MIRA
Dissolution Authority
300 Maxim Road, Hartford, Connecticut 06114 Telephone (860) 757-7700 Fax (860) 757-7725

MEMORANDUM

TO: **South Meadows Transition Committee**

FROM: **William P. Beccaro, Committee Chairperson**

DATE: **October 3, 2024**

RE: **Notice of Regular Meeting**

There will be a **regular meeting** of the **South Meadows Transition Committee** of the MIRA Dissolution Authority's Board of Directors on ***Wednesday, October 9, 2024 at 11:00 a.m. in the Board Room at 300 Maxim Road, Hartford, CT. Members of the public may also attend the meeting telephonically by calling (929) 205-6099, entering Meeting ID: 858 1861 1943 and Passcode: 661934# when prompted. (NOTE - there is very limited physical space in the Board Room - consequently, virtual public attendance is encouraged).*** The meeting is scheduled to conclude at 12:30 p.m. The purpose of this meeting will be:

1. Call to Order; Chair's Welcome

2. Public Comment (3 minutes per speaker)

3. Approval of Minutes of the September 4, 2024 Regular Committee Meeting (***Attachment 1***).

4. Presentation and Discussion of the following DRAFT Milestone Reports associated with the South Meadows Redevelopment Considerations Study:
   a. *Abandonment and Removal of Penetrations and Encroachments* of the flood control system (***Attachment 2***)
   b. *Floodwall Penetration Operation, Maintenance, and Inspection Plan* (***Attachment 3***)
   c. *Floodwall Penetration Emergency Preparedness Plan* (***Attachment 4***)
   d. *Review of Existing Site Conditions and Restrictions, and Potential Future Uses*

5. Update and Discussion Regarding the South Meadows Redevelopment Considerations Study, Including:
   a. Hazardous Building Materials Survey
   b. Second Public Informational Meeting to be Held November 12, 2024

6. Such other items that may properly come before the Committee.

Cc: Bert Hunter
Mark Daley
Christopher Shepard
Raymond Frigon (CT-DEEP)
Claire Quinn (CT-DEEP)
Jade Barber (CT-DEEP)
Robert Carr (Weston & Sampson)
Carl Stopper (TRC)

Attachment 1

South Meadows Transition Committee
September 4, 2024
Meeting Minutes

A Regular Meeting of the South Meadows Transition Committee of the MIRA Dissolution Authority was held on September 4, 2024. Present either in-person or via video or audio conferencing were:

Committee Present:	Director William Beccaro (Committee Chairperson) Director John Fonfara (via Zoom) Director Matthew Dayton Director Rachel Taylor (via Zoom) Director Bert Hunter (Ex Officio) (via Zoom) Member Frank Dellaripa
Other Directors Present:	David H. Barkin
Other Members Present:	Thomas Swarr
Authority Staff Present:	Mark T. Daley, President & CFO Christopher Shepard, Environmental Compliance Manager David Bodendorf, Mgr. of Engineering, Construction & Power Assets Thomas Gaffey, Director of Recycling & Enforcement (via Zoom) Roger Guzowski, Supply Chain Manager Cheryl Kaminsky, Comptroller (via Zoom) Ann Catino (Halloran & Sage), General Counsel
CT-DEEP Staff Present:	Jade Barber (via Zoom) David McKeegan (via Zoom) Claire Quinn (via Zoom)
Others Present:	Joanna Wozniak-Brown (via Zoom) Matthew Pafford, CT-DAS (via Zoom) Marcus Y. (via Zoom)

This meeting was recorded via ZOOM conferencing and is posted on the Authority's website at: https://www.ctmira.org/mira-dissolution-authority-south-meadows-transition-committee

1. Call to Order; Chair's Welcome

Committee Chairperson Beccaro called the meeting to order at 11:07 A.M. and confirmed that a quorum was present.

2. Public Comment (3 minutes per speaker)

Committee Chairperson Beccaro invited members of the public to address the Committee. There were no public comments, and Committee Chairperson Beccaro proceeded with the next agenda item.

3. Approval of Minutes of the July 10, 2024 Regular Committee Meeting

Committee Chairperson Beccaro requested a motion to approve the minutes of the July 10, 2024 Regular Committee Meeting. The motion was moved by Director Fonfara and seconded by Director Dayton.

Committee Chairperson Beccaro asked if there were any discussion, comments, corrections or modifications requested. Hearing none, Committee Chairperson Beccaro asked for a voice vote. The motion was approved unanimously by those in attendance, as indicated below:

Director	Raised	Second	Aye	Nay	Abstain
Chairperson Beccaro			X		
Matthew Dayton		X	X		
Rachel Taylor			X		
John Fonfara	X		X		
Dave Steuber					(Absent)

4. Review and Approve Resolution regarding execution of a RFS with Cohn Birnbaum & Shea P.C. for FY25 legal support associated with South Meadows Station remediation

Committee Chairperson Beccaro requested a motion to discuss the resolution. The motion was moved by Director Fonfara and seconded by Director Taylor.

RESOLVED: That the President is authorized to execute a Request for Services under the Authority's Legal Services Agreement with Cohn Birnbaum & Shea P.C. for Fiscal Year 2025 legal support associated with the Exit Strategy™ Contract and the South Meadow Station remediation project, as described in the Contract Summary attached hereto and substantially as discussed and presented at this meeting; and

FURTHER RESOLVED: That funds from the Mid CT Post Project Closure reserve be utilized to pay for the costs of the legal services under the Request for Services with Cohn Birnbaum & Shea P.C.

At Committee Chairperson Beccaro's request, Mr. Daley provided a summary of the resolution. Mr. Daley stated that Cohn Birnbaum & Shea serves as our legal counsel for South Meadows site remediation under our Exit Strategy™ contract for remediation of the South Meadows site to industrial/commercial standards. Mr. Daley noted that the FY25 legal costs for this legal counsel is estimated at $15,000, primarily for addressing comments/questions from DEEP on the draft environmental land use restriction (ELUR) that is proposed for recording in the City's Land Records, and for review work associated with the Verification Report that will be submitted after the ELUR is recorded. Mr. Daley noted that the $15,000 would be used from the last remaining reserve account associated with the Mid-Connecticut Project.

Committee Chairperson Beccaro asked if there was any additional discussion on the resolution. Hearing none, Committee Chairperson Beccaro asked for a roll-call vote. The motion was approved unanimously by those in attendance, as indicated below:

Director	Raised	Second	Aye	Nay	Abstain
Chairperson Beccaro			X		
Rachel Taylor		X	X		
Matthew M. Dayton			X		
David S. Steuber					(Absent)
John Fonfara	X		X		

5. Update and Discussion Regarding the South Meadows Redevelopment Considerations Study

Chairperson Beccaro introduced this update and discussion by noting that there are a number of subtopics listed for discussion. Chairperson Beccaro also noted that Attachment #3 of the Committee package includes a summary memo regarding the public project launch meeting that was held in July.

At Chairperson Beccaro request, Mr. Daley then began the update and discussion regarding the hazardous building materials (HBM) survey.

a. Hazardous Building Materials Survey

Mr. Daley noted that the HBM survey is running a little ahead of schedule. Eagle Environmental has substantially completed the field inspection and sampling work for potential asbestos-containing materials and lead-based paint. As of 8/20/2024, approximately 80 out of 500 sampled materials have tested positive for asbestos content. Analytical results for 125+ additional material samples are still pending. Eagle will return to the site to determine quantities of asbestos-containing building materials after all lab analytical results for asbestos are received. The quantified asbestos-containing materials will then feed into the cost estimates for building remediation, demolition, etc.

Mr. Daley then stated that Weston & Sampson Engineers (WSE) has identified approximately 50 different building materials that are being recommended for analysis of PCBs. Mr. Daley noted that no samples have been submitted for analysis of PCBs yet, but we intend to move forward with their recommendations regarding analysis. Mr. Daley noted that the sampled materials that will be analyzed for PCBs include paints, caulking, and other building materials.

b. Flood Protection System Plans

Mr. Daley then proceeded with an update regarding the flood protection system plans. Mr. Daley stated that WSE and its subconsultant are continuing their work on the three documents under the Study that are associated with the Hartford flood protection system on-site. These three documents are the Operation and Maintenance Manual; the Emergency Preparedness Plan; and the Dike Penetrations Inventory and Abandonment Requirements Report. Mr. Daley stated that the three documents will be delivered to the Authority as drafts on or about 9/23/2024.

Mr. Daley also noted that copies of the three draft documents would be provided to the Greater Hartford Flood Commission for its review at that time. Mr. Shepard followed Mr. Daley by noting that the Flood Commission is certainly the first reviewer, and that the U.S. Army Corps of Engineers and the CT-DEEP Dam Safety Division will also be provided copies of these draft documents for their review and comment.

c. **Schedule for Presentations of Milestone Reports to Committee**

Mr. Daley then proceeded with an update of the schedule for presentation of milestone reports to the South Meadows Transition Committee by WSE. Mr. Daley summarized the presentation schedule as follows:

- October 9, 2024 Committee meeting:
  - 3 Flood Protection System documents
  - Review of Existing Environmental Conditions and Conceptual Site Considerations

- November 6, 2024 Committee meeting: Results of building materials testing for PCBs

- December 4, 2024 Committee meeting: Full Hazardous Building Materials Survey report

- January 2025 Committee meeting (date not yet scheduled): Assessment of Potential Future Uses report

- February 2025 Committee meeting (date not yet scheduled): DRAFT of Full Study Report, which will ultimately be submitted to the State Legislature after it is finalized.

d. **Public Project Launch Meeting Held July 23, 2024**

Mr. Daley then proceeded with a review of the public project launch meeting that was held on July 23rd. Mr. Daley noted that Attachment 3 of the Committee package contains a summary memo from Led By Us & Associates (LBU) regarding the public project launch meeting and the participation. Mr. Daley noted the following highlights regarding the public project launch meeting:

i. A total of 33 individuals from the community participated in the public project launch meeting (23 in-person, 10 via Zoom), not including Authority representatives and the consulting team.

ii. A survey concerning the study was available, and 22 total responses were received. The memo in Attachment 3 includes a Survey Results Addendum which summarizes the survey responses. Mr. Daley noted the following takeaways from the survey:

- At total of 22 respondents completed the survey (11 before the public project launch meeting, and 11 after it).
- Strong interest was expressed in potential future use of the property as "public park/other green space" or "recreational use (i.e., biking, hiking, fishing, entertainment, etc.)"
- A number of respondents expressed that they thought that the advertising for the meeting could have been better.

e. **Second Public Informational Meeting to be Held in November**

Leading into the discussion on the second public informational meeting to be held, Mr. Daley noted that LBU has provided the Authority with some recommendations to improve the advertising for the meeting. LBU suggested that the Authority may want to consider:

- Additional advertising for the next meeting via social media; and/or
- Providing a presentation to the Hartford City Council at one of its scheduled meetings. Regarding this recommendation, Mr. Daley noted that there has been previous participation by the Hartford City Council in Authority meetings, including via the Members that are appointed to the Board by the City Council.

Mr. Daley then stated that LBU and WSE have suggested either of the following two dates for the second public informational meeting:

- Tuesday, November 12, 2024, or
- Thursday, November 14, 2024

Mr. Daley noted that the November meeting of the Authority's Board of Directors will be Wednesday, November 13, 2024.

Mr. Daley asked that the Committee members give consideration to the two suggested meeting dates leading up to next week's Board meeting, so that we can hopefully settle on a date at next week's Board meeting and reserve the meeting space. Mr. Daley indicated that LBU plans to reserve the Metzner Community Center again for the second public informational meeting.

Mr. Daley also noted that LBU and WSE have recommended development of a "Frequently Asked Questions" ("FAQ") sheet that can both be available on the Authority's web-site and be utilized as a hand-out during the second public informational meeting, and we are proceeding this recommendation.

Following the completion of Mr. Daley's updates on the Study, Director Barkin requested to further discuss the hazardous building materials piece of the Study. Director Barkin sought clarification on Eagle Environmental's role in the HBM survey, asking why a consultant was not hired to quantify and test building materials before bringing in Eagle (an abatement contractor). Mr. Daley clarified that Eagle is conducting building material sampling and analysis activities, and that there is no abatement planned as part of the current Study.

Director Barkin then asked the reason for sampling building materials at this time, instead of at some future point in time closer to decisions about building demolitions. Mr. Daley stated that we are conducting the sampling now in order to develop cost estimates under the Study for building abatement and demolition work. Director Barkin expressed the "feeling in the industry" that you do not test for PCBs until the time of actual demolition. Mr. Daley noted that this issue was previously raised and brought to the Authority's Board and Committee, with the primary concern being whether or not finding PCBs would trigger immediate removal work or start a clock ticking. Mr. Daley asked Mr. Shepard if he had anything to add. Mr. Shepard clarified that Eagle Environmental has been working as a subconsultant to WSE for the Study. Eagle has been conducting all asbestos and lead-based paint sampling/testing, and Eagle and WSE have been conferring on what materials should be sampled for PCB testing. Mr. Shepard stated that the PCB experts at WSE are guiding the PCB sampling portions of this project.

Director Barkin noted that DAS has a vested interest in the testing protocols and results, and he indicated that he would like to further discuss the matter of PCB testing with his internal team and get back to us before any analytical testing is completed. Mr. Shepard confirmed that no samples have been submitted for PCB analysis yet. Mr. Shepard also noted that CT-DEEP was pushing the Authority to test for PCBs in building materials as part of the Facility's Closure Plan, which is another reason that PCBs in building materials were included in the scope of this Study. Mr. Daley asked if Director Barkin could offer a timeframe, with the hope that we could resolve this matter by next week's Board meeting. Director Barkin stated one member of his internal team was attending this Committee meeting on-line, and they would have a conversation soon.

Committee Chairperson Beccaro then asked the Committee if they thought that it would be "appropriate and smart" to send correspondence to the Mayor's office and the City Council to offer a presentation regarding the Study, and also to confirm to them that there are publicly-available means for them to get information regarding the Study. Committee Chairperson Beccaro also asked if the second public information session should deliberately be scheduled in a different location.

In response to Committee Chairperson Beccaro's questions, Director Fonfara stated that he believes that it would be a good idea to initiate contact with the Mayor's office and the City Council. Regarding the venue, Director Fonfara stated that the more important aspect is to continue to connect with the community that does not see what is happening in the South Meadows as a priority in their lives, noting that there should be benefits to this community, such as employment or recreation, in the future. Director Fonfara suggested that LBU pursue some of the non-profits in the community, Council members, and the State Rep for the area in an effort to better connect with the community.

Director Taylor agreed that it is worth reaching out to the Mayor's office and the City Council in an effort to be as collaborative and transparent as possible. Regarding the venue for the next meeting, Director Taylor stated that it was important to understand what the goal of the meeting is and the importance of proximity to the South Meadows site. Director Taylor mentioned that the Park Street Library at the Lyric is located within a densely populated area and it is easy to get to, but this location is also farther away from the South Meadows site than the Metzner Community Center. Director Taylor also mentioned that there is a senior center in the South End run by Hyacinth, and Director Fonfara concurred that Hyacinth does a good job of getting people to attend monthly meetings that she runs.

Director Taylor also suggested that LBU could offer to present at regularly-scheduled meetings of other organizations, such as the City Council or the Hartford NRZs, in an effort to better publicize the next public informational meeting. Director Taylor then stated that it makes sense to keep the next public informational meeting as accessible as possible to the South End community. Member Swarr suggested that Parkville elementary school could be considered.

Committee Chairperson Beccaro indicated that he would like to have a conversation with LBU to discuss their community outreach, and review the list of people that they will be reaching out to in order to publicize the next public informational meeting.

Committee Chairperson Beccaro suggested that there be further discussion regarding the next public informational meeting during next week's meeting of the full Board.

Committee Chairperson Beccaro asked if there was any additional discussion, and Director Fonfara made reference to a recent letter received from GHIAA, which letter raised concerns about the continued use of the South Meadows facility as a trash-to-energy plant. Director Fonfara asked if anyone could explain the genesis of this letter. Director Hunter indicated that its sounds to him like there is a misunderstanding about a portion of the Study's scope of work, and he asked Mr. Daley to provide additional explanation, noting that the Authority's Board will not be the party that ultimately selects a future use for this property. Mr. Daley clarified that the scope of work identifies four potential future uses that the Board identified – industrial/commercial, residential, currently-permitted uses, and some combination of those three. Mr. Daley believes that identification of "currently permitted uses" is the genesis of GHIAA's letter. Mr. Daley noted that the Board has consistently taken the position that we are not making the final decisions for redevelopment, and that the Board is therefore not ruling any potential future uses "out," nor is it ruling any potential future uses "in." Mr. Daley also indicated that he does not believe anyone envisions another waste-to-energy plant as the future use, but the Board did not want to rule out some other, newer technology or smaller footprint technology that could be consistent with the existing permitted purpose. Committee Chairperson Beccaro added that the Authority is here to put potential future use options on the table for consideration, and talk about the time, effort and cost involved with those options. Director Fonfara then stated that there are strong feelings in Hartford that this site should not be used again for the disposal of trash, because the City did its part for State trash disposal for more than 40 years.

8. Other Items Brought Before Committee

Mr. Daley then provided additional information on other items related to the South Meadows property. Regarding the South Meadows site remediation being performed by TRC under the Exit Strategy™ contract, TRC submitted the proposed ELUR for Area 3-3 (PCBs beneath the contractor parking lot) to CT-DEEP on July 23, 2024, for review and comment/approval. CT-DEEP provided 7 comments overall on the proposed ELUR on August 21, 2024, and TRC and the Authority have 180 days (until February 17, 2025) to address all of CT-DEEP's comments on the proposed Area 3-3 ELUR. Committee Chairperson Beccaro asked if there were any surprises in the comments from CT-DEEP. Mr.

Shepard indicated that there was nothing of major concern, but that some of the comments pertaining to the ELUR survey may take time to address because the surveyor may need to come back out to the property in order to address them.

The next item discussed by Mr. Daley was that CT-DEEP issued to Eversource a temporary release from the existing ELUR at the South Meadows site so that Eversource could conduct subsurface investigations along the proposed route of a replacement underground duct bank. CT-DEEP granted the release in late June, and Eversource conducted their on-site work between August 19, 2024 and August 29, 2024. Mr. Daley noted that the ELUR release ends on September 30, 2024, and that Eversource is currently working on a report to CT-DEEP summarizing the completed work.

Mr. Daley then noted that we are moving forward with the structural evaluation for the Power Block Facility, which was previously authorized by the Board. This project will kick-off in the immediate future.

6. Adjournment

Committee Chairperson Beccaro asked if there were any other matters to discuss. Hearing none, Committee Chairperson Beccaro requested a motion to adjourn. Director Dayton moved to adjourn, and Committee Chairperson Beccaro adjourned the meeting at 11:47 A.M.

Attachment 2

2 October 2024 **DRAFT**

Christopher Shepard, P.E.
Environmental Compliance Manager
MIRA Dissolution Authority
300 Maxim Road
Hartford, CT 06114

Project 240840 – Abandonment and Removal of Penetrations and Encroachments, Former MIRA Facility, 100 Reserve Road and 300 Maxim Road, Hartford, CT

Dear Mr. Shepard:

At your request, Simpson Gumpertz & Heger Associates, Inc. (SGH) evaluated the existing utilities passing through or under the Hartford Flood Control System (HFCS) floodwall that extend through the former Materials Innovation and Recycling Authority (MIRA) Resource Recovery Facility (the Facility). As the utilities no longer serve a useful purpose, they must be removed or properly abandoned. This report describes the work required to remove the existing utilities and encroachments and provides a preliminary cost estimate for this work.

1. INTRODUCTION

1.1 Background

The Facility is a shuttered trash-to-energy power plant in the South Meadows Section of Hartford, Connecticut (Fig. 1). The Facility, constructed in the 1920s, was originally coal-fired, then transitioned to a combination of oil and coal. In the 1980s, a waste processing facility (WPF) was constructed at the site, and the power plant was converted for trash-to-energy use. The power plant portion of the site is referred to as the power block facility (PBF) to differentiate it from the WPF. The Facility stopped receiving, processing, and combusting waste in July 2022. Over the life of the Facility, there were six generating units, two of which (Units 5 and 6) were in use when operations ceased.

The Facility is located along the west bank of the Connecticut River. In response to the devastating floods in 1936 and 1938, the U.S. Army Corps of Engineers constructed a flood control system to reduce flooding risks. The HFCS consists of earthen dikes, concrete floodwalls, closure structures, and structures to facilitate drainage inside the protected area. The HFCS passes through the Facility, with most of the area adjacent to the PBF consisting of concrete floodwall. Several penetrations through or under the floodwall allow for the passage of pipes between the landside and the riverside.

The Greater Hartford Flood Commission (GHFC), which is the regulatory agency with stewardship over the HFCS, has expressed concerns that the existing utilities represent a risk to the HFCS. The potential transition of ownership and redevelopment increases this risk, as the new owner might not be as familiar with the operations and maintenance of these utilities. Therefore, the successor to MIRA, the MIRA Dissolution Authority (MDA) is developing a plan to abandon the existing utilities and remove the floodwall encroachments.

1.2 Objective

The objective of our assignment is to evaluate the scope of work required to abandon existing penetrations through or under the floodwall at the Facility, remove encroachments on the floodwall, and develop a cost estimate for this work.

1.3 Scope of Work

Our scope of work included the following tasks:

- Reviewing relevant documents provided to us by MDA and readily available public information.
- Visiting the site to observe the existing conditions and search for record drawings in the Facility's plan room.
- Attending a meeting with MDA and GHFC to discuss the work and understand GHFC's concerns regarding penetrations and encroachment.
- Preparing an Operations, Inspection, and Maintenance Plan and Emergency Preparedness Plan (both issued under separate cover).
- Developing a scope of work and cost estimate for utility abandonment and encroachment removal.
- Preparing this summary report.

2. EXISTING PENETRATIONS AND ENCROACHMENTS

2.1 Penetrations

Table 1 lists the existing utility penetrations through or under the floodwall. The penetrations are also shown in Figs. 2 and 3. Identification numbers consistent with the HFCS Operation and Maintenance Manual are provided for reference.

Table 1. Utility penetrations at the Facility.

ID No.	Station	Description	Diameter/Size and Material of Penetration	Status
HD-36	84+21M	Storm drain	12 in. dia. pipe - Cast Iron	Active
HD-37	85+28M	Compressed air and water	1.5 in. dia. city water 1 in. dia. compressed air 6 in. dia. service water	Inactive
HD-38	84+55M	Non-contact cooling water intake (Unit 6)	48 in. dia. pipe - Steel	Inactive
HD-43	86+77.5M	Service water intake	24 in. dia. pipe placed inside 48 in. dia. pipe - Steel	Inactive
HD-44	87+65M	Non-contact cooling water intake (Unit 5)	48 in. dia. pipe - Steel	Inactive
HD-45	87+40.6M	Water discharge (Source unknown)	14 in. dia. pipe - Cast Iron	Inactive
HD-46	87+35.85M	Service water discharge	48 in. dia. pipe - Steel	Inactive
HD-47	87+85M	Non-contact cooling water discharge (Unit 5)	48 in. dia. pipe - Steel	Inactive
HD-47a	88+34M	Non-contact cooling water discharge (Unit 6)	48 in. dia. pipe - Steel	Inactive
HD-48	89+3.65M	Storm drain (former ash pit)	12 in. dia. pipe - Cast Iron	Inactive
HD-49	90+75M	Oil pipe in former ash pit drain	8 in. dia. oil line (Steel) placed inside 10 in. dia. drain line (Cast iron)	Inactive
HD-50a	92+31.7M	Jet fuel line	8 in. dia. pipe - Steel	Inactive

There are no penetrations numbered HD-39 to HD-42.

2.2 Encroachments

Encroachments on or around the floodwall are also shown in Figs. 2 and 3 include the following:

- Pipes mounted on the riverside face of the floodwall and along the south oil dock.
- Cable trays mounted to the top of the floodwall.
- A utility bridge spanning from the PBF to the top of the floodwall.
- Catwalks spanning from Screenhouses No. 1 and No. 3 to the top of the floodwall.

There are also two stairways over the floodwall, but we do not consider these encroachments because they enhance accessibility to the riverside of the floodwall and can aid in inspections during periods of high water that require the operation of Closure Structure No. 4.

2.3 Intake and Discharge Tunnels

The cooling water for previously retired and removed Units 1 and 2 was conveyed by 9.5 ft tall by 7 ft wide concrete tunnels. The tunnels predate the floodwall construction. The intake tunnel runs from Screenhouse No. 2 to the PBF, roughly perpendicular to the floodwall (Fig. 4). The discharge tunnel runs directly above the intake tunnel in an integrated, double-barrel configuration, then runs south on the riverside of the floodwall, and finally turns eastward toward the river, where the tunnel outlets into a discharge channel, which is separated from the main river channel by a steel sheet pile wall. The floodwall includes a steel sheet pile cutoff wall embedded in its riverside toe. The tips of the sheet piles are at approximately El. -20 ft[1]. The sheet piles extend full depth up to the exterior face of the vertical tunnel walls, and where they cross the tunnels, extend to the discharge (upper) tunnel roof. A dumped concrete seal is placed on either side of the sheet pile on the tunnel roof. There do not appear to be any seals between the full-depth sheet piles and the tunnel walls. The bottom of the intake (lower) tunnel is at approximately El. -14 ft, about 6 ft above the full-depth sheet pile tips.

[1] Elevations in this report are referenced to the National Geodetic Vertical Datum of 1929.

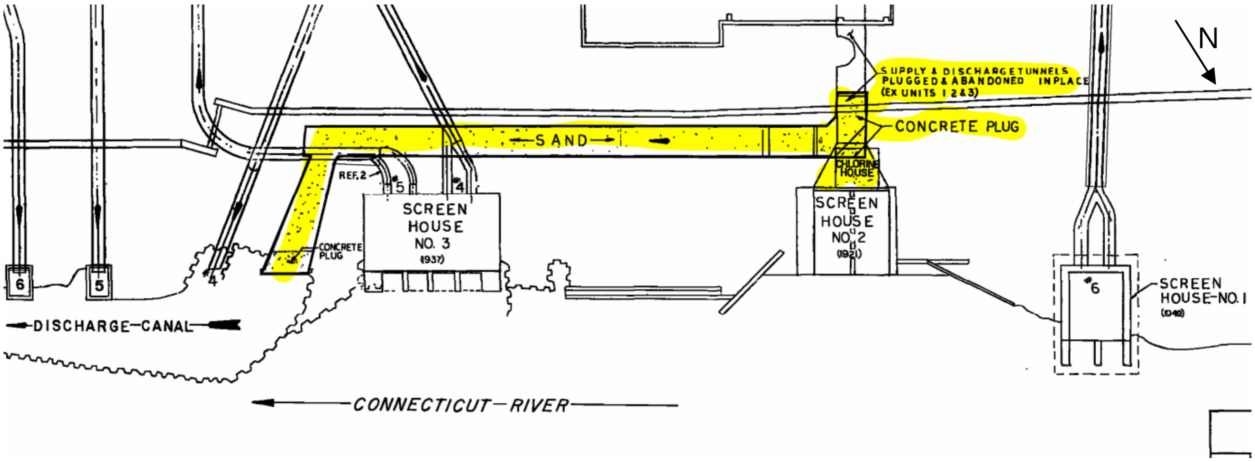

Figure 4. Plan view showing intake and discharge tunnels for former Units 1 and 2 (from HFCS 1981 Operation and Maintenance Manual).

After the retirement of Units 1 and 2 in the 1970s, both tunnels were abandoned. Based on a drawing that was included in the 1981 HFCS Operations and Maintenance Manual, both tunnels were abandoned by bulkheading the tunnels on either side of the floodwall and filling them with concrete to create an internal concrete plug. On the riverside, the discharge tunnel was filled with sand from the concrete plug to a second concrete plug at the discharge canal.

The GHFC has expressed concern that if the concrete plug in the discharge tunnel in the discharge canal were to be damaged, the sand could ravel out of the tunnel. If the empty tunnel were then to collapse, undermining of the floodwall toe could occur. In our opinion, the probability of these multiple events occurring is remote and unlikely to occur in one flooding event. However, given that the Facility has permanently ceased operation and is no longer staffed on a daily basis, it is possible that these multiple events could begin and progress for a period of time before being discovered during a periodic inspection.

To reduce the likelihood of this potential failure mode, MDA should consider replacing the sand fill with a more erosion-resistant material, such as flowable fill.

The width of the gaps between the steel sheet piles and the vertical tunnel walls is unknown. Seepage tends to concentrate around openings in seepage barriers, potentially leading to excessive seepage flow and sand boils. As part of the design, seepage analyses should be performed to estimate the seepage gradients for a hypothetical gap width. If the gradients exceed USACE maximums, it may be necessary to perform jet or permeation grouting to seal the gap. Grouting involves drilling a series of holes near the sheet pile-tunnel interface and injecting cement or chemical grout to reduce the soil permeability in the vicinity of the gap. Costs of grouting are not included in our evaluation because neither the necessity nor the scope of grouting can be determined without performing the seepage analyses.

3. GUIDELINES FOR ABANDONMENT OF PENETRATIONS

Guidelines for abandonment of penetrations are provided in USACE Engineer Manual EM 1110-2-2902, Engineering and Design, Conduits, Pipes, and Culverts Associated with Dams and Levee Systems, dated 31 December 2020. The two methods outlined in the USACE manual are removal and in-place decommissioning (i.e., infilling a pipe).

USACE indicates that in most cases, in-place decommissioning is more feasible than pipe removal due to technical and cost considerations. Except for the shallow burial depth of HD-50a, pipe removal is infeasible. Most of the pipes pass under the floodwall and through the steel sheet pile cutoff wall embedded in the toe of the floodwall footing. Removal would be very challenging, as it would require accessing the underside of the footing, supporting it during the work, and patching holes in the sheet pile cutoff wall.

The infilling process consists of bulkheading the pipe on both ends, cleaning and inspecting the interior of the pipe, and filling the pipe. Infilling materials include conventional concrete, cellular concrete (which includes a foaming agent to reduce its density), and cement grout. Filling is achieved by pumping the infill material into a port in one bulkhead until the pipe is filled. A port is also provided in the other bulkhead to allow for venting of air. If the pipe is sloped, the infill is pumped into the low side of the pipe to reduce the likelihood of trapping air in the pipe.

4. SCOPE OF WORK FOR ABANDONMENT OF UTILITIES AND REMOVAL OF ENCROACHMENTS

The scope of work for the abandonment of each utility and removal of encroachments is described below. While the process for abandoning each utility is similar, the configuration and access requirements vary. Many of the pipes require excavations to provide access to the pipe exterior. To minimize the footprint of the excavation, the sides of the excavation are often supported with a support of excavation (SOE) system. The SOE, which is typically designed by the contractor as part of their means and methods, could consist of sheet piles, timber sheeting, or a prefabricated trench box.

For pipes with diameters 14 in. and smaller, cement grout should be used due to flowability considerations. For pipes with diameters larger than 14 in., concrete can be used as a backfill material.

It is important to note that the property is subject to an Environmental Land Use Restriction (ELUR) that has been recorded in the City of Hartford’s Land Records. The ELUR serves as an institutional control over site-wide soil contamination, and it includes a prohibition against any on-site soil disturbance activities without first obtaining approval (a temporary release of the ELUR) from the Connecticut Department of Energy & Environmental Protection (CT DEEP). A soil management plan will have to be implemented to ensure that contaminated soil encountered during project work is properly controlled to protect human health and the environment, and all excavation, backfilling, and surface restoration work will have to be overseen by a Connecticut Licensed Environmental Professional (LEP).

4.1 HD-36 (Roof Drain Outfall)

Existing Conditions

HD-36 is a 12 in. cast-iron roof drainpipe passing below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. This pipe also receives stormwater runoff from the paved parking lot area located between the floodwall and the Facility's administrative building. The pipe invert is located approximately 9 ft below existing grade. The pipe has a gate valve in the valve chamber immediately to the landside of the floodwall and a flap valve at the outfall end of the pipe on the riverside.

Abandonment Scope

- Reroute the roof drain and parking lot catch basins to other storm drainage facilities.
- Cut pipe inside valve chamber and remove gate valve.
- Clean and inspect the pipe.
- Install internal bulkheads.
- Fill the pipe with cement grout from the riverside bulkhead.
- Cap the pipe ends[2].
- Fill the valve chamber with cellular concrete[3].

4.2 HD-37 (Inactive Compressed Air and Water)

Existing Conditions

HD-37 consists of three pipes with diameters of 1, 1.5, and 6 in., leading to the abandoned Chlorine House. The pipe inverts are located approximately 5 ft below existing grade.

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[2] Bulkheads can remain in place if they do not interfere with the installation of the caps at the pipe ends.
[3] Cellular concrete includes a foaming agent to reduce its density. The use of cellular concrete instead of higher density concrete can reduce the risk of settlement of the valve chamber due to the weight of the concrete.

Abandonment Scope

- Excavate an access pit on each side of the floodwall.
- Cut the pipes on each side of the floodwall.
- Clean and inspect the pipe.
- Install internal bulkheads.
- Fill the pipes with cement grout.
- Cap the pipe ends.
- Backfill the excavations and restore ground surface elevations and conditions to match the elevations and conditions prior to excavation (including pavement).

4.3 HD-38 (Inactive Unit 6 Non-Contact Cooling Water Intake)

Existing Conditions

HD-38 is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. This pipe formerly served as the cooling water intake for the Unit 6 steam condenser. The pipe runs from pumps inside Screenhouse No. 1 to the PBF. The pipe invert is approximately 21 ft below existing grade.

