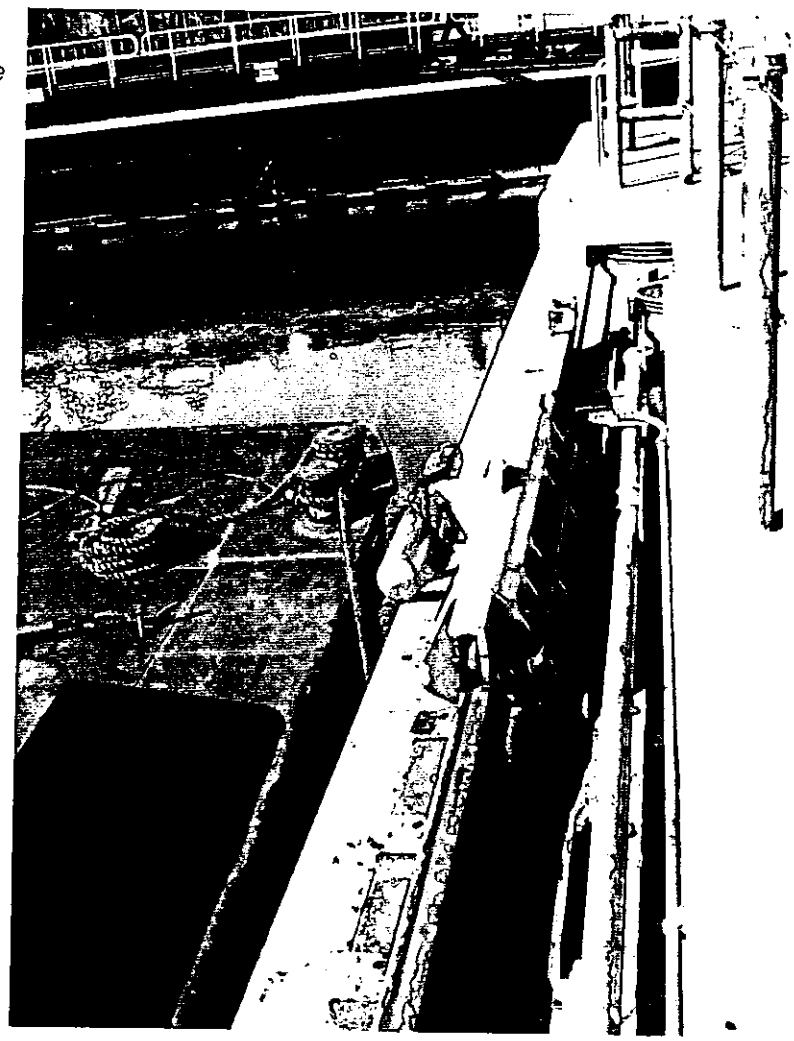
Montgomery Locks
Tow haulage winch in existing gallery of I wall.
Figure II-35



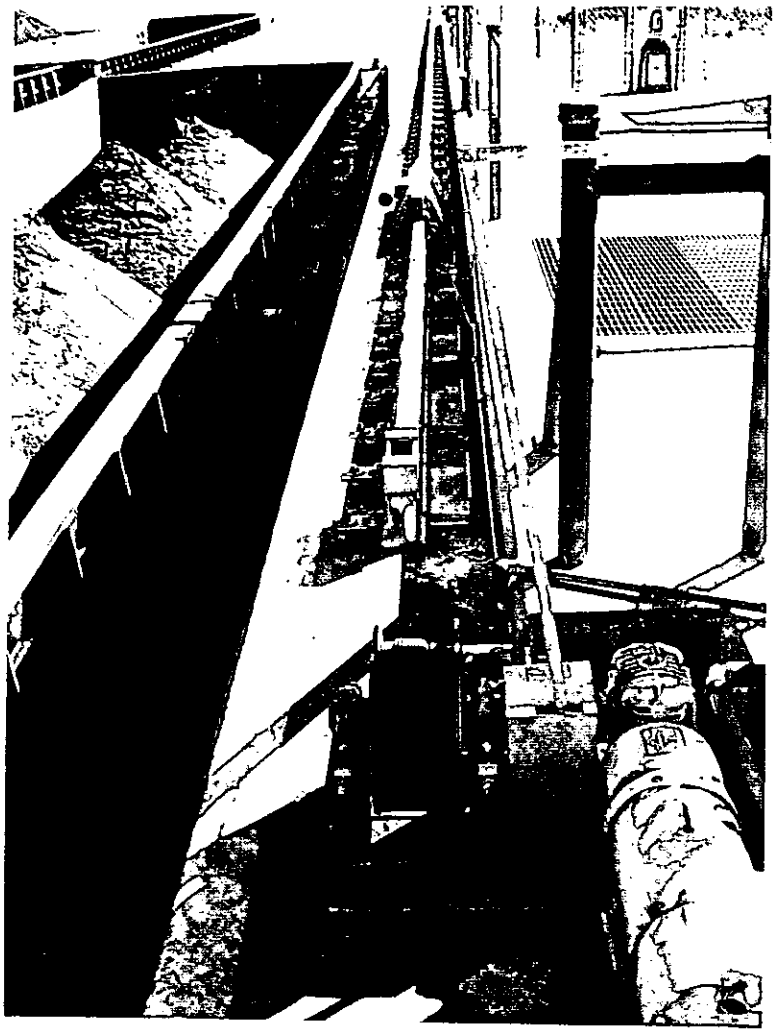
Montgomery Locks
Tow haulage motor unit on top of I wall.
Figure II-36



Montgomery Locks
Floating mooring bit on landside chamber wall.
Figure II-37



Montgomery Locks
Powered traveling kevel at end of chamber.
Figure II-38



Montgomery Locks
Traveling checkpost and retriever winch on upstream guidewall.
Figure II-39

Montgomery Locks
"Air tugger" (yellow) being installed on landside wall of chamber as a "backup" system.
Figure II-40

Section III

SECTION III

TIMING DATA AND OBSERVATIONS

The time savings associated with the extended guidewall & improved tow haulage units can be broken down into three parts; (1) the potential for reduction in approach time, (2) the potential for reduction in the extraction time of the first cut, and (3) the potential for reduction in service time by allowing the remake of the double cut to occur outside the chamber.

A. APPROACH TIME

The lengthening of the guidewall provides two elements of time savings in the approach. First, the longer wall gives a larger "landing surface" for the tow to steer for. Depending on which side of the chamber (land side or river side) that the new guidewall is placed and the outdraft at the time of approach, the tow may be able to make a faster approach at a larger target. Secondly, the tow will be able to stage itself just outside the lock chamber in a turnback condition because it can fit on the entire wall (and not have any part the tow "hanging off" the wall). When the lock is turned back, the tow will be able to move in immediately instead of leaving the bank, mooring buoy, or river's edge to make its approach.

Although the scope of this report does not include the quantification of time savings related to the new approach condition, these savings are very real. Placing new 1200' guidewalls (with their associated tow haulage systems) on the river side of the lock may provide greater time savings because of the outdraft conditions. Many locks around the country have guidewalls on the river side for just this reason.

B. EXTRACTION OF FIRST CUT

The time savings related to the extraction of the first cut can be achieved with a new interior tow haulage system such as those seen at locks mentioned in Section II. The current "unpowered" kevel/rail systems in the study area cannot provide any time savings in the physical extraction of the first cut. However, by providing a barge haulage system that can travel the full length of the lock approach wall and can both pull the barges as well as provide restraint to slow and stop the barge once out of the chamber, the efficiency of the first cut removal process could be improved.

Most of the winches observed in operation as part of a barge haulage system on the inland waterways system are rated at a top speed of 100 feet per minute. In practice these systems are operated at 50 feet per minute because of the inability of the systems to apply a restraining force to the barges. The table below compares the theoretical operating cycle times of the existing system with new systems having top speeds of 50, 100 and 200 feet per minute, respectively.

	Speed (fpm)	Ramp up time (min)	Ramp up distance (ft)	Haul time (min)	Haul Distance (ft)	Stopping Time (min)	Stopping Distance (ft)	Total Time (min)	Total Distance (ft)
Existing System	50	1	25	5.5	275	16.0	400	22.5	700
New System	50	1	25	12.5	625	2.0	50	15.5	700
New System	100	1	50	5.5	550	2.0	100	8.5	700
New System	200	1	100	2.0	400	2.0	200	5	700

Ramp up time - Assumed that it would take one minute to reach maximum speed.
Example: 50 fpm for 1 minute = travel of 25'

Stopping time - The existing system can only provide power in the extraction process to the point of location of the winch. At this point (400 from the end of the guidewall), the deceleration process begins. (This was assumed to be an average of 25 fpm, therfore taking two minutes. Example: 25 fpm for 400ft = 16 minutes.) For the powered kevel system, this distance is reduced to 50', a linear reduction based on the speed of the system due to the restraining ability.
Example: 50 fpm to 0 fpm (stop) = 2 minutes to cover 50 ft.

Haul time - This was based on the operating speed of the winch and distance remaining after calculating ramp up distance and stopping distance.
Example: distance of 625' @ 50 fpm = 12.5 minutes.

As can be seen in the column Total Time, the incremental improvement in time diminishes with an increase in the top speed of the haulage winch. This is primarily the result of the fact that the ramp-up to speed and the time to stop cover ever increasing percentages of the total distance to be traveled. This table is based on stopping the unpowered cut of barges on the existing 600' approach wall. If the approach walls are extended to 1200', the time to stop the unpowered cut is eliminated and the winch speed is maintained until the cut is clear of the gates.

The table below presents the same information as the table above but with the stopping zone occurring beyond the point where the cut is clear of the lock gates.

	Speed (fpm)	Ramp up time (min)	Ramp up distance (ft)	Haul time (min)	Haul Distance (ft)	Stopping Time (min)	Stopping Distance (ft)	Total Time (min)	Total Distance (ft)
Existing System	50	1	25	5.5	275	16.0	400	22.5	700
New System	50	1	25	13.5	675	0.0	0	14.5	700
New System	100	1	50	6.5	650	0.0	0	7.5	700
New System	200	1	100	3.0	600	0.0	0	4	700

The addition of a powered tow haulage system to the chamber itself will not only decrease the amount of time it takes to remove the cut, but it would also improve safety conditions as the lock operations staff would no longer have to handle the tow haulage cable.

C. REMAKE OF DOUBLE CUT OUTSIDE THE CHAMBER

Time savings can be gained by allowing the double cut to remake outside the limits of the lock chamber. This is due to the fact that the 1200' guidewall allows the second cut to completely exit the chamber before remaking with the first cut. This will allow the lock to be turned back for the next tow in significantly less time. This savings only occurs in a turnback lockage, however. Therefore an N-up/N-down Policy in conjunction with this scenario would provide full advantage of the turnback time savings.

Existing tow haulage systems can extract the first cut from the chamber, but an additional (powered) kevel is necessary to take the unpowered cut the full length of the wall. Outdraft conditions will likely require a second (unpowered) kevel to keep the other end of the unpowered cut snug to the wall as it moves to the end. However, powered tow haulage units are not the only answer. Switchboats and "Self-Help" towboats can also be used to move the unpowered cut to the end of the 1200' guidewall. When the main (1200') lock at Mel Price (Lock 26R) in Alton, IL is closed, the 600' chamber used; as there are no powered kevels at the auxiliary lock at Mel Price, the industry must rely on Switchboats and "Self-Help" towboats to extract the cuts to the end of the guidewall. Switchboats there were able to face-up to the unpowered cut and be ready for extraction prior to the gates being fully opened. They were also able to accelerate quickly and reach extraction speeds of 300 feet per minute.

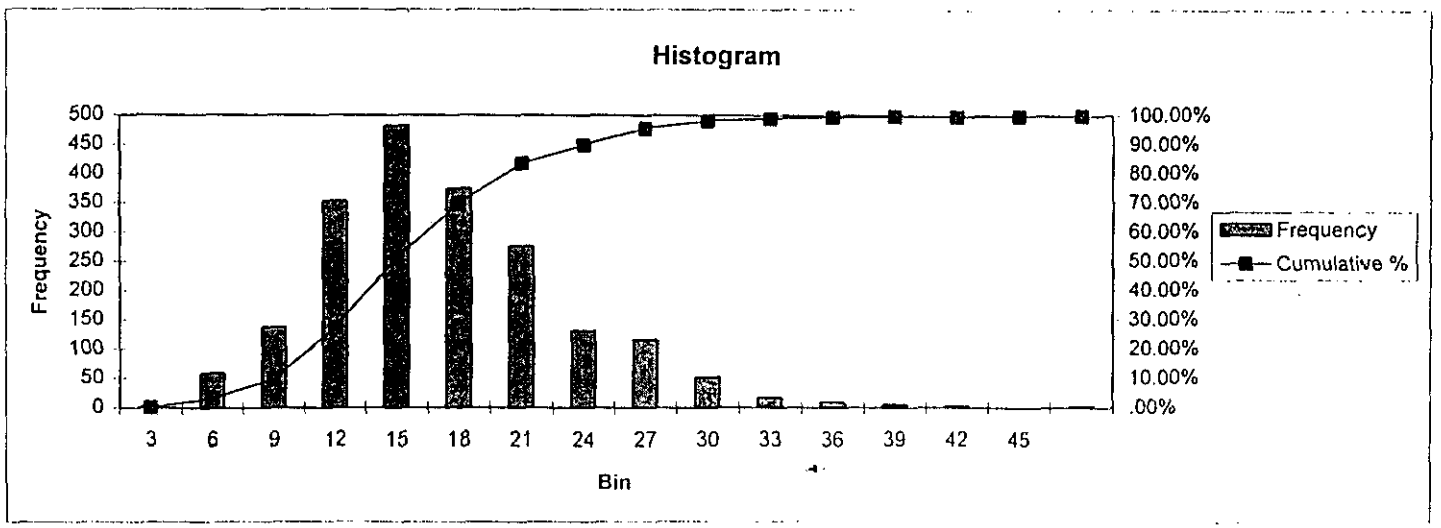
The time savings for this modification can be estimated from current OMNI data taken at the six lock sites under study. The data used for this analysis came from 1992 records of all double lockages at each lock. To ensure a 15-barge equivalent was used, the analysis extracted only those times for tow lengths greater than 1000' (at least 5 barges long, as each barge is about 200'). The time elements used were "SOE2" (Start of Exit of Second Cut, when the gates are fully recessed and the second, powered cut has permission to move out of the chamber) to "Bye Time" (when the lockman removes the headline of the barge and the entire (remade) cut moves out of the chamber). With the exception of the very small amount of time (about 2 minutes) that it takes the towboat to move the 50 feet necessary to face-up to the unpowered cut in the current lock configuration (600' guidewalls), this data yields the approximate time savings of the extended guidewall. This is

because the operation that requires this time (SOE2 to Bye-Time) would take place on the extended guidewall while the chamber is turned back for the next tow. (See the following pages for a comprehensive data analysis for each lock in the study area.)

DOUBLE LOCKAGES AT LOCK 20 IN 1992; End of Lockage 2nd Cut to Bye Time

Bin	*Frequency*	*Cumulative %*
3	4	.20%
6	59	3.11%
9	138	9.92%
12	354	27.39%
15	483	51.23%
18	374	69.69%
21	276	83.32%
24	131	89.78%
27	116	95.51%
30	52	98.08%
33	17	98.91%
36	10	99.41%
39	6	99.70%
42	3	99.85%
45	0	99.85%
More	3	100.00%

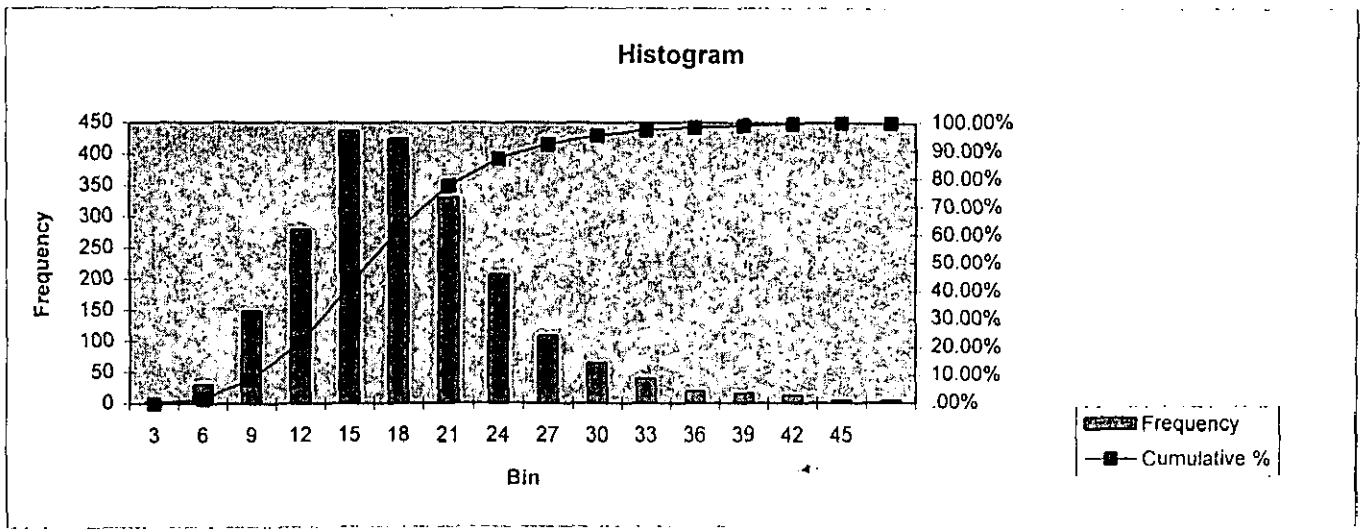
Lock 20 Data	
Mean	16.2
Standard Error	0.13
Median	15
Mode	15
Standard Deviation	6.04
Sample Variance	36.53
Kurtosis	1.88
Skewness	0.89
Range	51
Minimum	2
Maximum	53
Sum	32819
Count	2026
Confidence Level(95.000%)	0.26



DOUBLE LOCKAGES AT LOCK 21 IN 1992; End of Lockage 2nd Cut to Bye Time

Bin	*Frequency*	*Cumulative %*
3	3	.14%
6	31	1.59%
9	149	8.58%
12	279	21.65%
15	437	42.13%
18	425	62.04%
21	330	77.51%
24	207	87.21%
27	109	92.31%
30	65	95.36%
33	40	97.24%
36	20	98.17%
39	16	98.92%
42	13	99.53%
45	5	99.77%
More	5	100.00%

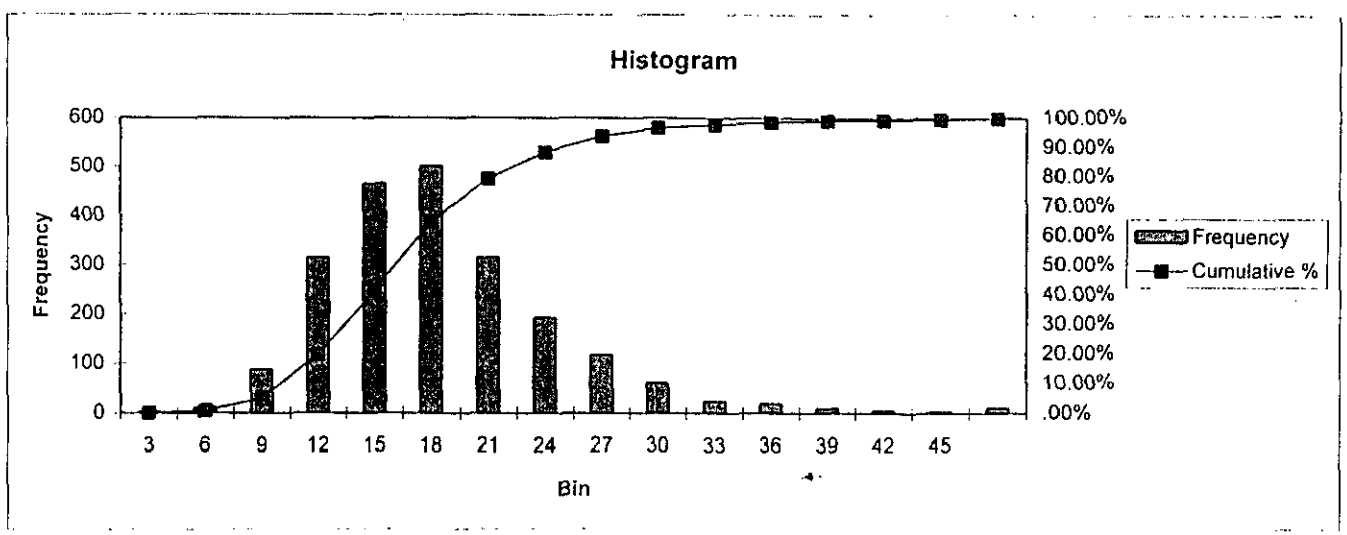
Lock 21 Data	
Mean	17.59
Standard Error	0.15
Median	17
Mode	15
Standard Deviation	7
Sample Variance	49.05
Kurtosis	8.84
Skewness	1.71
Range	85
Minimum	1
Maximum	86
Sum	37543
Count	2134
Confidence Level(95.000%)	0.3



DOUBLE LOCKAGES AT LOCK 22 IN 1992; End of Lockage 2nd Cut to Bye Time

Bin	*Frequency*	*Cumulative %*
3	3	.14%
6	12	.70%
9	88	4.80%
12	315	19.48%
15	466	41.19%
18	501	64.54%
21	315	79.22%
24	193	88.21%
27	118	93.71%
30	61	96.55%
33	24	97.67%
36	19	98.56%
39	10	99.02%
42	6	99.30%
45	3	99.44%
More	12	100.00%

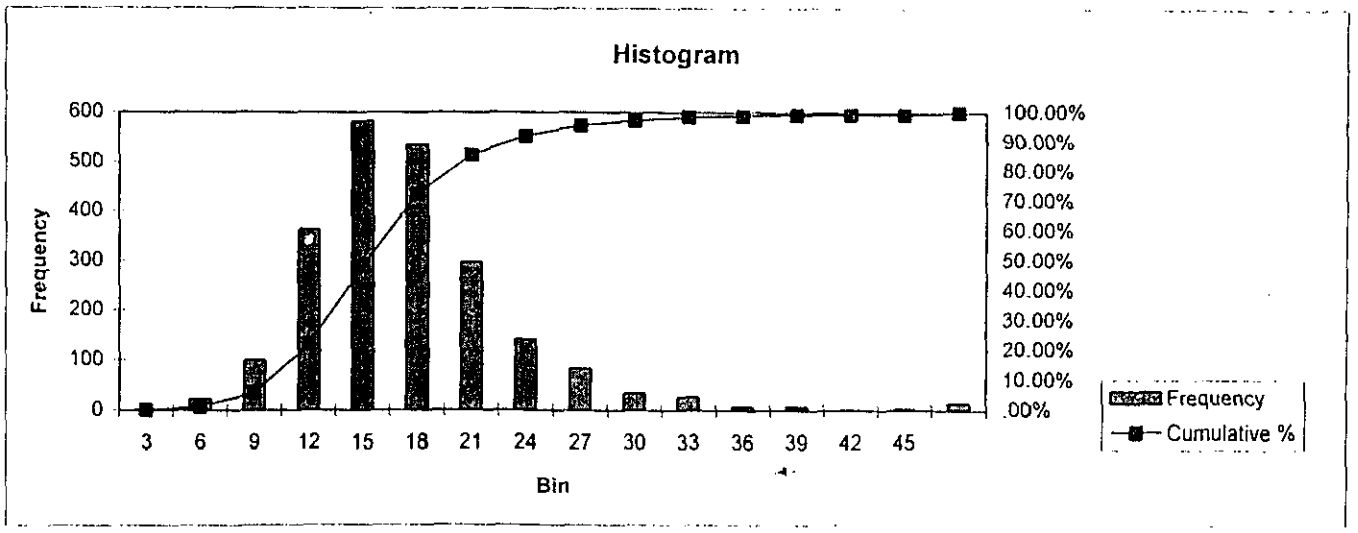
Lock 22 Data	
Mean	17.58
Standard Error	0.14
Median	17
Mode	16
Standard Deviation	6.69
Sample Variance	44.79
Kurtosis	16.43
Skewness	2.453
Range	95
Minimum	2
Maximum	97
Sum	37732
Count	2146
Confidence Level(95.000%)	0.28



DOUBLE LOCKAGES AT LOCK 24 IN 1992; End of Lockage 2nd Cut to Bye Time

Bin	*Frequency*	*Cumulative %*
3	2	.09%
6	23	1.12%
9	99	5.57%
12	363	21.89%
15	583	48.09%
18	536	72.18%
21	298	85.57%
24	141	91.91%
27	83	95.64%
30	35	97.21%
33	27	98.43%
36	8	98.79%
39	8	99.15%
42	1	99.19%
45	3	99.33%
More	15	100.00%

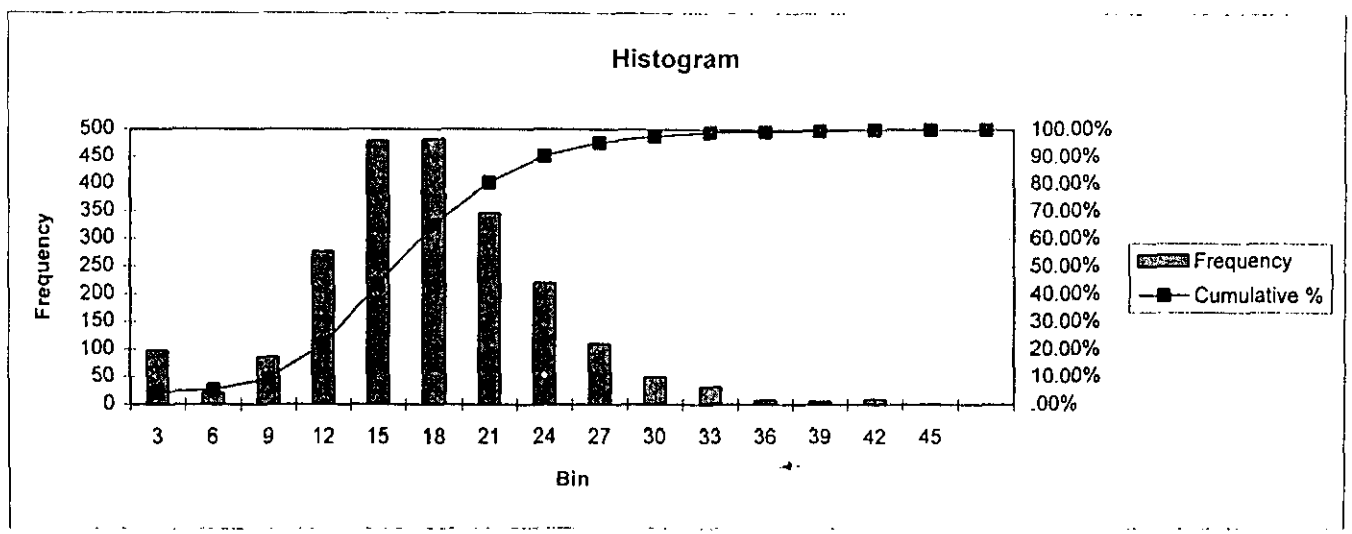
Lock 24 Data	
Mean	16.66
Standard Error	0.14
Median	16
Mode	15
Standard Deviation	6.48
Sample Variance	42.02
Kurtosis	24.92
Skewness	3.23
Range	99
Minimum	3
Maximum	102
Sum	37065
Count	2225
Confidence Level(95.000%)	0.27



DOUBLE LOCKAGES AT LOCK 25 IN 1992; End of Lockage 2nd Cut to Bye Time

Bin	*Frequency*	*Cumulative %*
3	98	4.40%
6	21	5.34%
9	86	9.20%
12	278	21.68%
15	479	43.18%
18	482	64.81%
21	346	80.34%
24	220	90.22%
27	111	95.20%
30	50	97.44%
33	32	98.88%
36	8	99.24%
39	6	99.51%
42	10	99.96%
45	1	100.00%
More	0	100.00%

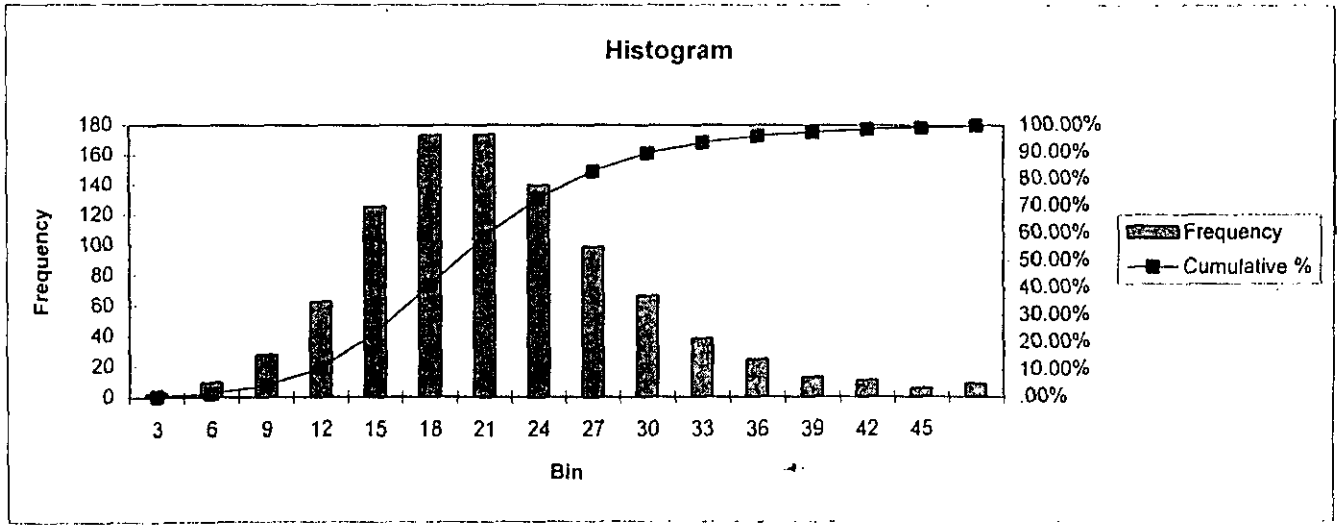
Lock 25 Data	
Mean	16.65
Standard Error	0.14
Median	16
Mode	15
Standard Deviation	6.37
Sample Variance	40.61
Kurtosis	1.18
Skewness	0.15
Range	40
Minimum	1
Maximum	41
Sum	37043
Count	2225
Confidence Level(95.000%)	0.26



DOUBLE LOCKAGES AT LAGRANGE LOCK IN 1992; End of Lockage 2nd Cut to Bye Time

Bin	*Frequency*	*Cumulative %*
3	3	.30%
6	10	1.32%
9	28	4.15%
12	63	10.54%
15	126	23.30%
18	174	40.93%
21	174	58.56%
24	140	72.75%
27	99	82.78%
30	67	89.56%
33	39	93.52%
36	25	96.05%
39	13	97.37%
42	11	98.48%
45	6	99.09%
More	9	100.00%

LaGrange Lock	
Mean	20.91
Standard Error	0.24
Median	20
Mode	20
Standard Deviation	7.68
Sample Variance	58.97
Kurtosis	1.26
Skewness	0.76
Range	57
Minimum	0
Maximum	57
Sum	20639
Count	987
Confidence Level(95.000%)	0.48



To summarize the average time savings (minus the 2 minutes needed for the towboat to face-up to its unpowered cut;

Lock	Mean Time	Estimated Reduction	Adjusted Mean
20	16.2	2	14.2
21	17.6	2	15.6
22	17.6	2	15.6
24	16.7	2	14.7
25	16.6	2	14.6
LaGrange	20.9	2	18.9

Therefore, it is estimated that the extended guidewalls alone will result in a 15 minute savings on Mississippi River turnback lockages and a 19 minute savings on Illinois River turnback lockages. In addition, the variability of this time savings will be reduced because it no longer depends on the human element involved in remaking the tows because it completely eliminates this step from the time process.

Section IV

SECTION IV

CONFIGURATIONS AND MOTIVE POWER

The following configurations apply to a "standard" lock for the purposes of evaluation. This standard lock is assumed to have a 600' chamber and a 1200' guidewall on each end. The entire length of available walls (guidewalls and lock wall) would therefore be 3,000 feet. The guidewall extension can be riverside or landside. The riverside version would be more costly as the extension would have to be from the bullnose of the river wall; but has no cost impact on the tow haulage systems comparison. The riverside guidewalls do help reduce the approach times in most cases, but are not feasible at all sites. The evaluation of "riverside" versus "landside" extensions will be performed in another evaluation of the NAV Report.

A. POWERED TRAVELING KEVEL CONFIGURATION

The powered traveling kevel extracts the unpowered cut in either direction using a rail-mounted device that is powered by a winch and cable system. This system is the most common one in use in the United States on locks that are small enough to require multiple cut extractions. Some examples of this system are presented with photographs in Section II of this report.

There are several configurations that could be used with this type of system. For ease of reference, they have been named for the hundreds of feet that they cover. The alternatives are:

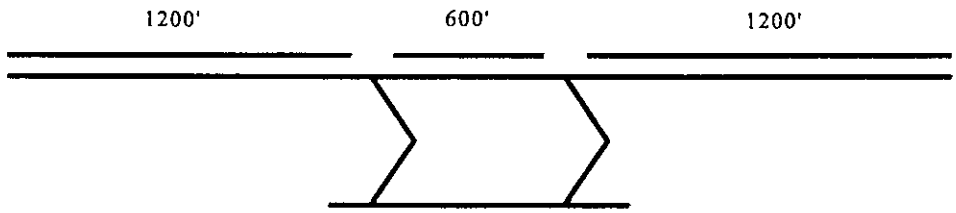
CONFIGURATION I	"12-6-12"
CONFIGURATION II	"12-18"
CONFIGURATION III	"30"
CONFIGURATION IV	"12-N-12"

("N" means utilization of the existing tow haulage system within the lock chamber)

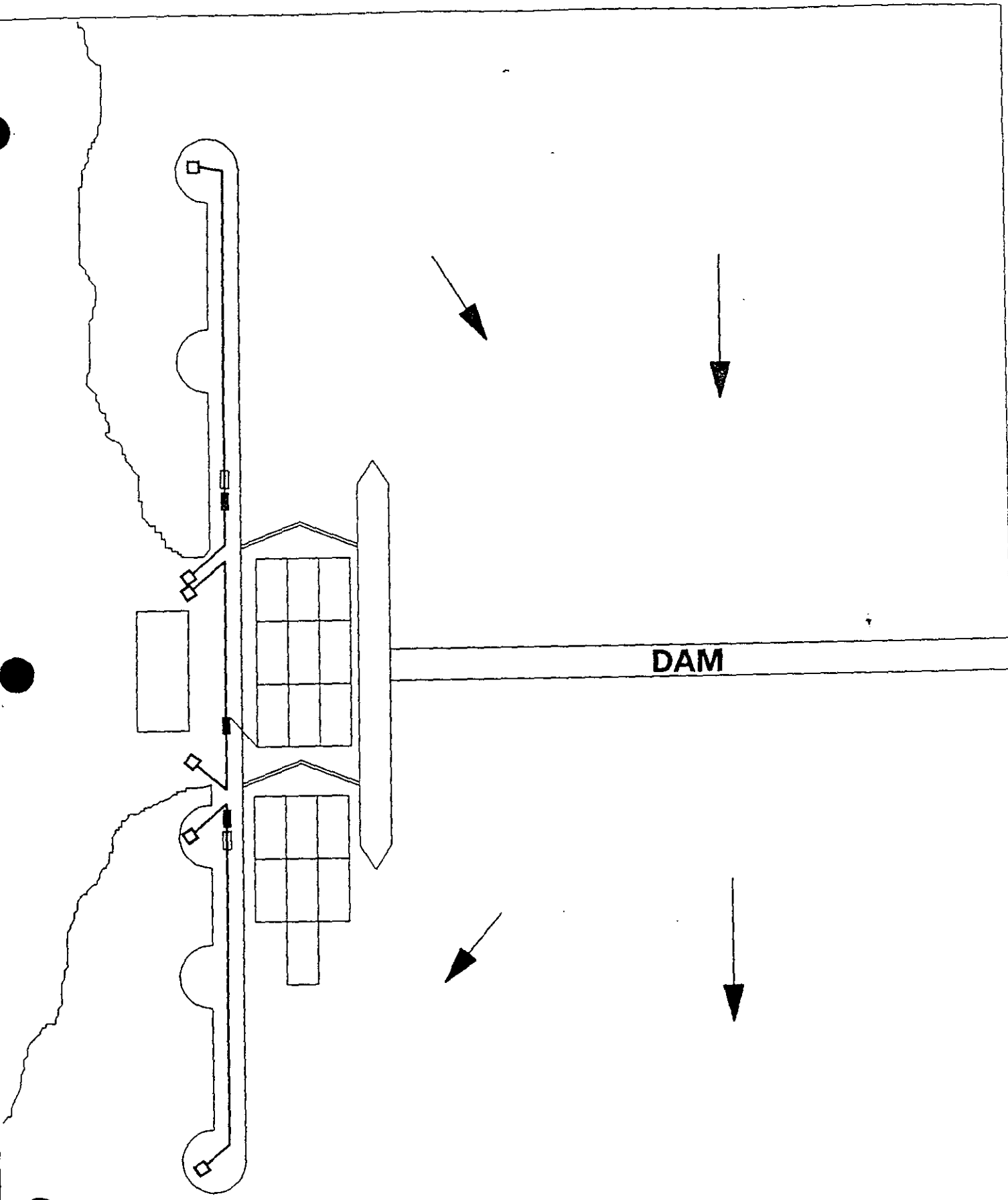
Each configuration is described in detail in the following pages.

1. Configuration I "12-6-12"

In this configuration, two kevels (one unpowered and one powered) travel the downstream guidewall (one to keep the head checked in and the other to power the cut down the wall). One powered kevel travels the length of the lock chamber for the initial pull. Two more kevels travel the upstream guidewall (one to keep the head checked in and the other to power the cut down the wall).



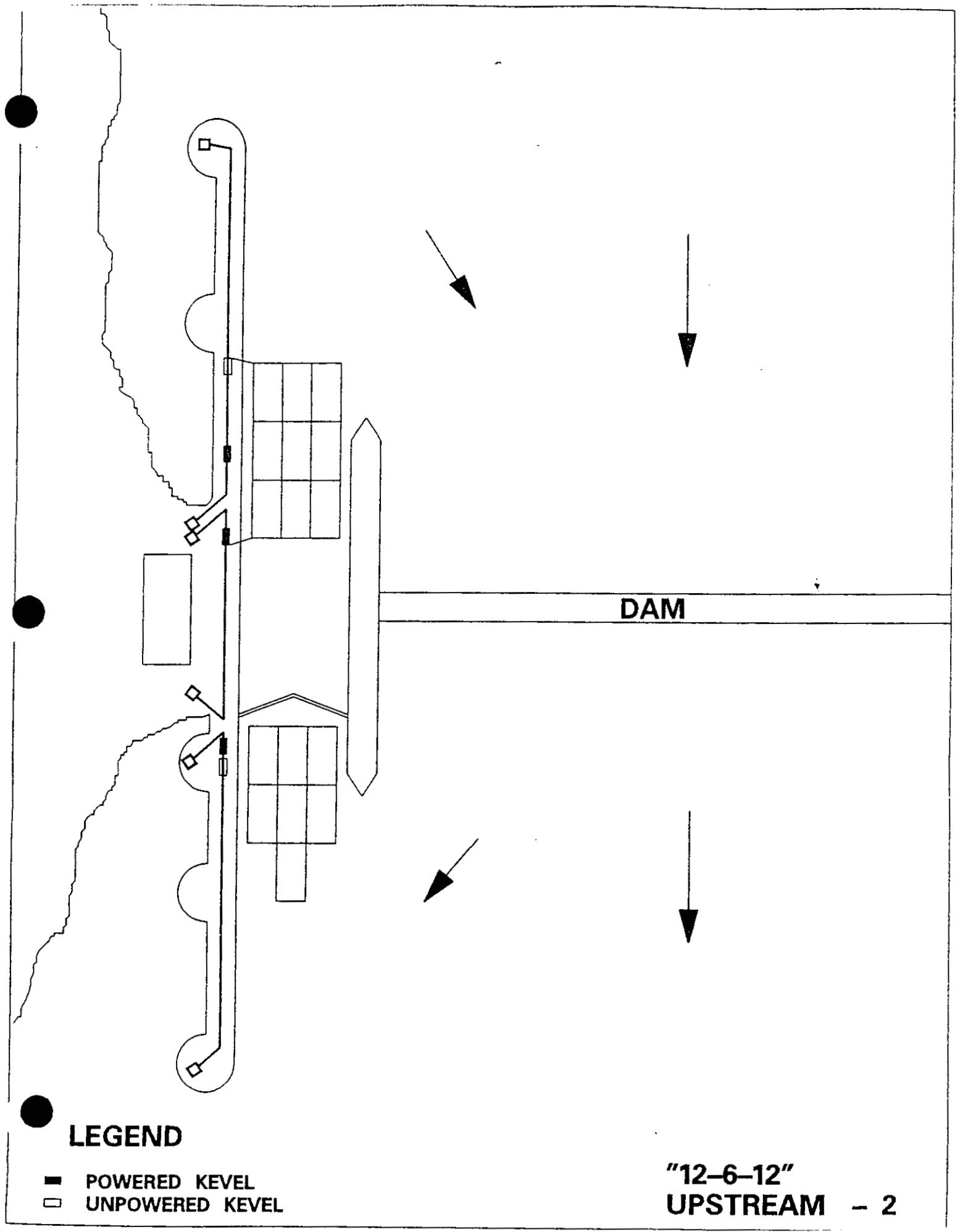
ADVANTAGES	DISADVANTAGES
Does not cross the miter gates	Have to attach twice for power (each way)
Accommodates change in wall elevation	Requires modification of hand rail, buttons, ladders, etc.
A breakdown (or shut down for maintenance) of one the subsystems would not prevent lockage of a double cut configuration	Would require removal of the existing tow haulage system

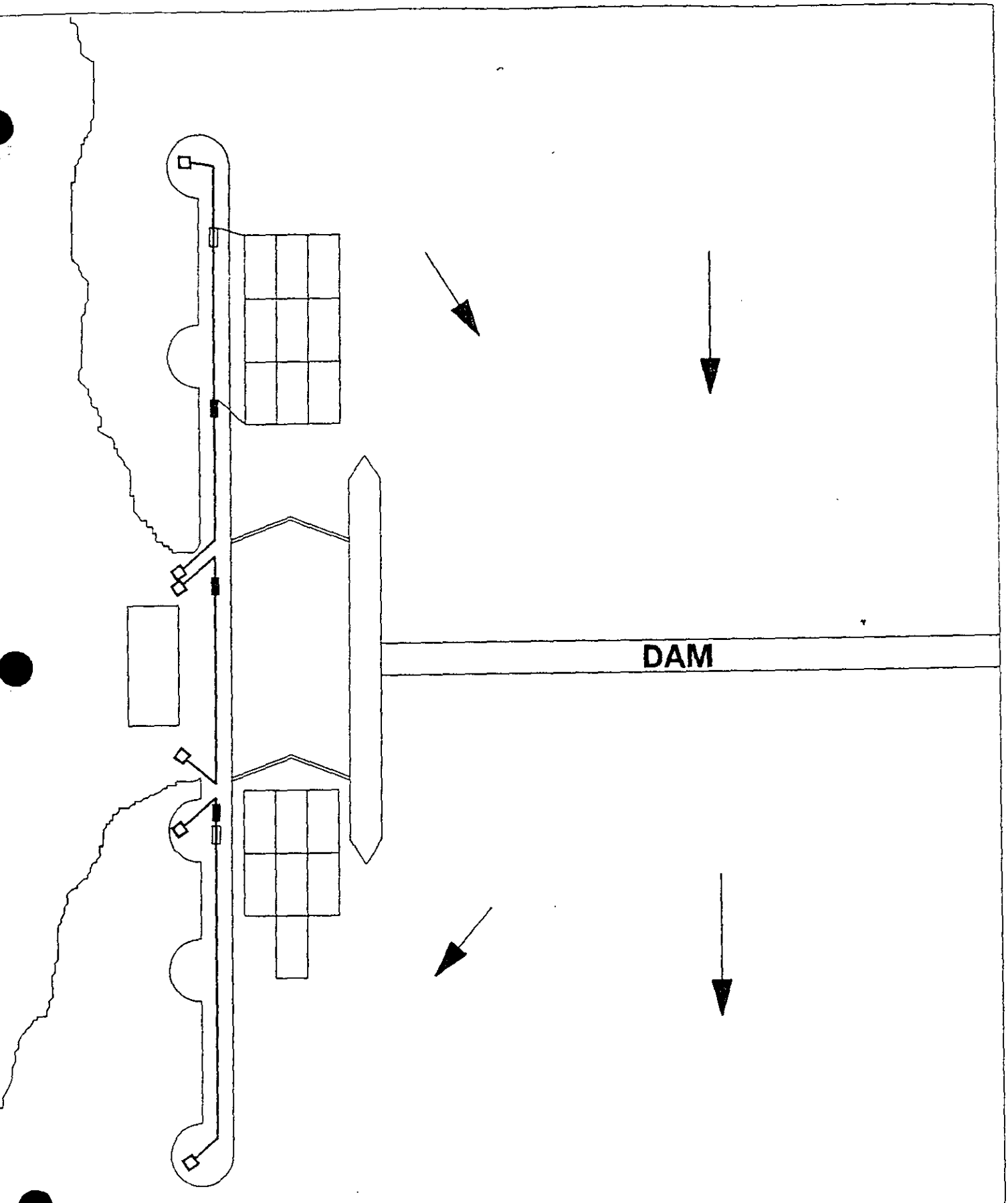


LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

"12-6-12"
UPSTREAM - 1

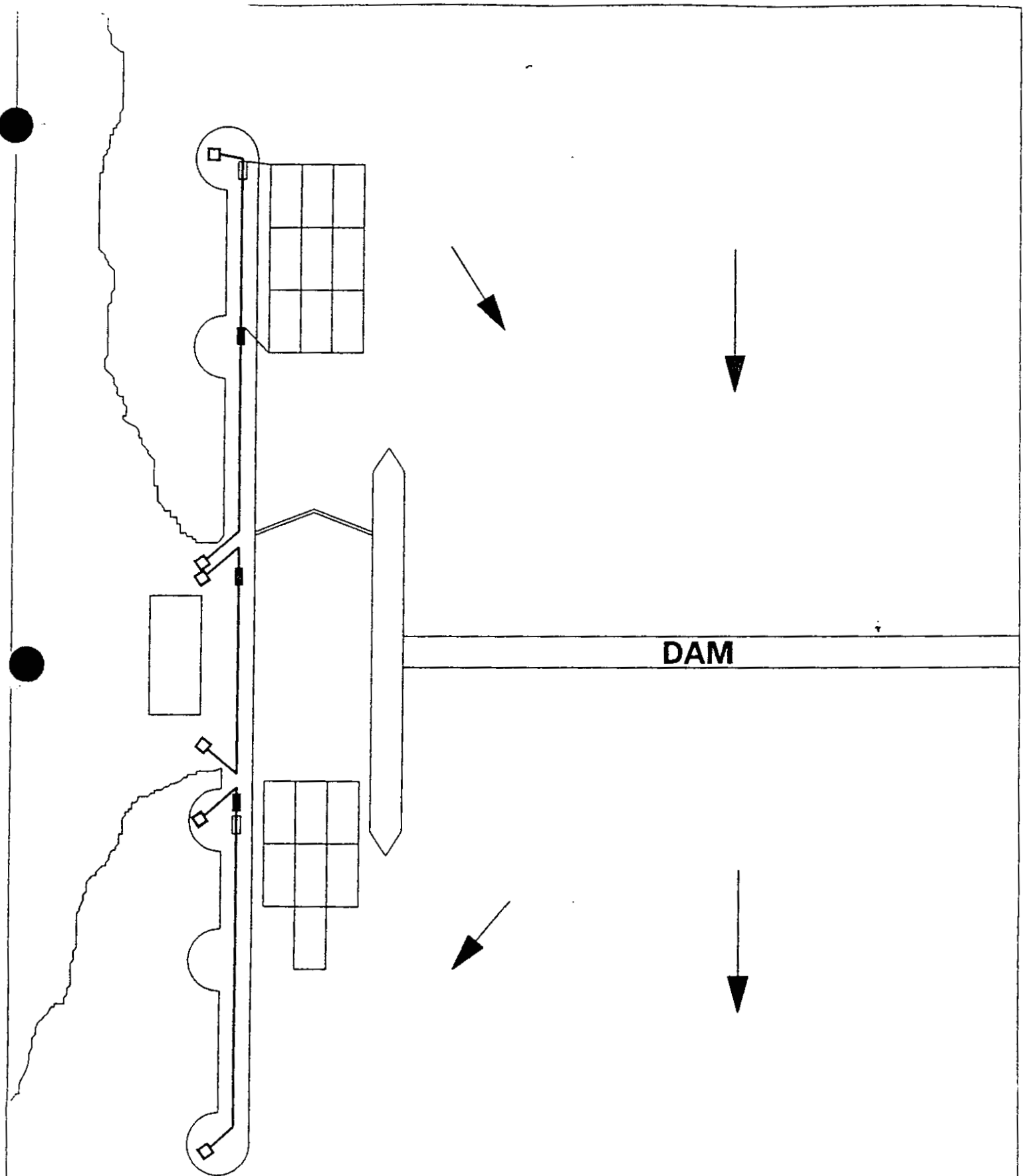

DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"12–6–12"
UPSTREAM – 2



LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

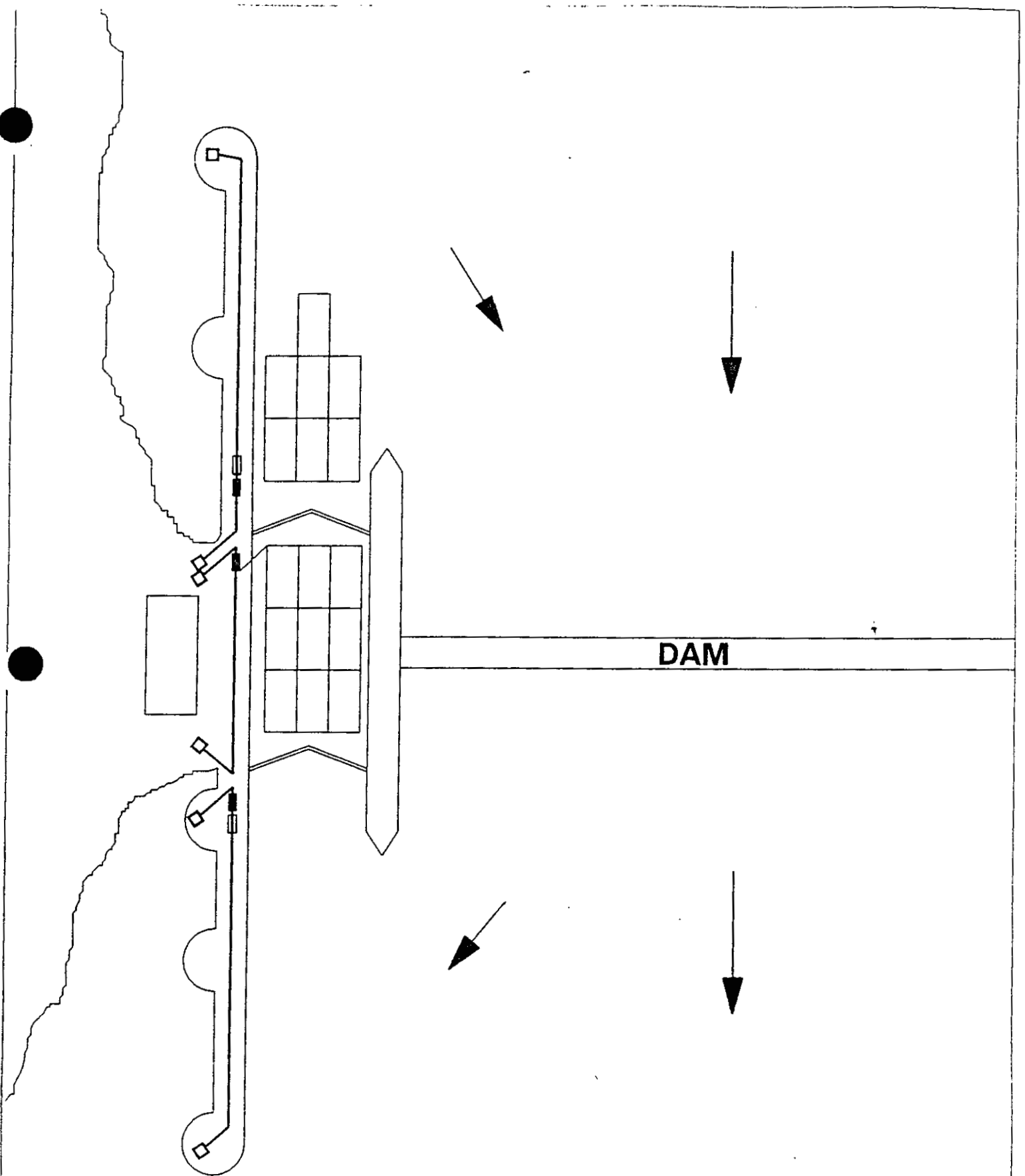
"12–6–12"
UPSTREAM – 3



LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

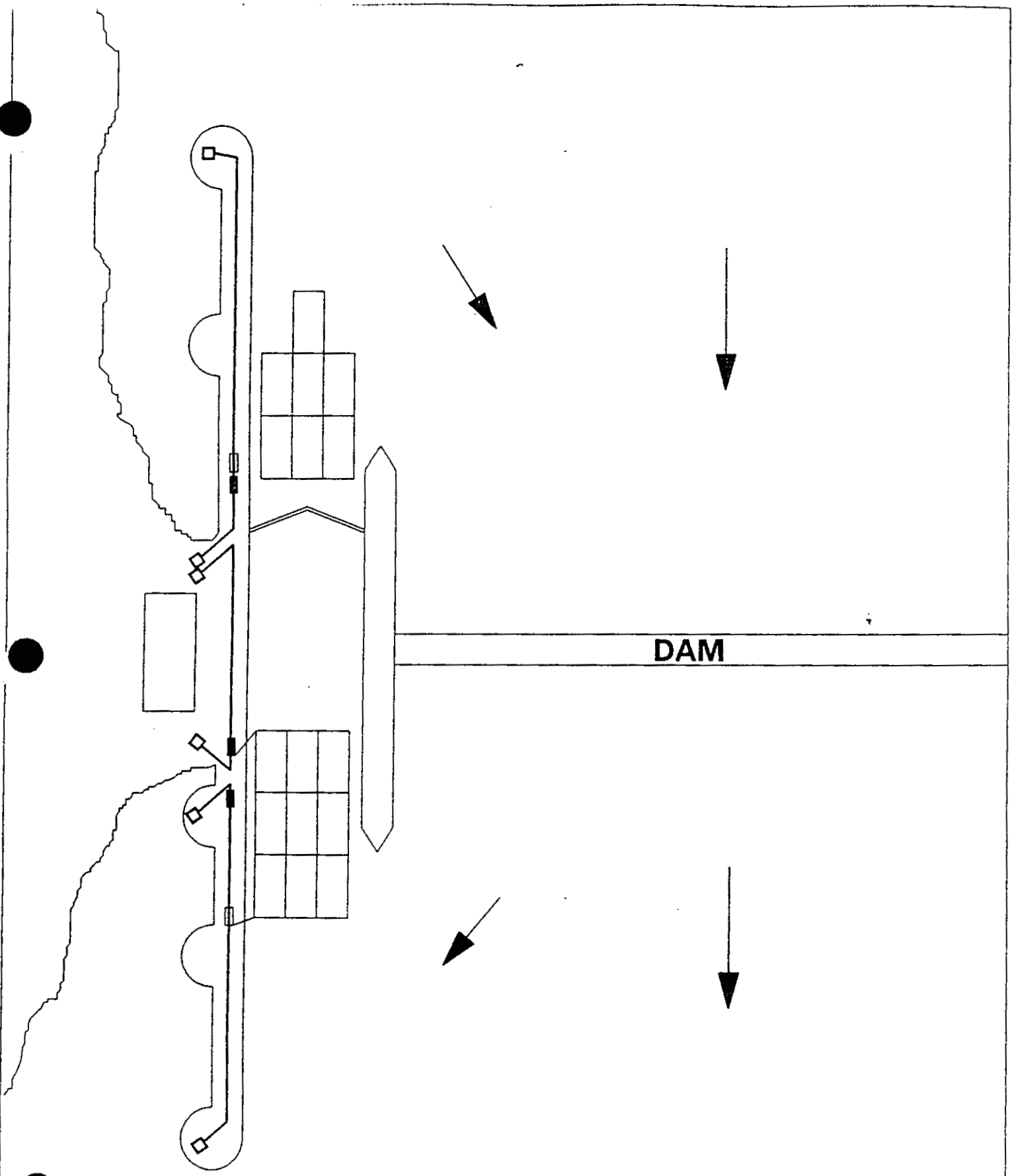
"12–6–12"
UPSTREAM – 4



LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

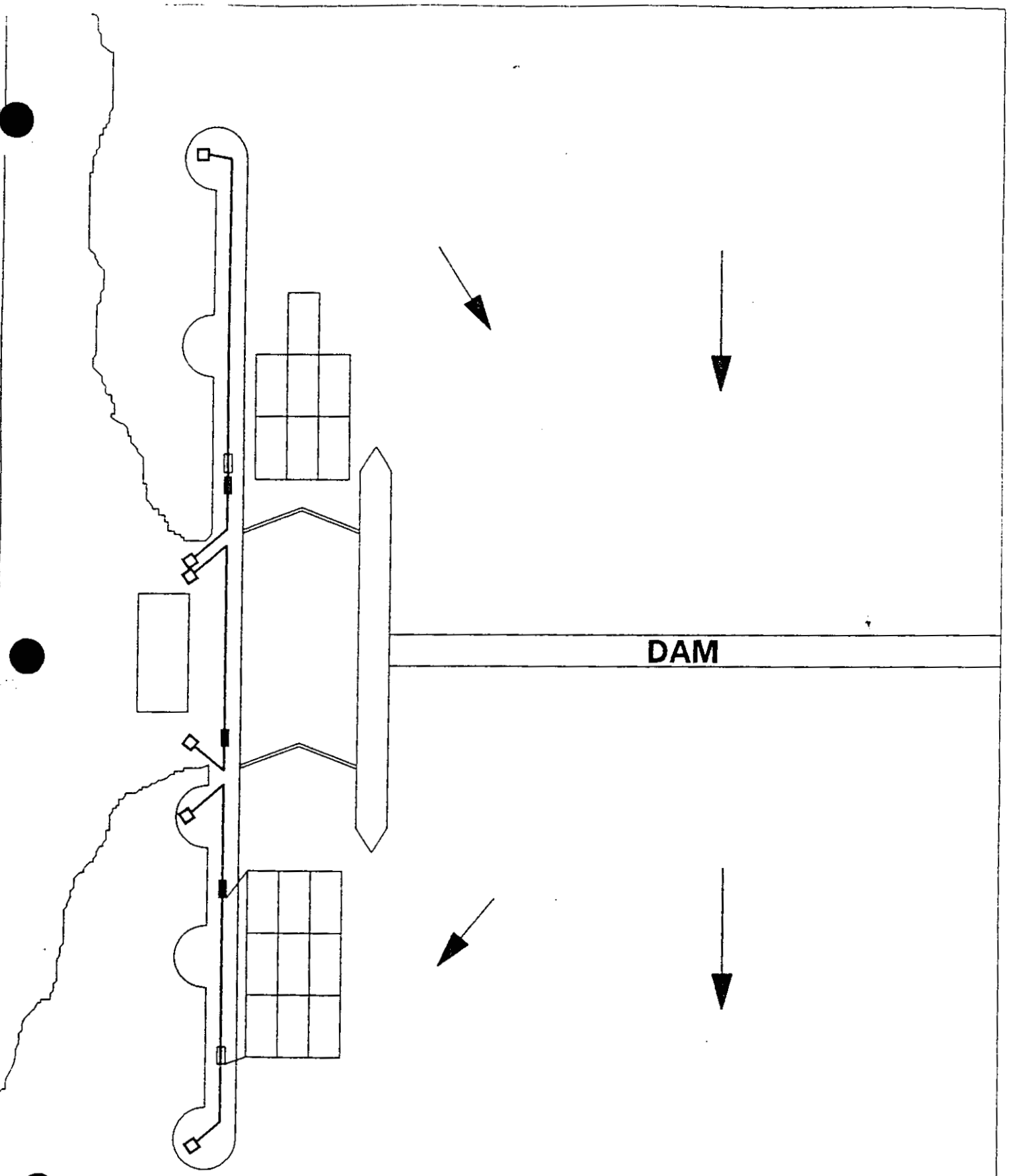
"12–6–12"
DOWNSTREAM – 1



LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

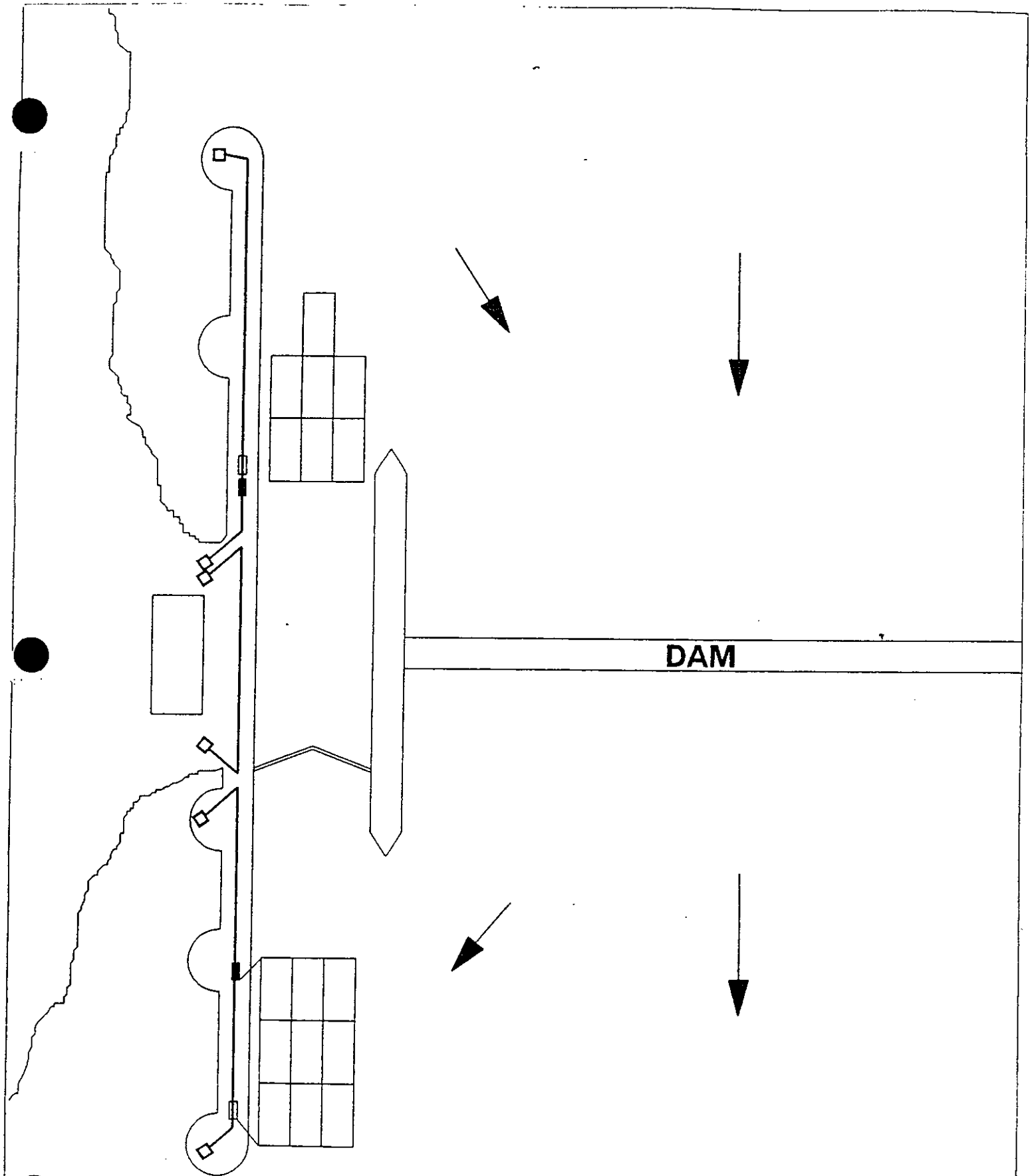
"12–6–12"
DOWNSTREAM – 2



LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

"12–6–12"
DOWNSTREAM – 3



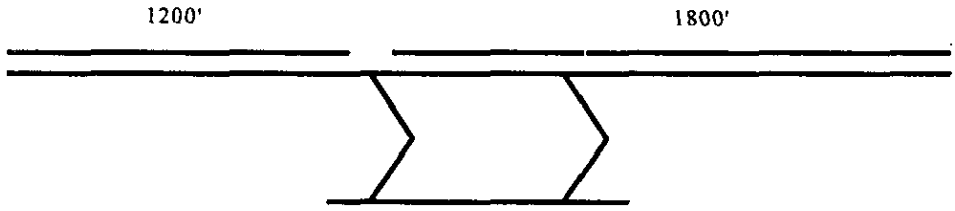
LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

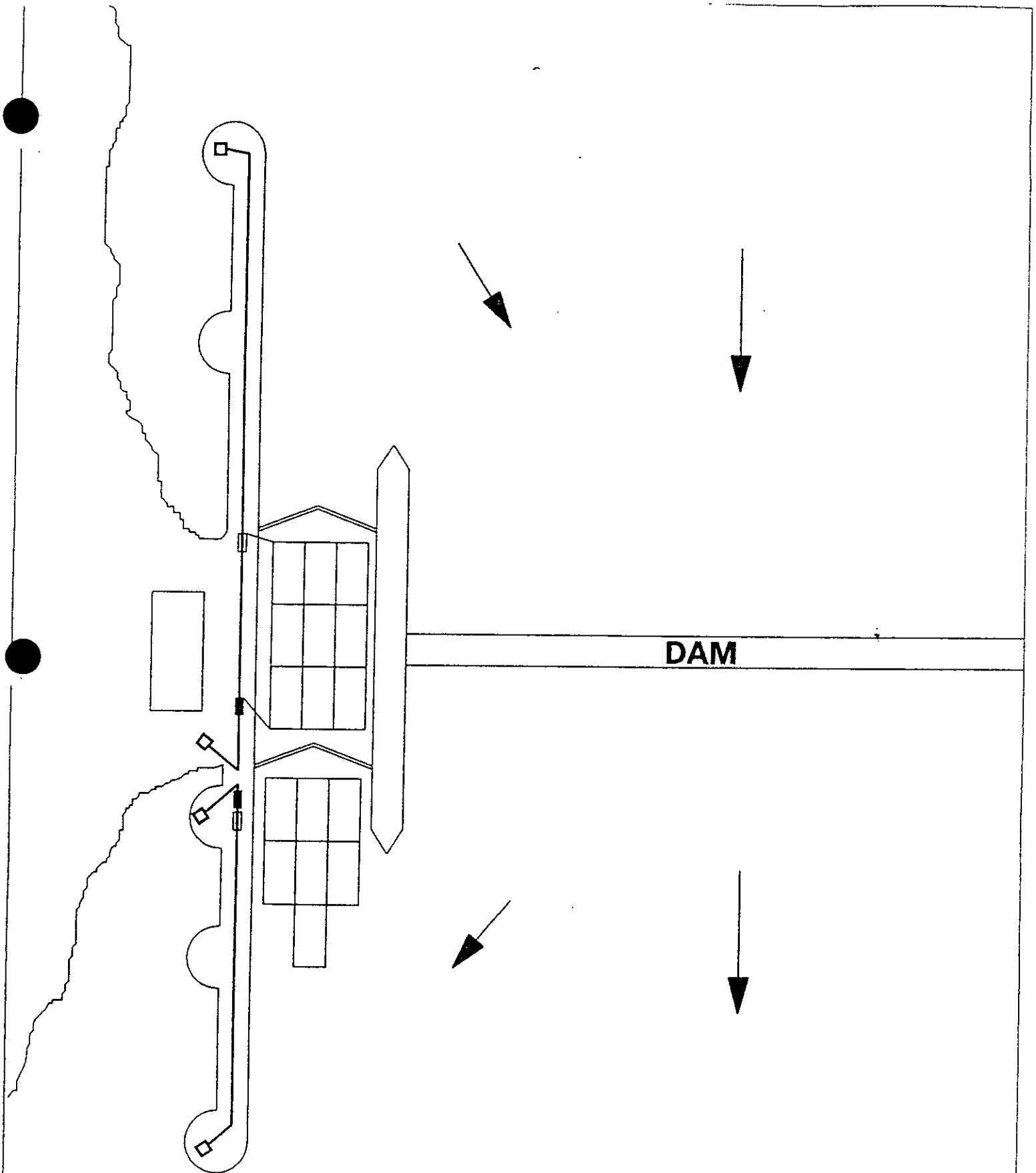
"12–6–12"
DOWNSTREAM – 4

2. Configuration II "12-18"

In this configuration, two kevels (one unpowered and one powered) travel the downstream guidewall (one to keep the head checked in and the other to power the cut down the wall). Two more kevels travel the length of the chamber and the upstream guidewall (one to keep the head checked in and the other to power the cut down the wall).



