A5.2.4.B

WAYFINDING, SIGNAGE, AND VISUAL DISPLAY

A5.2.4.B.1
VISUAL ELEMENTS STRATEGY

The signage and wayfinding strategy is to provide well-placed signage to efficiently guide passengers through the site from street to platform, as well as provide direction to passengers disembarking at the station. The signage will be clear, with the letters of sufficient height and contrasting colors for legibility reasons and to conform to accessibility requirements. The GLX Station Component Manual will be our guide in developing the various signage styles from station to street signs to track signs. Our signage designs will be presented to the MBTA for review at each stage of the design process.

A5.2.4.B.1.A
APPROACH TO PLACEMENT AND SYSTEM INTEGRATION

The placement of the signs will be in accordance with the GLX Station Component Manual, and final location will be determined by the design of the station and appropriate mounting locations that do not interfere with passenger and pedestrian movements and operator sight lines. Minimum mounting heights will be governed by the Accessibility guidelines

A5.2.4.B.1.B
INTUITIVE WAYFINDING

The signage is only one component of the wayfinding system, and will support the intuitive wayfinding that is built into the station design. The intuitive wayfinding techniques employed at the GLX stations consist of:

- Providing a direct route from street to elevator/stairs without multiple changes in direction
- Staggering the heights of structures so critical elements like elevators are easily seen from the street and the platform
- Using different flooring patterns or colors to further define a path and decision points

A5.2.4.B.1.C
ROUTING

The landscaping wayfinding and signage design is located on the Architectural site plans, which include a legend to clearly identify the planting and bed preparation required. The plans will also include wayfinding through the site, both accessible and non-accessible paths, and also identify both static signs and VMS.

A5.2.4.B.2
DRAWINGS

The landscaping wayfinding information is shown on station site context Drawings LES-A-2000, UNS-A-2000, ESS-A-2000, GSS-A-2000, MSS-A-2000, BAS-A-2000, and COS-A-2000, and on station site plan Drawings LES-A-2010, UNS-A-2010, ESS-A-2010, GSS-A-2010, MSS-A-2010, BAS-A-2010, and COS-A-2010 Series per Section A5.2.3.

A5.2.4.B.3
RENDERINGS

The following four renderings show the path to the platform at key decision-making points that GLP has developed for this technical proposal and are for reference purposes only.

Figure A5.2.4-6: Standard platform signage showing overall MBTA System map, Green Line map, and a third panel that features advertising or other MBTA information signage. This arrangement is similar to the Customer Assistance Area (“CAA”), which replaces the ad panel with an emergency phone.

View looking west to the Magoun Street entrance as one approaches from the Lowell Street Bridge.

View into the station from the pedestrian overpass; the bike shelter is to the right and the elevator tower is straight ahead. This is an example of direct and intuitive wayfinding.

View of the station platform as the passenger exits the elevator. To the right is the steel stairway and straight ahead is the fare vending equipment followed by a passenger shelter.

View looking back from the platform toward the elevator and stairs, and showing the main path of egress from the station.

Section A5.2.5

Vehicle Maintenance Facility

GLP's design provides an enhanced VMF by redistributing the spaces required in the RFP in a manner that provides for safe and efficient maintenance operations and allows for future expansions. This is achieved by relocating the main entrance away from the proposed future expansion area and the loading area, and closer to the main parking area.

INTRODUCTION

The Vehicle Maintenance Facility ("VMF"), is the LRV service and inspection facility that is situated between Lechmere and East Somerville stations on the proposed GLX Project. The site is in an industrial zone adjacent to the MBTA commuter rail maintenance facility; the VMF is in the eastern portion of the "L"-shaped yard. GLP's design of the VMF takes advantage of several opportunities, including the site and building configurations that achieve the most efficient daily operations while increasing facility safety, as well as designing with a focus on the future expansion.

A5.2.5.A

ARCHITECTURAL DESIGN

A5.2.5.A.1 APPROACH TO MEETING THE ARCHITECTURAL REQUIREMENTS

GLP has thoroughly reviewed the RFP documents, the original VMF design drawings, and the redefinition concept drawings. Our design drawings were developed by adhering to each of the respective RFP attachments, where applicable, supplemented by best practices and lessons learned from similar projects.

The VMF building is a one-story structure, approximately 55,000 square feet ("SF"), with three roof heights: 33, 28, and 16 feet as shown in **Figure A5.2.5-1**. The exterior walls of the building consist of

Figure A5.2.5-1: GLP's proposed VMF building design allows for more efficient and safe operations by relocating welfare spaces close to the parking, eliminating the need for staff to walk through yard operations.

Section Highlights

- GLP storage area design increases operational efficiency.
- Wheel truing track is relocated to an exterior wall to avoid impeding circulation in the shop.
- VMF designed to allow the facility to remain open for future expansion.
- GLP's design and configuration of the VMF creates a safer work environment for MBTA personnel working on shop floor and coming to the shop via the parking areas.

insulated concrete units up to 4 feet high, with insulated metal panels the rest of the height to the roof heights. The original VMF facility was approximately 90,000 SF, and was developed to a 90% level prior to cost-saving measures. The original design is well-documented in Volume 4A of the RFP and was used as a reference to inform our design for design intent and possible future expansion.

The main functions within the one story are:

- Open structure for maintenance functions of the main shop area
- Maintenance pits and pedestal track
- Pit for wheel truing machine
- Welfare facilities for shop personnel
- Loading area
- Storeroom

Per our approved VMF Innovation Alternate ATC, several locations of the specific rooms vary from the RFP drawings. Some variations are shown in **Figure A5.2.5-2**.

Emphasis in the design was placed on strengthening the critical operational spaces within the VMF. For instance:

- **The wheel truing function is shifted from the center of the VMF tracks to an outside track, Track 1.** This move relocates the wheel truing function to a position that eliminates negative impacts to shop circulation. The location of the wheel truer in the RFP would cause the central aisle of the shop to be blocked during the wheel truing process. The proposed location removes this impediment and shifts the noise of the function further from the rest of the shop. It also allows chips and swarf to be sent directly to the exterior for collection.
- **The loading bay is relocated from the north side of the facility to the south side.** This reduces potential problems of delivery vehicles fouling the tracks on the north side of the facility. The loading dock will also be directly adjacent to Parts Storage in our alternate concept, allowing for improved efficiency.
- **The group of functional elements along east exterior wall.** Storage-124, Cleaning Storage-122, Storage-120, Elec Room-119, Tele Room 118, and Fire Protection-117 are moved to the west side of facility. This allows Parts Storage to be directly adjacent to the loading dock. It will also put the Electrical and Fire Protection Rooms in a more central location, reducing the length of runs required for each discipline.
- **The truck wash is moved to the center of the facility and full height walls are added.** The central location allows the future lift track to be used for truck change-outs, and moves trucks in an efficient manner. The full height walls will contain dirty over spray from the truck wash into the general shop atmosphere. This will reduce cleaning and facilities maintenance requirements.
- **Welfare and support areas are moved to the north corner of VMF.** This move places the welfare and support areas directly adjacent to the employee parking area. This change from the RFP improves efficiency of pedestrian circulation and contributes to the overall safety of the shop arrangement.
- **A future LRV wash on the east side of the facility is not precluded with the approved ATC configuration.** The reconfigurations of functions as described above make it possible to add an LRV wash in the future.

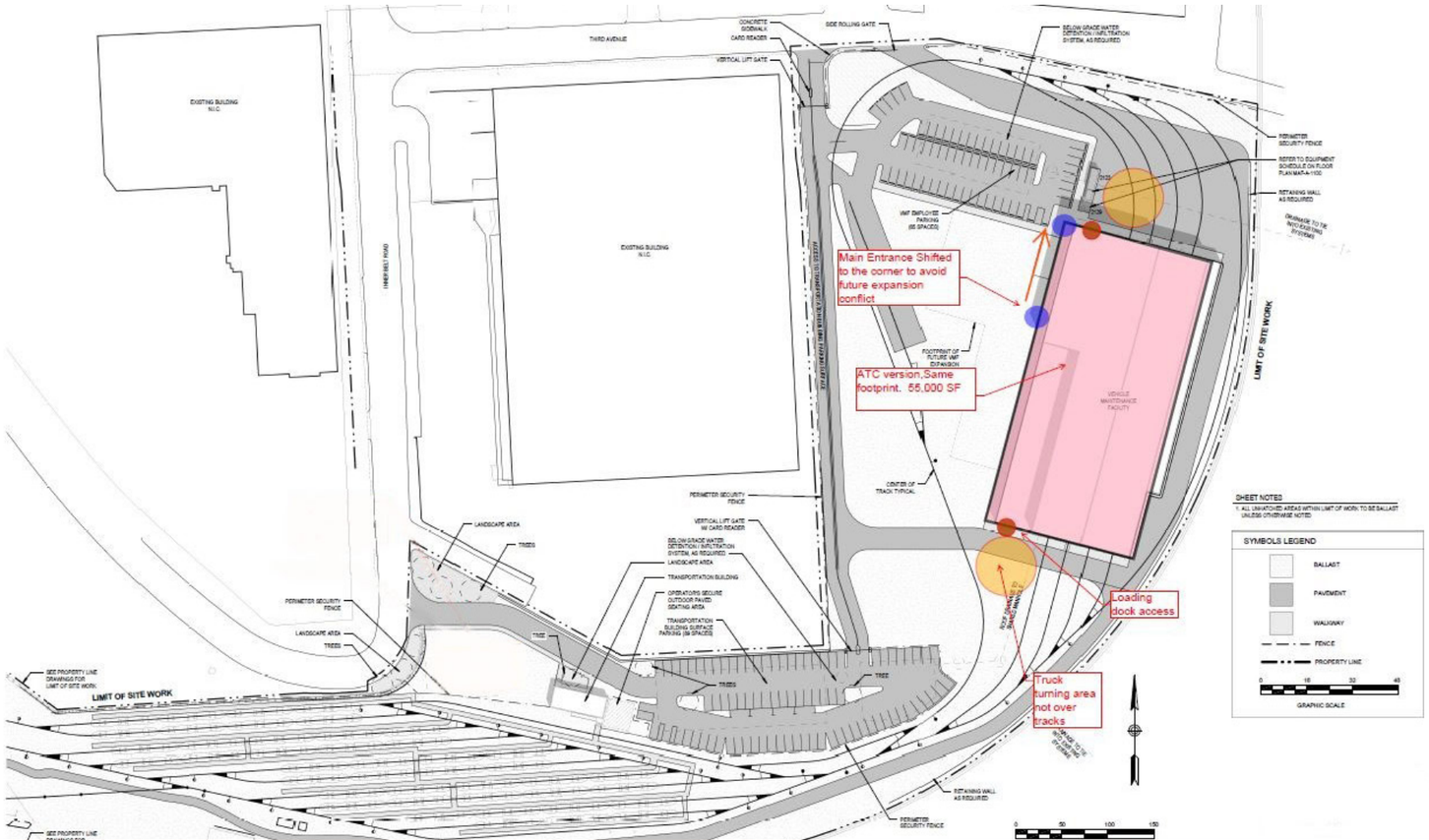

Figure A5.2.5-2: GLP has designed the facility for successful future expansions with space available on the west side for a large expansion and space available on the east side for a drive-through wash. The GLP design also allows for improved truck access by moving the loading dock from the north side to the south side.

A5.2.5.A.1.A
LIFE SAFETY CODES AND RELEVANT APPLICABLE STANDARDS

GLP VMF design incorporates the RFP documents, including code requirements, and adds the depth of national experience in rail maintenance facilities to provide the best and safest facility practical. The GLP design reflects years of experience delivering successful light rail maintenance facilities, including the Southwest Light Rail Transit Project, Metro Transit, Minneapolis, MN.

A5.2.5.A.1.B
VMF FLOOR AREAS

The gross area of GLP's design for the VMF is 55,000 SF, the same as the redefinition building. There are no deviations from the RFP room data sheets in regards to square footage or materials.

A5.2.5.A.1.C
BUILDINGS WITHIN THE VMF SITE

We will provide a one-story Transportation Building ("TB"), as shown in Exhibit 2B of the RFP and described in the TP. Documentation provided in the RFP includes a floor plan; our assumption is this will be a modular building using the same materials as the main shop. The TB program includes these main spaces:

- Two toilet rooms and a kitchenette
- Operators room for 30 people
- Two offices

The overall site placement follows the redefinition drawings provided in the RFP, with the original 90,000 SF future expansion possibility in mind. The massing and materials also follow the redefinition documents. These materials are tried and true practices used in shop construction, and will provide low-maintenance, high-durability finishes.

The elevations and sections were developed from the original design and applied to the redefinition version of the design. The RFP documents did not provide any requirements for square footage or percentage of fenestration, but based on our knowledge of train maintenance facilities, we are using the below percentages of glazing per elevation:

- 20% translucent panels on the east and west walls
- 10% translucent panels on the south wall
- 10% clear glazing on the north wall

Critical references listed were followed and informed our revised ATC:

- TP Volume 2-Exhibits 2A, 2B & 2I
- GLX Redefinition drawings
- Volume 4A VMF original 90,000 SF version

Selected sections from TP Volume 2 to note:

- **Section 13.1:** Vehicle maintenance building
- **Section 13.4:** Transportation building
- **13.4-1 Table:** Describes square footage of required spaces.
- **13.4.3.9 Room Criteria:** Lists the required details and dimensions.

A5.2.5.A.1.D
ARCHITECTURAL DRAWINGS

The VMF is shown on Drawings MAF-A-0000 (VMF building rendering), A-2000 (site plan), A-2010 (site, landscape and security), C-0001, C-0002 and C-0003 (civil site plans), A-2020 (VMF floor plan), A-3000 and A-4000 (VMF building elevations and sections), S-0001 (VMF roof framing and foundation), E-2001 (electrical single line diagram), E-2002 (special systems riser diagrams) and M-2003 (mechanical risers).

A site context plan on Sheet VMF-C-0001 TO 0003 shows the VMF and its relationship to the entire yard, including tracks, storage tracks, Transportation Building, parking, adjacent structures/land, property lines, and other relevant items. VMF features and components, including room designation, overall dimensions, egress, changes in floor elevation and industrial equipment are also included. Elevations include building heights, materials, track alignment, and adjacent components that may impact the fire access lane. A section through the entire VMF shows the structural and industrial components, including required clearances, building heights, materials, and selected interior elevations. Additional sections at selected locations show required industrial clearances.

A5.2.5.B
MECHANICAL, ELECTRICAL, AND PLANT

A5.2.5.B.1
APPROACH TO ELECTRICAL AND MECHANICAL REQUIREMENTS

GLP's approach to safeguarding that our design meets the MBTA's requirements in TP Sections 13.3, 13.5, 14.1, 14.2, 14.3, 14.4, 14.5, and 14.6, is a "top-down" systematic approach. Starting with the TPs set forth by MBTA, GLP has developed a base design that, when coupled with code review and lessons learned from past transit facility projects around the U.S., will meet the expectations of the MBTA. This approach to meeting the mechanical and electrical requirements is based on effective coordination and communication. By understanding the concerns of the construction and integration process, as well as the needs of the MBTA and MBTA staff using the facility, an effective, durable design has been developed that supports the GLX VMF processes and functions. This approach has proven successful on various large-scale transit facility projects, including the $1 billion Croton Harmon Maintenance Facility in Croton-on-the-Hudson, NY.

A5.2.5.B.1.A
ELECTRICAL SYSTEMS

The electrical service to the facility is derived from an Eversource secondary metered entrance that is then connected to a main distribution switchboard. From there, loads are segregated to dedicated panelboards based on load types, such as lighting, welding, and HVAC equipment.

Life safety systems such as emergency lighting, fire alarm, and fire protection are supplied by a UPS that has a battery backup capability of 90 minutes. This UPS also has two sources of power, the first a feeder from the normal utility supplied power systems, and the second, a generator-backed feeder from a local on-site emergency generator, automatically selectable upon power failure, through an automatic transfer switch. With this, life safety systems have three potential sources of power to provide reliable, redundant power service. The facility is also provided with a building lightning protection system that carries a UL Class 1 master label.

A5.2.5.B.1.B
PA, FIRE ALARM, SECURITY AND OTHER REQUIRED SYSTEMS

The VMF is provided with PA, telephone and data service, fire alarm and detection, surveillance CCTV for building perimeter monitoring, access control and intrusion detection for select exterior doors into the facility, and critical infrastructure spaces such as communications and electrical rooms. These systems are in accordance with the applicable TPs.

The PA system is integrated with the fire alarm system to comply with National Fire Protection Association ("NFPA") 72 requirements for mass evacuation. The cabling and pathway plant infrastructure for data is based on CAT 6e ANSI/EIA/TIA 568 and 569 requirements for gigabit data rates. Telephone cabling and pathway infrastructure is based on the same approach for IP-based telephone technology. The PA system is also driven off of the telephone system, with various paging zones within VMF based on operations and space use. The fire alarm system is in accordance with NFPA 72; the Massachusetts State Building Code; and the MBTA's specification for fire alarm systems, which detail additional requirements.

A5.2.5.B.1.C
MECHANICAL SYSTEMS

Mechanical systems within the VMF consist of HVAC, plumbing, fire protection, and compressed air services. HVAC for the main shop floor consists of rooftop units for ventilation and heating, with smaller office and support spaces that require conditioned air supplied by split-type, heat pump closed systems. Train roll up doors are provided with air curtains, with bathroom and locker room spaces provided with exhaust fans and heat recovery appliances per code. Plumbing and roof rainwater capture and drainage systems are provided in accordance with Code. Fire protection systems use wet charged systems in spaces that are environmentally maintained for temperatures above 32 degrees Fahrenheit as required by code, and dry type systems for those spaces in unmaintained areas.

A5.2.5.B.1.D
MAIN MECHANICAL EQUIPMENT SCHEDULES

GLP has developed a preliminary main HVAC Equipment schedule that we anticipate will be needed for efficient system operation of the VMF, low maintenance, durability, and low lifecycle cost.

Main HVAC Equipment Schedule

Tag No.	Description	Area Serviced	Features
HV-1	Gas Fired Rooftop Unit	ROOM 101	HV
HV-2	Gas Fired Rooftop Unit	ROOM 112	HV
HV-3	Gas Fired Rooftop Unit	ROOM 120	HV
HV-4	Gas Fired Rooftop Unit	ROOM 121, 122, 124	HV
HP-1	Variable Flow Refrigerant 15 Ton Heat Pump	ROOM 102, 107, 104, 105, 106, 108,109, 110	HVAC
HP-2	Heat Pump Unit Split System 1 Ton	ROOM 114	HVAC
HP-3	Heat Pump Unit Split System 1 Ton	ROOM 116	HVAC
HP-4	Heat Pump Unit Split System 1 Ton	ROOM 118, 119	HVAC
ERV-1	Gas Fired Roof Top Energy Ventilation Unit	ROOM 125A	HV
ERV-2	Gas Fired Roof Top Energy Ventilation Unit	ROOM 125B	HV
ERV-3	Gas Fired Roof Top Energy Ventilation Unit	ROOM 125C	HV
ERV-3	Gas Fired Roof Top Energy Ventilation Unit	ROOM 125D	HV

NOTE: H = HEATING, V = VENTILATION, AC = AIR CONDITIONING

Figure A5.2.5-3: GLP's proposed Main HVAC Equipment Schedule was developed from years of successfully deigning VMFs nationwide, including the New Haven Rail Yard Facilities Improvements, MTA Metro-North Railroad, New Haven, CT.

A5.2.5.B.1.E

BUILDING AUTOMATED CONTROL SYSTEM

HVAC, other mechanical systems, electrical power distribution equipment, and the facility lighting system are monitored and controlled by a building automated control system (building management system). This system is an integrated, programmable, intelligent hardware and software system that monitors and controls select functionality for each of the systems listed. The system also monitors energy usage and includes data logging, trending, and alarms for designated maintenance and operating personnel. The systems listed are provided with field devices that integrate into the control system through hardwired pairs, communications links, or wireless, to the main hub where the main processors reside, with requisite programming. Operator interface is available through a local workstation terminal on site, as well as remotely through a secured, web-based portal.

A5.2.5.B.1.F

PROPOSED ELECTRICAL UTILITY SERVICE SUPPLY POINT

The proposed electrical utility service supply point is through an Eversource secondary metered service. The design provides for the utility transformer pad, provided in accordance with Eversource requirements, located on the site in proximity to the VMF building, as well as secondary cable and conduit from this location to the main distribution switchboard in the VMF main electrical room. The design also includes empty conduit from the transformer pad to the property line for the primary cables. Eversource provides and installs the service transformer, installs and terminates the primary cables, and terminates the secondary cables at the transformer. Eversource also provides and installs the meter, the metering potential transformers and current transformers, in a metering cabinet provided in our design, in accordance with Eversource's requirements.