Abandonment Scope

- Install SOE on the landside of the pipe. The SOE will need to be set back about 25 ft from the floodwall stem to avoid conflicting with the floodwall footing and toe drain.
- Cut the pipe inside the SOE and at the discharge side of the pump in Screenhouse No. 1.
- Clean and inspect the pipe.
- Install internal bulkheads.
- Fill the pipe with concrete.
- Cap the pipe ends.
- Backfill the excavation and remove the SOE.

- Restore ground surface elevations and conditions to match the elevations and conditions prior to excavation (including pavement).

4.4 HD-43 (Inactive Service Water Intake)

Existing Conditions

HD-43 is a 24 in. metal pipe inside a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. The 48 in. pipe formerly served as the cooling water intake for the Unit 4 steam condenser. The 24 in. inner pipe, which was installed later, served as a service water intake. It is not known if the inner pipe was grouted inside the 48 in. diameter pipe or simply placed inside. This should be confirmed prior to and as part of the design process. The pipes run from pumps inside Screenhouse No. 3 to the PBF. The outer pipe invert is approximately 11 ft below existing grade.

Abandonment Scope

- Install SOE on the landside of the pipe. The SOE will need to be set back about 25 ft from the floodwall stem to avoid conflicting with the existing floodwall footing and toe drain.
- Cut the pipes inside the SOE and at the discharge side of the pump in Screenhouse No. 3.
- Clean and inspect the 24 in. inner pipe. Remove the inner pipe if the annulus between the inner 24 in. and outer 48 in. pipes is not grouted.
- Install internal bulkheads.
- Fill the 24 in. pipe with concrete.
- Cap the pipe ends.
- Backfill the excavation and remove the SOE.
- Restore ground surface elevations and conditions to match the elevations and conditions prior to excavation (including pavement).

4.5 HD-44 (Inactive Unit 5 Non-Contact Cooling Water Intake)

Existing Conditions

HD-44 is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. This pipe formerly served as the cooling water intake for the Unit 5 steam condenser. The pipe invert is approximately 14 ft below existing grade. The pipe runs from pumps inside Screenhouse No. 3 to the PBF.

Abandonment Scope

- Install SOE on the landside of the pipe. The SOE will need to be set back about 45 ft from the floodwall stem to avoid conflicting with the existing floodwall footing and toe drain.
- Cut the pipe inside the SOE and at the discharge side of the pumps in Screenhouse No. 3.
- Clean and inspect the pipe.
- Install internal bulkheads.
- Fill the pipe with concrete.
- Cap the pipe ends.
- Backfill the excavation and remove the SOE.
- Restore ground surface elevations and conditions to match the elevations and conditions prior to excavation (including pavement).

4.6 HD-45 (Inactive Water Discharge)

Existing Conditions

HD-45 is a 14 in. cast-iron water discharge pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. This pipe is adjacent and parallel to HD-46. The pipe invert is approximately 11 ft below existing grade. The pipe runs from the PBF to an outfall headwall in the river.

Abandonment Scope

- Install SOE on the landside of the pipe. This SOE will also include HD-46. The SOE will need to be set back about 25 ft from the floodwall stem to avoid conflicting with the existing floodwall footing and toe drain.
- Clean and inspect the pipe.
- Install an internal bulkhead on the riverside of the floodwall. To avoid excavation on the riverside of the floodwall or accessing the pipe through its discharge end, which is typically submerged, the riverside bulkhead could be a sacrificial, inflatable balloon plug installed 20 ft from the floodwall toe toward the outfall end.
- Install a short elbow section on the landside end, pointing upward, with its top about 6 in. higher than the crown of the existing pipe.
- Fill the pipe with cement grout via a tremie pipe inserted from the landside, extending to the riverside bulkhead. Pump until the grout overflows the elbow.
- Cap the landside end of the pipe.
- Backfill the excavation and remove the SOE.
- Restore ground surface elevations and conditions to match the elevations and conditions prior to excavation (including pavement).

4.7 HD-46 (Inactive Service Water Discharge)

Existing Conditions

HD-46 is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. This pipe formerly served as the service water discharge and is adjacent and parallel to HD-45. The pipe invert is approximately 14 ft below existing grade. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river.

Abandonment Scope

- Install SOE on the landside of the pipe. This SOE will also include HD-45. The SOE will need to be set back about 25 ft from the floodwall stem to avoid conflicting with the existing floodwall footing and toe drain.
- Cut the pipe inside the SOE.

- Clean and inspect the pipe.
- Install an inflatable balloon plug 20 ft from the floodwall toe toward the outfall.
- Install an internal bulkhead on the landside end of the pipe.
- Fill the pipe with concrete via a tremie pipe inserted from the landside, extending to the riverside bulkhead. Pump until the concrete overflows the elbow.
- Cap the landside end of the pipe.
- Backfill the excavation and remove the SOE.
- Restore ground surface elevations and conditions to match the elevations and conditions prior to excavation (including pavement).

4.8 HD-47 (Inactive Unit 5 Non-Contact Cooling Water Discharge)

Existing Conditions

HD-47 is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. This pipe formerly served as the cooling water discharge for the Unit 5 steam condenser. The pipe invert is approximately 21 ft below existing grade. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river.

Abandonment Scope

- Install SOE on the landside of the pipe. The SOE will need to be set back about 45 ft from the floodwall stem to avoid conflicting with the existing floodwall footing and toe drain.
- Cut the pipe inside the SOE.
- Clean and inspect the pipe.
- Install an inflatable balloon plug 20 ft from the floodwall toe toward the outfall.
- Install an internal bulkhead on the landside end of the pipe.
- Fill the pipe with concrete via a tremie pipe inserted from the landside, extending to the riverside bulkhead. Pump until the concrete overflows the elbow.
- Cap the landside end of the pipe.

- Backfill the excavation and remove the SOE.
- Restore ground surface elevations and conditions to match the elevations and conditions prior to excavation (including pavement).

4.9 HD-47a (Inactive Unit 6 Non-Contact Cooling Water Discharge)

Existing Conditions

HD-47a is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. This pipe formerly served as the cooling water discharge for the Unit 6 steam condenser. The pipe invert is approximately 14 ft below existing grade. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river.

Abandonment Scope

- Install SOE on the landside of the pipe. The SOE will need to be set back about 45 ft from the floodwall stem to avoid conflicting with the existing floodwall footing and toe drain.
- Clean and inspect the pipe.
- Install an inflatable balloon plug 20 ft from the floodwall toe toward the outfall.
- Install an internal bulkhead on the landside end of the pipe.
- Fill the pipe with concrete via a tremie pipe inserted from the landside, extending to the riverside bulkhead. Pump until the concrete overflows the elbow.
- Cap the landside end of the pipe.
- Backfill the excavation and remove the SOE.
- Restore ground surface elevations and conditions to match the elevations and conditions prior to excavation (including pavement).

4.10 HD-48 (Inactive Former Ash Pit Outfall)

Existing Conditions

HD-48 is a 12 in. cast-iron pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. The pipe invert is approximately 25 ft below existing grade. The pipe has a gate valve in the valve chamber immediately to the landside of the floodwall and a flap valve at the outfall end of the pipe on the riverside. Formerly an ash pit outfall, the pipe was later cut and capped landward of the valve chamber.

Abandonment Scope

- Cut pipe inside valve chamber and remove gate valve. Remove the flap valve at the outfall end.
- Clean and inspect the pipe.
- Install internal bulkheads.
- Fill the pipe with cement grout from the riverside bulkhead.
- Cap the pipe ends.
- Fill the valve chamber with cellular concrete.

4.11 HD-49 (Inactive Oil Line in Former Ash Pit Outfall)

Existing Conditions

HD-49 is an 8 in. steel pipe that was placed inside of a 10 in. cast-iron pipe that passes through the below-grade portion of the floodwall stem. The outer pipe invert is approximately 16 ft below existing grade. The original 10 in. pipe was an outfall for a former ash pit. The pipe discharged at a headwall on the riverbank on the riverside of the floodwall. On the landside of the floodwall, the pipe passed through a valve chamber and towards the ash pit. The 8 in. oil line runs from the south dock to the headwall, where it enters the original pipe. The newer oil line runs into the valve chamber, where the original pipe was cut. The pipe then bends 90 degrees and rises vertically in the valve chamber to approximately 5 ft below the top of the chamber. The pipe then bends 90 degrees and runs horizontally through the landside wall of the valve chamber, into a second valve chamber that shares a wall with the first, and then towards the Facility. The pipe has been cut inside the second valve chamber, with blind flanges attached to both cut ends.

Abandonment Scope

- Remove, containerize, and properly dispose offsite any residual fuel remaining in the pipe, without spilling any into the environment. Remove the 8 in. pipe from the south dock to the headwall.

- Cut the 8 in. pipe at the riverward valve chamber and remove the pipe within the valve chambers.
- Clean and inspect the 8 in. inner pipe. Remove the inner pipe if the annulus between the inner 8 in. and outer 10 in. pipes is not grouted.
- Install bulkheads.
- Fill the pipe with cement grout from the riverside bulkhead.
- Cap the 10 in. pipe ends.
- Fill the valve chambers with cellular concrete.

4.12 HD-50a (Inactive Liquid Fuel Line)

Existing Conditions

HD-50a is an 8 in. steel pipe, formerly carrying liquid fuel. The pipe runs from the south dock and then turns south (downriver) and then runs just below the ground surface in a 2 ft by 2 ft concrete encasement up on the dike riverside slope (the flood protection system transitions from floodwall to earth embankment just south of the south dock). The pipe then runs up over the dike crest, and down the landside dike slope. The top of the encasement is flush with the surrounding ground surface. The pipe terminates at the south dock with a gate valve and blind flange. The pipe invert is approximately 1 ft below existing grade.

Abandonment Scope

- Remove, containerize, and properly dispose offsite any residual fuel remaining in the pipe, without spilling any into the environment.
- Remove the pipe and concrete encasement from the end of the south dock to the landside dike toe.
- Backfill the excavation on the dike slope with compacted fill consistent with the surrounding soils (low-permeability clay topped with riprap on the riverside, sand topped with topsoil and seed on the landside).

4.13 Miscellaneous Encroachment Removal

There are several miscellaneous encroachments at or above grade. All miscellaneous encroachments can be removed with conventional construction equipment. Anchor holes should be patched appropriately with caulk or grout, with special attention paid to any holes that pass through the entire floodwall.

4.14 Discharge Tunnel Re-Backfilling

Re-Backfilling Scope

- Install SOE on the riverside of the floodwall, on top of the tunnel, to access the tunnel roof.
- Cut hole in the tunnel roof.
- Excavate sand backfill. Vacuum excavation methods could be used to clear enough room to lower a skid steer into the tunnel to complete the excavation.
- Clean and inspect tunnel walls.
- Backfill the tunnel with flowable fill.
- Backfill the excavation and remove the SOE.

4.15 General Site Work

In addition to the work described above, the work requires general site work, including:

- Development of a soil management plan to ensure proper handling of contaminated soil that will likely be encountered during excavation activities.
- Mobilization and demobilization.
- Site preparation, including installation of erosion and sediment controls, removal and disposing of asphalt, and establishment of soil management area(s).
- Dewatering, including pumping, system maintenance, and treatment of dewatering effluent. The normal river level is below the pipe invert elevations. However, the flow rate into the dewatering systems is expected to increase during periods of higher water (not necessarily flooding conditions). This is particularly true for HD-38 and HD-47, which are deeper than the other pipes.
- Utility location, including ground penetrating radar (GPR) survey and potholing to confirm GPR results.

- Restoration of surface conditions to meet pre-existing elevations and materials (i.e., asphalt pavement at least 3 in. thick).
- As-built survey and drawings and LEP documentation and certification for the work.

5. COST ESTIMATE

The estimated cost of the work described in Section 4 is about $2.65 million. Table 2 provides a further breakdown of the cost estimate. The estimate carries a 40% contingency, which reflects the conceptual level of project development at present. The cost estimate does not include disposal of asbestos-containing materials, any other hazardous building materials, or hazardous materials within the existing lines. The cost estimate assumes that the excavated soils can be reused as backfill. If environmental testing indicates that the soil cannot be reused as backfill, we estimate the additional cost to dispose of soil offsite and backfill the excavations with imported fill is $550,000.

Table 2. Cost estimate for utility abandonment and penetration removal.

Item	Cost
Mobilization and demobilization	$25,000
Site preparation	$70,000
Dewatering and treatment of effluent	$115,000
Utility location	$70,000
Excavate, clean, and bulkhead pipes	$660,000
Fill pipes and valve chambers	$175,000
Miscellaneous encroachment removal	$30,000
Tunnel re-backfilling	$400,000
As-builts	$20,000
Restoration of surface conditions	$10,000
LEP services	$42,000
Subtotal:	**$1,617,000**
Overhead, profit, insurance, and payment bond (17%)	$274,890
Subtotal:	**$1,891,890**
Contingency (40%)	$756,756
Estimated total construction cost:	**$2,648,646**

The cost estimate does not include design and permitting for the work. Permits that may be required include:

- USACE Section 404 Discharge of Dredged or Fill Material into Waters of the U.S.
- USACE Section 408 Request to Alter a USACE Civil Works Project.

- CT DEEP Section 401 Water Quality Certification.
- CT DEEP Dam Safety Permit.
- CT DEEP General Stormwater Permit.
- Temporary release from the Environmental Land Use Restrictions by CT DEEP Remediation Division.

6. LIMITATIONS

These construction cost estimates presented herein are opinions of the probable construction cost made by an engineering consultant. Neither the client nor SGH has control over the cost of labor, equipment, materials, or the contractor's means and methods of determining constructability, pricing, or schedule. These opinions of probable construction costs are based on our reasonable professional judgment and experience and do not constitute a warranty, express or implied, that contractor bids or negotiated prices for the work will not vary from those provided herein.

Sincerely yours,

Justin A. Dominguez, P.E.
Senior Project Manager
CT License No. PEN.0037690

Bryan P. Strohman, P.E.
Principal
CT License No. PEN.0033461

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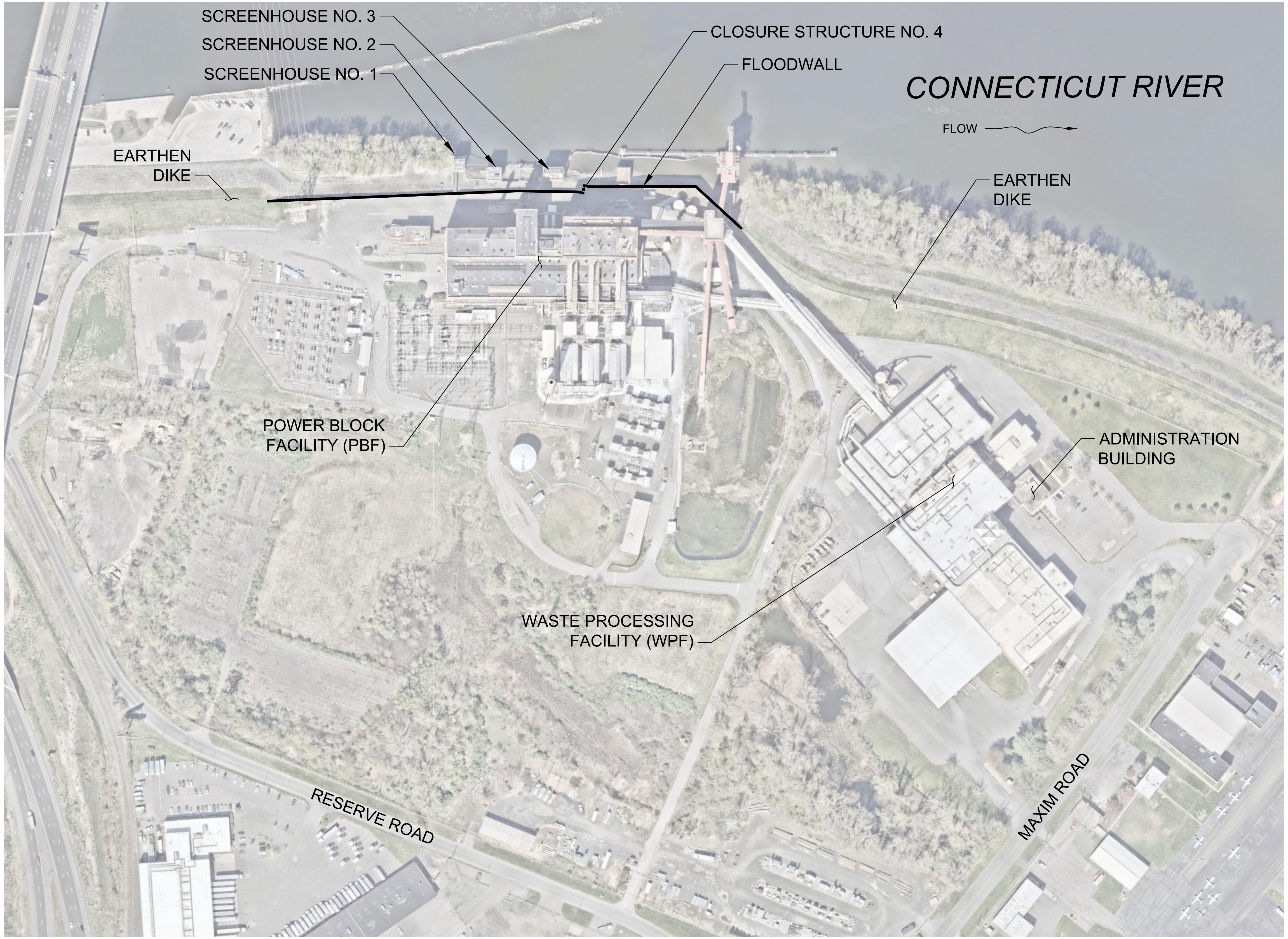
Encls.
cc: Robert Carr, P.E., LEP, Weston & Sampson



NOTES:
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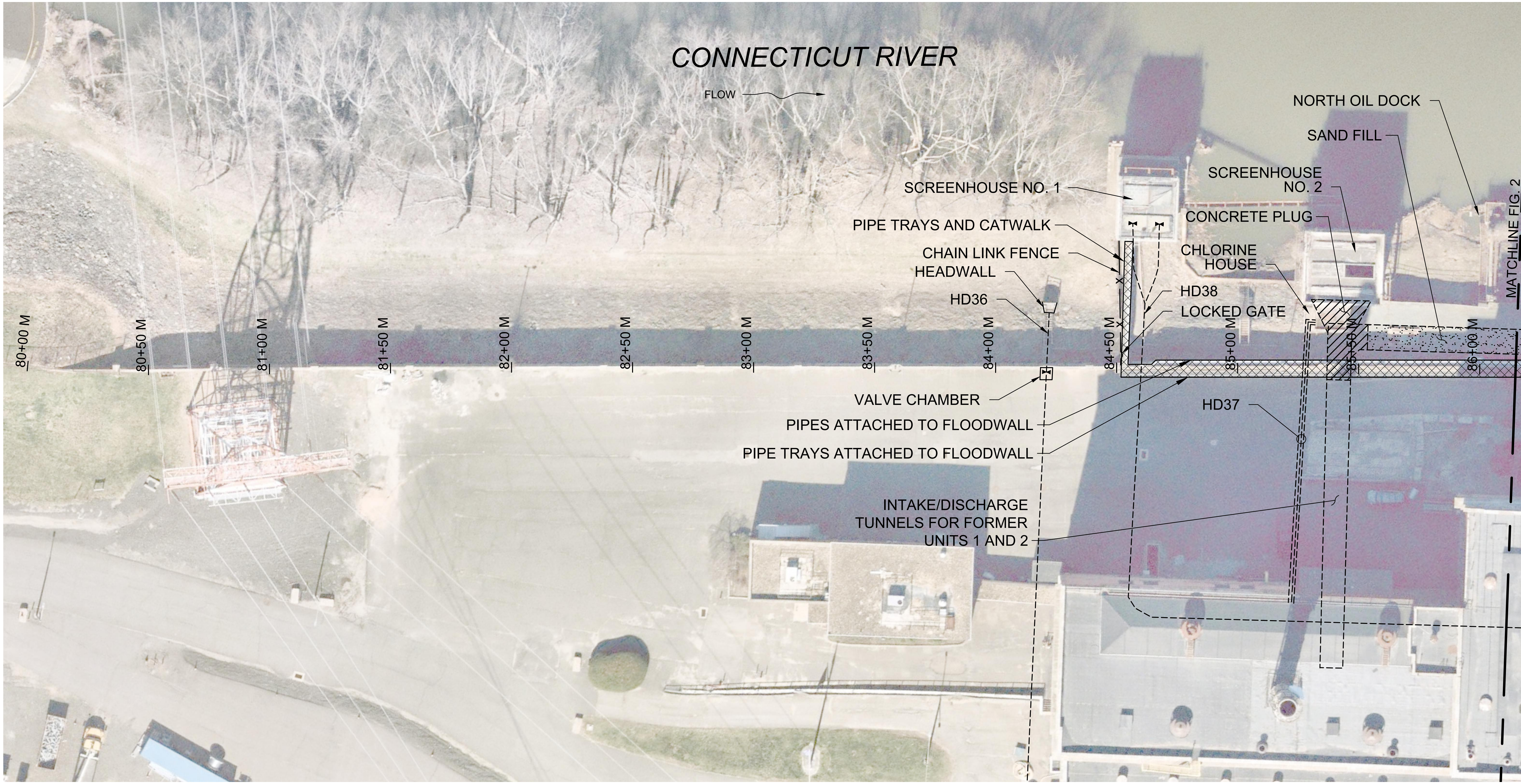
0 125' 250' 500' 750' 1000'

1" = 250'-0"

SIMPSON GUMPERTZ & HEGER
480 Totten Pond Road
Waltham, MA 02451
781.907.9000
sgh.com

Project:	MIRA DISSOLUTION AUTHORITY FLOODWALL PENETRATION ABANDONMENT AND ENCROACHMENT REMOVAL
Title:	SITE PLAN
Drawn:	RKP
Checked:	JAD
Approved:	BPS
Project No.:	240840
Drawing No.:	FIG. 1
Scale:	1" = 250'-0"
Date:	9/13/2024



NOTES:
1. AERIAL PHOTO © 2023 NEARMAP. REPRODUCED WITH PERMISSION.
2. LOCATIONS AND FLOOD CONTROL SYSTEM STATIONING HAVE NOT BEEN VERIFIED WITH SITE SURVEY AND THEREFORE, SHOULD BE CONSIDERED APPROXIMATE.

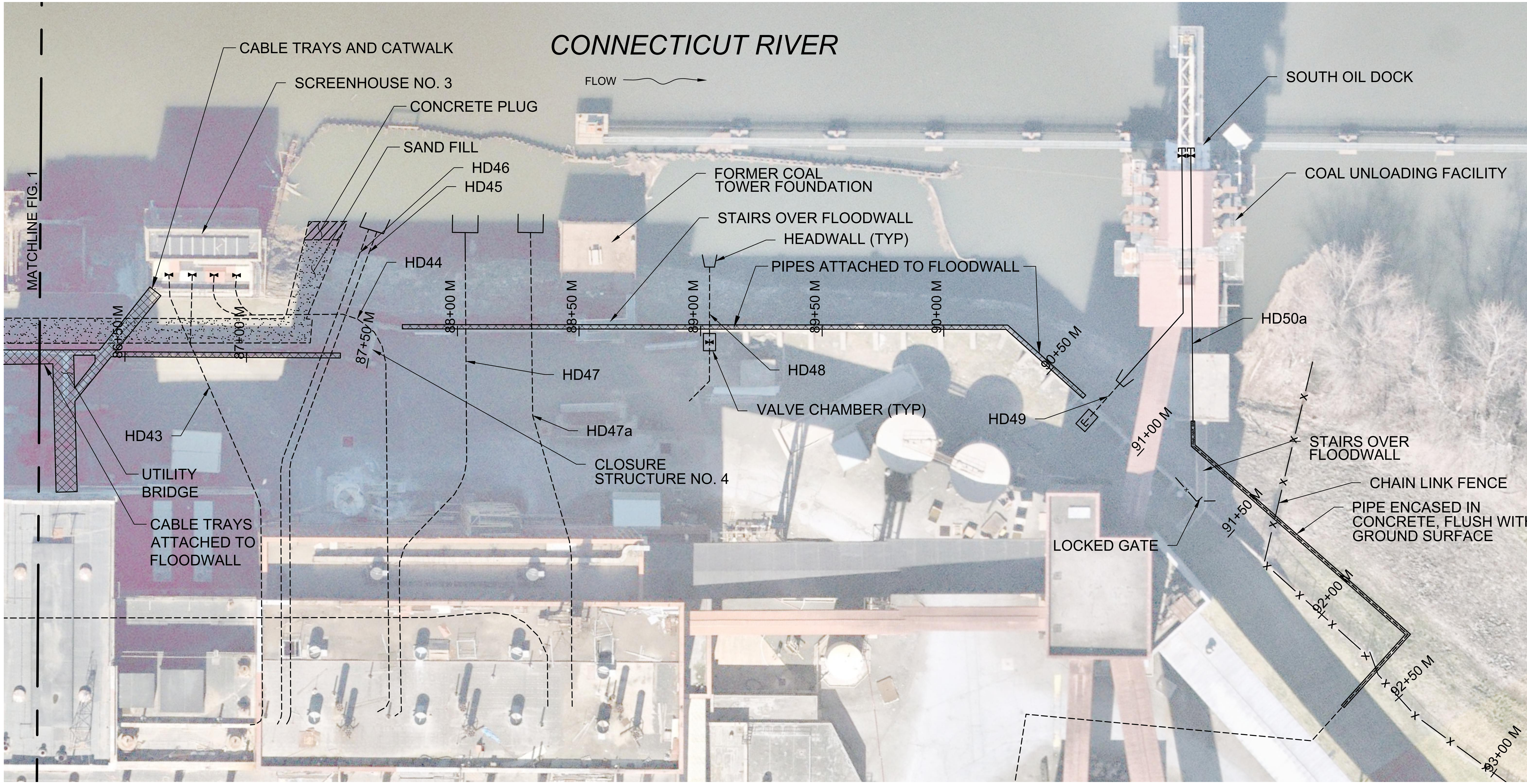
LEGEND:
- — — — BELOW GROUND PIPE
- ——— ABOVE GROUND PIPE
- GATE VALVE
- BLIND FLANGE

0 20' 40' 80' 120' 160'

1" = 40'-0"

SIMPSON GUMPERTZ & HEGER
480 Totten Pond Road
Waltham, MA 02451
781.907.9000
sgh.com

Project:	MIRA DISSOLUTION AUTHORITY FLOODWALL PENETRATION ABANDONMENT AND ENCROACHMENT REMOVAL
Title:	PENETRATION LOCATIONS
Drawing No.:	FIG. 2
Scale:	1" = 40'-0"
Drawn:	RKP
Checked:	JAD
Approved:	BPS
Project No.:	240840
Date:	10/2/2024



NOTES:
1. AERIAL PHOTO © 2023 NEARMAP. REPRODUCED WITH PERMISSION.
2. LOCATIONS AND FLOOD CONTROL SYSTEM STATIONING HAVE NOT BEEN VERIFIED WITH SITE SURVEY AND THEREFORE, SHOULD BE CONSIDERED APPROXIMATE

LEGEND:
- BELOW GROUND PIPE
- ABOVE GROUND PIPE
- GATE VALVE
- BLIND FLANGE

0 20' 40' 80' 120' 160'

1" = 40'-0"

SIMPSON GUMPERTZ & HEGER
480 Totten Pond Road
Waltham, MA 02451
781.907.9000
sgh.com

Project:	MIRA DISSOLUTION AUTHORITY FLOODWALL PENETRATION ABANDONMENT AND ENCROACHMENT REMOVAL
Title:	PENETRATION LOCATIONS
Drawing No.:	FIG. 3
Scale:	1" = 40'-0"
Drawn:	RKP
Checked:	JAD
Approved:	BPS
Project No.:	240840
Date:	10/2/2024

Attachment 3

FLOODWALL PENETRATION OPERATION, MAINTENANCE, AND INSPECTION PLAN

Materials Innovation and Recycling Authority
Resource Recovery Facility
Hartford, CT
2 October 2024 **DRAFT**

PREPARED FOR
MIRA Dissolution Authority
300 Maxim Road
Hartford, CT 06114

PREPARED BY
Simpson Gumpertz & Heger Associates, Inc.
480 Totten Pond Road
Waltham, MA 02451
O: 781.907.9000

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ILLUSTRATIONS

APPENDICES

ABBREVIATIONS

CCTV	Closed-Circuit Television
DAS	Department of Administrative Services
DPW	Department of Public Works
dia.	Diameter
El.	Elevation
EPP	Emergency Preparedness Plan
ft	Feet
GHFC	Greater Hartford Flood Commission
HFCS	Hartford Flood Control System
in.	Inch, inches
MDA	MIRA Dissolution Authority
MIRA	Materials Innovation and Recycling Authority
M.S.L.	Mean Sea Level
NGVD 29	National Geodetic Vertical Datum of 1929
No.	Number
NWS	National Weather Service
OIM	Operation, Inspection, and Maintenance
O&M	Operation and Maintenance
PBF	Power Block Facility
USACE	U.S. Army Corps of Engineers
WPF	Waste Processing Facility

1. INTRODUCTION

1.1 Background

The Materials Innovation and Recycling Authority (MIRA) Resource Recovery Facility (the Facility) is a shuttered trash-to-energy power plant in the South Meadows Section of Hartford, Connecticut (Fig 1). The Facility, constructed in the 1920s, was originally coal-fired, then transitioned to a combination of oil and coal. In the 1980s, a waste processing facility (WPF) was constructed at the site, and the power plant was converted for trash-to-energy use. The power plant portion of the site is referred to as the power block facility (PBF) to differentiate it from the WPF. The Facility stopped receiving, processing, and combusting waste in July 2022. Over the life of the Facility, there were six generating units, two of which (Units 5 and 6) were in use when operations ceased.

The Facility is located along the west bank of the Connecticut River. In response to the devastating floods in 1936 and 1938, the U.S. Army Corps of Engineers (USACE) constructed a flood control system to reduce flooding risks. The Hartford Flood Control System (HFCS) consists of earthen dikes, concrete floodwalls, closure structures, and structures to facilitate drainage inside the protected area. The HFCS passes through the Facility, with most of the area adjacent to the PBF consisting of concrete floodwall. Several penetrations through the floodwall allow for passage of pipes between the landside and the riverside.

After construction, the USACE handed over management of the flood control infrastructure to the City of Hartford as the Local Sponsor. The Greater Hartford Flood Commission (GHFC), a consortium of the communities protected by the HFCS, is presently the Local Sponsor.

In June 2024, the successor to MIRA, the MIRA Dissolution Authority (MDA), retained the services of Weston & Sampson Engineers, Inc. and its team, including Simpson Gumpertz & Heger Associates, Inc. to prepare a Redevelopment Considerations Study for the Facility. One of the Study's tasks was the review and documentation of penetrations through the HFCS floodwall, including the preparation of this Floodwall Penetration Operation, Inspection, and Maintenance Plan.

1.2 Purpose of Plan

The purpose of this plan is to provide guidance for the operation, inspection, and maintenance (OIM) of the penetrations at the Facility, which are important to the overall performance of the flood protection system. The companion to this OIM plan is the latest version of the Floodwall Penetration Emergency Preparedness Plan, which outlines the roles and responsibilities of those in charge of monitoring for and responding to emergency conditions involving penetrations through the floodwalls at the Facility.

Operations of other components of the HFCS, including the sections of floodwall and earthen dike within the Facility, are documented in the Operation & Maintenance Manual (O&M) for the Hartford Local Protection Project, Connecticut and Park Rivers (the HCFS O&M Manual).

1.3 Roles and Responsibilities

1.3.1 MIRA Dissolution Authority / Department of Administrative Services

The MDA was created by an act of the State of Connecticut Legislature – Public Act 23-170, effective 1 July 2023. As a result of this legislation, the MDA replaced MIRA and assumed MIRA's statutory duties and responsibilities.

The MDA is responsible for the operations, inspection, and maintenance of the penetrations through the HFCS within the Facility.

It is important to note that Public Act 23-170 also establishes the State of Connecticut Department of Administrative Services (DAS) as the successor agency to MDA, effective 1 July 2025. Therefore, DAS will assume responsibility for the operations, inspection, and maintenance of the penetrations through the HFCS within the Facility on 1 July 2025.

1.3.2 Greater Hartford Flood Commission

The GHFC is the regulatory authority with stewardship over public works constructed in the Greater Hartford area for the purpose of flood control on the Connecticut and Park Rivers, and on the tributaries of the Park River. The GHFC consists of seven members appointed by the governor, four being from the City of Hartford and one each from the towns of Bloomfield, Newington, and West Hartford.

The general duties and authorities of the GHFC and its designees include:

- Act for the elimination, prevention, and control of flooding and flood damage in the areas falling under its jurisdiction.
- Construct, supervise, operate, maintain, and dispose of flood control works such as dikes, floodwalls, pumping stations, reservoirs, sewer systems, conduits, bridges, highways, etc.
- Issue regulations for the purpose of flood control.
- Provide assurances to the Secretary of the Army regarding federally constructed flood control works.

1.3.3 City of Hartford Department of Public Works (DPW)

Maintenance of the HFCS is conducted by a permanent staff under the direction and supervision of the Department of Public Works for the City of Hartford. Hartford DPW's areas of responsibility include:

- Complete operation of the project during flood periods.
- Determining phases of preparedness, mobilization, and operations based on: National Weather Service (NWS) river and weather forecasts, and river stages on the Park River at Pope Park pumping station and on the Connecticut River at Hartford (Bulkeley Bridge).
- Training personnel in specific duties and holding periodic practice sessions to ensure efficient and effective maintenance and operation.
- Maintaining adequate contact with the NWS to obtain weather and flood forecasts.
- Maintenance of all project features.