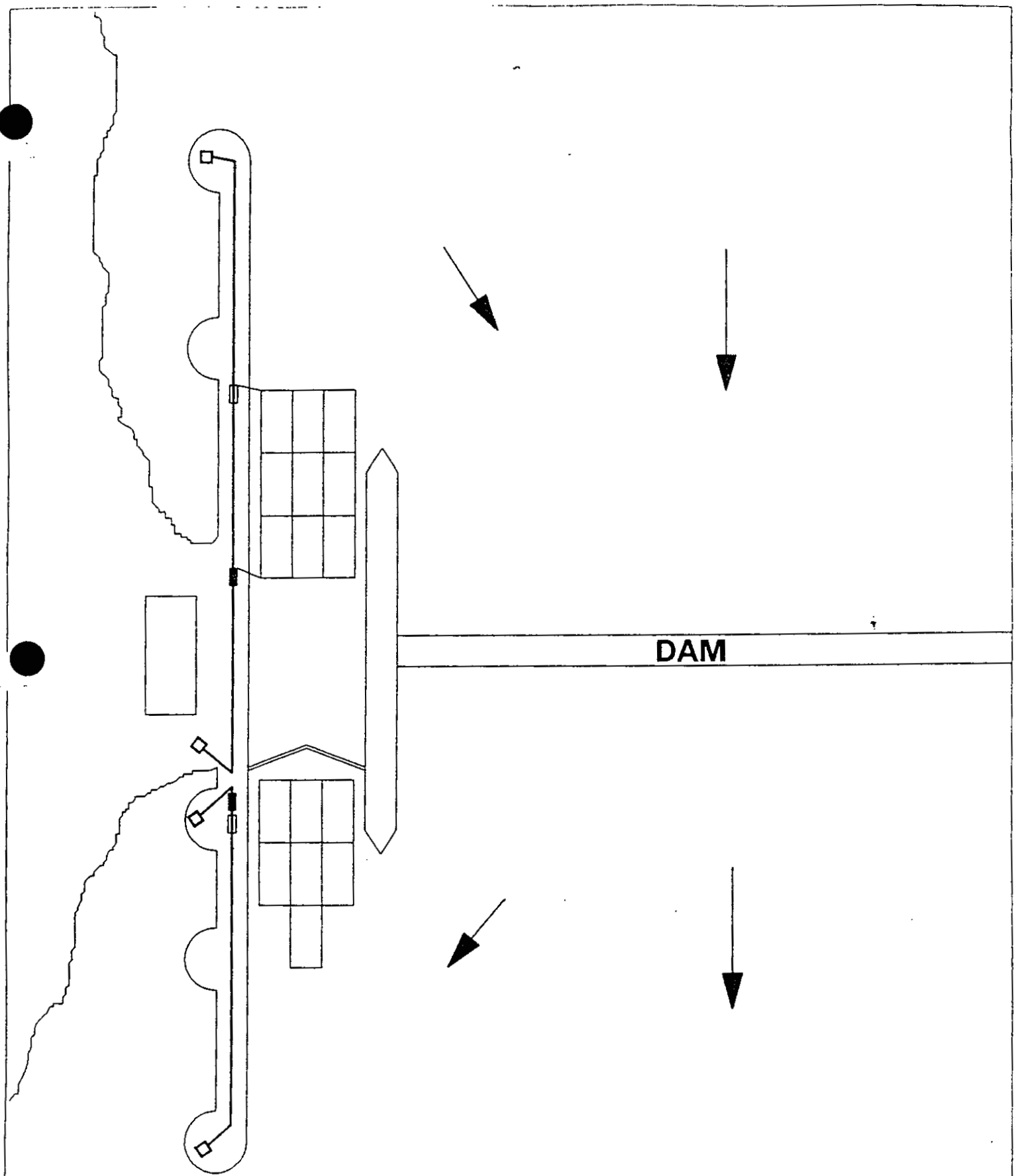
ADVANTAGES	DISADVANTAGES
Single powered pull upstream	One miter gate crossing required
Accommodates change in wall elevation	Have to attach twice for power for downstream lockages
	Requires modifications of handrail, buttons, ladders, etc.
	Would require removal of existing tow haulage system
	System failure could shut down lock



LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

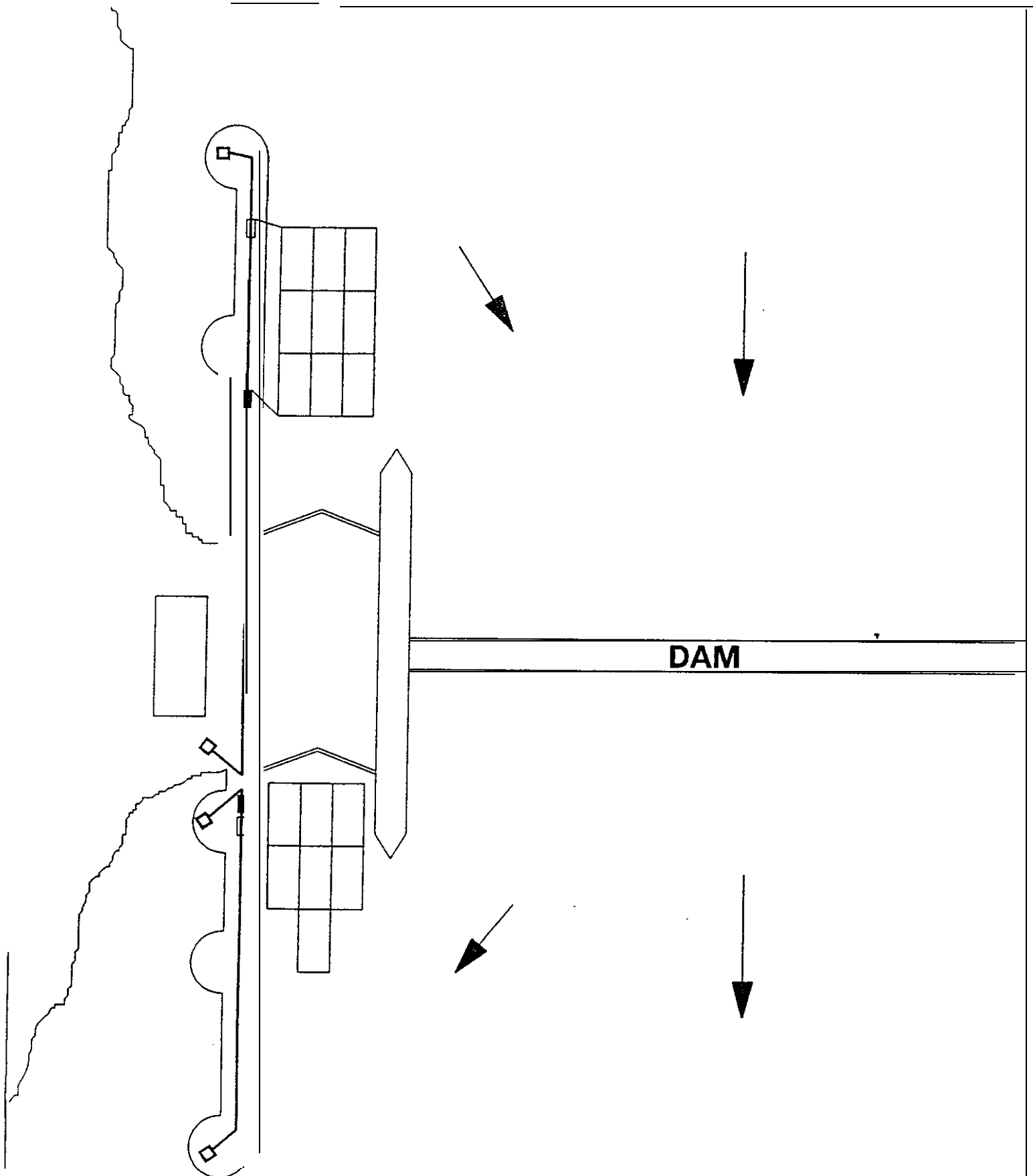
"12–18"
UPSTREAM – 1



LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

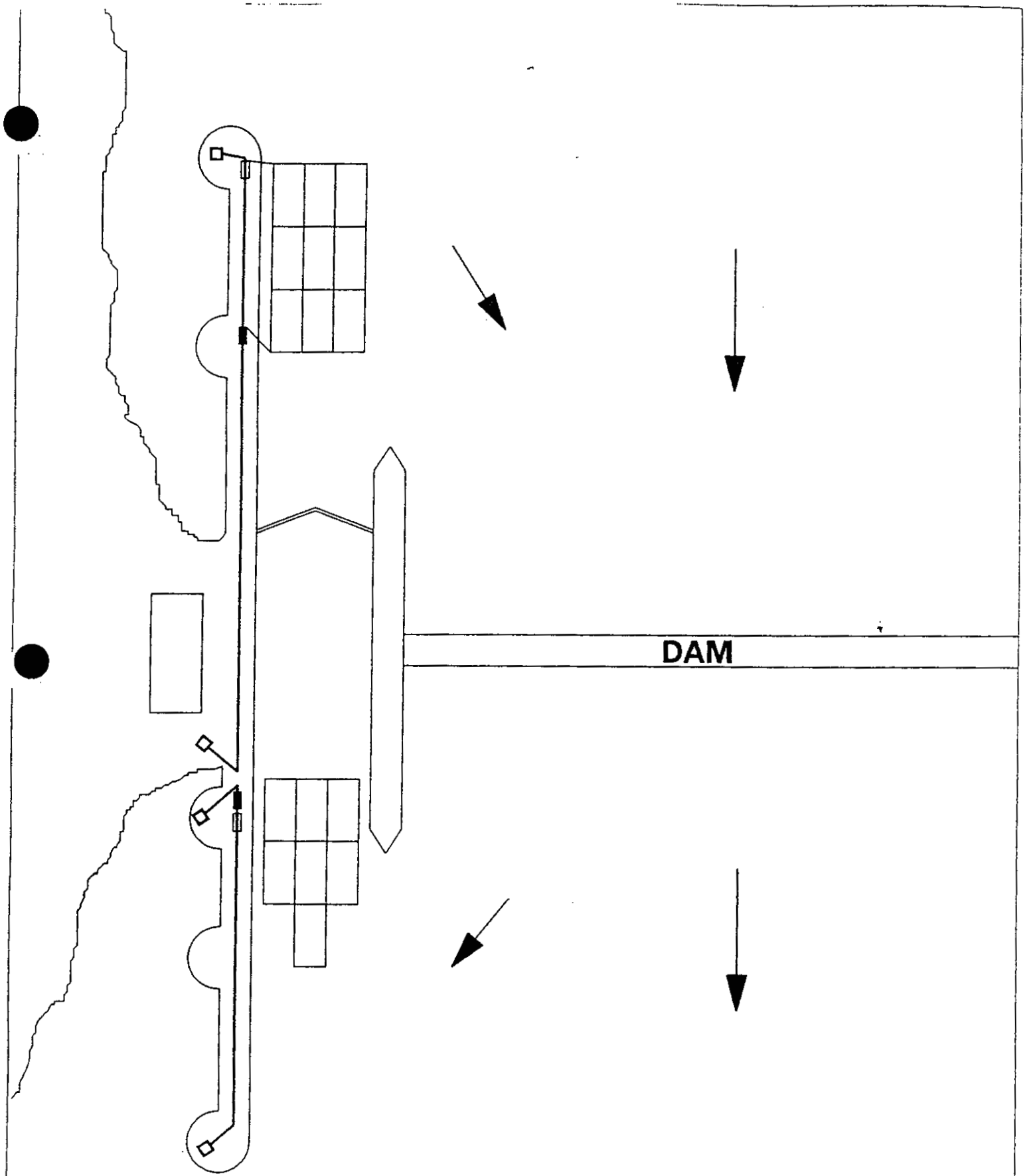
"12–18"
UPSTREAM – 2



LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

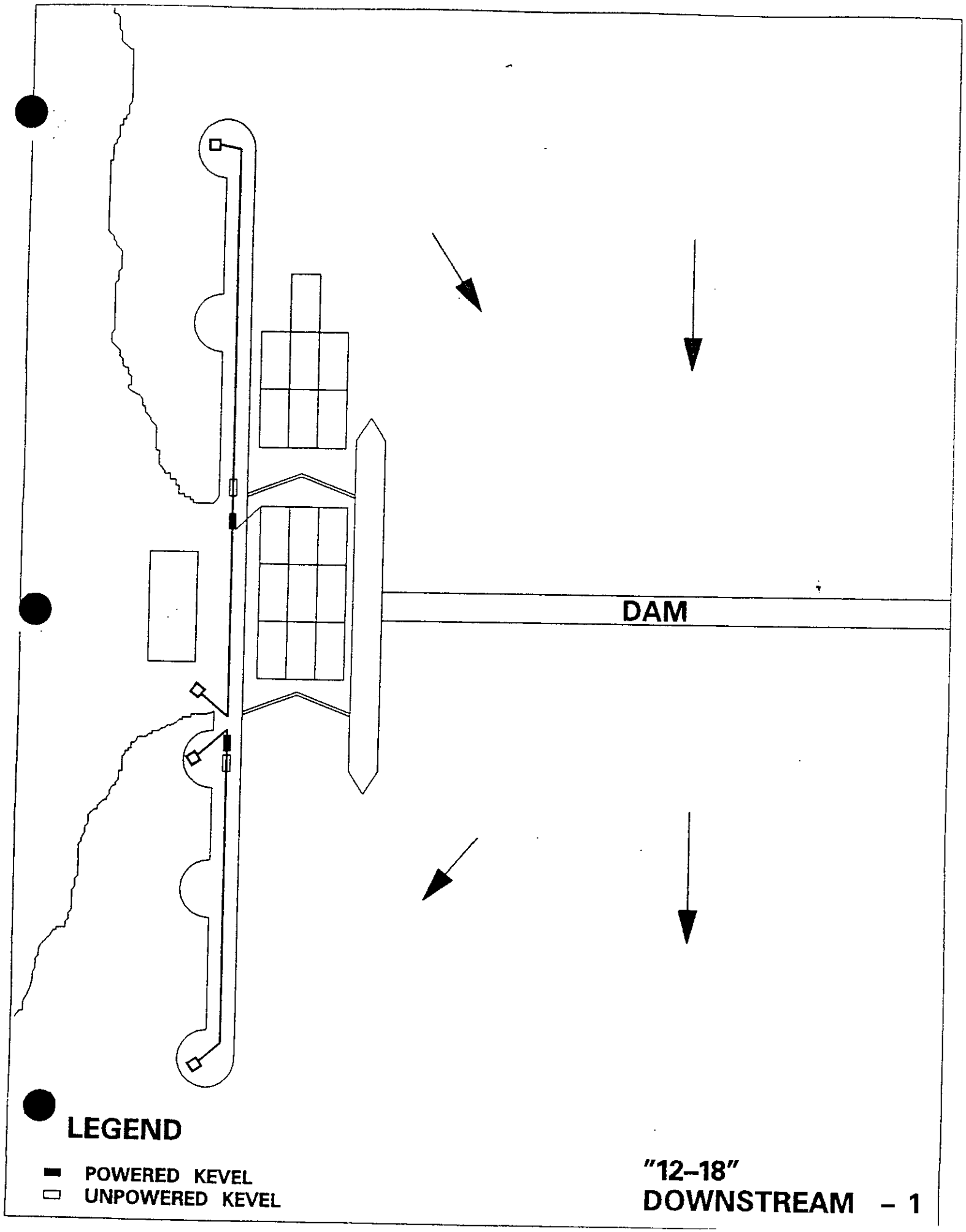
"12–18"
UPSTREAM

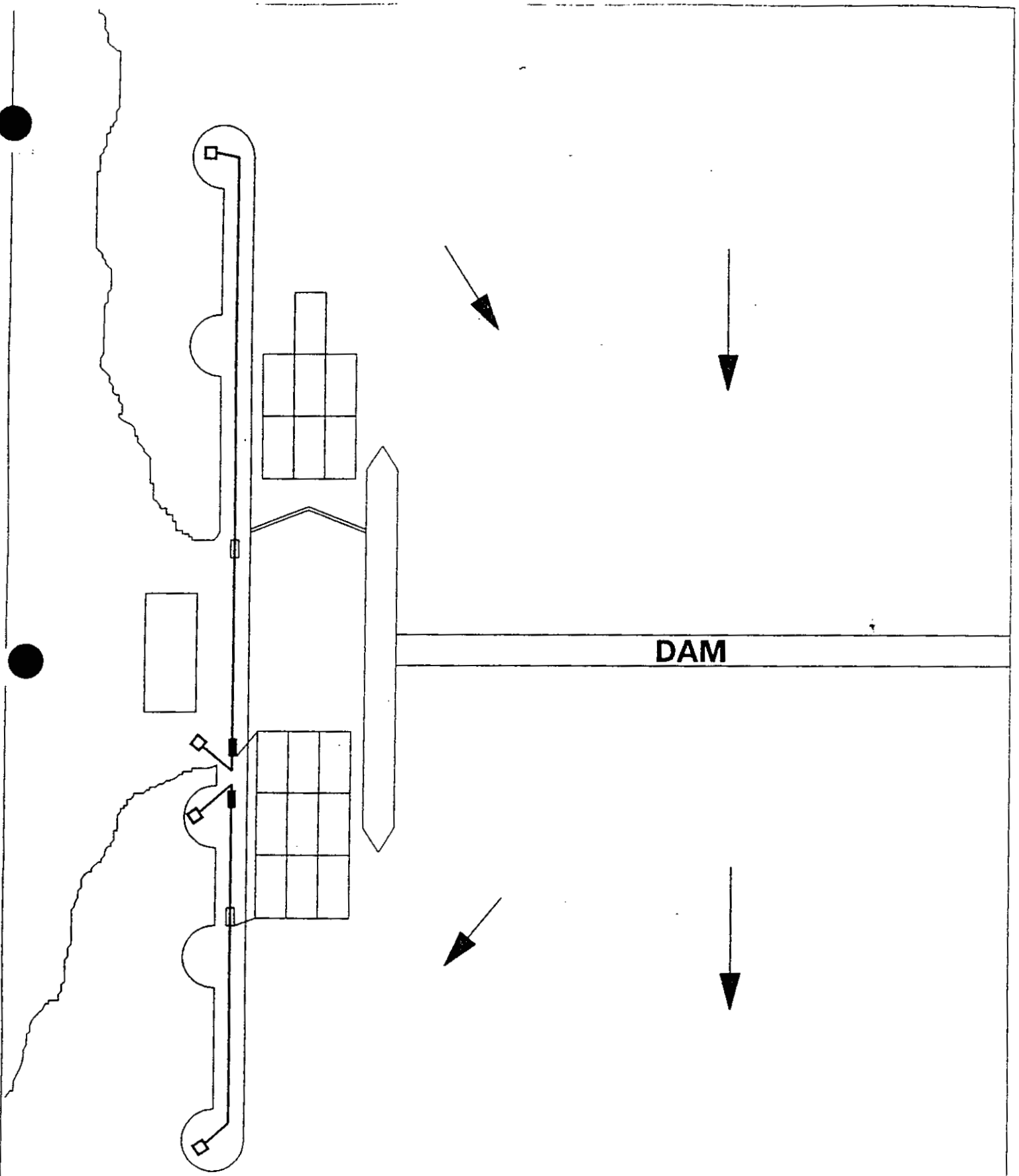


LEGEND

- POWERED KEVEL
- UNPOWERED KEVEL

"12–18"
UPSTREAM – 4

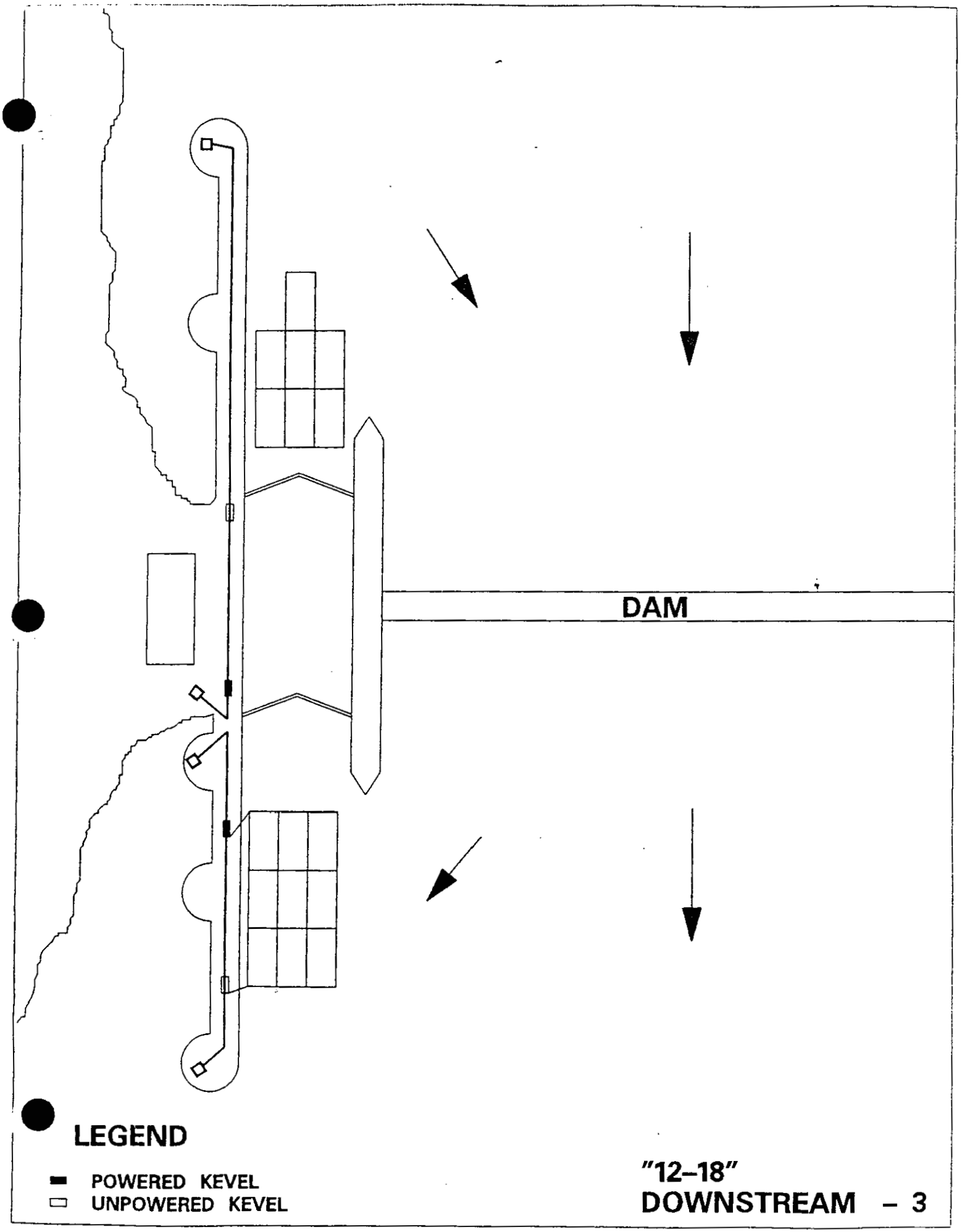

DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"12–18"
DOWNSTREAM – 1

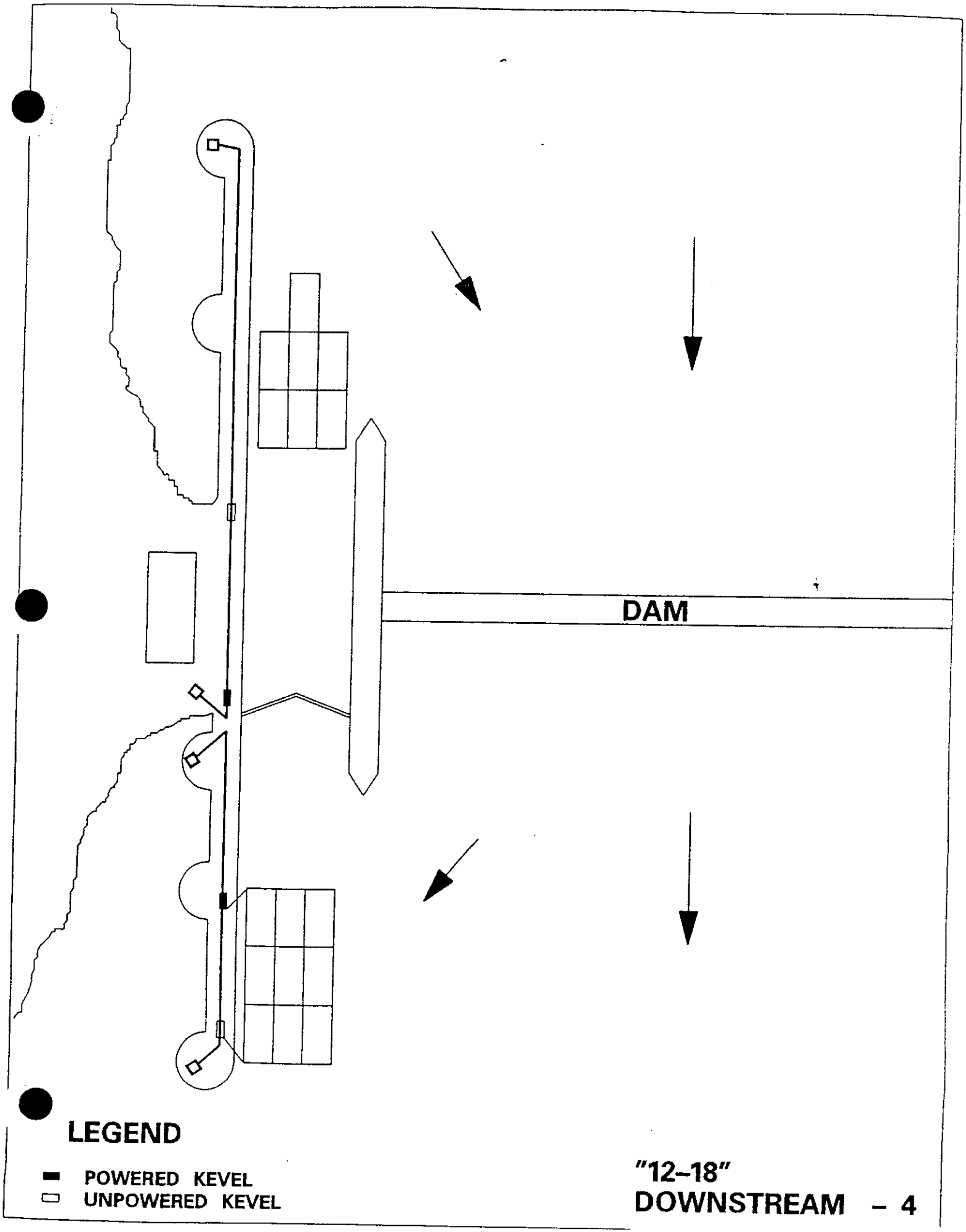


LEGEND

- POWERED KEVEL
- UNPOWERED KEVEL

"12–18"
DOWNSTREAM – 2

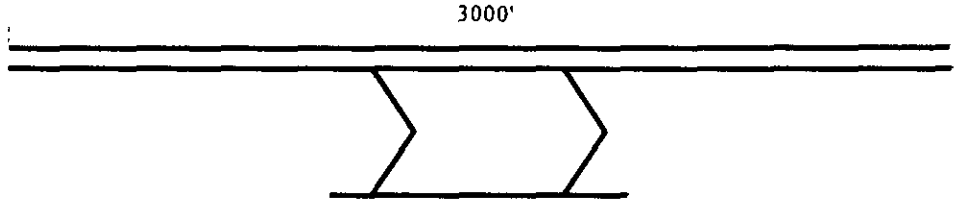

DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"12–18"
DOWNSTREAM – 3



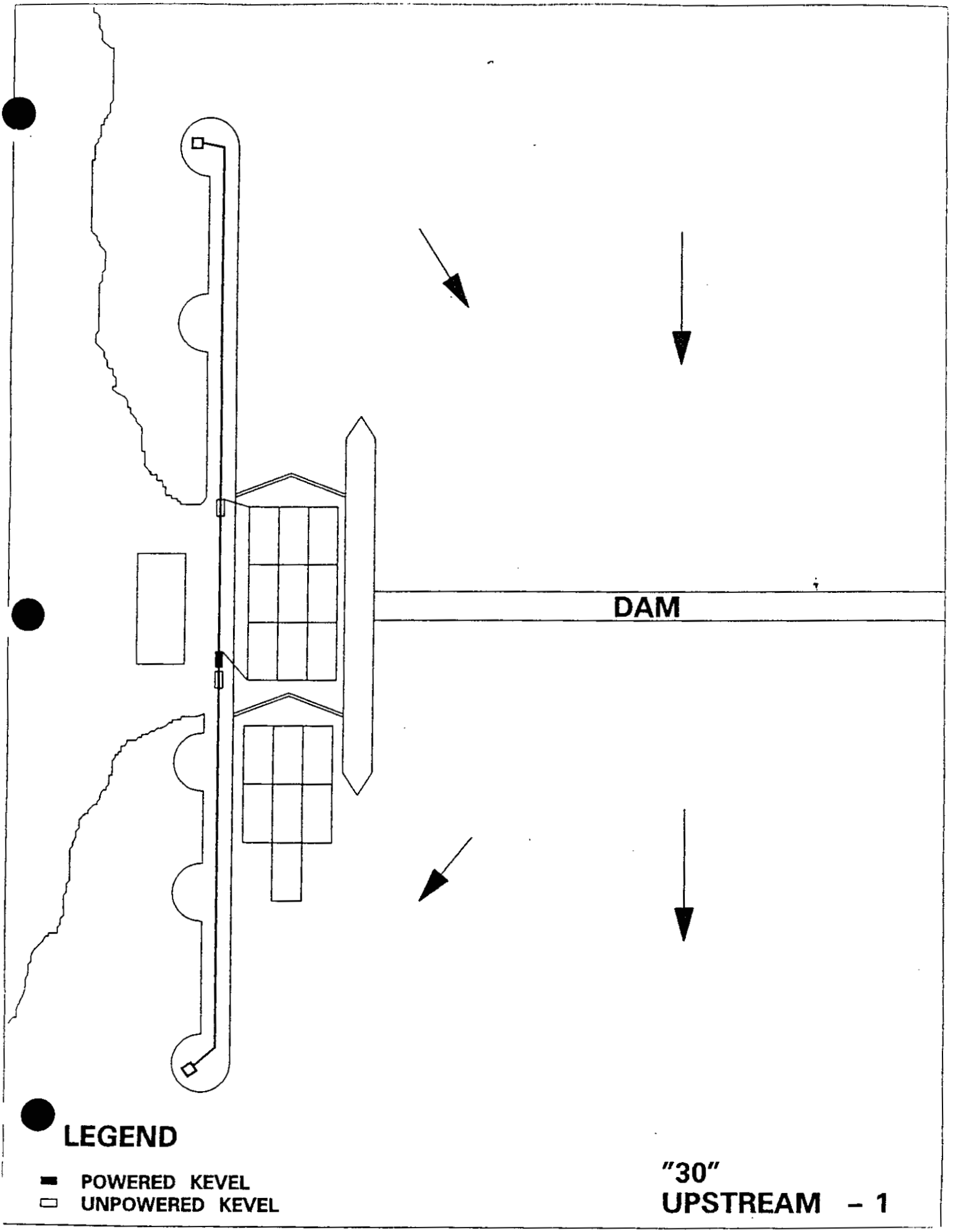
"12–18"
DOWNSTREAM – 4

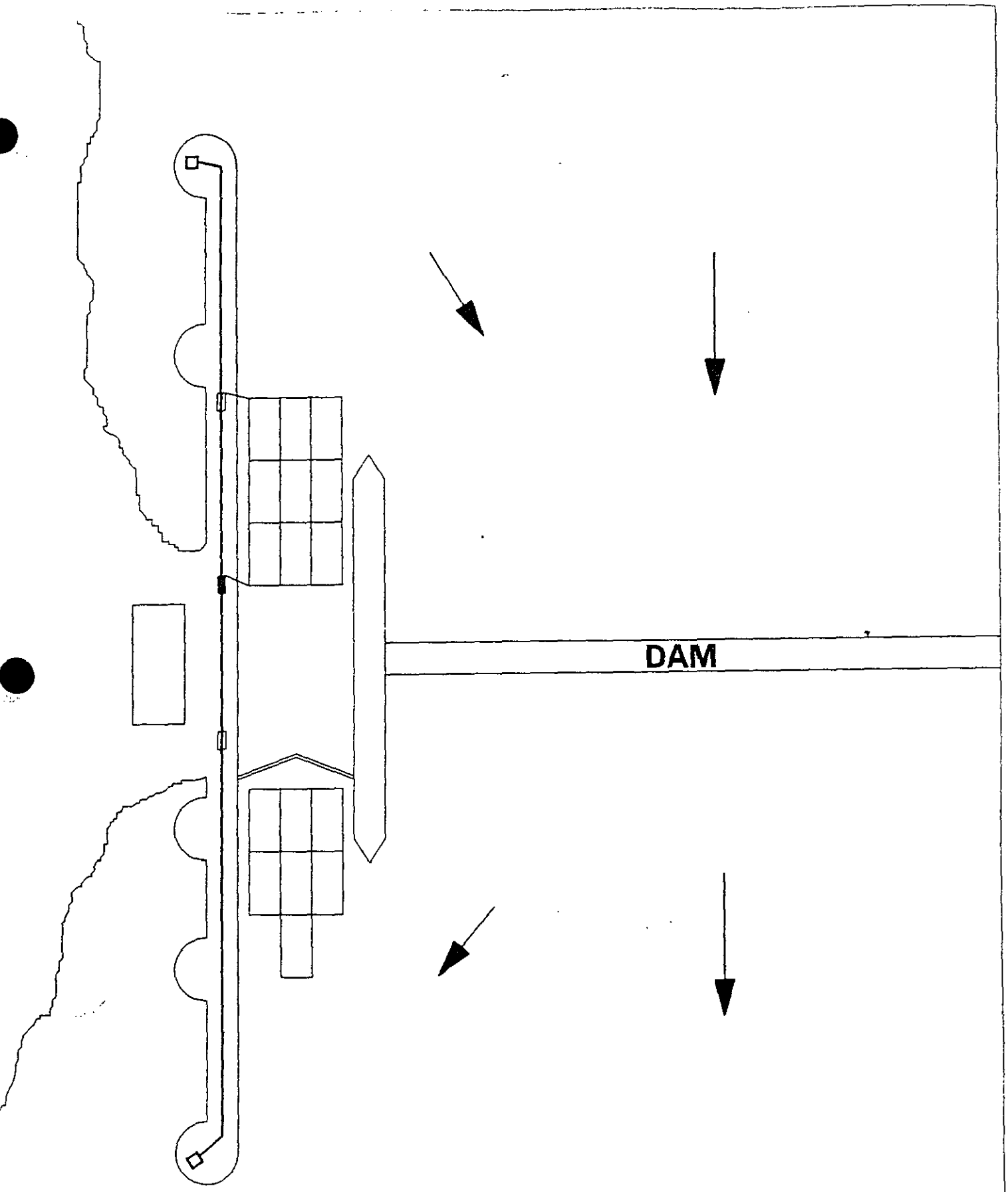
3. Configuration III "30"

In this configuration, two kevels (one unpowered and one powered) travel the entire 3000' length of the chamber and guidewalls combined (one to keep the head checked in and the other to power the cut down the wall).



ADVANTAGES	DISADVANTAGES
Single powered pull in both directions	Crosses both miter gates
	Requires modifications to handrails, buttons, ladders, etc.
	Does not accommodate change in wall elevations
	Would require removal of the existing tow haulage system
	Systerm failure would shut down lock

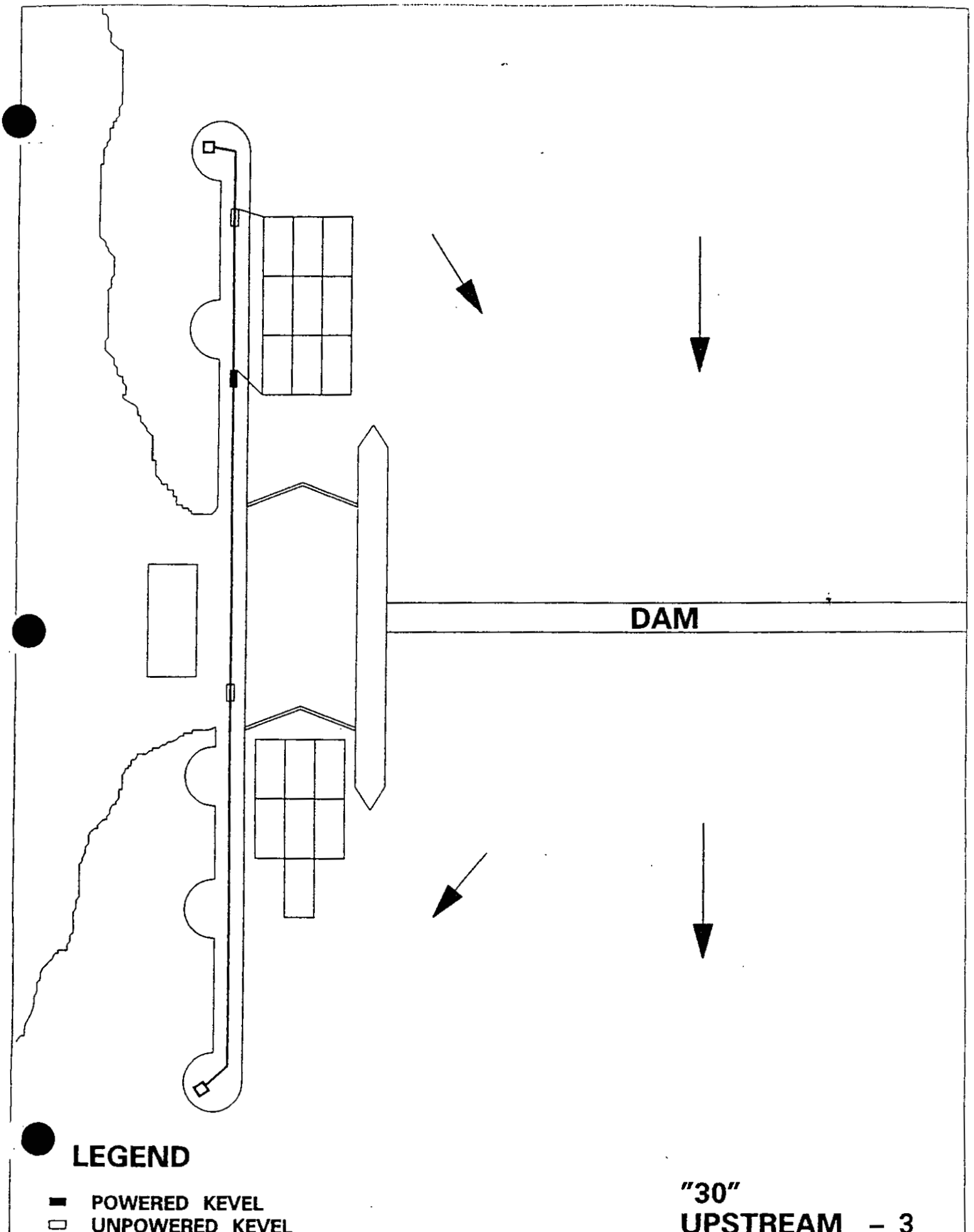

DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"30"
UPSTREAM - 1

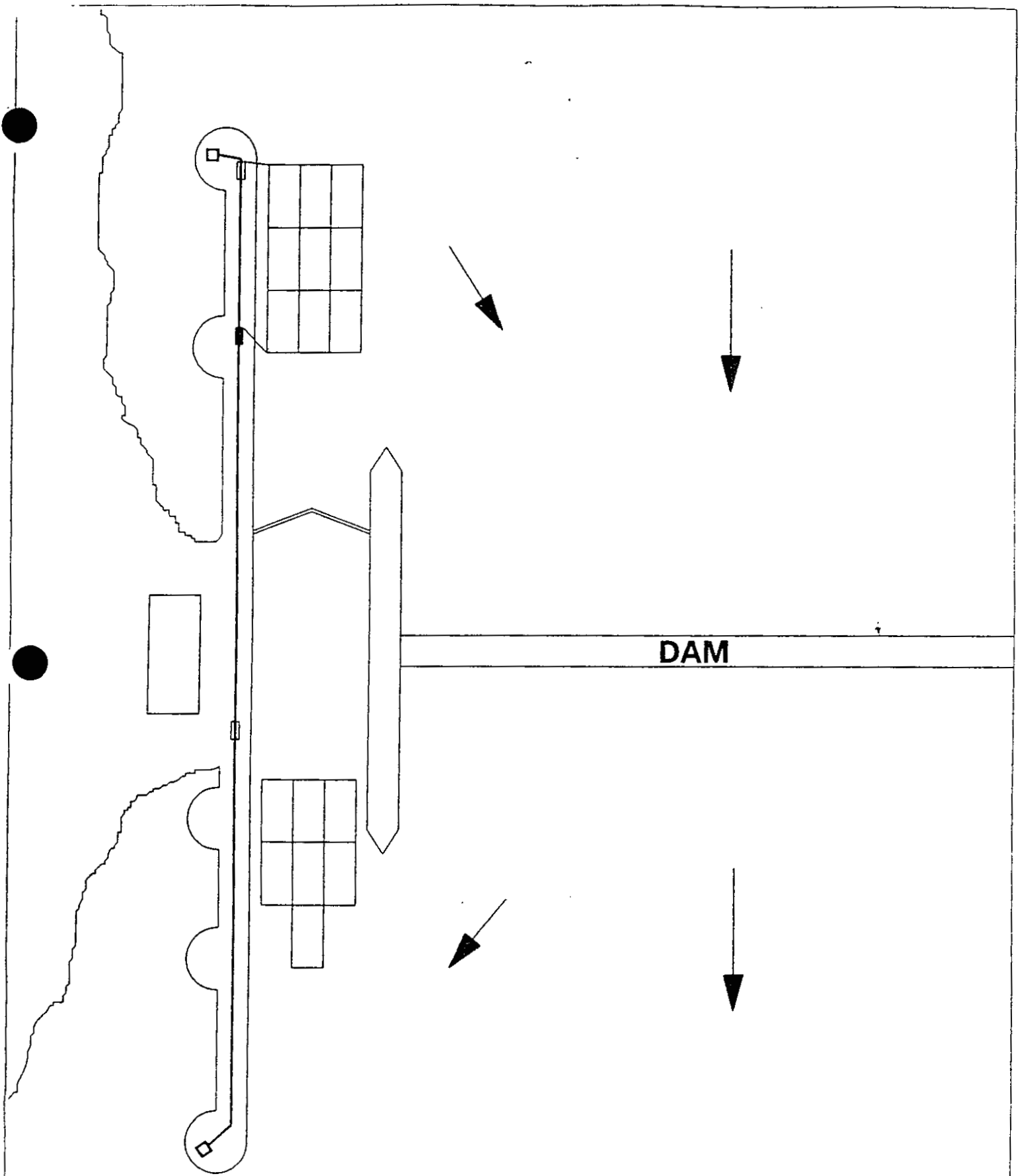


LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

"30"
UPSTREAM – 2

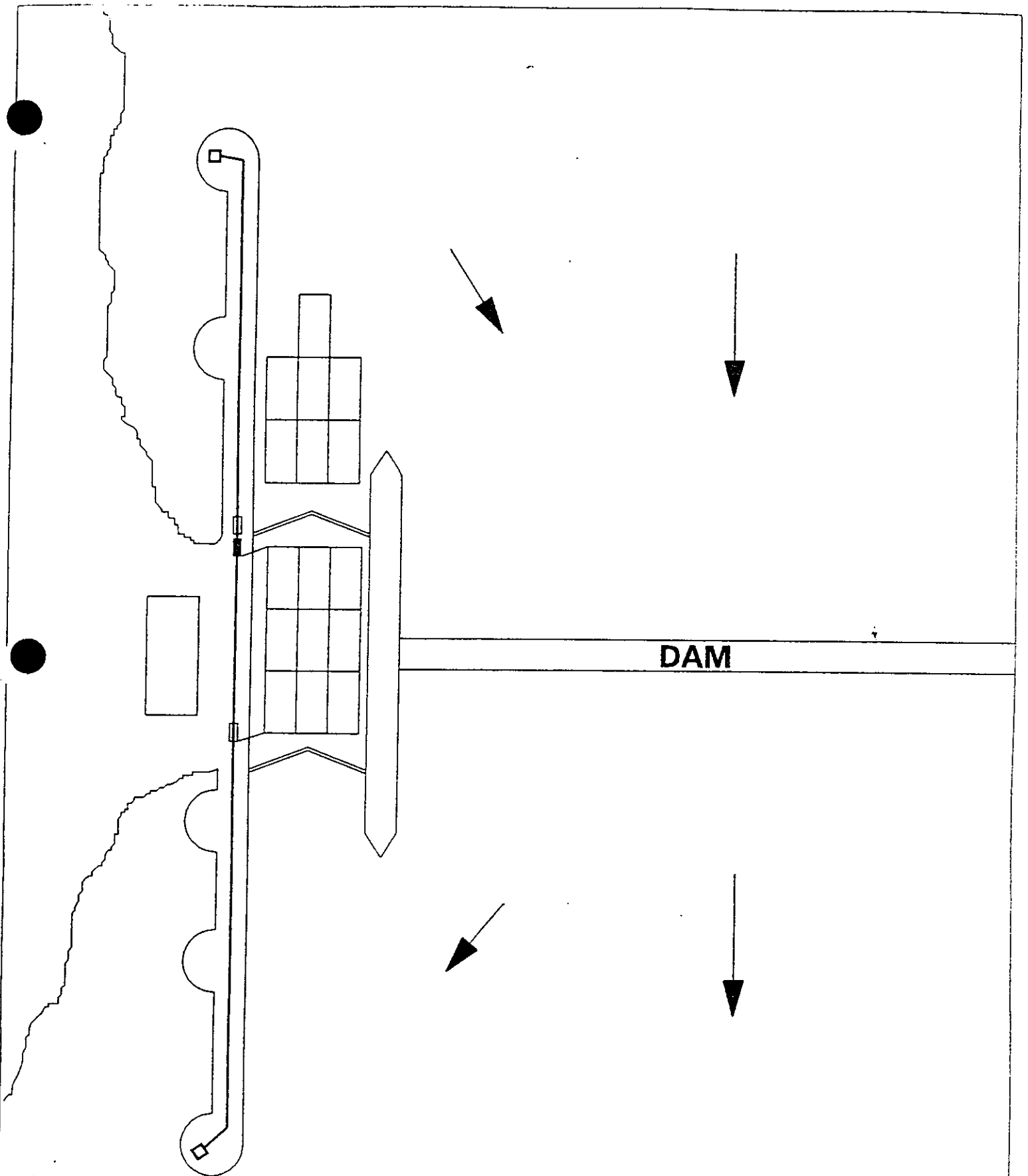

DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"30"
UPSTREAM - 3



LEGEND

- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

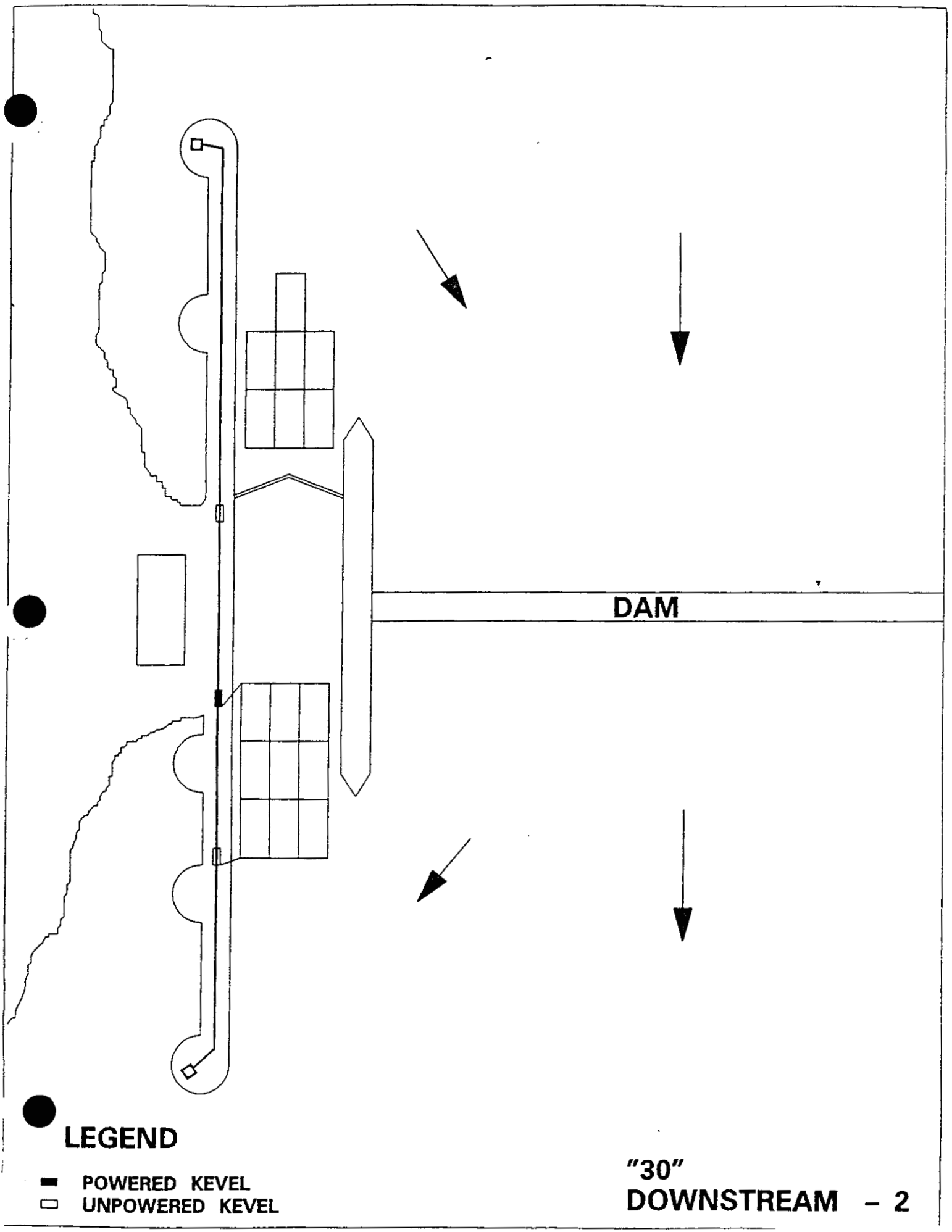
"30"
UPSTREAM – 4

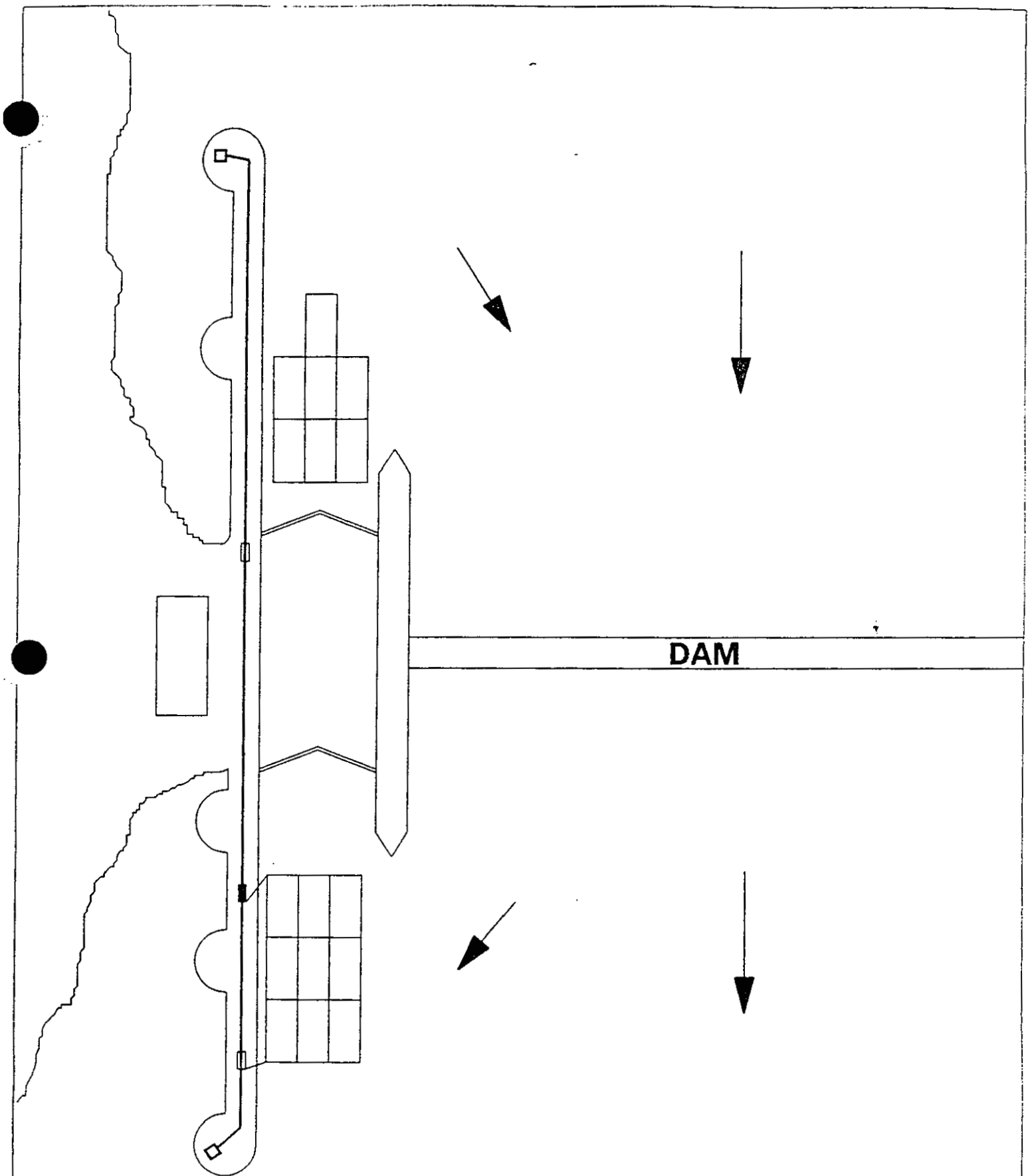


LEGEND

- POWERED KEVEL
- UNPOWERED KEVEL

"30"
DOWNSTREAM – 1

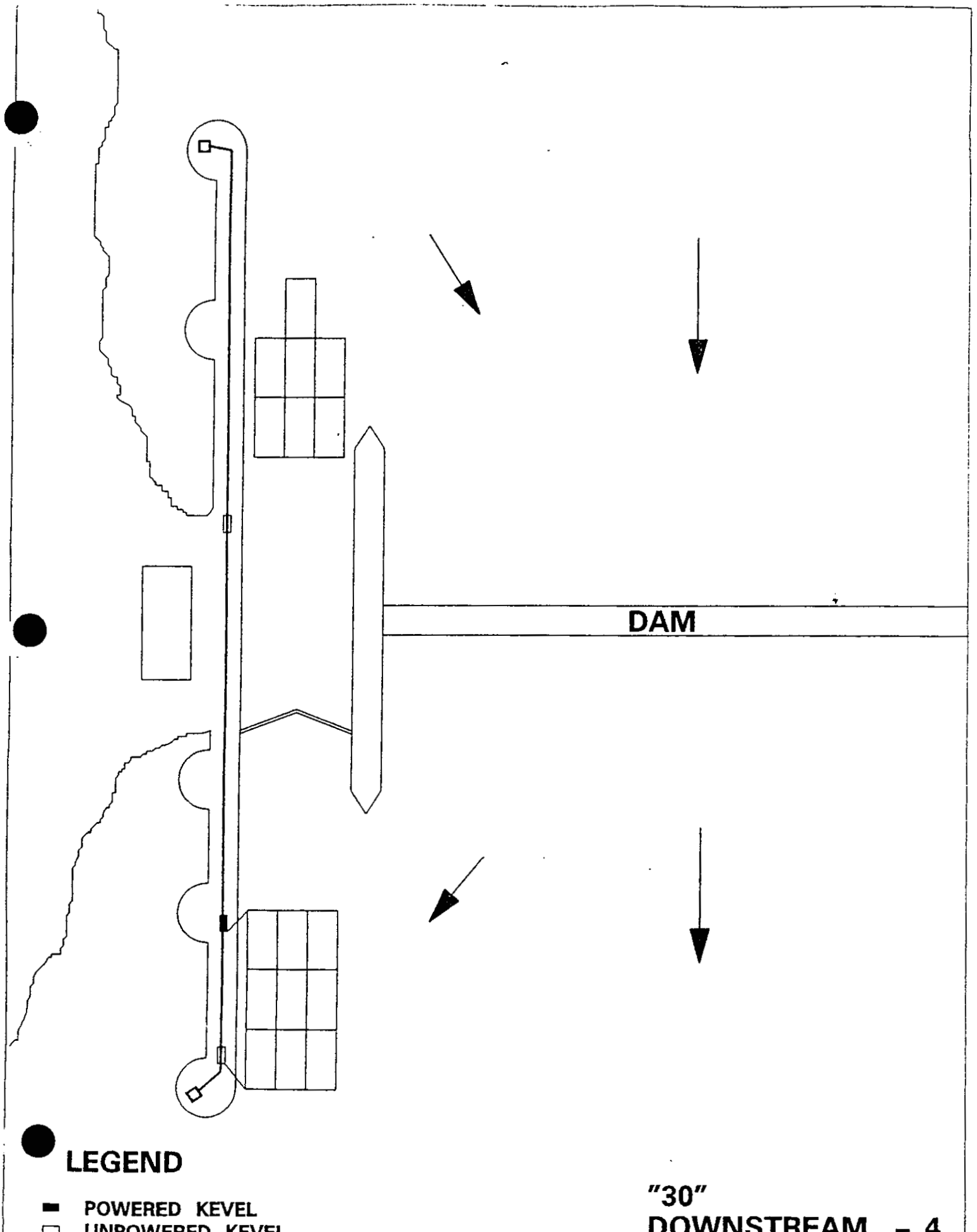

DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"30"
DOWNSTREAM - 2



LEGEND

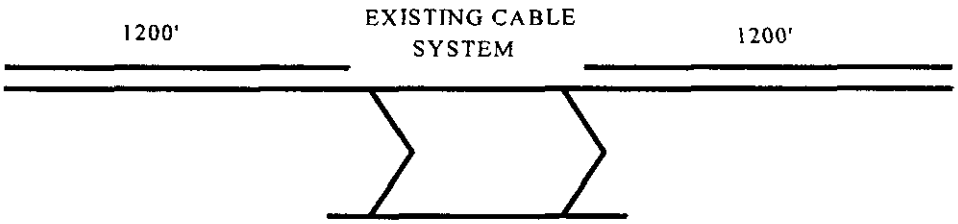
- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

"30"
DOWNSTREAM – 3

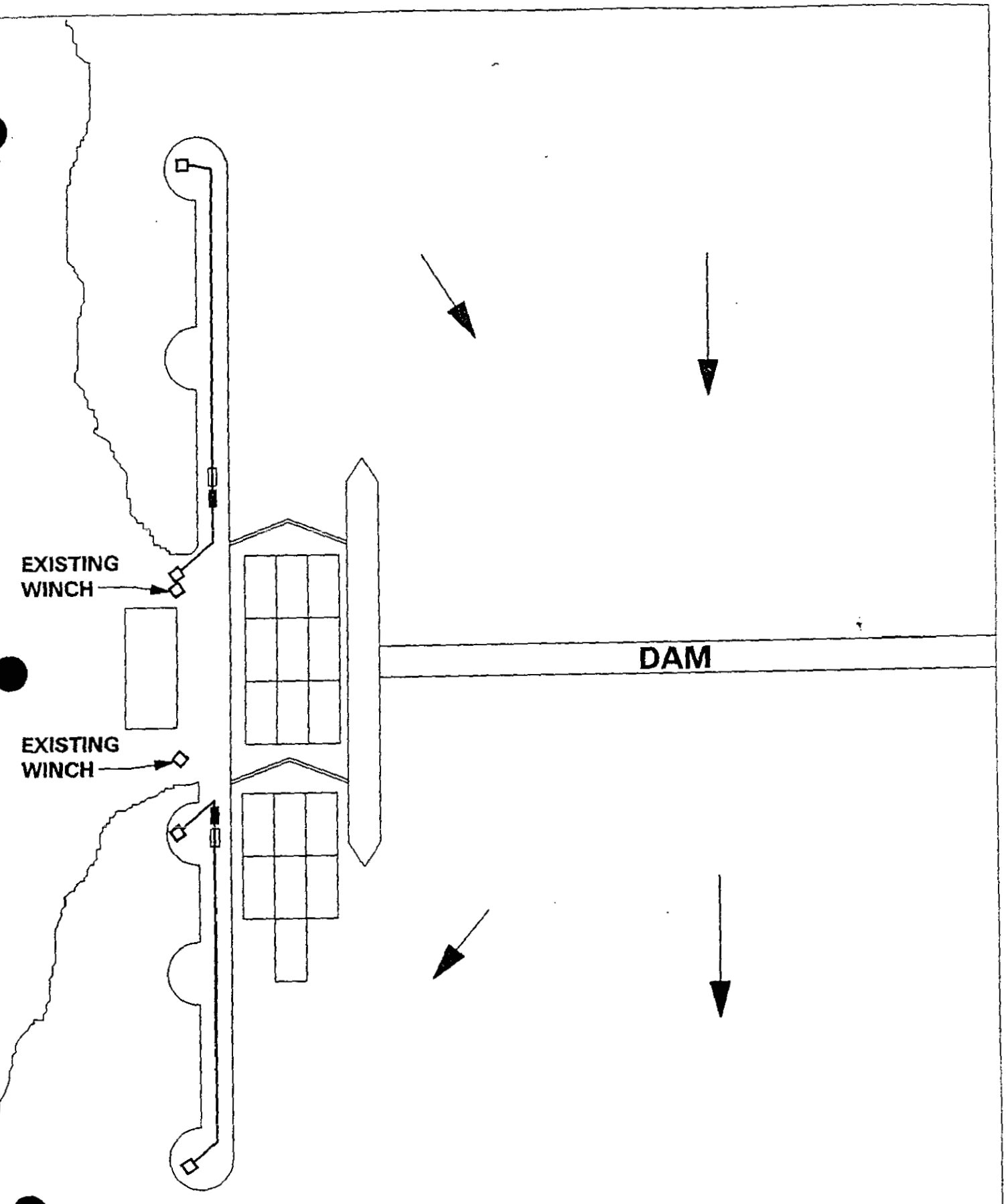

DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"30"
DOWNSTREAM - 4

4. Configuration IV "12-N-12"

In this configuration, two kevels (one unpowered and one powered) travel the downstream guidewall (one to keep the head checked in and the other to power the cut down the wall). The initial pull from the chamber comes from the existing tow haulage winches with their long lengths of cable. Two more kevels travel the upstream guidewall (one to keep the head checked in and the other to power the cut down the wall).