A5.2.5.B.2

ELECTRICAL AND SYSTEMS DRAWINGS

Select electrical drawings (sheets VMF-E-2001 TO 2002) that reflect the design described above are included in this proposal. These drawings describe and show the following:

- Electrical site layout showing location of incoming electrical service, switchgear, and duct banks to the VMF and TB
- Single-line diagram, preliminary sizing of equipment and feeders, and emergency and critical power systems
- Location points for tie-in to local electrical utility
- Riser diagrams for fire alarm, public address, telephone and data cabling, and pathway plants

A5.2.5.B.3

MECHANICAL DRAWINGS

Mechanical drawings reflecting the design described above are included in drawings VMF-E-2002 and VMF-M-2003. These drawings provide information on the following:

- Fire protection system schematic riser
- Gas riser diagram
- Drainage riser diagram
- Roof drainage riser diagram

A5.2.5.C

INDUSTRIAL PROCESSES AT VEHICLE MAINTENANCE FACILITY

A5.2.5.C.1

APPROACH

GLP has reviewed the RFP documents to gain a full understanding of the functional criteria, technical specifications, and conceptual plans for the VMF. This information has been used to generate industrial plans, an industrial equipment list, and an equipment information catalog. Following is a list of RFP documents used to compile this information:

- GLX TP Volume 2:
  - Volume 2- Exhibit 2B- Project Definition Plans
  - Volume 2- Exhibit 2A- Technical Specifications

The VMF sits in the middle of a loop track, with two leads connecting to the storage tracks. The VMF has four through tracks. There is a single, dead end, equipment track switched off the loop track.

A5.2.5.C.1.A FUNCTIONAL DESIGN CONCEPT

GLP's approved ATC layout will improve the VMF's functionality. Relocating the loading dock from the north wall of the facility to the south wall will separate truck movements from LRV circulation and eliminate the possibility of fouled tracks.

The truck wash location will be conveniently located between the two sets of vehicle lifts, and the enclosure will reduce overspray into the shop. The wheel truer is relocated to the east end of the shop to allow chips to go directly to the exterior, eliminating the need for double handling and segregating the function from the rest of the shop, increasing the efficiency and safety of the operations. The function shifts allow for centralized mechanical, electrical, and communications rooms, thereby requiring shorter runs for the proposed design and the future expansion. The material storage area is directly adjacent to the loading dock, which again reduces the distance material is moved through the active shop, as well as inefficiency and potential accidents. The rectangular shop layout should speed construction time and simplify a future addition to the west by relocating the main entrance to the north

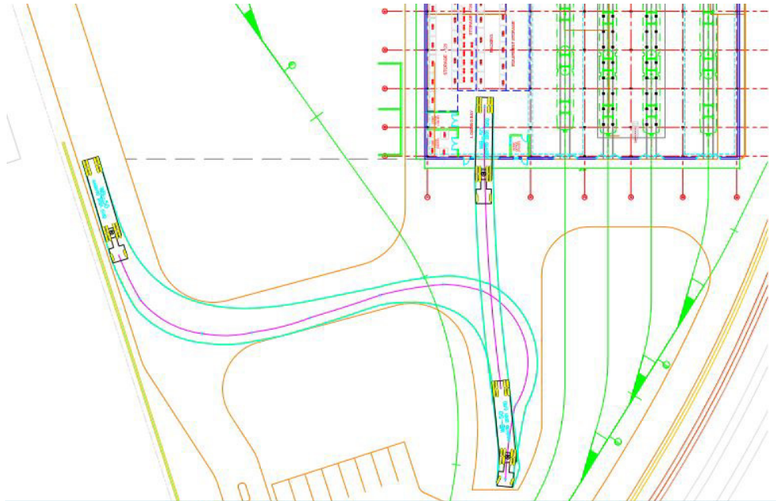

Figure A5.2.5-4: GLP has improved truck access by changing the truck route to cross only one track.

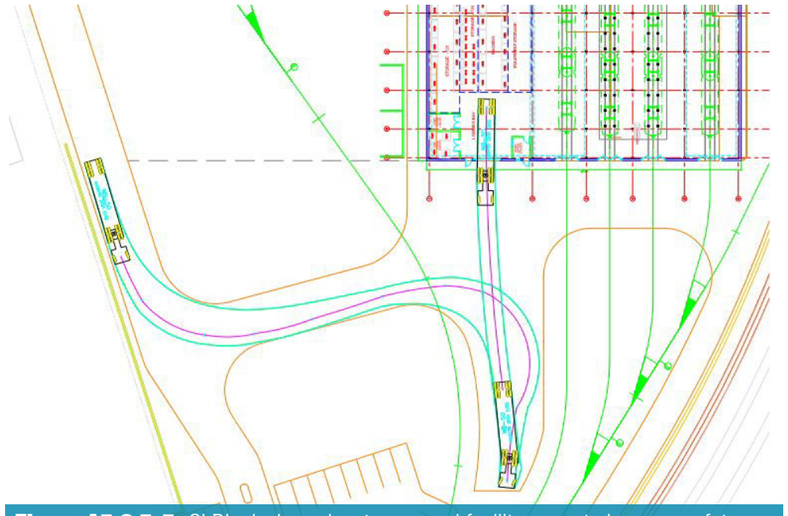

Figure A5.2.5-5: GLP's design relocates several facility areas to improve safety and functionality and provide an area for a potential future car wash.

away from the future expansion area. The ATC layout also leaves room for a drive-through wash to be added in the future.

In addition, locating the employee welfare spaces closer to the parking lot reduces unnecessary pedestrian movements through the facility.

A5.2.5.C.1.B

INTERFACE OF THE VMF WITH THE MAIN LINE

There are three yard leads ("YL") that connect VMF yard operations with revenue service on the main lines. Working from the VMF toward the west: the loop track of the VMF ties to MAF-1 RUNNER TRACK on

the south side of the storage tracks. MAF-1 RUNNER TRACK switches to YL4, which provides direct access to the Union Square Branch Eastbound revenue track, and it continues to YL3. YL3 has a switch to the westbound Medford Branch line. The north end of the VMF loop ties to MAF-1, which borders the north side of the storage tracks and leads to YL2, which leads to the eastbound Medford Branch line.

Mark	Description
1005	Board, Peg, Tool
1234	Pallet, Spill, Containment
1270	Rack-Storage-72 Bin
1290	Crusher, Oil Filter
1295	Rack, Bulk Storage
1325	Rack, Pallet, 3 Level
1330	Rack, Pallet, 3 Level
1340	Rack, Pallet, 3 Level
1345	Rack, Pallet, 3 Level
1511	Shelving Unit
1516	Shelving Unit
2123	Compactor, Trash
2129	Baler, Vertical
2196	Rotary Screw Compressor
2629	Vise
2296	Eye Wash, Primary, Portable Station Kit
3025	Tank, Parts, Cleaning
3050	Washer, High Pressure, Natural Gas
5041	Cart, Deionized Water, Portable
7530	Pump, Air-powered, Oils, Medium Pressure
7522	Pump, Air Piston
7706	Receiver, Waste Fluids
7937	Tank, Waste Collection, Integral Pump
8002	Platform Work Portable
8005	Platform Work Roof
8117	Workbench
9105	Crane, Bridge
9126	Crane, Bridge
9307	Forklift, Electric
9400	Hoist, LRV, In-Ground, with Body Strands, Rotating Hoists
9443	Hoists, Truck Repair, Above Slab
9705	Lift, Parts, Two Stops
9815	Pallet Jack

Figure A5.2.5-6: Based on our previous experience on the Bottineau LRT Project in Minneapolis, MN, and other similar projects, as well as our preliminary design, GLP has developed an industrial equipment list to meet the needs of MBTA's operations

GLP's design relocates the loading dock, storage area, welfare spaces and the wheel truer to improve safety and functionality. Additionally, GLP's design provides for future expansion to the west for additional maintenance functions, and to the east for a drive-through LRV wash.

A5.2.5.C.1.C

STORAGE

The storage tracks sit between the main line (to the west) and the VMF loop track (to the east). There are nine storage tracks running west to east, with a bypass track on both the north and south sides. There is storage for 39 LRVs on the dedicated storage tracks; four additional LRVs can be stored on the north bypass track if needed, as shown in the track layout drawings.

A5.2.5.C.1.D

EQUIPMENT

GLP compared the relevant section of the TPs to the equipment list on the original design plans, as well as to the equipment specifications, to compile the comprehensive equipment list shown in **Figure A5.2.5-6**.

A5.2.5.C.1.E

INDUSTRIAL DESIGN

The guidelines and general planning criteria below were used to develop the functional requirements for the proposed VMF:

- The VMF will be designed to accommodate type 7, 8, and 9 LRVs.
- The VMF will be a 24-hour operating, enclosed LRV maintenance and inspection facility serving the Medford Branch.
- The VMF will have capacity for daily inspections of 43 LRVs and daily interior cleanings of 70 cars.
- The VMF will accommodate the functions of light duty service and inspection, truck repair, wheel truing, pantograph service, HVAC, and electronics component change out.
- Vehicles will be moved into the shop as two-car coupled consists for sanding, interior cleaning, daily inspections, and rooftop access. Consists will be separated if the vehicle will be lifted.
- Shop tracks are all run-through.
- Minimum spacing between adjacent shop tracks is 22.5 feet.
- The main cross aisles located along both ends of the shop will be a minimum of 9 feet wide. The main center aisle through the shop will be a minimum of 15 feet wide.
- Main shop aisles will be wide enough to allow facilities maintenance scissor lifts or sky lifts to drive down the aisles.
- Consist positions on tracks 2 and 3 inside the VMF will be electrified using an OCS. Consist positions on tracks 1 and 4 will be provided with an overhead bridge crane for roof-level component removal and replacement, and will not be electrified by OCS.
- The OCS in the shop will be sectionalized by consist repair position. Maintainers will be able to individually control overhead power to each car position in the shop.

Figure A5.2-7: GLP has designed a loading bay configured to allow a bridge crane to load and unload a powered truck, the heaviest LRV component, from a flatbed truck. This efficient design will accommodate the material handling of all LRV components.

- Tracks 2 and 3 will be inspection pits with pedestal track that offers full access to one side of the vehicle and limited access to the opposite side.
- Major shop equipment items will be interlocked with the OCS as required for safe operation of the equipment. Examples of necessary interlocks are in-ground car hoists and overhead monorails, bridge cranes, and jib cranes which operate over electrified tracks. Tracks 2 and 3 will have interlocks with the overhead doors.
- Track 1 is a flat service bay with a mobile rooftop work platform along both sides of the track. This will allow access to a small portion of the car and provide fall protection. Auxiliary power stations ("APS") will be provided at this track at each LRV position.
- Track 1 will have a pit for a wheel truer.
- Track 4 will have in-ground lift capability and the ability to change out trucks. Trucks will be transferred to release tracks by a rotating hoist system.
- Tracks 1 and 4 will have full overhead bridge crane coverage by a 10-ton bridge crane.
- Foreperson offices will be located near the work areas they supervise.

Guidelines for activities to be carried out at the facility, and supported by its industrial design include:

- **Daily Inspection –** Each LRV will receive a daily inspection to ensure that the vehicle is fit for the day's revenue service. These visual and functional checks of the LRV's interior and exterior focus on high-wear and safety critical items such as wheels, brakes, doors, operator controls, and communication systems. The ability to completely walk around the car is required for this inspection. This inspection will be performed in the storage yard.

- **Interior Cleaning –** Vehicle interiors are cleaned every day. This activity involves removing all newspapers and loose debris, sweeping car floors, and dusting operator consoles and other specified surfaces. This activity will be performed in the VMF building.
- **Sand Replenishment –** The sandboxes on the cars will be accessible via ports located outside the car.
- **Scheduled Inspections –** Preventive maintenance inspections and scheduled component replacements will be performed on the LRVs to ensure the operational reliability of the cars and to minimize in-service failures and unscheduled repair work.
- **Corrective Maintenance/Running Repairs –** Running repairs are defined as minor unscheduled maintenance operations that generally can be completed in one eight-hour work shift with the average repair taking approximately four hours. Running repairs are a result of defects found during the scheduled inspections, or problems developed while in revenue service. The repair work is typically performed directly on the vehicle and can involve any of the major car components or systems. Most of these repairs are expected to be performed inside the shop; however, certain minor activities such as light bulb replacement can be performed on the vehicles in the storage yard, depending upon resource availability and VMF occupancy.
- **Component Change-outs –** To maximize the service availability of each LRV, the VMF will be designed to perform major component exchanges. Defective components, or those scheduled for replacement, will be removed from the vehicle and replaced with new or remanufactured components. The removed/defective components, including LRV trucks, can be repaired at the VMF or sent off site.
- **Minor Body Repairs –** Body repairs expected to be performed at the VMF will be limited to panel replacements, door and window replacements, operator seat replacements, and brake frame change-outs. Based on current repair rates, each vehicle is expected to visit the shop once a year for minor body repairs. Panel replacements, seat replacements, and other minor body repair activities can usually be completed in one shift.

Figure A5.2.5-8: GLP's design relocates the wheel true pit to an exterior wall to isolate wheel truing from other maintenance functions. This design has the benefits of improved shop circulation and ease of maintenance.

A5.2.5.C.2

DRAWINGS

Industrial drawing information is located on the architectural floor plan located on Sheet MAF-A-2020 in this technical solutions submission.

A5.2.5.D

BUILDING STRUCTURES AT THE VEHICLE MAINTENANCE FACILITY

A5.2.5.D.1

APPROACH

The structural system for a maintenance shop is developed to support the functional layout. Therefore, the structure design will heavily consider the industrial layout and limit the number of obstructions as much as possible, while also delivering a cost-effective solution. Industrial shops require large open bays; we will maximize the clear floor area by limiting the number of columns, strategically locating column lines, and using long span roof members. Long span roof members can have their challenges as well. Where moment frames are used, long span beams have less contribution to the frame stiffness, thus requiring deeper and heavier sections, which can affect the crane clearance envelope and building height. Brace frames are acceptable in such buildings, but should be located along the perimeter or at full height walls to avoid creating additional obstructions. In addition, roof deflection must be considered to avoid damage to the roofing system or any hung utilities. Careful detailing of long span roof members is required along roof eaves or parapets so that the changes in stiffness from the roof to the wall system do not create a weak point in the building envelope. **We will strive to achieve a balance between large unobstructed shop floor areas and a cost effective structural system.**

A5.2.5.D.1.A

DESIGN CRITERIA

GLP has reviewed the TPs and confirms our design will comply with the following codes, standards, and guides:

- Massachusetts State Building Code, 9th Edition, referred to below as "780 CMR"
- ASCE 7-10, Minimum Design Loads for Buildings and Other Structures
- AREMA Manual for Railway Engineering
- AISC 360-10 Steel Construction Manual 14th Edition
- AISC Design Guide 11: Floor Vibration Due to Human Activity
- AISC Seismic Provisions, as amended by 780 CMR
- ACI-318-11 Building Code Requirements for Structural Concrete
- ACI 301-16 Specifications for Structural Concrete
- ACI-530-11 Building Code Requirements for Masonry Structures
- AISI S100-07 – Specification for the Design of Cold Formed Steel Structural Members
- AWS D1.1-08 – Structural Welding Code – Steel
- AWS D1.3-08 – Structural Welding Code – Sheet Steel
- AWS D1.4-05 – Structural Welding Code – Reinforcing Steel
- MBG 531-09 – Metal Bar Grating Manual 7th Edition
- AASHTO LRFD Bridge Design Specifications, as supplemented by the FHWA Drilled Shaft Manual, the latest edition
- FM Global Property Loss Prevention Data Sheets; 1 28 Design Wind Loads, 1-31 Metal Roof Systems, and 1-54 Roof Loads for New Construction
- ASME Safety Code for Elevators and Escalators A17.1-10
- Commuter Rail Material Specifications, MBTA Railroad Operations
- Commuter Rail Design Standards Manual, MBTA Railroad Operations
- Book of Standard Plans – Track and Roadway, MBTA Railroad Operations
- Guide Specifications for Structural Design of Rapid Transit and Light Rail Structures, Gannet Fleming for MBTA

A5.2.5.D.1.B

SERVICEABILITY CRITERIA

In addition to the requirements of the Building Code and ASCE 7, designers will consult the MBMA Metal Buildings Systems Manual, AISE Technical Report No. 13, and AISC Design Guide 3 to determine best practices. Each component of the facility will be considered to meet their respective performance requirements. Particular attention will be given to serviceability requirements of bridge cranes, for which we recommend adhering to the serviceability requirements of AISE Technical Report 13.

- **Floor Framing –** Live Load Deflection = L/360; Total Load Deflection = L/240
- **Roof Framing –** Live/Wind/Snow Load Deflection = L/240; Total Load Deflection = L/180
- **Walls –** Wind Load Deflection = L/120
- **Drift –** H/400 or 1-inch at height of crane runways
- **Crane Runways –** Vertical Deflection = L/1000; Horizontal Deflection = L/600
- **Lateral Wind Load Deflection –** L/400 or 1-inch at crane runway

Attention will be given to components that support the train vehicle, including the body and truck lifts, wheel truing pit, and embedded rail and posted rail tracks. Serviceability requirements for these components will meet the requirements of AREMA.

A5.2.5.D.1.C

STRUCTURAL ELEMENTS

As soils present at the facility are not suitable for shallow foundations, the foundations will be constructed using CMC, also known as drilled displacement piles. The gravity load will be transferred to the foundations by reinforced concrete footings placed upon a load distribution mat, which consists of a geogrid reinforced select structural fill, placed atop the CMC. Lateral loads will be transferred to the substrate by friction. The CMC foundations will support the building frame system as well as the ground floor slab, tracks, and pits within the facility. The ground floor slab will be designed as an elevated slab. Grade beams will be used to support the train vehicle loads with one grade beam per rail. Transverse grade beams will be used to transfer the train loads to the CMC foundations located below building columns. Grade beams will also support the perimeter foundation wall. Additional CMC piers will be provided below the wheel truing pit and the in-ground lift pits. Underground utilities below the facility will be hung from the ground floor slab to prevent breaks due to differential settlement.

Track on pedestal will be supported on W8 posts. The minimum spacing of the posts is 4 feet on center. The rail will span between posts without any additional support. The posts will be designed per the structural loading requirements set forth in AREMA. The design loads will include all vertical loads (wheel loads + impact + rolling effects) and horizontal loads (longitudinal and transverse loads to rail). For longitudinal loads, X-braces will be provided at select spans to transfer the loads to the foundation. For transverse loads, the posts will be designed as a cantilever, which will require a fixed base plate connection.

W14 columns will be used for the majority of the building; W12 columns will be used for lean-to structures. All building columns will be supported on CMC foundations. The roof framing system will consist of W-shape or joist girders with open web joist infill framing. The perimeter will be framed with W-shapes. Supplemental framing will be provided to support large rooftop equipment. Angle or channel drop-in frames will be used near smaller rooftop equipment and at roof openings.

The building lateral system will consist of braced frames in the north-south direction, primary tension-only X-braces, and moment frames in the east-west direction. Moment frames columns will have fixed base plate connections to concrete footings. The facility will be designed to Seismic Design Category B per code requirement. The seismic force resisting system will be detailed following the requirements of R=3 or "Steel Systems Not Specifically Detailed for Seismic Resistance."

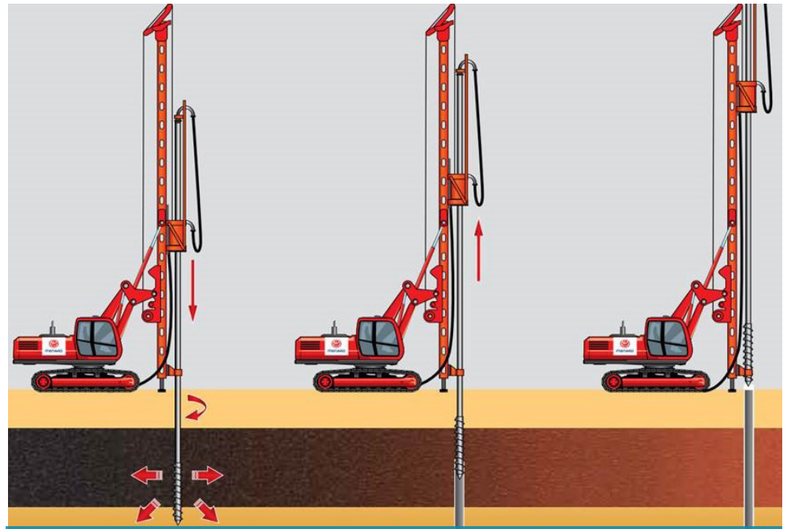

Figure A5.2.5-9: Drilled displacement

The building frame will be designed for an ultimate wind speed of 120 MPH and a service wind speed of 90 MPH with exposure Category C. Wind is expected to govern the lateral frame design. Drift due to wind and seismic must also be checked, especially in the direction of the moment frames.

A5.2.5.D.1.D WATERPROOFING SYSTEM, TYPE AND APPLICATION

The groundwater is shallow at the proposed location of the facility. It is recommended to use a waterproofing membrane at all pits. Equipment and service pits shall have a mud slab placed below the pit, followed by the waterproofing membrane. The waterproofing membrane will continue up the sides of the pit to the underside of the shop floor slab. The first-floor slab at grade level will be placed upon a vapor barrier.

A5.2.5.D.1.E FROST MITIGATION

All perimeter foundations, including grade beams, will be set with their bottom surface a minimum of 4 feet below grade to mitigate the potential for frost heave. Interior pile caps will not require frost protection as the facility is heated. Unlike a conventional pile foundation system, CMC foundation systems require footings set to frost depth since there is no positive connection between the piles and pile caps.

