

5.0 Preferred Flood Protection Alternative Development and Recommendation

A workshop was held with the City of West Haven on November 12, 2021 to discuss the alternatives presented above. The City agreed that temporary flood protection measures were not the preferred alternative because of the requirement for rapid deployment immediately before a flood and the likelihood that FEMA would not fund this alternative. The earthen berm and water inflated dam alternatives were eliminated because of a lack of space at the MPS and WPCF sites. The final selection became a perimeter floodwall for both sites. This alternative also minimizes the number of openings through the fixed wall. The City of West Haven has some aesthetic concerns with the sheet pile wall but is comfortable with the sheet piling above grade where not directly exposed to view by the public, and at all locations below grade.

The Geotechnical Investigation performed a limited environmental testing program which found contaminants in the soils and in particular water-soluble lead at the Main Pump Station site. These findings favor the installation of sheet pile over any other type of floodwall for below grade excavation as the sheet pile eliminates the need for costly remediation of the contaminants in the soil.

The arrangement preferred by the City was a combination of sheet pile, and concrete, or an architectural treatment of the sheet pile walls. These arrangements were investigated further to examine their impacts on costs and viability.

5.1 Further Development of Selected Alternative for WPCF and MPS

Several variations of the same perimeter floodwall concept were moved forward for further development and planning level cost budget estimating. Geotechnical reports were utilized to develop a conceptual design, and to address underground contaminant issues. Appendix B provides the results from the geotechnical investigations. As noted previously, a new topographic survey was utilized for each site in order to locate the flood walls, and to identify elevations and utilities to the extent possible. Appendix A provides the original topographic survey plans which were utilized in developing the alternatives.

It was noted that the flood walls will need to meet the regulations required by the Connecticut Dam Safety Regulatory Program. All flood protection options are being designed as water bearing structures and utilizing factors of safety common for construction of traditional dams for sliding, overturning, slope stability (soil stability and seepage), and cracking. Final designs for the selected flood wall alternatives can easily achieve the required factors of safety for such low heads and are constructed of materials commonly used for construction of dams or raising of dams.

Architectural panels such as the one shown in Figure 5-1 below as manufactured by Bunting Architectural Metals may be used to screen the sheet pile wall from the public and provide a more aesthetically appealing façade. These panels may be fabricated from plastics or various metals and painted for corrosion resistance, and in some cases may have mural type patterns painted on at additional cost.

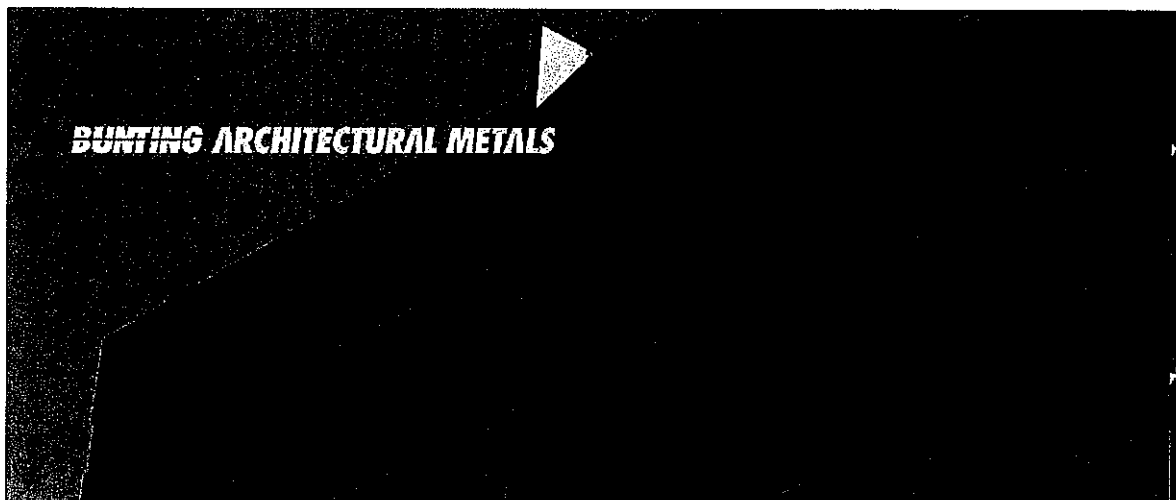


Figure 5-1: Architectural Metal Screening Panel

5.2 Environmental Review and Scoping

Based on the selected alternative being a below grade sheet pile wall to cutoff seepage and provide resistance to sliding and overturning, the environmental review meeting with the state regulators was postponed until later in the design process. We have performed an initial review of likely applicable regulations and determined that the selected alternatives are unlikely to have any significant issues with meeting the environmental regulations. Table 5-1 shows a list of likely environmental laws and regulations and how the selected alternatives can meet the requirements.