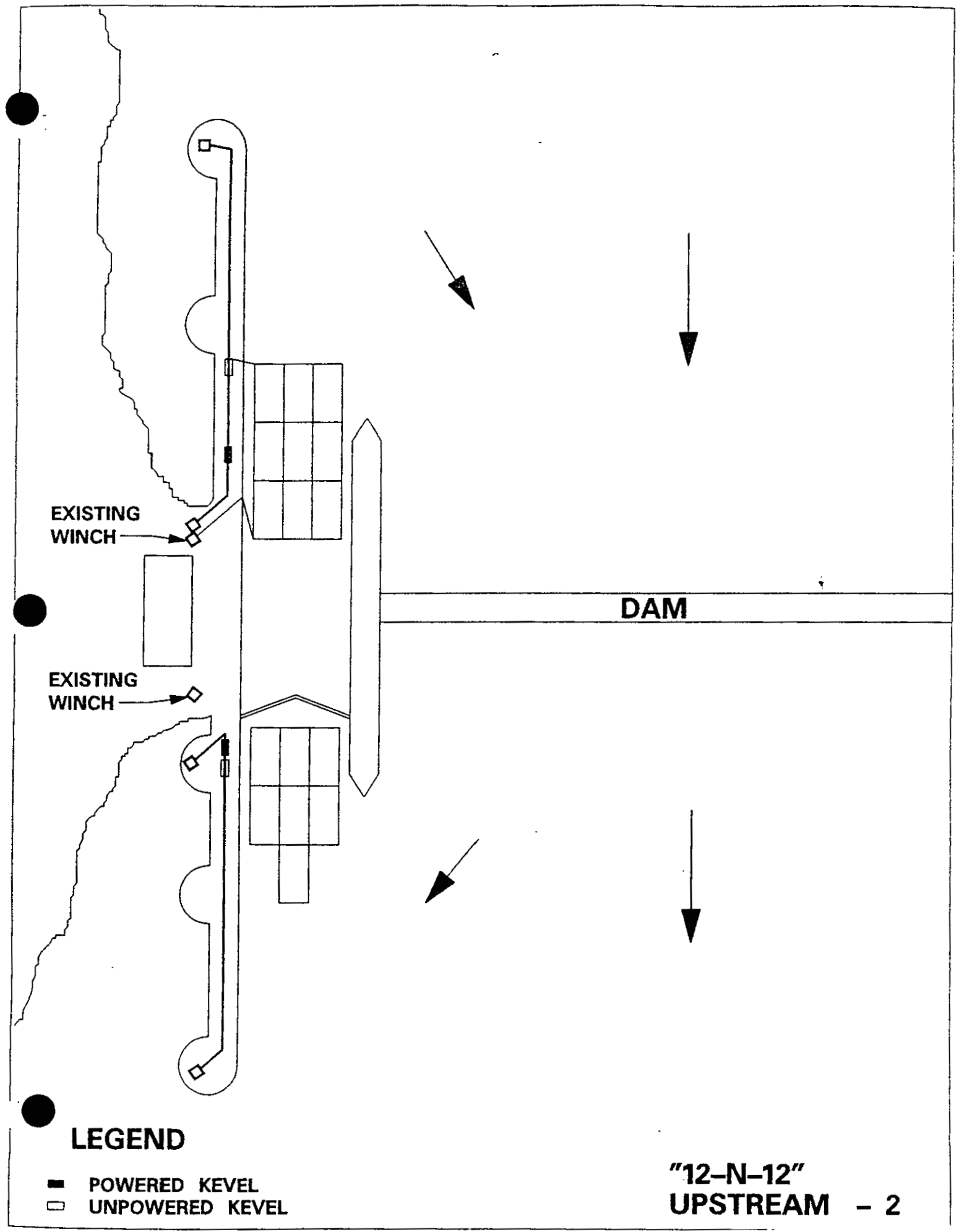
ADVANTAGES	DISADVANTAGES
Does not cross the miter gates	No time savings from existing cable system
No interference with mooring bits	Have to attach twice for power
Accommodates change in wall elevations	Requires lock operations staff to handle old tow haulage system cables for initial pull on unpowered cut in the lock chamber
No modifications required within the lock chamber	
A break down (or shut down for maintenance) of one of the subsystems would not prevent the lockage of a double cut configuration	

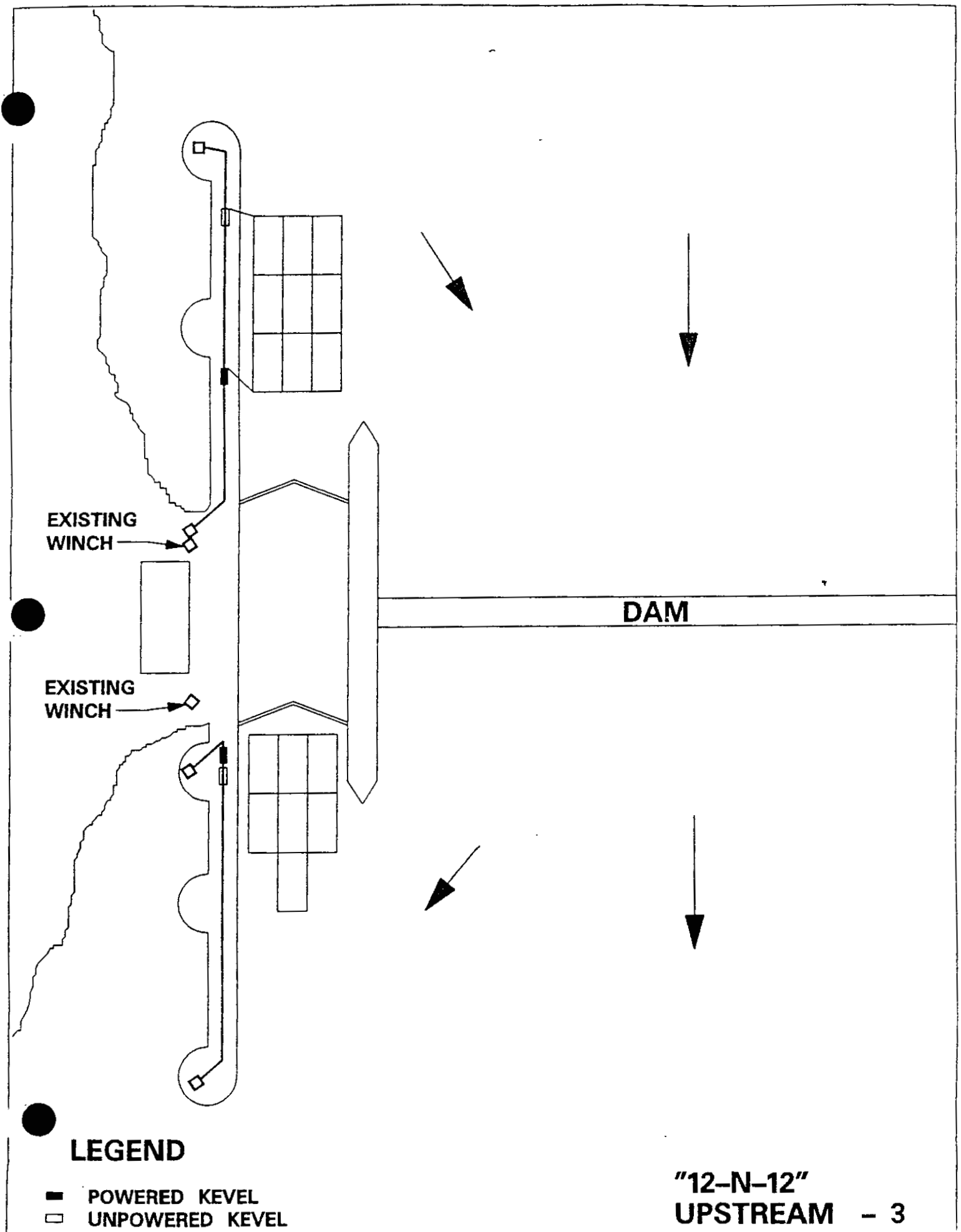


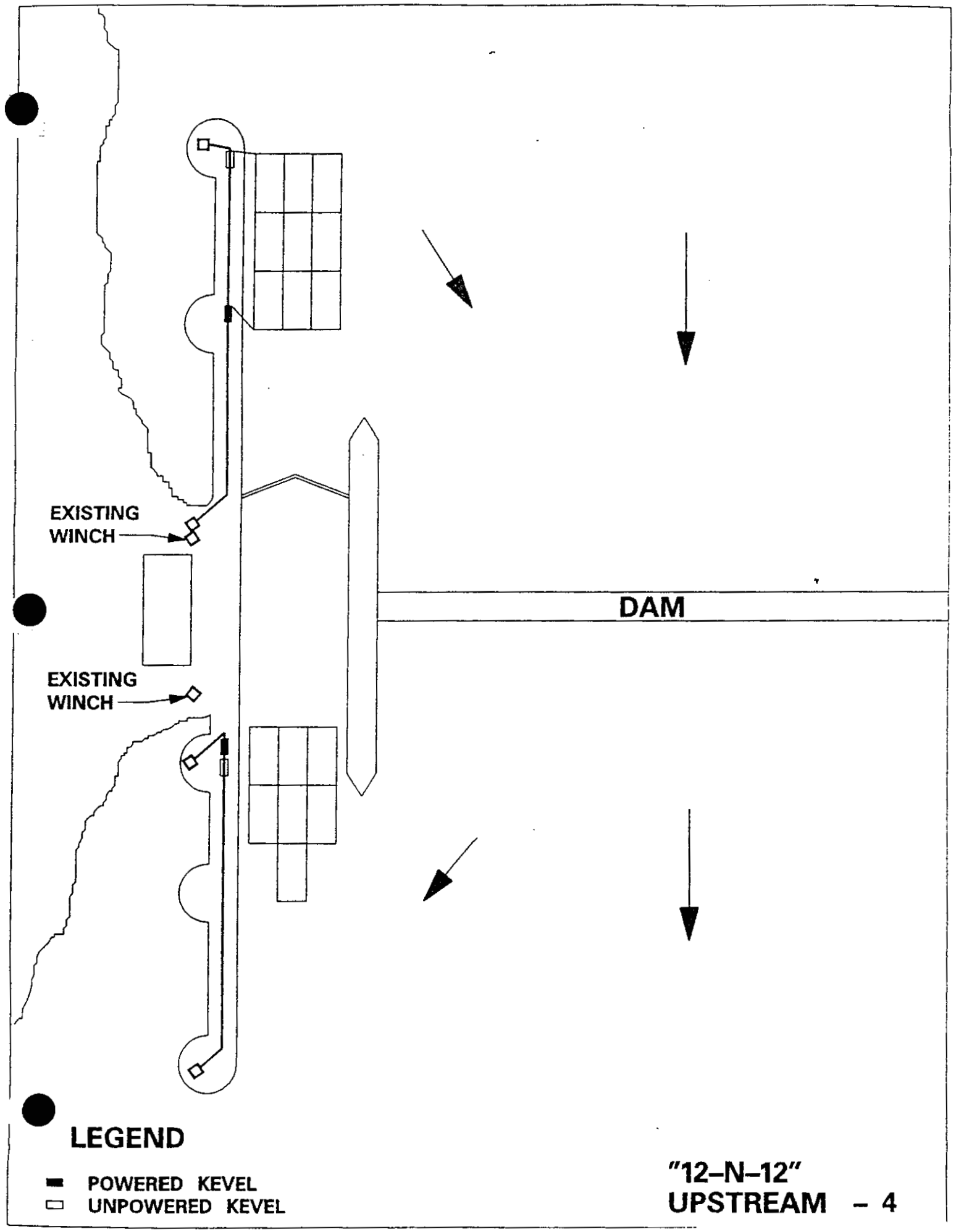
LEGEND

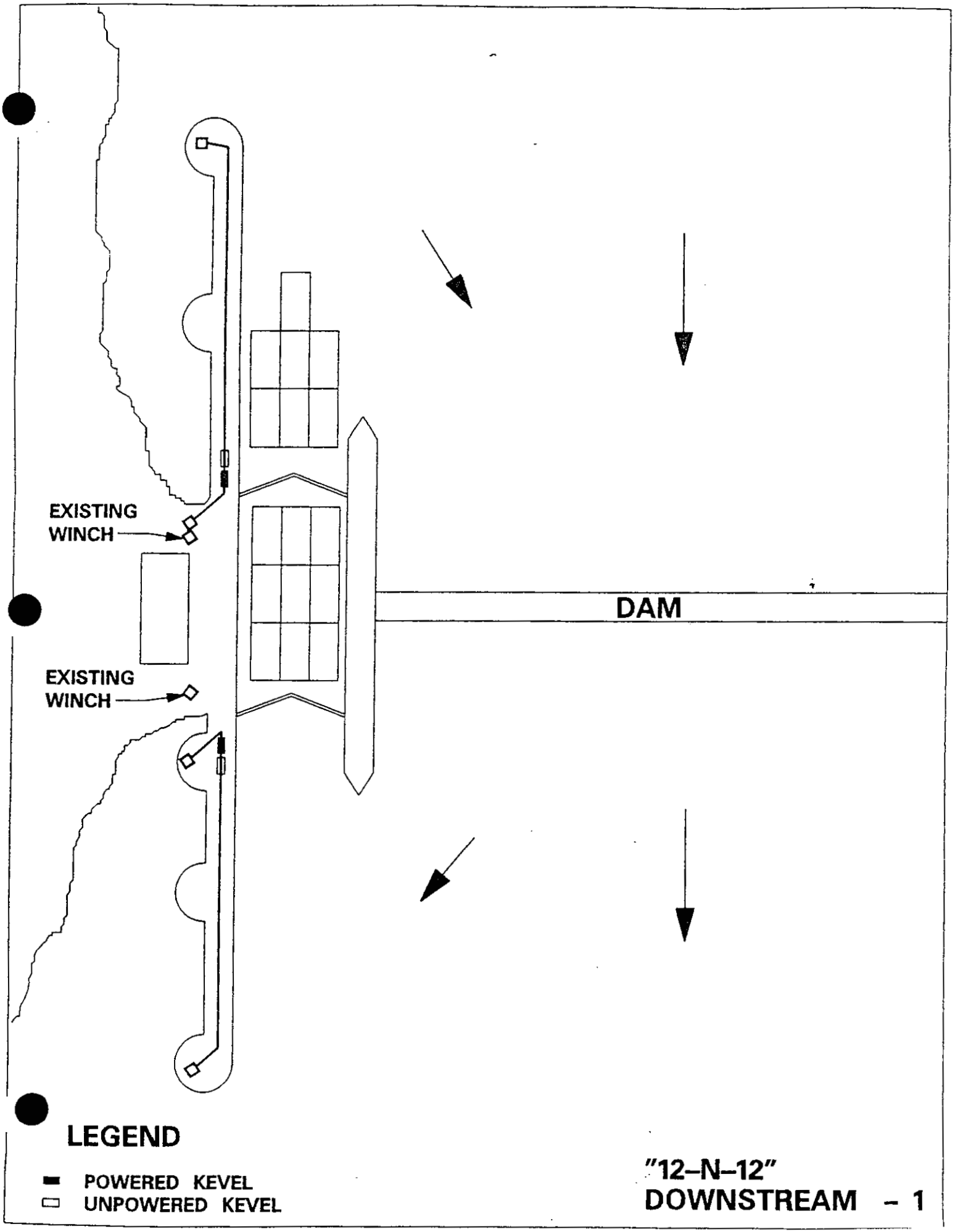
- ▬ POWERED KEVEL
- ▭ UNPOWERED KEVEL

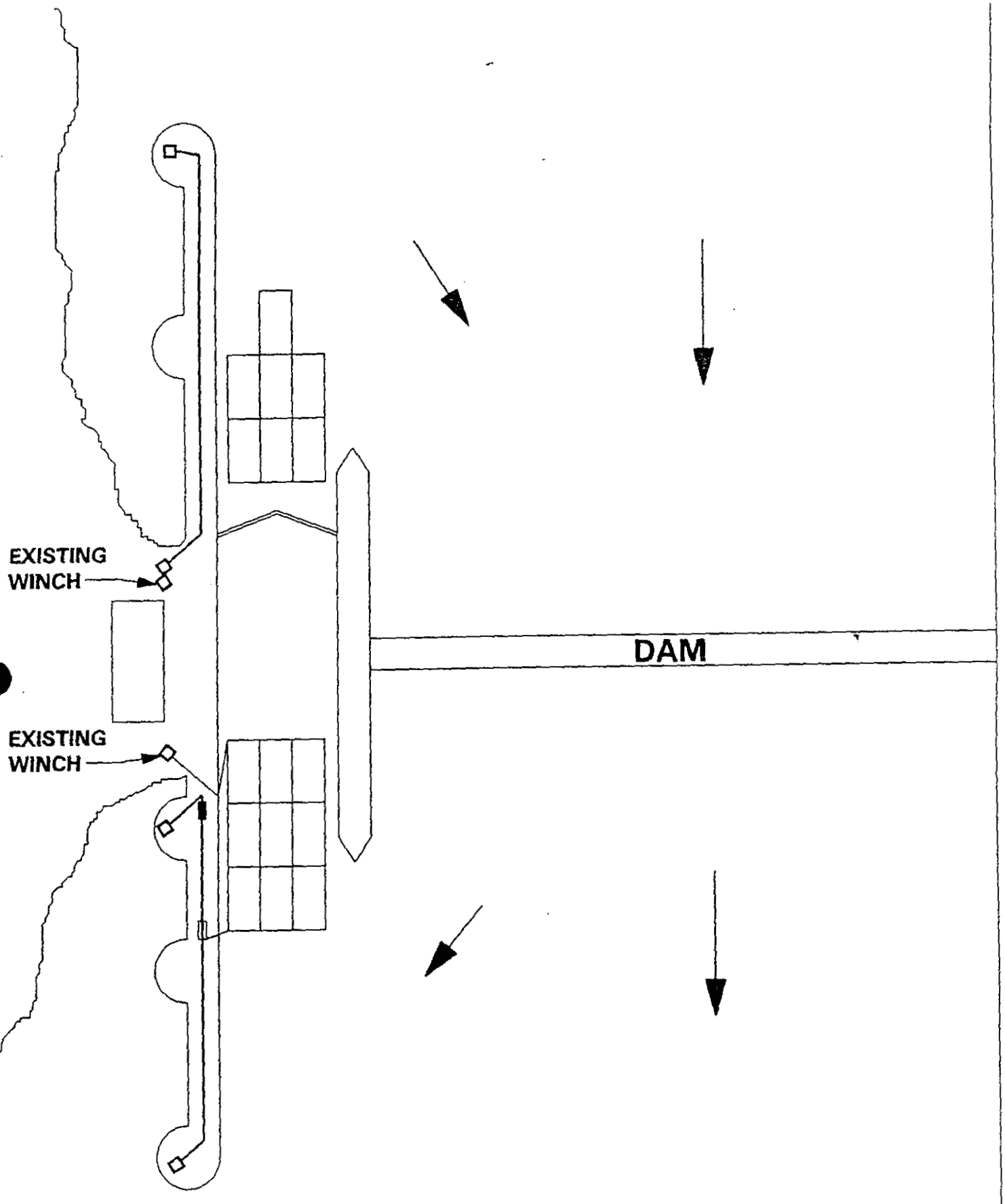
"12-N-12"
UPSTREAM - 1


EXISTING WINCH
EXISTING WINCH
DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"12-N-12"
UPSTREAM - 2


EXISTING WINCH
EXISTING WINCH
DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"12-N-12"
UPSTREAM - 3


EXISTING WINCH
EXISTING WINCH
DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"12–N–12"
UPSTREAM – 4

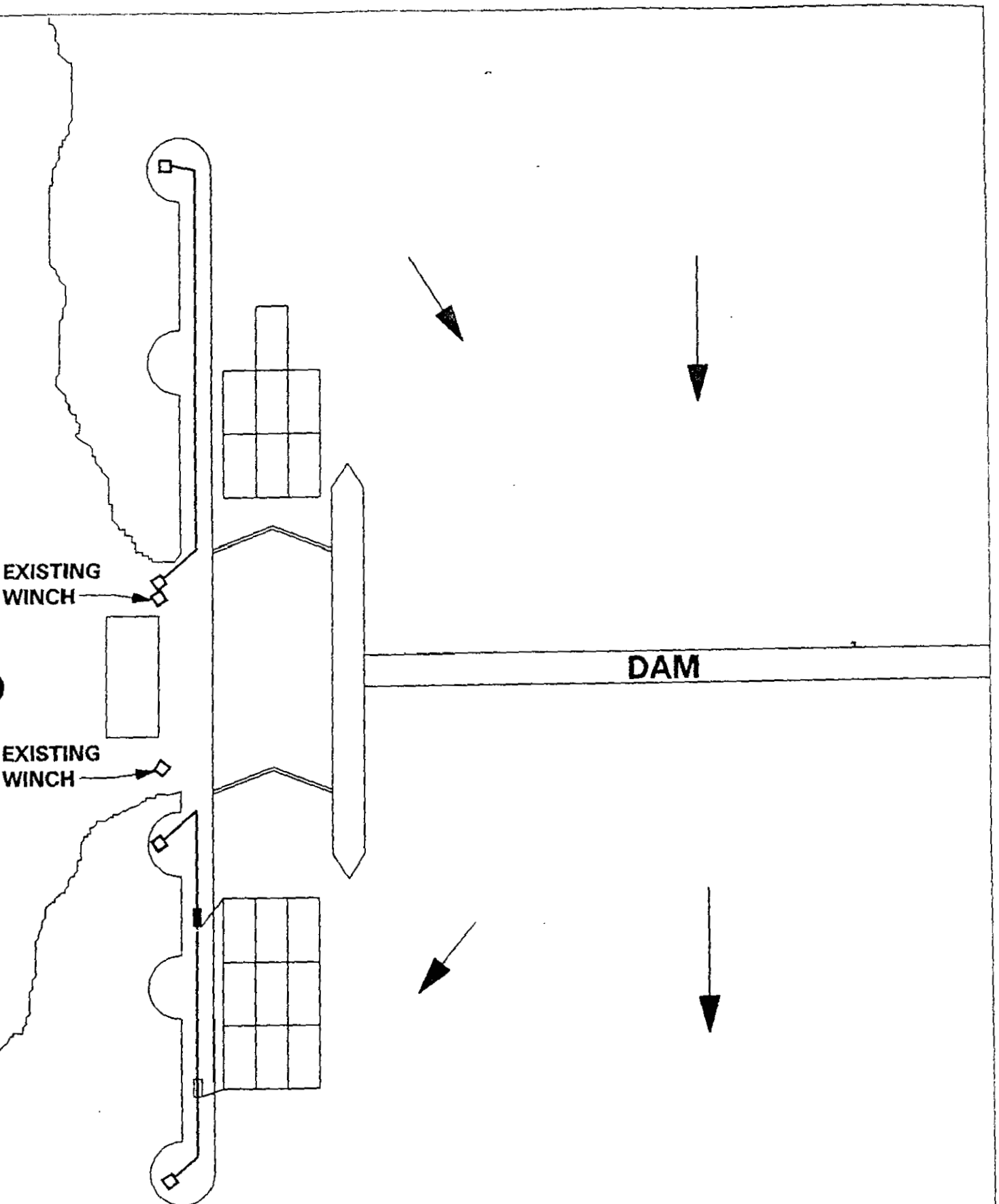

EXISTING WINCH
EXISTING WINCH
DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"12–N–12"
DOWNSTREAM – 1



LEGEND

- POWERED KEVEL
- UNPOWERED KEVEL

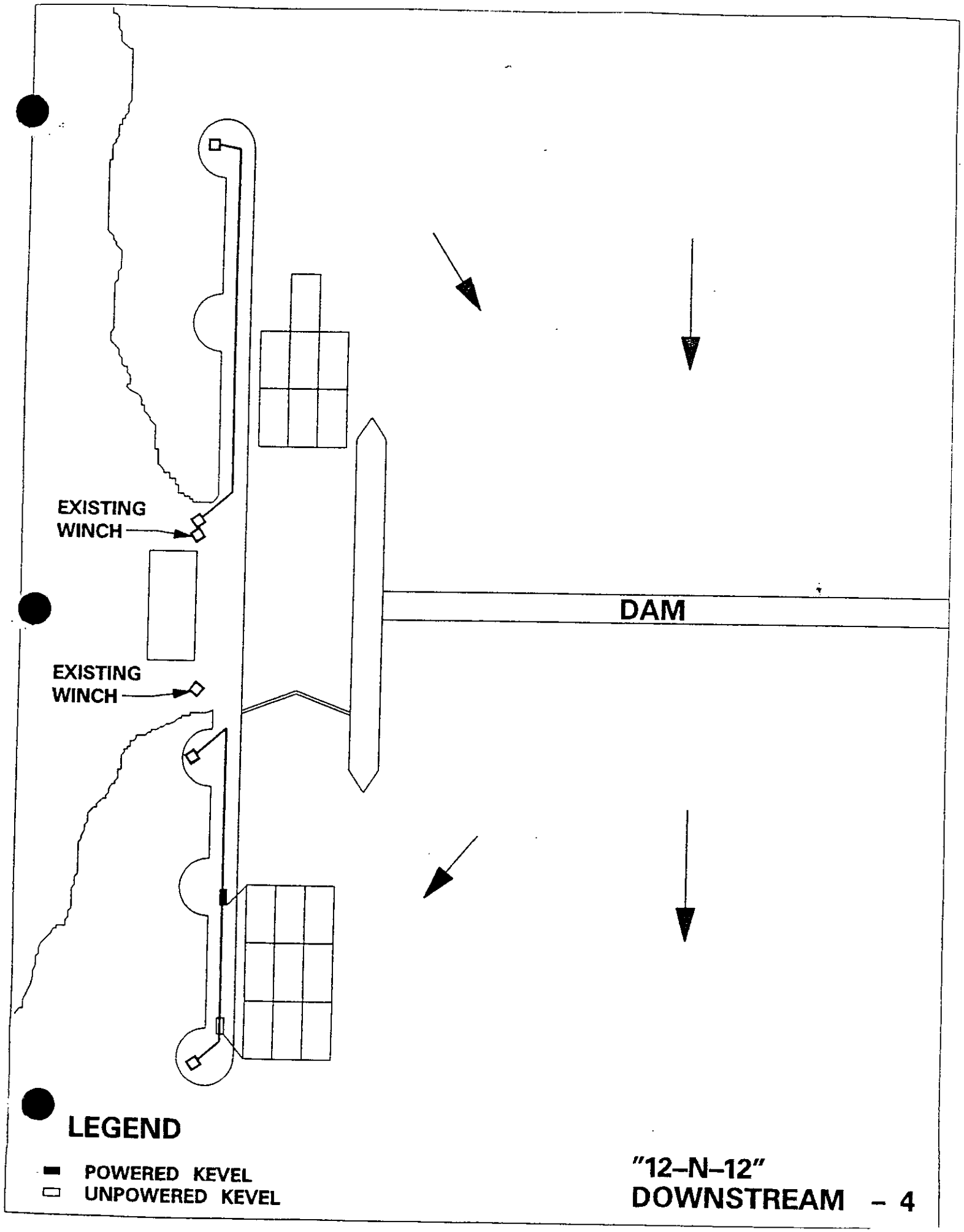
"12–N–12"
DOWNSTREAM – 2



LEGEND

- POWERED KEVEL
- UNPOWERED KEVEL

"12–N–12"
DOWNSTREAM – 3


EXISTING WINCH
EXISTING WINCH
DAM
LEGEND
POWERED KEVEL
UNPOWERED KEVEL
"12–N–12"
DOWNSTREAM – 4

B. POWER UNIT FOR TRAVELING KEVEL

1. Pull/Retard Winch &Cable System

This type of power system utilizes a multiple layer winch on each end of a section of rail. The winches oppose each other to prevent slack cable from occurring in the system. The winches can be used in either direction by swapping the "pull/retard" duties by utilizing a joystick control.

The advantages of this system are that it can use smaller winch drums (because of the multiple layers of wire than can be put on the drum) and a positive slack reduction method which helps prevent backlash, improper winding, excessive wear, and cable breakage. This type of system usually has a display board to assist lock operators by showing the operating speed of the winch. It is a proven, reliable method for power transfer to a traveling kevel (as seen in the Pittsburgh District). The disadvantage of this system is the need to maintain two winches (instead of one).

2. Endless Cable System

The "Endless Cable System" in this context is a single drum system that utilizes double lines. This type of system, as seen at Pickwick Locks, uses a single wrap on the drum which takes up from one end while it pays out on the other end. This system requires a tension device to keep slack out of the cable when it is under a load.

The advantage of this system is the need to use only one winch for an entire length of rail. The disadvantage is the size of that winch; the 1000' of traveling kevel rail at Pickwick Locks required an 8' diameter winch (because the cable can only have one layer on the drum). The size of the drum may obstruct views if it cannot be recessed (as it was at the Pickwick Lock).

The endless cable system also requires additional space for the cable to be returned to the

winch. Unless the cable feed and return configuration (horizontal or vertical) can be recessed into the lock/guidewalls, it will take up additional space along the top of the walls. This will present a problem at many of the sites within the study area.

3. Traction Power

This type of motive force would require the kevel to have its own power unit attached. It could pull the unpowered cut by using rubber tires to drive the kevel along the rail. The advantage of this system is the elimination of long cable runs, cable tension problems, and cable maintenance. The disadvantages include the fact that this is an unproven application for this type of technology, the need for guidewall space for the tires (rubber or steel) to grip the concrete, the weight requirements to provide traction friction, and the remote control mechanism that could be required to operate the device.

4. Cog Rail System

This system would consist of a kevel with its own power unit attached. The power would pull the unpowered cut along a notched rail by using cogs to transfer the load to the rail and guidewall. The advantage of this system is that it does not require a traction force like the tire system. The disadvantages include the expense of a special cogged rail, the redesign of the kevel for use on the new rail, and that it is an unproven application of this technology.

Section V

SECTION V

STRUCTURAL PARAMETERS

The magnitude of all loads transferred from the proposed tow haulage systems onto existing and future lock wall monoliths, via the line pull, is a major area of concern. The magnitude of the tow haulage loads acting on the lock wall monoliths will be evaluated in determining the adequacy of monolith pile foundations, whether existing or new. The different types of forces that contribute to the total lateral/longitudinal loads imparted to the lock wall monoliths by the tow haulage systems are discussed below.

A. STRUCTURAL LOAD CRITERIA

1. WIND LOADS ACTING ON EXPOSED BARGE SURFACES

Wind loads will be evaluated from all directions, acting on exposed barge surfaces. Loads from opposite directions will not be applied concurrently, but will be evaluated to determine the governing condition. It is assumed that for wind speeds in excess of the Beaufort scale of 8, the tow haulage system will not be in operation. Wind speed classified on a Beaufort scale of 8 represents a gale, defined as a velocity of 40 knots or 46 miles per hour. Therefore, the design wind speed has been set as 46 mph. Barges in both unloaded and loaded conditions will be evaluated to determine the governing condition. Design wind forces acting on the barge tow will equal the following:

$$F = \text{force} = (0.0034) * \{V(w)\}^2 * (A)$$

where $V(w)$ = design wind speed in knots

A = exposed area of the barge

Barge depth parameters used for the calculation of structural forces are a 15'-0" hull with a 4'-0" height of cargo. Depth of water displacement has been set at 12'-0" for a loaded barge, and 3'-0" for an unloaded barge. The 12'-0" water displacement depth for a loaded barge, which is 3'-0" greater than the 9'-0" "draft" generally required as a navigation standard, has been chosen to allow for barge overload conditions when higher water permits. A typical barge size of 35'-0" x 195'-0" will also be used in the calculations. Calculations determining wind loads are provided in Appendix III.

2. RIVER CURRENT FORCES ACTING ON WETTED SURFACES OF BARGES

The force of the current acting on the wetted surfaces of the barges can be divided into two types: dynamic and frictional. As current forces are dependent upon the wetted surface area of the barge tow, barges in both their unloaded and loaded conditions will be evaluated to determine the governing condition. The same barge as identified for wind load will be used for current force evaluation. Maximum current speed will be set at one knot (101.2 feet per minute), which approximates the maximum operation speed of the tow haulage system of 100 feet per minute. For determining the dynamic current force, the following equation shall be used:

$$P(\text{dynamic}) = \{A(h)\} \times 2.86 \times \{V(c)\}^2$$

where A(h) = Area of submerged hull (projected underwater area)

V(c) = Current speed in knots (use 1 knot)

For determining the frictional current force, the following equation shall be used:

$$P(\text{frictional}) = A(f) \times K \times \{V(c)\}^2$$

where A(p) = Wetted perimeter area

K = Constant, use 0.01 shape factor

V(c) = Current speed in knots (use 1 knot)

The two types of current forces shall be considered to act simultaneously. Current forces will be developed for both the unloaded and loaded conditions. Calculations determining the dynamic and frictional current forces are also provided in Appendix III.

3. FRICTIONAL LOADS DUE TO BARGE CONTACT WITH LOCK STRUCTURE

Due to loads acting normal to the longitudinal axis of the barge tow, the tow could come into contact with the existing lockwalls and guidewalls during tow haulage operations. If the barge tow comes into contact with the walls, an additional frictional or "drag" load will have to be overcome by the tow haulage system. A frictional coefficient of c = 0.25 will be used in the calculations.

B. STRUCTURAL LOAD DEVELOPMENT

Forces due to environmental (wind, current) and mechanical (berthing, racking) conditions were not evaluated unless imposed by the tow haulage system line pull. It was assumed that the existing lock wall monoliths were designed for forces in excess of or not applied from the tow haulage equipment. The tow haulage system line pull due to the forces previously noted were determined at various cable angles (both horizontal and vertical) to the existing lock structure. Wind and current loads were developed for these various angles to determine the worst case tow haulage loading condition on the lock structure. For outdraft conditions, where the barge tow is being pulled away from the lock structure by current forces, loads were also investigated based upon two hold-down points.

C. DISCUSSION OF RESULTS

A summary of the results of the load calculations is provided in tabular form with the calculations in Appendix III. It should be noted that resultant line pull loads due to current outdraft conditions are high. These resultant loads would be far in excess of the system's capacity. The

capacity of the system was based upon the capacity of the winches used in the pull-retard arrangement, with an operational capacity of 25,000# established for the winches. Outdraft loads in excess of this capacity would theoretically cause the system to fail. When conditions are such that the operational capacity of the winches may be exceeded, a safety mechanism should be built into the system (i.e. "weak link" discussed in Section VI of this report) to minimize the potential damages from a line break.

It should be noted that a broad range of cable angles were investigated, for both the horizontal and vertical planes, to determine the applicable loads. Operational conditions may dictate that a smaller range of angles would meet the towing industry requirements. By reducing the range of angles, the load ranges are thus reduced. Hence, the load capacity requirement of the tow haulage equipment (and subsequent sizes) could also be reflected within a smaller range.

Section VI

SECTION VI

STRUCTURAL MODIFICATION ISSUES

Evaluation of the feasibility of the two improved tow haulage system alternatives for use at Lock and Dams No. 20 thru 22, 24 and 25 on the Mississippi River and the LaGrange Lock and Dam on the Illinois Waterway depends upon many factors or concerns. This section of the report addresses various structural modification issues related to the implementation of the two selected tow haulage configurations in the study area.

A. GENERAL

The structural modification issues discussed in this section are depicted in detail on drawing Plate No. 1 through 10. The plates detail proposed locations of new traveling kevel rails at Lock and Dam No. 24 on the Mississippi River, and the LaGrange Lock and Dam on the Illinois Waterway. The plates also depict what modifications will be required as a direct result of the installation of these new sections of kevel rail and tow haulage units. It is assumed in this report that a minimum of 1200 linear feet of tow haulage rail is available along both the upper and lower guidewalls outside of the main lock chamber. This would require new upper and lower guidewall extensions at all lock and dam sites within the study area.

B. INSTALLATION OF THE NEW KEVEL RAIL

For the 12-6-12 option, a kevel rail will have to be provided along the entire length of both the upper and lower guidewalls, as well as within the main lock chamber between the miter gates. With the extended guidewalls, as previously noted, it was assumed that there would be 1200 linear feet of haulage capabilities from the face of the sill near the miter gates to the end of the kevel rail. The guidewall extension lengths are approximately 700 linear feet for both Lock and Dam No. 24 and the LaGrange Lock and Dam. For the 12-N-12 option, the only difference when compared to the 12-6-12 option is that new lengths of kevel rail are not provided within the main lock chamber.

It is assumed for this report that 140# rail will be used for all new lengths of kevel rail to be installed. Anchorage detailing shown on Plate No. 7 and 8 is for concept only, and should be verified or modified during final design for the actual haulage loads developed by the new system. In the final design of the new kevel rail anchorage system, the anchorage assembly should be designed to resist the maximum line loads that may be transferred into the kevel rail (based upon the line capacity), without consideration of any weak link being built into the system. Concerning the tow haulage system's weak link, a safety mechanism should be designed within the kevel unit itself (i.e. shear bolts/ pins, fuse links) based upon the capacity of the system's winches. Once the tension in the cable approaches the capacity of the rail anchorage the control link will cause the kevel to dump the haul line to the tow. The mechanism is designed in such a manner that the load in the line is first released and then the line is dumped. This two step release should avoid the problems of line whiplash normally associated with line breakage. The conditions that activate this release are those of high outdraft loadings. When such operating conditions exist, the deckhands should be required to tend a safety line that is secured to a fixed kevel, mooring post or line hook. If the kevel rail and its anchorage assembly were allowed to fail, the resulting "down" time experienced at the lock would be significant and would cause major problems within the barge hauling industry. If the cable lines themselves were considered the weak link, the safety of deck hands and operating personnel could be compromised. Building the weak link into the kevel unit itself protects the safety of all operating personnel, and also minimizes potential down time if there was a system overload.

The safety of the haulage unit itself is based on designing all elements around the stall load on the winch drives. On this basis all loads on equipment will be at safe working levels when the winch reaches its stall torque. Higher loads caused by forces acting on the barges will cause the winch to unwind.

The requirements for kevel rail installation at Lock and Dam No. 24 and the LaGrange Lock and Dam are detailed on Plate No. 1 through 10, and summarized as follows:

1. Lock and Dam No. 24

An existing kevel rail currently extends along the entire length of the lock's upper guidewall as depicted on Plate No. 7. It is assumed that the existing kevel rail can be reused as part of the new powered system. Prior to implementation into the new system, the anchorage of the existing rail must be evaluated for all loads associated with the new haulage system. For the purposes of this report, it has been assumed that the anchorage of the existing system is acceptable as part of the new configuration, and that the entire length of existing kevel rail can remain in place. New lengths of kevel rail will have to be installed along the entire length of the upper guidewall extension, as well as along the entire length of the lower guidewall (existing and new). This will be applicable for both the 12-6-12 and 12-N-12 options. A new kevel rail will also have to be installed within the main lock chamber for the 12-6-12 option. For the 12-N-12 option, the existing tow haulage winch will be used in place to extract barges from the lock chamber. The centerline of the new kevel rail will be located approximately 5 inches from the riverside face of the existing lock wall, both within the main lock chamber and on the guidewalls. Locating the new rail as close to the riverside face of the lockwall as possible enables appurtenances such as handrail and check posts to be located closer to the riverside face of the wall, thus maximizing the amount of operating room available for lock personnel. The 5 inch setback noted will allow the use of a Cushman cart along the full length of the lock (including adjacent to the Control Station), excluding the lower guidewall. A change in elevation of the top of lock wall at the beginning of the lower guidewall precludes use of the Cushman cart at this location. The new length of rail along the upper guidewall extension must align with the existing rail remaining in place; therefore, the exact setback will have to be verified in the field during installation. Field measurements indicated that the centerline of the existing rail is approximately 5 inches from the face of wall. The new kevel rail (including the base assembly) would be anchored into the top of the lock wall, and welded to the existing steel upper protection angle that extends along the full length of the guidewall. This is depicted on Plate No. 7. It should be noted that the height of the anchorage system used for the new lengths of kevel rail should match that of the existing rail anchorage system.

2. LaGrange Lock and Dam

An existing kevel rail currently extends the full length of both the upper and lower guidewalls at the LaGrange Lock and Dam. The centerline of the existing rail is approximately 1'-3" from the riverside face of the guidewalls. As depicted on Plate No. 8, it is assumed that the existing kevel rails can be reused as part of the new powered system. Again, prior to implementation into the new system, the anchorage of the existing rails must be evaluated for all loads associated with the new haulage system. It has been assumed in this report that the existing kevel rail on both the upper and lower guidewalls can remain in place. New lengths of kevel rail will have to be installed along the guidewall extensions for both the 12-6-12 and 12-N-12 options. A new kevel rail will also have to be installed within the main lock chamber for the 12-6-12 option. For the 12-N-12 option, the existing tow haulage winch will be used in place to extract barges from the lock chamber. The centerline of the new kevel rail on the guidewalls will remain at 1'-3" from the riverside face of the guidewall, to align with the existing rails. The centerline of the new rail within the main lock chamber will be set at 5 inches from the riverside face of the lock wall, as shown on Plate No. 8. This again was done to maximize operating room for lock personnel. Due to this, and the 7'-0" width of the top of the upper guidewall, Cushman carts will be able to run the full length of the lock, with the exception of the lower guidewall. A change in top of lock wall elevation at this location again precludes use of the carts along the lower guidewall. All new lengths of kevel rail will be anchored to the lock wall in the same manner as previously noted at Lock and Dam No. 24, also being welded to the existing steel upper protection angle. Again, the height of the anchorage system for the new lengths of kevel rail should match that of the existing rail.

C. HANDRAIL ELIMINATION OR SETBACK

The proposed locations of new lengths of kevel rail (from the riverside face of the lock wall) depicted on Plate No. 7 and 8 and previously noted herein require shifting of existing handrail at various locations. Handrail modifications required due to installation of new lengths of kevel rail are summarized as follows:

1. Lock and Dam No. 24

As noted on Plate No. 7, the existing handrail (both riverside and landside) along the upper guidewall can remain in place, with no modifications required. However, the riverside handrail along the lower guidewall may have to be shifted landward for clearance purposes. Field measurements indicated that the handrail along the lower guidewall is centered approximately 16-17 inches from the face of the guidewall, with the edge of its base flange approximately 13.5-14.5 inches from the face of the wall. Dependent upon the final design width of the kevel rail base assembly, the base flange of the handrail could interfere with the rail anchorage assembly. Relocation has been assumed for concept purposes. As shown on Plate No. 7, the handrail centerline will be shifted to 1'-6" from the face of the lock wall. When the handrail is shifted, the existing handrail post base flanges could be reused and anchored into the top of the existing lock wall with either expansion anchors or threaded rods grouted in place. The existing handrail along the riverside face of the main lock chamber will also have to be relocated landward, similar to that noted for the lower guidewall. Field measurements indicated that the existing handrail centerline was approximately 16 inches from the face of the lock wall. New handrail provided along the guidewall extensions will be installed to align with the existing handrail.

2. LaGrange Lock and Dam

As noted on Plate No. 8, no modifications to the existing handrail will be required. Adequate clearances between the existing handrail and the new kevel rail do exist. The new handrail along the guidewall extensions will be installed to align with the existing handrail.

D. ACCESS LADDER MODIFICATIONS

Ladders providing access from the river to the top of the lock wall exist at all lock sites being investigated. These ladders are embedded into the riverside face of the lock wall, and eventually tie into the handrail system running along the top of the lock wall. Installation of tow haulage rails

running along the top of the lock walls near the riverside edge would create safety concerns at all ladder locations. However, this condition currently exists at many locations, and is assumed to be acceptable. Also, conditions at the ends of both the upper and lower guidewalls (for both Lock and Dam No. 24 and the LaGrange Lock and Dam) as detailed on Plate No. 1, 3, 4 and 6 show the winch cable running from the end of kevel rail to its winch, over a ladder recess. This condition also exists at other locations, and is also assumed acceptable. Where shifting of existing handrail is required (as noted in paragraph C herein), additional handrail modifications at ladder recesses will also be necessary.

E. CHECKPOST MODIFICATIONS

As determined in discussions with lockmasters at various lock and dam sites, the height of existing check posts adjacent to kevel rails could be raised to improve the systems operations of the powered (and current unpowered) kevel system. Due to this, all existing check posts adjacent to either existing or proposed new kevel rails will be removed, with new taller check posts (extending 1'-6" above the top of lock wall surface) installed in their place. As shown on Plate No. 7 and 8, existing check posts are generally centered 2'-0" from the riverside face of the lock wall and guidewall. With new check posts to be installed, this centerline location could possibly be shifted slightly riverward to gain lock personnel more room for operations. Whether the new check posts remain centered 2'-0" from the face of wall, or are shifted riverward, their new location shall be such to clear any remaining embedments still in the existing lock wall and guidewall surface after the existing check posts have been removed. The size and anchorage of the new check posts shall be determined during final design.

F. UTILITY TRENCH MODIFICATIONS

Site visits to the locks and dams being investigated along the Mississippi River did not reveal any apparent utility trenches buried in the top of the existing lock walls; thus, no modifications are anticipated at these sites. Utility trenches which were originally built into the top of lockwall at the

LaGrange Lock and Dam, have since been filled in with concrete; thus, no modifications are anticipated at this site either.

G. MACHINERY/UTILITY RECESS PIT MODIFICATIONS

No modifications are anticipated at either Lock and Dam No. 24 or the LaGrange Lock and Dam. Due to the similarity of Lock and Dam No. 24 with the remaining study sites along the Mississippi River, it is anticipated that no modifications will be required at these sites either.

H. MODIFICATIONS REQUIRED FOR INSTALLATION OF NEW WINCHES

New winches will have to be installed at each end of all guidewalls at all sites, for both the 12-6-12 and 12-N-12 options. Two additional new winches will have to be installed for the 12-6-12 option, one at each end of the main lock chamber. A summary of the modifications required for the installation of new winches are as follows.

1. Lock and Dam No. 24

The new winches required at the downstream end of the lower guidewall and the upstream end of the upper guidewall will be supported on the new guidewall extensions. This is depicted on Plate No. 1 and 3. The new winches at the upstream end of the lower guidewall and the downstream end of the upper guidewall will have to be supported on a slab extension, cantilevered off of both the existing guidewall and the adjacent existing lock wall monolith. New winches within the main lock chamber, required for the 12-6-12 option, can be supported on the existing main lock wall monoliths.

2. LaGrange Lock and Dam:

The new winches required at the downstream end of the lower guidewall and the upstream end of the upper guidewall will be supported on the new cells being provided as part of the new guidewall extensions. This is depicted on Plate No. 4 and 6. The new winches at the upstream end of the lower guidewall and the downstream end of the upper guidewall will also have to be supported on slab extensions, cantilevered off of the existing lock wall monoliths. New winches within the main lock chamber, required for the 12-6-12 option, can be supported on the existing main lock wall monoliths.

I. MODIFICATIONS DUE TO GATE CROSSINGS

Neither the 12-6-12 nor the 12-N-12 option requires the tow haulage system to cross a miter gate. Therefore, no modifications due to gate crossings will be required.

J. MAINTENANCE ISSUES

Both alternatives will require additional equipment at the lock (winches, kevels, controls, and control panels). This additional equipment will be an added concern for lock operations personnel for maintenance and reliability. There would also be additional work to remove this equipment at locks that are susceptible to flooding.

Section VII

SECTION VII

SELECTED ALTERNATIVES

Representatives from each of the three Districts and the Consultant met in Rock Island, IL on April 25, 1995 to discuss the proposed configurations and to select two alternatives for further study. Lock Operations Staff from Lock & Dam No. 15 also participated in this meeting. The advantages and disadvantages of each configuration are listed in Section IV of this report. The following is a summary of the selection process.

A. POWERED TRAVELING KEVEL CONFIGURATIONS

The "30" and "12-18" configurations were eliminated for the following reasons:

1. In both of these configurations, the rail/cable crosses the miter gate so that when open, the traveling kevel can traverse the gate recess. The rail on the miter gates would be exposed to damage from barge traffic which frequently hits the gates. Damage to the rail along the gate would put the tow haulage system out of service and result in lengthy delays.

2. The process of raising and lowering the cable that spans the gate recess poses a safety concern as well as the time element issue.

3. There is a safety concern created by the raising of the cable as it generates slack in the cable. This "slack" can cause backlash, excessive cable wear, and potential breakage when the haulage unit is engaged.

4. The length of cable in these two configurations would require an extremely large drum - even with a pull-retard system. Based on the assumption that the drum and winches could not be recessed in the wall, the drum would cause an obstruction of the view of the lock operation staff.

5. The "30" configuration does not accommodate a change in wall elevation (lower guidewall) which occurs at several locations in the study area

6. If there were a failure in a component of the tow haulage unit of these two configurations, double lockages would be very difficult - or not possible at all.

The "12-6-12" and "12-N-12" configurations provide a "backup" system for double lockages. If the chamber tow haulage unit fails, the guidewall tow haulage unit could still extract the unpowered cut from the chamber. These configuration do not cross the miter gates, they accommodate changes in wall elevation, and minimize the drum size. These configurations are more expensive due to the additional tow haulage units required; however the benefits of system redundancy, safety, and minimizing shut downs due to barge damage out weigh the cost differential. For these reasons, the two configurations chosen were the 12-6-12 and 12-N-12 options.

B. POWER UNITS FOR TRAVELING KEVEL

The four types of units evaluated were:

1. Pull/Retard Configuration
2. Endless Cable Configuration
3. Traction Power Configuration
4. Cog Rail Configuration

The Traction Power and Cog Rail Systems were eliminated for three primary reasons:

1. Unproven application of this technology at a lock and dam facility
2. Insufficient space on the guidewalls and lock wall for the equipment required
3. Excess weight of equipment on the guidewalls

The Pull/Retard and Endless Cable Configurations were both determined to be acceptable for the following reasons:

1. Proven technology in operations
2. Safety and operational benefits
3. Minimal space requirements on walls
4. Cost

However, the Pull/Retard Configuration was more desirable for these reasons:

1. Smaller drum required (visibility)
2. Slack prevention design (minimizes cable breakage occurances)
3. Single run of cable minimizes space requirements on top of walls

Two power units to drive the winch system were evaluated; a hydraulically-driven winch, and an electrically driven winch with a variable frequency drive. Both units are currently in operation at different locations and both perform well. The order of magnitude costs are the same, Therefore either unit is acceptable to drive the winches in either of the configurations presented. For the purpose of cost development in Appendix II, the hydraulically driven unit was used.

C. CONCLUSIONS

The improved tow haulage equipment recommended will generate significant time savings in the locking process, with or without the guidewall extensions. The fact that the new tow haulage system can apply a restraining force to the barges generates time savings without the guidewall extensions. The tables that follow summarize the potential time savings (see Section III for details of development) of both scenarios with two different operating speeds of the new tow haulage system:

No Guidewall Extensions

Tow Haulage System	Speed	Time	Time Savings
Existing System	50 fpm	22.5 min.	-
New System	50 fpm	15.5 min.	7.0 minutes
New System	100 fpm	8.5 min.	14.0 minutes

With Guidewall Extensions

(w/ stopping zone clear of gate area)

Tow Haulage System	Speed	Time	Time Savings
Existing System	50 fpm	22.5 min.	-
New System	50 fpm	14.5 min.	8.0 minutes
New System	100 fpm	7.5 min.	15.0 minutes

An additional time savings is achieved (as discussed in Section III) with the guidewall extensions by allowing the remake of the cuts outside the gate area. This additional time savings is estimated to be 15 minutes for the Mississippi River Locks and 19 minutes for the Illinois River Locks for "turnback" lockages. Therefore the maximum time savings achievable with the proposed tow haulage system and extended guidewalls would be 30 minutes (15 minutes for the improved tow haulage equipment and 15 min. for the ability to remake the double cut on the extended guidewall) on the Mississippi River and 34 minutes (15 minutes for the improved tow haulage equipment and 19 min. for the ability to remake the double out on the extended guidewall) on the Illinois Waterway.

Section VIII

SECTION VIII

FEASIBILITY OF IMPLEMENTATION IN THE STUDY AREA

A. SITE VISITS

On Monday and Tuesday, May 1-2, 1995, Dave Diestelkamp, Mary Spence, and Tom Thee visited Locks 25, 24, 22, 21, and 20 on the Upper Mississippi River and LaGrange Lock on the Illinois Waterway. The purpose of this trip was to evaluate existing conditions at each of the sites relative to the placement of the selected powered traveling kevel options (12-6-12 and 12-N-12). We took measurements and photos, made sketches, verified plan data, and discusses operational concerns with lockmasters and lock operators.

The following pages of this section detail each lock in this order;

(a) Lock 25, Upper Mississippi River (Winfield, MO)

(b) Lock 24, Upper Mississippi River (Clarksville, MO)

(c) Lock 22, Upper Mississippi River (Saverton, MO)

(d) Lock 21, Upper Mississippi River (Quincy, IL)

(e) Lock 20, Upper Mississippi River (Canton, MO)

(f) LaGrange, Illinois Waterway (Versailles, IL)

Each lock was evaluated from upstream end to downstream end in the following order; upstream approach, upstream guidewall, chamber, downstream guidewall, downstream approach.

The weather on the first day (visiting Locks 25, 24, and 22) was cold and rainy. The second day (visiting Locks 21, 20 and LaGrange) was clear and slightly warmer, following the passage of the front. All of the locks were busy with traffic and were operating in "open river" conditions (all gates of the dam completely open). The large amounts of water flowing in the river created significant outdraft conditions on the upstream approach.

B. EVALUATION OF EACH SITE

The following is an evaluation of the feasibility of implementing the selected configurations at each the sites under study for this report:

1. LOCK 25

Lock 25, in Winfield, Missouri, has a 600' x 110' chamber with 600' guidewalls on each end. It is located on the right descending bank of the Upper Mississippi River at Mile Marker 241. The Lockmaster, Mr. Jerry Stoud, hosted our visit. The chamber has a winch and cable system on either end to extract unpowered cuts from the chamber. It also has an unpowered traveling kevel on the upstream guidewall.

The upper guidewall appears to have room for an additional 600' extension. This end of the lock has a unpowered traveling kevel that is used to hold the head of an unpowered cut on the wall. This kevel sits on 140 lb rail. The rail centerline is 6" from the edge of the wall. The hand railing, which sits over the buttons, is 23" from the face of the guidewall. The ladders are already covered by the rail. This presents a safety problem now which would not change with the addition of a powered kevel. The rail does not use low profile clips; bolts extend at least an inch up along the path of the kevel. This may provide an obstacle if a return cable is used (in an endless cable system), but may not pose a problem in a pull/retard winch system (Figures VIII-1 to 6).

The chamber has two floating mooring bitts, one on each end, which rise above the level of the lock wall in high water. The powered kevel would have to stop short of the floating mooring bitts (which are at the ends of the lock chamber); this would have a negligible affect on the transit of the kevel. The minimum opening between obstructions along the chamber wall is 46.5" (between the hand rail base and the control building protective plating (Figures 7 & 8).

The lower guidewall does not have a traveling kevel. However, the handrail is already set back over the buttons. This was done during a previous rehabilitation effort because barges were tearing the handrail off during their approaches. The handrail setback has solved this problem, but a similar problem may develop with a powered kevel rail. The indraft on the lower guidewall is significant, and the lower guidewall has sustain significant damage from barge strikes. The last 150' of wall has shifted back 6" and down 3". A cell was added just below the lower guidewall and barges make their approachs so as to land on this cell, rotate, and move into the chamber. When barges make their approach, their stern moves landward of this cell into a pocket of deep water. Extending this guidewall may create some land acquisition difficulties and may increase the potential for misalignments (Figures VIII-9 & 10).

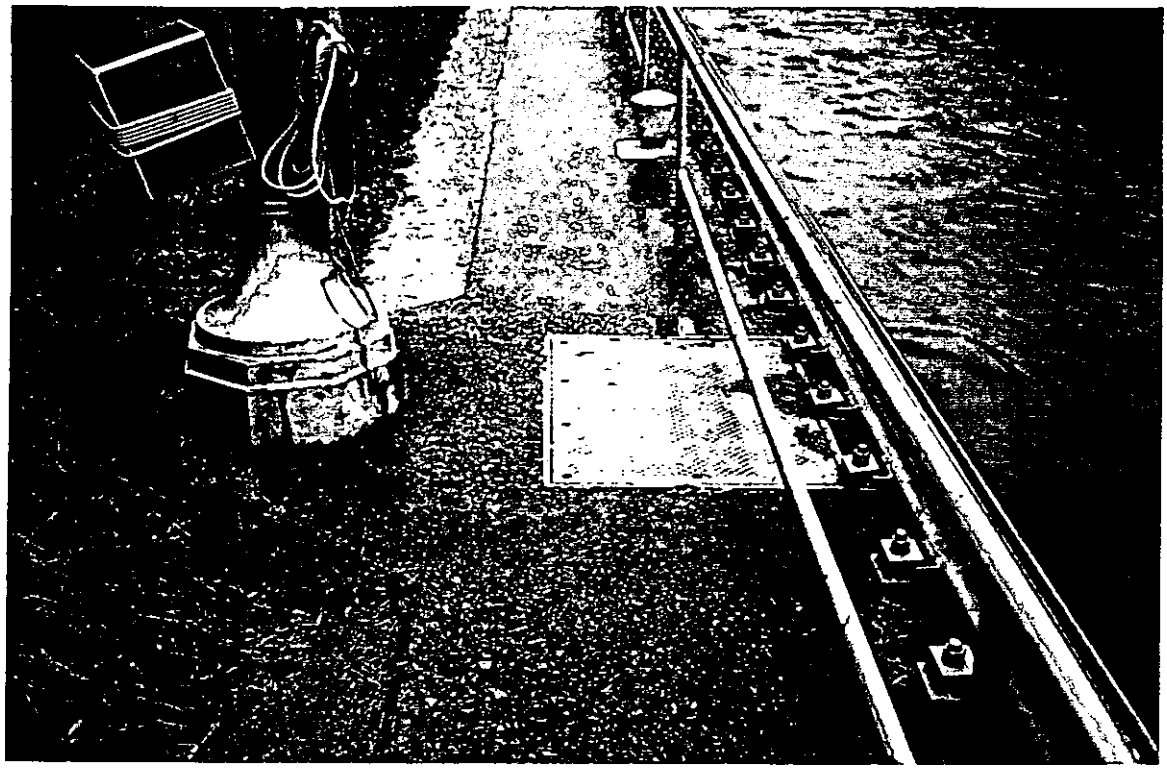
The installation of either of the two selected tow haulage system configurations would work at this site with some qualifications:

a. The lower guidewall extension would need further study relative to:
   - availability of land for acquisition
   - navigation changes/problems

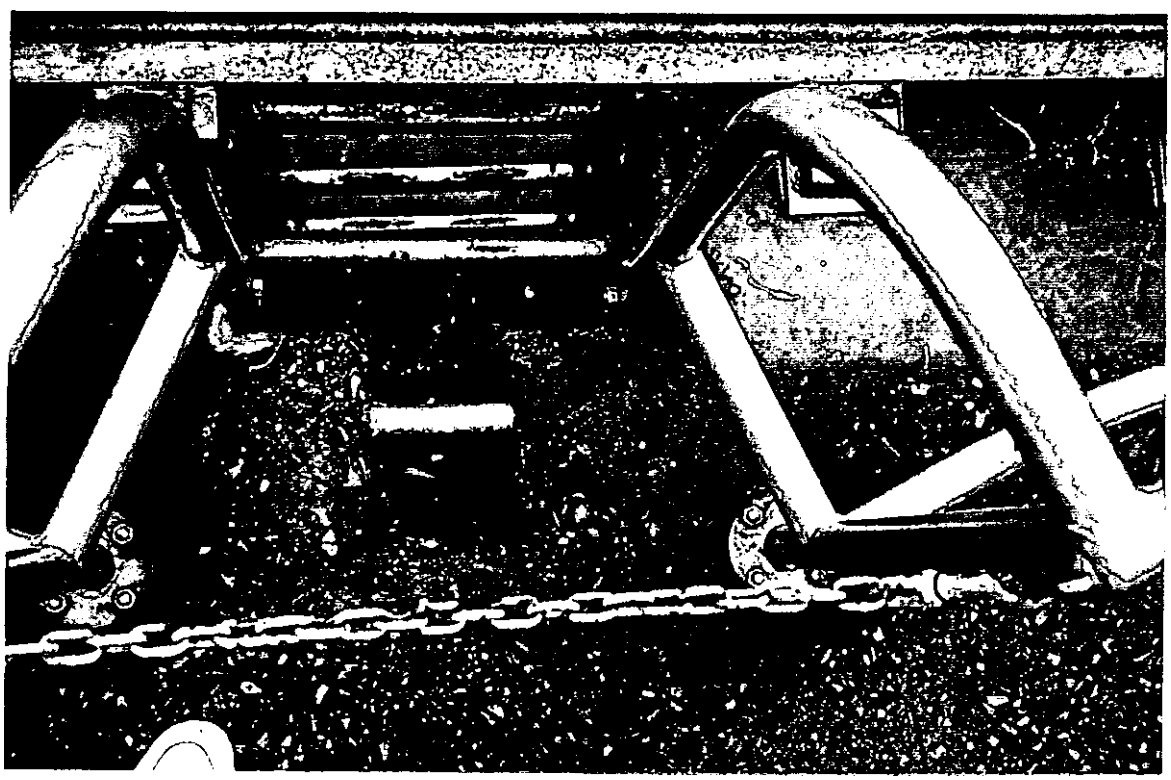
b. Tow misalignment issue relative to damage to appurtenances on lower guidewall

Lock 25
Upper approach.
Figure VIII-1

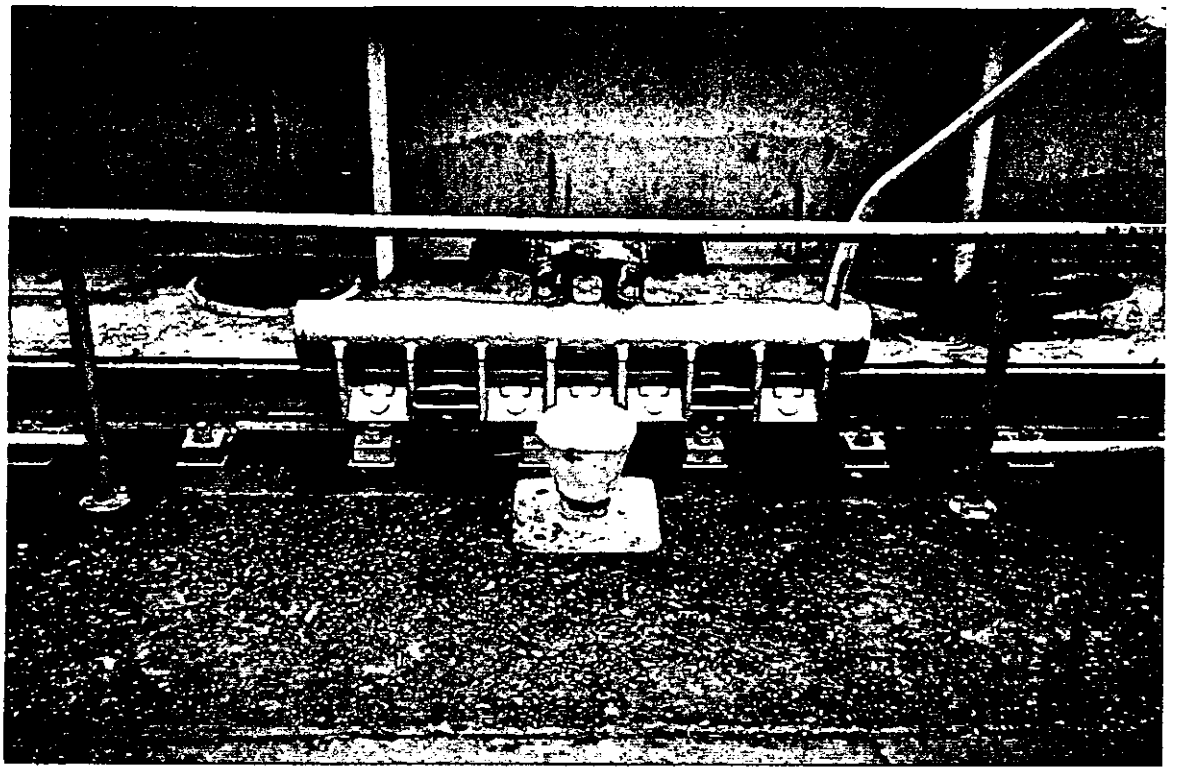
Lock 25
End of upstream guidewall.
Figure VII-2



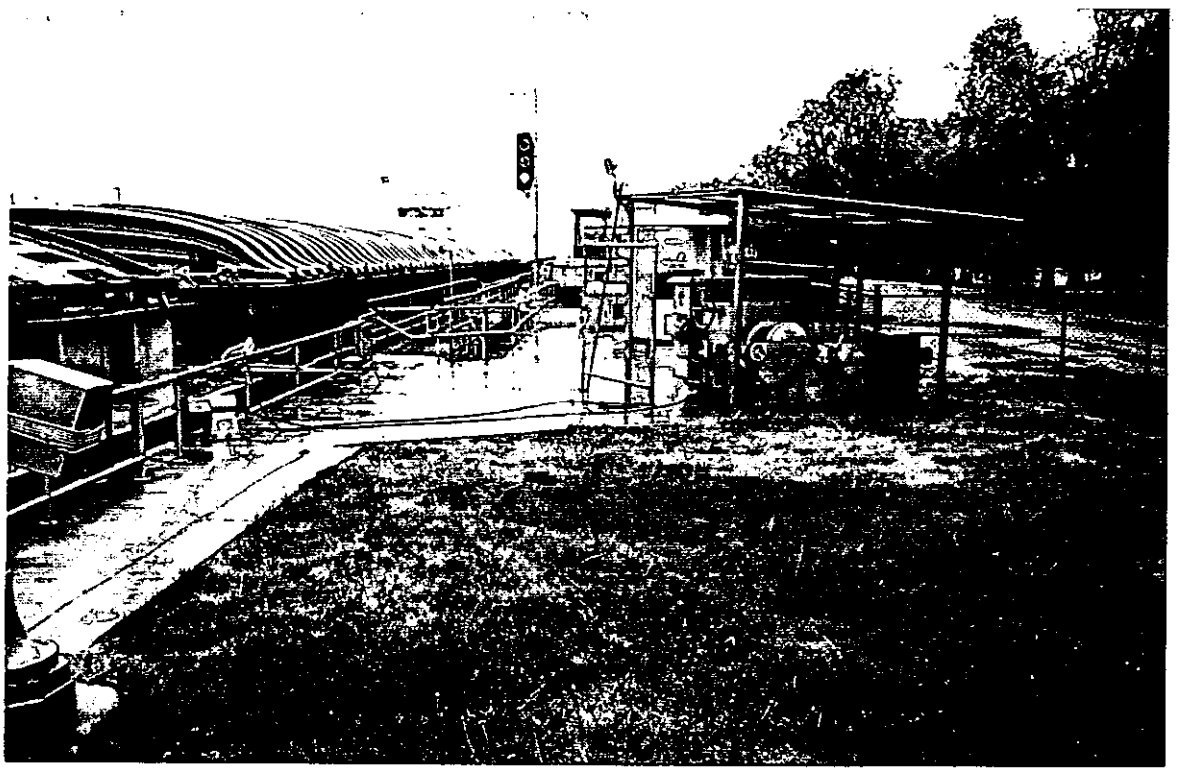
Lock 25
Upper guidewall.
Figure VIII-3



Lock 25
Upper guidewall ladder recess (covered by rail).
Figure VIII-4



Lock 25
Upper guidewall, existing traveling kevel.
Figure VIII-5

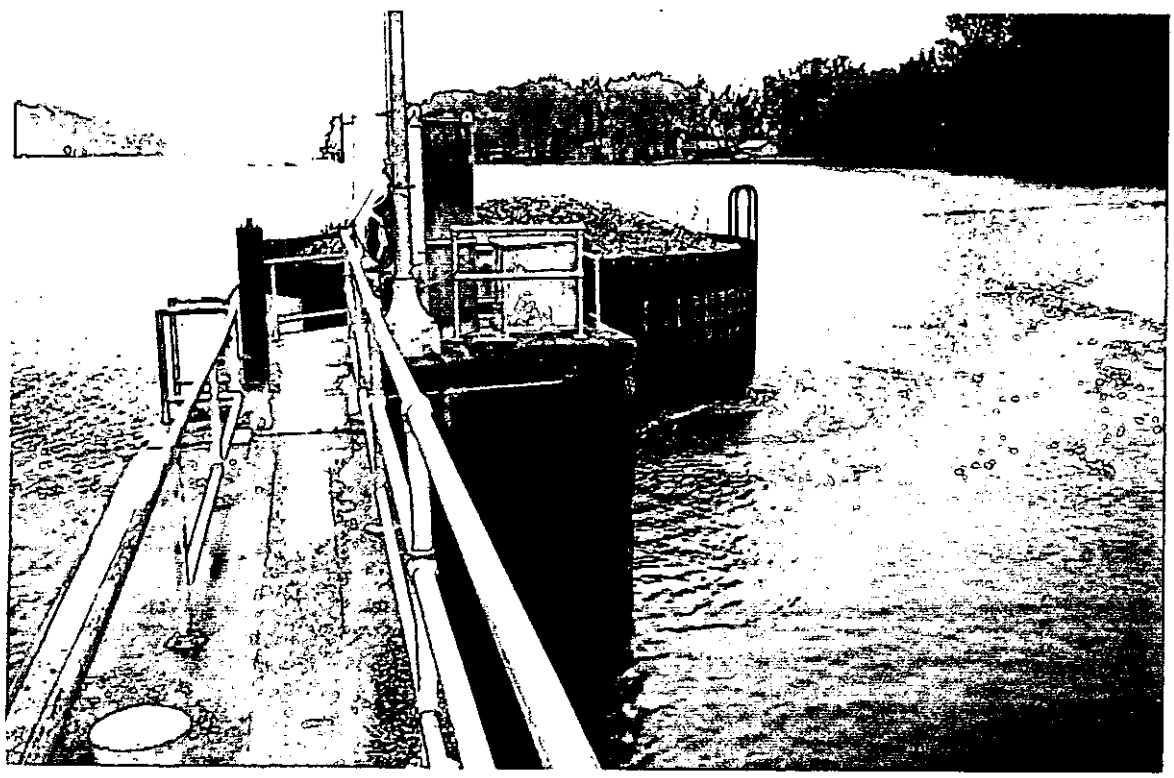


Lock 25
Upper tow haulage winch.
Figure VIII-6

Lock 25
Control building next to lock chamber.
Figure VIII-7

Lock 25
Chamber wall just below control building.
Figure VIII-8

Lock 25
Lower guidewall.
Figure VIII-9



Lock 25
Lower approach,
Figure VIII-10

2. LOCK 24

Lock 24, in Clarksville, Missouri, has a 600' x 110' chamber with 600' guidewalls on each end. It is located on the right descending bank of the Upper Mississippi River at Mile Marker 273. The Lockmaster, Mr. Chris Morgan, hosted our visit. The chamber has a winch and cable system on either end to extract unpowered cuts from the chamber. It also has an unpowered traveling kevel on the upstream guidewall.

The upper guidewall appears to have room for a 600' guidewall extension and a powered kevel. The existing rail is mounted in a similar fashion to that at Lock 25. It has a 2" clearance from the top of the wall and large bolts to hold the rail clips in place. The handrail is mounted at the same distance from the wall as the buttons (about 2 feet). See Figures VIII-11 to 14.