The adjacent Transportation building will be founded on a slab-on-ground with a perimeter cut-off wall. Frost protection will be achieved through rigid insulation applied to the cutoff wall and below grade horizontal wing insulation. Insulation will be specified based on the requirements of ASCE 32 for frost-protected shallow foundations for heated buildings.

A5.2.5.D.1.F CONSTRUCTION OF STRUCTURES

The VMF is completely within the specified ROW, and will not require additional ROW or easements to construct. The facility will be located within the footprint previously existing structures. It is anticipated that

abandoned foundations, most likely deep foundations such and pile or pier supporting systems, will be encountered during construction. In locations where abandoned concrete footings or pile caps coincide with the location of CMCs, the abandoned concrete will be excavated, removed, and their cavities backfilled with select structural fill. However, the CMC foundation system will not require the removal of the deep support elements (i.e., piles). The abandon footings will also be partially demolished where they conflict with new foundation concrete. No less than 12-inches clearance between new and abandoned concrete structures will be provided.

A5.2.5.D.2 VMF BUILDING STRUCTURES DRAWINGS

Structural drawings for the VMF are located on Drawing VMF-S-4010. All drawings are provided in an architectural scale. Plans are at 1/8 inch =1 foot. The structural drawing is divided into two sections. The first section consists of all foundation elements, which include CMC foundations, pier caps, grade beams, and ground floor slab. The second section consists of the steel framing system.

Section A5.2.6

Civil and Guideway

GLP's approach to optimizing the alignment within the confined ROW while meeting provides benefits that include minimizing the undercutting of the NHML tracks, reducing the risk of damage to the MWRA water main at Walnut Street, and simplifying the alignment of the Community Path. GLP believes these enhancements will reduce cost while creating improvements to the path that will be more beneficial to the community.

INTRODUCTION

Our challenge in designing the guideway is to balance meeting all the requirements in the TPs, while optimizing the alignment within the confined ROW. Our optimizations reduce construction costs while also providing benefits to the community.

Our work will meet all TPs, particularly Section 7 Site Preparation, Section 9 Roadways and Pathways, and Section 10 Commuter and Freight Trackwork.

The first optimization we explored was minimizing undercutting of the New Hampshire Mainline ("NHML") commuter rail tracks. As a result, we made changes in the vertical alignment compared to the profile provided in the RFP documents. GLP developed independent track profiles that provide the minimum 17-foot 9-inch vertical clearance at overhead bridges.

After consideration of alternative alignments, we developed a Community Path design that both saves construction costs and has community benefits. At Walnut Street, **our Community Path Elevation Increase ATC** raises the Community Path to street grade, which reduces: overall cost, the risk of damaging the MWRA water line, and the inherent risk of hitting bedrock in jacking a box culvert to allow the path to pass under Walnut Street. After considering the path on either side of the ROW between School Street and Central Street, we proposed to keep it on the west side as part of our base design. Both of these changes provide a community benefit of better connections with the neighborhood.

A community and cost-savings benefit to the GLX Project, GLP's Community Path Elevation Increase ATC saves on construction costs and minimizes risks, including possible damage to the MWRA water line.

A5.2.6.A

APPROACH TO MEETING THE REQUIREMENTS

In addition to designing with careful attention to the TPs and the referenced standards, we will work with the MBTA, municipalities, and local developers to ensure that our work is compatible with existing adjoining infrastructure. Our Team's Boston-based civil engineering staff has extensive experience working with key municipal officials, for example, from our work for the City of Somerville and our work with developers and institutions in Cambridge.

Our design approach for this Project includes creating a 3D model of the provided track alignments and profiles to be analyzed for modifications where applicable. The model will include other wayside elements including power duct banks, storm drainage, catenary poles, positive train control, wayside signals, cases, and signal/communication instrument houses. This modeling allows our Team to more easily coordinate changes among multiple disciplines as well as with various stakeholders.

In addition, the model aids GLP in construction because field changes can be designed immediately and pushed out to the field in a short period of time.

A5.2.6.A.1

OVERALL ALIGNMENT DESIGN ELEMENTS

The proposed GLX track alignment spans two branches. The Medford Branch meets the existing East Cambridge Viaduct at Land Boulevard and extends over the Fitchburg Mainline and through the former Yard 8 to Washington Street in Somerville and meets the NHML. From there, it continues to Tufts University in Medford within the confines of the existing ROW. The Union Square Branch will diverge from the Medford Branch at the Fitchburg Mainline and follow that ROW to Prospect Street in Somerville.

A VMF storage yard will be built to service both extensions by connecting to both the inbound and outbound Medford and Union Square Branch tracks.

Section Highlights

- GLP's optimization of the NHML alignment creates reduced cost and service disruption along NHML compared to the allowable amount of disruptions.
- GLP has raised the Community Path to meet Walnut Street to avoid a risk of damage to the MWRA water main and allows for better community connections.
- GLP has reduced structural costs and created better community connections with our design of the Community Path from School to Central on west side.
- In raising the Community Path to meet Medford Street, GLP has reduced structural costs.
- GLP's design approach retained major portions of the RFP design which will make the design phase shorter, expediting the start of major construction elements.

GLP's 3D model of the Project facilitates the evaluation of clearance envelopes for each track as well as line of sight, particularly approaching and leaving stations

As we analyze the provided design, we will recalculate design speeds to ensure compliance with the appropriate specifications, and then modify accordingly to accommodate the required operational performance of each line.

Transitions between track bedding types will be detailed such that track modulus changes are accounted for between the different cross sections. For example, expansion joints and transition ties will be used at bridge abutments to prevent excessive wear on the rails and other track materials.

Proper clearances will be designed into the track alignments and profiles such that all designs meet or exceed the minimum clearance criteria specified in the RFP. Designs will also include a 30-inch wide pathway for evacuation purposes per NFPA 130. Special track work configurations are being analyzed for operational movements as well as constructability. All special work will meet MBTA and GLX standards as laid out in the RFP documents.

STRUCTURAL CROSSINGS

GLP's approach to the structural crossings was to balance conformance with all clearance requirements while minimizing structural work. In this regard we made a number of changes from the RFP redefinition drawings, as shown in **Figure A5.2.6-1**.

Additional civil work includes, but is not limited to:

- Roadway work at bridges and stations
- Traffic improvements including signal system improvements, crosswalks, signing, and striping
- Constructing the bus loop at Lechmere as required by the TPs
- Construction of safety niches in Cedar Street
- Sitework for the Red Bridge TPSS, the Gilman Square (Pearl Street) TPSS, and the Ball Square TPSS
- Sitework at the VMF

Related work includes storm drainage (discussed in Section A5.2.7), retaining walls (discussed in Section A5.2.2), and utility bridges (discussed in Sections A5.2.2 and A5.2.9).

During the GLX Procurement, GLP designers and constructors developed a design that would minimize structural work. This effort confirmed conformance to the Project requirements without a major redesign effort, decreased the length of the design phase, and will expedite the start of major construction elements.

A5.2.6.A.2

GEOMETRIC ALIGNMENT

We have developed an optimized alignment that is in full compliance with the geometric design criteria for commuter rail and light rail track as per Section 10 of the TPs. Also, we have walked the corridor twice, and have taken our own measurements of existing clearances at bridges and retaining walls. This has helped the optimization process.

Per Section 10.1 of the TPs, design criteria will follow MBTA standards as relegated in the CRDSM, BSP, Track Maintenance Standards and MW-1 for Commuter and Freight Rail tracks. Per Section 10.2 of the TPs, design criteria will follow MBTA standards in the LRTMSS, BSTP, and CRDSM for GLX tracks.

5.2.6.A.3

WAYSIDE ELEMENTS

An important aspect of the civil design is the integration of all wayside elements into a set of composite utility drawings. These will start with the 3D drawings for the track alignment and add:

- Storm drainage
- Wayside signals
- Catenary poles
- Duct banks for power, signals, and communications
- Signal bungalows and cases
- Utility services for stations

While all wayside elements must meet specific criteria, certain requirements will have priority:

- Wayside signals are based on safe braking calculations and, along with the associated insulated joints, have little flexibility and must be accommodated subject to the clearance envelopes of adjacent tracks.
- The gravity storm drainage system must maintain its vertical profile, while power, signal, and communication ducts can vary in depth to cross over the drainage pipes.
- Signal huts, signal bungalows, or CIHs must be located where space is available but also with concern for maintenance access and line of sight requirements.
- Catenary support poles will be located to provide track clearances while avoiding conflicts with storm drainage. Pole spacing must not exceed maximums to keep catenary height within acceptable limits.
- Duct banks for power, signals, and communications will follow linear corridors not used by the storm drainage. Consideration will be given to the cross section, such that the duct banks do not interrupt lateral cross drainage of the trackbed to the underdrains.

Design Element	Design Approach
Horizontal Alignment	› Our analysis indicates little opportunity to vary from redefinition plans › We will optimize while maintaining required horizontal clearances
Vertical Alignment	› We optimized the verticle aligments by developing independent profiles for each track › Our revised alignments meet the minimum 17-foot 9-inch vertical clearance at overhead bridges while minimizing undercutting
Speed	› Our analysis indicates we will make only minor modifications to horizontal alignments from RFP › We will recalculate design speeds to ensure compliance within operational requirements
Clearance Envelope	› 3D model will allow verification of clearance envelope
Line of Sight	› Only minor modifications to horizontal alignments from RFP, which will maintain line of sight from previous design › Our 3D model will allow verification of line of sight
Transitions between the various track bedding types	› We will account for track modulus changes in track bed detailing to reduce rail wear
Special Track Work	› We have analyzed for operational movements as well as constructability › We will meet all MBTA and GLX standards

Figure A5.2.6-1: GLP's design approach retained major portions of the RFP design while optimizing others where there are clear benefits in terms of reduced costs, reduced construction duration, and community benefits.

A5.2.6.A.4

SUPPORT OF RAIL SYSTEMS EQUIPMENT

GLP has performed interface definition and management activities during the proposal phase of this Project. As an example, we have studied the pre-purchased TPSS equipment and performed a review and analysis to determine how best to fit it into the new Red Bridge Substation Building. In addition, GLP has performed location integration for signal huts.

GLP treats civil interfaces similarly to any other system integration issue. As described in Section A5.2.1, we will follow the left side of the V diagram to define the interfaces and the actions taken to resolve any conflicts. This process will be followed through the design process to catch potential conflicts, and then through the construction phase at early points to catch any unforeseen conflicts during design.

Location	Proposed Design Approach to Structural Crossings
Walnut Street	› Eliminate box culvert under bridge for Community Path by transitioning Path to cross street at grade to more effectively connect with and serve the community in this area.
Medford Street	› Eliminate reconstructing the bridge by widening the bridge with a precast concrete arch span behind the existing south abutment. Maintain the temporary utility bridge as permanent
School Street	› Modify the width of the bridge by adding a precast concrete span behind the southern abutment for the Green Line
Lowell Street	› Widen the bridge to accommodate the Green Line by removing the existing retaining wall to be installed behind the southern abutment wall. This adjustment will meet AREMA "heavy construction" collision design requirements.
Broadway	› Continue to reconstruct/retain the roadway bridge, and retain the temporary utility bridge as permanent. The new roadway bridge will span over the Commuter Rail and the Green Line tracks.
College Avenue	› Eliminate reconstructing the bridge by removing the northern sidewalk, adding a new right turn lane, and constructing a new pedestrian bridge.

Figure A5.2.6-2: For the GLX structural crossings, GLP carefully studied each location to optimize the alignment of all elements: the Green Line, NHML and the Community Path.

Figure A5.2.6-3: Our optimized NHML alignment will minimize work in the ROW while maintaining the necessary clearance of 17-ft. 9-in. to clear MBTA commuter rail trains in all locations, as well as freight trains.

Examples of systems that will be examined for these conflicts include signals, communications, traction power and OCS equipment and cabling and conduits.

SIGNAL EQUIPMENT

- **Signal Huts, Signal Bungalows, or CIHs –** Will be located to meet the operational needs of the signaling system while considering ROW constraints, conflicts with other railroad systems, drainage, and retaining walls.
- **Signals –** Will be coordinated with the civil structures to make sure that no obstructions exist that will limit sight lines, and that the proper foundations can be placed. In addition, other systems such as OCS poles, communications aerial cables, power aerial cables, and other wayside-mounted equipment will be closely coordinated with signal light locations to avoid conflicts that could affect operations.

COMMUNICATIONS EQUIPMENT

- **Pathways for Communications Systems –** This includes the backbone communications network signal cables, and other communications based cables. These cables will be located in conduits, mounted aerially, or placed in duct bank or cable trays. These methods of running the cable will be examined especially where structures or utility conflicts may exist. Restrictions on cable bending radii and protection of critical circuits will be a key factor in our pathway routing.
- **Intercoms, Speakers, CCTV Cameras, Displays, and Other Station Appliances –** All of these devices need to be closely coordinated and interfaces defined. Interfaces exist between each device on a station platform, but also with column design and facility design, to avoid blocking CCTV camera views or line of sight to digital displays.
- **Operational Control Center (OCC) –** The OCC houses many pieces of equipment both in the operating theater as well as in backroom equipment rooms. The sizes and access requirements for this equipment and the operations desks will be closely coordinated with architects to avoid conflicts with pedestrian circulation, visual interferences, and all electrical codes. Ease of maintenance issues are also covered.

TRACTION POWER AND OCS EQUIPMENT

- **TPSSs –** Each substation will require coordination between buildings and civil infrastructure. Careful consideration will be given to cable routing, equipment sizes, and access, as well as maintenance or replacement of equipment considerations due to the size of some pieces of equipment. Our Team has examined these to validate facility sizes and arrangements, and will examine this in further detail after notice to proceed, prior to procurement or installation activities.
- **Cable Routing and Stray Current –** Traction power cables are large and have unique requirements for routing and housing that create challenges for viaduct design and other interfaces. Stray current needs to be examined to take precautions to prevent stray current being leaked. These are issues that will be subject to traditional systems integration processes, discussed in Section A5.2.1.

CABLING AND CONDUITS

As described above, cable routing is a key issue for coordination to make sure that the design of civil and structural designs are compatible. One issue is how, regarding stations and facilities, to route cables to avoid unsightly aesthetic issues and to maintain the security of the cables. These items will be examined by our Team to provide aesthetically pleasing routing and security of the cables.

A.5.2.6.B

PLAN AND PROFILE ALIGNMENT DRAWINGS

Plan drawings are located in the Drawings section of this Part 4: Technical Solutions submission on sheets 000-C-0001 TO 0028. The track profiles are very similar to the profiles provide by MBTA in the RFP documents are therefore have been excluded here.

A5.2.6.C

COMMUNITY PATH PROFILE AND PLAN DRAWINGS

Plan drawings are located in the Drawings section of this Part 4: Technical Solutions submission on sheets 000-C-0001 TO 0028, and shows how GLP's design raises the Community Path (ATC - Community Path Elevation Increase) to cross Walnut and Medford streets at grade. This change saves the costs of constructing tunnels for the path under Walnut Street and behind the Medford Street Bridge abutment. Bringing the path to the grade of the neighborhood improves pedestrian and bicycle connections, and can increase the perception of safety by users.

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Section A5.2.7 Drainage and Stormwater Management

GLP's knowledge and understanding of the drainage in the GLX Project area stems from our team's experience in designing and constructing the existing storm drainage system along the Lowell Line, as well as WSP's design of the storm drainage system in Union Square and the Fitchburg Main Drain. This was applied to our approach to maximize the retention of portions of the 1992 storm drainage while augmenting the Union Square Branch drainage to prevent backflow from surcharges in the Somerville Avenue combined sewer.

INTRODUCTION

GLP brings a unique understanding to drainage and stormwater management for the GLX Project. Not only have GLP team members both designed and constructed the existing storm drainage system along the Lowell Line, but GLP's lead designer, WSP, has designed a major municipal storm drainage system adjacent to the Project area as well as the Fitchburg Main Drain. This understanding is the basis of our approach to maximize the retention of portions of the 1992 storm drainage while augmenting the Union Square Branch drainage to prevent backflow from surcharges in the Somerville Avenue combined sewer.

This experience provides GLP with a thorough knowledge of:

- The tributary areas and downstream constraints at the connection points, including the limitations on discharges to Millers River, which flows into the Charles River, an impaired waterbody
- The constraints and concerns regarding the hazardous materials contamination in the vicinity of 50 Tufts Street
- The requirement to keep flood elevations below the tracks in the critical flood prone areas, including the Fitchburg Mainline at Red Bridge, Washington Street under the NHML and Medford Branch, and Cedar Street to Broadway on the NHML and Medford Branch

GLP will provide both permanent and temporary drainage and stormwater management infrastructure that meets the requirements of Section 7.3 of the TPs. Stormwater flows will be handled separately from the sanitary sewer system, which is discussed in Section A5.2.9 Utilities.

A5.2.7.A
APPROACH TO STORMWATER MANAGEMENT

GLP will implement a stormwater management approach that was established under the initial Project undertaking, providing detention and infiltration systems to prevent increases in peak flows to municipal stormwater drainage systems while providing treatment of total suspended solids ("TSS") from the stormwater runoff prior to discharge to the municipal systems. This approach will also include low-impact development approaches, where feasible, to maintain natural hydrology.

A5.2.7.A.1
STORMWATER MANAGEMENT PLAN

GLP's design was developed to meet the requirements in the original Drainage Report and will continue to meet these requirements through final design. The various drainage systems ultimately discharge to either the Charles River or the Mystic River. The divide is at Medford Street.

MEDFORD BRANCH TRIBUTARY TO THE CHARLES RIVER

South of Medford Street, the Lower Lowell Main Drain, the VMF drainage, and the new drainage between Washington Street and Red Bridge, all contribute to the MBTA Fitchburg Main Drain and the triple culverts discharging to the Millers River, which flows into the Charles River. The drainage near Lechmere Station discharges separately to the Cambridge municipal storm drain system at NorthPoint, which discharges into the Lechmere Canal and then the Charles River. Most of the tributary area is within the rail ROW, but portions of adjacent land and the properties at 115 and 150/200 Inner Belt Road also contribute to the Fitchburg Main Drain.

The existing Lower Lowell Main Drain trunkline, consisting of 24- to 48-inch pipes adjacent to NHML Track 1, will remain and be supplemented by a new pipe along the Medford Branch GLX tracks. To control major storm flows, ensuring that downstream conveyances are not overwhelmed, the extended Lower Lowell Main Drain includes already constructed in-line storage (south of Washington Street) and detention basins by Red Bridge.

MEDFORD BRANCH TRIBUTARY TO THE MYSTIC RIVER

North of Medford Street, the Upper Lowell Main Drain extends up to the vicinity of Cedar Street. This line discharges to the Somerville municipal combined sewer system by Gilman Square, and ultimately discharges to the Mystic River. For this section, our proposed changes include:

Section Highlights

- GLP's knowledge of Somerville Avenue combined sewer hydraulics allows for better assurance to prevent flooding under Prospect Street Bridge.
- Reuse of trunkline pipes will reduce costs and construction disruption along NHML.
- GLP addressed contaminated material area by lining existing pipes and clay dams in trenches to prevent downstream migration of contaminated groundwater.
- GLP's experience working with the municipalities will expedite approvals for downstream connections.
- With both the designer and constructor of the existing Lowell Line Main Drain on our team, GLP has familiarity with the existing conditions that reduces the likelihood of additional costs for latent site conditions.

- Retaining the easterly 30- to 48-inch drainage pipe (predominantly 42-inch) and not replacing it with a 66-inch pipe as indicated in the redefinition plans.
- Providing an equivalent hydraulic capacity by add a new westerly pipe, of varying diameter, that will be hydraulically connected to the existing easterly system.

Without compromising hydraulic capacity, our proposed improvements reduce the construction work along the NHML tracks and retain or rehabilitate the existing pipes installed in 1992 and designed for railroad Cooper E80 loading. The existing easterly pipes will be maintained to the design life specified in the TPs by installing a new structural lining. No in-line detention storage is proposed for this system.

Within the City of Medford, the railroad drains discharge to the municipal system, which also discharges to the Mystic River.

UNION SQUARE BRANCH TRIBUTARY TO THE CHARLES RIVER

East of Medford Street, the Union Square drainage discharges to the existing MBTA Fitchburg Main Drain, which discharges to the Millers River and then the Charles River. West of Medford Street, the new drain discharges to the Somerville municipal storm drain in Linden and Merriam Streets. This line in turn discharges to the municipal combined sewer in Somerville Avenue, which ultimately discharges in wet weather to the Charles River via the Prison Point pump station.

Typical Drainage Cross Section - Medford St. to Cedar St.