Table 5-1: Summary of Environmental Regulations for Flood Protection

LIKELY ENVIRONMENTAL REGULATION	MEASURES INCLUDED IN DESIGN TO SATISFY REGULATORY REQUIREMENTS
Endangered Species Act	The identified threatened or endangered species in the area do not have habitat which is disturbed by the construction of the flood protection
Coastal Barrier Resources Act	This act applies to undeveloped land, particularly barrier islands. The only undeveloped land affected by the flood protection is to the north of the plant.
Clean Water Act	Coordination with USACE for Section 404 and CT DEEP for Section 401, there is limited work in coastal wetlands for the area north of the plant.
Magnuson-Stevens Act (Essential Fish Habitat)	There is limited in water work which could impact fish habitat and this is in tidal wetlands for the area north of the plant.
Coastal Management Act	The minimization of loss of property is in accordance with the goal of the Coastal Management Act, and with the exception of possible alterations to the

LIKELY ENVIRONMENTAL REGULATION	MEASURES INCLUDED IN DESIGN TO SATISFY REGULATORY REQUIREMENTS
	wetlands by the floodwall north of the plant is not affecting natural areas.
Executive Order 11988 – Floodplains	The flood protection is not for any new development but the protection of already existing developments and will not increase flooding risk for any other property owners. The protection of existing assets is in accordance with the overall goal of reducing flood losses.
Executive Order 11990 – Wetlands/State Wetlands	The flood protection measures are outside of designated wetlands with the exception of the area north of the plant.
Marine Mammal Protection Act	There is no risk to the life of marine mammals with the construction of the flood protection measures.
Migratory Bird Treaty Act	The flood protection measures are located in the Atlantic flyway, however they are in a heavily populated area and previously developed site and present minimal disturbance to land used by migrating birds.
Environmental Justice (EJ)/EO 12898	The overarching goal of the EO is to protect minority communities from disproportionate environmental pollution. The flood protection is designed to protect the WPCF from flood damage thereby preventing environmental pollution and protecting the communities around the harbor. No new facilities will be created which would increase pollution.
National Historic Preservation Act	No sites of historic significance will be destroyed or materially altered by the construction of the flood protection measures.

5.3 Planning Level Conceptual Design

Since the selected alternative(s) are all variations of a similar wall, the plan view and utilities are nearly identical and are shown in the following figures to more fully develop the alternative.

5.3.1 General Location and Layout

For the MPS, the full perimeter flood protection wall is shown in Figure 5-2. Note that this arrangement appears to have adequate distance from the property line along the two public streets to the buildings to allow either a berm, architectural screening panels, or a concrete wall above grade.