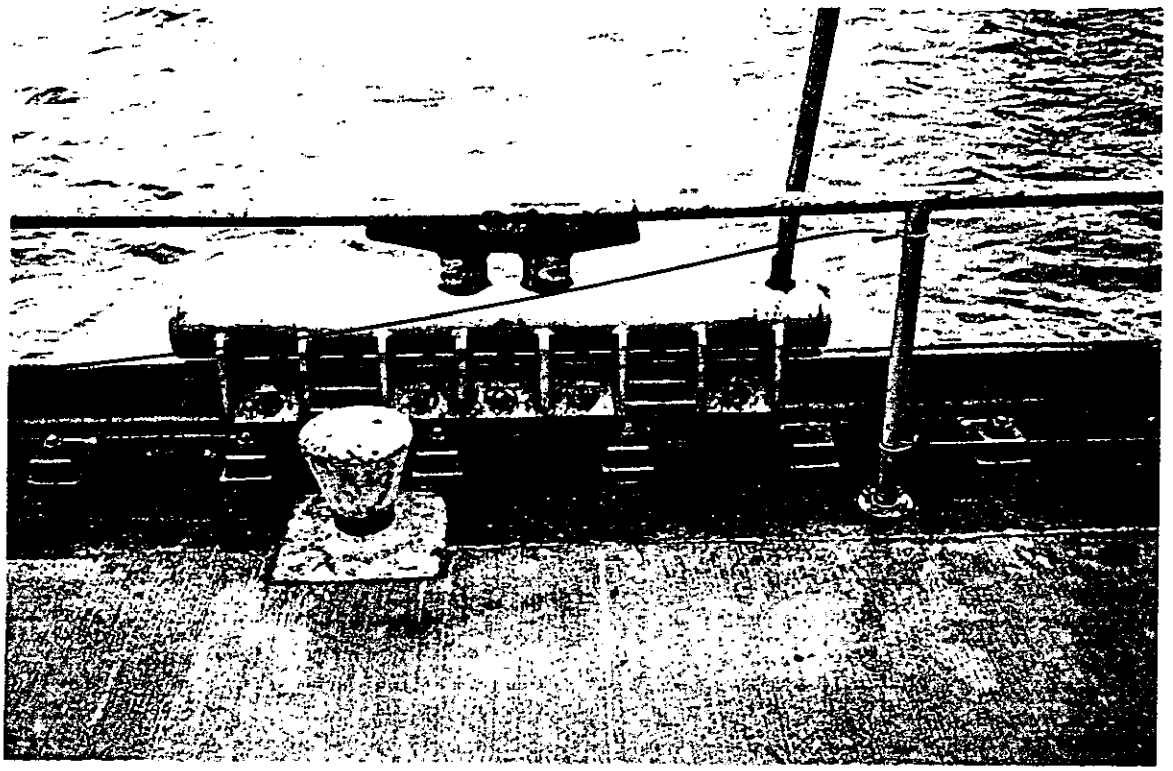
The chamber wall has buttons that are set back far enough from the wall, but the handrail would need to be moved back. This could create a clearance problem for the Cushman carts between the rail and the building. There are currently no buttons on the wall between the building and the chamber. The floating mooring bitts do extend above the top of the chamber wall in high water conditions. Since these two bitts are at the ends of the chamber, the rail could end just before reaching them. The ladder would be obstructed just as it is now on the upper guidewall (Figures VIII-15 & 16).

The lower guidewall is 2' below the elevation of the chamber wall. The handrails were set back 2' so that they were aligned with the buttons. However, they were then moved to 18" from the wall face so as to allow more room between handrails. A powered traveling kevel would require that the handrail be moved back to the 2' distance. The land side handrails could be mounted on the side, rather than the top, of the wall. This would free up more space between safety rails. There do not appear to be any major barriers with extending the lower guidewall (Figures VIII-17 & 18).

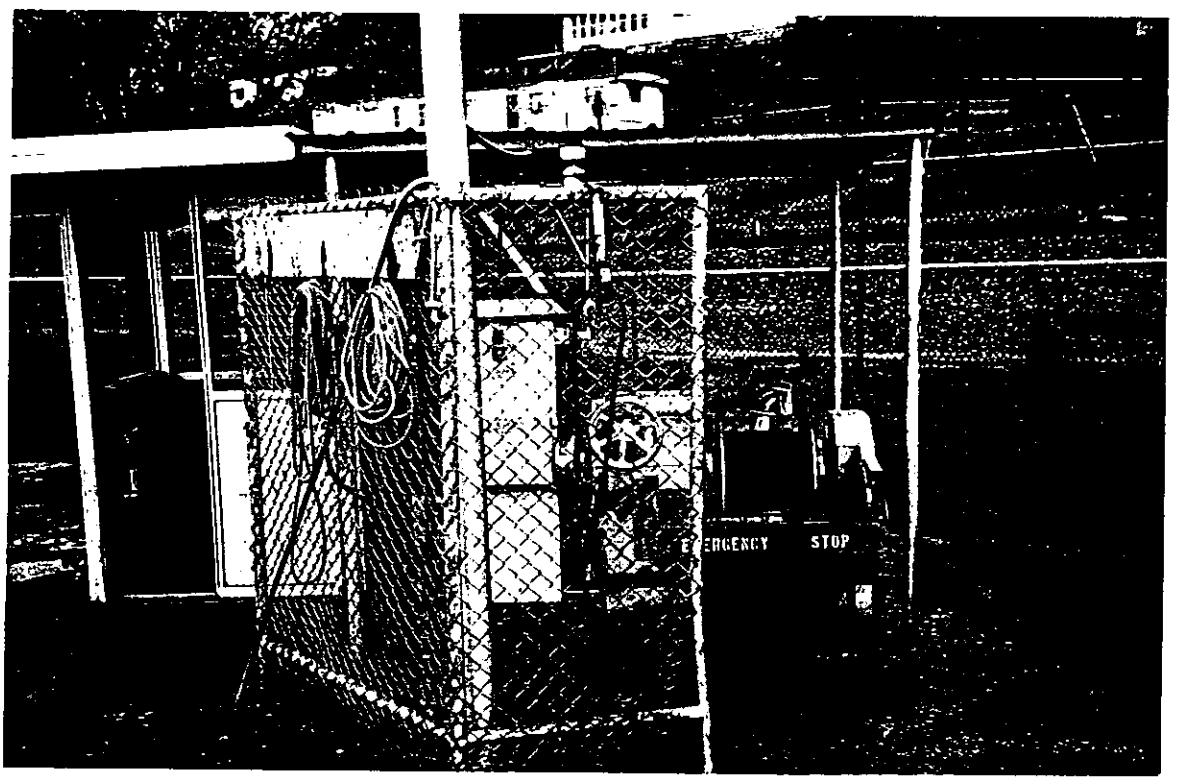
The installation of either of the two selected tow haulage system configurations would work at this site with the exception of a potential clearance problem for Cushman carts to clear the control building with the new rail system in place.

Lock 24
Upper approach.
Figure VIII-11

Lock 24
Upper guidewall.
Figure VIII-12



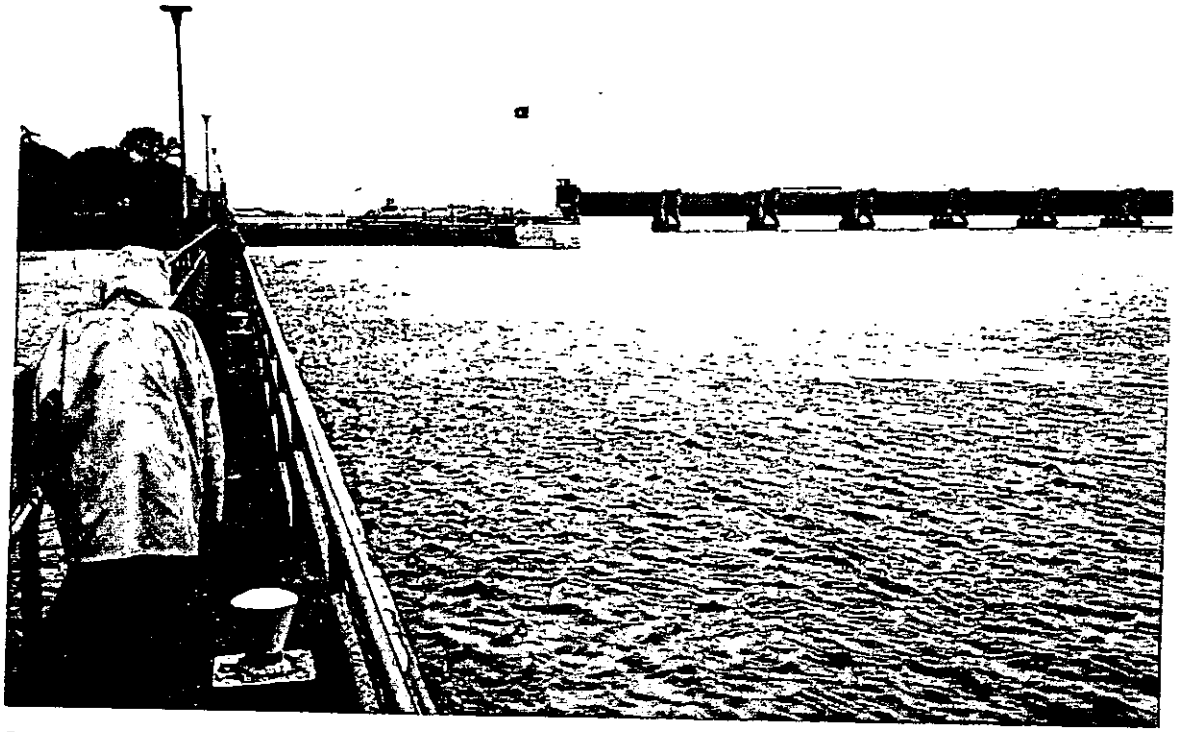
Lock 24
Unpowered traveling kevel.
Figure VIII-13



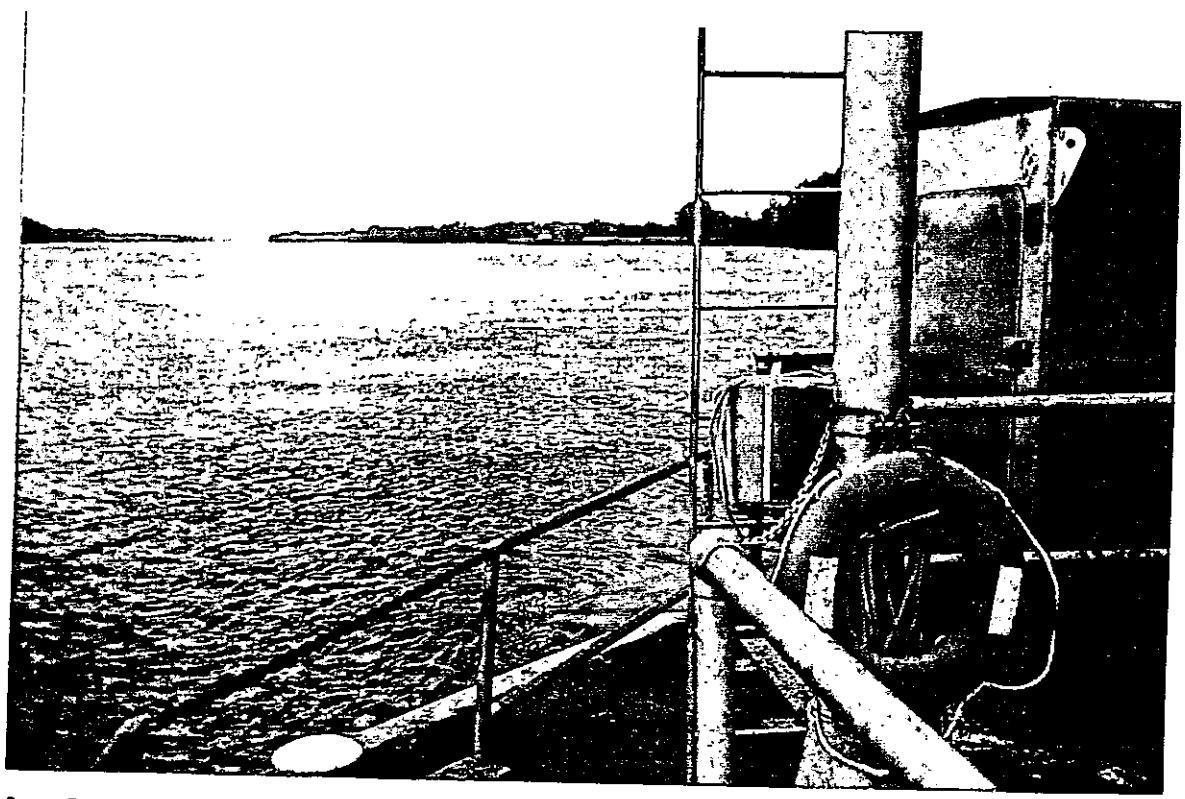
Lock 24
Upper tow haulage winch.
Figure VIII-14

Lock 24
Chamber wall at control building.
Figure VIII-15

Lock 24
Chamber wall (below control building).
Figure VIII-16



Lock 24
Lower guidewall.
Figure VIII-17



Lock 24
Lower approach.
Figure VIII-18

3. LOCK 22

Lock 22, in Saverton, Missouri, has a 600' x 110' chamber with 600' guidewalls on each end. It is located on the right descending bank of the Upper Mississippi River at Mile Marker 241. The Lockmaster, Mr. Gary Clark, hosted our visit. The chamber has a winch and cable system on either end to extract unpowered cuts from the chamber. It also has an unpowered traveling kevel on the upstream guidewall. It has high outdraft conditions and the indraft conditions on the lower guidewall were extremely severe due to a sunken barge obstructing some of the dam gates. A helper boat was working the chamber on the day of the site visit.

The upper guidewall had a rail whose centerline was 5" from the edge of the wall face and a handrail that was 16" from the wall face. The handrail and existing kevel rail could remain in place. The buttons were not raised and their centerlines were just inside of the hand railing. The smallest restriction along the upper wall was at the light pole which was 47" from the hand railing. There do not appear to be any major obstructions to extending the upper guidewall (Figures VIII-19 to 23).

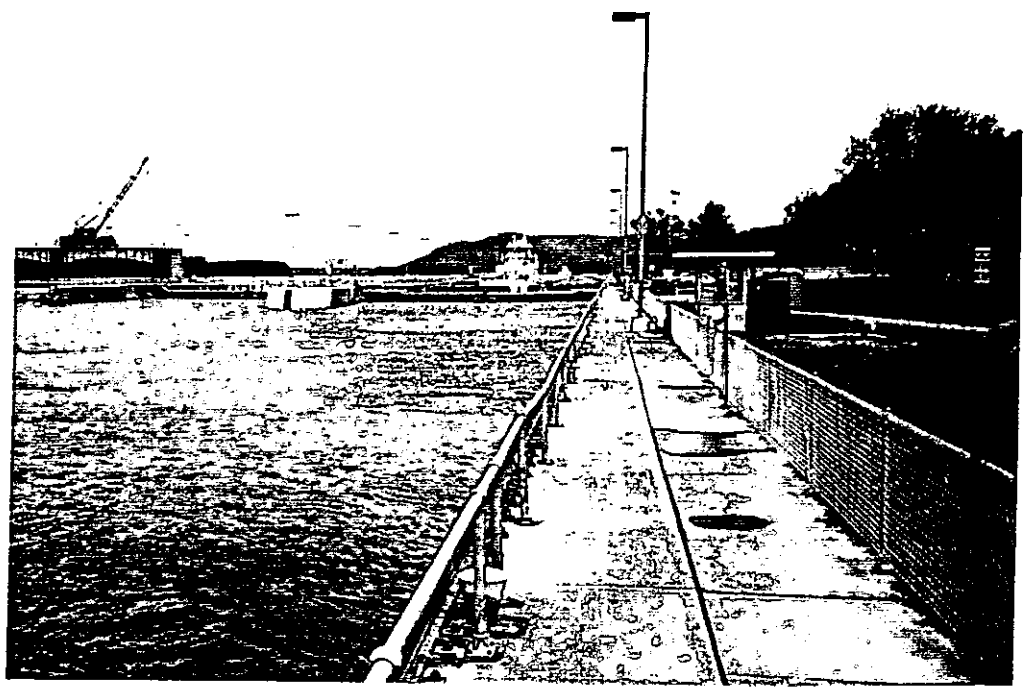
The chamber did not have floating mooring bitts. It did have three ladders on the wall; one at each end and one in the center. The end ladders were the ones that were fitted with floating mooring bitts on Locks 25 & 24. A new kevel rail would cover the center ladder recess (just as it does at Locks 24 & 25), but could stop short of the end recess, which are the most frequently used ladders. The hand railing and buttons sit up against the armor plating. There is 6' of available wall space next to the control building. The hand railing and buttons could be moved closer to the building (Figure VIII-24).

There is no change in elevation between the chamber and the lower guidewall. Like the chamber, the hand railing sits 11" away from the face of the wall. The light poles sit 5' away from the face of the wall and the edge of the concrete is 58" from the wall. There do

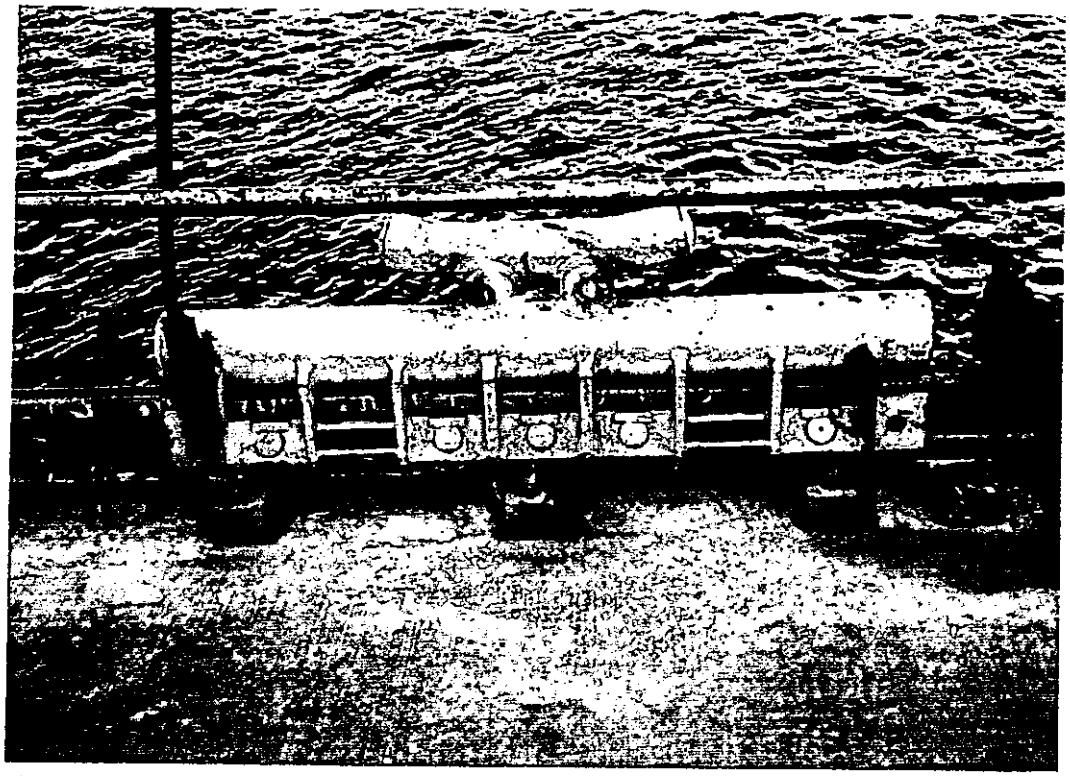
not appear to be any major obstructions to extending the lower guidewall (Figures VIII-25 to 26).

The installation of either of the two selected tow haulage system configurations would work at this site.

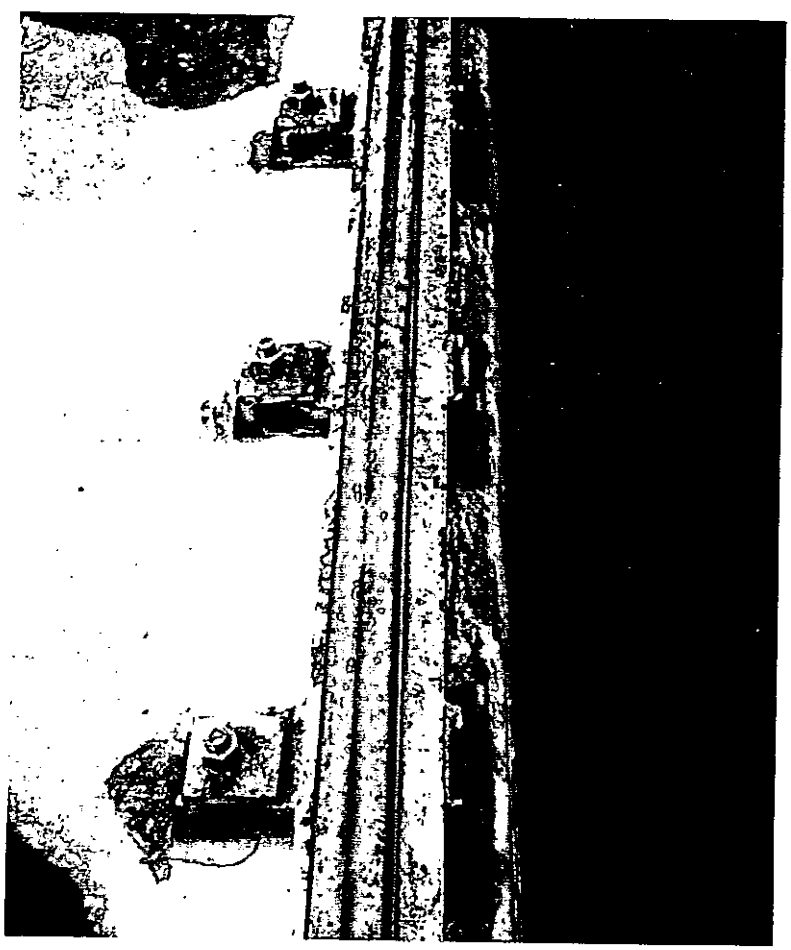
Lock 22
Upper approach.
Figure VIII-19



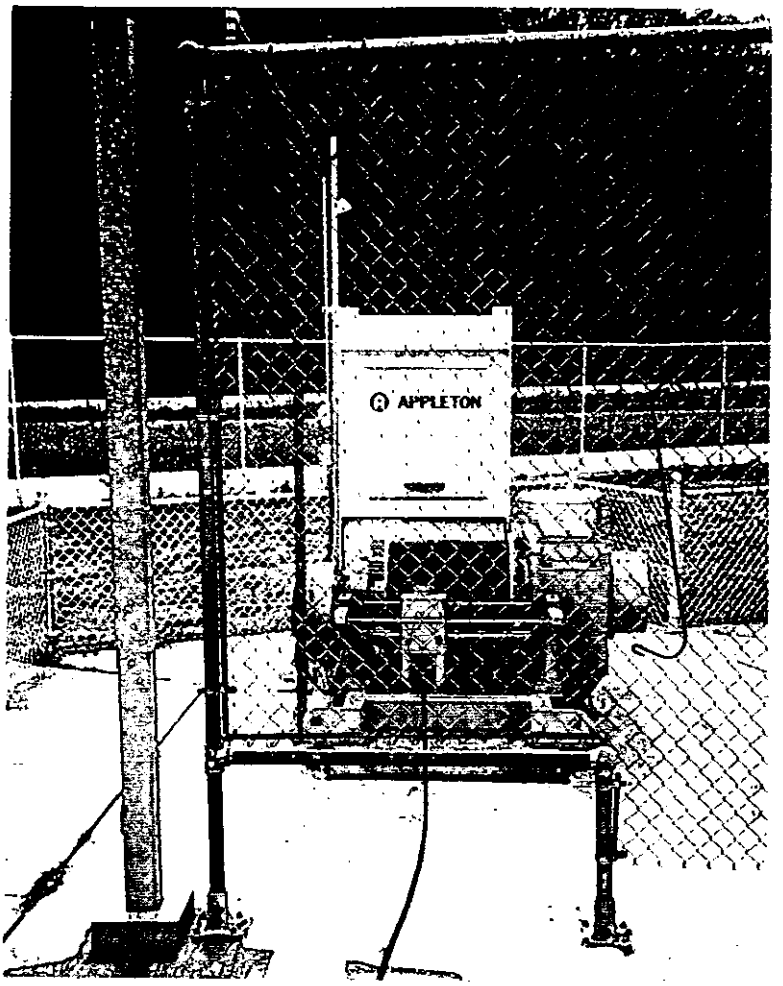
Lock 22
Upper guidewall.
Figure VIII-20



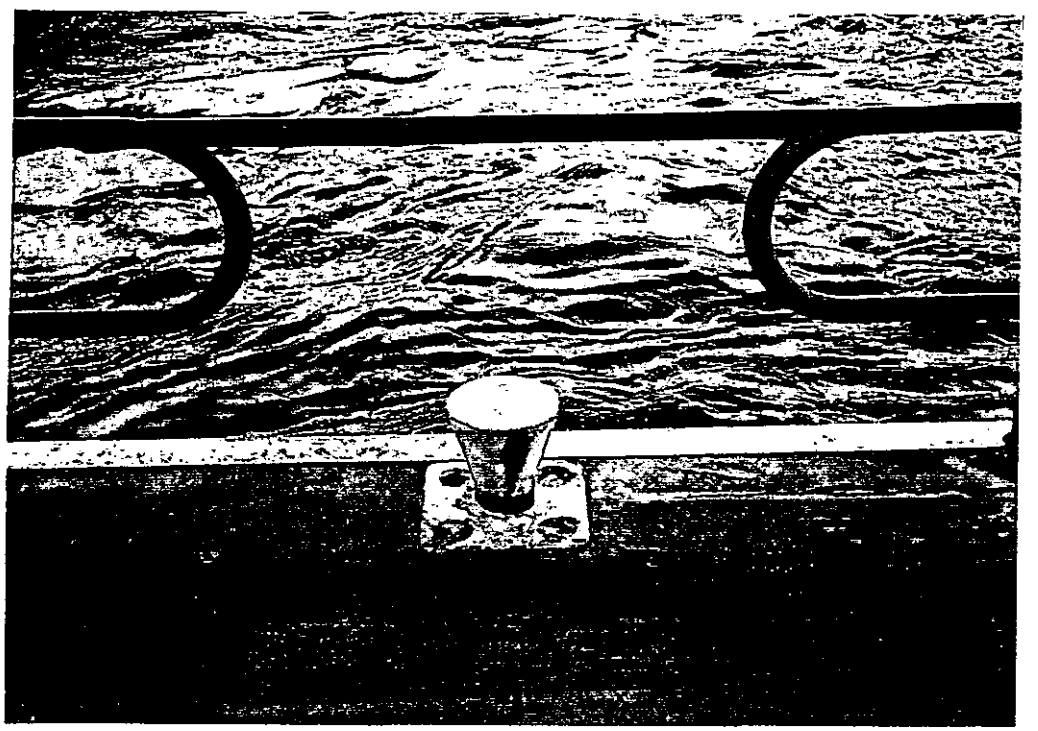
Lock 22
Unpowered traveling kevel.
Figure VIII-21



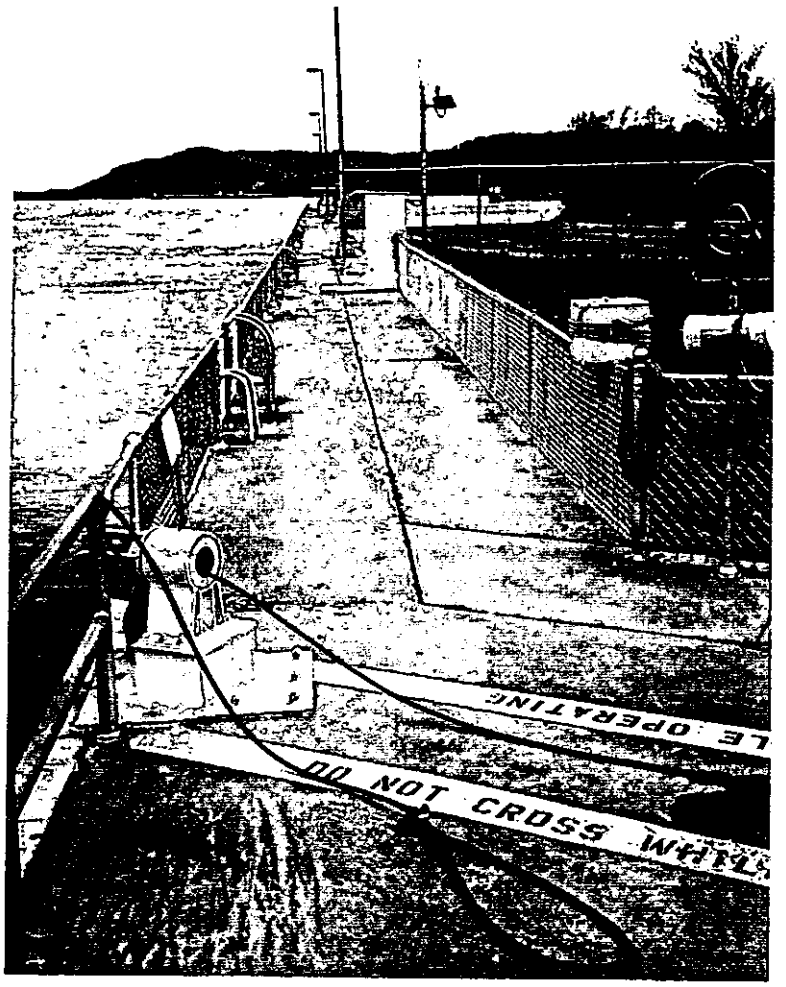
Lock 22
Unpowered traveling kevel rail.
Figure VIII-22



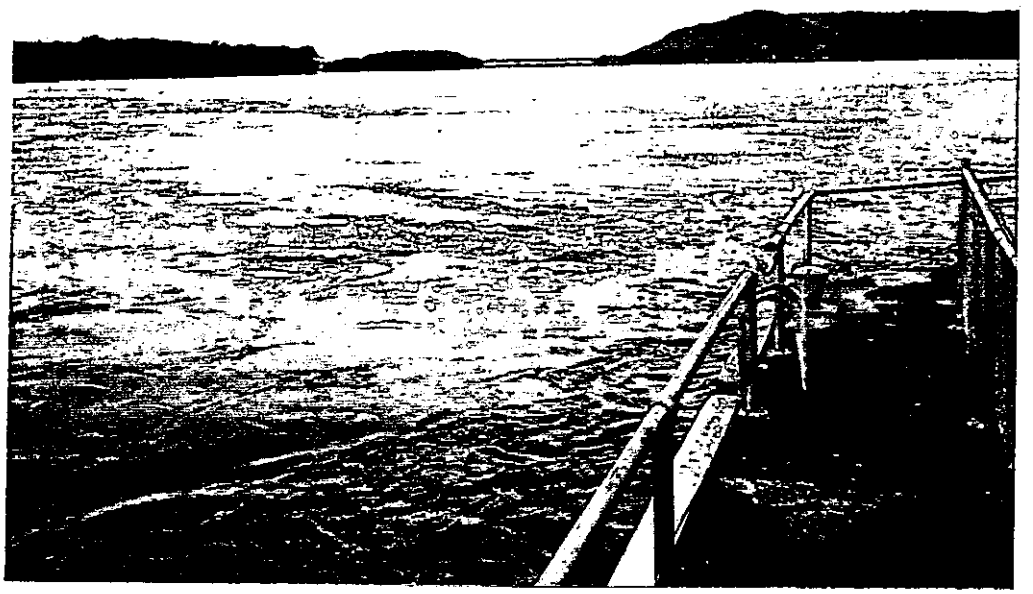
Lock 22
Existing tow haulage winch (lower).
Figure VIII-23



Lock 22
Chamber wall.
Figure VIII-24



Lock 22
Lower guidewall.
Figure VIII-25



Lock 22
Lower approach.
Figure VIII-26

4. LOCK 21

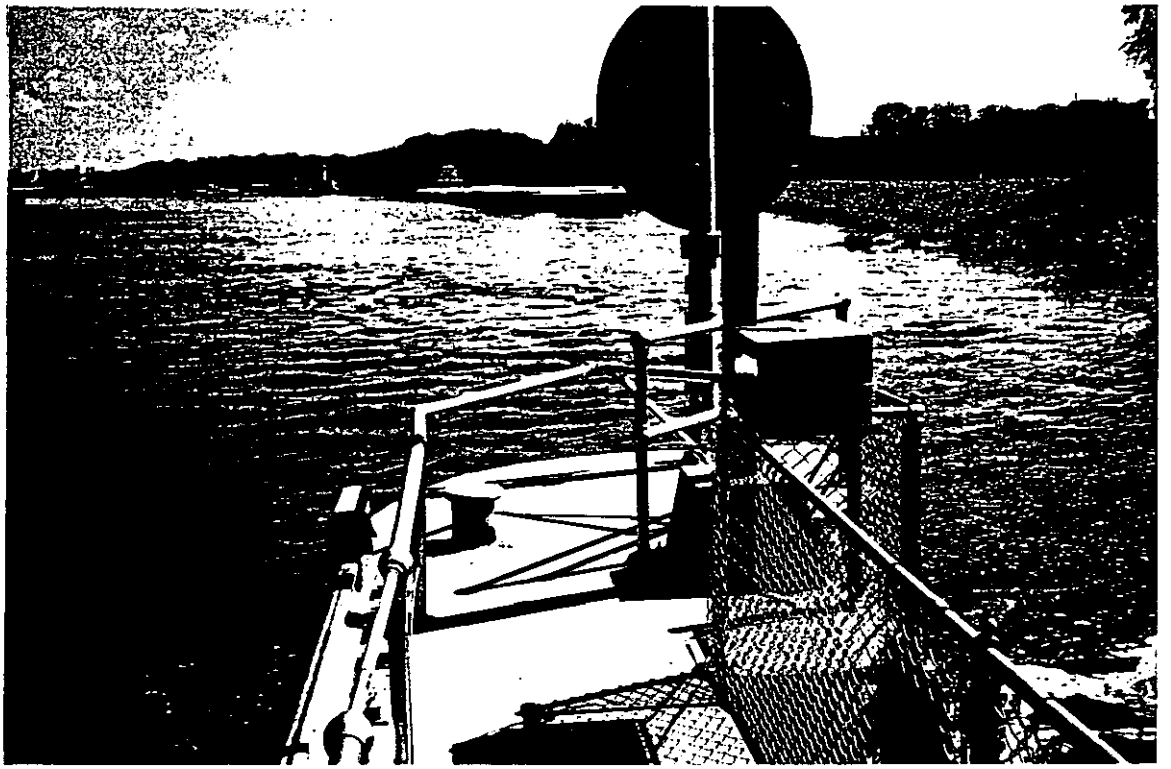
Lock 21, in Quincy, Illinois has a 600' x 110' chamber with 600' guidewalls on each end. It is located on the left descending bank of the Upper Mississippi River at Mile Marker 325. The Lockmaster, Mr. Tom Dunker, hosted our visit. The chamber has a winch and cable system on either end to extract unpowered cuts from the chamber. It also has an unpowered traveling kevel on the upstream guidewall.

The upper guidewall had a rail whose centerline was 5" from the edge of the wall face and a handrail that was 17" from the wall face. The handrail and existing kevel rail could remain in place. The buttons were not raised and their centerlines were just inside hand railing. The smallest restriction along the upper wall was between the handrail and the fence (40"). There do not appear to be any major obstructions to extending the upper guidewall (Figures VIII-27 to 30).

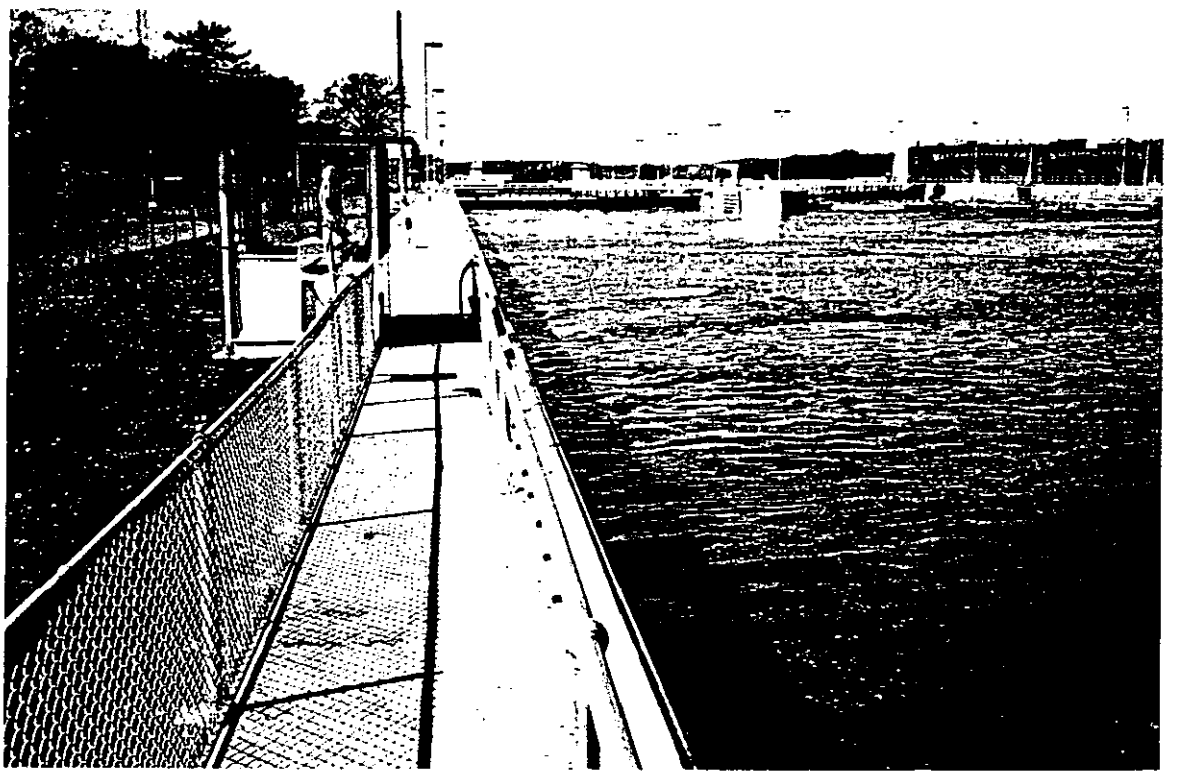
The chamber did not have floating mooring bitts. It did have three ladders on the wall; one at each end and one in the center. The end ladders were the ones that were fitted with floating mooring bitts on Locks 25 & 24. A new kevel rail would cover the center ladder recess (just as it does at Locks 24 & 25), but could stop short of the end recess, which are the most frequently used ladders. The hand railing was 11" from the face of the wall and the buttons were 16" from the face. The existing space between the building and the button is 40" (Figure VIII-31 & 32).

There is no change in elevation between the chamber and the lower guidewall. Like the chamber, the hand railing sits 11" away from the face of the wall. The light poles sit 5' away from the face of the wall and the edge of the concrete is 58" from the wall. There do not appear to be any major obstructions to extending the lower guidewall. See (Figures VIII-33 & 34).

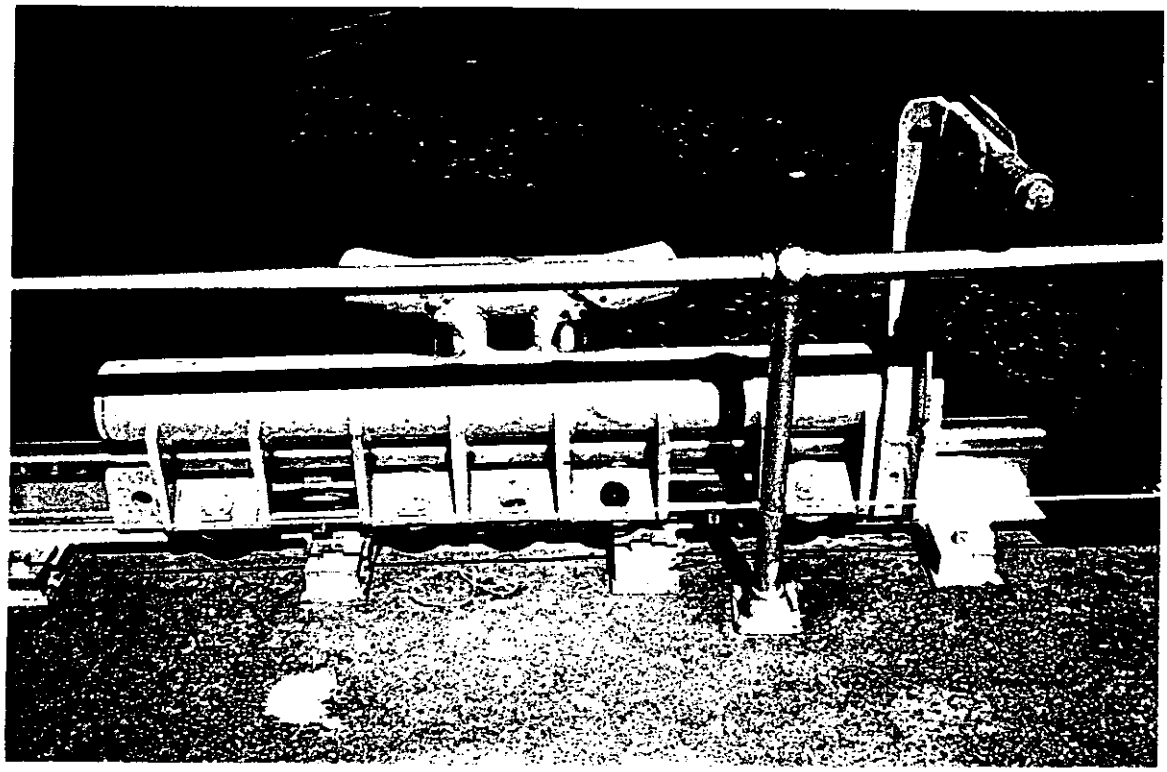
The installation of either of the two selected tow haulage system configurations would work at this site with the exception of a potential clearance problem on the upper guidewall for Cushman carts access. This clearance problem would be created due to the fence location and the gauge house relative to the new rail system. It does appear however that there is room to set back both of these features.



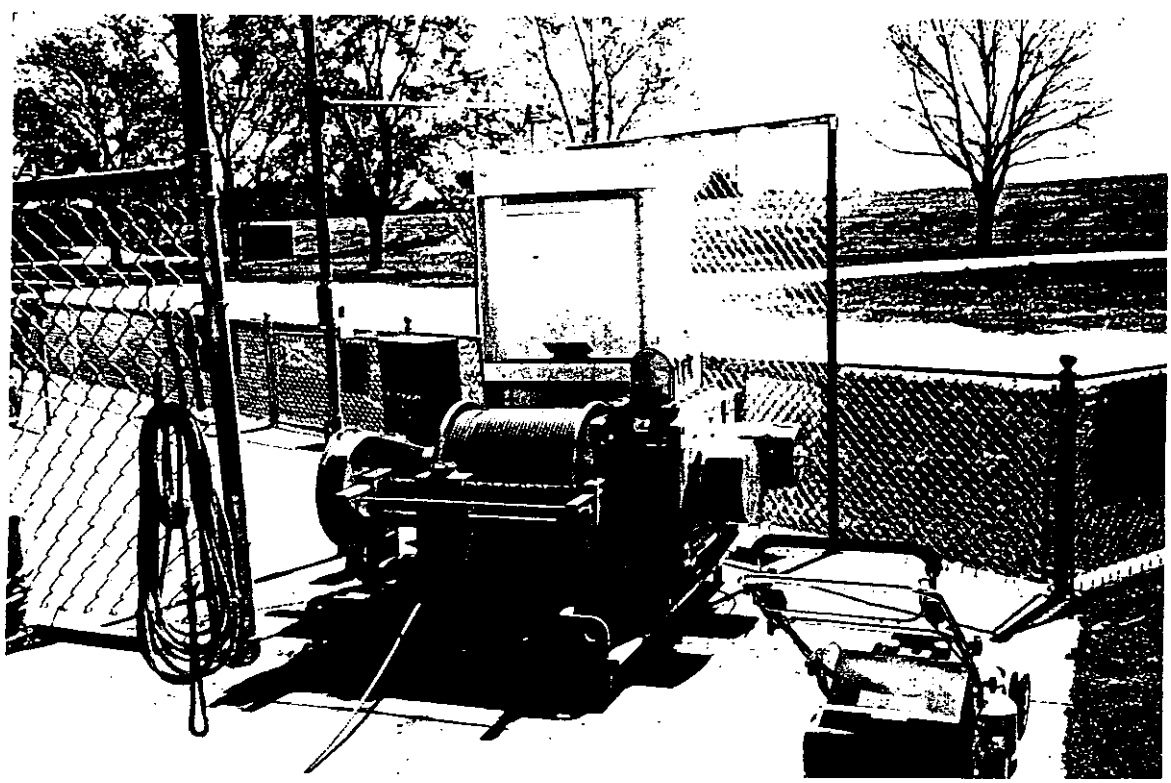
Lock 21
Upper approach.
Figure VIII-27



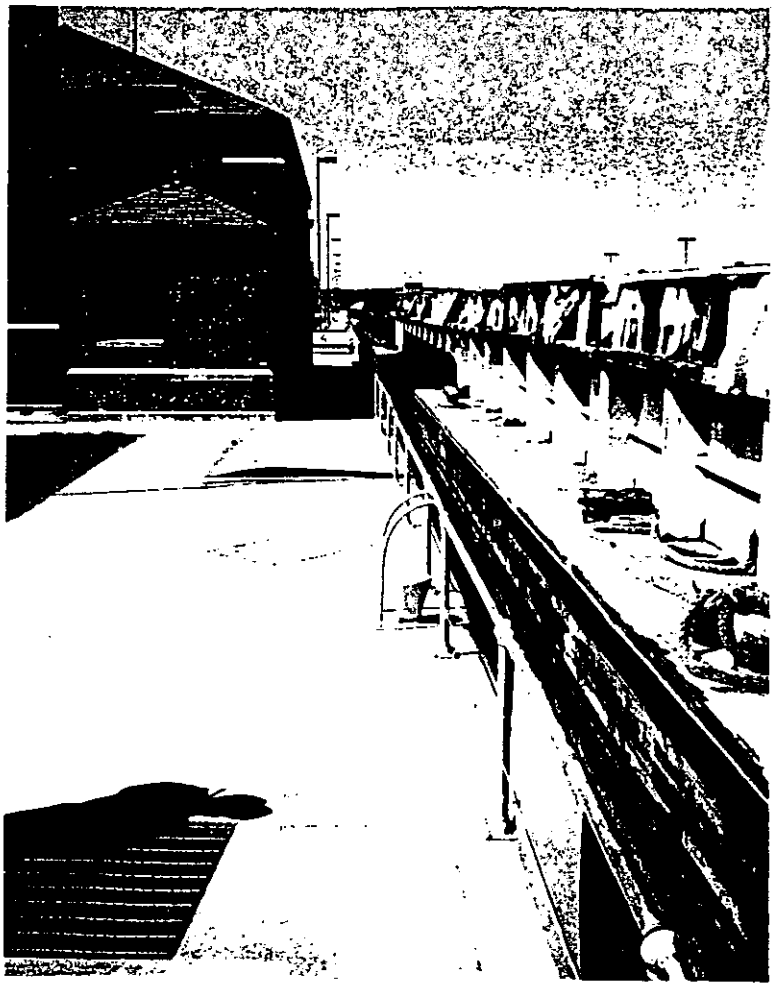
Lock 21
Upper guidewall.
Figure VIII-28



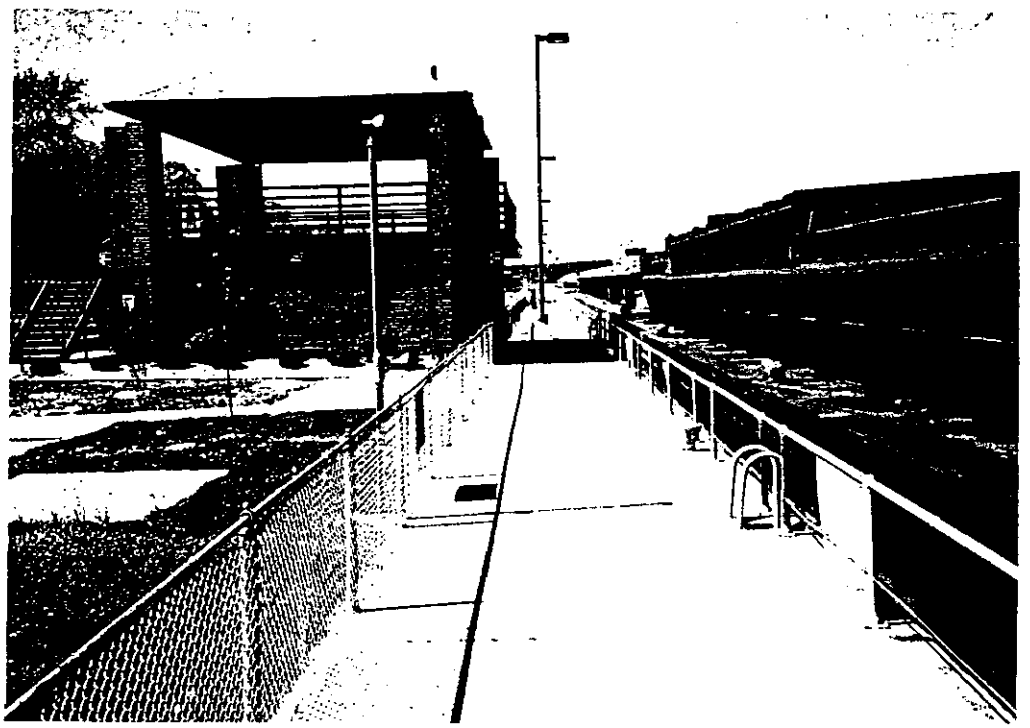
Lock 21
Unpowered traveling kevel.
Figure VIII-29



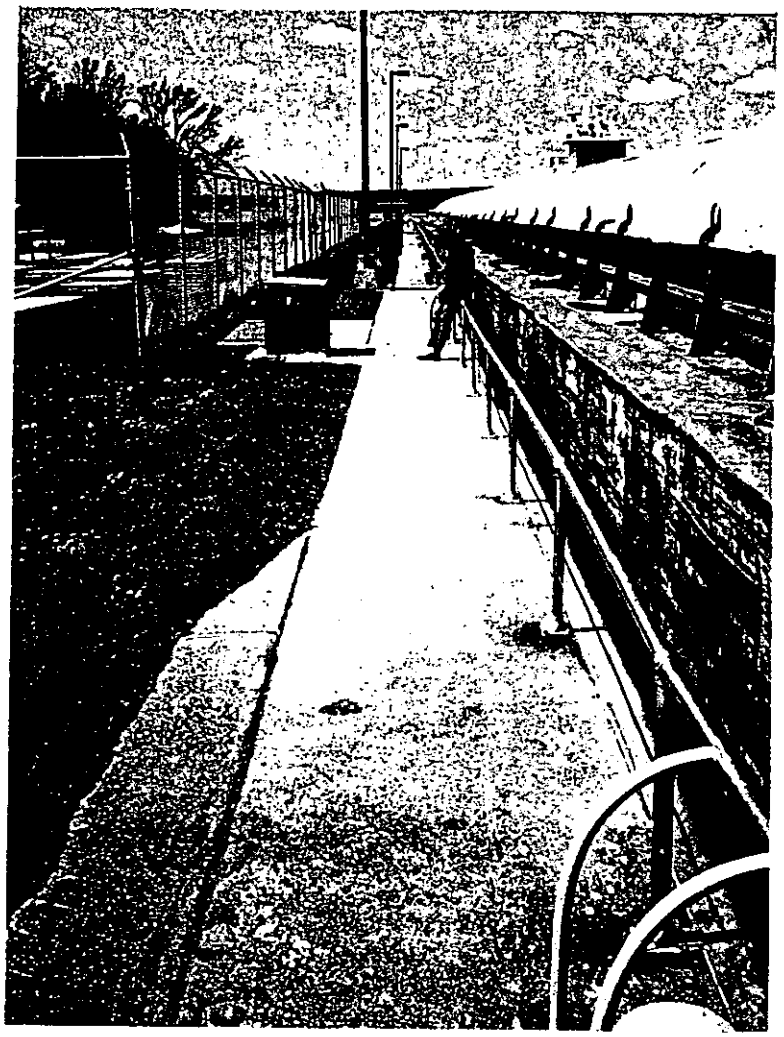
Lock 21
Existing tow haulage winch (lower).
Figure VIII-30



Lock 21
Chamber wall at control building.
Figure VIII-31



Lock 21
Chamber wall below control building.
Figure VIII-32



Lock 21
Lower guidewall.
Figure VIII-33

Lock 21
Lower approach.
Figure VIII-34

5. LOCK 20

Lock 20, in Canton, Missouri, has a 600' x 110' chamber with 600' guidewalls on each end. It is located on the right descending bank of the Upper Mississippi River at Mile Marker 343. The Lockmaster, Bill Robinson, hosted our visit. The chamber has a new winch and cable system on either end to extract unpowered cuts from the chamber. It also has an unpowered traveling kevel on the upstream guidewall.

The upper guidewall had a rail whose centerline was 5" from the edge of the wall face and a handrail that was 24" from the wall face. The handrail and existing kevel rail could remain in place. The buttons were not raised and their centerlines were centered 18" from the face of the wall. The smallest restriction along the upper wall was between the handrail and the light pole(s) (37"). There do not appear to be any major obstructions to extending the upper guidewall although many towboats like to wait in the "pocket" of still water next to the shoreline. According to the lockmaster, eliminating this waiting area could add 45 minutes to the exchange time. This delay would not be a factor in exchange lockages (Figures VIII-35 to 38).

The chamber did not have floating mooring bitts. It did have three ladders on the wall; one at each end and one in the center. The end ladders were the ones that were fitted with floating mooring bitts on Locks 25 & 24. A new kevel rail would cover the center ladder recess (just as it does at Locks 24 & 25), but could stop short of the end recess, which are the most frequently used ladders. The hand railing extensions (over the buttons) protruded 26" from the face of the wall and the buttons were centered 18" from the face. The existing space between the building and the railing extension was 46" (Figure VIII-39).

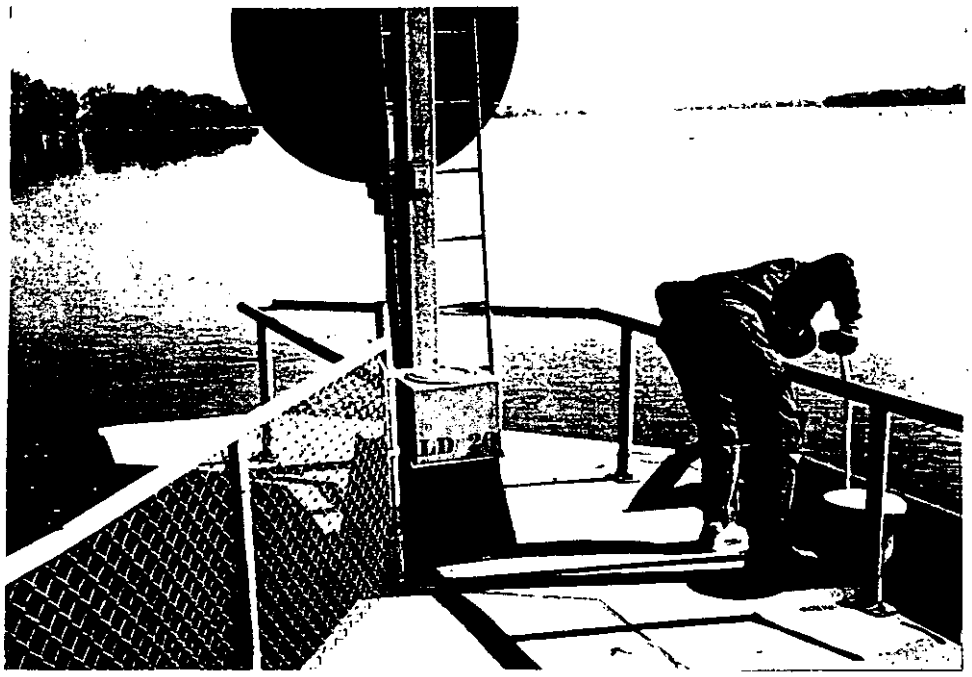
There is no change in elevation between the chamber and the lower guidewall. Like the chamber, the hand railing sits 18" away from the face of the wall. The light poles sit 63" away from the face of the wall leaving a clear area 37". Extending the lower guidewall could

be difficult. There is a fuel farm (with tanks, towboats, and a ferry) just downstream of the lock that could be affected by an extended approach. Towboats are advised to pass well clear of this area. Also, there is a small bridge and creek just to landward of the lower guidewall. This channel would have to be rerouted if a guidewall extension was added. The lockmaster had plans from the District showing how this channel realignment could be accomplished if the guidewall was extended (Figures VIII-41 to 44).

The installation of either of the two selected tow haulage system configurations would work at this site with some qualifications:

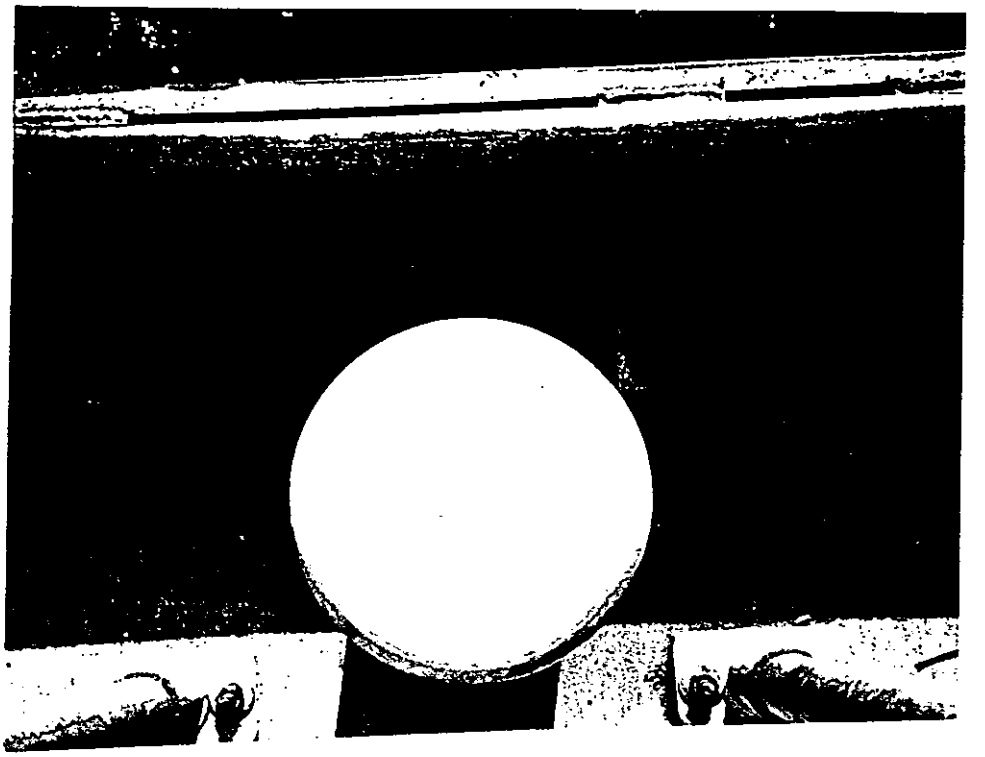
a. The upper guidewall extension would need further study relative to:
   - availability of land for acquisition
   - navigation changes/problems (increased approach time)

a. The lower guidewall extension would create several concerns:
   - would require land acquisition and a fuel tank farm relocation
   - channel realignment would be required (due to backwater conditions behind the wall including a creek)

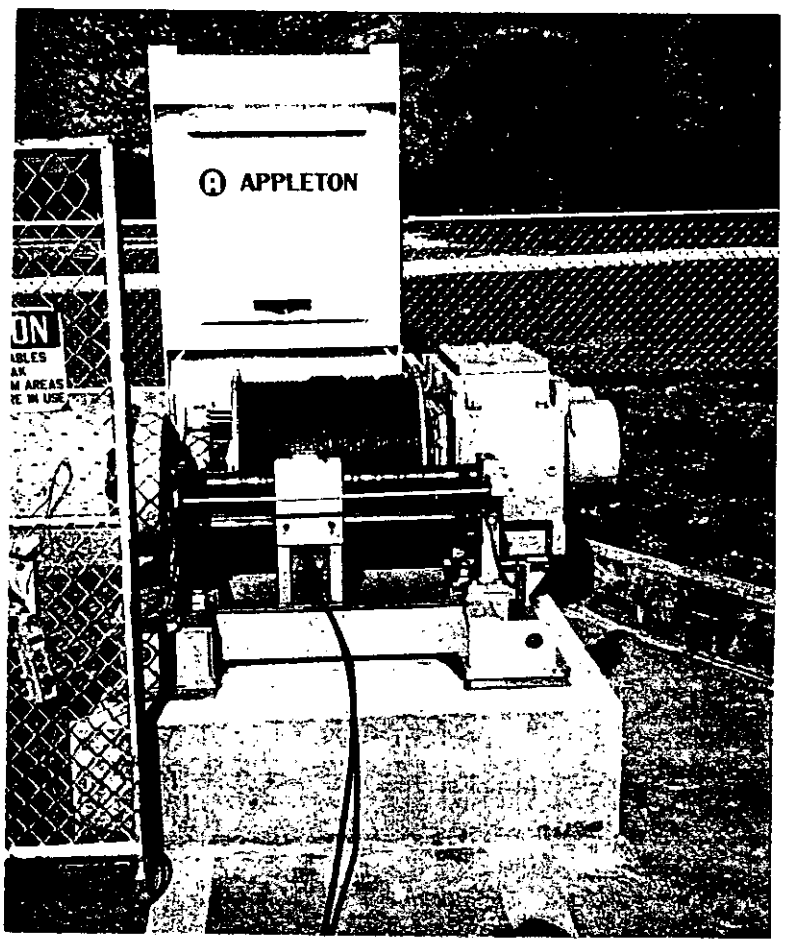


▲
Lock 20
Upper approach.
Figure VIII-35

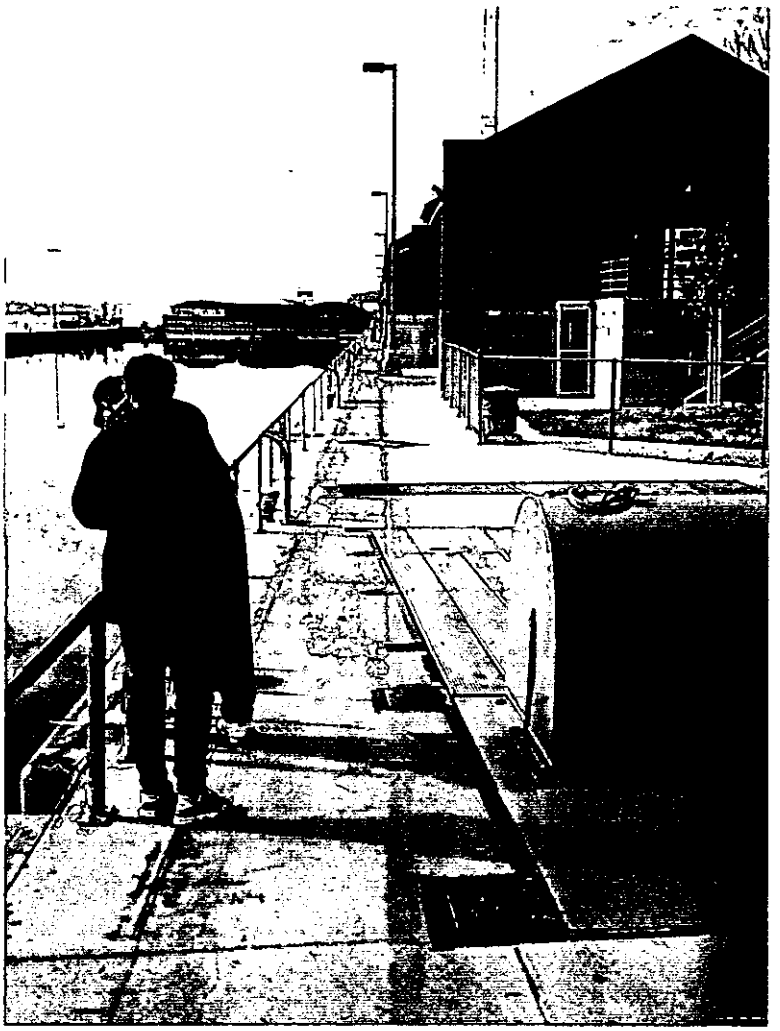
Lock 20
Upper guidewall.
Figure VIII-36



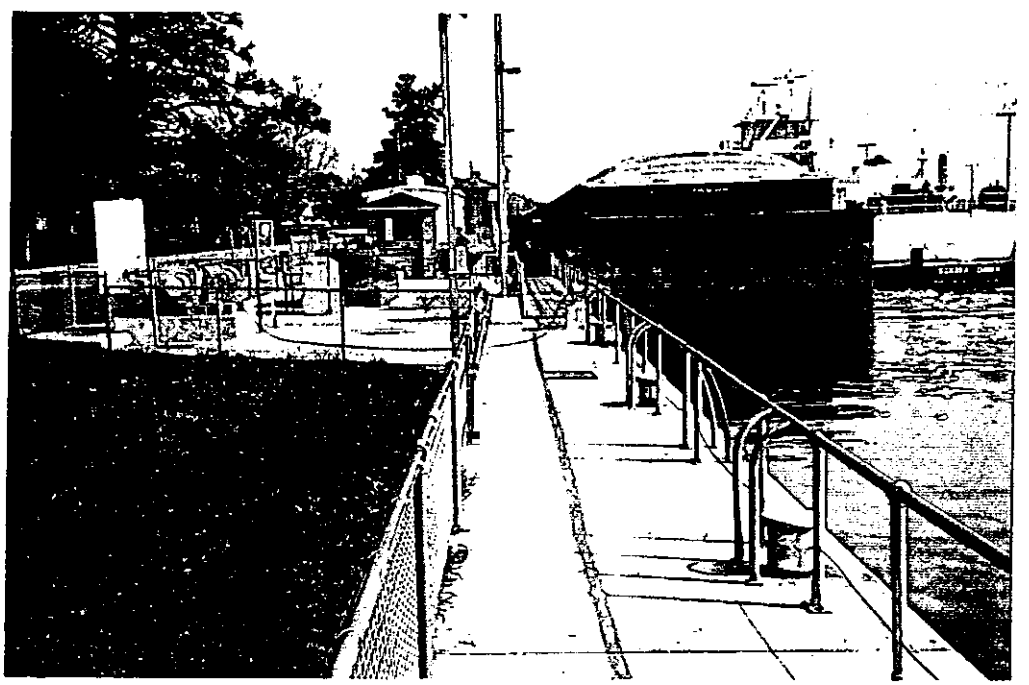
▲
Lock 20
Button, handrail, and kevel rail on upper guidewall.
Figure VIII-37



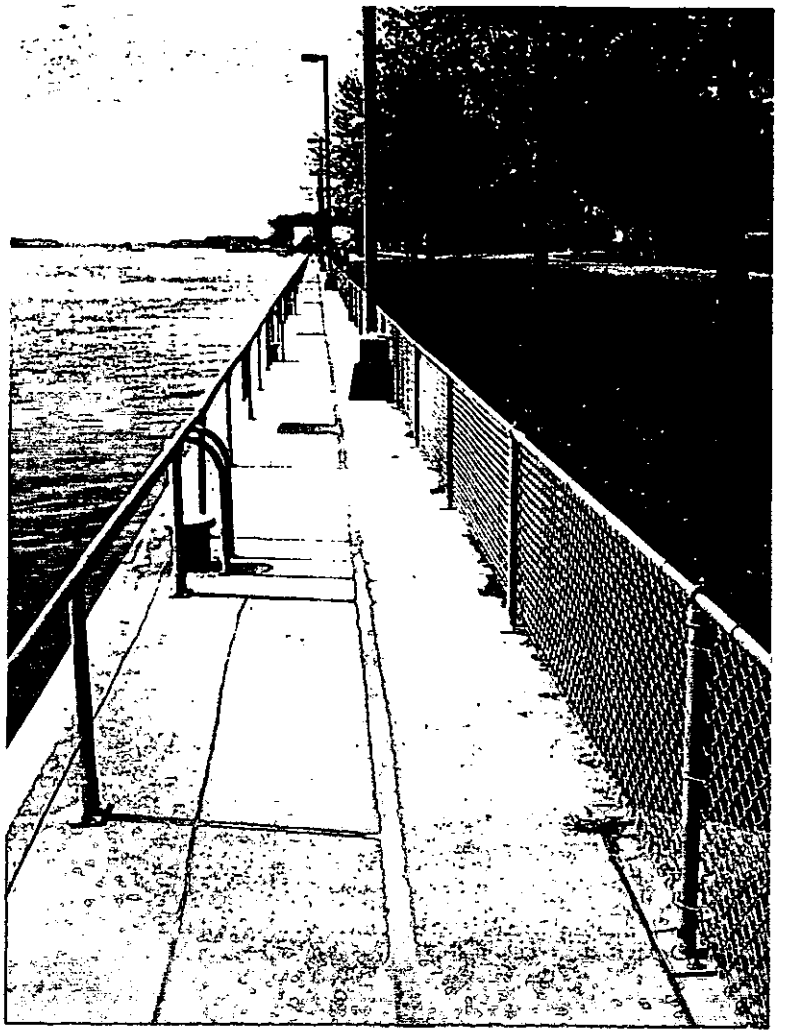
Lock 20
Existing tow haulage winch.
Figure VIII-38



Lock 20
Chamber wall and control building.
Figure VIII-39

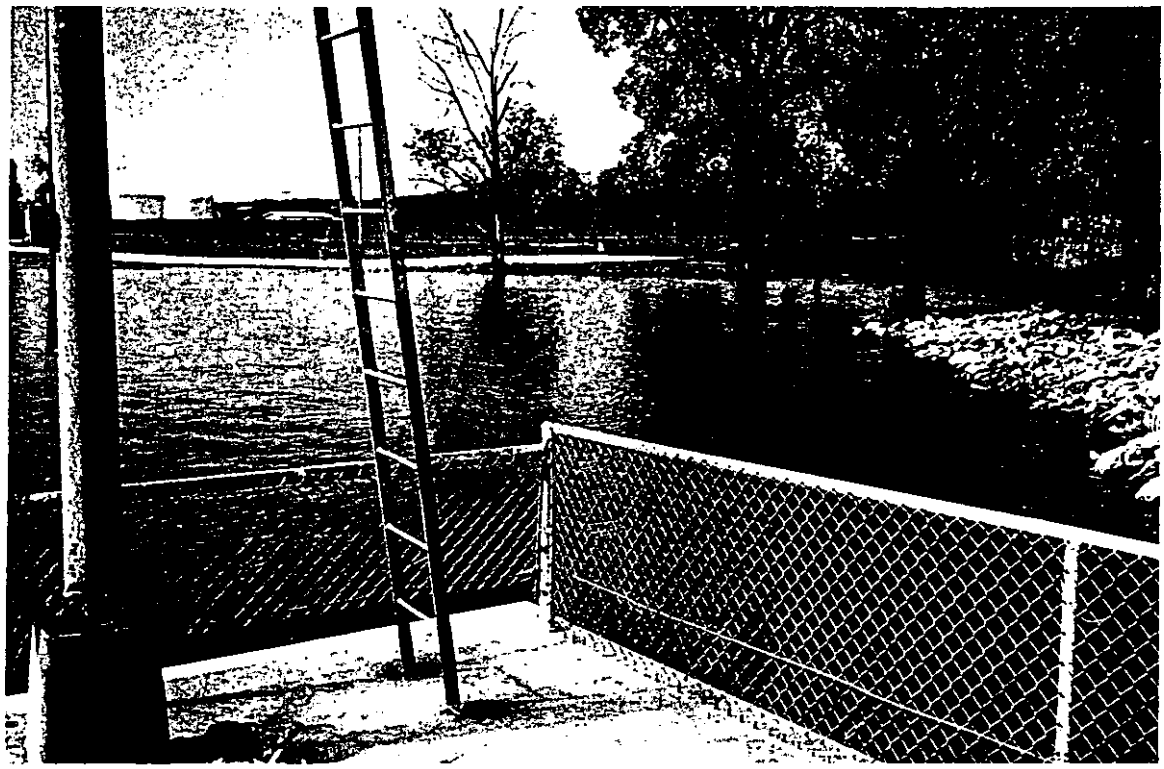


Lock 20
Lower guidewall and gate.
Figure VIII-40

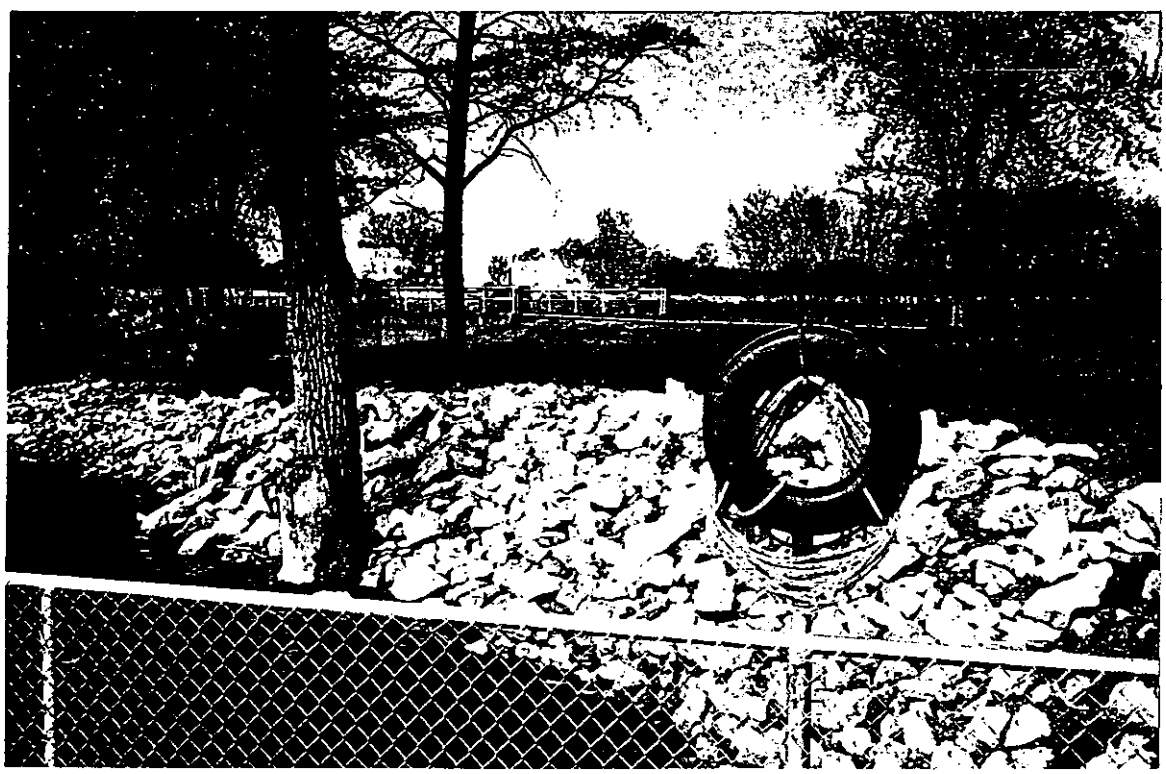


Lock 20
Lower guidewall.
Figure VIII-41

Lock 20
Lower approach.
Figure VIII-42



Lock 20
Channel and bridge at lower guidewall (left).
Figure VIII-43



Lock 20
Channel and bridge at lower guidewall (right).
Figure VIII-44

6. LAGRANGE LOCK

LaGrange Lock, near Versailles, Illinois, has a 600' x 110' chamber with 600' guidewalls on each end. It is located on the right descending bank of the Illinois River at Mile Marker 80. The Lockmaster, Mr. Stan Wallace, hosted our visit. The chamber has a winch and cable system on both ends to extract unpowered cuts from the chamber. It also has an unpowered traveling kevel on both guidewalls.