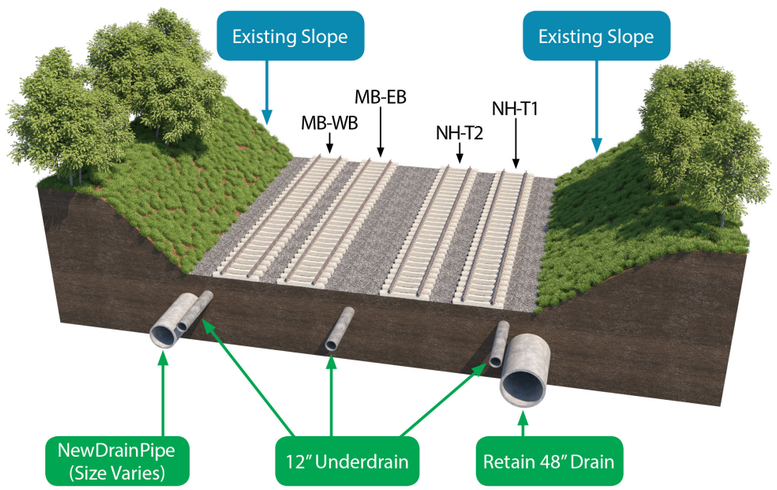


Figure A5.2.7-1: GLP's design will retain the existing 30- to 48-inch drainage pipe on the east side of the corridor between Medford Street and Lowell Street, while providing an equivalent hydraulic capacity by adding a new pipe on the west side of the corridor, hydraulically connected to the existing east side system.

While the 2016 GLX Drainage Report assumed the maximum flow in this 72-inch brick combined sewer would coincide with the sewer crown, we know, based on hydraulic modeling associated with WSP's sewer separation design for Somerville Avenue, that during even small storm events, the flow surcharges this sewer. To prevent flooding under the Prospect Street bridge, we propose to augment detention storage with a backflow preventer so that surcharged flows in the municipal line do not backflow into the MBTA system.

VEHICLE MAINTENANCE FACILITY

GLP's drainage design for the VMF is similar to the base design. The drainage from this site is split in two, with some flowing to the Third Street Pump Station, and the rest to the Red Bridge Pump Station. The existing system includes weirs, which will be cleaned and then bulkheaded to provide additional storage. All VMF drainage ultimately discharges to the Millers River, which flows into the Charles River.

MODIFICATIONS IN THE ROW

Overall, the proposed storm drainage system will maintain the existing storm drainage patterns. Although the Project adds two more tracks into the Lowell and Fitchburg ROWs, the overall increase in impervious cover will be minor, representing primarily station platforms, walkways, and some service roads. The VMF site will represent a net decrease in impervious cover compared to the pre-construction land uses.

A5.2.7.A.2

DESIGN STANDARDS AND CRITERIA

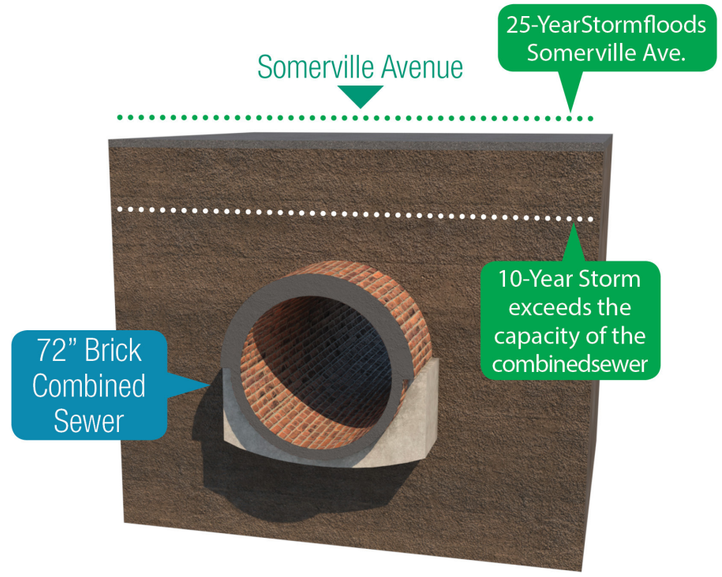
GLP's overall stormwater design will be based on the same basic criteria as the design to date (e.g., 50-year design storm, keeping water below top of tie in this storm, not exceeding the capacity of downstream systems at connection points). We will ensure the design complies with the Massachusetts Stormwater Standards as well as the requirements of three municipalities. Conforming to these criteria will address the elements of quantity (not exceeding downstream capacity) and quality (application of best management practices). New elements of the permanent stormwater systems will meet the project requirements, particularly that pipe and structure will support the Cooper E80 railroad loading.

GLP's construction methods will assure ongoing maintenance of drainage flows by staging the work so as to retain existing systems until the new systems are put in operation. We will assure proper drainage of the track bed during construction, to allow for ongoing rail operations. Our erosion control measures to protect downstream systems from sediment runoff by using protective devices at drain inlets.

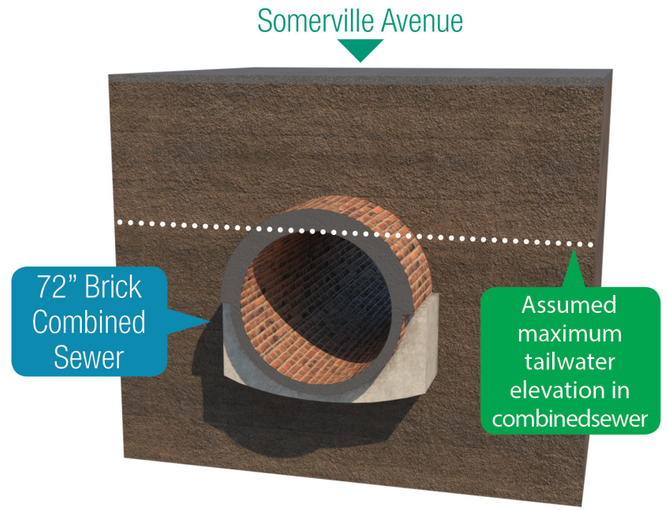
A5.2.7.A.3

STORMWATER RUNOFF MANAGEMENT

GLP's design will meet the Massachusetts Department of Environmental Protection ("MassDEP") stormwater management standards. As the GLX



Tailwater Condition Based on WSP's Somerville Ave. Sewer Separation Project for the City



Tailwater Condition Assumed in GLX Drainage Reports

Figure A5.2.7-2: GLP's designer WSP's understanding of actual storm flow elevations in the Somerville Avenue combined sewer will allow GLP to provide a storm system at Union Square Station that will be protected from surge tailwater conditions to prevent flooding under the Prospect Street Bridge.

Key Issue	Mitigation Strategy
Flood prone areas	
Red Bridge area of Fitchburg Mainline	Verify flood elevations are below top of rail
Washington Street under NHML	Verify pump is adequate to keep street passible through the 25-year storm; provide new storm drainage collection in Washington Street
Cedar Street area of NHML	Verify flood elevations are below top of rail
Groundwater	
High groundwater	Adequate underdrainage to drain track bed
Downstream capacity limitations	
General	Provide detention storage
Union Square branch west of Medford Street – lack of capacity in Somerville Avenue combined sewer	Provide detention storage and backflow valve so that combined sewer cannot backflow into the GLX storm drainage system.
Contaminated soils	
Contaminated soils by 50 Tufts Street, Somerville	Existing and new storm drainage pipes will be sealed to prevent infiltration into the MBTA drainage system. During construction, our groundwater treatment system will be designed to handle and treat contaminated groundwater. If the contaminated groundwater cannot be treated on site, it will be trucked off site for treatment and disposal.
Contaminated soils from groundwater	Clay dams in drainage trenches to limit migration of contaminated groundwater.
Total Maximum Daily Loads	
Strict total maximum daily load ("TMDL") restrictions in Charles River	Detention facilities at Red Bridge.

Figure A5.2.7-3: GLP's understanding of the GLX Project's drainage stems from our team's previous experience in the area and allows us to provide an effective mitigation strategy that will alleviate the potential for issues in the future.

Project is classified as a redevelopment under Standard 7, compliance will be to the maximum extent practicable for Standards 1 through 6. Our design will use all previously permitted municipal connections and comply with the conditions associated with these permits. To prevent overwhelming the capacity of downstream pipes, we will adhere to the MassDEP Standard 2 so that post-development peak discharge rates will not exceed pre-development discharge rates to the maximum extent practicable, or as superseded by previously permitted agreements with the local municipalities. To accomplish this, we will include all the detention facilities included in the previous designs.

For other municipal system connections in Cambridge, Medford, and Somerville, water quality standards will be met by using mechanical treatment for pavement areas, coupled with an infiltration system as previously permitted, and track ballast/underdrain systems along the track alignment.

Track underdrains will collect groundwater and stormwater runoff, filtering out dirt and contaminants as the flow passes through the ballast. No treatment is needed per the Massachusetts Stormwater Handbook, as the stormwater is collected within the pervious ballast.

The VMF is considered a land use with higher potential pollutant loads per MassDEP Stormwater Standard 5. This requires the use of specific structural stormwater BMPs determined by the Department as suitable for this application.

A5.2.7.A.4

KEY DRAINAGE ISSUES

In developing our drainage design, GLP has identified drainage issues in the project corridor. After review of these issues, a preliminary mitigation strategy for each has been established as illustrated in **Figure A5.2.7-3** and will be expanded upon further development of the design.

5.2.7.5

DRAINAGE SYSTEM

Collection of storm drainage will be accomplished by new catch basins collecting surface drainage and new underdrains collecting lateral cross drainage of the track bed. Collection will be largely consistent with the redefinition drawings.

Conveyance of storm flows will be accomplished by a mix of new and existing storm drain pipes. As previously noted, it is our intent to retain the trunklines of the existing Lowell Lower and Upper Main Drains (Washington Street to north of Lowell Street), while supplementing the existing pipes with a parallel line along the west side of the ROW. The proposed west drainage pipe will be a reinforced concrete pipe.

As specified in Section 7.3.3.2 of the TPs, GLP will provide proper cover (minimum of 2 feet of cover from top of pipe to bottom of tie), and the pipe loading crossing under railroad tracks will be Cooper E80.

Improvements to the Fitchburg Mainline and Millers River Drainage have largely been completed as part of the GMP-3 contract. This includes in-line detention storage and stormwater basins. Our Project responsibilities include completing the partially constructed pump stations that are now inactive (Washington Street Pump Station and Red Bridge Pump Station).

The various storm drain systems discharge to a finite number of approved outlets:

- **Lechmere area –** Cambridge municipal storm drain at NorthPoint;
- **Lower Lowell Main Drain and Fitchburg Main Drain (including the VMF) –** Millers River;
- **Upper Lowell Main Drain –** Somerville municipal combined sewer at Gilman Square;
- **Medford area –** Medford municipal system; and
- **Union Square Branch west of Medford Street –** Somerville municipal storm drain.

A5.2.7.B

STORMWATER MANAGEMENT DRAWINGS

A5.2.7.B.1

MINOR AND MAJOR (OVERLAND) FLOWS FOR THE ENTIRE SITE

Minor and major flows are directed to catch basins and underdrains. These drainage system items are indicated on Medford Branch Drainage Plans: 000-C-0029 to 000-C-0037

Medford Branch Corridor Plans: 000-C-0001 to 000-C-0022

Union Square Branch Corridor Plans: 000-C-0023 to 000-C-0028

Vehicle Maintenance & Storage Facility Site Plan: VMF-C-0001 to VMF-C-0003

A5.2.7.B.2

STORMWATER MANAGEMENT FACILITIES (QUANTITY AND QUALITY)

The previously constructed (GMP-3) facilities include the in-line storage in 90-inch diameter pipes and detention basins, shown on Medford Branch Corridor Plans: 000-C-0004 to 000-C-0007

Mechanical treatment systems are shown on Medford Branch Corridor Plan: 000-C-0002

The isolation of the system from the soil contamination near 50 Tufts Street is shown on Medford Branch Corridor Plan: 000-C-0002

Track underdrains, which collected stormwater through the ballast, are shown on Medford Branch Corridor Plans: 000-C-0002 to 000-C-0022

Medford Branch Drainage Plans: 000-C-00029 to 000-C0037

Union Square Branch Corridor Plans: 000-C-0025 to 000-C-0028;

Vehicle Maintenance & Storage Facility Site Plans: VMF-C-0001 to VMF-C-0003

Water quality treatment devices for the VMF are shown on Vehicle Maintenance & Storage Facility Site Plans: VMF-C-0001 & VMF-C-0002

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Section A5.2.8

Environmental Management Strategy

GLP will deliver unmatched environmental excellence to the GLX Project.

INTRODUCTION

The GLP Team has executed multiple projects with no notices of violation, work stoppages, or environmental permitting delays. We have met all permit requirements established for environmental, such as noise restrictions, disposal of soils, and erosion controls. In addition, GLP's Design and Construction teams have met all permit requirements for building codes and land use. For the GLX project, we will continue our successful approach to obtain and comply with required permits and environmental controls needed for the design, construction, and acceptance of the work.

A5.2.8.A

ENVIRONMENTAL TEAM STRUCTURE

The Organizational Chart (**Figure A5.2.8-1**) provides an outline of the Environmental Organization within the Project Organization as well as the direct and indirect reporting structure for the team. A copy of the Organizational Chart will be displayed in offices and construction site facilities and included within induction training.

Environmental management on the project will be the responsibility of all GLP personnel. It will not be solely the role of the Environmental Team, and within the GLP organization, all personnel will be responsible for:

- Complying with the Environmental Management Plan ("EMP") and associated plans.
- Complying with all environmental requirements applicable to their activities.
- Seeking advice from a member of the Environmental Team.

Figure A5.2.8-2 details roles identified within the GLP structure and the specific environmental responsibilities for those roles.

A5.2.8.B

ENVIRONMENTAL PROTECTION PLANS AND CONTINGENCY PLANS

The GLP Team will develop a comprehensive environmental protection program that will be documented in an Environmental Protection Plan ("EPP"). The EPP will provide the framework for the overall environmental management strategy for complying with environmental protection

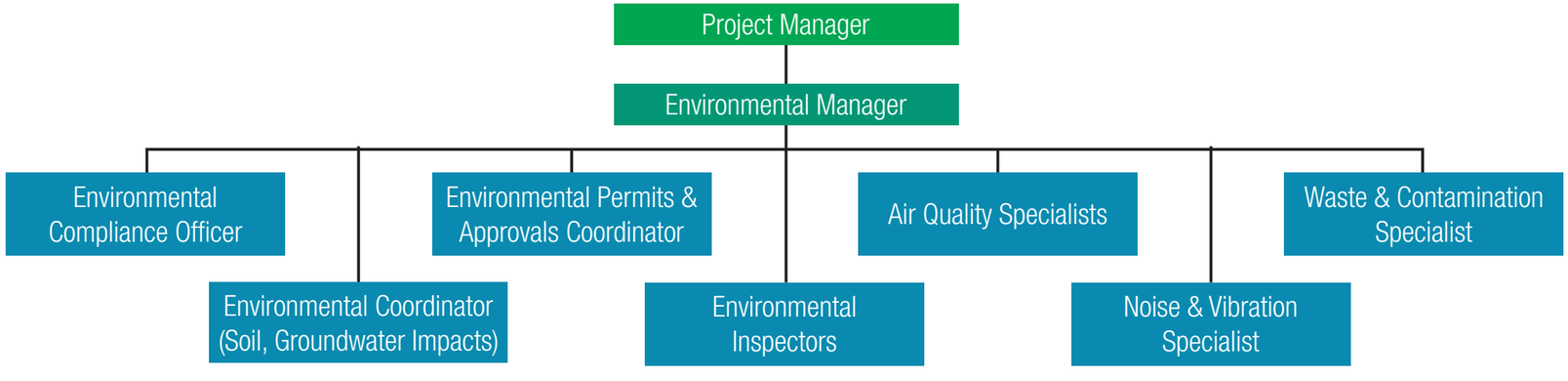

Figure A5.2.8-1: GLX Environmental Team Structure

Section Highlights

- GLP has expert staff in environmental permitting, policy, and best practices and that have experience in DB projects.
- GLP utilizes ISO 14001 ES&H Management System that will expedite excavation and stockpile testing activities..
- GLP hproposes an efficient on-site Soils Management Program.
- GLP is committed to education and coaching of all field personnel and subcontractors.
- GLP has formed and resourced an environmental management organization to be completely responsive to all project commitments.

Role	Responsibilities
Environmental Manager	A Key Individual for the entire Project who has defined authority over the establishment including environmental plans and procedures, as well as auditing and reporting on the status of, and compliance with the EMP, the Environmental Approvals and other environmental plans and reports and any terms and conditions associated with environmental permits, licenses, and approvals. The Environmental Manager will establish and maintain working relationships with relevant governmental authorities and stakeholders; take a lead role in internal environmental and sustainability design reviews, including development of mitigation and compensation proposals; and act as the single point of contact for GLP on all matters relating to environmental management.
Environmental Permits and Approvals Coordinator	Under direction of the Environmental Manager, is responsible for obtaining and verifying compliance with environmental permits, licenses, approvals, and agreements relating to the Works.
Environmental Coordinator (Soil and Groundwater)	Reports to the Environmental Manager and functions as a Team Lead looking after all matters related to excavated materials management, contamination, and groundwater. The Environmental Coordinator will develop and oversee the implementation of the Excavated Materials Management Plan, including the soil sampling strategy and procedures and the handling and transport of excavated materials. He or she will also work closely with the Permits and Approvals Coordinator throughout the approvals application process. The intent is that this role will be able to deploy soil, water, and/or other specialists on an as-needed basis.
Environmental Compliance Officers and Inspectors	Reporting to the Environmental Manager, these positions provide support to the overall Project Environmental Management Strategy. This includes field support in activities such as taking samples, carrying out inspections, and maintaining spill kit inventories. It will also include documentation, records, and reporting. The Team will be integrated into the GLP project management systems and interact daily with other GLP Team members, contractors and subcontractors, the MBTA, regulators, and the public as required.
Air Quality Specialist	Fulfills the requirements for the Emissions Summary Dispersion Model and develops an air monitoring strategy for the life of the GLX Project.
Noise and Vibration Specialist	Develops and implements noise and vibration assessment strategies to aid in developing a noise and vibration abatement and monitoring strategy for the life of the Project
Waste and Contamination Specialist	Assists with waste minimization plans; source separation program; and waste auditing, handling, and disposal. May also perform Spill Risk Assessments as per the Spills Plan.

Figure A5.2.8-2: GLX Environmental Team's roles and responsibilities.

requirements, commitments, and agreements during design, demolition, construction, and start-up.

ENVIRONMENTAL MANAGEMENT PLAN

The GLP EMP will be a "living document" subject to regular updates. Where improvements (technological or procedural) are identified to better protect against environmental risks, the EMP and relevant environmental Control Plans will be updated to incorporate the improved operation/process.

Other inclusions in the EMP are compliance monitoring and reporting requirements (detailed further under Section (D)), roles and responsibilities, environmental obligations, and lessons learned.

Where identified, improvements to design and construction practices, will be assessed and, where feasible, incorporated into the EMP.

ENVIRONMENTAL PROTECTION TRAINING PLAN

Training construction personnel regarding compliance with environmental commitments is essential to achieving compliance. The GLP Team will develop training plans to provide the knowledge needed to achieve compliance, create awareness of sensitive environmental receptors, and create an understanding of the importance of compliance.

EXCAVATED MATERIAL MANAGEMENT PLAN

This plan will be developed and implemented for the site that describes the types of excavated materials and how they will be handled. Soils removed from the sites will be pre-classified using in situ borings and soil tests to determine appropriate hauling and storage methods. Suitable materials may be stored on-site for reuse as backfill. Contaminated material will be identified, segregated, and disposed of off-site at an approved treatment facility.

Erosion and sediment control measures will be installed before starting work and maintained to prevent sediment from leaving the site. We will use measures to manage water flowing onto the site, as well as water being pumped or diverted from the site, such that sediment is filtered out prior to the water entering a water body.

We will use only approved dewatering methods in approved areas contain suspended sediment where in-water work is required. Dredging spoils, construction waste and materials, uprooted or cut aquatic plants, and accumulated debris will be stored above the high-water mark of nearby water bodies and controlled to prevent re-entry. Regular inspection and maintenance of erosion and sediment control measures and structures will be performed during the course of construction.

SPILL PREVENTION AND POLLUTION RESPONSE PLAN

GLP will prepare a Spill Prevention Plan ("SPP") for implementation during the Project. The main focus is to prevent spills from occurring by addressing the responsible delivery, storage, and dispensing of solid and liquid chemicals that will be used by GLP during construction, including fuels, lubricants, solvents, de-icing agents, and water treatment chemicals. The SPP will include emergency response procedures to limit the migration of contaminants from the original release location. Notification requirements will be documented for regulators, and for members within the Project Team.

We will track which chemicals, fuels, and lubricants are used on the Project and the specific procedures used for spill cleanup. Material Safety Data Sheets ("SDS") will be available at each construction site for reference on how to clean up a specific contaminant spill, proper personal protective equipment ("PPE"), and emergency contact numbers. Spill kits will be located in fueling and maintenance areas and on service trucks. The spill plan all soil samples will be stored in the Project office and contain information on clean-up procedures for various environmental situations (spill to ground, water bodies, air, etc.) and contact lists on who must be contacted. All employees will be trained in spill prevention and response as a fundamental part of employee orientation and training. Inspection of spill kit materials will be scheduled regularly by a member of the environmental team. All material used will be disposed of properly and replenished immediately after any spill cleanup.

ARCHAEOLOGICAL RISK MANAGEMENT PLAN

We will prepare an Archaeological Risk Management Plan to address potential issues and implement recommendations from the previous archaeological reports. Where the assessments have identified archaeological significant resources, a licensed archaeologist will be retained to monitor the excavation during construction activities.

When archaeological finds are exposed, we will follow applicable heritage laws and protocol, especially if human remains are discovered. Previously undocumented archaeological resources will be appropriately documented and managed by qualified specialists.