1.3.4 National Weather Service

The NWS has no direct role in the operations of the project; however, it has the responsibility of issuing weather and flood forecasts to the general public. The NWS maintains the Northeast River Forecast Center at Bloomfield, Connecticut, which is the official agency for issuing flood watches, warnings, and forecasts in the Connecticut River basin. River forecasts for the

Connecticut River (U.S. Geologic Survey Gage # 01190070 at the Bulkeley Bridge) can be viewed online, at https://water.noaa.gov/gauges/HFDC3. Weather forecasts and reports for the area are issued by the NWS office at Bradley Field in Windsor Locks.

1.3.5 U.S. Army Corps of Engineers

The USACE Reservoir Control Center continually monitors rainfall and runoff conditions in much of New England. This climatologic and hydrologic information is available upon request online at http://www.reservoircontrol.com.

1.4 Elevation Datum

The elevations in this manual are referenced to the National Geodetic Vertical Datum of 1929 (NGVD or NGVD 29), also referred to as Mean Sea Level (M.S.L.) in USACE record drawings for the HFCS. The Bulkeley Bridge gage zero is set to NGVD, so all gage readings indicate the water elevation in feet NGVD.

1.5 Description of Flood Control System within MIRA Facility Limits

The section of the HFCS within the Facility consists of portions of earthen dike and floodwall. The earthen dikes generally consist of freely draining river sand with a clay blanket and stone riprap face on the riverside slope, a steel sheet pile seepage cutoff wall at the riverside toe, and a gravel toe drain at the landside toe. The landside slope is three units horizontal to one unit vertical (3H:1V). The riverside slope varies from 2.5H:1V to 3H:1V.

The floodwalls consist of reinforced concrete T-wall with a steel sheet pile seepage cutoff wall embedded in the riverside toe and a gravel toe drain at the landside heel. South of the former coal tower, 2 ft wide concrete buttresses are provided on approximately 11 to 15 ft centers. The ground to the riverside of the floodwall is generally flat between Screenhouses No. 1 and No. 3 with a steel sheet pile bulkhead and the walls of the screenhouses providing grade separation from the river. To the north and south of the screenhouses, the riprap-face ground slopes down toward the river at slopes ranging from 2H:1V to 1H:1V.

The floodwall originally had three openings. Two of them, a bulkhead door and a 6 ft wide stop-log closure, were permanently plugged with reinforced concrete in 2015. The remaining opening (referred to as Closure Structure No. 4 in the GHFC O&M Manual) is closed during high water with aluminum panels stored in a rack attached to an adjacent section of floodwall. Locked chain link fences prevent unauthorized access along fence lines to the north of Screenhouse No. 1, to the south of the floodwall, and through Closure Structure No. 4.

2. DESCRIPTION OF PENETRATIONS

2.1 General

Descriptions for the penetrations within the Facility are provided below. Over time, some penetrations through the floodwall have been properly abandoned, either by removing them or filling them with concrete as they cross through or under the floodwall. To reduce confusion, these abandoned penetrations are not listed in this manual. The remaining, non-abandoned penetrations are shown in Figs. 2 and 3 and summarized in Table 1. Most of these penetrations are inactive. Inactive means that the penetration is no longer used but has not been removed or properly abandoned. Inactive status does not mean that a penetration does not pose a potential risk to the flood control system. Therefore, these penetrations must still be inspected and maintained, as outlined in Sections 4 and 5.

2.2 HD-36 (Roof Drain Outfall)

HD-36 is a 12 in. cast-iron roof drainpipe passing below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, north of Screenhouse No. 1. This pipe also receives stormwater runoff from the paved parking lot area located between the floodwall and the Facility's administrative building. The pipe invert elevation at the floodwall centerline is at El. 21.92 ft. The pipe passes through a valve chamber adjacent to the floodwall on the landside. The pipe has a gate valve in the valve chamber immediately to the landside of the floodwall and a flap valve at the outfall end of the pipe on the riverside. This line is active.

2.3 HD-37 (Inactive Compressed Air and Water)

HD-37 consists of three pipes (1 in. dia. compressed air, 1.5 in. dia. city water, and 6 in. dia. service water) passing through the floodwall base and leading to the abandoned Chlorine House. The pipe inverts at the floodwall centerline are at El. 25.0 ft. The pipe material is unknown. These lines are inactive.

2.4 HD-38 (Inactive Unit 6 Non-Contact Cooling Water Intake)

HD-38 is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. This pipe formerly served as the cooling water intake for the Unit 6 steam condenser. The pipe invert at the floodwall centerline is at approximately El. 9.5 ft. Two pumps in Screenhouse No. 1 draw water from the river and discharge into two pipes that merge on the riverside of the floodwall. The line continues as the single, 48 in. pipe into the PBF. Gate valves are provided in Screenhouse No. 1 on the discharge side of the pumps. These gate valves are intended to be permanently closed. This line is inactive.

2.5 HD-43 (Inactive Service Water Intake)

HD-43 is a 24 in. metal pipe inside a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. The 48 in. pipe formerly served as the cooling water intake for the Unit 4 steam condenser. The 24 in. inner pipe, which was installed later, served as a service water intake. It is not known if the inner pipe was grouted inside the 48 in. diameter pipe or simply placed inside. The 48 in. pipe invert at the floodwall centerline is at approximately El. 17.77 ft. Two pumps in Screenhouse No. 3 draw water from the river and discharge into two pipes that merge inside the screenhouse. The line continues as the single, 24 in. pipe into the PBF. Gate valves are provided in Screenhouse No. 3 on the discharge side of the pumps. These gate valves are intended to be permanently closed. This line is inactive.

2.6 HD-44 (Inactive Unit 5 Non-Contact Cooling Water Intake)

HD-44 is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, at Closure Structure No. 4. This pipe formerly served as the cooling water intake for the Unit 5 steam condenser. The pipe invert at the floodwall centerline is at El. 16.3 ft. Two pumps in Screenhouse No. 3 draw water from the river and discharge into two pipes that merge on the riverside of the floodwall. The line continues as the single, 48 in. pipe into the PBF. Gate valves are provided in Screenhouse No. 3 on the discharge side of the pumps. This line is inactive.

2.7 HD-45 (Inactive Water Discharge)

HD-45 is a 14 in. cast-iron water discharge pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, south of Screenhouse No. 3. This pipe is adjacent and parallel to HD-46. The pipe invert at the floodwall centerline is at El. 22.25 ft. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river. It is unclear whether there are any valves on this line or where they might be located. This line is inactive.

2.8 HD-46 (Inactive Service Water Discharge)

HD-46 is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, south of Screenhouse No. 3. This pipe formerly served as the service water discharge and is adjacent and parallel to HD-45. The pipe invert at the floodwall centerline is at El. 18.0 ft. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river. It is unclear whether there are any valves on this line or where they might be located. This line is inactive.

2.9 HD-47 (Inactive Unit 5 Non-Contact Cooling Water Discharge)

HD-47 is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, south of Closure Structure No. 4. This pipe formerly served as the cooling water discharge for the Unit 5 steam condenser. The pipe invert at the floodwall centerline is at El. 17.13 ft. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river. A gate valve is provided on the discharge side of the Unit 5 steam condenser, in the Turbine Hall. This line is inactive.

2.10 HD-47a (Inactive Unit 6 Non-Contact Cooling Water Discharge)

HD-47a is a 48 in. steel pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, north of the former coal tower foundation. This pipe formerly served as the cooling water discharge for the Unit 6 steam condenser. The pipe invert at the floodwall centerline is at El. 17.13 ft. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river. A gate valve is provided on the discharge side of the Unit 6 steam condenser, in the Turbine Hall. This line is inactive.

2.11 HD-48 (Inactive Former Ash Pit Outfall)

HD-48 is a 12 in. cast-iron pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, south of the former coal tower foundation. The pipe invert at the floodwall centerline is at approximately El. 9.5 ft. The pipe has a gate valve in the valve chamber immediately to the landside of the floodwall and a flap valve at the outfall end of the pipe on the riverside. Formerly an ash pit outfall, the pipe was later cut and capped landward of the valve chamber. This line is inactive.

2.12 HD-49 (Inactive Oil Line in Former Ash Pit Outfall)

HD-49 is an 8 in. steel pipe that was placed inside of a 10 in. cast-iron pipe that passes through the below grade portion of the floodwall stem, near the coal unloading facility. The outer pipe invert at the floodwall centerline is at El. 16.86 ft. The original 10 in. pipe was an outfall for a former ash pit. The pipe discharged at a headwall on the riverbank on the riverside of the floodwall. On the landside of the floodwall, the pipe passed through a valve chamber and towards the ash pit. The 8 in. oil line runs from the south dock to the headwall, where it enters the original pipe. The newer oil line runs into the valve chamber, where the original pipe was cut. The pipe then bends 90 degrees and rises vertically in the valve chamber to approximately 5 ft below the top of the chamber. The pipe then bends 90 degrees and runs horizontally through the landside wall of the valve chamber, into a second valve chamber that shares a wall with the first, and then towards the Facility. The pipe has been cut inside the second valve chamber, with blind flanges attached to both cut ends. This line is inactive.

2.13 HD-50a (Inactive Liquid Fuel Line)

HD-50a is an 8 in. steel pipe, formerly carrying liquid fuel. The pipe runs from the south dock and then turns south (downriver) and then runs just below the ground surface in a 2 ft by 2 ft concrete encasement up on the dike riverside slope (the flood protection system transitions from floodwall to earth embankment just south of the south dock). The pipe then runs up over the dike crest, and down the landside dike slope. The top of the encasement is flush with the surrounding ground surface. The pipe invert at the dike centerline is approximately El. 42.5 ft. The pipe terminates at the south dock with a gate valve and blind flange. This line is inactive.

3. OPERATIONS

3.1 General

Many of the penetrations are inactive. Valves on these pipes should always be left closed. Specific guidance for each penetration is discussed below.

3.2 HD-36 (Roof Drain Outfall)

On the landside of the floodwall, there is a valve chamber containing a gate valve. The stem of the gate valve rises to approximately 18 in. below the valve chamber cover. The stem can be turned with a square head valve key. On the riverside of the floodwall, there is a flap valve at the end of the pipe.

The landside gate valve shall be closed when the Connecticut River at Bulkeley Bridge gage is predicted to reach a stage of 21.5 ft, as outlined in the Floodwall Penetration EPP.

3.3 HD-37 (Inactive Compressed Air and Water)

There are no known operable parts for this penetration.

3.4 HD-38 (Inactive Unit 6 Non-Contact Cooling Water Intake)

On the riverside, there are two gate valves in Screenhouse No. 1, one on each of the intake pumps. The valves are in the closed position and should always be left closed.

3.5 HD-43 (Inactive Service Water Intake)

On the riverside, there are two gate valves in Screenhouse No. 3, one on each of the intake pumps. The valves are in the closed position and should always be left closed.

3.6 HD-44 (Inactive Unit 5 Non-Contact Cooling Water Intake)

On the riverside, there are two gate valves in Screenhouse No. 3, one on each of the intake pumps. The valves are in the closed position and should always be left closed.

3.7 HD-45 (Inactive Water Discharge)

There are no known operable parts for this penetration.

3.8 HD-46 (Inactive Service Water Discharge)

There are no known operable parts for this penetration.

3.9 HD-47 (Inactive Unit 5 Non-Contact Cooling Water Discharge)

On the landside, there is a gate valve on the discharge side of the Unit 5 steam condenser, in the Turbine Hall. This valve should always be left closed.

3.10 HD-47a (Inactive Unit 6 Non-Contact Cooling Water Discharge)

On the landside, there is a gate valve on the discharge side of the Unit 6 steam condenser, in the Turbine Hall. This valve should always be left closed.

3.11 HD-48 (Inactive Former Ash Pit Outfall)

On the landside of the floodwall, there is a valve chamber containing a gate valve. The handwheel for the valve is at the bottom of the valve chamber. On the riverside of the floodwall, there is a flap valve at the end of the pipe.

The gate valve should always be left closed. The valve chamber is a confined space.

3.12 HD-49 (Inactive Oil Line in Former Ash Pit Outfall)

The pipe has a gate valve on the riverside and is covered with a steel blind flange on both the riverside and landside. The valve is in the closed position and should always be left closed. The blind flanges should always remain in place.

3.13 HD-50a (Inactive Liquid Fuel Line)

The pipe has a gate valve on the riverside and is covered with a steel blind flange on the riverside. The valve is in the closed position and should always be left closed. The blind flange should always remain in place.

4. INSPECTION

4.1 General

Routine inspections shall be performed annually, preferably at the same time as one of the quarterly maintenance intervals to reduce the number of entries into the valve chambers. The inspection checklist is provided in Appendix A.

Requirements for inspections before, during, and after a flood event are outlined in the Floodwall Penetration EPP, which will be activated if floodwaters are predicted to reach El. 11.0 ft, with an initial pre-flood inspection triggered when floodwaters reach El. 12.0 ft. The inspection checklist shall be completed in a similar manner as the routine inspection. The riverside of the floodwall may not be accessible during flooding.

4.2 Routine Inspections

The penetrations shall be checked for the deficiencies listed below. If any deficiencies are observed, they shall be noted on the checklist along with the penetration ID number. Deficiencies must be addressed as soon as practical.

<u>Ground Surface Near Penetrations</u>

- Settlement, depressions, or sinkholes.
- Soft soil.
- Erosion.
- Wet spots or flowing water.
- Sand boils or sand piles.

<u>Exposed Sections of Pipe</u>

- Cracking.
- Holes.
- Deterioration or excessive corrosion.

<u>Flap Gates</u>

- Debris preventing the flap gate from closing.
- Flap gate not swinging freely.
- Debris or sediment around the flap gate.
- Damage or distress to the headwall.
- Movement of the headwall.

<u>Gate Valves</u>

- Leakage or damage.
- Locks and chains on handwheels missing.
- Gate open (for permanently closed gates).
- Gate does not move freely (for HD-36, roof drain outfall).

<u>Valve Chambers</u>

- Missing or damaged chamber cover.
- Spalling or deterioration of concrete.
- Cracks or holes in concrete.
- Leakage of water or soil through concrete.
- Excessive corrosion or deterioration of steps.

4.3 CCTV Inspection of Roof Drain Outfall (HD-36)

The roof drain is the only remaining active penetration. It must be inspected every five years using a closed-circuit television (CCTV) camera. The pipe can be accessed from the flap gate on the riverside. The pipe shall be inspected from the outfall to at least 50 ft landward of the floodwall stem. The inspection shall be performed in accordance with requirements outlined in USACE EM 1110-2-2902, Conduits, Pipes, and Culverts Associated with Dams and Levee Systems dated 31 December 2020.

The pipe shall be checked for the deficiencies listed below. If any deficiencies are observed, they shall be noted on the CCTV inspection report. Deficiencies must be addressed as soon as practical.

- Blockages in the pipe due to debris or sedimentation. Note if jetting was required to advance the camera.
- Water ponding, which could be a sign of pipe settlement.
- Cracking, corrosion, or deterioration.
- Separation of joints.
- Intrusion from roots at joints.
- Voids near any joint separation.
- Leakage into or out of the conduit.

5. MAINTENANCE

5.1 General

Maintenance shall be performed quarterly.

5.2 Valve Chambers

Maintenance of valve chambers, regardless of whether the valve chamber contains an operable gate, consists of:

- Dewatering of the valve chamber and cleaning accumulated sediment and/or debris.
- Cleaning the chamber cover frame and verifying that the cover seats properly in the frame.

5.3 HD-36 (Roof Drain Outfall)

5.3.1 Gate Valve

Maintenance of the gate valve consists of:

- Replacing worn seals.
- Lubricating the stem gear and all other moving parts.
- Removing excess grease.
- Trial-operating the gate through its full range of motion and verifying an adequate seal when closed.

5.3.2 Flap Gate

Maintenance of the flap gate consists of:

- Cleaning accumulated sediment and/or debris from the gate seating surface, headwall, and surrounding area.
- Verifying that the flap moves freely and seats flush on the outfall pipe.
- Verifying that the seating surfaces are free of nicks, dents, or any other damage that would compromise the seal.
- Lubricating the hinge.

6. DRAWINGS

Relevant record drawings for each penetration are provided in Appendix B.

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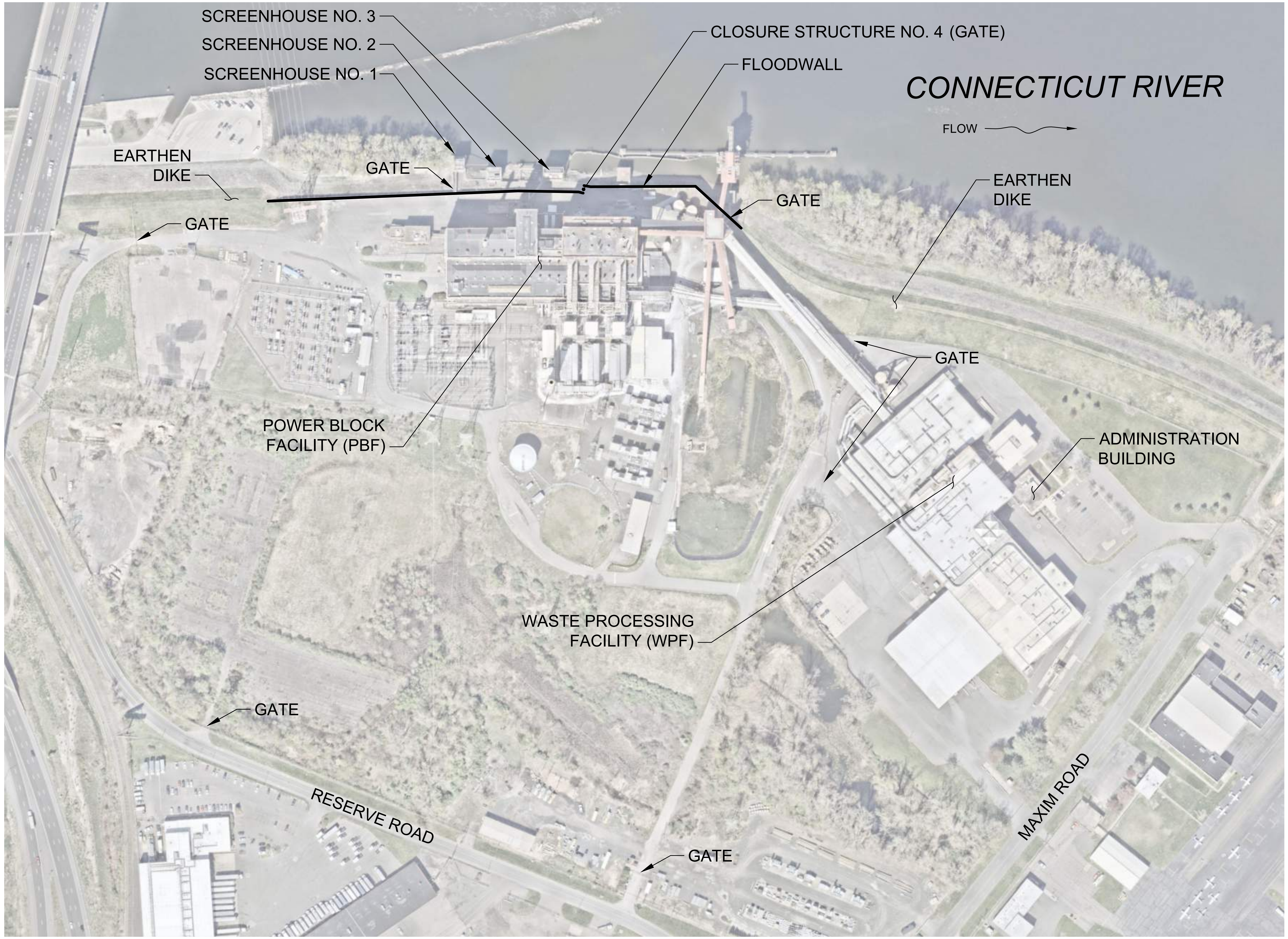
Table 1. Floodwall Penetration Inventory
MIRA Dissolution Authority

ID No.	Station	Description	Diameter/Size and Material of Penetration	Invert Elevation at Floodwall Centerline (ft NGVD 29)	Status	Backflow Prevention Measures
HD-36	84+21M	Roof drain outfall	12 in. dia. pipe - Cast Iron	21.92	Active	Flap valve at riverside outfall, gate valve in valve chamber immediately landside
HD-37	85+28M	Compressed air and water	1.5 in. dia. city water 1 in. dia. compressed air 6 in. dia. service water	25.0	Inactive	Unknown
HD-38	84+55M	Non-contact cooling water intake (Unit 6)	48 in. dia. pipe - Steel	~9.5	Inactive	Two gate valves in Screenhouse No. 1 on riverside, one on each intake pump
HD-43	86+77.5M	Service water intake	24 in. dia. pipe placed inside 48 in. dia. pipe - Steel	17.77	Inactive	Two gate valves in Screenhouse No. 3 on riverside, one on each intake pump
HD-44	87+65M	Non-contact cooling water intake (Unit 5)	48 in. dia. pipe - Steel	16.3	Inactive	Two gate valves in Screenhouse No. 3 on riverside, one on each intake pump
HD-45	87+40.6M	Water discharge (Source unknown)	14 in. dia. pipe - Cast Iron	22.25	Inactive	Unknown
HD-46	87+35.85M	Service water discharge	48 in. dia. pipe - Steel	18.0	Inactive	Unknown
HD-47	87+85M	Non-contact cooling water discharge (Unit 5)	48 in. dia. pipe - Steel	~9.5	Inactive	Gate valve in turbine hall on landside
HD-47a	88+34M	Non-contact cooling water discharge (Unit 6)	48 in. dia. pipe - Steel	17.13	Inactive	Gate valve in turbine hall on landside
HD-48	89+3.65M	Storm drain (former ash pit outfall)	12 in. dia. pipe - Cast Iron	7.72	Inactive	Flap valve at riverside outfall, gate valve in valve chamber immediately landside
HD-49	90+75M	Oil pipe in former ash pit outfall	8 in. dia. oil line (Steel) placed inside 10 in. dia. drain line (Cast Iron)	16.86	Inactive	Blind flange and gate valve at south dock on riverside, blind flange in valve chamber immediately landside
HD-50a	92+31.7M	Liquid fuel line	8 in. steel pipe encased in concrete	~43.5	Inactive	Blind flange and gate valve at south dock on riverside



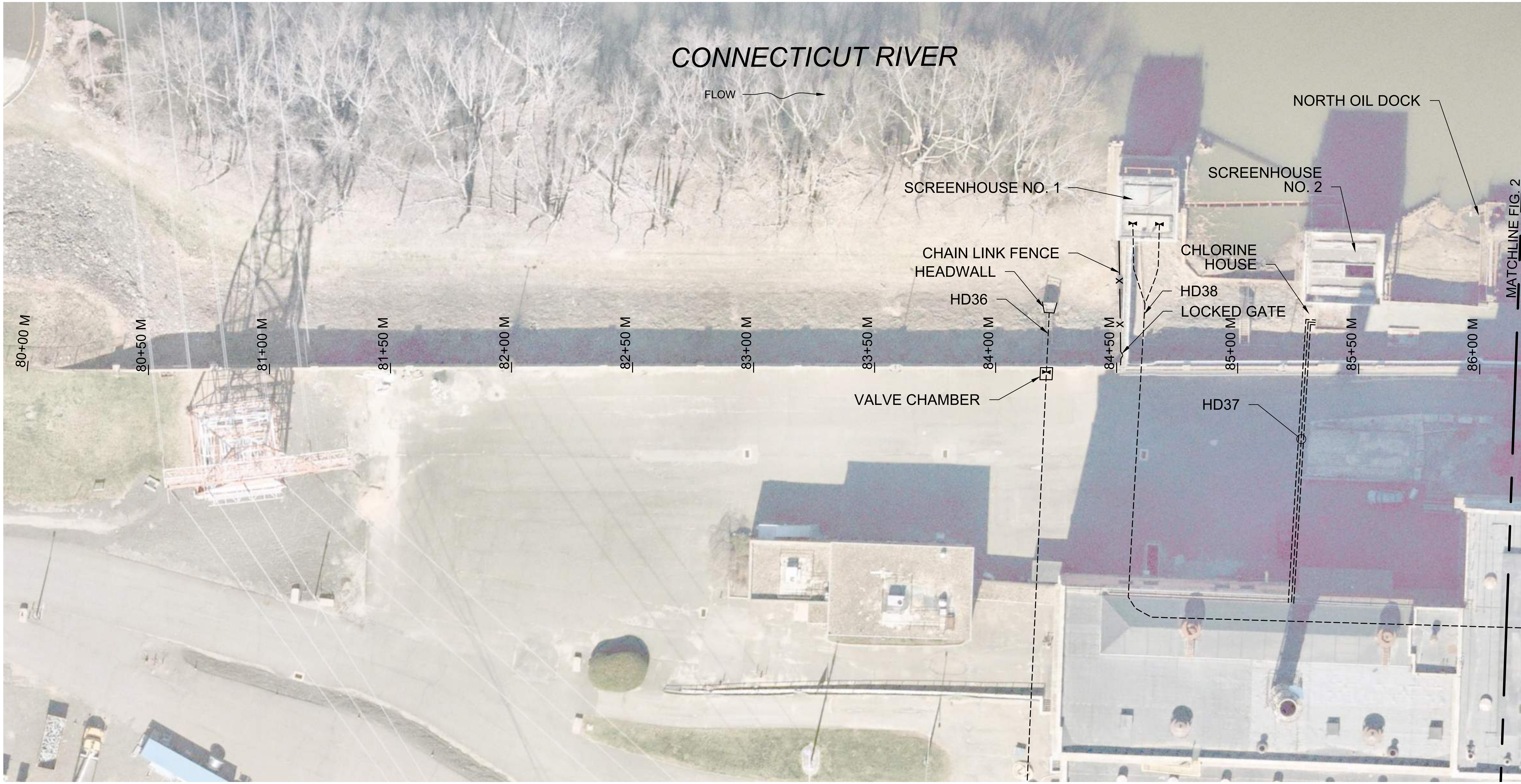
NOTES:
1. AERIAL PHOTO © 2023 NEARMAP. REPRODUCED WITH PERMISSION.

0 125' 250' 500' 750' 1000'

1" = 250'-0"

SIMPSON GUMPERTZ & HEGER
480 Totten Pond Road
Waltham, MA 02451
781.907.9000
sgh.com

Project:	MIRA DISSOLUTION AUTHORITY FLOODWALL PENETRATION OPERATION, MAINTENANCE, AND INSPECTION MANUAL
Title:	SITE PLAN
Drawn:	RKP
Checked:	JAD
Approved:	BPS
Project No.:	240840
Drawing No.:	FIG. 1
Scale:	1" = 250'-0"
Date:	9/13/2024



NOTES:
1. AERIAL PHOTO © 2023 NEARMAP. REPRODUCED WITH PERMISSION.
2. LOCATIONS AND FLOOD CONTROL SYSTEM STATIONING HAVE NOT BEEN VERIFIED WITH SITE SURVEY AND THEREFORE, SHOULD BE CONSIDERED APPROXIMATE.

LEGEND:
- BELOW GROUND PIPE
- ABOVE GROUND PIPE
- GATE VALVE
- BLIND FLANGE

0 20' 40' 80' 120' 160'
1" = 40'-0"

SIMPSON GUMPERTZ & HEGER
480 Totten Pond Road
Waltham, MA 02451
781.907.9000
sgh.com

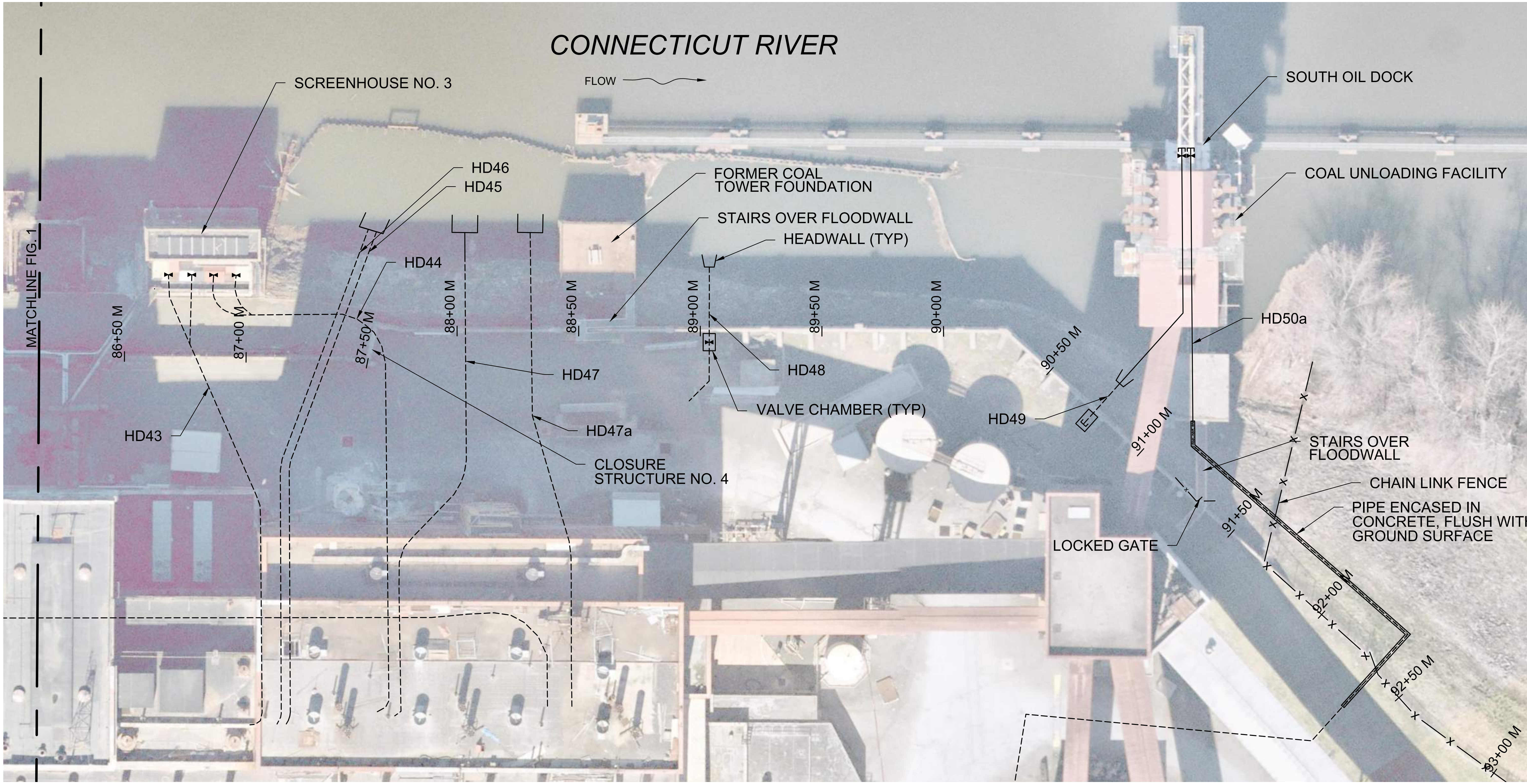
Project: MIRA DISSOLUTION AUTHORITY FLOODWALL PENETRATION OPERATION, MAINTENANCE, AND INSPECTION MANUAL

Title: PENETRATION LOCATIONS

Drawing No.: FIG. 2

Scale: 1" = 40'-0"

Drawn:	Checked:	Approved:	Project No.:	Date:
RKP	JAD	BPS	240840	10/2/2024



NOTES:
1. AERIAL PHOTO © 2023 NEARMAP. REPRODUCED WITH PERMISSION.
2. LOCATIONS AND FLOOD CONTROL SYSTEM STATIONING HAVE NOT BEEN VERIFIED WITH SITE SURVEY AND THEREFORE, SHOULD BE CONSIDERED APPROXIMATE

LEGEND:
- — — — BELOW GROUND PIPE
- ——— ABOVE GROUND PIPE
- GATE VALVE
- BLIND FLANGE

0 20' 40' 80' 120' 160'
1" = 40'-0"

SIMPSON GUMPERTZ & HEGER
480 Totten Pond Road
Waltham, MA 02451
781.907.9000
sgh.com

Project:	MIRA DISSOLUTION AUTHORITY FLOODWALL PENETRATION OPERATION, MAINTENANCE, AND INSPECTION MANUAL
Title:	PENETRATION LOCATIONS
Drawing No.:	FIG. 3
Scale:	1" = 40'-0"
Drawn:	RKP
Checked:	JAD
Approved:	BPS
Project No.:	240840
Date:	10/2/2024

APPENDIX A

MIRA Dissolution Authority

Floodwall Penetration Inspection Checklist

Date of Inspection: ____________________

Inspection Type (Routine or Pre-/During-/Post-Flooding): ____________________

Inspector: ____________________

If any of the deficencies below are observed, they shall be marked "Y" below and photographed. Provide detailed notes of the observed conditions.
Any observed deficiencies shall be addressed as soon as practical.