LaGrange is an exceptional lock in that is subject to a very dynamic river environment. The river rises above the level of the lock walls frequently and with little warning (as little as 1-2 hours). This is due to its location 3 miles below the confluence of the LeMoine River (also known as Crooked Creek) and the Illinois River. A 6" local rainfall can dramatically affect the water level at the lock via this ungauged creek. In addition, the lock is located just 8 miles downstream from the confluence of the Sangamon River and the Illinois River. The Sangamon River drains a large part of the Indiana drainage basin and is gauged. The ever-changing river environment has caused LaGrange Lock to be modified (out of necessity) to go underwater quickly. With as little as 2 hours notice, the lock crew must disassemble and move all equipment that could be damaged by high water and large floating trees. All of the handrails fold down, the control booths are craned onto an existing barge, the tow haulage winches are craned onto a flatbed truck, and all lock signs are pulled out of their mounts and hauled to higher ground (about 1300' away). The main building's first floor windows have already been bricked in and all equipment (pumps, bubbler system, furnace, etc.) is now permanently anchored to the second floor. All of the high masthead lights (which used to be washed away during most floods) have now been mounted on 16' high concrete structures that are pointed like a ship's bow on the upstream end. (Figures VIII-45 & 46) Even the traveling kevel is being considered for removal as the sand in the flooding water is taking its toll on the wheel bearings of this device.

Another major consideration at LaGrange is its limited electrical power. The current amperage at the lock is insufficient for current lock operations in the winter and barely sufficient in

the summer for night lockages. Additional power requirements (such as that from additional tow haulage winches) would require a full investigation of the electrical needs of the lock at all times of the year with a corresponding upgrade in electrical service to the site.

The upper guidewall has a rail whose centerline is 16" from the edge of the wall face and a handrail that is 29.5" from the wall face. The handrail and existing kevel rail could remain in place. The buttons are raised and their centerlines are about 29.5" from the face of the wall. There does not appear to be any major obstructions to extending the upper guidewall (Figures VIII-47 & 48).

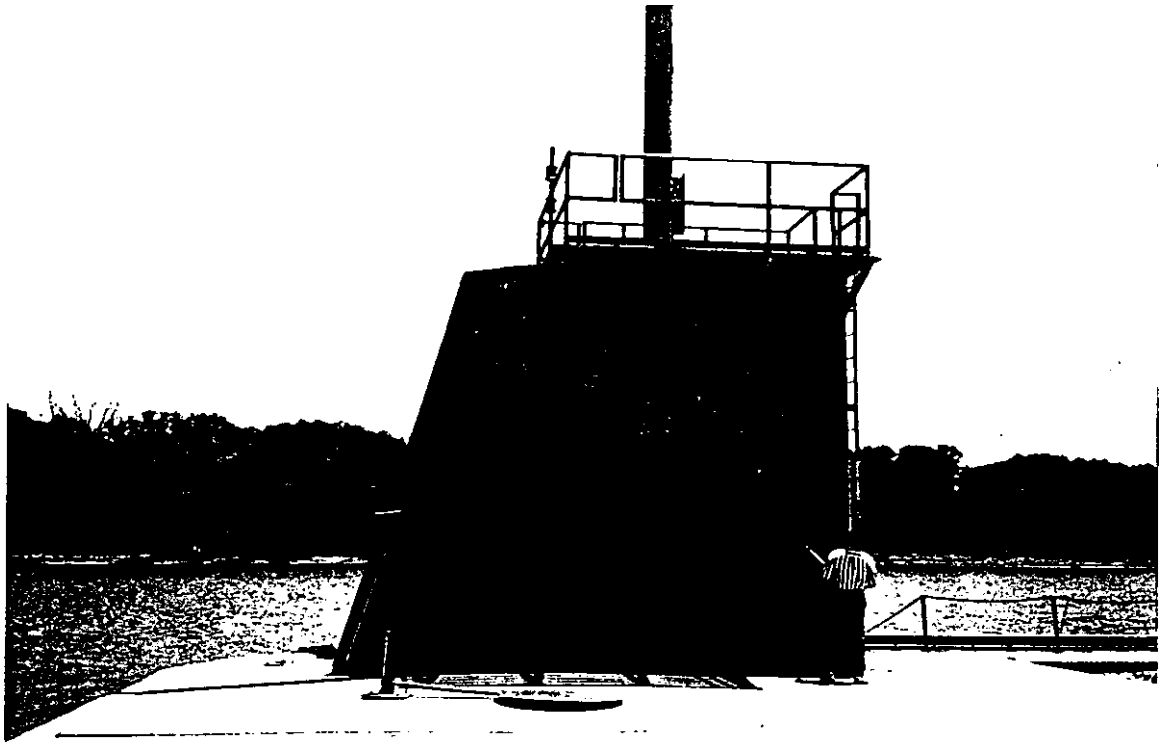
The chamber does not have floating mooring bitts. The hand railing is 28" from the face of the wall and the buttons are centered 24" from the face. The existing space between the building and the railing extension is 42" (Figures VIII-49 & 50).

There is a 2' change in elevation between the chamber and the lower guidewall. The hand railing and buttons sit 30" away from the face of the wall. Extending the lower guidewall requires a modification of the boundary between the St. Louis and Rock Island Districts as this is the demarcation line between the two Districts (Figures VIII-51 & 52).

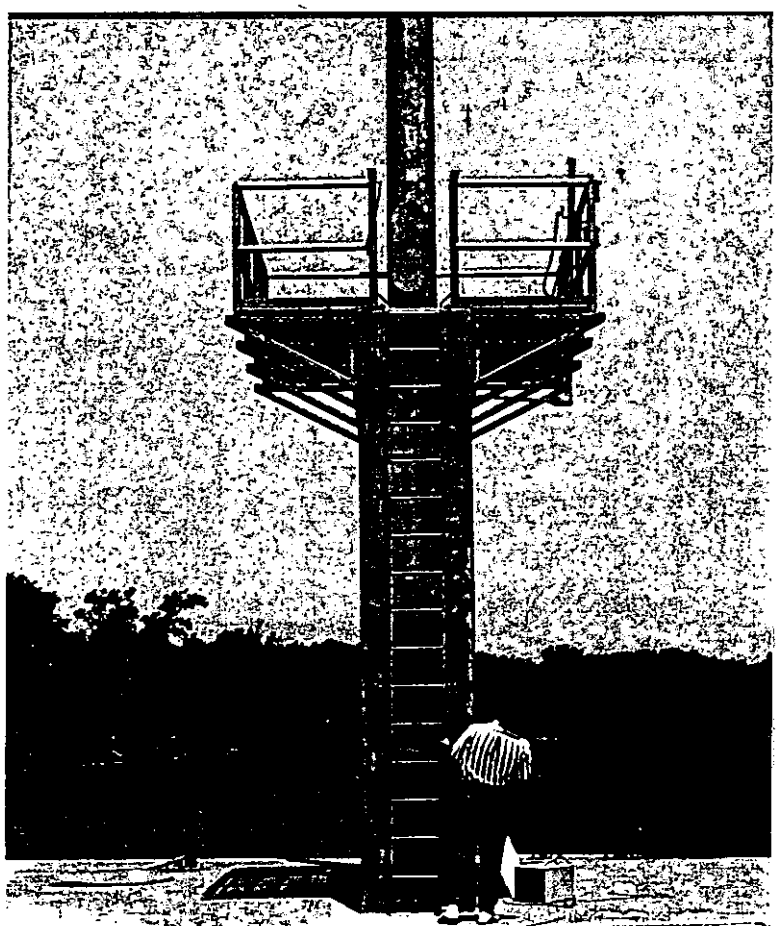
The installation of either of the two selected tow haulage system configurations would work, but would require special design and construction considerations such as:

a. All major operation al components would need to be designed to be removable (winches and kevels).

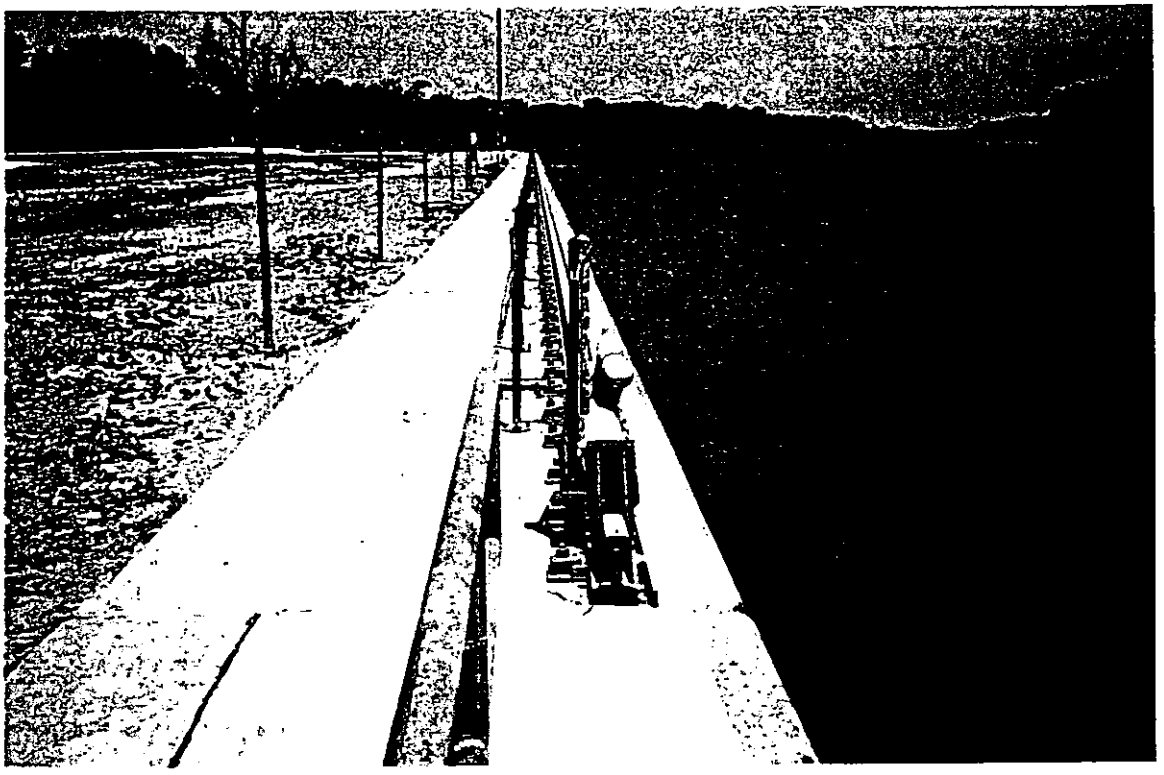
b. Resolving power supply problem



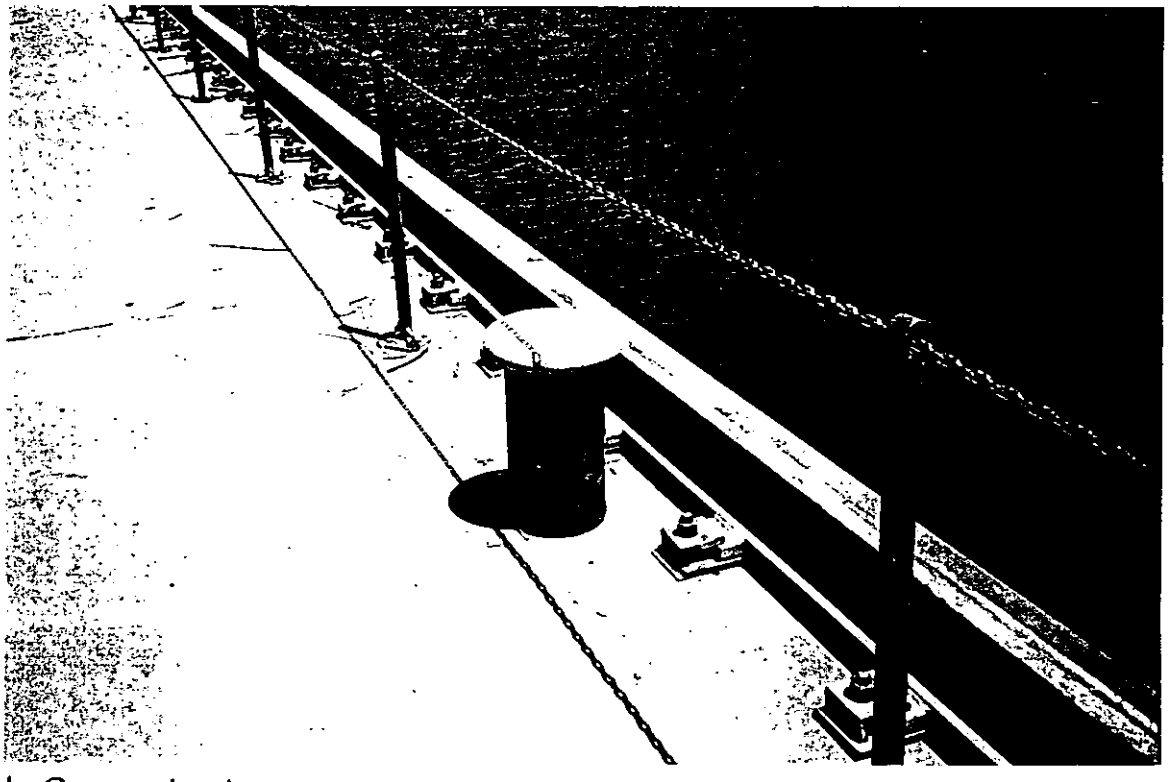
LaGrange Lock
Upper guidewall high mast light-profile
Figure VIII-45



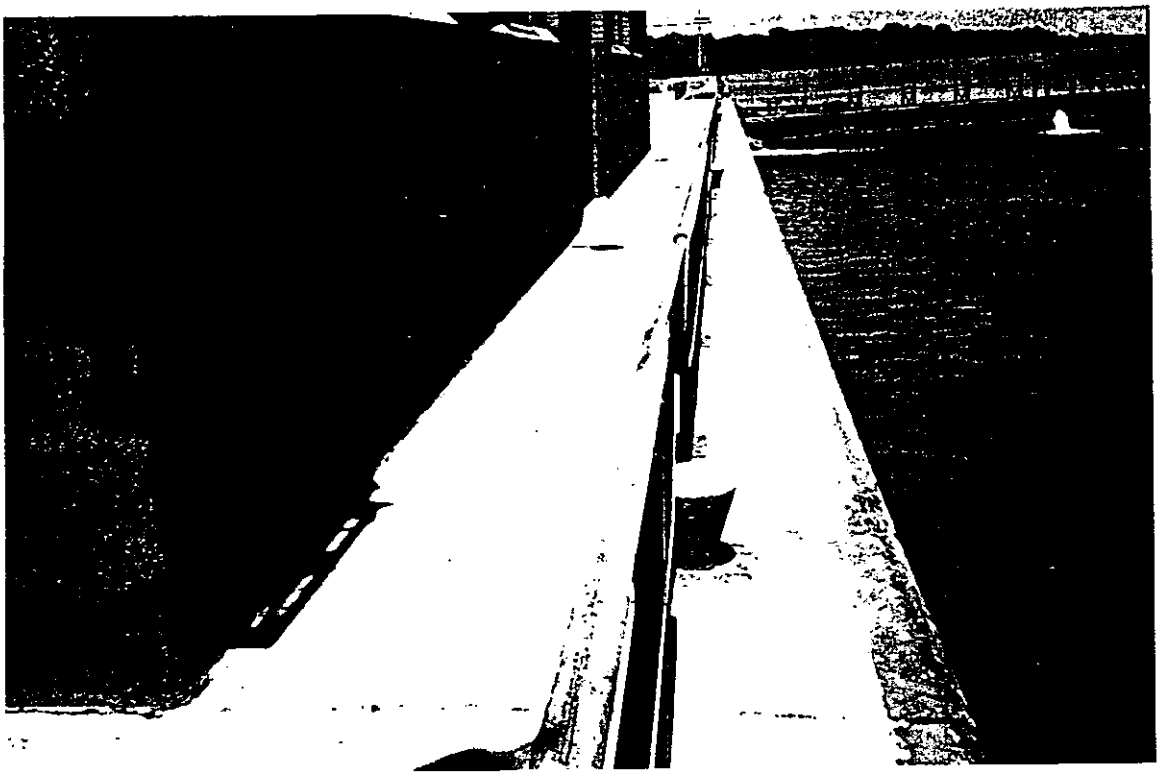
LaGrange Lock
Upper *guidewall high mast light-section*
Figure VIII-46



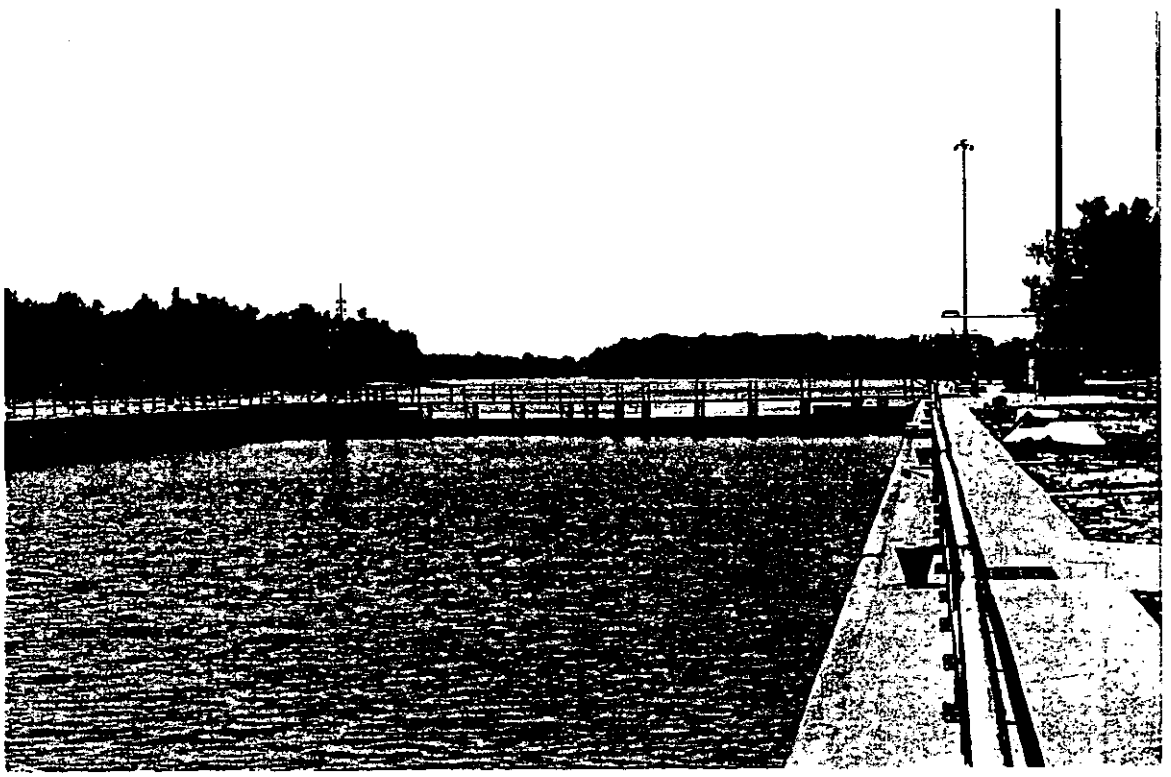
LaGrange Lock
Upper guidewall and approach
Figure VIII-47



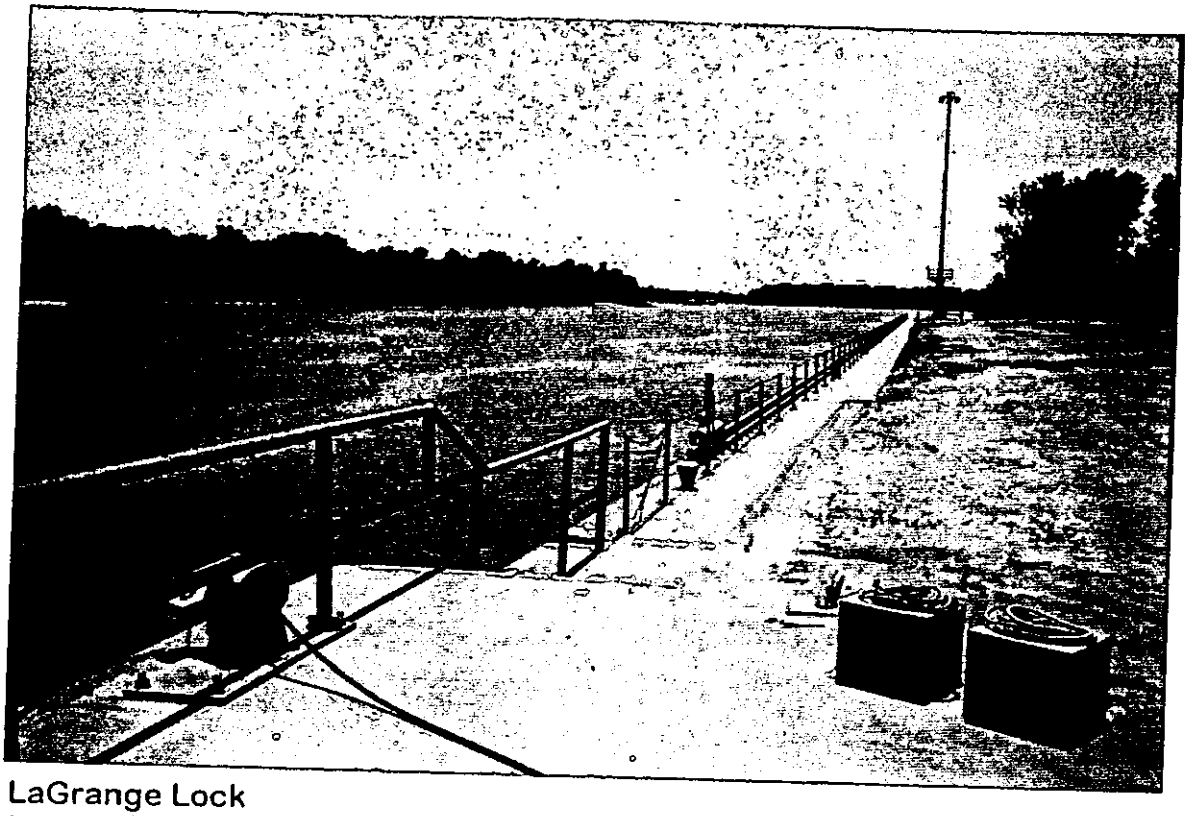
LaGrange Lock
Upper guidewall detail
Figure VIII-48



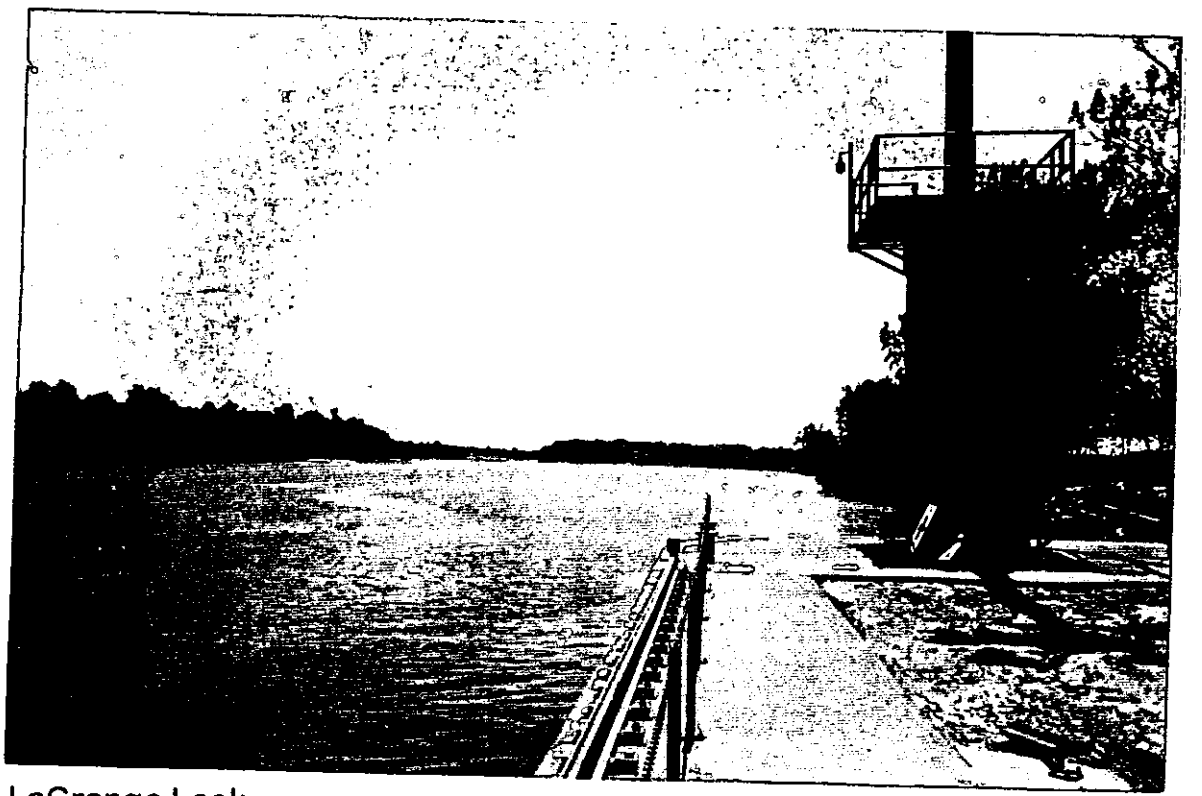
LaGrange Lock
Chamber wall along building
Figure VIII-49



LaGrange Lock
Chamber wall looking downstream
Figure VIII-50



LaGrange Lock
Lower guidewall
Figure VIII-51



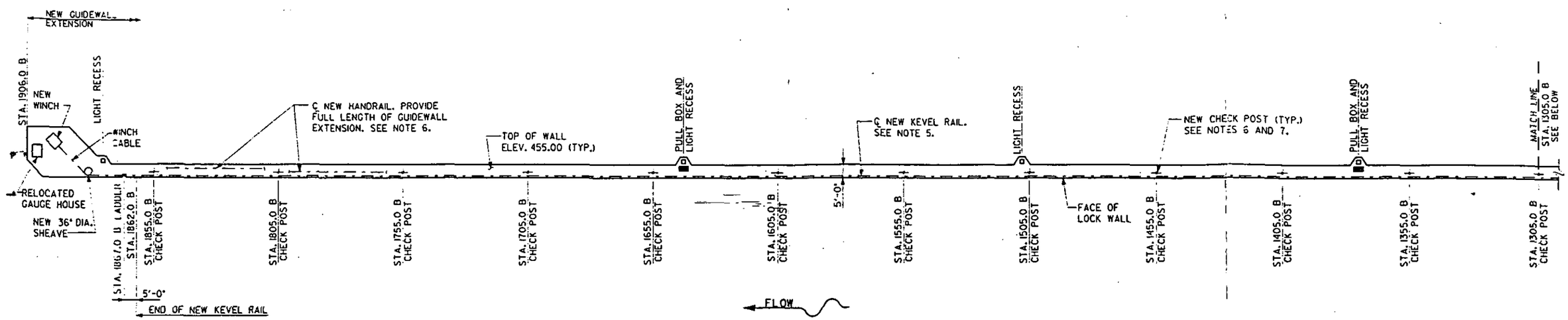
LaGrange Lock
Lower guidewall and approach
Figure VIII-52

Appendix I

APPENDIX I

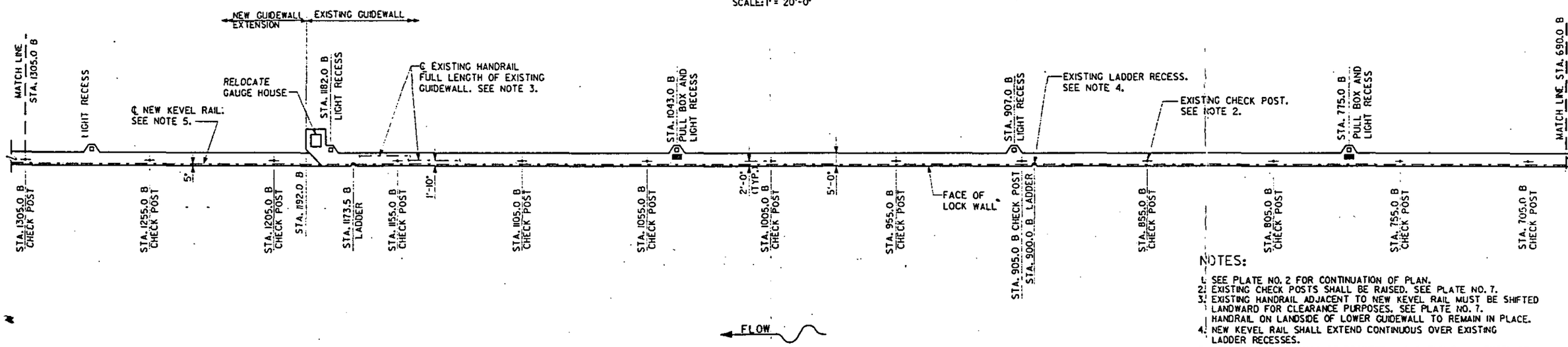
PLATES 1 THROUGH 10

TOW HAULAGE SYSTEM PLANS AND DETAILS



PLAN - STATION 1906.0B THRU STATION 1305.0B

SCALE: 1" = 20'-0"



PLAN - STATION 1305.0B THRU STATION 690.0B

SCALE: 1" = 20'-0"

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

NOTES:

1. SEE PLATE NO. 2 FOR CONTINUATION OF PLAN.
2. EXISTING CHECK POSTS SHALL BE RAISED. SEE PLATE NO. 7.
3. EXISTING HANDRAIL ADJACENT TO NEW KEVEL RAIL MUST BE SHIFTED LANDWARD FOR CLEARANCE PURPOSES. SEE PLATE NO. 7. HANDRAIL ON LANDSIDE OF LOWER GUIDEWALL TO REMAIN IN PLACE.
4. NEW KEVEL RAIL SHALL EXTEND CONTINUOUS OVER EXISTING LADDER RECESSES.
5. NEW KEVEL RAIL SHALL BE PROVIDED ALONG THE FULL LENGTH OF GUIDEWALL (EXISTING AND NEW) FOR BOTH OPTION 12-6-12 AND 12-N-12.
6. NEW CHECK POSTS AND HANDRAIL SHALL BE LOCATED TO PROVIDE ADEQUATE CLEARANCE WITH NEW KEVEL RAIL. RIVERSIDE HANDRAIL SHALL ALIGN WITH EXISTING BEING SHIFTED ON THE EXISTING GUIDEWALL. SEE PLATE NO. 7.
7. NEW CHECK POSTS ON GUIDEWALL EXTENSION PROVIDED AT 50'-0" INTERVALS FOR CONCEPT PURPOSES.

REVISION	DATE	DESCRIPTION	BY

Sverdrup CIVIL, INC.
13723 RIVERPORT DRIVE
MARYLAND HEIGHTS, MO. 63043

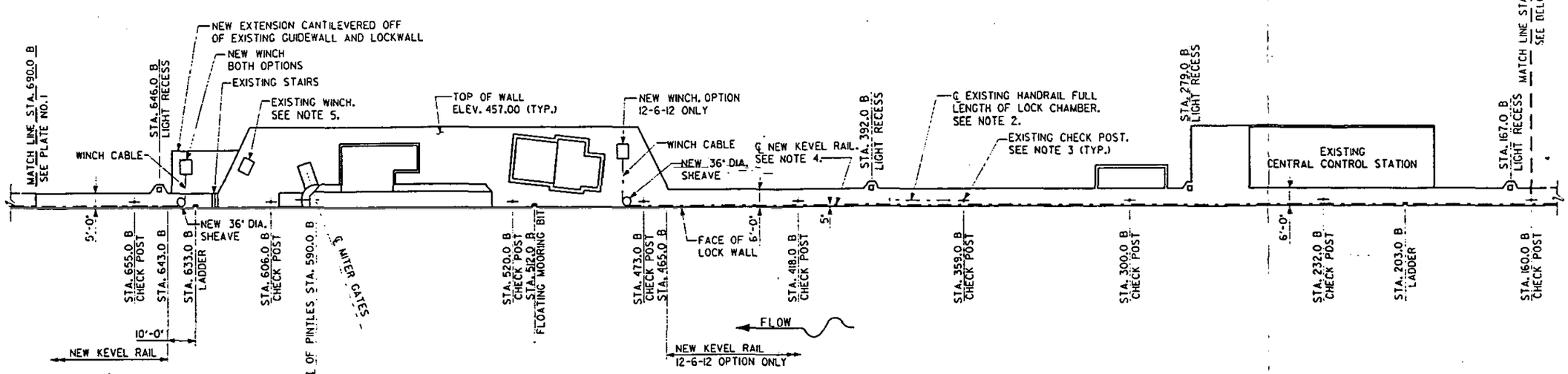
OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DRAWN BY: R. PETTITT
DESIGNED BY: T. THEE
CHECKED BY: X
SUBMITTED BY: X
SUPERVISOR - ENGINEER
APPROVED: X
APPROVED: X
CHIEF, ENGINEERING DIVISION
DATE:

MISSISSIPPI RIVER, MISSOURI
LOCK NO. 24
IMPROVED TOW HAULAGE SYSTEM
LOCK, STRUCTURE AND GUIDEWALLS
PLAN
STATION 1906.0B THRU STATION 690.0B

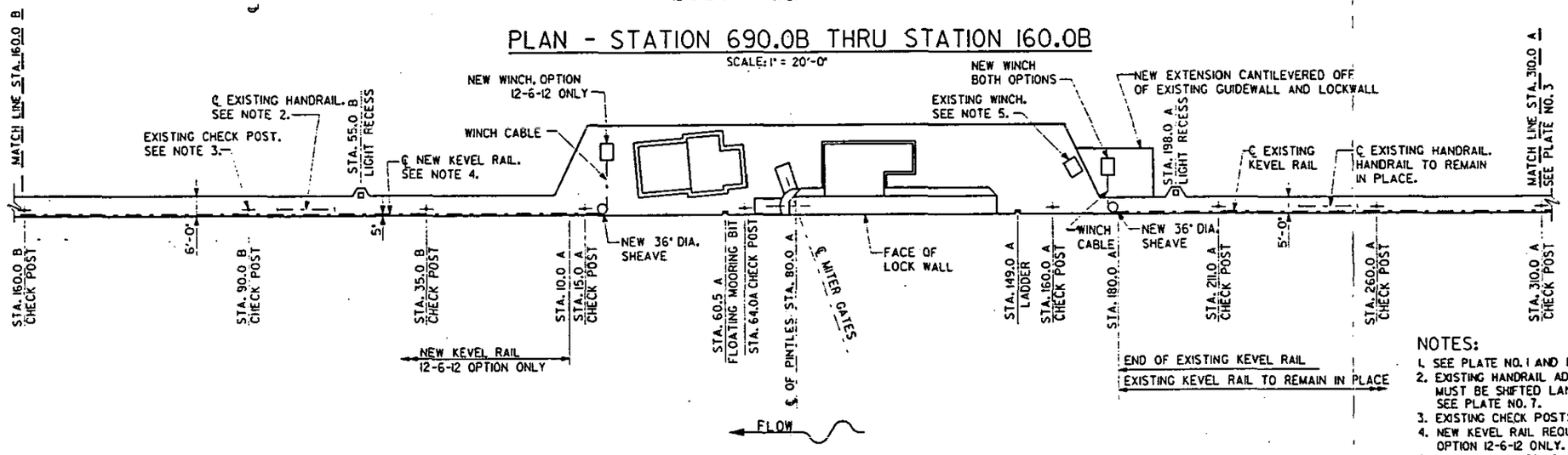
SCALE: AS SHOWN
SPEC. DATE:
DRAWING NUMBER
PLATE NO. 1
SHEET OF
FILE NO.

12026 L24S00LDGN



PLAN - STATION 690.0B THRU STATION 160.0B

SCALE: 1" = 20'-0"



PLAN - STATION 160.0B THRU STATION 310.0A

SCALE: 1" = 20'-0"

NOTES:

1. SEE PLATE NO. 1 AND PLATE NO. 3 FOR CONTINUATION OF PLAN.
2. EXISTING HANDRAIL ADJACENT TO NEW KEVEL RAIL MUST BE SHIFTED LANDWARD FOR CLEARANCE PURPOSES. SEE PLATE NO. 7.
3. EXISTING CHECK POSTS SHALL BE RAISED. SEE PLATE NO. 7.
4. NEW KEVEL RAIL REQUIRED IN MAIN LOCK CHAMBER FOR OPTION 12-6-12 ONLY.
5. EXISTING WINCHES (2) SHALL REMAIN IN USE FOR THE 12-N-12 OPTION ONLY, AND SHALL BE ABANDONED IN PLACE FOR THE 12-6-12 OPTION.

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

REVISION	DATE	DESCRIPTION	BY

Sverdrup CIVIL, INC.
13723 RIVERPORT DRIVE
MARYLAND HEIGHTS, MO. 63043

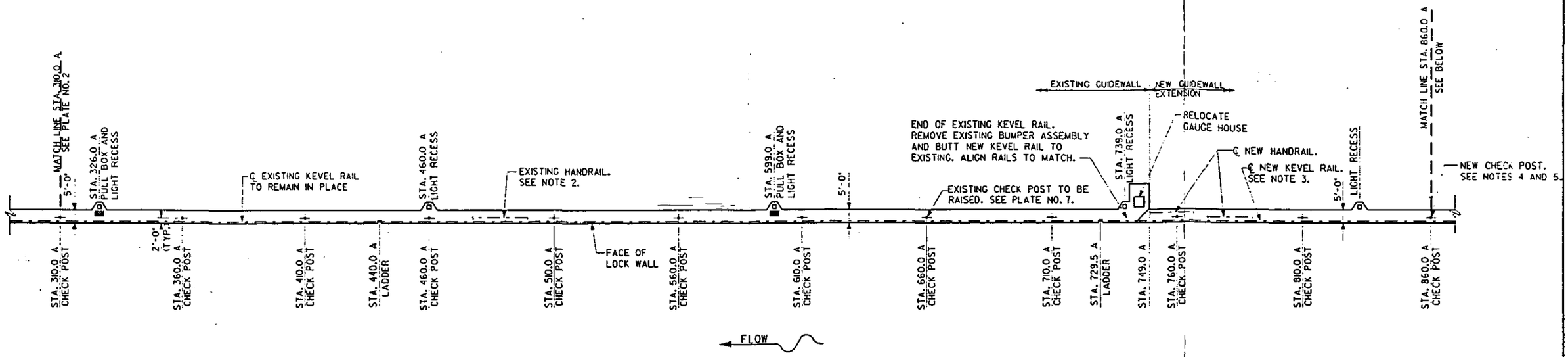
OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DRAWN BY: R. PETTIT
DESIGNED BY: T. THEE
CHECKED BY: X
SUBMITTED BY: X
PROJECT ENGINEER
APPROVED: X
CHIEF, CHIEF ENGINEERING DIVISION
APPROVED:
DATE:
SCALE: AS SHOWN
SPEC. DATE:

MISSISSIPPI RIVER, MISSOURI
LOCK NO. 24
IMPROVED TOW HAULAGE SYSTEM
LOCK STRUCTURE AND GUIDEWALLS
PLAN
STATION 690.0B THRU STATION 310.0A

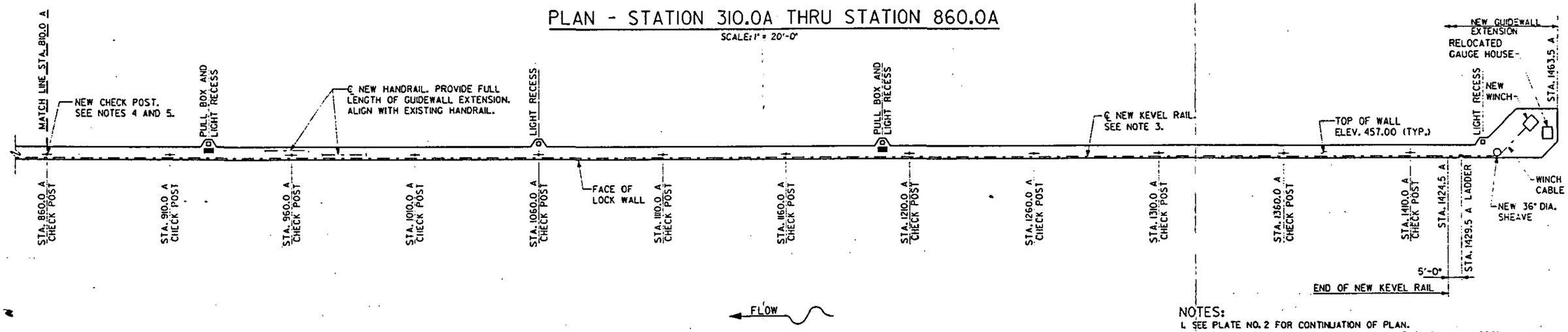
DRAWING NUMBER
PLATE NO. 2
SHEET OF FILE NO.

12026 L24SUB2.DGN



PLAN - STATION 310.0A THRU STATION 860.0A

SCALE: 1" = 20'-0"



PLAN - STATION 860.0A THRU STATION 1463.5A

SCALE: 1" = 20'-0"

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

NOTES:

1. SEE PLATE NO. 2 FOR CONTINUATION OF PLAN.
2. EXISTING HANDRAIL ADJACENT TO EXISTING KEVEL RAIL ON UPPER GUIDEWALL TO REMAIN IN PLACE.
3. NEW KEVEL RAIL SHALL BE PROVIDED FULL LENGTH OF GUIDEWALL EXTENSION FOR BOTH THE 12-6-12 AND 12-N-12 OPTIONS.
4. NEW HANDRAIL AND CHECK POSTS ON GUIDEWALL EXTENSION SHALL BE LOCATED SUCH THAT ADEQUATE CLEARANCE TO THE NEW KEVEL RAIL IS PROVIDED. SEE PLATE NO. 7.
5. NEW CHECK POSTS ON GUIDEWALL EXTENSION PROVIDED AT 50'-0" INTERVALS FOR CONCEPT PURPOSES.

REVISION	DATE	DESCRIPTION	BY

Boardman CIVIL, INC.
13723 RIVERPORT DRIVE
MARYLAND HEIGHTS, MO. 63043

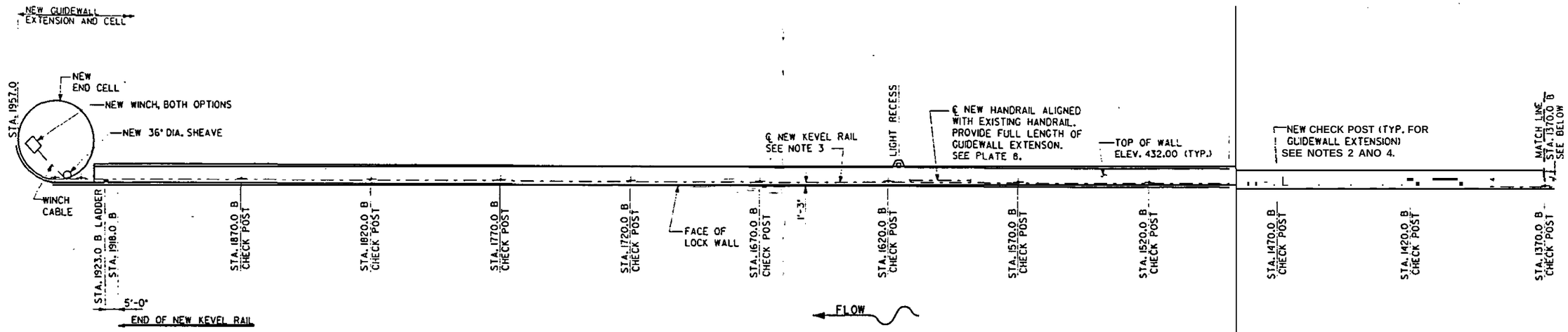
OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DRAWN BY: R. PETTITT
DESIGNED BY: T. THEE
CHECKED BY: X
SUBMITTED BY: X
ARCHITECT - ENGINEER
APPROVED:
APPROVED:
CHIEF, ENGINEERING DIVISION
DATE:

MISSISSIPPI RIVER, MISSOURI
LOCK NO. 24
IMPROVED TOW HAULAGE SYSTEM
LOCK STRUCTURE AND GUIDEWALLS
PLAN
STATION 310.0A THRU STATION 1463.5A

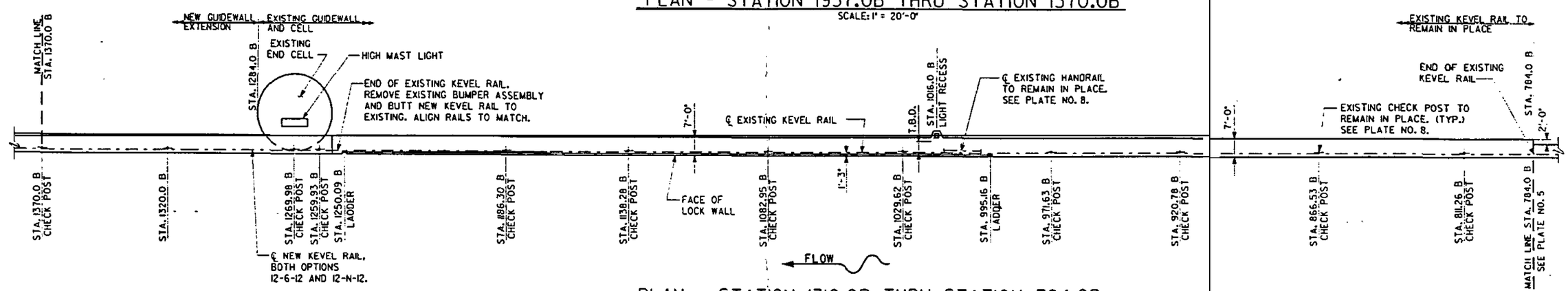
SCALE: AS SHOWN
SPEC. DATE:
DRAWING NUMBER
PLATE NO. 3
SHEET OF
FILE NO.

L245003.DGN
12026



PLAN - STATION 1957.0B THRU STATION 1370.0B

SCALE: 1" = 20'-0"



PLAN - STATION 1310.0B THRU STATION 784.0B

SCALE: 1" = 20'-0"

N " E S :

L E PLATE NO. 5 FOR CONTINUATION OF PLAN.

2. W HANDRAIL AND CHECK POSTS ON GUIDEWALL EXTENSION SHALL LOCATED SUCH THAT ADEQUATE CLEARANCE TO THE NEW KEVEL IL IS PROVIDED, AND SHALL ALIGN WITH EXISTING. SEE PLATE NO. 8.

3. W KEVEL RAIL SHALL BE PROVIDED FULL LENGTH OF NEW GUIDEWALL R BOTH THE 12-6-12 AND 12-N-12 TOW HAULAGE OPTIONS.

4. W CHECK POSTS ON GUIDEWALL EXTENSION PROVIDED AT 50'-0" 'ERVALS FOR CONCEPT PURPOSES.

20 0 20 40

1"=20'-0"

NO.	DATE	DESCRIPTION	BY

Sverdrup CIVIL, INC.
13723 RIVERPORT DRIVE
MARYLAND HEIGHTS, MO. 63043

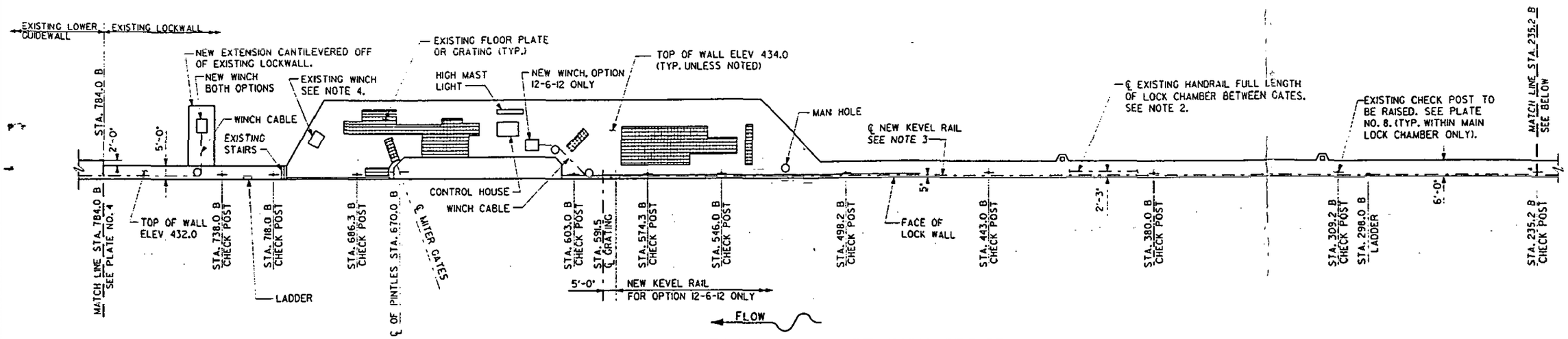
OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAN
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

BY: R. PETTIT
CD BY: T. THEE
D BY:
TD:
CHECKED:
APPROVED:
CHIEF, ENGINEERING DIVISION
DATE:
FORMED BY ENGINEER CIRCULAR NO. 1110-1-1
SCALE: AS SHOWN
SPEC. DATE:

ILLINOIS WATERWAY
LAGRANGE LOCK AND DAM
IMPROVED TOW HAULAGE SYSTEM
LOCK STRUCTURE AND GUIDEWALLS
PLAN
STATION 1957.0B THRU STATION 784.0B

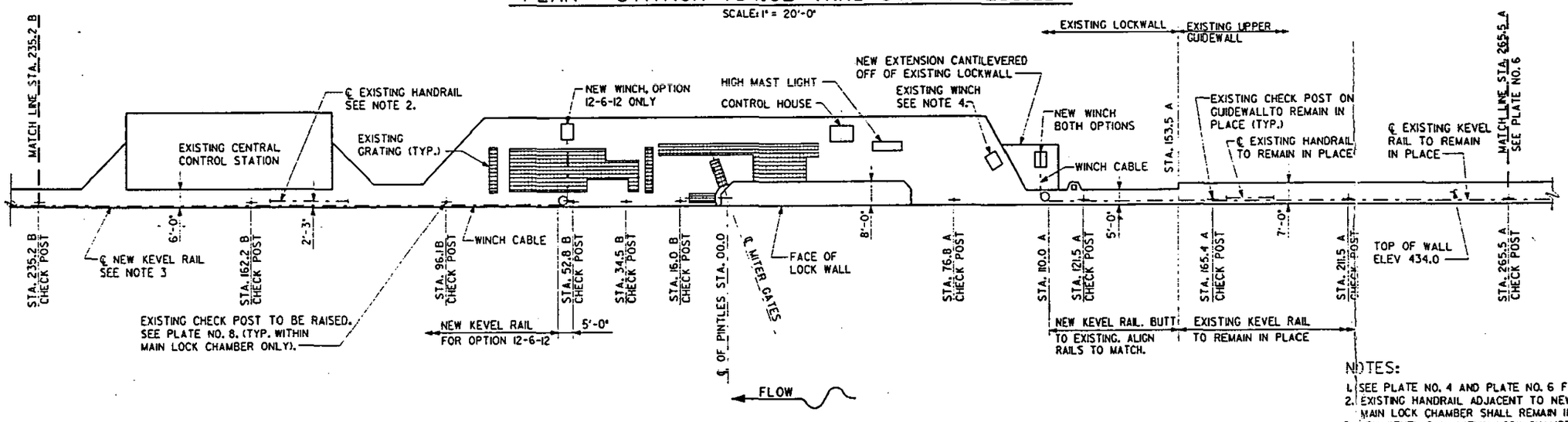
DRAWING NUMBER
PLATE NO. 4

SHEET OF FILE NO.



PLAN - STATION 784.0B THRU STATION 235.2B

SCALE: 1" = 20'-0"



PLAN - STATION 235.2B THRU STATION 265.5A

SCALE: 1" = 20'-0"

NOTES:

1. SEE PLATE NO. 4 AND PLATE NO. 6 FOR CONTINUATION OF PLAN.
2. EXISTING HANDRAIL ADJACENT TO NEW KEVEL RAIL WITHIN THE MAIN LOCK CHAMBER SHALL REMAIN IN PLACE. SEE PLATE NO. 8.
3. NEW KEVEL RAIL WITHIN LOCK CHAMBER REQUIRED ONLY FOR THE 12-6-12 OPTION.
4. EXISTING WINCH SHALL REMAIN IN PLACE FOR THE 12-N-12 OPTION ONLY, AND SHALL BE REMOVED FOR THE 12-6-12 OPTION.

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

REVISION	DATE	DESCRIPTION	BY

Everdrup CIVIL, INC.
13723 RIVERPORT DRIVE
MARYLAND HEIGHTS, MO. 63043

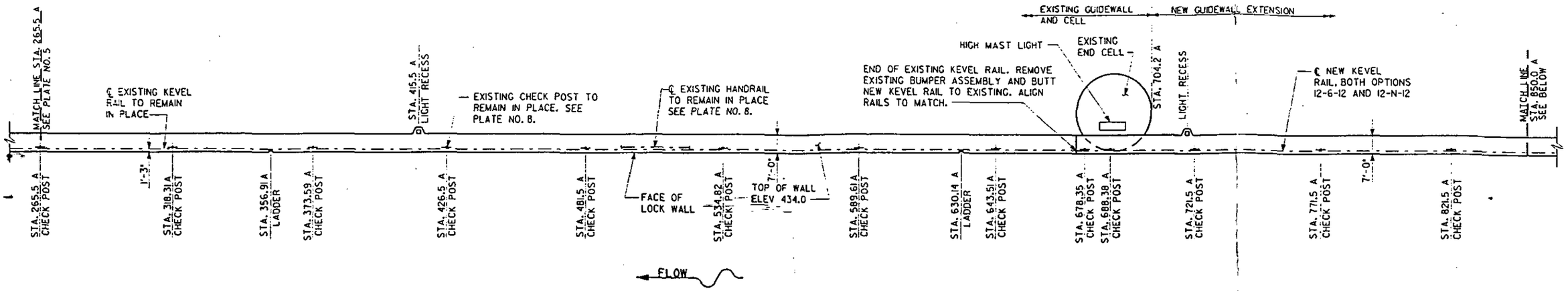
OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DRAWN BY: R. PETTITT
DESIGNED BY: T. THEE
CHECKED BY: X
SUBMITTED BY: X
APPROVED: X
CHIEF, ENGINEERING DIVISION

ILLINOIS WATERWAY
LAGRANGE LOCK AND DAM
IMPROVED TOW HAULAGE SYSTEM
LOCK STRUCTURE AND GUIDEWALLS
PLAN
STATION 784.0B THRU STATION 265.5A

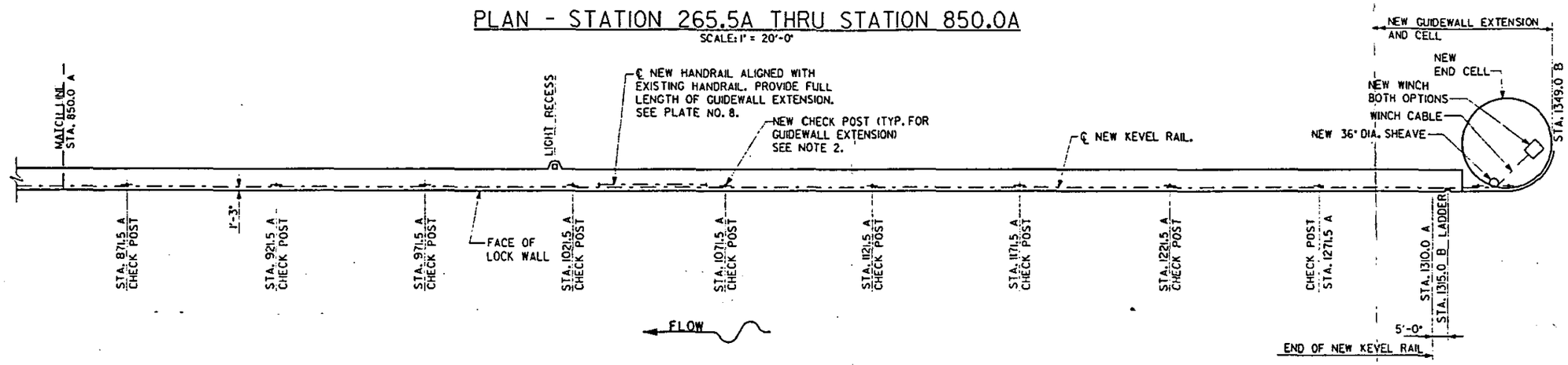
SCALE: AS SHOWN
DRAWING NUMBER: PLATE NO. 5

12026 LAGSGUZ.DGN



PLAN - STATION 265.5A THRU STATION 850.0A

SCALE: 1" = 20'-0"



PLAN - STATION 850.0A THRU STATION 1349.0A

SCALE: 1" = 20'-0"

NOTES:

1. SEE PLATE NO. 5 FOR CONTINUATION OF PLAN.
2. NEW HANDRAIL AND CHECK POSTS ON GUIDEWALL EXTENSION SHALL BE LOCATED SUCH THAT ADEQUATE CLEARANCE TO THE NEW KEVEL RAIL IS PROVIDED, AND SHALL ALIGN WITH EXISTING. SEE PLATE NO. 8.
3. NEW CHECKPOSTS ON GUIDEWALL EXTENSION PROVIDED AT 50'-0" INTERVALS FOR CONCEPT PURPOSES.