The plan will comply with the requirements of the MBTA. Approvals and permit requirements for work at Historic properties will be in accordance with the Historic Properties Section 106 Memorandum of Agreement ("MOA") and Amendment #1 of the MOA.

AIR QUALITY/DUST CONTROL PLAN

The Dust Control Plan will be developed to identify possible sources and provide mitigation measures. Where construction activities could potentially generate airborne dust or fumes, appropriate methods of control will be implemented, and employees will be trained on the plan. The plan is detailed in Section 5.2.8.h.

NOISE AND VIBRATION CONTROL PLAN

Noise and vibration considerations affecting design are related to stationary source operations and vehicle operations, which must be controlled at receivers in the local vicinity. Stationary sources include equipment and bus movements at the VMF and bus facility, as well as substations throughout the GLX.

Airborne noise from vehicle operations emanates directly from the vehicles as well as from wheel-rail interaction, which is increased at special track work locations and at curves with small radii. Ground-borne vibration is transmitted through the rail support structure, ground strata, building foundations, and building structure, where it may be radiated as ground-borne noise.

Each of these factors will be taken into account during design to control noise and vibration levels appropriately to meet Project requirements and reduce the risk of disturbing local residents and other building occupants.

EQUIPMENT OPERATION PLAN

Although not an explicit environmental plan, there will be environmental components included with each piece of equipment to raise operator awareness, especially when working in a sensitive environment or water body, such as:

- Verifying that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species, and noxious weeds.
- Operating machinery on land above the high-water mark in a manner that minimizes disturbance to the banks and bed of the water body, especially where steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds exist.
- Washing, refueling, and servicing machinery and store fuel and other materials in such a way so as to prevent any pollutant sources from entering the water.

The EPP and its component elements will be modified as needed as the Project progresses through construction.

A5.2.8.C

COMPLIANCE WITH ENVIRONMENTAL COMMITMENTS AND AGREEMENTS

We will perform environmental management for the GLX Project work through our Environmental Department, which provides centralized leadership on all environmental issues affecting the project. The Environmental Team will prepare project policy and statement of principles on environmental compliance, to be endorsed by the Project Manager.

Environmental management is an overarching theme within our workplace culture. Our entire workforce, including subcontractors, will be held accountable for active participation in the environmental program.

We will be responsible for spreading awareness about GLP policy and expectations to co-workers and lower-tier subcontractors. Our environmental management principles involve endorsing and recognizing positive behaviors and leadership within the entire workforce.

We will implement an ISO 14001 based Environmental Management System ("EMS") during construction and effectively integrate environmental requirements and processes into the project organization and work products from design through construction and project close-out.

The basic elements of the EMS we will follow include, but are not limited to, the following:

- Policy and principles.
- Definition of roles and responsibilities.
- Compliance processes and procedures.
- Environmental Compliance Matrix.
- Aspect Register.
- Targets and objectives.
- Contract and subcontract requirements.
- Design and construction planning.
- Environmental controls/mitigation methods.
- Environmental quality assurance/quality control (QA/QC) inspection.
- Management review and audits.
- Document control.
- Environmental awareness training.
- Trend analysis and continuous improvement.

During Design and Construction Planning, GLP will incorporate all permit requirements into our design and construction work plans. Our final construction drawings will indicate the requirements to meet applicable agencies and codes. To ensure compliance to other requirements, our Environmental Manager will participate in engineering reviews of project specifications and plans at multiple design levels and prior to issuance to construction. We will prepare and regularly update permit compliance drawings for the alignment that show regulatory limits, call out site-specific permit conditions, identify environmental issues, and identify locations and dates for various permits and modifications. We will capture the information used to prepare the drawings linking permitting and technical data to geographic locations. Our construction personnel and subcontractors will be familiar with project commitments and requirements for the locations where they are working. They will incorporate and tailor mitigation measures to particular work site locations as required and appropriate.

As part of construction planning, Construction will sequentially prepare numerous work plans that cover specific portions of the project alignment. These work plans will identify key construction issues and activities, staging sequence, risk management, schedules, and work locations within specific work sites. The work plan will also

Figure A5.2.8-3: All on-site construction personnel will receive environmental protection training to ensure compliance with environmental commitments.

identify necessary mitigation and control measures for environmental management. During preparation of work plans, the construction planner will consult with our Environmental Manager and review the relevant portions of the plans and permits to confirm environmental requirements and controls. Each work plan will note the environmental topics and specific mitigation measures required for the particular work site. The Construction Team will incorporate environmental tasks into its schedules and work planning processes, so construction is prepared to proceed efficiently. This includes showing, on the schedules, the upfront tasks and timing of regulatory approvals, baseline environmental surveys, work plan reviews, training, and erosion control installation. Work planning will heavily emphasize identification of environmental requirements and mitigation measures, pre-construction meetings, and walkdowns of the site.

ENVIRONMENTAL COMPLIANCE MATRIX

BMPs for large transportation projects include the ability to demonstrate regulatory compliance by systematically recording and tracking project commitments and permit conditions while concurrently integrating them into project planning and execution. By incorporating requirements early and efficiently, we can identify and better manage schedule and cost issues. We can meet regulatory and community expectations in a proactive fashion and prepare design packages and construction work plans, inclusive and compliant with the relevant environmental requirements.

The Environmental Compliance Matrix will be used to log, distribute, and track permit conditions to confirm their proper and timely integration into planning and work execution. Overall, the Environmental Compliance Matrix will provide reference to environmental requirements and their source documents. It will list the requirements, actions necessary to

complete them, the responsible project groups, and status. In this way, all parties within the project execution team will be able to view a single document listing the permit conditions and commitments affecting their areas of responsibility.

The Environmental Compliance Matrix will be updated quarterly and used by our environmental management to track and demonstrate regulatory compliance throughout the GLX Project work execution.

To facilitate incorporation of the various commitments, the matrix items will be sorted and distributed by the Environmental Manager to the various project groups that have responsibility for the particular subject. The Environmental Compliance Matrix and permit termination will be the basis for final close-out of environmental requirements at the end of the contract.

A5.2.8.D

MONITORING, INSPECTION AND REPORTING

ENVIRONMENTAL MONITORING REQUIREMENTS

Monitoring requirements will be identified for each environmentally significant aspect and agreed upon with MBTA prior to implementation. Monitoring requirements will be included within the EMP and be reviewed regularly. The following have been highlighted as potential monitoring requirements for the Project in regard to water management: shallow groundwater mini-piezometers, discharge water compliance monitoring, construction erosion and sediment control inspections, noise and vibration monitoring, stream baseflow and mini-piezometers, surface water quality, groundwater levels and quality, and water-taking compliance monitoring.

Monitoring activities will be focused in areas where the Project has the potential to have the greatest impact, such as additional noise and vibration monitoring at sensitive receptors or where construction equipment must integrate with the public. For example, during the Construction period, trucks and construction equipment will require access to and from the station sites and the VMF.

INSPECTION

Environmental site inspections will be carried out at a required frequency by a member of the Environmental Team. Inspections will cover legal and contractual conformity and will be reported in a format specified and approved by the MBTA.

Details of aspect-specific inspections will be provided in each of the aspect control plans. At a minimum, aspect-specific inspections will be carried out on noise control, air quality, and dust and waste management.

Any incidents observed during site inspection will be raised on the project incident management system following the inspection.

REPORTING

Reports will be prepared for each set of monitoring data collected under the EMP (and associated control plans) as well as where required by the regulatory authority and/or permit/legal requirements.

A5.2.8.E

MANAGEMENT OF CONTAMINATED MATERIALS

The Excavated Material Management Plan (“EMMP”) will form part of the Soil and Groundwater Management Strategy that will be prepared to address the handling, management, and disposal of excavated soil (both clean and contaminated) that is excavated during construction activities. GLP will retain a Qualified Person to develop the plan.

Excavated soils will be tested and conditions for soil reuse will be identified. Suitable reuse thresholds levels will be established for total petroleum hydrocarbons, and volatile organic compounds. Remediation techniques and engineering controls will be applied where applicable. In addition, soil samples will be collected from areas of suspected contamination that: 1) has had historical releases of non-petroleum hazardous chemicals; 2) was used for operations that involved significant quantities of non-petroleum hazardous chemicals; or 3) during excavation, is found by sight or smell to be contaminated with apparent non-petroleum hazardous chemicals, will be tested for potential toxicity characteristics such as ignitability, corrosivity, or reactivity. Any soils for reuse or disposal will also be tested per disposal facility requirements. We will not transfer soils that exceed any of the defined thresholds in the Plan for use as fill or cover; rather, we will manage and dispose these soils in accordance with the disposal or reuse options described in the Project specifications and in compliance with MassDEP COMM 97-001.

Field personnel will also be trained to recognize potentially contaminated soil conditions. Well-developed identification, notification, and coordination processes between Construction, MBTA representatives, and remediation contractors, will lead to proper handling of contaminated materials.

We will develop and implement a Waste Management Process (“WMP”) in accordance with requirements. The key elements of the WMP will focus on waste identification,storage and segregation by waste type/ stream Furthermore, a waste minimization program, including defined targets for the salvage, reuse, or recycling of project wastes, and where necessary, options for waste disposal off-site in accordance with project and regulatory requirements.

We will choose waste reduction targets to align with project performance goals and practicable industry standards. We will emphasize the need for proper waste management, including the project-defined waste reduction principles and strategies, to project personnel in the new-hire training program and through ongoing workforce training and compliance monitoring of subcontractors in the field. Our WMP will include provisions for the tracking of waste generation and disposition (i.e., salvage and reuse).

Figure A5.2.8-4: Excavated soils will be identified and pre-classified according to the EMMP.

A5.2.8.F

EXCAVATED SOIL MANAGEMENT

Our strategy for excavated soil management includes disposal or reuse of excess soil and like material. Clean soil that is excavated from the various sites, will be identified and pre-classified in accordance with the EMMP. The EMMP will include soil sampling and analysis for soil that is being transferred, the estimated volume of the transfer, a site plan indicating the area and depth from which the soil originated, and a list of potential receiving sites.

A5.2.8.G

NOISE AND VIBRATION

Effective noise control is important for protecting communities, natural areas, and the construction workforce. The tolerance of construction noise and need for controls will vary by location as a function of construction activity, proximity to sensitive receptors, land use, and line-of-sight between construction and receptors.

We will tailor mitigation measures to match site-specific (land use) conditions found during baseline surveys and integrate them during construction planning for each new phase of construction. Heightened attention to noise control measures will be needed and implemented in some cases because of the proximity and sensitivity of nearby residences and businesses.

Planned construction activities at each work site will be reviewed. For each major work task, the corresponding construction equipment operations will be established, in terms of equipment types, locations, and work hours. Construction noise levels will be predicted at nearby sensitive receptors to identify potential impacts and determine which

Figure A5.2.8-5: GLP is experienced in noise & vibration monitoring for rail projects nationwide, using the latest instrumentation for measuring noise levels.

noise sources contribute significantly to the overall noise levels. This will enable site-specific mitigation measures to be established to address the relevant construction noise limits.

A proactive noise and vibration management process will be developed and implemented during the Construction period. This could include measuring noise levels to follow up with a complaint or installing a remote monitoring system capable of continuous data collection and live alerts and preset threshold levels. In the event that monitored noise or vibration levels exceed limits and public complaints are received, response actions will be taken to identify corresponding activities and implement further targeted mitigation measures to the extent feasible.

We will identify sensitive receptors, assess impacts, and implement mitigation measures to minimize impacts to adjacent neighborhoods.

To minimize construction noise and vibration impacts, we will:

- Identify sensitive receptors and prioritize work methods to minimize noise sources in the vicinity of those receptors.
- Be proactive in noise abatement to reduce complaints.
- Actively perform community relations through our Communications Team

Sound attenuation hoarding and double silt fencing can keep construction noise and fugitive dust emissions inside the compounds.

A5.2.8.H

AIRBORNE PARTICULATE MATTER

Construction methods will minimize emissions and airborne particulates by adhering to the Air Quality and Dust Control Plan and procedures. Air quality will be monitored and reviewed against air quality standards; this data will be used to modify work methods and practices as appropriate.

The Dust Control Plan will be developed to identify possible sources and provide mitigation measures. Where construction activities could potentially generate airborne dust or fumes, appropriate methods of control will be implemented. A dedicated water truck will continuously provide wet suppression. Loading and transferring dry materials will be controlled so that fugitive dust does not affect adjacent lands or worker health. Our trained mechanics will maintain diesel engine equipment to reduce the particulate matter to acceptable levels. Ongoing monitoring and sampling will keep the demolition and construction activities in compliance.

A5.2.8.I

CONSTRUCTION AND DEMOLITION WASTE

GLP will recycle at least 90% by weight of the total non-hazardous demolition debris on the GLX site. One hundred percent of the excess excavated soils will be hauled to local licensed waste facilities and repurposed as landfill soil topping layers. GLP will recycle 100% of the steel from the existing buildings, and the Lechmere Viaduct as scrap metal. One hundred percent of the excess concrete, bricks, and blocks from building demolition and the existing Lechmere Viaduct deck will be crushed and repurposed as aggregate. Wood debris will be reduced in volume and sent to a construction and demolition landfill.

GLP is committed to using hazardous or contaminated soils generated from work in on-site fills. Since there are less than 20,000 cubic yards (“CY”) of on-site fills available on the GLX, excess hazardous, contaminated soils, and unsuitable soils beyond that value from on-site cuts will need to leave the site to a licensed landfill. The landfill will recycle this waste as landfill soil topping layers. GLP will also recycle miscellaneous construction debris generated from the new construction work, including scrap steel from the structures and scrap copper from electrical cabling.

A5.2.8.J

LANDSCAPING WASTE

All plant materials removed from the corridor will be directed to composting sites within the local jurisdictions wherever possible. In some locations, on-site chipping and grinding of removed vegetation may be used for temporary erosion control rolls and mats. Chipped or ground vegetation may also be used for top dressing and mulching of planting beds where shrubs, trees and or perennial plantings will be used. Existing site soil suitable for landscape uses will be stockpiled and protected from contamination from other construction activity and reinstalled for use in new landscape areas within the corridor.

A5.2.8.K

TRAINING

Environmental awareness training is a mandatory part of GLP new employee orientation for all manual and non-manual employees,

The Following Environmental Toolbox Talks are Available From GLP:

- ✓ Aerosol Can Management & Disposal
- ✓ Air Permit Basics
- ✓ Anti-Idling
- ✓ Be a Good Neighbor: Don’t Be a Nuisance
- ✓ Construction Waste Management
- ✓ Dewatering
- ✓ Dust Suppression
- ✓ EMS
- ✓ Endangered Species
- ✓ Erosion & Sediment Control Basics
- ✓ Migratory Birds
- ✓ Petroleum Product Transfer
- ✓ SPCC Basics
- ✓ Spill Prevention
- ✓ Spill Response
- ✓ Stormwater Sampling
- ✓ SWPPP Basics
- ✓ Tack Buggy Operations
- ✓ Water Quality Protection

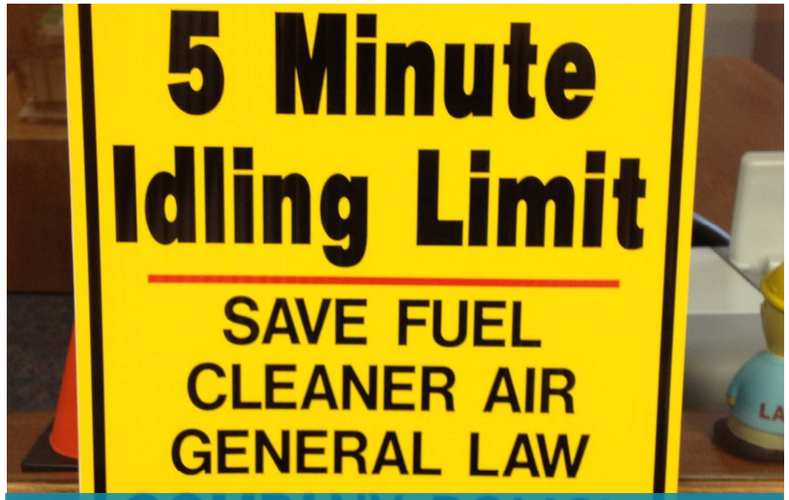

Figure A5.2.8-6: GLP employs air quality protection strategies from all team members to comply with environmental requirements set forth in the TPs.

Figure A5.2.8-7: GLP will reuse 100% of the MBTA-provided materials including steel located at Casco Bay for the construction of the Lechemere Viaduct.

suppliers, and subcontractor personnel. We will choose waste reduction targets to align with project performance goals and practicable industry standards. We will emphasize the need for proper waste management, including the project-defined waste reduction principles and strategies, to project personnel in the new-hire training program and through ongoing workforce training and compliance monitoring of subcontractors in the field. Our WMP will include provisions for the tracking of waste generation and disposition (i.e., salvage and reuse).

An Environmental Training Matrix will be included within the EMP and detail training and competency requirements of employees across the organization. Training needs within GLP are determined from a review of role responsibilities in each key project area. The matrix will detail specific training courses, target audience, and dates of training to be carried out.

A5.2.8.L
AIR QUALITY

The project Technical Provisions ("TPs") require a Work Zone Air Quality Monitoring Program. This program will include air quality protection strategies that address dust control related to excavation and earthwork operations, and demolition. The program will also consider air borne asbestos and other items that may affect air quality such as idling vehicles. Air quality monitoring and mitigation for this section shall be coordinated with the overall requirements during construction with Section A5.2.8.H AIRBORNE PARTICULATE MATTER.

A5.2.8.M
INDOOR AIR QUALITY

The project's TPs require indoor air quality measures to be integrated into the design of the facilities as well as during the construction of the facilities. The facility designs are required to comply with ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality. Spaces with variable occupant loads, such as training rooms, will be served by HVAC systems that provide ventilation based upon carbon dioxide concentration measurements as these types of spaces can be challenging to ventilate adequately. The construction phase indoor air quality protection measures will be provided through the implementation of a Construction Indoor Air Quality Management Plan that meets the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association ("SMACNA") IAQ Guidelines for Occupied Building Under Construction. This plan will address HVAC system protection strategies, emission source control strategies, contaminant pathway interruption strategies, housekeeping strategies as well as scheduling strategies that assure construction activities are sequenced to minimize the impact on indoor air quality.

A5.2.8.N
USE OF EXISTING EQUIPMENT AND MATERIALS

GLP will reuse 100% of the MBTA-provided equipment and materials on the GLX Project. We have adopted the Lechmere Viaduct and Washington Street Bridge designs and will reuse all the steel previously purchased and located at Casco Bay and High Steel. We will also be using all the pump and piping equipment provided for the Washington Street and Red Bridge pump stations. Most importantly, GLP will be using all the Powell-supplied traction power equipment and transformers for the Red Bridge TPSS and obtaining a full warranty from the manufacturer. GLP's plan submitted in our TPSS ATC includes shipping the equipment back to Powell's factory, installing it in modular TPSS buildings, and retesting before shipping back to the GLX.

A5.2.8.0
BUILDING COMMISSIONING

The commissioning plan will provide direction for the commissioning process during construction, providing resolution for issues such as scheduling; roles and responsibilities; lines of communication and reporting; approvals; and coordination between the commissioning agent, the contractors and the MBTA.

Commissioning is a systematic process of ensuring that the building systems perform per the design intent and the MBTA's operational requirements. All equipment and systems should be installed per manufacturer's recommendations and industry best practices and standards.

Commissioning will include documenting the design intent, followed by activities in the construction, acceptance, and warranty phases of the Project. Contractor participation in commissioning activities will follow the requirements defined in the specifications. The three main goals of the commissioning process are: facilitate the final acceptance of the Project as soon as possible; facilitate the transfer of the Project to the MBTA's maintenance staff; and ensure that the comfort systems meet the requirements of the occupants.

Commissioning is also intended to achieve the following specific objectives: document that equipment is installed and started per manufacturer's recommendations; document that equipment and systems receive complete operational checkout by installing contractors; document system performance with thorough functional performance testing and monitoring; verify the completeness of operations and maintenance materials; and ensure that the owner's operating personnel are adequately trained on the O&M of building equipment.

The systems typically commissioned for projects of this type include HVAC and associated control system, pumps, water heaters, piping systems, ductwork, packaged air conditioning and heat pump units, fire protection systems, fire alarm and detection systems, fire and smoke dampers, electrical and emergency power systems, scheduled and daylight dimming controls, and occupancy sensors.

A5.2.8.P
STORAGE

GLP will minimize the storage of materials on the ground because the general plan is for tractor/trailer deliveries to drop their trailer at the laydown yard and have a local tractor bring the material to the work front at the appropriate time. Under this scenario, the material does not have to be double-handled or stored on the ground. If materials need to be unloaded and stored, GLP will put them on proper wood dunnage to avoid damage.

