Chicopee, Hampden County, MA

USACE Section 408 Request

River Mills at Chicopee Falls Site Redevelopment

June 2017

River Mills at Chicopee Falls Site Redevelopment

Prepared for:

City of Chicopee
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BETA Project No. 5100

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USACE Section 408 Request

Chicopee, Hampden County, MA

River Mills at Chicopee Falls Site Redevelopment

Prepared by: BETA GROUP, INC.
Prepared for: US Army Corps of Engineers, New England District

June 2017

EXECUTIVE SUMMARY

On behalf of the City of Chicopee, BETA Group, Inc. (BETA) has prepared this United States Army Corps of Engineers (USACE) Section 408 request to allow for the placement of backfill along an earthen levee on a portion of the Chicopee Falls Local Protection Project easement in order to facilitate future redevelopment of the former Uniroyal and Facemate properties.

The City will not be using federally-owned property for any of these activities. The entire project will be constructed on property owned by the City. The flood control works were designed and constructed by the USACE for locations along the Chicopee and Connecticut Rivers in the City of Chicopee in response to floods in the 1930s and 1950s. The USACE was responsible for the design and construction of the levees, while the City provided all of the lands, easements, and rights-of-way necessary for the construction. A permanent easement to the levee was provided to the City by the US Rubber Company in 1965 and the City subsequently acquired the former Uniroyal property (formerly US Rubber) and former Facemate property. Information on the real estate ownership, along with survey plans and deed references is provided in Section 2.1.7 and Appendix D.

The City of Chicopee has prepared a redevelopment plan for the former manufacturing complex. This project represents a significant economic opportunity for the City to meet its redevelopment goals for the site. An endorsement of the project from the City is included as Appendix B.

The fill will be supplied by importing excess construction fill from regional construction projects. BETA has prepared a Fill Management Plan (FMP) in support of the filling activities. The City anticipates that this plan will be reviewed and approved by the Massachusetts Department of Environmental Protection (MassDEP). Key excerpts from the FMP, related to the fill procedures, acceptance criteria, and quality control are provided in Section 3.0.

The fill will be placed and compacted so as to raise the elevation of the project site to the height of the flood control levee and to re-grade the entire site for future redevelopment. Abandoned Site buildings located on the lower elevations have either been demolished or future demolition is planned. As the levee was installed on this portion of the property to protect these abandoned buildings, it is the City's opinion that this alteration will not impair the usefulness of the USACE flood control project (including the projects authorized purpose).

A Slope Stability Analysis in support of the project was completed in September 2016 (Appendix C).

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1.0 PROJECT DESCRIPTION

The City of Chicopee proposes to place backfill along a portion of the Chicopee Falls Local Protection Project easement and adjacent upland areas in order to facilitate future redevelopment of the River Mills and Chicopee Falls redevelopment site. The former Facemate and Uniroyal Tire Complex properties are located adjacent to the Chicopee River in Chicopee, Massachusetts (Locus Map – Figure 1). The site is bounded by the Chicopee River and the Chicopee Falls Local Protection Project on the west, Oak Street to the north, Grove Street and West Main Street to the east and Front Street to the southeast.

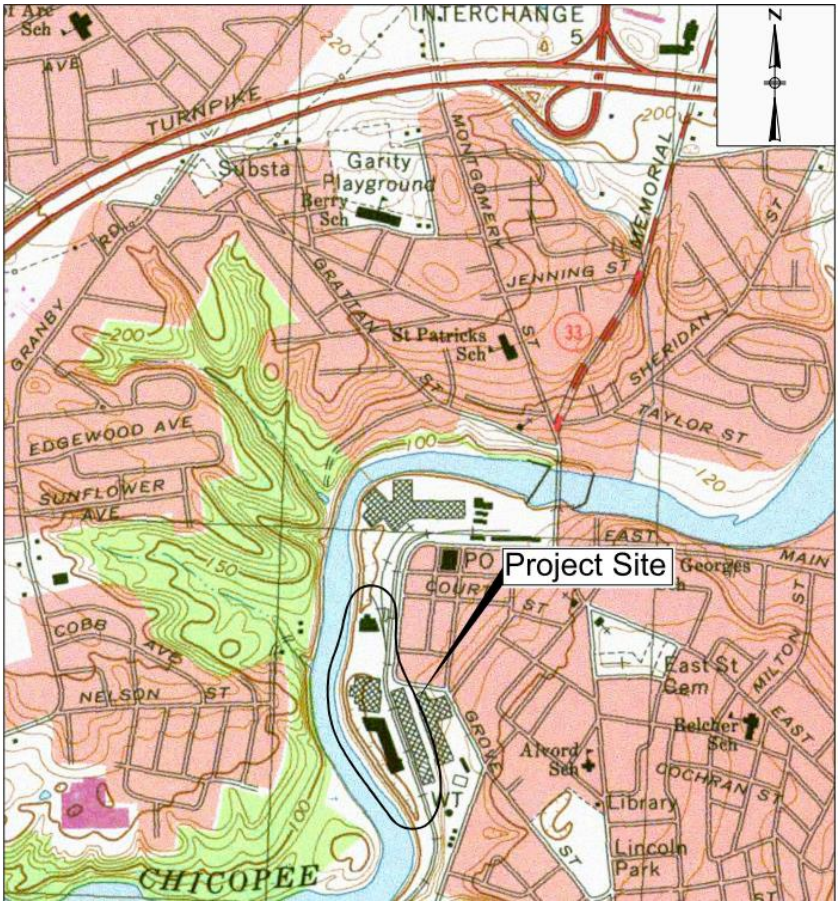


Figure 1. Project Locus

Former Uniroyal Site

The former Uniroyal Site was originally developed during the late 1800s. In 1870, the property was used as a lumber yard by the Chicopee Manufacturing Company. From 1896 to 1898 the property was owned by the Spaulding and Pepper Company, which manufactured bicycle tires. The Fisk Rubber Company, which later changed its name to United States Rubber Company and then to Uniroyal, Inc., manufactured bicycle, automobile and truck tires and adhesives from 1898 to 1981.

Uniroyal, Inc. closed its plant in 1980 and sold the property to the Facemate Corporation in 1981. Facemate leased portions of the Uniroyal buildings to various companies for manufacturing, printing, machine shops, office, storage and health care facilities. Several buildings on the site have been demolished to date.

Former Facemate Site

Between 1823 and 1915, the former Facemate property and much of the surrounding area was owned by the Chicopee Manufacturing Company. During this time, the property was used for the manufacture and processing of cotton cloth. In 1915, Johnson & Johnson Services, Inc. purchased the property, and continued the production of cotton cloth. Circa 1977, the Property was purchased by the Facemate Corporation which produced finished cotton and synthetic cloth at the Property. In 2003, Facemate filed for bankruptcy and was forced to shut down due to bank foreclosure proceedings. The property had been vacant since 2003. The City of Chicopee acquired ownership of the property in 2010 for the non-payment of taxes, and subsequently conducted assessment and remediation activities subdivided the former Facemate property into three separate lots for re-development: Lot 1, Senior Center Parcel (Lot 2) and Lot 4. The activities proposed under this submittal are to occur on Lot 1, located on the southern portion of the former Facemate property abutting the former Uniroyal property.

1.1 CHICOPEE FALLS FLOOD CONTROL SYSTEM DESCRIPTION

Flood control works were designed and constructed by the United States Army Corps of Engineers (USACE) for locations along the Chicopee and Connecticut Rivers in the City of Chicopee (City) in response to floods in the 1930s and 1950s. Construction along the Connecticut River and the North and South Banks of the Chicopee River was conducted in a series of construction contracts initiated in 1938 and completed in 1942, collectively known as the Chicopee Local Protection Project (CLPP).

The Flood Control Works in the City of Chicopee was constructed by the United States Army Corps of Engineers (USACE) in four separate systems (the Plainfield Street Flood Control System, the South Bank Chicopee River Flood Control System, the Willimansett Flood Control System, and the Chicopee Falls Flood Control System).

This project will be completed along a portion of an earthen levee associated with the Chicopee Falls Flood Control System. On behalf of the City of Chicopee, Baystate Environmental Consultants (BEC) prepared a FEMA accreditation report for the Chicopee Falls Flood Control System in 2010. The purpose of the report was for submittal to FEMA for their use in establishing risk zones for the National Flood Insurance Program (NFIP) maps and document compliance with the minimum design, operation, and maintenance standards for levee systems established in 44 CFR 65.10. This included an embankment, foundation and stability analysis. Excerpts of the BEC report are included in Appendix A.

Riprap slope protection on the riverside and a toe drain on the landside were constructed on the levee. According to the BEC report, the typical cross section consists of compacted random fill on the landside with compacted impervious soil on the riverside with an impervious foundation cutoff. The Oak Street Pumping Station was built into the levee at Station 49+15. Two gate valves with catwalk access are located in this segment in close proximity to the pumping station. One was an intake for the now defunct U.S. Rubber Company facility with associated improvements, while the other is an outlet from the Oak Street Pumping Station.

This project includes a portion of the segment of earthen levee that extends from Station 25+45 to Station 54+15 (See Figure 2 from the BEC report below). A typical cross section of the levee is provided in Appendix A.

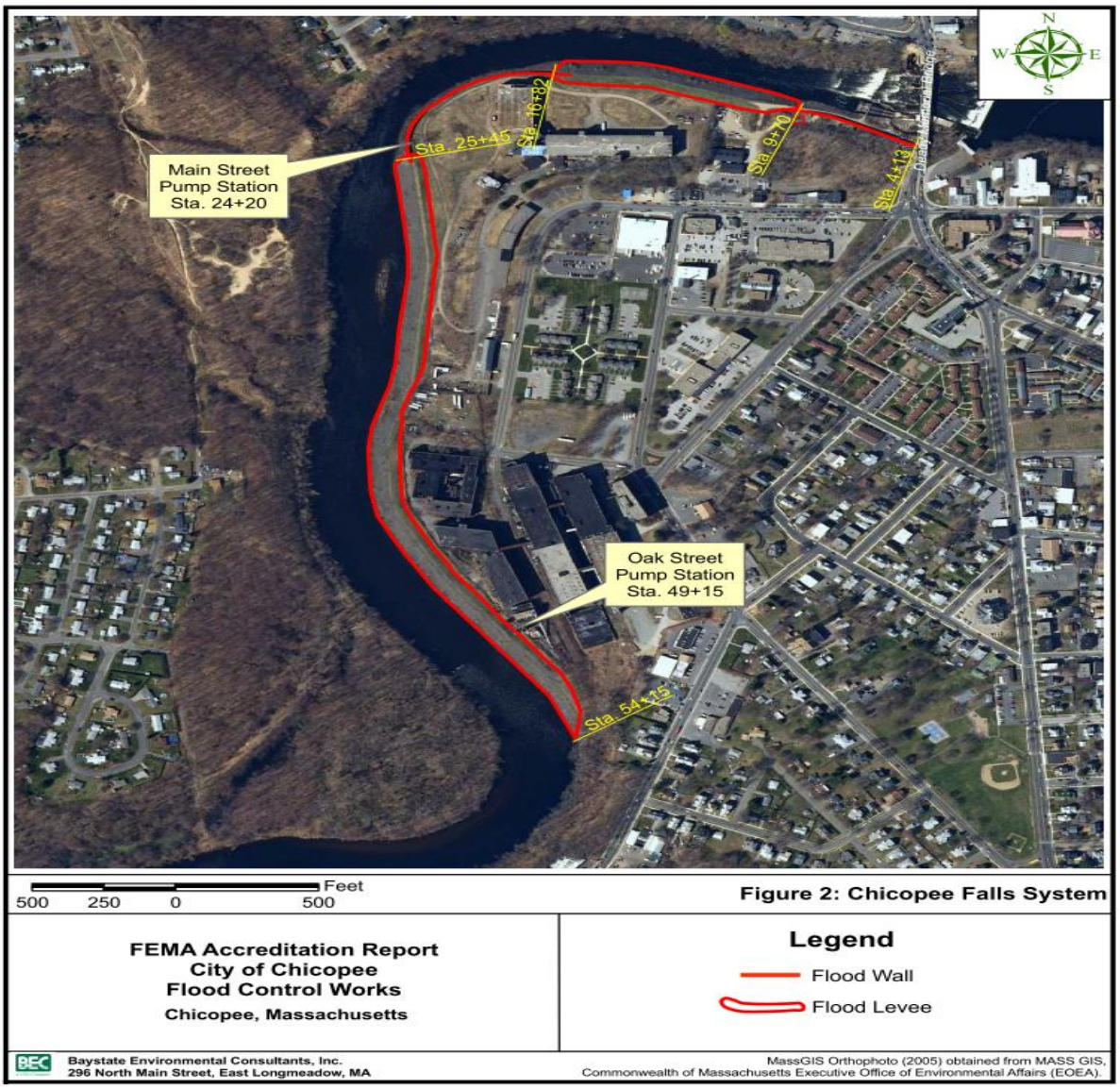


Figure 2. Chicopee Falls System, from BEC Report

2.0 PURPOSE, NEED AND SCOPE FOR THE PROPOSED ACTION

2.1.1 PROJECT PURPOSE

The purpose of the project is to provide the City of Chicopee a site suitable for redevelopment of the former Uniroyal/Facemate property and to eliminate long term operating and maintenance costs for a portion of the Chicopee Falls flood control levee drainage system as the vacant buildings at the lower elevations have been or are in the process of being demolished.

2.1.2 PROJECT NEED/CITY ENDORSEMENT

A Photo of the flood control levee and former Uniroyal Building 8 footprint (Summer 2016).

The City of Chicopee has prepared a redevelopment plan for the former manufacturing complex in Chicopee Falls. In order to further the redevelopment of the former Uniroyal/Facemate portion of the complex the City needs to generate revenue to prepare the site for future redevelopment in accordance with the redevelopment plan.

The importation of excess construction fill from the region will enable the City to raise the site elevation and provide future developers a suitable site.

In addition, the City is incurring ongoing operation and maintenance costs for the Chicopee Falls flood control levee storm drainage system adjacent to the site. Placement of fill adjacent to the levee will enable the abandonment of the existing storm drainage system and eliminate the ongoing O&M costs.

Finally, there is a recognized need for suitable sites in the region where excess construction fill can be properly disposed. The Project site represents an opportunity to develop such a site, suitably managed and properly constructed to fulfill both the regional need for disposal sites and meet the City's redevelopment goals for the site. An endorsement of the project from the City is included as Appendix B.

2.1.3 Description of Proposed Alteration

The scope of work (SOW) will affect two areas:

Former Uniroyal Site

This proposed fill area is located on the northwestern portion of the former Uniroyal Property, located at 154 Grove Street in Chicopee, Massachusetts. The proposed SOW will affect the lower tier of the former Uniroyal Site, which is abutted to the east by Site buildings and a railroad spur and to the west by the levee associated with the Chicopee Falls flood control dike along the Chicopee River. The topography of the lower tier slopes downward sharply towards the Chicopee River; the elevation of the lower tier is approximately seventeen (17) feet below the top of the flood control levee.

Former Facemate Site

The proposed SOW will affect the lower elevation areas along the southern portion of Lot 1 on the former Facemate property, located at 5 West Main Street. The topography of this area slopes downward in an area where a former building was located. The elevation of this area is approximately ten (10) feet below the top of the flood control levee.

These two areas are shown on the Backfill Management Plan provided as Figure 3.

2.1.4 Technical Analysis and Design

Excess construction fill will be imported from construction sites in the area. The fill will be placed and compacted so as to raise the elevation of the Project site to the height of the flood control levee and to grade the entire site for future redevelopment. Abandoned Site buildings located in the lower tier of the former Uniroyal property have either been demolished or future demolition is planned. As the levee was installed on this portion of the property to protect these abandoned buildings, it is the City's opinion that this alteration will not impair the usefulness of the USACE flood control project (including the projects authorized purpose).

In September 2016, a Slope Stability Analysis was completed. This study is described in Section 2.1.8 and included as Appendix C. A Site plan indicating the fill area, property boundaries and a cross section of the proposed fill area is attached as Figures 3 through 6.

2.1.5 Authorization Pursuant of Section 10/404/103

The City is not pursuing authorization pursuant to Sections 10/404/103. There are no Navigable Waters or Waters of the United States that will be affected by the proposed project. Further, the proposed project does not involve the transportation of dredged material to a designated ocean disposal site.

2.1.6 Section 221 of the Flood Control Act of 1970

As described on federalregister.gov (Guidelines for Carrying Out Section 221(a)(4) of the Flood Control Act of 1970, as Amended):

- Section 221 is a comprehensive authority that addresses the affording of credit for the value of in-kind contributions provided by a non-Federal sponsor toward its required cost share (excluding the required 5 percent cash for structural flood damage reduction projects and the

additional 10 percent cash payment over 30 years for navigation projects) if those in-kind contributions are determined to be integral to a study or project.

- The types of in-kind contributions eligible for credit include planning activities (including data collection and other services needed for a feasibility study); design related to construction; and construction (including management; mitigation; and construction materials and services).

Credit under Section 221 of the Flood Control Act of 1970, as amended, or other law or approval under Section 204(f) of the WRDA 1986 will not be sought.

2.1.7 Property Ownership/Real Estate Requirements

The project does not involve any federally owned property. The project will be totally constructed on property owned by the City. As described in the BEC report, the flood control project was a "cooperative Federal/City effort, the USACE was responsible for the design and construction of the levees, while the City provided all of the lands, easements, and rights-of-way necessary for the construction. The City also agreed to maintain and operate the flood control works after completion, in accordance with federally prescribed regulations. These requirements are detailed in the Code of Federal Regulations, 33 CFR 208.10 which is entitled, "Local flood protection works; maintenance and operation of structures and facilities".

A permanent easement to the levee was granted to the City by the US Rubber Company in 1965. A copy of the easement recorded in the Hampden County Registry of Deeds is provided in Appendix D. The City acquired the former Uniroyal property (formerly US Rubber) and former Facemate property in 2009. A 2009 survey plan of the Chicopee Flood Control Works (by Heritage Surveys, Inc.) is also provided in Appendix D. The Heritage survey plan depicts the former Uniroyal and Facemate properties including the easement, property boundaries, levee and provides associated deed references. The location of the easement and utilities in reference to the proposed fill areas are provided as Figure 3 through 5. Any future conveyance by the City of all or any relevant portion of the subject property would retain an easement to the City to the easement areas as shown on survey plans provided in Appendix D.

2.1.8 Hydrologic and Hydraulic System Performance Analysis

A Massachusetts-registered Professional Engineer, Michael J. Talbot of O'Reilly, Talbot and Okun (OTO), conducted a slope stability analysis for the Uniroyal Filling project to evaluate the potential impacts of the project. The OTO work included review of previous plans and reports prepared by the U.S. Army Corps of Engineers (USACE) and Baystate Environmental Consultants (BEC), stability analyses of the proposed conditions, and preparation of a report (See Appendix C).

The OTO slope stability analysis was based on information provided in the following documents:

- Plan titled "Topographic Plan of Land in Chicopee, Massachusetts, Surveyed for The City of Chicopee" by Heritage Surveys, Inc., dated December 12, 2009;
- Plan set titled "Connecticut River Flood Control Project, Chicopee Falls, Mass" prepared by Green Engineering Affiliates, Inc. for the U.S. Army Engineer Division, New England, dated April 1963;
- Design memorandum titled "Chicopee Falls Local Protection Project, Design Memorandum No. 5" by the U.S. Army Engineering Division, New England, dated March 1963;
- "FEMA Accreditation Report, Chicopee Falls Flood Control System" by Baystate Environmental Consultants, Inc., dated November 2010; and

- "Design and Construction of Levees Engineering Manual"- EM 1110-2-1913, U.S. Army Corps of Engineers, dated April 2000.

The information obtained from these sources that were used in their evaluation included the following:

- Details on levee construction;
- Design flood elevations and river levels;
- Existing ground surface topography;
- Subsurface information; and
- Soil properties.

2.1.8.1 SLOPE STABILITY ANALYSIS

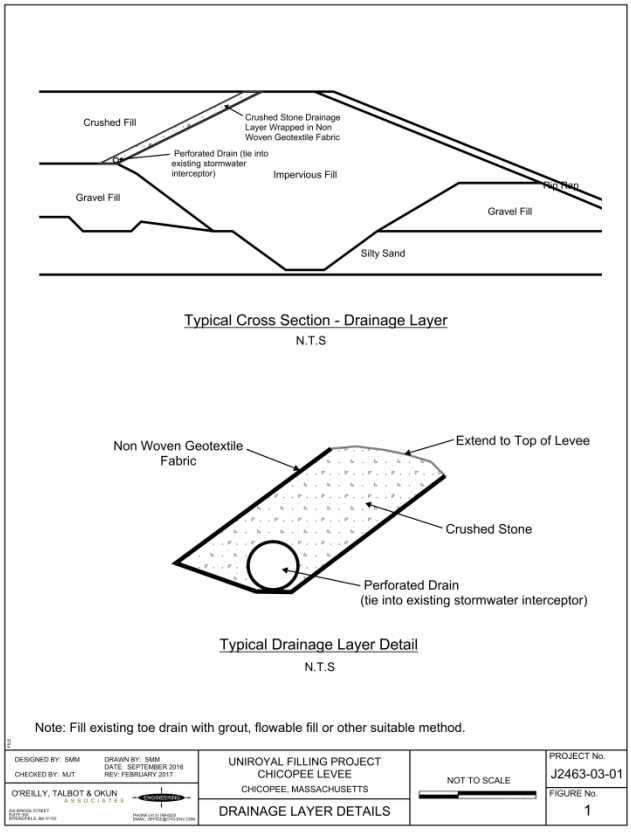
Slope stability was evaluated by OTO using the SLOPE/W computer program using the Spencer method. The SLOPE/W program performs a limit equilibrium analysis using various analytical methods to determine the factor of safety and the critical failure surface. The Spencer method, which assumes that the resultant interslice forces have constant slope through the sliding mass, was chosen per USACE guidance.

The slope stability for typical design conditions of the work area was evaluated using a limit equilibrium analyses. The Spencer Method determines the critical failure surface and the minimum factor of safety. Levee slope stability was analyzed for critical design condition as described in the USACE *Design and Construction of Levees*, EM 1110-2- 1913, namely under normal, 100 year flood conditions, and rapid drawdown. For these analyses, only failure into the river side was considered, since the placement of fill on the landward side increases the resistance to failures in that direction.

Results

In the USACE design manual, the recommended minimum factor of safety for rapid drawdown is between 1.0 to 1.2, and the recommended minimum factor of safety for long term (steady seepage) is 1.4. OTO used a value of 1.4 for normal water conditions as a specific factor of safety for normal conditions was not provided in the USACE design manual. OTO concluded that the computed factors of safety for the proposed conditions met or exceeded the required minimums specified above. Additionally, values computed by OTO were similar to those computed by BEC. Based upon their evaluation, OTO concluded that the proposed fill will likely have little effect on the stability of the levee.

To limit the buildup of hydrostatic pressures against the landside of the levee, OTO



recommended that a drainage layer be placed between the landside slope and proposed construction fill. The drainage layer should consist of a minimum of one foot of crushed stone wrapped in a non-woven geotextile fabric and be tied into the existing toe drain.

A typical drainage detail from the OTO is shown to the right. The OTO report is included as Appendix C.

2.1.9 Environmental Compliance

To comply with NEPA, the planning and decision-making process for actions proposed by Federal agencies involves a study of other relevant environmental statutes and regulations. The NEPA process, however, does not replace procedural or substantive requirements of other environmental statutes and regulations. It addresses them collectively in the form of an EA or EIS, which enables the decision maker to have a comprehensive view of major environmental issues and requirements associated with the proposed action. According to CEQ regulations (40 CFR 1500.2), the requirements of NEPA must be integrated "with other planning and environmental review procedures required by law or by agency so that all such procedures run concurrently rather than consecutively."

BETA group prepared an Environmental Assessment (EA) to examine potential effects of the proposed action and No Action alternative on resource areas including land use; air quality; noise; geology and soils; water resources; biological resources; cultural resources; socioeconomics and environmental justice; utility infrastructure; and hazardous and toxic materials/wastes. This EA is included as Appendix E

2.1.10 Real Estate Requirements

See Section 2.1.7.

2.1.11 Executive Order 11988 Considerations

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.

Compliance: The Proposed Action would not affect the 1% Annual Chance floodplain or the Regulatory Floodway associated with the Chicopee River adjacent to the site. The Chicopee Falls Local Protection Project borders the project site to the west and confines the floodplain and floodway in the project area. The project complies with the Executive Order.

2.1.12 Requester Review Plan Requirement

Per EC 1165-2-214, a Type II independent external peer review (IEPR) shall be conducted on design and construction activities for any project where potential hazards pose a significant threat to human life (public safety). The reviews shall consider the adequacy, appropriateness, and acceptability of the design and construction activities in assuring public health, safety, and welfare. This applies to new projects and to the major repair, rehabilitation, replacement, or modification of existing facilities.

Other factors to consider for conducting a Type II review of a project or components of a project are:

a. The project involves the use of innovative materials or techniques where the engineering is based on novel methods, presents complex challenges for interpretations, contains

precedent-setting methods or models, or presents conclusions that are likely to change prevailing practices;

b. The project design requires redundancy, resiliency, and robustness:
   - Redundancy is the duplication of critical components of a system with the intention of increasing reliability of the system, usually in the case of a backup or failsafe.
   - Resiliency is the ability to avoid, minimize, withstand, and recover from the effects of adversity, whether natural or manmade, under all circumstances of use.
   - Robustness is the ability of a system to continue to operate correctly across a wide range of operational conditions (the wider the range of conditions, the more robust the system), with minimal damage, alteration or loss of functionality, and to fail gracefully outside of that range.

c. The project has unique construction sequencing or a reduced or overlapping design construction schedule; for example, significant project features accomplished using the Design-Build or Early Contractor Involvement (ECI) delivery systems.

If the district determines, by following the procedures of EC 1165-2-214, that a Type TII IEPR is required, the City will be required to submit a Type II IEPR review Plan. The City believes, based upon the nature of the project and the findings of the stability analysis that the project does not pose a significant threat to human life or safety.

2.1.13 Levee Operation and Maintenance

Until the City obtains approvals from the USACE for modifications, all current operation and maintenance activities and required inspections related to the levee and Oak Street pumping station will be adhered to.

3.0 Fill Material Handling and Placement

3.1 Fill Management Plan

BETA has prepared a Fill Management Plan (FMP) in support of the filling activities at the former Uniroyal and Facemate Sites. Key excerpts from the FMP, related to the fill procedures, proposed fill acceptance criteria, and quality control are provided below.

The purpose of the FMP is to formalize the fill management/acceptance process in order to meet the applicable soil re-use requirements and to give Generators a sufficient level of comfort that their material is being handled appropriately. The City's LSP (Alan Hanscom, BETA Group, Inc.), in coordination with LSPs/QEPs at Generator sites, is responsible for reviewing fill characterization data so that only fill meeting acceptance standards and approved under this FMP are brought to the proposed fill areas.

Soils may be accepted for re-use from properties that are Massachusetts Contingency Plan (MCP) Disposal Sites, as defined in 310 CMR 40.0006, and from properties that are not MCP Disposal Sites so long as they meet the screening requirements. It is estimated that approximately 100,000 cubic yards (150,000 tons) of soil of acceptable chemical and physical quality will be needed to bring the site to required grade for development. Upon completion of the filling and remedial activities, an Activity and

Use Limitation (AUL) will be implemented in connection with Massachusetts Contingency Plan (MCP) and Toxic Substance Control Act (TSCA) cleanup work being undertaken at the former Uniroyal Site by Michelin North America, Inc..

3.1.1 Initial Screening Requirements

All soils considered acceptable for use must meet the following initial criteria:

- Soils, including certain sediments, must not contain any hazardous waste, as defined under RCRA Subtitle D and the Massachusetts Hazardous Waste Regulations (310 CMR 30.000). Soils are considered to contain a hazardous waste when, if generated, they exhibit one or more characteristics of a hazardous waste (toxicity, ignitability, corrosivity or reactivity) or if they contain a listed hazardous waste;
- Soils must not include large stones (cobbles or boulders), masonry, stumps, asphalt, or waste material, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or associated parts. Soils with a high percentage of organic matter will not be accepted; and,
- Soils must not meet the MCP definition of "Contaminated Soil" or "Remediation Waste", as defined in 310 CMR 40.0006. Specifically, the concentrations of analytes in soil must be below the MCP Reportable Concentrations in Soil applicable to the generation site.

3.1.2 Field Screening Requirements

The following criteria are applicable to all soils proposed for re-use, regardless of whether they were generated from an MCP Disposal Site.

- Field screening results of soil headspace from representative samples must not exhibit an average reading of Total Organic Vapors (TOV) in the jar headspace exceeding five parts per million by volume (ppmv) due to constituents attributable to volatile compounds. If screening has not been performed by the Generator, it may be performed at the staging areas on the former Uniroyal and Facemate properties by the Operator or Site LSP or another designated party as appropriate to verify certain loads. If screening results in exceedances of the criteria above, the load(s) will be rejected.
- The soil must not exhibit any visual staining, discolorations or olfactory odors indicative of OHM releases as demonstrated by the representative of the soil to be imported. Soils containing nuisance odors such as petroleum, chemicals, solvents, and/or organic material/hydrogen sulfide will be rejected.
- The soils must not contain any refuse or trash. Inert solid wastes that comprise less than 1% of the total volume will be permitted. The soil may contain ancillary non-coated or non-painted brick pieces or non-coated/stained or non-impregnated concrete pieces less than 6-inches diameter or cobbles/rock fragments less than 6-inches diameter if it is contained within certain fill soils in very small quantities. This material must be less than 50% of the fill material. If soils contain more than this amount, they must be designated as Asphalt, Brick, Concrete (ABC) material. Loads received that contain more than the acceptable amount of solid debris will be rejected and sent back to its origin at the Generator's cost.

- Soil may contain naturally deposited silt and clay and a certain portion of naturally occurring organic content and moisture since drainage of the soil can occur on EU-7 and Lot 1 while it is being stored, blended, and re-worked as supervised by the Operator. The physical quality will be reviewed by the Operator and soil will be placed in accordance with the soil blending plan for final disposition.

3.1.3 Soil Handling and Placement

In general, material will be accepted between 7:00 am and 5:00 pm Monday through Friday. Material may be accepted after these hours or on weekends with coordination with City.

Once the truck is weighed, the driver will proceed to the Site staging area. The access road for both proposed fill areas is located adjacent to the intersection of Oak Street and West Main Street, as shown on Figure 3.

The Site Operator will collect the MSR or BOL from the driver, record the name of the trucking company, verify the source of the material against the "approved list", and visually inspect the contents of the trucks for unacceptable fill materials and any visual or olfactory evidence of contamination, including nuisance odors. If the fill does not contain unacceptable material and there is no visual or olfactory evidence of contamination, it will be directed to the area for off- loading. Otherwise, it will be rejected. The Generator of the rejected material will be notified immediately not to ship any additional fill to the Site until the source of the unacceptable fill is identified and corrective action taken to prevent future problems. In addition, the Generator must remove the rejected material off-site at the Generator's expense.

The City's Representative will maintain a daily log of the following activities:

- Identification of the truck transporting fill material;
- Weight and source of material for each truck;
- Physical characteristic and results of headspace screening if any for each truck; and
- Location of the fill placed

3.1.4 Grading and Filling Plan

Prior to filling operations, a survey of both fill areas will be conducted to determine existing surface elevations, to establish a benchmark for elevation reference, and to determine the final elevations for the fill material and the cap. Utility poles with overhead utility lines will need to be removed and the electric lines will need to be relocated, likely in an underground conduit, outside the proposed fill area.

During filling activities, surface elevations will be surveyed on a quarterly basis to monitor the progress of fill operations, and to adjust operations as needed.

Final elevations will be surveyed at the completion of filling activities, and after construction of the final cap. These elevations will be used to create record drawings of the fill areas upon completion of the project, including plan and section views of the backfill area and cap.

Manholes associated with the interceptor drain are present in the proposed fill area. These manholes will be raised in elevation to meet the proposed grade at the Site.

3.2 REPORTING

The City's LSP will prepare an inspection report documenting the findings of each inspection, including laboratory analytical results, and will submit each report on a quarterly basis to the MassDEP and the City of Chicopee Health Department. The report will include, but not be limited to, the following information:

- Details regarding the filling activities compared to the requirements of this FMP;
- Any deviations from this FMP, and any corrective actions taken by the City;
- A table summarizing the quantities of fill received and placed since the last report, and a summary of the number of truck loads and quantity of fill materials rejected;
- A table summarizing the analytical results of soil samples collected during the inspections; and
- Copies of the laboratory analytical reports, including the chain of custody documentation.

In addition to the above requirements, each report will be signed by the LSP and will include the following certification signed by the LSP, and an authorized City representative:

> *I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information. I believe that the information is true, accurate and complete. I am aware that there are significant penalties, both civil and criminal, for submitting false information.*

4.0 IMPLEMENTATION SCHEDULE

An implementation schedule for the project is provided below.

Fill Management Schedule
Former Uniroyal and Facemate Properties
Chicopee, Massachusetts

January 2017

Task #	Task	SubTask	Comment/Description	Status
Permitting Tasks				
1	Stormwater Management	Stormwater Pollution Prevention Plan (SWPPP)	SWPPP to be developed and implemented to control and manage storm water runoff during Phase I and Phase II backfill operations	
		Install Stormwater Controls	Likely stormwater controls to include temporary settling basin with forebay, straw wattles, and silt fence	
		Periodic Inspections	Following installation, monthly inspections of the stormwater management controls will be conducted to verify stormwater controls are effective	
2	MassDEP Permitting to allow for acceptance of material	Fill Management Plan (FMP) Preparation	Update the Fill Management Plan (FMP), including procedures to stage, characterize and manage incoming material. FMP to be submitted to MassDEP for comment and approval	
			MassDEP Review Period.....*Approval vs ACO?*	
			Address MassDEP comments on the FMP	
Phase I - Backfill Operations in areas outside Flood Control Easement				
3	Material Acceptance and Placement	Site Preparation	Set up weight scale, staging area(s)	
			Install markers indicating location of flood control easement and utilities. No backfill to be placed within flood control easement during Phase I	
		Bid Document Preparation	Prepare City RFP to accept material	
		Material Submittal Review	Review material profiles and analytical submittals to verify that the soil, sediment and/or ABC materials meet the requirements of the FMP and conditions required by the MassDEP	
		Quality Assurance/Quality Control (QA/QC)	As material comes in, it will be inspected in accordance with requirements of the FMP to verify it is consistent with the material profile provided by the generator	
		Material Placement	Material placed in proposed fill area following completion of QA/QC procedures	
Phase II - Backfilling on Flood Control Easement				
4	Army Corp Permitting	NEPA EA	Prepare and submit NEPA EA to Army Corps for review	
		408 filing	Submit 408 filing for approval of modification and alteration of Army Corps Project	
			ACOE Review Period.....*estimated at 6-8 weeks*	
			Address Comments by Army Corps on EA and Section 408 Application	
5	Engineering Design for Backfill Operations			
		Drainage Design	Drainage system to be installed along the landward side of the levee in the fill area and connected to the existing interceptor drain	
		Utility Relocation	Overhead electric lines are present within the proposed fill area. Utility poles will removed and the electric lines will be relocated, possibly in an underground conduit, outside the proposed fill area	
		Utility Relocation	Manholes associated with the interceptor drain are present in the proposed fill area. These manholes will be raised up approx. 12 feet due to proposed fill placement	
		Contract Documents	Contract document to be prepared for relocation of utilities and manhole modifications	
		Contract Documents	Contract documents for installation of drainage system in fill placement area	
6	Phase II Material Acceptance and Placement	Material Acceptance and Placement	Following same procedures for acceptance and placement of material used during Phase I of the Backfill Operations	

FIGURES

CITY OF CHICOPEE DIKE, FLOOD CONTROL, AND SURFACE DRAIN EASEMENT
BOOK 3119, PAGE 206
PLAN BOOK 99, PAGE 9

PROPOSED FILL AREA
NOT TO EXCEED ELEVATION OF LEVEE

TOP OF LEVEE

PROPOSED FILL AREA
NOT TO EXCEED ELEVATION OF LEVEE

TOP OF LEVEE

STA. 45+00

STA. 35+00

STA. 30+00

DIKE

DIKE

CHICOPEE RIVER

CHICOPEE RIVER

EU-7

EU-6

FORMER BUILDING 1

FORMER BUILDING 2

FORMER BUILDING 3

FORMER BUILDING 4

FORMER BUILDING 5

FORMER BUILDING 6

FORMER BUILDING 7

FORMER BUILDING 8

FORMER BUILDING 14

CITY OF CHICOPEE

BOOK 3102 PAGE 558
BOOK 13344 PAGE 589
BOOK 15274 PAGE 379
BOOK 18247 PAGE 351
BOOK 18258 PAGE 319

PLAN BOOK 99 PAGES 9-12
PLAN BOOK 161 PAGES 6-9
PLAN BOOK 369 PAGES 87-90

BASKIN BLDG (BLDG C)

LOT 1

W. MAIN STREET

DAK STREET

OAK STREET PUMPING STATION

200,000 GALLON AST (#6 FUEL OIL)

BUILDING 15

BUILDING 28 N. EXTENSION

BUILDING 28 E. EXTENSION

BUILDING 28 SOUTH ADDITION

BUILDING 27

FORMER FACEMATE PROPERTY

CITY OF CHICOPEE

BOOK 3119 PAGE 206
BOOK 13344 PAGE 589
BOOK 17783 PAGE 139
BOOK 18258 PAGE 319

PLAN BOOK 99 PAGES 9-12
PLAN BOOK 200 PAGE 54-61
PLAN BOOK 369 PAGES 87-90

FORMER BUILDING 33

BUILDING 42

BUILDING 26

25 BUILDING

39 BUILDING FORMER

FORMER BUILDING 43

FORMER GAS PUMP

EMPLOYEE CREDIT UNION CHICOPEE MUNICIPAL

MIRROR & GLASS CHICOPEE

BUILDING STORE RETAIL

SERVICE STATION (FORMER GASOLINE) FORMER PION PONTIAC

FRONT STREET

GROVE STREET

GROVE STREET

FORMER UNIROYAL PROPERTY

NOTES:

1) Elevation contours obtained from Planimetric and Topograph dataset provided by Infotech, Inc., January 2010.
2) Zoning data obtained from MassGIS Level 3 Assessor's Parcel Mapping data set.
3) Location of easement referenced from 'Preliminary' Chicopee Flood Control Works, Sheets 3-5, by Heritage Surveys, dated May 2, 2012, Sheets and 4

LEGEND

- DEMOLISHED BUILDING
- EXISTING BUILDING
- ELEV. CONTOUR
- PROPERTY LINE
- LIMITS OF FILL AREA
- FLOOD CONTROL EASEMENT

BETA
www.BETA-Inc.com

GRAPHIC SCALE
150 75 0 75 150 300
(IN FEET)
1 inch = 150 ft.

Former Uniroyal Complex and Facemate Properties
154 Grove Street & 5 West Main Street
Chicopee, MA

Figure 3
Site Plan

D:\5100s\5100 - Chicopee - Uniroyal LSP Services\Drawing Files\2017-1-26 FillManagementPlan.dwg

CITY OF CHICOPEE
BOOK 17783 PAGE 130 - 142
PLAN BOOK 200 PAGE 54-57

STA. 45+00

STA. 50+00

DIKE

CHICOPEE RIVER

OAK STREET PUMPING STATION

200,000 GALLON AST (#6 FUEL OIL)

FORMER BUILDING 14

FORMER BUILDING 8

FORMER BUILDING 7

FORMER BUILDING 4

FORMER BUILDING 2

FORMER BUILDING 1

FORMER BUILDING 5

FORMER BUILDING 6

FORMER BUILDING 3

FORMER BUILDING 3

EU-7

BUILDING 15

BUILDING 28 North

BUILDING 28 South

BUILDING 28 E. EXTENSION

BUILDING 28 N. EXTENSION

BLDG. 28 ADDITION

BLDG. 29

BLDG. 40

OAK STREET

1) Elevation contours obtained from Planimetric and Topograph dataset provided by Infotech, Inc., January 2010.
2) Zoning data obtained from MassGIS Level 3 Assessor's Parcel Mapping data set.

LEGEND

- DEMOLISHED BUILDING
- EXISTING BUILDING
- ELEV. CONTOUR
- PROPERTY LINE
- LIMITS OF FILL AREA
- FLOOD CONTROL EASEMEI
- CATCH BASIN
- DRAINAGE MANHOLE
- UTILITY POLE

BETA
www.BETA-Inc.com

GRAPHIC SCALE
80 40 0 40 80 160
(IN FEET)
1 inch = 80 ft.

Former Uniroyal Complex and Facemate Properties
154 Grove Street & 5 West Main Street
Chicopee, MA

Figure 4
Utility Plan
Former Uniroyal Facility

D:\5100s\5100 - Chicopee - Uniroyal LSP Services\Drawing Files\Uniroyal\2017-1-26 FillManagementPlan.dwg

CITY OF CHICOPEE
BOOK 18247 PAGE 351
PLAN BOOK 99 PAGE 9

STA. 35+00

STA. 30+00

STA. 25+00

CHICOPEE RIVER

DIKE

SLOT DRAIN

EU-6

MH#16

18"RCP

CB/MH#15

CB/MH#14

8"TD

24"

MH#13

CB/MH#12

FLOOD WALL

MH#11

8"TD CO1

OR

BASKIN BLDG (BLDG C)

TO BE CAPPED

LOT 1

BLDG 3

FORMER 1,000 GALLON UST (NO. 2 FUEL OIL)

W. MAIN STREET

80 85 90 95 100 105

1) Elevation contours obtained from Planimetric and Topograph dataset provided by Infotech, Inc., January 2010.
2) Zoning data obtained from MassGIS Level 3 Assessor's Parcel Mapping data set.

LEGEND

- DEMOLISHED BUILDING
- EXISTING BUILDING
- ELEV. CONTOUR
- PROPERTY LINE
- LIMITS OF FILL AREA
- FLOOD CONTROL EASEMEN
- CATCH BASIN
- DRAINAGE MANHOLE
- UTILITY POLE

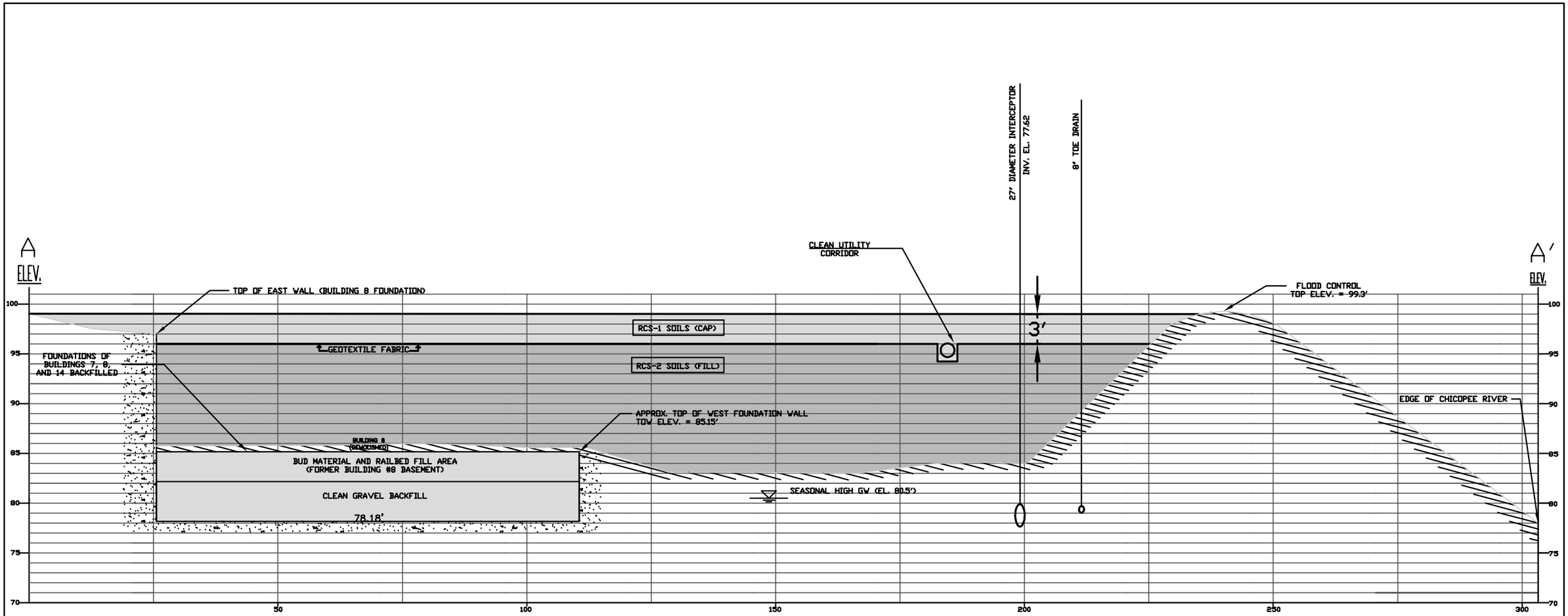
BETA
www.BETA-Inc.com

GRAPHIC SCALE
80 40 0 40 80 160
(IN FEET)
1 inch = 80 ft.

Former Uniroyal Complex and Facemate Properties
154 Grove Street & 5 West Main Street
Chicopee, MA

Figure 5
Utility Plan
Baskin Parcel

D:\5100s\5100 - Chicopee - Uniroyal LSP Services\Drawing Files\Uniroyal\2017-1-26 FillManagementPlan.dwg



SECTION A - A′

NOTE: ELEVATIONS WERE CALCULATED BASED ON THE NORTH AMERICAN DATUM 1988 (NAV 88)

27-INCH RCP PIPE SHOWN AS INDICATED ON CHICOPEE RIVER FLOOD CONTROL PLAN, DEC 1962.

PLAN REFERENCES

TOPOGRAPHIC INFO OBTAINED FROM:

1. BETA GROUP
   FOUNDATION BACKFILL PLAN,
   YEAR 2016

2. DURKEE, WHITE
   PLAN OF LAND IN THE CITY OF CHICOPEE, MASSACHUSETTS,
   YEAR 2012

3. HERITAGE SURVEYS INC.
   TOPOGRAPHIC PLAN OF LAND IN CHICOPEE, MASSACHUSETTS,
   YEAR 2009

BETA CELEBRATING 35 YEARS

Former Uniroyal Property - Lower Tier Backfill Schematic

Chicopee, Massachusetts

Horizontal Scale: 1"=20' Vertical: 1"=10'

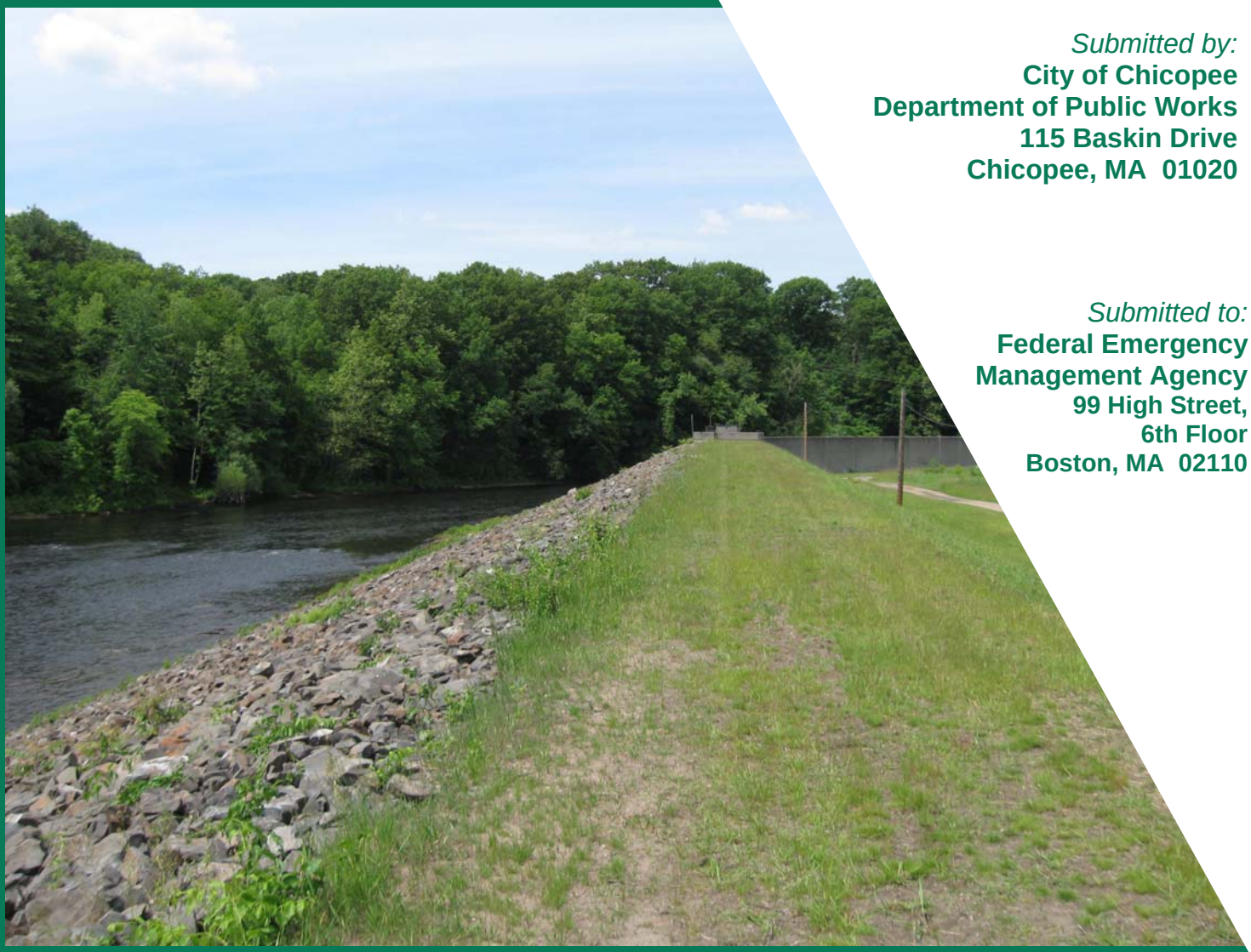
Jan. 25, 2017

Figure 6
Cross Section
A - A'

APPENDIX A – Excerpts of FEMA Accreditation Report, BEC, Nov 2010

FEMA Accreditation Report
Chicopee Falls Flood Control System
Chicopee, Massachusetts

November, 2010



Submitted by:
City of Chicopee
Department of Public Works
115 Baskin Drive
Chicopee, MA 01020

Submitted to:
Federal Emergency Management Agency
99 High Street, 6th Floor
Boston, MA 02110

Prepared by:
Baystate Environmental Consultants , Inc.
1350 Main Street, Suite 1400
Springfield, MA 01103
413-726-2100

FEMA ACCREDITATION REPORT
CHICOPEE FALLS FLOOD CONTROL SYSTEM
CHICOPEE, MASSACHUSETTS

TABLE OF CONTENTS

APPENDICES

SECTION 1

INTRODUCTION

1.1 PURPOSE AND STANDARD OF CARE

The purpose of this report is to compile and present engineering opinions, survey documentation and analyses of the Chicopee Falls Flood Control System in Chicopee, Massachusetts to the Federal Emergency Management Agency (FEMA) for their sole use in establishing risk zones for the National Flood Insurance Program (NFIP) maps. Use of this report or the opinions and findings in the report in whole or in part by any other party, or for any other project or purpose is not intended nor authorized and may lead to inappropriate conclusions. Reliance upon the information presented in this report by any other party other than FEMA, without Baystate Environmental Consultants, Inc. (BEC) prior written permission shall be at that other party's sole risk and without any liability to BEC.

The findings, opinions and conclusions contained herein are based on the work conducted as part of the contracted scope of services undertaken pursuant to contractual terms with the City and reflect professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as professional opinions and judgments built upon the limited data gathered during the course of the work. To understand how these opinions were developed, and to understand the intended use of the report, the report must be read in its entirety including the stated limitations.

The Code of Federal Regulations, Title 44 Part 65 addresses "Identification and Mapping of Special Hazard Areas" within which is Paragraph 65.10, "Mapping of areas protected by levee systems". This report is intended to document compliance with the minimum design, operation, and maintenance standards for levee systems established in 44 CFR 65.10, a copy of which is appended to this report.

This report opines that the Chicopee Falls Flood Control System meets the minimum criteria for design, operation and maintenance as established in 44 CFR 65.10 during a one-percent annual chance flood as determined by FEMA and issued in April, 2009, within the preliminary Flood Insurance Study and Flood Insurance Rate Maps for Hampden County, Massachusetts which includes all of the City of Chicopee. It must be noted that the one-percent annual chance flood is used by FEMA only as a flood insurance criterion.

1.2 LOCATION AND DESCRIPTION OF FLOOD CONTROL SYSTEM

The Flood Control Works in the City of Chicopee, Hampden County, Massachusetts was constructed by the United States Army Corps of Engineers (USACE) in four separate systems, namely the Plainfield Street Flood Control System, the South Bank Chicopee River Flood Control System, the Willimansett Flood Control System, and the Chicopee Falls Flood Control System. In total, the Flood Control Works within the City consists of 25,820 linear feet of earthen levee, 7,500 linear feet of flood control walls, eight pumping stations, three cast-in-place concrete closure structures, and various appurtenant drainage features. Figure 1 is a locus plan of the four systems in Chicopee. Although all four systems do share a common Operation and Maintenance Manual, each system is physically independent from one another. As such, individual Accreditation Reports have been prepared for each system.

The Chicopee Falls Flood Control System consists of two segments of cast-in-place concrete flood walls and two segments of earthen levee, extending along the southern bank of the Chicopee River from the Deady Memorial Bridge to higher ground at a railroad, for a total length of 5,002 linear feet. USACE plans for this section are dated 1963. In addition, two stormwater pumping stations were constructed: the Main Street Pumping Station and the Oak Street Pumping Station. Following is a description of the system based upon the USACE plans and other available information.

From the Deady Bridge at Station 4+13, a segment of cast-in-place cantilever concrete wall extends westerly (downstream) for 557 linear feet to Station 9+70. The first 400± feet of wall is founded directly on ledge with rock anchors, while the last 157 feet is founded on earth. The exposed wall height is approximately 20 feet on both the landside and riverside. A perforated pipe toe drain surrounded by stone and filter sand was installed adjacent to the wall footing on the landward side from Station 6+80 to the downstream end of the wall. Stone slope protection was installed on the riverside of the wall starting at Station 5+90 and continues to the earthen levee slope protection, which begins at Station 9+70.

An earthen levee was constructed from Station 9+70 to Station 16+82 for a length of 712 feet, including riprap slope protection on the riverside and a perforated pipe toe drain surrounded with stone and filter sand along the bottom of the levee slope on the landside. The typical levee cross section consists of compacted random fill on the landside and compacted impervious soil on the riverside, including an impervious foundation cutoff. The top of levee is approximately 17 feet higher than the landside grading.

A second segment of cast-in-place cantilever concrete floodwall extends from Station 16+82 to Station 25+45 for a length of 863 feet. This wall segment is located on the inside of a bend of the Chicopee River where flow direction turns approximately 90 degrees from westerly to southerly. This entire segment of wall is founded directly on ledge, and a perforated pipe toe drain surrounded by stone and filter sand was installed adjacent to the wall footing on the landside. Riprap slope protection was installed on the riverside. The wall stem has an exposure of approximately 16 feet on the landside and 20 feet facing the river. The Main Street Pumping Station was constructed into the wall at Station 24+20.

A second segment of earthen levee extends 2,870 linear feet from Station 25+45 to Station 54+15. Riprap slope protection on the riverside and a toe drain on the landside were also constructed. The typical cross section consists of compacted random fill on the landside with compacted impervious soil on the riverside with an impervious foundation cutoff. The Oak Street Pumping Station was built into the levee at Station 49+15. Two gate valves with catwalk access are located in this segment in close proximity to the pumping station. One was an intake for the now defunct U.S. Rubber Company facility with associated improvements, while the other is an outlet from the Oak Street Pumping Station. A new downstream pressure drain is also shown on the USACE plans downstream from the pumping station near Station 52+50.

A collector drain line was constructed on the landside of the system from Station 7+00 to the Main Street Pumping Station and also from Station 34+70 to the Main Street Pumping Station. A second drainage line that discharges to the Oak Street Pumping Station was also built adjacent to the levee toe on the landside from Station 39+00 to Station 51+20. The USACE constructed a pressure drain with an inlet upstream of the Deady Bridge at the Chicopee River Falls gatehouse to an outlet through the levee at Station 36+10. The pressure line was controlled by various sluice gates and appears to have provided process water to various manufacturing facilities within the area protected by the Chicopee Falls system. The USACE plans indicate that the section of the drain from the gatehouse to the manhole at Station 3+00 was only temporary and was to be removed when the process water line was no longer needed. A bypass was also constructed that tied the pressure drain into the collector drain at Station 39+00.

The Chicopee Falls Flood Control System also included the relocation and/or widening of a 3,700± ft segment of the Chicopee River. From approximately Sta. 30+17 to 52+00±, the river was relocated from east to west by excavation of the western (right) bank to an elevation of 75.0 ft (Mean Sea Level Datum) with a newly constructed bank rising on a 1 on 2 slope to a 15-ft wide shelf at elevation 81.0. The eastern (left) bank was filled in association with construction of the earthen levee. Three storm drain outfalls discharging at the right bank were modified to accommodate the relocated riverbank. From Sta. 52+00± to a point approximately 1,330 ft downstream of the end of the Chicopee Falls Flood Control Works, the channel was widened by excavation of the western (right) bank to an elevation of 75.0 ft (Mean Sea Level Datum) with a newly constructed bank rising on a 1 on 2 slope to a 15-ft wide shelf at elevation 81.0. The elevation increases from the shelf at a 1 on 2.5 slope until meeting natural high ground. No alterations were made to the eastern (left) bank downstream of the end of the levee.

During a visual inspection of current conditions along this system and based upon a comparison to prior documents, a number of changes were noted to have taken place since the original construction by the Corps of Engineers. Although not intended to be a complete listing, identified changes include:

1) The Oak Street and Main Street Pumping Stations were upgraded in a contract by the City in approximately 1999. All work was approved by USACE according to the City. Under that contract the roofs were replaced. New fuel tanks were installed to meet standards for spill prevention.

2) The Deady Memorial Bridge over the Chicopee River was rebuilt and the last concrete floodwall panel adjacent to and connecting with the bridge abutment appears to have been reconstructed.

3) The USACE plans indicate that the section of the former industrial water intake (leading to the pressure flow process water line) in the Deady Bridge area from the gatehouse to the manhole at Station 3+00 was only temporary and was to be removed when the process water line was no longer needed. According to the City, the line has reportedly been abandoned and is understood to be closed.

4) Storm drainage has been installed at the rebuilt Deady Memorial Bridge with manholes at the corners of the southern abutment connected to a pipe installed along the riverside face of the flood control wall. A small concrete wall was constructed in front of the floodwall and the storm drain pipe installed between the two walls at a shallow depth with the pipe partially exposed. The pipe is corrugated metal approximately 30 inches in diameter and visually terminates at a concrete (thrust) block cast against the floodwall on the riverside near Station 6+50. It is surmised that the drain line turns perpendicular to the wall at this concrete block and discharges to the river.

5) A power line was installed with a vertical riser on the riverside face of the floodwall near Station 6+75.

6) A hydropower generating facility was built on the riverside of the floodwall with an intake at the Chicopee Falls.

7) A gravel vehicle access drive to the power generating facility was installed near Station 10+00. An access way on the landside from Main Street ramps up to the top of the levee, crosses over to the riverside, turns parallel to the river and slopes downward in front of the upstream floodwall. The drive has a locked gate on the landside of the levee.

8) Access to the Oak Street Pumping Station is no longer possible through the closed U.S. Rubber Company plant site. A gravel vehicle access drive has been constructed from the right of way near Station 10+00 along the landward toe of slope to the Main Street Pumping Station. The gravel drive continues toward the Oak Street Pumping Station including a paved ramp from the landside toe at Station 35+50 to Station 36+25. Thereafter, the access drive is along the top of levee to a turnaround at the downstream limit of the levee.

9) The industrial water intake for the former U.S. Rubber Company plant near the Oak Street Pumping Station has been closed since the factory stopped operation and is exercised annually by the City.

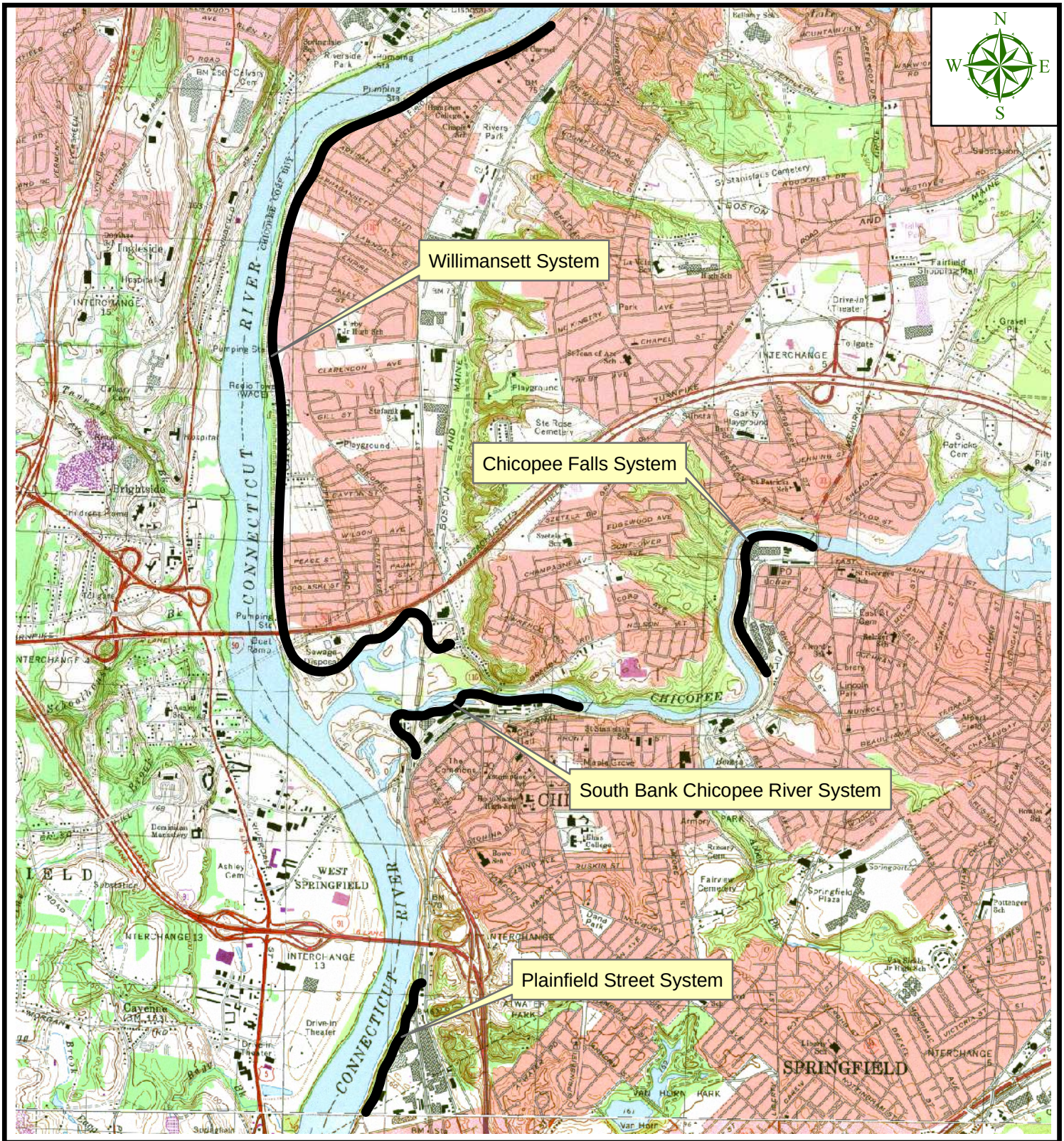


Figure 1: Locus Map

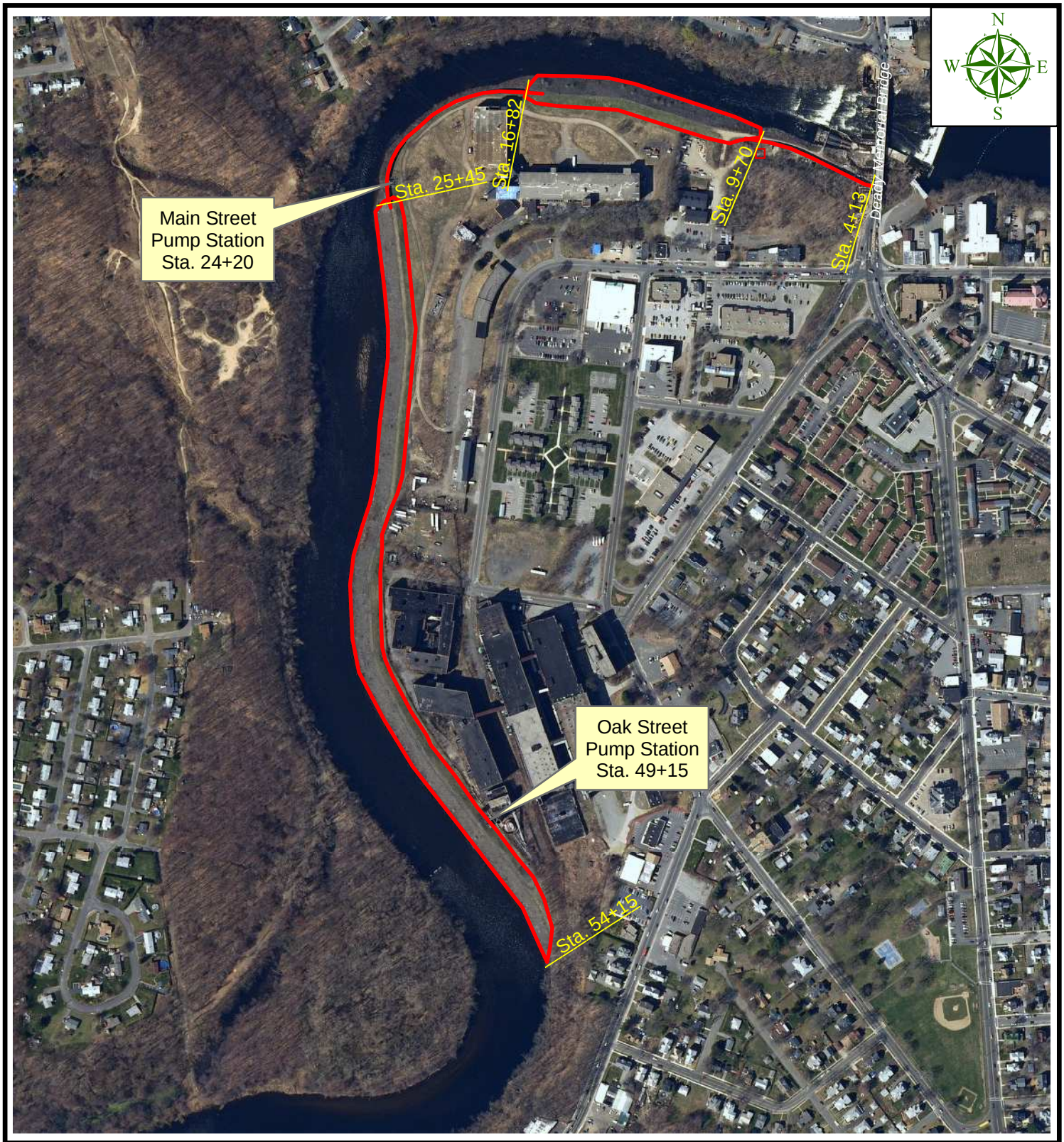
FEMA Accreditation Report
City of Chicopee
Flood Control Works

Chicopee, Massachusetts

USGS TOPOGRAPHIC QUADRANGLE MAP
SPRINGFIELD NORTH, MA, 1979

Baystate Environmental Consultants, Inc.
296 North Main Street, East Longmeadow, MA

Data obtained from MASS GIS, Commowealth of Massachusetts Executive Office of Environmental Affairs (EOEA)



Feet
500 250 0 500

Figure 2: Chicopee Falls System

FEMA Accreditation Report
City of Chicopee
Flood Control Works

Chicopee, Massachusetts

Legend

Flood Wall

Flood Levee

Baystate Environmental Consultants, Inc.
296 North Main Street, East Longmeadow, MA

MassGIS Orthophoto (2005) obtained from MASS GIS, Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA).