Item to Check	Penetrations												Notes
	HD-36 (Roof Drain Outfall)	HD-37 (Inactive Compressed Air and Water)	HD-38 (Inactive Unit 6 Non-Contact Cooling Water Intake)	HD-43 (Inactive Service Water Intake)	HD-44 (Inactive Unit 5 Non-Contact Cooling Water Intake)	HD-45 (Inactive Water Discharge)	HD-46 (Inactive Service Water Discharge)	HD-47 (Inactive Unit 5 Non-Contact Cooling Water Discharge)	HD-47a (Inactive Unit 6 Non-Contact Cooling Water Discharge)	HD-48 (Inactive Former Ash Pit Outfall)	HD-49 (Inactive Oil Line in Former Ash Pit Outfall)	HD-50a (Inactive Liquid Fuel Line)	
Ground Surface Near Penetrations													
Settlement, depressions, or sinkholes													
Soft soil													
Erosion													
Wet spots or flowing water													
Sand boils or sand piles													
Exposed Sections of Pipe													
Cracking													
Holes													
Deterioration or excessive corrosion													
Flap Gates													
Debris preventing the flap gate from closing													
Flap gate not swinging freely													
Debris or sediment around the flap gate													
Damage or distress to the headwall													
Movement of the headwall													

MIRA Dissolution Authority

Floodwall Penetration Inspection Checklist

Date of Inspection: ______________________

Inspection Type (Routine or Pre-/During-/Post-Flooding): ______________________

Inspector: ______________________

If any of the deficencies below are observed, they shall be marked "Y" below and photographed. Provide detailed notes of the observed conditions.
Any observed deficiencies shall be addressed as soon as practical.

Item to Check	Penetrations: HD-36 (Roof Drain Outfall)	HD-37 (Inactive Compressed Air and Water)	HD-38 (Inactive Unit 6 Non-Contact Cooling Water Intake)	HD-43 (Inactive Service Water Intake)	HD-44 (Inactive Unit 5 Non-Contact Cooling Water Intake)	HD-45 (Inactive Water Discharge)	HD-46 (Inactive Service Water Discharge)	HD-47 (Inactive Unit 5 Non-Contact Cooling Water Discharge)	HD-47a (Inactive Unit 6 Non-Contact Cooling Water Discharge)	HD-48 (Inactive Former Ash Pit Outfall)	HD-49 (Inactive Oil Line in Former Ash Pit Outfall)	HD-50a (Inactive Liquid Fuel Line)	Notes
Gate valves													
Leakage or damage													
Locks and chains on handwheels missing													
Gate open (for permanently closed gates)													
Gate does not move freely													
Valve chambers													
Missing or damaged chamber cover													
Spalling or deterioration of concrete													
Cracks or holes in concrete													
Leakage of water or soil through concrete													
Excessive corrosion or deterioration of steps													

Additional Notes:

____

____

____

____

NOTE: The Record Drawings have been removed from Appendix B for brevity and due to file size constraints associated with emailing the Committee package.

APPENDIX B

Attachment 4

MIRA
Dissolution Authority

SGH

FLOODWALL PENETRATION EMERGENCY PREPAREDNESS PLAN

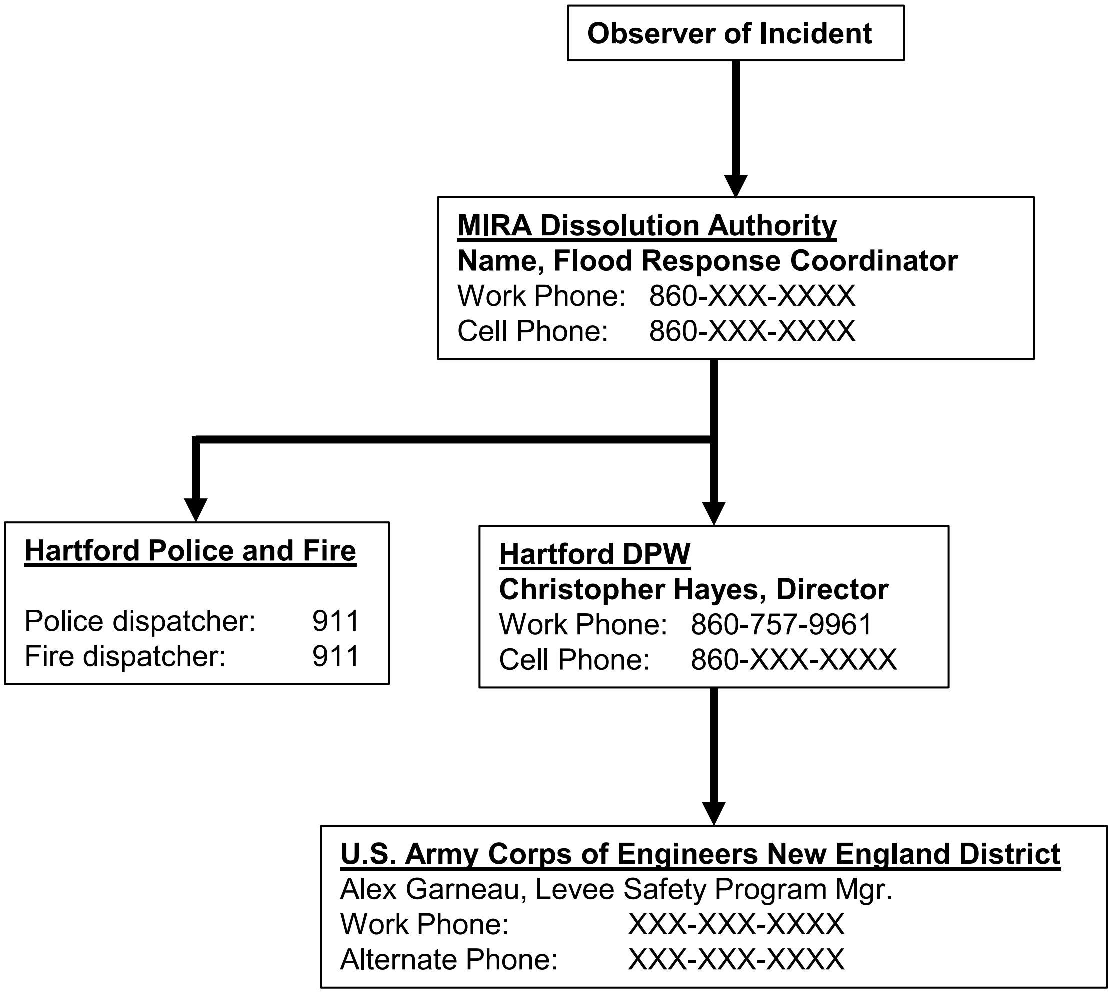
Materials Innovation and Recycling Authority
Resource Recovery Facility
Hartford, CT
16 September 2024 **DRAFT**

PREPARED FOR
MIRA Dissolution Authority
300 Maxim Road
Hartford, CT 06114

PREPARED BY
Simpson Gumpertz & Heger Inc.
480 Totten Pond Road
Waltham, MA 02451
O: 781.907.9000

NOTIFICATION FLOWCHART

MIRA RESOURCE RECOVERY FACILITY FLOODWALL PENETRATIONS
EMERGENCY PREPAREDNESS PLAN
MIRA DISSOLUTION AUTHORITY



16 September 2024

Emergency Contact List

Floodwall Penetration Emergency Preparedness Plan

Materials Innovation and Recycling Authority

Resource Recovery Facility

Title	Name	Phone	Other Phone	Email
MIRA Dissolution Authority				
Flood Reponse Coordinator				
Superintendent				
Add others as appropriate				
City of Hartford				
Fire Department Dispatcher		911		
Police Department Dispatcher		911		
Director of Public Works	Christopher Hayes	860-757-9961	XXX-XXX-XXXX	christopher.hayes@hartford.gov
Deputy Director of Public Works	Petrel Maylor	860-757-9968	XXX-XXX-XXXX	maylp002@hartford.gov
Others?				
Greater Hartford Flood Commission				
Frank Dellaripa	Director	860-757-9975	XXX-XXX-XXXX	frank.dellaripa@hartford.gov
Others?				
U.S. Army Corps of Engineers New England District				
Main Office		978-318-8111		
Operations Division (office hours)		978-318-8326		
Emergency Management Office		978-318-8274		
National Weather Service				
Lead Forecaster (all hours)		508-823-1983		
River Forecast Center		508-824-4799		
Connecticut River at Bulkeley Bridge Gage	https://water.noaa.gov/gauges/HFDC3			
Local Contractors/Equipment Rental				
Any MDA preferred?				

Table of Contents

NOTIFICATION FLOWCHART

CONTENTS **Page**

ILLUSTRATIONS

APPENDIX

ABBREVIATIONS

cfs	Cubic feet per second
CTDOT	Connecticut Department of Transportation
DPW	Department of Public Works
dia.	Diameter
El.	Elevation
EPP	Emergency Preparedness Plan
ft	Feet
GHFC	Greater Hartford Flood Control System
HFCS	Hartford Flood Control System
in.	Inch, inches
MDA	MIRA Dissolution Authority
MIRA	Materials Innovation and Recycling Authority
M.S.L.	Mean Sea Level
NGVD 29	National Geodetic Vertical Datum of 1929
No.	Number
NWS	National Weather Service
PBF	Power Block Facility
USACE	U.S. Army Corps of Engineers
WPF	Waste Processing Facility

1. SUMMARY OF EMERGENCY PREPAREDNESS PLAN RESPONSIBILITIES

Entity	Responsibilities
MIRA Dissolution Authority (MDA)	• Inspect and patrol floodwall penetrations at the Facility. • Identify and assess emergency conditions for penetrations at the Facility. • Notify Hartford DPW of emergency conditions. • Take corrective action at the Facility. • Issue penetration condition status reports to Hartford DPW.
City of Hartford Department of Public Works (DPW)	• Inspect and patrol the Hartford Flood Control System (HFCS), including the portion that passes through the Facility. • Identify and assess emergency conditions for the floodwalls and levees at the Facility and along the rest of the system. • Receive penetration condition status reports from MDA. • Notify MDA of changes in flood response phase. • Issue flood prediction. • Issue HFCS condition status reports and assistance requests to Hartford Police and Fire. • Issue assistance requests to the USACE. • Support MDA in taking corrective action at the Facility.
City of Hartford Police, Fire, and Rescue	• Receive HFCS condition status reports and assistance requests from Hartford DPW. • Notify the public in the event an evacuation is necessary. • Conduct evacuation from inundation areas, if required. • Render assistance to Hartford DPW, as necessary. • Render assistance to MDA, as necessary.
City of Hartford Mayor, Chief Executive Officer, or Fire Chief	• Issue evacuation orders in accordance with the City's Emergency Operation Plan.
U.S. Army Corps of Engineers (USACE) New England Division	• Render assistance to Hartford DPW, as necessary.
National Weather Service (NWS)	• Issue reports weather forecasts to the general public. • Maintain the Northeast River Forecast Center, which issues flood watches, warnings and forecasts for the Connecticut River Basin.

2. NOTIFICATION FLOWCHART

The notification flowchart is located at the beginning of this document and is also located in the MDA's administrative office. A copy has also been provided to the Greater Hartford Flood Commission (GHFC) for incorporation into the HFCS Operation and Maintenance Manual.

Use of this notification flowchart assumes that MDA's Flood Response Coordinator (the Coordinator) will be contacted upon first identification of a potential emergency situation.

3. PURPOSE

This Emergency Preparedness Plan (EPP) defines the roles and responsibilities of those in charge of monitoring for and responding to emergency conditions involving penetrations through the floodwalls at the Materials Innovation and Recycling Authority (MIRA) Resource Recovery Facility (the Facility). The companion to this EPP is the latest version of the Floodwall Penetration Operations, Maintenance, and Inspection Plan, which outlines routine activities involving the penetrations.

4. FACILITY AND SYSTEM DESCRIPTION

4.1 Facility

The Facility is a shuttered trash-to-energy power plant in the South Meadows Section of Hartford, Connecticut (Fig. 1). The Facility, constructed in the 1920s, was originally coal-fired, then transitioned to a combination of oil and coal. In the 1980s, a waste processing facility (WPF) was constructed at the site and the power plant was converted for trash-to-energy use. The power plant portion of the site is referred to as the power block facility (PBF) to differentiate it from the WPF. The Facility stopped receiving, processing, and combusting waste in July 2022. Over the life of the Facility, there were six generating units, two of which (Units 5 and 6) were in use when operations ceased.

4.2 Flood Control System

The Facility is located along the west bank of the Connecticut River. In response to the devastating floods in 1936 and 1938, the U.S. Army Corps of Engineers constructed a flood control system to reduce flooding risks. The HFCS consists of earthen dike, concrete floodwalls, and structures to facilitate drainage inside the protected area. The HFCS passes through the Facility, with most of the area adjacent to the PBF consisting of concrete floodwall. Several penetrations through the floodwall allow for passage of pipes between the landside and the riverside.

4.3 Penetrations

4.3.1 General

Descriptions for the penetrations within the Facility are provided below. Over time, some penetrations through the floodwall have been properly abandoned, either by removing them or filling them with concrete as they cross through or under the floodwall. To reduce confusion, these abandoned penetrations are not listed in this EPP. The remaining, non-abandoned penetrations are shown in Figs. 2 and 3 and summarized in Table 1. Most of these penetrations are inactive. Inactive means that the penetration is no longer used but has not been removed or properly abandoned. Inactive status does not mean that a penetration does not pose a potential risk to the flood control system.

4.3.2 HD-35 (Three Inactive Oil Lines)

HD-35 consists of three 8 in. steel oil pipes passing through the above-grade portion of the floodwall stem, just south of the transition from earthen dike to floodwall. The pipe inverts are at approximately El. 31 ft. The pipes each have a valve on the landside of the floodwall stem and have been cut at the riverside of the floodwall stem, with blind flanges covering the riverside ends. These lines are inactive.

4.3.3 HD-36 (Roof Drain Outfall)

HD-36 is a 12 in. cast-iron roof drainpipe passing below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, north of Screenhouse No. 1. The pipe invert elevation at the floodwall centerline is at El. 21.92 ft. The pipe passes through a valve chamber adjacent to the floodwall on the landside. The pipe has a gate valve in the valve chamber immediately to the landside of the floodwall and a flap valve at the outfall end of the pipe on the riverside. This line is active.

4.3.4 HD-37 (Inactive Compressed Air and Water)

HD-37 consists of three pipes (1 in. dia. compressed air, 1.5 in. dia. city water, and 6 in. dia. service water) passing through the floodwall base and leading to the abandoned Chlorine House. The pipe inverts at the floodwall centerline are at El. 25.0 ft. The pipe material is unknown. These lines are inactive.

4.3.5 HD-38 (Inactive Unit 6 Process Water Intake)

HD-38 is a 48 in. cast-iron pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. This pipe formerly served as the process water intake for Unit 6. The pipe invert at the floodwall centerline is at approximately El. 9.5 ft. Two pumps in Screenhouse No. 1 draw water from the river and discharge into two pipes that merge on the riverside of the floodwall. The line continues as the single, 48 in. pipe into the PBF. Gate valves are provided on the discharge side of the pumps and in the PBF. These gate valves are intended to be permanently closed. This line is inactive.

4.3.6 HD-43 (Inactive Service Water Intake)

HD-43 is a 24 in. metal pipe inside a 48 in. cast-iron pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing. The 48 in. pipe formerly served as the process water intake for Unit 4. The 24 in. inner pipe, which was installed later, served as a service water intake. It is not known if the inner pipe was grouted inside the 48 in. diameter pipe or simply placed inside. The pipe invert at the floodwall centerline is at approximately El. 19.25 ft. Two pumps in Screenhouse No. 3 draw water from the river and discharge into two pipes that merge inside the screenhouse. The line continues as the single, 24 in. pipe into the PBF. Gate valves are provided on the discharge side of the pumps. These gate valves are intended to be permanently closed. This line is inactive.

4.3.7 HD-44 (Inactive Unit 5 Process Water Intake)

HD-44 is a 48 in. cast-iron pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, at Closure Structure No. 4. This pipe formerly served as the process water intake for Unit 5. The pipe invert at the floodwall centerline is at El. 16.3 ft. Two pumps in Screenhouse No. 3 draw water from the river and discharge into two pipes that merge on the riverside of the floodwall. The line continues as the single, 48 in. pipe into the PBF. Gate valves are provided in Screenhouse No. 3 on the riverside and in the PBF. This line is inactive.

4.3.8 HD-45 (Inactive Water Discharge)

HD-45 is a 14 in. cast-iron water discharge pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, south of Screenhouse No. 3. This pipe is adjacent and parallel to HD-46. The pipe invert at the floodwall centerline is at El. 22.25 ft. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river. It is unclear whether there are any valves on this line or where they might be located. This line is inactive.

4.3.9 HD-46 (Inactive Service Water Discharge)

HD-46 is a 48 in. cast-iron pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, south of Screenhouse No. 3. This pipe formerly served as the service water discharge and is adjacent and parallel to HD-45. The pipe invert at the floodwall centerline is at El. 18.0 ft. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river. It is unclear whether there are any valves on this line or where they might be located. This line is inactive.

4.3.10 HD-47 (Inactive Unit 5 Process Water Discharge)

HD-47 is a 48 in. cast-iron pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, south of Closure Structure No. 4. This pipe formerly served as the process water discharge for Unit 5. The pipe invert at the floodwall centerline is at El. 17.13 ft. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river. It is unclear whether there are any valves on this line or where they might be located. This line is inactive.

4.3.11 HD-47a (Inactive Unit 6 Process Water Discharge)

HD-47a is a 48 in. cast-iron pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, north of the former coal tower foundation. This pipe formerly served as the process water discharge for Unit 6. The pipe invert at the floodwall centerline is at El. 17.13 ft. The pipe runs from the PBF to a steel sheet pile outfall headwall in the river. This line is inactive.

4.3.12 HD-48 (Inactive Former Ash Pit Outfall)

HD-48 is a 12 in. cast-iron pipe that passes below the base of the floodwall and through the sheet pile wall below the toe of the floodwall footing, south of the former coal tower foundation. The pipe invert at the floodwall centerline is at approximately El. 9.5 ft. The pipe has a gate valve in the valve chamber immediately to the landside of the floodwall and a flap valve at the outfall end of the pipe on the riverside. Formerly an ash pit outfall, the pipe was later cut and capped landward of the valve chamber. This line is inactive.

4.3.13 HD-49 (Inactive Oil Line in Former Ash Pit Outfall)

HD-49 is an 8 in. cast-iron pipe that was placed inside of a 10 in. pipe that passes through the below-grade portion of the floodwall stem, near the coal unloading facility. The outer pipe invert at the floodwall centerline is at El. 16.86 ft. The original 10 in. pipe was an outfall for a former ash pit. The pipe discharged at a headwall on the riverbank on the riverside of the floodwall. On the landside of the floodwall, the pipe passed through a valve chamber and towards the ash pit. The 8 in. oil line runs from the south dock to the headwall, where it enters the original pipe. The newer oil line runs into the valve chamber, where the original pipe was cut. The pipe then bends 90° and rises vertically in the valve chamber to approximately 5 ft below the top of the chamber. The pipe then bends 90° and runs horizontally through the landside wall of the valve chamber, into a second valve chamber that shares a wall with the first, and then towards the Facility. The pipe has been cut inside the valve chamber, with blind flanges attached to both cut ends. This line is inactive.

4.3.14 HD-50a (Inactive Jet Fuel Line)

HD-50a is an 8 in. steel pipe, formerly carrying jet fuel. The pipe runs from the south dock and then turns south (downriver) and then runs just below the ground surface in a 2 ft by 2 ft concrete encasement up on the dike riverside slope (the flood protection system transitions from floodwall to earth embankment just south of the south dock). The pipe then runs up over the dike crest, and down the landside dike slope. The top of the encasement is flush with the surrounding ground surface. The pipe invert at the dike centerline is approximately El. 42.5 ft. The pipe terminates at the south dock with a gate valve and blind flange. This line is inactive.

5. FLOOD RESPONSE PROCESS

The flood response process outlined below is based on guidance in the USACE Levee Owner's Manual for Non-Federal Flood Control Works, dated March 2006, and is consistent with the flood response process in the HFCS Operation and Manual, dated June 2009.

Flood response is divided into four phases:

- **Notification Phase:** Alert all response personnel of possible flooding.
- **Phase 1:** Preliminary Response Activities (before river reaches flood stage).
- **Phase 2:** Full Response Activities (after river reaches flood stage).
- **Phase 3:** Cessation (after flood recedes to non-damaging level).

Operating personnel shall follow the instructions below. Hartford DPW will notify MDA of the triggering of each phase, in accordance with the HFCS Operation and Maintenance Manual.

5.1 Notification Phase

The Notification Phase will begin if any of these conditions are met:

1. The NWS issues a report on a storm posing a threat to southern New England or issues a flood watch.
2. The Connecticut River at Bulkeley Bridge gage reaches a stage of **11.0 ft**[1] or discharge of **37,000 cubic feet per second (cfs)**.
3. The Park River at Pope Park Pumping Station gage reaches a stage of **22.0 ft** or discharge of **4,000 cfs**.

If the Notification Phase is reached, the Coordinator shall notify response personnel of the potential for activation.

5.2 Phase 1 – Preliminary Response

Phase 1 will begin if any of these conditions are met:

1. The NWS River Forecast Center issues a flood warning for southern New England.

[1] The elevations in this manual are referenced to the National Geodetic Vertical Datum of 1929 (NGVD or NGVD 29), also referred to as Mean Sea Level (M.S.L.) in USACE record drawings for the HFCS. The Bulkeley Bridge gage zero is set to NGVD, so all gage readings are water elevations in ft NGVD.

2. NWS indicates on their website that high flows could occur on the Connecticut or Park Rivers.

3. The Connecticut River at Bulkeley Bridge gage reaches a stage of 12.0 ft or discharge of 42,000 cfs.

4. The Park River at Pope Park Pumping Station gage reaches a stage of 23.6 ft or discharge of 5,400 cfs.

Phase 1 activities shall be completed before the Connecticut River at Bulkeley Bridge gage reaches a stage of **16.0 ft**. Phase 1 activities consist of the following:

- Initial mobilization of response personnel.
- Completing a pre-flood inspection.
- Patrolling the Facility daily.

5.2.1 Initial Mobilization

Initial mobilization consists of the following tasks:

- Launch a skeleton organization capable of quick expansion. Assign responsibilities to staff members, including pre-flooding inspection, daily floodwall patrol, and daily monitoring of the PBF.
- Review this EPP and previous lessons learned and identify problem areas.
- Provide all staff with required keys, controls, rosters, and a list and plan of project features.
- Coordinate with Hartford DPW.
- Begin keeping a log of emergency operations activities.

5.2.2 Pre-Flood Inspection

The pre-flood inspection will be carried out as outlined in the Facility's Floodwall Penetration Operation, Inspection, and Maintenance Plan. Particular attention should be paid to ensuring that all gate valves are closed, except for the HD-36 (12 in. dia. storm drain) valve. The HD-36 gate valve and flap valve must be trial-operated to confirm that they are in an operable condition. If not, immediate steps should be taken to repair. If the flap gate cannot be closed, it should be blocked with sandbags and plastic sheeting.

5.2.3 Phase 1 General Maintenance

Once the pre-flood inspection has been completed, the Coordinator should evaluate the results and organize personnel to take care of any pressing maintenance issues, before the river rises further. Emergency maintenance activities are no substitute for normal annual maintenance. Maintenance activities should not wait until high water.

5.2.4 Other Phase 1 Activities

Once the pre-flood inspection has been completed, the Coordinator should organize personnel to complete the following activities:

- Review assignments for patrols.
- Obtain lists of all construction equipment, motorboats, cars, earthmoving equipment, and trucks that can be made available.
- Assess needed support (vehicles, radios, etc.).
- Verify serviceability of flood-fighting equipment.

5.2.5 Patrols

The Facility shall be patrolled at least once per day during the Phase 1 Preliminary Response. Guidance for patrols is provided in Section 5.5.

5.2.6 Closure of HD-36 (Storm Drain Outfall) Gate Valve

The HD-36 pipe invert at the floodwall centerline is at El. 21.9 ft. The landside gate valve shall be **closed** when the Connecticut River at Bulkeley Bridge gage is predicted to reach a stage of **20.0 ft**. The gate valve shall remain closed until the gage falls below a stage of 21.0 ft.

5.3 Phase 2 – Full Response

Phase 2 will begin when the Connecticut River at Bulkeley Bridge gage reaches a stage of **24 ft**, and patrols shall be increased to every 4 hrs. When the gage reaches a stage of **28 ft**, patrols shall be increased to a continuous basis.

5.3.1 Activation of Project Facilities

The only gate valve that is not permanently closed is located at HD-36. Closure Structure No. 4, will be closed by Hartford DPW when the Connecticut River at Bulkeley Bridge gage reaches a stage of 28.5 ft and will remain in place until waters recede to a stage of 29.5 ft. The activation of the closure will reduce access to the riverside, but access is still possible via the stairways over the floodwall.

5.3.2 Continuing Activities

The following activities shall be performed during the Phase 2 Full Response:

- Patrol at the prescribed frequency, 24/7, and at increased frequency as the situation requires.
- Be sure gates are closed, and all maintenance is complete, as described in Phase 1.
- Completely remove padlocks from interior access gates to facilitate patrols.
- Monitor inventory of flood fighting equipment, materials, and supplies as they are used.
- Repair any erosion and seepage problems identified by patrols as quickly as possible, as described in Section 5.6 and Appendix A.
- Portable pumps may be used to pump water over the floodwall, if water is ponding in undesirable areas or is rising too quickly in ponding areas. Ponding areas should be continually patrolled during high water.

5.3.3 Evacuation

The City of Hartford maintains a comprehensive plan for the evacuation of areas protected by the HFCS in case of a levee failure or other flood emergency. Such an evacuation could be activated if a threshold river flood elevation is reached or based on observations by flood response personnel of an emergency condition (e.g., potential levee breach). Evacuation orders will be issued by the City of Hartford to the general public, but the Hartford DPW might also relay these orders to MDA. For this reason, it is essential that communication between the MDA and Hartford DPW be maintained during a flood event.

5.4 Phase 3 – Cessation

Flood operations will cease once the Connecticut River returns to non-damaging levels. Phase 3 will begin when the following conditions are met:

1. The Connecticut River at Bulkeley Bridge gage recedes to a stage of 12.0 ft or discharge of 44,500 cfs.

2. The Park River at Pope Park Pumping Station gage reaches a stage of 24.0 ft or discharge of 7,400 cfs.

Once the water has subsided and it is not predicted to rise again, the Facility should be returned to the pre-flood condition:

- Reopen the HD-36 gate valve once the Connecticut River at Bulkeley Bridge gage has receded to a stage of **21.0 ft**.

- Remove and properly dispose of all temporary protection measures (e.g., sandbags and material placed during flood fighting).

- Relock all access gates.

- Take an inventory of all remaining flood-fighting equipment, sandbags, plastic, and other supplies. Repair or replace damaged equipment and restock supplies such as sandbags or plastic in preparation for the next flood event.

- Salvage any materials and supplies.

- Return all borrowed equipment.

- Identify whether remaining materials can be reused within the community.

- Inspect the area around each penetration, noting locations of damage and the extent of damage at each location.

- Coordinate potential rehabilitation with the GHFC.

- Soon after the event, meet with key personnel, volunteer representatives, and community partners to debrief, share remaining concerns, and discuss lessons that were learned during the event.

- Document the event: keep a map record of the Facility, indicating areas that were in stress at the time of the flooding. This is useful for making repairs or improvements, and for use as a guide to focus attention on these areas during the next flood event.

- Revise this EPP to account for lessons learned and changes to recommended procedures.

- For future planning, locate and keep records of the flood's high-water marks; keep these records along with any rainfall and river data gathered.
- Make repairs to the penetrations as soon as possible, in preparation for the next flood event.

5.5 Patrols

The purpose of patrolling is to detect problems early so that they can be addressed promptly. Patrols should be conducted in teams rather than by individuals. The frequency of patrols is as follows:

Flood Response Phase	Connecticut River at Bulkeley Bridge Stage (ft)	Frequency
Phase 1	12.0 – 24.0	Once per day
Phase 2	24.0 – 28.0	Every 4 hrs
	28.0+	Continuously

Any signs of distress or potential issues should be reported to the Coordinator, who will notify Hartford DPW.

5.5.1 Responsibilities

Patrol responsibilities include the following:

- Take photographs of all significant issues.
- On the landside of the floodwall, look for sand boils, wet areas, soft areas, seepage, or sinkholes surrounding penetrations.
- Look for slides or sloughs around outfall headwalls.
- Look for wave wash or scouring around outfall headwalls.
- Check flap and gate valves for proper closure.
- Look for settlement or movement of the floodwall around penetrations.
- Look for sand boils and seepage in the PBF, particularly along intake and discharge pipes that penetrate the floodwall.

5.5.2 Equipment for Patrols

Equipment for patrols includes the following:

- This Floodwall Penetration Emergency Preparedness Plan.

- Floodwall Penetration Operation, Inspection, and Maintenance Plan.
- Portable radio or cell phone.
- Watch.
- Logbook.
- Weather gear.
- Flashlights and headlamps.
- Life jackets.
- Probing rod.
- Mark-out supplies (wooden stakes, flagging, and spray paint).
- 40 ft of 1/2 in. nylon safety line to connect team members.
- Camera.
- Ladder.

5.5.3 Safety Precautions

When patrolling on the riverside of the floodwall, all patrol members shall wear life jackets. Any patrol operations that require a patrol member to descend a dike or riverbank slope should wear a safety line attached to another member at the top of the slope. Note that the riverbank slopes that are covered with grouted riprap are very steep and will be impossible to access safely. Do not attempt to descend these slopes.

Once Hartford DPW operates Closure Structure No. 4, access and sightlines to the riverside will be limited. The tops of the floodwalls are approximately 10 to 15 ft above the surrounding grade. When patrolling floodwalls, the patrol should not attempt to walk the top of the wall. Conditions on the waterside can be observed using a ladder or the two stairs that go over the floodwall.

Each person on the patrol should be thoroughly familiar with the community evacuation plan and signals. If evacuation is necessary, the patrol team should move to a predetermined location and keep the team intact. If evacuated, when returning to the Facility, physical conditions may be considerably different from those observed prior to the evacuation, especially if the floodwall or dikes were overtopped. If overtopping occurs during the darkness, patrols shall not be resumed until daylight, though there may be cases where this recommendation cannot be followed.

5.6 Flood Fighting

Any signs of distress or potential issues should be reported to the Coordinator, who will notify Hartford DPW of the emergency condition. MDA personnel should attempt to repair issues immediately. The Coordinator must compare staffing levels, equipment, and supplies to those required, and clearly communicate the need for assistance if necessary.

The penetrations at the Facility either pass through the concrete floodwall or through the sheet pile seepage cutoff wall embedded in the riverside toe of the floodwall. Therefore, they represent a hole in the flood control system. Floodwaters will try to make their way to the landside, and the penetrations represent a spot of potential weakness. Water can flow either through the pipes or in the soil alongside the pipe.

Guidance for flood fighting is provided in Appendix A, which is the flood fighting appendix of the USACE Levee Owner's Manual. Particular attention should be paid to Section 3 - Seepage (pp. 15 - 20 of the appendix). Note that other signs of distress may occur, which are also addressed in Appendix A.

The rings of stacked sandbags to address sand boils outlined in Appendix A may not be sufficient to stop sand boils that develop around a penetration. The continued loss of soil from a boil can increase seepage flow rates, which further accelerates the loss of soil. This situation can quickly undermine the floodwall, leading to a breach.

If a boil cannot be stopped using a sandbag ring, place an inverted filter over the boil. An inverted filter consists of sand first, then crushed stone, and then riprap. The footprint of the inverted filter should extend at least 5 ft beyond the extent of the boil. Each layer of the filter should be at least 2 ft thick.

6. ROLES AND RESPONSIBILITIES

6.1 MIRA Dissolution Authority

The MDA is responsible for the operations, inspection, and maintenance of the penetrations through the HFCS within the Facility, including flood response in coordination with Hartford DPW.

Flood response responsibilities include the following:

- Inspecting and patrolling floodwall penetrations at the Facility.
- Identifying and assessing emergency conditions for penetrations at the Facility.
- Notifying Hartford DPW of emergency conditions.
- Taking corrective action at the Facility.
- Issuing penetration condition status reports to Hartford DPW.

6.2 Greater Hartford Flood Commission

The GHFC is the regulatory authority with stewardship over public works constructed in the Greater Hartford area for the purpose of flood control on the Connecticut and Park Rivers, and on the tributaries of the Park River.

The GHFC delegates operation, inspection, and maintenance duties to the Hartford DPW, as described below.

6.3 Hartford DPW

Maintenance of the HFCS is conducted by a permanent staff under the direction and supervision of the Hartford DPW. Hartford DPW's areas of responsibility include:

- Complete operation of the project during flood periods.
- Determining phases of preparedness, mobilization, and operations based on: NWS river and weather forecasts, and river stages on the Park River at Pope Park pumping station and on the Connecticut River at Hartford (Bulkeley Bridge).
- Training personnel in specific duties and holding periodic practice sessions to ensure efficient and effective maintenance and operation.

- Maintaining adequate contact with the NWS to obtain weather and flood forecasts.
- Maintenance of all project features.

6.4 Hartford Police and Fire

Hartford Police and Fire responsibilities include:

- Receiving HFCS condition status reports and assistance requests from Hartford DPW.
- Notifying the public in the event an evacuation is necessary.
- Conducting evacuation from inundation areas, if required.
- Rendering assistance to Hartford DPW, as necessary.
- Rendering assistance to MDA, as necessary.