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

REVISION	DATE	DESCRIPTION	BY

Dowdrup CIVIL, INC.
13723 RIVERPORT DRIVE
MARYLAND HEIGHTS, MO. 63043

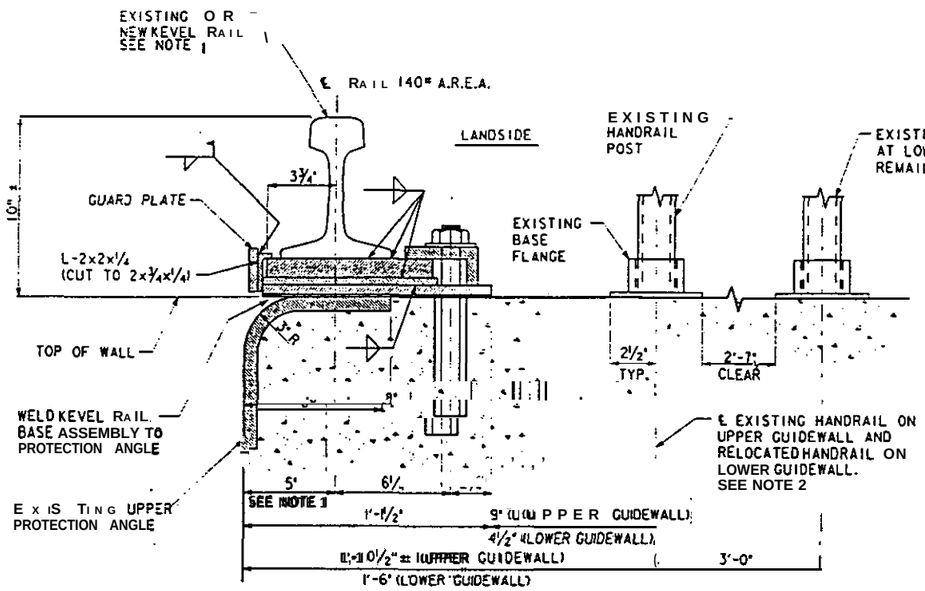
OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DRAWN BY: R. PETTITT
DESIGNED BY: T. THEE
CHECKED BY: X
SUBMITTED BY: X
PROJECT ENGINEER
APPROVED: CHIEF
APPROVED: CHIEF, ENGINEERING DIVISION
DATE:

ILLINOIS WATERWAY
LAGRANGE LOCK AND DAM
IMPROVED TOW HAULAGE SYSTEM
LOCK STRUCTURE AND GUIDEWALLS
PLAN
STATION 265.5A THRU STATION 1349.0A

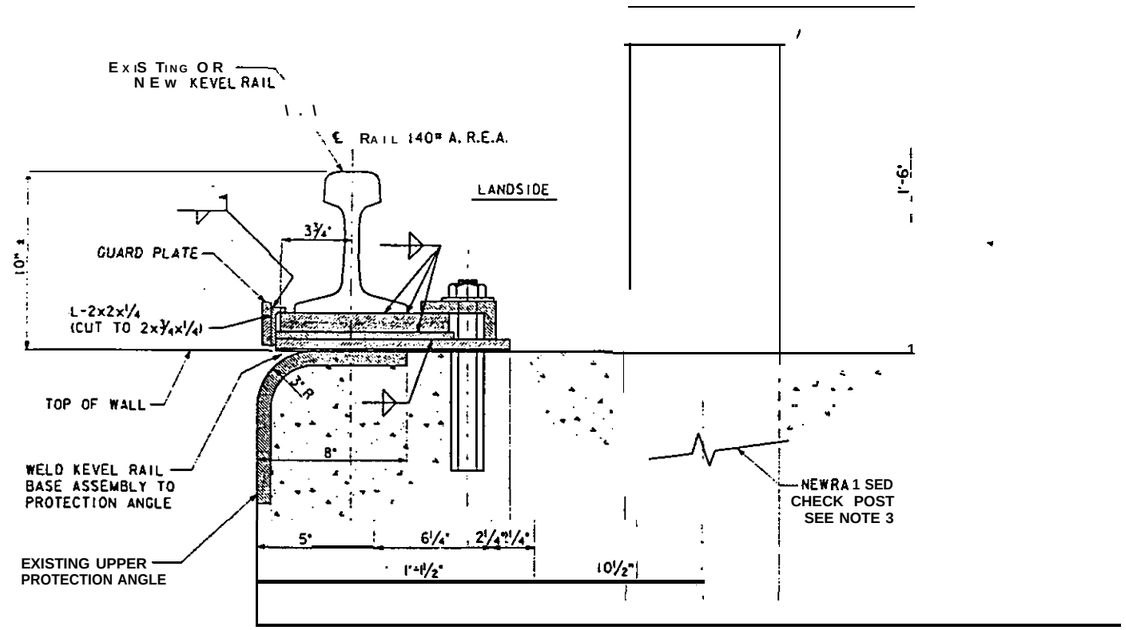
AS REQUIRED BY ENGINEER CIRCULAR NO. 1110-1-16
SCALE: AS SHOWN
SPEC. DATE:
DRAWING NUMBER
PLATE NO. 6
SHEET OF FILE NO.

LAGS003.DGN
12026



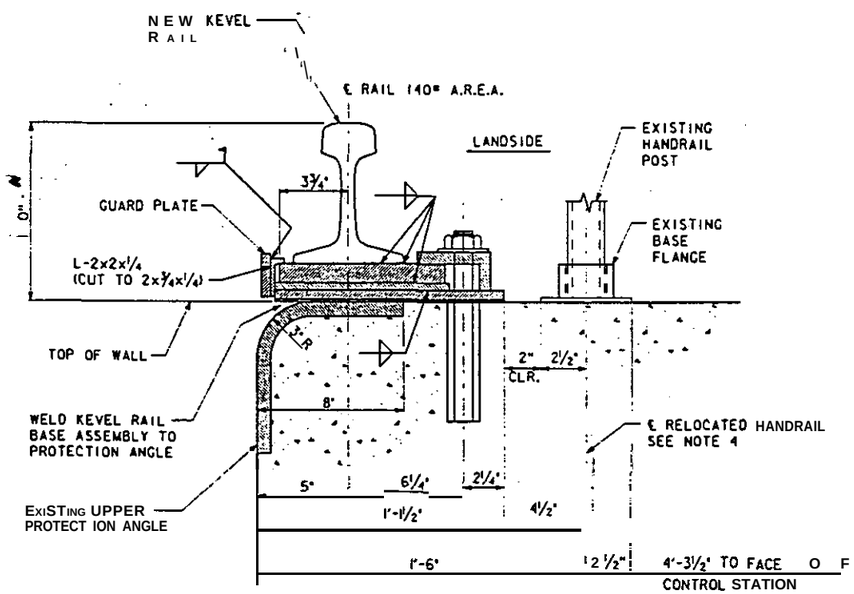
TYPICAL GUIDEWALL SECTION (UPPER AND LOWER)

CHECK POSTS NOT SHOWN
SCALE: 3"=1'-0"



TYPICAL SECTION AT CHECK POST FOR GUIDEWALLS AND MAIN LOCK CHAMBER

SCALE: 3"=1'-0"



TYPICAL SECTION WITHIN MAIN LOCK CHAMBER

CHECK POSTS NOT SHOWN
SCALE: 3"=1'-0"

NOTES:

1. EXISTING KEVEL RAIL ON UPPER GUIDEWALL SHALL REMAIN IN PLACE. WHERE APPLICABLE, NEW RAIL SHALL BUTT AGAINST EXISTING RAIL AND MATCH BOTH THE VERTICAL AND HORIZONTAL ALIGNMENT OF THE EXISTING RAIL.
2. EXISTING HANDRAIL ON UPPER GUIDEWALL SHALL REMAIN IN PLACE. EXISTING HANDRAIL ON THE LOWER GUIDEWALL MAY HAVE TO BE SHIFTED LANDWARD, DEPENDENT UPON THE FINAL CONFIGURATION OF THE KEVEL RAIL BASE ASSEMBLY. *IF HANDRAIL IS SHIFTED, REUSE EXISTING BASE FLANGES AND ANCHOR INTO TOP* OF LOCK WALL WITH THREADED RODS OR EXPANSION ANCHORS. RELOCATION HAS BEEN ASSUMED FOR CONCEPT PURPOSES.
3. SIZE AND ANCHORAGE OF NEW CHECK POST TO BE DETERMINED IN FINAL DESIGN. ALL NEW CHECK POSTS MAY BE SHIFTED RIVERWARD TO GAIN ADDITIONAL CLEARANCE FOR CUSHMAN CART ACCESS, DEPENDENT UPON FINAL KEVEL RAIL BASE ANCHORAGE DESIGN. PLAN LOCATIONS OF NEW CHECK POSTS SHALL BE SHIFTED AS REQUIRED TO CLEAR REMAINING EMBEDMENTS OF POSTS BEING REMOVED.
4. EXISTING HANDRAIL WITHIN THE MAIN LOCK CHAMBER MUST BE SHIFTED LANDWARD. REUSE EXISTING BASE FLANGES AND ANCHOR INTO TOP OF WALL WITH THREADED RODS OR EXPANSION ANCHORS.

0" 3" 6" 1'
3" = 1'-0"

REVISION	DATE	DESCRIPTION	BY

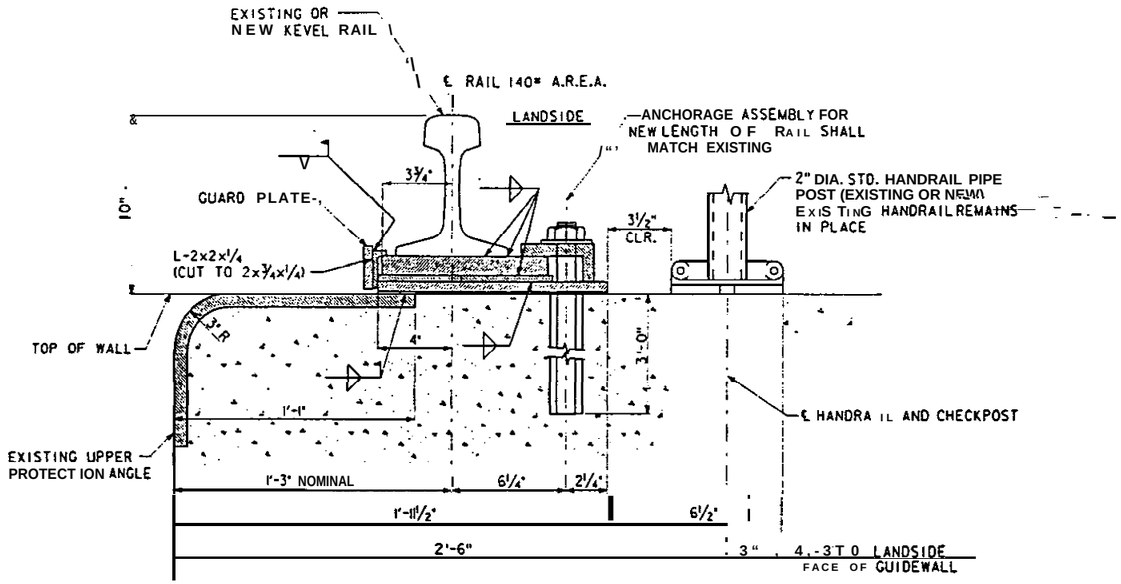
Sverdrup CIVIL, INC.
13723 RIVERPORT DRIVE
MARYLAND HEIGHTS, MO. 63043

OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DRAWN: R. BILEY
DESIGNED: T. TREE
CHECKED:
SUBMITTED BY:
PROJECT ENGINEER
APPROVED:
CHIEF
APPROVED:
CHIEF, ENGINEERING DIVISION
DATE:
AS REQUIRED BY ENGINEER CIRCULAR NO. 1110-1-8
SCALE: AS SHOWN
SPEC. DATE:

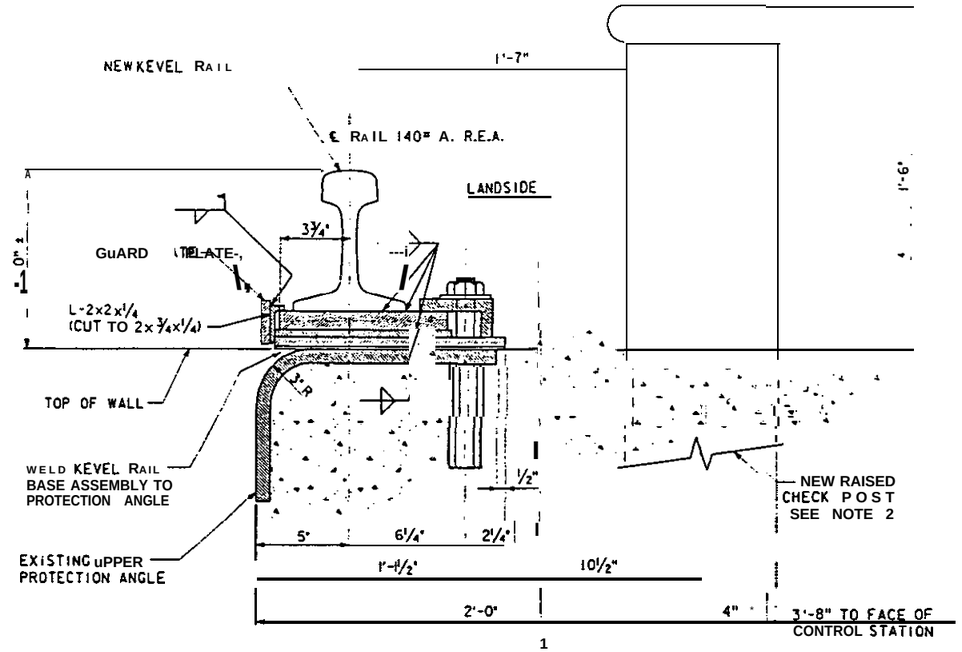
MISSISSIPPI RIVER, MISSOURI
LOCK NO. 24
IMPROVED TOW HAULAGE SYSTEM
LOCK STRUCTURE AND GUIDEWALLS
MISC. SECTIONS AND DETAILS

DRAWING NUMBER
PLATE NO. 7
SHEET OF FILE NO.



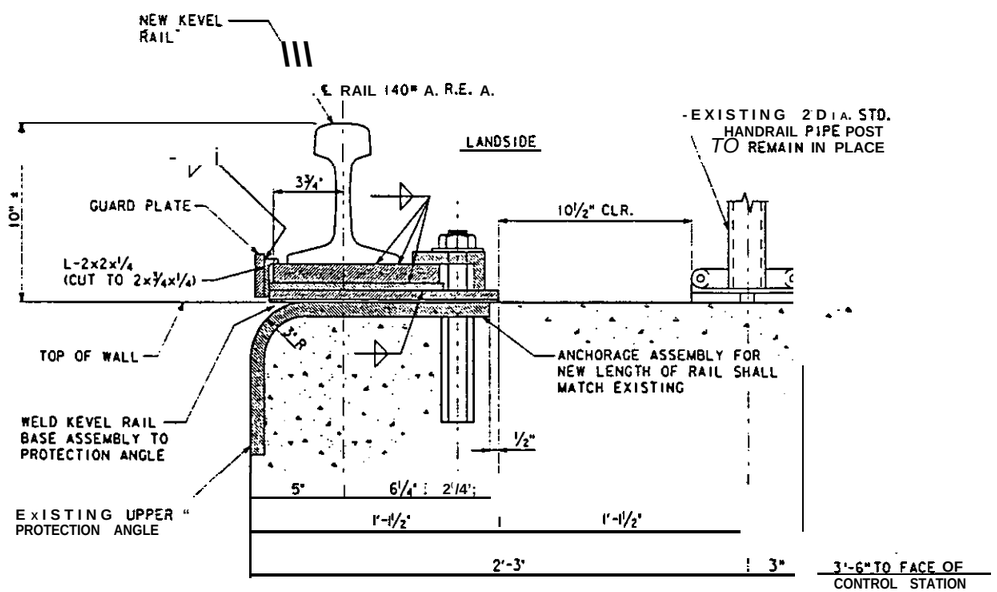
TYPICAL GUIDEWALL SECTION (UPPER AND LOWER)

CHECK POSTS NOT SHOWN, SEE NOTE 1
SCALE: 3"=1'-0"



TYPICAL SECTION WITHIN MAIN LOCK CHAMBER AT CHECK POST

SCALE: 3"=1'-0"



TYPICAL SECTION WITHIN MAIN LOCK CHAMBER

CHECK POSTS NOT SHOWN
SCALE: 3"=1'-0"

NOTES:

1. EXISTING CHECK POSTS ALONG BOTH UPPER AND LOWER GUIDEWALLS SHALL REMAIN IN PLACE, MODIFICATIONS REQUIRED.
2. SIZE AND ANCHORAGE OF NEW CHECK POSTS TO BE DETERMINED IN FINAL DESIGN. ALL NEW CHECK POSTS SHALL REMAIN CENTERED 2,-0. FROM FACE OF WALL, BUT SHALL BE SHIFTED AS REQUIRED IN PLAN TO CLEAR REMAINING EMBEDMENTS OF EXISTING POSTS BEING REMOVED.

REVISION	DATE	DESCRIPTION	BY

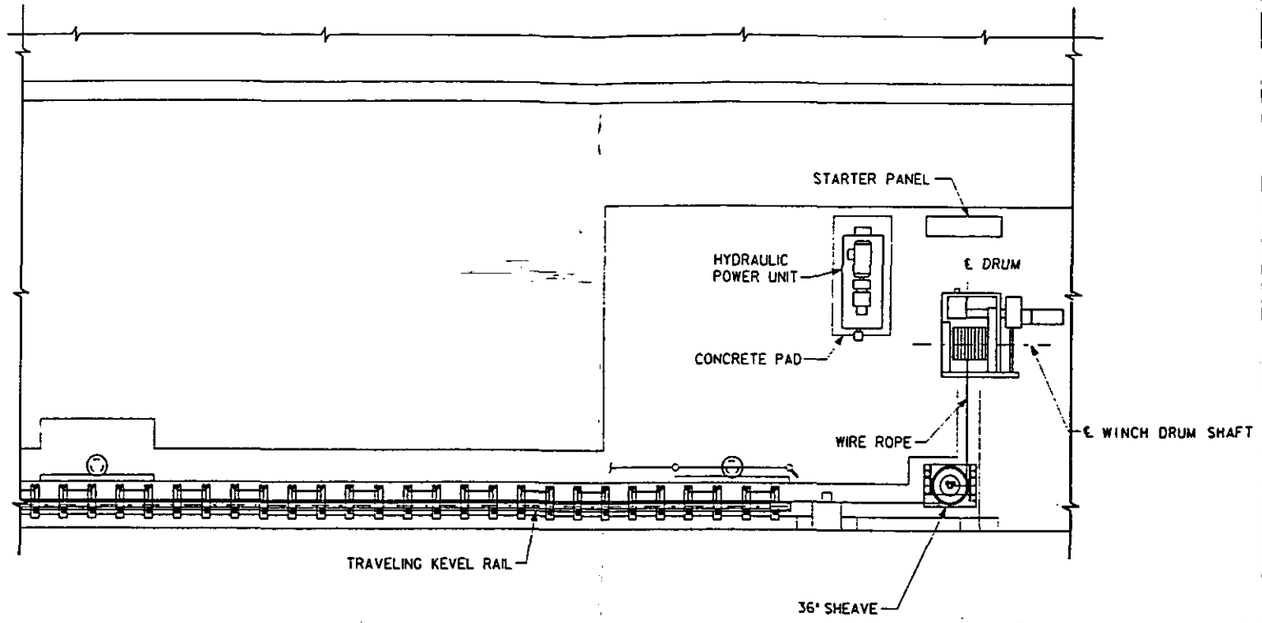
Boardman CIVIL, INC. 13723 RIVERPORT DRIVE MARYLAND 20794

OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

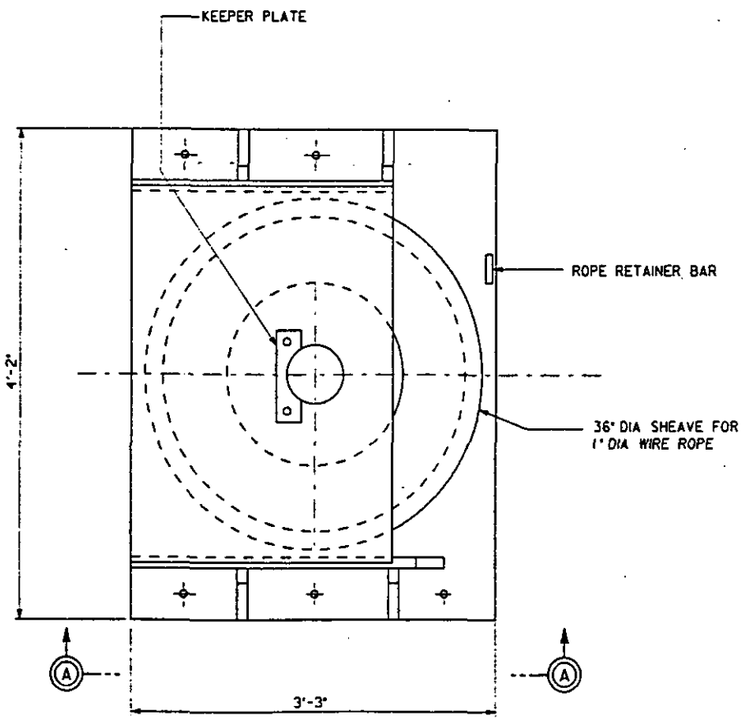
DRAWN: R. RILEY
DESIGNED BY: T. THEE
CHECKED BY:
SUBMITTED: ARCHITECT - ENGINEER
APPROVED:
APPROVED: CHIEF, ENGINEERING DIVISION

ILLINOIS WATERWAY
LAGRANGE LOCK AND DAM
IMPROVED TOW HAULAGE SYSTEM
LOCK STRUCTURE AND GUIDEWALLS
MISC. SECTIONS AND DETAILS

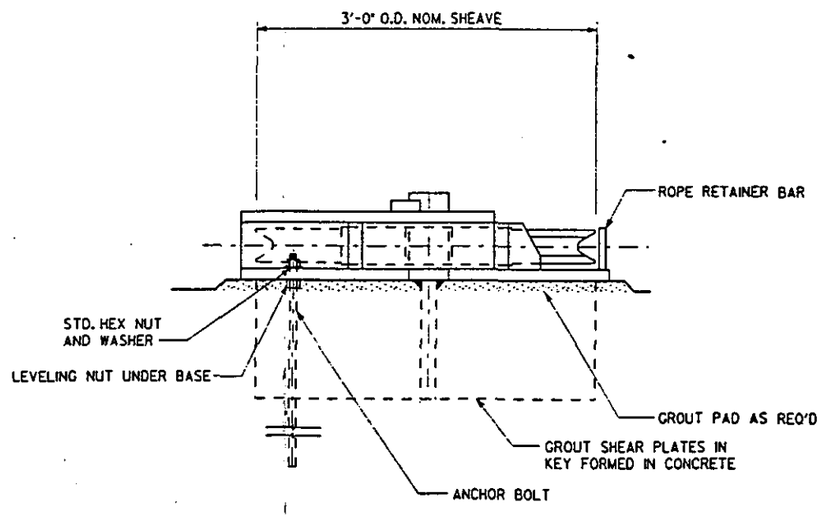
SCALE: AS SHOWN
SPEC. DATE:
DRAWING NUMBER
PLATE NO. 8
SHEET OF FILE NO.



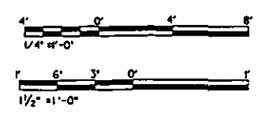
PLAN
SCALE 1/4"=1'-0"



36 INCH SHEAVE
SCALE: 1 1/2"=1'-0"



SECTION A-A
SCALE: 1 1/2"=1'-0"



NOTES
1. PULL-RETARD WINCH, HYDRAULICALLY DRIVEN.

REVISION	DATE	DESCRIPTION	BY

Boardman CIVIL, INC.
13723 RIVERPORT DRIVE
MARYLAND HEIGHTS, MO. 63043

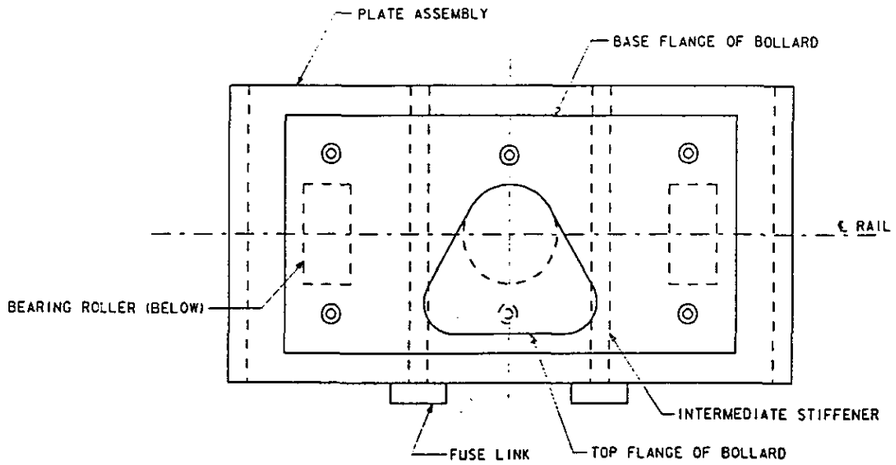
OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DRAWN BY: R. RILEY
DESIGNED BY: T. THEE
CHECKED BY: X
SUBMITTED BY: X
PROJECT ENGINEER
APPROVED:
APPROVED:
DATE:
CHIEF, ENGINEERING DIVISION

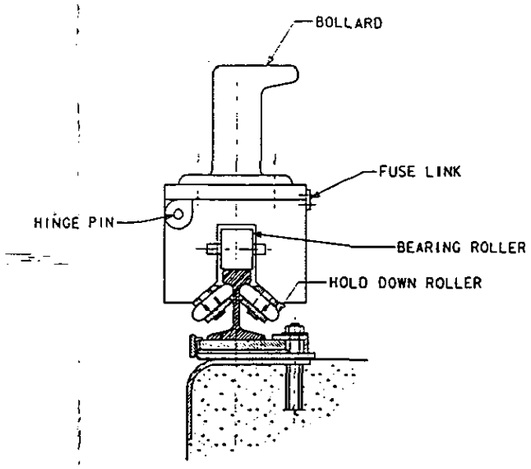
MISSISSIPPI RIVER, MISSOURI
LOCK NO. 24 AND LAGRANGE LOCK AND DAM
IMPROVED TOW HAULAGE SYSTEM
MISCELLANEOUS EQUIPMENT DETAILS

SCALE: AS SHOWN
SPEC. DATE:
DRAWING NUMBER
PLATE NO. 9
SHEET OF
FILE NO.

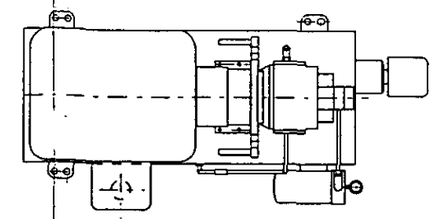
12026 L245006.DGN



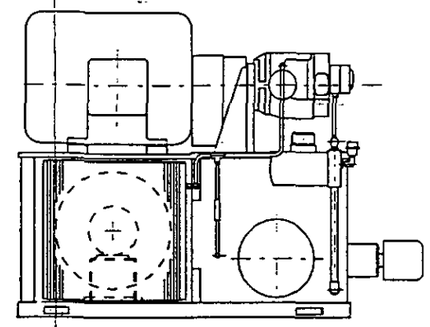
PLAN VIEW OF TRAVELING KEVEL
NO SCALE



SECTION THROUGH TRAVELING KEVEL
NO SCALE

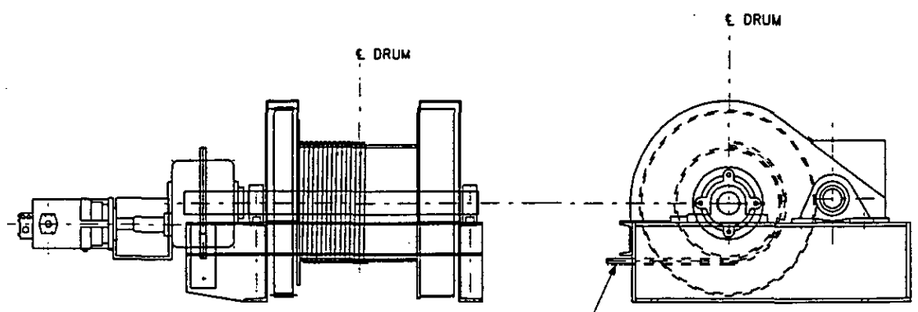


PLAN VIEW



ELEVATION VIEW

HYDRAULIC POWER UNIT
SCALE: 1"=1'-0"



PLAN VIEW

ELEVATION VIEW

TOW HAULAGE WINCH UNIT
SCALE: 1"=1'-0"

REVISION	DATE	DESCRIPTION	BY

Sverdrup CIVIL, INC.
13723 RIVERPORT DRIVE
MARYLAND HEIGHTS, MO. 63043

OFFICE OF THE DISTRICT ENGINEER
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DRAWN BY: R. RILEY
DESIGNED BY: T. THEE
CHECKED BY: X
SUBMITTED BY: X
ARCHITECT - ENGINEER

MISSISSIPPI RIVER, MISSOURI
LOCK NO. 24 AND LAGRANGE LOCK AND DAM
IMPROVED TOW HAULAGE SYSTEM
MISCELLANEOUS EQUIPMENT DETAILS

APPROVED: CHIEF, ENGINEERING DIVISION
DATE:
SCALE: AS SHOWN
SPEC. DATE:
DRAWING NUMBER
PLATE NO. 10
SHEET OF FILE NO.

L245007.DGN
12026

Appendix II

APPENDIX II

COST ESTIMATES

APPENDIX II

COST ESTIMATES

The following cost estimates are prepared as part of the study on "Improved Tow Haulage Systems". Several assumptions were required to develop the estimate and are listed below. The estimate is in four (4) parts, one for each of the two configurations at each of the two sites. The assumptions were as follows:

1. The existing rail, base plates, anchorage, and kevel are acceptable for use "as is" for the 12-N-12 alternate on the upper guidewall at Lock & Dam 24 and both guidewalls at LaGrange Lock & Dam.

2. The guidewall extension costs were not included as they are not part of this study. However, it was assumed the costs for appurtenances related to the tow haulage equipment required on the guidewall extensions would be included in this estimate.

3. Winches for the existing system are to be removed for the 12-6-12 alternate and are to be used in place for the 12-N-12 alternate.

4. Power/control cables to be in rigid steel conduit at back of guidewalls to a point at the miter gate monoliths. At this point it will transition to an existing pull box or cable trench.

5. A pull/retared type winch system was used for costing including a hydraulic-type power unit to drive the system.

CONSTRUCTION COST ESTIMATE
IMPROVED TOW HAULAGE SYSTEM
LOCK AND DAM #24 - MISSISSIPPI RIVER
12-6-12 ALTERNATE

ITEM DESCRIPTION	UNIT	UNIT OF MEASURE	COST PER UNIT	ITEM COST
140 HP WINCH (W/POWER UNIT& POWER PANEL)	6	EACH	$80,000	$480,000
2 1" DIA WIRE ROPE (2 @ 1400', 1 @ 700')	3500	LF	$5	$17,500
336 DIA SHEAVES w/ ASSEMBLY	6	EACH	$5,000	$30,000
4 140# RAIL (w/ PLATES, CLIPS, & ANCHORS)	2500	LF	$60	$150,000
5 TOW HAULAGE BITTS	5	EACH	$3,000	$15,000
6 CONCRETE FOUNDATION FOR WINCHES	2	EACH	$10,000	$20,000
7 RIGID STEEL CONDUIT	4800	LF	$10	$48,000
8 POWER/CONTROL CABLES	6000	LF	$10	$60,000
9 CONTROLS/MCC MODIFICATIONS AND ADD.	1	EACH	$10,000	$10,000
10 REMOVAL OF WINCH (W/CONTROLS)	2	EACH	$5,000	$10,000
11 REMOVAL OF CHECKPOSTS	31	EACH	$250	$7,750
12 INSTALL NEW CHECKPOSTS	31	EACH	$3,500	$108,500
13 REMOVAIJRELOCATION OF HANDRAILING	1100	LF	$20	$22,000
14 MISC. STRUCTURAL MODS. (LADDERS, TRENCHES	1	EACH	$10,000	$10,000
REMOTE CONTROL STATION	2	EACH	$2,000	$4,000
TESTING/START-UP SERVICES	1	EACH	$15,000	$15,000
17 TRAINING	1	EACH	$5,000	$5,000
SUBTOTAL - COST				$1,012,750
25% CONTINGENCY				$253,188
TOTAL COST				$1,265,938

CONSTRUCTION COST ESTIMATE
IMPROVED TOW HAULAGE SYSTEM
LOCK AND DAM #24 - MISSISSIPPI RIVER
12-N-12 ALTERNATE

ITEM DESCRIPTION	UNIT	UNIT OF MEASURE	OST PE ŮNIT	ITEM COST
1 40 HP WINCH (w/POWER UNIT& POWER PANEL)	4	EACH	$80,000	$320,000
2 1" DIA WIRE ROPE (2 @ 1400'. GUIDEWALLS)	2800	LF	$5	$14,000
336 DIA SHEAVES w/ ASSEMBLY	4	EACH	$5,000	$20,000
4 140# RAIL (w/ PLATES, CLIPS, & ANCHORS)	2000	LF	$60	$120,000
5 TOW HAULAGE BITTS	4	EACH	$3,000	$12,000
6 CONCRETE FOUNDATION FOR WINCHES	2	EACH	$10,000	$20,000
7 RIGID STEEL CONDUIT	4800	LF	$10	$48,000
8 POWER/CONTROL CABLES	4800	LF	$10	$48,000
9 MCC AND CONTROLS ADDITION/MODIFCATION	1	EACH	$10,000	$10,000
10 REMOVAL OF CHECKPOSTS	22	EACH	$250	$5,500
11 INSTALL NEW CHECKPOSTS	22	EACH	$3,500	$77,000
12 REMOVAL/RELOCATION OF HANDRAILING	500	LF	$20	$10,000
13 MISC. STRUCTURAL MODS. (LADDERS, TRENCHES)	1	EACH	$10,000	$10,000
14 REMOTE CONTROL STATION	2	EACH	$2,000	$4,000
5 TESTING/START-UP	1	EACH	$15,000	$15,000
6 TRAINING	1	EACH	$5,000	$5,000
SUBTOTAL - COST				$738,500
25% CONTINGENCY				$184,625
TOTAL COST				$923,125

CONSTRUCTION COST ESTIMATE
IMPROVED TOW HAULAGE SYSTEM
LAGRANGE LOCK AND DAM - ILLINOIS WATERWAY
12-6-12 ALTERNATE

ITEM DESCRIPTION	UNIT	UNIT OF MEASURE	OST PE UNIT	ITEM COST
1 40 HP WINCH (W/POWER UNIT& POWER PANEL)	6	EACH	$80,000	$480,000
2 1" DIA WIRE ROPE (1400', 1400', AND 700')	3500	LF	$5	$17,500
336 DIA SHEAVES w/ ASSEMBLY	7	EACH	$5,000	$35,000
4 140# RAIL (w/ PLATES, CLIPS, & ANCHORS)	1950	LF	$60	$117,000
5 TOW HAULAGE BITTS	5	EACH	$3,000	$15,000
6 CONCRETE FOUNDATION FOR WINCHES	2	EACH	$10,000	$20,000
7 RIGID STEEL CONDUIT	4800	LF	$10	$48,000
8 POWER/CONTROL CABLES	6000	LF	$10	$60,000
9 MCC AND CONTROLS ADDITION/MODIFCATION	1	EACH	$10,000	$10,000
10 REMOVAL OF WINCHES (W/CONTROLS)	2	EACH	$5,000	$10,000
11 REMOVAL OF CHECKPOSTS	30	EACH	$250	$7,500
12 INSTALL NEW CHECKPOSTS	30	EACH	$3,500	$105,000
13 REMOVAIJRELOCATION OF HANDRAILING	0	LF	$20	$0
14 MISC. STRUCTURAL MODS. (LADDERS, TRENCHES	1	EACH	$10,000	$10,000
15 REMOTE CONTROL STATION	2	EACH	$2,000	$4,000
16 TESTING/START-UP	1	EACH	$15,000	$15,000
'17 TRAINING	1	EACH	$5,000	$5,000
SUBTOTAL - COST				$959,000
25% CONTINGENCY				$239,750
TOTAL COST				$1,198,750

CONSTRUCTION COST ESTIMATE
IMPROVED TOW HAULAGE SYSTEM
LAGRANGE LOCK AND DAM - ILLINOIS WATERWAY
12-N-12 ALTERNATE

ITEM DESCRIPTION	UNIT	UNIT OF MEASURE	COST PER UNIT	ITEM COST
140 HP WINCH (W/POWER UNIT& POWER PANEL)	4	EACH	$80,000	$320,000
2 1" DIA WIRE ROPE (1400' EACH)	2800	LF	$5	$14,000
336 DIA SHEAVES w/ ASSEMBLY	4	EACH	$5,000	$20,000
4 140# RAIL (w/ PLATES, CLIPS, & ANCHORS)	1350	LF	$60	$81,000
5 TOW HAULAGE BITTS	4	EACH	$3,000	$12,000
6 CONCRETE FOUNDATION FOR WINCHES	2	EACH	$10,000	$20,000
7 RIGID STEEL CONDUIT	4800	LF	$10	$48,000
8 POWER/CONTROL CABLES	4800	LF	$10	$48,000
9 MCC AND CONTROLS ADDITION/MODIFCATION	1	EACH	$10,000	$10,000
10 REMOVAL OF CHECKPOSTS	20	EACH	$250	$5,000
11 INSTALL NEW CHECKPOSTS	20	EACH	$3,500	$70,000
12 REMOVAIJRELOCATION OF HANDRAILING	0	LF	$20	$0
13 MISC. STRUCTURAL MODS. (LADDERS, TRENCHES	1	EACH	$10,000	$10,000
14 REMOTE CONTROL STATION	2	EACH	$2,000	$4,000
15 TESTING/START-UP	1	EACH	$15,000	$15,000
16 TRAINING	1	EACH	$5,000	$5,000
SUBTOTAL - COST				$682,000
25% CONTINGENCY				$170,500
TOTAL COST				$852,500

Appendix III

APPENDIX III

STRUCTURAL CALCULATIONS

SVERDRUP

JOB Improved Tow Haulage Equipment

COMPUTATIONS FOR Tow Haulage Loads

SHEET NO. 1 OF 11

DATE 5/25/95

BY RAW CHKD

DESIGN CRITERIA

Scope: Determine forces to be applied to the lock structure due to the application of a tow haulage equipment system.

Forces to be applied from the tow haulage system via the line pull.

Forces due to environmental (wind, current,) and mechanical (berthing, racking,) are not evaluated unless imposed by the tow line pull. It is assumed that the existing lock walls are designed for forces in excess or not applied from tow haulage equipment.

Determine line pull forces based on operational use of tow haulage system. It is assumed that during extraordinary events such as high winds, high water currents and seismic events the barge tows and resulting haulage equipment will not be in use.

SVERDRUP

JOB

COMPUTATIONS FOR

SHEET NO. 2 OF 11

DATE 5/25/95

BY RAW CHKD

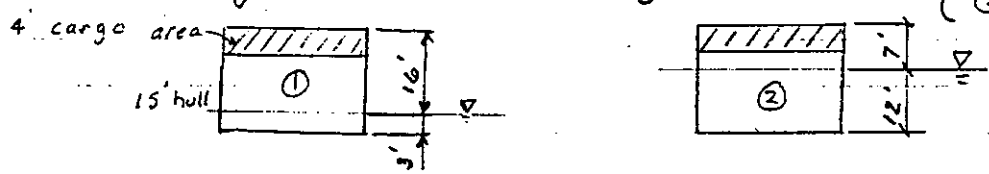
DESIGN CRITERIA

Environmental Forces:

1. Wind

- For wind speed in excess of Beaufort Scale of 8 the tow haulage system will not be in use.

- Beaufort Scale = 8 = Gale = 40 knots ≅ 46 mph
  ∴ Use design wind speed = 46 mph
- Use 15' hull w/ 4' height of cargoe
- Design for two loading conditions { ① Unloaded ② Loaded



- Use $F = .0034\ V_w^2\ A\ (1.3)$ per Gaythwaite

V_w = wind speed in knots
A = Vessel Area - Exposed sq. ft
F = Force in lbs

- Compute vector components per angle of wind

- Shape factor = 1.3

① Unloaded

$A_x = 16' \times 105' = 1680\ \square'$
$A_y = 16' \times 585' = 9360\ \square'$

② Loaded

$A_x = 7' \times 105' = 735\ \square'$
$A_y = 7' \times 585' = 4095\ \square'$

SVERDRUP

JOB

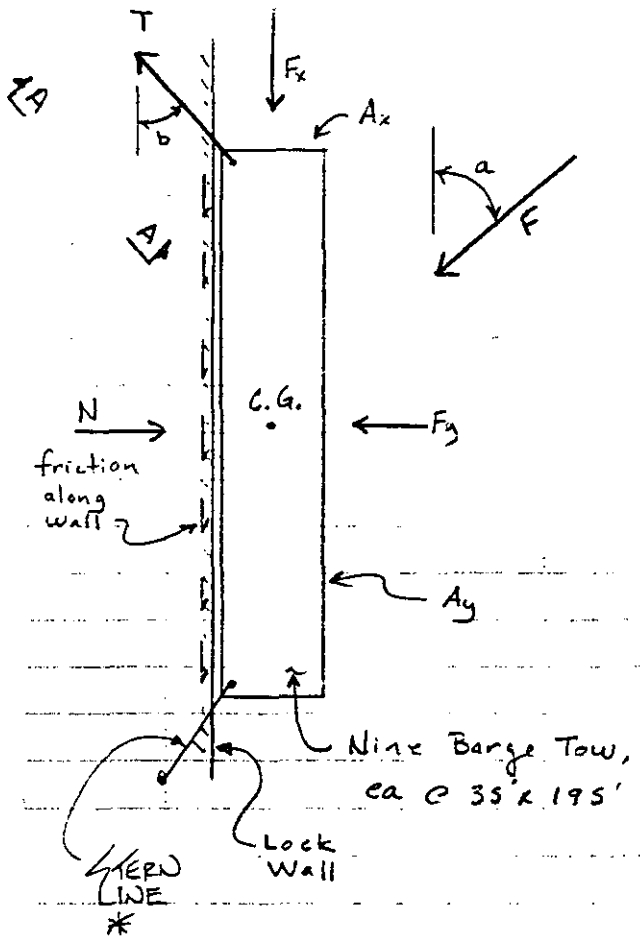
COMPUTATIONS FOR

SHEET NO. 3 OF 11

DATE 5/25/95

BY RAW CHKD

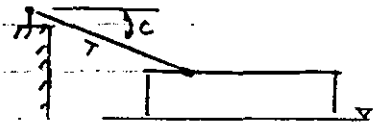
Wind & Current Force Schematic



a = angle of Force (wind or Current)
F = Force
T = Tensile force in cable, (Line Pull)
b = cable angle, w/r plane of barge
c = cable angle, vertical

F_x = Longitudinal Force vector
F_y = Horizontal Force vector
N = Normal Force, Reaction to F_y
f = friction force along wall using
$N = F_y$, as normal force & $c = 0.25$
$\sim f = cN$

Outdraft Condition = Force @ 270°
~pulling barge tow away from lock wall due to current flow towards dam



View A-A

T = Line Pull

$T = \Sigma T_x / [(\cos b)(\cos c)]$

* Assumed used to prevent Barge Rotation.

Tow Haulage System
Wind Loads Loaded Condition

Fx = .0034(cos a)(Vw^2)(Ax)(1.3)
Fy = .0034(sin a)(Vw^2)(Ay)(1.3)
shape factor = 1.3

Line Pull = T
T = Tx Sum/ (cos b)(cos c)

c = line angle from horizontal
b = line angle in wind plane
Tx from Fx = Fx
Tx from Fy = (f)(Fy)
f = friction coeff. (0.25)
Tx Sum = Summation of Tx's

Constants

Vw =	40	knots
Ax =	840	sq ft
Ay =	4680	sq ft
a =	angle of wind	

a	Fx (kips)	Fy (kips)		Tx from Fx	Tx from Fy		Tx Sum
0	6	0		5.9	0.0		5.9
30	5	17		5.1	4.1		9.3
60	3	29		3.0	7.2		10.1
90	0	33		0.0	8.3		8.3
120	-3	29		-3.0	-7.2		-10.1
150	-5	17		-5.1	-4.1		-9.3
180	-6	0		-5.9	0.0		-5.9

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 0					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
5.9	6	6	6	7	8
9.3	9	9	10	11	13
10.1	10	10	11	12	14
8.3	8	8	9	10	12
-10.1	-10	-10	-11	-12	-14
-9.3	-9	-9	-10	-11	-13
-5.9	-6	-6	-6	-7	-8

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 30					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
5.9	7	7	7	8	10
9.3	11	11	11	12	15
10.1	12	12	12	13	16
8.3	10	10	10	11	14
-10.1	-12	-12	-12	-13	-16
-9.3	-11	-11	-11	-12	-15
-5.9	-7	-7	-7	-8	-10

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 10					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
5.9	6	6	6	7	8
9.3	9	10	10	11	13
10.1	10	10	11	12	15
8.3	8	9	9	10	12
-10.1	-10	-10	-11	-12	-15
-9.3	-9	-10	-10	-11	-13
-5.9	-6	-6	-6	-7	-8

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 45					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
5.9	8	8	9	10	12
9.3	13	13	14	15	19
10.1	14	15	15	16	20
8.3	12	12	12	14	17
-10.1	-14	-15	-15	-16	-20
-9.3	-13	-13	-14	-15	-19
-5.9	-8	-8	-9	-10	-12

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 20					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
5.9	6	6	7	7	9
9.3	10	10	11	11	14
10.1	11	11	11	12	15
8.3	9	9	9	10	12
-10.1	-11	-11	-11	-12	-15
-9.3	-10	-10	-11	-11	-14
-5.9	-6	-6	-7	-7	-9

Tow Haulage System
Wind Loads Unloaded Condition

Fx = .0034(cos a)(Vw^2)(Ax)(1.3)
Fy = .0034(sin a)(Vw^2)(Ay)(1.3)
shape factor = 1.3

Constants
Vw = 40 knots
Ax = 1680 sq ft
Ay = 9360 sq ft
a = angle of wind

Line Pull = T
T = Tx Sum/ (cos b)(cos c)

c = line angle from horizontal
b = line angle in wind plane
Tx from Fx = Fx
Tx from Fy = (f)(Fy)
f = friction coeff. (0.25)
Tx Sum = Summation of Tx's

a	Fx (kips)	Fy (kips)		Tx from Fx	Tx from Fy		Tx Sum
0	12	0		11.9	0.0		11.9
30	10	33		10.3	8.3		18.6
60	6	57		5.9	14.3		20.3
90	0	66		0.0	16.5		16.5
120	-6	57		-5.9	14.3		8.4
150	-10	33		-10.3	-8.3		-18.6
180	-12	0		-11.9	0.0		-11.9

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 0					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
11.9	12	12	13	14	17
18.6	19	19	20	21	26
20.3	20	21	22	23	29
16.5	17	17	18	19	23
8.4	8	9	9	10	12
-18.6	-19	-19	-20	-21	-26
-11.9	-12	-12	-13	-14	-17

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 30					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
11.9	14	14	15	16	19
18.6	22	22	23	25	30
20.3	24	24	25	27	33
16.5	19	19	20	22	27
8.4	10	10	10	11	14
-18.6	-22	-22	-23	-25	-30
-11.9	-14	-14	-15	-16	-19

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 10					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
11.9	12	12	13	14	17
18.6	19	19	20	22	27
20.3	21	21	22	24	29
16.5	17	17	18	19	24
8.4	9	9	9	10	12
-18.6	-19	-19	-20	-22	-27
-11.9	-12	-12	-13	-14	-17

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 45					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
11.9	17	17	18	19	24
18.6	26	27	28	30	37
20.3	29	29	31	33	41
16.5	23	24	25	27	33
8.4	12	12	13	14	17
-18.6	-26	-27	-28	-30	-37
-11.9	-17	-17	-18	-19	-24

Line Pull T @ various cable angles (kips)					
Barge angle from horizontal c = 20					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
11.9	13	13	13	15	18
18.6	20	20	21	23	28
20.3	22	22	23	25	31
16.5	18	18	19	20	25
8.4	9	9	10	10	13
-18.6	-20	-20	-21	-23	-28
-11.9	-13	-13	-13	-15	-18

SVERDRUP

JOB

COMPUTATIONS FOR

SHEET NO. 6 OF 11

DATE 5/25/95

BY RAW CHKD

2. Current Forces

- Apply similar as wind loads.

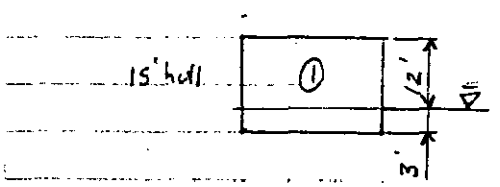
projected · Use $F = 2.86\, V_c^2 A_h$

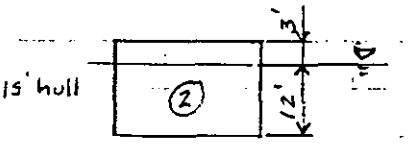
friction · Use $F = K\, V_c^2 A_p$

V_c = speed in knots
A_h = projected underwater area, sq ft.
F = Force in lbs
A_p = wetted perimeter
K = constant ~ .01 shape factor

- Use operation speed = 100 ft. per min ~ 1 Knot for current velocity
- Determine vector components per angle of applied current
- Use 9 barge tow as one unit vessel - 105' x 585'

- Use two loading conditions: ① Unloaded
② Loaded





Projected Areas:

① Unloaded
$A_x = 3' \times 105' = 315\ \square'$
$A_y = 3' \times 585' = 1755\ \square'$

② Loaded
$A_x = 12 \times 105 = 1260\ \square'$
$A_y = 12 \times 585 = 7020\ \square'$

Friction Area Wetted Perimeter *

① Unloaded
$A_f = 3 \times (105 + 585)2 + (105 \times 585)$
$A_f = 65{,}565\ \square'$

② Loaded
$A_f = 12 \times (105 + 585)2 + (105 \times 585)$
$A_f = 77{,}985\ \square'$

* Summary of forces indicate negligible effect; not considered further, see sht. 9.

Tow Haulage System
Current Loads
Loaded Condition
Fx = 2.86(cos a)(Vc^2)(Ax)
Fy = 2.86(sin a)(Vc^2)(Ay)

Line Pull = T
T = Tx Sum/ (cos b)(cos c)

c = line angle from horizontal
b = line angle in barge plane
Tx from Fx = Fx
Tx from Fy = (f)Fy
f = friction coeff. (0.25)
Tx Sum = Summation of Tx's

Constants

Vc =	1	knots
Ax =	1260	sq ft
Ay =	7020	sq ft
a =	angle of current flow	

a	Fx (kips)	Fy (kips)		Tx from Fx	Tx from Fy		Tx Sum
0	4	0		3.6	0.0		3.6
30	3	10		3.1	2.5		5.6
60	2	17		1.8	4.3		6.1
90	0	20		0.0	5.0		5.0
120	-2	17		-1.8	4.3		2.5
150	-3	10		-3.1	2.5		-0.6
180	-4	0		-3.6	0.0		-3.6

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 0					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
3.6	4	4	4	4	5
5.6	6	6	6	6	8
6.1	6	6	6	7	9
5	5	5	5	6	7
2.5	3	3	3	3	4
-0.6	-1	-1	-1	-1	-1
-3.6	-4	-4	-4	-4	-5

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 30					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
3.6	4	4	4	5	6
5.6	6	7	7	7	9
6.1	7	7	7	8	10
5	6	6	6	7	8
2.5	3	3	3	3	4
-0.6	-1	-1	-1	-1	-1
-3.6	-4	-4	-4	-5	-6

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 10					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
3.6	4	4	4	4	5
5.6	6	6	6	7	8
6.1	6	6	7	7	9
5	5	5	5	6	7
2.5	3	3	3	3	4
-0.6	-1	-1	-1	-1	-1
-3.6	-4	-4	-4	-4	-5

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 45					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
3.6	5	5	5	6	7
5.6	8	8	8	9	11
6.1	9	9	9	10	12
5	7	7	8	8	10
2.5	4	4	4	4	5
-0.6	-1	-1	-1	-1	-1
-3.6	-5	-5	-5	-6	-7

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 20					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
3.6	4	4	4	4	5
5.6	6	6	6	7	8
6.1	7	7	7	7	9
5	5	5	6	6	8
2.5	3	3	3	3	4
-0.6	-1	-1	-1	-1	-1
-3.6	-4	-4	-4	-4	-5

Tow Haulage System
Current Loads
Unloaded Condition
Fx = 2.86(cos a)(Vc^2)(Ax)
Fy = 2.86(sin a)(Vc^2)(Ay)

Line Pull = T
T = Tx Sum/ (cos b)(cos c)

c = line angle from horizontal
b = line angle in barge plane
Tx from Fx = Fx
Tx from Fy = (f)Fy
f = friction coeff. (0.25)
Tx Sum = Summation of Tx's

Constants

Vc =	1	knots
Ax =	315	sq ft
Ay =	1755	sq ft
a =	angle of current flow	

a	Fx (kips)	Fy (kips)		Tx from Fx	Tx from Fy		Tx Sum
0	1	0		0.9	0.0		0.9
30	1	3		0.8	0.6		1.4
60	0	4		0.5	1.1		1.5
90	0	5		0.0	1.3		1.3
120	-0	4		-0.5	1.1		0.6
150	-1	3		-0.8	0.6		-0.2
180	-1	0		-0.9	0.0		-0.9

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 0					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
0.9	1	1	1	1	1
1.4	1	1	1	2	2
1.5	2	2	2	2	2
1.3	1	1	1	2	2
0.6	1	1	1	1	1
-0.2	-0	-0	-0	-0	-0
-0.9	-1	-1	-1	-1	-1

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 30					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
0.9	1	1	1	1	1
1.4	2	2	2	2	2
1.5	2	2	2	2	2
1.3	2	2	2	2	2
0.6	1	1	1	1	1
-0.2	-0	-0	-0	-0	-0
-0.9	-1	-1	-1	-1	-1

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 10					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
0.9	1	1	1	1	1
1.4	1	1	2	2	2
1.5	2	2	2	2	2
1.3	1	1	1	2	2
0.6	1	1	1	1	1
-0.2	-0	-0	-0	-0	-0
-0.9	-1	-1	-1	-1	-1

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 45					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
0.9	1	1	1	1	2
1.4	2	2	2	2	3
1.5	2	2	2	2	3
1.3	2	2	2	2	3
0.6	1	1	1	1	1
-0.2	-0	-0	-0	-0	-0
-0.9	-1	-1	-1	-1	-2

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 20					
Tx Sum	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
0.9	1	1	1	1	1
1.4	1	2	2	2	2
1.5	2	2	2	2	2
1.3	1	1	1	2	2
0.6	1	1	1	1	1
-0.2	-0	-0	-0	-0	-0
-0.9	-1	-1	-1	-1	-1

Tow Haulage System
Current Loads Frictional Area
Loaded Condition
Fx = 0.01(cos a)(Vc^2)(A)
Fy = 0.01(sin a)(Vc^2)(A)

Line Pull

Tx = (cos b)(T)
Ty = (sin b)(T)

Constants
Vc = 1 knot
A = 65565 sq ft

a = angle of current flow

b = line angle
Tx = Fx
Tx = (f)Fy

f = friction coeff. (0.25)

a	Fx (kips)	Fy (kips)		Tx from F_x	Tx from F_y		Tx Sum
0	1	0		1	0		1
30	1	0		1	0		1
60	0	1		0	0		1
90	0	1		0	0		0
120	-0	1		-0	0		-0
150	-1	0		-1	0		-1
180	-1	0		-1	0		-1

Line pull T @ various cable angles (kips)					
a	T @ 5	T @ 10	T @ 20	T @ 30	T @ 45
0	1	1	1	1	1
30	1	1	1	1	1
60	1	1	1	1	1
90	0	0	0	0	0
120	-0	-0	-0	-0	-0
150	-1	-1	-1	-1	-1
180	-1	-1	-1	-1	-1

forces considered negligible, not used further

Tow Haulage System
Current Loads
Outdraft Condition
Fx = 2.86(cos a)(Vc^2)(Ax)
Fy = 2.86(sin a)(Vc^2)(Ay)

Line Pull = T
T = Fy/ [(2)(sin b)*(cos c)]

c = line angle from horizontal
b = line angle in barge plane

Vc = 1 knots
Ay = 1755 sq ft Unloaded condition
Ay = 7020 sq ft Loaded Condition
a = angle of current flow away from lock wall, use a = 270

Condition	a	Fy (kips)
Unloaded	270	-5
Loaded	270	-20

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 0					
Fy	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
-5	-29	-14	-7	-5	-4
-20	-115	-58	-29	-20	-14

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 10					
Fy	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
-5	-29	-15	-7	-5	-4
-20	-117	-58	-30	-20	-14

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 20					
Fy	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
-5	-31	-15	-8	-5	-4
-20	-122	-61	-31	-21	-15

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 30					
Fy	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
-5	-33	-17	-8	-6	-4
-20	-132	-66	-34	-23	-16

Line pull T @ various cable angles (kips)					
Barge angle from horizontal c = 45					
Fy	b @ 5	b @ 10	b @ 20	b @ 30	b @ 45
-5	-41	-20	-10	-7	-5
-20	-162	-81	-41	-28	-20

SVERDRUP

JOB

COMPUTATIONS FOR

SHEET NO. 11 OF 11

DATE Aug. 7, 1995

BY R&W CHKD

Summary of Wind + Current Line Pull Loads

b = cable angle w/ barge plane

c = cable angle from horiz.

Loaded Condition
Max Wind Lds (k)

c \ b	5°	10°	20°	30°	45°
0°	10	10	11	12	14
10°	10	10	11	12	15
20°	11	11	11	12	15
30°	12	12	12	13	16
45°	14	15	15	16	20

UnLoaded Condition
Max Wind Ld (k)

c \ b	5°	10°	20°	30°	45°
0°	20	21	22	23	29
10°	21	21	22	24	29
20°	22	22	23	25	31
30°	24	24	25	27	33
45°	29	29	31	33	41

Max Current (k)

c \ b	5°	10°	20°	30°	45°
0°	6	6	6	7	9
10°	6	6	7	7	9
20°	7	7	7	7	9
30°	7	7	7	8	10
45°	9	9	9	10	12

Max Current Ld. (k)

c \ b	5°	10°	20°	30°	45°
0°	2	2	2	2	2
10°	2	2	2	2	2
20°	2	2	2	2	2
30°	2	2	2	2	2
45°	2	2	2	2	3

Outdraft Condition

Max Line Pull @ Loaded = 162^k @ b = 5°, c = 45°

Max Line Pull @ Unloaded = 41^k @ b = 5°, c = 45°

Appendix IV

APPENDIX IV

TIMING DATA

LOCK: Starved Rock Date: 16Aug 94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Sebring
b.	Tow Type	Setover	
c.	Number of Barges	2	Fuel Barges
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	12:13:10		
			00:01:20	
2.	First Cut In	12:14:30		
			00:08:00	tie off barges to wall
3.	Begin Reconfiguration	12:22:30		
			00:02:20	
4.	End Reconfiguration	12:24:50		
			00:00:02	
5.	Start Gate Closure	12:24:52		
			00:01:42	
6.	Gate Closed	12:26:34		
			00:11:41	
7.	End Fill/Empty	12:38:15		
			00:02:03	
8.	Gate Recessed	12:40:18		
			00:00:02	
9.	Begin Reconfiguration	12:40:20		
			00:05:40	reconfig during exit
10.	End Reconfiguration	12:46:00		
			00:02:20	
11.	Tow Stern Over Sill	12:48:20		

Lock: Starved Rock Date: 16 Aug 94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	2	Bob Koch
b.	Tow Type	Double	
c.	Number of Barges	15	+2 Recreational Vessels
d.	Type of Entry	Fly	Exchange Exit
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	13:30:00		
			00:12:00	
2.	First Cut In	13:42:00		
			00:04:28	
3.	Second Cut Loose	13:46:28		
			00:02:52	
4.	Second Cut Clear of Gate	13:49:20		
			00:00:28	
5.	Start Gate Closure	13:49:48		
			00:01:44	
6.	Gate Closed	13:51:32		
			00:12:28	
7.	End Fill/Empty	14:04:00		
			00:02:20	
8.	Gate Recessed	14:06:20		
			00:01:50	
9.	First Cut Begins Exit	14:08:10		
			00:11:20	used tow haulage unit
10.	First Cut Stern Over Gate	14:19:30		
			00:01:30	moor cut prior to closure
11.	Start Gate Closure	14:21:00		
			00:01:56	
12.	Gate Closed	14:22:56		
			00:16:04	
13.	End Fill/Empty	14:39:00		
			00:02:12	
14.	Gate Recessed	14:41:12		
			00:03:48	
15.	Second Cut Bow Over Gate	14:45:00		
			00:08:00	
16.	Second Cut Clear of Gate	14:53:00		
			00:05:15	
17.	Start Gate Closure	14:58:15		
			00:01:55	
18.	Gate Closed	15:00:10		
			00:12:50	
19.	End Fill/Empty	15:13:00		
			00:03:09	
20.	Gate Recessed	15:16:09		
			00:00:51	
21.	Second Cut Begins Exit	15:17:00		
			00:03:00	
22.	Cuts Bump together	15:20:00		
			00:24:10	includes 10 min delay for exch. vsl
23.	Tow Starts Exit	15:44:10		to moor @ cell in approach
			00:05:20	
24.	Tow Stern Over Sill	15:49:30		

Lock: Starved Rock Date: 16 Aug 94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Vicksburg
b.	Tow Type	Double	
c.	Number of Barges	9	3x3 configuration
d.	Type of Entry	Exchange	Moored at cell in upstream approach
e.	Upbound/Downbound	Dwnbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	16:13:45		
			00:06:15	
2.	First Cut In	16:20:00		
			00:02:00	
3.	Second Cut Loose	16:22:00		
			00:02:14	
4.	Second Cut Clear of Gate	16:24:14		
			00:01:01	
5.	Start Gate Closure	16:25:15		
			00:01:55	
6.	Gate Closed	16:27:10		
			00:10:05	
7.	End Fill/Empty	16:37:15		
			00:02:01	
8.	Gate Recessed	16:39:16		
			00:01:39	
9.	First Cut Begins Exit	16:40:55		
			00:08:50	
10.	First Cut Stern Over Gate	16:49:45		
			00:07:05	wait on rec vsl to enter in exchange
11.	Start Gate Closure	16:56:50		
			00:02:05	
12.	Gate Closed	16:58:55		
			00:11:11	
13.	End Fill/Empty	17:10:06		
			00:01:57	
14.	Gate Recessed	17:12:03		
			00:04:13	
15.	Second Cut Bow Over Gate	17:16:16		
			00:00:27	2nd cut was towboat only
16.	Second Cut Clear of Gate	17:16:43		
			00:00:17	
17.	Start Gate Closure	17:17:00		
			00:01:45	
18.	Gate Closed	17:18:45		
			00:13:15	
19.	End Fill/Empty	17:32:00		
			00:02:08	
20.	Gate Recessed	17:34:08		
			00:00:12	
21.	Second Cut Begins Exit	17:34:20		
			00:01:35	
22.	Cuts Bump together	17:35:55		
			00:03:35	
23.	Tow Starts Exit	17:39:30		
			00:01:00	2nd cut was towboat only
24.	Tow Stern Over Sill	17:40:30		

Lock: Starved Rock **Date:** **16 Auq 94**

ITEM	DESCRIPTION		Notes:
a.	Observation Number	4	Karen Renee
b.	Tow Type	Knockout	
c.	Number of Barges	6	
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	18:49:00		
			00:12:00	
2.	First Cut In	19:01:00		
			00:01:00	
3.	Begin Reconfiguration	19:02:00		
			00:03:00	
4.	End Reconfiguration	19:05:00		
			00:00:05	
5.	Start Gate Closure	19:05:05		
			00:01:52	
6.	Gate Closed	19:06:57		
			00:12:33	
7.	End Fill/Empty	19:19:30		
			00:02:05	
8.	Gate Recessed	19:21:35		
			00:01:25	
9.	Begin Reconfiguration	19:23:00		
			00:03:00	reconfig during exit
10.	End Reconfiguration	19:26:00		
			00:04:25	
11.	Tow Stern Over Sill	19:30:25		

Lock: Starved Rock Date: 16 Aug 94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	5	Nancy S
b.	Tow Type	Knockout	
c.	Number of Barges	5	
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Dwnbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	19:50:00		
			00:07:58	
2.	First Cut In	19:57:58		
			00:00:20	
3.	Begin Reconfiguration	19:58:18		
			00:01:02	
4.	End Reconfiguration	19:59:20		
			00:00:15	
5.	Start Gate Closure	19:59:35		
			00:01:45	
6.	Gate Closed	20:01:20		
			00:09:38	
7.	End Fill/Empty	20:10:58		
			00:01:53	
8.	Gate Recessed	20:12:51		
			00:04:39	exiting
9.	Begin Reconfiguration	20:17:30		
			00:02:43	reconfig during exit
10.	End Reconfiguration	20:20:13		
			00:04:33	
11.	Tow Stern Over Sill	20:24:46		

Lock: Starved Rock Date: 16 Aug 94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	6	Lois Ann
b.	Tow Type	Double	Inexperienced Deckhands
c.	Number of Barges	10	2x5 configuration
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Upbound	Night Lockage

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	20:58:30		
			00:11:28	
2.	First Cut In	21:09:58		
			00:09:17	
3.	Second Cut Loose	21:19:15		
			00:01:45	
4.	Second Cut Clear of Gate	21:21:00		
			00:00:18	
5.	Start Gate Closure	21:21:18		
			00:02:05	
6.	Gate Closed	21:23:23		
			00:11:39	
7.	End Fill/Empty	21:35:02		
			00:02:04	
8.	Gate Recessed	21:37:06		
			00:01:54	
9.	First Cut Begins Exit	21:39:00		
			00:09:00	used tow haulage unit
10.	First Cut Stern Over Gate	21:48:00		
			00:02:12	moor cut prior to closure
11.	Start Gate Closure	21:50:12		
			00:02:05	
12.	Gate Closed	21:52:17		
			00:15:34	
13.	End Fill/Empty	22:07:51		
			00:02:19	
14.	Gate Recessed	22:10:10		
			00:02:35	
15.	Second Cut Bow Over Gate	22:12:45		
			00:07:53	
16.	Second Cut Clear of Gate	22:20:38		
			00:04:29	moor cut before closing gates
17.	Start Gate Closure	22:25:07		
			00:01:53	
18.	Gate Closed	22:27:00		
			00:11:45	
19.	End Fill/Empty	22:38:45		
			00:01:59	
20.	Gate Recessed	22:40:44		
			00:00:16	
21.	Second Cut Begins Exit	22:41:00		
			00:07:50	
22.	Cuts Bump together	22:48:50		
			00:14:10	
23.	Tow Starts Exit	23:03:00		
			00:08:00	
24.	Tow Stern Over Sill	23:11:00		

Lock: Starved Rock Date: 17Aug94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	7	Rambler
b.	Tow Type	Double	second cut; tug only
c.	Number of Barges	9	3x3 configuration
d.	Type of Entry	Fly	3 rec vessels during turnback
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	11:04:47		
			00:13:13	
2.	First Cut In	11:18:00		
			00:00:43	
3.	Second Cut Loose	11:18:43		
			00:00:17	
4.	Second Cut Clear of Gate	11:19:00		
			00:00:15	
5.	Start Gate Closure	11:19:15		
			00:01:52	
6.	Gate Closed	11:21:07		
			00:13:28	
7.	End Fill/Empty	11:34:35		
			00:01:59	
8.	Gate Recessed	11:36:34		
			00:01.11	2 min delay for rec vsls
9.	First Cut Begins Exit	11:37:45		
			00:15:15	used tow haulage unit
10.	First Cut Stern Over Gate	11:53:00		
			00:07:57	5 min delay for rec vsls to enter
11.	Start Gate Closure	12:00:57		
			00:02:09	
12.	Gate Closed	12:03:06		
			00:13:14	
13.	End Fill/Empty	12:16:20		
			00:01:50	
14.	Gate Recessed	12:18:10		
			00:02:40	delay for rec vsls to depart
15.	Second Cut Bow Over Gate	12:20:50		
			00:00:25	tug only
16.	Second Cut Clear of Gate	12:21:15		
			00:00:10	
17.	Start Gate Closure	12:21:25		
			00:01:55	
18.	Gate Closed	12:23:20		
			00:14:36	
19.	End Fill/Empty	12:37:56		
			00:02:02	
20.	Gate Recessed	12:39:58		
			00:00:01	
21.	Second Cut Begins Exit	12:39:59		
			00:02:18	stern over sill prior to cuts together
22.	Cuts Bump together	12:42:17		
			N/A	
23.	Tow Starts Exit	N/A		
			N/A	
24.	Tow Stern Over Sill	N/A		