1.3 REPORT LIMITATIONS

1. This Report has been prepared for the exclusive use by FEMA for specific application to the accreditation of these flood control works for their sole purpose of establishing risk zones for the National Flood Insurance Program, in accordance with generally accepted engineering practices. No other warranty, express or implied, is made.

2. This Report has been prepared for the purpose of allowing the City of Chicopee, MA to fulfill its responsibility to provide data and documentation to FEMA demonstrating that the flood control system meets the criteria within 44 CFR 65.10. This Report is a compliance determination by Baystate Environmental Consultants, Inc. (BEC) and is not a determination of how the flood control works will perform in an actual flood event.

3. The observations described in this Report were made under the conditions stated. The opinions, conclusions and results presented in the Report were based solely on the services described, and not on scientific tasks or procedures beyond the scope of described services or the time constraints of the project.

4. In preparing this Report, BEC has relied on certain information provided by the City of Chicopee as well as Federal, state, and local officials and other parties referenced. BEC has also relied on certain information contained in the files of the City as well as Federal, state, and local officials and other parties which were available to BEC at the time of the analysis. Although there may have been some degree of overlap in the information provided by these various sources, BEC did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this work.

5. In reviewing this Report, it should be realized that the reported existing conditions of the various components of the flood control system are based on observations of field conditions during the course of the evaluation along with data made available to BEC. The observations of conditions in the field reflect only the situation present at the specific moment in time the observations were made, under the specific conditions present.

6. It is important to note that the condition of any flood control system depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the flood control system will continue to represent the condition of the flood control system at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions or increased risk may be detected.

7. BEC based any hydraulic analyses on existing conditions, site plans made available to BEC as of the date of this Report, prior hydraulic studies completed by others and made available, or upon field reconnaissance. In the event that any changes in the nature,

design or location of the flood control system, its appurtenant structures, or drainage areas contributing to the pumping stations are planned, the conclusions and recommendations contained in this Report shall not be considered valid unless the changes are reviewed and conclusions of this Report are modified or verified by BEC. Any BEC hydrologic analyses presented herein are for the rainfall volumes and distributions stated herein. For storm or riverine flood conditions other than those analyzed, the response of the flood control works and pumping stations has not been evaluated.

8. Relative to subsurface conditions, the generalized soil profiles provided in this Report and on our subsurface exploration logs are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location, refer to the exploration logs. Actual subsurface conditions are likely more complex than indicated in the Report. Mathematical modeling is, by its very nature, a simplification of actual conditions. In constructing the model, point specific data was generalized and extrapolated across the study area. In addition, in areas where field data was not available, professional judgment, based on experiences and regional information, was relied upon to construct the model.

9. Water level readings have been made in test holes and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. However, fluctuations in the level of the groundwater occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The observed water table may be other than indicated in the Report.

10. Our services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

11. Observations or opinions regarding foundation drainage, waterproofing, and moisture control address the conventional geotechnical aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

1.4 AUTHORIZATION

On May 23, 2007 the City of Chicopee entered into a contract for professional services with BEC relative to the City's Flood Control Works. This contract was subsequently amended on September 9, 2009, to include the work task to, "conduct an engineering evaluation of the flood control works and prepare data and documentation for the City to submit to FEMA for accreditation to demonstrate the flood control works meets the requirement of the National Flood Insurance Program as per current Code of Federal Regulations, (44 CFR Section 65.10)". A copy of the original contract with terms and conditions as well as a copy of the September 9, 2009 amendment are appended to this report. This report concludes this work task as related to the Chicopee Falls Flood Control System and is subject to the terms and conditions of the amended contract.

SECTION 2

LEVEE SYSTEM EVALUATION

2.1 STATEMENT OF LEVEE SYSTEM EVALUATION
Date of Statement: November 12, 2010

This Statement of Levee System Evaluation is made solely to the U.S. Federal Emergency Management Agency (FEMA) for the purpose of obtaining accreditation of the Chicopee Falls Flood Control System in the City of Chicopee, Hampden County, Massachusetts, one of four separate systems owned, operated and maintained by the City. Reliance upon this Statement by any other party without written authorization from the signatory is at such other party's sole risk and without any liability to BEC or the signatory.

This Statement is made in accordance with the requirements stated in the Code of Federal Regulations, Title 44 – Emergency Management and Assistance, Part 65 – Identification and Mapping of Special Hazard Areas (10-1-07 Edition). The meaning and context of the term "certification", is derived from the definition provided in 44 CFR 65.2 (b), which states:

> *For the purpose of this part, a certification by a registered professional engineer or other party does not constitute a warranty or guarantee of performance, expressed, or implied. Certification of data is a statement that the data is accurate to the best of certifier's knowledge. Certification of analyses is a statement that the analyses have been performed correctly and in accordance with sound engineering practices. Certification of structural works is a statement that the works are designed in accordance with sound engineering. Certification of "as-built" conditions is a statement that the structure(s) has been built according to the plans being certified, is in place, and is fully functioning.*

"Sound engineering practices" are defined by the signatory as performed in a manner consistent with the degree of skill and care ordinarily exercised by members of the engineering profession currently practicing in the same locality under similar conditions.

Analyses have been limited to the "Base flood" test condition only, to be utilized by FEMA to establish risk zone determinations under the NFIP. For the purposes of this Statement, the "Base flood" is defined by FEMA as the one-percent annual chance flood, documented in the Flood Insurance Study, Hampden County, Massachusetts and Incorporated Areas, Volume 1, 2 and 3 and dated "Preliminary, April 30, 2009".

"As-built" is defined as and limited by the signatory to those visual attributes which could be observed, mapped and documented on the enclosed topographic survey and the field investigations documented in this report. BEC did not observe nor document the original construction of the Chicopee Falls Flood Control System or subsequent construction activities and use of the "As-built" plans other than for general informational purposes is at the user's sole risk.

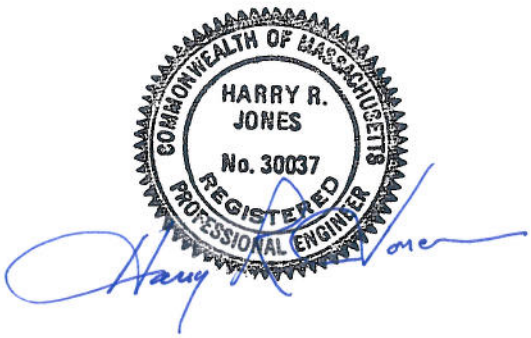
"Fully functional" is defined by the signatory as the physical conditions as of the Date of Statement.

This Statement applies solely to the development of National Flood Insurance Program insurance rates and is not a representation that any accredited levee will provide for the safety, health, and welfare of the public.

In accordance with 44 CFR 65.2 (b) and as supported by the information contained within this report, this is to state that:

- DATA – The data presented within this submission is accurate to the best of the signatory's knowledge.
- ANALYSES – The analyses have been performed correctly and in accordance with sound engineering practices.
- STRUCTURAL WORKS – The works are designed in accordance with sound engineering practices to provide protection from the base flood.
- "AS-BUILT" CONDITION – The structure(s) has been built according to the plans, is in place, and is fully functional to the best of the signatory's knowledge.

This Statement is provided in accordance and consistent with the definitions provided in 44 CFR 65.2(b) and further per the definitions and limitations described within this report and the subsequent Engineer's Opinions, mapping and documentation.



Harry R. Jones, P.E.
Baystate Environmental Consultants, Inc.
296 North Main Street
East Longmeadow, MA 01028

Date: Nov. 12, 2010

2.2 RESIDUAL RISK AND PUBLIC SAFETY

Under the NFIP, levee certification is a prerequisite for receiving levee accreditation from FEMA. With an accredited levee, areas which would otherwise be subject to flooding by the one-percent annual chance flood event will be designated as Zone X or moderate risk zone, as opposed to Zone A or high risk zone. The single and only purpose for this report is a determination of compliance with 44 CFR 65.10, and as such, a distinction must be emphasized between this report's purpose and the issue of public safety.

Risk is the product of the probability of an event's occurrence and the consequences or damages related thereof. FEMA has established a uniform probability factor of one-percent for the annual chance flood event as the means of determining flood insurance rates on a national basis. Since FEMA applies this same probability to a site with nominal or low consequences as well as to those sites with a severe or high consequence, the degree of risk varies and is not uniformly applied to all flood control systems. At the Chicopee Falls system, significant loss of lives and property could result. Thus, a significant public safety risk remains associated with the Chicopee Falls Flood Control System regardless of any designation under the NFIP. The Chicopee Falls system may reduce the probability of flooding but it does not eliminate the risk.

The Chicopee River has a long history of severe flooding events that have impacted the vicinity of the Chicopee Falls Flood Control System. The flooding events of September, 1938 and August, 1955 directly led to the USACE's construction of the Chicopee Falls system. According to the December, 1962 Chicopee Falls Local Protection Project Design Memorandum No. 2 by the USACE, the maximum flood of record on the Chicopee River had a peak discharge of 45,200 CFS in September, 1938, as recorded in Springfield. The report also noted that the Chicopee Falls Local Protection Project was designed for a flood discharge of 70,000 CFS at Chicopee Falls. The current FEMA Flood Insurance Study documents the estimated flood discharge for the one-percent annual chance flood (100-year) event as 32,000 CFS whereas that of the 0.2-percent annual chance flood (500-year) event to be 62,000 CFS. From a numerical perspective, this accreditation documents the performance of this system when subjected to an annual chance flood peak flow rate which is just over 70% of the documented flood of record flow rate and only 45% of that in the original USACE design.

SECTION 3

ENGINEER'S OPINIONS OF DESIGN CRITERIA

3.1 EVALUATION OF FREEBOARD - 44 CFR 65.10(b)(1)

This minimum design standard as stated in 44 CFR 65.10(b)(1) specifies the following:

1.) *Riverine levees must provide a minimum freeboard of three feet above the water-surface level of the base flood* (one-percent annual chance flood).

2.) *An additional one foot above the minimum is required within 100 feet in either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted.*

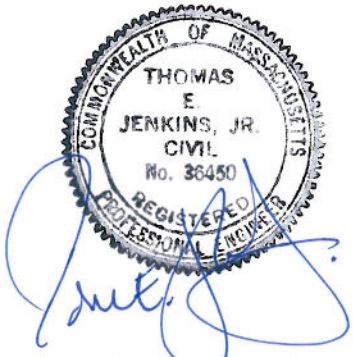
3.) *An additional one-half foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required.*

To verify this design standard, a system profile was prepared and is reproduced in the attached Appendix A-4.1. The system extends from the Deady Bridge downstream 5,002 feet to higher ground at a railroad embankment. Actual field spot elevations along the top of the system were obtained by Heritage Surveys, Inc. in October-November, 2009 taken at an approximate five hundred foot interval and are reproduced on the "As-Built" drawings, dated December, 2009. The top of system is illustrated on the profile as a solid black line with spot elevations indicated. The base flood profile information was obtained from the Preliminary Flood Insurance Study, Hampden County, Massachusetts, FIS #25013CV001, April, 2009 and is represented as a blue line on the system profile.

The freeboard criteria are also illustrated on the profile in red shading, Criteria One being a uniform three feet above the base flood elevation. Criteria Two applies at the Deady Bridge site. Criteria Three is additive to Criteria One and Two and is also illustrated in red. At all locations along the Chicopee Falls system, the top of wall or top of levee elevations are higher than the base flood elevations plus the applicable freeboard criteria.

It is the opinion of this professional engineer that the Chicopee Falls Flood Control System in Chicopee, Massachusetts meets the 44 CFR 65.10(b)(1) freeboard requirements for the base (one-percent annual chance) flood.

Opinion offered by:



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(Seal and Date)

11/12/10

3.2 EVALUATION OF CLOSURES - 44 CFR 65.10(b)(2)

This minimum design standard as stated in 44 CFR 65.10(b)(2) specifies the following:

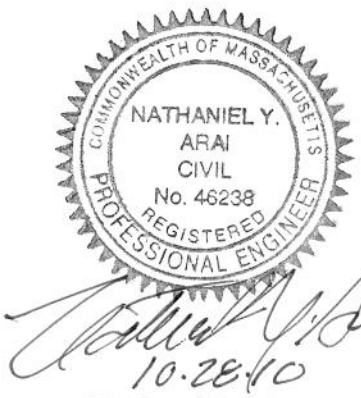
All openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice.

To verify this design standard, a closures report was prepared including a matrix of Flood System Penetrations Summary which is reproduced in Appendix A-4.2. All documented openings passing through the Chicopee Falls system outlet to the Chicopee River. In addition to the discharge lines from the Main Street and Oak Street Pumping Stations, four penetrations identified in the USACE plans were field verified. One is a pressure drain controlled by a sluice gate located upstream near West Main Street that is operated and maintained by the City. Another is the discharge pipe from a single grated basin located at the crest of the levee, well above the one-percent chance flood elevation. The third opening is a prior industrial intake line closed by a gate valve that is now operated and maintained by the City. Last is a pressure drain pipe from a storm drain system located well above the one-percent chance annual flood elevation.

Both pumping stations have outfalls that discharge by gravity flow during normal river flow events. During high flow conditions, gates are closed on the gravity discharge lines and interior flows are diverted to the pumping stations which then pump drainage flows to the river. Each pump is protected against backflow in the event that it may not be in operation at any time during river flooding. All gates and valves are maintained and operated by the City.

It is the opinion of this professional engineer that the Chicopee Falls Flood Control System in Chicopee, Massachusetts meets the 44 CFR 65.10(b)(2) closures requirements for the base flood (one-percent annual chance flood).

Opinion offered by:



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3.3 EVALUATION OF EMBANKMENT PROTECTION - 44CFR65.10(b)(3)

This minimum design standard as stated in 44 CFR 65.10(b)(3) specifies the following:

Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include, but are not limited to: Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes.

To verify this design standard, an Embankment Protection Analysis, Chicopee Falls Flood Control System was prepared, dated October 2010. A copy of this analysis is reproduced in the attached Appendix A-4.3. The analysis was performed in accordance with applicable methods and guidelines in the USACE Engineering Manual on Hydraulic Design of Flood Control Channels (EM 1110-2-1601, Change 1, 30 Jun 94), USACE Coastal Engineering Manual, Part II (EM 1110-2-1100, Change 2, 1 August 2008), and the United States Department of Agriculture, Soil Conservation Service (USDA SCS) Handbook of Channel Design for Soil and Water Conservation (TP-61, 1954).

The side slope flow velocities at various cross sections of the Chicopee River along the reach of the Chicopee Falls Flood Control System were below the acceptable velocities for riprap slope protection as present and thus the riprap protection is adequate. In the area where riprap is not present, the floodwall is founded directly on ledge with rock anchors, thus any erosion of the embankment in this area is unlikely to cause failure of the floodwall. Wind and wave action was based upon wave height determined at this site to be 1.6 feet. The available freeboard for the base flood is approximately 7.1 feet thus indicating that overtopping and related erosion and failure is not expected to occur. Average channel velocities are such that it is not expected that any impacts of ice or debris will cause significant damage to the system.

It is the opinion of this professional engineer that the Chicopee Falls Flood Control System in Chicopee, Massachusetts meets the 44 CFR 65.10(b)(3) embankment protection requirements for the base (one-percent annual chance) flood.

Opinion offered by:

Rosalie T. Starvish, P.E.
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(Seal and Date)

3.4 EVALUATION OF EMBANKMENT AND FOUNDATION STABILITY – 44 CFR 65.10(b)(4)

This minimum design standard as stated in 44 CFR 65.10(b)(4) specifies the following:

Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability. An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in the U.S. Army Corps of Engineers (COE) manual, "Design and Construction of Levees" (EM 1110-2-1913, Chapter 6, Section II), may be used. The factors that shall be addressed in the analyses include: Depth of flooding, duration of flooding, embankment geometry and length of seepage path at critical location, embankment and foundation materials, embankment compaction, penetration, other design factors affecting seepage (such as drainage layers), and other design factors affecting embankment and foundation stability (such as berms).

To verify this design standard, seepage was evaluated by creating typical levee cross-sections based upon recent topographic survey information, recent boring logs, historical boring logs (USACE pre-construction borings), laboratory data, empirical correlations from SPT N-value data and engineering literature. These parameters were input into SEEP/W 2007, a two-dimensional finite element seepage modeling software created by GEO-SLOPE International, Ltd. Models were analyzed with and without the toe-drain to analyze additional load cases that could impact seepage through the levee. Flow and exit gradients were computed within the toe drain and at the landside toe of the levee and were all below the limiting gradient of 0.5 per US Army Corps Technical Letter ETL 110-2-569 *Design Guidance for Levee Underseepage* for Normal and 100 Year Flood elevations.

The parent SEEP/W model was incorporated into SLOPE/W, a two-dimensional finite element slope stability modeling software created by GEO-SLOPE International, Ltd. with additional parameters including unit weight, strength and internal friction angle based upon laboratory data and empirical correlations from SPT N-value data and engineering literature. Factors of Safety against slope failure on the landside and riverside were analyzed under normal and 100 flood (steady-state and sudden drawdown conditions).

Based upon our slope stability evaluation of the Chicopee Falls levee, it is our opinion that the levee is in compliance with 44 CFR 65.10 (4). Summary sheets showing computed factors of safety for the various loading conditions and for each cross-section can be found in Appendix A-4.4.

A qualitative liquefaction analysis was performed on the Chicopee Falls Levee to evaluate whether the levee exhibited certain characteristics that would make it more susceptible to liquefaction (i.e. soil samples with high N-values and high fines contents are generally not as susceptible to liquefaction as loose, clean sands with low fines contents). It is our opinion that based upon the qualitative liquefaction analysis, a more in-depth quantitative analysis was not required.

It is the opinion of this professional engineer that the Chicopee Falls Flood Control System in Chicopee, Massachusetts meets the 44 CFR 65.10(b)(4) embankment and foundation requirements for the base flood (one-percent annual chance flood).

Opinion offered by:

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(Seal and Date)

3.5 EVALUATION OF SETTLEMENT - 44 CFR 65.10(b)(5)

This minimum design standard as stated in 44 CFR 65.10(b)(5) specifies the following:

Engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum standards set forth in paragraph (b)(1) of this section. This analysis must address embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods. In addition detailed settlement analysis using procedures such as those described in the COE manual, "Soil Mechanics Design-Settlement Analysis" (EM 1100-2-1904) must be submitted.

To verify this design standard, primary and secondary settlement of the varved foundation soils were estimated using one-dimensional consolidation theory, empirical correlations and published literature, as well as GZA's recent boring and survey information. Consolidation of granular soils was considered to occur immediately and to have been accounted for during the construction of the levee. Settlement analysis was conducted in general accordance with EM 1110-1-1904 *Settlement Analysis*, published by the USACE, dated September 30, 1990.

Primary settlement was estimated at approximately 3 inches, 90% of which was estimated to have been completed by 1964. Since end of primary consolidation, an estimated one-half inch of secondary settlement has occurred, resulting in a total of about 3.5 inches since construction. Approximately ¼ to ½ inch of secondary settlement (also known as creep) is expected to occur over the next 50-100 years.

Based upon our settlement evaluation of the Chicopee Falls Levee, it is our opinion that the levee is in compliance with 44 CFR 65.10(b)(5) and that freeboard has not sufficiently been affected by resulting post-construction settlement. Any increase in fill or loading above the USACE record drawings and recent survey by Heritage Survey renders this opinion null and void.

It is the opinion of this professional engineer that the Chicopee Falls Flood Control System in Chicopee, Massachusetts meets the 44 CFR 65.10(b)(5) settlement requirements for the base flood (one-percent annual chance flood).

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3.6 EVALUATION OF INTERIOR FLOODING - 44CFR65.10(b)(6)

This minimum design standard as stated in 44 CFR 65.10(b)(6) specifies the following:

An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than one foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters.

To verify this design standard, an Interior Flooding Analysis, Chicopee Falls Flood Control System was prepared, dated May, 2010 and submitted to FEMA for review and acceptance under the technical appeal process. A copy of this analysis along with the appeal resolution letter from FEMA dated July 19, 2010 are reproduced in the attached Appendix A-4.6. The analysis was conducted in accordance with the USACE's Engineering Circular on Certification of Levee Systems (EC 1110-2-6067) and their Engineer Manual, Hydrologic Analysis of Interior Areas (EM 1110-2-1413). The Coincident Frequency Method was utilized for this analysis due to the relative independence of the exterior (i.e., river flooding) event to the interior (localized flooding) event.

A total area of 16 acres drains to the Main Street Pumping Station and 15 acres drains to the Oak Street Pumping Station based upon information provided by the City and existing topographic mapping from the digital elevation model provided by FEMA which in turn was based upon a Light Detection and Ranging(LiDAR) survey. The discharge rates of the pumping stations were based upon the original pump test curves provided by the manufacturer of the installed pumps. The Chicopee River Stage Frequency curves were developed from USGS gage data at Indian Orchard, Springfield which had a record period of 82 years.

The Coincident Frequency Analysis concluded that the one-percent chance interior flooding elevation was lower than the lowest ground surface elevation within the Main Street and the Oak Street Pumping Station drainage areas and therefore there is no interior flooding associated with the base flood at the Chicopee Falls Flood Control System.

It is the opinion of this professional engineer that the Chicopee Falls Flood Control System in Chicopee, Massachusetts meets the 44 CFR 65.10(b)(6) interior drainage requirements for the base flood.

Opinion offered by:

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(Seal and Date)

3.7 EVALUATION OF OTHER DESIGN CRITERIA (STRUCTURAL) - 44CFR65.10(b)(7)

This minimum design standard as stated in 44CFR65.10(b)(7) specifies the following:

In unique situations, such as those where the levee system has relatively high vulnerability, FEMA may require that other design criteria and analyses be submitted to show that the levees provide adequate protection. In such situations, sound engineering practice will be the standard on which FEMA will base its determinations. FEMA will also provide the rationale for requiring this additional information.

To the best of our knowledge FEMA has not identified other design criteria in need of evaluation for the Chicopee Falls Flood Control System. However it is the signatory's opinion that a structural evaluation of the flood protection walls was warranted. The objectives of our structural evaluation were to determine, with reasonable certainty, that the structures meet current design standards and are in a suitable condition to perform as intended and therefore meet the requirements of 44CFR65.10(b)(7). This evaluation of the Chicopee Falls Flood Control System floodwalls was accomplished by visiting the site and viewing the structures; reviewing available original design drawings, Construction Drawings, calculations, and previous inspection reports; evaluating recently collected site data; and performing structural calculations in accordance with current design standards.

Guidance in the performance of our structural evaluation was taken from the U. S. Army Corps of Engineers Draft Technical Letter No. 1110-570, *Certification of Levee Systems for the National Flood Insurance Program (NFIP)*, 12 September 2007. Parameters used in our calculations included the existing available design and construction documentation and data obtained from recently completed topographic surveys, subsurface exploration programs, laboratory testing and hydraulic analyses.

Our structural engineers visited the subject site on December 17, 2009. They walked the length of the system to visually observe the condition of the exposed portions of the flood wall.
Our structural engineers reviewed the original design documents in order to determine the assumed loading conditions and to review how the structural elements were designed. The result of the original analysis was compared to the current USACE guidance to verify that the structures meet current design requirements specified in the following documents:

1. USACE Manual EM 1110-2-2100 *Stability Analysis of Concrete Structures.*
2. USACE Manual EM 1110-2-2104 *Strength Design for Reinforced Concrete Hydraulic Structures.*
3. USACE Manual EM 1110-2-2502 *Retaining and Flood Walls.*

A total of 11 different wall sections have been evaluated using methods prescribed in USACE Manual EM 1110-2-2502 *Retaining and Flood Walls.* Our engineers evaluated each section for the load condition resulting from the one-percent-annual chance flood as required by FEMA Regulations 44 CFR 65.10. The floodwalls were evaluated for sliding stability, overturning stability, foundation soil bearing capacity and strength and serviceability of the structural members. A presentation of our analyses, methods and results can be found in Appendix A-4.7.

Based on our observations, the floodwalls appear to be constructed as indicated in the Record Drawings and to be structurally sound. The results of our analyses indicate that, as originally designed, the structures meet current design standards for the base flood event.

It is the opinion of this professional engineer that the Chicopee Falls Flood Control System floodwalls meet the requirements of 44CFR65.10(b)(7) for the base flood (one-percent annual chance flood).

Opinion offered by
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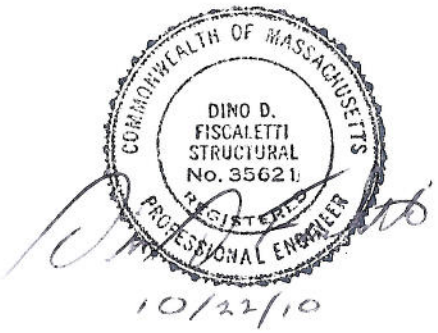


SECTION 4

ENGINEER'S OPINION OF OPERATION PLANS AND CRITERIA

4. ENGINEER'S OPINION OF OPERATION PLANS AND CRITERIA

Operation of the Chicopee Falls Flood Protection System levee embankment, floodwalls, pump stations, and penetrations is the responsibility of the Chicopee Department of Public Works as detailed in the appended Operation and Maintenance (O&M) Manual, Chicopee and Chicopee Falls, Massachusetts, Local Protection Projects, Connecticut and Chicopee Rivers, October, 2010. This document was officially adopted by the City Council as the Operations and Maintenance Manual for all flood protection systems in the City of Chicopee, MA.

In BEC's opinion, this operation plan as detailed in the O&M Manual:

- Establishes all operation activities are under the jurisdiction of the City of Chicopee Department of Public Works;

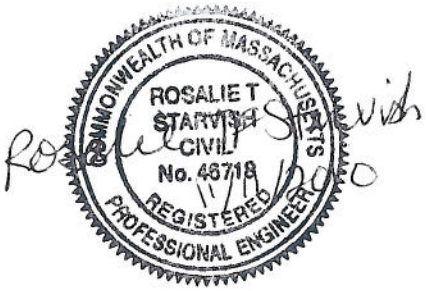
- For Closures: Documents the flood warning system used to trigger emergency operation activities and demonstrates that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before flood waters reach the base of the closure; a formal plan of operation including specific actions and assignments of responsibility by individual name or title, and provisions for periodic operation, at not less than one-year intervals, of the closure structure for testing and training purposes;

- For Interior Drainage Systems: Documents the flood warning system used to trigger emergency operation activities and demonstrates that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system, a formal plan of operation including specific actions and assignments of responsibility by individual name or title; provision for manual backup for the activation of automatic systems, and provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes with no more than one year lapse between either the inspections or the operations.

Other operating plans and criteria to ensure that adequate protection is provided in specific situations have not been identified by FEMA to the knowledge of BEC.

In accordance with the definitions and limitations set forth in 44 CFR 65.2(b), it is the opinion of this professional engineer that this O&M Manual meets the minimum operation requirements specified in 44 CFR 65.10(c).

Opinion offered by:



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(Seal and Date)

SECTION 5

ENGINEER'S OPINION OF MAINTENANCE PLANS AND CRITERIA

5. ENGINEER'S OPINION OF MAINTENANCE PLANS AND CRITERIA

Maintenance of the Chicopee Falls Flood Protection System levee embankment, floodwalls, pump stations, and penetrations is the responsibility of the Chicopee Department of Public Works as detailed in the appended Operations and Maintenance (O&M) Manual, Chicopee and Chicopee Falls, Massachusetts Local Protection Projects, Connecticut and Chicopee Rivers, October, 2010. This document was officially adopted by the City Council as the Operations and Maintenance Manual for all flood protection systems in the City of Chicopee, MA.

In BEC's opinion, this maintenance plan as detailed in the O&M Manual:

- Establishes that all maintenance activities are under the jurisdiction of the City of Chicopee Department of Public Works;
- Documents the formal procedures that ensures that the stability, height, and overall integrity of the levee and its associated structures and system are maintained;
- Specifies the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance.

In accordance with the definitions and limitations set forth in 44 CFR 65.2(b), it is the opinion of this professional engineer that this O&M Manual meets the minimum maintenance requirements specified in 44 CFR 65.10(d).

Opinion offered by:

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(Seal and Date)

SECTION 6

AS BUILT PLANS

SECTION 6. AS BUILT PLANS

44CFR65.10(e), titled "Certification requirements" includes the statement, "Also, certified as-built plans of the levee must be submitted." Also within 44CFR65.2, titled "Definitions" is the statement, "Certification of "as-built" conditions is a statement that the structure(s) has been built according to the plans being certified, is in place, and is fully functioning." In response to these requirements a topographic survey of the Chicopee Falls Flood Control System was prepared based upon aerial photography and supplemented with ground surveys performed from May, 2008 through September, 2009. "As-built" is defined as and limited to those visual attributes which could be observed and documented. BEC did not observe nor document the original construction of the Chicopee Falls Flood Control System or that of subsequent construction activities and use of the "As-built" plans other than for general informational purposes is at the user's sole risk.

The five sheet plan set of topographic mapping is enclosed within this report in Appendix A-5. Plans are titled "Chicopee Falls System, Chicopee Flood Control Works, Chicopee, MA", dated December 12, 2009 and stamped by a MA Licensed Land Surveyor.

APPENDIX A-3

GEOTECHNICAL DATA
AND
LABORATORY ANALYSES

GEOTECHNICAL DATA

CHICOPEE FALLS FLOOD CONTROL SYSTEM

CHICOPEE FLOOD CONTROL WORKS

CITY OF CHICOPEE

HAMPDEN COUNTY, MASSACHUSETTS

November, 2010

GZA GeoEnvironmental, Inc.

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GeoEnvironmental, Inc.

Engineers and
Scientists

August 19, 2010
File No. 15.0702100.50

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INTRODUCTION:

GZA GeoEnvironmental, Inc. (GZA) is pleased to submit this geotechnical data report for the Chicopee Falls Levee of the Chicopee Flood Control Works in Chicopee, Massachusetts. This report presents the results of field and laboratory programs completed as part of our geotechnical study. Conclusions and recommendations relative to levee seepage and stability analysis will be provided separately. Please note that this report is subject to the limitations provided in Section 1.3. Elevations included in this report are referenced to the North American Vertical Datum of 1988 (NAVD 88). Please note that many original U.S. Army Corps. of Engineers project plans and documentation are in the Means Sea Level datum, approximately 0.7 feet above the NAVD 88 datum in the Chicopee local area. (MSL-0.7'=NAVD 88)

BACKGROUND

GZA's understanding of the project is based on our work at the site, discussions with the City of Chicopee Department of Public Works, and the following project documents:

- A drawing set entitled "Chicopee Falls, Chicopee River, Massachusetts," prepared by Green Engineering Affiliates, Inc., Boston, MA for the U.S Army Engineer Division, Waltham, MA, dated April 1963, sheets 1-63;

- A design memorandum entitled, "Chicopee Falls, Local Protection Project, Chicopee River, Massachusetts, Design Memorandum No. 5, Embankments and Foundations," prepared by the U.S Army Engineer Division, New England Waltham, MA, dated March 1963, 16 pp;

- A five sheet plan set of topographic mapping prepared by Heritage Surveys, Inc. dated December 12, 2009 and entitled "Topographic Plan of Land in Chicopee, Massachusetts, Surveyed for the City of Chicopee.

EXISTING CONDITIONS

In response to significant flooding events in the 1930s and 1950s, flood control works were designed and constructed by the United States Army Corps of Engineers (USACE) for locations along the Chicopee and Connecticut Rivers in the City of Chicopee (City). Construction along the Connecticut River and the North and South Banks of the Chicopee River was conducted in a series of construction contracts initiated in 1938 and completed in 1942, collectively known as the Chicopee Local Protection Project (CLPP).

In total, the Chicopee Flood Control Works (CFCW) consists of 25,820 linear feet of earthen levee, 7,500 linear feet of flood control walls, eight pump stations, three cast-in-place concrete closure structures, and various appurtenant drainage features. The CFCW was constructed in four separate systems, namely the Plainfield Street system, the South Bank Chicopee River system, the Willimansett system, and the Chicopee Falls system. The Chicopee Falls system is shown on Figure 1, consisting of improved embankment and concrete floodwall from Station 0+00 at the Deady Memorial Bridge to high ground near Front Street at Station 54+15.

As a cooperative Federal/City effort, the USACE was responsible for the design and construction, while the City provided all of the lands, easements, and rights-of-way necessary for the construction. The City also agreed to maintain and operate the flood control works after completion, in accordance with federally prescribed regulations. These requirements are detailed in the Code of Federal Regulations, 33 CFR 208.10 which is entitled, "Local flood protection works; maintenance and operation of structures and facilities".

SUBSURFACE EXPLORATIONS

The subsurface explorations presented herein include borings from previous subsurface investigations by the USACE (designated by "BH") prior to construction, as well as the program of recent subsurface explorations performed for this project. The previous and recent subsurface explorations are described below.

Previous Explorations

In addition to the recent explorations, our study included the review of subsurface explorations and data from previous subsurface evaluations performed prior to the levee's construction.

Subsurface conditions from record drawings were used to supplement the current geotechnical evaluation and provide confirmation on levee and flood wall foundation soils. These test boring locations and exploration logs from the previous study are included in Section A-3.1. Soil samples were classified using the USACE Providence District Soil Classification System which corresponds to a soil unit number and grain size distribution. The previous borings generally encountered fill over fluvial sands, silts and gravels (often noted as till) underlain by red shale (and occasionally conglomerate and sandstone). Varved soils were identified on previous USACE boring logs in the vicinity of Station 50+00 and further south.

Recent Explorations

The subsurface exploration program performed for this project consisted of 11 borings which are described below. Borings were completed using the rotary (drive and wash) method with cased techniques in general accordance with our Comprehensive Work Plan dated December 29, 2009 and accepted by the USACE in a letter dated January 7,

2010, applicable ASTM and USACE standards and observed fulltime by GZA personnel. Standard Penetration Tests (SPTs) and split spoon sampling were generally performed continuously in the upper 8 feet of the borings, and at 5-foot intervals thereafter. Representative soil samples were collected from the split spoon samples and stored in jars for later review and laboratory testing. Boreholes were tremie-grouted with a bentonite/cement grout upon completion. Logs of the recently performed borings are included in Section A-3.2 and the approximate boring locations are shown on Figures 2 through 5.

Borings

Eleven test borings were performed between January 6, 2009 and February 4, 2010 at the Chicopee Falls levee section (CF-1 through CF-11) by A&A Test Boring of South Windsor, CT using a Diedrich D-120 all-terrain drill rig, and were observed by GZA personnel. Borings were generally spaced 500 linear feet apart along the top of the levee and at transitions between earth embankment and flood wall sections. Completed boring depths ranged between 20 and 80 feet below ground surface.

LABORATORY ANALYSES

GZA performed thirteen laboratory gradation analyses and one percent organics test from recovered soil samples along the Chicopee Falls Levee in accordance with applicable ASTM Standards D422 and D2974. The geotechnical laboratory test results are included in Section A-3.3, and summarized on Table 1.

SUBSURFACE CONDITIONS

Ground surface elevations on the landside of the Chicopee Falls were generally between 89 and 92 feet (NAVD 88), slightly higher west of Station 10 (rising up to El. 95) and slightly lower alongside the former Facemate property (sloping down to El. 84). River-side toe elevations range from approximately El. 82 at the east end to approximately El. 78 at the west end. Top of levee/floodwall elevations of the Chicopee Falls system ranged between El. 110 and El. 99, decreasing in elevation with increasing Station (NAVD 88).

Soils

Brief soil descriptions are provided below. Detailed information about subsurface conditions based on recent and historical borings, as well as assumed parameters for unit weight, hydraulic conductivity and internal friction angle can be found in the attached summary sheets and analysis profiles located in Appendix A-4.4 of the FEMA Accreditation report.

Fill – Four to thirty-seven feet of fill, consisting of dense to very dense, fine to coarse SAND, with little to some fine to coarse gravel and trace to some Silt and trace amounts of loose to medium fine to coarse sand and Silt, with occasional

trace amounts of brick, ash, wood, plastic and organics. Average fill thickness was around 25 feet, with the smallest amount of fill occurring near the Deady Memorial Bridge where rock elevation is closest to the ground surface. Bottom of fill elevations generally seemed to correspond to the river elevation, where loose blow counts and losses of washwater were occasionally observed.

USACE drawings identify multiple fill zones consisting of compacted impervious fill and compacted random fill in the typical levee sections. These two soil types are also specified in the Chicopee Falls Design Memo. Compacted impervious fill "is a well graded gravelly, silty, clayey sand (SM-SC) with at least 20% passing the No. 200 sieve" (USACE, 9). Compacted random fill can consist of "any granular materials which contain no organic or decaying matter, are essentially non-plastic in nature, and contain no gravel sizes larger than 2/3 the allowable life thickness will be usable" (USACE, 10). No distinction between these soil types was observed in the borings as would be expected based on the geometry shown on the USACE drawings. Laboratory gradations were performed on both sample types and plotted against USACE Design Memo gradations. Sample gradations from the zones classified as either random or impervious were found to satisfy both gradation curves. It is GZA's opinion that the levee was likely constructed of the more conservative compacted impervious fill to simplify construction, or based on availability, while satisfying design requirements.

Sand and Gravel/Till – A very dense brown to red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt was observed beneath the fill except in boring CF-9. Top of Sand and Gravel/Till elevations ranged between 82 and 86 at Stations 10+00 and 16+70 (dipping briefly to El. 74 at Station 13+30) decreasing to El. 60 at Station 60.5 and 65 at Stations 44+60 and 50+00, respectively.

Varved Silt/Clay – Hard, brown, varved soils were encountered in boring CF-11 at Station 50+00, approximately 22.5 feet in thickness (also noted in the design memo). Field torvane measurements of shear strength on recovered split-spoon samples ranged from 0.65 to 1.45 tons per square foot. Pocket penetrometer readings ranged from 3.25 to over 4 tons per square foot.

Weathered Rock/Sandstone Bedrock – Red-brown Sandstone with occasional Shale zones was encountered below the Fill in borings CF-1 and CF-9, the Varved Silt/Clay in boring CF-11 and below the Sand and Gravel/Till in the remaining borings (except for CF-7 which was terminated prior to encountering bedrock). In general the top of rock decreases in elevation from upstream (El. 89 in CF-1) to downstream (El. 20 in CF-11). The bedrock generally increased in quality with depth, ranging from completely weathered to slightly weathered with RQD values (defined as the sum of lengths over 4" divided by the total run length) as high as 72 percent.

Groundwater

Groundwater levels were measured during performance of the test borings and generally seemed to correspond with the approximate river elevation at the test boring location, with average elevation ranging between Elevation 82 and 83 NAVD88. This data is similar to data collected prior to construction (varying date). No observation wells or piezometers were installed. River elevation data for both the Chicopee and Connecticut Rivers are recorded daily by City Flood Control. In conversations with the Flood Control Foreman, Ernest Laflamme, an electronic database of river levels is also maintained and updated yearly.

Note that fluctuations in the groundwater levels will occur due to variations in season, precipitation, temperature, river level, impacts from existing utilities, and other factors different than those existing at the time of the explorations.

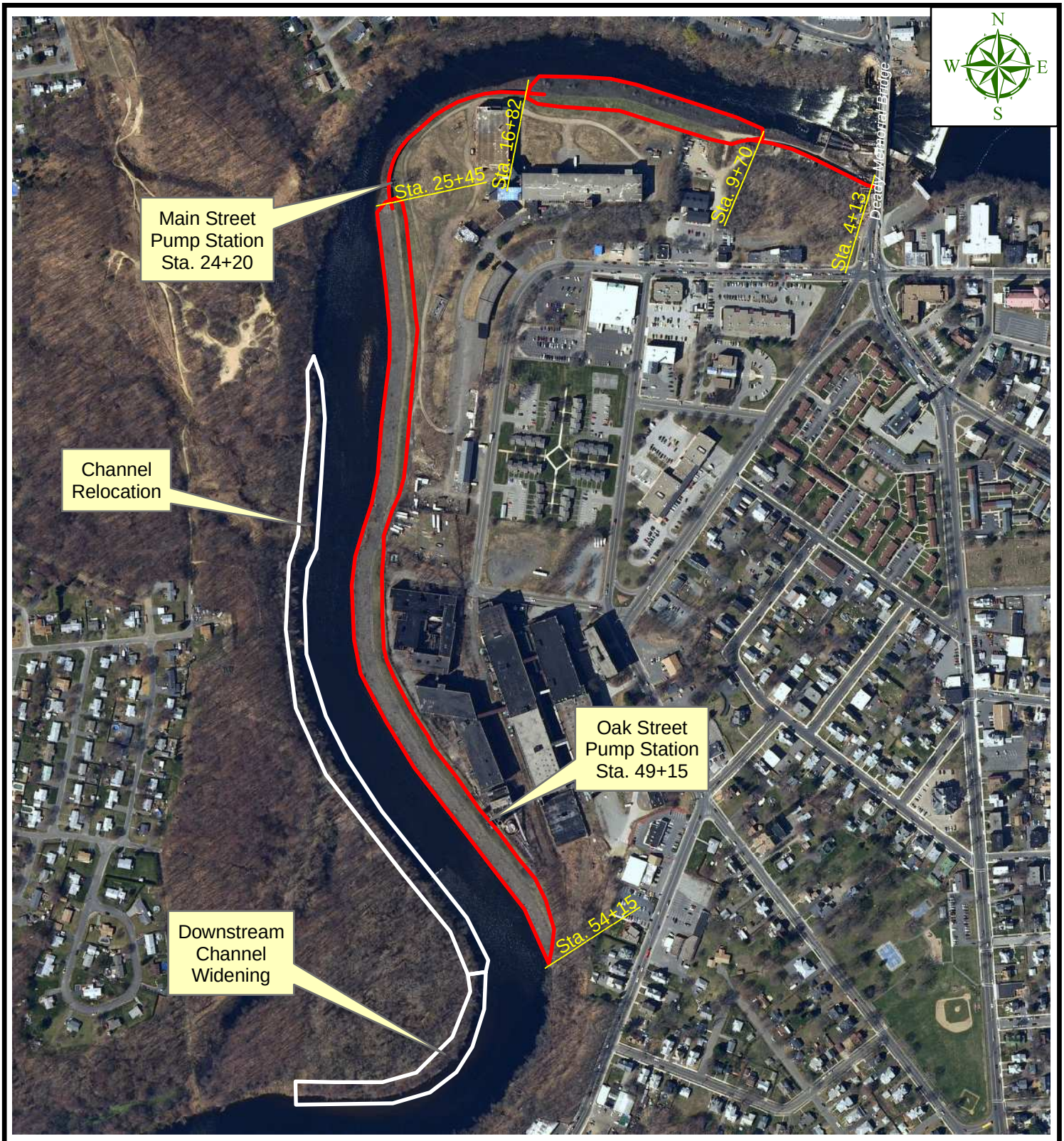
TABLE

Chicopee Flood Control Works
GZA Project No. 15.0702100.50
Chicopee Falls Levee - Geotechnical Laboratory Testing Summary

							Percent By Weight:							
									Fines					
Boring	Sample	Station [1]	Depth (ft.)	Elevation [2]	USACE [3]	Stratum [4]	Gravel	Sand	Silt	Clay	WC [5]	LL	PL	PI	Comments
CF-3	S-2	13+30 LC	3	104	Cpt. Imp. Fill	Fill	15	54	31		--	--	--	--	
CF-3	S-5	13+30 LC	11	96	Cpt. Rdm. Fill	Fill	27	54	19		--	--	--	--	
CF-3	S-7	13+30 LC	21	86	Cpt. Rdm. Fill	Fill	25	60	15		--	--	--	--	
CF-3	S-9	13+30 LC	28	79	-	Fill	13	72	15		--	--	--	--	5.4% Organic
CF-5	S-2	13+30 RC	3	104	Cpt. Imp. Fill	Fill	21	51	28		--	--	--	--	
CF-5	S-5	13+30 RC	11	96	Cpt. Rdm. Fill	Fill	32	45	22		--	--	--	--	
CF-5	S-11	13+30 RC	29	78	Cpt. Rdm. Fill	Fill	11	74	15		--	--	--	--	
CF-6	S-5	25+50 RC	11	93	Cpt. Imp. Fill	Fill	15	60	25		--	--	--	--	
CF-7	S-5	30+00 RC	11	91			19	53	28		--	--	--	--	
CF-7	S-12	30+00 RC	36	66	Till	S+G	53	37	10		--	--	--	--	
CF-11	S-3	50+00 RC	5	94	Cpt. Imp. Fill	Fill	11	63	26		--	--	--	--	
CF-11	S-5	50+00 RC	11	88	Cpt. Rdm. Fill	Fill	18	59	24		--	--	--	--	
CF-11	S-13	50+00 RC	32	67	Cpt. Imp. Fill	Fill	10	62	28		--	--	--	--	

1. Stationing is approximate. "RC" = Riverside Crest, "LC" = Landside Crest
2. Elevations referenced to the NAVD88 datum and are in the text.
3. "USACE" refers to stratum description from typical levee sections in record drawings or Design Memo by U.S. Army Engineers. "Imp. Blkt." = Impervious Blanket, "Perv. Mat." = Pervious Material
4. "S+G" = Sand and Gravel, "Varved" = Varved Silt and Clay, N/A = Not Analyzed
5. WC = Water Content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index, Tv = Torvane, readings in tons/square foot.
6. All tests conducted in general accordance with applicable ASTM Standards D2216, D4318, 2974, and D422.

FIGURES



Feet
500 250 0 500

Figure 1: Chicopee Falls System

Comprehensive Work Plan
for Drilling Services and Geotechnical Testing
of the Flood Control Works

Chicopee, Massachusetts

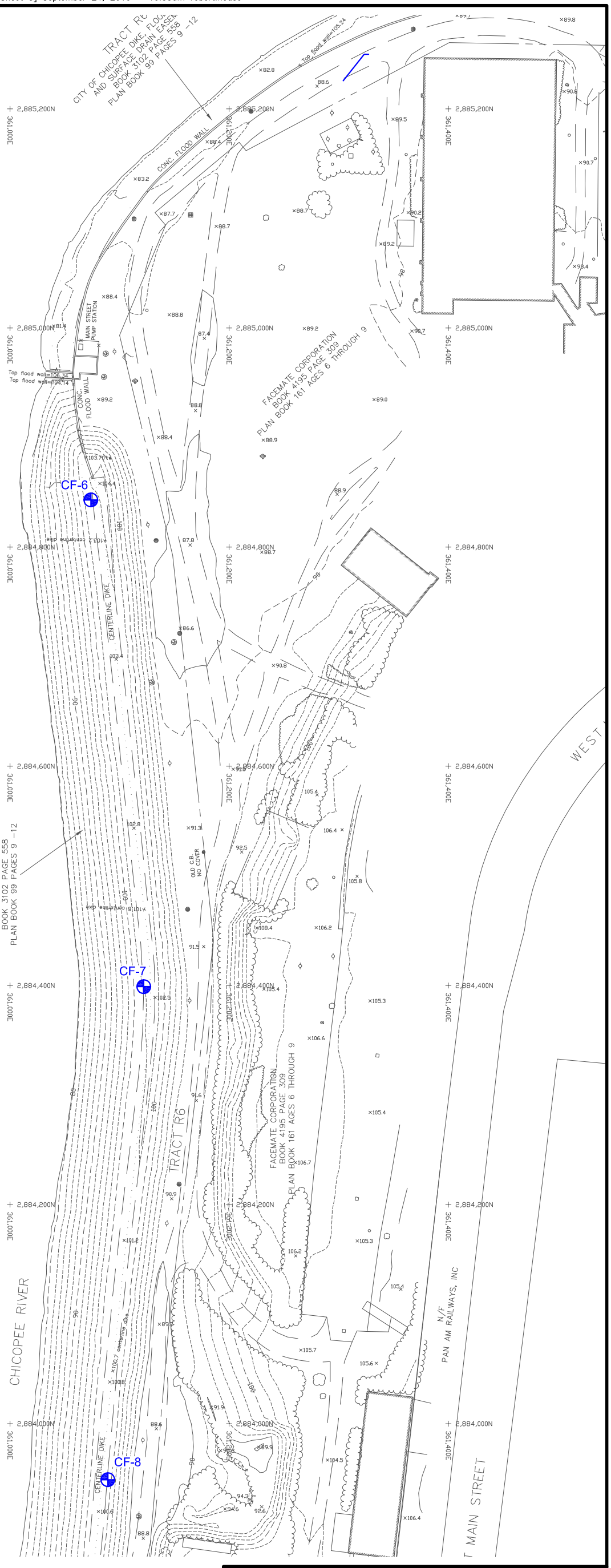
Legend

Flood Wall

Flood Levee

Baystate Environmental Consultants, Inc.
296 North Main Street, East Longmeadow, MA

MassGIS Orthophoto (2005) obtained from MASS GIS,
Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA).



MERIDIAN OF THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM 1983 DATUM

SURVEYOR'S NOTES:

1. TOPOGRAPHIC DATA SHOWN HEREON IS BASED UPON AERIAL PHOTOGRAPHY TAKEN DURING APRIL, 2008. PHOTOGRAPHY AND MAPPING WERE PERFORMED BY COL–EAST, INC. OF NORTH ADAMS, MA AND SUPPLEMENTED WITH GROUND SURVEYS PERFORMED BY HERITAGE SURVEYS, INC. FROM MAY, 2008 THROUGH SEPTEMBER, 2009.

2. FOR REFERENCE TO BOUNDARY LINE AND EASEMENTS SEE A PLAN PREPARED BY HERITAGE SURVEYS, INC. TITLED "PLAN OF FLOOD CONTROL AND DIKE EASEMENT IN CHICOPEE, MASSACHUSETTS SURVEYED FOR THE CITY OF CHICOPEE", DATED JUNE 15, 2009, SHEETS 1 THROUGH 4.

3. UNDERGROUND UTILITY LOCATIONS SHOWN HEREON ARE BASED UPON SURFACE FEATURES AS LOCATED BY SURVEY AND AVAILABLE RECORD DATA, AND ARE APPROXIMATE. ACTUAL LOCATIONS SHOULD BE VERIFIED WITH THE APPROPRIATE UTILITY COMPANY AND/OR MUNICIPAL DEPARTMENT PRIOR TO FINAL DESIGN AND/OR CONSTRUCTION.

4. LOCATION OF FLOOD WALL AND DIKE BASELINES SHOWN ARE APPROXIMATE AND ARE BASED UPON PLANS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS FOR CHICOPEE RIVER FLOOD CONTROL DATED APRIL, 1963. NO MONUMENTATION OF BASELINES WAS FOUND AND IS HISTORICAL ONLY.

5. TOP OF CONCRETE FLOOD WALL AND CENTERLINE DIKE GRADES IN BOLD TYPE ARE FIELD LOCATED BY SURVEY AND ARE NOT THE RESULT OF AERIAL MAPPING.

N W E S

0 50' 100' 200'

SCALE IN FEET

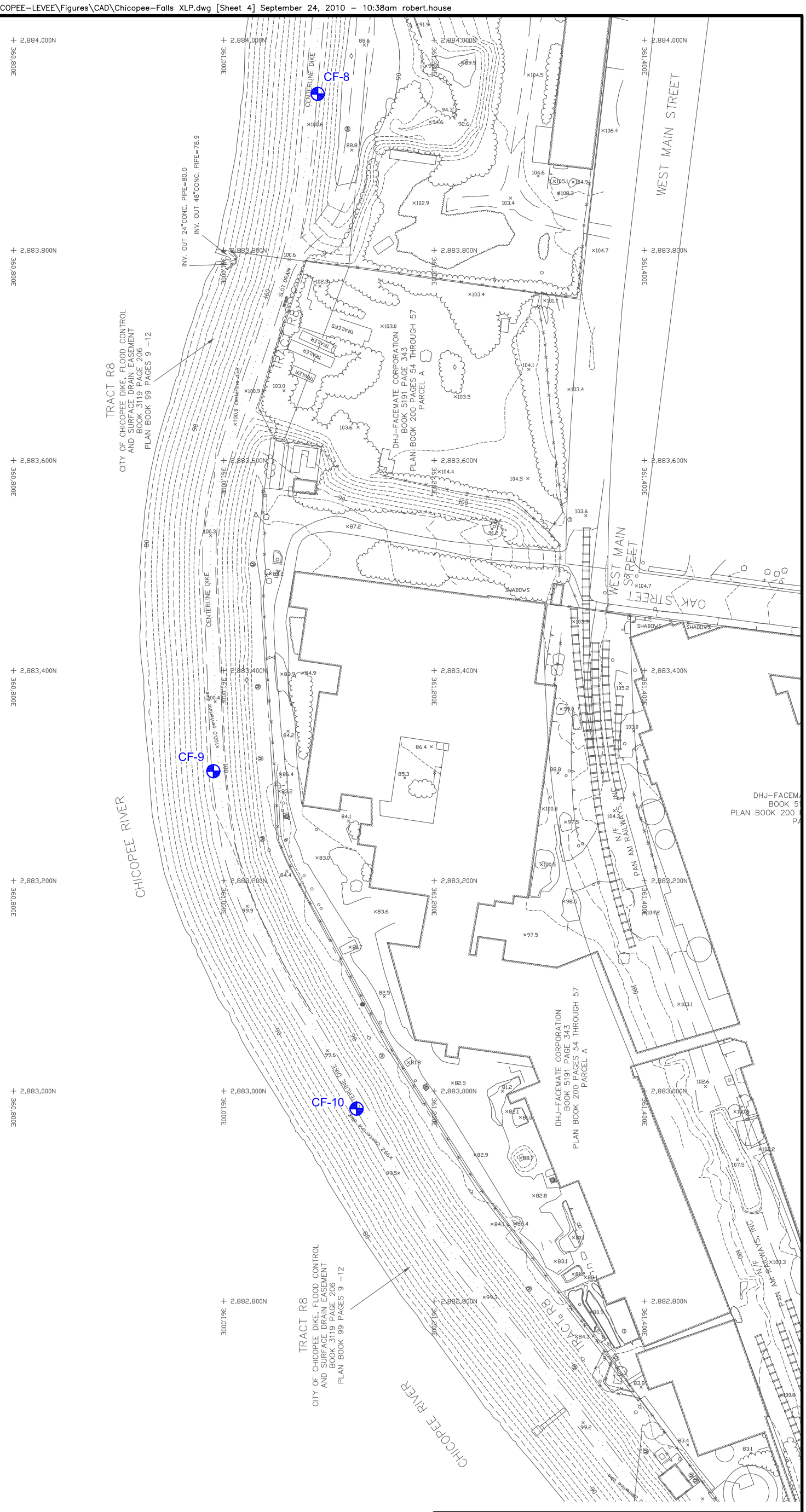
BORING COMPLETED BY A&A TEST BORING OF SOUTH WINDSOR, CT AND OBSERVED BY GZA PERSONNEL BETWEEN JANUARY 6, 2010 AND FEBRUARY 4, 2010

CHICOPEE FALLS

CHICOPEE, MASSACHUSETTS

CHICOPEE FALLS FLOOD PROTECTION SYSTEM EXPLORATION LOCATION PLAN

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists, ONE EDGEWATER DRIVE, NORWOOD, MA 02062, 781-278-3700		PREPARED FOR: CITY OF CHICOPEE DEPT. OF PUBLIC WORKS	
PROJ MGR: NA	REVIEWED BY: ABB	CHECKED BY: CT	FIGURE 3
DESIGNED BY: DF/ABB	DRAWN BY: GAS	SCALE: 1 INCH = 100 FEET	
DATE: 6-30-2010	PROJECT NO. 15.0702100	REVISION NO.	



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N
W E
S

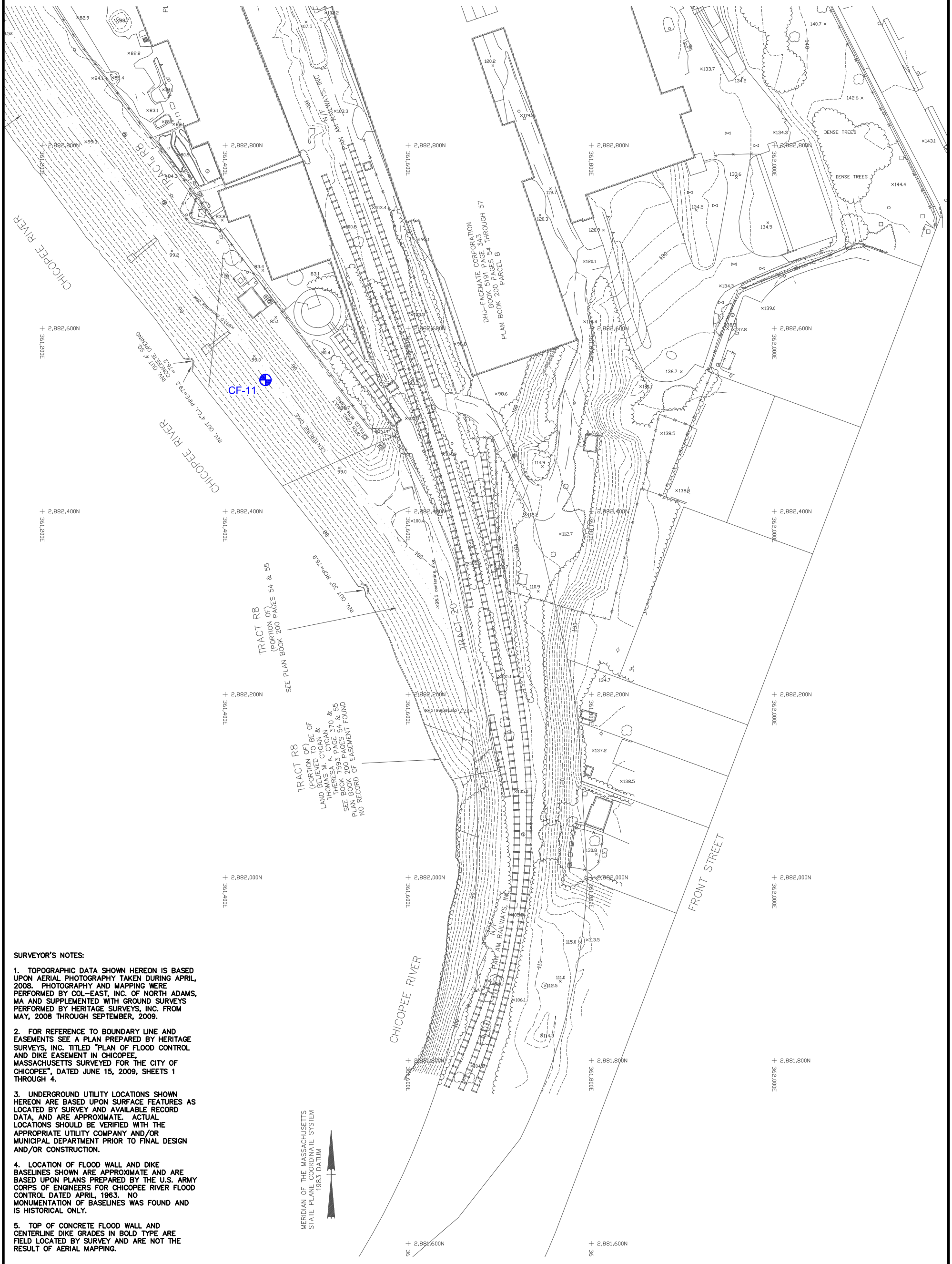
0 50' 100' 200'
SCALE IN FEET

BORING COMPLETED BY A&A TEST BORING OF SOUTH WINDSOR, CT AND OBSERVED BY GZA PERSONNEL BETWEEN JANUARY 6, 2010 AND FEBRUARY 4, 2010

CHICOPEE FALLS
CHICOPEE, MASSACHUSETTS

CHICOPEE FALLS FLOOD PROTECTION SYSTEM EXPLORATION LOCATION PLAN

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists, ONE EDGEWATER DRIVE, NORWOOD, MA 02062, 781-278-3700		PREPARED FOR: CITY OF CHICOPEE DEPT. OF PUBLIC WORKS	
PROJ MGR: NA	REVIEWED BY: ABB	CHECKED BY: CT	FIGURE 4
DESIGNED BY: DF/ABB	DRAWN BY: GAS	SCALE: 1 INCH = 100 FEET	
DATE: 6-30-2010	PROJECT NO. 15.0702100	REVISION NO.	



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BORING COMPLETED BY A&A TEST BORING OF SOUTH WINDSOR, CT AND OBSERVED BY GZA PERSONNEL BETWEEN JANUARY 6, 2010 AND FEBRUARY 4, 2010

CHICOPEE FALLS
CHICOPEE, MASSACHUSETTS

CHICOPEE FALLS FLOOD PROTECTION SYSTEM EXPLORATION LOCATION PLAN

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists, ONE EDGEWATER DRIVE, NORWOOD, MA 02062, 781-278-3700		PREPARED FOR: CITY OF CHICOPEE DEPT. OF PUBLIC WORKS	
PROJ MGR: NA	REVIEWED BY: ABB	CHECKED BY: CT	FIGURE 5
DESIGNED BY: DF/ABB	DRAWN BY: GAS	SCALE: 1 INCH = 100 FEET	
DATE: 6-30-2010	PROJECT NO. 15.0702100	REVISION NO.	