6.5 National Weather Service

The NWS has no direct role in the operations of the project; however, it has the responsibility of issuing weather and flood forecasts to the general public. The NWS maintains the Northeast River Forecast Center at Bloomfield, Connecticut, which is the official agency for issuing flood watches, warnings, and forecasts in the Connecticut River basin. River forecasts for the Connecticut River (U.S. Geologic Survey Gage # 01190070 at the Bulkeley Bridge) can be viewed online, at https://water.noaa.gov/gauges/HFDC3. Weather forecasts and reports for the area are issued by the NWS office at Bradley Field in Windsor Locks.

6.6 U.S. Army Corps of Engineers

The USACE Reservoir Control Center continually monitors rainfall and runoff conditions in much of New England. This climatologic and hydrologic information is available upon request online at http://www.reservoircontrol.com.

Representatives of the USACE Division Engineer stand ready to assist the City of Hartford in the operation of the HFCS. This in no way lessens the responsibility of the City of Hartford in the operation of the project or MDA in the operation of floodwall penetrations at the Facility.

6.7 Notification and Communication Responsibilities

The notification and coordination responsibilities are as follows:

MDA to Hartford DPW:

- Notify Hartford DPW of emergency conditions and termination of emergencies.
- Issue Hartford DPW penetration condition status reports.

Hartford DPW to MDA:

- Notify MDA of activation or change in flood response status.

Hartford DPW to Hartford Police and Fire:

- Issue HFCS condition status reports and assistance requests.

6.8 Evacuation Responsibilities

The City of Hartford Mayor, Chief Executive Officer, or anyone legally administering that office is responsible for issuing evacuation orders, in accordance with their Emergency Operation Plan. In addition, the Fire Chief or senior fire officer-in-charge (Incident Commander) has statutory authority to order an evacuation.

Evacuation orders will be issued to the general public, so the City will not notify MDA specifically. Depending on timing, the Hartford DPW might notify MDA of an imminent evacuation order prior to general public notification.

6.9 Flood Response Coordinator Responsibilities

The Flood Response Coordinator is an MDA employee who will be in charge of flood response. The Coordinator is responsible for managing the flood response program, developing and maintaining the staffing roster for flood response personnel, and organizing training sessions. During flood response, the Coordinator will be the main point of contact with the GHFC and City of Hartford emergency personnel.

7. PREPAREDNESS

7.1 Access to the Site

Access to the site is restricted via a chain-link fence. There are three roadway access gates to the Facility, as shown in Fig. 3:

1. South gate (Maxim Road).
2. West gate (Reserve Road).
3. North gate (Reserve Road).

Additionally, there are two gates separating the PBF and the WPF.

On the riverside of the floodwall, chain link fences restrict access to the screenhouses and coal unloading facility.

During flood response, the Coordinator will direct all access in and out of the site. All flood response personnel shall be given gate access codes and keys to the gates.

7.2 Response During Periods of Darkness

The Facility is well-lit for operational use during periods of darkness and as an aid to inspection. However, some areas riverward of the floodwall may not be well-lit. Should electrical power be unavailable, lighting for inspections and patrols will be provided by headlamps and flashlights. A light tower will also be available for lighting of specific areas. If additional lighting is required, it will be acquired by the Coordinator.

7.3 Response during Weekends and Holidays

Procedures for contacting or notifying personnel during weekends and holidays will be consistent with the Notification Flowchart, which provides 24 hr phone numbers for individuals and entities who are required to be notified.

7.4 Response During Adverse Weather

Severe weather may occur during flood response activities. During lightning or winds exceeding 60 mph, MDA personnel will remain indoors and will not conduct repairs or inspections until conditions are safe.

7.5 Emergency Supplies and Information

The following equipment will be kept onsite to aid in flood response:

- Front-end loader.
- Sandbags.
- Plastic sheeting.
- Shovels.
- Emergency lighting (light tower, flashlights, and headlamps).
- Two-way radios.
- Life jackets.
- Pumps and hoses.
- Bolt cutters.
- Ladders.
- Mark-out supplies (wooden stakes, flagging, and spray paint).
- Probing rods.

The following materials shall be stockpiled:

- Sand for sandbags (no specific gradation): 25 tons.
- Sand for inverted filter (Connecticut Dept. of Transportation [CTDOT] M.01.03 Fine Aggregate): 25 tons.
- Crushed stone for inverted filter (CTDOT M.01.02 Coarse Aggregate No. 67): 25 tons.
- Riprap for inverted filter (CTDOT M.12.02 Modified Riprap): 25 tons.

7.6 Training and Exercise

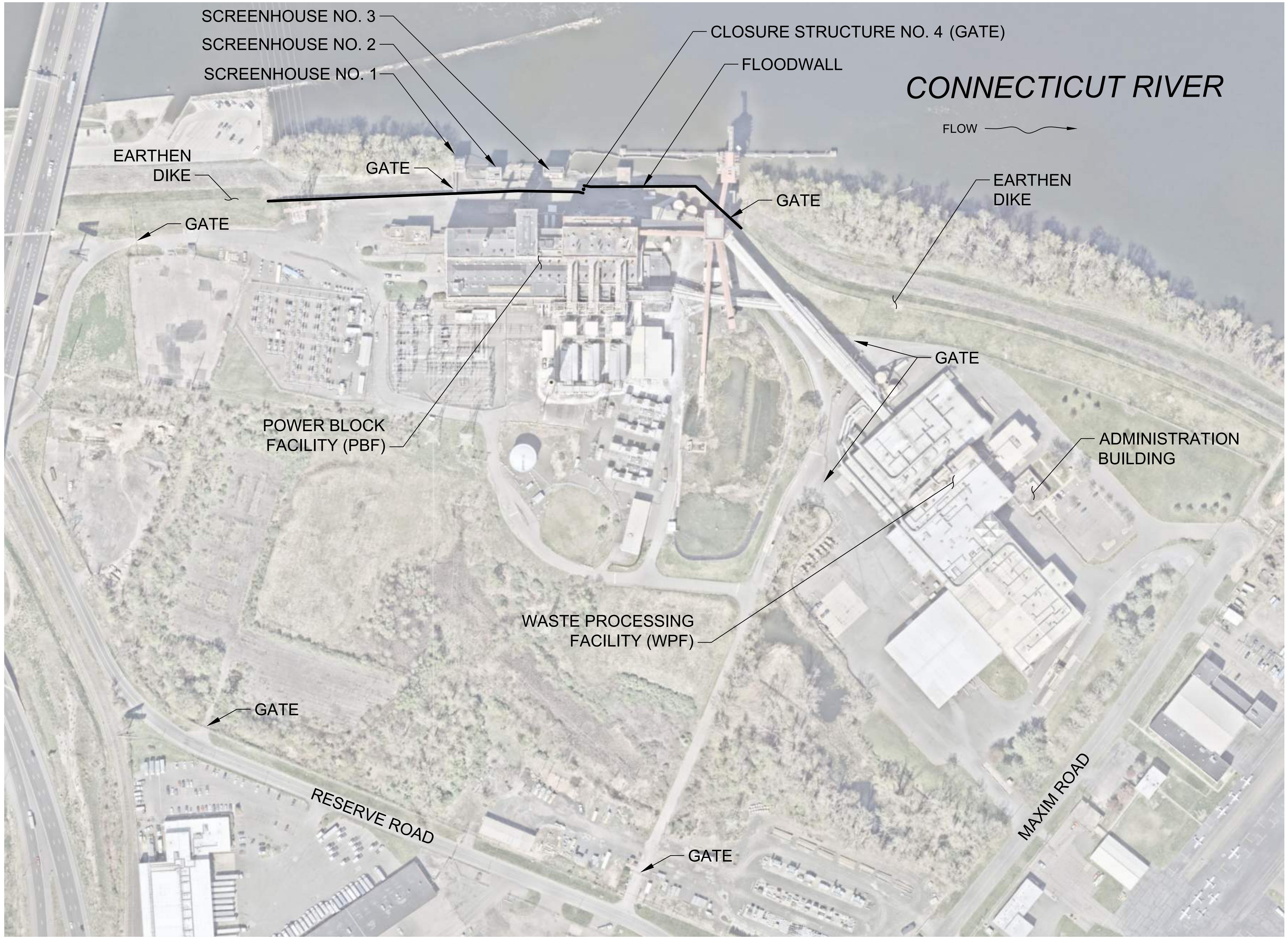
Flood response personnel shall be trained to operate, inspect, and maintain the floodwall penetrations. Training shall be held at least annually. Additional training sessions may be held as needed to train new personnel. At the end of each training session, a feedback session should be held to discuss areas of improvement. Training records shall be kept for all flood response personnel.

Training shall include the following:

- Site walk to visit all penetrations, all valves (exterior, in Screenhouses, and in the PBF), emergency supply storerooms, and emergency stockpiles.
- Walkthrough of notification process and communications protocol, including a trial exercise.
- Operations, inspections, and maintenance procedures.
- Signs of distress during flooding.
- Flood-fighting techniques.
- Communication system testing.

Table 1. Floodwall Penetration Inventory
MIRA Dissolution Authority

ID No.	Station	Description	Diameter/Size and Material of Penetration	Invert Elevation at Floodwall Centerline (ft NGVD 29)	Status	Backflow Prevention Measures
HD-35	80+59M	Oil lines	Three 8 in. dia. pipes - Steel	~31	Inactive	Gate valves on landside
HD-36	84+21M	Roof drain	12 in. dia. pipe - Cast Iron	21.92	Active	Flap valve at outfall, gate valve in MH immediately landside
HD-37	85+28M	Compressed air and water	1.5 in. dia. city water 1 in. dia. compressed air 6 in. dia. service water	25.0	Inactive	Unknown
HD-38	84+55M	Process water intake (Unit 6)	48 in. dia. pipe - Cast Iron	~9.5	Inactive	Gate valve in Screenhouse No. 1
HD-43	86+77.5M	Service water intake	24 in. dia. pipe placed inside 48 in. dia. pipe - Cast Iron	19.25	Inactive	Two gate valves in Screenhouse No. 3, one on each intake pump
HD-44	87+65M	Process water intake (Unit 5)	48 in. dia. pipe - Cast Iron	16.3	Inactive	Two gate valves in Screenhouse No. 3, one on each intake pump
HD-45	87+40.6M	Water discharge (Source unknown)	14 in. dia. pipe - Cast Iron	22.25	Inactive	Unknown
HD-46	87+35.85M	Service water discharge	48 in. dia. pipe - Cast Iron	18.0	Inactive	Unknown
HD-47	87+85M	Process water discharge (Unit 5)	48 in. dia. pipe - Cast Iron	~9.5	Inactive	Unknown
HD-47a	88+34M	Process water discharge (Unit 6)	48 in. dia. pipe - Cast Iron	17.13	Inactive	Unknown
HD-48	89+3.65M	Storm drain (former ash pit)	12 in. dia. pipe - Cast Iron	7.72	Inactive	Flap valve at outfall, gate valve on landside.
HD-49	90+75M	Oil pipe in former ash pit drain	8 in. dia. oil line (Steel) placed inside 10 in. dia. drain line (Cast Iron)	16.86	Inactive	Blind flange and gate valve at south dock, blind flange in valve chamber
HD-50a	92+31.7M	Jet fuel line	8 in. steel pipe encased in concrete	~43.5	Inactive	Gate valve on the riverside



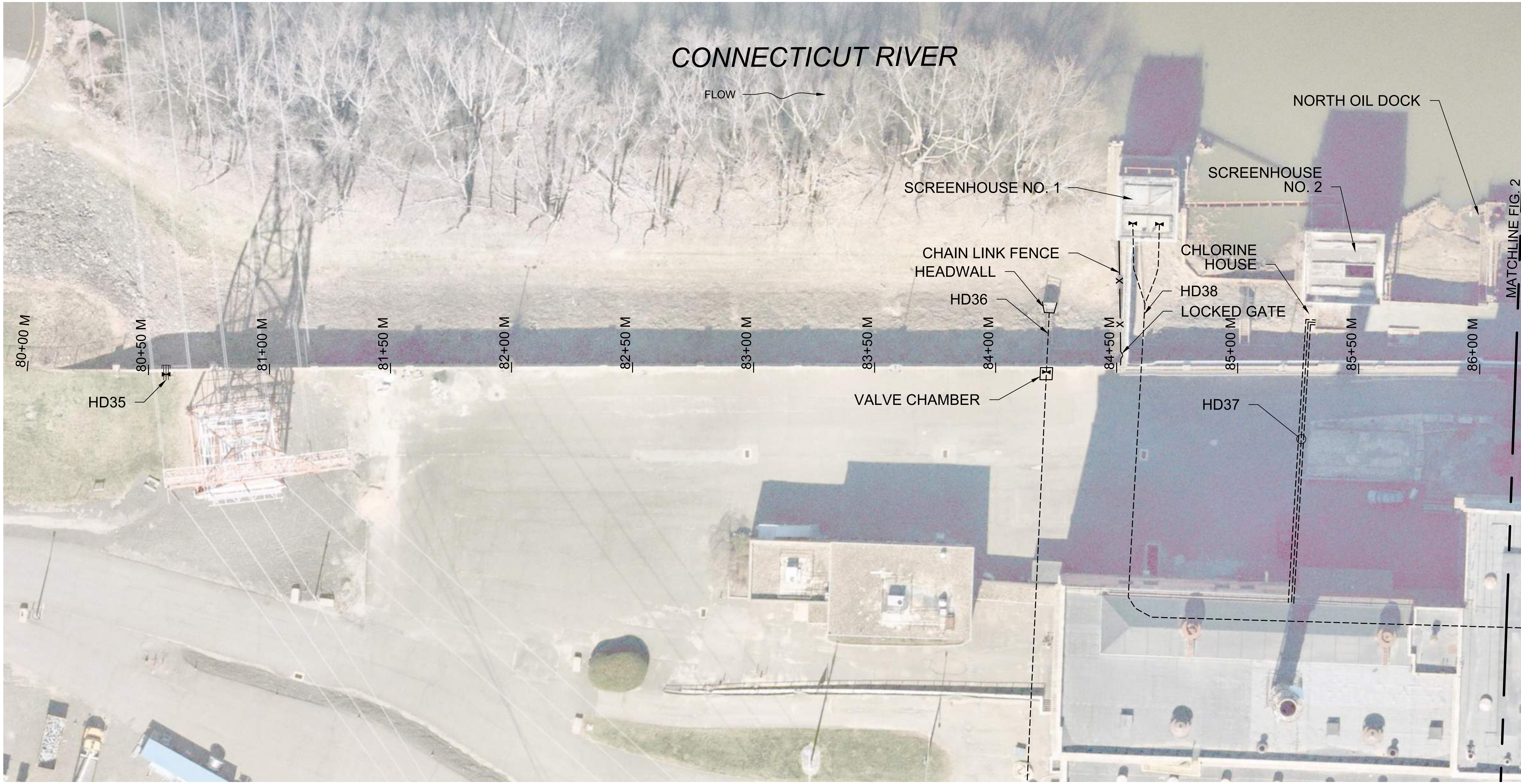
NOTES:
1. AERIAL PHOTO © 2023 NEARMAP. REPRODUCED WITH PERMISSION.

0 125' 250' 500' 750' 1000'

1" = 250'-0"

SIMPSON GUMPERTZ & HEGER
480 Totten Pond Road
Waltham, MA 02451
781.907.9000
sgh.com

Project:	MIRA DISSOLUTION AUTHORITY FLOODWALL PENETRATION EMERGENCY PREPAREDNESS PLAN
Title:	SITE PLAN
Drawn:	RKP
Checked:	JAD
Approved:	BPS
Project No.:	240840
Drawing No.:	FIG. 1
Scale:	1" = 250'-0"
Date:	9/13/2024



NOTES:

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2. LOCATIONS AND FLOOD CONTROL SYSTEM STATIONING HAVE NOT BEEN VERIFIED WITH SITE SURVEY AND THEREFORE, SHOULD BE CONSIDERED APPROXIMATE.

LEGEND:

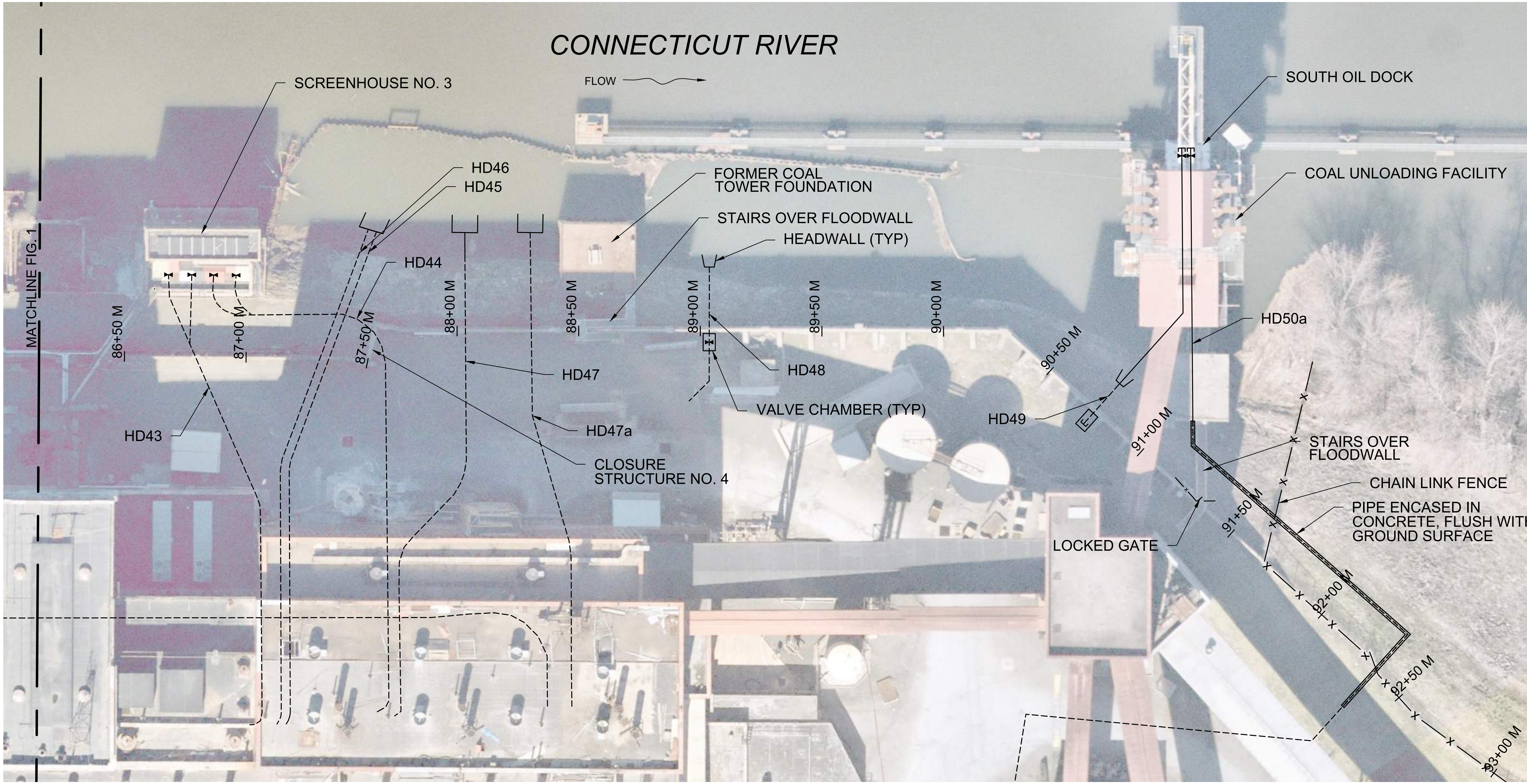
- — — — BELOW GROUND PIPE
- ——— ABOVE GROUND PIPE
- GATE VALVE
- BLIND FLANGE

0 20' 40' 80' 120' 160'

1" = 40'-0"

SIMPSON GUMPERTZ & HEGER
480 Totten Pond Road
Waltham, MA 02451
781.907.9000
sgh.com

Project:	MIRA DISSOLUTION AUTHORITY FLOODWALL PENETRATION EMERGENCY PREPAREDNESS PLAN
Title:	PENETRATION LOCATIONS
Drawn:	RKP
Checked:	JAD
Approved:	BPS
Project No.:	240840
Drawing No.:	FIG. 2
Scale:	1" = 40'-0"
Date:	9/16/2024



NOTES:
1. AERIAL PHOTO © 2023 NEARMAP. REPRODUCED WITH PERMISSION.
2. LOCATIONS AND FLOOD CONTROL SYSTEM STATIONING HAVE NOT BEEN VERIFIED WITH SITE SURVEY AND THEREFORE, SHOULD BE CONSIDERED APPROXIMATE

LEGEND:
- BELOW GROUND PIPE
- ABOVE GROUND PIPE
- GATE VALVE
- BLIND FLANGE

0 20' 40' 80' 120' 160'

1" = 40'-0"

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480 Totten Pond Road
Waltham, MA 02451
781.907.9000
sgh.com

Project:	MIRA DISSOLUTION AUTHORITY FLOODWALL PENETRATION EMERGENCY PREPAREDNESS PLAN
Title:	PENETRATION LOCATIONS
Drawing No.:	FIG. 3
Scale:	1" = 40'-0"
Drawn:	RKP
Checked:	JAD
Approved:	BPS
Project No.:	240840
Date:	9/16/2024

APPENDIX A

APPENDIX D: Flood Fighting Techniques on Levees

Appendix D Contents

Plates

1. Introduction

If a well-constructed levee of correct cross section is properly maintained and is not overtopped, it should hold throughout any major flood event. However, the levee is still in potential danger whenever there is water against it. The danger increases with the height of water, the duration of the flood stage, the intensity of the current, and the wave action against the levee face. There are three primary factors that lead to levee failures.

1. Overtopping
2. Seepage problems such as sandboils or slides
3. Erosion from the current or waves

Potential levee failures may be prevented if prompt action is taken and proper methods of treatment are employed. This appendix describes some of the general actions that should be taken to raise the crown of a levee or to respond to sandboils, seepage problems, or wave wash if these problems are identified during a patrol. The methods described have been developed from many years of experience in dealing with problems that arise as a result of high water, and should be followed as closely as possible. (The intent of this isn’t to destroy personal initiative when dealing with unusual emergencies. On the contrary, if a dangerous situation occurs along a levee line, immediate action is demanded using the materials and labor at hand. However, an emergency is not a time in which to experiment, and these proven methods should be employed wherever possible.) Conditions and problems may arise which are not adequately covered by the suggestions provided or if there’s any doubt as to the proper procedure that should be taken, the local U.S. Army Corps of Engineers district Emergency Management Office should immediately be consulted for advice and assistance.

2. Overtopping

A levee is overtopped when water flows over the levee crown. Low reaches in the levee crown must be identified as early as possible and raised to a uniform level. If the stream is predicted to approach or exceed the height of the existing levee, immediate attention should be given to raising the levee crown.

On the other hand, if the stream is likely to crest many feet beyond the elevation of the levee, the best approach may be to simply allow the levee to overtop, so that flood fight efforts can be redirected to other areas. If this is the case, low reaches in the levee crown need to be raised, leveled or otherwise prepared so that it overtops uniformly, to keep the damage to a minimum. Ideally, the levee should be allowed to overtop uniformly along the downstream portion of the system, so the protected area is "backfilled" with flood water. If the levee is breached due to the overtopping along the downstream portion of the FCW, it prevents the full force of the river's current from flowing into the protected area. An upstream breach will allow the river current to bring in much more debris (for example, entire trees), and would possibly cause much more scouring damage to the protected area than a downstream overtopping breach. It's very important that you contact the Corps district office when faced with decisions relating to the overtopping of a levee, as the Corps has a great deal of experience with flood fighting and can provide technical assistance and guidance as needed.

Generally, emergency barriers are constructed 2 feet above the current predicted river crest. For example, if the river is predicted to rise 1 1/2 feet beyond the elevation of the levee, then a 3 ½ foot capping would be necessary in order to maintain two feet of freeboard as a factor of safety. If the crest prediction increases during construction, additional height must be added.

2.1 Options for Raising a Levee

There are a number of ways that the levee crown can be raised. Provided the work is done well in advance of the high water, in areas where there is sufficient space for construction and with the proper equipment, the most efficient means of raising low stretches of the levee is to scarify the surface, haul in fill material and compact it in place, as discussed in section 2.2, below. However, this is not always possible. No heavy equipment should be used on a levee when water is near the top, as the vibration may cause a failure. In no case should such equipment be allowed on an earthen levee after the levee has commenced to seep. For these reasons, raising the elevation with compacted earthen fill may not be an option. The levee crown may alternately be raised with a sandbag capping or with flashboard structures. Jersey barriers have also successfully been converted into floodwalls during emergency situations.

Additionally, there are a large number of contemporary technologies that may be used to raise an emergency levee; including bladders, structurally supported membranes, and lightweight shells that are filled with sand from a bucket loader. The Corps' Engineer Research and Development Center has recently completed a rigorous and impartial study on several of these flood fight technologies. You are encouraged to visit http://chl.erdc.usace.army.mil/ffs for details on the tests and products, since this site will have the Corps' most current information on the subject, and the website will be updated as additional products are tested.

With so many options available for raising a flood barrier, there are several things you should consider as you decide how to best protect your community:

a. Cost of materials and labor

The materials for sandbag construction are generally much less expensive than the alternatives. Sandbag construction is very labor intensive, but at the same time, volunteer labor is often readily available during high water.

b. Available time

Flashboards or contemporary options are better suited to conditions when there is little time available for the construction, because they typically require less labor and can be put in place much faster than sandbag levees.

c. Allowable seepage

Most construction methods will allow some degree of seepage through the structure. As is the case with sandbags, modifications may be made to the basic designs so that the seepage is reduced, but these modifications usually take additional time to construct.

d. Suitability for construction in the given area

Sandbags are extremely versatile and sandbag structures can be constructed almost anywhere. Sandbags can be used to close small roads or to fill gaps, or can be built into long stretches of levees if there is adequate time and manpower. Flashboards and newer technologies are generally not as versatile, but depending on the technology and the construction, they are typically well suited for raising the elevation over longer stretches.

e. Equipment requirements

Sandbag structures can be built without heavy machinery, which may be required for some other options. There are a number of situations where it’s not possible to use even light earthmoving machinery. For example, there might not be enough space for the machinery, or the foundations might be too unstable. Also, individual landowners may object to the use of machinery over their properties.

f. Necessary elevation

Though sandbag levees are best suited for elevations of 3 feet or less, they have successfully been used to raise elevations by 20 feet or more in extreme flooding situations. Flashboards are typically only built to a maximum of 3 feet, and the elevation provided by other technologies varies. In deciding between the various options, it’s important to consider how reliably they can forecast the crest height of the river. If the river stage might rise several feet beyond what is currently predicted, a sandbag levee could be raised higher, while it would be much more difficult to raise something like a flashboard or Jersey barrier structure.

g. Disposal

Burlap sandbags are biodegradable and relatively easy to remove and dispose of. Other options typically take much longer to remove and create more waste. Some are reusable.

Situations may arise when one of the more contemporary products may be readily available and appropriate for the given conditions, when there would be insufficient workers available to protect the area with sandbags or when time was extremely limited; and in these situations the cost of using these products may be justified. While it would be prohibitively expensive for the Corps to stockpile enough inventories to adequately address all problems that might be faced across the country, the Corps may purchase such items and make them available for public sponsors if conditions warrant. However, in the majority of situations, sandbags are almost always preferred and recommended during flood fights when construction with earthen fill is not possible. The following sections provide specific guidance on raising levees using earthen fill, sandbags, and flashboards.

2.2 Raising a Levee with Earthen Fill

a. Borrow Area and Haul Road

Borrow material can become a critical item of supply in some areas due to long haul, project isolation, or for other reasons. The two prime requisites for a borrow area are that adequate material be available and that the site be accessible at all times. The quantity estimate plus an additional 50 percent should provide the basis for the area requirement, in order to provide suitable materials for levee construction as covered below. The area must be located so that it will not become isolated from the project by high water. Local contractors and local officials are the best source of information on available borrow areas. In undeveloped areas, the area should be cleared of brush, trees, and debris, with topsoil and humus being stripped. In early spring, it will probably be necessary to rip the area to remove frozen material. An effort should be made to borrow from the area in such a manner that the area will be relatively smooth and free draining when the operation is complete. The haul road may be an existing road or street, or it may have to be constructed. To mitigate damages, it is highly desirable to use unpaved trails and roads, or to construct a road if the haul distance is short. In any case, the road should be maintained to avoid unnecessary traffic delays. The use of flagmen and warning signs is mandatory at major crossings, such as highways, near schools, and at major pedestrian crossings. It may become necessary to stockpile material near anticipated trouble areas.

b. Equipment

One of the important considerations in earthwork construction is the selection of proper equipment to do the work. Under emergency conditions, obtaining normally specified earthwork equipment will be difficult and the work will generally be done with locally available equipment. It may be wise to call for technical assistance in the early contract stage to ensure that proper and efficient equipment use is proposed. If possible, compaction equipment should be used in flood barrier construction. This may involve sheepsfoot, rubber-tired, or vibratory rollers. Scrapers should be used for hauling when possible because of speed (on short haul) and large capacity. Truck haul, however, has been the most widely used. A ripper is almost essential for opening borrow areas in the early spring. A bulldozer of some size is mandatory on the job to help spread dumped fill and provide some compaction.

c. Foundation preparation

One of the primary differences in the construction of emergency levees and the construction of permanent levees lies in the preparation of the foundation. Prior to any embankment construction, it's very important that the foundation is prepared, particularly if the levee is to be left in place. For emergency construction during spring flooding, the first item of work will probably be snow removal. The snow should be pushed riverward so as to decrease ponding when it melts. Any trees that might be present should be cut and the stumps removed. If at all possible, any obstructions above the ground (brush or similar debris) should be removed. The foundation should then be stripped of topsoil and surface humus. (Clearing and grubbing, structure removal and stripping should be performed only if time permits.) Stripping may be impossible if the ground is frozen, and in this case, the foundation should be ripped or scarified, if possible, to provide a tough surface for the material to bond to. Every effort should be made to remove all ice or soil containing ice lenses. Frost or frozen ground can give a false sense of security in the early stages of a flood fight. It can act as a rigid boundary and support the levee, but when it thaws, the soil strength may be reduced sufficiently for cracking or the development of slides. The ice also forms an impervious barrier to prevent seepage. This may result in a considerable build-up in pressure under the soils landward of the levee and, upon thawing, pressure may be sufficient to cause sudden blowouts. If this condition exists, it must be monitored, and one must be prepared to act quickly if sliding or boiling starts. If stripping is possible, the material should be pushed landward and riverward of the toe of levee and windrowed. After the flood, this material can be spread on the slopes to provide topsoil for vegetation.

d. Materials

Earth fill materials for emergency levees will come from local borrow areas. An attempt should be made to utilize materials which are compatible with the foundation materials as explained below. However, due to time limitation, any local materials may be used if reasonable construction procedures are followed. The materials should not contain large frozen pieces of earth.

i. Clay

Clay is preferred because the section can be made smaller (steeper side slopes). Also, clay is relatively impervious, and has relatively high resistance to erosion when it's compacted. A disadvantage in using clay is that adequate compaction is difficult to obtain without proper equipment. Additionally, the water content in impervious fill can impact the compaction needs. Efforts are typically made at the borrow site to obtain material with the optimal moisture; otherwise, if that is not possible, more time may be required for compaction. Another disadvantage is that the clay may be wet and sub-freezing temperatures may cause the material to freeze in the borrow pit and in the hauling equipment. Weather could cause delays and should definitely be considered in the overall construction effort.

ii. Sand

If sand is used, the section should comply as closely as possible with recommendations in the paragraph titled Levee Section, below. Flat slopes are important, as steep slopes without poly coverage will cause seepage through the levee to outcrop high on the landward slope, and may cause the slope to slump.

iii. Silt

Material that is primarily silt should be avoided, and if it is used, poly facing must be applied to the river slope. Silt, upon wetting, tends to collapse under its own weight and is very susceptible to erosion.

e. Levee Section

In standard levees, the foundation soils and available construction materials generally dictate the design configuration of the levee. Therefore, even under emergency conditions, an attempt should be made to make the embankment compatible with the foundation. Information on foundation soils may be available from local officials or engineers, and it should be utilized. The three foundation conditions and the levee sections cited below are classical and idealized, and usual field conditions depart from them to various degrees. However, they should be used as a guide so that possible serious flood fight problems might be lessened during high water. In determining the top width of any type of section, consideration should be given as to whether a revised forecast will require additional fill to be placed. A top width adequate for construction equipment will facilitate raising the levee. Finally, actual levee construction will in cases, depend on time, materials, and right-of-way available.

i. Sand Foundation

If the foundation material under the emergency levee is sand or some other pervious material, the following guidance is provided:

- If the levee section is to be made of sand, use a minimum of 1V (Vertical) on 3H (Horizontal) river slopes. A 1V on 4H river slope is preferable, and will be less susceptible to erosion, but a 1V on 3H slope is considered an adequate minimum for emergency purposes. Use 1V on 5H for the landward slope, and 10-foot top width.

- If the levee section is to be made of clay, use 1V on 2 1/2 H for both slopes. 1V on 3H slopes are preferable, but 1V on 1 ½ H is an acceptable minimum for emergency purposes. The bottom width should comply with creep ratio criteria; i.e., L (across bottom) should be equal to C x H; where C=9 for fine gravel and 15 for fine sand in the foundation, and H is levee height.