5-4

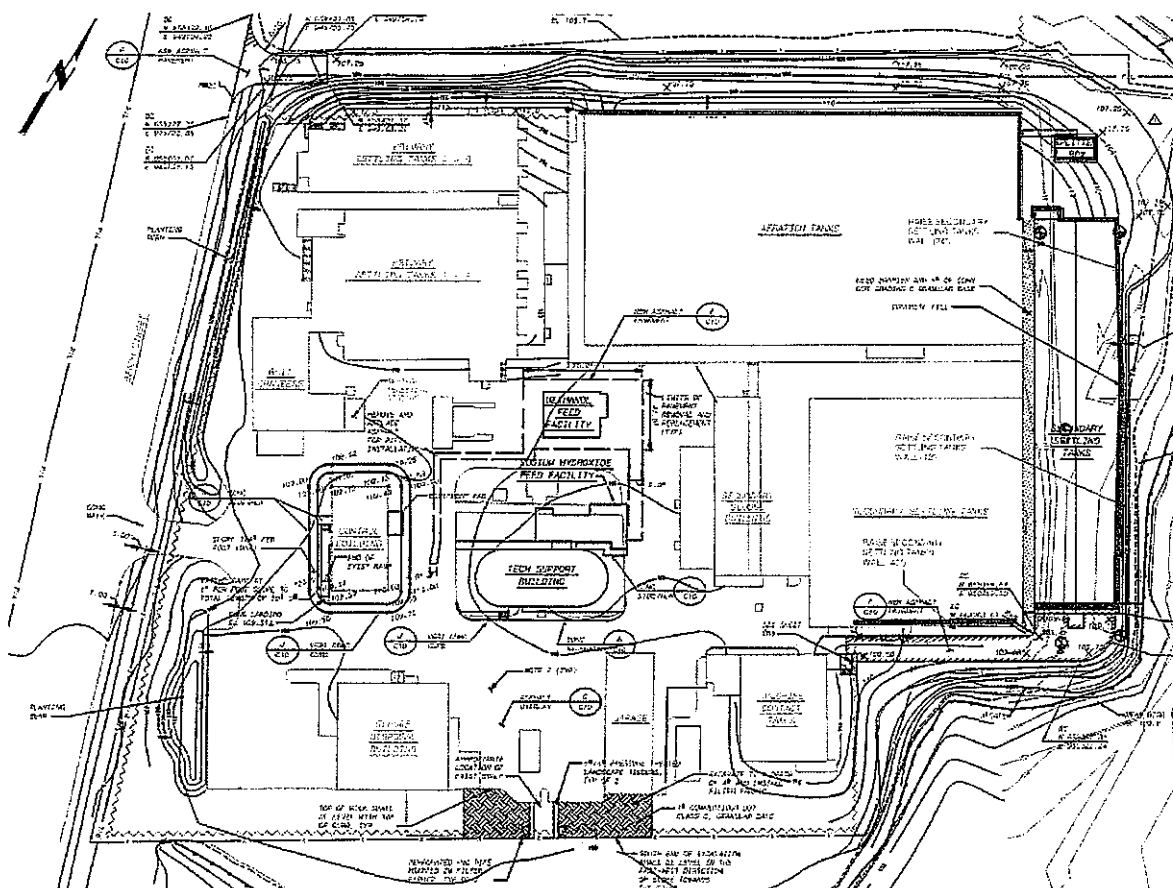


Figure 5-3: WPCF Selected Alternative - Perimeter Flood Protection Wall

5.3.2 Additional Utility Requirements Needed for Support and Implementation

The use of the pneumatic cylinders for the actuation of the floodgates allows for only a simple portable air compressor and receiver and requires no new utilities be installed for the gate. The wall (either sheet pile or concrete) requires no new utilities and there is no plan to instrument the floodwall to monitor movement or seepage. Both the MPS and the WPCF will need one new pump station to handle the seepage and direct precipitation. This new pump station will require the installation of drainage piping connections to the pump station and electrical and controls systems.

5.3.3 Constructability and Other Challenges in Implementation

The constructability of the sheet pile below grade is relatively simple and has a few currently recognized challenges for its implementation. The first challenge is driving the sheet pile very close to existing walls or facilities. In the case of the MPS, this occurs on the NW side of the electrical gear and emergency generator. However, there is an opportunity to expand the site slightly to the north as this is also City property. This will be explored further during design. For the WPCF site, it is noted that driving the sheet pile very close to the wall ends at the Primary Settling Tanks, and the Secondary Settling Tanks near the Chlorine Contact Tank may pose some challenges.

A second challenge is where existing conduits penetrate the below grade flood wall. The sheet piling cannot be placed below the existing utilities and another method of sealing off the pathway from seepage will need to be developed. Compaction grouting or other method of stabilizing the soil could be used but will need to be determined during design. Additionally, if the conduit is deep, there may be no need to grout around the opening if the seepage path is sufficient to prevent soil stability problems. At the MPS, as shown in Figure 5-2, there are several storm drains that enter and exit the area inside the floodwall. These must be modified so no storm drain pipe is entering the protected area, and all storm drains leaving the area require a backwater or check valve to prevent backflow into the protected area.

The composite sheet pile and concrete wall is also highly constructable as the grade beam can be constructed very shallow, or possibly at grade to minimize the need for dewatering and eliminate the need for remediation of contaminated soils.

5.3.4 Estimated Impact on Operations During Implementation and Long-Term

The selected flood wall for both the MPS and the WPCF sites will have minimal impact on normal operations during construction. Except for the seepage/site drainage pump stations, the work would largely take place along the perimeter fence area of the sites. No direct shutoffs of any process related equipment or shutdowns of electrical power are readily envisioned for their installations. There is the general decrease in available space with laydown of materials, and large construction equipment on site which will make access to facilities less convenient, but the selected flood protection measures are the least intrusive of all of the available options. Furthermore, operation of the flood gates is very simple as only three gates in total need to be operated, and they can all be operated pneumatically by a portable air compressor, likely taking one person approximately one hour of time before a storm event. This also is the least time for preparation before a potential flood event of any of the examined alternatives.

5.3.5 Process Reliability

The selected alternative at each of the two sites is a cantilever wall relying on the strength of the soil to resist the force of the water from sliding and overturning. This system has been used numerous times and proven effective over a long period of time on applications such as dams. Regarding the floodgates, the system relies on air pressure to raise the flood gate, but after it is raised, the pressure of the water keeps the gate in position should the air cylinders fail.

5.3.6 Estimated Implementation Time

The construction period varies depending on the final decision of materials (all sheet pile or composite sheet pile and concrete). An all steel sheet pile wall should be completed within one year, including the pump stations for each site. A composite sheet pile and concrete wall is expected to take slightly longer to construct.