SECTION A-3.2

RECENT BORING LOGS
(CF-1 THROUGH CF-11)

GZA GeoEnvironmental, Inc.
Engineers and Scientists

CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-6
Page: 1 **of** 2
File No.: 15.0702100.50
Check: DMB

Contractor: A&A Drilling, LLC
Foreman: A. Augustine
Logged by: R. House
Date Start/Finish: 1-18-10 / 1-19-10
Boring Location: See Plan
GS Elev.: 103'± **Datum:** NAVD88

	Auger/ Casing	Sampler
Type:	HSA/Steel	S.S.
I.D.:	2-1/4"/4"	2" O.D.
Hammer Wt.:	300 lbs.	140 lb.
Hammer Fall:	24"	30"
Other:		NX Core

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
See	Note 3.			
1/18/10	1545	17'	40'	45 min.
1/19/10	0715	23'	40'	15.5 hours

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
0	S-1	24/4	0-2	31-22 18-11		S-1: Dense, brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt, trace Organics	FILL	1	None
1								2	
2	S-2	24/12	2-4	11-21 22-18		Piece of Gravel observed in spoon tip. S-2: Dense, brown, fine to coarse SAND, some fine Gravel, trace Silt		3	
3									
4	S-3	24/16	4-6	17-22 20-23	33 54	S-3: Dense, brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt			
5									
6	S-4	24/18	6-8	19-22 25-25	59 87	S-4: Dense, brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt, trace Ash			
7									
8					125				
9					60				
10	S-5	24/13	10-12	22-15 15-23	43 87	S-5: Brown, fine to coarse SAND, some Silt, little fine Gravel			
11									
12					72				
13					65				
14					63				
15	S-6	24/12	15-17	22-23 31-25	67 260	S-6: Very dense, brown, fine to coarse SAND, some fine to coarse Gravel, some Silt, trace Brick			
16									
17					272				
18					119				
19					65		19' SAND AND GRAVEL		
20	S-7	24/11	20-22	22-28 26-48	53 61	S-7: Very dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt		4	
21									
22					64				
23					70				
24					60				
25	S-8	24/13	25-27	31-42 30-27	49 57	S-8: Very dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt			
26									
27					62				
28					70				
29							30'		

REMARKS

1. SPT conducted using "safety" hammer and 2" diameter split spoon sampler.
2. Borehole advanced from 0 to 4 feet below grade using 2 1/4" I.D. hollow stem augers. Borehole advanced 4 to 40 feet below grade with 4" flush joint casing and rotary wash methods. Drilling wash water introduced to borehole at 8 feet below grade to completion of boring.
3. No groundwater encountered prior to drilling wash water being introduced to borehole at 8 feet below grade. Groundwater reading performed after introduction of drilling wash water to borehole and may represent perched drilling fluid and may not be representative of actual groundwater conditions.
4. Driller roller bitted ahead prior to driving casing from 20 to 40 feet.
5. Shale fragments present in samples S-9 and S-10.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA
GeoEnvironmental, Inc.
Engineers and Scientists

CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-6
Page: 2 **of** 2
File No.: 15.0702100.50
Check: DMB

Depth	Sample Information					Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.				
31	S-9	24/13	30-32	51-33 35-32	63 49	S-9: Very dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt	TILL	5	
32					62				
33					61				
34					121				
35	S-10	17/14	35-36.5	31-57 100/5"	68	S-10: Brown, fine to coarse SAND, little fine to coarse Gravel, little Silt			
36					71				
37					57				
38					51				
39					80				
40	S-11	4/4	40-40.3	100/4" min/ft		S-11: Brown, completely weathered SHALE	40' SANDSTONE		
41	CR-1	60/48	41-46	5:00		CR-1: Soft to moderately hard, moderate to very severely weathered, fine grained, red-brown SANDSTONE with very close to closely spaced, horizontal joints/fractures RQD = 20%		6	
42				6:00					
43				5:30					
44				8:15					
45				8:00					
46	CR-2	60/60	46-51	7:00		CR-2: Soft to moderately hard, moderate to severely weathered, fine grained, red-brown SANDSTONE with very close to closely spaced, horizontal to sub-horizontal joints/fractures RQD = 41%			
47				10:00					
48				4:30				7	
49				5:00					
50				5:15					
51	CR-3	60/60	51-56	3:15		CR-3: Soft to moderately hard, moderately severe to slight weathering, medium grained, red-brown to brown SANDSTONE with very close to closely spaced, horizontal to vertical joints/fractures RQD = 33% Last 21": Dark brown in color			
52				2:30					
53				3:00					
54				3:15					
55				3:00					
56						End of Exploration at 56'	56'	8	
57									
58									
59									
60									
61									
62									
63									
64									

REMARKS

6. Times represent penetration in minutes/foot. RQD = Rock Quality Deesignation.
7. Driller increased penetration rate between 48 and 49 feet.
8. Borehole tremie grouted to ground surface with 2/3 tub (~30 gallons/tub) bentonite/cement grout upon completion. (Approximately 20 gallons actual vs 28 gallons theoretical.)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: CF-6

15.0702100.50 BORINGS CHICOPEE FALLS.GPJ GZADEPTH.GDT 8/20/10

GZA GeoEnvironmental, Inc.
Engineers and Scientists

CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-7
Page: 1 **of** 2
File No.: 15.0702100.50
Check: DMB

Contractor: A&A Drilling, LLC
Foreman: A. Augustine
Logged by: R. House
Date Start/Finish: 1-19-10 / 1-20-10
Boring Location: See Plan
GS Elev.: 102'± **Datum:** NAVD88

	Auger/ Casing	Sampler
Type:	HSA/Steel	S.S.
I.D.:	2-1/4"/4"	2" O.D.
Hammer Wt.:	300 lbs.	140 lb.
Hammer Fall:	24"	30"
Other:		NX Core

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
See	Note 4.			
1/19/10	1555	18'	38.5'	5 min.
1/20/10	0715	21.5'	38.5'	15.3 hours

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
0	S-1	24/12	0-2	37-23		S-1: Dense, brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt, trace Organics	0.2' TOPSOIL FILL	1	None
1				11-14				2	
2	S-2	24/0	2-4	39-39		S-2: No sample recovered		3	
3	S-2A	24/18	2-4	30-13		S-2A: Brown, fine to coarse SAND, little fine Gravel, little Silt		4	
4	S-3	24/12	4-6	8-17	35	S-3: Dense, brown to red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt			
5				14-39	43				
6	S-4	24/17	6-8	49-22	49	S-4: Dense, red-brown to dark brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt, trace Brick			
7				15-8	69				
8					78				
9					64				
10	S-5	24/12	10-12	22-23	27	S-5: Brown, fine to coarse SAND, some Silt, little fine to coarse Gravel			
11				27-28	37				
12					52				
13					62				
14					52			5	
15	S-6	24/2	15-17	17-18	34	S-6: Dense, red BRICK, some fine to coarse Sand, trace Silt			
16				17-34	29				
17	S-7	24/11	17-19	14-9	39	S-7: Medium dense, red-brown to dark brown, fine to coarse SAND and BRICK, little Silt, little Ash			
18				12-17	55				
19	S-8	24/7	19-21	16-14	36	S-8: Dense, brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt (possible wash)			
20				19-26	61				
21	S-9	24/6	21-23	51-71	68	(Piece of Gravel observed in spoon tip.)	21' SAND AND GRAVEL (TILL)		
22				40-29	90	S-9: Very dense, brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt			
23					195				
24					155				
25	S-10	24/8	25-27	35-47	39	S-10: Very dense, red-brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt Piece of Gravel observed in spoon tip.		6	
26				43-69	43				
27					68				
28					117				
29					160				

REMARKS

1. SPT conducting using "safety" hammer and 2" diameter split spoon sampler. 7"x5" cobble removed from top 1 foot.
2. Borehole advanced from 0 to 4 feet below grade using 2 1/4" I.D. hollow stem augers. Borehole advanced from 4 to 38.5 feet below grade with 4" flush joint casing and rotary wash methods. Drilling wash water introduced to borehole at 8 feet below grade to completion of boring.
3. No recovery in sample S-2. Therefore sample S-2A redrove into side of borehole.
4. No groundwater encountered prior to drilling wash water being introduced to borehole at 8 feet below grade. Groundwater reading performed after introduction of drilling wash water to borehole and may represent perched drilling fluid and may not be representative of actual groundwater conditions.
5. Driller noted change in wash color from brown to black at 14.5 feet. Loss of casing fluid at 15 feet.
6. Driller roller bitted ahead prior to driving casing from 25 to 38.5 feet. Shale fragments observed in S-10 and S-12.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-7
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Depth	Sample Information					Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.				
31	S-11	9/1	30-30.8	73-100/3"	50	S-11: Brown, fine to coarse GRAVEL and fine to coarse SAND, little Silt (Piece of Gravel observed in spoon tip.)	SAND AND GRAVEL (TILL)	7	
32					42				
33					69				
34					80				
35					117				
36	S-12	24/11	35-37	42-40	40	S-12: Brown, fine to coarse GRAVEL and fine to coarse SAND, little Silt			
37				40-66	60				
38					95				
39					300/6"		38.5' SANDSTONE		
40	S-13	1/1	39.9-40	100/1"		S-13: Very dense, brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt			
41	CR-1	54/50	40-44.5	7:30		CR-1: Soft to moderately hard, moderately to very severe weathering, fine grained, red-brown SANDSTONE with very close to close, horizontal to vertical joints/fractures			
42				4:30					
43				5:30					
44				9:00					
45				5:45/6"		Extremely weathered from 43.5 to 44 feet RQD = 0% End of Exploration at 44.5'	44.5'	8	
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									
61									
62									
63									
64									

REMARKS

7. Moderate to heavy drill chatter from 30 to 40 feet. Driller noted change in drilling effort at 38.5 feet.
8. Borehole tremie grouted to ground surface with 2/3 tub (~30 gallons) bentonite/cement grout (approximately 23 gallons actual vs 23 gallons theoretical).

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: CF-7

15.0702100.50 BORINGS CHICOPEE FALLS.GPJ GZADEPTH.GDT 8/20/10

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-8
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File No.: 15.0702100.50
Check: DMB

Contractor: A&A Drilling, LLC
Foreman: A. Augustine
Logged by: R. House
Date Start/Finish: 1-20-10 / 1-21-10
Boring Location: See Plan
GS Elev.: 101'± **Datum:** NAVD88

	Auger/ Casing	Sampler
Type:	HSA/Steel	S.S.
I.D.:	2-1/4"/3"	2" O.D.
Hammer Wt.:	300 lbs.	140 lb.
Hammer Fall:	24"	30"
Other:		

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
See	Note 3.			
1/20/10	1540	13.5'	16'	10 min.
1/21/10	0730	15'	16'	16 hours
1/21/10	1140	14'	37'	10 min.

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
1	S-1	24/17	0-2	9-19 20-32		S-1: Top 6": Dark brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, trace Organics	0.5' TOPSOIL FILL	1 2	None
2	S-2	9/7	2-2.8	47-100/3"		S-2: Brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt Piece of Gravel in spoon tip.		3	
3	S-3	24/16	3-5	23-30 41-62		S-3: Very dense, brown to red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt			
5	S-4	9/5	5-5.8	31-100/3"		S-4: Brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt			
7	S-5	24/16	7-9	24-52 42-45	38 52 130 138	S-5: Very dense, dark brown to gray, fine to coarse SAND, some Silt, little fine to coarse Gravel, trace Brick			
10	S-6	24/6	10-12	35-34 37-80	37 20	S-6: Very dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt (Piece of Gravel observed in spoon tip.)			
12	S-7	24/6	12-14	18-28 17-15	32 48	S-7: Dense, brown to yellow, fine to coarse SAND and fine to coarse GRAVEL, trace Silt, trace Brick			
14	S-8	24/16	14-16	20-19 19-32	22 53	S-8: Dense, brown, fine to coarse SAND, some Silt, little fine Gravel, trace Brick			
16	S-9	24/4	16-18	10-11 5-3	13 20	S-9: Medium dense, brown, fine to coarse SAND, little Silt, little fine Gravel, trace Brick, trace Ceramic			
18	S-10	24/6	18-20	4-2 4-5	22 24	S-10: Top 3" Gray ASH Bottom 3": Tan-brown, fine SAND, some Silt			
20	S-11	24/8	20-22	6-7 9-13	14 20	S-11: Medium dense, tan, fine to medium SAND, little Silt			
22	S-12	24/16	22-24	8-22 51-39	33 73 110	S-12: Top 9": Tan, fine to medium SAND, little Silt Bottom 7": Brown to red-brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt	23' SAND AND GRAVEL (TILL)		
25	S-13	24/13	25-27	44-43 54-78	37 37 51 64	S-13: Very dense, brown to red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt		4	

REMARKS

1. SPT conducted using "safety" hammer and 2" diameter split spoon sampler.
2. Borehole advanced from 0 to 5 feet below grade using 2 1/4" I.D. hollow stem augers. Borehole advanced from 5 to 37 feet below grade with 3" flush joint casing and rotary wash methods. Drilling wash water introduced to borehole at 5 feet below grade to completion of boring.
3. No groundwater encountered prior to drilling wash water being introduced to borehole at 5 feet below grade. Groundwater reading performed after introduction of drilling wash water to borehole and may represent perched drilling fluid and may not be representative of actual groundwater conditions.
4. Driller roller bitted ahead prior to driving casing from 25 to 37 feet.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

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Depth	Sample Information					Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.				
31	S-14	14.5/9	30-31.2	38-129 100/2.5"	20 25	S-14: Brown, fine to coarse GRAVEL, some fine to coarse Sand, little Silt	SAND AND GRAVEL (TILL)		
32					46				
33					117				
34					145				
35	S-15	3/1	35-35.3	100/3"	58	S-15: Brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt	36' WEATHERED BEDROCK		
36					191				
37									
38	S-16	1/1	38-38.1	100/1"		S-16: Red-brown, fine to coarse SAND and fine to coarse GRAVEL (Weathered Rock)	38.1'	5 6	
39						End of Exploration at 38.1'			
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									
61									
62									
63									
64									

REMARKS

5. Driller noted change in wash water color from brown to red-brown at 38 feet possibly indicating change in material.
6. Borehole tremie grouted to ground surface with 2/3 tub bentonite/cement grout (~30 gallons/tub) upon completion. (Approximately 20 gallons actual vs 19 gallons theoretical.)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: CF-8

15.0702100.50 BORINGS CHICOPEE FALLS.GPJ GZADEPTH.GDT 8/20/10

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-9
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File No.: 15.0702100.50
Check: DMB

Contractor: A&A Drilling, LLC
Foreman: A. Augustine
Logged by: R. House
Date Start/Finish: 1-21-10 / 1-26-10
Boring Location: See Plan
GS Elev.: 99'± **Datum:** NAVD88

	Auger/ Casing	Sampler
Type:	HSA	S.S.
I.D.:	2-1/4"/3"	2" O.D.
Hammer Wt.:	300 lbs.	140 lb.
Hammer Fall:	24"	30"
Other:		

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
1/22/10	0715	2.5'	14'	15 hours
1/22/10	1510	19.5'	50'	10 min.
1/26/10	0720	21'	50'	3.5 days
1/26/10	1015	17.5'	60'	5 min.

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
1	S-1	24/8	0-2	19-25 8-8		S-1: Top 1": Dark brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt, trace Organics	0.5' ROADWAY MATERIAL FILL	1	None
2								2	
3	S-2	24/12	2-4	12-18 21-25		Bottom 7": Brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt S-2: Dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt		3	
4	S-3	24/7	4-6	16-22 9-11	13	S-3: Dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt Piece of gravel observed in spoon tip.			
5					13				
6	S-4	24/20	6-8	16-26 20-18	47	S-4: Top 13": Brown, fine to coarse SAND, little Silt, little fine to coarse Gravel			
7					60	Bottom 7": Tan to brown, fine SAND, some Silt			
8					71				
9					103				
10	S-5	16/4	10-11.3	69-105 100/4"	14	S-5: Top 3": Tan to brown, fine SAND, some Silt		4	
11					14	Bottom 1": Brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt			
12					27	Piece of Gravel observed in spoon tip.			
13					52				
14	S-6	17/8	14-15.4	33-61 100/5"	27	S-6: Brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, trace Brick			
15					44				
16					39				
17					30				
18					37				
19					40				
20	S-7	24/13	20-22	27-50 96-80	38	S-7: Very dense, brown to dark brown, fine to coarse SAND, little fine to coarse Gravel, little Silt, trace Brick, trace Glass, trace Fiber (Piece of Gravel observed in spoon tip)			
21					30				
22					28				
23					21				
24					42				
25	S-8	24/10	25-27	35-32 29-28	60	S-8: Very dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt			
26					57				
27	S-9	24/11	27-29	32-31 23-24	96	S-9: Very dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt			
28					63				
29	S-10	24/9	29-31	21-24	59	S-10: Dense, brown, fine to coarse SAND,			

REMARKS

1. SPT conducted using "safety" hammer and 2" diameter split spoon sampler. Cobbles 4"x4" 6x4" (2), and 8"x14" removed from top 6 inches.
2. Borehole advanced from 0 to 4 feet below grade using 2 1/4" I.D. hollow stem augers. Borehole advanced from 4 to 61 feet below grade with 3" flush joint casing and rotary wash methods. Drilling wash water introduced to borehole at 8 feet below grade to completion of boring.
3. No groundwater encountered prior to drilling wash water being introduced to borehole at 8 feet below grade. Groundwater reading performed after introduction of drilling wash water to borehole and may represent perched drilling fluid and may not be representative of actual groundwater conditions.
4. Driller roller bitted ahead prior to driving casing from 10 to 25 feet.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

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Depth	Sample Information					Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.				
				17-8		some fine to coarse Gravel, little Silt	FILL		
31	S-11	24/6	31-33	44-31	34	S-11: Dense, brown, fine to coarse SAND, some fine to coarse Gravel, some Silt			
32				16-11	67				
33	S-12	24/3	33-35	11-10	48	S-12: Medium dense, brown, fine to coarse SAND, some Silt, little fine to coarse Gravel			
34				6-5	37				
35	S-13	24/6	35-37	3-7	30	S-13: Top 2": Brown, fine to coarse SAND and SILT, little fine to coarse Gravel		5	
36				19-37	41	Bottom 4": Brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt	37'		
37	S-14	6/6	37-37.5	100/6"	34	S-14: Brown, fine to coarse SAND, little Gravel, trace Silt	TILL		
38					189	(Piece of Gravel observed in spoon tip.)			
39					310				
40	S-15	4/1	40-40.3	100/4"	450	S-15: Brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt			
41					77				
42					111				
43					74				
44					112				
45	S-16	10/4	45-45.8	105-100/4"	82	S-16: Brown, fine to coarse SAND, some Silt, little fine Gravel			
46					64				
47					44				
48					50				
49					79				
50	S-17	10/8	50-50.8	99-100/4"	83	S-17: Brown, fine to coarse SAND, some Silt, little fine Gravel			
51					83				
52					107				
53					69				
54					82				
55	S-18	24/16	55-57	60-67	82	S-18: Very dense, brown, fine SAND and SILT, trace fine Gravel			
56				72-39	54				
57					42				
58					67			6	
59					262		59' WEATHERED BEDROCK		
60	S-20	2/1	61-61.2	100/2"	309/1"	S-20: Red-brown WEATHERED ROCK			
61	S-19	2/1	60-60.2	100/2"		S-19: Red-brown WEATHERED ROCK	61.2'		
62						End of Exploration at 61.2'		7	
63									
64									

REMARKS

5. Driller roller bitted ahead prior to driving casing from 35 to 61 feet. Possible obstructions 37 to 40 feet.
6. Driller noted change in drilling effort at 58.5 to 59 feet.
7. Borehole tremie grouted to ground surface with 1 tub bentonite/cement grout (~30 gallons/tub) upon completion. (Approximately 30 gallons actual vs 30 gallons theoretical.)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: CF-9

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-10
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File No.: 15.0702100.50
Check: DMB

Contractor: A&A Drilling, LLC
Foreman: A. Augustine
Logged by: R. House
Date Start/Finish: 1-26-10 / 2-1-10
Boring Location: See Plan
GS Elev.: 99'± **Datum:** NAVD88

	Auger/ Casing	Sampler
Type:	HSA/Steel	S.S.
I.D.:	2-1/4"/3"	2" O.D.
Hammer Wt.:	300 lbs.	140 lb.
Hammer Fall:	24"	30"
Other:		NX Core

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
1/27/10	0735	11'	15'	16 hours
1/28/10	0740	18.5'	55'	16.5 hours
2/1/10	0725	18'	35'	2.5 days
2/1/10	1235	14.5'	55'	45 min.

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
1	S-1	24/2	0-2	6-13 16-16		S-1: Medium dense, dark brown, fine to coarse GRAVEL, little fine to coarse Sand, trace Organics, trace Silt	ROADWAY MATERIAL 0.9' FILL	1 2	None
2 3	S-2	24/8	2-4	5-7 12-15		S-2: Medium dense, brown, fine to coarse SAND, some Silt, little fine to coarse Gravel, trace Organics		3	
4 5	S-3	24/10	4-6	8-15 10-20	11 33	S-3: Medium dense, brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt			
6 7	S-4	24/17	6-8	23-23 28-19	46 90	S-4: Top 14": Brown to red-brown, fine to coarse SAND and fine to coarse GRAVEL, some Silt			
8 9	S-5	24/10	8-10	34-33 38-42	39 147	Bottom 3": Gray, fine SAND, some Silt S-5: Very dense, gray-brown, fine SAND, some Silt, trace fine Gravel			
10					21			4	
11					28			5	
12					44				
13					61				
14					200				
15 16	S-6	24/10	15-17	73-68 50-57	32 34	S-6: Very dense, gray-brown, fine to coarse SAND, some Silt, little fine Gravel, trace Brick			
17					39				
18					40				
19					64				
20 21	S-7	24/12	20-22	41-46 36-21	72 46	S-7: Very dense, gray-brown to red-brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt			
22					64	(Piece of gravel observed in spoon tip.)			
23					48				
24					48				
25 26	S-8	24/8	25-27	13-9 9-8	38 46	S-8: Medium dense, brown, fine to coarse SAND, some Silt, little fine Gravel			
27 28	S-9	24/10	27-29	3-5 7-6	46 49	S-9: Medium dense, brown, fine to coarse SAND, some Silt, little fine Gravel			
29	S-10	24/6	29-31	7-22	60	S-10: Dense, brown to red-brown, fine to			

REMARKS

1. SPT conducted using "safety" hammer and 2" diameter split spoon sampler.
2. Borehole advanced from 0 to 4 feet below grade using 2-1/4 I.D. hollow stem augers. Borehole advanced from 4 to 57 feet below grade with 3" flush joint casing and rotary wash methods. Drilling wash water introduced to borehole at 8 feet below grade to completion of boring.
3. No groundwater encountered prior to introduction of drilling wash water at 8 feet below grade. Groundwater readings above 18 feet likely perched drill fluid and not indicative of actual groundwater. Groundwater reading performed after introduction of drilling wash water to borehole and may represent perched drilling fluid and may not be representative of actual groundwater conditions.
4. Driller roller bitted ahead, prior to driving casing from 10 to 25 feet.
5. Additional groundwater readings were taken on 1/26/10 and 1/27/10 with minimal stablization periods. Groundwater was measured 6 feet below ground surface on 1/26/10 (casing 15 feet below ground surface). Groundwater measured 18 feet below ground surface on 1/27/10 (casing 55 feet below ground surface).

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

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Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
				17-17	61	coarse SAND and fine to coarse Gravel, trace Silt	FILL		
31	S-11	10.5/5	31-31.9	14-100/4.5"	56	(Piece of gravel observed in spoon tip.) S-11: Brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt		6	
32					37				
33					40	(Piece of gravel observed in spoon tip.)			
34					76				
35	S-12	24/8	35-37	30-42	61	S-12: Very dense, brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt			
36				55-49	40				
37					59	(Piece of gravel observed in spoon tip.)			
38					127		38.5' SAND AND GRAVEL (TILL)		
39					193				
40	S-13	10/7	40-41.8	96-100/4"	120	S-13: Brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt			
41					260				
42					275				
43					350				
44					440				
45	S-14	10/7	45-45.8	73-100/4"	75	S-14: Brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt			
46					50				
47					184				
48					95				
49					500				
50	S-15	6/2	50-50.5	125/6"	140	S-15: Brown, fine to coarse SAND, little fine to coarse Gravel, little Silt			
51					67			7	
52					68				
53					63				
54					134				
55	S-16	6/5	55-55.5	110/6"	170	S-16: Brown, fine to coarse SAND, little fine to coarse Gravel, little Silt			
56					500		56' WEATHERED SHALE		
57								8	
58								9	
59	S-17	1/0	59.9-60	100/1"		S-17: No sample obtained. Shale fragments in spoon tip.			
60	CR-1	60/54	60-65	10:00		CR-1: Top 9": Soft, moderately severe to very severe weathering, medium grained, gray SANDSTONE with horizontal to sub-horizontal, iron-oxide stained joints/fractures		10	
61				6:15			61' SANDSTONE	11	
62				12:00					
63				9:45					
64				13:00		Bottom 45": Medium, moderate to slightly weathered, fine-grained, red-brown SANDSTONE with horizontal to			

REMARKS

6. Shale fragments observed in samples S-10, S-12 and S-13.
7. Driller roller bitted ahead, prior to driving casing from 51 to 57 feet.
8. Casing refusal at 57 feet.
9. Driller noted brief change in washwater color from brown to orange-brown around 58 feet.
10. Washwater briefly changed color to milky-gray at 60.8 feet, turned to red-brown around 61.5 feet.
11. Times represent penetration in min/foot. RQD = Rock Quality Designation.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-10
Page: 3 **of** 3
File No.: 15.0702100.50
Check: DMB

Depth	Sample Information					Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.				
66	CR-2	60/60	65-70	11:30		sub-horizontal joints/fractures RQD = 40% CR-2: Soft to moderately hard, moderate weathering, fine grained, red-brown SANDSTONE with horizontal to sub-horizontal, iron-oxide stained joints/fractures with gray Shale transition zones from 66 to 66.7 feet and 67.5 to 68.3 feet RQD = 21% End of Exploration at 70'	SANDSTONE	12	
67				13:00					
68				8:45					
69				7:00					
70				5:00			70'	13	
71									
72									
73									
74									
75									
76									
77									
78									
79									
80									
81									
82									
83									
84									
85									
86									
87									
88									
89									
90									
91									
92									
93									
94									
95									
96									
97									
98									
99									

REMARKS

12. Driller increased penetration rate around 66.8 feet. No significant fluid loss during coring.
13. Borehole grouted to ground surface with 1 tub bentonite/cement grout (~30 gallons/tub) upon completion.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-11
Page: 1 **of** 3
File No.: 15.0702100.50
Check: DMB

Contractor: A&A Drilling, LLC
Foreman: A. Augustine
Logged by: R. House
Date Start/Finish: 2-1-10 / 2-4-10
Boring Location: See Plan
GS Elev.: 98'± **Datum:** NAVD88

	Auger/ Casing	Sampler
Type:	HSA/Steel	S.S.
I.D.:	2-1/4"/4"	2" O.D.
Hammer Wt.:	300 lbs.	140 lb.
Hammer Fall:	24"	30"
Other:		

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
2/2/10	1250	6'	25'	40 min.
2/3/10	0736	14'	31'	16.5 hours
2/3/10	1545	10'	60'	10 min.
2/4/10	0725	10'	60'	15.5 hours
2/4/10	1256	12.5'	75'	45 min.

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
1	S-1	24/12	0-2	24-30 13-13		S-1: Top 1": Dark brown, fine SAND and SILT, trace Organics Middle 6": Brown, fine to coarse SAND, little fine to coarse Gravel, little Silt Bottom 5": Light brown, fine to medium SAND, some fine to coarse Gravel, little Silt	0.1' TOPSOIL FILL	1	None
2								2	
3	S-2	24/11	2-4	27-27 26-16				3	
4	S-3	24/16	4-6	13-33 28-32	59	S-2: Very dense, brown, fine to medium SAND, some Silt, little fine to coarse Gravel, trace Brick			
5					75				
6	S-4	24/12	6-8	24-25 32-30	97	S-3: Brown, fine to medium SAND, little Silt, little fine Gravel			
7					172	S-4: Very dense, brown, fine to medium SAND, some fine to coarse Gravel, little Silt			
8					193				
9					120				
10	S-5	24/12	10-12	63-66 42-22	41	S-5: Brown, fine to coarse SAND, some Silt, little fine to coarse Gravel		4	
11					31				
12					30				
13					89				
14					200				
15	S-6	24/7	15-17	82-88 63-34	83	S-6: Very dense, brown, fine to coarse SAND and fine to coarse GRAVEL, some Silt		5	
16					47				
17					36				
18					46				
19					90				
20	S-7	24/0	20-22	47-46 54-53	44	S-7: No sample recovered		6	
21					37				
22	S-8	24/0	22-24	41-53 23-22	34	S-8: No sample recovered			
23					50				
24					60				
25	S-9	24/7	25-27	24-37 28-32	44	S-9: Very dense, brown, fine to coarse SAND and fine to coarse GRAVEL, some Silt			
26					41				
27	S-10	24/7	27-29	32-26 19-15	79	S-10: Very dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt			
28					49				
29	S-11	24/0	29-31	13-8	40	S-11: No sample recovered			

REMARKS

1. SPT conducted using "safety" hammer and 2" diameter split spoon sampler. Cobbles 3"x4" and 5"x4" removed from top foot.
2. Borehole advanced from 0 to 4 feet below grade using 2-1/4" I.D. hollow stem augers. Borehole advanced from 4 to 75 feet below grade with 4" flush joint casing and rotary wash methods. Drilling wash water introduced to borehole at 8 feet below grade to completion of boring.
3. Groundwater readings taken after introduction of drilling fluid and measured groundwater readings likely perched drilling fluid and not indicative of actual groundwater.
4. Driller roller bitted ahead, prior to driving casing from 10 to 29 feet.
5. Shale fragments observed in sample S-6.
6. Driller noted little to no resistance when removing spoon S-7 from sampling depth. Possible that cobble was encountered and advanced down by spoon based on blows and lack of recoveries.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: CF-11

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-11
Page: 2 **of** 3
File No.: 15.0702100.50
Check: DMB

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
				6-5	30		FILL		
31	S-12	24/0	31-33		71	S-12: No sample recovered		7	
32	S-13	10/18	31-31.8		73	S-13: Brown, fine to coarse SAND, some Silt, little fine Gravel		8	
33	S-14	24/6	33-35	31-15	75	S-14: Medium dense, brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt	33' SAND AND GRAVEL	9	
34				10-16	60				
35	S-15	24/0	35-37	19-22	99	S-15: No sampled recovered			
36				22-29	120				
37	S-16	24/3	37-39	32-20	123	S-16: Dense, brown, fine to coarse GRAVEL, some fine to coarse Sand, little Silt			
38				15-13	91				
39					350/6"				
40	S-17	24/12	40-42	28-31	88	S-17: Very dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt (Piece of gravel observed in spoon tip.)			
41				28-24	68				
42					76				
43					77				
44					143				
45	S-18	24/16	45-47	31-31	74	S-18: Very dense, brown, fine to coarse SAND, some Silt, little fine Gravel			
46				51-69	69				
47					75				
48					91				
49					300				
50	S-19	3/1	50-50.3	100/3"	251	S-19: Brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt		10	
51					187				
52					135				
53					75			11	
54					87				
55	S-20	24/9	55-57	21-25	100	S-20: Top 6": Brown, fine to coarse SAND, some fine to coarse Gravel, little Silt Bottom 3": Brown, CLAY and SILT, little coarse Gravel	56' SILT AND CLAY		
56				26-30	103				
57					100				
58					81				
59					116				
60	S-21	24/24	60-62	12-17	89	S-21: Hard, brown, SILT and CLAY, trace fine Sand Tv = 0.65 tsf		12	
61				20-21	72				
62					72				
63					76				
64					93				

REMARKS

7. No recovery of sample S-12. Therefore sample S-13 redrove into other side of borehole. Sample S-12 not conducted in accordance with ASTM D1586. Hammer dropped greater than 30" in attempt to obtain recovery. Upon retrieval, playtex liner, inserted in spoon and resampled. Recovery successful. Liner also used in sample S-14.
8. Falling head test conducted over zone between 31 to 35 feet, following sampling.
9. Driller roller bitted ahead, prior to driving casing from 31 to 35 feet and 39.5 to 75 feet. S-17 sampled open hole.
10. Shale fragments observed in sample S-19.
11. Driller noted heavy roller bit resistance at 53 feet.
12. Tv = Field Torvane Shear Strength in tons per square feet (tsf).
13. PP = Pocket penetrometer compressive strength readings in tons per square foot (tsf).

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CHICOPEE FALLS LEVEE
CHICOPEE, MASSACHUSETTS

Boring No.: CF-11
Page: 3 **of** 3
File No.: 15.0702100.50
Check: DMB

Depth	Sample Information					Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Casing Blows/ Ft.				
66	S-22	24/24	65-67	19-37 39-82	97 70	S-22: Hard, brown, Clayey SILT, little fine Sand PP = >4 tsf (Silt)	SILT AND CLAY	13	
67					52				
68					66			14	
69					86				
70	S-23	24/24	70-72	22-20 17-21	63	S-23: Hard, brown, SILT and CLAY, trace fine Gravel, trace fine Sand PP = 3.25 tsf Tv = 1 tsf			
71					55				
72					65				
73					69				
74					81				
75	S-24	24/24	75-77	22-14 20-24		S-24: Hard, brown, CLAY and SILT PP = 3.5 tsf Tv = 1.45 tsf			
76									
77									
78							78.5'	15	
79							WEATHERED BEDROCK		
80	S-25	1/0.5	80-80.1	100/1"		S-25: Red-brown, fine to coarse GRAVEL (WEATHERED ROCK), little fine to coarse Sand, little Silt End of Exploration at 80.1'	80'	16	
81									
82									
83									
84									
85									
86									
87									
88									
89									
90									
91									
92									
93									
94									
95									
96									
97									
98									
99									

REMARKS

14. Driller noted rod chatter at 68 feet.
15. Driller noted heavy roller bit resistance at 78 feet. Roller bitted additional two feet and sampled S-25.
16. Borehole tremie grouted to ground surface with 1 1/2 tubs bentonite/cement grout (~30 gallons/tub) upon completion.

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SECTION A-3.3

GEOTECHNICAL LABORATORY RESULTS

LABORATORY TESTING DATA SHEET

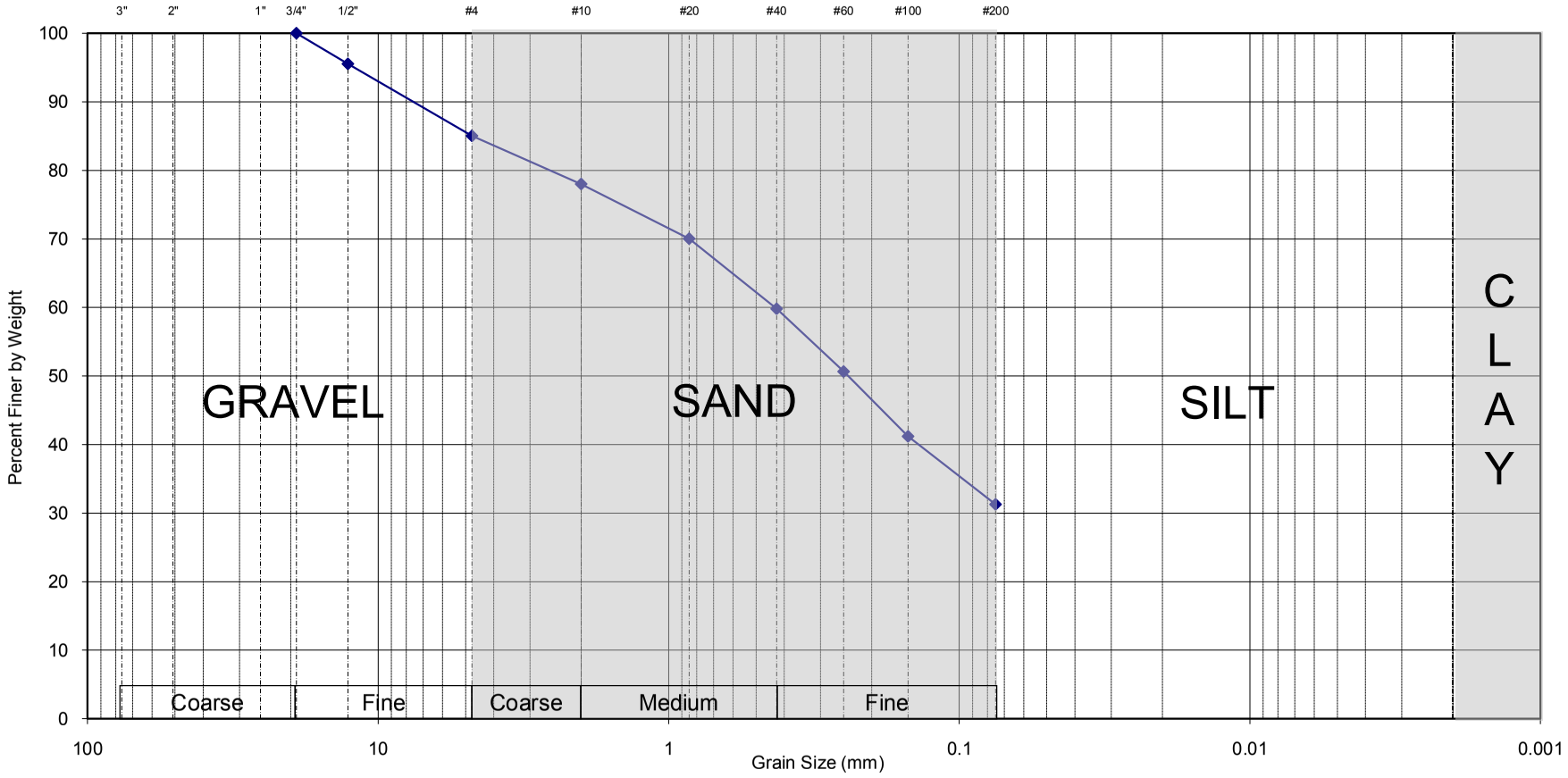
Project Name Chicopee Flood Control Works | Location Chicopee, MA | Reviewed By [signature]

Project No. 15.0702100.50 | Assigned By R. House

Project Engineer M. Taylor/A. Bjarngard | Report Date 3/24/2010 | Date Reviewed 3/24/2010

Boring No.	Sample No.	Depth ft.	Lab No.	Identification Tests							Strength Tests						Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	Dry unit wt. pcf	Perme-ability cm/sec	Torvane or Type Test	$\overline{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	
CF-3	S-2	2-4	25				31										Brown f-c SAND some Silt, little fine Gravel (SM)
CF-3	S-5	10-12	26				19										Brown f-c SAND some f-c Gravel, little Silt (SM)
CF-3	S-7	20-22	27				15										Brown f-c SAND some fine Gravel, little Silt (SM)
CF-3	S-9	27-29	28				15		5.4								Brown f-c SAND, little Silt little fine Gravel (trace Org.) (SM)
CF-5	S-2	2-4	29				28										Brown f-c SAND some Silt, some f-c Gravel (SM)
CF-5	S-5	10-12	30				22										Brown f-c SAND some f-c Gravel, some Silt (SM)
CF-5	S-11	28-30	31				15										Brown f-c SAND little Silt, little fine Gravel (SM)
CF-6	S-5	10-12	32				25										Brown f-c SAND some Silt, little fine Gravel (SM)
CF-7	S-5	10-12	33				28										Brown f-c SAND some Silt, little f-c Gravel (SM)
CF-7	S-12	35-37	34				10										Brown f-c GRAVEL and f-c SAND, little Silt (GW-GM)
CF-11	S-3	4-6	35				26										Brown f-m SAND little Silt, little fine Gravel (SM)
CF-11	S-5	10-12	36				24										Brown f-c SAND some Silt, little f-c Gravel (SM)
CF-11	S-13	31-33	37				28										Brown f-c SAND some Silt, little fine Gravel (SM)

U.S. STANDARD SIEVE AND HYDROMETER



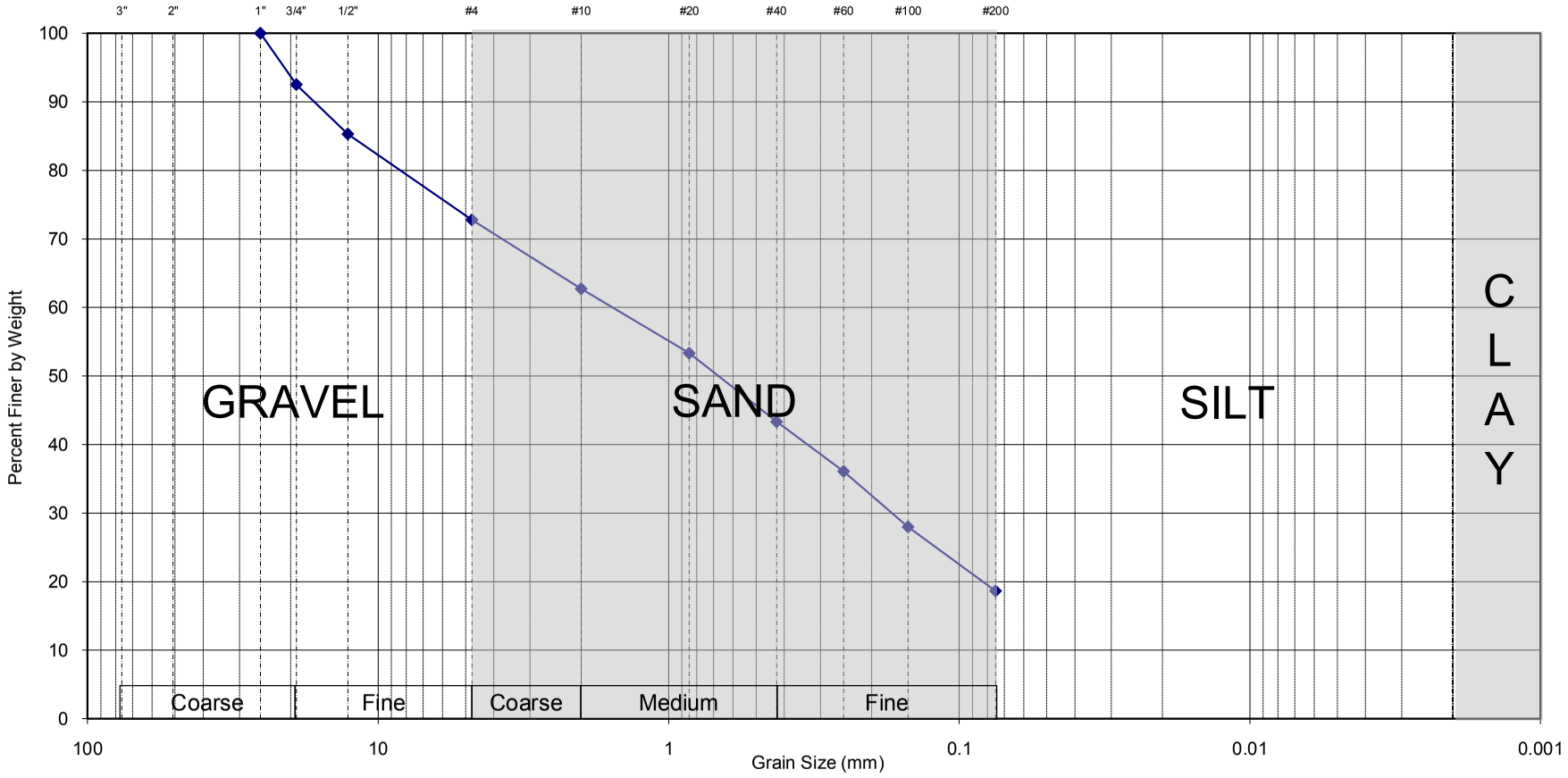
Gravel	Sand	Fines
15.0%	53.7%	31.3%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
25	CF-3	S-2	2-4'	Brown f-c SAND, some Silt, little fine Gravel (SM)				

Chicopee Flood Control Works
Chicopee, MA
GZA File # 15.0702100.50

Tested by: MST/PEC Date: 3/18/10
Reviewed by: MBP Date: 3/24/10

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
27.2%	54.1%	18.6%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
26	CF-3	S-5	10-12'	Brown f-c SAND, some f-c Gravel, little Silt (SM)				

Chicopee Flood Control Works
Chicopee, MA
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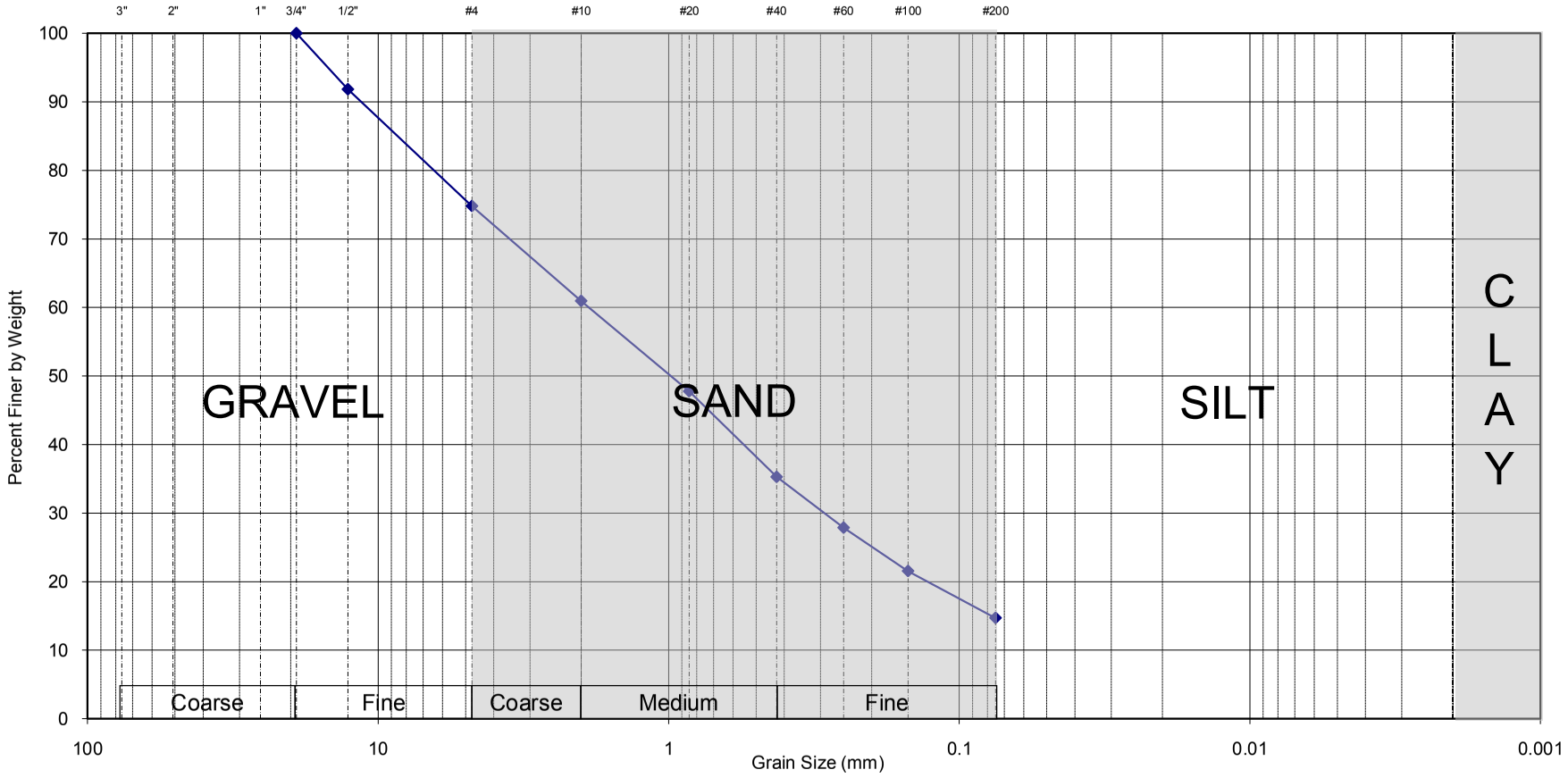

Gravel	Sand	Fines
25.2%	60.1%	14.7%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
27	CF-3	S-7	20-22'	Brown f-c SAND, some fine Gravel, little Silt (SM)				

Chicopee Flood Control Works
Chicopee, MA
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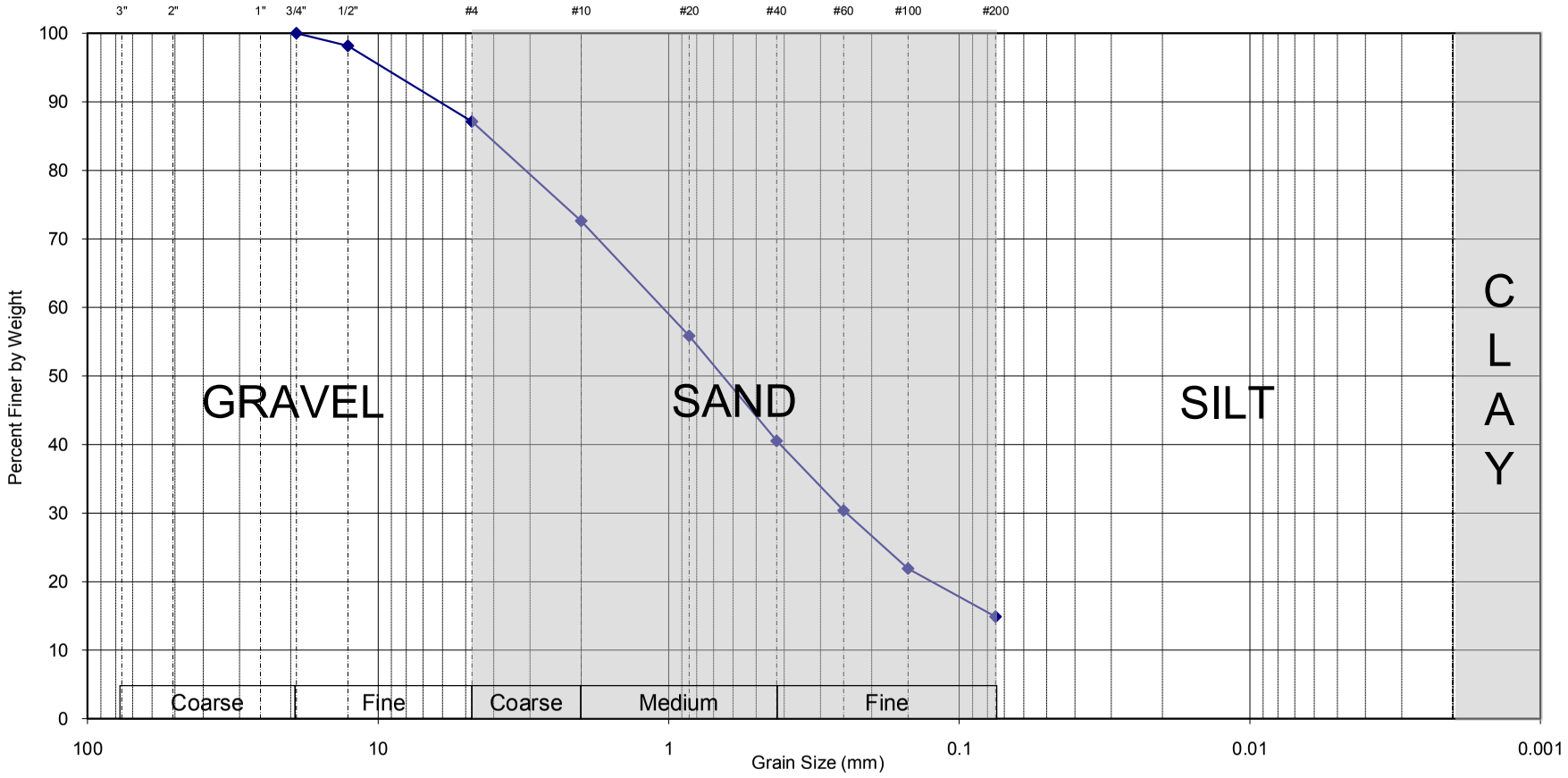

Gravel	Sand	Fines
12.9%	72.2%	14.9%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
28	CF-3	S-9	27-29'	Brown f-c SAND, little Silt, little fine Gravel (tr. Organics) (SM)				

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Chicopee, MA
GZA File # 15.0702100.50

Tested by: MST/PEC Date: 3/18/10
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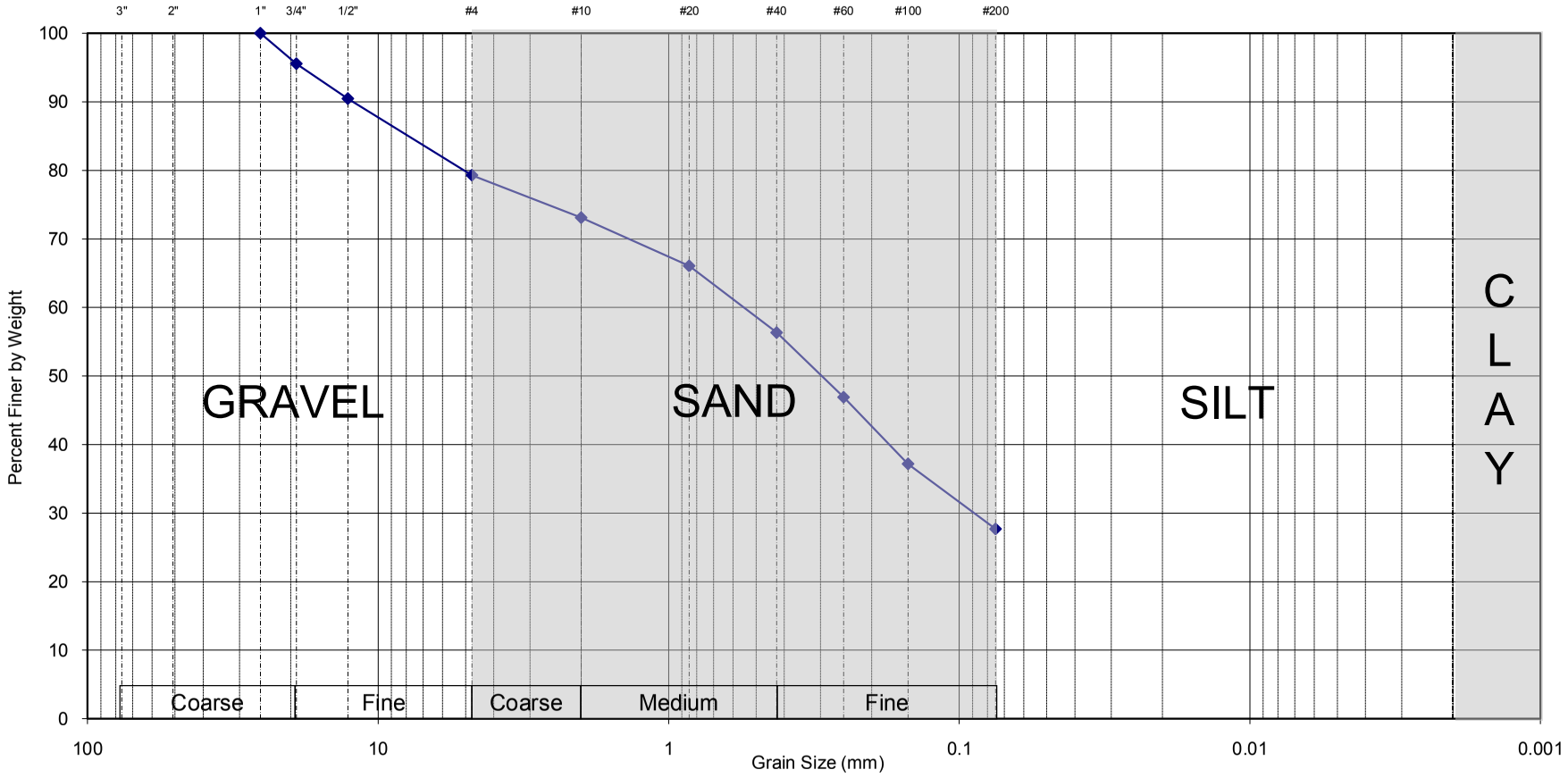
U.S. STANDARD SIEVE AND HYDROMETER



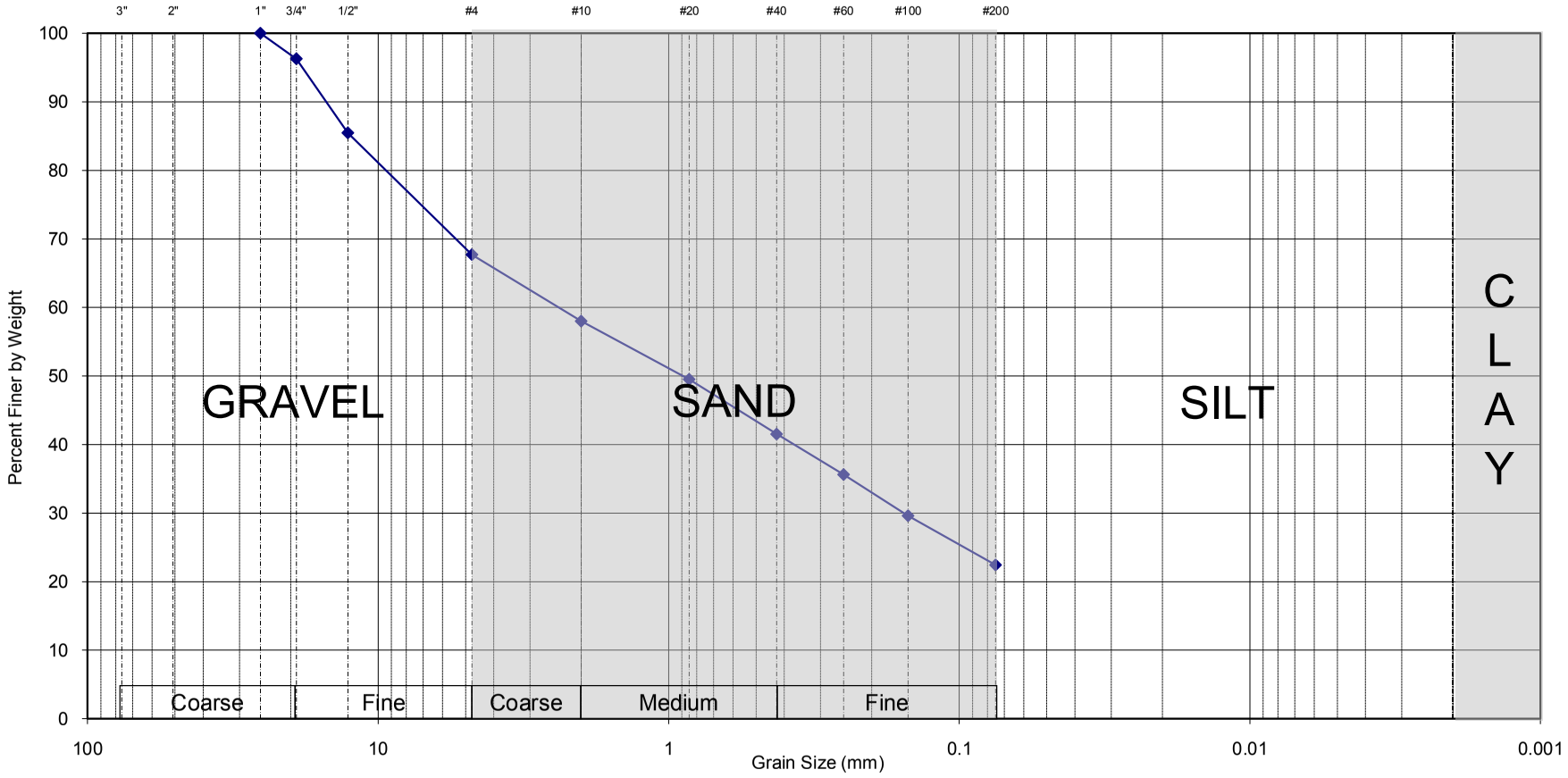
Gravel	Sand	Fines
20.7%	51.6%	27.7%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
29	CF-5	S-2	2-4'	Brown f-c SAND, some Silt, some f-c Gravel (SM)				

Chicopee Flood Control Works
Chicopee, MA
GZA File # 15.0702100.50

Tested by: MST/PEC Date: 3/18/10
Reviewed by: MBP Date: 3/24/10

U.S. STANDARD SIEVE AND HYDROMETER



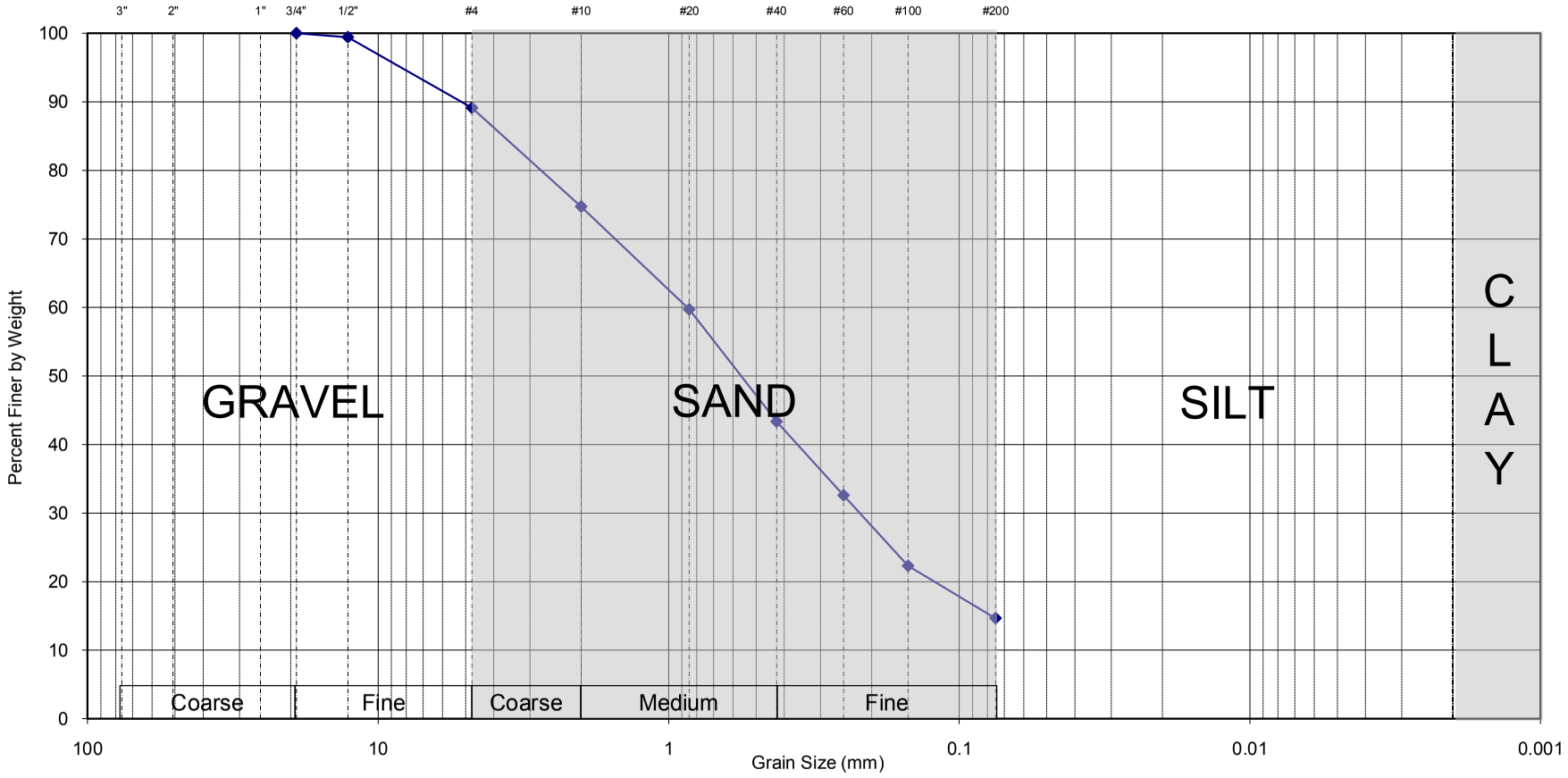
Gravel	Sand	Fines
32.3%	45.3%	22.4%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
30	CF-5	S-5	10-12'	Brown f-c SAND, some f-c Gravel, some Silt (SM)				

Chicopee Flood Control Works
Chicopee, MA
GZA File # 15.0702100.50

Tested by: MST/PEC Date: 3/18/10
Reviewed by: MBP Date: 3/24/10

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
10.9%	74.5%	14.7%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
31	CF-5	S-11	28-30'	Brown f-c SAND, little Silt, little fine Gravel (SM)				

Chicopee Flood Control Works
Chicopee, MA
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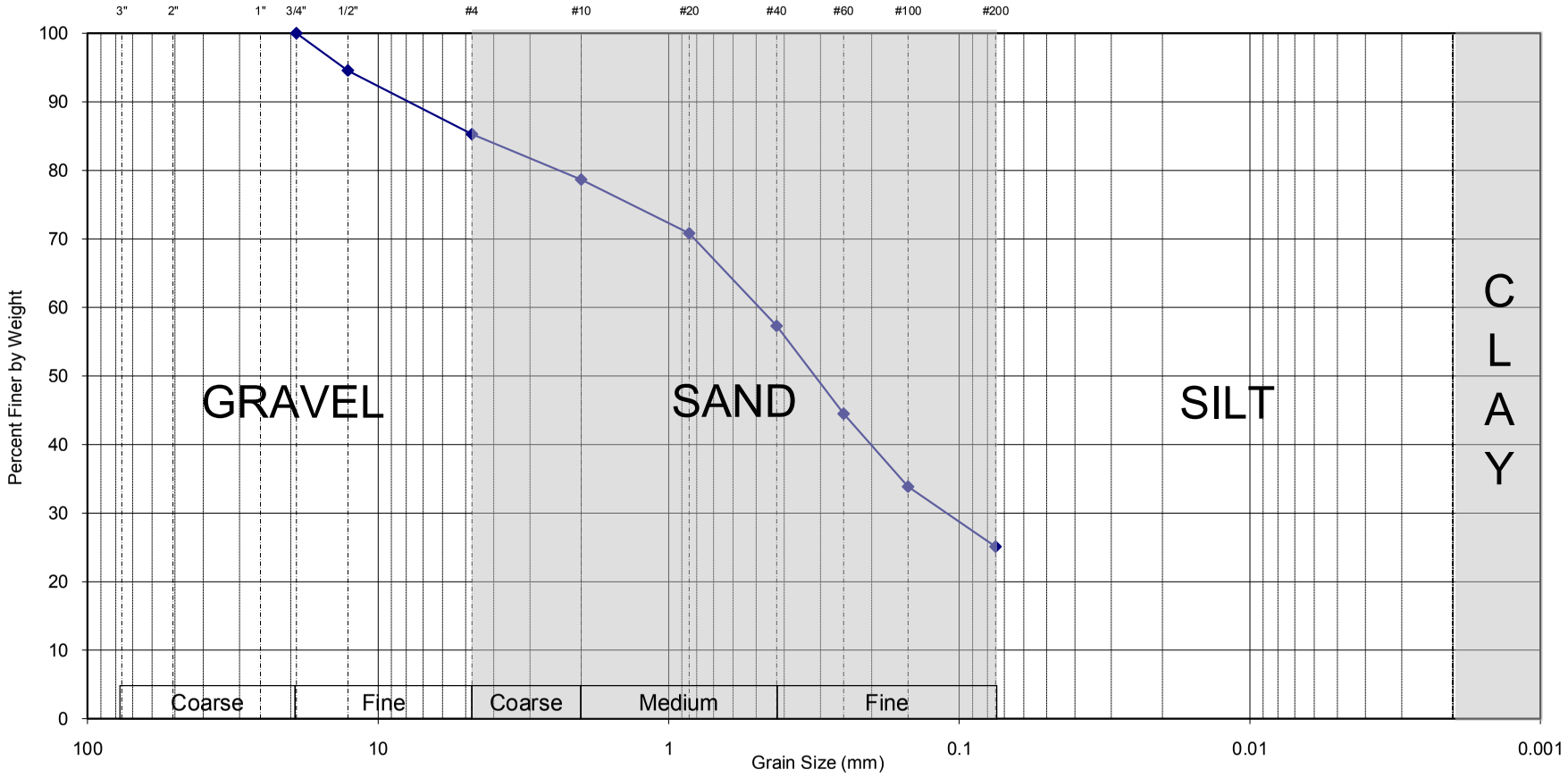
U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
14.7%	60.2%	25.1%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
32	CF-6	S-5	10-12'	Brown f-c SAND, some Silt, little fine Gravel (SM)				