This criteria can be met by using berms either landward or riverward of the levee. Berm thickness should be 3 feet or greater. Berms are used mainly to control or to relieve uplift pressures and will not reduce seepage significantly.

ii. Clay Foundation

If the foundation material under the emergency levee is clay, the following guidance is provided:

- If the levee section is to be made of sand, it should be constructed with 1V on 3H for the river slope. Again, a 1V on 4H is preferable, but the steeper slope is considered adequate for emergency purposes. Use 1V on 5H for the landward slope, and a 10-foot top width, as described in the previous section.

- If the levee section is to be made of clay, use 1V on 2 1/2 H for both slopes. 1V on 3H slopes are preferable for clay levees, but 1V on 1 ½ H is an acceptable minimum for emergency purposes. With a clay foundation, there is no need to construct additional berms.

iii. Clay Layer over a Sand Foundation

If the foundation material is such that there is an impervious clay layer resting over a pervious sand layer, the following guidance is provided:

- If the levee section is to be made of sand, use a minimum of 1V (Vertical) on 3H (Horizontal) river slopes for emergency purposes. A 1V on 4H slope is preferable, if this construction is possible. 1V on 5H landward slope, and 10-foot top width. In addition, a landside berm of sufficient thickness may be necessary to prevent rupture of the clay layer. The berm may be constructed of sand, gravel, or clay, but since berms made of clay generally need to be wider and thicker than those made of pervious materials, it would probably reduce the construction effort to build the berm with sand or gravel, if these materials were available. Standard design of berms requires considerable information and detailed analysis of soil conditions. However, prior technical assistance may reduce berm construction requirements in any emergency situation.

- If the levee section is to be made of clay, use 1 V on 2 1/2 H for both slopes. Again, 1V on 3H slopes are preferable, but 1V on 1 ½ H is an acceptable minimum for emergency purposes. Additionally, a berm may be necessary to prevent rupture of the impervious top stratum.

f. Placement

Layers should be started out to the full width of the embankment base, and subsequent lifts shall be placed so that the tops are substantially horizontal. In general, the levee section should be homogeneous. However, when materials of varying permeability are encountered in the borrow area, the more pervious material should be placed on the landside of the embankment.

g. Compaction

As stated above, obtaining proper compaction equipment for a given soil type will be difficult. It is expected in most cases that the only compaction will be from that due to the hauling and spreading equipment, i.e., construction traffic routed over the fill. It is to be realized that even the minimum requirements may not be possible or feasible, and, if situation demands, material should be placed and compacted in any way possible and the levee observed closely for signs of distress. A construction engineer should ideally oversee the design of emergency levees. Use of these guidelines should not be taken as a guarantee that a safe structure will be constructed.

i. Pervious Fill

Material shall be placed in layers not more than 12 inches in thickness prior to compaction. In emergency situations, each layer should be compacted at the very minimum by one pass of the hauling equipment. However, whenever time, cost and availability of equipment will permit, a much safer structure will result if each layer gets compacted by a minimum of 3 complete passes of a crawler-type tractor, or by 2 passes of a vibratory roller.

ii. Impervious Fill

Fill material shall be placed in layers not exceeding 9 inches prior to compaction. In emergency situations, each layer should receive at least one complete coverage of the track or wheel of the placing equipment or equivalent. However, whenever time, cost and availability of equipment will permit, a much safer structure will result if each layer gets compacted by a minimum of 4-6 complete passes of a tamping type roller or 4 complete passes of a rubber-tired roller.

2.3 Raising a Levee with Sandbags

a. Sandbags

Sandbags are available in plastic and in burlap. The preferred bags are untreated, close weave burlap sacks available at feed or hardware stores. Empty bags should be stockpiled for emergency use, and can be stored for approximately 8 years in a rodent-free environment with low humidity. Don’t fill the bags ahead of time, because they will deteriorate quickly. Commercial polypropylene sandbags are also effective in a flood fight, but since plastic bags are not readily biodegradable, burlap bags will allow more options for disposal if the bags are not going to be reused. (No sandbags should be left in place after the flood fight, regardless of whether they are burlap or plastic.) Do not use garbage bags, as they are too slick to stack; and don’t use feed sacks, as they are too large to handle. Experience shows that bags work well if they are approximately 14 inches wide and 24 inches deep.

b. Fill Material

A sandy soil is most desirable for filling sandbags, as it's easiest to shovel, and the bags can most easily be shaped as needed. Fine sand tends to leak through the weave in the bag, and if it is used it should be double bagged. Silty soils also tend to leak through the bags, and both silty soils and clays are difficult to shape into place. Gravelly or rocky soils are generally poor choices for sandbag structures because of their permeability, though rocks and gravel may be used in sandbags in order to divert water flows, to fill holes, or to hold objects in position. However, any usable material at or near the site has definite advantages. Material should generally not be removed from within 500 feet of the landward toe of a levee, except for in extreme emergency situations.

c. Sandbag Filling

Filling sandbags manually requires two people. One member of the team folds the throat of the bag outward to form a collar, and holds it open so that the other person can shovel in material. The one holding the bag should hold it between or slightly in front of his or her feet, either crouching with his elbows resting on his knees or standing with his knees slightly flexed, while keeping his head and face as far away from the shovel as possible. Both people should be wearing gloves to protect their hands, and safety goggles may also be desirable, especially on dry or windy days.

Figure D.1 *This two-person team is positioned properly for sandbag filling.*

If they are available during large-scale operations, bag-holding racks and power loading equipment can expedite the operation. Sandbag filling machines can be very effective if they are functioning correctly. Alternately, some people have reported success with improvised sandbag filling devices during a flood response. Inverted traffic cones or large metal funnels have been placed into holes in a table, and feeding bins with doors in their bases have been used to pour sand into bags.

Regardless of what method you use to fill them, bags should be filled between <u>one-half (1/2) to two-thirds (2/3)</u> of their capacity. This keeps the bag from getting too heavy, but more importantly, sandbag structures do not seal or keep out water as well if the bags are more than 2/3 full. Be very careful not to overfill or under fill the bags.

d. Tied vs. Untied Bags

Although tied sandbags are generally easier to handle and stockpile, <u>untied</u> sandbags are recommended for most situations, because untied bags make a better seal when they're stacked. Since the bags aren't more than 2/3 full, they can be transported almost as easily whether they're tied or untied. Tied sandbags should be used only for special situations when the bags need to be pre-filled and stockpiled, or for specific purposes such as filling holes or for holding objects in position.

e. Preparing the Ground

Any debris must be removed from the area before the bags are laid in place. Typically, flat headed shovels are used to scrape up ("scarp") the sod or gravel where they are to be laid, to get down to the solid ground where the bags are to be laid. Do not scarp the ground beyond the area directly under the sandbags, because the sod cover in other areas is needed to protect the ground from erosion.

Before laying the bags along the entire length of an area to raise the levee, it's important that you first fill in any low areas with sandbags or with tightly packed earth, so that subsequent sandbag layers will be kept level.

f. Sandbag Placement

When laying the sandbags, the open end of the unfilled portion of the bag is folded over to form a triangle. If tied bags are used, flatten or flare the tied end. Place the partially filled bags lengthwise and parallel to the direction of flow, so the bottom of the bag faces downstream and the folded end faces upstream. (This positioning reduces the chance that floating debris will snag on the tucks and open the bags.)

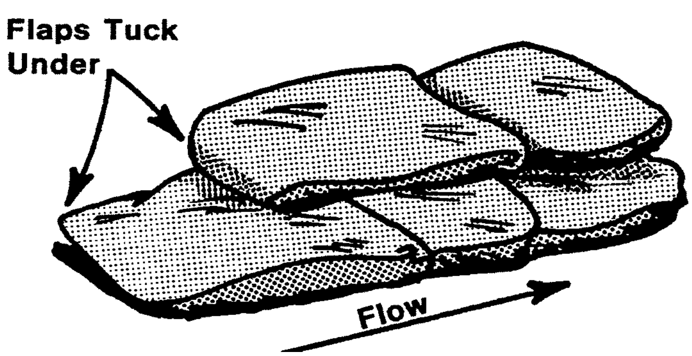


Figure D.2 *Sandbag placement – tucking in the flaps.*

Figure D.3 *Sandbag placement – compacting bags together.*

Tuck the flaps under, keeping the unfilled portion under the weight of the sack. Overlap the next bag slightly over the one before it, so that the top of that sandbag layer can be flattened without leaving any gaps between the bags. Once a bag is placed, it's very important that you then walk over it, stomp on it, or maul it into place to eliminate voids and form a tight seal.

When succeeding layers are added, stagger the bags like bricks, so that each one is placed over the gap between the two below it. This ensures that each seam is interlocked between bags and strengthens the structure. (There should never be less than 1/3 the length of a bag overlapping with the ones beneath it.) When placed properly, each bag should raise the elevation of the structure by 4 inches.

g. Sandbag Levees

Sandbags can be used to raise the height of an existing levee or can be used over open ground to protect an area with no levee at all. Any time a sandbag levee will be constructed over one layer high; the bag should be stacked in a pyramid structure to ensure stability. The basic rules of thumb in constructing these structures is that they must be approximately <u>three times as wide as they are high</u>, and the sandbags should be staggered within each layers just as they are staggered from one layer to the next. The directions of the bags (transverse or longitudinal) may be alternated, as long as no loose ends are left exposed. Use this rule of thumb in determining the dimensions of the pyramid:

- 1 bag in length equals about 1 foot
- 3 bags in width equals about 2 ½ feet
- 3 bags in height equals about 1 foot

When building these structures on top of an existing levee, the bags should begin 1 foot from the riverward crown (shoulder) of the levee. Where space is extremely limited on the levee crown, this distance may be reduced but the structure should never be built less than 6 inches from the edge of the levee crown. Stamp each bag in place, overlap sacks, maintain staggered joint placement, and tuck in any loose ends.

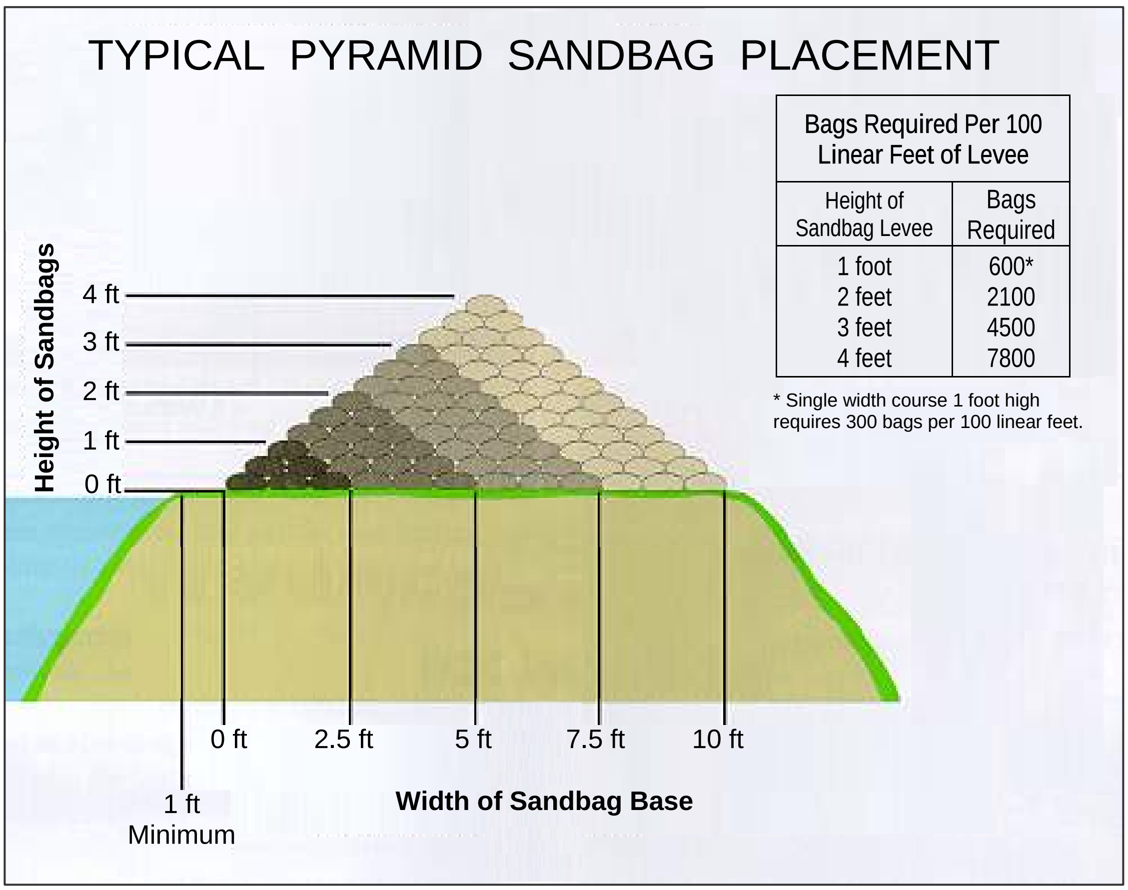


Figure D.4 *Pyramid sandbag placement.*

h. Material, Tools, and Labor Requirements for Sandbag Levee

Listed below are the materials, tools, and labor required to construct 100 linear feet of sandbag levee, two feet high, with a haul distance of 1 mile round trip.

i. Materials and Tools

1,800 Sandbags
10 Shovels
27 Flash lights
10 Tons sand (approx)
2 Emergency light sets
2 Radios or cell phones (one at filling site; one at laying site)
6 Pickup trucks

ii. Labor Requirements:

10 Filling sandbags
5 Loading
6 Hauling
5 Laying
2 Foremen (1 at sandbag filling site, 1 at work site)
28 People required, total

iii. Time Requirements:

With given resources, the time for completion is estimated at 2 ½ hours, from start to finish.

i. Bonding Trench and Plastic Sheeting

Seepage through a sandbag structure can be kept to a minimum if the structure is built carefully using untied bags. One method that's been successfully used to reduce the seepage through a sandbag levee and to increase the horizontal stability is to construct a bonding trench under the structure before the sandbags are laid in place, as pictured below. An additional precaution is to build the structure over some plastic sheeting, which is pulled up and over the structure once it's complete.

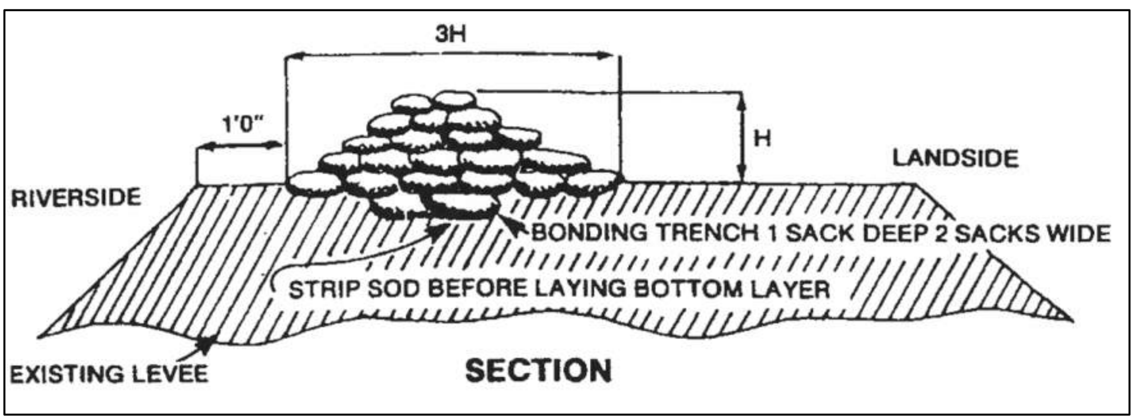


Figure D.5 *Sketch of a typical levee raise with bonding trench.*

While it's always recommended at least to scarp the ground before the bags are laid, the decision to dig this trench or use the plastic sheeting depends on local conditions, as well as on the expected height of the structure and the time that's available to build it. One of the primary concerns when considering bonding trenches and/or plastic sheeting is the amount of time that's available. If there's sufficient time and adequate material, the seepage can be reduced, but if there is very little time available, the ground should be scarped and a typical sandbag structure constructed with no bonding trench at all. An additional concern is whether the sandbag levee would have to be raised in the future, because any plastic sheeting has to be removed before the structure can be raised.

If plastic sheeting is to be used in conjunction with the sandbag levee, begin by digging a bonding trench 2 sandbags wide and one sandbag deep. The edge of the plastic is placed in the hole and weighed down with sandbags, with most of the plastic laying out in the direction of the river. It's very important that the plastic is never laid across the entire width of the sandbag levee base. Sandbag levees are held together by frictional forces between the bags and with the ground surface; sandbag structures are much less stable when wrapped with plastic, and can slide apart under high water. Construct the sandbag levee over the sheeting, pull the plastic up and overtop of the structure and weigh it down with sandbags on the landward side. Always work from downstream to upstream so that the upstream plastic seams all overlap the ones downstream, in order to prevent debris from snagging the plastic and pulling the sandbag levee apart.

2.4 Raising the levee with Flashboards or Lumber and Sack Cappings

If it appears that the levee raise would have to hold back more than 18 inches of water, consideration should be given to use of a lumber and sack capping or a flashboard capping. A lumber and sack capping is shown in plate 3, which may be used as a guide to estimate the materials required for a levee raise of about 3 feet. A flashboard structure is very similar, but the face of the structure is constructed of plywood instead of boards. These wooden facings provide a more positive control against excessive through seepage than is provided by sandbags alone. Either structure can be supported from behind with either sandbags or with compacted earthen fill, depending on how accessible the crown of the levee is to earthmoving machinery.

Additionally, plastic sheeting may be installed on the riverside face of the plywood or flashboards, to protect the wood and reduce seepage through the flashboards. Flashboards do tend to leak a little, depending on how they are constructed and how the boards expand when they're wet; though these structures are never constructed without a sandbag backing. If plastic sheeting is to be used, it should extend 1' riverward from the riverside bottom of the plywood/flashboard. A row of sandbags should then be stamped into place along the riverside bottom edge of the plywood/flashboards to help prevent seepage under the flashboard system. The plastic is brought up the riverside of the plywood/flashboards and over the top to the landside supports and held in place by sandbags or nails where necessary. Field conditions, the available time, and the availability of materials would dictate the actual requirements.

3. Seepage

As a river or stream rises, the hydrostatic pressure against a levee slope increases significantly and can force water into and under the levee embankment. Even when a levee is properly constructed and of such mass to resist the destructive action of flood water, this seepage tends to push its way through regions of least resistance (such as sandy layers under the levee or animal burrows) out to the surface on the landward side of the structure. If there isn't sufficient pressure on the landward side to hold back the seepage water, it will break through the ground surface on the landward side, in the form of bubbling springs, which erode and carry soil particles from under the levee.

Seepage is almost impossible to eliminate and attempt to do so may create a much more severe condition. Seepage is generally not a problem unless 1) the landward levee slope becomes saturated over a large area, 2) seepage water is carrying material from the levee, or 3) pumping capacity is exceeded. Pumping of seepage should be held to a minimum, and ponding should be allowed during high water to the extent that it doesn't cause damages. Several levees were endangered during past floods by attempts to keep low areas pumped dry, and additional time and effort were expended in controlling sandboils caused by pumping. Therefore, seepage should be permitted if no apparent ill-effects are observed and if adequate pumping capacity is available.

3.1 Effects of Underseepage

Underseepage can produce three distinctly different effects on a levee, depending upon the condition of flow under the levee.

a. Piping Flow

In extreme conditions of excessive underseepage, the movement of seepage water erodes the foundation materials, and a clearly defined pipe or tube develops under the levee. Unless corrective actions are taken, water continues to erode and enlarge this pipe, so that a cavern develops under the levee, and levee material collapses to fill in the void. In an advanced state, piping under the levee can be identified by a slumping of the levee crown, and the levee can quickly fail if it's overtopped through this low spot. To prevent this condition from developing, any boils found to be transporting soil material need to be treated as early as possible.

b. Non-Piping Flow

In this case, seepage water flows under the levee without following a well-defined path, and results in one or more boils outcropping at or near the landside toe. The flow from these boils tends to undercut and ravel the landside toe, resulting in sloughing of the landward slope. Sloughing is the movement of small amounts of soils from the embankment slopes. Sloughing may also occur if the levee embankment becomes saturated as a result of prolonged high creek stages. Evidence of this type of failure is found in undercutting and raveling at the landside toe.

c. Saturating Flow

In this case, numerous small boils, many of which are scarcely noticeable, outcrop at or near the landside toe. While no boil may appear dangerous in itself, a group of boils may cause significant damage. The flowing water may erode away supporting material and/or keep the area saturated and cause flotation ("quickness") of the soil, reducing the shearing strength of the material at the toe (where maximum shearing stress occurs) which could lead to slope failure. In a slope failure condition, a substantial section of the levee embankment breaks away along a clearly defined crack and slides away from the levee. The displacement of the soil will result in a reduction in the cross sectional area of the levee and poses a major threat to the integrity of the structure.

3.2 Sandboils

a. Identification of Sand Boils

Sandboils usually occur within 10 to 300 feet from the landside toe of the levee and, in some instances, have occurred up to 1,000 feet away. Boils will have an obvious exit (such as a rodent hole), but the hole may be very small. When material is carried upward through a boil, it is deposited in a circular pattern around the exit location, and is comparable to an ant hill or volcano. Alternately, sandboils may exit into standing water. In this case, they may be difficult to identify, especially if the hole is small and the water cloudy from siltation. If you see any movement in what appears to be standing water on the landward side of the structure, this may be the exit point for a sandboil. Carefully approach the site, disturbing the water as little as possible, and let the water settle in order to look for the exit point. If there is no distinct hole, the water flow is not a threat. All boils should be conspicuously marked with flagging so that patrols can locate them without difficulty and observe changes in their condition.

You can tell how serious a boil is by the color of the water that is coming out. If the water is relatively clear, it means that there is relatively little material being eroded away through the boil. The site should be monitored regularly for changes, but nothing else should be done to treat the clear boil. If it’s dark or muddy, then it’s full of material that’s been eroded away from under the levee, and must be treated immediately. Boils may quickly grow very large, and boils, which are discharging clear water, may suddenly begin to discharge soil materials along with the seepage flows. For this reason, any boil, whether the flow is clear or muddy, can potentially lead to the failure of the levee and must be monitored closely.

b. Treatment of Sandboils

The most common and accepted method of treating sandboils that are displacing soil is to construct a ring of sandbags around the boil(s) as illustrated in Figure D.7. The purpose of the ring is to raise a head of water over the boil to counterbalance the upward pressure of the seepage flow. The height of the water column is adjusted so that the water exiting the boil runs clear and no longer removes soil from the levee foundation. It’s extremely important that the flow of water is never stopped completely, as this may cause additional boils to break out nearby. Treated areas should be kept under constant surveillance until the water recedes.

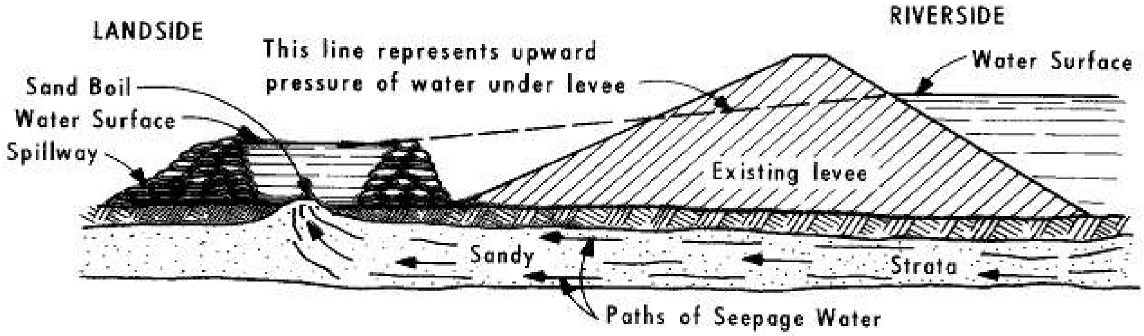


Figure D.6 *To treat the sandboil, the pressure of the seepage water is counterbalanced by hydrostatic pressure from the column of water in the ring levee.*

The diameter and height of the ring will depend on the actual conditions at each sandboil. The base width should be at least 1½ times the contemplated height, and the inner ring of sandbags should begin between one and three feet from outer edge of the sandboil. "Weak" or "quick" ground near a boil should be included within the sack ring to prevent these areas from developing into new boils when the active boil is treated. Where several sandboils develop in a localized area, a ring levee of sandbags should be constructed around the entire area. The ring should ideally be of sufficient diameter to permit sacking operations to keep ahead of the flow of water. When a sandboil is located near the levee toe, the sandbag ring may be tied into the landside slope of the levee, as shown in Figure D.8.

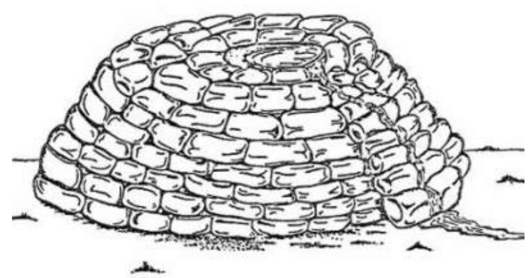


Figure D.7 *Sketch of a typical ring levee with spillway.*

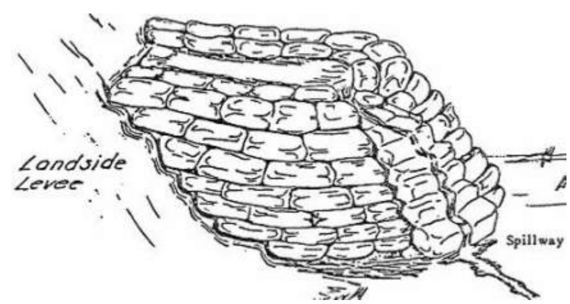


Figure D.8 *Sketch of ring levee tied to a levee slope, with spillway. Construction against the levee slope results in a U-shaped sandbag "chimney."*

The base or foundation for the sack ring should be cleared of debris and scarified to provide a reasonably watertight bond between the ground surface and the sandbags. The ring is constructed with sacks filled approximately two-thirds (2/3) full of sand, and tamped firmly into place. Do not tie the ends of the sacks. When adding subsequent layers, the joints should be staggered for stability and water tightness. The untied ends of sandbags should be laid towards the inside of the ring and folded under. The height of the sack ring should be only sufficient to slow the flow until the water exiting the boil runs clean. Never place sandbags directly over the sandboil or attempt to completely stop the flow through the boils, as this may result in other boils developing nearby.

A spillway or exit channel should be constructed on the top of the sack ring so that the level of the water in the ring levee can be adjusted, and the overflow water can be carried a safe distance from the boil, away from the direction of the levee. Because the height of the water is the critical factor in adjusting the rate of flow through the boil, the spillway will require constant monitoring and adjustment once the sandbag ring levee is filled with water. This spillway is normally constructed of sandbags, but alternately, a V-shaped drain can be constructed of two boards; or PVC pipe, plastic sheeting, or other materials may be helpful in building the spillway.

c. Material, Tools, and Labor Requirements for Sandbag Ring Levee:
Materials, tools, and labor required to construct a Sandbag Ring Levee 2½ feet high and 10 feet in diameter with a haul distance of 1 mile round trip.

i. Materials and Tools:
1,125 Sandbags
5 Shovels, long or short handle
9 Tons of sand (approximately)
5 Pick up trucks
2 Radios or cell phones (one at filling site; one at laying site)
2 Emergency light sets
15 Flashlights
15 Pairs of work gloves

ii. Labor Requirements:
4 Filling sandbags
3 Loading/ carrying
5 Hauling to work site
3 Laying (placement)
2 Foremen (1 at sandbag filling site 1 at work site)
17 People required, total

iii. Time Requirements:
With given resources, time for construction is estimated to be 1-½ hours from start to finish.

d. Alternate Methods of Treating Sandboils

An alternate method of ringing sandboils is by use of corrugated sheet-steel piling, as shown in Figure D.9. The area is cleared of debris, and the piling is driven about 1-½ feet into the ground around the boil. This method accomplishes the same task faster than sandbagging, but is limited in use by the availability of material, equipment, and the location and foundation condition of boils. Expedient methods can be improvised in other ways, to include using sections of corrugated metal piping. Special care must be taken with the design of these structures to make sure there is a reliable means for adjusting the water level, so the water column doesn't completely stop the flow of water through the boil.

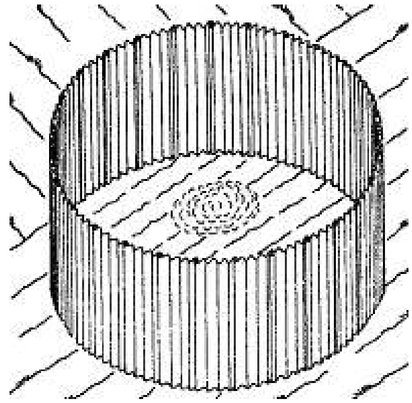


Figure D.9 *A ring of steel-sheet piling can alternately be used to ring the boil, if conditions permit.*

Alternately, it may sometimes be possible to locate the inlet side of a boil under the water on the riverward bank of the levee. A swirl may be observed in the water at this point, or the location of the entry point may have been identified after a previous high water event. Sometimes, because of the current, the swirling vortex appears on the water's surface slightly downstream of the actual opening. If the opening is located, it may be possible to block the seepage flow at its entry point, since blocking the entry point may take much less time than constructing a sandbag ring levee. If the entry point is located, it can be blocked by anchoring a sheet of plastic over the area, using rope and sandbags. It may sometimes be possible to plug a flooded animal burrow by placing a mixture of manure and straw or dry hay into the water at the burrow entrance. If the entry point is blocked, both the blockage and the location of boil need to be closely monitored for any changes.

3.3 Sloughs

If seepage causes saturation and sloughing of the landward slope, the slope should ideally be flattened to 1V (vertical) on 4H (horizontal) or flatter. Material for flattening should be at least as pervious as the embankment material. If any sloughs develop in the levee, all soft areas should be thoroughly drained by excavating shallow ditches in the side slopes, as shown in Plate 4. Contact your Corps district office before undertaking this method.

3.4 Floating Soil Conditions

When seepage exits landward of the levee toe at a pressure that creates a sensation like the soil is fluid, the levee and foundation become susceptible to sliding and/or sloughing which can lead to an embankment failure. A fluid soil condition is an indicator that soil particles or the soil mass is floating, and the soil's ability to support a load such as a vehicle or heavy equipment and/or the levee embankment itself has been reduced. When this condition is observed, the safety, health and welfare of those individuals who are responding to the flood fight and/or those who live within the protected area must come first. Consideration must be given to evacuating the area. If the sod layer appears to pop loose or lift up, evacuate the area immediately. In a past flood, this condition was observed and successfully solved with the placement of clean, free-draining sand fill, classified as SP medium to fine sand, with less than 5 percent fines passing the number 200 sieve. The sand was brought in from another location (away from the levee), and a bulldozer was used to push the sand over the area, creating a blanket some 3 feet in thickness and some 20 feet in width. The thickness and width necessary may vary depending on the observed conditions.

3.5 Other Seepage Related Considerations

Any basement or similar depression near the levee should be closely watched for heaving of floors, caving of walls, and boil activity. It may become necessary to support basement walls or weight down basement floors by intentionally flooding the basement with clean water, to prevent walls from caving in, piping, or excessive seepage.

4. Erosion

4.1 Wave Wash

During high water, continuing wave action against a levee slope can erode wide terraces along the length of the levee. This causes scour or beaching along the riverward slope of the levee and reduces the cross sectional area, which can potentially lead to a failure. This type of damage doesn't typically arise during short (hour-long) storms, especially if the slope has good sod cover. However, during longer periods of high water, especially during windy or icy conditions, the damage can develop very rapidly. The section leader should study the levee beforehand to assess the potential for wave wash. All potential trouble areas should be located well in advance, and section leaders should assemble a reserve supply of materials (filled sandbags, lumber, stakes, plastic sheeting, rock, etc) close to locations most likely to experience such damage. During periods of high wind and high water, when waves attack a levee, ample labor should be assembled and experienced personnel should patrol the areas to identify the beginnings of scour, washouts, or breaching. Because wave wash damage can spread rapidly, it is important that damaged areas are treated as soon as they are identified. There are a number of accepted methods of protecting a levee against wave wash.

a. Sandbags

In emergency situations, the preferred treatment method is to place sandbags in to the cut as shown in Plate 5. The filled sacks should be laid in sections of sufficient length to give protection well above the anticipated rise.

b. Plastic Sheeting and Sandbags

Experience has shown that a combination of plastic sheeting and sandbags is one of the most expedient, effective and economical methods of combating slope attack in a flood situation. Other materials such as snow fence, cotton, or burlap have successfully been used in place of the plastic in the past. Poly and sandbags can be used in a variety of combinations, and time becomes the factor that may determine which combination to use. Ideally, poly and sandbag protection should be placed in the dry. However, many cases of unexpected slope attack will occur during high water, and a method for placement in the wet is covered below. See Plates 6 and 7 for recommended methods of laying poly and sandbags. Plate 8 shows a minimal configuration for emergency use. Since each flood fight project is generally unique (river, personnel available, materials, etc.), specific details of placement and materials handling will not be covered, though some guidelines are provided below. Field personnel must be aware of resources available when using poly and sandbags.

i. Dry Placement

Anchoring the poly along the riverward toe is important for a successful job. It may be done in three different ways: 1) after completion of the levee, a trench excavated along the toe, poly placed in the trench, and the trench backfilled; 2) poly placed flat-out away from the toe, and earth pushed over the flap; 3) poly placed flat-out from the toe and one or more rows of sandbags placed over the flap. The poly should then be unrolled up the slope and over the top enough to allow for anchoring with sandbags. Poly should be placed from downstream to upstream along the slopes and overlapped at least two feet. The poly is now ready for the "hold-down" sandbags.