Lock: 24 Date: 18Aug94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	1	Mary H. Morrison
b.	Tow Type	Double	
c.	Number of Barges	15	3x5 configuration
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Dwnbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:53:56		
			00:08:25	
2.	First Cut In	10:02:21		
			00:01:50	
3.	Second Cut Loose	10:04:11		
			00:02:19	
4.	Second Cut Clear of Gate	10:06:30		
			00:00:30	
5.	Start Gate Closure	10:07:00		
			00:02:10	
6.	Gate Closed	10:09:10		
			00:06:40	
7.	End Fill/Empty	10:15:50		
			00:02:10	
8.	Gate Recessed	10:18:00		
			00:02:16	
9.	First Cut Begins Exit	10:20:16		
			00:16:17	used tow haulage unit
10.	First Cut Stern Over Gate	10:36:33		
			00:00:11	
11.	Start Gate Closure	10:36:44		
			00:01:56	
12.	Gate Closed	10:38:40		
			00:06:05	
13.	End Fill/Empty	10:44:45		
			00:01:55	
14.	Gate Recessed	10:46:40		
			00:00:15	
15.	Second Cut Bow Over Gate	10:46:55		
			00:05:15	
16.	Second Cut Clear of Gate	10:52:10		
			00:00:55	
17.	Start Gate Closure	10:53:05		
			00:02:10	
18.	Gate Closed	10:55:15		
			00:07:25	
19.	End Fill/Empty	11:02:40		
			00:01:50	
20.	Gate Recessed	11:04:30		
			00:02:30	delay for fouled mooring line
21.	Second Cut Begins Exit	11:07:00		
			00:04:00	
22.	Cuts Bump together	11:11:00		
			00:09:00	
23.	Tow Starts Exit	11:20:00		
			00:04:06	
24.	Tow Stern Over Sill	11:24:06		

Lock: 24 Date: 18Aug94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	2	Bill O'Donley
b.	Tow Type	Single	
c.	Number of Barges	2	in line
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Dwnbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	11:40:30		
			00:01:50	
2.	Entry Complete	11:42:20		
			00:00:20	
3.	Start Gate Closure	11:42:40		
			00:01:50	
4.	Gate Closed	11:44:30		
			00:05:30	
5.	End Fill/Empty	11:50:00		
			00:01:55	
6.	Gate Recessed	11:51:55		
			00:00:05	
7.	Begin Exit	11:52:00		
			00:02:00	
8.	Tow Stern Over Sill	11:54:00		

Lock: 24 Date: 18Aug94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Ardyce Randall
b.	Tow Type	Double	
c.	Number of Barges	15	3x5 configuration
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	15:45:25		
			00:08:55	
2.	First Cut In	15:54:20		
			00:01:35	
3.	Second Cut Loose	15:55:55		
			00:01:20	
4.	Second Cut Clear of Gate	15:57:15		
			00:00:10	
5.	Start Gate Closure	15:57:25		
			00:02:01	
6.	Gate Closed	15:59:26		
			00:05:42	
7.	End Fill/Empty	16:05:08		
			00:01:57	
8.	Gate Recessed	16:07:05		
			00:02:15	drag cable for tow haul unit
9.	First Cut Begins Exit	16:09:20		
			00:08:10	used tow haulage unit
10.	First Cut Stern Over Gate	16:17:30		
			00:00:05	
11.	Start Gate Closure	16:17:35		
			00:01:55	
12.	Gate Closed	16:19:30		
			00:10:20	
13.	End Fill/Empty	16:29:50		
			00:02:01	
14.	Gate Recessed	16:31:51		
			00:00:24	
15.	Second Cut Bow Over Gate	16:32:15		
			00:06:11	
16.	Second Cut Clear of Gate	16:38:26		
			00:00:31	
17.	Start Gate Closure	16:38:57		
			00:02:01	
18.	Gate Closed	16:40:58		
			00:06:10	
19.	End Fill/Empty	16:47:08		
			00:01:55	
20.	Gate Recessed	16:49:03		
			00:00:07	
21.	Second Cut Begins Exit	16:49:10		
			00:02:55	
22.	Cuts Bump together	16:52:05		
			00:11:45	
23.	Tow Starts Exit	17:03:50		
			00:03:10	
24.	Tow Stern Over Sill	17:07:00		

Lock: 24 Date: 18Aug94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	4	Sir Robert
b.	Tow Type	Single	
c.	Number of Barges	4	2x2 configuration
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Dwnbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	18:33:20		
			00:04:25	
2.	Entry Complete	18:37:45		
			00:00:55	
3.	Start Gate Closure	18:38:40		
			00:02:00	
4.	Gate Closed	18:40:40		
			00:06:02	
5.	End Fill/Empty	18:46:42		
			00:02:04	
6.	Gate Recessed	18:48:46		
			00:00:29	
7.	Begin Exit	18:49:15		
			00:03:05	
8.	Tow Stern Over Sill	18:52:20		

Lock: 2 4 Date: 18 Aug 94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	5	Kay D
b.	Tow Type	Single	
c.	Number of Barges	2	Fuel Barges
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	19:06:50		
			00:04:20	
2.	Entry Complete	19:10:10		
			00:00:50	
3.	Start Gate Closure	19:11:00		
			00:02:00	
4.	Gate Closed	19:13:00		
			00:08:28	
5.	End Fill/Empty	19:21:28		
			00:01:59	
6.	Gate Recessed	19:23:27		
			00:00:03	
7.	Begin Exit	19:23:30		
			00:02:50	
8.	Tow Stern Over Sill	19:26:20		

Lock: 24 Date: 18Aug94

ITEM	DESCRIPTION		Notes:
a.	Observation Number	6	American Beauty
b.	Tow Type	Double	
c.	Number of Barges	15	3x5 configuration
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Dwnbound	Night Lockage

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	20:41:00		
			00:10:03	
2.	First Cut In	20:51:03		
			00:03:27	
3.	Second Cut Loose	20:54:30		
			00:01:10	
4.	Second Cut Clear of Gate	20:55:40		
			00:00:15	
5.	Start Gate Closure	20:55:55		
			00:02:25	
6.	Gate Closed	20:58:20		
			00:05:28	
7.	End Fill/Empty	21:03:48		
			00:01:57	
8.	Gate Recessed	21:05:45		
			00:02:15	drag cable for tow haul unit
9.	First Cut Begins Exit	21:08:00		
			00:16:17	used tow haulage unit
10.	First cut Stern Over Gate	21:24:17		
			00:01:08	moor cut before closing gates
11.	Start Gate Closure	21:25:25		
			00:02:02	
12.	Gate Closed	21:27:27		
			00:06:00	
13.	End Fill/Empty	21:33:27		
			00:01:58	
14.	Gate Recessed	21:35:25		
			00:01:25	
15.	Second Cut Bow Over Gate	21:36:50		
			00:03:40	
16.	Second Cut Clear of Gate	21:40:30		
			00:01:20	
17.	Start Gate Closure	21:41:50		
			00:02:00	
18.	Gate Closed	21:43:50		
			00:07:25	
19.	End Fill/Empty	21:51:15		
			00:01:51	
20.	Gate Recessed	21:53:06		
			00:00:01	
21.	Second Cut Begins Exit	21:53:07		
			00:03:53	
22.	Cuts Bump together	21:57:00		
			00:13:05	
23.	Tow Starts Exit	22:10:05		
			00:04:32	
24.	Tow Stern Over Sill	22:14:37		

Lock:	Mel Price (26R)		Date: 02-27-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	1	Charles W. Clark (Mrs. Rachael)
b.	Tow Type	Single	
c.	Number of Barges	1	
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	08:09:37		
			00:02:11	
2.	Entry Complete	08:11:48		
			00:00:21	
3.	Start Gate Closure	08:12:09		
			00:02:53	
4.	Gate Closed	08:15:02		
			00:05:13	
5.	End Fill/Empty	08:20:15		
			00:02:03	
6.	Gate Recessed	08:22:18		
			00:00:02	
7.	Begin Exit	08:22:20		
			00:03:08	
8.	Tow Stern Over Sill	08:25:28		

Lock:	Mel Price (26R)		**Date:**	02-27-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	2		Robert Love
b.	Tow Type	Single		
c.	Number of Barges	2		Empty
d.	Type of Entry	Fly		
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:22:34		
			00:03:00	
2.	Entry Complete	09:25:34		
			00:00:04	
3.	Start Gate Closure	09:25:38		
			00:03:04	
4.	Gate Closed	09:28:42		
			00:05:30	
5.	End Fill/Empty	09:34:12		
			00:01:58	
6.	Gate Recessed	09:36:10		
			00:00:05	
7.	Begin Exit	09:36:15		
			00:04:10	
8.	Tow Stern Over Sill	09:40:25		

Lock:	Mel Price (26R)		Date: 02-27-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Bob Stith
b.	Tow Type	Double	
c.	Number of Barges	16	3x3, 3x2+1
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	12:16:12		
			00:06:26	
2.	First Cut In	12:22:38		
			00:03:07	
3.	Second Cut Loose	12:25:45		
			00:01:15	
4.	Second Cut Clear of Gate	12:27:00		
			00:00:08	
5.	Start Gate Closure	12:27:08		
			00:03:14	
6.	Gate Closed	12:30:22		
			00:05:18	
7.	End Fill/Empty	12:35:40		
			00:02:04	
8.	Gate Recessed	12:37:44		
			00:00:18	
9.	First Cut Begins Exit	12:38:02		
			00:06:00	Helper Boat
10.	First cut Stern Over Gate	12:44:02		
			00:00:23	
11.	Start Gate Closure	12:44:25		
			00:02:57	
12.	Gate Closed	12:47:22		
			00:05:40	
13.	End Fill/Empty	12:53:02		
			00:02:00	
14.	Gate Recessed	12:55:02		
			00:01:28	
15.	Second Cut Bow Over Gate	12:56:30		
			00:06:41	
16.	Second Cut Clear of Gate	13:03:11		
			00:00:21	
17.	Start Gate Closure	13:03:32		
			00:02:59	
18.	Gate Closed	13:06:31		
			00:05:14	
19.	End Fill/Empty	13:11:45		
			00:02:13	
20.	Gate Recessed	13:13:58		
			00:00:42	
21.	Second Cut Begins Exit	13:14:40		
			00:03:30	
22.	Cuts Bump together	13:18:10		
			00:17:29	Second cut occupies chamber
23.	Tow Starts Exit	13:35:39		
			00:02:49	
24.	Tow Stern Over Sill	13:38:28		

Lock:	Mel Price (26R)		Date: 02-27-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	4	Cooperative Vanguard
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	14:09:46		
			00:06:53	
2.	First Cut In	14:16:39		
			00:03:02	
3.	Second Cut Loose	14:19:41		
			00:01:26	
4.	Second Cut Clear of Gate	14:21:07		
			00:00:22	
5.	Start Gate Closure	14:21:29		
			00:03:04	
6.	Gate Closed	14:24:33		
			00:05:35	
7.	End Fill/Empty	14:30:08		
			00:02:02	
8.	Gate Recessed	14:32:10		
			00:00:40	
9.	First Cut Begins Exit	14:32:50		
			00:07:04	Helper Boat
10.	First cut Stern Over Gate	14:39:54		
			00:00:02	
11.	Start Gate Closure	14:39:56		
			00:03:02	
12.	Gate Closed	14:42:58		
			00:05:14	
13.	End Fill/Empty	14:48:12		
			00:02:10	
14.	Gate Recessed	14:50:22		
			00:02:08	
15.	Second Cut Bow Over Gate	14:52:30		
			00:04:31	
16.	Second Cut Clear of Gate	14:57:01		
			00:00:07	
17.	Start Gate Closure	14:57:08		
			00:02:47	
18.	Gate Closed	14:59:55		
			00:05:45	
19.	End Fill/Empty	15:05:40		
			00:02:09	
20.	Gate Recessed	15:07:49		
			00:01:06	
21.	Second Cut Begins Exit	15:08:55		
			00:05:37	
22.	Tow Stern Over Sill	15:14:32		
			00:03:38	
23.	Cuts Bump together	15:18:10		

Lock:	Mel Price (26R)		Date:	02-27-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	5	Coral Dawn	
b.	Tow Type	Double		
c.	Number of Barges	15	3x3, 3x2	
d.	Type of Entry	Fly		
e.	Upbound/Downbound	Downbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	15:27:19		
			00:07:10	
2.	First Cut In	15:34:29		
			00:01:53	
3.	Second Cut Loose	15:36:22		
			00:01:36	
4.	Second Cut Clear of Gate	15:37:58		
			00:00:13	
5.	Start Gate Closure	15:38:11		
			00:02:50	
6.	Gate Closed	15:41:01		
			00:05:39	
7.	End Fill/Empty	15:46:40		
			00:02:09	
8.	Gate Recessed	15:48:49		
			00:00:43	
9.	First Cut Begins Exit	15:49:32		
			00:07:29	Helper Boat
10.	First cut Stern Over Gate	15:57:01		
			00:00:00	
11.	Start Gate Closure	15:57:01		
			00:03:03	
12.	Gate Closed	16:00:04		
			00:05:05	
13.	End Fill/Empty	16:05:09		
			00:02:16	
14.	Gate Recessed	16:07:25		
			00:01:49	
15.	Second Cut Bow Over Gate	16:09:14		
			00:05:18	
16.	Second Cut Clear of Gate	16:14:32		
			00:00:07	
17.	Start Gate Closure	16:14:39		
			00:02:46	
18.	Gate Closed	16:17:25		
			00:05:46	
19.	End Fill/Empty	16:23:11		
			00:02:08	
20.	Gate Recessed	16:25:19		
			00:00:23	
21.	Second Cut Begins Exit	16:25:42		
			00:04:37	
22.	Cuts Bump together	16:30:19		
			00:07:55	
23.	Tow Starts Exit	16:38:14		
			00:04:30	
24.	Tow Stern Over Sill	16:42:44		

Lock:	Mel Price (26R)		Date: 02-28-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	1	Cooperative Vanguard
b.	Tow Type	Double	
c.	Number of Barges	16	3x3, 3x2+1 Empty
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	08:43:56		
			00:08:02	
2.	First Cut In	08:51:58		
			00:02:16	
3.	Second Cut Loose	08:54:14		
			00:02:25	
4.	Second Cut Clear of Gate	08:56:39		
			00:00:08	
5.	Start Gate Closure	08:56:47		
			00:03:03	
6.	Gate Closed	08:59:50		
			00:05:02	
7.	End Fill/Empty	09:04:52		
			00:02:15	
8.	Gate Recessed	09:07:07		
			00:00:02	
9.	First Cut Begins Exit	09:07:09		
			00:03:16	Helper Boat
10.	First cut Stern Over Gate	09:10:25		
			00:00:06	
11.	Start Gate Closure	09:10:31		
			00:02:51	
12.	Gate Closed	09:13:22		
			00:05:44	
13.	End Fill/Empty	09:19:06		
			00:02:08	
14.	Gate Recessed	09:21:14		
			00:01:32	
15.	Second Cut Bow Over Gate	09:22:46		
			00:07:06	
16.	Second Cut Clear of Gate	09:29:52		
			00:00:28	
17.	Start Gate Closure	09:30:20		
			00:03:01	
18.	Gate Closed	09:33:21		
			00:05:03	
19.	End Fill/Empty	09:38:24		
			00:02:14	
20.	Gate Recessed	09:40:38		
			00:00:19	
21.	Second Cut Begins Exit	09:40:57		
			00:06:13	
22.	Tow Stern Over Sill	09:47:10		
			00:01:32	
23.	Cuts Bump together	09:48:42		

Lock:	Mel Price (26R)		Date: 02-28-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	2	Jack D. Wofford
b.	Tow Type	Double	
c.	Number of Barges	14	2-3-3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	10:00:18		
			00:09:48	
2.	First Cut In	10:10:06		
			00:03:39	
3.	Second Cut Loose	10:13:45		
			00:01:55	
4.	Second Cut Clear of Gate	10:15:40		
			00:00:09	
5.	Start Gate Closure	10:15:49		
			00:03:01	
6.	Gate Closed	10:18:50		
			00:05:06	
7.	End Fill/Empty	10:23:56		
			00:02:14	
8.	Gate Recessed	10:26:10		
			00:00:12	
9.	First Cut Begins Exit	10:26:22		
			00:06:55	Helper Boat
10.	First cut Stern Over Gate	10:33:17		
			00:00:13	
11.	Start Gate Closure	10:33:30		
			00:02:56	
12.	Gate Closed	10:36:26		
			00:05:29	
13.	End Fill/Empty	10:41:55		
			00:02:10	
14.	Gate Recessed	10:44:05		
			00:02:03	
15.	Second Cut Bow Over Gate	10:46:08		
			00:04:22	
16.	Second Cut Clear of Gate	10:50:30		
			00:00:11	
17.	Start Gate Closure	10:50:41		
			00:03:00	
18.	Gate Closed	10:53:41		
			00:05:02	
19.	End Fill/Empty	10:58:43		
			00:02:15	
20.	Gate Recessed	11:00:58		
			00:00:40	
21.	Second Cut Begins Exit	11:01:38		
			00:04:40	
22.	Tow Stern Over Sill	11:06:18		
			00:01:20	
23.	Cuts Bump together	11:07:38		

Lock:	Mel Price (26R)		Date: 02-28-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Sarah Elizabeth
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 2x3
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	11:19:16		
			00:08:58	
2.	First Cut In	11:28:14		
			00:04:41	
3.	Second Cut Loose	11:32:55		
			00:01:53	
4.	Second Cut Clear of Gate	11:34:48		
			00:00:17	
5.	Start Gate Closure	11:35:05		
			00:03:03	
6.	Gate Closed	11:38:08		
			00:05:06	
7.	End Fill/Empty	11:43:14		
			00:02:14	
8.	Gate Recessed	11:45:28		
			00:00:24	
9.	First Cut Begins Exit	11:45:52		
			00:03:21	Helper Boat
10.	First cut Stern Over Gate	11:49:13		
			00:00:10	
11.	Start Gate Closure	11:49:23		
			00:02:58	
12.	Gate Closed	11:52:21		
			00:05:34	
13.	End Fill/Empty	11:57:55		
			00:02:10	
14.	Gate Recessed	12:00:05		
			00:01:33	
15.	Second Cut Bow Over Gate	12:01:38		
			00:04:32	
16.	Second Cut Clear of Gate	12:06:10		
			00:00:07	
17.	Start Gate Closure	12:06:17		
			00:02:57	
18.	Gate Closed	12:09:14		
			00:05:04	
19.	End Fill/Empty	12:14:18		
			00:02:14	
20.	Gate Recessed	12:16:32		
			00:00:09	
21.	Second Cut Begins Exit	12:16:41		
			00:05:09	
22.	Tow Stern Over Sill	12:21:50		
			00:02:25	
23.	Cuts Bump together	12:24:15		

Lock:	Mel Price (26R)		Date: 02-28-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	4 4	L.W. Matteson, Inc. (Bull Frog)
b.	Tow Type	Single	
c.	Number of Barges	8	Work barges, varing sizes (dredge
d.	Type of Entry	Fly	material) - 2 tugs
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	13:54:15		
			00:05:16	
2.	Entry Complete	13:59:31		
			00:00:10	
3.	Start Gate Closure	13:59:41		
			00:02:58	
4.	Gate Closed	14:02:39		
			00:05:31	
5.	End Fill/Empty	14:08:10		
			00:02:10	
6.	Gate Recessed	14:10:20		
			00:00:31	
7.	Begin Exit	14:10:51		
			00:03:12	
8.	Tow Stern Over Sill	14:14:03		

Lock:	Mel Price (26R)		Date: 02-28-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	5	Alter Barge Line, Inc. (Renee G.)
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2 (Grain)
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	14:43:14		
			00:08:31	
2.	First Cut In	14:51:45		
			00:02:34	
3.	Second Cut Loose	14:54:19		
			00:02:03	
4.	Second Cut Clear of Gate	14:56:22		
			00:00:09	
5.	Start Gate Closure	14:56:31		
			00:02:58	
6.	Gate Closed	14:59:29		
			00:05:26	
7.	End Fill/Empty	15:04:55		
			00:02:15	
8.	Gate Recessed	15:07:10		
			00:00:36	
9.	First Cut Begins Exit	15:07:46		
			00:05:37	Helper Boat
10.	First cut Stern Over Gate	15:13:23		
			00:00:15	
11.	Start Gate Closure	15:13:38		
			00:03:00	
12.	Gate Closed	15:16:38		
			00:05:05	
13.	End Fill/Empty	15:21:43		
			00:02:14	
14.	Gate Recessed	15:23:57		
			00:02:22	
15.	Second Cut Bow Over Gate	15:26:19		
			00:05:55	
16.	Second Cut Clear of Gate	15:32:14		
			00:00:55	
17.	Start Gate Closure	15:33:09		
			00:03:03	
18.	Gate Closed	15:36:12		
			00:05:28	
19.	End Fill/Empty	15:41:40		
			00:02:09	
20.	Gate Recessed	15:43:49		
			00:00:35	
21.	Second Cut Begins Exit	15:44:24		
			00:04:27	
22.	Cuts Bump together	15:48:51		
			00:15:25	
23.	Tow Starts Exit	16:04:16		
			00:08:40	
24.	Tow Stern Over Sill	16:12:56		

Lock:	Mel Price (26R)		**Date:**	03-01-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	1	Mary D.	
b.	Tow Type	Knockout		
c.	Number of Barges	6	2x3	
d.	Type of Entry	Fly		
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	08:52:20		
			00:12:55	
2.	Entry Complete	09:05:15		
			00:00:16	
3.	Start Gate Closure	09:05:31		
			00:03:02	
4.	Gate Closed	09:08:33		
			00:05:39	
5.	End Fill/Empty	09:14:12		
			00:02:13	
6.	Gate Recessed	09:16:25		
			00:01:15	
7.	Begin Exit	09:17:40		
			00:05:07	
8.	Tow Stern Over Sill	09:22:47		

Lock:	Mel Price (26R)		Date: 03-01-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	2	Ron Shankin
b.	Tow Type	Double	
c.	Number of Barges	14	3x3, 3+2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:35:28		
			00:06:03	
2.	First Cut In	09:41:31		
			00:09:01	
3.	Second Cut Loose	09:50:32		
			00:01:16	
4.	Second Cut Clear of Gate	09:51:48		
			00:00:09	
5.	Start Gate Closure	09:51:57		
			00:03:02	
6.	Gate Closed	09:54:59		
			00:04:54	
7.	End Fill/Empty	09:59:53		
			00:02:09	
8.	Gate Recessed	10:02:02		
			00:00:15	
9.	First Cut Begins Exit	10:02:17		
			00:03:03	Helper Boat
10.	First cut Stern Over Gate	10:05:20		
			00:00:09	
11.	Start Gate Closure	10:05:29		
			00:03:02	
12.	Gate Closed	10:08:31		
			00:05:25	
13.	End Fill/Empty	10:13:56		
			00:02:11	
14.	Gate Recessed	10:16:07		
			00:01:06	
15.	Second Cut Bow Over Gate	10:17:13		
			00:04:15	
16.	Second Cut Clear of Gate	10:21:28		
			00:00:03	
17.	Start Gate Closure	10:21:31		
			00:02:58	
18.	Gate Closed	10:24:29		
			00:04:47	
19.	End Fill/Empty	10:29:16		
			00:02:13	
20.	Gate Recessed	10:31:29		
			00:00:12	
21.	Second Cut Begins Exit	10:31:41		
			00:03:44	
22.	Tow Stern Over Sill	10:35:25		
			00:01:37	
23.	Cuts Bump together	10:37:02		

Lock:	Mel Price (26R)		Date: 03-01-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Cooperative Mariner
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	10:47:48		
			00:06:21	
2.	First Cut In	10:54:09		
			00:02:53	
3.	Second Cut Loose	10:57:02		
			00:01:28	
4.	Second Cut Clear of Gate	10:58:30		
			00:00:12	
5.	Start Gate Closure	10:58:42		
			00:03:00	
6.	Gate Closed	11:01:42		
			00:04:49	
7.	End Fill/Empty	11:06:31		
			00:02:16	
8.	Gate Recessed	11:08:47		
			00:00:05	
9.	First Cut Begins Exit	11:08:52		
			00:03:58	Helper Boat
10.	First cut Stern Over Gate	11:12:50		
			00:00:12	
11.	Start Gate Closure	11:13:02		
			00:02:57	
12.	Gate Closed	11:15:59		
			00:05:23	
13.	End Fill/Empty	11:21:22		
			00:02:10	
14.	Gate Recessed	11:23:32		
			00:01:12	
15.	Second Cut Bow Over Gate	11:24:44		
			00:03:32	
16.	Second Cut Clear of Gate	11:28:16		
			00:00:04	
17.	Start Gate Closure	11:28:20		
			00:02:59	
18.	Gate Closed	11:31:19		
			00:04:46	
19.	End Fill/Empty	11:36:05		
			00:02:15	
20.	Gate Recessed	11:38:20		
			00:00:08	
21.	Second Cut Begins Exit	11:38:28		
			00:03:26	
22.	Cuts Bump together	11:41:54		
			00:08:32	
23.	Tow Starts Exit	11:50:26		
			00:02:37	
24.	Tow Stern Over Sill	11:53:03		

Lock:	Mel Price (26R)		Date: 03-01-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	4	Hornet
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	14:05:25		
			00:05:09	
2.	First Cut In	14:10:34		
			00:03:06	
3.	Second Cut Loose	14:13:40		
			00:01:23	
4.	Second Cut Clear of Gate	14:15:03		
			00:00:11	
5.	Start Gate Closure	14:15:14		
			00:03:01	
6.	Gate Closed	14:18:15		
			00:04:41	
7.	End Fill/Empty	14:22:56		
			00:02:13	
8.	Gate Recessed	14:25:09		
			00:00:07	
9.	First Cut Begins Exit	14:25:16		
			00:03:16	
10.	First cut Stern Over Gate	14:28:32		
			00:00:54	
11.	Start Gate Closure	14:29:26		
			00:02:58	
12.	Gate Closed	14:32:24		
			00:05:27	
13.	End Fill/Empty	14:37:51		
			00:02:10	
14.	Gate Recessed	14:40:01		
			00:01:22	
15.	Second Cut Bow Over Gate	14:41:23		
			00:03:27	
16.	Second Cut Clear of Gate	14:44:50		
			00:00:11	
17.	Start Gate Closure	14:45:01		
			00:03:00	
18.	Gate Closed	14:48:01		
			00:04:50	
19.	End Fill/Empty	14:52:51		
			00:02:08	
20.	Gate Recessed	14:54:59		
			00:00:59	
21.	Second Cut Begins Exit	14:55:58		
			00:02:48	
22.	Cuts Bump together	14:58:46		
			00:07:08	
23.	Tow Starts Exit	15:05:54		
			00:01:56	
24.	Tow Stern Over Sill	15:07:50		

Lock:	Mel Price (26R)		Date: 03-02-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	1	Melinda Brent
b.	Tow Type	Single	
c.	Number of Barges	1	
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	06:52:24		
			00:01:11	
2.	Entry Complete	06:53:35		
			00:00:19	
3.	Start Gate Closure	06:53:54		
			00:02:58	
4.	Gate Closed	06:56:52		
			00:05:22	
5.	End Fill/Empty	07:02:14		
			00:02:10	
6.	Gate Recessed	07:04:24		
			00:00:35	
7.	Begin Exit	07:04:59		
			00:01:59	
8.	Tow Stern Over Sill	07:06:58		

Lock:	Mel Price (26R)		Date: 03-02-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	2	Beverly Ann
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	08:46:03		
			00:08:29	
2.	First Cut In	08:54:32		
			00:02:40	
3.	Second Cut Loose	08:57:12		
			00:01:12	
4.	Second Cut Clear of Gate	08:58:24		
			00:00:13	
5.	Start Gate Closure	08:58:37		
			00:02:59	
6.	Gate Closed	09:01:36		
			00:05:24	
7.	End Fill/Empty	09:07:00		
			00:03:10	
8.	Gate Recessed	09:10:10		
			00:00:11	
9.	First Cut Begins Exit	09:10:21		
			00:07:48	Helper Boat
10.	First cut Stern Over Gate	09:18:09		
			00:00:12	
11.	Start Gate Closure	09:18:21		
			00:03:03	
12.	Gate Closed	09:21:24		
			00:04:40	
13.	End Fill/Empty	09:26:04		
			00:02:14	
14.	Gate Recessed	09:28:18		
			00:02:24	
15.	Second Cut Bow Over Gate	09:30:42		
			00:04:14	
16.	Second Cut Clear of Gate	09:34:56		
			00:00:11	
17.	Start Gate Closure	09:35:07		
			00:02:59	
18.	Gate Closed	09:38:06		
			00:05:25	
19.	End Fill/Empty	09:43:31		
			00:02:08	
20.	Gate Recessed	09:45:39		
			00:00:39	
21.	Second Cut Begins Exit	09:46:18		
			00:05:34	
22.	Tow Stern Over Sill	09:51:52		
			00:02:44	
23.	Cuts Bump together	09:54:36		

Lock:	Mel Price (26R)		Date: 03-02-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Normania
b.	Tow Type	Double	
c.	Number of Barges	12	3x2, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	10:04:32		
			00:04:52	
2.	First Cut In	10:09:24		
			00:06:52	
3.	Second Cut Loose	10:16:16		
			00:01:55	
4.	Second Cut Clear of Gate	10:18:11		
			00:00:14	
5.	Start Gate Closure	10:18:25		
			00:02:58	
6.	Gate Closed	10:21:23		
			00:05:20	
7.	End Fill/Empty	10:26:43		
			00:02:12	
8.	Gate Recessed	10:28:55		
			00:00:46	
9.	First Cut Begins Exit	10:29:41		
			00:05:42	Helper Boat
10.	First cut Stern Over Gate	10:35:23		
			00:00:07	
11.	Start Gate Closure	10:35:30		
			00:02:59	
12.	Gate Closed	10:38:29		
			00:04:43	
13.	End Fill/Empty	10:43:12		
			00:02:14	
14.	Gate Recessed	10:45:26		
			00:02:19	
15.	Second Cut Bow Over Gate	10:47:45		
			00:02:41	
16.	Second Cut Clear of Gate	10:50:26		
			00:00:17	
17.	Start Gate Closure	10:50:43		
			00:02:59	
18.	Gate Closed	10:53:42		
			00:05:26	
19.	End Fill/Empty	10:59:08		
			00:02:11	
20.	Gate Recessed	11:01:19		
			00:00:37	
21.	Second Cut Begins Exit	11:01:56		
			00:04:35	
22.	Tow Stern Over Sill	11:06:31		
			00:02:40	
23.	Cuts Bump together	11:09:11		

Lock:	Mel Price (26R)		**Date:**	03-02-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	4	Karen Ann	
b.	Tow Type	Single		
c.	Number of Barges	2	Work barge & tug (Angela Kay)	
d.	Type of Entry	Exchange		
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	11:13:04		
			00:00:28	
2.	Entry Complete	11:13:32		
			00:00:30	
3.	Start Gate Closure	11:14:02		
			00:03:02	
4.	Gate Closed	11:17:04		
			00:04:46	
5.	End Fill/Empty	11:21:50		
			00:02:09	
6.	Gate Recessed	11:23:59		
			00:00:21	
7.	Begin Exit	11:24:20		
			00:01:32	
8.	Tow Stern Over Sill	11:25:52		

Lock:	Mel Price (26R)		Date:	03-02-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	5		Hugh C. Blaske
b.	Tow Type	Double		
c.	Number of Barges	15		3x3, 3x2
d.	Type of Entry	Fly		
e.	Upbound/Downbound	Downbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	11:49:02		
			00:05:14	
2.	First Cut In	11:54:16		
			00:04:20	
3.	Second Cut Loose	11:58:36		
			00:01:22	2. Bow over sill
4.	Second Cut Clear of Gate	11:59:58		
			00:00:12	
5.	Start Gate Closure	12:00:10		
			00:02:57	
6.	Gate Closed	12:03:07		
			00:05:25	3. End of 1st Cut
7.	End Fill/Empty	12:08:32		
			00:02:29	
8.	Gate Recessed	12:11:01		
			00:00:21	
9.	First Cut Begins Exit	12:11:22		
			00:06:50	Helper Boat
10.	First cut Stern Over Gate	12:18:12		4. Start of Exit 1st Cut
			00:00:05	
11.	Start Gate Closure	12:18:17		
			00:03:01	
12.	Gate Closed	12:21:18		
			00:04:22	5. End of 1st Lockage
13.	End Fill/Empty	12:25:40		
			00:02:31	
14.	Gate Recessed	12:28:11		
			00:01:47	
15.	Second Cut Bow Over Gate	12:29:58		
			00:04:19	6. Start of Locking 2nd Cut
16.	Second Cut Clear of Gate	12:34:17		
			00:00:16	7. Entry time 2nd cut
17.	Start Gate Closure	12:34:33		
			00:02:55	
18.	Gate Closed	12:37:28		
			00:05:24	8. End of Entry 2nd Cut
19.	End Fill/Empty	12:42:52		
			00:02:12	
20.	Gate Recessed	12:45:04		
			00:00:48	
21.	Second Cut Begins Exit	12:45:52		
			00:05:04	
22.	Tow Stern Over Sill	12:50:56		
			00:02:46	9. Start of Exit 2nd Cut
23.	Cuts Bump together	12:53:42		

not all.

Lock:	Mel Price (26R)		Date: 03-02-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	6 6	DBS Dominque You
b.	Tow Type	Single	
c.	Number of Barges	4	2x2
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	13:20:03		
			00:02:03	
2.	Entry Complete	13:22:06		
			00:00:34	
3.	Start Gate Closure	13:22:40		
			00:03:02	
4.	Gate Closed	13:25:42		
			00:07:54	
5.	End Fill/Empty	13:33:36		
			00:02:55	
6.	Gate Recessed	13:36:31		
			00:00:17	
7.	Begin Exit	13:36:48		
			00:01:51	
8.	Tow Stern Over Sill	13:38:39		

Lock:	Mel Price (26R)		Date: 03-02-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	7	Evey-T
b.	Tow Type	Double	
c.	Number of Barges	14	3x3, 3+2
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	14:15:37		
			00:04:14	
2.	First Cut In	14:19:51		
			00:03:50	
3.	Second Cut Loose	14:23:41		
			00:01:22	
4.	Second Cut Clear of Gate	14:25:03		
			00:01:27	
5.	Start Gate Closure	14:26:30		
			00:02:56	
6.	Gate Closed	14:29:26		
			00:04:56	
7.	End Fill/Empty	14:34:22		
			00:02:12	
8.	Gate Recessed	14:36:34		
			00:00:30	
9.	First Cut Begins Exit	14:37:04		
			00:03:39	Helper Boat
10.	First cut Stern Over Gate	14:40:43		
			00:01:11	
11.	Start Gate Closure	14:41:54		
			00:02:57	
12.	Gate Closed	14:44:51		
			00:05:22	
13.	End Fill/Empty	1450:131:::		.::
			00:02:11	
14.	Gate Recessed	14:52:24		
			00:01:05	
15.	Second Cut Bow Over Gate	14:53:29		
			00:02:52	
16.	Second Cut Clear of Gate	14:56:21		
			00:00:06	
17.	Start Gate Closure	14:56:27		
			00:02:59	
18.	Gate Closed	14:59:26		
			00:04:48	
19.	End Fill/Empty	15:04:14		
			00:02:12	
20.	Gate Recessed	15:06:26		
			00:00:30	
21.	Second Cut Begins Exit	15:06:56		
			00:03:49	
22.	Tow Stern Over Sill	15:10:45		
			00:01:05	
23.	Cuts Bump together	15:11:50		

Lock:	Mel Price (26R)		Date: 03-02-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	8	Kevin Flowers
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	15:23:23		
			00:10:01	
2.	First Cut In	15:33:24		
			00:04:22	
3.	Second Cut Loose	15:37:46		
			00:01:38	
4.	Second Cut Clear of Gate	15:39:24		
			00:01:08	
5.	Start Gate Closure	15:40:32		
			00:03:01	
6.	Gate Closed	15:43:33		
			00:04:44	
7.	End Fill/Empty	15:48:17		
			00:02:14	
8.	Gate Recessed	15:50:31		
			00:00:09	
9.	First Cut Begins Exit	15:50:40		
			00:08:09	
10.	First cut Stern Over Gate	15:58:49		
			00:00:15	
11.	Start Gate Closure	15:59:04		
			00:02:57	
12.	Gate Closed	16:02:01		
			00:05:23	
13.	End Fill/Empty	16:07:24		
			00:02:09	
14.	Gate Recessed	16:09:33		
			00:01:40	
15.	Second Cut Bow Over Gate	16:11:13		
			00:06:09	
16.	Second Cut Clear of Gate	16:17:22		
			00:00:14	
17.	Start Gate Closure	16:17:36		
			00:03:01	
18.	Gate Closed	16:20:37		
			00:06:59	
19.	End Fill/Empty	16:25:23		
			00:02:13	
20.	Gate Recessed	16:27:36		
			00:05:50	
21.	Second Cut Begins Exit	16:27:48		
			00:05:38	
22.	Tow Stern Over Sill	16:33:26		
			00:01:41	
23.	Cuts Bump together	16:35:07		

Lock:	Mel Price (26R)		Date: 03-03-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	1	Charles Lehman
b.	Tow Type	Double	
c.	Number of Barges	16	3x3, 3x2+1
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	06:59:53		
			00:08:57	
2.	First Cut In	07:08:50		
			00:02:20	
3.	Second Cut Loose	07:11:10		
			00:02:11	
4.	Second Cut Clear of Gate	07:13:21		
			00:00:11	
5.	Start Gate Closure	07:13:32		
			00:02:54	
6.	Gate Closed	07:16:26		
			00:04:55	
7.	End Fill/Empty	07:21:21		
			00:02:13	
8.	Gate Recessed	07:23:34		
			00:00:15	
9.	First Cut Begins Exit	07:23:49		
			00:07:17	Helper Boat
10.	First cut Stern Over Gate	07:31:06		
			00:00:12	
11.	Start Gate Closure	07:31:18		
			00:02:59	
12.	Gate Closed	07:34:17		
			00:05:21	
13.	End Fill/Empty	07:39:38		
			00:02:09	
14.	Gate Recessed	07:41:47		
			00:02:49	
15.	Second Cut Bow Over Gate	07:44:36		
			00:05:59	
16.	Second Cut Clear of Gate	07:50:35		
			00:01:13	
17.	Start Gate Closure	07:51:48		
			00:02:59	
18.	Gate Closed	07:54:47		
			00:04:48	
19.	End Fill/Empty	07:59:35		
			00:02:16	
20.	Gate Recessed	08:01:51		
			00:00:28	
21.	Second Cut Begins Exit	08:02:19		
			00:05:08	
22.	Tow Stern Over Sill	08:07:27		
			00:00:52	
23.	Cuts Bump together	08:08:19		

Lock:	Mel Price (26R)		Date:	03-03-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	2	Melinda Brent	
b.	Tow Type	Single		
c.	Number of Barges	4	2x2	
d.	Type of Entry	Turnback		
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	08:24:32		
			00:08:39	
2.	Entry Complete	08:33:11		
			00:00:15	
3.	Start Gate Closure	08:33:26		
			00:03:04	
4.	Gate Closed	08:36:30		
			00:04:41	
5.	End Fill/Empty	08:41:11		
			00:02:13	
6.	Gate Recessed	08:43:24		
			00:00:20	
7.	Begin Exit	08:43:44		
			00:06:12	
8.	Tow Stern Over Sill	08:49:56		

Lock:	Mel Price (26R)		Date:	03-03-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	3	Leviticus	
b.	Tow Type	Single		
c.	Number of Barges	6	3x2	
d.	Type of Entry	Turnback		
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:04:04		
			00:04:52	
2.	Entry Complete	09:08:56		
			00:00:15	
3.	Start Gate Closure	09:09:11		
			00:02:57	
4.	Gate Closed	09:12:08		
			00:04:48	
5.	End Fill/Empty	09:16:56		
			00:02:13	
6.	Gate Recessed	09:19:09		
			00:01:33	
7.	Begin Exit	09:20:42		
			00:03:36	
8.	Tow Stern Over Sill	09:24:18		

Lock:	Mel Price (26R)		**Date:**	03-03-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	4	C.W. Rushing	
b.	Tow Type	Single		
c.	Number of Barges	1		
d.	Type of Entry	Exchange		
e.	Upbound/Downbound	Downbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:38:58		
			00:01:31	
2.	Entry Complete	09:40:29		
			00:00:15	
3.	Start Gate Closure	09:40:44		
			00:02:58	
4.	Gate Closed	09:43:42		
			00:05:26	
5.	End Fill/Empty	09:49:08		
			00:02:09	
6.	Gate Recessed	09:51:17		
			00:00:18	
7.	Begin Exit	09:51:35		
			00:02:06	
8.	Tow Stern Over Sill	09:53:41		

Lock:	Mel Price (26R)		Date: 03-03-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	5	Phyllis
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	10:07:02		
			00:09:04	
2.	First Cut In	10:16:06		
			00:05:56	
3.	Second Cut Loose	10:22:02		
			00:02:00	
4.	Second Cut Clear of Gate	10:24:02		
			00:00:14	
5.	Start Gate Closure	10:24:16		
			00:02:58	
6.	Gate Closed	10:27:14		
			00:05:22	
7.	End Fill/Empty	10:32:36		
			00:02:11	
8.	Gate Recessed	10:34:47		
			00:00:35	
9.	First Cut Begins Exit	10:35:22		
			00:07:12	Helper Boat
10.	First cut Stern Over Gate	10:42:34		
			00:00:09	
11.	Start Gate Closure	10:42:43		
			00:02:55	
12.	Gate Closed	10:45:38		
			00:04:54	
13.	End Fill/Empty	10:50:32		
			00:02:13	
14.	Gate Recessed	10:52:45		
			00:02:11	
15.	Second Cut Bow Over Gate	10:54:56		
			00:04:14	
16.	Second Cut Clear of Gate	10:59:10		
			00:00:29	
17.	Start Gate Closure	10:59:39		
			00:02:58	
18.	Gate Closed	11:02:37		
			00:05:26	
19.	End Fill/Empty	11:08:03		
			00:02:10	
20.	Gate Recessed	11:10:13		
			00:00:23	
21.	Second Cut Begins Exit	11:10:36		
			00:05:08	
22.	Tow Stern Over Sill	11:15:44		
			00:04:11	
23.	Cuts Bump together	11:19:55		

Lock:	Mel Price (26R)		Date:	03-03-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	6	Ruth Brent	
b.	Tow Type	Knockout		
c.	Number of Barges	2	1+1	
d.	Type of Entry	Exhchange		
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	12:01:55		
			00:13:38	
2.	Entry Complete	12:15:33		
			00:00:12	
3.	Start Gate Closure	12:15:45		
			00:02:59	
4.	Gate Closed	12:18:44		
			00:05:40	
5.	End Fill/Empty	12:24:24		
			00:02:14	
6.	Gate Recessed	12:26:38		
			00:00:16	
7.	Begin Exit	12:26:54		
			00:09:12	
8.	Tow Stern Over Sill	12:36:06		

Lock:	Mel Price (26R)		Date: 03-03-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	7	Decatur Lady
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	13:01:18		
			00:07:04	
2.	First Cut In	13:08:22		
			00:03:54	
3.	Second Cut Loose	13:12:16		
			00:01:29	
4.	Second Cut Clear of Gate	13:13:45		
			00:00:23	
5.	Start Gate Closure	13:14:08		
			00:02:58	
6.	Gate Closed	13:17:06		
			00:05:26	
7.	End Fill/Empty	13:22:32		
			00:02:10	
8.	Gate Recessed	13:24:42		
			00:00:26	
9.	First Cut Begins Exit	13:25:08		
			00:07:05	Helper Boat
10.	First cut Stern Over Gate	13:32:13		
			00:00:08	
11.	Start Gate Closure	13:32:21		
			00:03:01	
12.	Gate Closed	13:35:22		
			00:04:48	
13.	End Fill/Empty	13:40:10		
			00:02:15	
14.	Gate Recessed	13:42:25		
			00:02:26	
15.	Second Cut Bow Over Gate	13:44:51		
			00:04:16	
16.	Second Cut Clear of Gate	13:49:07		
			00:00:28	
17.	Start Gate Closure	13:49:35		
			00:02:59	
18.	Gate Closed	13:52:34		
			00:05:21	
19.	End Fill/Empty	13:57:55		
			00:02:12	
20.	Gate Recessed	14:00:07		
			00:00:23	
21.	Second Cut Begins Exit	14:00:30		
			00:06:14	
22.	Tow Stern Over Sill	14:06:44		
			00:03:18	
23.	Cuts Bump together	14:10:02		

Lock:	Mel Price (26R)		Date: 03-03-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	8	Kevin Michael
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	14:21:03		
			00:06:01	
2.	First Cut In	14:27:04		
			00:02:14	
3.	Second Cut Loose	14:29:18		
			00:01:26	
4.	Second Cut Clear of Gate	14:30:44		
			00:00:31	
5.	Start Gate Closure	14:31:15		
			00:02:59	
6.	Gate Closed	14:34:14		
			00:05:17	
7.	End Fill/Empty	14:39:31		
			00:02:11	
8.	Gate Recessed	14:41:42		
			00:00:41	
9.	First Cut Begins Exit	14:42:23		
			00:08:30	Helper Boat
10.	First cut Stern Over Gate	14:50:53		
			00:00:06	
11.	Start Gate Closure	14:50:59		
			00:02:58	
12.	Gate Closed	14:53:57		
			00:04:43	
13.	End Fill/Empty	14:58:40		
			00:02:13	
14.	Gate Recessed	15:00:53		
			00:03:03	
15.	Second Cut Bow Over Gate	15:03:56		
			00:04:47	
16.	Second Cut Clear of Gate	15:08:43		
			00:00:14	
17.	Start Gate Closure	15:08:57		
			00:02:59	
18.	Gate Closed	15:11:56		
			00:05:28	
19.	End Fill/Empty	15:17:24		
			00:02:12	
20.	Gate Recessed	15:19:36		
			00:00:28	
21.	Second Cut Begins Exit	15:20:04		
			00:04:57	
22.	Tow Stern Over Sill	15:25:01		
			00:02:17	
23.	Cuts Bump together	15:27:18		

Lock:	Mel Price (26R)		Date: 03-08-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	1	Charles W. Clark
b.	Tow Type	Single	
c.	Number of Barges	1	
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	07:42:01		
			00:02:40	
2.	Entry Complete	07:44:41		
			00:00:01	
3.	Start Gate Closure	07:44:42		
			00:03:02	
4.	Gate Closed	07:47:44		
			00:05:11	
5.	End Fill/Empty	07:52:55		
			00:02:10	
6.	Gate Recessed	07:55:05		
			00:00:37	
7.	Begin Exit	07:55:42		
			00:03:17	
8.	Tow Stern Over Sill	07:58:59		

Lock:	Mel Price (26R)		Date: 03-08-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	2	Renee G.
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbour	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	08:13:46		
			00:07:24	
2.	First Cut In	08:21:10		
			00:03:07	
3.	Second Cut Loose	08:24:17		
			00:01:28	
4.	Second Cut Clear of Gate	08:25:45		
			00:00:09	
5.	Start Gate Closure	08:25:54		
			00:02:59	
6.	Gate Closed	08:28:53		
			00:05:08	
7.	End Fill/Empty	08:34:01		
			00:02:15	
8.	Gate Recessed	08:36:16		
			00:00:58	
9.	First Cut Begins Exit	08:37:14		
			00:07:13	Helper Boat
10.	First cut Stern Over Gate	08:44:27		
			00:00:08	
11.	Start Gate Closure	08:44:35		
			00:03:02	
12.	Gate Closed	08:47:37		
			00:04:42	
13.	End Fill/Empty	08:52:19		
			00:02:13	
14.	Gate Recessed	08:54:32		
			00:02:29	
15.	Second Cut Bow Over Gate	08:57:01		
			00:03:33	
16.	Second Cut Clear of Gate	09:00:34		
			00:00:14	
17.	Start Gate Closure	09:00:48		
			00:02:58	
18.	Gate Closed	09:03:46		
			00:05:12	
19.	End Fill/Empty	09:08:58		
			00:02:12	
20.	Gate Recessed	09:11:10		
			00:00:37	
21.	Second Cut Begins Exit	09:11:47		
			00:04:43	
22.	Tow Stern Over Sill	09:16:30		
			00:03:42	
23.	Cuts Bump together	09:20:12		

Lock:	Mel Price (26R)		Date: 03-08-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Lydia E. Campbell
b.	Tow Type	Double	
c.	Number of Barges	6	2x2, 2X1
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:32:58		
			00:06:02	
2.	First Cut In	09:39:00		
			00:06:43	
3.	Second Cut Loose	09:45:43		
			00:02:03	
4.	Second Cut Clear of Gate	09:47:46		
			00:00:01	
5.	Start Gate Closure	09:47:47		
			00:03:00	
6.	Gate Closed	09:50:47		
			00:05:15	
7.	End Fill/Empty	09:56:02		
			00:02:13	
8.	Gate Recessed	09:58:15		
			00:01:09	
9.	First Cut Begins Exit	09:59:24		
			00:06:29	Helper Boat
10.	First cut Stern Over Gate	10:05:53		
			00:00:08	
11.	Start Gate Closure	10:06:01		
			00:03:02	
12.	Gate Closed	10:09:03		
			00:04:41	
13.	End Fill/Empty	10:13:44		
			00:02:13	
14.	Gate Recessed	10:15:57		
			00:02:39	
15.	Second Cut Bow Over Gate	10:18:36		
			00:05:39	
16.	Second Cut Clear of Gate	10:24:15		
			00:00:01	
17.	Start Gate Closure	10:24:16		
			00:02:57	
18.	Gate Closed	10:27:13		
			00:05:09	
19.	End Fill/Empty	10:32:22		
			00:02:12	
20.	Gate Recessed	10:34:34		
			00:00:47	
21.	Second Cut Begins Exit	10:35:21		
			00:05:08	
22.	Tow Stern Over Sill	10:40:29		
			00:03:48	
23.	Cuts Bump together	10:44:17		

Lock:	Mel Price (26R)		Date: 03-08-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	4	Jack D. Wofford
b.	Tow Type	Double	
c.	Number of Barges	12	3x2, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	10:54:13		
			00:03:33	
2.	First Cut In	10:57:46		
			00:02:38	
3.	Second Cut Loose	11:00:24		
			00:01:38	
4.	Second Cut Clear of Gate	11:02:02		
			00:00:09	
5.	Start Gate Closure	11:02:11		
			00:02:57	
6.	Gate Closed	11:05:08		
			00:05:16	
7.	End Fill/Empty	11:10:24		
			00:02:12	
8.	Gate Recessed	11:12:36		
			00:00:53	
9.	First Cut Begins Exit	11:13:29		
			00:06:00	Helper Boat
10.	First cut Stern Over Gate	11:19:29		
			00:00:11	
11.	Start Gate Closure	11:19:40		
			00:03:00	
12.	Gate Closed	11:22:40		
			00:04:39	
13.	End Fill/Empty	11:27:19		
			00:02:13	
14.	Gate Recessed	11:29:32		
			00:01:56	
15.	Second Cut Bow Over Gate	11:31:28		
			00:04:17	
16.	Second Cut Clear of Gate	11:35:45		
			00:00:21	
17.	Start Gate Closure	11:36:06		
			00:02:57	
18.	Gate Closed	11:39:03		
			00:05:15	
19.	End Fill/Empty	11:44:18		
			00:02:12	
20.	Gate Recessed	11:46:30		
			00:00:36	
21.	Second Cut Begins Exit	11:47:06		
			00:04:14	
22.	Tow Stern Over Sill	11:51:20		
			00:02:52	
23.	Cuts Bump together	11:54:12		

Lock:	Mel Price (26R)		Date: 03-08-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	5	Eddie Waxier
b.	Tow Type	Single	
c.	Number of Barges	4	2x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	12:03:34		
			00:02:48	
2.	Entry Complete	12:06:22		
			00:00:22	
3.	Start Gate Closure	12:06:44		
			00:02:58	
4.	Gate Closed	12:09:42		
			00:05:13	
5.	End Fill/Empty	12:14:55		
			00:02:10	
6.	Gate Recessed	12:17:05		
			00:00:29	
7.	Begin Exit	12:17:34		
			00:02:51	
8.	Tow Stern Over Sill	12:20:25		

Lock:	Mel Price (26R)		Date: 03-08-955
ITEM	DESCRIPTION		Notes:
a.	Observation Number	6	Herman Pott
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	CC
1.	Bow Over Sill	12:33:01		
			00:07:13	
2.	First Cut In	12:40:14		
			00:04:56	
3.	Second Cut Loose	12:45:10		
			00:01:06	
4.	Second Cut Clear of Gate	12:46:16		
			00:00:06	
5.	Start Gate Closure	12:46:22		
			00:02:58	
6.	Gate Closed	12:49:20		
			00:05:13	
7.	End Fill/Empty	12:54:33		
			00:02:12	
8.	Gate Recessed	12:56:45		
			00:00:49	
9.	First Cut Begins Exit	12:57:34		
			00:06:36	Helper Boat
10.	First cut Stern Over Gate	13:04:10		
			00:00:11	
11.	Start Gate Closure	13:04:21		
			00:03:01	
12.	Gate Closed	13:07:22		
			00:04:36	
13.	End Fill/Empty	13:11:58		
			00:02:14	
14.	Gate Recessed	13:14:12		
			00:02:13	
15.	Second Cut Bow Over Gate	13:16:25		
			00:03:43	
16.	Second Cut Clear of Gate	13:20:08		
			00:00:37	
17.	Start Gate Closure	13:20:45		
			00:02:58	
18.	Gate Closed	13:23:43		
			00:05:15	
19.	End Fill/Empty	13:28:58		
			00:02:12	
20.	Gate Recessed	13:31:10		
			00:00:33	
21.	Second Cut Begins Exit	13:31:43		
			00:03:52	
22.	Tow Stern Over Sill	13:35:35		
			00:02:46	
23.	Cuts Bump together	13:38:21		

Lock:	Mel Price (26R)		Date: 03-08-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	7	Clolinger
b.	Tow Type	Single	
c.	Number of Barges	1	
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	13:46:46		
			00:00:48	
2.	Entry Complete	13:47:34		
			23:59:57	
3.	Start Gate Closure	13:47:30		
			00:02:58	
4.	Gate Closed	13:50:28		
			00:05:10	
5.	End Fill/Empty	13:55:38		
			00:02:13	
6.	Gate Recessed	13:57:51		
			00:00:27	
7.	Begin Exit	13:58:18		
			00:01:51	
8.	Tow Stern Over Sill	14:00:09		

Lock	Mel Price (26R)		Date:	03-08-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	8	Sarah Elizabeth	
b.	Tow Type	Double		
c.	Number of Barges	15	3x3, 3x2	
d.	Type of Entry	Turnback		
e.	Upbound/Downbound	Downbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	14:11:27		
			00:05:17	
2.	First Cut In	14:16:44		
			00:04:06	
3.	Second Cut Loose	14:20:50		
			00:01:34	
4.	Second Cut Clear of Gate	14:22:24		
			00:00:12	
5.	Start Gate Closure	14:22:36		
			00:02:58	
6.	Gate Closed	14:25:34		
			00:05:10	
7.	End Fill/Empty	14:30:44		
			00:02:11	
8.	Gate Recessed	14:32:55		
			00:00:44	
9.	First Cut Begins Exit	14:33:39		
			00:05:13	Helper Boat
10.	First cut Stern Over Gate	14:38:52		
			00:00:09	
11.	Start Gate Closure	14:39:01		
			00:03:01	
12.	Gate Closed	14:42:02		
			00:04:36	
13.	End Fill/Empty	14:46:38		
			00:02:14	
14.	Gate Recessed	14:48:52		
			00:01:44	
15.	Second Cut Bow Over Gate	14:50:36		
			00:03:46	
16.	Second Cut Clear of Gate	14:54:22		
			00:00:08	
17.	Start Gate Closure	14:54:30		
			00:02:58	
18.	Gate Closed	14:57:28		
			00:05:10	
19.	End Fill/Empty	15:02:38		
			00:02:13	
20.	Gate Recessed	15:04:51		
			00:00:32	
21.	Second Cut Begins Exit	15:05:23		
			00:05:05	
22.	Tow Stern Over Sill	15:10:28		
			00:03:05	
23.	Cuts Bump together	15:13:33		

Lock:	Mel Price (26R)		Date:	03-09-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	1		Floyd H. Blaske
b.	Tow Type	Double		
c.	Number of Barges	15		3x3, 3x2
d.	Type of Entry	Turnback		
e.	Upbound/Downbound	Downbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	06:37:00		
2.	First Cut In			Not Observed
3.	Second Cut Loose			Not Observed
4.	Second Cut Clear of Gate			Not Observed
5.	Start Gate Closure			Not Observed
6.	Gate Closed	06:53:44		
			00:05:15	
7.	End Fill/Empty	06:58:59		
			00:02:05	
8.	Gate Recessed	07:01:04		
			00:00:34	
9.	First Cut Begins Exit	07:01:38		
			00:07:42	Helper Boat
10.	First cut Stern Over Gate	07:09:20		
			00:00:02	
11.	Start Gate Closure	07:09:22		
			00:03:02	
12.	Gate Closed	07:12:24		
			00:04:49	
13.	End Fill/Empty	07:17:13		
			00:02:12	
14.	Gate Recessed	07:19:25		
			00:02:01	
15.	Second Cut Bow Over Gate	07:21:26		
			00:04:02	
16.	Second Cut Clear of Gate	07:25:28		
			00:00:36	
17.	Start Gate Closure	07:26:04		
			00:02:58	
18.	Gate Closed	07:29:02		
			00:05:14	
19.	End Fill/Empty	07:34:16		
			00:02:11	
20.	Gate Recessed	07:36:27		
			00:00:27	
21.	Second Cut Begins Exit	07:36:54		
			00:04:42	
22.	Tow Stern Over Sill	07:41:36		
			00:03:46	
23.	Cuts Bump together	07:45:22		

Lock:	Mel Price (26R)		Date:	03-09-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	2		William C. Norman
b.	Tow Type	Double		
c.	Number of Barges	12		3x2, 3x2
d.	Type of Entry	Turnback		
e.	Upbound/Downbound	Downbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	07:54:42		
			00:06:33	
2.	First Cut In	08:01:15		
			00:02:39	
3.	Second Cut Loose	08:03:54		
			00:01:51	
4.	Second Cut Clear of Gate	08:05:45		
			00:00:13	
5.	Start Gate Closure	08:05:58		
			00:02:59	
6.	Gate Closed	08:08:57		
			00:05:14	
7.	End Fill/Empty	08:14:11		
			00:02:17	
8.	Gate Recessed	08:16:28		
			00:00:21	
9.	First Cut Begins Exit	08:16:49		
			00:06:26	Helper Boat
10.	First cut Stern Over Gate	08:23:15		
			00:00:01	
11.	Start Gate Closure	08:23:16		
			00:03:02	
12.	Gate Closed	08:26:18		
			00:04:51	
13.	End Fill/Empty	08:31:09		
			00:02:13	
14.	Gate Recessed	08:33:22		
			00:02:40	
15.	Second Cut Bow Over Gate	08:36:02		
			00:04:19	
16.	Second Cut Clear of Gate	08:40:21		
			00:00:11	
17.	Start Gate Closure	08:40:32		
			00:02:58	
18.	Gate Closed	08:43:30		
			00:05:15	
19.	End Fill/Empty	08:48:45		
			00:02:12	
20.	Gate Recessed	08:50:57		
			00:00:35	
21.	Second Cut Begins Exit	08:51:32		
			00:06:18	
22.	Tow Stern Over Sill	08:57:50		
			00:04:35	
23.	Cuts Bump together	09:02:25		

Lock:	Mel Price (26R)		Date: 03-09-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Davy Crockett
b.	Tow Type	Single	
c.	Number of Barges	2	1+1
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:11:27		
			00:02:58	
2.	Entry Complete	09:14:25		
			00:00:24	
3.	Start Gate Closure	09:14:49		
			00:02:59	
4.	Gate Closed	09:17:48		
			00:05:13	
5.	End Fill/Empty	09:23:01		
			00:02:12	
6.	Gate Recessed	09:25:13		
			00:00:26	
7.	Begin Exit	09:25:39		
			00:01:52	
8.	Tow Stern Over Sill	09:27:31		

Lock:	Mel Price (26R)		Date: 03-09-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	4	Daniel Webster
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:59:20		
			00:07:54	
2.	First Cut In	10:07:14		
			00:05:22	
3.	Second Cut Loose	10:12:36		
			00:02:04	
4.	Second Cut Clear of Gate	10:14:40		
			00:00:11	
5.	Start Gate Closure	10:14:51		
			00:03:01	
6.	Gate Closed	10:17:52		
			00:04:49	
7.	End Fill/Empty	10:22:41		
			00:02:14	
8.	Gate Recessed	10:24:55		
			00:00:21	
9.	First Cut Begins Exit	10:25:16		
			00:04:35	Helper Boat
10.	First cut Stern Over Gate	10:29:51		
			00:00:11	
11.	Start Gate Closure	10:30:02		
			00:02:58	
12.	Gate Closed	10:33:00		
			00:05:16	
13.	End Fill/Empty	10:38:16		
			00:02:11	
14.	Gate Recessed	10:40:27		
			00:02:04	
15.	Second Cut Bow Over Gate	10:42:31		
			00:05:45	
16.	Second Cut Clear of Gate	10:48:16		
			00:00:07	
17.	Start Gate Closure	10:48:23		
			00:03:00	
18.	Gate Closed	10:51:23		
			00:04:49	
19.	End Fill/Empty	10:56:12		
			00:02:13	
20.	Gate Recessed	10:58:25		
			00:00:23	
21.	Second Cut Begins Exit	10:58:48		
			00:03:51	
22.	Cuts Bump together	11:02:39		
			00:12:28	
23.	Tow Starts Exit	11:15:07		
			00:02:29	

Lock:	Mel Price (26R)		Date: 03-09-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	5	Charlotte
b.	Tow Type	Single	
c.	Number of Barges	2	2x1
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	11:32:22		
			00:01:42	
2.	Entry Complete	11:34:04		
			00:00:21	
3.	Start Gate Closure	11:34:25		
			00:02:59	
4.	Gate Closed	11:37:24		
			00:05:18	
5.	End Fill/Empty	11:42:42		
			00:02:11	
6.	Gate Recessed	11:44:53		
			00:00:37	
7.	Begin Exit	11:45:30		
			00:03:03	
8.	Tow Stern Over Sill	11:48:33		

Lock:	Mel Price (26R)		Date: 03-09-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	6	Cooperative Vanguard
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	15:16:45		
			00:06:31	
2.	First Cut In	15:23:16		
			00:01:58	
3.	Second Cut Loose	15:25:14		
			00:01:21	
4.	Second Cut Clear of Gate	15:26:35		
			00:00:12	
5.	Start Gate Closure	15:26:47		
			00:02:56	
6.	Gate Closed	15:29:43		
			00:05:18	
7.	End Fill/Empty	15:35:01		
			00:02:11	
8.	Gate Recessed	15:37:12		
			00:00:39	
9.	First Cut Begins Exit	15:37:51		
			00:07:45	Helper Boat
10.	First cut Stern Over Gate	15:45:36		
			00:00:19	
11.	Start Gate Closure	15:45:55		
			00:03:01	
12.	Gate Closed	15:48:56		
			00:04:45	
13.	End Fill/Empty	15:53:41		
			00:02:14	
14.	Gate Recessed	15:55:55		
			00:02:23	
15.	Second Cut Bow Over Gate	15:58:18		
			00:05:07	
16.	Second Cut Clear of Gate	16:03:25		
			00:00:22	
17.	Start Gate Closure	16:03:47		
			00:03:00	
18.	Gate Closed	16:06:47		
			00:05:13	
19.	End Fill/Empty	16:12:00		
			00:02:12	
20.	Gate Recessed	16:14:12		
			00:00:47	
21.	Second Cut Begins Exit	16:14:59		
			00:04:12	
22.	Cuts Bump together	16:19:11		
			00:14:53	
23.	Tow Starts Exit	16:34:04		
			00:04:30	

Lock:	Mel Price (26R)		Date:	03-10-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	1		Conti-Arlie
b.	Tow Type	Double		
c.	Number of Barges	16		3x3, 3x2+1
d.	Type of Entry	Turnback		
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	06:50:22		
			00:11:40	
2.	First Cut In	07:02:02		
			00:02:22	
3.	Second Cut Loose	07:04:24		
			00:01:50	
4.	Second Cut Clear of Gate	07:06:14		
			00:00:11	
5.	Start Gate Closure	07:06:25		
			00:03:01	
6.	Gate Closed	07:09:26		
			00:04:48	
7.	End Fill/Empty	07:14:14		
			00:02:14	
8.	Gate Recessed	07:16:28		
			00:00:13	
9.	First Cut Begins Exit	07:16:41		
			00:06:55	Helper Boat
10.	First cut Stern Over Gate	07:23:36		
			00:00:19	
11.	Start Gate Closure	07:23:55		
			00:02:59	
12.	Gate Closed	07:26:54		
			00:05:15	
13.	End Fill/Empty	07:32:09		
			00:02:12	
14.	Gate Recessed	07:34:21		
			00:01:21	
15.	Second Cut Bow Over Gate	07:35:42		
			00:04:56	
16.	Second Cut Clear of Gate	07:40:38		
			00:00:17	
17.	Start Gate Closure	07:40:55		
			00:02:59	
18.	Gate Closed	07:43:54		
			00:04:44	
19.	End Fill/Empty	07:48:38		
			00:02:15	
20.	Gate Recessed	07:50:53		
			00:00:11	
21.	Second Cut Begins Exit	07:51:04		
			00:05:42	
22.	Tow Stern Over Sill	07:56:46		
			00:04:45	
23.	Cuts Bump together	08:01:31		

Lock:	Mel Price (26R)		Date: 03-10-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	2	Marvin E. Norman
b.	Tow Type	Double	
c.	Number of Barges	10	2x3, 2x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	08:10:46		
			00:10:56	
2.	First Cut In	08:21:42		
			00:02:59	
3.	Second Cut Loose	08:24:41		
			00:01:47	
4.	Second Cut Clear of Gate	08:26:28		
			00:00:13	
5.	Start Gate Closure	08:26:41		
			00:03:00	
6.	Gate Closed	08:29:41		
			00:04:43	
7.	End Fill/Empty	08:34:24		
			00:02:15	
8.	Gate Recessed	08:36:39		
			00:00:55	
9.	First Cut Begins Exit	08:37:34		
			00:05:21	Helper Boat
10.	First cut Stern Over Gate	08:42:55		
			00:00:25	
11.	Start Gate Closure	08:43:20		
			00:02:59	
12.	Gate Closed	08:46:19		
			00:05:15	
13.	End Fill/Empty	08:51:34		
			00:02:11	
14.	Gate Recessed	08:53:45		
			00:01:25	
15.	Second Cut Bow Over Gate	08:55:10		
			00:06:39	
16.	Second Cut Clear of Gate	09:01:49		
			00:00:08	
17.	Start Gate Closure	09:01:57		
			00:03:00	
18.	Gate Closed	09:04:57		
			00:04:44	
19.	End Fill/Empty	09:09:41		
			00:02:13	
20.	Gate Recessed	09:11:54		
			00:00:39	
21.	Second Cut Begins Exit	09:12:33		
			00:05:13	
22.	Tow Stern Over Sill	09:17:46		
			00:04:39	
23.	Cuts Bump together	09:22:25		

Lock:	Mel Price (26R)		Date: 03-10-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	Robert Y. Love
b.	Tow Type	Single	
c.	Number of Barges	2	1+1
d.	Type of Entry	Turnback	Knockout (Tow only)
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:29:42		
			00:13:42	
2.	Entry Complete	09:43:24		
			00:00:06	
3.	Start Gate Closure	09:43:30		
			00:02:59	
4.	Gate Closed	09:46:29		
			00:04:46	
5.	End Fill/Empty	09:51:15		
			00:02:13	
6.	Gate Recessed	09:53:28		
			00:00:14	
7.	Begin Exit	09:53:42		
			00:07:01	
8.	Tow Stern Over Sill	10:00:43		