Chicopee Flood Control Works
Chicopee, MA
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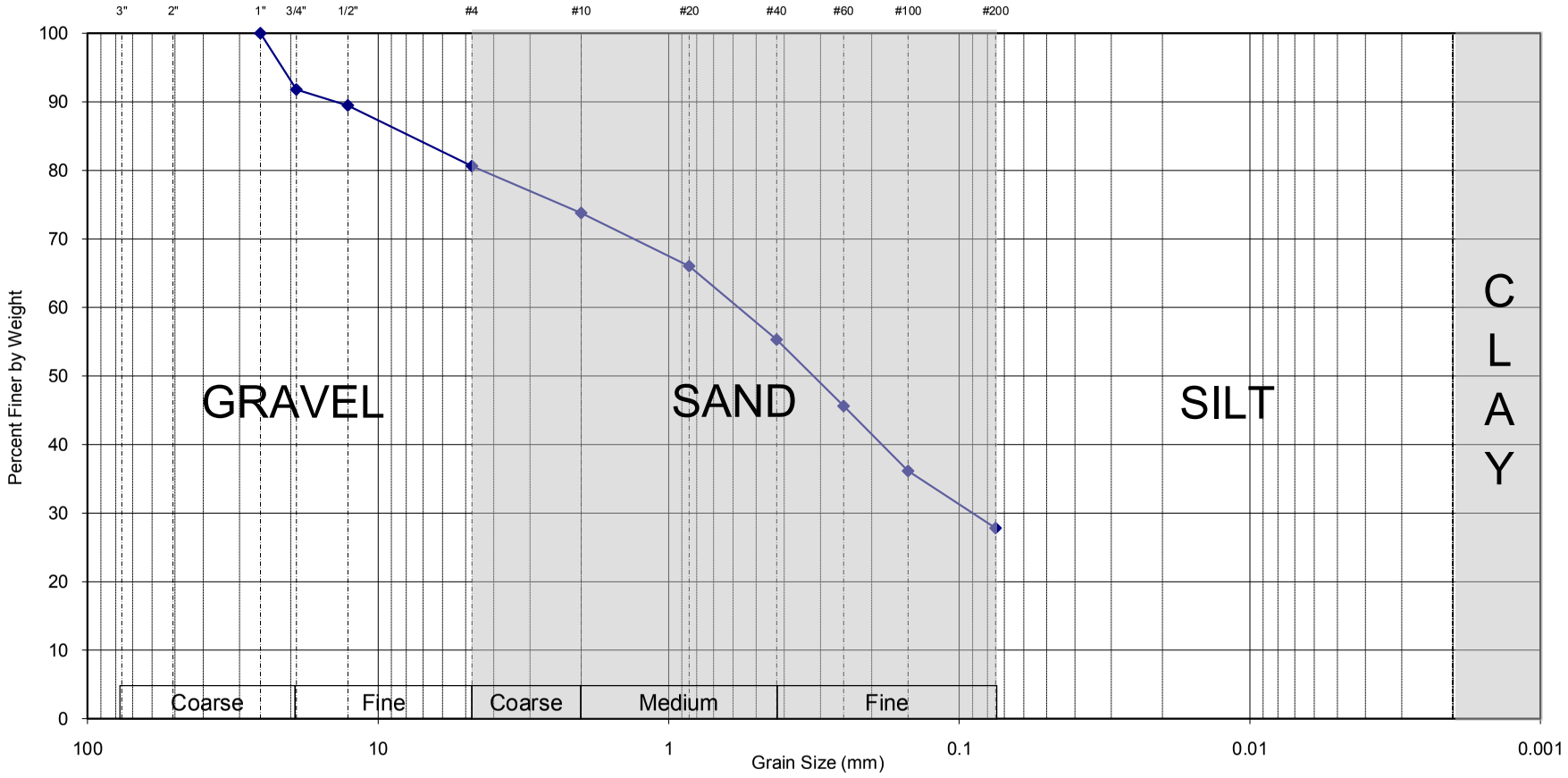

Gravel	Sand	Fines
19.4%	52.8%	27.8%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
33	CF-7	S-5	10-12'	Brown f-c SAND, some Silt, little f-c Gravel (SM)				

Chicopee Flood Control Works
Chicopee, MA
GZA File # 15.0702100.50

Tested by: MST/PEC Date: 3/18/10
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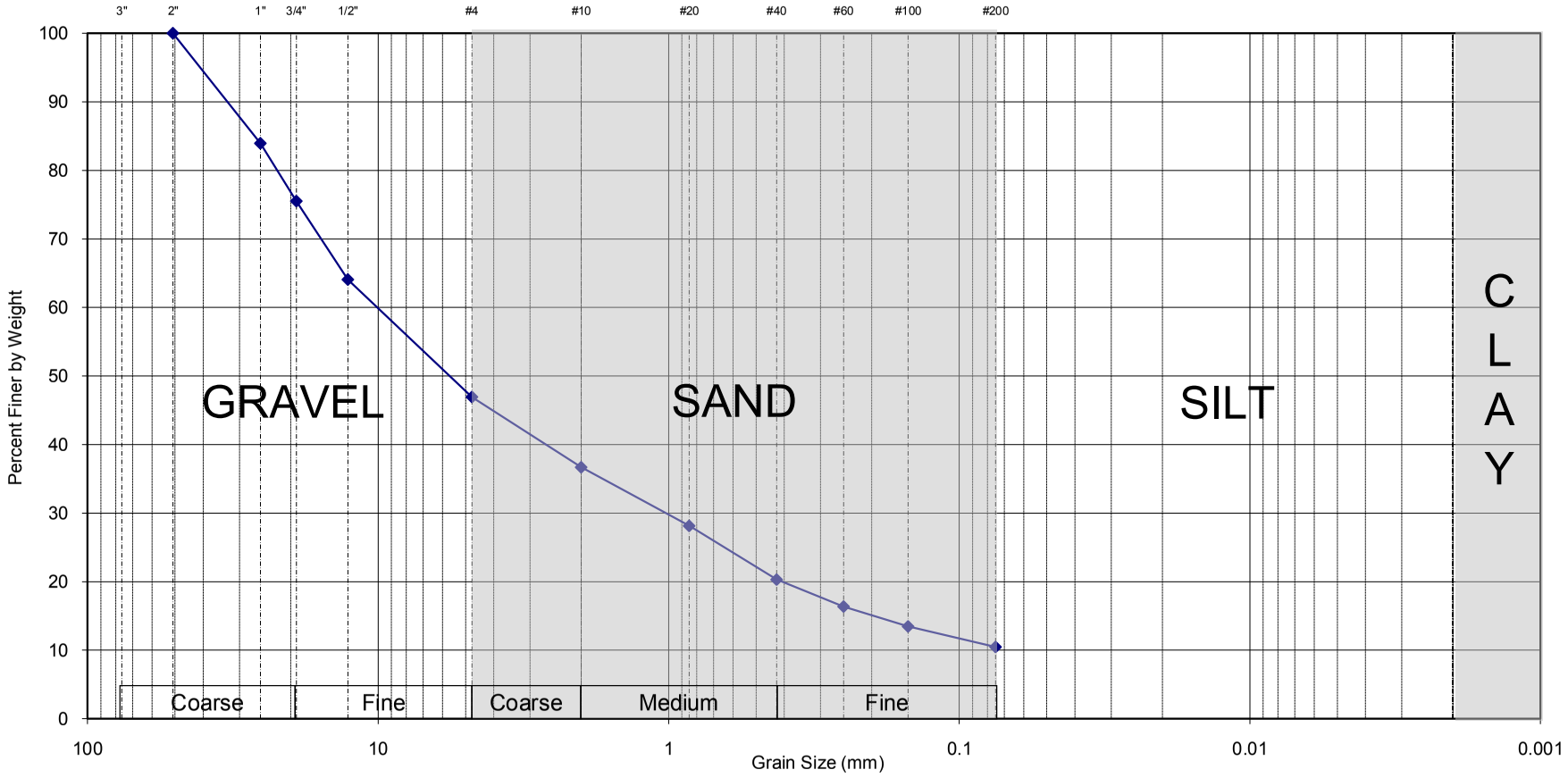
U.S. STANDARD SIEVE AND HYDROMETER



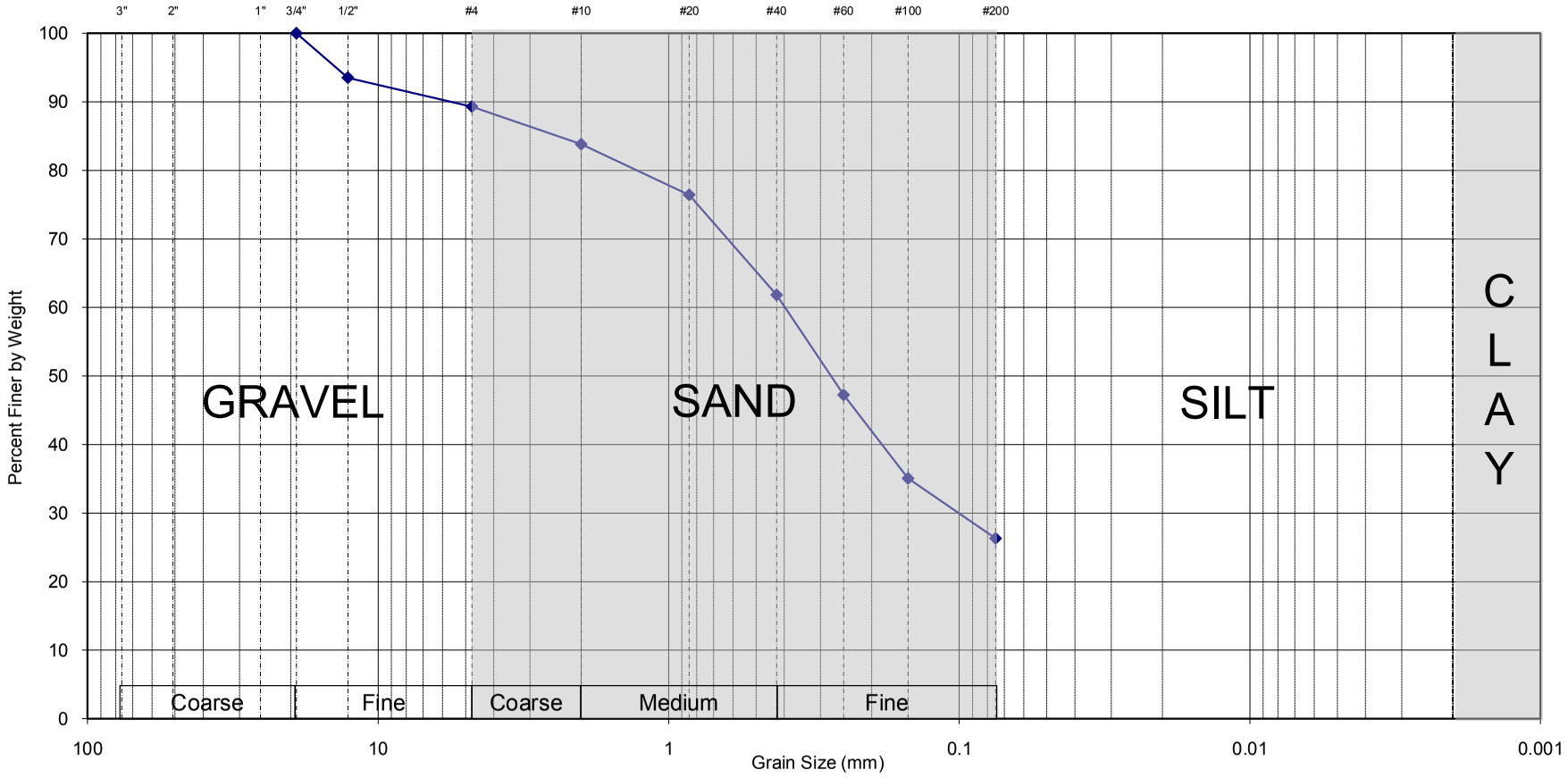
Gravel	Sand	Fines
53.1%	36.5%	10.5%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
34	CF-7	S-12	35-37'	Brown f-c GRAVEL and f-c SAND, little Silt (GW-GM)				

Chicopee Flood Control Works
Chicopee, MA
GZA File # 15.0702100.50

Tested by: MST/PEC Date: 3/18/10
Reviewed by: MBP Date: 3/24/10

U.S. STANDARD SIEVE AND HYDROMETER



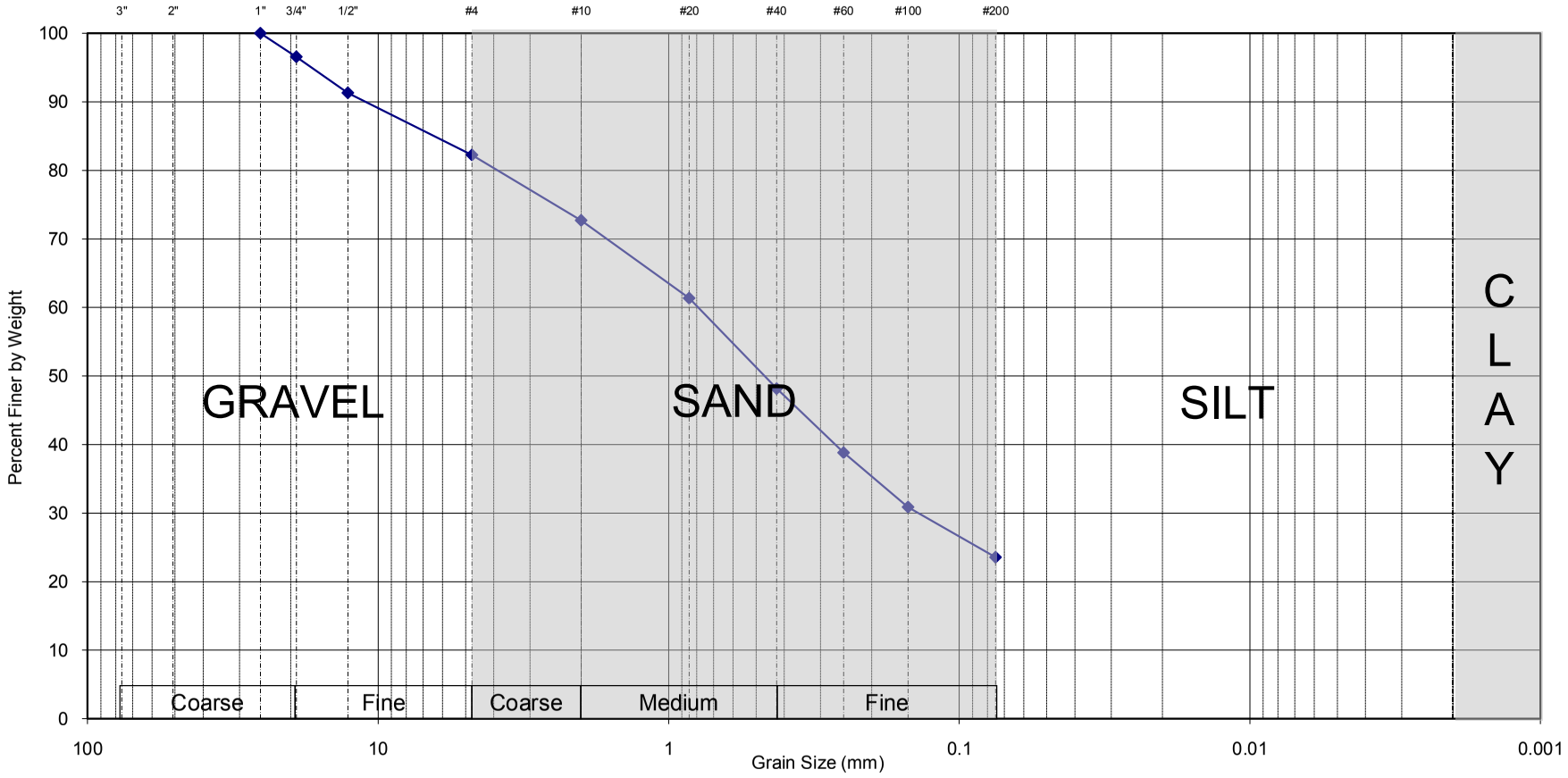
Gravel	Sand	Fines
10.7%	63.0%	26.3%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
35	CF-11	S-3	4-6'	Brown f-m SAND, some Silt, little fine Gravel (SM)				

Chicopee Flood Control Works
Chicopee, MA
GZA File # 15.0702100.50

Tested by: MST/PEC Date: 3/18/10
Reviewed by: MBP Date: 3/24/10

U.S. STANDARD SIEVE AND HYDROMETER



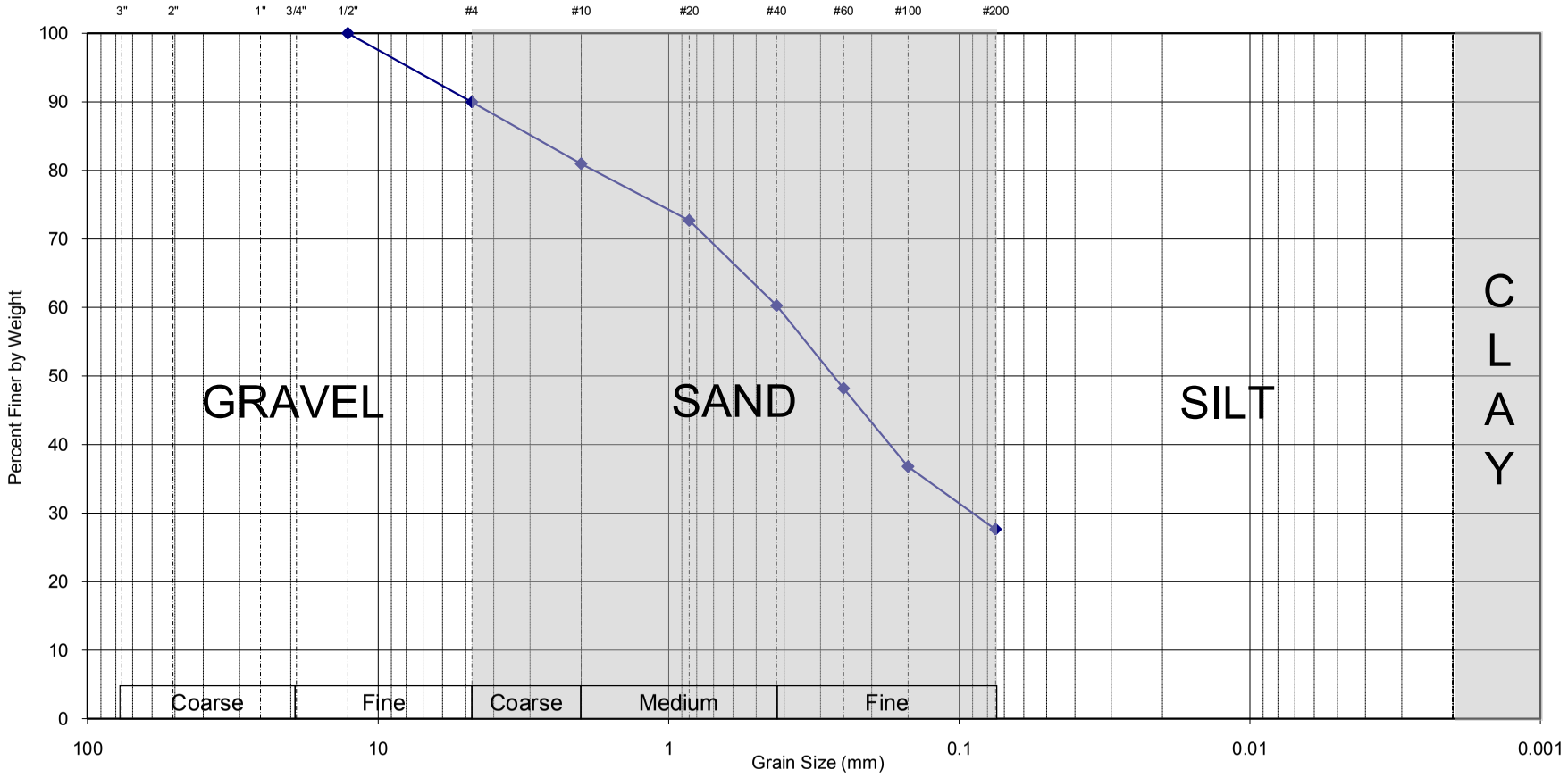
Gravel	Sand	Fines
17.8%	58.7%	23.6%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
36	CF-11	S-5	10-12'	Brown f-c SAND, some Silt, little f-c Gravel (SM)				

Chicopee Flood Control Works
Chicopee, MA
GZA File # 15.0702100.50

Tested by: MST/PEC Date: 3/18/10
Reviewed by: MBP Date: 3/24/10

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
10.0%	62.3%	27.6%

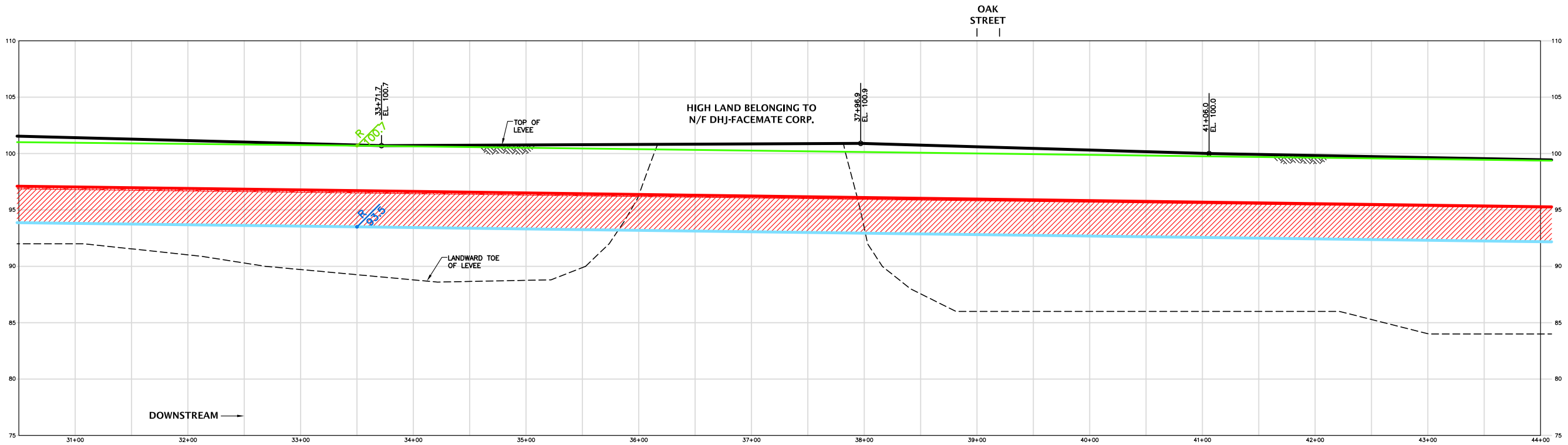
Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
37	CF-11	S-13	31-33'	Brown f-c SAND, some Silt, little fine Gravel (SM)				

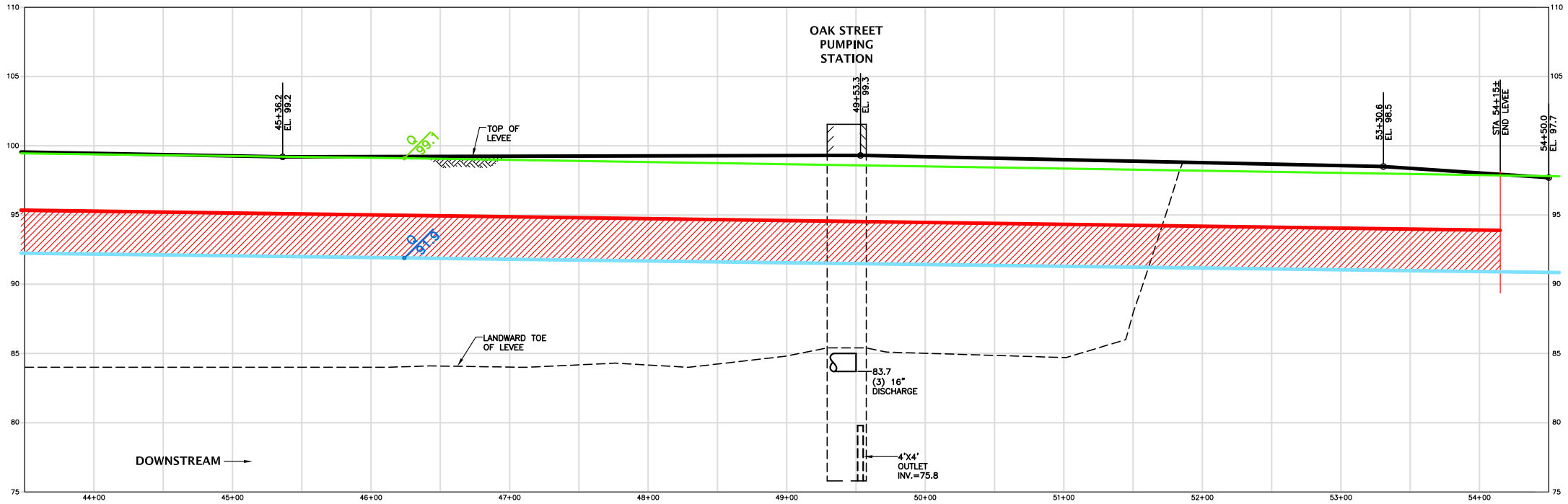
Chicopee Flood Control Works
Chicopee, MA
GZA File # 15.0702100.50

Tested by: MST/PEC Date: 3/18/10
Reviewed by: MBP Date: 3/24/10

APPENDIX A-4.1

FREEBOARD





GENERAL NOTES:

1. ALL ELEVATIONS SHOWN ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. TOP OF LEVEE INFORMATION OBTAINED BY HERITAGE SURVEYS, INC., OCTOBER-DECEMBER, 2009, AND AS SHOWN ON THE FLOOD CONTROL SYSTEM "AS-BUILT" DRAWINGS, DECEMBER, 2009.
3. STATIONING REFERS TO THE FLOOD CONTROL SYSTEM LEVEE CENTERLINE AS DEPICTED ON THE ORIGINAL U.S. ARMY CORPS OF ENGINEERS CONSTRUCTION DRAWINGS OR RECORD DRAWINGS, AS AVAILABLE.
4. BASE FLOOD (1-PERCENT-ANNUAL CHANCE) AND 500-YEAR FLOOD PROFILE INFORMATION WAS OBTAINED FROM THE PRELIMINARY FLOOD INSURANCE STUDY, HAMPDEN COUNTY, MASSACHUSETTS, FIS # 25013CV001, FEDERAL EMERGENCY MANAGEMENT AGENCY, APRIL 30, 2009.

No.	DATE	REVISION	BY

LEGEND

- 5+47.8 EL. 88.7 — TOP OF LEVEE ELEVATION BY FIELD SURVEY MAY 2008 – SEPT. 2009
- TOP OF EARTHEN LEVEE
- TOP OF CONCRETE FLOODWALL
- LANDWARD TOE OF LEVEE
- LANDWARD GRADE AT FLOODWALL
- RIVERWARD GRADE AT FLOODWALL
- BASE (1% CHANCE) FLOOD PROFILE
- BASE FLOOD ELEVATION AT FIS CROSS SECTION
- TOTAL REQUIRED FREEBOARD
- 500-YR. FLOOD PROFILE

FREEBOARD CRITERIA:

[AS PER 44 CFR 65.10(b)(1)(i)]

CRITERION #1: PROVIDE MINIMUM FREEBOARD OF THREE FEET ABOVE THE WATER-SURFACE LEVEL OF THE BASE (1% CHANCE) FLOOD

CRITERION #2: AN ADDITIONAL ONE FOOT ABOVE THE MINIMUM IS REQUIRED WITHIN 100 FEET IN EITHER SIDE OF STRUCTURES (SUCH AS BRIDGES) RIVERWARD OF THE LEVEE OR WHEREVER THE FLOW IS CONSTRICTED.

CRITERION #3: AN ADDITIONAL ONE-HALF FOOT ABOVE THE MINIMUM AT THE UPSTREAM END OF THE LEVEE, TAPERING TO NOT LESS THAN THE MINIMUM AT THE DOWNSTREAM OF THE LEVEE, IS ALSO REQUIRED.

SHEET TITLE:
CHICOPEE FALLS SYSTEM STA 31+00 TO STA 54+15± (HIGH GROUND)

PROJECT AND LOCATION:
FREEBOARD EVALUATIONS CITY OF CHICOPEE, MA FLOOD CONTROL WORKS

PREPARED FOR:
CITY OF CHICOPEE DEPARTMENT OF PUBLIC WORKS CHICOPEE MA

BAYSTATE ENVIRONMENTAL CONSULTANTS INC.
A GZA Company
Civil Engineers – Planners – Environmental Scientists
296 North Main Street, East Longmeadow, MA 01028
120 Mountain Avenue, Bloomfield, CT 06002

BEC PROJECT No.	15.0702100.40
SCALE	VERT. 1"=10' HOR. 1"=100'
DATE	JUNE, 2010
DRAWN BY	EDM
CHECKED BY	TEJ

SHEET No. **2** OF 2 SHTS

APPENDIX A-4.2

CLOSURES

Item	Location	Station	Description	Shown on USACE	Observed in field?	Comments	O&M MANUAL INFO.
1	Chicopee Falls	36+10	48" diam. RCP pressure drain with gate structure	YES	YES	Previously utilized by US Rubber Co. Gate located near Main Street in chamber operated and maintained by CIty	Sluice gates formerly operated for flushing lower level drainage system of former U.S. Rubber Co. consist of 48" diam. gravity discharge conduit, 24" sluice gate and a 48" sluice gate; under both normal & flood conditions, the 48" gate should remain wide open & the 24" tightly closed. During a localized storm causing local runoff not accompanied by a rise in the river level above el. 90.0, the 24" gate should be opened completely and slowly closing the 48" gate to flush 24" diam. bypass pipe.
2	Chicopee Falls	36+10	24" diam. RCP storm drain connected to drop inlet	YES	YES	Outfall shares same headwall as 48" diam. RCP. Pipe outlets slotted drain near top of levee which is higer than the one percent chance flood elevation.	
3	Chicopee Falls	48+00	30"x30" intake with gate structures on both sides	YES	YES	Previously utilized by U.S. Rubber Co. and no longer in use. Gate closed and pumps not operating.	See below * U.S. Rubber Co. no longer in operation. Gate is to be maintained in the CLOSED position.
4	Chicopee Falls	52+50	30" diam. RCP pressure drain	YES	YES	Outfall is from an area higher than the one percent chance flood elevation.	

* From Section VI of *Operation and Maintenance Manual,* USACE, 1984: "6-01. DESCRIPTION - Located at Sta. 48+00 are process water intake (30x30 sluice gate) and intake cooling water structure (30" wafer butterfly valve and 30" gate valve). Wafer butterfly maintains water levels between el. 77 and 79 in existing intake structure. 30" gate valve is, normally open but should be closed with cooling water pumps stopped. 6-03. OPERTION - When the river level is rising and reaches El. 79, the 30" wafer butterfly valve in the gate structure behind the dike should be throttled and constantly controlled to maintain the water level in the pit between El. 77 & 79. The elev. of the top of the gate structure is 84.5. Therefore, the water must be so controlled that the level at all times is between 5.5 and 7.5 ft below the top of the structure. This must be constantly watched as the level will change as the river level changes and also as the demand from the pumps change. The 30" gate valve also located in the gate structure should be closed if the cooling water pumps are stopped and the pressure through the wafer butterfly valve causes the water level in the pit to exceed El. 79. The sluice gate located on the river side of the dike should be kept open at all times. It should be closed only in the event of a rupture in the conduit between the 30" gate valve and the river."

APPENDIX A-4.3

EMBANKMENT PROTECTION

ANALYSIS OF EMBANKMENT PROTECTION

CHICOPEE FALLS FLOOD CONTROL SYSTEM

CHICOPEE FLOOD CONTROL WORKS

CITY OF CHICOPEE

HAMPDEN COUNTY, MASSACHUSETTS

October 2010

Baystate Environmental Consultants, Inc.

A GZA Company

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Tables

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Appendices

1 INTRODUCTION

The federal regulations pertaining to mapping of areas protected by levee systems require an analysis of embankment protection which demonstrates "*that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include, but are not limited to: Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes*" (44 CFR 65.10(b)(3)).

The analysis of embankment protection was performed in accordance with 44 CFR 65.10(b)(3) and by the application of methods and guidelines found in the United States Army Corps of Engineers (USACE) Engineering Manual on Hydraulic Design of Flood Control Channels (EM 1110-2-1601, Change 1, 30 Jun 94), USACE Coastal Engineering Manual, Part II (EM 1110-2-1100, Change 2, 1 August 2008), and United States Department of Agriculture, Soil Conservation Service (USDA SCS) Handbook of Channel Design for Soil and Water Conservation (TP-61, 1954).

The following sources were consulted for information supporting the analysis of embankment protection:

- Federal Emergency Management Agency (FEMA), *Preliminary Flood Insurance Study Number 25013CV001* (April 30, 2009).
- Heritage Surveys, Inc. *Topographic Plan of Land in Chicopee, MA*, (December, 2009).
- National Climatic Data Center, "Climatic Wind Data for the United States" (November 1998).

1.1 Chicopee Falls Flood Control System Description

The Chicopee River is described by lettered cross-sections in the Preliminary Flood Insurance Study (FIS) for Hampden County, MA (April 30, 2009). The segment of the Chicopee River along which the Chicopee Falls Flood Control System is located extends from approximately Cross-Section "U" (upstream) to Cross-Section "Q" (downstream). The Chicopee Falls Flood Control System consists of two segments of cast-in-place concrete floodwall and two segments of earthen levee, for a total length of 5,002 linear feet. From the Deady Bridge upstream extending for 557 linear feet downstream, the system consists of cast-in-place cantilever concrete floodwall. The upstream 400± feet of wall is founded directly on ledge with rock anchors, while the last 157± feet is founded on earth. The exposed wall height is approximately 20 feet on both the landside and the riverside. The next downstream segment of the system consists of 712± feet of earthen levee. The top of levee is approximately 17 feet higher than the landside grading. The second segment of cast-in-place cantilever concrete floodwall extends for another 863± feet downstream. This wall section is located on the inside of a bend in the Chicopee River where flow direction turns approximately 90 degrees from westerly to southerly. This entire segment of wall is

founded directly on ledge, and the exposed wall height is approximately 16 feet on the landside and 20 feet on the riverside. The second segment of earthen levee extends 2,870± linear feet downstream to complete the system.

Approximately eleven soil borings were recently performed along the Chicopee Falls Flood Control System and observed by GZA, and were advanced to depths ranging from approximately 20 to 80 feet below the ground surface (January/February, 2010). Seven (7) of the borings were performed either at the top of the levee near the riverside edge, or on the riverside slope. The borings indicated that soils near the surface of the levee consist primarily of sand with some gravel and silt.

Almost the entire length of the Chicopee Falls Flood Control System is protected on the riverside with hand- or machine-placed stone riprap. The riprap is angular rock, 1± ft in diameter, on average, and placed to provide a reasonably smooth surface approximately 18 inches thick. The USACE Specifications for construction of the Chicopee Falls Flood Control System indicate that "The material for stone slope protection shall consist of a well graded, angular quarry run stone which can be placed in an 18-inch layer. The maximum size stone shall weigh more than 200 pounds. The minimum size stone shall weigh less than 40 pounds. Material shall contain not more than 10 percent by weight of fragments that pass a two inch screen." Along the upstream section of floodwall, between the Deady Bridge and the beginning of the earthen levee section, the embankment riverward of the floodwall is covered mostly by grassy vegetation.

The City of Chicopee maintains the levees with regular mowing of the grass turf, repair of animal burrows, removal of drift and debris, repair of displaced riprap, and repair of erosion. Grass is generally maintained at a height between 4 and 8 inches.

2 EMBANKMENT PROTECTION ANALYSIS

2.1 Flow Velocity Impacts

Equation 3-3 of EM 1110-2-1601 computes the allowable characteristic side slope velocity of a channel based on the minimum riprap size of which 30% is finer by weight (D_{30}) and the local depth of flow. Based on the USACE's material specifications for stone slope protection described above in Section 1.1, the minimum size stone shall weigh less than 40 pounds. Assuming a unit weight of 100 pounds per cubic foot, a stone of 40 pounds is approximately 0.4 cubic foot in volume. A stone of 0.4 cubic foot in volume equates approximately to a rock of 0.91 feet in diameter. As most of the stone, as specified, must be greater than this size, it was assumed that the D_{30} for existing riprap along the Chicopee Falls Flood Control System is at least 0.91 ft, or 11± inches. Field inspections confirmed that the existing riprap generally conforms to the specifications. Therefore, as a check on slope protection along the Chicopee Falls Flood Control System, Equation 3-3 of EM 1110-2-1601 was used to estimate the characteristic side slope velocity for a D_{30} of 11 inches, under the consideration that existing riprap has a D_{30} of greater than 11 inches. The characteristic side slope velocity may be considered the allowable velocity for areas with riprap.

Equation 3-3 computes the characteristic side slope velocity based on the local depth of flow, both of which are typically taken at the subsection adjacent to the bank in the cross-section modeled in a water-

surface profile computation. However, FEMA did not perform a new detailed study of the Chicopee River as part of the *Preliminary Flood Insurance Study* (FIS) *Number 25013CV001* (April 30, 2009). Therefore, a hydraulic model from which characteristic side slope velocities and local depths of flow along the Chicopee River could be estimated was unavailable. The best available source for velocity and depth data was the tabulated mean floodway velocities and flood profiles for the Chicopee River published in the Preliminary FIS. Cross-sections 'Q' through 'U' from the Preliminary FIS overlap the Chicopee Falls Flood Control System along the Chicopee River. The mean floodway velocities and levee surface cover at the locations of these cross-sections are listed in the following table.

Based on the maximum depth of flow at the applicable cross-sections for the 1% annual chance event, as shown on the Flood Profiles for the Chicopee River in the FEMA FIS, the computed characteristic side slope (allowable) velocity as computed by Equation 3-3 for a D_{30} of 11 inches ranged from approximately 12.9 to 13.6 feet per second (fps). Calculations are attached in Appendix A.

Table 1. Flow Velocities for Chicopee Falls Flood Control System along the Chicopee River.

Cross-section*	Distance in feet above confluence with Connecticut River*	Floodway Width (feet)*	Mean Floodway Velocity (feet per second)*	Levee Surface Cover
Q	12,100	339	6.1	Riprap
R	13,470	283	6.5	Riprap
S	15,040	201	10.5	Riprap
T	16,090	282	6.8	Riprap
U	16,360	351	7.4	Vegetation

*From Federal Emergency Management Agency (FEMA), *Preliminary Flood Insurance Study Number 25013CV001* (April 30, 2009).

The mean floodway velocities indicated in the FEMA Preliminary FIS are under 12.9 fps at all of the cross-sections. At cross-sections 'Q', 'R', 'S', and 'T', the existing cover at the levee is adequate to protect against erosion, even conservatively assuming that the characteristic side slope velocities are equal to the mean floodway velocities from the 1% annual chance flood. In open channel flow, velocity is not uniform across the area in flow, due to the adhesion between the wetted surface of the channel and the water. Generally, the velocity is at a maximum towards the center of the channel cross-section, and decreases towards the edges of the channel cross-section. Thus, it is concluded that the existing riprap protection is more than adequate to protect the embankment against erosion from the 1% annual chance flood.

The embankment riverward of the floodwall at cross-section 'U' is vegetated, rather than surfaced with riprap. Table 2-5 of EM 1110-2-1601 provides suggested maximum permissible mean channel velocities for design of non-scouring flood control channels based on channel material. For a channel material of sandy silt with Kentucky bluegrass, the maximum permissible mean channel velocity is 5.0 feet per second (fps), provided that the grass cover is good and maintained properly. This is equal to the recommended permissible velocity for "easily eroded soil" covered with Kentucky bluegrass indicated in Table 3 of the Handbook of Channel Design for Soil and Water Conservation, TP-61 (USDA SCS, 1954).

The mean floodway velocity at cross-section 'U' of 7.4 fps exceeds the suggested maximum permissible mean channel velocity of 5.0 fps. However, it is likely that the velocity adjacent to the earthen slope is significantly less than 7.4 fps, due to the typical variations in velocity across an open channel. Furthermore, the section of the floodwall in the vicinity of cross-section 'U' is founded directly on ledge with rock anchors; thus, erosion of the embankment riverward of the floodwall in this area is unlikely to cause failure of the floodwall.

In summary, the majority of the riverside embankment along the Chicopee Falls Flood Control System is adequately protected against erosion from the 1% annual chance flood due to cover of riprap. Within the upstream section where the embankment riverward of the floodwall is covered by vegetation, the characteristic side slope velocity is likely such that the vegetation provides adequate protection against erosion from the 1% annual chance flood. Even if the vegetation did not provide adequate protection against erosion, the floodwall in this area is founded on ledge with rock anchors, and erosion of the embankment would be unlikely to cause failure of the floodwall.

2.2 Wind and Wave Action

The effects of wind and wave action were evaluated by estimating the maximum wave height using the simplified procedures in EM 1110-2-1100, Coastal Engineering Manual (Part II), 1 August 2008 (Change 2).

Wave prediction was based on an assumed sustained wind equivalent to the peak recorded wind gust at the Chicopee Falls/Westover Air Force Base recording station, located 75.0 meters above sea level. The peak gust of 79 miles per hour had a prevailing wind direction of west-northwest (WNW). Data were obtained from "Climatic Wind Data for the United States" (National Climatic Data Center, November 1998).

Using the "Step-by-step procedure for simplified estimate of winds for wave prediction" outlined in EM 1110-2-1100, the wind speed of 79 miles per hour (35 meters/second) was adjusted to represent overwater wind speed. The resulting wind speed used in subsequent analyses was 42 meters/second. Calculations are shown in Appendix B.

Wave height was estimated using the equations in EM 1110-2-1100 applicable to wave growth with fetch, in which the wave height depends on straight line fetch distance and wind speed. The straight line fetch distance was approximated by determining the location along the flood control system at which the longest fetch could occur over water in a WNW direction and during the base flood as indicated by FEMA floodplain mapping.

The longest fetch along the Chicopee Falls Flood Control System is 292± meters, located at the downstream end of the levee, as shown in Figure 1. At this location, available base flood freeboard is approximately 7.1 feet, which is representative of the lowest available freeboard along the system.

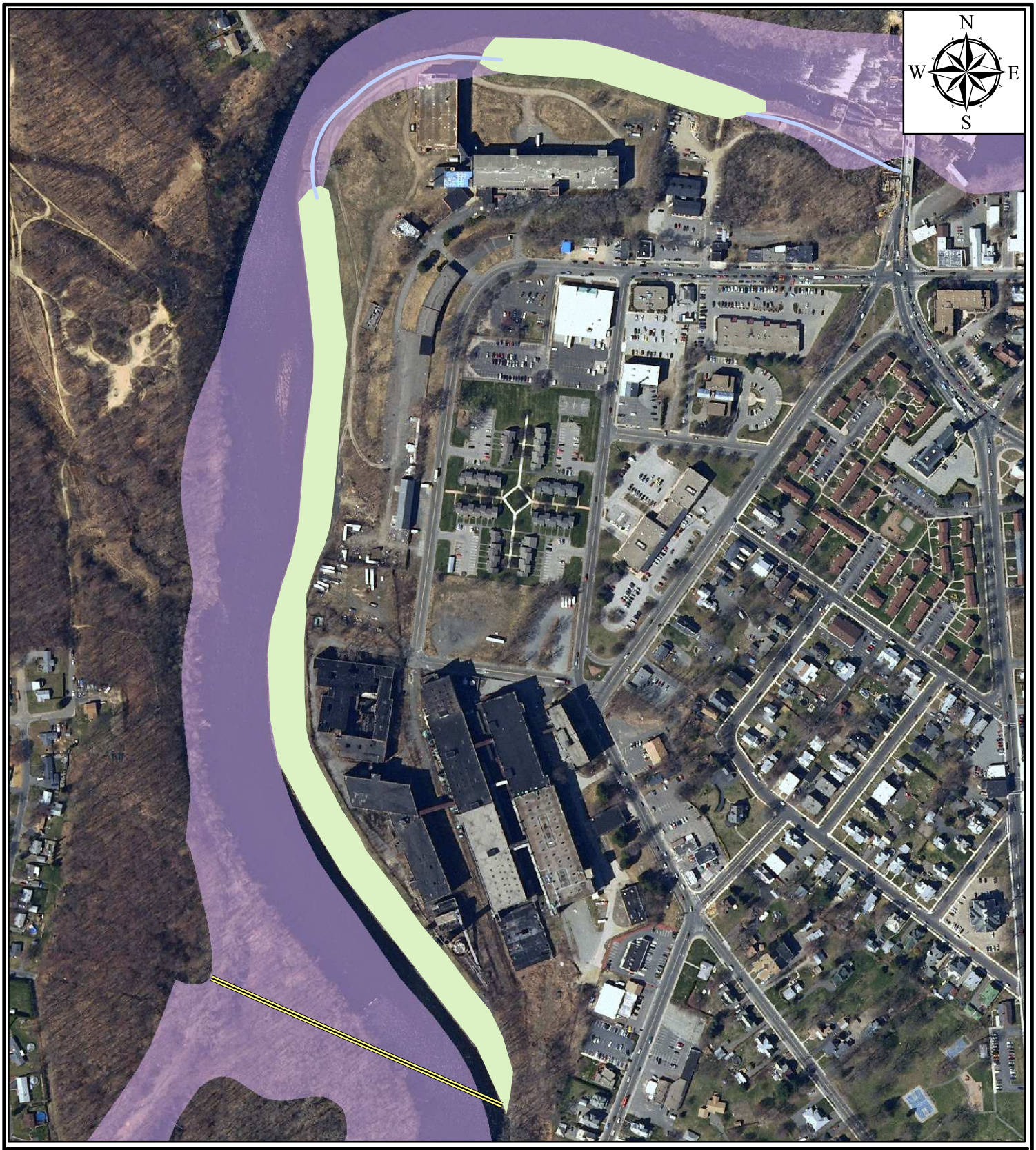
The estimated wave height was checked for shallow water limitations in accordance with the procedures in EM 1110-2-1100. Calculations are shown in Appendix B.

The input parameters and results are summarized in the following Table 2.

As the predicted wave height is less than the available freeboard for the base flood, overtopping is not expected to occur. Therefore, appreciable erosion and failure of the flood control system due to wave action is unlikely.

Table 2. Wave Height Computation Input and Results

Flood Control System	**Chicopee Falls**
Peak Gust Wind Speed (mph)	79
Peak Gust Wind Speed (m/s)	35
Peak Gust Prevailing Wind Direction	WNW
Wind Speed Adjusted for Overwater (m/s)	42
Fetch (m)	292
Wave Height (m)	0.48
Wave Height (ft)	1.6
Available Freeboard for Base Flood (ft)	7.1



400 200 0 400 Feet

Legend

- FEMA Flood Zone A
- Floodwall
- Fetch
- Earthen Dike

LONGEST FETCH

Embankment Protection Analysis
Chicopee Falls Flood Control System
Chicopee, Massachusetts

MassGIS Orthophoto (2005)

FEMA Flood Zone A from Q3 Flood Data produced by FEMA, July 1997.

Baystate Environmental Consultants, Inc.
296 North Main Street, East Longmeadow, MA
A GZA Company

Project No: 15.0702100.40

Drawn by: RTS

Checked by: TEJ

Date: August 2010

Figure No: 1

2.3 Ice and Debris Impacts

There are no areas of the Chicopee Falls Flood Control System along the Chicopee River that are likely to experience direct impacts of ice or debris. The hydroelectric dam located upstream of the Deady Bridge will contain some of the ice and debris during the 1% annual chance flood. Ice formation on the Chicopee River through Chicopee is rare, and does not coincide with the typical timing of flood events during the spring months when the temperatures are above freezing. Average channel velocities of about 6 to 10 feet per second are such that it is not expected that any impacts of ice or debris will cause significant damage to the system.

3 CONCLUSION

No appreciable erosion of the levee embankment is expected during the base flood due to currents, waves, or ice and debris impacts which would result in failure of the levee embankment. The Chicopee Falls Flood Control System levee meets the requirements of 44 CFR 65.10 for embankment protection.

APPENDIX A-4.4

EMBANKMENT
AND
FOUNDATION
SEEPAGE & STABILITY

EMBANKMENT AND FOUNDATION SEEPAGE AND STABILITY ANALYSIS
CHICOPEE FALLS FLOOD CONTROL SYSTEM

CHICOPEE FLOOD CONTROL WORKS
CITY OF CHICOPEE
HAMPDEN COUNTY, MASSACHUSETTS

November, 2010
GZA GeoEnvironmental, Inc.

1 SEEPAGE

Seepage was evaluated for the Chicopee Falls Levee using SEEP/W 2007 a two-dimensional finite element seepage modeling software created by GEO-SLOPE International, Ltd, and analyzed in general accordance with USACE Technical Letter ETL 110-2-569 *Design Guidance for Levee Underseepage.* Seepage was evaluated for Normal and 100 Year Flood per FEMA regulations 44 CRF 65.2 and 65.10, assuming steady-state seepage conditions. Flow and exit gradients were estimated in the vicinity of the drain from SEEP/W results and compared to the limiting gradient criteria of 0.5. The seepage analyses were also performed with an assumed non-functional toe drain in order to determine if the required criteria would be met even with a compromised or non-functioning drain.

2 STABILITY

Slope Stability simulations were performed using guidance from USACE *Design and Construction of Levees*, EM 1110-2-1913 under normal and 100 year flood (steady-state seepage and sudden drawdown), for the landside and riverside slopes. Models were evaluated using SLOPE/W, a two-dimensional finite element slope stability modeling software created by GEO-SLOPE International, Ltd. utilizing the Spencer method and incorporating the parent SEEP/W model's seepage forces and phreatic surfaces. Staged Rapid Drawdown was modeled using the USACE 3-stage method.

3 TYPICAL SECTIONS

Station 13+30 (typical of Station 9+50 to 16+82 and 25+25 to 39+25) was selected as a representative cross-section to analyze the Chicopee Falls Levee system, as Station 13+30 had the loosest fill and loss of washwater was noted during boring (indicative of high permeability). Station 13+30 appears to represent the "worst case" along the Chicopee Falls Levee. An additional cross section was analyzed at Station 41+00 (typical of Station 39+25 to Station 50+00) that did not incorporate the gravelly sand layer. Two final cross sections were analyzed for seepage only at Station 9+00 (typical of Station 0+00 to 9+50) and 20+00 (typical of Station 16+82 to 25+50), as representative "worst-case" wall sections, where the difference between flood elevation and landside grade and/or difference between bottom of footing and top of bedrock were greatest.

4 SEEPAGE ANALYSES AND RESULTS

Hydraulic conductivities were estimated from grain-size distribution correlations and from published literature. Material properties and a typical cross-section can be found at the end of Appendix A-4.4. Boundary conditions were applied along the landside ground and wall surface. The toe drain was modeled as a point element with zero pressure head, surrounded by a flux section to estimate drain flow. An additional load case was modeled without the toe drain to check whether seepage would present an issue if the toe-drain was not functioning as designed. Elevations for normal and flood pools can be found in the Calculation Summary Sheets and the Freeboard Evaluation Plans at the end of Appendix A-4.4.

The computed exit gradients for the Chicopee Falls Levee system were found to be less than the limiting gradient criteria of 0.5, per ETL 110-2-569 *Design Guidance for Levee Underseepage.* The evaluated sections of the Chicopee Falls Levee had acceptable gradients for the 100-year flood with and without a functioning toe drain. Estimates of gradients and unit flow rates through the toe drain can be found in the Calculation Summary Sheet at the end of Appendix A-4.4.

5 STABILITY ANALYSES AND RESULTS

Minimum factors of safety against normal and flood conditions were conservatively assumed to be 1.4 using USACE guidance from EM 1110-2-1913. A specific factor of safety for sudden drawdown is not given in EM 1110-2-1913, but rather a range from 1.0 to 1.2 based upon the period of sustained flood level is recommended. GZA used a value of 1.0 for factor of safety against sudden drawdown in our analyses, which we consider appropriate based upon our assumption of steady-state seepage and instantaneous flood elevations. Material unit weights, strength and internal friction angle values were estimated using SPT N-value correlations and values from published engineering literature.

All computed factors of safety against sliding were greater than the minimums specified above.

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Engineers and Scientists
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http://www.gza.com

JOB	15.0702100.50 - Chicopee River Levee		
SHEET NO.	1	**OF**	2
CALCULATED BY	RDH/JGD	**DATE**	5/13/2010
CHECKED BY	JGD	**DATE**	5/13/2010
SCALE		N/A	

Objective: To assess seepage and stability of the **Chicopee Falls Section** of the Chicopee Flood Control Works

Method:

1) Develop typical cross section of levee at **Station 13+30, typical from Station 9+50 to 16+82 and 25+25 to 39+25** (See attached figure).
2) Determine material parameters from test borings and typical values of similar materials.
3) Calculate location of phreatic surface within levee for normal and flood conditions, using SEEP/W. Calculate factor of safety against piping failure (where applicable).
4) Using pore water data from SEEP/W, calculate factors of safety against slope failure for the following load cases defined by requirements of EM 1110-2-1913, Section 6-7302. Steady-state factors of safety calculated for both riverside and landside slopes using Spencer method. Rapid drawdown factor of safety calculated using USACE 3-stage method.

Case #1 - Steady-state seepage at normal pool
Case #2 - Steady-state seepage at 100yr Flood
Case #3 - Rapid Drawdown from 100 yr Flood (Riverside only)

5) Where applicable, the above load cases were also checked for non-functioning drains and/or cutoffs

Subsurface Information:

- Test borings CF-1 through CF-11 and Exploration Location Plan by GZA (2009)
- "Chicopee River Flood Control - Chicopee Falls, Chicopee River, Massachusetts" U.S. Army Engineer Division, New England Corps of Engineers, Waltham, Mass. Dated April 1963
- "Chicopee Falls Local Protection Project - Design Memorandum No. 5 - Embankments and Foundations" U.S. Army Engineer Division, New England Corps of Engineers, Waltham, Mass. Dated March 1963

Assumptions:

- Soil strata interpreted from available test boring data and design drawings, actual configuration may vary.

Material Properties:

Strata	Total Unit Weight, γ_t	Effective Strength		Total Strength		K Ratio (k_v/k_h)	Saturated Horizontal Permeability, k_{sat}		Notes
		Cohesion,	Friction	Cohesion, c	Friction				
Impervious Fill	118	0	35	0	35	1	4.6E-06	1.4E-04	(2),(3)
Existing Fill	120	0	30	0	30	1	3.3E-05	1.0E-03	(4),(5)
Silty Sand	110	0	30	0	27	1	4.6E-06	1.4E-04	(2),(4)
Gravelly Sand	130	0	35	0	35	1	6.6E-05	2.0E-03	(2),(4)
Riprap	140	0	42	0	42	1	8.0E-03	2.4E-01	(1)
Sandstone	-	-	-	-	-	1	1.6E-06	5.0E-05	(1),(6)

(1) - Unit weight and permeability values based on typical values for similar materials
(2) - Permeability values estimated from correlations with grain size distribution
(3) - Drained strength values based on correlations from SPT-N testing, total strength values are estimated
(4) - Drained strength based on values in USACE design
(5) - Permeability values based values used in USACE report
(6) - Strength of sandstone not included in slope stability analysis (assumed impenetrable)

Analysis Results:

SEEPAGE ANALYSIS RESULTS - EXISTING CONDITIONS

Case	River Elevation	Unit Flowrate, Q [(1)] (through slope into drain)	Exit Gradient, i_e [(1)]	Limiting Gradient[(2)]	OK?
1	Normal (El. ±83)	0 $ft^3/s/ft$	N/A	0.5	Y
2	100yr Flood (El. 97.9)	3.3E-05 $ft^3/s/ft$	0.04	0.5	Y
2a	100yr Flood (No Drain)	0 $ft^3/s/ft$	0.14	0.5	Y

- Note: Factor of safety values less than recommended values are shown in italics
(1) - Flow and exit gradient estimated from results of SEEP/W analysis at toe drain or landside face of the levee
(2) - Limiting gradient per requirements of US Army Corps Technical Letter ETL 1110-2-569 "DESIGN GUIDANCE FOR LEVEE UNDERSEEPAGE"

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Engineers and Scientists

JOB	15.0702100.50 - Chicopee River Levee		
SHEET NO.	2	**OF**	2
CALCULATED BY	RDH/JGD	**DATE**	5/13/2010
CHECKED BY	JGD	**DATE**	5/13/2010
SCALE		N/A	

SLOPE STABILITY ANALYSIS RESULTS - EXISTING CONDITIONS

Load Case	Loading Condition	Levee Face	Factor of Safety		Comments / Notes
			Minimum	Existing	
1	Normal Conditions	Riverside	1.4	1.61	
		Landside		1.64	
2	100-year Flood (Steady State)	Riverside	1.4	1.73	
		Landside		1.62	
3	Sudden drawdown from 100yr Flood	Riverside	1.0 - 1.2(1)	1.27	

SLOPE STABILITY ANALYSIS RESULTS - EXISTING CONDITIONS - NON-FUNCTIONING DRAINS

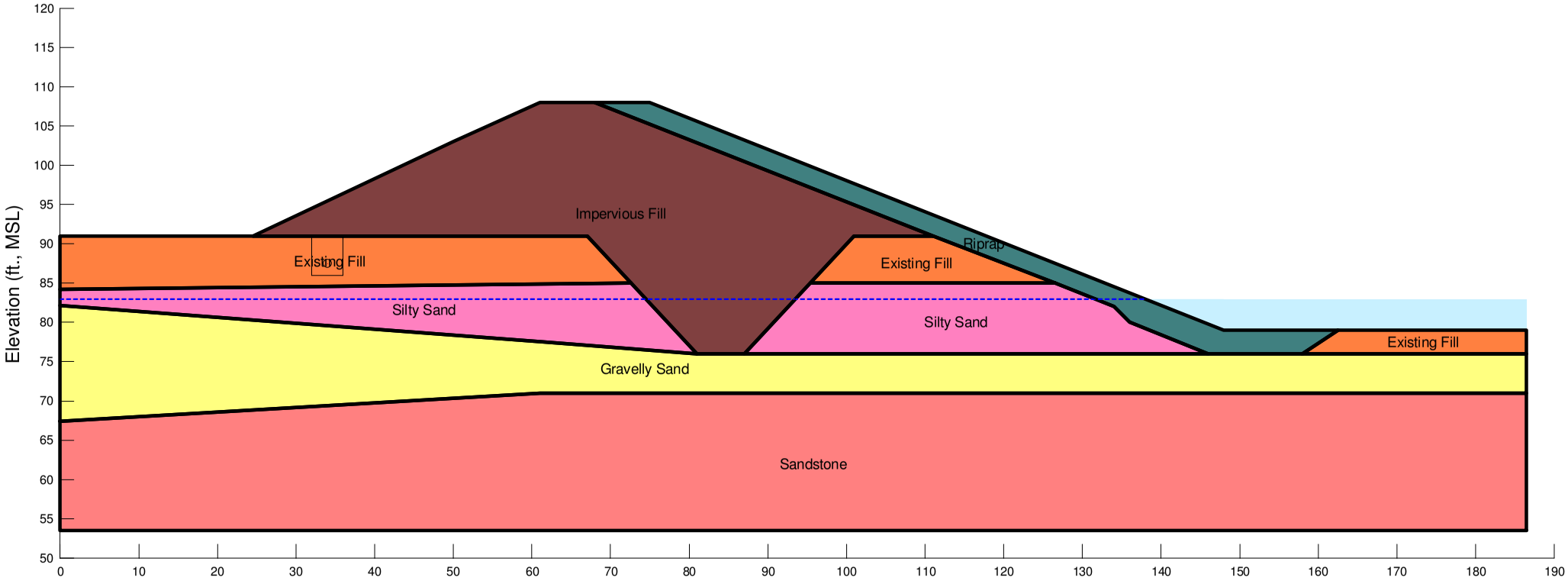
Load Case	Loading Condition	Levee Face	Factor of Safety		Comments / Notes
			Minimum	Existing	
1	Normal Conditions	Riverside	1.4	-	Same as Previous
		Landside		-	Same as Previous
2	100-year Flood (Steady State)	Riverside	1.4	1.70	
		Landside		1.47	
3	Sudden drawdown from 100yr Flood	Riverside	1.0 - 1.2(1)	1.27	

- Note: Factor of safety values less than recommended values are shown in italics

(1) - FS = 1.0 applies to flood levels unlikely to persist for long periods prior to drawdown, FS = 1.2 applies to levels likely to persist for long periods prior to drawdown.