It is mandatory that poly placed on levee slopes be held down along the slopes as well. An effective method of anchoring poly is a grid system of sandbags, unless extremely high velocities, heavy debris or a large amount of ice is anticipated. Then, a solid blanket of bags over the poly should be used. A grid system can be constructed faster and requires fewer bags and much less labor than a total covering. Various grid systems include vertical rows of lapped bags, two-by-four lumber held down by attached bags, and rows of bags held by a continuous rope tied to each bag. Poly has been held down by a system using two bags tied with rope and the rope saddled over the levee crown with a bag on each slope.

ii. Placement in the Wet

In many situations during high water, poly and sandbags placed in the wet must provide the emergency protection. Wet placement may also be required to replace or maintain damaged poly or poly displaced by current action. Plate 7 shows a typical section of levee covered in the wet. Sandbag anchors are formed at the bottom edge and ends of the poly by bunching the poly around a fistful of sand or rock, and tying the sandbags to this fist-sized ball. Counterweights consisting of two or more sandbags connected by a length of 1/4-inch rope are used to hold the center portion of the poly down. The number of counterweights will depend on the uniformity of the levee slope and current velocity. Placement of the poly consists of first casting out the poly sheet with the bottom weights and then adding counterweights to slowly sink the poly sheet into place. The poly, in most cases, will continue to move down slope until the bottom edge reaches the toe of the slope. Sufficient counterweights should be added to insure that no air voids exist between the poly and the levee face and to keep the poly from flapping or being carried away in the current. For this reason, it is important to have enough counterweights prepared prior to the placement of the sheet.

iii. Overuse of Plastic Sheeting

In past floods, there has been a tendency to overuse and in some cases misuse poly on slopes. For example, on well-compacted clay embankments, in areas of relatively low velocities, use of poly would be excessive. Plastic should never be used on the landward slopes, as it holds through-seepage against the levee slope. A critical analysis of a situation should be made before poly and sandbags are used, with a view toward less waste and more efficient use of these materials and available manpower. However, if a situation is doubtful, poly should be used rather than risk a failure. Critical areas should have priority.

c. Moveable Panels

Wave wash may also be effectively checked by the use of movable panels constructed of lumber. These panels are anchored in place on the levee slope with stakes and are weighted down with sandbags or stone as shown on Plate 9. A portable bulkhead constructed with lumber and staked into placed is another alternate type of wave wash protection.

d. Miscellaneous Measures

Several other methods of slope protection have been used. Straw bales pegged into the slope were successful against wave action, as was straw spread on the slope and overlain with snow fence.

4.2 Scours

Scouring occurs when the current velocity against the levee is adequate to remove levee embankment materials. Once scouring begins to occur, the protective sod cover is damaged or destroyed and additional scour may develop very quickly. Careful observation should be made along the entire length of the riverside of the levee during high water periods, and especially in locations where the current flow is two feet per second or more. Scouring will most likely develop at road crossing ramps and at locations where pipes, sewers, and other structures penetrate the levee. It may also develop in ditches, excavations or building basements near the levee, around riverside stability berms, or in other locations where there is an obstruction to the smooth flow of water along the levee face. If any scour is observed, soundings should be taken if possible to determine the extent of damage and the amount of treatment required.

a. Deflection Weirs

Deflection weirs (also known as bendway weirs), extending 10 feet or more into the channel have been effective in deflecting current away from the levees. These emergency structures can be constructed using lumber, stakes, brush, sandbags, and stone, and are tied in place as shown on Plates 10 and 11. Snow fence, plain riprap, compacted earth or any other substantial materials available may also be used; even old car bodies have been used in the past. Preferably, the weirs should be placed in the dry at locations where severe scour may be anticipated, because construction during high water will be very difficult. A series of weirs may be needed to protect the area, or a longer weir may be constructed in the water parallel to the levee. Care should be given in the placement of weirs, because haphazard placement may be shift the current towards other banks and lead to even worse scouring. Hydraulic technical assistance should be sought if questions arise in the use of emergency weirs.

b. Plastic Sheeting

Plastic sheeting may be useful in protecting the embankment from scouring, as described under the previous section on wave wash.

c. Other Protection

If scour begins to take place after water is up on the levee, a protective berm should be constructed over the entire scour area using stone, slag, or other durable material with sufficient size and weight withstand the erosive velocity of the current. Construction of this berm will generally require equipment capable of operating from the levee crown. Riprap has been used to provide slope protection where erosive forces were too large to be effectively controlled by other means. Objections to using riprap when flood fighting include the cost and the large quantities that are typically necessary to protect a given area. It's usually very difficult to control the placement of the riprap, particularly during times of high water, but careful use of an excavator has been effective even in difficult conditions.

Figure D.10 *Placement of Riprap. Careful use of an excavator may allow for more accurate placement than is shown above.*

4.3 Ice and Floating Debris

Sometimes ice conditions are such that protection provided by the methods outlined above will not be totally effective. The primary method for protecting a levee slope from debris or ice attack is to construct a floating boom parallel to the levee embankment. Logs, driftwood, or any available timber are cabled together end to end and moored to the ground in such a way that they float out in the current about 15 feet from the water's edge. Depending on the size of the logs, the boom will deflect floating objects. Since a detailed discussion of ice jams lies beyond the scope of this manual, please refer to the references in Appendix I for additional information.

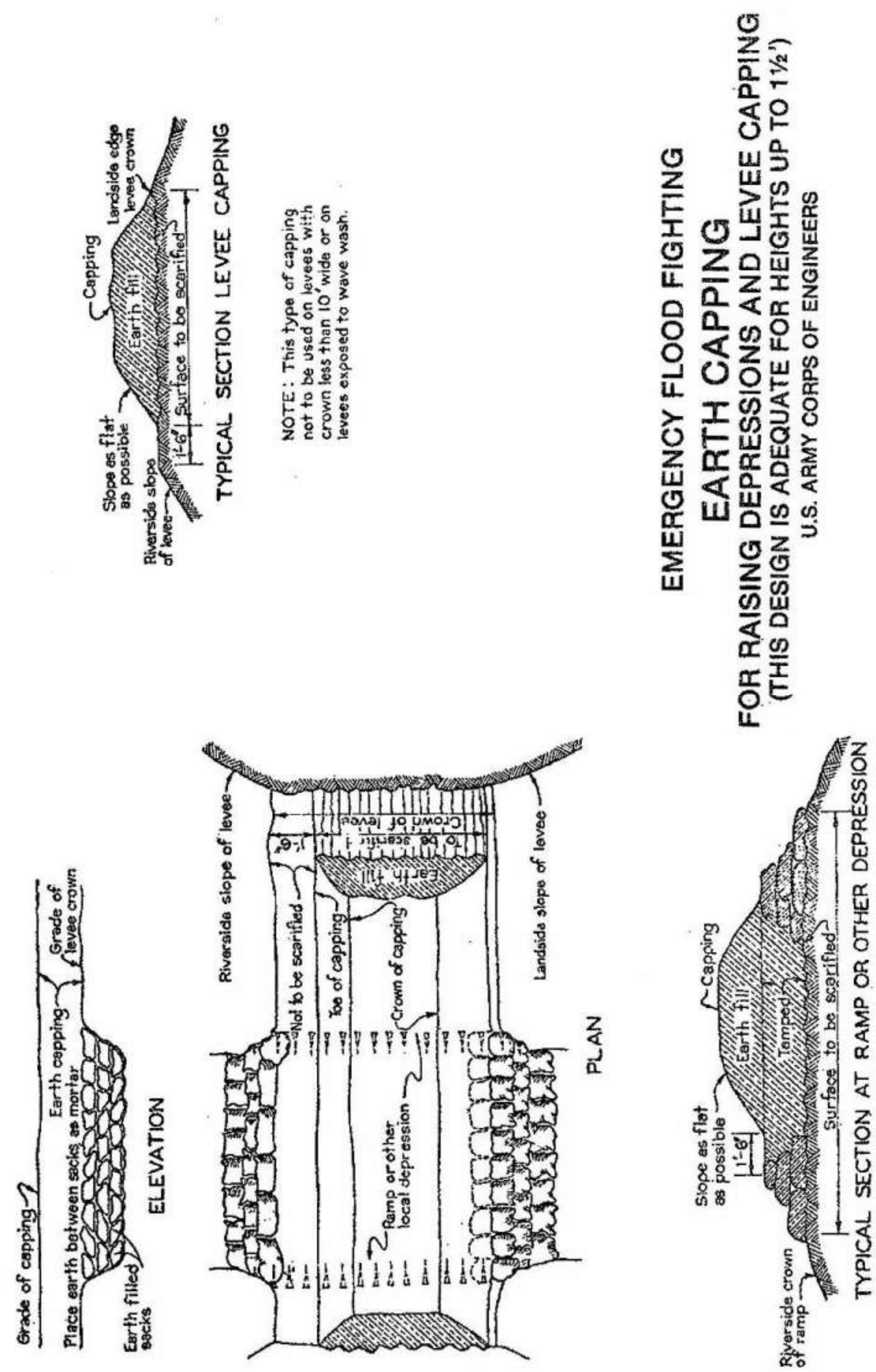

Grade of capping
Place earth between sacks as mortar
Earth capping
Grade of levee crown
Earth filled sacks
ELEVATION
Riverside slope of levee
Not to be scarified
Toe of capping
Crown of capping
Earth fill
To be scarified
Crown of levee
1'-6"
Ramp or other local depression
Landside slope of levee
PLAN
Slope as flat as possible
1'-6'
Capping
Earth fill
Tamped
Surface to be scarified
Riverside crown of ramp
TYPICAL SECTION AT RAMP OR OTHER DEPRESSION
Slope as flat as possible
Capping
Landside edge levee crown
Riverside slope of levee
1'-6'
Earth fill
Surface to be scarified
TYPICAL SECTION LEVEE CAPPING
NOTE: This type of capping not to be used on levees with crown less than 10' wide or on levees exposed to wave wash.
EMERGENCY FLOOD FIGHTING
EARTH CAPPING
FOR RAISING DEPRESSIONS AND LEVEE CAPPING
(THIS DESIGN IS ADEQUATE FOR HEIGHTS UP TO 1½')
U.S. ARMY CORPS OF ENGINEERS

Plate 1

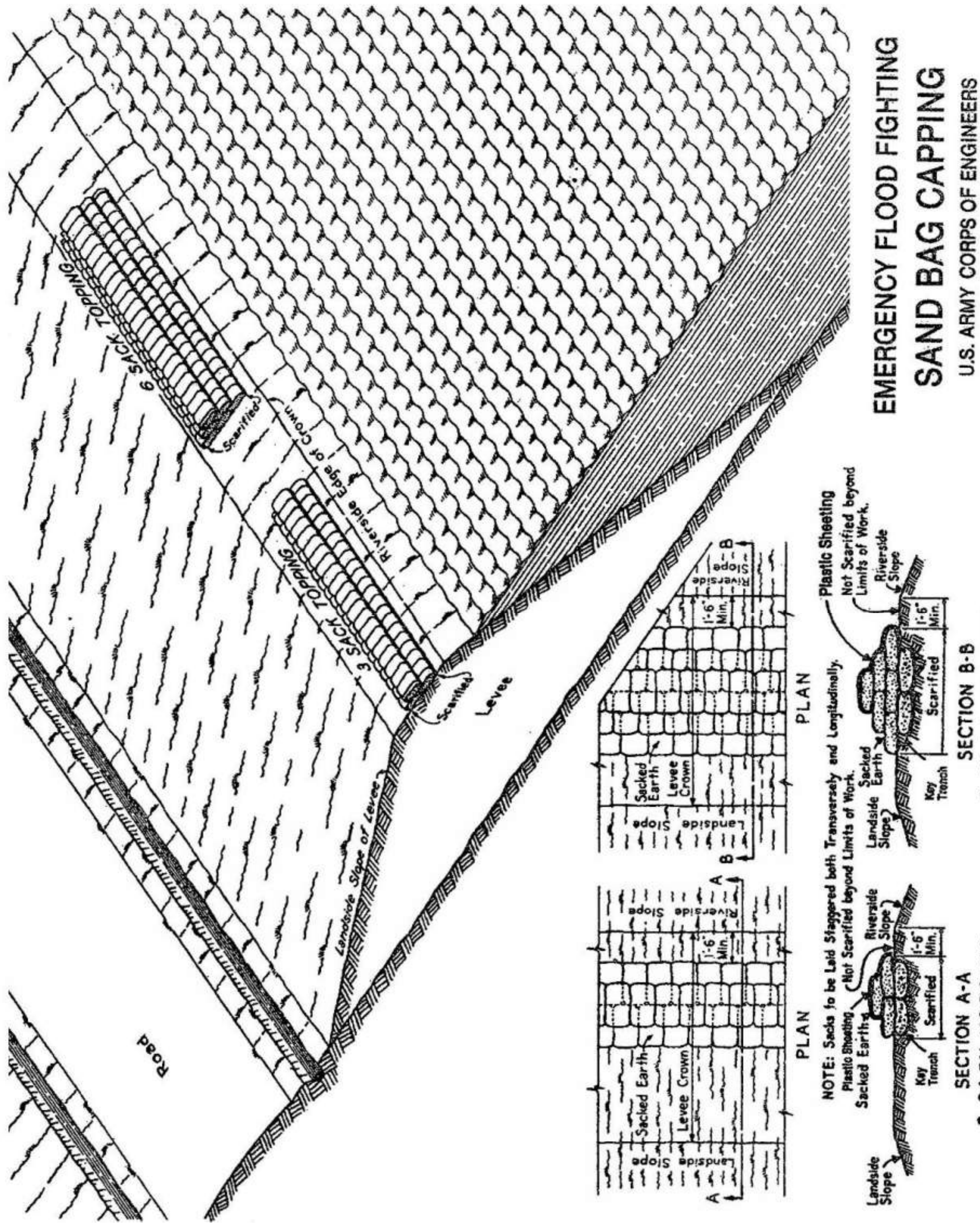
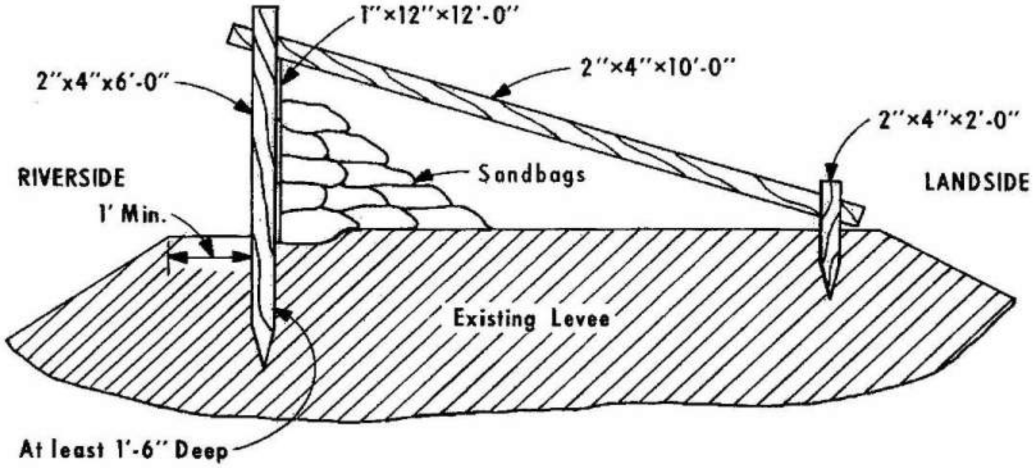
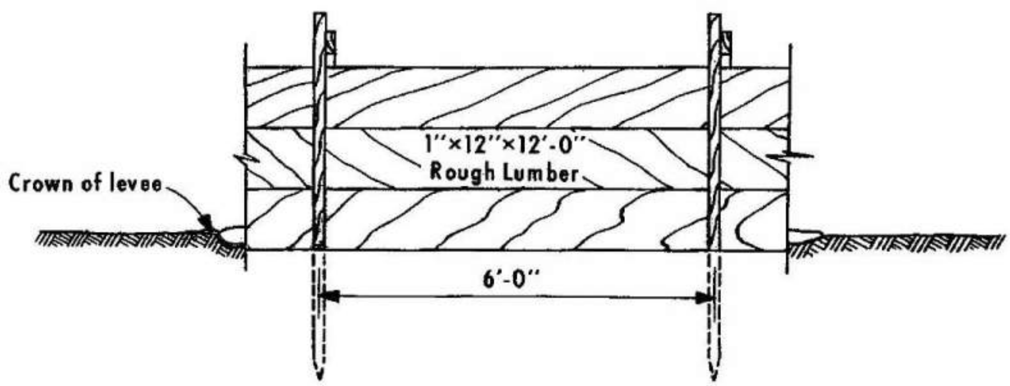

EMERGENCY FLOOD FIGHTING
SAND BAG CAPPING
U.S. ARMY CORPS OF ENGINEERS
6 SACK TOPPING
3 SACK TOPPING
Riverside Edge of Crown
Scarified
Levee
Landside Slope of Levee
Road
PLAN
SECTION A-A
3 SACK TOPPING
SECTION B-B
6 SACK TOPPING
NOTE: Sacks to be Laid Staggered both Transversely and Longitudinally.
Plastic Sheeting
Not Scarified beyond Limits of Work.
Sacked Earth
Levee Crown
Landside Slope
Riverside Slope
Key Trench
1'-6" Min.

Plate 2



SECTION



FRONT ELEVATION

BILL OF MATERIAL FOR 100 FT.
LUMBER
25 pieces 1"×12"×12'-0"
17 pieces 2"×4"×10'-0"
17 pieces 2"×4"×6'-0"
17 pieces 2"×4"×2'-0"
NAILS
2 lbs 8d Common
2 lbs 16d Common
SANDBAGS
1100 Filled Bags

CONSTRUCTION METHODS
FOR
HIGH WATER

LUMBER AND SACK TOPPING

U. S. ARMY CORPS OF ENGINEERS

Plate 3

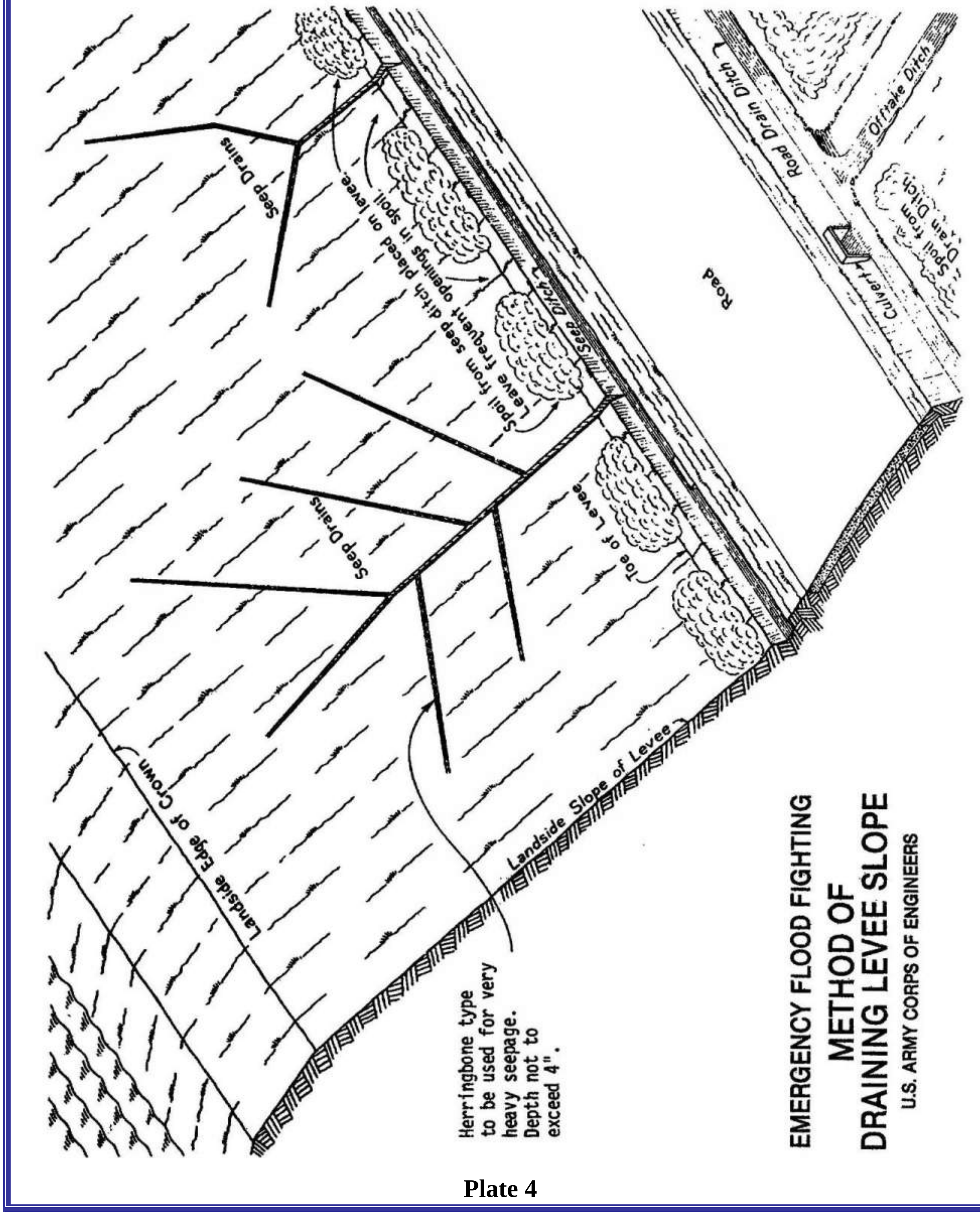

Seep Drains
Spoil from seep ditch placed on levee
Leave frequent openings in spoil
Seep Ditch
Road
Road Drain Ditch
Offtake Ditch
Spoil from Drain Ditch
Culvert
Seep Drains
Toe of Levee
Landside Edge of Crown
Landside Slope of Levee
Herringbone type to be used for very heavy seepage. Depth not to exceed 4".
EMERGENCY FLOOD FIGHTING
METHOD OF
DRAINING LEVEE SLOPE
U.S. ARMY CORPS OF ENGINEERS

Plate 4

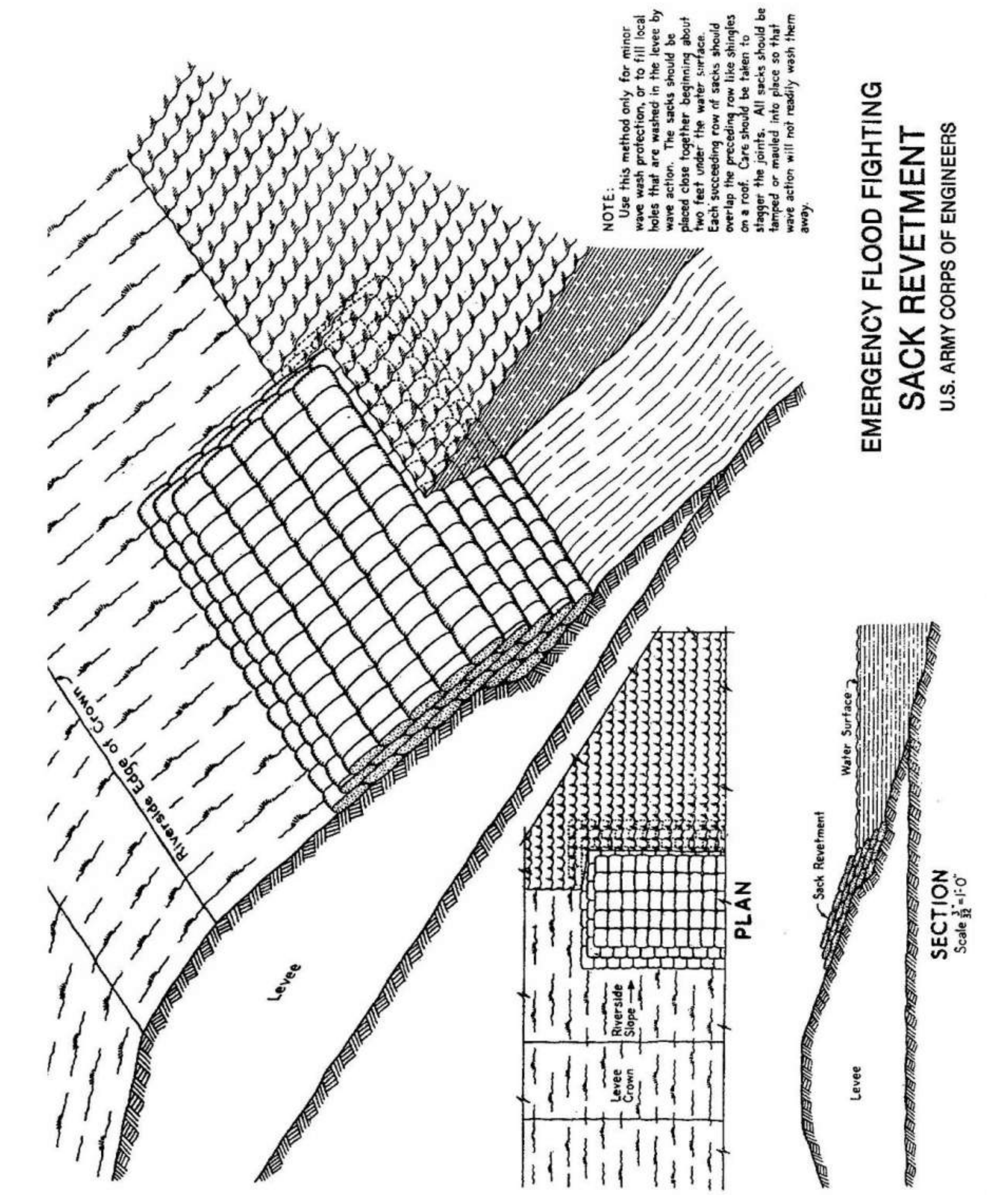

NOTE:
Use this method only for minor wave wash protection, or to fill local holes that are washed in the levee by wave action. The sacks should be placed close together beginning about two feet under the water surface. Each succeeding row of sacks should overlap the preceding row like shingles on a roof. Care should be taken to stagger the joints. All sacks should be tamped or mauled into place so that wave action will not readily wash them away.
EMERGENCY FLOOD FIGHTING
SACK REVETMENT
U.S. ARMY CORPS OF ENGINEERS
Riverside Edge of Crown
Levee
Levee Crown
Riverside Slope
PLAN
Sack Revetment
Water Surface
Levee
SECTION
Scale 3/32"=1'-0"

Plate 5

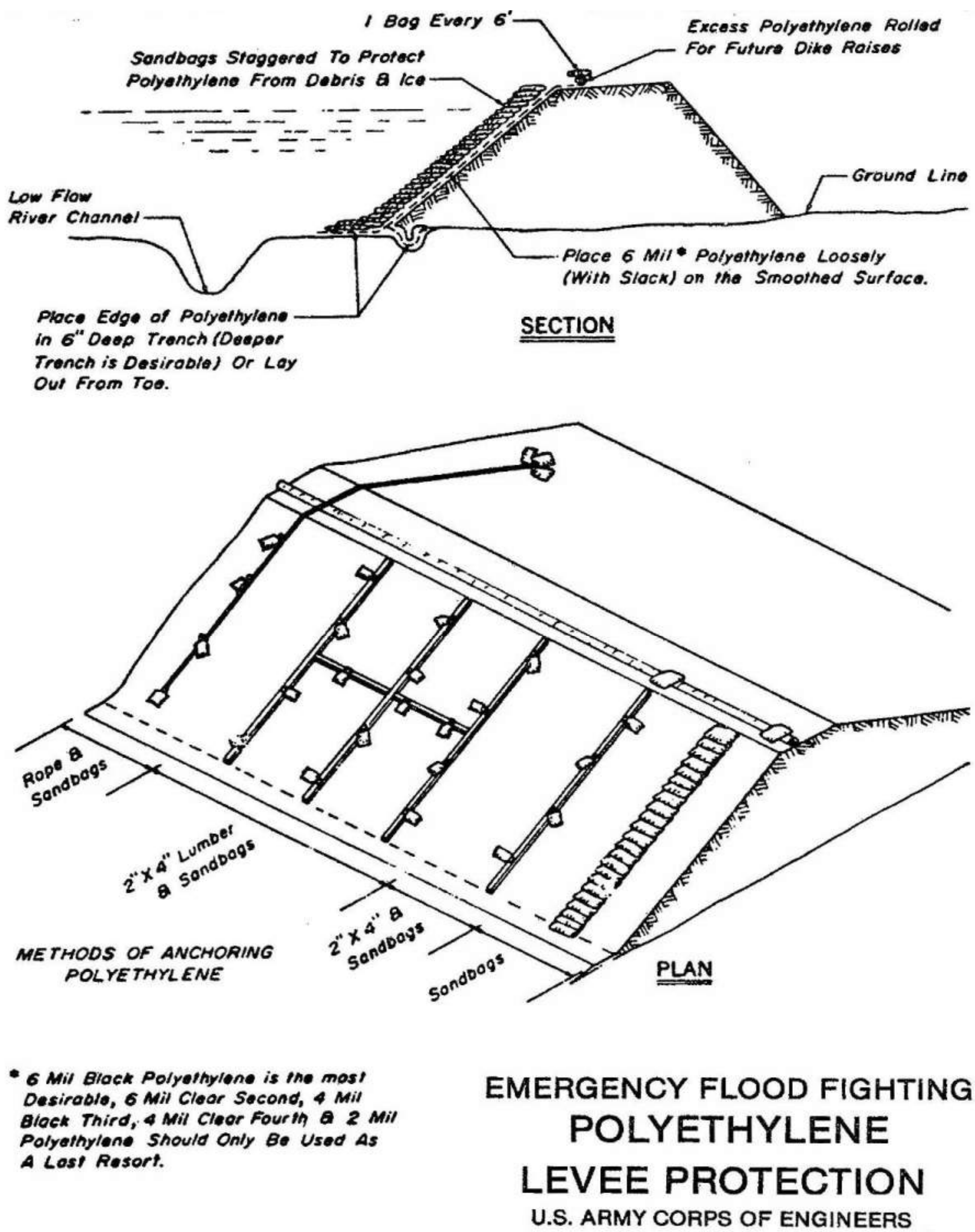
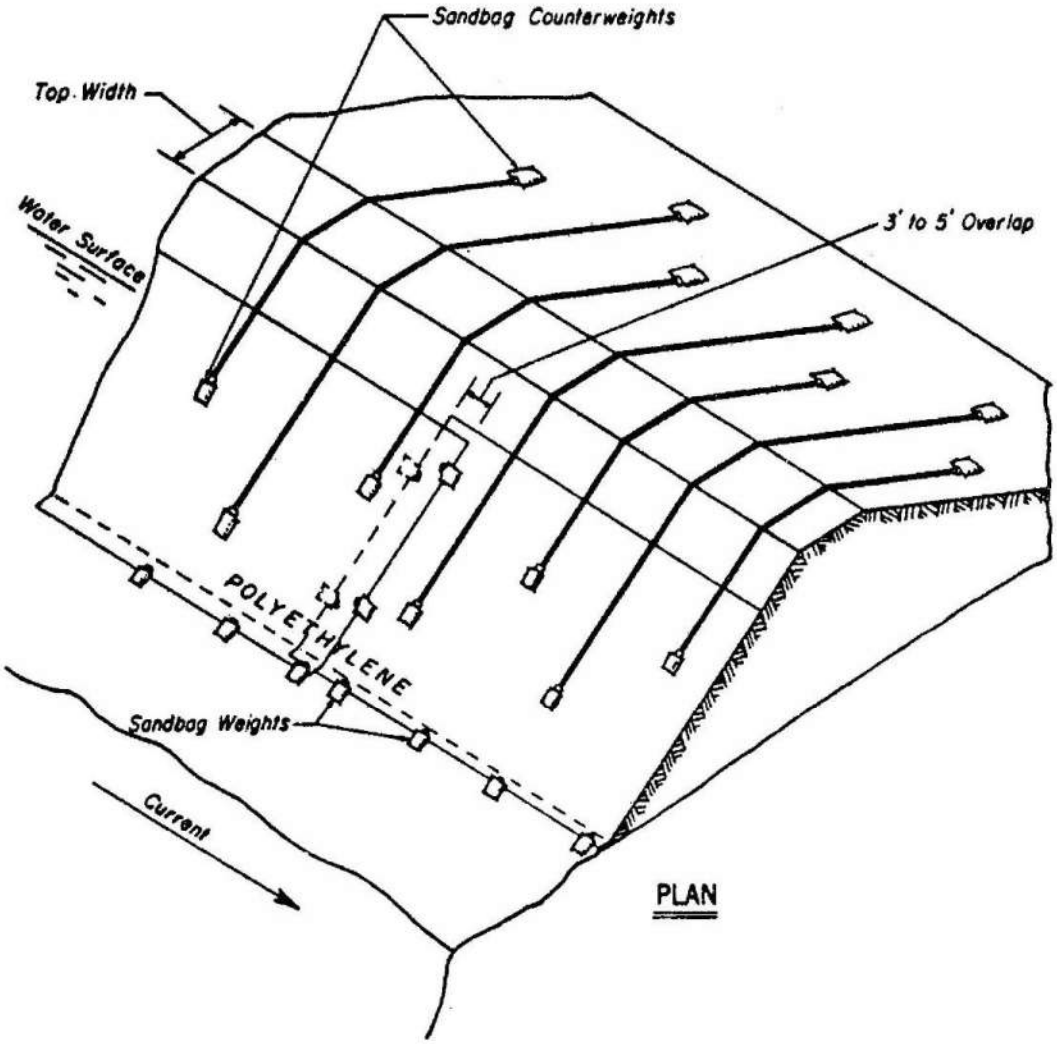
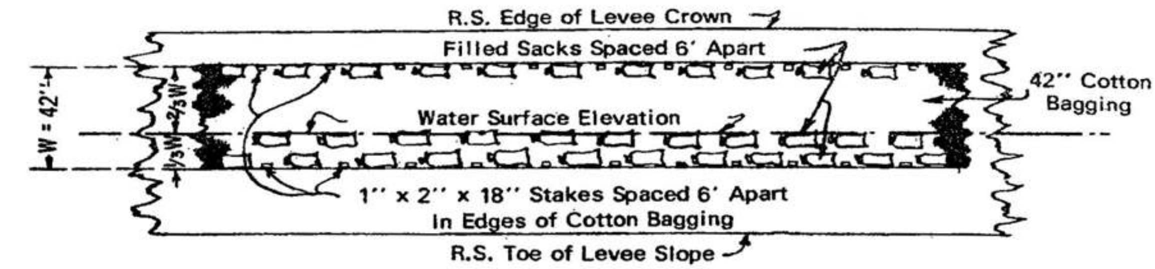

I Bag Every 6'
Excess Polyethylene Rolled For Future Dike Raises
Sandbags Staggered To Protect Polyethylene From Debris & Ice
Ground Line
Low Flow River Channel
Place 6 Mil* Polyethylene Loosely (With Slack) on the Smoothed Surface.
Place Edge of Polyethylene in 6" Deep Trench (Deeper Trench is Desirable) Or Lay Out From Toe.
SECTION
Rope & Sandbags
2"X4" Lumber & Sandbags
2"X4" & Sandbags
Sandbags
METHODS OF ANCHORING POLYETHYLENE
PLAN
* 6 Mil Black Polyethylene is the most Desirable, 6 Mil Clear Second, 4 Mil Black Third, 4 Mil Clear Fourth & 2 Mil Polyethylene Should Only Be Used As A Last Resort.
EMERGENCY FLOOD FIGHTING
POLYETHYLENE
LEVEE PROTECTION
U.S. ARMY CORPS OF ENGINEERS

Plate 6

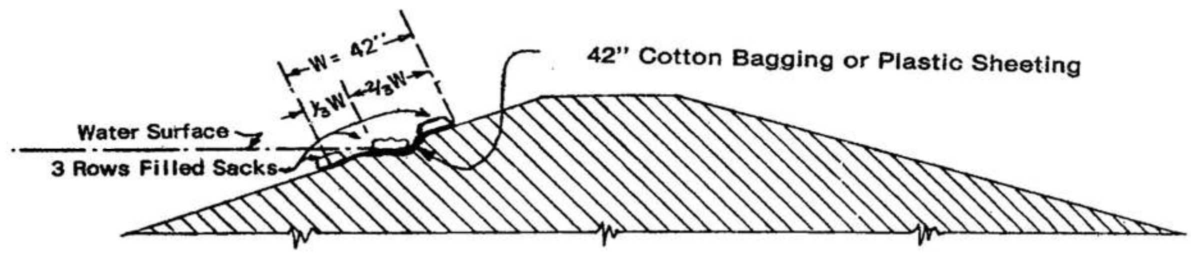


EMERGENCY FLOOD FIGHTING
PLACEMENT OF
POLYETHYLENE
SHEETING IN THE WET
U.S. ARMY CORPS OF ENGINEERS

Plate 7



PLAN



CROSS SECTION

BILL OF MATERIAL
TO CONSTRUCT 180 FT.