A5.2.8.Q

LANDSCAPE PLANT SELECTION

The plantings will be selected from native and non-invasive plant lists established by Commonwealth and local agencies and horticultural references. The selected plantings will have a reliable record of drought tolerance and will not require ongoing fertilization beyond the maintenance period. During the Design phase, the location and microclimate conditions expected in each planting area will be summarized and paired with native species that thrive in similar conditions

A5.2.8.R

WILDLIFE HABITAT

Based on the Green Line Extension Project DEIR/EA and Section 4(f) Evaluation, wildlife habitat is not significant in the Project area or its surroundings. The majority of land affected is considered low-value habitat that does not provide significant benefits and impacts are not expected to have significant effects in the project area. However, vegetation in the segment between College Avenue and just north of Winthrop Street has a diverse plant community that has good wildlife food resources and provides cover for small animals. This area also provides feeding or nesting habitat for several bird species and a red-tailed hawk has been observed feeding, roosting and potentially nesting in the area. The GLP Team will minimize impacts in this area to the extent possible. A wildlife habitat field reconnaissance will be conducted at the start of the Project to confirm habitat that potentially could be affected by the project. The habitat assessment will include identifying nests for sensitive bird species that could be present in the area. The GLP Team will work with applicable regulatory agencies to minimize impacts on affected species and determine the need to relocate nests or implement other measures to avoid or minimize impacts.

A5.2.8.S

PEST CONTROL

GLP will implement and comply with the MBTA's rodent control program along the GLX alignment, including a daily collection of trash from worker lunch breaks. Also, GLP will implement permanent bird deterrents on horizontal surfaces near station pedestrian areas where potential roosting would create long-term issues for the MBTA customers. GLP plans to use energy-passive bird deterrent strategies, including bird slides, bird spikes, and bird wire, at these locations.

A5.2.8.T

LIGHTING

The lighting design will follow the MBTA lighting standards as well as other applicable recommendations from the Illumination Engineering Society of North American (IESNA), including following the recommendations of Technical Manual TM-11 for the mitigation of light trespass as well as IDA-friendly exterior lighting when applicable. The lighting improvements will use new white LED lighting technology to focus lighting where it is needed, improve color rendering of the environment, and more easily control the lighting system for the intended use of the facility by making use of the LED's control and dimming functionalities.

Control of artificial light will be specified for each circumstance: examples are to control light by shutting off lights for dusk-to-dawn operation, daylight harvesting, and dimming for selected curfews or when a space is not in use. These types of controls can be implemented with photocells, time clocks, and building lighting management systems. A system such as this can minimize energy usage and provide a centralized control for scheduling and reporting.

A5.2.8.U

ENERGY-EFFICIENT LIGHTING

All locations, interior and exterior will use LED solid-state luminaires. These luminaires will be sensibly selected to have a long life and superior energy efficiency than other incumbent lamp technologies. The luminaires will be carefully selected to use a high lumen per wattage ratio, to be sure that the energy used is low without compromising light-level requirements or the quality of light.

A5.2.8.V

WATER

The project's TPs require the use of water conserving fixtures such as the used of ultra-low flow toilets, faucets, and fixtures that bear the US Environmental Protection Agency's (EPA's) WaterSense label. WaterSense-labeled products are certified to use at least 20% less water the regular models. The project will also incorporate instantaneous point-of-use water heaters that promote water and energy conservation.

GLP Team members have a core value of protecting and enhancing the environment. We will pursue this value by:

- ✓ Complying with federal, state, and local regulations and the standards and policies set forth by the Corporation and the Environmental Management System.
- ✓ Continually improving environmental performance and preventing pollution by using industry best practices.
- ✓ Evaluating our operations and activities to establish and pursue objectives and targets to minimize environmental impacts to the air, land and water.
- ✓ Reducing emissions associated with Climate Change.
- ✓ Engaging in environmental stewardship for preservation of native species and habitats.
- ✓ Conserving natural resources and energy by increasing efficiency, utilizing innovative technologies, increasing recycled content and reducing waste.
- ✓ Conducting training to ensure employees are competent and aware of their environmental responsibilities and the provisions of this policy.
- ✓ Encouraging employees to report to their supervisor conditions that deviate from environmental best practices.
- ✓ Maintaining programs for compliance audits, nonconformance and corrective actions.
- ✓ Providing human and financial resources to accomplish the environmental objectives and targets.
- ✓ Communicating this policy to our employees and making it available to the public.
- ✓ We believe this commitment is a benefit to our employees, families, customers and the communities we serve today, tomorrow and for many generations. This commitment is a primary objective for all levels of management.

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Section A5.2.9

Utilities

Reducing utility impacts is GLP's mission. Our approach to minimize bridge reconstruction along the corridor has a direct benefit to the project's bottom line. Our Utility Team's history with working with each of the three municipalities, as well as the private utilities companies, will streamline the utility coordination process. This, in combination with the expertise of Construction Team, will provide support during all aspects of the GLX Project.

Section Highlights

- GLP will significantly reduce utility relocations by converting temporary utility bridges to permanent, reducing cost and disruptions of service related to utility relocations.
- GLP team members have a long history of working closely with Cambridge, Somerville and Medford.
- GLP's revised design at Walnut Street will eliminate the need to tunnel under the vital 48-foot MWRA water main; reducing both project cost and risk of damage to the pipeline.
- Strong relationship with private utilities will facilitate and expedite communications and coordination, resulting in more expedited relocations of utilities.
- GLP will take preventive measures to protect the PTC fiber optic network, thereby protecting ongoing MBTA, Amtrak and freight rail operations.

INTRODUCTION

GLP has a long history working in the three municipalities along the GLX branches. Maintaining service and understanding activation/deactivation of the utility systems is key. Our goal is to minimize shut-off times and relocations. Early engagement and consistent communication with the utility companies, as well as the each of the municipalities and governing agencies, is essential.

Our approach of retaining the utility bridges at Medford Street and the Broadway roadway bridges significantly reduces the need to relocate the utilities at these locations. At both locations, our approach will eliminate the need to relocate utilities back to the adjacent roadway bridges. At School Street, the extension of the roadway bridge will require a temporary relocation of the existing power and communications conduits temporarily supported by a temporary truss over the easterly sidewalk. Once the new span is built, these lines, as well as the water line, will be relocated back onto the existing roadway bridge and the temporary bridge removed. GLP's approach also eliminates the risk to the existing 48-inch MWRA water line at the Walnut Street bridge. Rather than tunneling under the line for the Community Path, we will slope the path up to street grade, crossing over the water line.

With the balance of remaining utility work in the Mainline, VMF and the Fitchburg Line, GLP's approach to utilities is based on our experience on complex projects in urban, developed areas, and adheres to the following tenets:

- Utility work must be conducted safely, early, and minimizing service disruptions to customers
- We must avoid damage to existing utilities; this is both a safety issue and a cost and schedule issue. Therefore:
  - It is critical to locate existing utilities prior to beginning excavation
  - Excavation and ground support techniques must ensure the support and safety of in-service utilities to prevent interruption of service to utility customers

We have project-experienced engineers, field supervisors, and construction personnel who know the work processes and understand local utility and related environmental requirements. Our civil engineers, in coordination with other disciplines (track, structural, architecture and ROW), will work collaboratively with the Construction Team to plan and sequence the utility relocations with an eye to construction methods, as well as supporting and protecting the utilities before and after relocation with the least amount of interruption.

We can execute utility work in a cost-effective and time-sensitive manner because of our complete understanding of the scope of the utility work and its impacts to follow-on construction activities. We have reviewed and updated the Utility Conflict Matrix in **Figure A5.2.9-1**, which illustrates the complexity of this work.

The work in the Utility Conflict Matrix will be coordinated with the overall construction scheduling to identify the timing of each utility relocation.

A5.2.9.A UTILITY INFRASTRUCTURE RELOCATION PLAN

A5.2.9.A.1 IDENTIFICATION OF EXISTING UTILITY INFRASTRUCTURE

The key to successful utility management is early identification and an understanding of each utility's extent of service and potential for impacts to stakeholders, construction work, and schedule. With the updated Utility Conflict Matrix as a guide, we will confirm the locations of these utilities as well as other potentially-impacted utilities along the alignment. All existing utility infrastructure will be listed by their horizontal location and extents, size, depth, type, and status, as well as owner.

This compiled information will be checked against the survey, as-builts, utility meeting notes, and new communications with the utility owners, MBTA, and municipalities. The results will be summarized in an updated Utility Conflict Matrix.

Area	ID #	Plan Sheet	Approx. Station	Centerline	Utility Type	Description	Unit	Assumed Conflict Quantity	Potential Conflict	Action
2	004	000-U-2001	179+00	MB-EB	Electrical	Electric Box on Existing Viaduct	EA	1	Pier 1 Viaduct Adjustments	Remove
2	006	000-U-2001	181+23	MB-EB	Drainage	8" PVC Drain	LF	12	Pier 3 Viaduct	Demo & Cap
2	006.1	000-U-2001	182+28	MB-EB	Water	Water Valve	EA	2	Pier 4 Viaduct	Relocate
2	007	000-U-2001	181+50	MB-EB	Drainage	10" PVC Drain	LF	35	Leighton St. Pier 4 Demo	Demo & Cap
2	007.1	000-U-2001	181+72	MB-EB	Signal & Comm	Telecom Line	LF	10	Proposed Drain Line & Pier Demo	Demo & Cap
2	009.1	000-U-2001	Multi	MB-EB	Electrical	10 EA Light Post - Avalon	EA	10	Pier 4 & 5 Viaduct	Replace
2	011	000-U-2002	185+81	MB-EB	Drainage	36" RCP Drain	LF	25	Pier 7 Shafts	Protect in Place
2	012	000-U-2002	185+81	MB-EB	Drainage	36" RCP Drain	LF	25	Pier 7 Shafts	Protect in Place
2	012.1	000-U-2002	187+00	MB-EB	Drainage	36" RCP Drain	LF	20	Pier 8 Shafts	Protect in Place
2	014.1	000-U-2002	187+23	MB-EB	Electrical	4-4" Elect Line - Demo old	LF	25	Pier 8 Shafts	Demo & Cap
2	015	000-U-2002	187+00	MB-EB	Drainage	36" RCP Drain	LF	20	Pier 8 Shafts	Protect in Place
2	016.01	000-U-2002	187+23	MB-EB	Gas	8" Gas Main	LF	160	Lechmere South Head House	Demo & Cap
2	019	000-U-2002	187+87	MB-EB	Sewer	20" PVC Sanitary Sewer	LF	10	DMH 100	Protect in Place
2	020	000-U-2002	187+87	MB-EB	Sewer	24" CS Sewer	LF	10	DMH 100	Demo & Cap
2	021	000-U-2002	188+00	MB-EB	Water	8" Water	LF	10	Drain Pipe P(101)	Protect in Place
2	022	000-U-2002	188+07	MB-EB	Gas	8" Steel Gas Main	LF	10	Drain Pipe P(101)	Protect in Place
2	023	000-U-2002	188+07	MB-EB	Electrical	Electric Lines	LF	10	Drain Pipe P(101)	Protect in Place
2	025	000-U-2002	188+53	MB-EB	Signal & Comm	Telecom MH	EA	1	Lechmere Station	Demo & Cap
2	025.02	000-U-2002	188+53	MB-EB	Signal & Comm	Creosote Conduit	LF	60	Subsurface Detention System	Demo & Cap
2	030.03	000-U-2002	188+60	MB-EB	Drainage	24" RCP Drain	LF	10	NP Blvd Drain Pipe P(20)	Protect in Place
2	030.04	000-U-2002	188+93	MB-EB	Water	12" Water	LF	50	NP Blvd Drain Pipe P(20)	Protect in Place
2	030.05	000-U-2002	189+60	MB-EB	Drainage	Catch Basin	EA	1	NP Blvd Drain Pipe P(20)	Protect in Place
2	030.06	000-U-2002	190+00	MB-EB	Electrical	Utility Pole & OH Lines	EA	2	NP Blvd Drain Pipe P(20)	Protect in Place
2	035.1	000-U-2002	187+36	MB-EB	Water	Water Line	LF	30	South Head House	Demo & Cap
2	030.07	000-U-2003	190+00	MB-EB	Electrical	Underground Electric 4"	LF	50	Drain Pipe P(19)	Demo
2	030.08	000-U-2003	190+35	MB-EB	Drainage	Record Drainage	LF	50	Drain Pipe P(19)	Protect in Place
2	032	000-U-2003	191+00	MB-EB	Sewer	12" Brick Sanitary Sewer	LF	60	Drain Pipe P(18) & Det. System	Demo & Cap
2	033	000-U-2003	191+45	MB-EB	Water	8" Water Line	LF	10	Drain Pipe P(14)	Demo & Cap
2	034	000-U-2003	192+00	MB-EB	Water	Water Line Record	LF	10	Drain Pipe P(14)	Demo & Cap
2	036	000-U-2003	193+65	MB-EB	Electrical	Generator	EA	1	Pier 13 Shaft	Protect in Place
2	040.6	000-U-2003	193+25	MB-EB	Drainage	8" VC Drain Pipe	LF	75	Drain Pipe P(3)	Demo & Cap
2	040.7	000-U-2003	192+90	MB-EB	Drainage	Catch Basin	EA	2	Proposed Bus Station	Demo & Cap
2	040.4	000-U-2004	196+80	MB-EB	Electrical	Transformer	EA	1	Span Pier 16-17 Viaduct	Protect in Place
2	040.10	000-U-2004	197+00	MB-EB	Water	Water Gate	EA	1	Pier 16	Remove
2	054	000-U-2005	4+50	US-EB	Signal & Comm	9-4" Duct	LF	70	Pier 4 UEV	Relocate
2	055	000-U-2005	206+10	MB-EB	Water	2" Copper Service	LF	10	Communication Line	Protect in Place
2	056	000-U-2005	206+10	MB-EB	Electrical	Electric Line for Security Gate	LF	10	Communication Line	Protect in Place

Area	ID #	Plan Sheet	Approx. Station	Centerline	Utility Type	Description	Unit	Assumed Conflict Quantity	Potential Conflict	Action
2	057	000-U-2005	206+10	MB-EB	Communication	Comm Line for Security Gate	LF	10	Communication Line	Protect in Place
2	058	000-U-2006	209+26	MB-EB	Electrical	EMH Power to LC2	EA	1	Pier 29	Demo
2	059	000-U-2006	210+00	MB-EB	Drainage	12" PVC UD	LF	30	Pier 30 Shaft	Demo & Cap
2	059.1	000-U-2006	209+30	MB-EB	Drainage	12" PVC UD	LF	30	Pier 29 Shaft	Demo & Cap
2	061	000-U-2006	211+00	MB-EB	Electrical	9-4" Elect Ducts	LF	120	UYV Pier 3	Relocate
2	063	000-U-2006	210+10	MB-EB	Electrical	Utility Poles - 3 EA	EA	3	Drain Pipe UD7	Remove
2	069	000-U-2006	209+40	MB-EB	Electrical	Utility Poles - 2 EA	EA	2	US+EB 8+00 Viaduct	Remove
2	087.06	000-U-2006	210+90	MB-EB	Drainage	24" RCP Drain	LF	10	UD10	Protect in Place
2	087.07	000-U-2006	211+50	MB-EB	Drainage	15" RCP Drain	LF	10	YL-1 Wall	Demo & Cap
2	087.08	000-U-2006	211+50	MB-EB	Drainage	12" RCP Drain	LF	10	YL-1 Wall	Protect in Place
2	087.09	000-U-2006	211+20	MB-EB	Drainage	24" RCP Drain	LF	10	YL-1 Wall	Protect in Place
2	091	000-U-2008	225+64	MB-EB	Signal & Comm	36-1-1/4 HDPE	LF	10	Drain Pipe P340	Protect in Place
2	092	000-U-2008	225+64	MB-EB	Signal & Comm	36-1-1/4 HDPE	LF	10	Drain Pipe P369	Protect in Place
1	095.01	000-U-2010	237+56	MB-EB	Electrical	10-4" B Fiber Lines Verizon	LF	140	Washington St. Deep Drainage	Protect in Place
1	095.02	000-U-2010	237+70	MB-EB	Electrical	Electric Lines 2-16" Steel Sleeved 115 KV Lines NSTAR	LF	20	Washington St. North Abut	Protect in Place
1	095.03	000-U-2010	237+50	MB-EB	Water	20" Water	LF	24	Washington St. Deep Drainage	Protect in Place
1	095.04	000-U-2010	237+25	MB-EB	Signal & Comm	12-3.5" Electric Lines NSTAR	LF	10	Washington St. Deep Drainage	Protect in Place
1	095.05	000-U-2010	237+25	MB-EB	Signal & Comm	60-1-1/4 Telecomm Zayo	LF	10	Washington St. Deep Drainage	Protect in Place
1	095.06	000-U-2010	237+43	MB-EB	Drainage	12" CMP Drain	LF	15	Washington St. Deep Drainage	Demo & Cap
1	095.07	000-U-2010	237+70	MB-EB	Electrical	Electric Lines 2-16" Steel Sleeved 115 KV Lines NSTAR	LF	10	Washington St. North Abut	Protect in Place
1	095.08	000-U-2010	237+25	MB-EB	Drainage	24" RCP Drain	LF	10	Washington St. Deep Drainage	Demo & Cap
1	095.09	000-U-2010	237+25	MB-EB	Signal & Comm	60-1-1/4 Telecomm Zayo	LF	8	Washington St. Deep Drainage	Protect in Place
1	095.10	000-U-2010	237+25	MB-EB	Signal & Comm	10-4" B Fiber Lines Verizon	LF	8	Washington St. Deep Drainage	Protect in Place
1	095.11	000-U-2010	237+17	MB-EB	Drainage	18" RCP Drain	LF	20	Washington St. South Abut.	Demo & Cap
1	095.12	000-U-2010	237+33	MB-EB	Drainage	12" RCP Drain	LF	10	Washington St. Deep Drainage	Demo & Cap
1	095.13	000-U-2010	237+25	MB-EB	Signal & Comm	60-1-1/4 Telecomm Zayo	LF	8	Washington St. Deep Drainage	Protect in Place
1	095.15	000-U-2010	237+25	MB-EB	Signal & Comm	10-4" B Fiber Lines Verizon	LF	240	Washington St. Deep Drainage	Protect in Place
1	095.16	000-U-2010	237+50	MB-EB	Water	Twin 20" DI	LF	10	Washington St. Station Sewer	Protect in Place
1	095.17	000-U-2010	237+05	MB-EB	Gas	2-36" CL 22 PSIG Gas NGRID	LF	130	Washington St. South Abut. SOE	Protect in Place
1	095.21	000-U-2010	237+70	MB-EB	Electrical	Utility Pole	EA	1	YL-10 Track Shift	To Remain
1	103.1	000-U-2010	237+90	MB-EB	Drainage	DMH	EA	2	Drain Pipe P230-3	Demo & Cap
1	104.2	000-U-2010	238+00	MB-EB	Drainage	10" CCP	LF	10	Drain Pipe P230-3	Demo & Cap
1	101	000-U-2011	240+00	MB-EB	Drainage	18" DIP Catch Basin	EA	1	Drain Pipe 375 or Track YL-10 96+00	Demo & Cap
1	102	000-U-2011	238+15	MB-EB	Drainage	48"x42" Stone Drain	LF	280	Drain Pipe P-230	Demo & Cap
1	103	000-U-2011	238+13	MB-EB	Drainage	8" PVC Drain	LF	10	Drain Pipe P-230	Demo & Cap
1	104	000-U-2011	238+10	MB-EB	Drainage	10" CCP	LF	10	Drain Pipe P-230	Demo & Cap
1	104.4	000-U-2011	239+85	MB-EB	Drainage	36" RCP Drain	LF	10	Drain Pipe P-375	Demo & Cap
1	104.5	000-U-2011	240+00	MB-EB	Drainage	DMH	EA	1	Drain Pipe P-375	Demo & Cap
1	104.6	000-U-2011	Multi	MB-EB	Electrical	Utility Poles	EA	5	Drain Pipe P239-9	Remove & Reset