- Refer to Attached SLOPE/W slope stability analysis graphical results

Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 13+30 - Normal Conditions

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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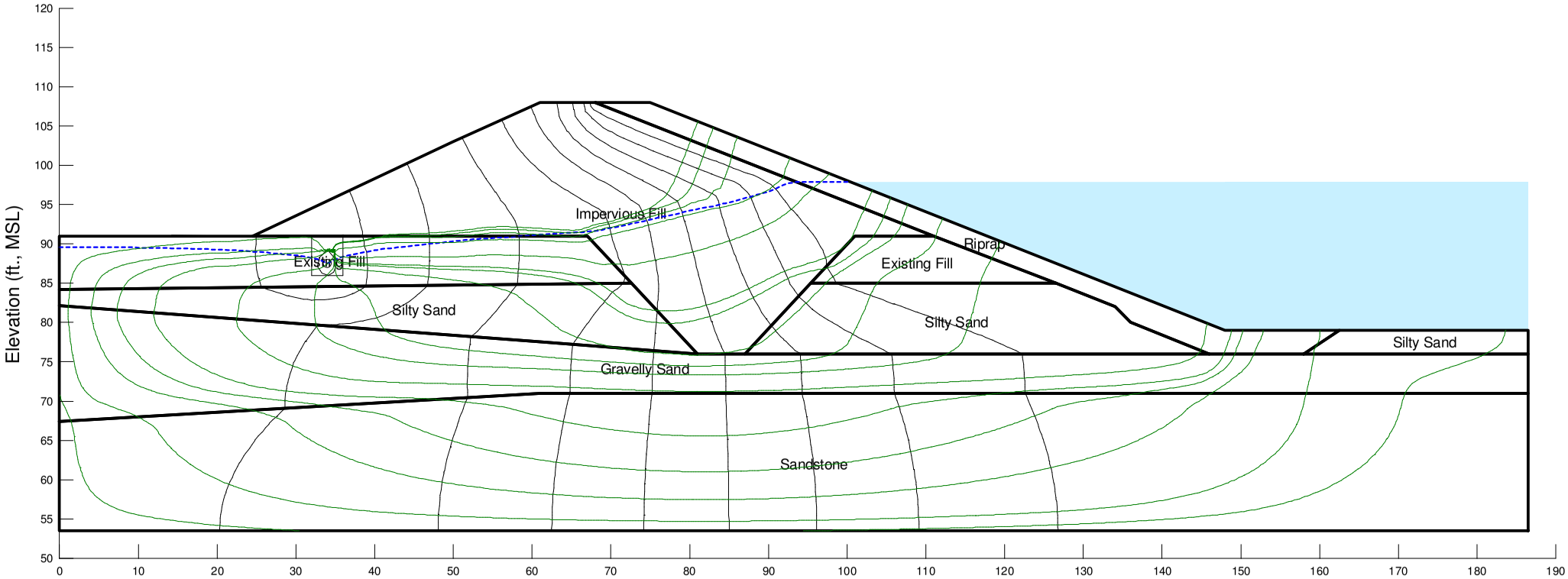
Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 13+30 - 100yr Flood

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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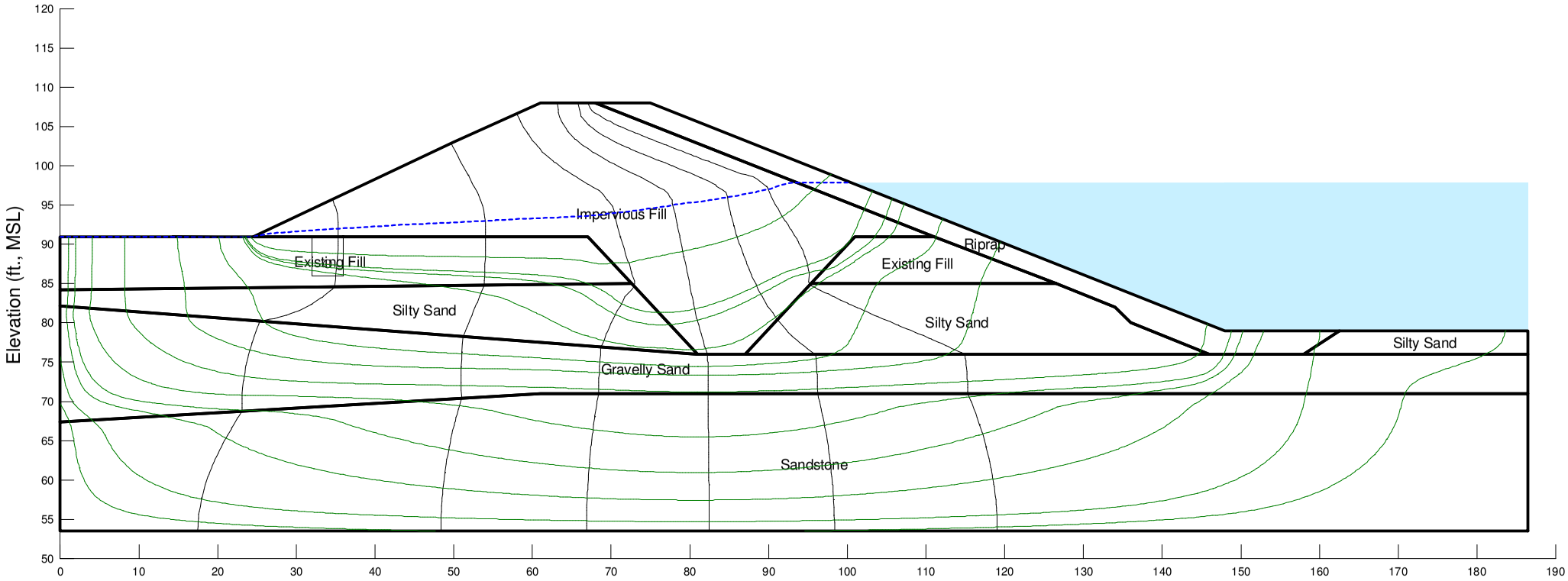
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 13+30 - 100yr Flood (No Drain)

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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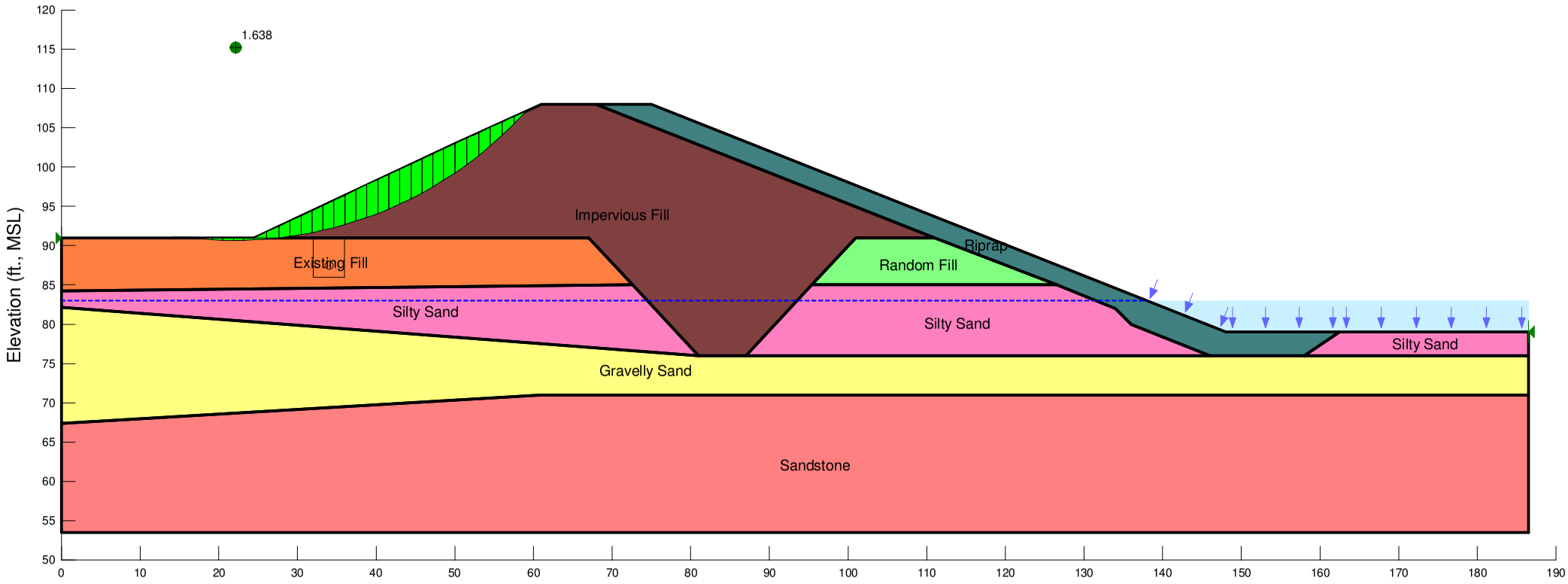
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 13+30 Landside Slope Stability - Normal Conditions

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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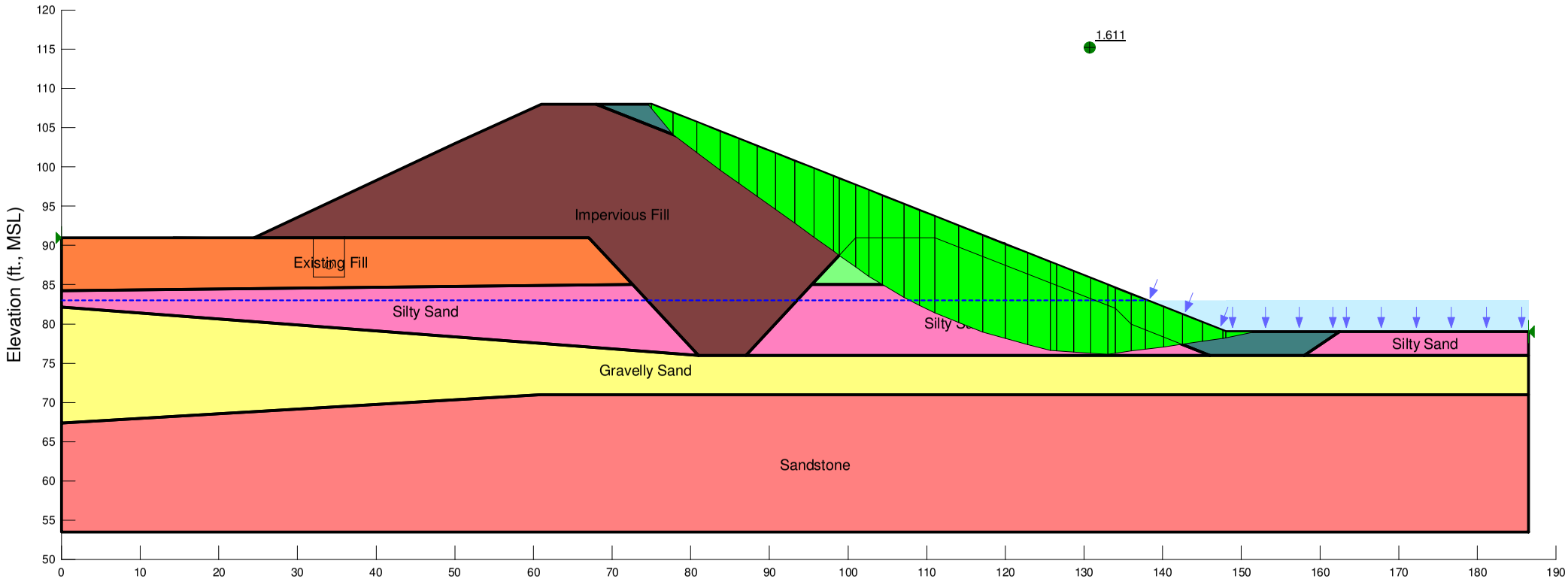
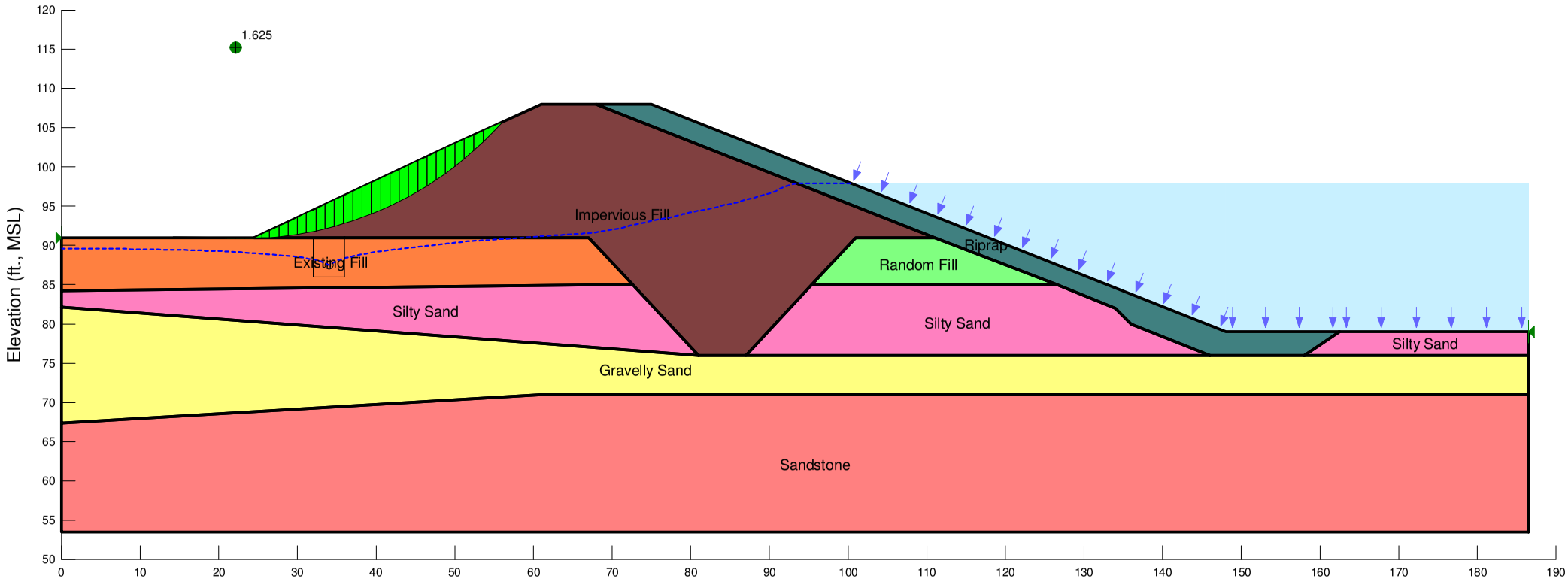
Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 13+30 Riverside Slope Stability - Normal Conditions

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 13+30 Landside Slope Stability - 100yr Flood

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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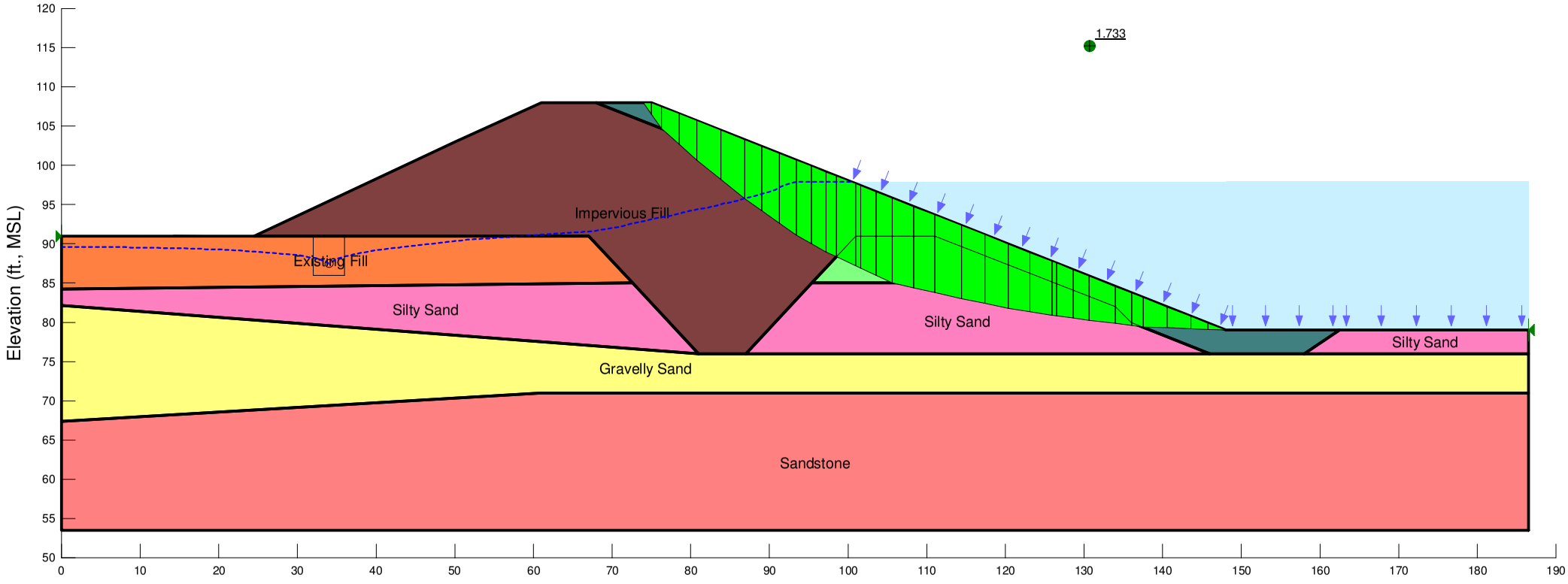
Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 13+30 Riverside Slope Stability - 100yr Flood

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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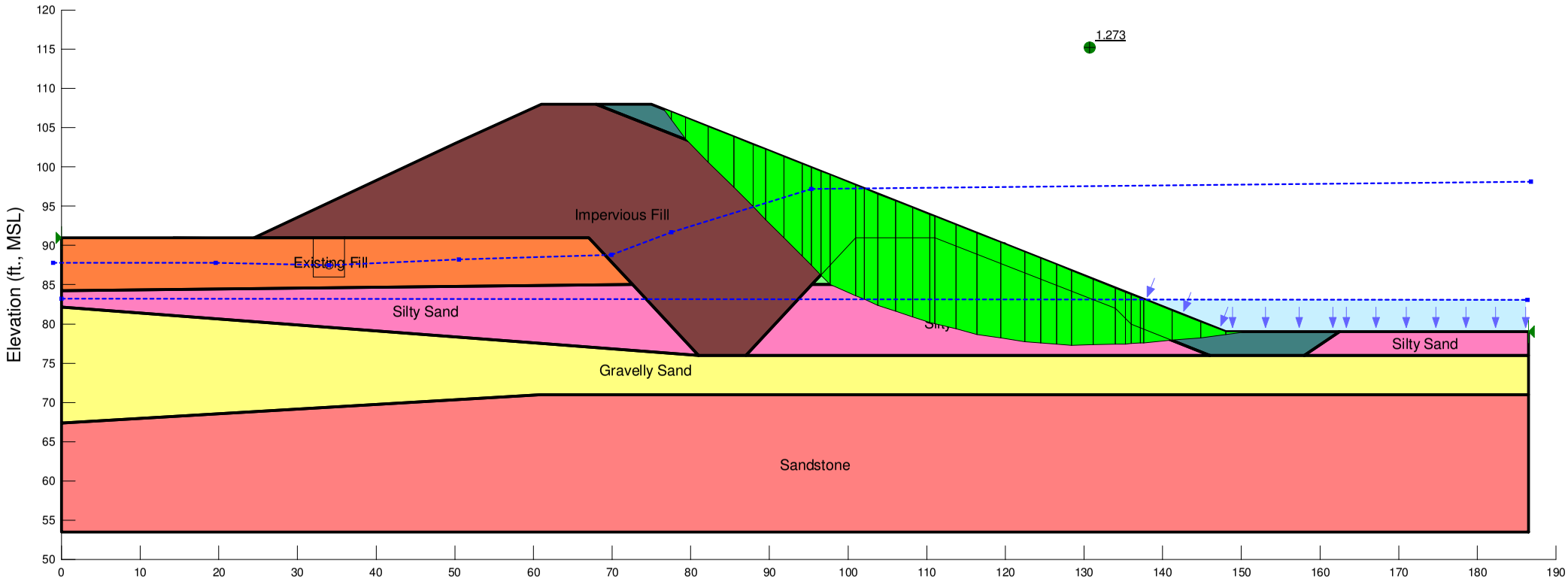
GZA Project No. 15.0702100.50



Station 13+30 Riverside Slope Stability - 100yr Drawdown

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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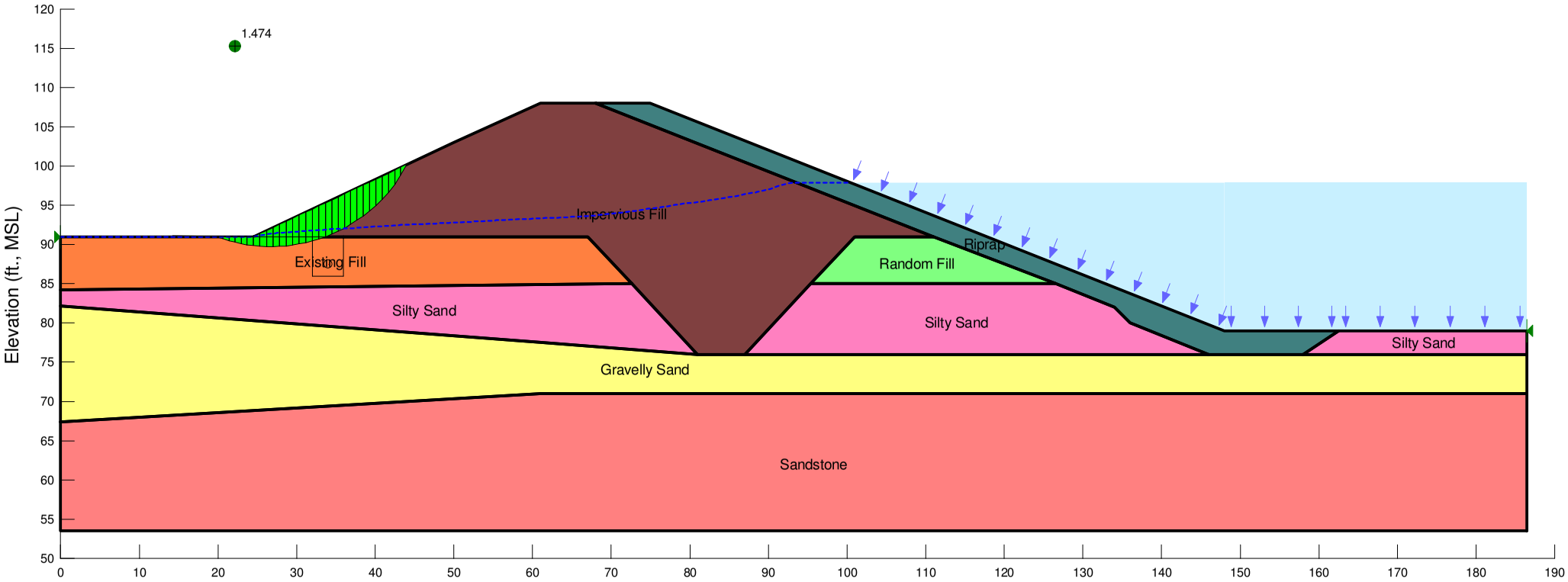
Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 13+30 Landside Slope Stability - 100yr Flood (No Drain)

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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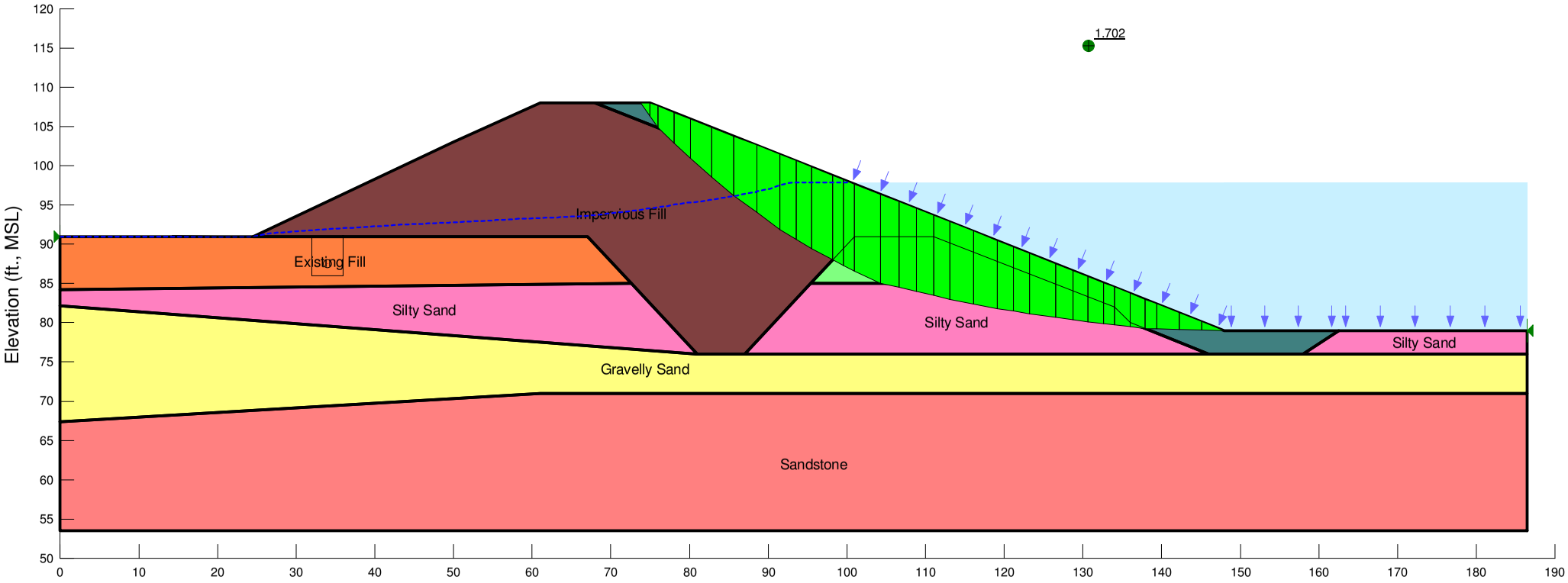

Station 13+30 Riverside Slope Stability - 100yr Flood (No Drain)

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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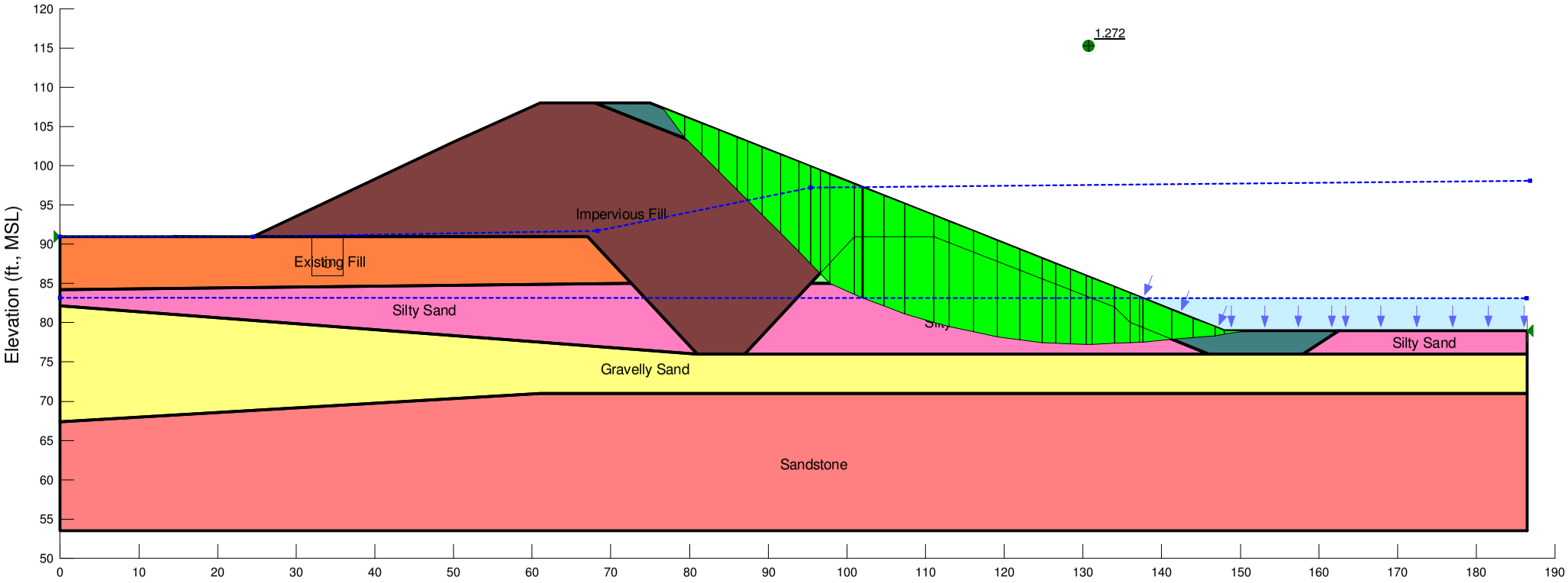

Station 13+30 Riverside Slope Stability - 100yr Drawdown (No Drain)

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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JOB	15.0702100.50 - Chicopee River Levee		
SHEET NO.	1	OF	2
CALCULATED BY	RDH/JGD	DATE	5/13/2010
CHECKED BY	JGD	DATE	5/13/2010
SCALE		N/A	

Objective: To assess seepage and stability of the **Chicopee Falls Section** of the Chicopee Flood Control Works

Method:

1) Develop typical cross section of levee at **Station 41+00, typical from Station 39+25 to 51+15** (See attached figure).
2) Determine material parameters from test borings and typical values of similar materials.
3) Calculate location of phreatic surface within levee for normal and flood conditions, using SEEP/W. Calculate factor of safety against piping failure (where applicable).
4) Using pore water data from SEEP/W, calculate factors of safety against slope failure for the following load cases defined by requirements of EM 1110-2-1913, Section 6-7302. Steady-state factors of safety calculated for both riverside and landside slopes using Spencer method. Rapid drawdown factor of safety calculated using USACE 3-stage method.

Case #1 - Steady-state seepage at normal pool
Case #2 - Steady-state seepage at 100 yr Flood
Case #3 - Rapid Drawdown from 100 yr Flood (Riverside only)

5) Where applicable, the above load cases were also checked for non-functioning drains

Subsurface Information:

- Test borings CF-8 through CF-11 and Exploration Location Plan by GZA (2009)
- "Chicopee River Flood Control - Chicopee Falls, Chicopee River, Massachusetts" U.S. Army Engineer Division, New England Corps of Engineers, Waltham, Mass. Dated April 1963
- "Chicopee Falls Local Protection Project - Design Memorandum No. 5 - Embankments and Foundations" U.S. Army Engineer Division, New England Corps of Engineers, Waltham, Mass. Dated March 1963

Assumptions:

- Soil strata interpreted from available test boring data and design drawings, actual configuration may vary.

Material Properties:

Strata	Total Unit Weight, γ_t	Effective Strength		Total Strength		K Ratio (k_v/k_h)	Saturated Horizontal Permeability, k_{sat}		Notes
		Cohesion,	Friction	Cohesion, c	Friction				
Impervious Fill	118	0	35	0	35	1	4.6E-06	1.4E-04	(2),(3)
Random Fill	120	0	32	0	32	1	2.5E-03	7.6E-02	(1),(3)
Existing Fill	120	0	25	0	25	1	3.3E-04	1.0E-02	(4),(5)
Silty Sand	110	0	30	0	27	1	4.6E-06	1.4E-04	(2),(4)
Gravelly Sand	130	0	35	0	35	1	6.6E-05	2.0E-03	(2),(4)
Riprap	140	0	42	0	42	1	8.0E-03	2.4E-01	(1)

(1) - Unit weight and permeability values based on typical values for similar materials
(2) - Permeability values estimated from correlations with grain size distribution
(3) - Drained strength values based on correlations from SPT-N testing, total strength values are estimated
(4) - Drained strength based on values in USACE design
(5) - Permeability values based values used in USACE report
(6) - Strength of sandstone not included in slope stability analysis (assumed impenetrable)

Analysis Results:

SEEPAGE ANALYSIS RESULTS - EXISTING CONDITIONS

Case	River Elevation	Unit Flowrate, Q [(1)] (through slope into drain)	Exit Gradient, i_e [(1)]	Limiting Gradient[(2)]	OK?
1	Normal (El. ±80)	-	N/A	0.5	Y
2	100yr Flood (El. 93)	9.7E-05	0.05	0.5	Y
2a	100yr Flood (No Drain)	-	0.08	0.5	Y

- Note: Factor of safety values less than recommended values are shown in italics
(1) - Flow and exit gradient estimated from results of SEEP/W analysis at toe drain or landside face of the levee
(2) - Limiting gradient per requirements of US Army Corps Technical Letter ETL 1110-2-569 "DESIGN GUIDANCE FOR LEVEE UNDERSEEPAGE"

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Engineers and Scientists

JOB	15.0702100.50 - Chicopee River Levee		
SHEET NO.	2	**OF**	2
CALCULATED BY	RDH/JGD	**DATE**	5/13/2010
CHECKED BY	JGD	**DATE**	5/13/2010
SCALE		N/A	

SLOPE STABILITY ANALYSIS RESULTS - EXISTING CONDITIONS

Load Case	Loading Condition	Levee Face	Factor of Safety		Comments / Notes
			Minimum	Existing	
1	Normal Conditions	Riverside	1.4	1.57	
		Landside		1.56	
2	100-year Flood (Steady State)	Riverside	1.4	1.71	
		Landside		1.56	
3	Sudden drawdown from 100yr Flood	Riverside	1.0 - 1.2(1)	1.51	

SLOPE STABILITY ANALYSIS RESULTS - EXISTING CONDITIONS - NON-FUNCTIONING DRAINS

Load Case	Loading Condition	Levee Face	Factor of Safety		Comments / Notes
			Minimum	Existing	
1	Normal Conditions	Riverside	1.4	-	Same as Previous
		Landside		-	Same as Previous
2	100-year Flood (Steady State)	Riverside	1.4	1.70	
		Landside		1.55	
3	Sudden drawdown from 100yr Flood	Riverside	1.0 - 1.2(1)	1.51	

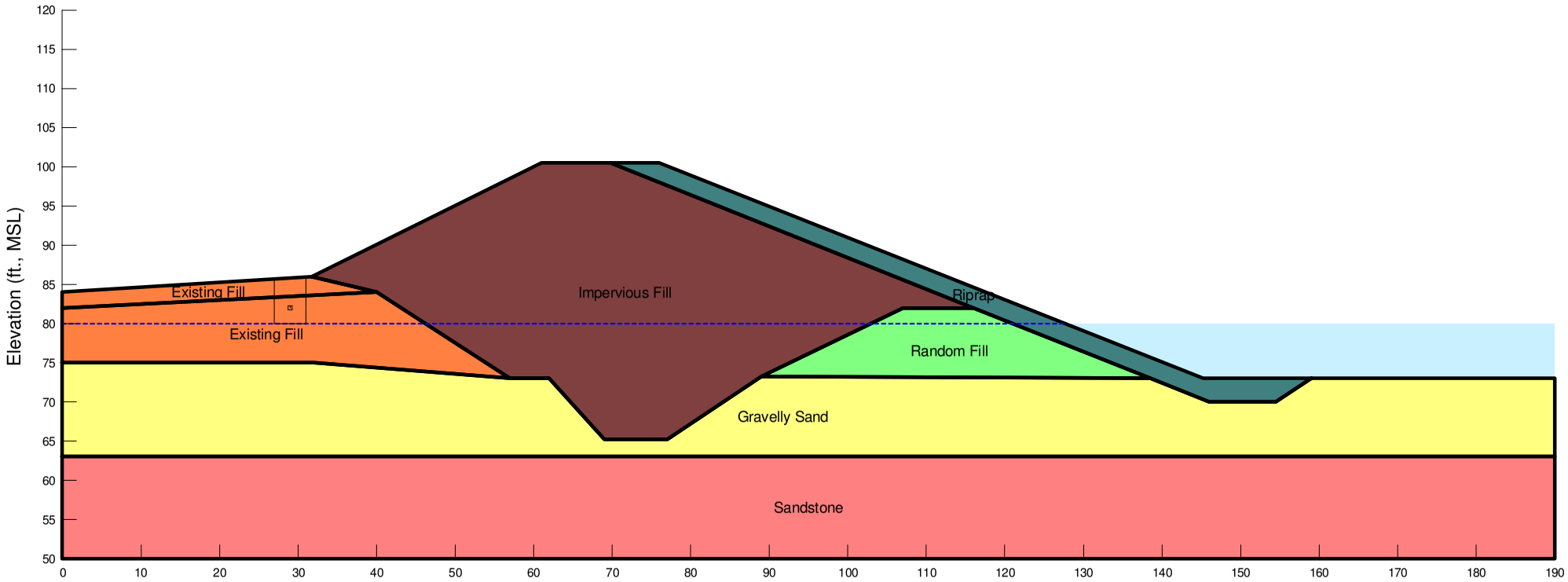
- Note: Factor of safety values less than recommended values are shown in italics

(1) - FS = 1.0 applies to flood levels unlikely to persist for long periods prior to drawdown, FS = 1.2 applies to levels likely to persist for long periods prior to drawdown.

~~(2) - Factor of safety not provided in EM 1110-2-1913~~

- Refer to Attached SLOPE/W slope stability analysis graphical results

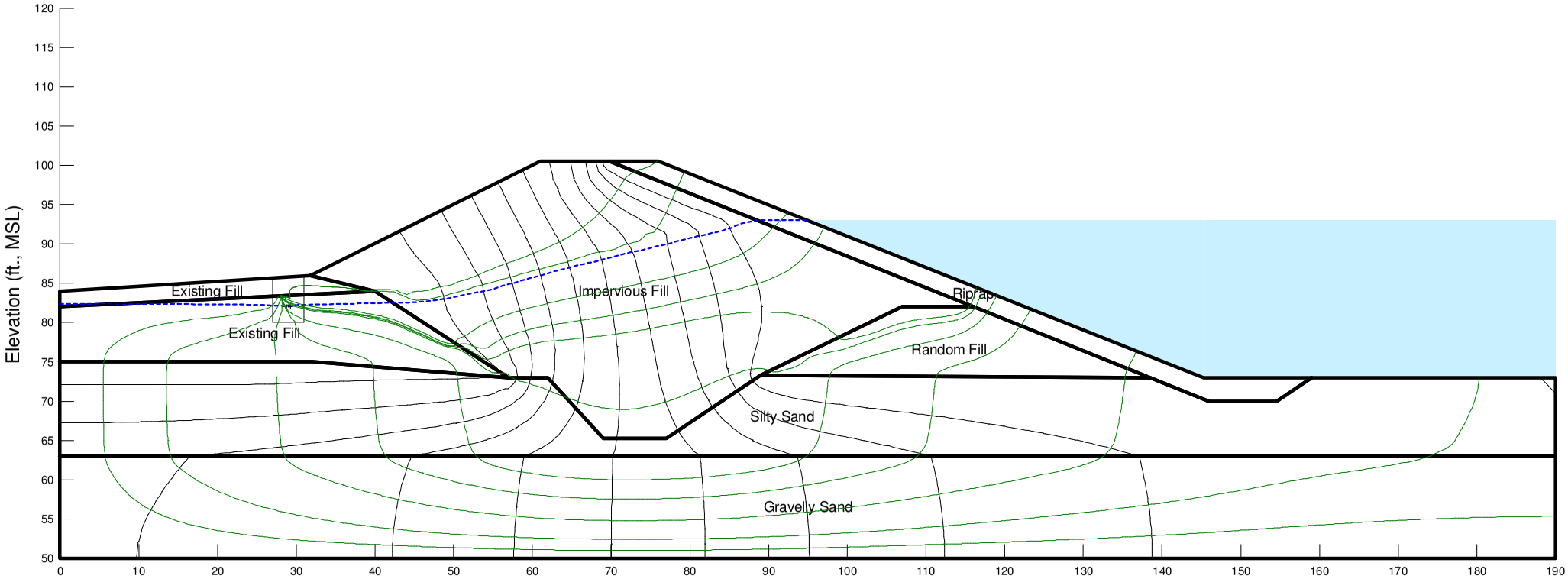
Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 41+00 - Normal Conditions

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

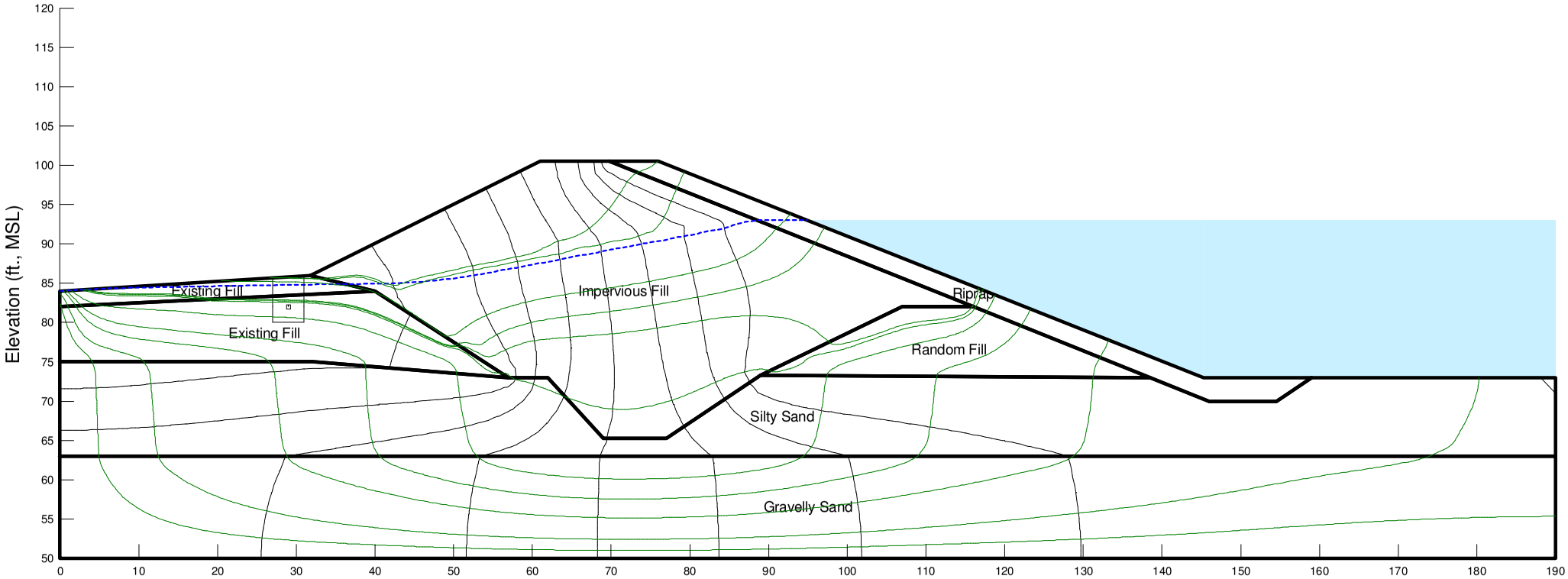
Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 41+00 - 100yr Flood

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 41+00 - 100yr Flood (No Drain)

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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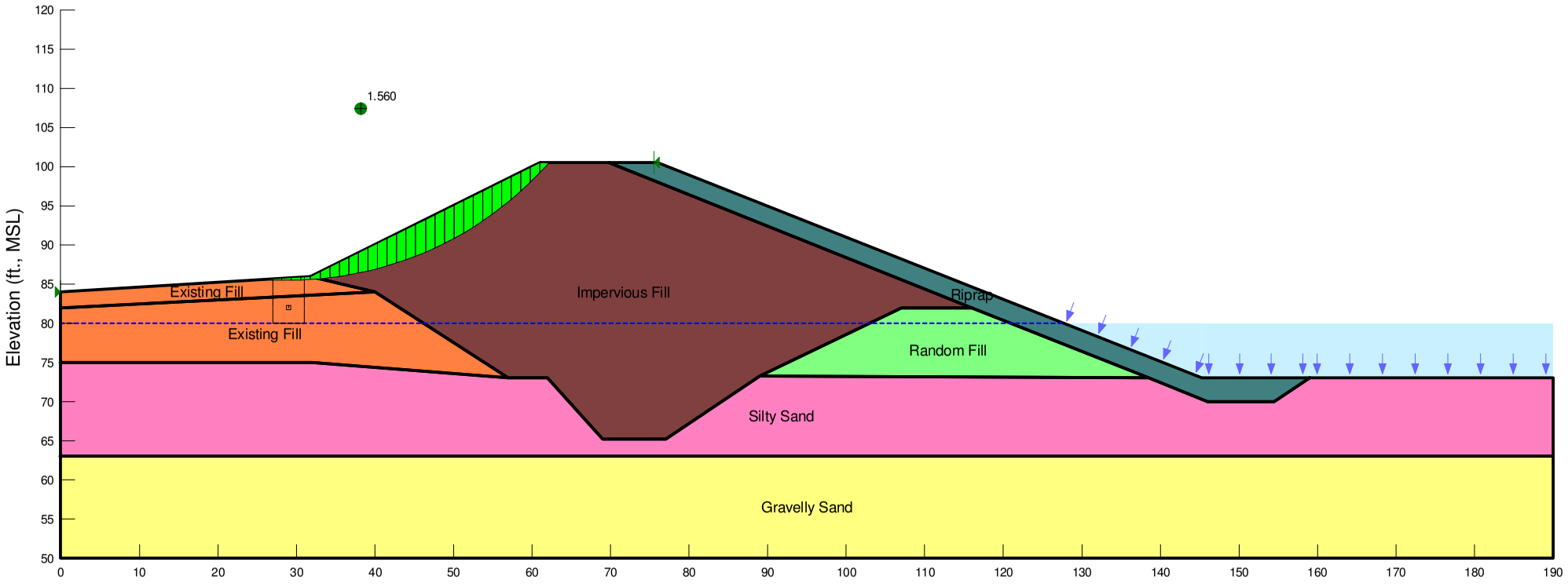

Station 41+00 - Landside Slope Stability - Normal Conditions

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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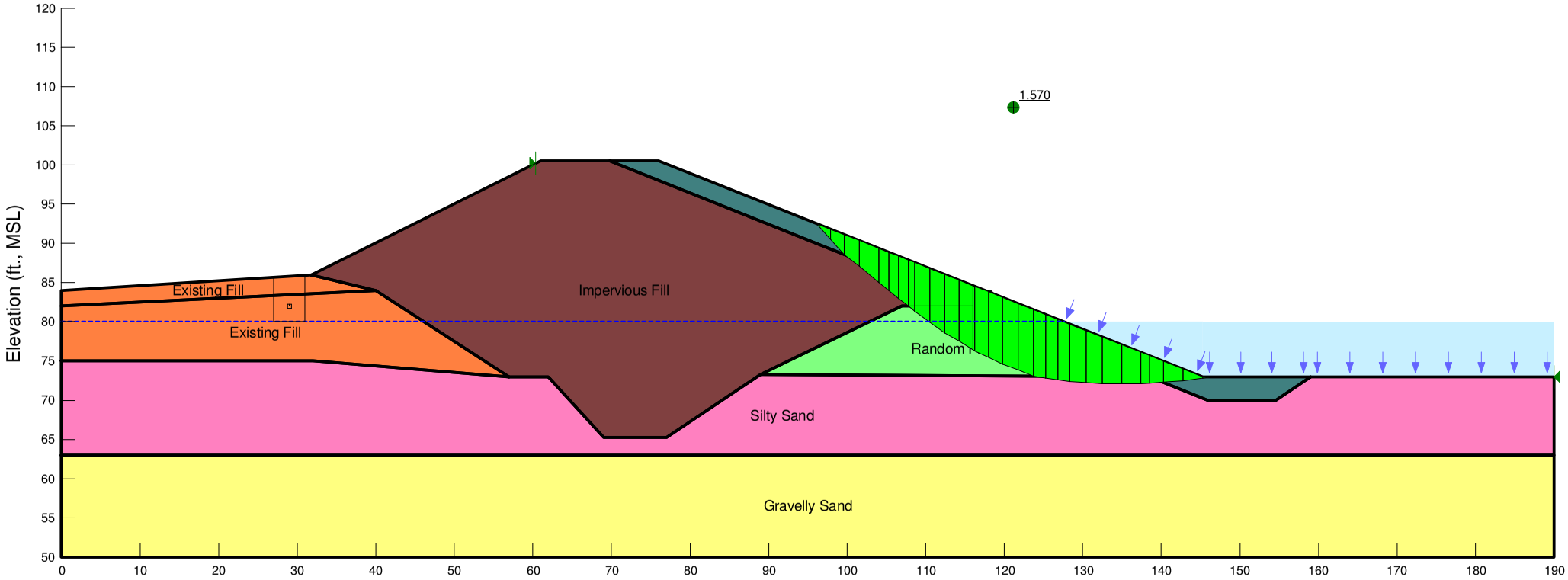
Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 41+00 - Riverside Slope Stability - Normal Conditions

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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Chicopee, Massachusetts
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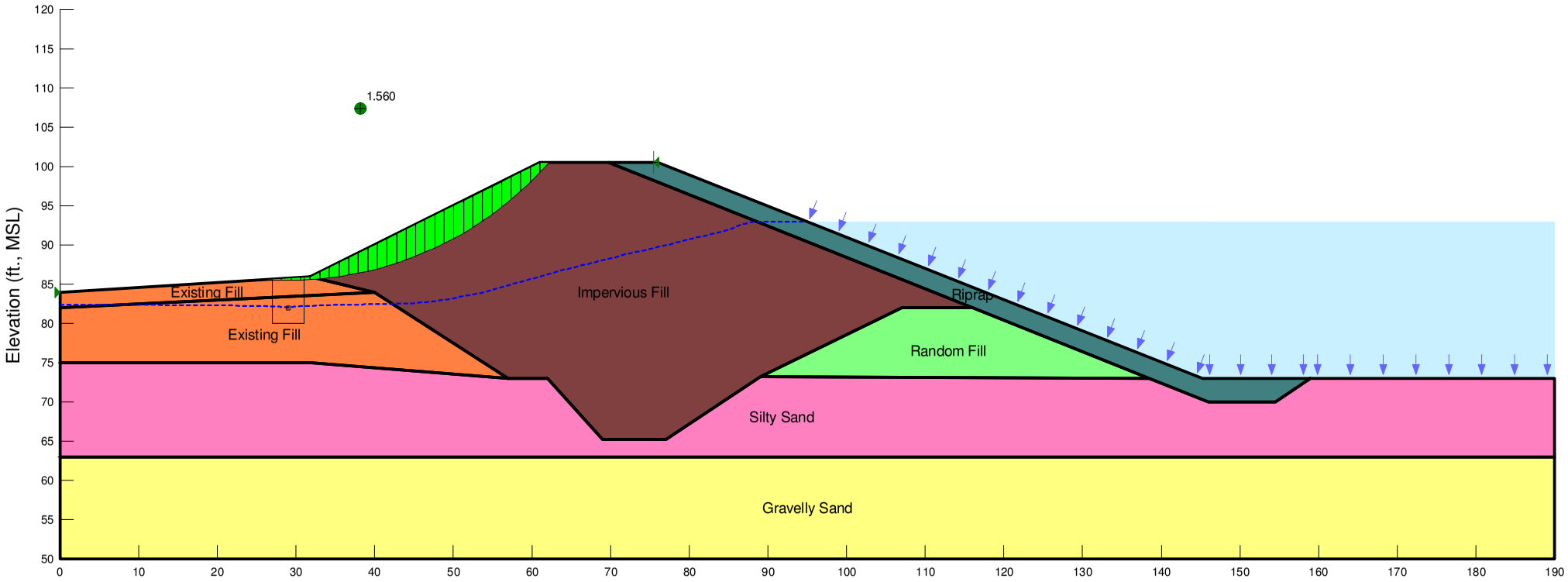

Station 41+00 - Landside Slope Stability - 100yr Flood

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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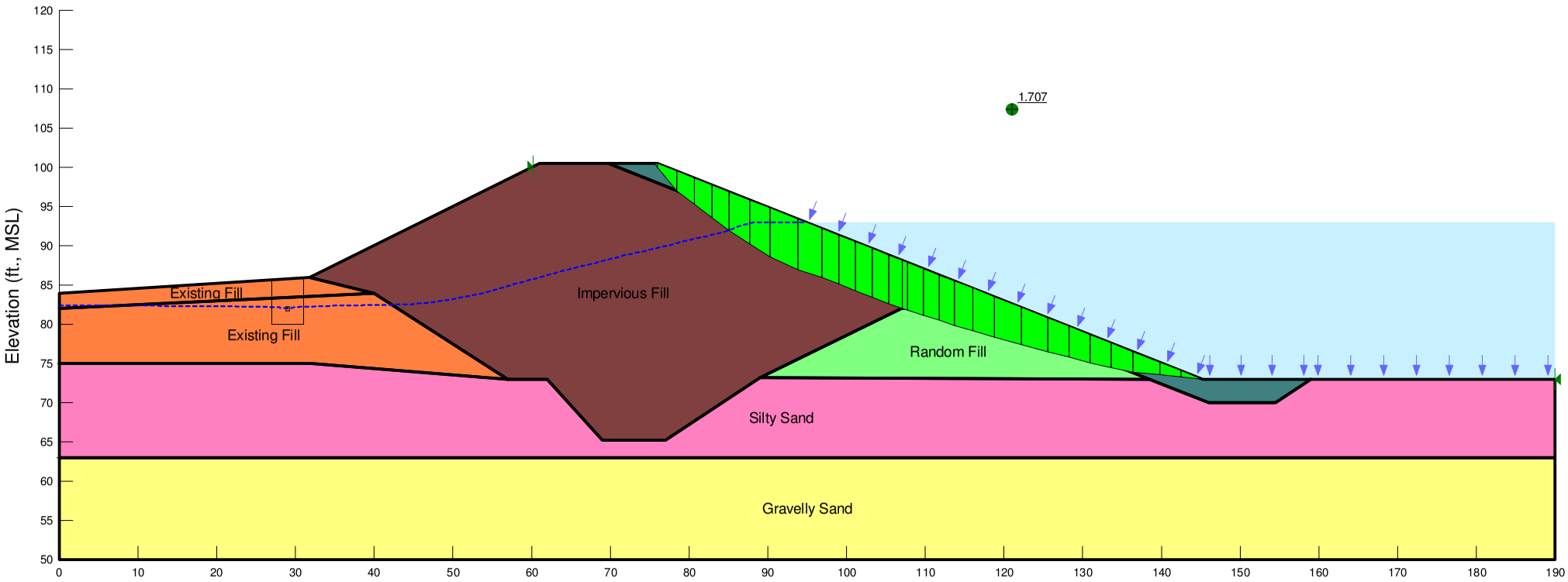

Station 41+00 - Riverside Slope Stability - 100yr Flood

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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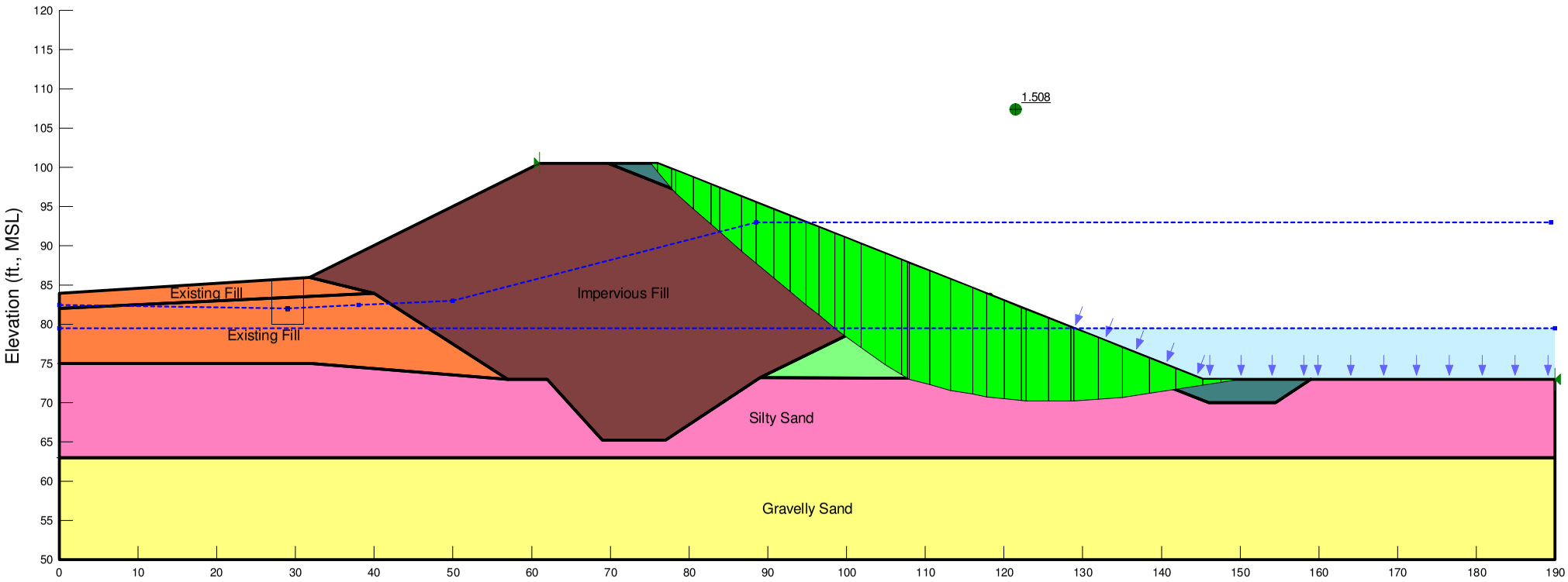

Station 41+00 - Riverside Slope Stability - 100yr Drawdown

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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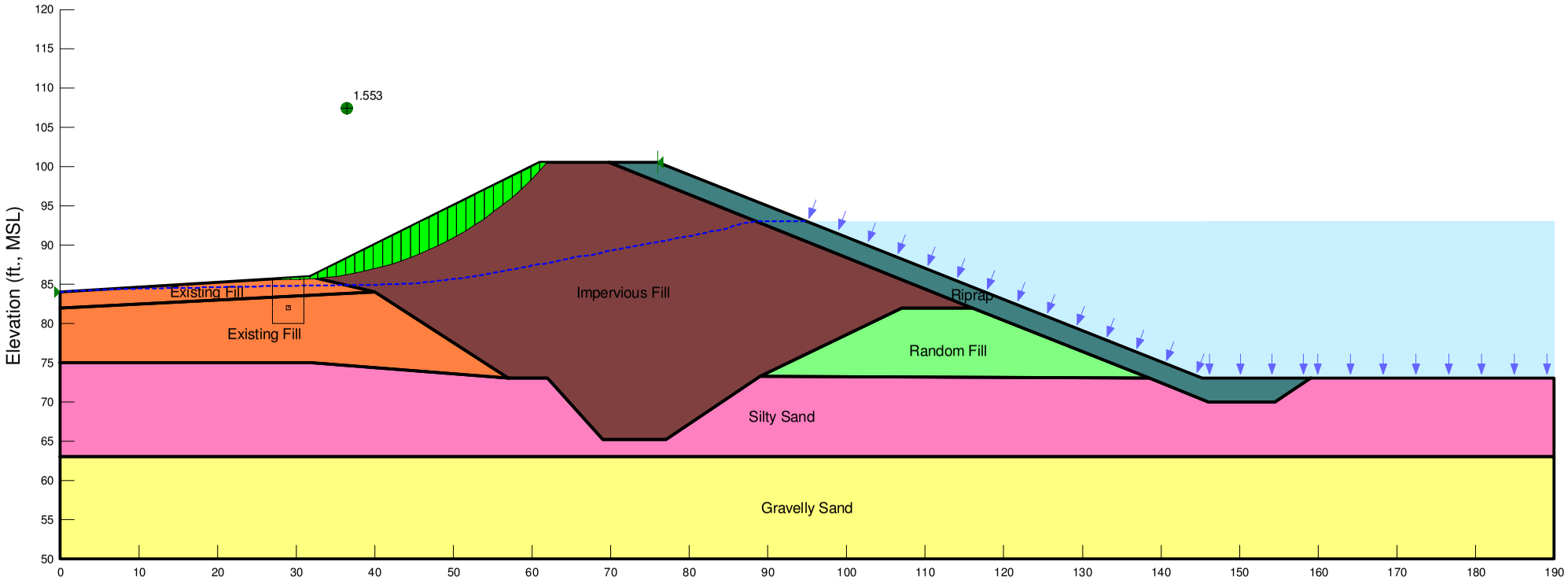
Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 41+00 - Landside Slope Stability - 100yr Flood (No Drain)

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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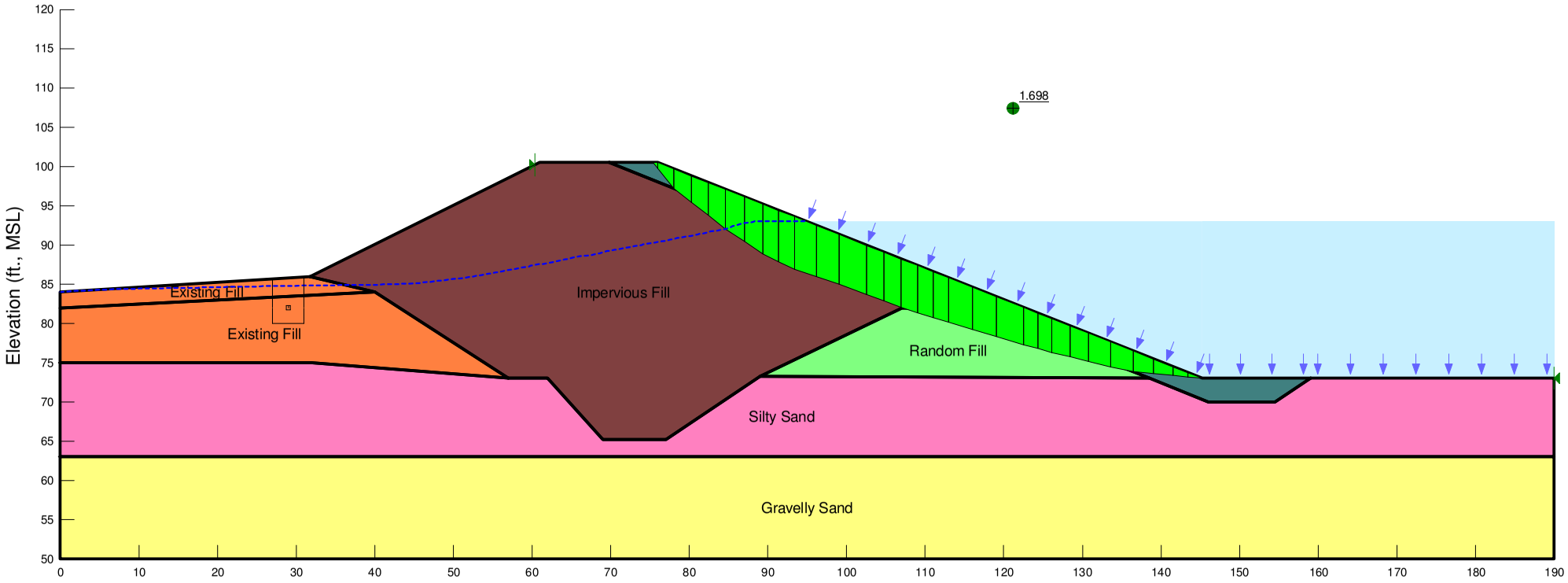
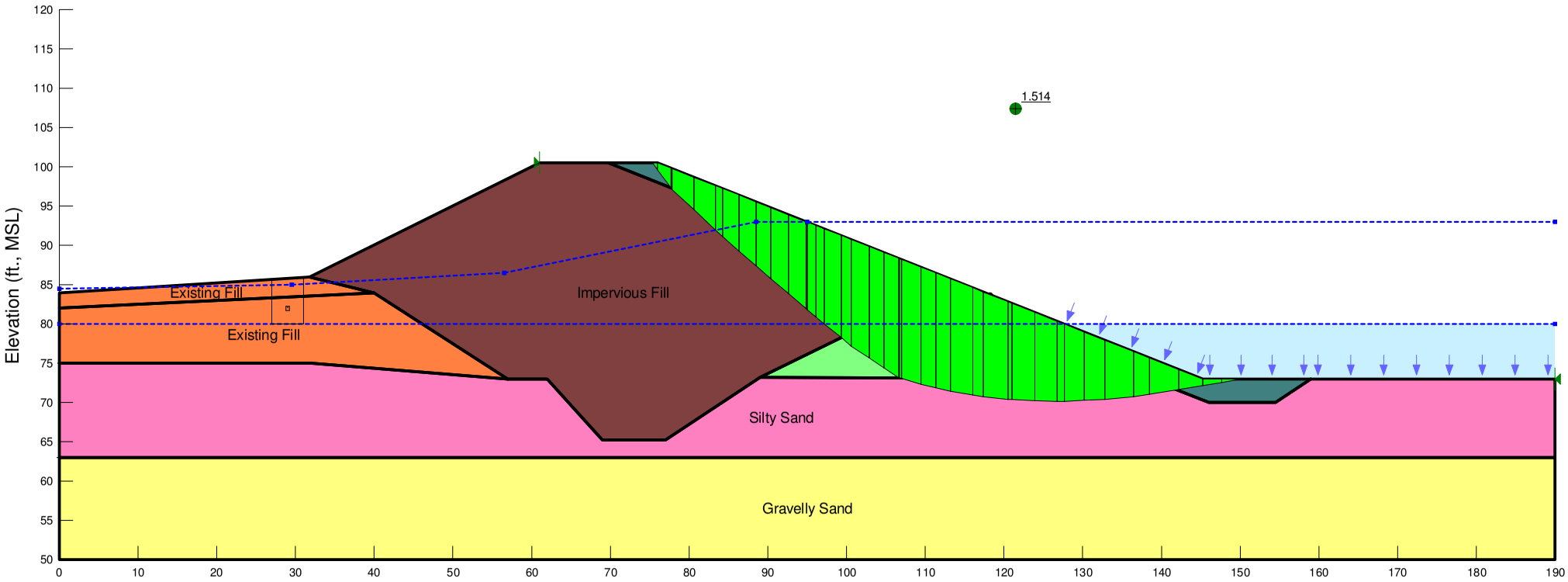
Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 41+00 - Riverside Slope Stability - 100yr Flood (No Drain)

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

Chicopee Flood Control - Chicopee Falls Section
Chicopee, Massachusetts
GZA Project No. 15.0702100.50



Station 41+00 - Riverside Slope Stability - 100yr Drawdown (No Drain)

Note: Elevations in Means Sea Level datum. To convert to NAVD88, subtract 0.7' (MSL = NAVD88 + 0.7').

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JOB	15.0702100.50 - Chicopee River Levee		
SHEET NO.	1	**OF**	2
CALCULATED BY	JGD	**DATE**	6/17/2010
CHECKED BY	ABB	**DATE**	
SCALE		N/A	

Objective: To assess seepage FS for the flood walls of the **Chicopee Falls Section** of the Chicopee Flood Control Works

Method:

1) Develop typical cross section of flood wall at "worst-case" stations.
   a) Stations having the largest difference bewteen flood elevations and landside grade
   b) Stations having the largest difference bewteen the bottom of footing and top of bedrock.
2) Determine subsurface profile from closest test borings and Corps design drawings.
3) Using soil parameters developed for levee embankment analyses, calculate exit gradient using SEEP/W. If a soil layer exists for the wall section which wasn't used in the embankment analyses, estimate permeability using grain-size correlations (if tested) or typical values for similar materials.
4) The following cases were analyzed and compared to the USACE limiting gradient of 0.5:

Case #1 - 100-yr Flood - Operating Drain
Case #2 - 100-yr Flood - No Drain

Subsurface Information:

- Test borings CF-1 through CF-11 and Exploration Location Plan by GZA (2009)
- "Chicopee River Flood Control - Chicopee Falls, Chicopee River, Massachusetts" U.S. Army Engineer Division, New England Corps of Engineers, Waltham, Mass. Dated April 1963
- "Chicopee Falls Local Protection Project - Design Memorandum No. 5 - Embankments and Foundations" U.S. Army Engineer Division, New England Corps of Engineers, Waltham, Mass. Dated March 1963

Assumptions:

- Soil strata interpreted from available test boring data and design drawings, actual configuration may vary.

Material Properties:

Strata	K Ratio (k_v/k_h)	Saturated Horizontal Permeability, k_{sat} ft/s	Saturated Horizontal Permeability, k_{sat} cm/s	Notes
Random Fill	1	3.3E-04	1.0E-02	(3)
Existing Fill	1	3.3E-05	1.0E-03	(1)
Silty Sand	1	4.6E-06	1.4E-04	(2)
Gravelly Sand	1	6.6E-05	2.0E-03	(2)
Riprap	1	8.0E-03	2.4E-01	(1)
Sandstone	1	1.6E-06	5.0E-05	(1)
Concrete	1	3.3E-11	1.0E-09	(1)

(1) - Permeability values based on typical values for similar materials
(2) - Permeability values estimated from correlations with grain size distribution
(3) - Permeability values based values used in USACE report

Analysis Results:

SEEPAGE ANALYSIS RESULTS - STATION 9+00 (TYPICAL FROM STATION 0+00 TO 9+50)

Case	River Elevation	Landside Elevation[1]	Max. Exit Gradient, i_e [2]	Limiting Gradient[3]	OK?
1	100yr Flood (El. 99.3)	83	0.03	0.5	OK
2	100yr Flood (No Drain)	92	0.13	0.5	OK

SEEPAGE ANALYSIS RESULTS - STATION 20+00 (TYPICAL FROM STATION 16+82 TO 25+50)

Case	River Elevation	Landside Elevation[1]	Max. Exit Gradient, i_e [2]	Limiting Gradient[3]	OK?
1	100yr Flood (El. 99.3)	84	<0.01	0.5	**OK**
2	100yr Flood (No Drain)	88.5	0.03	0.5	OK

- Note: Factor of safety values less than recommended values are shown in italics
(1) - Landside elevation refers to grade or toe drain, depending on the case
(2) - Flow and exit gradient estimated from results of SEEP/W analysis at toe drain or landside ground surface
(3) - Limiting gradient per requirements of US Army Corps Technical Letter ETL 1110-2-569 "DESIGN GUIDANCE FOR LEVEE UNDERSEEPAGE'

APPENDIX A-4.5

SETTLEMENT

APPENDIX A-4.6

INTERIOR FLOODING

U.S. Department of Homeland Security
Region I
99 High Street, 6th Floor
Boston, Massachusetts, 02110-2320

FEMA

July 19, 2010

The Honorable Michael D. Bissonnette
17 Springfield Street
Chicopee, MA 01013

Appeal Resolution and Revised Preliminary Digital Flood Insurance Rate Map

Dear Mayor Bissonnette:

Thank you for your interest and engagement with us through the floodmap revision process. As you recall, preliminary Hampden County Digital Flood Insurance Rate Maps (DFIRMs) and Flood Insurance Study (FIS) report were provided to your community on April 30, 2009. We recognize the impact the revised flood mapping could have on the community and have devoted close and serious attention to the matter. The purpose of this letter is to provide you with a revised preliminary DFIRM for your community, as well as to give you a status update and describe next steps in the process.

We have completed our preliminary review of the Interior Drainage Analysis submitted to FEMA on May 26, 2010 in support of the City of Chicopee's prior technical appeal that was submitted to FEMA during the 90-day appeal period offered for Hampden County. This appeal addressed the extent of the flooding represented on the preliminary DFIRMs in the vicinity of the drainage pump station locations behind the Chicopee Flood Control Systems and demonstrated a new extent of flooding based on an interior drainage analysis. While the technical analyses submitted for each individual pumping station demonstrates the ability of the flood control system to reduce flooding on the protected side of the levee system, FEMA cannot accept the appeal until the City attains certification of the Chicopee flood control system as providing protection from the 1-percent-annual-chance flood. We are aware that the City continues to work closely with USACE to make improvements so that the Chicopee flood control systems may ultimately be certifiable. FEMA greatly appreciates your continued efforts towards reaching this goal. Once certification is achieved, the City may submit data at any time showing that the criteria of Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44 CFR 65.10) have been met. If the required data and documentation are acceptable, FEMA will initiate a map revision to accredit the levee system and map the impacted areas on the landward side of the levee system as being protected from the 1-percent-annual-chance flood. As the interior drainage analysis submitted appears to be technically valid, we will retain this appeal information so that it may be used in future mapping updates as described above and as appropriate.

In accordance with 44 CFR 65.10, it is the responsibility of the community or other party seeking recognition of a levee system, to provide the data and documentation defined and outlined in 44 CFR 65.10. Specifically, the design and construction data provided must be certified by a registered professional engineer or by a Federal agency with responsibility for levee design.

As was noted in the supporting analyses of your appeal, Plainfield Street Flood Control System along the Connecticut River is a continuation of a flood control system in the City of Springfield. As a result of the Springfield accredited flood control system and Springfield appeal resolution, the following current preliminary DFIRM panel has been revised and affects a portion of the City of Chicopee: 25013C0213C.