1 Roll Jute Cotton Bagging 42" x 180'
90 Filled Sacks
60 Stakes 1" x 2" x 18" = 15 Bd. Ft.

INSTRUCTIONS

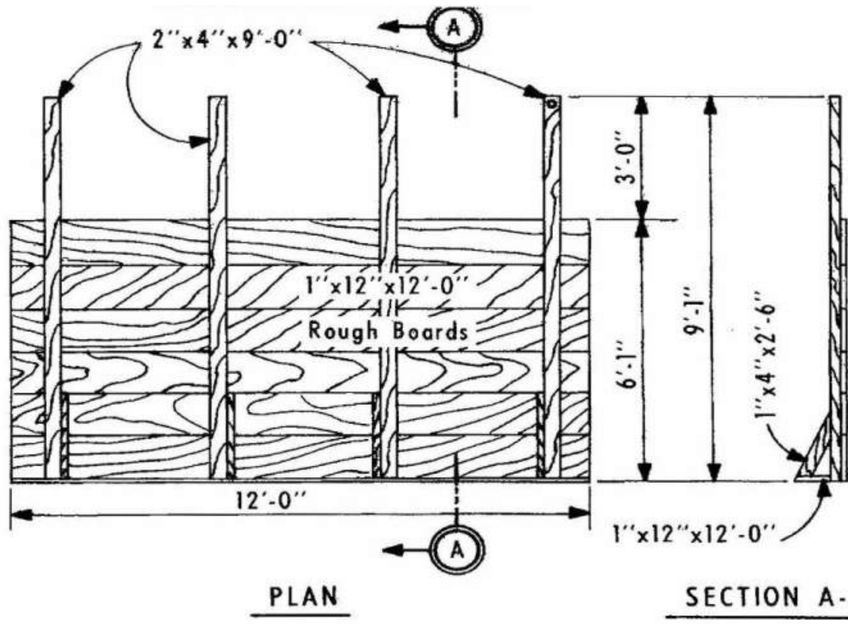
Lay 42" cotton bagging (Jute) longitudinally along riverside slope of levee with approximate 2/3 width above water surface.

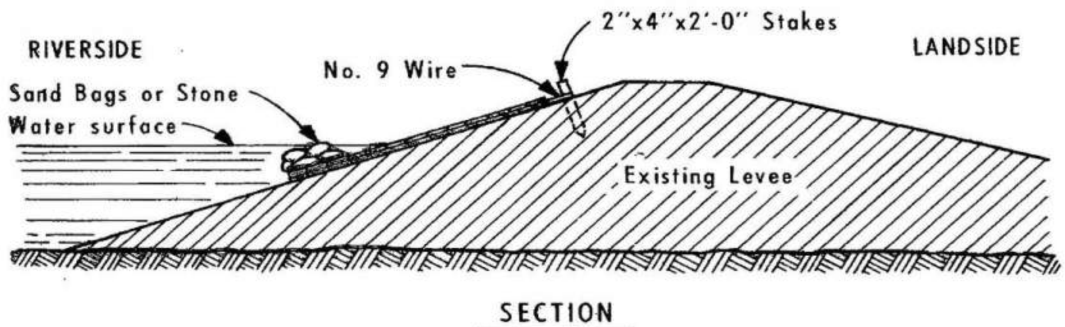
Weight bagging along edges and at water surface with filled sacks spaced approximately 6' apart. Drive stakes alternately between sacks along both edges of bagging.

If additional width is required, lace two or more widths of bagging together and lay as desired.

EMERGENCY FLOOD FIGHTING
TYPE OF WAVEWASH PROTECTION
U.S. ARMY CORPS OF ENGINEERS

Plate 8

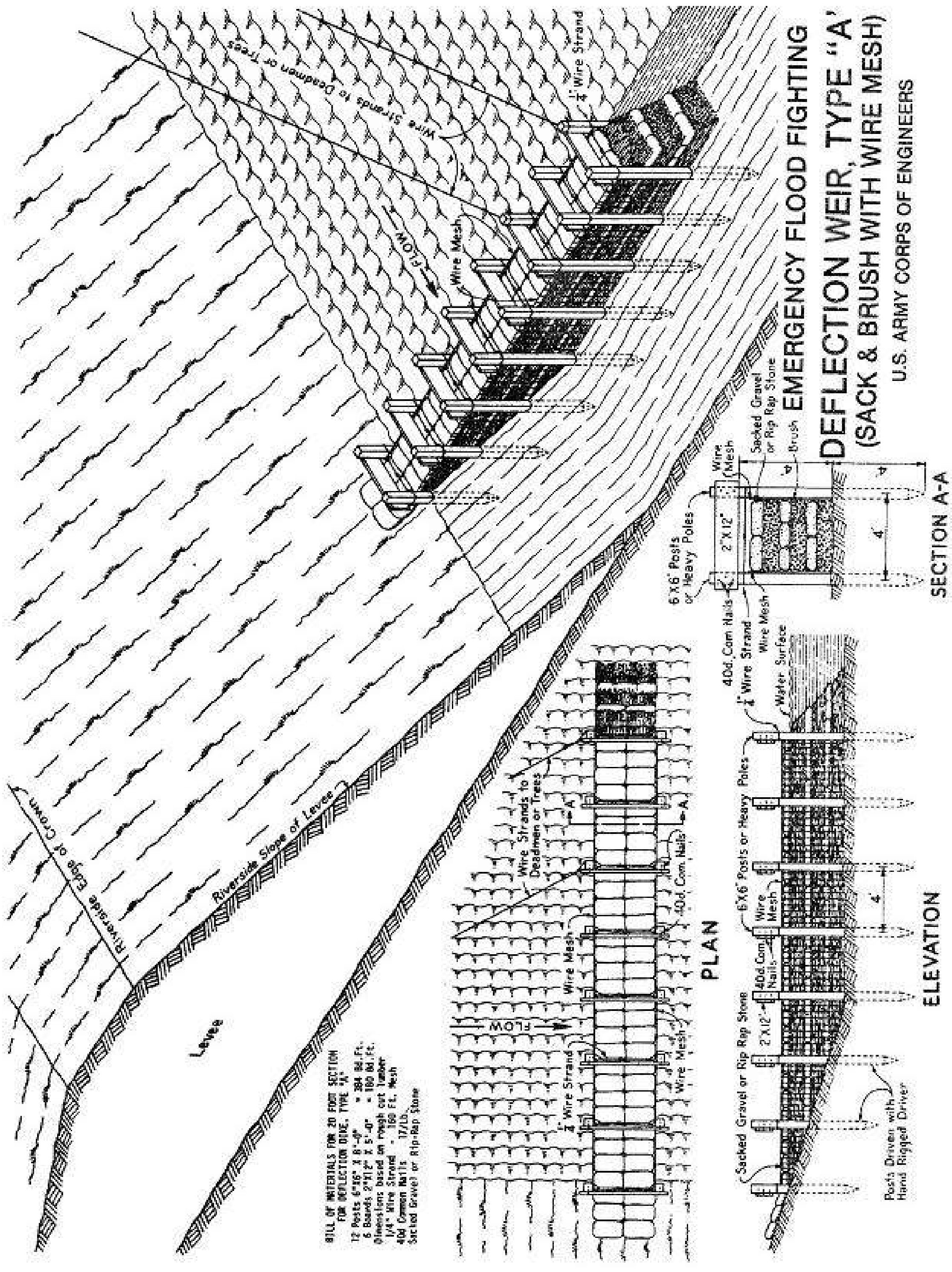




BILL OF MATERIAL FOR 100 FT.
LUMBER
55 Pieces 1"x12"x12'-0" 32 Pieces 1"x4"x2'-6" 32 Pieces 2"x4"x9'-0" 32 Pieces 2"x4"x2'-0"
WIRE
100 Ft. No. 9
NAILS
6lbs. 8d Common

CONSTRUCTION METHODS
FOR
HIGH WATER
WAVE WASH PROTECTION MOVABLE
U. S. ARMY CORPS OF ENGINEERS

Plate 9



EMERGENCY FLOOD FIGHTING
DEFLECTION WEIR, TYPE "A"
(SACK & BRUSH WITH WIRE MESH)
U.S. ARMY CORPS OF ENGINEERS
SECTION A-A
PLAN
ELEVATION
Riverside Edge of Crown
Riverside Slope of Levee
Levee
Wire Strands to Deadmen or Trees
Wire Mesh
FLOW
1/4" Wire Strand
6"X6" Posts or Heavy Poles
2"X12"
Sacked Gravel or Rip Rap Stone
Brush
Water Surface
40d. Com. Nails
Posts Driven with Hand Rigged Driver

Plate 10

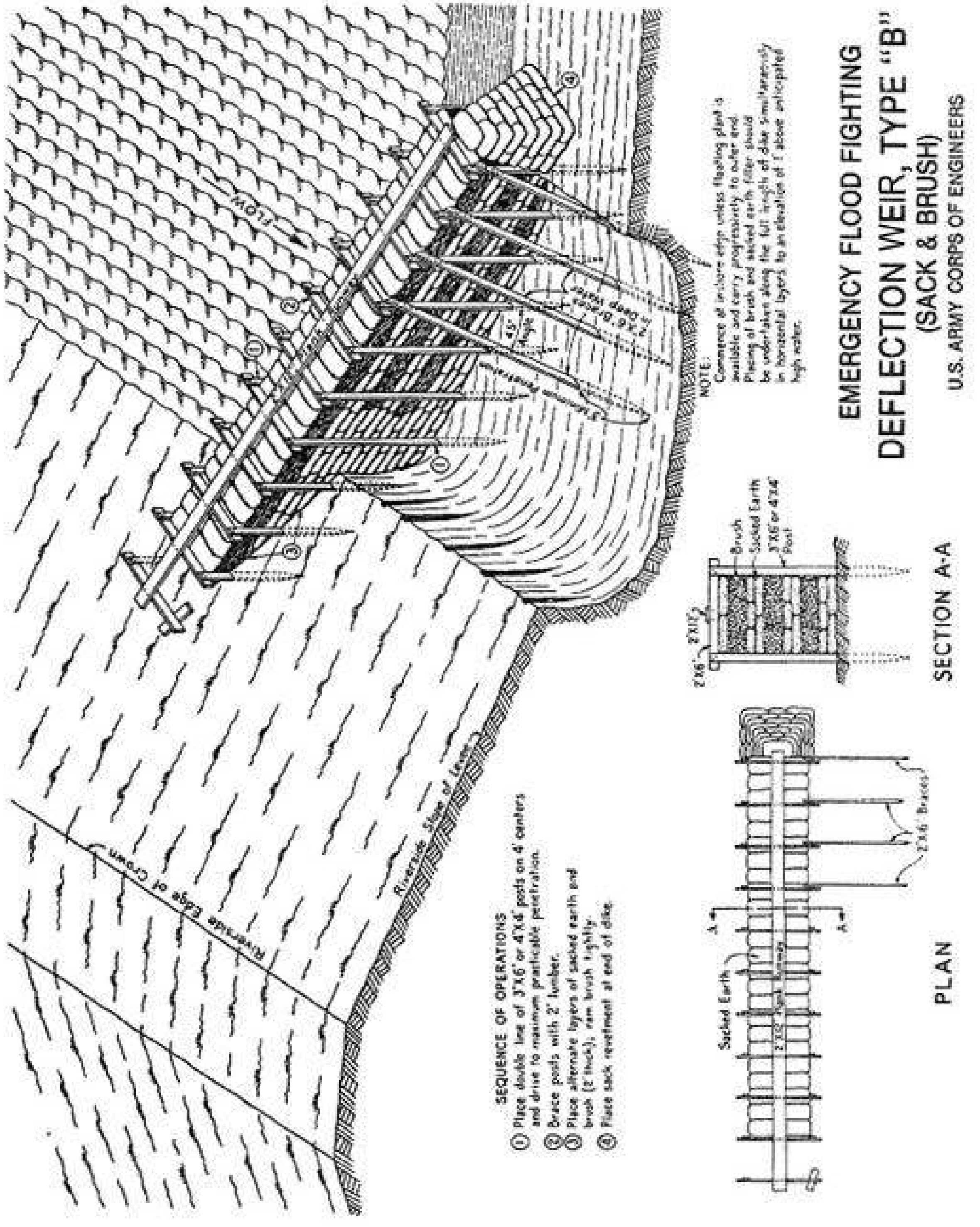

EMERGENCY FLOOD FIGHTING
DEFLECTION WEIR, TYPE "B"
(SACK & BRUSH)
U.S. ARMY CORPS OF ENGINEERS
FLOW
Riverside Edge of Crown
Riverside Slope of Levee
SEQUENCE OF OPERATIONS
① Place double line of 3"X6" or 4"X4" posts on 4' centers and drive to maximum practicable penetration.
② Brace posts with 2" lumber.
③ Place alternate layers of sacked earth and brush (2' thick); ram brush tightly.
④ Place sack revetment at end of dike.
SECTION A-A
PLAN
Sacked Earth
Brush
2"X6" Braces

Plate 11

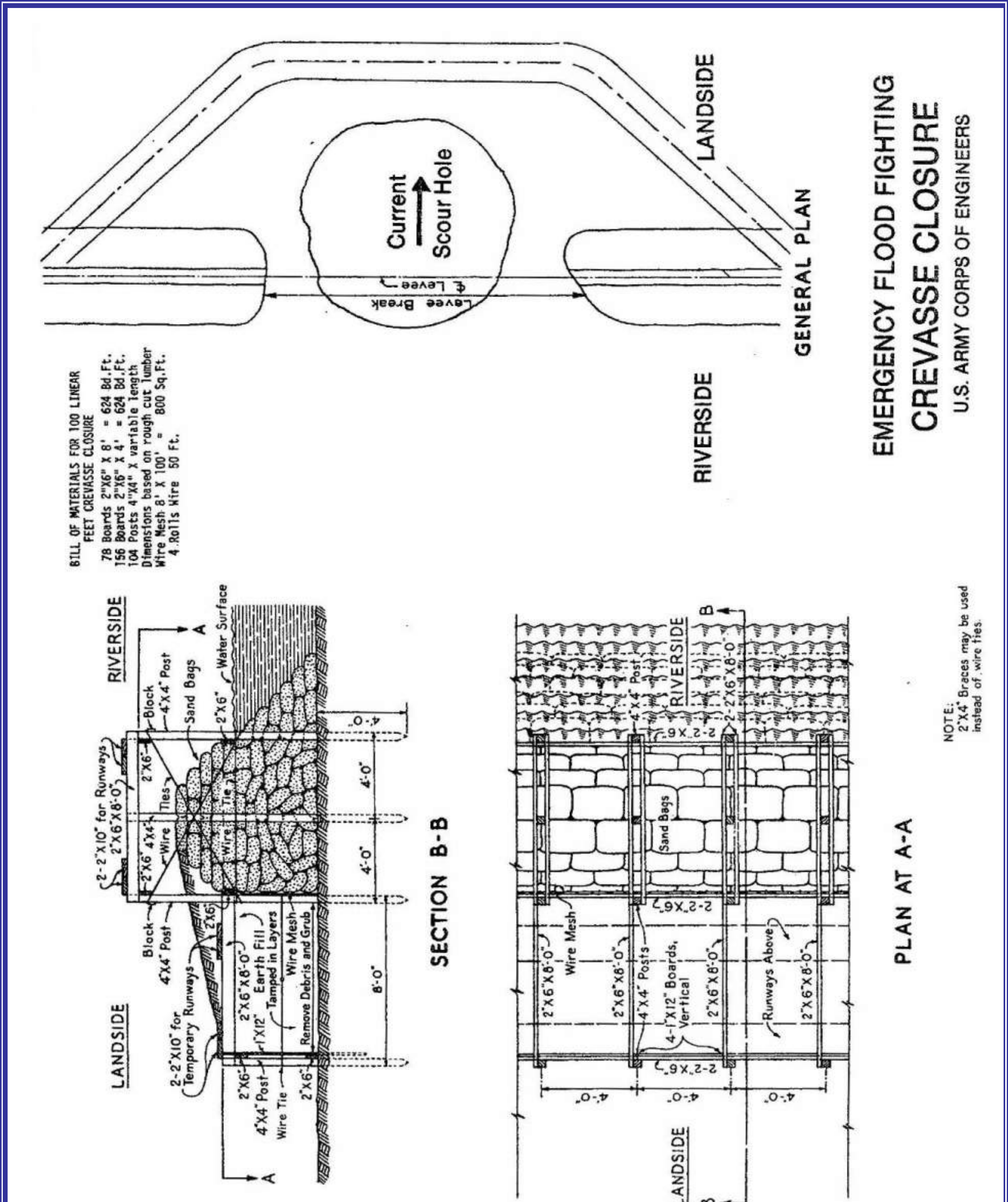
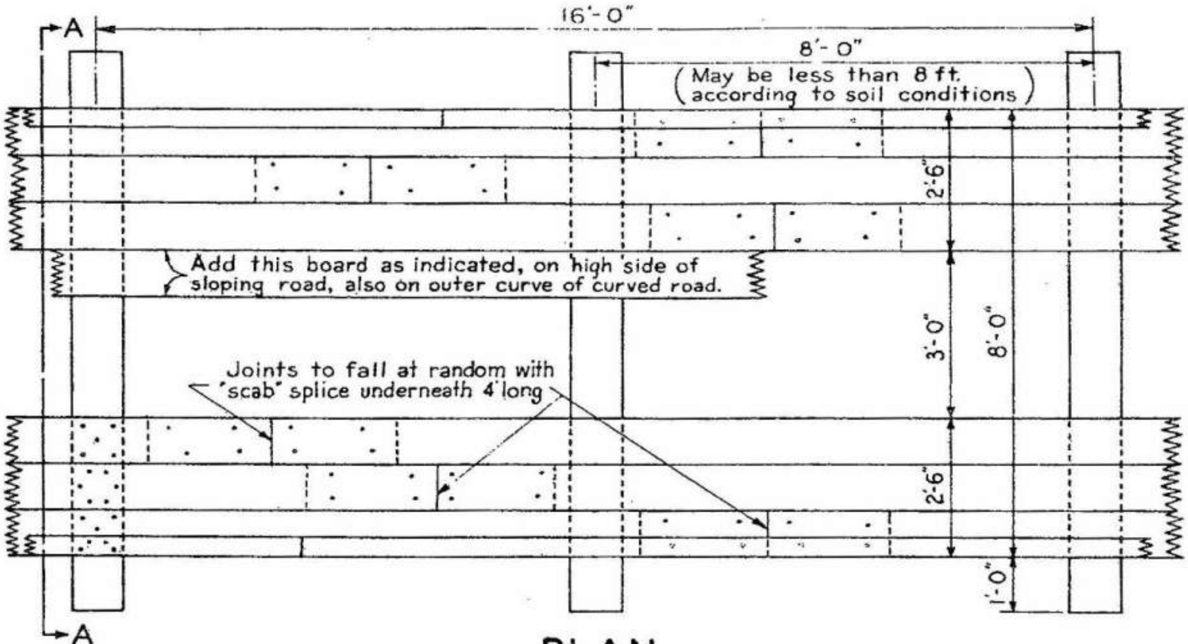
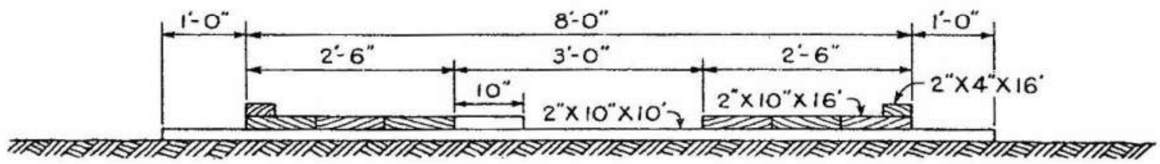

EMERGENCY FLOOD FIGHTING
CREVASSE CLOSURE
U.S. ARMY CORPS OF ENGINEERS
GENERAL PLAN
LANDSIDE
RIVERSIDE
Current
Scour Hole
Levee Break
℄ Levee
BILL OF MATERIALS FOR 100 LINEAR FEET CREVASSE CLOSURE
78 Boards 2"X6" X 8' = 624 Bd.Ft.
156 Boards 2"X6" X 4' = 624 Bd.Ft.
104 Posts 4"X4" X variable length
Dimensions based on rough cut lumber
Wire Mesh 8' X 100' = 800 Sq.Ft.
4 Rolls Wire 50 Ft.
SECTION B-B
Sand Bags
Water Surface
Wire Mesh
Earth Fill Tamped in Layers
Remove Debris and Grub
2-2"X10" for Temporary Runways
2-2"X10" for Runways
4"X4" Post
Block
Wire Tie
PLAN AT A-A
Runways Above
4"X4" Posts
4-1"X12" Boards, Vertical
NOTE: 2"X4" Braces may be used instead of wire ties.

Plate 12



PLAN
Scale $\frac{3}{8}$" = 1'-0"



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

BILL OF MATERIALS FOR
100 LINEAR FEET OF ROADWAY

Cross Members	13 Pcs. 2"X10"X10' =	217 Bd. Ft.
Road Bed	38 Pcs. 2"X10"X16'* =	1014 Bd. Ft.
Guard Rail	13 Pcs. 2"X4"X16'* =	139 Bd. Ft.
	Total	1370 Bd. Ft.

18 Lbs. 30d. Common Nails
10 Lbs. 60d. Common Nails

Kind of Lumber: Hardwood, Rough.

Actual quantities. No allowance made for waste.

NOTE:
Where foundation is very soft, 12 ft. flooring should be used with cross members at 6 ft. centers. In this case add approximately $33\frac{1}{3}$% or $\frac{1}{3}$ to Bill of Materials at left, for 100 ft. of roadway.

* Random not less than 12'

EMERGENCY FLOOD FIGHTING
PLANK ROAD
U.S. ARMY CORPS OF ENGINEERS

Plate 13

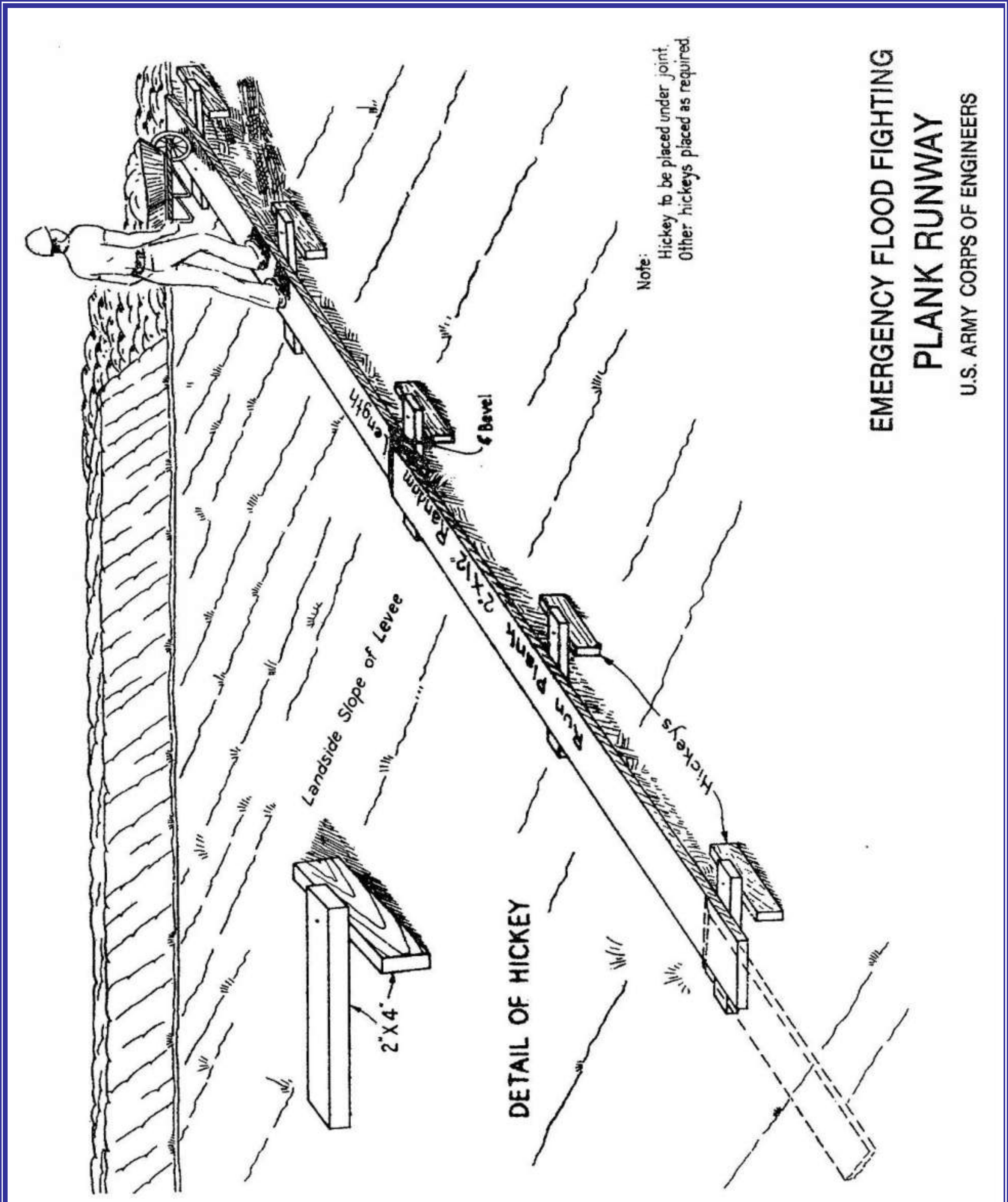

EMERGENCY FLOOD FIGHTING
PLANK RUNWAY
U.S. ARMY CORPS OF ENGINEERS
Note:
Hickey to be placed under joint.
Other hickeys placed as required.
DETAIL OF HICKEY
2"X4"
Landside Slope of Levee
Run Plank 2"x12" Random Length
Hickeys
℄ Bevel

Plate 14

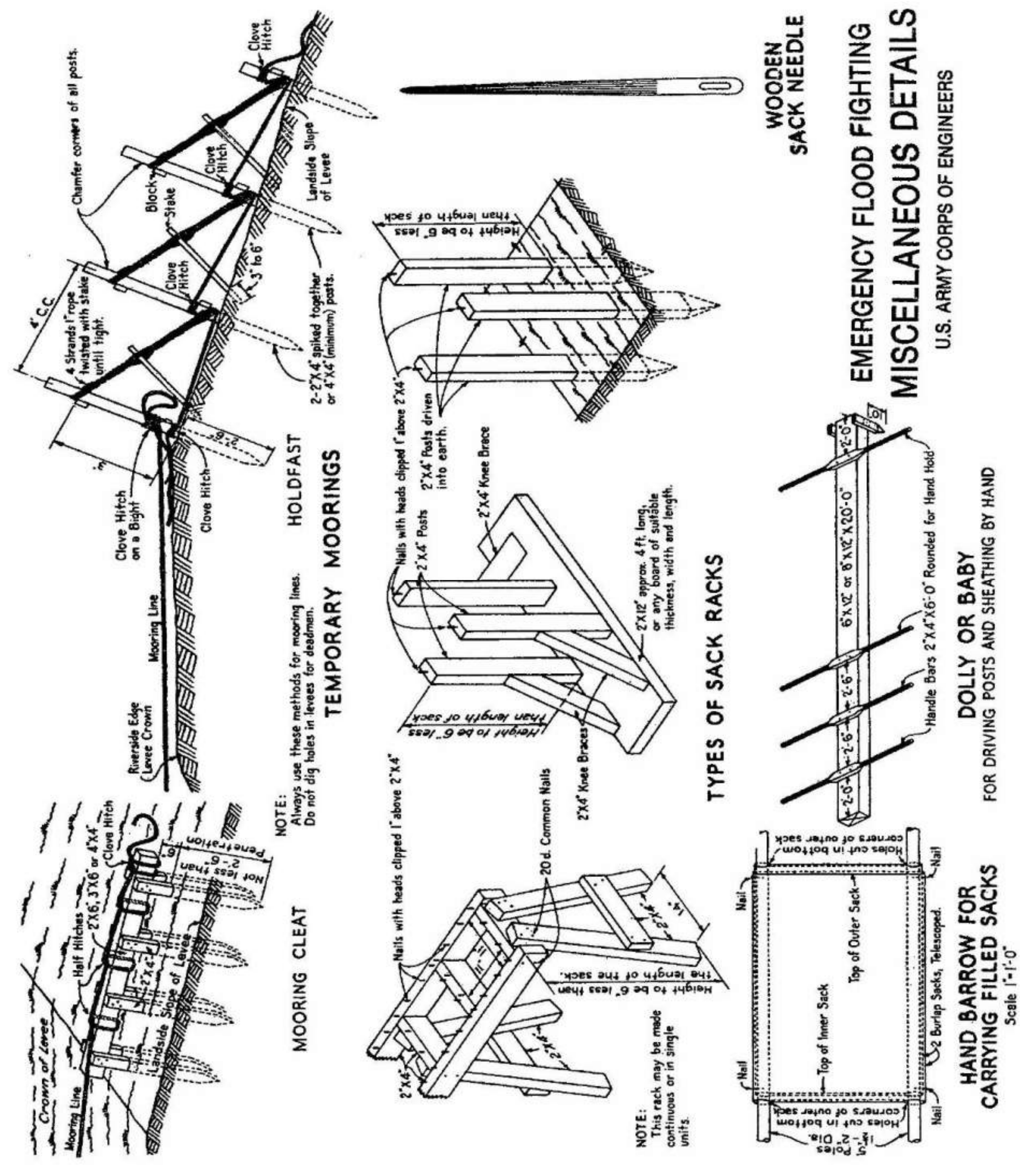

EMERGENCY FLOOD FIGHTING
MISCELLANEOUS DETAILS
U.S. ARMY CORPS OF ENGINEERS
MOORING CLEAT
TEMPORARY MOORINGS
HOLDFAST
TYPES OF SACK RACKS
WOODEN SACK NEEDLE
HAND BARROW FOR CARRYING FILLED SACKS
DOLLY OR BABY
FOR DRIVING POSTS AND SHEATHING BY HAND

Plate 15