Lock:	Mel Price (26R)		Date: 03-10-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	4	Herman Pott
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	10:13:33		
			00:09:37	
2.	First Cut In	10:23:10		
			00:05:57	
3.	Second Cut Loose	10:29:07		
			00:01:56	
4.	Second Cut Clear of Gate	10:31:03		
			00:00:12	
5.	Start Gate Closure	10:31:15		
			00:03:00	
6.	Gate Closed	10:34:15		
			00:04:39	
7.	End Fill/Empty	10:38:54		
			00:02:14	
8.	Gate Recessed	10:41:08		
			00:00:14	
9.	First Cut Begins Exit	10:41:22		
			00:07:22	Helper Boat
10.	First cut Stern Over Gate	10:48:44		
			00:00:17	
11.	Start Gate Closure	10:49:01		
			00:02:58	
12.	Gate Closed	10:51:59		
			00:05:10	
13.	End Fill/Empty	10:57:09		
			00:02:11	
14.	Gate Recessed	10:59:20		
			00:01:59	
15.	Second Cut Bow Over Gate	11:01:19		
			00:04:37	
16.	Second Cut Clear of Gate	11:05:56		
			00:01:28	
17.	Start Gate Closure	11:07:24		
			00:03:00	
18.	Gate Closed	11:10:24		
			00:04:40	
19.	End Fill/Empty	11:15:04		
			00:02:14	
20.	Gate Recessed	11:17:18		
			00:00:23	
21	Second Cut Begins Exit	11:17:41		
			00:04:39	
22.	Tow Stern Over Sill	11:22:20		
			00:01:59	
23.	Cuts Bump together	11:24:19		

Lock:	Mel Price (26R)		Date: 03-10-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	5	(Clyde Butcher
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	11:36:20		
			00:11:21	
2.	First Cut In	11:47:41		
			00:03:26	
3.	Second Cut Loose	11:51:07		
			00:01:54	
4.	Second Cut Clear of Gate	11:53:01		
			00:00:11	
5.	Start Gate Closure	11:53:12		
			00:02:59	
6.	Gate Closed	11:56:11		
			00:04:43	
7.	End Fill/Empty	12:00:54		
			00:02:14	
8.	Gate Recessed	12:03:08		
			00:00:21	
9.	First Cut Begins Exit	12:03:29		
			00:06:43	Helper Boat
10.	First cut Stern Over Gate	12:10:12		
			00:00:14	
11.	Start Gate Closure	12:10:26		
			00:02:59	
12.	Gate Closed	12:13:25		
			00:05:15	
13.	End Fill/Empty	12:18:40		
			00:02:10	
14.	Gate Recessed	12:20:50		
			00:01:41	
15.	Second Cut Bow Over Gate	12:22:31		
			00:04:07	
16.	Second Cut Clear of Gate	12:26:38		
			00:00:00	
17.	Start Gate Closure	12:26:38		
			00:02:59	
18.	Gate Closed	12:29:37		
			00:04:41	
19.	End Fill/Empty	12:34:18		
			00:02:15	
20.	Gate Recessed	12:36:33		
			00:00:30	
21.	Second Cut Begins Exit	12:37:03		
			00:04:12	
22.	Tow Stern Over Sill	12:41:15		
			00:02:18	
23.	Cuts Bump together	12:43:33		

Lock:	Mel Price (26R)		Date:	03-10-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	6		Frank Stegbauer
b.	Tow Type	Single		
c.	Number of Barges	3		Chemical
d.	Type of Entry	Turnback		Set Over
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	12:53:07		
			00:14:28	First 2 barges in at 12:58:32
2.	Entry Complete	13:07:35		
			00:00:16	
3.	Start Gate Closure	13:07:51		
			00:02:58	
4.	Gate Closed	13:10:49		
			00:04:39	
5.	End Fill/Empty	13:15:28		
			00:02:15	
6.	Gate Recessed	13:17:43		
			00:00:45	
7.	Begin Exit	13:18:28		
			00:05:41	
8.	Tow Stern Over Sill	13:24:09		

Lock:	Mel Price (26R)		Date:	03-10-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	7	Ardyce Randall	
b.	Tow Type	Double		
c.	Number of Barges	16	3x3, 3x2+1	
d.	Type of Entry	Turnback		
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	13:36:17		
			00:06:51	
2.	First Cut In	13:43:08		
			00:03:30	
3.	Second Cut Loose	13:46:38		
			00:01:24	
4.	Second Cut Clear of Gate	13:48:02		
			00:00:10	
5.	Start Gate Closure	13:48:12		
			00:02:58	
6.	Gate Closed	13:51:10		
			00:04:38	
7.	End Fill/Empty	13:55:48		
			00:02:11	
8.	Gate Recessed	13:57:59		
			00:00:35	
9.	First Cut Begins Exit	13:58:34		
			00:03:46	Helper Boat
10.	First cut Stern Over Gate	14:02:20		
			00:00:12	
11.	Start Gate Closure	14:02:32		
			00:02:58	
12.	Gate Closed	14:05:30		
			00:05:16	
13.	End Fill/Empty	14:10:46		
			00:02:09	
14.	Gate Recessed	14:12:55		
			00:01:02	
15.	Second Cut Bow Over Gate	14:13:57		
			00:05:08	
16.	Second Cut Clear of Gate	14:19:05		
			00:00:27	
17.	Start Gate Closure	14:19:32		
			00:03:00	
18.	Gate Closed	14:22:32		
			00:04:43	
19.	End Fill/Empty	14:27:15		
			00:02:14	
20.	Gate Recessed	14:29:29		
			00:00:22	
21.	Second Cut Begins Exit	14:29:51		
			00:03:31	
22.	Tow Stern Over Sill	14:33:22		
			00:02:44	
23.	Cuts Bump together	14:36:06		

Lock:	Mel Price (26R)		Date: 03-10-95	
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	8	Eddie Waxler	
b.	Tow Type	Single		
c.	Number of Barges	3		
d.	Type of Entry	Turnback	Setover	
e.	Upbound/Downbound	Upbound		
NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	14:46:08		
			00:08:15	
2.	Entry Complete	14:54:23		
			00:00:08	
3.	Start Gate Closure	14:54:31		
			00:02:58	
4.	Gate Closed	14:57:29		
			00:05:14	
5.	End Fill/Empty	15:02:43		
			00:02:15	
6.	Gate Recessed	15:04:58		
			00:00:18	
7.	Begin Exit	15:05:16		
			00:05:26	
8.	Tow Stern Over Sill	15:10:42		

Lock: Mel Price (26R)			Date: 03-13-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	1	Rose-M
b.	Tow Type	Double	
c.	Number of Barges	9	3x3, Tow
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	06:46:42		
			00:09:15	
2.	First Cut In	06:55:57		
			00:02:19	
3.	Second Cut Loose	06:58:16		
			00:00:14	
4.	Second Cut Clear of Gate	06:58:30		
			00:00:01	
5.	Start Gate Closure	06:58:31		
			00:03:00	
6.	Gate Closed	07:01:31		
			00:05:21	
7.	End Fill/Empty	07:06:52		
			00:02:12	
8.	Gate Recessed	07:09:04		
			00:01:13	
9.	First Cut Begins Exit	07:10:17		
			00:06:53	Helper Boat
10.	First cut Stern Over Gate	07:17:10		
			00:00:01	
11.	Start Gate Closure	07:17:11		
			00:03:01	
12.	Gate Closed	07:20:12		
			00:05:01	
13.	End Fill/Empty	07:25:13		
			00:02:14	
14.	Gate Recessed	07:27:27		
			00:00:17	
15.	Second Cut Bow Over Gate	07:27:44		
			00:00:10	
16.	Second Cut Clear of Gate	07:27:54		
			00:00:17	
17.	Start Gate Closure	07:28:11		
			00:02:59	
18.	Gate Closed	07:31:10		
			00:05:18	
19.	End Fill/Empty	07:36:28		
			00:02:14	
20.	Gate Recessed	07:38:42		
			23:59:54	
21.	Second Cut Begins Exit	07:38:35		
			00:00:50	
22.	Tow Stern Over Sill	07:39:25		
			00:00:44	
23.	Cuts Bump together	07:40:09		

Lock:	Mel Price (26R)		Date: 03-13-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	2	Frank Stegbauer
b.	Tow Type	Single	
c.	Number of Barges	3	
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	07:52:57		
			00:06:45	
2.	Entry Complete	07:59:42		
			00:00:23	
3.	Start Gate Closure	08:00:05		
			00:02:59	
4.	Gate Closed	08:03:04		
			00:05:16	
5.	End Fill/Empty	08:08:20		
			00:02:14	
6.	Gate Recessed	08:10:34		
			00:00:27	
7.	Begin Exit	08:11:01		
			00:04:26	
8.	Tow Stern Over Sill	08:15:27		

Lock:	Mel Price (26R)		Date: 03-13-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	3	De LaSalle
b.	Tow Type	Double	
c.	Number of Barges	14	2+3+3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	08:32:03		
			00:07:25	
2.	First Cut In	08:39:28		
			00:03:23	
3.	Second Cut Loose	08:42:51		
			00:01:34	
4.	Second Cut Clear of Gate	08:44:25		
			00:00:06	
5.	Start Gate Closure	08:44:31		
			00:02:59	
6.	Gate Closed	08:47:30		
			00:05:23	
7.	End Fill/Empty	08:52:53		
			00:02:11	
8.	Gate Recessed	08:55:04		
			00:00:57	
9.	First Cut Begins Exit	08:56:01		
			00:06:10	Helper Boat
10.	First cut Stern Over Gate	09:02:11		
			00:00:02	
11.	Start Gate Closure	09:02:13		
			00:02:55	
12.	Gate Closed	09:05:08		
			00:05:04	
13.	End Fill/Empty	09:10:12		
			00:02:15	
14.	Gate Recessed	09:12:27		
			00:02:12	
15.	Second Cut Bow Over Gate	09:14:39		
			00:06:09	
16.	Second Cut Clear of Gate	09:20:48		
			00:00:24	
17.	Start Gate Closure	09:21:12		
			00:03:00	
18.	Gate Closed	09:24:12		
			00:05:20	
19.	End Fill/Empty	09:29:32		
			00:02:12	
20.	Gate Recessed	09:31:44		
			00:00:47	
21.	Second Cut Begins Exit	09:32:31		
			00:06:23	
22.	Tow Stern Over Sill	09:38:54		
			00:03:38	
23.	Cuts Bump together	09:42:32		

Lock:	Mel Price (26R)		Date: 03-13-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	4	Evey-T
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	09:53:26		
			00:11:36	
2.	First Cut In	10:05:02		
			00:03:24	
3.	Second Cut Loose	10:08:26		
			00:01:46	
4.	Second Cut Clear of Gate	10:10:12		
			00:00:10	
5.	Start Gate Closure	10:10:22		
			00:02:59	
6.	Gate Closed	10:13:21		
			00:05:23	
7.	End Fill/Empty	10:18:44		
			00:02:31	
8.	Gate Recessed	10:21:15		
			00:00:09	
9.	First Cut Begins Exit	10:21:24		
			00:08:11	Helper Boat
10.	First cut Stern Over Gate	10:29:35		
			00:00:02	
11.	Start Gate Closure	10:29:37		
			00:02:59	
12.	Gate Closed	10:32:36		
			00:05:01	
13.	End Fill/Empty	10:37:37		
			00:02:14	
14.	Gate Recessed	10:39:51		
			00:02:18	
15.	Second Cut Bow Over Gate	10:42:09		
			00:07:26	
16.	Second Cut Clear of Gate	10:49:35		
			00:00:22	
17.	Start Gate Closure	10:49:57		
			00:03:01	
18.	Gate Closed	10:52:58		
			00:05:18	
19.	End Fill/Empty	10:58:16		
			00:02:14	
20.	Gate Recessed	11:00:30		
			00:01:11	
21.	Second Cut Begins Exit	11:01:41		
			00:04:21	
22.	Cuts Bump together	11:06:02		
			00:12:32	
23.	Tow Starts Exit	11:18:34		
			00:04:55	

Lock:	Mel Price (26R)		Date:	03-13-95
ITEM	DESCRIPTION		Notes:	
a.	Observation Number	5		Brother Collins
b.	Tow Type	Double		
c.	Number of Barges	16		3x3, 3x2+1
d.	Type of Entry	Exchange		
e.	Upbound/Downbound	Upbound		

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	12:03:22		
			00:07:51	
2.	First Cut In	12:11:13		
			00:07:30	
3.	Second Cut Loose	12:18:43		
			00:01:56	
4.	Second Cut Clear of Gate	12:20:39		
			00:00:03	
5.	Start Gate Closure	12:20:42		
			00:03:00	
6.	Gate Closed	12:23:42		
			00:04:54	
7.	End Fill/Empty	12:28:36		
			00:02:15	
8.	Gate Recessed	12:30:51		
			00:00:35	
9.	First Cut Begins Exit	12:31:26		
			00:03:10	
10.	First cut Stern Over Gate	12:34:36		
			00:00:07	
11.	Start Gate Closure	12:34:43		
			00:02:59	
12.	Gate Closed	12:37:42		
			00:05:19	
13.	End Fill/Empty	12:43:01		
			00:02:13	
14.	Gate Recessed	12:45:14		
			00:01:39	
15.	Second Cut Bow Over Gate	12:46:53		
			00:06:13	
16.	Second Cut Clear of Gate	12:53:06		
			00:00:45	
17.	Start Gate Closure	12:53:51		
			00:02:58	
18.	Gate Closed	12:56:49		
			00:04:57	
19.	End Fill/Empty	13:01:46		
			00:02:13	
20.	Gate Recessed	13:03:59		
			00:00:15	
21.	Second Cut Begins Exit	13:04:14		
			00:04:34	
22.	Tow Stern OVer Sill	13:08:48		
			00:03:51	
23.	Cuts Bump together	13:12:39		

Lock:	Mel Price (26R)		Date: 03-13-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	6	Melody Golding
b.	Tow Type	Single	
c.	Number of Barges	4	2x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	13:24:12		
			00:07:58	
2.	Entry Complete	13:32:10		
			00:00:12	
3.	Start Gate Closure	13:32:22		
			00:02:59	
4.	Gate Closed	13:35:21		
			00:08:01	
5.	End Fill/Empty	13:43:22		
			00:02:14	
6.	Gate Recessed	13:45:36		
			00:00:10	
7.	Begin Exit	13:45:46		
			00:06:26	
8.	Tow Stern Over Sill	13:52:12		

Lock:	Mel Price (26R)		Date: 03-13-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	7	Daniel Webster
b.	Tow Type	Double	
c.	Number of Barges	14	2+3+3, 3+2+1
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	14:05:29		
			00:14:41	Came in at an angle, took more tim
2.	First Cut In	14:20:10		
			00:03:49	
3.	Second Cut Loose	14:23:59		
			00:02:57	
4.	Second Cut Clear of Gate	14:26:56		
			00:00:19	
5.	Start Gate Closure	14:27:15		
			00:02:53	
6.	Gate Closed	14:30:08		
			00:06:43	
7.	End Fill/Empty	14:36:51		
			00:02:15	
8.	Gate Recessed	14:39:06		
			00:01:35	
9.	First Cut Begins Exit	14:40:41		
			00:05:10	Helper Boat
10.	First cut Stern Over Gate	14:45:51		
			00:00:13	
11.	Start Gate Closure	14:46:04		
			00:02:59	
12.	Gate Closed	14:49:03		
			00:05:21	
13.	End Fill/Empty	14:54:24		
			00:02:10	
14.	Gate Recessed	14:56:34		
			00:01:52	
15.	Second Cut Bow Over Gate	14:58:26		
			00:06:53	
16.	Second Cut Clear of Gate	15:05:19		
			00:00:36	
17.	Start Gate Closure	15:05:55		
			00:02:59	
18.	Gate Closed	15:08:54		
			00:06:02	
19.	End Fill/Empty	15:14:56		
			00:02:14	
20.	Gate Recessed	15:17:10		
			00:00:11	
21.	Second Cut Begins Exit	15:17:21		
			00:05:19	
22.	Tow Stern Over Sill	15:22:40		
			00:02:38	
23.	Cuts Bump together	15:25:18		

Lock:	Mel Price (26R)		Date: 03-14-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	1	Gordon Jones
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Fly	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	08:54:41		
			00:08:36	
2.	First Cut In	09:03:17		
			00:01:27	
3.	Second Cut Loose	09:04:44		
			00:01:43	
4.	Second Cut Clear of Gate	09:06:27		
			00:00:03	
5.	Start Gate Closure	09:06:30		
			00:02:59	
6.	Gate Closed	09:09:29		
			00:05:12	
7.	End Fill/Empty	09:14:41		
			00:03:03	
8.	Gate Recessed	09:17:44		
			00:00:21	
9.	First Cut Begins Exit	09:18:05		
			00:07:17	Helper Boat
10.	First cut Stern Over Gate	09:25:22		
			00:00:10	
11.	Start Gate Closure	09:25:32		
			00:03:00	
12.	Gate Closed	09:28:32		
			00:04:59	
13.	End Fill/Empty	09:33:31		
			00:02:15	
14.	Gate Recessed	09:35:46		
			00:02:22	
15.	Second Cut Bow Over Gate	09:38:08		
			00:03:59	
16.	Second Cut Clear of Gate	09:42:07		
			00:00:18	
17.	Start Gate Closure	09:42:25		
			00:02:59	
18.	Gate Closed	09:45:24		
			00:05:10	
19.	End Fill/Empty	09:50:34		
			00:02:12	
20.	Gate Recessed	09:52:46		
			00:00:47	
21.	Second Cut Begins Exit	09:53:33		
			00:06:49	
22.	Cuts Bump together	10:00:22		
			00:04:12	
23.	Tow Starts Exit	10:04:34		

Lock:	Mel Price (26R)		Date: 03-14-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	2	R.W. Naye
b.	Tow Type	Single	
c.	Number of Barges	7	3x2+1
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	10:13:27		
			00:06:57	
2.	Entry Complete	10:20:24		
			00:00:20	
3.	Start Gate Closure	10:20:44		
			00:02:59	
4.	Gate Closed	10:23:43		
			00:05:16	
5.	End Fill/Empty	10:28:59		
			00:02:13	
6.	Gate Recessed	10:31:12		
			00:00:42	
7.	Begin Exit	10:31:54		
			00:04:08	
8.	Tow Stern Over Sill	10:36:02		

Lock	Mel Price (26R)		Date: 03-14-95
ITEM	DESCRIPTION		Notes ""
a.	Observation Number	3	Ruth D. Jones
b.	Tow Type	Double	
c.	Number of Barges	15	3x3. 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	10:48:45		
			00:05:23	
2.	First Cut In	10:54:08		
			00:04:01	
3.	Second Cut Loose	10:58:09		
			00:01:17	
4.	Second Cut Clear of Gate	10:59:26		
			00:00:05	
5.	Start Gate Closure	10:59:31		
			00:02:59	
6.	Gate Closed	11:02:30		
			00:05:14	
7.	End Fill/Empty	11:07:44		
			00:02:37	
8.	Gate Recessed	11:10:21		
			00:00:21	
9.	First Cut Begins Exit	11:10:42		
			00:07:28	Helper Boat
10.	First cut Stern Over Gate	11:18:10		
			00:00:01	
11.	Start Gate Closure	11:18:11		
			00:03:00	
12.	Gate Closed	11:21:11		
			00:04:59	
13.	End Fill/Empty	11:26:10		
			00:02:15	
14.	Gate Recessed	11:28:25		
			00:02:16	
15.	Second Cut Bow Over Gate	11:30:41		
			00:03:05	
16.	Second Cut Clear of Gate	11:33:46		
			00:00:02	
17.	Start Gate Closure	11:33:48		
			00:03:00	
18.	Gate Closed	11:36:48		
			00:05:16	
19.	End Fill/Empty	11:42:04		
			00:02:12	
20.	Gate Recessed	11:44:16		
			00:00:22	
21.	Second Cut Begins Exit	11:44:38		
			00:04:11	
22.	Tow Stern Over Sill	11:48:49		
			00:02:50	
23.	Cuts Bump together	11:51:39		

Lock:	Mel Price (26R)		Date: 03-14-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	4	Ginny Stone
b.	Tow Type	Single	
c.	Number of Barges	6	3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	12:01:07		
			00:07:18	
2.	Entry Complete	12:08:25		
			00:00:27	
3.	Start Gate Closure	12:08:52		
			00:03:00	
4.	Gate Closed	12:11:52		
			00:05:11	
5.	End Fill/Empty	12:17:03		
			00:02:13	
6.	Gate Recessed	12:19:16		
			00:00:41	
7.	Begin Exit	12:19:57		
			00:04:07	
8.	Tow Stern Over Sill	12:24:04		

Lock:	Mel Price (26R)		Date: 03-14-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	5	Grand Tower (COE)
b.	Tow Type	Single	
c.	Number of Barges	1	Crane Barge
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Upbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	I BOW Over Sill	12:26:40		
			00:00:43	
2.	Entry Complete	12:27:23		
			00:00:21	
3.	Start Gate Closure	12:27:44		
			00:03:01	
4.	Gate Closed	12:30:45		
			00:04:59	
5.	End Fill/Empty	12:35:44		
			00:02:15	
6.	Gate Recessed	12:37:59		
			00:00:00	
7.	Begin Exit	12:37:59		
			00:00:12	
8.	Tow Stern Over Sill	12:38:11		

Lock:	Mel Price (26R)		Date: 03-14-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	6	American Beauty
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Exchange	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	12:45:09		
			00:06:07	
2.	First Cut In	12:51:16		
			00:02:59	
3.	Second Cut Loose	12:54:15		
			00:01:53	
4.	Second Cut Clear of Gate	12:56:08		
			00:00:04	
5.	Start Gate Closure	12:56:12		
			00:02:58	
6.	Gate Closed	12:59:10		
			00:05:16	
7.	End Fill/Empty	13:04:26		
			00:02:10	
8.	Gate Recessed	13:06:36		
			00:00:26	
9.	First Cut Begins Exit	13:07:02		
			00:07:35	Helper Boat
10.	First cut Stern Over Gate	13:14:37		
			00:00:01	
11.	Start Gate Closure	13:14:38		
			00:02:58	
12.	Gate Closed	13:17:36		
			00:04:53	
13.	End Fill/Empty	13:22:29		
			00:02:15	
14.	Gate Recessed	13:24:44		
			00:02:17	
15.	Second Cut Bow Over Gate	13:27:01		
			00:05:43	
16.	Second Cut Clear of Gate	13:32:44		
			00:00:11	
17.	Start Gate Closure	13:32:55		
			00:02:59	
18.	Gate Closed	13:35:54		
			00:05:09	
19.	End Fill/Empty	13:41:03		
			00:02:13	
20.	Gate Recessed	13:43:16		
			00:00:35	
21.	Second Cut Begins Exit	13:43:51		
			00:05:40	
22.	Tow Stern Over Sill	13:49:31		
			00:03:02	
23.	Cuts Bump together	13:52:33		

Lock:	Mel Price (26R)		Date: 03-14-95
ITEM	DESCRIPTION		Notes:
a.	Observation Number	7	Joyce Hale
b.	Tow Type	Double	
c.	Number of Barges	15	3x3, 3x2
d.	Type of Entry	Turnback	
e.	Upbound/Downbound	Downbound	

NO.	EVENT	CLOCK	ELAPSED	COMMENTS
1.	Bow Over Sill	14:02:38		
			00:05:01	
2.	First Cut In	14:07:39		
			00:04:02	
3.	Second Cut Loose	14:11:41		
			00:01:19	
4.	Second Cut Clear of Gate	14:13:00		
			00:00:11	
5.	Start Gate Closure	14:13:11		
			00:03:00	
6.	Gate Closed	14:16:11		
			00:07:20	
7.	End Fill/Empty	14:23:31		
			00:02:13	
8.	Gate Recessed	14:25:44		
			00:00:34	
9.	First Cut Begins Exit	14:26:18		
			00:07:04	Helper Boat
10.	First cut Stern Over Gate	14:33:22		
			00:00:09	
11.	Start Gate Closure	14:33:31		
			00:02:58	
12.	Gate Closed	14:36:29		
			00:06:53	
13.	End Fill/Empty	14:43:22		
			00:02:14	
14.	Gate Recessed	14:45:36		
			00:02:12	
15.	Second Cut Bow Over Gate	14:47:48		
			00:04:17	
16.	Second Cut Clear of Gate	14:52:05		
			00:00:09	
17.	Start Gate Closure	14:52:14		
			00:03:26	
18.	Gate Closed	14:55:40		
			00:05:14	
19.	End Fill/Empty	15:00:54		
			00:02:14	
20.	Gate Recessed	15:03:08		
			00:00:36	
21.	Second Cut Begins Exit	15:03:44		
			00:06:10	
22.	Tow Stern Over Sill	15:09:54		
			00:03:18	
23.	Cuts Bump together	15:13:12		

Short Form

1.	Approach	Bow Over Sill - Entry Complete
2.	Gate (Close)	Entry Complete - Gate Closed
3.	Empty	Gate Closed - End Fill/Empty
4.	Gate (Open)	End Fill/Empty - Gate Recessed
5.	Exit	Gate Recessed - Tow Stern Over Sill

Long Form

1.	Entry	Bow Over Sill - Second Cut Clear of Gate
2.	Gate (Close)	Second Cut Clear of Gate - Gate Closed
3.	Empty	Gate Closed - End Fill/Empty
4.	Gate (Open)	End Fill/Empty - Gate Recessed
5.	First Cut (Remove)	Gate Recessed - First Cut Stern Over Gate
6.	Gate (Close)	First Cut Stern Over Gate - Gate Closed
7.	Fill	Gate Closed - End Fill/Empty
8.	Gate (Open)	End Fill/Empty - Gate Recessed
9.	Second Cut (Enter)	Gate Recessed - Second Cut Clear of Gate
10.	Gate (Close)	Second Cut Clear of Gate - Gate Closed
11.	Empty	Gate Closed - End Fill/Empty
12.	Gate (Open)	End Fill/Empty - Gate Recessed
13.	Exit	Gate Recessed - Tow Stern Over Sill

			Bow Over Sill		Entry Complete		Total
1	02-27-95	#1	08:09:37		08:11:48		00:02:11
2		#2	09:22:34		09:25:34		00:03:00
3	02-28-95	#4	13:54:15		13:59:31		00:05:16
4	03-01-95	#1	08:52:20		09:05:15		00:12:55
5	03-02-95	#1	06:52:24		06:53:35		00:01:11
6		#4	11:13:04		11:13:32		00:00:28
7		#6	13:20:03		13:22:06		00:02:03
8	03-03-95	#2	08:24:32		08:33:11		00:08:39
9		#3	09:04:04		09:08:56		00:04:52
10		#4	09:38:58		09:40:29		00:01:31
11		#6	12:01:55		12:15:33		00:13:38
12	03-08-95	#1	07:42:01		07:44:41		00:02:40
13		#5	12:03:34		12:06:22		00:02:48
14		#7	13:46:46		13:47:34		00:00:48
15	03-09-95	#3	09:11:27		09:14:25		00:02:58
16		#5	11:32:22		11:34:04		00:01:42
17	03-10-95	#3	09:29:42		09:43:24		00:13:42
18		#6	12:53:07		13:07:35		00:14:28
19		#8	14:46:08		14:54:23		00:08:15
20	03-13-95	#2	07:52:57		07:59:42		00:06:45
21		#6	13:24:12		13:32:10		00:07:58
22	03-14-95	#2	10:13:27		10:20:24		00:06:57
23		#4	12:07:07		12:08:25		00:01:18
24		#5	12:26:40		12:27:23		00:00:43
Totals			18:23:16		20:30:02		02:06:46

Average **00:05:17**

			Entry Complete		Gate Closed		Total
1	02-27-95	#1	08:11:48		08:15:02		00:03:14
2		#2	09:25:34		09:28:42		00:03:08
3	02-28-95	#4	13:59:31		14:02:39		00:03:08
4	03-01-95	#1	09:05:15		09:08:33		00:03:18
5	03-02-95	#1	06:53:35		06:56:52		00:03:17
6		#4	11:13:32		11:17:04		00:03:32
7		#6	13:22:06		13:25:42		00:03:36
8	03-03-95	#2	08:33:11		08:36:30		00:03:19
9		#3	09:08:56		09:12:08		00:03:12
10		#4	09:40:29		09:43:42		00:03:13
11		#6	12:15:33		12:18:44		00:03:11
12	03-08-95	#1	07:44:41		07:47:44		00:03:03
13		#5	12:06:22		12:09:42		00:03:20
14		#7	13:47:34		13:50:28		00:02:54
15	03-09-95	#3	09:14:25		09:17:48		00:03:23
16		#5	11:34:04		11:37:24		00:03:20
17	03-10-95	#3	09:43:24		09:46:29		00:03:05
18		#6	13:07:35		13:10:49		00:03:14
19		#8	14:54:23		14:57:29		00:03:06
20	03-13-95	#2	07:59:42		08:03:04		00:03:22
21		#6	13:32:10		13:35:21		00:03:11
22	03-14-95	#2	10:20:24		10:23:43		00:03:19
23		#4	12:08:25		12:11:52		00:03:27
24		#5	12:27:23		12:30:45		00:03:22
Totals			20:30:02		21:48:16		01:18:14

Average **00:03:16**

			Gate Closed	End Fill/Empty	Total
1	02-27-95	#1	08:15:02	08:20:15	00:05:13
2		#2	09:28:42	09:34:12	00:05:30
3	02-28-95	#4	14:02:39	14:08:10	00:05:31
4	03-01-95	#1	09:08:33	09:14:12	00:05:39
5	03-02-95	#1	06:56:52	07:02:14	00:05:22
6		#4	11:17:04	11:21:50	00:04:46
7		#6	13:25:42	13:33:36	00:07:54
8	03-03-95	#2	08:36:30	08:41:11	00:04:41
9		#3	09:12:08	09:16:56	00:04:48
10		#4	09:43:42	09:49:08	00:05:26
11		#6	12:18:44	12:24:24	00:05:40
12	03-08-95	#1	07:47:44	07:52:55	00:05:11
13		#5	12:09:42	12:14:55	00:05:13
14		#7	13:50:28	13:55:38	00:05:10
15	03-09-95	#3	09:17:48	09:23:01	00:05:13
16		#5	11:37:24	11:42:42	00:05:18
17	03-10-95	#3	09:46:29	09:51:15	00:04:46
18		#6	13:10:49	13:15:28	00:04:39
19		#8	14:57:29	15:02:43	00:05:14
20	03-13-95	#2	08:03:04	08:08:20	00:05:16
21		#6	13:35:21	13:43:22	00:08:01
22	03-14-95	#2	10:23:43	10:28:59	00:05:16
23		#4	12:11:52	12:17:03	00:05:11
24		#5	12:30:45	12:35:44	00:04:59
Totals			21:48:16	23:58:13	02:09:57

Average **00:05:25**

			End Fill/Empty		Gate Recessed		Total
1	02-27-95	#1	08:20:15		08:22:18		00:02:03
2		#2	09:34:12		09:36:10		00:01:58
3	02-28-95	#4	14:08:10		14:10:20		00:02:10
4	03-01-95	#1	09:14:12		09:16:25		00:02:13
5	03-02-95	#1	07:02:14		07:04:24		00:02:10
6		#4	11:21:50		11:23:59		00:02:09
7		#6	13:33:36		13:36:31		00:02:55
8	03-03-95	#2	08:41:11		08:43:24		00:02:13
9		#3	09:16:56		09:19:09		00:02:13
10		#4	09:49:08		09:51:17		00:02:09
11		#6	12:24:24		12:26:38		00:02:14
12	03-08-95	#1	07:52:55		07:55:05		00:02:10
13		#5	12:14:55		12:17:05		00:02:10
14		#7	13:55:38		13:57:51		00:02:13
15	03-09-95	#3	09:23:01		09:25:13		00:02:12
16		#5	11:42:42		11:44:53		00:02:11
17	03-10-95	#3	09:51:15		09:53:28		00:02:13
18		#6	13:15:28		13:17:43		00:02:15
19		#8	15:02:43		15:04:58		00:02:15
20	03-13-95	#2	08:08:20		08:10:34		00:02:14
21		#6	13:43:22		13:45:36		00:02:14
22	03-14-95	#2	10:28:59		10:31:12		00:02:13
23		#4	12:17:03		12:19:16		00:02:13
24		#5	12:35:44		12:37:59		00:02:15
Totals			23:58:13		00:51:28		00:53:15

Average **00:02:13**

			Gate Recessed		Tow Over Sill		Total
1	02-27-95	#1	08:22:18		08:25:28		00:03:10
2		#2	09:36:10		09:40:25		00:04:15
3	02-28-95	#4	14:10:20		14:14:03		00:03:43
4	03-01-95	#1	09:16:25		09:22:47		00:06:22
5	03-02-95	#1	07:04:24		07:06:58		00:02:34
6		#4	11:23:59		11:25:52		00:01:53
7		#6	13:36:31		13:38:39		00:02:08
8	03-03-95	#2	08:43:24		08:49:56		00:06:32
9		#3	09:19:09		09:24:18		00:05:09
10		#4	09:51:17		09:53:41		00:02:24
11		#6	12:26:38		12:36:06		00:09:28
12	03-08-95	#1	07:55:05		07:58:59		00:03:54
13		#5	12:17:05		12:20:25		00:03:20
14		#7	13:57:51		14:00:09		00:02:18
15	03-09-95	#3	09:25:13		09:27:31		00:02:18
16		#5	11:44:53		11:48:33		00:03:40
17	03-10-95	#3	09:53:28		10:00:43		00:07:15
18		#6	13:17:43		13:24:09		00:06:26
19		#8	15:04:58		15:10:42		00:05:44
20	03-13-95	#2	08:10:34		08:15:27		00:04:53
21		#6	13:45:36		13:52:12		00:06:36
22	03-14-95	#2	10:31:12		10:36:02		00:04:50
23		#4	12:19:16		12:24:04		00:04:48
24		#5	12:37:59		12:38:11		00:00:12
Totals			00:51:28		02:35:20		01:43:52

Average **00:04:20**

			Bow Over Sill	2nd Cut Clear Gate	Total
1	02-27-95	#3	12:16:12	12:27:00	00:10:48
2		#4	14:09:46	14:21:07	00:11:21
3		#5	15:27:19	15:37:58	00:10:39
4	02-28-95	#1	08:43:56	08:56:39	00:12:43
5		#2	10:00:18	10:15:40	00:15:22
6		#3	11:19:16	11:34:48	00:15:32
7		#5	14:43:14	14:56:22	00:13:08
8	03-01-95	#2	09:35:28	09:51:48	00:16:20
9		#3	10:47:48	10:58:30	00:10:42
10		#4	14:05:25	14:15:03	00:09:38
11	03-02-95	#2	08:46:03	08:58:24	00:12:21
12		#3	10:05:32	10:18:11	00:12:39
13		#5	11:49:02	11:59:58	00:10:56
14		#7	14:15:37	14:25:03	00:09:26
15		#8	15:23:23	15:39:24	00:16:01
16	03-03-95	#1	06:59:53	07:13:21	00:13:28
17		#5	10:07:02	10:24:02	00:17:00
18		#7	13:01:18	13:13:45	00:12:27
19		#8	14:21:03	14:30:44	00:09:41
20	03-08-95	#2	08:13:46	08:25:45	00:11:59
21		#3	09:32:58	09:47:46	00:14:48
22		#4	10:54:13	11:02:02	00:07:49
23		#6	12:33:01	12:46:16	00:13:15
24		#8	14:11:27	14:22:24	00:10:57
25	03-09-95	#1			00:00:00
26		#2	07:54:42	08:05:45	00:11:03
27		#4	09:59:20	10:14:40	00:15:20
28		#6	15:16:45	15:26:35	00:09:50
29	03-10-95	#1	06:50:22	07:06:14	00:15:52
30		#2	08:10:46	08:26:28	00:15:42
31		#4	10:13:33	10:31:03	00:17:30
32		#5	11:36:20	11:53:01	00:16:41
33		#7	13:36:17	13:48:02	00:11:45
34	03-13-95	#1	06:46:42	06:58:30	00:11:48
35		#3	08:32:03	08:44:25	00:12:22
36		#4	09:53:26	10:10:12	00:16:46
37		#5	12:03:22	12:20:39	00:17:17
38		#7	14:05:29	14:26:56	00:21:27
39	03-14-95	#1	08:54:41	09:06:27	00:11:46
40		#3	10:48:45	10:59:26	00:10:41
41		#6	12:45:09	12:56:08	00:10:59
42		#7	14:02:38	14:13:00	00:10:22
Totals			06:53:20	15:49:31	08:56:11

Average **00:12:46**

			2nd Cut Clear Gate		Gate Closed		Total
1	02-27-95	#3	12:27:00		12:30:22		00:03:22
2		#4	14:21:07		14:24:33		00:03:26
3		#5	15:37:58		15:41:01		00:03:03
4	02-28-95	#1	08:56:39		08:59:50		00:03:11
5		#2	10:15:40		10:18:50		00:03:10
6		#3	11:34:48		11:38:08		00:03:20
7		#5	14:56:22		14:59:29		00:03:07
8	03-01-95	#2	09:51:48		09:54:59		00:03:11
9		#3	10:58:30		11:01:42		00:03:12
10		#4	14:15:03		14:18:15		00:03:12
11	03-02-95	#2	08:58:24		09:01:36		00:03:12
12		#3	10:18:11		10:21:23		00:03:12
13		#5	11:59:58		12:03:07		00:03:09
14		#7	14:25:03		14:29:26		00:04:23
15		#8	15:39:24		15:43:33		00:04:09
16	03-03-95	#1	07:13:21		07:16:26		00:03:05
17		#5	10:24:02		10:27:14		00:03:12
18		#7	13:13:45		13:17:06		00:03:21
19		#8	14:30:44		14:34:14		00:03:30
20	03-08-95	#2	08:25:45		08:28:53		00:03:08
21		#3	09:47:46		09:50:47		00:03:01
22		#4	11:02:02		11:05:08		00:03:06
23		#6	12:46:16		12:49:20		00:03:04
24		#8	14:22:24		14:25:34		00:03:10
25	03-09-95	#1					00:00:00
26		#2	08:05:45		08:08:57		00:03:12
27		#4	10:14:40		10:17:52		00:03:12
28		#6	15:26:35		15:29:43		00:03:08
29	03-10-95	#1	07:06:14		07:09:26		00:03:12
30		#2	08:26:28		08:29:41		00:03:13
31		#4	10:31:03		10:34:15		00:03:12
32		#5	11:53:01		11:56:11		00:03:10
33		#7	13:48:02		13:51:10		00:03:08
34	03-13-95	#1	06:58:30		07:01:31		00:03:01
35		#3	08:44:25		08:47:30		00:03:05
36		#4	10:10:12		10:13:21		00:03:09
37		#5	12:20:39		12:23:42		00:03:03
38		#7	14:26:56		14:30:08		00:03:12
39	03-14-95	#1	09:06:27		09:09:29		00:03:02
40		#3	10:59:26		11:02:30		00:03:04
41		#6	12:56:08		12:59:10		00:03:02
42		#7	14:13:00		14:16:11		00:03:11
Totals			15:49:31		18:01:43		02:12:12

Average **00:03:09**

			Gate Closed	End Fill/Empty	Total
1	02-27-95	#3	12:30:22	12:35:40	00:05:18
2		#4	14:24:33	14:30:08	00:05:35
3		#5	15:41:01	15:46:40	00:05:39
4	02-28-95	#1	08:59:50	09:04:52	00:05:02
5		#2	10:18:50	10:23:56	00:05:06
6		#3	11:38:08	11:43:14	00:05:06
7		#5	14:59:29	15:04:55	00:05:26
8	03-01-95	#2	09:54:59	09:59:53	00:04:54
9		#3	11:01:42	11:06:31	00:04:49
10		#4	14:18:15	14:22:56	00:04:41
11	03-02-95	#2	09:01:36	09:07:00	00:05:24
12		#3	10:21:23	10:26:43	00:05:20
13		#5	12:03:07	12:08:32	00:05:25
14		#7	14:29:26	14:34:22	00:04:56
15		#8	15:43:33	15:48:17	00:04:44
16	03-03-95	#1	07:16:26	07:21:21	00:04:55
17		#5	10:27:14	10:32:36	00:05:22
18		#7	13:17:06	13:22:32	00:05:26
19		#8	14:34:14	14:39:31	00:05:17
20	03-08-95	#2	08:28:53	08:34:01	00:05:08
21		#3	09:50:47	09:56:02	00:05:15
22		#4	11:05:08	11:10:24	00:05:16
23		#6	12:49:20	12:54:33	00:05:13
24		#8	14:25:34	14:30:44	00:05:10
25	03-09-95	#1	06:53:44	06:58:59	00:05:15
26		#2	08:08:57	08:14:11	00:05:14
27		#4	10:17:52	10:22:41	00:04:49
28		#6	15:29:43	15:35:01	00:05:18
29	03-10-95	#1	07:09:26	07:14:14	00:04:48
30		#2	08:29:41	08:34:24	00:04:43
31		#4	10:34:15	10:38:54	00:04:39
32		#5	11:56:11	12:00:54	00:04:43
33		#7	13:51:10	13:55:48	00:04:38
34	03-13-95	#1	07:01:31	07:06:52	00:05:21
35		#3	08:47:30	08:52:53	00:05:23
36		#4	10:13:21	10:18:44	00:05:23
37		#5	12:23:42	12:28:36	00:04:54
38		#7	14:30:08	14:36:51	00:06:43
39	03-14-95	#1	09:09:29	09:14:41	00:05:12
40		#3	11:02:30	11:07:44	00:05:14
41		#6	12:59:10	13:04:26	00:05:16
42		#7	14:16:11	14:23:31	00:07:20
Totals			00:55:27	04:34:47	03:39:20

Average **00:05:13**

			End Fill/Empty		Gate Recessed		Total
1	02-27-95	#3	12:35:40		12:37:44		00:02:04
2		#4	14:30:08		14:32:10		00:02:02
3		#5	15:46:40		15:48:49		00:02:09
4	02-28-95	#1	09:04:52		09:07:07		00:02:15
5		#2	10:23:56		10:26:10		00:02:14
6		#3	11:43:14		11:45:28		00:02:14
7		#5	15:04:55		15:07:10		00:02:15
8	03-01-95	#2	09:59:53		10:02:02		00:02:09
9		#3	11:06:31		11:08:47		00:02:16
10		#4	14:22:56		14:25:09		00:02:13
11	03-02-95	#2	09:07:00		09:10:10		00:03:10
12		#3	10:26:43		10:28:55		00:02:12
13		#5	12:08:32		12:11:01		00:02:29
14		#7	14:34:22		14:36:34		00:02:12
15		#8	15:48:17		15:50:31		00:02:14
16	03-03-95	#1	07:21:21		07:23:34		00:02:13
17		#5	10:32:36		10:34:47		00:02:11
18		#7	13:22:32		13:24:42		00:02:10
19		#8	14:39:31		14:41:42		00:02:11
20	03-08-95	#2	08:34:01		08:36:16		00:02:15
21		#3	09:56:02		09:58:15		00:02:13
22		#4	11:10:24		11:12:36		00:02:12
23		#6	12:54:33		12:56:45		00:02:12
24		#8	14:30:44		14:32:55		00:02:11
25	03-09-95	#1	06:58:59		07:01:04		00:02:05
26		#2	08:14:11		08:16:28		00:02:17
27		#4	10:22:41		10:24:55		00:02:14
28		#6	15:35:01		15:37:12		00:02:11
29	03-10-95	#1	07:14:14		07:16:28		00:02:14
30		#2	08:34:24		08:36:39		00:02:15
31		#4	10:38:54		10:41:08		00:02:14
32		#5	12:00:54		12:03:08		00:02:14
33		#7	13:55:48		13:57:59		00:02:11
34	03-13-95	#1	07:06:52		07:09:04		00:02:12
35		#3	08:52:53		08:55:04		00:02:11
36		#4	10:18:44		10:21:15		00:02:31
37		#5	12:28:36		12:30:51		00:02:15
38		#7	14:36:51		14:39:06		00:02:15
39	03-14-95	#1	09:14:41		09:17:44		00:03:03
40		#3	11:07:44		11:10:21		00:02:37
41		#6	13:04:26		13:06:36		00:02:10
42		#7	14:23:31		14:25:44		00:02:13
Totals			04:34:47		06:10:05		01:35:18

Average **00:02:16**

			Gate Recessed	1st Cut Over Gate	Total
1	02-27-95	#3	12:37:44	12:44:02	00:06:18
2		#4	14:32:10	14:39:54	00:07:44
3		#5	15:48:49	15:57:01	00:08:12
4	02-28-95	#1	09:07:07	09:10:25	00:03:18
5		#2	10:26:10	10:33:17	00:07:07
6		#3	11:45:28	11:49:13	00:03:45
7		#5	15:07:10	15:13:23	00:06:13
8	03-01-95	#2	10:02:02	10:05:20	00:03:18
9		#3	11:08:47	11:12:50	00:04:03
10		#4	14:25:09	14:28:32	00:03:23
11	03-02-95	#2	09:10:10	09:18:09	00:07:59
12		#3	10:28:55	10:35:23	00:06:28
13		#5	12:11:01	12:18:12	00:07:11
14		#7	14:36:34	14:40:43	00:04:09
15		#8	15:50:31	15:58:49	00:08:18
16	03-03-95	#1	07:23:34	07:31:06	00:07:32
17		#5	10:34:47	10:42:34	00:07:47
18		#7	13:24:42	13:32:13	00:07:31
19		#8	14:41:42	14:50:53	00:09:11
20	03-08-95	#2	08:36:16	08:44:27	00:08:11
21		#3	09:58:15	10:05:53	00:07:38
22		#4	11:12:36	11:19:29	00:06:53
23		#6	12:56:45	13:04:10	00:07:25
24		#8	14:32:55	14:38:52	00:05:57
25	03-09-95	#1	07:01:04	07:09:20	00:08:16
26		#2	08:16:28	08:23:15	00:06:47
27		#4	10:24:55	10:29:51	00:04:56
28		#6	15:37:12	15:45:36	00:08:24
29	03-10-95	#1	07:16:28	07:23:36	00:07:08
30		#2	08:36:39	08:42:55	00:06:16
31		#4	10:41:08	10:48:44	00:07:36
32		#5	12:03:08	12:10:12	00:07:04
33		#7	13:57:59	14:02:20	00:04:21
34	03-13-95	#1	07:09:04	07:17:10	00:08:06
35		#3	08:55:04	09:02:11	00:07:07
36		#4	10:21:15	10:29:35	00:08:20
37		#5	12:30:51	12:34:36	00:03:45
38		#7	14:39:06	14:45:51	00:06:45
39	03-14-95	#1	09:17:44	09:25:22	00:07:38
40		#3	11:10:21	11:18:10	00:07:49
41		#6	13:06:36	13:14:37	00:08:01
42		#7	14:25:44	14:33:22	00:07:38
Totals			06:10:05	10:51:33	04:41:28

Average 00:06:42

exit
1st cuts w/
Switch boards

			1st Cut Over Gate		Gate Closed		Total
1	02-27-95	#3	12:44:02		12:47:22		00:03:20
2		#4	14:39:54		14:42:58		00:03:04
3		#5	15:57:01		16:00:04		00:03:03
4	02-28-95	#1	09:10:25		09:13:22		00:02:57
5		#2	10:33:17		10:36:26		00:03:09
6		#3	11:49:13		11:52:21		00:03:08
7		#5	15:13:23		15:16:38		00:03:15
8	03-01-95	#2	10:05:20		10:08:31		00:03:11
9		#3	11:12:50		11:15:59		00:03:09
10		#4	14:28:32		14:32:24		00:03:52
11	03-02-95	#2	09:18:09		09:21:24		00:03:15
12		#3	10:35:23		10:38:29		00:03:06
13		#5	12:18:12		12:21:18		00:03:06
14		#7	14:40:43		14:44:51		00:04:08
15		#8	15:58:49		16:02:01		00:03:12
16	03-03-95	#1	07:31:06		07:34:17		00:03:11
17		#5	10:42:34		10:45:38		00:03:04
18		#7	13:32:13		13:35:22		00:03:09
19		#8	14:50:53		14:53:57		00:03:04
20	03-08-95	#2	08:44:27		08:47:37		00:03:10
21		#3	10:05:53		10:09:03		00:03:10
22		#4	11:19:29		11:22:40		00:03:11
23		#6	13:04:10		13:07:22		00:03:12
24		#8	14:38:52		14:42:02		00:03:10
25	03-09-95	#1	07:09:20		07:12:24		00:03:04
26		#2	08:23:15		08:26:18		00:03:03
27		#4	10:29:51		10:33:00		00:03:09
28		#6	15:45:36		15:48:56		00:03:20
29	03-10-95	#1	07:23:36		07:26:54		00:03:18
30		#2	08:42:55		08:46:19		00:03:24
31		#4	10:48:44		10:51:59		00:03:15
32		#5	12:10:12		12:13:25		00:03:13
33		#7	14:02:20		14:05:30		00:03:10
34	03-13-95	#1	07:17:10		07:20:12		00:03:02
35		#3	09:02:11		09:05:08		00:02:57
36		#4	10:29:35		10:32:36		00:03:01
37		#5	12:34:36		12:37:42		00:03:06
38		#7	14:45:51		14:49:03		00:03:12
39	03-14-95	#1	09:25:22		09:28:32		00:03:10
40		#3	11:18:10		11:21:11		00:03:01
41		#6	13:14:37		13:17:36		00:02:59
42		#7	14:33:22		14:36:29		00:03:07
Totals			10:51:33		13:05:20		02:13:47

Average **00:03:11**

			Gate Closed	End Fill/Empty	Total
1	02-27-95	#3	12:47:22	12:53:02	00:05:40
2		#4	14:42:58	14:48:12	00:05:14
3		#5	16:00:04	16:05:09	00:05:05
4	02-28-95	#1	09:13:22	09:19:06	00:05:44
5		#2	10:36:26	10:41:55	00:05:29
6		#3	11:52:21	11:57:55	00:05:34
7		#5	15:16:38	15:21:43	00:05:05
8	03-01-95	#2	10:08:31	10:13:56	00:05:25
9		#3	11:15:59	11:21:22	00:05:23
10		#4	14:32:24	14:37:51	00:05:27
11	03-02-95	#2	09:21:24	09:26:04	00:04:40
12		#3	10:38:29	10:43:12	00:04:43
13		#5	12:21:18	12:25:40	00:04:22
14		#7	14:44:51	14:50:13	00:05:22
15		#8	16:02:01	16:07:24	00:05:23
16	03-03-95	#1	07:34:17	07:39:38	00:05:21
17		#5	10:45:38	10:50:32	00:04:54
18		#7	13:35:22	13:40:10	00:04:48
19		#8	14:53:57	14:58:40	00:04:43
20	03-08-95	#2	08:47:37	08:52:01	00:04:24
21		#3	10:09:03	10:13:44	00:04:41
22		#4	11:22:40	11:27:19	00:04:39
23		#6	13:07:22	13:11:58	00:04:36
24		#8	14:42:02	14:46:38	00:04:36
25	03-09-95	#1	07:12:24	07:17:13	00:04:49
26		#2	08:26:18	08:31:09	00:04:51
27		#4	10:33:00	10:38:16	00:05:16
28		#6	15:48:56	15:53:41	00:04:45
29	03-10-95	#1	07:26:54	07:32:09	00:05:15
30		#2	08:46:19	08:51:34	00:05:15
31		#4	10:51:59	10:57:09	00:05:10
32		#5	12:13:25	12:18:40	00:05:15
33		#7	14:05:30	14:10:46	00:05:16
34	03-13-95	#1	07:20:12	07:25:13	00:05:01
35		#3	09:05:08	09:10:12	00:05:04
36		#4	10:32:36	10:37:37	00:05:01
37		#5	12:37:42	12:43:01	00:05:19
38		#7	14:49:03	14:54:24	00:05:21
39	03-14-95	#1	09:28:32	09:33:31	00:04:59
40		#3	11:21:11	11:26:10	00:04:59
41		#6	13:17:36	13:22:29	00:04:53
42		#7	14:36:29	14:43:22	00:06:53
Totals			13:05:20	16:40:00	03:34:40

Average **00:05:07**

			End Fill/Empty		Gate Recessed		Total
1	02-27-95	#3	12:53:02		12:55:02		00:02:00
2		#4	14:48:12		14:50:22		00:02:10
3		#5	16:05:09		16:07:25		00:02:16
4	02-28-95	#1	09:19:06		09:21:14		00:02:08
5		#2	10:41:55		10:44:05		00:02:10
6		#3	11:57:55		12:00:05		00:02:10
7		#5	15:21:43		15:23:57		00:02:14
8	03-01-95	#2	10:13:56		10:16:07		00:02:11
9		#3	11:21:22		11:23:32		00:02:10
10		#4	14:37:51		14:40:01		00:02:10
11	03-02-95	#2	09:26:04		09:28:18		00:02:14
12		#3	10:43:12		10:45:26		00:02:14
13		#5	12:25:40		12:28:11		00:02:31
14		#7	14:50:13		14:52:24		00:02:11
15		#8	16:07:24		16:09:33		00:02:09
16	03-03-95	#1	07:39:38		07:41:47		00:02:09
17		#5	10:50:32		10:52:45		00:02:13
18		#7	13:40:10		13:42:25		00:02:15
19		#8	14:58:40		15:00:53		00:02:13
20	03-08-95	#2	08:52:01		08:54:32		00:02:31
21		#3	10:13:44		10:15:57		00:02:13
22		#4	11:27:19		11:29:32		00:02:13
23		#6	13:11:58		13:14:12		00:02:14
24		#8	14:46:38		14:48:52		00:02:14
25	03-09-95	#1	07:17:13		07:19:25		00:02:12
26		#2	08:31:09		08:33:22		00:02:13
27		#4	10:38:16		10:40:27		00:02:11
28		#6	15:53:41		15:55:55		00:02:14
29	03-10-95	#1	07:32:09		07:34:21		00:02:12
30		#2	08:51:34		08:53:45		00:02:11
31		#4	10:57:09		10:59:20		00:02:11
32		#5	12:18:40		12:20:50		00:02:10
33		#7	14:10:46		14:12:55		00:02:09
34	03-13-95	#1	07:25:13		07:27:27		00:02:14
35		#3	09:10:12		09:12:27		00:02:15
36		#4	10:37:37		10:39:51		00:02:14
37		#5	12:43:01		12:45:14		00:02:13
38		#7	14:54:24		14:56:34		00:02:10
39	03-14-95	#1	09:33:31		09:35:46		00:02:15
40		#3	11:26:10		11:28:25		00:02:15
41		#6	13:22:29		13:24:44		00:02:15
42		#7	14:43:22		14:45:36		00:02:14
Totals			16:40:00		18:13:01		01:33:01

Average **00:02:13**

Entry of Second cut.

			Gate Recessed		2nd Cut Clear		Total
1	02-27-95	#3	12:55:02		13:03:11		00:08:09
2		#4	14:50:22		14:57:01		00:06:39
3		#5	16:07:25		16:14:32		00:07:07
4	02-28-95	#1	09:21:14		09:29:52		00:08:38
5		#2	10:44:05		10:50:30		00:06:25
6		#3	12:00:05		12:06:10		00:06:05
7		#5	15:23:57		15:32:14		00:08:17
8	03-01-95	#2	10:16:07		10:21:28		00:05:21
9		#3	11:23:32		11:28:16		00:04:44
10		#4	14:40:01		14:44:50		00:04:49
11	03-02-95	#2	09:28:18		09:34:56		00:06:38
12		#3	10:45:26		10:50:26		00:05:00
13		#5	12:28:11		12:34:17		00:06:06
14		#7	14:52:24		14:56:21		00:03:57
15		#8	16:09:33		16:17:22		00:07:49
16	03-03-95	#1	07:41:47		07:50:35		00:08:48
17		#5	10:52:45		10:59:10		00:06:25
18		#7	13:42:25		13:49:07		00:06:42
19		#8	15:00:53		15:08:43		00:07:50
20	03-08-95	#2	08:54:32		09:00:34		00:06:02
21		#3	10:15:57		10:24:15		00:08:18
22		#4	11:29:32		11:35:45		00:06:13
23		#6	13:14:12		13:20:08		00:05:56
24		#8	14:48:52		14:54:22		00:05:30
25	03-09-95	#1	07:19:25		07:25:28		00:06:03
26		#2	08:33:22		08:40:21		00:06:59
27		#4	10:40:27		10:48:16		00:07:49
28		#6	15:55:55		16:03:25		00:07:30
29	03-10-95	#1	07:34:21		07:40:38		00:06:17
30		#2	08:53:45		09:01:49		00:08:04
31		#4	10:59:20		11:05:56		00:06:36
32		#5	12:20:50		12:26:38		00:05:48
33		#7	14:12:55		14:19:05		00:06:10
34	03-13-95	#1	07:27:27		07:27:54		00:00:27
35		#3	09:12:27		09:20:48		00:08:21
36		#4	10:39:51		10:49:35		00:09:44
37		#5	12:45:14		12:53:06		00:07:52
38		#7	14:56:34		15:05:19		00:08:45
39	03-14-95	#1	09:35:46		09:42:07		00:06:21
40		#3	11:28:25		11:33:46		00:05:21
41		#6	13:24:44		13:32:44		00:08:00
42		#7	14:45:36		14:52:05		00:06:29
Totals			18:13:01		22:53:05		04:40:04

Exit 2nd cut under power

Average **00:06:40**

			2nd Cut Clear		Gate Closed		Total
1	02-27-95	#3	13:03:11		13:06:31		00:03:20
2		#4	14:57:01		14:59:55		00:02:54
3		#5	16:14:32		16:17:25		00:02:53
4	02-28-95	#1	09:29:52		09:33:21		00:03:29
5		#2	10:50:30		10:53:41		00:03:11
6		#3	12:06:10		12:09:14		00:03:04
7		#5	15:32:14		15:36:12		00:03:58
8	03-01-95	#2	10:21:28		10:24:29		00:03:01
9		#3	11:28:16		11:31:19		00:03:03
10		#4	14:44:50		14:48:01		00:03:11
11	03-02-95	#2	09:34:56		09:38:06		00:03:10
12		#3	10:50:26		10:53:42		00:03:16
13		#5	12:34:17		12:37:28		00:03:11
14		#7	14:56:21		14:59:26		00:03:05
15		#8	16:17:22		16:20:37		00:03:15
16	03-03-95	#1	07:50:35		07:54:47		00:04:12
17		#5	10:59:10		11:02:37		00:03:27
18		#7	13:49:07		13:52:34		00:03:27
19		#8	15:08:43		15:11:56		00:03:13
20	03-08-95	#2	09:00:34		09:03:46		00:03:12
21		#3	10:24:15		10:27:13		00:02:58
22		#4	11:35:45		11:39:03		00:03:18
23		#6	13:20:08		13:23:43		00:03:35
24		#8	14:54:22		14:57:28		00:03:06
25	03-09-95	#1	07:25:28		07:29:02		00:03:34
26		#2	08:40:21		08:43:30		00:03:09
27		#4	10:48:16		10:51:23		00:03:07
28		#6	16:03:25		16:06:47		00:03:22
29	03-10-95	#1	07:40:38		07:43:54		00:03:16
30		#2	09:01:49		09:04:57		00:03:08
31		#4	11:05:56		11:10:24		00:04:28
32		#5	12:26:38		12:29:37		00:02:59
33		#7	14:19:05		14:22:32		00:03:27
34	03-13-95	#1	07:27:54		07:31:10		00:03:16
35		#3	09:20:48		09:24:12		00:03:24
36		#4	10:49:35		10:52:58		00:03:23
37		#5	12:53:06		12:56:49		00:03:43
38		#7	15:05:19		15:08:54		00:03:35
39	03-14-95	#1	09:42:07		09:45:24		00:03:17
40		#3	11:33:46		11:36:48		00:03:02
41		#6	13:32:44		13:35:54		00:03:10
42		#7	14:52:05		14:55:40		00:03:35
Totals			22:53:05		01:12:29		02:19:24

Average **00:03:19**

			Gate Closed	End Fill/Empty	Total
1	02-27-95	#3	13:06:31	13:11:45	00:05:14
2		#4	14:59:55	15:05:40	00:05:45
3		#5	16:17:25	16:23:11	00:05:46
4	02-28-95	#1	09:33:21	09:38:24	00:05:03
5		#2	10:53:41	10:58:43	00:05:02
6		#3	12:09:14	12:14:18	00:05:04
7		#5	15:36:12	15:41:40	00:05:28
8	03-01-95	#2	10:24:29	10:29:16	00:04:47
9		#3	11:31:19	11:36:05	00:04:46
10		#4	14:48:01	14:52:51	00:04:50
11	03-02-95	#2	09:38:06	09:43:31	00:05:25
12		#3	10:53:42	10:59:08	00:05:26
13		#5	12:37:28	12:42:52	00:05:24
14		#7	14:59:26	15:04:14	00:04:48
15		#8	16:20:37	16:25:23	00:04:46
16	03-03-95	#1	07:54:47	07:59:35	00:04:48
17		#5	11:02:37	11:08:03	00:05:26
18		#7	13:52:34	13:57:55	00:05:21
19		#8	15:11:56	15:17:24	00:05:28
20	03-08-95	#2	09:03:46	09:08:58	00:05:12
21		#3	10:27:13	10:32:22	00:05:09
22		#4	11:39:03	11:44:18	00:05:15
23		#6	13:23:43	13:28:58	00:05:15
24		#8	14:57:28	15:02:38	00:05:10
25	03-09-95	#1	07:29:02	07:34:16	00:05:14
26		#2	08:43:30	08:48:45	00:05:15
27		#4	10:51:23	10:56:12	00:04:49
28		#6	16:06:47	16:12:00	00:05:13
29	03-10-95	#1	07:43:54	07:48:38	00:04:44
30		#2	09:04:57	09:09:41	00:04:44
31		#4	11:10:24	11:15:04	00:04:40
32		#5	12:29:37	12:34:18	00:04:41
33		#7	14:22:32	14:27:15	00:04:43
34	03-13-95	#1	07:31:10	07:36:28	00:05:18
35		#3	09:24:12	09:29:32	00:05:20
36		#4	10:52:58	10:58:16	00:05:18
37		#5	12:56:49	13:01:46	00:04:57
38		#7	15:08:54	15:14:56	00:06:02
39	03-14-95	#1	09:45:24	09:50:34	00:05:10
40		#3	11:36:48	11:42:04	00:05:16
41		#6	13:35:54	13:41:03	00:05:09
42		#7	14:55:40	15:00:54	00:05:14
Totals			01:12:29	04:48:54	03:36:25

Average **00:05:09**

			End Fill/Empty		Gate Recessed		Total
1	02-27-95	#3	13:11:45		13:13:58		00:02:13
2		#4	15:05:40		15:07:49		00:02:09
3		#5	16:23:11		16:25:19		00:02:08
4	02-28-95	#1	09:38:24		09:40:38		00:02:14
5		#2	10:58:43		11:00:58		00:02:15
6		#3	12:14:18		12:16:32		00:02:14
7		#5	15:41:40		15:43:49		00:02:09
8	03-01-95	#2	10:29:16		10:31:29		00:02:13
9		#3	11:36:05		11:38:20		00:02:15
10		#4	14:52:51		14:54:59		00:02:08
11	03-02-95	#2	09:43:31		09:45:39		00:02:08
12		#3	10:59:08		11:01:19		00:02:11
13		#5	12:42:52		12:45:04		00:02:12
14		#7	15:04:14		15:06:26		00:02:12
15		#8	16:25:23		16:27:36		00:02:13
16	03-03-95	#1	07:59:35		08:01:51		00:02:16
17		#5	11:08:03		11:10:13		00:02:10
18		#7	13:57:55		14:00:07		00:02:12
19		#8	15:17:24		15:19:36		00:02:12
20	03-08-95	#2	09:08:58		09:11:10		00:02:12
21		#3	10:32:22		10:34:34		00:02:12
22		#4	11:44:18		11:46:30		00:02:12
23		#6	13:28:58		13:31:10		00:02:12
24		#8	15:02:38		15:04:51		00:02:13
25	03-09-95	#1	07:34:16		07:36:27		00:02:11
26		#2	08:48:45		08:50:57		00:02:12
27		#4	10:56:12		10:58:25		00:02:13
28		#6	16:12:00		16:14:12		00:02:12
29	03-10-95	#1	07:48:38		07:50:53		00:02:15
30		#2	09:09:41		09:11:54		00:02:13
31		#4	11:15:04		11:17:18		00:02:14
32		#5	12:34:18		12:36:33		00:02:15
33		#7	14:27:15		14:29:29		00:02:14
34	03-13-95	#1	07:36:28		07:38:42		00:02:14
35		#3	09:29:32		09:31:44		00:02:12
36		#4	10:58:16		11:00:30		00:02:14
37		#5	13:01:46		13:03:59		00:02:13
38		#7	15:14:56		15:17:10		00:02:14
39	03-14-95	#1	09:50:34		09:52:46		00:02:12
40		#3	11:42:04		11:44:16		00:02:12
41		#6	13:41:03		13:43:16		00:02:13
42		#7	15:00:54		15:03:08		00:02:14
Totals			04:48:54		06:21:36		01:32:42

Average **00:02:12**

			Gate Recessed		Tow Over Sill		Total
1	02-27-95	#3	13:13:58		13:38:28		00:24:30
2		#4	15:07:49		15:18:10		00:10:21
3		#5	16:25:19		16:42:44		00:17:25
4	02-28-95	#1	09:40:38		09:48:42		00:08:04
5		#2	11:00:58		11:07:38		00:06:40
6		#3	12:16:32		12:24:15		00:07:43
7		#5	15:43:49		16:12:56		00:29:07
8	03-01-95	#2	10:31:29		10:37:02		00:05:33
9		#3	11:38:20		11:53:03		00:14:43
10		#4	14:54:59		15:07:50		00:12:51
11	03-02-95	#2	09:45:39		09:54:36		00:08:57
12		#3	11:01:19		11:09:11		00:07:52
13		#5	12:45:04		12:53:42		00:08:38
14		#7	15:06:26		15:11:50		00:05:24
15		#8	16:27:36		16:35:07		00:07:31
16	03-03-95	#1	08:01:51		08:08:19		00:06:28
17		#5	11:10:13		11:19:55		00:09:42
18		#7	14:00:07		14:10:02		00:09:55
19		#8	15:19:36		15:27:18		00:07:42
20	03-08-95	#2	09:11:10		09:20:12		00:09:02
21		#3	10:34:34		10:44:17		00:09:43
22		#4	11:46:30		11:54:12		00:07:42
23		#6	13:31:10		13:38:21		00:07:11
24		#8	15:04:51		15:13:33		00:08:42
25	03-09-95	#1	07:36:27		07:45:22		00:08:55
26		#2	08:50:57		09:02:25		00:11:28
27		#4	10:58:25		11:17:36		00:19:11
28		#6	16:14:12		16:38:34		00:24:22
29	03-10-95	#1	07:50:53		08:01:31		00:10:38
30		#2	09:11:54		09:22:25		00:10:31
31		#4	11:17:18		11:24:19		00:07:01
32		#5	12:36:33		12:43:33		00:07:00
33		#7	14:29:29		14:36:06		00:06:37
34	03-13-95	#1	07:38:42		07:40:09		00:01:27
35		#3	09:31:44		09:42:32		00:10:48
36		#4	11:00:30		11:23:29		00:22:59
37		#5	13:03:59		13:12:39		00:08:40
38		#7	15:17:10		15:25:18		00:08:08
39	03-14-95	#1	09:52:46		10:04:34		00:11:48
40		#3	11:44:16		11:51:39		00:07:23
41		#6	13:43:16		13:52:33		00:09:17
42		#7	15:03:08		15:13:12		00:10:04
Totals			06:21:36		13:49:19		07:27:43

Average **00:10:40**

	Mel Price LocK Average
Entry	00:12:46
Gate (Close)	00:03:09
Empty	00:05:13
Gate (Open)	00:02:16
First Cut (Remove)	00:06:42
Gate (Close)	00:03:11
Fill	00:05:07
Gate (Open)	00:02:13
Second Cut (Enter)	00:06:40
Gate (Close)	00:03:19
Empty	00:05:09
Gate (Open)	00:02:12
Exit	00:10:40
TOTAL	01:08:37

	Mel Price LocK Average
Approach	00:05:17
Gate (Close)	00:03:16
Empty	00:05:25
Gate (Open)	00:02:13
Exit	00:04:20
TOTAL	00:20:30