For your review and comment, we have mailed you a CD containing a PDF of the above-mentioned revised preliminary DFIRM panel and a hard copy of the revised preliminary DFIRM panel was forwarded to your community's Floodplain Administrator. The revised copy will replace the current preliminary map panel for the community. Please note that not all panels in your community were affected by this revised preliminary issuance.

Your community will have 30 days from the receipt of this letter to comment on this revised information. All comments should be compiled and verified by the community and sent to FEMA Region I, attention:

David Mendelsohn
99 High Street, 6th Floor
Boston, MA 02110

After this comment period has ended and all comments have been addressed, the Letter of Final Determination (LFD) will be sent to you. The new DFIRMs and FIS report for your community will become effective 6 months later. Following the LFD date and before the effective date, you will be reminded that your community must adopt new floodplain ordinances or modify existing ordinances as necessary to reflect any changes in the DFIRMs or FIS report, including reference to the new effective date. If you or other community officials have any questions regarding the floodplain ordinance for your community, you may raise them at the community coordination meeting if such a meeting is held, or you may discuss those issues with your State NFIP Coordinator. Approximately 1 or 2 months before the effective date, we will send your community printed copies of the DFIRMs and FIS report.

The floodmap gives your community the means to mitigate flood risk through improved floodplain management policies and tactics and enables your citizens to mitigate their risk through implementing flood-resistant building techniques and/or buying flood insurance. These maps can also play an important part of your community's disaster planning. It is important to FEMA that we collaborate with you to develop the most accurate flood maps possible. If you have any questions about the flood map update process , have suggested areas for improvement, or are interested in discussing the

enclosed data, please contact Kerry Bogdan with FEMA Region I, at (617) 956-7576 or David Mendelsohn with FEMA Region I, at (617) 832-4713.

Sincerely,

Michael J. Goetz, Branch Chief
Mitigation Division

Enclosure: Revised Preliminary DFIRM CD

cc: (Enclosure not included)
The Honorable Deval Patrick, Governor
The Honorable John F. Kerry, U.S. Senator
The Honorable Scott Brown., U.S. Senator
The Honorable John W. Olver, U.S. Congressman
The Honorable Richard E. Neal, U.S. Congressman
The Honorable James T. Welch, State Representative
Natalie M. Blais, Congressman Olver's Office
Thomas Hamel, Chief Operator, Chicopee DPW
Stanley W. Kulig, Superintendent of Public Works
Rosalie Starvish, Baystate Environmental Consultants, Inc.
Scott Michalak, U.S. Army Corps of Engineers
Richard Zingarelli, State Floodplain Manager, MA Dept. of Conservation and Recreation
Kerry Bogdan, FEMA Region I
David Mendelsohn, FEMA Region I
Stuart Rooney, AECOM
Laura Keating, Regional Service Center

INTERIOR FLOODING ANALYSIS

CHICOPEE FALLS FLOOD CONTROL SYSTEM

CHICOPEE FLOOD CONTROL WORKS

CITY OF CHICOPEE

HAMPDEN COUNTY, MASSACHUSETTS

May, 2010

Baystate Environmental Consultants, Inc.

A GZA Company

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Tables

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Appendices

1 INTRODUCTION

The interior drainage analysis for the City of Chicopee's Chicopee Falls Flood Control System was performed in accordance with 44 CFR 65.10(b)(6), and the United States Army Corps of Engineers (USACE) Engineering Circular on Certification of Levee Systems (EC 1110-2-6067).

The following sources were consulted for information supporting the interior drainage analysis:

- U.S. Army Corps of Engineers, *Connecticut River Flood Control; Chicopee Falls Local Protection Project; Chicopee River, Massachusetts; Design Memorandum No. 2; General Design, Hydrology, Hydraulics & Geology* (December 1962).
- U.S. Army Corps of Engineers, *Operation and Maintenance Manual For Flood Protective Works on Connecticut and Chicopee Rivers at Chicopee - Chicopee Falls, Massachusetts* (1984).
- Federal Emergency Management Agency, *Preliminary Flood Insurance Study Number 25013CV001* (April 30, 2009)

All elevations referenced in this report are NAVD88 datum.

1.1 Sources of Flooding

The Chicopee Falls Flood Control System protects the Chicopee Falls section of the City of Chicopee from flooding along the Chicopee River.

1.2 Chicopee Flood Control Works Overview

The Chicopee Flood Control Works (CFCW) includes the Chicopee Local Protection Project (CLPP) and the Chicopee Falls Local Protection Project (CFLPP). The CFCW was constructed in four separated systems, namely the Willimansett System, the Plainfield Street System, the South Bank Chicopee River System, and the Chicopee Falls System. The CFCW, its four systems, and the sources of flooding are summarized below.

Table 1. City of Chicopee Flood Control Works

Chicopee Flood Control Works (CFCW)	
Chicopee Local Protection Project (CLPP)	**Source of Flooding**
Willimansett System	Connecticut River
Plainfield Street System	Connecticut River
South Bank Chicopee River System	Chicopee River
Chicopee Falls Local Protection Project (CFLPP)	**Source of Flooding**
Chicopee Falls System	Chicopee River

This report describes the interior drainage analysis for the Chicopee Falls System. In total, the Chicopee Falls System includes two (2) pumping stations. The attached locus plan (Figure 1) illustrates the locations of the Main Street and Oak Street pumping stations.

1.3 Chicopee Falls System

The Chicopee Falls System includes two pumping stations: the Main Street Pumping Station and the Oak Street Pumping Station, which discharge stormwater runoff and toe drain seepage from the low-lying areas landward of the flood control system. The 31±acre interior drainage area is divided between the Main Street Pumping Station to the north (upstream), at 16± acres, and the Oak Street Pumping Station to the south (downstream), at 15± acres. Collector drains which run alongside the flood control system discharge to both pumping stations. There also are floodwall and levee toe drains which discharge to the collector drains.

The two pumping stations are of a similar design. Each pumping station has one (1) gravity-flow outlet to the Chicopee River, which is used during low river stages. Each has sluice gates which control and direct the flow of stormwater runoff to either the gravity outlet or the pumping wet well, depending upon river conditions.

The Main Street Pumping Station's gravity outlet is a 36-inch square conduit. The pumping station houses two (2) Detroit diesel engines driving two (2) 16-inch propeller pumps, each with a rated capacity of 20 cubic feet per second (cfs) at a static head of 19.4 feet and a total dynamic head of 21.4 feet (river at high stage). Both pumps discharge through the pumping station's riverward wall, directly to the Chicopee River.

The Oak Street Pumping Station's gravity outlet is a 48-inch square conduit. The pumping station houses three (3) Detroit diesel engines and three (3) 16-inch propeller pumps, each with a rated capacity of 16 cfs at a static head of 21.1 feet and a total dynamic head of 23.5 feet (river at high stage). All three pumps discharge to the 48-inch outlet, which serves as a pressure conduit discharging to the Chicopee River when the appropriate sluice gates are closed.

2 INTERIOR HYDROLOGIC ANALYSIS

The U.S. Army Corps of Engineers Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) was used to apply the Soil Conservation Service (SCS) curve number loss and unit hydrograph models to generate runoff hydrographs from each of the interior drainage areas. For each pumping station, the HEC-HMS model includes one or more subwatershed(s) that represents the interior drainage area. The model uses applied precipitation in the form of a hypothetical, SCS Type III, 24-hour storm distribution, and drainage area characteristics to generate runoff.

2.1 Precipitation

Precipitation was applied to each drainage area in the HEC-HMS model as a hypothetical, SCS Type III, 24-hour storm distribution. The depth in inches applied for each storm event frequency is summarized as follows.

Table 2. Precipitation

Storm Event Frequency	24-Hour Precipitation Depth (inches)
1-Year	2.5
2-Year	3.1
5-Year	3.8
10-Year	4.5
25-Year	5.2
50-Year	5.8
100-Year	6.6
500-Year	7.9

The precipitation depths for the 2-, 5-, 10-, 25-, 50-, and 100-year frequency storm events were obtained from the Intensity-Duration-Frequency (IDF) curve for Springfield, Massachusetts, from the Massachusetts Department of Transportation (MassDOT), Highway Design Manual (1997). These curves were compiled from information included in Technical Paper No. 25, *Rainfall Intensity-Duration-Frequency Curves*, U.S. Weather Bureau (December, 1955). The depth for the 1-year frequency storm event was taken from Technical Paper (TP) No. 40, *Rainfall Frequency Atlas of the United States* (1963), as the Springfield IDF curves did not exhibit a 1-year frequency event. The depth for the 500-year frequency storm event was extrapolated from the existing data.

2.2 Interior Drainage Areas

The City of Chicopee provided mapping of the areas draining to each pumping station based upon stormwater collection systems and the current status of combined sewer system diversions and separation efforts. Neither of the Chicopee Falls System pumping stations are believed to receive wet weather flow discharges from combined sewer systems within Chicopee Falls. Drainage areas were delineated based on the information provided by the City, as well as a review of existing topography taken from *Topographic Plan of Land in Chicopee, MA*, Heritage Surveys, Inc. (Preliminary-December 12, 2009), and the Massachusetts Geographic Information System (MassGIS) Digital Elevation Model (February, 2005). Other sources of information which were reviewed as part of the drainage area delineations include the USACE design documents for each of the pumping stations, and the following plans as they relate to drainage:

1. Map of Phased Recommended Plan, Final Long-Term CSO Control Plan, Chicopee, Massachusetts, Tighe & Bond Consulting Engineers (October, 2009)

Existing conditions were reviewed in the field to validate these prior plans. The interior drainage areas for the Main Street and Oak Street Pumping Stations are shown on Figures 2 and 3, and the computed areas in acres of each drainage area are included in Table 3.

The SCS (USDA's Soil Conservation Service, now the Natural Resources Conservation Service) runoff curve number (CN) is an empirical parameter used in hydrology for predicting direct runoff or infiltration from rainfall excess. The CN is widely used and is an efficient method for determining the approximate amount of direct runoff from a rainfall event in a particular watershed or drainage area. It is a function of the hydrologic soil group (HSG), the land use/cover complex, and the antecedent moisture condition.

These three watershed factors have the most significant impact in determining runoff from a watershed, and, in conjunction with precipitation data, provide the basis for runoff volume estimation.

The HSG is identified for each soil type in the SCS soil classification system. There are four groups ranging from A, for soils with high infiltration rates and low runoff potential, to D, for soils with low infiltration rates and high runoff potential. The MassGIS SCS soil group datalayer was utilized to identify the soil types within each drainage area. Each soil type was then categorized according to its HSG by reference to the Hampden County Soil Survey (SCS). For those soils which had a compound classification (e.g. were classified as C/D, B/C, etc.), a single representative HSG was calculated, based on a weighting of the individual soils in the map unit. A map of soil types within the drainage areas to the Main Street and Oak Street Pumping Stations is included as Figure 4.

The land uses within each drainage area were identified by reference to the MassGIS Land Use 2005 datalayer. The land uses were modified to reflect current conditions as needed. Each land use is associated with a curve number depending on the HSG within the area. A composite curve number for each drainage area was generated based on the areas of each HSG within each land use. Tables summarizing the composite curve number calculation for both drainage areas are included in Appendix A. Average antecedent soil moisture conditions (Condition II) were assumed. The resulting curve numbers are listed in Table 3.

The SCS unit hydrograph method applies the lag time to scale the dimensionless generalized hydrograph to produce the unit hydrograph used in the analysis. The standard lag is defined as the length of time between the centroid of precipitation mass and the peak flow of the resulting hydrograph. Studies by the SCS found that in general the lag time can be approximated as 60% of the time of concentration, which was applied for this analysis.

The time of concentration is the time required for water to travel from the most hydrologically remote point in the drainage area to the point of collection. It is computed as the sum of the travel times of sheet flow, shallow concentrated flow, and channel or pipe flow. The travel time of sheet flow depends on the length of flow, surface cover, precipitation intensity and slope. For this analysis, the length of sheet flow was assumed to be on the order of 50 to 100 feet, while the slope was assumed to be 2 percent. The precipitation intensity was represented by the 2-year, 24-hour rainfall depth using the Welle and Woodward (1986) equation for sheet flow (McCuen, R.H., Hydrologic Analysis and Design, 2nd ed., 1998). The Manning's Roughness Coefficient (n) for overland flow surfaces represents surface cover effects.

The travel times of shallow concentrated flow and channel/pipe flow are computed based on the velocity of flow. The velocity of shallow concentrated flow was computed using the Manning's Equation. By applying assumed values for the hydraulic radius and Manning's n coefficient, the equation is simplified to provide a relationship between the velocity and the average slope of the surface. The hydraulic radius and Manning's n are incorporated into a factor, k, which varies with surface cover. The slope of shallow concentrated flow was assumed to be 2 percent for this analysis.

Chicopee Falls is a highly-developed area; thus, drainage is delivered to the pumping stations via a network of pipes. Therefore, the last segment of the time of concentration calculation assumes pipe flow. Flow capacities of these closed systems were not specifically computed, as that effort is beyond the scope of this analysis. The travel time is computed as the length of pipe flow divided by the velocity of flow. A

velocity of 2.5 feet per second was assumed for pipe flow in Chicopee Falls. The lag times for each drainage area are included in Table 3.

Table 3. Drainage Area Characteristics

Drainage Area	Area (acres)	Curve Number	Lag Time (minutes)
Main Street	16	88	50
Oak Street	15	92	10

Appendix A includes the calculations for the composite SCS runoff curve number and lag time for each drainage area.

2.3 Other Sources of Pumping Station Inflow

As indicated in the table below, the Main Street and Oak Street pumping stations receive inflow from the toe drains, generally limited to periods of high river stage. The toe drain seepage flows applied in the model are based on information provided in the USACE design reports for the pumping stations. There are no additional sources of inflow to the pumping stations.

Table 4. Other Sources of Pumping Station Inflow

Pumping Station	Assumed Toe Drain Seepage Flow (cfs)
Main Street	6 (during high river stage only)
Oak Street	4 (during high river stage only)

3 INTERIOR HYDRAULIC ANALYSIS

HEC-HMS is used to evaluate the hydraulics of discharge from each interior area to the river through the levee. During an interior storm event, interior drainage may discharge to the river via a gravity outlet through the levee, or by being pumped through the pumping station. The method of discharge will depend on the exterior river stage during the interior storm event, identified on the river frequency curves as the Pump Activation Elevation. In HEC-HMS, the potential interior flooding area is represented by a reservoir. HEC-HMS has the capability of modeling discharge from a reservoir through gravity outlets and/or by pumping. Models were developed for each pumping station that incorporate both gravity outlets and pumping. In addition, the model includes setting a tailwater on each reservoir to represent the exterior river stage.

Reservoirs are defined in HEC-HMS by a stage-storage curve. Reservoir stage-storage data for each of the pumping stations was determined based on the Digital Elevation Model (Feb., 2005) provided by the Massachusetts Geographic Information System (MassGIS). The storage volume between elevations was computed using ESRI's ArcGIS 3D Analyst. The Main Street and Oak Street pumping stations do not have storage ponds; thus, the potential flood storage areas were defined by the topographical characteristics of each drainage area's lower elevations. The storage provided by the sump for each pumping station

was incorporated into the stage-storage data. The stage-storage data for each pumping station is included in Appendix B.

The pumps are defined in HEC-HMS by pump-head discharge curves, which are based on the pump capacity information provided in the U.S. Army Corps of Engineers' "Analysis of Design" documents prepared for each of the pumping stations. The discharge varies with the head on the pump which depends on the exterior river stage. The pump-head discharge curves are included in Appendix C. The derivation of the curve for each pumping station is described below.

For simplicity in modeling, it was conservatively assumed that the efficiency of the drainage systems conveying runoff to each pumping station is 100%. That is, it was assumed that all direct runoff generated over the drainage area was able to enter the drainage system and reach the pumping stations with no delay or surcharging. In reality, inefficiencies (such as undersized pipes or clogged inlets) of the drainage system would impede the conveyance of direct runoff to the pumping stations. Modeling results indicated no interior flooding at Main Street and Oak Street pumping stations; thus, it was deemed unnecessary to further refine the models for these pumping stations by including some allowance for the inefficiency of the drainage systems.

The specific assumptions applied to the hydraulic model for each pumping station are described as follows.

3.1 Main Street Pumping Station

Pump capacity curves were not provided in the USACE Design Memorandum No. 2, General Design, Hydrology, Hydraulics & Geology (December 1962) for the Main Street Pumping Station. However, pump design capacities were provided for two values of pump head; thus, a simplified pump head-discharge curve was developed using the provided values. The two pumps at the Main Street Pumping Station were field tested on April 1, 2010, to verify pumping capacities. The Chicopee River elevation was below the pump discharge elevation during the test. Two trials were performed for each pump, in which the time to reach various stages in the wet well was recorded. The average pump rate for each pump was then computed. The pump tests indicated an overall pumping station pumping rate equivalent to about 82% of the design pumping rates provided. Pump test data is included in Appendix D. The subsequent interior drainage analysis was conducted for both full design pumping rates and at reduced pumping rates equivalent to 82% of the design pumping rates, which is representative of documented pumping rates. Full station capacity consists of two 16-inch pumps.

3.2 Oak Street Pumping Station

Pump capacity curves were not provided in the USACE Design Memorandum No. 2, General Design, Hydrology, Hydraulics & Geology (December 1962) for the Oak Street Pumping Station. However, pump design capacities were provided for two values of pump head; thus, a simplified pump head-discharge curve was developed using the provided values. The three pumps at the Oak Street Pumping Station were field tested on April 1, 2010, to verify pumping capacities. The Chicopee River elevation was below the pump discharge elevation during the test. Two trials were performed for each pump, in which the time to reach various stages in the wet well was recorded. The average pump rate for each pump was then computed. The pump tests indicated an overall pumping station pumping rate equivalent

to about 65% of the design pumping rates provided. Pump test data is included in Appendix D. The subsequent interior drainage analysis was conducted for both full design pumping rates and at reduced pumping rates equivalent to 65% of the design pumping rates, which is representative of documented pumping rates. Full station capacity consists of three 16-inch pumps.

Elevations of interest for these pumping stations are listed below.

Table 5. Elevations of Interest, feet (NAVD88)

Pumping Station	Elevation of Gravity Outlet	Pump Activation Elevation	Approximate Exterior Ground Elevation at Pumping Station Location	Elevation of Levee at Pumping Station Location	Elevation of Riverine 100-Year Flood at Pumping Station Location
Main Street	76.3	81.8	89.0	104.4	94.6
Oak Street	75.3	78.3	85.1	99.3	91.4

4 COINCIDENT FREQUENCY ANALYSIS

The federal regulations pertaining to mapping of areas protected by levee systems indicates that the analysis of interior flooding must be based on *"the joint probability of interior and exterior flooding"* (44 CFR 65.10(b)(6)). The USACE Engineering Circular on Certification of Levee Systems (EC 1110-2-6067) states: *"The analysis of interior flooding is based on a coincident analysis of exterior and interior stages that includes the capacity of gravity and blocked gravity drainage features. Coincident analysis for interior areas is explained in Chapter 4 of EM 1110-2-1413, Hydrologic Analysis of Interior Areas. For riverine levee systems, the interior analysis considers interior rainfall events during both low river stages (gravity conditions) and high river stages when the gravity outlets are closed (blocked conditions) and the performance of pumping stations as might exist."* The U.S. Army Corps of Engineers' Engineer Manual, "Hydrologic Analysis of Interior Areas" (EM 1110-2-1413) provides guidance for a "Coincident Frequency Method" of analysis which computes the percent chance exceedance frequencies of various interior flooding elevations based on the probabilities of exceeding given exterior river stages during different interior storm events. Coincidence is the degree to which the interior and exterior events occur at the same time. The Coincident Frequency analysis provides a method to compute the joint probability of interior and exterior flooding and to determine the base flood elevation for interior areas.

The Coincident Frequency Method is a probabilistic approach that is applicable to areas where the occurrence of the exterior and interior events are independent, such that the physical and meteorologic processes of the exterior and interior events are unrelated. Relatively small interior areas located along large rivers, such as in Chicopee, are typically independent. At the confluence of the Connecticut River

and the Chicopee River, the watershed to the Connecticut and Chicopee Rivers are 9,000± square miles and 722± square miles, respectively. The drainage area to the Main Street Pumping Station is 16 acres and to the Oak Street Pumping Station is 15 acres. The ratio of river watershed to interior drainage area is approximately 30,000:1. As such, the behavior of interior runoff generation is highly independent of the river's hydrologic behavior, and the Coincident Frequency Method is a valid approach in this setting.

In accordance with the Coincident Frequency Method, the probability of exceeding a given interior flooding elevation, "A", is computed as follows:

$$P(A) = \sum_{i=1}^{n} [P(A/Bi) \times P(Bi)]$$

Where:

A = given interior flooding elevation;

Bi = given exterior river stage, from i = 1 to n stages;

P(A) = total probability of attaining a given interior flooding elevation;

P(Bi) = probability that the river is at a given exterior river stage;

P(A/Bi) = probability of attaining a given interior flooding elevation if the exterior river stage is at a specific elevation.

The river stages, Bi, and probabilities of each river stage, P(Bi), were determined from the Chicopee River Stage Frequency curves developed by the local USGS gage data at Indian Orchard, Springfield, MA (USGS 01177000). The period of record spans from 1928 to the present. The Chicopee River modified stage frequency curves at Main Street and Oak Street Pumping Stations were determined by translating the Indian Orchard gage data to the locations of the pumping stations based on the stages at each location, as indicated by the flood profiles computed by the U.S. Army Corps of Engineers in the Chicopee Falls Local Protection Project Design Memorandum No. 2. The differences in stage vary with discharge; thus, the translated stages were computed depending on the recorded discharge at Indian Orchard.

Table 6. Adjustments for Stage Frequency Curves

From USACE Profiles:

Chicopee River Discharge, cuft/sec	Main St. Stage, feet (NAVD88)	Oak St. Stage, feet (NAVD88)	Indian Orchard Stage, feet (NAVD88)
10,000	85.0	82.4	136.6
70,000	96.8	94.7	142.6

Stage Adjustment, as compared to Indian Orchard gage data:

Chicopee River Discharge, cuft/sec	Main St. Stage, feet (NAVD88)	Oak St. Stage, feet (NAVD88)
10,000	- 51.6	- 54.2
70,000	- 45.8	- 47.9

Each location-specific stage frequency curve is divided into stage intervals, with each stage interval represented by an index stage, Bi. The probability of each index stage, P(Bi), is computed as the fraction of the percent of time the index stage is equaled or exceeded, in accordance with EM 1110-2-1413. The Chicopee River stage frequency curves for each pumping station are reproduced in Appendix E.

The probability of attaining a given interior flooding elevation if the exterior river stage is at a specific elevation, P(A/Bi), is considered as equivalent to the annual probability of the interior storm events evaluated in the model, as follows:

Table 7. Probability of Attaining a Given Interior Flooding Elevation, if the Exterior River Stage is at a Specific Elevation.

Interior Storm Return Period (Year)	**Interior Storm Annual Probability (P(A/Bi))**
1	1.000
2	0.500
5	0.200
10	0.100
25	0.040
50	0.020
100	0.010
500	0.002

Each interior storm event is analyzed at each exterior river index stage to compute each corresponding interior flooding elevation. The probabilities associated with the various combinations of interior storm events and exterior stage which produce a given interior flooding elevation are multiplied and then summed to compute the total probability of exceeding that interior flooding elevation. A plot of interior flooding stages versus the total probabilities of exceeding each interior flooding stage reveals the interior flooding stage at which the total probability is equal to 0.01 (1%). This recurrence interval is selected by the Federal Emergency Management Agency (FEMA) as the "base flood" for estimating the extent of interior flooding and the calculation of flood insurance rates under the National Flood Insurance Program (NFIP).

Appendix F reproduces the coincident frequency analysis matrices and resultant curves. Matrix One computes the values of [P(A/Bi) x P(B)] for each of the selected river index stages. Each index stage is the midpoint elevation of a selected range of river stage. Matrix Two identifies the interior flood storage elevation for each interior storm event and for each river index stage. The family of curves on Graph One illustrates the relationship of the interior flood elevation and the [P(A/Bi) x P(B)] values for each river

index stage. Then, for each interior flood elevation, the intercept of each index stage curve is summed to provide a value of $\sum$ [P(A/Bi) x P(B)], which is the probability of interior flooding to that particular elevation. These values are then plotted on Graph Two and, for purposes of FEMA interior flooding mapping, P(A) was set at 0.01. The 1% change interior flood elevation is then read directly off Graph Two using linear interpolation between adjacent data points.

5 RESULTS

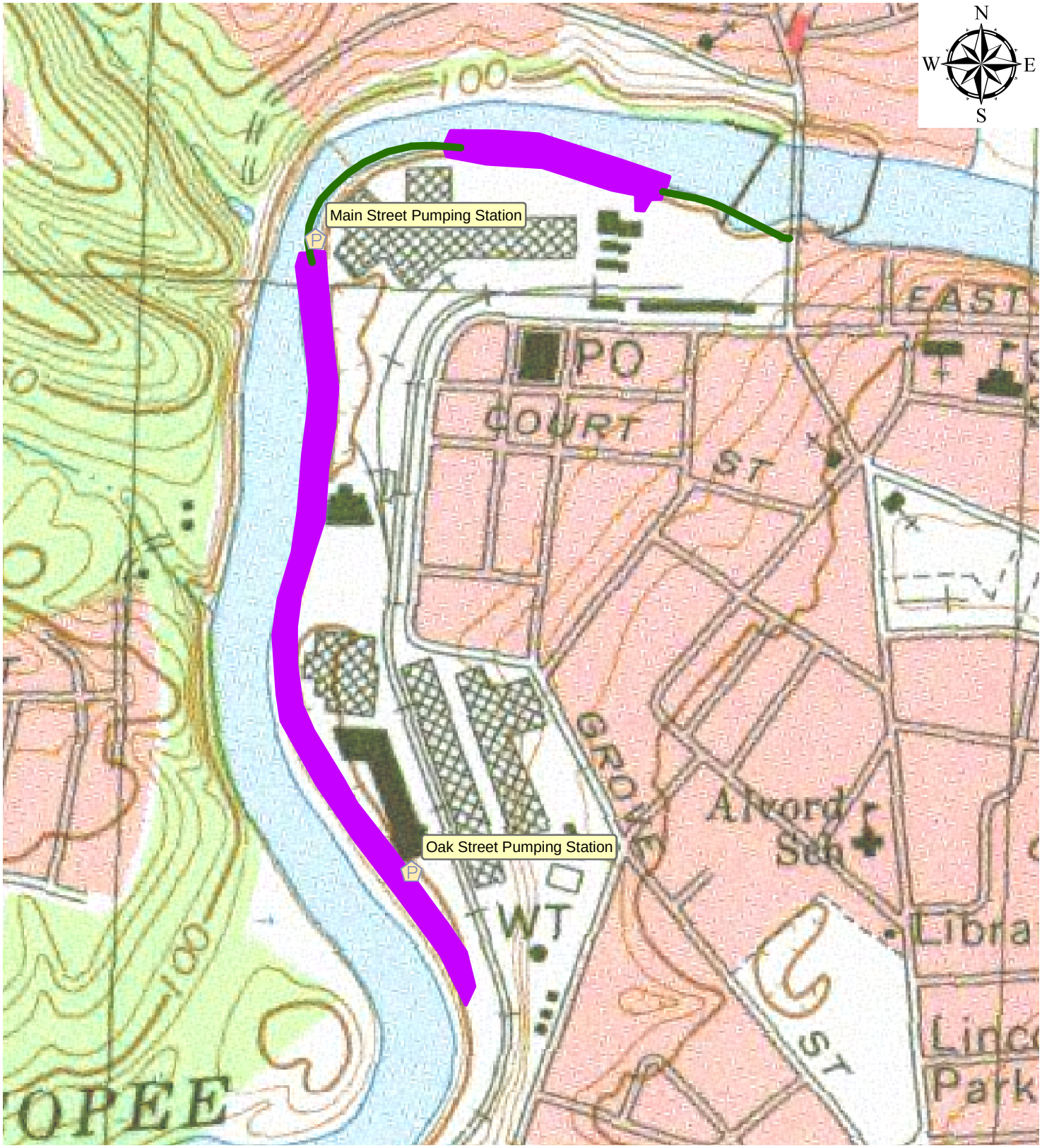
The computed interior stages resulting from the analyses of various combinations of exterior river index stage and interior storm return period for each pumping station are shown on the Coincident Frequency Analysis Matrices in Appendix F. For each pumping station, also included in Appendix F is the summation of probabilities to compute the total probability of exceeding a given interior flooding elevation and determination of the resulting 1% chance interior elevation. The 1% chance interior elevation at each pumping station is summarized in the table below. Also shown is the total area and average depth of interior flooding.

Using design pumping capacities, the computed flood elevation at the Main Street pumping station was 78.6, and at the Oak Street pumping station was 78.7. The predicted 1% chance interior flood elevations at both the Main Street and Oak Street pumping stations do not exceed the lowest ground surface elevations within their respective drainage areas, as indicated by the topographic contours generated from the MassGIS Digital Elevation Model. Therefore, there is no interior flooding associated with the 1% chance event at either of these pumping stations. Using modified pumping rates in the modeling, based on the pumping field tests as described in Sections 3.1 and 3.2, had no impact on the resulting 1% chance interior flood extent and elevations.

Table 8. 1% Chance Interior Flood Results

Pumping Station	1% Chance Interior Flood Elevation (ft, NAVD88)	Total Area of 1% Chance Interior Flood (acres)	Average Depth of 1% Chance Interior Flood (ft)
Main Street	78.6	0	0
Oak Street	78.7	0	0

Figures



500 250 0 500 Feet	**LOCUS MAP**	**Project No:** 15.0702100.40
Legend Floodwalls Levees Chicopee Pumping Stations	**Chicopee Falls Flood Control System Chicopee, Massachusetts**	**Drawn by:** ATR **Checked by:** RTFS **Date:** May, 2010
	MassGIS Orthophoto (2005)	**Figure No:** 1
Baystate Environmental Consultants, Inc. **296 North Main Street, East Longmeadow, MA**	Data obtained from MASS GIS, Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs (EEA).	

Feet
0 250 500 1,000

MAIN STREET P.S. DRAINAGE AREA

Legend

- Pumping Station (P.S.)
- Main Street P.S. Drainage Area

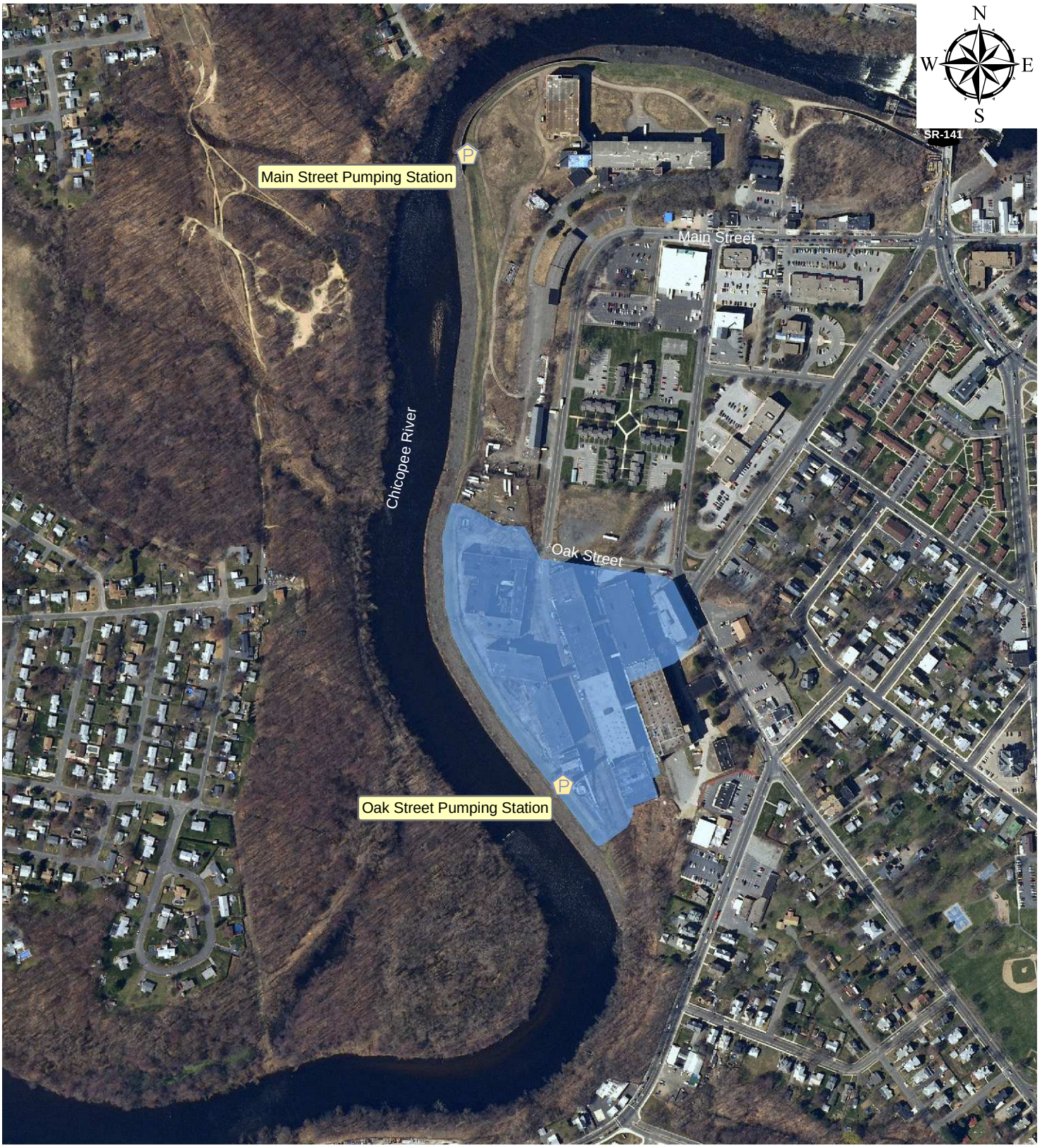
Interior Drainage Analysis
Chicopee Falls Flood Control System
Chicopee, Massachusetts

MassGIS Orthophoto (2005)

Data obtained from MASS GIS, Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs (EEA).

Baystate Environmental Consultants, Inc.
296 North Main Street, East Longmeadow, MA
A GZA Company

Project No: 15.0702100.40
Drawn by: MTF
Checked by: RTFS
Date: May, 2010
Figure No: 2



0 250 500 1,000 Feet

OAK STREET P.S. DRAINAGE AREA

Legend

- Pumping Station (P.S.)
- Oak Street P.S. Drainage Area

Interior Drainage Analysis
Chicopee Falls Flood Control System
Chicopee, Massachusetts

MassGIS Orthophoto (2005)

Data obtained from MASS GIS, Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs (EEA).

Baystate Environmental Consultants, Inc.
296 North Main Street, East Longmeadow, MA
A GZA Company

Project No: 15.0702100.40

Drawn by: MTF

Checked by: RTFS

Date: May, 2010

Figure No: 3

Feet
0 250 500 1,000

Soils Legend

1	Water
602	Urban Land
737	Terrace Escarpments
739C	Urban Land: Hinckley-Windsor Association

Baystate Environmental Consultants, Inc.
296 North Main Street, East Longmeadow, MA

Soils Map

Interior Drainage Analysis
Chicopee Falls Flood Control System
Chicopee, Massachusetts

MassGIS Orthophoto (2005)

Data obtained from MASS GIS, Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs (EEA).

Project No: 15.0702100.40

Drawn by: MTF

Checked by: RTFS

Date: May, 2010

Figure No: 4

APPENDIX A-4.7

OTHER DESIGN CRITERIA (STRUCTURAL)

STRUCTURAL ANALYSIS

CHICOPEE FALLS FLOOD CONTROL SYSTEM

CHICOPEE FLOOD CONTROL WORKS

CITY OF CHICOPEE

HAMPDEN COUNTY, MASSACHUSETTS

October, 2010

Baystate Environmental Consultants, Inc.

A GZA Company

BACKGROUND

GZA's understanding of the project is based on our review of 44CFR65.10, our work at the site, discussions with the City of Chicopee, and the following project documents:

- A Plan set, entitled "Connecticut River Flood Control Project, Chicopee Falls, Mass., Plans for the Local Protection Project, Construction of, Chicopee River, Massachusetts, " prepared by the U.S Army Engineer Division, New England, Corp of Engineers, Waltham, Mass., dated June 1963, sheets 1- 68.

EXISTING CONDITIONS

The Chicopee Falls system is comprised of two sections of concrete flood wall, one approximately 530 feet long and the other approximately 860 feet long, installed at the top of an earthen embankment. The first wall section begins at the South abutment of the Deady Memorial Bridge, at project station 4+37.5 and extends about 530 feet to the west to Sta 9+69.8 along the southern/eastern shore of the Chicopee River. The final 20 feet at the western terminus of the floodwall, Sta 9+49.8 to Sta 9+69.8, is embedded in an earthen dike. The dike continues along the shore to the west until the second section of wall begins at project station 16+81.5. The second wall extends about 860 feet to the west along the eastern shore of the Connecticut River, to Sta 25+44.5. The final 20 feet at each end of the second wall is embedded in earthen dikes. The second length of dike, starting at Sta 25+24., extends to the southern terminus of the flood control system.

STRUCTURAL EVALUATION

Our structural engineers reviewed the original design documents in order to determine the assumed loading conditions and to review how the structural elements were designed. The results of the original analysis were compared to the current USACE guidance to verify that the structures meet current design requirements specified in the following documents:

1. USACE Manual EM 1110-2-2100 *Stability Analysis of Concrete Structures.*

2. USACE Manual EM 1110-2-2104 *Strength Design for Reinforced Concrete Hydraulic Structures.*

3. USACE Manual EM 1110-2-2502 *Retaining And Flood Walls.*

A total of eleven different wall sections between two sets of stations: 4+37.5 to 9+69.8 and 16+81.5 to 25+44.5 have been evaluated for this analysis with the methods prescribed in Reference 3. Our engineers evaluated each section for the load condition of the 1-percent-annual chance flood as required by FEMA Regulations 44 CFR 65.10. Analysis parameters and results are included in this Appendix 4.7. It is our opinion that the floodwalls will perform adequately under the 1-percent-annual-chance flood.

As prescribed by the USACE, the floodwalls were evaluated for sliding stability, overturning stability, foundation soil bearing capacity and strength and serviceability of the floodwalls. The floodwalls were analyzed as inland flood walls, critical structures with Case R1, "Usual Loading" conditions applied. Elevations and geometry data were taken from the 1963 USACE Construction Drawings referenced above, adjusted for the current survey datum. The flood wall section analysis is heavily based on Example 3 on page N-22 of Reference 3.

MATERIAL PROPERTIES

Subsurface conditions varied significantly over the length of the floodwalls. The original construction drawings indicate that much of the northern portion of the floodwall adjacent to the Deady Bridge is founded on rock and that the wall footing is secured with rock anchors. The subsurface investigations undertaken for this evaluation encountered weathered rock in the vicinity of the bottom of wall footing, east (up-station) of Sta 6+00±.

The effects of rock anchors were conservatively neglected in our analyses. In the original design documents, the floodwalls were designed for a flood elevation greater than the 1-percent-annual-chance flood upon which this current evaluation is based. The higher flood level necessitated the use of rock anchors (in the design calculations) to maintain wall stability. Confirmation of the rock anchor installation was not included in this evaluation as the current analyses indicate that they are not required for stability during the 1-percent-annual-chance flood.

Table 1 - Material properties for the wall sections analyzed were selected based on the original design calculations and field observations made for this report.

MATERIAL PROPERTIES		
Backfill Soil:		
Cohesion of Backfill soil un-drained	0.00	PSF
Cohesion of Backfill soil drained	0.00	PSF
Friction angle of backfill soil	26.50 – 35.00*	DEG
Developed friction angle = .0.667 x friction angle	17.67 – 23.33*	DEG
Coefficient of earth pressure at rest (Ko = 1-sin□)	0.43 – 0.55	
Unit weight of soil backfill per unit volume	100.00 – 130.00*	PCF
Unit weight of water	62.50	PCF
Saturated unit weight of soil	125.00 – 135.00*	PCF
Buoyant unit weight	62.50 – 72.50*	PCF
Buoyant unit weight on land side due to seepage	78.81 – 123.06*	PCF
Concrete:		
Unit Weight of Concrete	150.00	PCF
Unconfined Compressive Strength	4000.00	PSI

Steel Reinforcing Strength	60000.00	PSI
Depth of concrete cover for deign	3.00 – 4.50*	IN
Strength reduction factor □	0.90	
Shear factor	0.85	

* Values vary along length of wall. For specific values refer to Wall Analysis Data Sheets

Lateral Soil Forces

Lateral soil forces were calculated based on methods prescribed in Reference 3. We have assumed that a vertical soil tension crack will form at the riverside (RS) edge of the footing thus minimizing any active soil forces on the RS of the wall and footing. The passive soil force on the landside (LS) of the wall is included for bearing pressure and overturning calculations but neglected for the sliding stability analysis. All wall sections analyzed meet or exceed all of the USACE recommended factors of safety. For the wall section models, the ground surface elevations on the riverside and landside vary but are considered to be level as they extend away from the wall. Since the active and passive soil pressures are neglected in the sliding analysis, the coefficient of active and passive earth pressures are not calculated. To balance the wall in the lateral direction for the calculation of bearing pressures, we have calculated a required passive soil pressure and then back-calculated a required coefficient of passive earth pressure to achieve this balanced condition. The engineer then reviewed this "back-calculated" coefficient to decide if this value is reasonable. This value is presented as "Kp required to balance horizontal forces" on the analysis summary page.

Sliding Stability

Floodwall sliding stability was evaluated based on Reference 3, Section 4-14. The friction factor for sliding was based upon either a cast-concrete/soil or cast-concrete/rock interface, depending upon location. The contribution of any potential sliding resistance of the rock anchors was neglected.

Bearing Capacity

Floodwall foundation bearing capacity was evaluated based on Reference 3, Chapter 5. Given the firm nature of the underlying rock or soils and the width of the footings, bearing capacity is not an issue of concern for the subject walls.

APPENDIX A-6

CITY OF CHICOPEE
OPERATION
AND
MAINTENANCE
MANUAL
(BOUND SEPARTELY)

APPENDIX B – City of Chicopee Project Endorsement

CITY OF CHICOPEE

May 16, 2016

Richard J. Kos
Mayor

Michael L. Bachand, P.E.
Levee Safety Program Manager
United States Army Corps of Engineers
New England District
696 Virginia Road
Concord, Massachusetts 01742

Re: **City of Chicopee**
Chicopee Falls – Flood Control Works
Intent to Apply for Section 408 Approval

Dear Mr. Bachand:

The City of Chicopee is proposing to backfill the lower tier of the former Uniroyal property in Chicopee with excess construction soils prior to redevelopment. Earlier this year we discussed the proposal with you at an initial coordination meeting attended by City Department of Public Works and Community Development staff, our Consultants, BETA Group Inc., and Special Environmental Counsel, Louis Moore. We believe that the proposed backfilling can be done safely and cost effectively to enhance the property and eliminate long term operating and maintenance costs related to the flood control structure.

Please consider this the City's Letter of Intent to Apply for Approval under 33 U.S.C., § 408. It is the City's understanding that the U.S. Army Corps of Engineers (USACE) will assign staff to this project to provide assistance with and coordination of the necessary permitting and approval requirements. We are proceeding with the technical review and initiating design calculations for the proposal. We will be working with designated USACE staff on these issues as well as coordinating on real estate issues and permitting requirements.

Accordingly, I am requesting that you advise Michael Vedovelli, the City's Director of Community Development, of the USACE technical and legal staff assigned to this project. In the meantime, please contact Mr. Vedovelli at (413) 594-1489 or mvedovelli@chicopeema.gov with any questions or concerns related to this matter.

Very truly yours,

Richard J. Kos
Mayor

cc: Jeff Neece, Chicopee DPW
Joe Kietner, Chicopee DPW
Michael Vedovelli, Chicopee OCD
Alan Hanscom, BETA Associates, Inc.
Louis S. Moore, Esq., Annino, Draper & Moore, P.C.

APPENDIX C – Slope Stability Analysis, OTO, Sept. 2016

EnvironmentalSafetyHealthGeotechnical

O'Reilly, Talbot & Okun
[A S S O C I A T E S]
ENGINEERING

293 Bridge Street
Suite 500
Springfield, MA 01103
Tel 413 788 6222
Fax 413 788 8830
www.oto-env.com

J2463-03-01
September 14, 2016

BETA Group, Inc.
315 Norwood Park South
Norwood, Massachusetts 02062
Attn: Alan Hanscom

Re: Chicopee Levee Slope Stability
Uniroyal Filling Project
Chicopee, Massachusetts

Dear Mr. Hanscom:

This letter presents results for the slope stability analysis for the Uniroyal Filling project located in Chicopee, Massachusetts. Our work involved the review of previous plans and reports prepared by the U.S. Army Corps of Engineers (USACE) and Baystate Environmental Consultants (BEC), stability analyses of the proposed conditions, and preparation of this report. No subsurface information or testing was performed as part of this project. The analyses presented in this report are limited to the assumed conditions as described below. Should any of the conditions change, we recommend that additional analyses be performed to evaluate the proposed changes.

This letter is subject to the attached Limitations.

SITE INFORMATION & PROPOSED WORK

The Site is located within the former Uniroyal Complex off Grove Street in Chicopee, Massachusetts. Specifically, the area addressed in this letter is located within the lower level, western portion of the Site, adjacent to the Chicopee River levee. At the time of this letter, we understand that a portion of the buildings within the proposed work area have been demolished and that the remaining buildings will be demolished prior to the start of filling. Existing condition plans prepared by Heritage Survey, Inc. and dated 2009 are attached as Sheets 1 through Sheet 5.

The proposed work will consist of filling behind the levee with excess construction soils as part of an overall redevelopment of the Site. The fill will be placed in the low lying areas created between the levee and the sloping terrain in the eastern portion of the Site. We understand that backfill soils will consist of excess construction soils from local construction sites. The soils may contain oil and hazardous constituents at concentrations below reportable conditions in the Massachusetts Contingency Plan (MCP). A Beneficial Use Determination (BUD) will be obtained from the MassDEP to allow the subject fill soils to be reused at the Site. Since fill will be placed against the existing levee, a permit from the USACE will also be obtained.

We understand that the area to be filled is approximately located between levee stations 30+00 and 50+00. This area does not extend to the floodwall located further upstream,

which terminates at approximate station 25+50. According to project plans, the fill soils will be placed to the approximate top of the levee (approximate elevation 100); therefore, maximum fill heights will be on the order of 15 feet. A final grading plan has not been prepared at the time of this letter; however, we have assumed that the fill soils on the land side (east) of the levee, extend along a relatively flat surface until grades are matched to the east.

INFORMATION SOURCES

The slope stability analysis was based on information provided in the following documents:

- Plan titled "Topographic Plan of Land in Chicopee, Massachusetts, Surveyed for The City of Chicopee" by Heritage Surveys, Inc., dated December 12, 2009;
- Plan set titled "Connecticut River Flood Control Project, Chicopee Falls, Mass" prepared by Green Engineering Affiliates, Inc. for the U.S. Army Engineer Division, New England, dated April 1963;
- Design memorandum titled "Chicopee Falls Local Protection Project, Design Memorandum No. 5" by the U.S. Army Engineering Division, New England, dated March 1963;
- "FEMA Accreditation Report, Chicopee Falls Flood Control System" by Baystate Environmental Consultants, Inc., dated November 2010; and
- "Design and Construction of Levees Engineering Manual"- EM 1110-2-1913, U.S. Army Corps of Engineers, dated April 2000.

The information obtained from these sources that were used in our evaluation included the following:

- Details on levee construction;
- Design flood elevations and river levels;
- Existing ground surface topography;
- Subsurface information; and
- Soil properties.

SLOPE STABILITY ANALYSIS

Slope stability was evaluated using the SLOPE/W computer program using the Spencer method. The SLOPE/W program performs a limit equilibrium analysis using various analytical methods to determine the factor of safety and the critical failure surface. The Spencer method, which assumes that the resultant interslice forces have constant slope through the sliding mass, was chosen per USACE guidance.

The slope stability for typical design conditions of the work area was evaluated using a limit equilibrium analyses. The Spencer Method determines the critical failure surface and the minimum factor of safety. Levee slope stability was analyzed for critical design condition as described in the USACE *Design and Construction of Levees*, EM 1110-2-1913, namely under normal, 100 year flood conditions, and rapid drawdown. For these analyses, only failure into the river side was considered, since the placement of fill on the landward side increases the resistance to failures in that direction. The results of the recent analyses are attached.

Model Information

Our analysis was performed on a section modeled at Station 41+00, which is described in BEC's report as being typical of station 39+25 to station 50+00. In addition, a "worst case" section was analyzed at Station 13+30. This section is typical of Stations 9+50 to 16+82 and Stations 25+25 to 39+25. Levee geometry was based upon typical cross sections provided in the "Connecticut River Flood Control Project, Chicopee Falls, Mass" plan set and stability analysis provided in BEC's report. Soil properties were based upon information provided in BEC's report. A table of soil values used in the analysis is provided below.

Table 1
Soil Properties

Soil Layer	Total Unit Weight (lb/ft3)	Effective Strength		Total Strength	
		Cohesion	Friction	Cohesion	Friction
Compacted Impervious Fill	118	0	35	0	35
Compacted Gravel Fill	120	0	32	0	32
Silty Sand	110	0	30	0	27
Till	130	0	35	0	35
Riprap	140	0	42	0	42
Crushed Fill	120	0	30	0	30

Notes:

1. Assumed soil properties based upon values provided in 2010 BEC report.

The sections were analyzed for the three separate conditions as described in the USACE manual: rapid drawdown (performed using the USACE 3-stage method), long-term (steady seepage during 100 year flood conditions), and normal water conditions. Analyses of each of these potential failure mechanisms for existing conditions were previously evaluated by BEC, and were documented in their November 2010 FEMA Accreditation Report (a copy of the pertinent portion of that report, Appendix A-4.4 is attached). An additional condition was analyzed for total embankment failure during rapid drawdown. In general, this analysis forced the failure plane to be seated within the underlying silty sand (or weakest layer).

As provided in the USACE design manual, the recommended minimum factor of safety for rapid drawdown is between 1.0 to 1.2, and the recommended minimum factor of safety for long term (steady seepage) is 1.4. A specific factor of safety for normal water conditions is not provided in the USACE design manual; therefore, a value of 1.4 was used.

Results

Based upon our analysis, the computed factors of safety for the proposed conditions met or exceeded the required minimums specified above. The results are compared to previous values and required minimums are shown in Table 2. In general, the computed values for each condition were similar to the computed values by BEC and the proposed

landside filling has only minimal impact on levee stability. Therefore, it appears that the proposed fill will likely have little effect on the stability of the levee.

Table 2
Factors of Safety Against Sliding

Condition	Analyzed Factor of Safety			USACE Minimum Factor of Safety
	Proposed Conditions		Existing Condition	
	Station 41+00	Station 13+30	BEC Factor of Safety	
Normal Water Conditions	1.5	1.5	1.6	None Provided [1.]
Long Term (Steady Seepage)	1.6	1.5	1.7	1.4
Rapid Drawdown	1.4	1.2	1.3 - 1.5	1.0 - 1.2
Total Embankment (Failure within silty sand)	2.4	1.7	Not Analyzed	None Provided [1.]

Notes:

1. No minimum factor of safety provided, assumed to be 1.4

This analyses are limited to the assumed conditions as described above. Should any of the conditions change, we recommend that analyses be performed to evaluate the proposed changes.

ADDITIONAL RECOMMENDATIONS

To limit the buildup of hydrostatic pressures against the landside of the levee, we recommend that a drainage layer be placed between the landside slope and proposed construction fill. The drainage layer should consist of a minimum of one foot of crushed stone wrapped in a non-woven geotextile fabric and be tied into the existing toe drain. A typical drainage detail is attached as Figure 1. The crushed stone should meet the grain size requirements presented in Table 3.

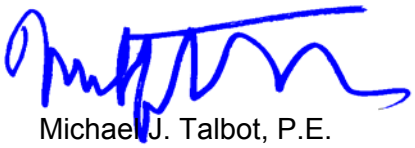
Table 3
Grain Size Distribution

Size	Crushed Stone
	Percent Finer by Weight
4 inch	100
1 inch	100
¾ inch	90-100
½ inch	10-50
⅜ inch	0-20
No. 4	0-5

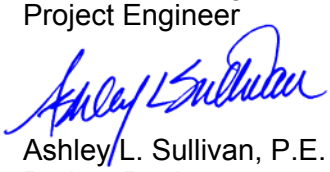
We appreciate the opportunity to be considered for this project. If you have any questions, please do not hesitate to contact us.

Sincerely yours,
O'Reilly, Talbot & Okun Associates, Inc.

Stephen McLaughlin
Project Engineer



Michael J. Talbot, P.E.
Principal



Ashley L. Sullivan, P.E.
Project Reviewer

Attachments: Limitations, Topographic Plans (Sheet 1 through 5), Drainage Detail, OTO 2016 Slope Stability Analysis – Proposed Fill Condition, BEC Appendix A-4.4 – 2010 Embankment and Foundation Seepage Stability

LIMITATIONS

LIMITATIONS

1. The observations presented in this report were made under the conditions described herein. The conclusions presented in this report were based solely upon the services described in the report and not on scientific tasks or procedures beyond the scope of the project or the time and budgetary constraints imposed by the client. The work described in this report was carried out in accordance with the Statement of Terms and Conditions attached to our proposal.

2. The analysis and recommendations submitted in this report are based in part upon the data obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it may be necessary to reevaluate the recommendations of this report.

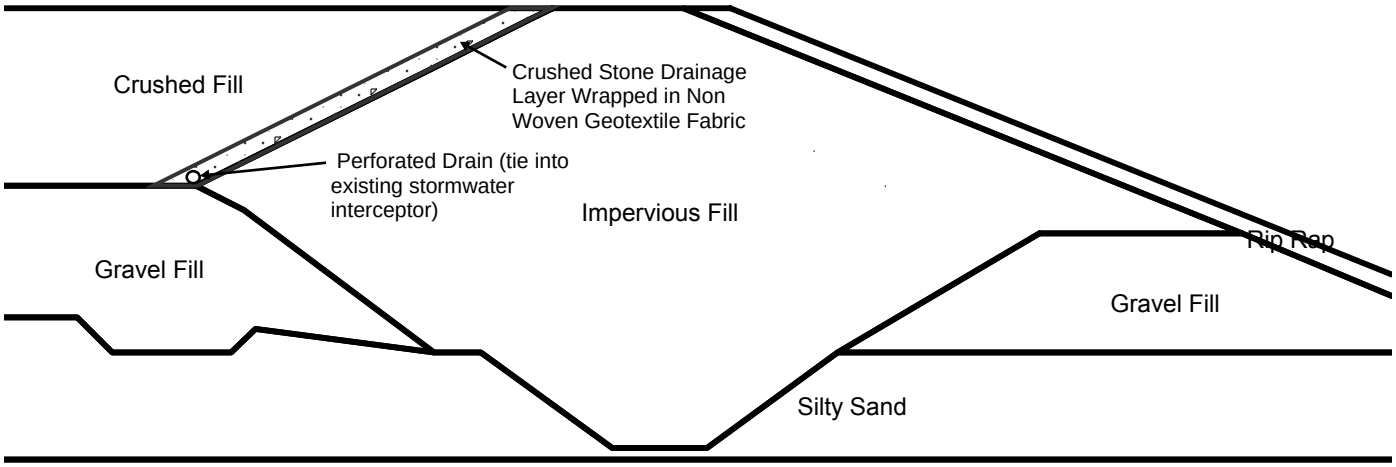
3. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.

4. In the event that any changes in the nature, design or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by O'Reilly, Talbot & Okun Associates Inc. It is recommended that we be retained to provide a general review of final plans and specifications.

5. Our report was prepared for the exclusive benefit of our client. Reliance upon the report and its conclusions is not made to third parties or future property owners.

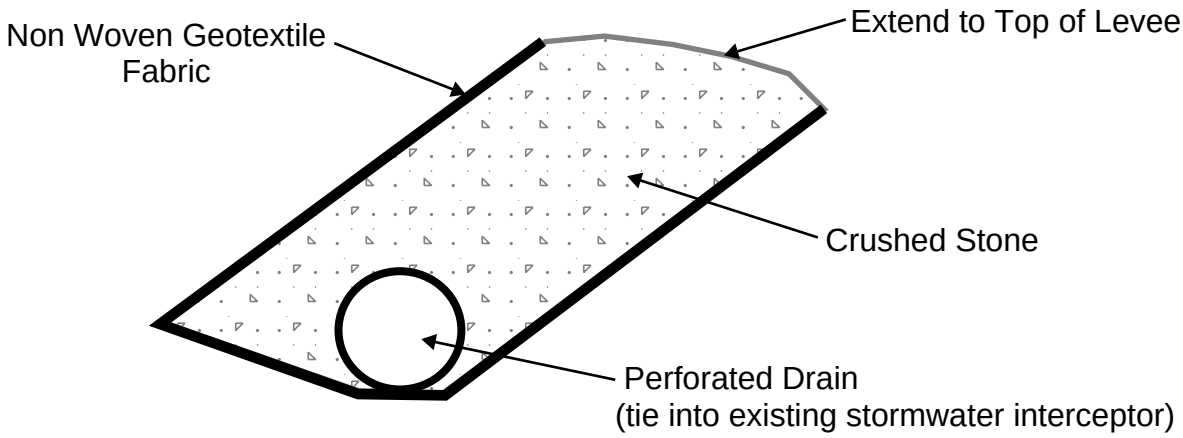
SITE PLANS

DRAINAGE DETAIL



Typical Cross Section - Drainage Layer

N.T.S



Typical Drainage Layer Detail

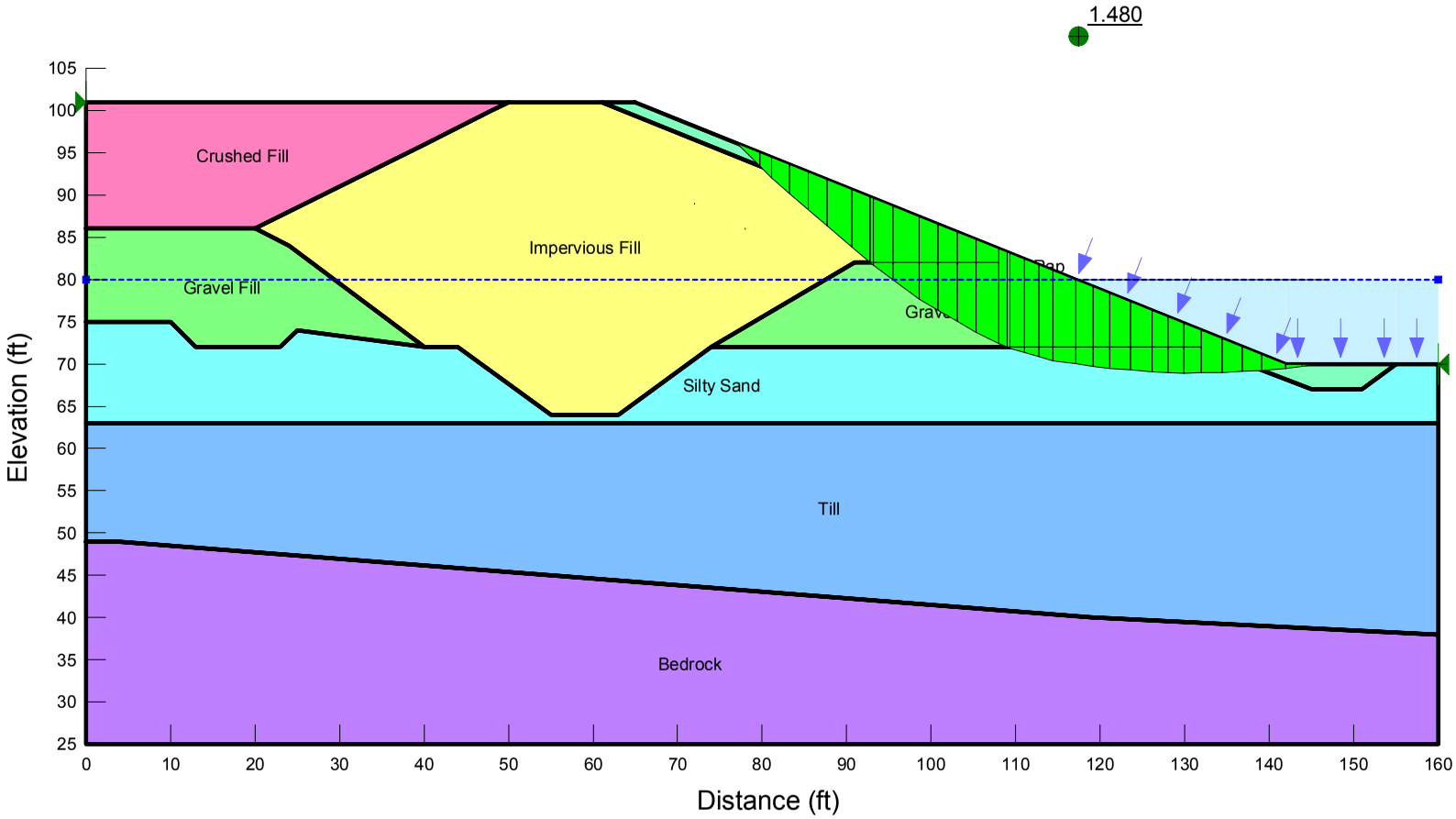
N.T.S

Note: Fill existing toe drain with grout, flowable fill or other suitable method.