Area	ID #	Plan Sheet	Approx. Station	Centerline	Utility Type	Description	Unit	Assumed Conflict Quantity	Potential Conflict	Action
1	104.7	000-U-2011	243+25	MB-EB	Signal & Comm	Protect Bungalow	EA	1	Green Line TrackMB-WB 242+00	Protect in Place
1	105	000-U-2012	Multi	MB-EB	Electrical	Utility Poles	EA	7	Multi	Remove
1	106	000-U-2013	Multi	MB-EB	Electrical	Utility Poles	EA	7	Multi	Remove
1	107	000-U-2014	Multi	MB-EB	Electrical	Utility Poles	EA	5	Multi	Remove
1	108	000-U-2015	Multi	MB-EB	Electrical	Utility Poles	EA	4	Multi	Remove
1	108.1	000-U-2016	272+85	MB-EB	Electrical	Power Line	LF	350	Abandon Power Line	Abandon Power Line
1	109	000-U-2016	Multi	MB-EB	Electrical	Utility and Light Poles	EA	6	Multi	Remove
1	110	000-U-2019	Multi	MB-EB	Electrical	Utility Poles	EA	2	Multi	Remove
1	111	000-U-2020	Multi	MB-EB	Electrical	Utility Poles	EA	5	Multi	Remove
1	112	000-U-2021	Multi	MB-EB	Electrical	Utility Poles	EA	4	Multi	Remove
1	113	000-U-2023	Multi	MB-EB	Electrical	Utility Poles	EA	4	Multi	Remove
1	114	000-U-2024	Multi	MB-EB	Electrical	Utility Poles	EA	4	Multi	Remove
1	115	000-U-2025	Multi	MB-EB	Electrical	Utility Poles	EA	9	Multi	Remove
1	116	000-U-2026	Multi	MB-EB	Electrical	Utility Poles	EA	3	Multi	Remove
1	116.3	000-U-2027	335+75	MB-EB	Drainage	Underdrains	LF	10	Drain Pipe P63	Protect in Place
1	117	000-U-2027	Multi	MB-EB	Electrical	Utility Poles	EA	5	Multi	Remove
1	118	000-U-2028	Multi	MB-EB	Electrical	Utility Poles	EA	4	Multi	Remove
1	119	000-U-2029	Multi	MB-EB	Electrical	Utility Poles	EA	2	Multi	Remove
1	221	000-U-2029	350+00	MB-EB	Signal & Comm	Temp 4" Fiber Optic Comm	LF	40	MH92	Demo & Cap
1	233	000-U-2030	357+20	MB-EB	Water	24" MDC CI	LF	20	Drain Pipe Link 113	Demo & Cap
1	222	000-U-2030	Multi	MB-EB	Electrical	Utility Poles	EA	5	Multi	Remove
1	234	000-U-2030	357+20	MB-EB	Water	30" MDC (Abandoned)	LF	20	MH 53 & Drain Pipe Link 113	Demo & Cap
1	235	000-U-2030	357+20	MB-EB	Drainage	12" CMP	LF	10	Drain Pipe P73	Protect in Place
1	235.1	000-U-2030	357+25	MB-EB	Drainage	30" RCP	LF	80	Drain Pipe Link 113	Demo & Cap
1	237	000-U-2030	353+35	MB-EB	Signal & Comm	Tufts 2-4" Proposed MH and Aerial Removal	LF	100	Proposed Track	Relocation
1	231	000-U-2031	358+27	MB-EB	Water	24" MDC CI	LF	10	Pcol23	Demo & Cap
1	232	000-U-2031	358+10	MB-EB	Water	30" MDC (Abandoned)	LF	11	Pcol23	Demo & Cap
1	240	000-U-2031	358+37	MB-EB	Signal & Comm	AT&T Fiber Optic Line PVC Conduit	LF	10	Pcol41	Demo & Cap
1	242	000-U-2031	358+40	MB-EB	Water	24" MDC CI	LF	20	Pcol41	Demo & Cap
1	243	000-U-2031	358+35	MB-EB	Water	30" MDC (Abandoned)	LF	20	Pcol41	Demo & Cap
1	243.1	000-U-2031	Multi	MB-EB	Electrical	Utility Poles	EA	6	Multi	Remove
1	244	000-U-2031	358+35	MB-EB	Drainage	15" CMP	LF	10	Pcol41	Demo & Cap
1	248	000-U-2031	361+28	MB-EB	Drainage	15" RCP	LF	10	Pcol40	Protect in Place
1	303.2	000-U-2032	Multi	MB-EB	Electrical	Utility Pole	EA	5	Multi	Protect in Place
1	303.3	000-U-2032	363+65	MB-EB	Gas	Existing Gas Line Across Bridge	LF	10	Retaining Wall ME-10 CIP Cut	Protect in Place
1	304	000-U-2033	Multi	MB-EB	Electrical	Utility Pole	EA	6	Multi	Protect in Place
1	305	000-U-2034	Multi	MB-EB	Electrical	Utility Pole	EA	3	Multi	Protect in Place
1	306	000-U-2036	Multi	MB-EB	Electrical	Utility Pole	EA	1	Multi	Protect in Place
2	071	000-U-2042	6+25	US-EB	Drainage	10" Drain Line 6' Below Grade	LF	50	US-EB 6+50 Viaduct Pier US-EB P6	Precon RFI 00240

Area	ID #	Plan Sheet	Approx. Station	Centerline	Utility Type	Description	Unit	Assumed Conflict Quantity	Potential Conflict	Action
2	913	000-U-2042	3+00	US-WB	Electrical	9-4" Elect Ducts	LF	20	YL Pier 2	Remove Once Swift Interlocking is in
2	903	000-U-2043	5+15	US-WB	Electrical	6-4" Elect Ducts	LF	20	US-WB Pier 4	Protect in Place and Remove Once Swift Interlocking is in
2	904	000-U-2043	5+15	US-WB	Signal & Comm	2-4" Duct Signal & Comm	LF	40	US-WB Pier 4	Remove Once Swift Interlocking is in
2	905	000-U-2043	4+80	US-WB	Drainage	12" PVC UD	LF	60	P400	Demo & Cap
2	912	000-U-2043	4+45	US-WB	Electrical	9-4" Elect Ducts	LF	20	US-WB Pier 3	Remove Once Swift Interlocking is in
2	916	000-U-2043	3+59	US-WB	Signal & Comm	2-4" Duct Signal & Comm	LF	20	YL Pier 3	Protect in Place and Remove Once Swift Interlocking is in
2	843	000-U-2044	8+75	US-WB	Signal & Comm	S&C 4-4" Duct (Assumed Size)	LF	10	Noise Barrier N-3A	Demo & Cap
2	844	000-U-2044	11+90	US-WB	Water	12" Waterline	LF	10	Noise Barrier N-3A	Protect in Place
2	846	000-U-2044	11+50	US-WB	Signal & Comm	S&C 14-4" Duct (Verizon)	LF	24	Noise Barrier N-3A	Protect in Place
2	848	000-U-2044	10+70	US-WB	Signal & Comm	S&C 4-4" Duct	ea	1	Noise Barrier N-3A	Protect in Place and Remove Once Swift Interlocking is in
2	850	000-U-2044	11+30	US-WB	Electrical	12-4" 15KV Duct (NSTAR)	LF	24	Noise Barrier N-3A	Protect in Place
2	856	000-U-2044	11+80	US-WB	Electrical	6-4" Duct	LF	36	P118	Protect in Place and Remove Once Swift Interlocking is in
2	857	000-U-2044	10+30	US-WB	Signal & Comm	Assume 2-4" Duct	LF	12	P203	Protect in Place
2	860	000-U-2044	10+50	US-WB	Electrical	4-4" Duct Elect. Assumed	LF	10	Drain Pipe P203-2	Protect in Place and Remove Once Swift Interlocking is in
2	866	000-U-2044	11+00	US-WB	Signal & Comm	S&C 14-4" Duct (assumed Size) Verizon	LF	140	US-WB Touchdown	Protect in Place
2	869	000-U-2044	9+50	US-WB	Drainage	15" Record Drain Line	LF	60	US-WB Touchdown Shaft	Demo & Cap
2	871.01	000-U-2044	10+20	US-WB	Gas	4" Gas Service (Abandoned)	LF	160	Noise Barrier N-3A	Demo & Cap
2	824	000-U-2045	17+10	US-WB	Drainage	12" PVC UD	LF	200	Drain Line P51, Retaining Wall UN-1	Demo
2	824.1	000-U-2045	17+90	US-WB	Drainage	Drain MH	EA	1	Drain Line P51, Retaining Wall UN-2	Demo
2	824.2	000-U-2045	17+80	US-WB	Electrical	Electrical UP	EA	1	Drain Line P51, Retaining Wall UN-3	Protect in Place
2	826.1	000-U-2045	16+10	US-WB	Drainage	Drain CB	EA	1	P299 Drain Pipe	Demo
2	824.3	000-U-2045	16+65	US-WB	Signal & Comm	Signal & Comm Line	LF	50	P51	Protect in Place
2	828.2	000-U-2045	15+20	US-WB	Electrical	4-4" Duct Elect. Assumed	LF	10	MH 213.1	Demo
2	816	000-U-2046	23+64	US-WB	Drainage	6" VC Drain	LF	200	Retaining Wall UN-2 (CIP), P308 Drain	No Impact
2	817	000-U-2046	24+42	US-WB	Gas	8" Gas ST LP (1963)	LF	200	Retaining Wall UN-2	No Impact
2	819	000-U-2046	22+40	US-WB	Electrical	Utility Poles - 2EA	EA	2	Retaining Wall UN-2	No Impact
2	814	000-U-2047	29+50	US-WB	Drainage	12" RCP Drain	LF	80	Retaining Wall UN-2, Noise N-17	No Impact
2	814.01	000-U-2047	25+40	US-WB	Electrical	Electrical Transformer	EA	1	Retaining Wall UN-2	No Impact
2	812	000-U-2048	31+90	US-WB	Drainage	4" PVC Drain	LF	10	Noise N-17, Green Line Track Shift	Demo & Cap
2	805	000-U-2049	40+25	US-WB	Gas	2-36" Gas Mains	LF	60	Union Square Station	Protect in Place
2	805.01	000-U-2049	40+00	US-WB	Electrical	36" Steel Sleeve Elect. Under Tracks (Abandoned)	LF	30	Union Square Station	Demo & Cap
2	923	000-U-2072	81+20	YL-10	Drainage	8" PVC Drain	LF	10	P518 & MH519	Protect in Place
2	924	000-U-2072	81+65	YL-10	Drainage	54" RCP Drain	LF	10	MH517	Protect in Place
2	925	000-U-2073	87+90	YL-10	Water	16" Water Record	LF	10	YL-10 88+00 Drainage	Protect in Place
2	926	000-U-2073	87+55	YL-10	Drainage	8" CMP Drain	LF	10	YL-10 88+00 Drainage	Protect in Place
2	927	000-U-2073	85+80	YL-10	Water	12" Water Line	LF	10	YL-10 86+00 Drainage	Protect in Place

Figure A5.2.9-1: GLP has developed a Utility Conflict Matrix to identify any potential conflicts or issues that may arise from design or construction of the GLX Project.

A5.2.9.A.2

RECOMMENDED UTILITY WORK

MAINLINE - BRIDGES

There are three utility bridges constructed as part of a previous contract that were meant to facilitate the reconstruction of the adjacent roadway bridges. At Medford Street and Broadway, the temporary utility bridges will be maintained as permanent. The temporary utility bridge at School Street will be removed. The existing utility bridges at Walnut Street and College Avenue will be protected and maintained. The following are highlights from the Utility Conflict Matrix.

1. At Walnut Street, the MWRA 48-inch water main that crosses on the existing utility bridge will be protected.
2. At Medford Street, the previously relocated telecommunications and electrical utilities are on the utility bridge, which we will make permanent. These lines will be supported and protected in place during the installation of the proposed precast concrete arch tunnel to allow for the Medford Branch westbound track to be installed.

   At School Street – similar to Medford Street – the roadway bridge will be lengthened by adding a short span over the Medford Branch westbound track. This lengthening will take place in lieu of a full reconstruction. In order to construct the new span, the existing electric and communications conduits will require temporary relocation until the deck of the new span is installed, after which the conduits will be relocated to their original location on the roadway bridge superstructure. The water main previously installed on the temporary utility bridge will be transferred to its original location on the existing roadway bridge superstructure.
3. At the Lowell Street Bridge, the overhead wires will be protected during construction and the existing utilities in the road approach will be supported in place during the removal of an existing retaining wall. There are no utilities attached to the roadway bridge at this location.
4. At Broadway, the utilities systems installed on the temporary utility bridge will be activated to allow for the roadway bridge to be reconstructed. The utility bridge will become permanent.
5. At College Avenue, the MWRA 48-inch and 20-inch water mains that cross on the existing utility bridge will be protected.

CORRIDOR

The following is a sample listing of the utility systems assessed along the corridor:

- The base design calls for relocating the existing vitrified clay sewer siphon at Charles Ryan Road to avoid the difficulties of maintaining this siphon. Our solution is to build this replacement between Murdock Street and Charles Ryan Road within a permanent MBTA easement (#MB-294-PE-1).

Figure A5.2.9-2: Walnut Street Bridge utility bridge with 48-in. MWRA water main. By bringing the Community Path to street grade, GLP reduces the cost and risk of tunneling under this vital pipeline

Figure A5.2.9-3: GLP will convert the temporary utility bridge at Medford Street into a permanent structure, thereby reducing the cost of relocating utilities back to the roadway bridge

- Between Broadway and College Avenue Station is a set of four AT&T telecom (CORE) lines. A length of these lines were relocated as part of the GMP2 contract where the NHML tracks were shifted at the Harvard Street Bridge. GLP will reconstruct the remaining portion of these CORE lines and relocate them to the east side of the corridor (where they were originally).
- At Sycamore Street, we will maintain and protect the existing drain that is supported off the side of the bridge superstructure.
- There is one MWRA water line that we will replace just north of Broadway at Ball Square (between Broadway and Newbern Avenue).
- We will also replace a 24-inch MWRA line across the corridor, and cut and cap the existing.
- We will maintain and protect the existing Algonquin gas line at McGrath Highway.

Figure A5.2.9-4: School Street roadway and utility bridges. After GLP constructs the new span for the roadway bridge, the water main will be relocated back to the roadway bridge and the temporary utility bridge will be removed, providing additional space in the ROW for other Project elements.

Figure A5.2.9-5: Transitions of water, power and communications lines from underground to the utility bridge. GLP will convert the temporary utility bridge to permanent, thereby reducing the cost and service interruptions to customers associated with relocating utilities back to the roadway bridge

Figure A5.2.9-6: GLP will convert the temporary utility bridge at Broadway into a permanent structure, thereby reducing the cost and service interruptions to customers associated with relocating utilities back to the roadway bridge

Figure A5.2.9-7: GLP will convert the temporary utility bridge at Broadway into a permanent structure, thereby reducing the cost and service interruptions to customers associated with relocating utilities back to the roadway bridge.

- Just south of Medford street there are two major Algonquin gas lines (14-inch and 20-inch) that will be maintained.
- The two 345kV transmission lines (Eversource), which are carried in two 30-inch steel pipes, will be maintained and protected.
- There are two Tufts University communications lines just south of College Avenue that we will relocate.

A5.2.9.A.3

ASSUMPTIONS AND CONSIDERATIONS

GLP's design makes the following assumptions:

- The previous public and private utility company meetings documented all utilities to be considered during design and construction.
- All as-builts will be available and dependable.
- All installed utility systems meet the respective Utility Owner's standards.
- The temporary utility bridges were designed and installed to be maintained as permanent.
- Any utility previously installed along the corridors meets the MBTA requirements.

A5.2.9.A.4

COORDINATION WITH UTILITY COMPANIES

Maintaining good working relationships with Utility Owners is essential. We will conduct a kick-off meeting with all Utility Owners to review the proposed scope of work, confirm that we possess the current versions of each utility company's specifications, and collect as-built information for all existing utilities.

GLP has staff who are well-versed in utility coordination, and have existing relationships with utility engineers at local utility companies , municipalities, and Tufts University.

We will conform to the requirements, specifications, and standard practices of the affected Utility Owners. We will coordinate early with Utility Owners to determine the division of responsibilities between GLP and the Utility Owners. Early coordination is critical to ensuring that utility work does not delay the Project schedule.

We will establish biweekly utility meetings (or as appropriate) with the MBTA, relevant subcontractors, and the Utility Owners. During these meetings, we will:

1. Issue the current schedule.
2. Confirm milestones for completions of utility relocations.
3. Identify critical and sub-critical utility relocations.
4. Review progress on all elements of critical and sub-critical utility work.
5. Review progress on non-critical utility relocations.
6. Review plans to temporarily support existing utilities in place.

We have reviewed the Redefinition Drawings to understand what work will be constructed by adjacent property developers and to identify where we will need to coordinate with them.

There are several agreements provided in the reference documents (Section 14.6). We reviewed the requirements and developed a baseline document for each company's proposed scope of work for each utility across the entire GLX limits. Through the detailing of these baseline documents, we can confirm anticipated duration of work required by each Utility Owner, as well as limits on concurrent activities during the construction period. These activities have provided us with a firm basis of understanding of scope and schedule for the required utility relocation work.

As noted in the TPs (Section 7.4.3.4), we will coordinate with National Grid regarding its concerns with the Project interfering with the two 13.8kV power lines buried near the proposed Ball Square Station.

A5.2.9.A.5

MANAGING UTILITY SERVICE INTERRUPTIONS

GLP understands the vital importance of properly managing service interruptions. We will closely coordinate with utility customers and property owners to make certain that proper communication and notice is provided.

Interruptions to services can be minimized by focusing on the limits of the impacted utility system serving the properties, identifying how the utility system is providing service to the customer, documenting any redundant feeds within the system, and developing a plan that includes providing temporary utilities and an activate and deactivate sequence for the effective utility.

A5.9.2.A.6

UTILITY IMPACTS

GLP's approach to identification of critical utilities begins with our development of an updated Utility Conflict Matrix as described in section A5.2.9.A.1. Within the matrix, we will add a column indicating the criticality of the utility in terms of the purpose it serves and the difficulty of service restoration should it be damaged.

GLP's next step will occur prior to commencing any excavation work, when we will complete a comprehensive investigation to determine the locations of existing utilities within the entire footprint of the Project. We also will use nondestructive methods, whenever possible, to locate utilities and mark their locations to alert workers of their presence.

With the locations identified, GLP will then develop an engineering design to support and protect utilities temporarily exposed across an excavation. GLP will also protect underground utilities by installing purpose-designed support of excavation when excavating within the zone of influence of the line. This will minimize any movement of the line during excavation.

GLP understands the potential danger to construction workers resulting from utility "hits." We will use processes developed over many years of experience to protect personnel as well as existing and newly installed utilities.

Prior to the start of any excavation, our crews will obtain, review, and store on site an excavation permit, approved by the Lead Field Engineer or his/her designee. This permit will not be approved until the Field

Engineer confirms the locations of all known utilities; locations of all critical utilities will be confirmed through potholing.

The following activities will regularly take place:

- We will check temporarily exposed utilities for stability immediately after a significant weather event and rectify unsatisfactory conditions at once.
- Our crews will use hand tools to complete backfilling in the immediate vicinity of existing utilities.
- We will compact fill both below and around the utilities to prevent later settlement of the utility.

A5.2.9.A.7

APPROACH TO COORDINATION WITH ALL OTHER UTILITY INFRASTRUCTURE RELOCATIONS IN THE SAME AREA

GLP will coordinate with Utility Owners, stakeholders, businesses, and property owners during the entire process: planning, installation, outages, inspection, and acceptance. We will use our lessons learned from previous projects, which required extensive coordination with stakeholders and property owners.

On the GLX Project, we will incorporate routine meetings with established utility contacts during both the design and construction phases to make certain that all scope and schedule concerns are received and translated into successful mitigation strategies. Thus, last-minute scope changes and potential schedule delays will be significantly reduced.

GLP's approach to coordination for utility conflicts involving multiple parties (such as the sewer work at School Street and at Murdock and Charles Ryan Road) is to coordinate early and often.

A5.2.9.A.8

UTILITY SERVICES FOR THE PROJECT

Utility services will be required at the stations, the VMF, the TPSSs and the pump stations.

- The stations without elevators will require electric, telecommunications, and storm drainage.
- Lechmere and College Avenue stations will also require water and sewer services.
- The VMF will require electric, telecommunications, gas, sewer, storm and water.
- The TPSSs will have water and sewer services as well as two Eversource feeders to the rectifier transformers providing traction power.
- Existing power supplies will be maintained to the pump stations within the Project

A5.2.9.A.9

MAINTAINING, PROTECTING, AND RELOCATING POSITIVE TRAIN CONTROL FIBER OPTIC CABLE

Our approach to maintaining, protecting, and relocating Positive Train Control ("PTC") fiber optic cable begins with understanding the importance of the line. It includes understanding where it is located, identifying precautionary actions to prevent damage to the line, and preparing for the relocation of the cable.

PTC FIBER NETWORK DESCRIPTION

The MBTA commuter rail system is currently installing an ACSES II Positive Train Control ("PTC") system that is scheduled to go into service in January 2019. Mandated by federal law, PTC is a comprehensive signaling and train control architecture that ensures safe train separation and operation with the use of vital wayside track circuits, signals, computer-based interlocking, wayside interrogator units ("WIU"), and automatic train protection ("ATP") on board each locomotive.

Within the GLX Project area along the NHML corridor, the MBTA is currently installing a fiber optic line from Winchester Signal Instrument House ("SIH") to the Commuter Rail Operating Control Center ("CROCC") in Somerville, south of the East Somerville GLX Station. The fiber optic network provides for PTC messaging between the CROCC, interlocking, and the intermediate signal locations. The physical network will consist of 48-strand, single-mode fiber optic cables installed either on poles or in duct banks and conduit, depending site conditions.