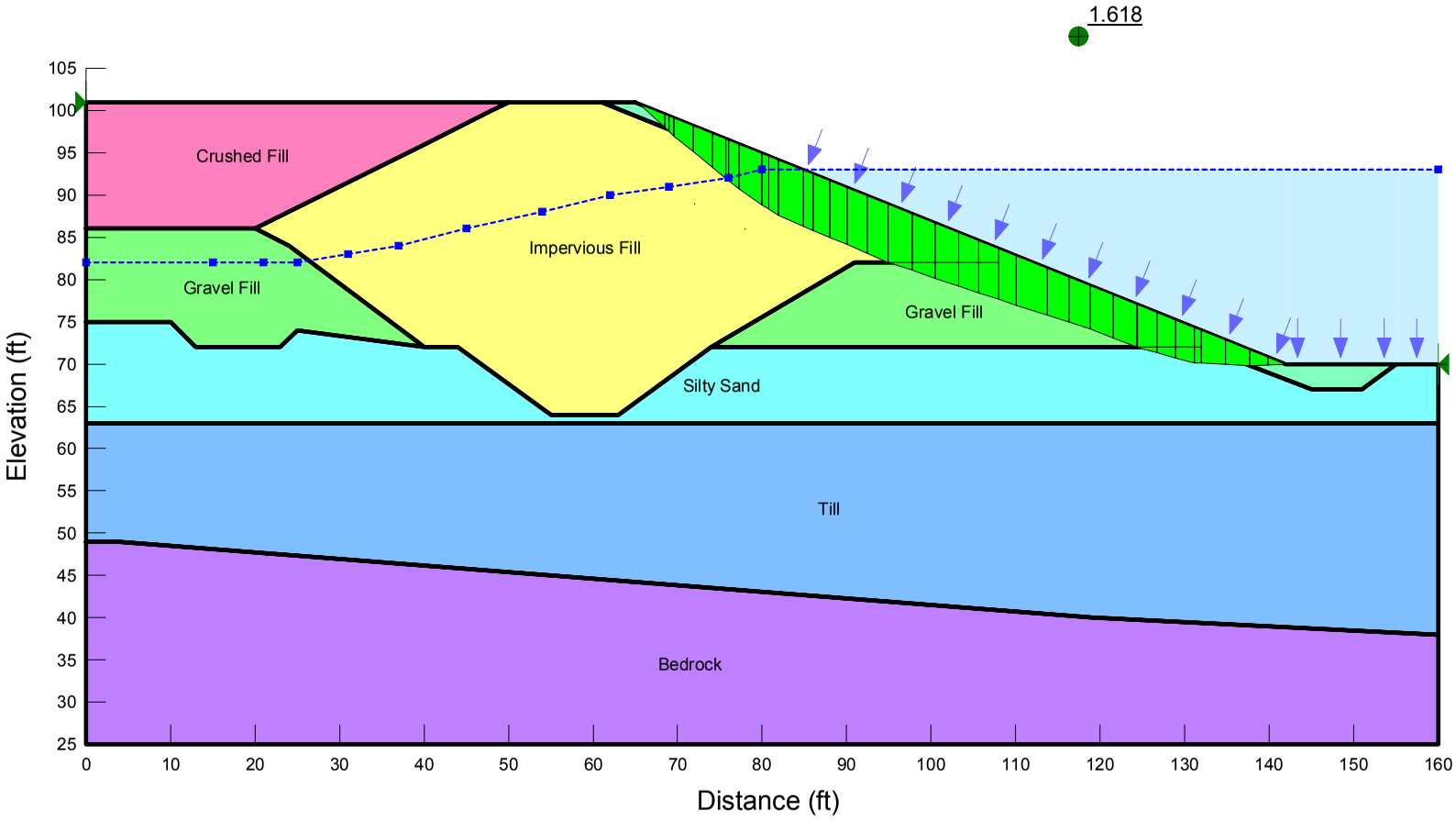
FILE

DESIGNED BY: SMM DRAWN BY: SMM DATE: SEPTEMBER 2016 CHECKED BY: MJT REV: FEBRUARY 2017	UNIROYAL FILLING PROJECT CHICOPEE LEVEE CHICOPEE, MASSACHUSETTS	NOT TO SCALE	PROJECT No. J2463-03-01
O'REILLY, TALBOT & OKUN ASSOCIATES ENGINEERING 293 BRIDGE STREET SUITE 500 SPRINGFIELD, MA 01103 PHONE:(413) 788-6222 EMAIL: OFFICE@OTO-ENV.COM	DRAINAGE LAYER DETAILS		FIGURE No. 1

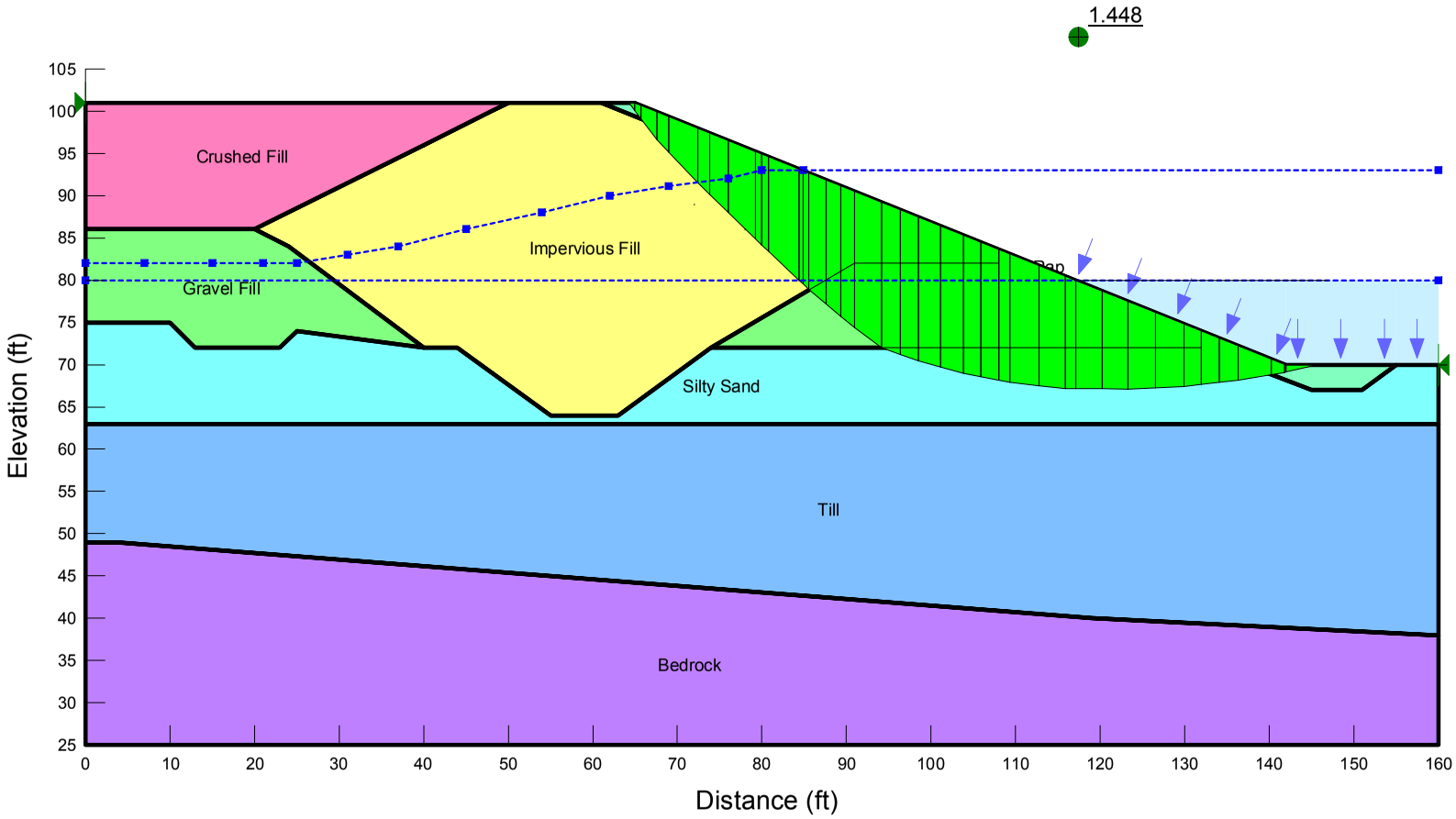
2016 SLOPE STABILITY ANALYSIS - PROPOSED FILL CONDITION



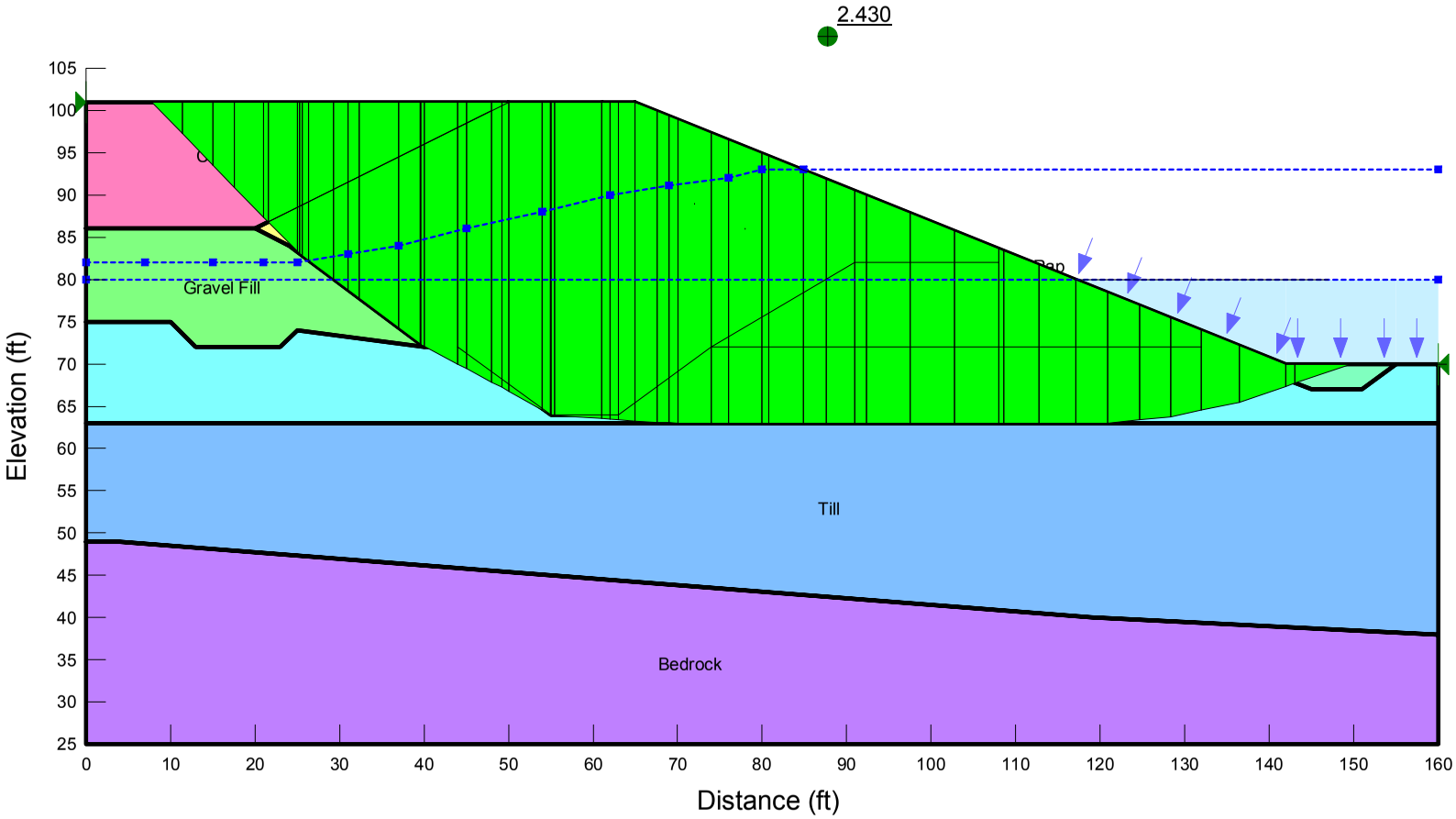
Station 41+00 - Normal Water Conditions



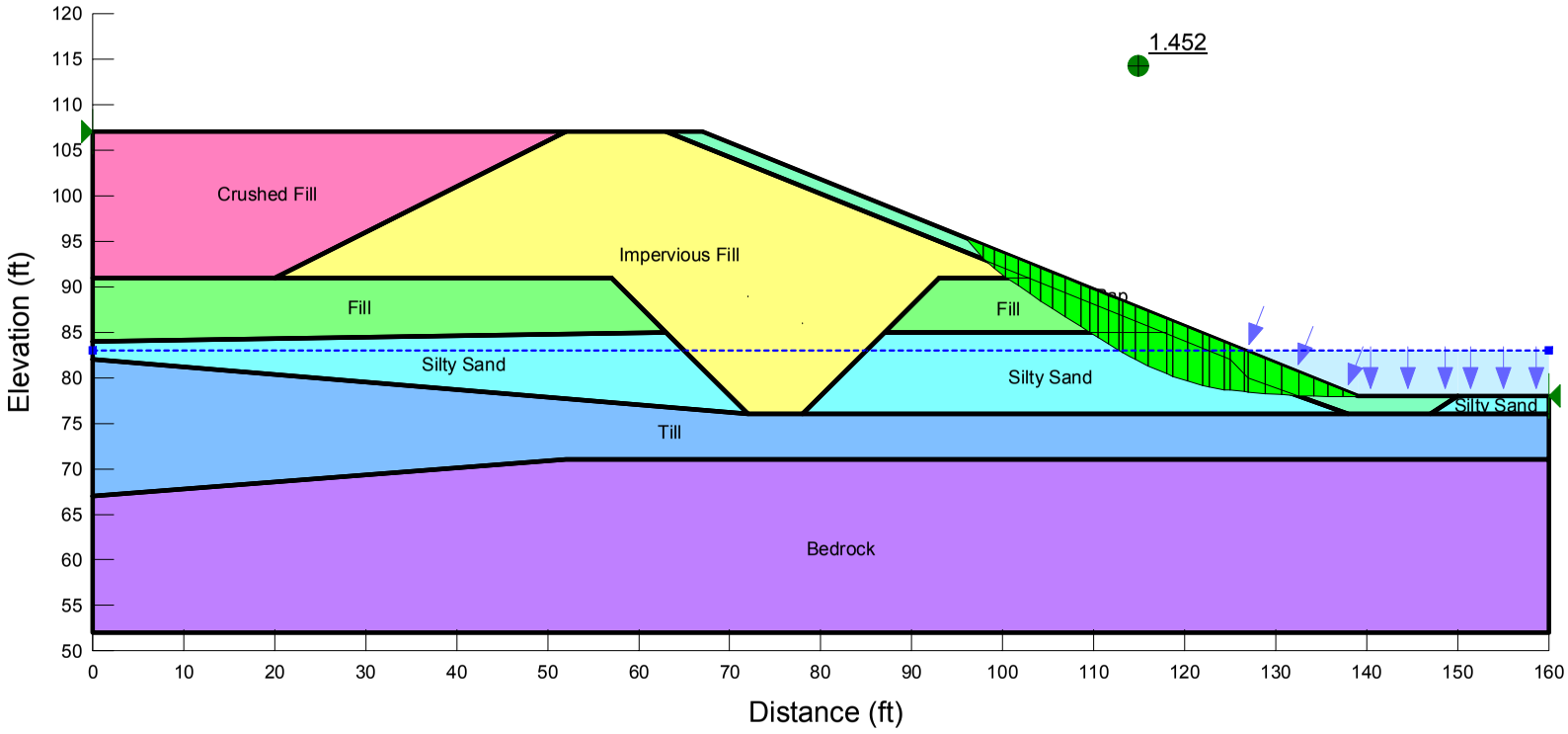
Station 41+00 - 100yr Flood



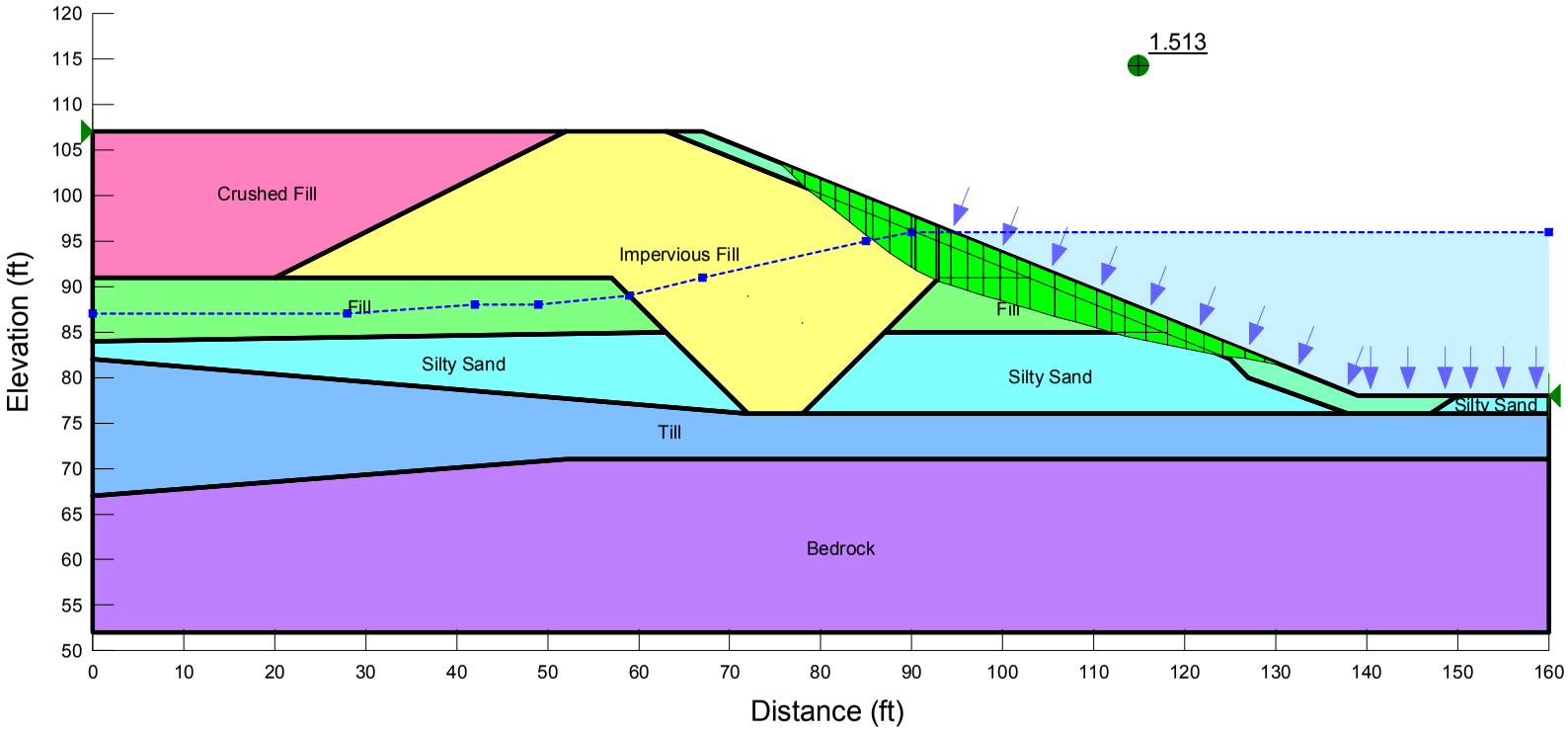
Station 41+00 - 100yr Rapid Drawdown



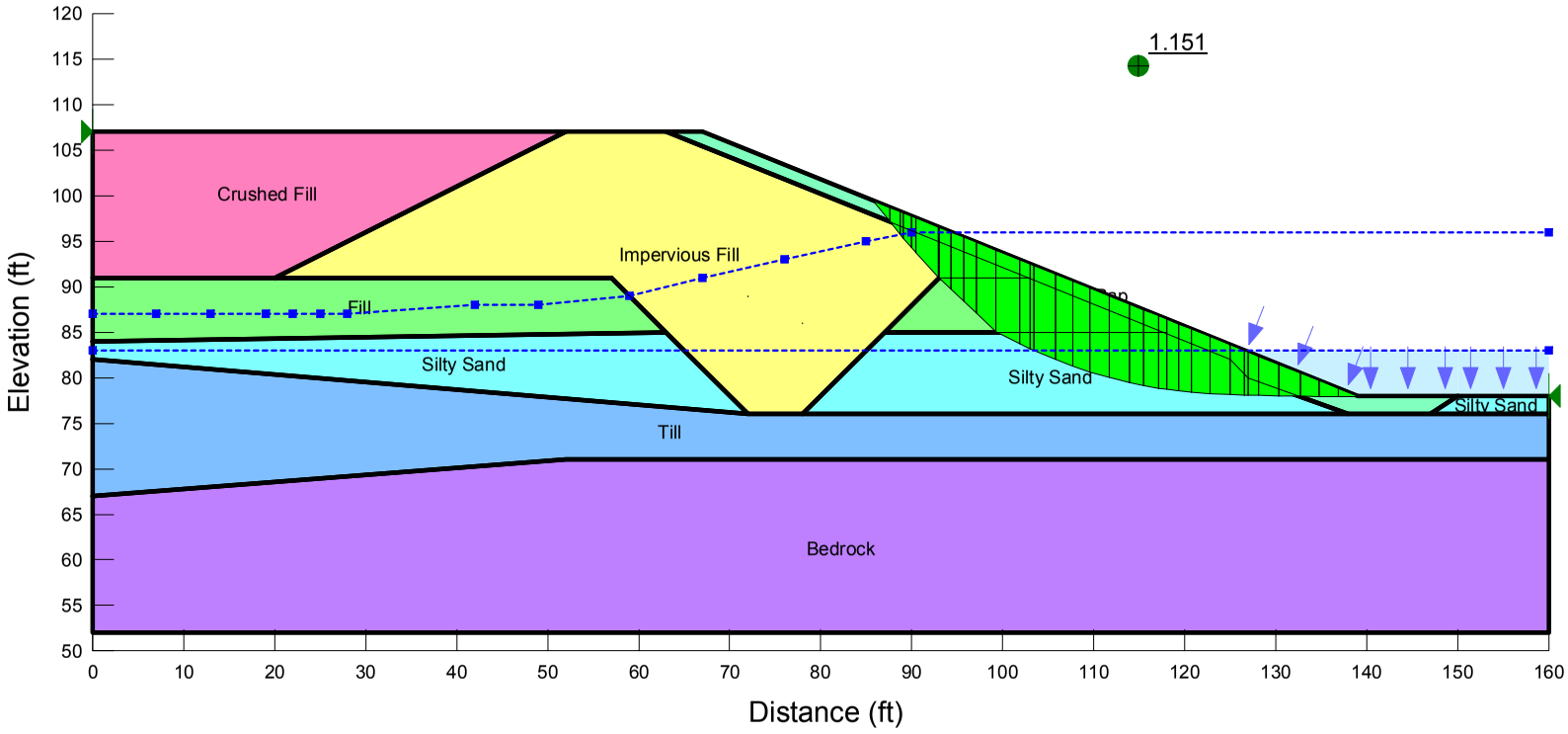
Station 41+00 - 100yr Rapid Drawdown - Embankment Failure



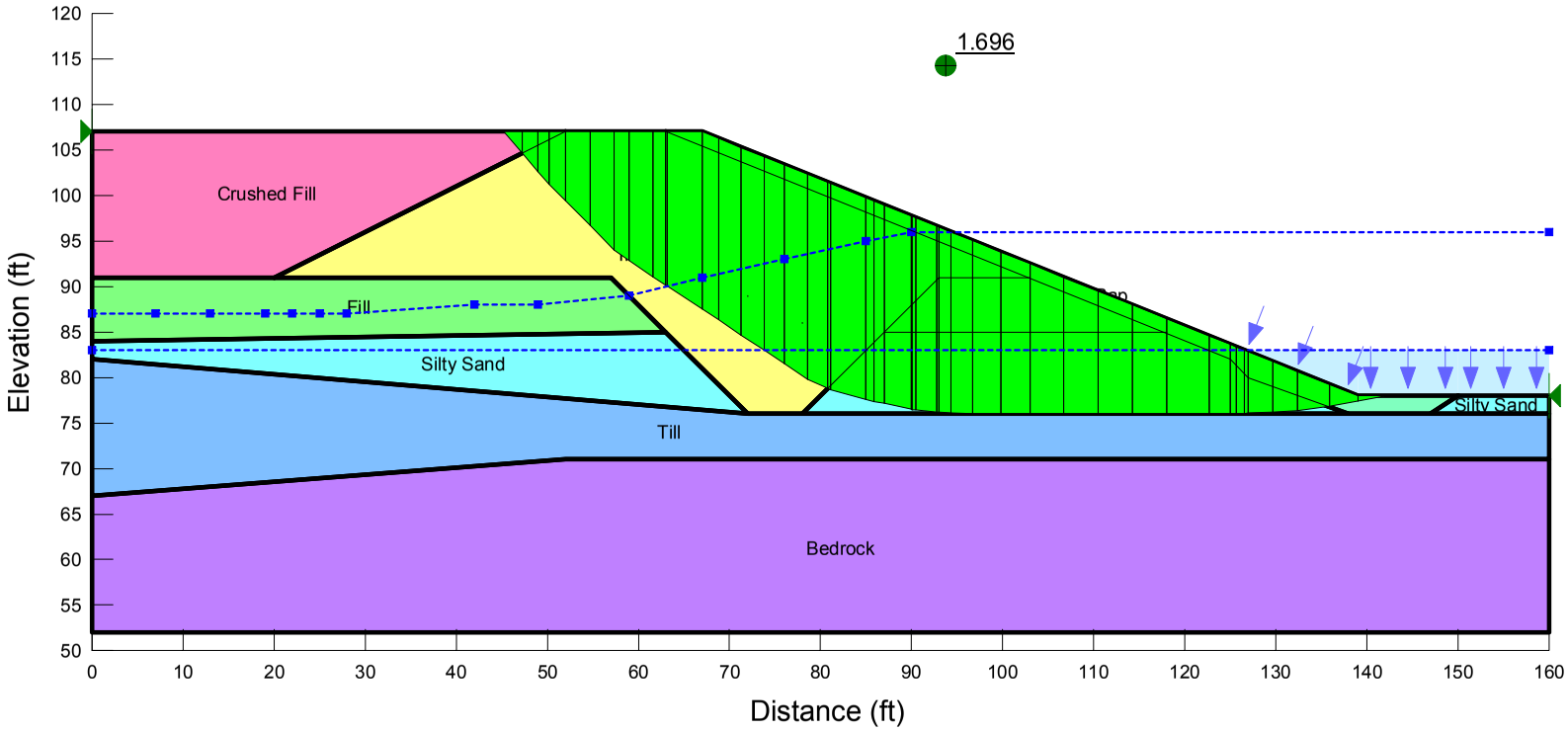
Station 13+30 - Normal Water Conditions



Station 13+30 - 100yr Flood

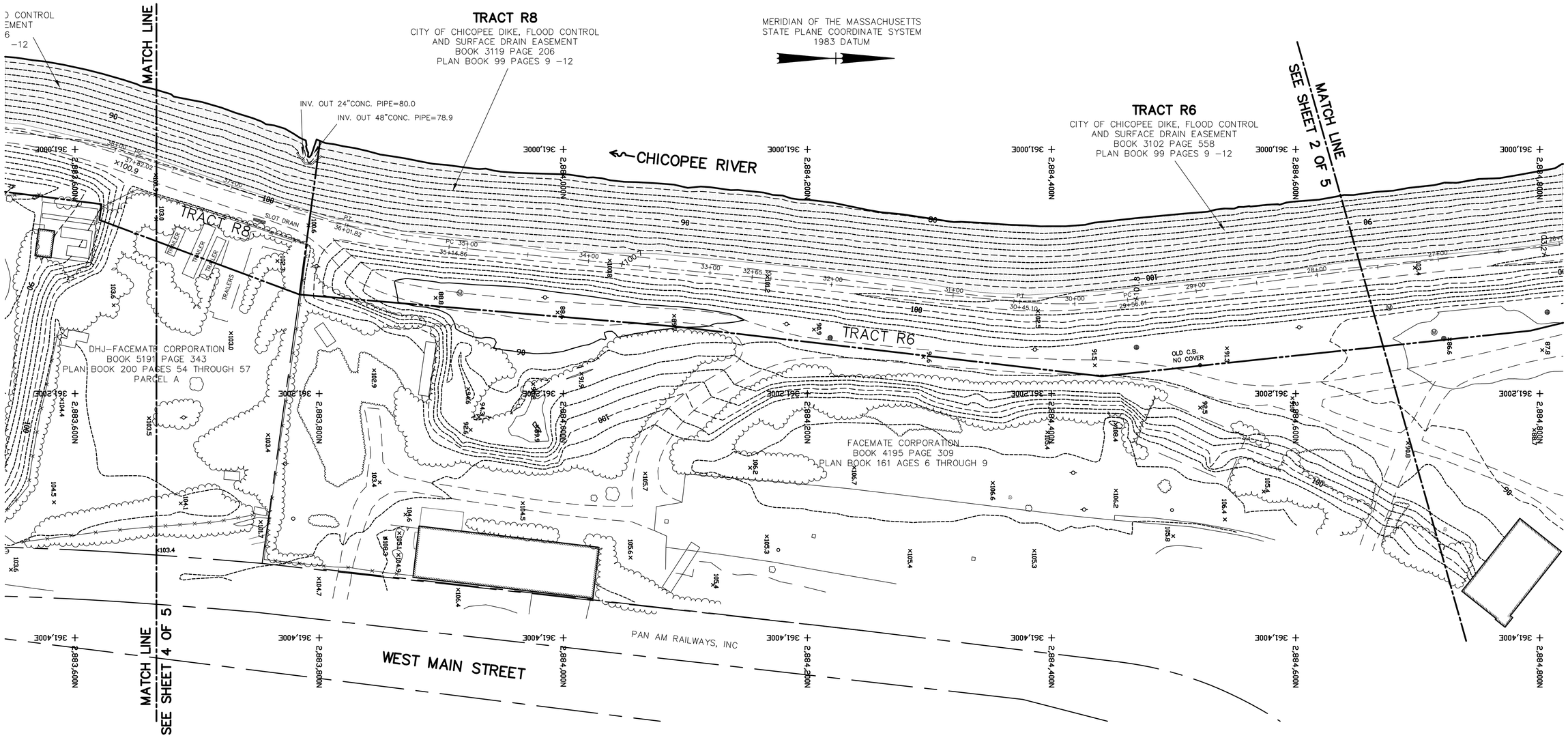


Station 13+30 - 100yr Rapid Drawdown



Station 13+30 - 100yr Rapid Drawdown - Embankment Failure

APPENDIX D – Easement and Survey Plans



LINE & SYMBOL LEGEND

- TRAFFIC SIGNAL
- RAILROAD CONTROL BOX
- RAILROAD SWITCH
- SHRUB
- ROCK
- MARSH SYMBOL
- HYDRANT
- GATE/VALVE
- UTILITY VAULT
- UNCERTAIN HYDRANT
- MANHOLE
- UNCERTAIN MANHOLE
- CATCH BASINS
- UNCERTAIN CATCH BASIN
- UTILITY POLE
- UTILITY POLE WITH LIGHT
- STREET LIGHT
- GUY ANCHOR
- UNCERTAIN UTILITY POLE
- UTILITY BOX
- POLE
- POST
- UNCERTAIN POLE
- ROAD SIGN
- MONUMENT
- UNCERTAIN OBJECT
- ×723.8 SPOT HEIGHT
- ×74.0 FIELD LOCATED GRADE
- TREE
- RIP–RAP

- FENCE
- GUARD RAIL
- PARTLY VISIBLE FENCE
- RETAINING WALL
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- FLOOD CONTROL EASEMENT
- CONCRETE FLOOD WALL
- APPROXIMATE LEVEE BASELINE
- OTHER EASEMENT LINES
- PAVED ROAD
- DIRT DRIVE
- RAILROAD
- BUILDING
- TREE LINE
- SCRUB LINE
- HEDGE ROW
- BOUNDARY LINE

SURVEYOR'S NOTES:

1. TOPOGRAPHIC DATA SHOWN HEREON IS BASED UPON AERIAL PHOTOGRAPHY TAKEN DURING APRIL, 2008. PHOTOGRAPHY AND MAPPING WERE PERFORMED BY COL–EAST, INC. OF NORTH ADAMS, MA AND SUPPLEMENTED WITH GROUND SURVEYS PERFORMED BY HERITAGE SURVEYS, INC. FROM MAY, 2008 THROUGH SEPTEMBER, 2009.

2. FOR REFERENCE TO BOUNDARY LINE AND EASEMENTS SEE A PLAN PREPARED BY HERITAGE SURVEYS, INC. TITLED "PLAN OF FLOOD CONTROL AND LEVEE EASEMENT IN CHICOPEE, MASSACHUSETTS SURVEYED FOR THE CITY OF CHICOPEE", DATED JUNE 15, 2009, SHEETS 1 THROUGH 4.

3. UNDERGROUND UTILITY LOCATIONS SHOWN HEREON ARE BASED UPON SURFACE FEATURES AS LOCATED BY SURVEY AND AVAILABLE RECORD DATA, AND ARE APPROXIMATE. ACTUAL LOCATIONS SHOULD BE VERIFIED WITH THE APPROPRIATE UTILITY COMPANY AND/OR MUNICIPAL DEPARTMENT PRIOR TO FINAL DESIGN AND/OR CONSTRUCTION.

4. LOCATION OF FLOODWALL AND LEVEE BASELINES SHOWN ARE APPROXIMATE AND ARE BASED UPON PLANS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS FOR CHICOPEE RIVER FLOOD CONTROL DATED APRIL, 1963. NO MONUMENTATION OF BASELINES WAS FOUND AND IS HISTORICAL ONLY.

5. TOP CONCRETE FLOODWALL AND CENTERLINE LEVEE GRADES IN BOLD TYPE ARE FIELD LOCATED BY SURVEY AND ARE NOT THE RESULT OF AERIAL MAPPING. REFER TO LEGEND FOR AERIAL SPOT HEIGHT INDICATORS.

NORTH AMERICAN VERTICAL DATUM 1988

NOTE: FOR THIS FLOOD CONTROL SYSTEM, ELEVATIONS IN NGVD29 CAN BE OBTAINED BY ADDING 0.70 FEET TO THE ELEVATIONS SHOWN ON THIS PLAN.

CHICOPEE FLOOD CONTROL WORKS
CHICOPEE FALLS SYSTEM SHEET 3 OF 5

TOPOGRAPHIC PLAN OF LAND IN
CHICOPEE, MASSACHUSETTS
SURVEYED FOR
THE CITY OF CHICOPEE

SCALE: 1" = 40'

0' 20' 40' 60' 80' 120'

DATE: DECEMBER 12, 2009

HERITAGE SURVEYS, INC.
REGISTERED PROFESSIONAL LAND SURVEYORS
COLLEGE HIGHWAY & CLARK STREET
POST OFFICE BOX 1
SOUTHAMPTON, MASSACHUSETTS
(413) 527–3600

COMMONWEALTH OF MASSACHUSETTS
BRUCE A COOMBS
No. 27814

JOB # 6289–080505 | DWG # 6289FALLS TOPO | MAP # 6289–091212

MERIDIAN OF THE MASSACHUSETTS
STATE PLANE COORDINATE SYSTEM
1983 DATUM

CHICOPEE RIVER

TRACT R8
CITY OF CHICOPEE DIKE, FLOOD CONTROL
AND SURFACE DRAIN EASEMENT
BOOK 3119 PAGE 206
PLAN BOOK 99 PAGES 9 –12

MATCH LINE

SEE SHEET 5 OF 5
MATCH LINE

361,000E
361,200E
361,400E
2,882,800N
2,883,000N
2,883,200N
2,883,400N
2,883,600N

CONTROL VALVE STRUCTURE

INV. OUT 4" C.I. PIPE=79.2

INV. OUT 4' SQ. CONCRETE OPENING =76.2

OVERHEAD PIPE

T.B.M. #3
SPIKE IN UTILITY POLE #10–899
ELEVATION = 85.07
N.A.V.D. 1988

DHJ–FACEMATE CORPORATION
BOOK 5191 PAGE 343
PLAN BOOK 200 PAGES 54 THROUGH 57
PARCEL A

PAN AM RAILWAYS, INC

TRAILER
TRAILERS

SHADOW

WEST MAIN STREET

OAK STREET

MATCH LINE
SEE SHEET 3 OF 5

LINE & SYMBOL LEGEND

- TRAFFIC SIGNAL
- RAILROAD CONTROL BOX
- RAILROAD SWITCH
- SHRUB
- ROCK
- MARSH SYMBOL
- HYDRANT
- GATE/VALVE
- UTILITY VAULT
- UNCERTAIN HYDRANT
- MANHOLE
- UNCERTAIN MANHOLE
- CATCH BASINS
- UNCERTAIN CATCH BASIN
- UTILITY POLE
- UTILITY POLE WITH LIGHT
- STREET LIGHT
- GUY ANCHOR
- UNCERTAIN UTILITY POLE
- UTILITY BOX
- POLE
- POST
- UNCERTAIN POLE
- ROAD SIGN
- MONUMENT
- UNCERTAIN OBJECT
- ×723.8 SPOT HEIGHT
- ×74.0 FIELD LOCATED GRADE
- TREE

RIP–RAP

- FENCE
- GUARD RAIL
- PARTLY VISIBLE FENCE
- RETAINING WALL
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- FLOOD CONTROL EASEMENT
- CONCRETE FLOOD WALL
- APPROXIMATE LEVEE BASELINE
- OTHER EASEMENT LINES
- PAVED ROAD
- DIRT DRIVE
- RAILROAD
- BUILDING
- TREE LINE
- SCRUB LINE
- HEDGE ROW
- BOUNDARY LINE

SURVEYOR'S NOTES:

1. TOPOGRAPHIC DATA SHOWN HEREON IS BASED UPON AERIAL PHOTOGRAPHY TAKEN DURING APRIL, 2008. PHOTOGRAPHY AND MAPPING WERE PERFORMED BY COL–EAST, INC. OF NORTH ADAMS, MA AND SUPPLEMENTED WITH GROUND SURVEYS PERFORMED BY HERITAGE SURVEYS, INC. FROM MAY, 2008 THROUGH SEPTEMBER, 2009.

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4. LOCATION OF FLOODWALL AND LEVEE BASELINES SHOWN ARE APPROXIMATE AND ARE BASED UPON PLANS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS FOR CHICOPEE RIVER FLOOD CONTROL DATED APRIL, 1963. NO MONUMENTATION OF BASELINES WAS FOUND AND IS HISTORICAL ONLY.

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NORTH AMERICAN VERTICAL DATUM 1988

NOTE: FOR THIS FLOOD CONTROL SYSTEM, ELEVATIONS IN NGVD29 CAN BE OBTAINED BY ADDING 0.70 FEET TO THE ELEVATIONS SHOWN ON THIS PLAN.

CHICOPEE FLOOD CONTROL WORKS
CHICOPEE FALLS SYSTEM SHEET 4 OF 5

TOPOGRAPHIC PLAN OF LAND IN
CHICOPEE, MASSACHUSETTS
SURVEYED FOR
THE CITY OF CHICOPEE

SCALE: 1" = 40'

0' 20' 40' 60' 80' 120'

DATE: DECEMBER 12, 2009

HERITAGE SURVEYS, INC.
REGISTERED PROFESSIONAL LAND SURVEYORS
COLLEGE HIGHWAY & CLARK STREET
POST OFFICE BOX 1
SOUTHAMPTON, MASSACHUSETTS
(413) 527–3600

COMMONWEALTH OF MASSACHUSETTS
BRUCE A COOMBS
No. 27814

JOB # 6289–080505 | DWG # 6289FALLS TOPO | MAP # 6289–091212

TRACT R8
(PORTION OF)
LAND BELIEVED TO BE OF
THOMAS M. CYGAN &
THERESA A. CYGAN
SEE BOOK 7593 PAGE 370 &
PLAN BOOK 200 PAGES 54 & 55
NO RECORD OF EASEMENT FOUND

TRACT R8
(PORTION OF)
SEE PLAN BOOK 200 PAGES 54 & 55

CHICOPEE RIVER

MATCH LINE
SEE SHEET 4 OF 5

INV. OUT 30" RCP=76.9

INV. OUT 4"C.I. PIPE=79.2

INV. OUT 4' SQ.
CONCRETE OPENING
=76.2

CONTROL VALVE STRUCTURE

OPEN CONC. VAULT
FILLED WITH DEBRIS

TRACT 20

TRACT R8

PAN AM RAILWAYS, INC.

FRONT STREET

DHJ-FACEMATE CORPORATION
BOOK 5191 PAGE 343
PLAN BOOK 200 PAGES 54 THROUGH 57
PARCEL B

LINE & SYMBOL LEGEND

- TRAFFIC SIGNAL
- RAILROAD CONTROL BOX
- RAILROAD SWITCH
- SHRUB
- ROCK
- MARSH SYMBOL
- HYDRANT
- GATE/VALVE
- UTILITY VAULT
- UNCERTAIN HYDRANT
- MANHOLE
- UNCERTAIN MANHOLE
- CATCH BASINS
- UNCERTAIN CATCH BASIN
- UTILITY POLE
- UTILITY POLE WITH LIGHT
- STREET LIGHT
- GUY ANCHOR
- UNCERTAIN UTILITY POLE
- UTILITY BOX
- POLE
- POST
- UNCERTAIN POLE
- ROAD SIGN
- MONUMENT
- UNCERTAIN OBJECT
- ×723.8 SPOT HEIGHT
- ×74.0 FIELD LOCATED GRADE
- TREE
- RIP-RAP

- FENCE
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- PARTLY VISIBLE FENCE
- RETAINING WALL
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- FLOOD CONTROL EASEMENT
- CONCRETE FLOOD WALL
- APPROXIMATE LEVEE BASELINE
- OTHER EASEMENT LINES
- PAVED ROAD
- DIRT DRIVE
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- BUILDING
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- SCRUB LINE
- HEDGE ROW
- BOUNDARY LINE

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NORTH AMERICAN VERTICAL DATUM 1988

NOTE: FOR THIS FLOOD CONTROL SYSTEM, ELEVATIONS IN NGVD29 CAN BE OBTAINED BY ADDING 0.70 FEET TO THE ELEVATIONS SHOWN ON THIS PLAN.

CHICOPEE FLOOD CONTROL WORKS
CHICOPEE FALLS SYSTEM SHEET 5 OF 5

TOPOGRAPHIC PLAN OF LAND IN
CHICOPEE, MASSACHUSETTS
SURVEYED FOR
THE CITY OF CHICOPEE

SCALE: 1" = 40'

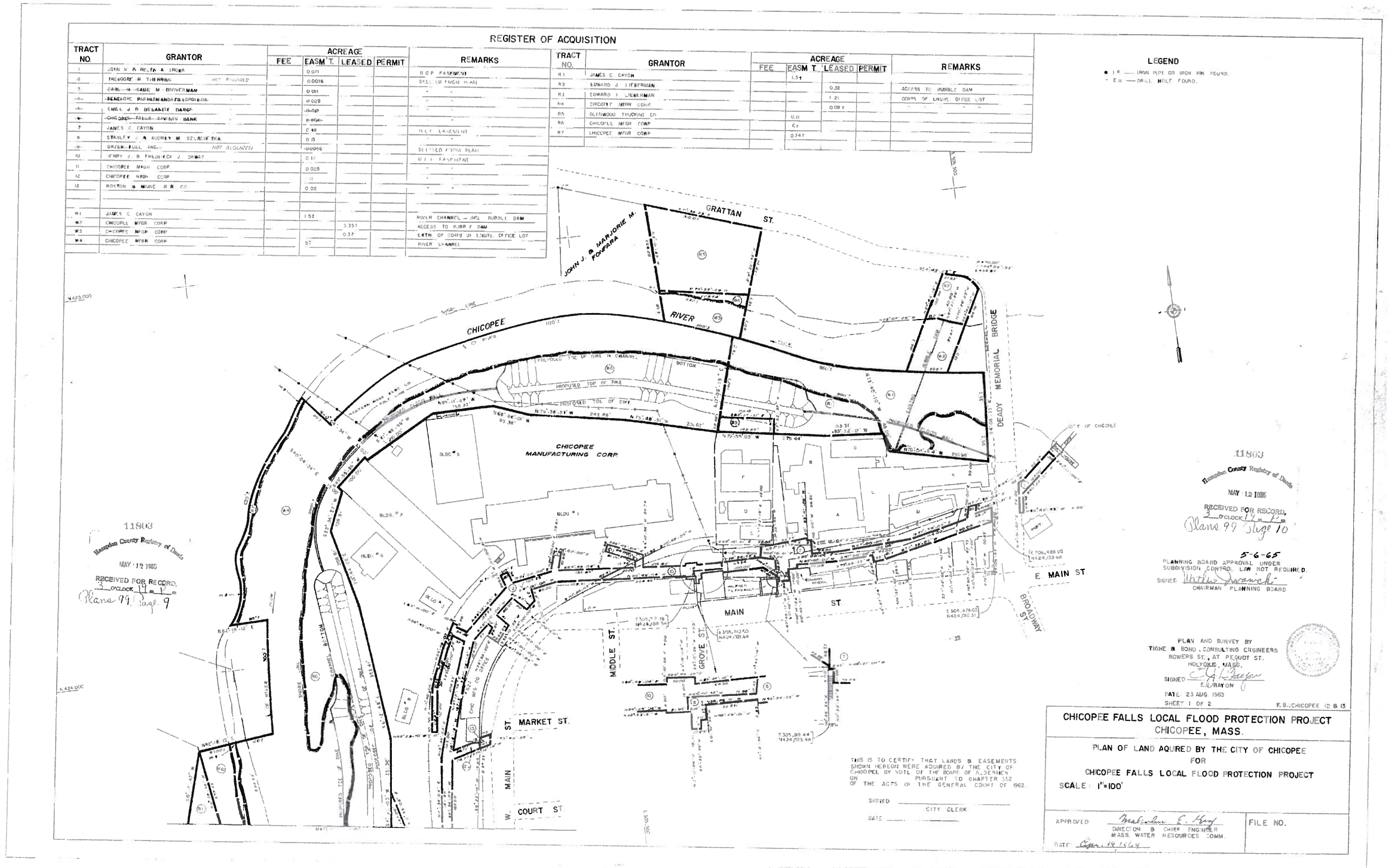
0' 20' 40' 60' 80' 120'

DATE: DECEMBER 12, 2009

HERITAGE SURVEYS, INC.
REGISTERED PROFESSIONAL LAND SURVEYORS
COLLEGE HIGHWAY & CLARK STREET
POST OFFICE BOX 1
SOUTHAMPTON, MASSACHUSETTS
(413) 527-3600

COMMONWEALTH OF MASSACHUSETTS
BRUCE A. COOMBS
No. 27814

JOB # 6289-080505 | DWG # 6289FALLS TOPO | MAP # 6289-091212


REGISTER OF ACQUISITION
TRACT NO.
GRANTOR
ACREAGE
FEE
EASM'T.
LEASED
PERMIT
REMARKS
JAMES C. CAYON
EDWARD J. FITZPATRICK
EDWARD L. GUILFOYLE
CHICOPEE MFGR. CORP.
GLENWOOD TRUCKING CO.
CHICOPEE MFGR. CORP.
CHICOPEE MFGR. CORP.
ACCESS TO RUBBLE DAM
CORR. OF LANDS, OFFICE LOT
RIVER CHANNEL — INCL. RUBBLE DAM
ACCESS TO PUMP F DAM
EXTN. OF CORR. OF LANDS, OFFICE LOT
RIVER CHANNEL
LEGEND
I.P. — IRON PIPE OR IRON PIN FOUND.
D.H. — DRILL HOLE FOUND.
GRATTAN ST.
JOHN J. & MARJORIE M. FOPIANA
CHICOPEE
RIVER
CHICOPEE MANUFACTURING CORP.
BLDG. 1
BLDG. 2
BLDG. 3
BLDG. 4
BLDG. 5
DEALY MEMORIAL BRIDGE
CITY OF CHICOPEE
E. MAIN ST.
MAIN ST.
BROADWAY ST.
MIDDLE ST.
GROVE ST.
MARKET ST.
W. COURT ST.
MAIN ST.
PROPOSED TOP OF DIKE
PROPOSED TOE OF DIKE
BOTTOM
11803
Hampden County Registry of Deeds
MAY 12 1965
RECEIVED FOR RECORD
2 O'CLOCK P.M.
Plans 99 Page 10
5-6-65
PLANNING BOARD APPROVAL UNDER SUBDIVISION CONTROL LAW NOT REQUIRED.
SIGNED
CHAIRMAN PLANNING BOARD
11803
Hampden County Registry of Deeds
MAY 12 1965
RECEIVED FOR RECORD
2 O'CLOCK P.M.
Plans 99 Page 9
PLAN AND SURVEY BY
TIGHE & BOND, CONSULTING ENGINEERS
ROWERS ST., AT PEQUOT ST.
HOLYOKE, MASS.
SIGNED
E.J. BARTON
DATE 23 AUG. 1963
SHEET 1 OF 2
F.B. CHICOPEE 12 & 13
THIS IS TO CERTIFY THAT LANDS & EASEMENTS SHOWN HEREON WERE AQUIRED BY THE CITY OF CHICOPEE BY VOTE OF THE BOARD OF ALDERMEN ON PURSUANT TO CHAPTER 152 OF THE ACTS OF THE GENERAL COURT OF 1962.
SIGNED
CITY CLERK
DATE
CHICOPEE FALLS LOCAL FLOOD PROTECTION PROJECT
CHICOPEE, MASS.
PLAN OF LAND AQUIRED BY THE CITY OF CHICOPEE
FOR
CHICOPEE FALLS LOCAL FLOOD PROTECTION PROJECT
SCALE: 1"=100'
APPROVED
DIRECTOR & CHIEF ENGINEER
MASS. WATER RESOURCES COMM.
DATE
FILE NO.

REGISTER OF ACQUISITION

TRACT NO.	GRANTOR	ACREAGE FEE	ACREAGE EASM'T.	ACREAGE LEASED	ACREAGE PERMIT	REMARKS
14	U.S. RUBBER CO.		0.19			RCP EASEMENT
15	U.S. RUBBER CO.		0.17			" "
16	U.S. RUBBER CO.		0.13			" "
17	U.S. RUBBER CO.		0.24			" "
18	BOSTON & MAINE R.R. CO.		0.018			" "
19	BOSTON & MAINE R.R. CO.		0.015			" "
20	BOSTON & MAINE R.R. CO.		0.13			DIKE EASEMENT
20A	BOSTON & MAINE R.R. CO.		0.10			RCP EASEMENT
21	U.S. RUBBER CO.		0.06			" "
~~R6A~~	~~CHICOPEE MFGR. CORP.~~ NOT ACQUIRED		~~.033~~			DELETED FROM PLAN
R8	U.S. RUBBER CO.		3.0±			
R9	CHICOPEE MFGR. CORP.		0.35±			
R10	WESTERN MASS. ELECTRIC CO.		2.8±			
R11	FRANK J. & MARY A. MURDZA		0.72			
R12	WALTER S. MURDZA	0.84				
R13	U.S. RUBBER CO.		26±			ACCESS FROM HAMPDEN ST.

LEGEND

- S.B. — STONE BOUND FOUND.
- I.P. — IRON PIPE OR IRON PIN FOUND.

PLAN AND SURVEY BY
TIGHE & BOND, CONSULTING ENGINEERS
BOWERS ST., AT PEQUOT ST.
HOLYOKE, MASS.
SIGNED E.J. Bayon
E.J. BAYON
DATE: 23 AUG. 1963
SHEET 2 OF 2 F.B.; CHICOPEE 12 & 13

COMMONWEALTH OF MASSACHUSETTS — EDWARD J. BAYON — No. 6611 — REGISTERED LAND SURVEYOR

THIS IS TO CERTIFY THAT LANDS & EASEMENTS SHOWN HEREON WERE AQUIRED BY THE CITY OF CHICOPEE BY VOTE OF THE BOARD OF ALDERMEN ON _____ PURSUANT TO CHAPTER 552 OF THE ACTS OF THE GENERAL COURT OF 1962.

SIGNED _____
CITY CLERK
DATE _____

5-6-65
PLANNING BOARD APPROVAL UNDER SUBDIVISION CONTROL LAW NOT REQUIRED.
SIGNED Walter Swanski
CHAIRMAN PLANNING BOARD

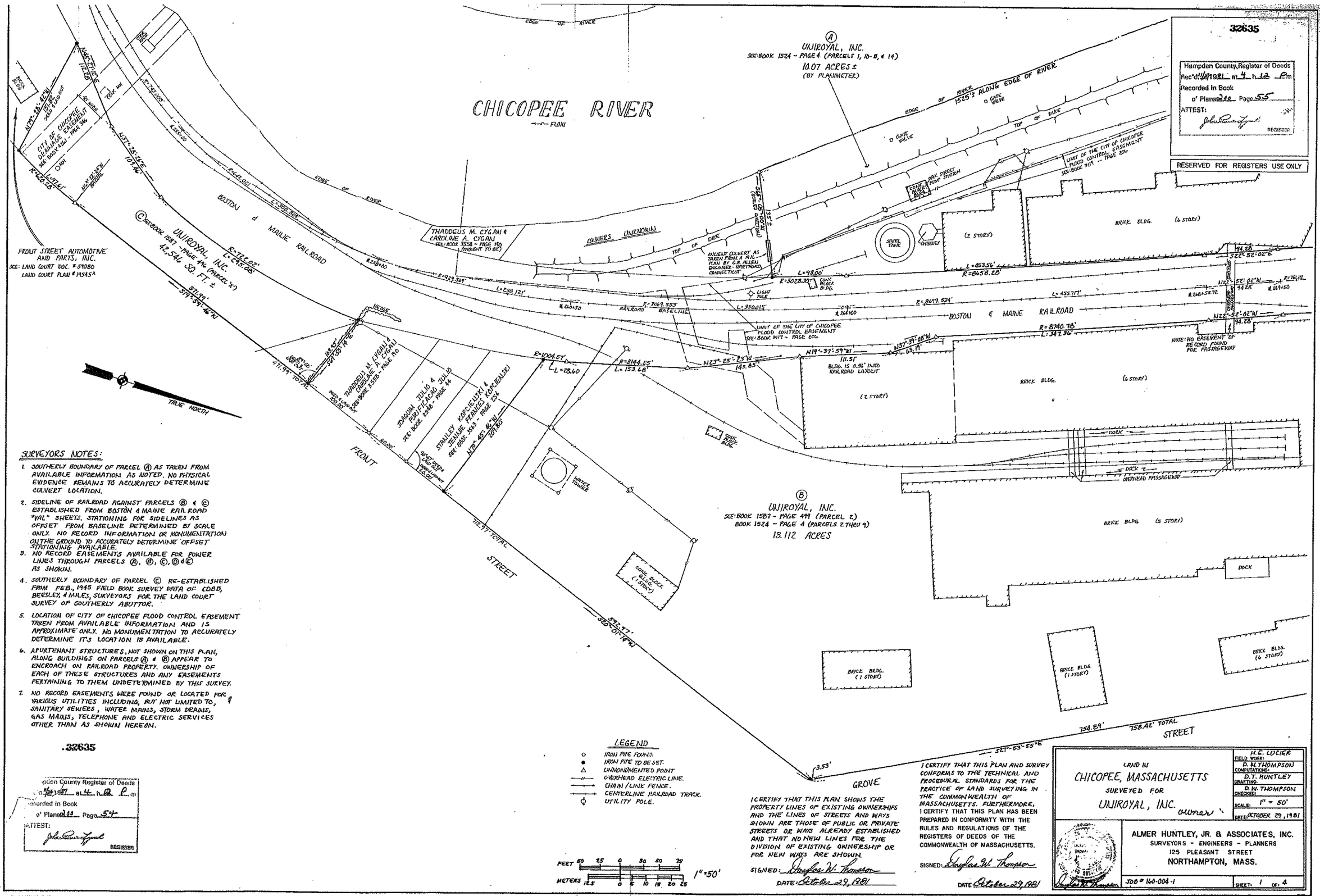
CHICOPEE FALLS LOCAL FLOOD PROTECTION PROJECT
CHICOPEE, MASS.

PLAN OF LAND AQUIRED BY THE CITY OF CHICOPEE
FOR
CHICOPEE FALLS LOCAL FLOOD PROTECTION PROJECT

SCALE: 1" = 100'

APPROVED: Malcolm E. Peabody
DIRECTOR & CHIEF ENGINEER
MASS. WATER RESOURCES COMM.
DATE: April 14, 1965

FILE NO.



32635

Hampden County, Register of Deeds
Rec'd 11/4/1981 at 4 h 12 Pm
Recorded in Book
of Plans 248 Page 55
ATTEST: John Francis Egan
REGISTER

RESERVED FOR REGISTERS USE ONLY

SURVEYORS NOTES:

1. SOUTHERLY BOUNDARY OF PARCEL (A) AS TAKEN FROM AVAILABLE INFORMATION AS NOTED. NO PHYSICAL EVIDENCE REMAINS TO ACCURATELY DETERMINE CULVERT LOCATION.
2. SIDELINE OF RAILROAD AGAINST PARCELS (B) & (C) ESTABLISHED FROM BOSTON & MAINE RAIL ROAD "VAL" SHEETS. STATIONING FOR SIDELINES AS OFFSET FROM BASELINE DETERMINED BY SCALE ONLY. NO RECORD INFORMATION OR MONUMENTATION ON THE GROUND TO ACCURATELY DETERMINE OFFSET STATIONING AVAILABLE.
3. NO RECORD EASEMENTS AVAILABLE FOR POWER LINES THROUGH PARCELS (A), (B), (C), (D) & (E) AS SHOWN.
4. SOUTHERLY BOUNDARY OF PARCEL (C) RE-ESTABLISHED FROM FEB. 1945 FIELD BOOK SURVEY DATA OF COBB, BEESLEY, & MILES, SURVEYORS FOR THE LAND COURT SURVEY OF SOUTHERLY ABUTTOR.
5. LOCATION OF CITY OF CHICOPEE FLOOD CONTROL EASEMENT TAKEN FROM AVAILABLE INFORMATION AND IS APPROXIMATE ONLY. NO MONUMENTATION TO ACCURATELY DETERMINE ITS LOCATION IS AVAILABLE.
6. APURTENANT STRUCTURES, NOT SHOWN ON THIS PLAN, ALONG BUILDINGS ON PARCELS (A) & (B) APPEAR TO ENCROACH ON RAILROAD PROPERTY. OWNERSHIP OF EACH OF THESE STRUCTURES AND ANY EASEMENTS PERTAINING TO THEM UNDETERMINED BY THIS SURVEY.
7. NO RECORD EASEMENTS WERE FOUND OR LOCATED FOR VARIOUS UTILITIES INCLUDING, BUT NOT LIMITED TO, SANITARY SEWERS, WATER MAINS, STORM DRAINS, GAS MAINS, TELEPHONE AND ELECTRIC SERVICES OTHER THAN AS SHOWN HEREON.

32635

Hampden County Register of Deeds
Rec'd 11/4/1981 at 4 h 12 P m
Recorded in Book
of Plans 248 Page 54
ATTEST: John Francis Egan
REGISTER

LEGEND

- IRON PIPE FOUND.
- IRON PIPE TO BE SET.
- UNMONUMENTED POINT
- OVERHEAD ELECTRIC LINE.
- CHAIN / LINK FENCE.
- CENTERLINE RAILROAD TRACK.
- UTILITY POLE.

FEET 50 25 0 30 50 75
METERS 12.5 0 5 10 15 20 25
1" = 50'

I CERTIFY THAT THIS PLAN SHOWS THE PROPERTY LINES OF EXISTING OWNERSHIPS AND THE LINES OF STREETS AND WAYS SHOWN ARE THOSE OF PUBLIC OR PRIVATE STREETS OR WAYS ALREADY ESTABLISHED AND THAT NO NEW LINES FOR THE DIVISION OF EXISTING OWNERSHIP OR FOR NEW WAYS ARE SHOWN.

SIGNED: Douglas W. Thompson
DATE: October 29, 1981

I CERTIFY THAT THIS PLAN AND SURVEY CONFORMS TO THE TECHNICAL AND PROCEDURAL STANDARDS FOR THE PRACTICE OF LAND SURVEYING IN THE COMMONWEALTH OF MASSACHUSETTS. FUETHERMORE, I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

SIGNED: Douglas W. Thompson
DATE: October 29, 1981

LAND IN
CHICOPEE, MASSACHUSETTS
SURVEYED FOR
UNIROYAL, INC. owner

FIELD WORK:	H.E. LUCIER
COMPUTATIONS:	D. W. THOMPSON
DRAFTING:	D.T. HUNTLEY
CHECKED:	D. W. THOMPSON
SCALE:	1" = 50'
DATE:	OCTOBER 29, 1981

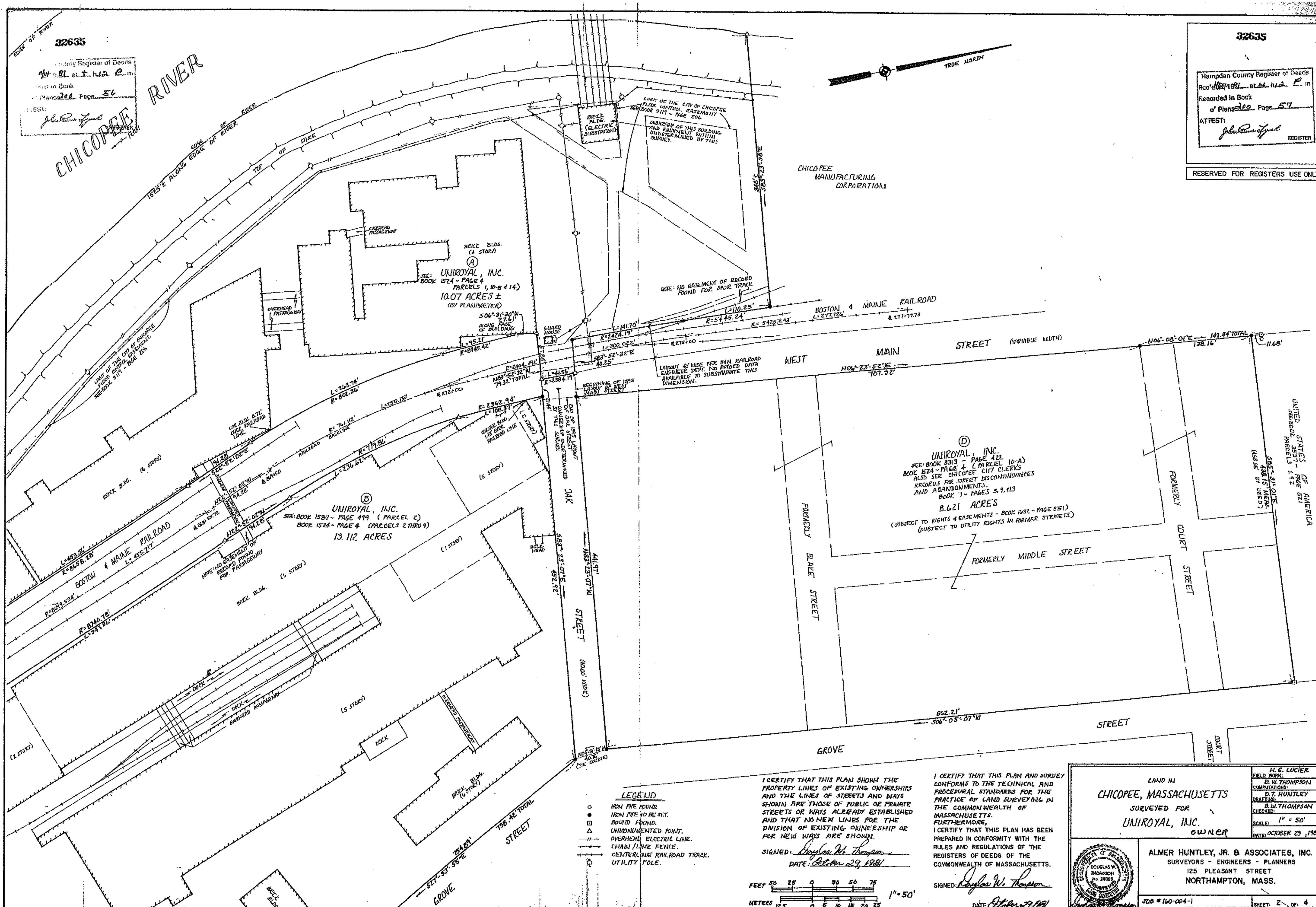
ALMER HUNTLEY, JR. & ASSOCIATES, INC.
SURVEYORS - ENGINEERS - PLANNERS
125 PLEASANT STREET
NORTHAMPTON, MASS.

JOB # 160-004-1
SHEET: 1 OF: 4

KEUFFEL & ESSER CO. 65603

11-59 A

11-59 A


32635
Hampden County Register of Deeds
Rec'd at m
Recorded in Book of Plans 200 Page 56
ATTEST:
REGISTER
32635
Hampden County Register of Deeds
Recorded in Book of Plans 200 Page 57
ATTEST:
REGISTER
RESERVED FOR REGISTERS USE ONLY
TRUE NORTH
CHICOPEE RIVER
EDGE OF RIVER
1525'± ALONG EDGE OF RIVER
TOP OF DIKE
LIMIT OF THE CITY OF CHICOPEE FLOOD CONTROL EASEMENT SEE BOOK 3119 ~ PAGE 206
BRICK BLDG. (ELECTRIC SUBSTATION)
OWNERSHIP OF THIS BUILDING AND EQUIPMENT WITHIN UNDETERMINED BY THIS SURVEY.
CHICOPEE MANUFACTURING CORPORATION
OVERHEAD PASSAGEWAY
BRICK BLDG. (4 STORY)
Ⓐ
UNIROYAL, INC.
SEE: BOOK 1524 ~ PAGE 4 PARCELS 1, 10-B & 14)
10.07 ACRES ±
(BY PLANIMETER)
S06°-31'-30"W 27.61' ALONG FACE OF BUILDING
NOTE: NO EASEMENT OF RECORD FOUND FOR SPUR TRACK
BOSTON & MAINE RAILROAD
WEST MAIN STREET (VARIABLE WIDTH)
N06°-23'-52"E 707.32'
N06°-08'-01"E 149.84' TOTAL 138.16'
LAYOUT 40' WIDE PER B&M RAILROAD ENGINEER DEPT. NO RECORD DATA AVAILABLE TO SUBSTANTIATE THIS DIMENSION.
BEGINNING OF 1895 LAYOUT OF WEST MAIN STREET
GUARD HOUSE
N83°-52'-32"W 74.32' TOTAL
S83°-52'-32"E 40.25'
END OF 1895 LAYOUT OF OAK STREET EXACT LOCATION UNDETERMINED BY THIS SURVEY.
BRICK BLDG. (6 STORY)
Ⓑ
UNIROYAL, INC.
SEE: BOOK 1587 ~ PAGE 419 (PARCEL 2)
BOOK 1524 ~ PAGE 4 (PARCELS 2 THRU 9)
13.112 ACRES
BOSTON & MAINE RAILROAD
NOTE: NO EASEMENT OF RECORD FOUND FOR PASSAGEWAY
BRICK BLDG. (6 STORY)
(5 STORY)
(1 STORY)
(2 STORY)
BRICK BLDG. (4 STORY)
DOCK
OVERHEAD PASSAGEWAY
OAK STREET (40.00' WIDE)
S83°-23'-07"E 492.92'
N83°-23'-07"W 441.91'
Ⓓ
UNIROYAL, INC.
SEE: BOOK 3313 ~ PAGE 422
BOOK 1524 ~ PAGE 4 (PARCEL 10-A)
ALSO SEE CHICOPEE CITY CLERKS RECORDS FOR STREET DISCONTINUANCES AND ABANDONMENTS. BOOK 7 ~ PAGES 5, 9, 13
8.621 ACRES
(SUBJECT TO RIGHTS & EASEMENTS - BOOK 1632 - PAGE 551)
(SUBJECT TO UTILITY RIGHTS IN FORMER STREETS)
FORMERLY BLAKE STREET
FORMERLY MIDDLE STREET
FORMERLY COURT STREET
UNITED STATES OF AMERICA SEE BOOK 3573 ~ PAGE 521 PARCELS 1 & 2
GROVE STREET
S06°-05'-07"W 862.21'
COURT STREET
GROVE STREET
S27°-53'-55"E 758.42' TOTAL
LEGEND
IRON PIPE FOUND.
IRON PIPE TO BE SET.
BOUND FOUND.
UNMONUMENTED POINT.
OVERHEAD ELECTRIC LINE.
CHAIN LINK FENCE.
CENTERLINE RAILROAD TRACK.
UTILITY POLE.
I CERTIFY THAT THIS PLAN SHOWS THE PROPERTY LINES OF EXISTING OWNERSHIPS AND THE LINES OF STREETS AND WAYS SHOWN ARE THOSE OF PUBLIC OR PRIVATE STREETS OR WAYS ALREADY ESTABLISHED AND THAT NO NEW LINES FOR THE DIVISION OF EXISTING OWNERSHIP OR FOR NEW WAYS ARE SHOWN.
SIGNED: Douglas W. Thompson
DATE: October 29, 1981
I CERTIFY THAT THIS PLAN AND SURVEY CONFORMS TO THE TECHNICAL AND PROCEDURAL STANDARDS FOR THE PRACTICE OF LAND SURVEYING IN THE COMMONWEALTH OF MASSACHUSETTS. FURTHERMORE,
I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.
SIGNED: Douglas W. Thompson
DATE: October 29, 1981
FEET 50 25 0 30 50 75
METERS 12.5 0 5 10 15 20 25
1" = 50'
LAND IN CHICOPEE, MASSACHUSETTS SURVEYED FOR UNIROYAL, INC. OWNER
FIELD WORK: H. G. LUCIER
COMPUTATIONS: D. W. THOMPSON
DRAFTING: D. T. HUNTLEY
CHECKED: D. W. THOMPSON
SCALE: 1" = 50'
DATE: OCTOBER 29, 1981
ALMER HUNTLEY, JR. & ASSOCIATES, INC.
SURVEYORS - ENGINEERS - PLANNERS
125 PLEASANT STREET
NORTHAMPTON, MASS.
JOB # 160-004-1
SHEET: 2 OF 4
DOUGLAS W. THOMPSON No. 26065 REGISTERED LAND SURVEYOR

Bk 17783 Pg139 #30020
05-11-2009 @ 02:32p

QUITCLAIM DEED

KNOW ALL MEN BY THESE PRESENTS that **FACEMATE CORPORATION a/k/a DHJ FACEMATE CORPORATION** of 5 West Main Street, Chicopee, Hampden County, Massachusetts,

In accordance with an Agreement for Judgment filed with the Hampden County Superior Court, Civil Docket No. HDCV2005-00299

grant to THE **CITY OF CHICOPEE,** a municipal corporation duly established under the laws of the Commonwealth of Massachusetts and having its usual place of business at 17 Springfield Street, Chicopee, Hampden County, Massachusetts

WITH QUITCLAIM COVENANTS

The land located in the City of Chicopee, County of Hampden, Commonwealth of Massachusetts and as bounded and described in the attachment hereto marked "Exhibit A", together with all buildings and improvements and structures located thereon.

Subject to facts shown on survey prepared by Almer Huntley, Jr. & Associates, Inc. dated October 29, 1981 as set forth in Book of Plans 200, Pages 54 thru 61.

BEING a portion of the premises conveyed to the grantor herein by deed of UNIROYAL, INC. dated November 10, 1981 and recorded with the Hampden County Registry of Deeds in Book 5191, Page 343.

"THIS TRANSFER DOES NOT CONSTITUTE ALL OR SUBSTANTIALLY ALL OF THE ASSETS OF THE GRANTOR CORPORATION."

Executed as a sealed instrument this 30th day of April 2009.

WITNESS

FACEMATE CORPORATION
Its President and Treasurer
Walter F. Mroziński

COMMONWEALTH OF MASSACHUSETTS

HAMPDEN, SS. **April 30, 2009**

On this 30th day of April 2009 the undersigned notary public, personally appeared Walter F. Mroziński, who proved to me through satisfactory evidence of identification, which was a Massachusetts Drivers License, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he signed it voluntarily for its stated purpose on behalf of Facemate Corporation.

LAURA EDEN HEEMSKERK
NOTARY PUBLIC
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires Dec. 24, 2015

Notary Public LAURA EDEN HEEMSKERK
My Commission Expires: 12/24/15

EXHIBIT "A"

The following are descriptions of three (3) parcels of land in Chicopee, Massachusetts, shown on 4 sheets of a plan by Almer Huntley, Jr., & Associates, Inc., Surveyors, Engineers, Planners, 125 Pleasant Street, Northampton, Massachusetts entitled "Land in Chicopee, Massachusetts Surveyed for – Uniroyal, Inc." and are bounded and described according to said plan as follows:

PARCEL – A

Beginning at an iron pin on the Westerly line of land of the Boston & Maine Railroad at the Southeasterly corner of land of Chicopee Manufacturing Corporation;

Thence, running Southerly along a curve to the left having a radius of 5445.24 feet an arc distance of 110.25 feet to a point of compound curvature;

Thence, running Southerly along a curve to the left having a radius of 2424.19 feet an arc distance of 141.70 feet to an iron pin;

Thence, running S83°-52'-32"E a distance of 40.25 feet to a point, the last three (3) courses being along the Westerly line of Boston & Maine Railroad;

Thence, running Southerly along land of unknown owners along a curve to the left having a radius of 2384.19 feet an arc distance of 41.56 feet to a point;

Thence, running N83°-52'-32"W a distance of 57.88 feet to the Northeast corner of a 4 story brick building;

Thence, running S06°-31'-30"W along the East face of said building 27.61 feet to a point;

Thence, running Southerly along a curve to the left having a radius of 2445.42 feet an arc distance of 95.121 feet to a point of compound curvature;

Thence, running Southerly and Southeasterly along a curve to the left having a radius of 802.36 feet an arc distance of 263.74 feet to a point;

Thence, running S22°-52'-02"E a distance of 94.28 feet to a point;

Thence, running Southeasterly along a curve to the right having a radius of 8658.28 feet an arc distance of 453.56 feet to a point of compound curvature;

Thence, running Southerly along a curve to the right having a radius of 3028.30 feet an arc distance of 93.00 feet to an iron pin at the Southeasterly corner of the parcel herein described, the last seven (7) courses being along land of the Boston & Maine Railroad;

Thence, running S65°-05'-00"W along land of unknown owners a distance of 135 feet, more or less, to a point on the East edge of the Chicopee River;

Thence, running Northwesterly and Northerly along the East edge of the Chicopee River 1525 feet, more or less, to a point;

Thence, running S83°-23'-38"E along land of Chicopee Manufacturing Corporation 340 feet, more or less, to the point of beginning.

The above described parcel contains 10.07 acres, more or less.

PARCEL – B

Beginning at an iron pin on the Southerly line of Oak Street at the intersection with the Southwesterly line of Grove Street;

Thence, running S27°-53'=55"E along the Southwesterly line of Grove Street 758.42 feet to an iron pin on the Northwesterly line of Front Street;

Thence, running S20°-01'-14"W along the Northwesterly line of Front Street 592.96 feet to an iron pin at the Northeasterly corner of land of Stanley Kopcienski & Jennie Frances Kopcienski;

Thence, running N70°-45'-46"W along said Kopcienski 209.80 feet to an iron pin on the Easterly line of the Boston & Maine Railroad;

Thence, running Northwesterly along a curve to the left having a radius of 1004.57 feet an arc distance of 28.60 feet to a point of compound curvature;

Thence, running Northwesterly along a curve to the left having a radius of 3144.55 feet an arc distance of 153.68 feet to a point;

Thence, running N23°-25'-23"W a distance of 143.85 feet to a point;

Thence, running N19°-37'-95"W a distance of 111.51 feet to a point;

Thence, running N37°-39'-08"W a distance of 63.19 feet to a point;

Thence, running Northwesterly along a curve to the left having a radius of 8740.78 feet an arc distance of 347.36 feet to a point;

Thence, running N22°-52'-02"W a distance of 94.28 feet to a point;

Thence, running Northwesterly and Northerly along a curve to the right having a radius of 719.86 feet an arc distance of 236.62 feet to a point of compound curvature;

Thence, running Northerly along a curve to the right having a radius of 2,362.94 feet an arc distance of 108.37 feet to a point, the last nine (9) courses being along the Easterly line of the Boston & Maine Railroad;

Thence, running S83°-23'-07"E along land of unknown owners and along the Southerly line of Oak Street 452.92 feet to the point of beginning.

The above described parcel contains 13.112 acres.

EXCEPTING THEREFROM said parcel previously conveyed to Chicopee Municipal Employees Credit Union by deed dated January 9, 1987 and recorded with the Hampden County Registry of Deeds in Book 6493, Page 595.

EXCEPTING THEREFROM said parcel previously conveyed to Thomas M. Zombik and Veronica T. Zombik by deed dated January 31, 1989 and recorded with the Hampden County Registry of Deeds in Book 7089, Page 304.

EXCEPTING THEREFROM said parcel previously conveyed to John Salema a/k/a Joao Salema and Natalia Salema a/k/a Maria N. Salema by deed dated May 8, 1997 and recorded with the Hampden County Registry of Deeds in Book 9855, Page 107.

PARCEL – C

Beginning at an iron pin on the Northwesterly line of Front Street at the Southeasterly corner of land of Thaddeus M. Cygan & Caroline A. Cygan;

Thence, running S19°-59'-46"W along the Northwesterly line of Front Street 371.99 feet to a point;

Thence, running Southwesterly along said Front Street along a curve to the right having a radius of 620.28 feet an arc distance of 97.61 feet to an iron pin at the Northeasterly corner of land of Front Street Automotive and Parts, Inc.;

Thence, running N79°-28'-42"W along said Front Street Automotive and Parts, Inc. 151.82 feet to an iron pin in the Northeasterly line of land of the Boston & Maine Railroad;

Thence, running N48°-27'-12"E a distance of 112.28 feet to a point;

Thence, running N37°-28'-26"E a distance of 109.46 feet to a point;

Thence, running Northeasterly and Northerly along a curve to the left having a radius of 722.02 feet an arc distance of 295.08 feet to an iron pin at the Southwesterly corner of the aforementioned Cygan; the last three (3) courses being along land of the Boston & Maine Railroad;

Thence, running S69°-50'-14"E along said Cygan 103.95 feet to the point of beginning.

The above described parcel contains 42,545 square feet, more or less;

Bk 17783 Pg143 #30021
05-11-2009 @ 02:32p

QUITCLAIM DEED

KNOW ALL MEN BY THESE PRESENTS that **DHJ FACEMATE CORPORATION A/K/A FACEMATE CORPORATION** of 5 West Main Street, Chicopee, Hampden County, Massachusetts,

In accordance with an Agreement for Judgment filed with the Hampden County Superior Court, Civil Docket No. HDCV2005-00299

grant to THE **CITY OF CHICOPEE,** a municipal corporation duly established under the laws of the Commonwealth of Massachusetts and having its usual place of business at 17 Springfield Street, Chicopee, Hampden County, Massachusetts

Hereby grants to the Grantee all the Grantor's right, title and interest, without any warranties or covenants of title whatsoever, in a certain parcel of land, and the buildings, fixtures and improvements thereon, if any, situated in Chicopee, Hampden County, Massachusetts (hereinafter referred to as the "Premises") described as follows:

SEE EXHIBIT "A' ATTACHED HERETO AND MADE A PART HEREOF BY THIS REFERENCE

This conveyance is made subject to the following reservations, conditions, covenants and agreements:

1. This conveyance is made without granting any right of way, either by necessity or otherwise over any remaining land or location of the Grantor.

2. The Grantor hereby reserves to itself, its successors, assigns, affiliates and licensees, a permanent right of way, license and easement in, on, over, under, across and through the Premises for the purpose of accessing, constructing, installing, operating, maintaining, modifying, repairing, replacing, relocating and removing a telecommunications system or other system for transmission of intelligence or information by any means, whether now existing or hereafter devised, including such poles, pipes, wires, fibers, fiberoptic cables, repeater stations, attachments, appurtenances, structures or other equipment and property

of any description necessary or useful for the same (hereinafter referred to as the "Telecommunications Easement"). The Grantor further reserves the right to freely lease, license, mortgage, assign, pledge and otherwise alienate the Telecommunications Easement. The Grantee hereby covenants with the Grantor to recognize the Telecommunications Easement and, without the payment of any further consideration, to execute, acknowledge and deliver such instruments suitable for recording with the registry of deeds as the Grantor may reasonably require to confirm and acknowledge title to the Telecommunications Easement in the Grantor.

3. There is excepted from this conveyance any and all railroad tracks, railroad track materials (including, but not limited to, ties, connections, switches and ballast), and/or related equipment located in whole or in part within the Premises (hereinafter referred to as the "Trackage") and this conveyance is subject to the right of the Grantor to enter the Premises from time to time and at any and all times within the ninety (90) day period commencing with and subsequent to the date of delivery of this deed, with such men, equipment and materials as, in the sole and reasonable opinion of the Principal Engineering Officer of the Grantor, are necessary for the removal of such Trackage. Days during the months December, January, February and March shall not be counted or included in the aforesaid ninety (90) day period. If the Trackage is not removed from the Premises by the expiration of said ninety (90) day period, the Trackage shall be deemed abandoned by the Grantor and shall then become the property of the Grantee. **Nothing in this paragraph shall affect the rights of Facemate Corporation, its agents or assigns, from its right to remove personal property and railroad tracks as provided under a Settlement Agreement between Facemate Corporation and the City of Chicopee dated March 7, 2009.**

4. There is excepted from this conveyance any and all advertising signs and/or billboards located upon the Premises which are not owned by the Grantor. Furthermore, this conveyance is subject to the right of the owners of said signs and/or billboards to remove them from the Premises within ninety (90) days from the date of delivery of this deed.

5. By the acceptance of this deed and as part consideration therefor, the Grantee hereby assumes any and all agreements, covenants, obligations and liabilities of the Grantor in respect to any underground facilities, drainage culverts, walls, crossings and/or other structures of any nature and description located in whole or in part within the Premises.

6. By the acceptance of this deed and as part consideration therefor, the Grantee covenants and agrees to indemnify, defend and hold harmless the Grantor (including its officers, employees, agents, directors, shareholders and affiliates) from and against any and all loss, liability, damage, cost and expense (including reasonable attorneys' fees) occasioned by or associated with any claims, suits and/or enforcement actions (including any administrative or judicial proceedings and any remedial, removal or response actions) ever asserted, threatened, instituted or requested by any person and/or governmental agency on account of: (a) any release of oil or hazardous materials or substances of any description on, upon or into the Premises in contravention of any ordinance, law or statute (including, but not limited to, the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (42 U.S.C. Section 9601, et. seq., as amended); and (b) any and all damage to real or personal property, natural resources and/or harm or injury to persons alleged to have resulted from such release of oil or hazardous materials or substances.

7. By the acceptance of this deed and as part consideration therefor, the Grantee hereby covenants and agrees to build and forever maintain fences (together with any necessary gates), suitable to the Principal Engineering Officer of the Grantor, along the boundaries of the Premises which are common to remaining land or location of the Grantor (hereinafter referred to as the "Fences"), if such Fences are ever required in the sole and reasonable opinion of said Principal Engineering Officer. If the Grantee fails to install, maintain, repair or replace the Fences within sixty (60) days after having been requested or ordered to do so by the said Principal Engineering Officer of the Grantor, then the Grantor shall have the right to so install, maintain, repair or replace the Fences. The Grantee further covenants and agrees that, upon the rendering of a bill for the expense of such installation, maintenance, repair or replacement of the Fences, the Grantee shall pay said bill in full within thirty (30) days fro the date of receiving it. The Grantee further covenants and agrees that if said bill is not paid within thirty (30) days, it shall become subject to a finance charge computed at a periodic rate of 1.5% per month applied to the previous balance after deducting any current payment. If said finance charge is now lawful, then the finance charge shall then be the highest lawful amount which does not exceed said 1.5% per month charge. If the Grantee, for any reason whatsoever, fails to pay said bill (and finance charges, if applicable) the Grantee shall pay all Grantor's costs of collection, including reasonable attorneys' fees and expenses.

8. This conveyance is subject to the following restrictions for the benefit of other land or location of the Grantor, to wit: that from the date of this deed, the Grantor shall not be liable to the Grantee or any lessee or user of the Premises (or any part thereof) for any damage to any buildings or property upon them caused by fire, whether communicated directly or indirectly by or from locomotive engines or any description upon the railroad operated by the Grantor, or otherwise.

9. By the acceptance of this deed and as part consideration therefor, the Grantee hereby covenants and agrees to make no use of the Premises which, in the sole and reasonable opinion of the Principal Engineering Officer of the Grantor, adversely affects, increases or decreases drainage to, from, upon or in any remaining land or location of the Grantor. The Grantee further covenants and agrees not to permit or allow, either directly or indirectly, any drainage to flow from the Premises onto other land or location of the Grantor (including, but not limited to, flowing drainage from the Premises into or to existing drainage ditches or culverts located either in part or entirely upon remaining land and location of the Grantor.) Furthermore, the Grantee covenants and agrees to indemnify and save the Grantor harmless from and against any and all loss, cost, damage or expense including, but not limited to, the cost of defending all claims and/or suits for property damage, personal injury or death arising out of or in any way attributable to any breach of these covenants in respect to drainage.

10. There is excepted from this conveyance any and all overhead, surface or underground signal and communication line facilities of the Grantor located within the limits of the Premises and this conveyance is subject to the Grantor and its licensees to use any such facilities in their present locations and to enter upon the Premises from time to time to maintain, repair, replace, renew, relay or remove such facilities.

11. Whenever used in this deed, the term "Grantor" shall not only refer to the FACEMATE CORPORATION, but also its successors, assigns, affiliates and the term "Grantee" shall not only refer to CITY OF CHICOPEE, but also its successors, assigns and grantees, as the case may be.

12. The several reservations, conditions, covenants and agreements contained in this deed are to be considered as running with the land and are to be binding upon the Grantee forever.

"THIS TRANSFER DOES NOT CONSTITUTE ALL OR SUBSTANTIALLY ALL OF THE ASSETS OF THE GRANTOR CORPORATION."

Executed as a sealed instrument this day of April, 2009.

WITNESS

FACEMATE CORPORATION
Its President and Treasurer
Walter F. Mroziński

COMMONWEALTH OF MASSACHUSETTS

HAMPDEN, SS. **April 30, 2009**

On this 30th day of April 2009 the undersigned notary public, personally appeared Walter F. Mroziński, who proved to me through satisfactory evidence of identification, which was a Massachusetts Drivers License, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he signed it voluntarily for its stated purpose on behalf of Facemate Corporation.

LAURA EDEN HEEMSKERK
NOTARY PUBLIC
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires Dec. 24, 2015

Notary Public LAURA EDEN HEEMSKERK
My Commission Expires: 12/24/15.

EXHIBIT A

A certain line of railroad of varying width, including all the fixtures and improvements thereon, known as the "Chicopee Falls Branch", located in Chicopee, Hampden County, Massachusetts (the "Line"). The Line is described on unrecorded federal valuation plans as lying on valuation section 42.2, maps 1, 2 and 3 between station points 208+20 and 282+52 along the centerline of the railroad tracks on said Line. The Line contains two parcels, extending a distance of approximately 7,432 feet and is more particularly described as follows:

PARCEL I

Beginning at said station point 208+20, which is approximately 170 feet east of the easterly sideline of Grape Street in said Chicopee, thence running north to a point approximately 40 feet south of the south bank of the Chicopee River, thence running and running in a generally southerly and easterly direction parallel to, and approximately 40 feet south of, said southerly bank of the Chicopee River a distance of approximately 320 feet to a point, thence turning and running in a generally northerly direction to said south bank of the Chicopee River, thence continuing generally south, east and north along said south bank of the Chicopee River to the point of intersection therewith with land now or formerly of U.S. Rubber Co., thence continuing by sad land of U.S. Rubber Co. to Oak Street, thence turning and running east along the southerly sideline of said Oak Street a distance of approximately 80 feet to other land now or formerly of U.S. Rubber Co., thence turning and running generally south, west and north in various courses by said other land of U.S. Rubber Co. and by land now or formerly of J. Hafet, Burtworth Carpet Company, Darcy Pie Company, City of Chicopee (Chicopee Power Station, Manual Training School and Chicopee High School), G. Blaisdell, Richard Crowin, Starzyk, Murphy, Ludden, J. Devan, Ryate Estate, City of Chicopee, Kinna Heirs, and others, to a point 25 feet south of said station point 208+20, thence turning and running approximately 25 feet north to said station point 208+20, and the place of beginning.

Meaning and intending to convey all the Grantor's right, title and interest in Parcel I of said Line as acquired by virtue of the following instruments (running successively south, east and north towards Oak Street):

(1) Deed of Merrick Murphy dated May 29, 1846 and recorded with the Hampden County Registry of Deeds at Book 132, Page 154;

(2) Deed of John Chase dated February 8, 1847 and recorded with said Deeds at Book 132, page 498;

(3) Condemnation by Location filed with the Clerk of Courts for Hampden County on March 27, 1847 against Charles McClellan;

(4) Condemnation by Location filed with the Clerk of Courts for Hampden County on March 27, 1847 against John Chase;

(5) Condemnation by Location filed with the Clerk of Courts for Hampden County on March 27, 1847 against Charles McClellan;

(6) Deed of George Rumrill dated July 3, 1846 and recorded with said Deeds at Book 132, Page 201;

(7) County Commissioner's Decree dated May 20, 1846 against Erastus Taylor, as filed with the records of the County Commissions of Hampden County, April Term 1846;

(8) Deed of Erastus Taylor dated August 8, 1846 and recorded with said Deeds at Book 132, Page 276;

(9) Deed of Delia Towne dated July 29, 1846 and recorded with said Deeds at Book 132, Page 234;

(10) Deed of Daniel Warren dated July 3, 1846 and recorded with said Deeds at Book 132, Page 228; and

(11) Condemnation by Location filed with the Clerk of Courts for Hampden County on March 27, 1847 against Chicopee Manufacturing Co.

BEING a portion of the premises conveyed to the grantor herein by deed of The Boston and Maine Corporation dated January 4, 1990 and recorded with the Hampden County Registry of Deeds in Book 7362, Page 362.

558

BOOK 3102 PAGE 558

7977

EASEMENT

KNOW ALL MEN BY THESE PRESENTS, that JOHNSON & JOHNSON, a New Jersey corporation, having a place of business in the City of Chicopee, County of Hampden, Commonwealth of Massachusetts, as grantor, in consideration of the sum of ONE (1) DOLLAR and other good and valuable consideration paid by the City of Chicopee, the receipt whereof is hereby acknowledged, does hereby give, grant, sell and convey unto the said City of Chicopee and its successors and assigns forever, a perpetual, permanent and assignable easement and right-of-way in and to the lands more particularly described herein to construct, maintain, repair, operate, patrol, replace or remove "A dike, flood wall, surface drain system with fittings, and all appliances attached thereto, together with all reasonable facilities in relation to the Chicopee Falls Local Flood Protection Project" and to pass freely to and from the same in any manner with vehicles and equipment for the purpose of maintaining, constructing and repairing said Project, and including the rights hereinafter described, in, upon, under, over and across a certain parcel of land situated in the City of Chicopee, County of Hampden, Commonwealth of Massachusetts, being more particularly bounded and described as follows:

FIRST PARCEL -

Beginning at the southeasterly corner of the tract herein described, said point being the northlymost corner and projection of Tract 10 as shown on Sheet 1 of plans titled "Chicopee Falls Local Flood Protection Project, Chicopee, Massachusetts, Scale : 1"=100', Tighe & Bond, Consulting Engineers";

thence S 70°58'09" W a distance of twenty-one and ninety-three hundredths (21.93) feet along a northwesterly

property line of land now or formerly of Henry J. and Frederick J. Orwat, also being a northwesterly line of Tract 10 to a point;

thence N 66°49'04" W a distance of eighty-one (81) feet to a point;

thence N 23°10'56" E a distance of twenty (20) feet to a point;

thence S 66°49'04" E a distance of ninety-six (96) feet to a point;

thence S 5°10'56" W a distance of seven (7) feet to the point of beginning and containing about twenty-five thousandths (0.025) acres; being Tract 11 as shown on Sheet 1 of plans titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond, Consulting Engineers", which plans are on file in the office of the City Engineer of the City of Chicopee.

SECOND PARCEL -

Beginning at the southeasterly corner of the tract herein described, said point being N 82°31'29" W a distance of twenty-three (23) feet along the northerly property line of land now or formerly of the United States Rubber Company from an iron pipe marking the northeast corner of said United States Rubber Company and having coordinates of N 423,093.20, E 305,034 .72 in the Massachusetts State Coordinate System;

thence N 82°31'29" W a distance of thirty (30) feet along the northerly property line of the United States Rubber Company to a point;

thence N 4°50'41" E a distance of one hundred thirteen and ninety-one hundredths (113.91) feet to the easterlymost projection of a platform attached to Building D of the Chicopee Manufacturing Corp.;

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thence N 2°10'16" W a distance of two hundred twelve and fifty hundredths (212.50) feet to the northeasterly corner of Tract R6A;

thence N 2°32'42" E a distance of one hundred nineteen and fifty-eight hundredths (119.58) feet to a point;

thence N 6°34'03" E a distance of one hundred sixty-seven and eighty-four hundredths (167.84) feet to a point;

thence N 15°34'03" E a distance of one hundred five (105) feet to a point;

thence N 19°18'56" E a distance of two hundred four and thirty-three hundredths (204.33) feet to a point;

thence N 56°30'00" W a distance of thirty-seven (37) feet to a point;

thence S 26°45'00" W a distance of thirty-five (35) feet to a point;

thence S 23°00'00" W a distance of seventy-five (75) feet to a point;

thence S 17°30'00" W a distance of thirty (30) feet to a point;

thence S 7°30'00" W a distance of one hundred twelve (112) feet to a point;

thence N 82°29'50" W a distance of ten (10) feet to a point;

thence N 7°30'00" E a distance of one hundred twelve and eighty-seven hundredths (112.87) feet to a point;

thence N 17°30'00" E a distance of thirty-one and thirty-five hundredths (31.35) feet to a point;

thence N 23°00'00" E a distance of seventy-five and eighty-one hundredths (75.81) feet to a point;

thence N 26°45'00" E a distance of sixty-four and thirty-three hundredths (64.33) feet to a point;

thence S 63°15'00" E a distance of ten (10) feet to a point;

thence S 26°45'00" W a distance of eight and eighty-six hundredths (8.86) feet to a point;

thence S 56°30'00" E a distance of thirty-four and twenty-two hundredths (34.22) feet to a point;

thence N 48° 12'40" E a distance of one hundred fifty-seven and twenty-two hundredths (157.22) feet to a point;

thence N 19°00'00" W a distance of thirty-five and forty-six hundredths (35.46) feet to a point;

thence N 71°00'00" E a distance of twenty (20) feet to a point;

thence S 19°00'00" E a distance of thirty-four and no hundredths (34.00) feet to a point;

thence N 81°00'00" E a distance of one hundred five and thirty-eight hundredths (105.38) feet to a point;

thence N 20°00'00" E a distance of fifty-eight and sixty-seven hundredths (58.67) feet to a point;

thence S 70°00'00" E a distance of twenty and no hundredths (20.00) feet to a point;

thence S 20°00'00" W a distance of fifty and no hundredths (50.00) feet to a point;

thence S 84°49'04" E a distance of one hundred fifty-three and eighty-four hundredths (153.84) feet to the northwesterly property line of land now or formerly of Henry J. and Frederick J. Orwat;

thence S 70°58'09" W a distance of sixty-five and eighty-three hundredths (65.83) feet along said westerly property line of Henry J. and Frederick J. Orwat, also being a northwesterly line of Tract 10 to a point being the westerly corner of Tract 10;

thence N 84°49'04" W a distance of one hundred five and eighty-one hundredths (105.81) feet to a point;

thence S 81°00'00" W a distance of sixty-nine and no hundredths (69.00) feet to a point;

thence S 9°00'00" E a distance of thirty-three and no hundredths (33.00) feet to a point;

thence S 48°00'00" W a distance of twenty-nine and eighty-five hundredths (29,85) feet to a point;

thence N 42°00'00" W a distance of fifty and no hundredths (50.00) feet to a point;

thence S 48°00'00" W a distance of sixty and no hundredths (60.00) feet to a point;

thence S 42°00'00" E a distance of forty-one and no hundredths (41.00) feet to a point;

thence S 36°10'23" W a distance of fifty-five and twenty-five hundredths (55.25) feet to the northeasterly face of Building B2A of the Chicopee Manufacturing Corp.;

thence N 47°08'54" W a distance of thirty-five and no hundredths (35.00) feet along the northeasterly face of said Chicopee Manufacturing Corp. building to a point;

thence N 35°53'20" E a distance of twenty-eight and twenty-seven hundredths (28.27) feet to a point;

thence N 42°00'00" W a distance of twelve and no hundredths (12.00) feet to a point;

thence S 48°00'00" W a distance of fifty-seven and no hundredths (57.00) feet to a point;

thence S 20°46'14" W a distance of one hundred twenty-four and no hundredths (124.00) feet to a point, said point being a distance of 2 ft. westerly of the westerly face of Chicopee Manufacturing Corp. Building B2A;

thence S 16°16'14" W a distance of one hundred sixty-seven and thirteen hundredths (167.13) feet to a point;

thence N 76°12'18" E a distance of fifty-six and seventy-five hundredths (56.75) feet to a point;

thence S 83°42'23" E a distance of about fifteen (15) feet to a westerly property line of the Boston & Maine Railroad Company, said last course being a distance of one (1) foot from the southerly face of Chicopee Manufacturing Corp. Building B2A;

thence S 6°33'14" W a distance of fifteen and eighty-four hundredths (15.84) feet along said westerly property line of Boston & Maine Railroad Company to a point;

thence S 76°12'18" W a distance of seventy-six and ninety-three (76.93) feet to a point, said last four courses describing a projection designated as Tract 12A for identification purposes;

thence S 6°34'03" W a distance of one hundred sixty-three and no hundredths (163.00) feet;

thence S 2°34'03" W a distance of one hundred seventeen and no hundredths (117.00) feet to a point;

thence S 0°55'57" E a distance of one hundred fifty-six and ninety-four (156.94) feet to a point, said point being one (1) foot westerly of the westerly face of Chicopee Manufacturing Corp. Building C;

thence S 6°26'42" W a distance of fifty and no hundredths (50.00) feet to a point, said last course being a distance of one (1) foot westerly and parallel to the westerly face of Chicopee Manufacturing Corp. Building C;

thence S 83°33'18" E a distance of nine and no hundredths (9.00) feet, said course being one (1) foot southerly and parallel to the southerly face of Chicopee Manufacturing Corporation Building C;

thence S 2°01'41" W a distance of one hundred twenty-two and sixty-seven hundredths (122.67) feet to the land now or formerly of the United States Rubber Company and the point of beginning and containing about one and eleven hundredths (1.11) acres; being Tract 12 as shown on Sheets 1 and 2 of plans titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Mass.,Scale: 1"=100', Tighe & Bond, Consulting Engineers", and which said plans are on file in the office of the City Engineer of the City of Chicopee.

THIRD PARCEL -

Beginning at the northwesterly corner of property now or formerly of the U. S. Rubber Company at the Chicopee River;

thence southerly along the easterly shore of the Chicopee River a distance of about nineteen hundred (1900) feet to the southwesterly corner of Tract R8 as shown on Sheet 2 of plans titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond, Consulting Engineers;

thence S 78°11'55" W a distance of about one hundred (100) feet to the center of the Chicopee River;

thence southerly and/or westerly along the centerline of the Chicopee River a distance of about eleven hundred seventy-five (1175) feet to a point;

thence N 2°45'00" W a distance of about one hundred twenty (120) feet to the northerly shore of the Chicopee River;

thence easterly and/or northerly along the northerly and/or westerly shore of the Chicopee River a distance of about twenty-seven hundred (2700) feet to land of the Chicopee Manufacturing Corporation, said point being the southeasterly corner of Tract R9;

thence northerly along the low water mark of the westerly shore of the Chicopee River a distance of about nine hundred fifteen (915) feet to a point;

thence N 82°18'12" E a distance of about one hundred (100) feet to the center of the Chicopee River;

thence in a northerly direction along the centerline of the Chicopee River a distance of about three hundred feet (300ft.) to a point;

thence S 82°18'12" W a distance of about eighty (80) feet to the low water line of the westerly shore of the Chicopee River, said point being the southeasterly corner of Tract R7;

thence northeasterly along the low water line of the westerly shore of the Chicopee River a distance of about six hundred thirty (630) feet to a point; said point being the northeasterly corner of Tract R7;

thence S 40°04'34" E a distance of about ninety (90) feet to the center of the Chicopee River;

thence northerly and easterly along the centerline of the Chicopee River a distance of about eleven hundred twenty (1120) feet to a point; said point being the northwesterly corner of Tract W1;

thence S 17°09'19" W a distance of about seventy-five (75) feet to the southerly shore of the Chicopee River, said point being a southwesterly corner of Tract W1, also being the northwesterly corner of Tract R1;

thence westerly and southerly along the southerly and easterly shore of the Chicopee River a distance of about twenty-nine hundred (2900) feet to the northerly property line of U.S. Rubber Company, being the point of beginning, and containing about nine (9) acres; being Tract W4 as shown on Sheet 1 and Sheet 2 of plans titled "Chicopee Falls Local Flood Protection

Project, Chicopee Mass., Scale: 1"=100', Tighe & Bond, Consulting Engineers", and which said plans are on file in the office of the City Engineer of the City of Chicopee.

FOURTH PARCEL -

Beginning at a northerly corner of the tract herein described, said point being the northwesterly corner of Tract R1, also being the northwesterly corner of property now or formerly of James C. Cayon;

thence S 17°09'19" W a distance of about one hundred forty (140) feet from the southerly shore of the Chicopee River to the northwesterly corner of the land now or formerly of the Glenwood Trucking Co., also being the northwesterly corner of Tract R5;

thence continuing on same course a distance of thirty-two and fifty-eight (32.58) feet alongh the westerly line of the Glenwood Trucking Co. to a point;

thence N 75°48'51" W a distance of two hundred thirty-six and sixty-seven hundredths (236.67) feet to a point;

thence N 79°36'39" W a distance of two hundred forty-two and eighty-eight hundredths (242.88) feet to a point;

thence N 68°36'01" W a distance of ninety-five and thirty-eight hundredths (95.38) feet to a point;

thence N 89°11'47" W a distance of one hundred fifty-eight and twenty-seven hundredths (158.27) feet to a point, said last course being parallel to and two (2) feet northerly of the northerly face of the platform attached to Building 5 of the Chicopee Manufacturing Corp.;

thence S 61°49'49" W a distance of two hundred ten (210) feet to a point one (1) foot northeasterly from the northeasterly face of Building 2 of the Chicopee Manufacturing Corp.;

thence N 40°04'34" W a distance of ten (10) feet, said course being one (1) foot northeasterly of the northeast face of said Building 2;

thence S 49°55'26" W a distance of one hundred (100) feet, said course being parallel to and one (1) foot from the northwesterly face of said Building 2;

thence S 40°04'34" E a distance of fifteen (15) feet, said course being parallel to and at a distance of two (2) feet from the southwesterly face of Building 2 of the Chicopee Manufacturing Corp.;

thence S 22°34'27" W a distance of one hundred eight and ninety-one (108.91) feet to a point;

thence S 13°44'02" E a distance of two hundred six and eighty-one hundredths (206.81) feet to a point;

thence S 6°12'48" E a distance of three hundred fifty-three and forty-one hundredths (353.41) feet to a point;

thence S 6°30'00" W a distance of three hundred fifty-one (351) feet to a point;

thence S 4°42'21" W a distance of three hundred nine and forty-five hundredths (309.45) feet to the northerly boundary of the United States Rubber Company;

thence N 82°31'29" W a distance of about one hundred (100) feet along the northerly property line of the United States Rubber Company to the easterly shore of the Chicopee River;

thence northerly and easterly along the easterly and southerly shore of the Chicopee River for a distance of about twenty-nine hundred (2900) feet to the point of beginning and containing about six (6) acres, being Tract R6 as shown on Sheets 1 and 2 of plans titled: "Chicopee Falls Local Flood Protection Project, Chicopee Massachusetts, Scale: 1"=100', Tighe & Bond,

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Consulting Engineers", and which said plans are on file in the office of the City Engineer of the City of Chicopee. Tract R6 subject to Western Mass. Electric Co. rights of way for electrical transmission lines.

FIFTH PARCEL -

Beginning at the northeasterly corner of the tract herein described, said point being at the intersection of the low water mark of the northwesterly shore of the Chicopee River and the line of the northeasterly face of Chicopee Manufacturing Corp. Building 2 extended, said line having a bearing of N 40°04'34" W from the northeasterly corner of said Building 2;

R7

thence southwesterly along the northwesterly shore of the Chicopee River a distance of about six hundred thirty (630) feet to a point;

thence S 82°18'12" W a distance of about seventeen and no hundredths (17.00) feet to a point, said point being a distance of sixteen and five-tenths (16.5) feet westerly of the low water mark of the westerly shore of the Chicopee River;

thence northeasterly along a line being parallel to and sixteen and five-tenths (16.5) feet northwesterly from the low water mark of the northwesterly shore of the Chicopee River a distance of about six hundred thirty (630) feet to a point;

thence S 40°04'34" E a distance of about seventeen (17) feet to the point of beginning, and containing about twenty-four hundredths (0.24) acres, being Tract R-7 as shown on Sheet 1 of plans titled "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond, Consulting Engineers", and which said plans are on file in the office of the City Engineer of the City of Chicopee.

SIXTH PARCEL -

Beginning at the northeasterly corner of the tract herein described, said point being located as follows: Beginning at an iron pin, lying along the southerly line of Nelson St. at the intersection of the westerly line of Hampden St.; thence N 3°26'31" E a distance of five hundred nine and ninety-four hundredths (509.94) ft. to a stone bound on the easterly line of Hampden St. said land located at coordinates N 423,137.87; E 304,039.26 Mass. State Board Coordinate System; thence S 53° 01'29" E a distance of one hundred seventy-three and seventy-six hundredths (173.76) ft. along property now or formerly of the United States Rubber Company and property now or formerly of the Western Mass. Electric Company to a point; thence N 15° 17'47" E a distance of seven hundred five and sixteen hundredths (705.16) ft. along the westerly lines of Tracts R-11 and R-12 to a point; thence N 82°18'12" E a distance of about ninety-six and fifty hundredths (96.50) ft. to the low water mark of the westerly shore of the Chicopee River, said point being the northeasterly corner of Tract R-9;

thence along the low water mark of the westerly shore of the Chicopee River in a southerly direction a distance of about nine hundred fifteen (915) feet to property now or formerly of the United States Rubber Company;

thence N 84°31'42" W a distance of about twenty (20) ft. along land of United States Rubber Company to a point;

thence N 5°31'16" E a distance of about one hundred forty-five and thirty-five hundredths (145.35) ft. along property now or formerly of United States Rubber Company and Western Mass. Electric Co., to a point being sixteen and five tenths (16.5) ft. westerly of the low water mark of the westerly shore of the Chicopee River;

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thence northerly along a line parallel to and sixteen and five tenths (16.5) ft. westerly of the low water line of the westerly shore of the Chicopee River for a distance of about seven hundred seventy (770) ft. to a point;

thence N 82°18'12" E a distance of about sixteen and five tenths (16.5) ft. to the point of beginning and containing about 0.35 acres; being Tract R-9 as shown on Sheet 2 of plans titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond, Consulting Engineers, and which said plans are on file in the office of the City Engineer of the City of Chicopee.

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Together with the right to trim, cut, fell and remove therefrom all trees, underbrush and other vegetation within the limits of said easement or right-of-way, and for such distance beyond said limits and adjacent thereto as is necessary to provide adequate clearance and to eliminate interference with, or hazards to the structures or utilities placed or constructed on, over or under said land within the limits of said easement.

Reserving, however, to the grantor, its successors and assigns forever, all right, title, interest and privilege, as may be exercised and enjoyed without interference with or abridgement of the easement and right-of-way.

The grantor agrees to the following covenants which shall run with the land subjected to easement.

(a) That the City of Chicopee may grant, convey, transfer, assign or permit the use and occupation of, by grant of easement, lease, license, permit or otherwise, all or any part

of the easement and rights granted herein, to any individual, partnership, corporation or political body, for any purpose related to the construction, maintenance or repair of the dikes, flood walls and drain system of the Chicopee Falls Local Flood Protection Project.

(b) That the payment by the City of Chicopee of the consideration recited herein shall constitute full, fair value and full compensation to the grantor, for the easement and rights herein granted, whether such easement and rights shall be exercised by the City of Chicopee or by any of its grantees, transferees, assignees, lessees, licensees, or permittees as described in the foregoing subsection (a) of this paragraph; and the grantor expressly releases and relinquishes any and all claims against any of the aforementioned for further or future payment of consideration for the aforesaid easement and rights except as stated herein.

Said easement and rights shall continue in perpetuity from the date of this instrument conveying the same to the City of Chicopee and its successors and assigns.

Subject to existing easements for public roads and highways, for public utilities, for railroads, and pipe lines.

Meaning and intending to convey an easement entered in the same premises conveyed to the grantor herein by deed of Chicopee Manufacturing Corp. dated December 31, 1962, and recorded with the Hampden County Registry of Deeds, Book 3091 , Page236 .

TO HAVE AND TO HOLD the easement and right-of-way with all the privileges thereof, unto the said City of Chicopee and its successors and assigns, to its and their use and behoof forever.

By acceptance of this grant the City of Chicopee and its successors and assigns covenant, for the duration of, and with respect to the easement and rights set forth herein, that:

(a) They will, at their expense, on completion of any construction, maintenance or repair of the Chicopee Falls Local Flood Protection Project on the lands of the grantor, fill all holes and trenches and restore the surface of the grantor's property to its normal condition and if the ground settles or subsides at any place, such settlement shall be refilled and the ground level restored to its normal condition. All debris will be removed and all surface and subsurface appurtenances of the grantor will be restored.

(b) All private roadways, parking lots, etc., on the lands of the grantor which are used by the City of Chicopee, its successors and assigns, or any contractors or agents in connection with the Chicopee Falls Local Flood Protection Project will be maintained in a safe and usable condition at all times and, if damaged, will be restored to their normal condition and all such roadways, parking lots, etc., under which the surface drain system is installed will be restored after any construction, maintenance or repair to their normal condition.

(c) Grantor shall have the right to inspect the easement and right-of-way at any time and the City of Chicopee, its successors and assigns, will perform such acts as may be reasonably requested by the grantor to protect its property.

(d) The City of Chicopee, its successors and assigns, will bear the expense of all damage to the property of the grantor located outside of the above-described easement and

right-of-way caused by the construction, maintenance or repair of the Chicopee Falls Local Flood Protection Project.

IN WITNESS WHEREOF, the said grantor, JOHNSON & JOHNSON has hereunto set its hand and seal this 12th day of February 1965.

JOHNSON & JOHNSON

By John J. Smith
President
Surgical Manufacturing Company
Division of Johnson & Johnson

ATTEST:

David E. Calkins
Assistant Secretary

STATE OF NEW JERSEY)
COUNTY OF MIDDLESEX)

Then personally appeared the above named David E. Calkins and acknowledged the foregoing instrument to be the free act and deed of the corporation, before me

Joan E. Holsey
Notary Public

My commission expires

NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Oct. , 1966

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BOOK 3102 PAGE 574

STATE OF NEW JERSEY }
COUNTY OF MIDDLESEX } ss.:

Then personally appeared the above-named JOHN J. SMITH, President of Chicopee Manufacturing Company, Division of Johnson & Johnson, and acknowledged the attached instrument to the City of Chicopee to be the free act and deed of the corporation, before me

Notary Public

NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Oct. 17, 1966.

CITY OF CHICOPEE
MASSACHUSETTS
OFFICE OF THE CITY CLERK

ARTHUR BALTHAZAR
CITY CLERK

March 29, 1965

Mayor Edward Lysek:

I hereby certify that the following order, recommended by the Mayor, was passed by the Board of Aldermen at a meeting held March 23, 1965, presented to the Mayor March 26, 1965, and approved by the Mayor March 26, 1965:

ORDERED THAT, the City of Chicopee accept from the Chicopee Manufacturing Company, a division of Johnson & Johnson, a deed dated February 12, 1965, wherein the said Chicopee Manufacturing Company conveys to the City of Chicopee certain rights and easements in relation to the Chicopee Falls Local Flood Protection Project.

Attest:

City Clerk

AB/jg

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BOOK 3102 PAGE 575

I, JAMES SCOTT HILL, Secretary of Johnson & Johnson, a corporation duly organized and existing under the laws of the State of New Jersey, hereby certify that a meeting of the Board of Directors of said Corporation was duly called and held on the 18th day of January, 1965, and that at said meeting, at which a quorum was present and voting throughout, the following resolution, upon motion duly made and seconded, was duly and unanimously adopted:

RESOLVED: that John J. Smith, President, Chicopee Manufacturing Company, a division of the Corporation, or the President, any Vice-President, the Secretary and any Assistant Secretary, be, and each of them hereby is, authorized to execute and deliver, on behalf of this Corporation, any and all deeds and other instruments necessary to grant and convey unto the City of Chicopee, County of Hampden, Commonwealth of Massachusetts, an easement and right-of-way to the lands of the Corporation in the City of Chicopee to be used in connection with the Chicopee Falls Local Flood Protection Project, and to take whatever other action is necessary or advisable in furtherance of the foregoing resolution.

As said Secretary of Johnson & Johnson, I further certify that the foregoing resolution has not been repealed, annulled, altered or amended in any respect but remains in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of Johnson & Johnson this day of March, 1965.

JOHNSON & JOHNSON SEAL 1887

James Scott Hill
Secretary
Johnson & Johnson

APPROVED
APR 6 1965
3:31 PM
REGISTRY OF DEEDS

6EA-6
2/1/65

15911

EASEMENT

KNOW ALL MEN BY THESE PRESENTS that UNITED STATES RUBBER COMPANY, a corporation organized and existing under the laws of the State of New Jersey, having its principal office at Rockefeller Center, Number 1230 Avenue of the Americas, New York 20, N. Y., in consideration of ONE (1) DOLLAR paid by the CITY OF CHICOPEE, the receipt whereof is hereby acknowledged, do hereby grant, unto the said City of Chicopee and its successors and assigns forever, a perpetual, permanent and assignable easement and rights for the right-of-way to construct, maintain, repair, operate, patrol, replace and/or remove "A dike, Flood wall, a surface drain system with fittings and all appliances attached thereto together with all reasonable facilities in relation to Chicopee Falls Local Flood Protection Project", and to pass freely over the same in any manner with vehicles and equipment for the purpose of maintaining, constructing and repairing said system, and including the rights hereinafter described in, upon, under over and across certain parcels of land situated in the City of Chicopee, County of Hampden, Commonwealth of Massachusetts, being more particularly bounded and described as follows: -

FIRST PARCEL - Beginning at the northeasterly corner of the tract herein described, said point being N 82°31' 29" W, a distance of twenty-three and no hundredths (23.00) feet along the southerly property line of land of the Chicopee Manufacturing Corp, from an iron pipe marking the northeasterly corner of United States Rubber Company property at land of the Chicopee Manufacturing Corp, and the Boston & Maine Railroad Company, said iron pipe located at coordinates N 823,093.20, E 305,034.72 in the Massachusetts State Coordinate System

thence S 45°38'21" W a distance of one hundred eighty-two

and fifty-three hundredths (182.53) feet to a point;

thence N 78°42'18" W a distance of twenty-six and sixty-five hundredths (26.65) feet along the northerly line of Tract 15 to a point;

thence N 45°38'21" E a distance of one hundred fifty and twenty-seven hundredths (150.27) feet to a point;

thence N 82°31'29" W, a distance of one hundred fifty-three and forty-three (153.43) feet to a point;

thence N 26°17'42" E, a distance of twenty-four and sixty-one hundredths (24.61) feet along an easterly line of Tract 18 to the property line of the Chicopee Manufacturing Corporation;

thence S 82°31'29" E a distance of two hundred twenty-three and ninety-four hundredths (223.94) feet along the southerly property of Chicopee Manufacturing Corporation to the place of beginning and containing about nineteen hundredths (0.19) acres; being Tract 14 as shown on Sheet 2 of plans titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Massachusetts, Scale: 1"=100', Tighe & Bond, Consulting Engineers", which plans are on file in the office of the City Engineer of the City of Chicopee and which was filed in the Hampden County Registry of Deeds on May 12, 1965, Book of Plans 99, Pages 9, 10, 11 and 12.

SECOND PARCEL - Beginning at the northerly corner of the tract herein described, said point being N 82°31'29" W a distance of twenty-three and no hundredths (23.00) feet along the southerly property line of land of the Chicopee Manufacturing Corp. from an iron pipe marking the northeast corner of United States Rubber Company property at land of the Chicopee Manufacturing Corp. and the Boston & Maine Railroad Company; said iron pipe located at Coordinates N 423,093.20, E 305,034.72 in the Massachusetts State Coordinate System.

thence S 7°45'00" E a distance of ninety-three and no hundredths (93.00) feet to a point;

thence S 4°30'00" E a distance of about forty-seven (47) feet to land now or formerly of the Boston & Maine Railroad Company;

thence S 3°24'10" W a distance of about thirty-two (32) feet along the westerly property line of land now or formerly of the Boston & Maine Railroad Company to a point;

thence N 4°30'00" W a distance of about seventy-nine (79) feet to a point;

thence N 7°45'00" W a distance of sixty-nine and twenty-six hundredths (69.26) feet to a point;

thence N 82°31'20" W a distance of twenty and thirty-eight hundredths (20.38) feet to a point;

thence N 45°38'21" E a distance of thirty and no hundredths (30.00) feet along the southeasterly line of Tract 14 to the point of beginning and containing about twenty-four hundredths (0.24) acres; being Tract 17 as shown on Sheet 2 of plans aforementioned titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond, Consulting Engineers", which said plans are on file in the office of the City Engineer of the City of Chicopee.

THIRD PARCEL - Beginning at the northeasterly corner of the tract herein described, said point being S 70°39'35" W a distance of five (5) feet from the southeasterly corner of United States Rubber Company building No. 33;

thence S 23°00'00" W a distance of ninety-three and no hundredths (93.00) feet to a point;

thence S 63°00'00" W a distance of thirty-three and no hundredths (33.00) feet to a point;

thence S 5°30'00" E a distance of about twenty-six (26) feet to the easterly line of property now or formerly of the Boston & Maine Railroad Company;

thence N 22°30'00" W a distance of about forty-five (45) feet along the easterly line of property of the Boston & Maine Railroad Company to a point;

thence N 23°00'00" E a distance of about twenty-six (26) feet to a point;

thence N 63°00'00" E a distance of forty and no hundredths (40.00) feet to a point;

thence N 23°00'00" E a distance of forty and no hundredths (40.00) feet to the southerly face of United States Rubber Company building No. 33;

thence N 70°39'35" E a distance of eighteen and ninety-four hundredths (18.94) feet along the southerly face of the United States Rubber Company building No. 33 to the point of beginning and containing about six hundredths (0.06) acres; being Tract 21 as shown on Sheet 2 of plans aforementioned titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond Consulting Engineers", and which said plans are on file in the office of the City Engineer of the City of Chicopee.

FOURTH PARCEL - That portion of the below described parcel which runs from the westerly shoreline of the Chicopee River to a line measured twenty-five (25) feet westerly from the top of slope to the dike and parallel thereto, and also including that part of ABANDONED WEST OAK STREET which is the access road to said dike:

Beginning at a westerly corner of the tract herein described, said point being N 84°49'51" E a distance of one hundred fifty-six and fifty-seven hundredths (156.57) feet projected along the southerly line of Nelson St. extended from an iron pin at the intersection of the southerly line of Nelson St. and the westerly line of Hampden St.;

thence S 2°45'00" E a distance of eleven hundred thirty

(1130) feet thru land of the United States Rubber Company to a point;

thence S 84°45'00" E a distance of one hundred eighty and no hundredths (180.00) feet to a point;

thence S 2°45'00" E a distance of about five hundred ten (510) feet along other land of the United States Rubber Company to the northerly shore of the Chicopee River;

thence easterly and northerly along the shore of the Chicopee River a distance of about twenty-seven hundred (2700) feet to a point;

thence N 84°31'42" W a distance of about twenty (20) feet along land now or formerly of the Chicopee Manufacturing Corp. to a point;

thence N 5°31'16" E a distance of twenty-five and thirty-five hundredths (25.35) feet along land now or formerly of the Chicopee Manufacturing Corp. to a point;

thence N 68°02'29" W a distance of two hundred fifty-five and thirty-two hundredths (255.32) feet along property now or formerly of the Western Mass. Electric Company to a stone bound;

thence N 53°01'29" W a distance of ninety and fifty-two hundredths (90.52) feet along a southerly line of land now or formerly of Western Mass. Electric Company to a point;

thence S 15°17'47" W a distance of two hundred one and sixteen hundredths (201.16) feet to a point;

thence N 84°31'42" W a distance of one hundred five and fifty-three hundredths (105.53) feet to the easterly line of Hampden Street;

thence S 5°07'18" E a distance of fifty and forty-four hundredths (50.44) feet along the easterly line of Hampden St. to a point;

thence S 84°31'42" E a distance of one hundred five and fifty-three hundredths (105.53) feet to a point;

thence S 2°07'42" E a distance of one hundred eleven and eighty-three hundredths (111.83) feet to a point;

thence N 84°49'51" E a distance of twenty-seven and no hundredths (27.00) feet to a point;

thence S 2°14'09" E a distance of one hundred thirty-two and no hundredths (132.00) feet along the easterly line of other property of the United States Rubber Company and the easterly property line of land now or formerly of Theodore Murdza to a point marking the southeasterly corner of the said land of Theodore Murdza;

thence S 84°49'51" W a distance of twenty-five (25) feet along the southerly line of land now or formerly of Theodore Murdza to the point of beginning, and containing about twenty-six (26) acres; being Tract R-13 as shown on Sheet 2 of plans aforementioned titled "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond, Consulting Engineers", and which said plans are on file in the office of the City Engineer of the City of Chicopee.

FIFTH PARCEL - Beginning at the northeasterly corner of the tract herein described, said point also being the southeasterly corner of Tract 14 as shown on Sheet 2 of plans titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Tighe & Bond, Consulting Engineers";

thence S 42°21'01" W a distance of fifty-five and thirty-seven hundredths (55.37) feet to a point;

thence S 45°38'21" W a distance of one hundred fifty-one and sixty-one hundredths (151.61) feet to a point;

thence N 8°48'44" W a distance of twenty-seven and four hundredths (27.04) feet along an easterly line of Tract R-8 to a point; thence N 45°38'21" E a distance of one hundred ten and ninety-four hundredths (110.94) feet to a point;

thence N 7°10'40" E a distance of twenty-five and no hundredths (25.00) feet to a point;

thence N 82°49'20" W a distance of fifty-seven and no hundredths (57.00) feet to a point;

thence N 20°17'42" E a distance of thirty-five and no hundredths (35.00) feet along an easterly line of Tract R-8 to a point;

thence S 78°42'18" E a distance of one hundred thirteen and no hundredths (113.00) feet to the point of beginning and containing about seventeen hundredths (0.17) acres;

being Tract 15 as shown on Sheet 2 of plans aforementioned titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond, Inc., Consulting Engineers", and which said plans are on file in the office of the City Engineer of the City of Chicopee;

SIXTH PARCEL - Beginning at the intersection of the southerly line of Oak Street and the westerly line of West Main Street;

thence N 82°45'10" W a distance of thirty-one and sixty-seven hundredths (31.67) feet along the southerly line of Oak Street extended to a point;

thence N 7°14'50" E a distance of thirty-two and seventy-five hundredths (32.75) feet to a point;

thence N 36°47'18" W a distance of eighty-five and no hundredths (85.00) feet to a point;

thence N 78°41'34" W a distance of one hundred thirty-six and thirty-seven hundredths (136.37) feet to a point;

thence N 48°21'01" E a distance of sixteen and thirty-four hundredths (16.34) feet along the southeasterly line of Tract 15 to a point;

thence S 78°41'34" E a distance of one hundred twenty-seven and ninety-four hundredths (127.94) feet to a point;

thence S 66°30'00" E a distance of about forty-nine (49)

feet to the westerly property line of land now or formerly of the Boston & Maine Railroad Company;

thence S 3°24'10" E a distance of about twenty-eight (28) feet along a westerly property line of land now or formerly of the Boston & Maine Railroad Company to a point;

thence S 3°24'10" E a distance of about forty (40) feet along a southerly property line of land now or formerly of the Boston & Maine Railroad Company to the westerly line of West Main Street;

thence S 3°24'10" W a distance of sixty-six and fifteen hundredths (66.15) feet along the westerly line of West Main Street to the point of beginning and containing about thirteen hundredths (0.13) acres; being Tract 16 as shown on Sheet 2 of plans aforementioned titled; "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond, Consulting Engineers"; and which said plans are on file in the office of the City Engineer of the City of Chicopee. Said Tract 16 being subject to railroad track location rights and railroad crossing rights of the Boston & Maine Railroad Company.

SEVENTH PARCEL - Beginning at the northeasterly corner of said parcel herein described, said point being N 82°31'29" W a distance of two hundred forty-six and ninety-four hundredths (246.94) feet along the southerly property line of the Chicopee Manufacturing Corp. from an iron pipe marking the northeasterly corner of the United States Rubber Company property at the land of Chicopee Manufacturing Corp. and the Boston & Maine Railroad Company, said iron pipe located at coordinates N 423,093.26, E 305,034.72 in the Massachusetts State Coordinate System;

thence S 20°17'42" W a distance of one hundred seventy-four and eighty-nine hundredths (174.89) feet to a point;

thence N 82°49'20" W a distance of thirteen and no hundredths (13.00) feet to a point, said course being two (2) feet northerly of the north face of the foundation of the Western Mass. Electric Company Transformer Station;

thence S 7°10'40" W a distance of one hundred twelve and no hundredths (112.00) feet, said course being 2 ft. westerly and parallel to the westerly face of the foundation of the Western Mass. Electric Company Transformer Station;

thence S 8°48'44" E a distance of thirty-one and fifty-nine hundredths (31.59) feet to a point;

thence S 0°13'28" E a distance of fifteen and thirty-two hundredths (15.32) feet along the westerly face of the United States Rubber Company concrete retaining wall;

thence S 3°56'37" E a distance of two hundred twenty-four and thirty-seven hundredths (224.37) feet along the westerly face of said wall and United States Rubber Company buildings No. 13 and No. 11 to a point;

thence S 23°29'55" E a distance of twenty-four and eighty-three hundredths (24.83) feet along the westerly face of building No. 11 to a point;

thence S 28°29'15" E a distance of two hundred two and fifty-seven hundredths (202.57) feet along the westerly wall of Building No. 11 and the westerly face of said concrete wall to a point;

thence S 32°36'05" E a distance of one hundred fifty-six and thirty-seven hundredths (156.37) feet along the westerly face of said concrete wall to a point;

thence S 37°24'41" E a distance of two hundred fifty-four and no hundredths (254.00) feet along the westerly face of the concrete wall and the westerly face of Building No. 9 to a point;

thence N 52°35'19" E a distance of eight and no hundredths (8.00) feet to a point;

thence S 36°44'52" E a distance of eighty-six and one hundredths (86.01) feet to a point;

thence S 39°47'47" E a distance of twenty-four and one hundredths (24.01) feet to a point;

thence S 52°35'19" W a distance of eight and no hundredths (8.00) feet to the westerly face of said concrete retaining wall;

thence S 37°24'41" E a distance of one hundred fifty-nine and thirty hundredths (159.30) feet along the westerly face of the concrete wall to a point;

thence N 89°35'19" E a distance of twenty-five and no hundredths (25.00) feet to a point;

thence S 27°36'07" E a distance of about thirty-one (31) feet to a point at the westerly property line of the Boston & Maine Railroad Company, said point being point "X" for identification;

thence southerly along the curve to the right a distance of about three hundred sixty (360) feet to a point, said last course being along the westerly line of property of the Boston & Maine Railroad Company;

thence S 78°11'55" W about twenty-five and no hundredths (25.00) feet to the easterly shore of the Chicopee River;

thence northerly along the shoreline of the river a distance of about nineteen hundred (1900) feet to the southerly property line of the Chicopee Manufacturing Corp.;

thence S 82°31'29" E a distance of about one hundred (100) feet along the southerly property line of the Chicopee Manufacturing Corp. to the point of beginning and containing about three (3) acres; being Tract R-8 as shown on Sheet 2 of plans aforementioned titled: "Chicopee Falls Local Flood Protection Project, Chicopee, Mass., Scale: 1"=100', Tighe & Bond, Consulting Engineers", and which said plans are on file in the office of the

City Engineer of the City of Chicopee,

* * * * * * * * * * *

Together with the right to trim, cut, fell and remove therefrom all trees and underbrush and obstructions and any other vegetation, structures or obstacles within the limits of said easement of right-of-way.

Reserving, however, to the grantors, their heirs, executors, administrators, successors and assigns, all right, title, interest and privilege, as may be exercised and enjoyed without interference with or abridgement of the easement and rights granted for said right-of-way.

The grantor further agrees to abide by the following covenants which shall run with the land subjected to easement.

(a) That the City of Chicopee may grant, convey, transfer or assign or permit the use and occupation of, by grant of easement, lease, license, permit or otherwise, all or any part of the easement and rights granted herein, to an individual, partnership, corporation or political body, for any purpose consistent with the purpose of rights herein granted and the rights retained by the grantor.

(b) That the payment of the United States of America and/or the City of Chicopee of the consideration recited herein shall constitute full fair value and full compensation to the grantor, for the easement and rights granted herein, whether such easement and rights shall be exercised by the City of Chicopee or by any of its grantees, transferees, assignees, lessees, licensees, or permittees as described in the foregoing subsection (a) of this paragraph; and the grantor expressly releases and relinquishes any and all claims against any of the aforementioned for further or future payment of consideration for the aforesaid easement and rights granted herein.

Said aforementioned easement and rights shall continue in perpetuity from the date of this instrument conveying the same to the City of Chicopee and its successors and assigns.

Subject to existing easements for public roads and highways, for public utilities, for railroads, and pipe lines.

To HAVE and to HOLD the easement and rights for right of way with all the privileges thereof, unto the said City of Chicopee and its successors and assigns, to its and their use and behoof forever.

IN WITNESS WHEREOF, the said grantor, UNITED STATES RUBBER COMPANY, has hereunto set its hand and seal this 28th day of April 1965.

Signed, Sealed and Delivered in the presence of:

UNITED STATES RUBBER COMPANY

By H N Barrett
Attorney-in-Fact

STATE OF NEW YORK)
: SS.:
COUNTY OF NEW YORK)

Then personally appeared the above named H. N. Barrett and acknowledged the foregoing instrument to be the free act and deed of the corporation, before me this 28th day of April ~~March~~, 1965.

Marion Lacey
Notary Public

MARION LACEY
Notary Public, State of New York
No. 31-7275520
Qualified in New York County
Commission Expires March 30, 1967

My Commission Expires

Form 1

State of New York, } ss.:
County of New York, }

No. 83818

I, JAMES McGUIRRIN, County Clerk and Clerk of the Supreme Court, New York County, a Court of Record having by law a seal, DO HEREBY CERTIFY that Marion Lacey whose name is subscribed to the annexed affidavit, deposition, certificate of acknowledgment or proof, was at the time of taking the same a NOTARY PUBLIC in and for the State of New York, duly commissioned and sworn and qualified to act as such throughout the State of New York; that pursuant to law a commission, or a certificate of his official character, and his autograph signature, have been filed in my office; that as such Notary Public he was duly authorized by the laws of the State of New York to administer oaths and affirmations, to receive and certify the acknowledgment or proof of deeds, mortgages, powers of attorney and other written instruments for lands, tenements and hereditaments to be read in evidence or recorded in this State, to protest notes and to take and certify affidavits and depositions; and that I am well acquainted with the handwriting of such Notary Public, or have compared the signature on the annexed instrument with his autograph signature deposited in my office, and believe that the signature is genuine.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal this APR 30 1965

FEE PAID 50¢

James McGuirrin
County Clerk and Clerk of the Supreme Court, New York County

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CITY OF CHICOPEE
MASSACHUSETTS
OFFICE OF THE CITY CLERK

ARTHUR BALTHAZAR
CITY CLERK

May 21, 1965

Law Department:

I hereby certify that the following order, recommended by the Mayor, was passed by the Board of Aldermen at a meeting held May 18, 1965, presented to the Mayor May 21, 1965 and approved by the Mayor May 21, 1965:

ORDERED THAT THE CITY OF CHICOPEE ACCEPT A DEED FROM THE UNITED STATES RUBBER COMPANY CONCERNING CERTAIN EASEMENTS AND RIGHTS IN RELATION TO LAND ON WHICH IS LOCATED THE CHICOPEE FALLS LOCAL FLOOD PROTECTION FACILITIES, AS SHOWN ON A DEED, DATED APRIL 28, 1965, AND PRESENTLY ON FILE IN THE OFFICE OF THE LAW DEPARTMENT.

Attest:

Arthur Balthazar
City Clerk

EXTRACT FROM MINUTES OF MEETING OF THE BOARD OF DIRECTORS OF UNITED STATES RUBBER COMPANY, HELD MAY 9, 1962

ORGANIZATION MATTERS

Execution of
Contracts and Other Documents

Upon motion, duly made and seconded, it was unanimously

VOTED: That, effective July 1, 1962, the President (namely, George R. Vila), or the Financial Vice President (namely, Frank J. McGrath), be and each of them hereby is authorized, in the name and on behalf of the Company, to enter into any contract or to execute and deliver any instrument necessary or proper in connection with the affairs of the Company, and in the usual course of its business, and in connection therewith, to pledge the credit of the Company, to purchase, sell, lease or convey assets or rights affecting assets, to execute powers of attorney, and to compromise or settle any claim, action, suit or proceeding by or against the Company; and it was

FURTHER VOTED: That, effective July 1, 1962, the President (namely, George R. Vila), or the Financial Vice President (namely, Frank J. McGrath), be and each of them hereby is authorized to delegate to any other officer, employee or agent of the Company, the authority, or any part thereof, granted to him by the Board of Directors or the Executive Committee to enter into any contract or to execute and deliver any instrument in the name and on behalf of the Company, any such delegation to be specific, and to be subject to such limitations and restrictions, as the person making such delegation shall determine.

I HEREBY CERTIFY that the foregoing is a true and correct extract from the minutes of a meeting of the Board of Directors of United States Rubber Company, duly called and held May 9, 1962, at which meeting a quorum was present and acting throughout.

I FURTHER CERTIFY that said resolutions and the authority thereby granted are in full force and effect and have not been modified or revoked.

WITNESS my hand and the seal of said United States Rubber Company, this 7th day of June, 1965.

Henry W. Roth
ASSISTANT SECRETARY

64-4
6/7/65

I, FRANK J. McGRATH, Financial Vice President of United States Rubber Company, acting under the authority given to me by the Board of Directors of said Company at its meeting held May 9, 1962, do hereby delegate to Harold N. Barrett, Divisional President of U. S. Rubber Tire Company, authority in the name and on behalf of the Company to execute and deliver the following types of contracts, agreements and other documents insofar as they relate to the operations of the U. S. Rubber Tire Company:

1. The following types of contracts, agreements and other documents relating to real estate. Authority under items 1(a) through 1(d) may not be delegated to others.

a. Contracts, agreements and other documents relating to the purchase or sale of real estate, provided the subject real estate is within the scope of an approved appropriation request;

b. Leases and sub-leases of real property provided (1) they are within the scope of an approved appropriation request or (2) the annual rental does not exceed $100,000 and the aggregate rental for the term of the lease, excluding optional renewals, does not exceed $500,000;

c. Grants of easements or rights of way; and

d. Side track agreements.

2. Bids, bonds, proposals, contracts or other instruments relating to the sale of goods and services to Federal, State of Local Governments or Agencies thereof. This authority may be delegated to others.

3. Other contracts and agreements for the sale, rental or other conveyance of goods, materials or other things produced by the Company or purchased for resale in the normal course of business, provided such contracts do not extend beyond one year without a six months' cancellation clause. This authority may be delegated to others.

Further delegations by you, as and to the extent authorized above, shall be made by written instrument setting forth the specific delegation and the limitations and restrictions, if any. One copy of each such instrument shall be delivered to the person to whom the authority is delegated and one copy to the Secretary of the Company.

F. J. McGrath
Financial Vice President

UNITED STATES RUBBER COMPANY ★ ORGANIZED 1892

STATE OF NEW YORK)
: ss.:
COUNTY OF NEW YORK)

On this 11th day of June, 1965 before me personally appeared F. J. McGrath to me known to be the person described in and who executed the foregoing instrument, and acknowledged that he executed the same as his free act and deed.

Grace I. Petterson
Notary Public
GRACE I. PETTERSON
Notary Public, State of New York
No. 30-3079630 Qualified in Nassau Co.
Certificate Filed in New York County
Term Expires March 30, 1967

GRACE I. PETTERSON ★ NOTARY PUBLIC ★ STATE OF NEW YORK

RECEIVED
JUN 1 61965
AT 2 55 00 M AND
REC'D FROM THE ORIGINAL

My Commission Expires:

APPENDIX E – Environmental Assessment, BETA, Nov. 2016 (Not included, submitted as separately bound report)