REQUIREMENTS FOR MAINTAINING THE PTC FIBER OPTIC NETWORK

It is incumbent upon GLP to ensure that the PTC fiber optic network remains at a high level of integrity and reliability during construction activities on the GLX Project, specifically on or near the NHML. The PTC fiber optic network will still undergo the testing phase starting January 2018, and the entire PTC system will go into revenue service in January 2019. To prevent damage to the fiber optic network, GLP will undertake these precautionary actions:

- Locate and protect the PTC fiber optic network prior to the start of construction activities. The line will be along the east side of the NHML, adjacent to track NH-T1.
- Where overhead, the poles will be protected by barriers or fencing
- Where underground, the location will be staked out and mapped, to warn all crews performing excavation of the location of the duct bank.
- Evaluate and identify any construction activity on this side of the ROW that is close to the fiber optics line. This could include:
  - Reconstruction of track NH-T1
  - Storm drainage trunklines and underdrains
  - Retaining wall and noise wall construction
  - Access points to the ROW (e.g., by Roger's Foam, Tufts Street)
- If the line can remain in place during the construction activity, a protective action will be identified to prevent damage to the line.
  - Wherever practicable, construction near the line will be scheduled during shutdown periods to eliminate the risk to commuter rail operations if damage were to occur during operating hours.
- If the line would require a temporary or permanent relocation to accommodate construction, the procedures outlined in the MBTA document "PTC Fiber Optic Protection and Performance Specification for GLX Project" (issued in Addendum 8) will be strictly followed. This includes a proposed relocation of a portion of the PTC pole line to accommodate this Project.
  - To the maximum extent practical, work associated with a temporary or permanent relocation will be scheduled during shutdown periods to minimize impacts to the PTC system during operating hours.
  - GLP will maximize the use of the available slack provided in the existing PTC fiber optic line to minimize the requirements for splicing during the permanent relocation.

A5.2.9.B

BENEFITS OF THE GLP APPROACH

In addition to our locally experienced staff, our design includes aspects that benefit the utilities work. Specifically, we will minimize utility relocations at Medford Street and Broadway by retaining and making permanent the previously constructed utility bridges. This benefits the Utility Owners and their customers by reducing any service interruptions related to the relocations. It will also benefit the GLX Project by saving construction time and reducing overall project costs.

At Walnut Street, our change to the vertical alignment of the Community Path will take it over Medford Street and the existing MWRA 48-inch water main, reducing the risk of possible damage to the line from tunneling under it. This benefits the MWRA with less risk of possible damage to its line, and no need for a possible preemptive shutdown of the line during tunneling. It also will benefit the Project by reducing the risk to GLP, which in turn reduces the overall project cost.

A5.2.9.C

PERMANENT AND TEMPORARY RELOCATION / PROTECTION PLANS

The utility information can be found on the following drawings:

Medford Street Bridge	MEB-S-2000
School Street Bridge	SCB-S-2000
Walnut Street Bridge	WSB-S-2000
Lowell Street Bridge	LSB-S-2000
Broadway Street Bridge	BRB-S-2000
Mainline Corridor Composite plans	000-C-0001 to 000-C-0022
Union Square Corridor Composite Plans	000-C-0023 to 000-C-C-0028
Vehicle Maintenance Facility	VMF C-1000 to VMF-C-1003

DRAWING INDEX

GENERAL	000-G-0001	INDEX OF DRAWINGS
	000-G-0002	DRAWING COMPLIANCE MATRIX SHEET 1 OF 2
	000-G-0003	DRAWING COMPLIANCE MATRIX SHEET 2 OF 2
RETAINING WALLS	RWS-S-1001	GLX CORRIDOR WALL SCHEMATIC SHEET 1 OF 2
	RWS-S-1002	GLX CORRIDOR WALL SCHEMATIC SHEET 2 OF 2
	RWS-S-5001	RETAINING WALL DETAILS SOLDIER PILE AND LAGGING (SPL)
	RWS-S-5002	RETAINING WALL DETAILS MODULAR PRECAST BLOCK (MPB) & SOIL NAIL WALL
	RWS-S-5003	RETAINING WALL DETAILS EPS SUPPORT, MICRO PILE WALL & CRIB WALL REHAB
VIADUCTS	VDT-S-0001	VIADUCT KEY PLAN
	LEV-S-2001	LECHMERE VIADUCT PLAN AND ELEVATION SPANS 6 TO 8
	LEV-S-3000	TYP VIADUCT SECTIONS AND DETAILS SHEET 1 OF 2
	LEV-S-3001	TYP VIADUCT SECTIONS AND DETAILS SHEET 1 OF 2
BRIDGES	WAS-S-2000	WASHINGTON STREET GENERAL PLAN AND ELEVATION
	WSB-S-2000	WALNUT STREET GENERAL PLAN AND ELEVATION
	MEB-S-2000	MEDFORD STREET GENERAL PLAN AND ELEVATION
	MEB-S-2001	MEDFORD STREET TYPICAL SECTION AND DETAILS
	SCB-S-2000	SCHOOL STREET GENERAL PLAN AND ELEVATION
	SCB-S-2001	SCHOOL STREET TYPICAL SECTION AND DETAILS
	LSB-S-2000	LOWELL STREET GENERAL PLAN AND ELEVATION
	CED-S-2000	CEDAR STREET GENERAL PLAN AND ELEVATION
	BRB-S-2000	BROADWAY GENERAL PLAN AND ELEVATION
	BRB-S-2001	BROADWAY TYPICAL SECTION AND DETAILS
	COB-S-2000	COLLEGE AVENUE GENERAL PLAN AND ELEVATION
CORRIDOR PLANS	000-C-0001	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 175+00 TO STA MB-EB 184+50
	000-C-0002	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 184+50 TO STA MB-EB 193+00
	000-C-0003	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 193+00 TO STA MB-EB 201+50
	000-C-0004	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 201+50 TO STA MB-EB 210+50
	000-C-0005	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 210+50 TO STA MB-EB 218+50
	000-C-0006	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 218+50 TO STA MB-EB 227+50
	000-C-0007	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 227+50 TO STA MB-EB 237+50
	000-C-0008	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 237+50 TO STA MB-EB 246+50
	000-C-0009	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 246+50 TO STA MB-EB 256+50
	000-C-0010	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 256+50 TO STA MB-EB 265+00
	000-C-0011	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 265+00 TO STA MB-EB 271+50
	000-C-0012	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 271+50 TO STA MB-EB 281+50
	000-C-0013	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 281+50 TO STA MB-EB 291+50
	000-C-0014	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 291+50 TO STA MB-EB 301+50
	000-C-0015	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 301+50 TO STA MB-EB 311+50
	000-C-0016	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 311+50 TO STA MB-EB 321+50
	000-C-0017	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 321+50 TO STA MB-EB 331+50
	000-C-0018	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 331+50 TO STA MB-EB 341+50
	000-C-0019	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 341+50 TO STA MB-EB 351+50
	000-C-0020	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 351+50 TO STA MB-EB 361+50
	000-C-0021	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 361+50 TO STA MB-EB 371+50
	000-C-0022	MEDFORD BRANCH CORRIDOR PLAN STA MB-EB 371+50 TO STA MB-EB 380+00
	000-C-0023	UNION SQUARE BRANCH CORRIDOR PLAN STA US-EB 0+00 TO STA US-EB 6+00
	000-C-0024	UNION SQUARE BRANCH CORRIDOR PLAN STA US-EB 6+00 TO STA US-EB 15+00
	000-C-0025	UNION SQUARE BRANCH CORRIDOR PLAN STA US-EB 15+00 TO STA US-EB 24+00
	000-C-0026	UNION SQUARE BRANCH CORRIDOR PLAN STA US-EB 24+00 TO STA US-EB 32+00
	000-C-0027	UNION SQUARE BRANCH CORRIDOR PLAN STA US-EB 32+00 TO STA US-EB 40+50
	000-C-0028	UNION SQUARE BRANCH CORRIDOR PLAN STA US-EB 40+50 TO STA US-EB 46+00
DRAINAGE PLANS	000-C-0029	MEDFORD BRANCH DRAINAGE PLAN STA MB-EB 237+50 TO STA MB-EB 246+50
	000-C-0030	MEDFORD BRANCH DRAINAGE PLAN STA MB-EB 246+50 TO STA MB-EB 256+50
	000-C-0031	MEDFORD BRANCH DRAINAGE PLAN STA MB-EB 256+50 TO STA MB-EB 265+25
	000-C-0032	MEDFORD BRANCH DRAINAGE PLAN STA MB-EB 265+25 TO STA MB-EB 271+50
	000-C-0033	MEDFORD BRANCH DRAINAGE PLAN STA MB-EB 271+50 TO STA MB-EB 281+50
	000-C-0034	MEDFORD BRANCH DRAINAGE PLAN STA MB-EB 281+50 TO STA MB-EB 291+50
	000-C-0035	MEDFORD BRANCH DRAINAGE PLAN STA MB-EB 291+50 TO STA MB-EB 301+50
	000-C-0036	MEDFORD BRANCH DRAINAGE PLAN STA MB-EB 301+50 TO STA MB-EB 311+50
	000-C-0037	MEDFORD BRANCH DRAINAGE PLAN STA MB-EB 311+50 TO STA MB-EB 321+50
TRACK SECTIONS AND DETAILS	000-K-3000	SPECIAL TRACKWORK SCHEDULE
	000-K-3101	TRACK DETAILS BALLAST MAT
	000-K-3200	TRACK DETAILS RESTRAINING RAIL/BALLASTED & DIRECT FIXATION TRACK
	000-K-3201	TRACK DETAILS BALLASTED TRACK BUMPING POST
COMMUNICATIONS	LES-E-2000	TYPICAL STATION EQUIPMENT LAYOUT PLAN (LECHMERE STATION)
	LES-E-2001	TYPICAL STATION CCTV COVERAGE PLAN (LECHMERE STATION)
STATIONS	LES-A-2000	LECHMERE STATION SITE CONTEXT PLAN
	UNS-A-2000	UNION SQUARE STATION SITE CONTEXT PLAN
	ESS-A-2000	EAST SOMERVILLE STATION SITE CONTEXT PLAN
	GSS-A-2000	GILMAN SQUARE STATION SITE CONTEXT PLAN
	MSS-A-2000	MAGOUN SQUARE STATION SITE CONTEXT PLAN
	BAS-A-2000	BALL SQUARE STATION SITE CONTEXT PLAN
	COS-A-2000	COLLEGE STATION SITE CONTEXT PLAN
	LES-A-2010	LECHMERE STATION SITE PLAN
	UNS-A-2010	UNION SQUARE STATION SITE PLAN
	ESS-A-2010	EAST SOMERVILLE STATION SITE PLAN
	GSS-A-2010	GILMAN SQUARE STATION SITE PLAN
	MSS-A-2010	MAGOUN SQUARE STATION SITE PLAN
	BAS-A-2010	BALL SQUARE STATION SITE PLAN
	COS-A-2010	COLLEGE STATION SITE PLAN
	STA-A-8000	STATION DETAILS, ELEVATION, TYPICAL STATION DETAILS
VMF	MAF-A-0000	VMF RENDERING, TRANSPORTATION BUILDING PLAN
	MAF-A-2000	VMF SITE PLAN
	MAF-A-2010	VMF SITE PLAN, LANDSCAPE AND SITE SECURITY
	VMF-C-0001	VEHICLE MAINTENANCE AND STORAGE FACILITY SITE PLAN SHEET 1 OF 3
	VMF-C-0002	VEHICLE MAINTENANCE AND STORAGE FACILITY SITE PLAN SHEET 2 OF 3
	VMF-C-0003	VEHICLE MAINTENANCE AND STORAGE FACILITY SITE PLAN SHEET 3 OF 3
	MAF-A-2020	VMF FLOOR/INDUSTRIAL PLAN
	MAF-A-3000	VMF ELEVATIONS
	MAF-A-4000	VMF SECTIONS
	VMF-S-4010	VMF FOUNDATION AND ROOF FRAMING PLAN
	VMF-E-2001	VMF ELECTRICAL SINGLE LINE DIAGRAM
	VMF-E-2002	VMF SPECIAL SYSTEMS RISER DIAGRAMS
	VMF-M-2003	VMF MECHANICAL RISERS
TRACTION POWER SUBSTATIONS	SYS-TP-0033	TRACTION POWER 13 KV AC FEEDER SCHEMATIC
	GTP-TP-8000	BALL SQUARE SUBSTATION
	GTP-TP-8001	PEARL STREET TPSS SINGLE LINE DRAWING
	BTP-TP-8001	BALL SQUARE TPSS SINGLE LINE DRAWING
	RTP-TP-8001	RED BRIDGE TPSS SINGLE LINE DRAWING

CORRIDOR PLAN LEGEND

H	OCS POLE
●	SIGNAL (TYP)
HTR	HEATER CASING
	DOWN GUY PILE FOUNDATION ANCHOR
	DOUBLE DOWN GUY PILE FOUNDATION ANCHOR
JBT	JUNCTION BOX - TRACK
JBS	JUNCTION BOX - SWITCH
	PATH SIGN

GLX Green Line Extension

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GREEN LINE EXTENSION PROJECT

MBTA CONTRACT NO. E22CN07

CAMBRIDGE/SOMERVILLE/ MEDFORD,MASSACHUSETTS

TECHNICAL PROPOSAL

DEPARTMENT OF TRANSPORTATION
FEDERAL TRANSIT ADMINISTRATION
CAPITAL GRANT CONTRACT

SEPTEMBER 28, 2017

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
GREEN LINE EXTENSION DESIGN-BUILD PROJECT
MBTA CONTRACT NO. E22CN07
SOMERVILLE/MEDFORD, MASSACHUSETTS

INDEX SHEET

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ISSUE	DATE	DESCRIPTION	BY	CHK'D	APP'D
0	09/28/2017	TECHNICAL PROPOSAL			

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DRAWING COMPLIANCE MATRIX

SECTION #	PROPOSAL COMPONENT	SUBMISSION SECTION DETAIL	SHEET #
A5.2.1	SYSTEMS AND SYSTEM INTEGRATION	C) COMMUNICATION SYSTEM DESIGN 1) AN OVERALL SYSTEMS TOPOLOGY/SYSTEMS CONNECTION DIAGRAM HIGHLIGHTING THE INTERFACES OF THE KEY SUBSYSTEMS WITHIN THE PROJECT, INCLUDING THE FOLLOWING: A. FIBER OPTIC NETWORK; B. VOICE OVER INTERNET PROTOCOL (“VOIP”) TELEPHONE SYSTEM; C. PUBLIC ADDRESS (“PA”) AND TRANSIT PASSENGER INFORMATION SYSTEM (“TPIS”); D. CLOSED CIRCUIT TELEVISION (“CCTV”); E. SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (“SCADA”) WITH HUB MONITORING AND CONTROL SYSTEMS (“HMCS”); F. ACCESS CONTROL SYSTEM; G. FARE SYSTEM INTERFACE; AND H. UNINTERRUPTIBLE POWER SUPPLY (“UPS”);	1) THE OVERALL SYSTEMS TOPOLOGY/SYSTEMS CONNECTION DIAGRAM WILL BE AS INDICATED IN THE CONTRACT DOCUMENTS, SHEETS SC-SYS-7001 AND 7002, VOLUME 2, EXHIBIT 2B, PROJECT DEFINITION PLANS, WITH FURTHER DETAILING TO OCCUR IN FINAL DESIGN."
A5.2.1	SYSTEMS AND SYSTEM INTEGRATION	D) TRACK WORK SYSTEM DESIGN 2) PROVIDE A DESCRIPTION AND DRAWING OF THE PROPOSED END OF TRACK DEVICE AND AN EXPLANATION DEMONSTRATING THAT IT IS IN ACCORDANCE WITH THE VOLUME 2 TECHNICAL PROVISIONS; 4) PROVIDE SPECIAL TRACK WORK DRAWINGS (SCALE 1:100), INCLUDING THE FOLLOWING: A. SPECIAL TRACK WORK GEOMETRY, GUARDRAILS, AND RESTRAINING RAILS; B. ALL PROPOSED TRACK STRUCTURE/RAIL FASTENING SYSTEMS AND THEIR ASSOCIATED ASSEMBLIES; AND C. THE SIGNALS AND COMMUNICATIONS INFRASTRUCTURE.	D2) SHEET 000-K-3201 D4A) SHEET 000-K-3000 D4B) SHEETS 000-K-3200 AND 000-K-3101 D4C) THIS ITEM IS ADDRESSED IN THE TECHNICAL PROPOSAL
A5.2.1	SYSTEMS AND SYSTEM INTEGRATION	E) TRACTION POWER SYSTEM DESIGN 3) A CONCEPTUAL TRACTION POWER SYSTEM SINGLE LINE DIAGRAM, INCLUDING, MAIN LINE, YARD LEADS, AND ALL YARD TRACKS.	E3) SHEETS SYS-TP-0033, GTP-TP-8000, GTP-TP-8001, BTP-TP-8001, RTP-TP-8001
A5.2.1	SYSTEMS AND SYSTEM INTEGRATION	F) OVERHEAD CONTACT SYSTEM (“OCS”) DESIGN 3) TYPICAL OCS POLE ARRANGEMENTS WITHIN AT-GRADE SECTIONS AND IN AREAS WITH CENTERLINE SPACE CONSTRAINTS.	F3) SHEETS 000-C-0001 TO 000-C-0028
A5.2.2	ELEVATED GUIDEWAY AND STRUCTURES ALONG THE GUIDEWAY	2) PROVIDE AT A SCALE OF 1:200 STRUCTURAL DRAWINGS OF A REPRESENTATIVE EXAMPLE OF THE RETAINING WALLS, NOISE BARRIERS, AND STOPS, INCLUDING, ELEVATIONS, SECTIONS, AND DETAILS TO DESCRIBE THE INTENDED SYSTEMS AND INTEGRATION WITH THE ARCHITECTURAL, DRAINAGE, AND OTHER SYSTEMS, AT AN APPROPRIATE SCALE TO COMMUNICATE THE DESIGN INTENT.	C1) SHEETS 000-C-0001 TO 000-C-0028 SHEETS RWS-S-5001 TO RWS-S-5003 SHEETS VDT-S-0001, LEV-S-2001, LEV-S-3000, LEV-S-3001 (STOPS ARE INCLUDED IN THE STATION SHEETS; XXX-A-2000 SERIES, XXX-A-2010 SERIES AND STA-A-8000)
A5.2.2	ELEVATED GUIDEWAY AND STRUCTURES ALONG THE GUIDEWAY	B) BRIDGE AND UNDERPASS STRUCTURES 3) PROVIDE DRAWINGS WITH PLAN, CROSS SECTION, AND ELEVATIONS SHOWING THE STRUCTURAL FORM AND DESIGN INTERPRETATION OF THE PROJECT REQUIREMENTS FOR ALL BRIDGES.	B3) SHEETS WAS-S-2000, WSB-S-2000, MEB-S-2000, MEB-S-2001, SCB-S-2000, SCB-S-2001, LSB-S-2000, CED-S-2000, BRB-S-2000, BRB-S-2001, COB-S-2000
A5.2.3	STATIONS	B) THE PROPOSER SHALL PROVIDE ARCHITECTURAL DRAWINGS OF EACH STATION, INCLUDING THE FOLLOWING: 1) A CONTEXT PLAN AT A MINIMUM OF 1:500 SCALE; 2) SITE PLANS AND SECTIONS AND ELEVATIONS AT 1:200 SCALE OR AS APPROPRIATE WITH ENLARGED VIEWS TO CLEARLY ILLUSTRATE THE DESIGN OF ALL STATION ELEMENTS, INCLUDING THE FOLLOWING: A. SHELTERS, FURNISHINGS, FINISHES, FIXTURES, AND EQUIPMENT; AND B. SIGNAGE, LIGHTING, CATENARY, AND FARE COLLECTION EQUIPMENT; AND 3) ANY ADDITIONAL DETAILS AND/OR KEY DIMENSIONS AS REQUIRED DEMONSTRATING THAT VOLUME 2 TECHNICAL PROVISIONS, SECTION 12.1, CAN BE MET OR EXCEEDED.	B1) XXX-A-2000 SERIES B2) XXX-A-2010 SERIES AND SHEET STA-A-8000 B3) XXX-A-2010 SERIES AND SHEET STA-A-8000
A5.2.4	LANDSCAPING AND STATION SIGNAGE DESIGN	A) LANDSCAPE ARCHITECTURE 2) PROVIDE LANDSCAPE DRAWINGS (REPRESENTATIVE PLANS AND SECTIONS) FOR STATIONS AT A SCALE 1:200, OR AS APPROPRIATE, DEMONSTRATING THE FOLLOWING: A) INTEGRATION OF THE SYSTEM INTO THE SURROUNDING URBAN CONTEXT; B) IDENTIFICATION OF PEDESTRIAN AND CYCLING CONNECTIONS; C) CONSISTENCY OF A SYSTEM-WIDE STREETSCAPE; AND D) ACCESSIBILITY; AND 3) PROVIDE RENDERINGS AT AN APPROPRIATE SCALE TO ILLUSTRATE TYPICAL GRADING, MATERIALS, SITE AMENITIES AND FURNISHINGS, INCLUDING LIGHTING, BICYCLE RACKS, SIGNAGE, PLANT MATERIAL, AND OTHER ELEMENTS TO DEMONSTRATE COMPLIANCE WITH TECHNICAL PROVISIONS.	B2) XXX-A-2010 SERIES B3) RENDERINGS ARE INCLUDED IN THE TECHNICAL PROPOSAL
A5.2.4	LANDSCAPING AND STATION SIGNAGE DESIGN	B) WAYFINDING, SIGNAGE, AND VISUAL DISPLAY 2) PROVIDE DRAWINGS (REPRESENTATIVE PLANS) AT A SCALE 1:200, OR AS APPROPRIATE, DEMONSTRATING THE FOLLOWING: A) STATION SITE PLANS SHOWING TYPICAL WAYFINDING ROUTING WITH SIGN PLACEMENT AND WAYFINDING ROUTES, INCLUDING ACCESSIBLE AND NON-ACCESSIBLE ROUTES; AND B) SIGNAGE PLANS SHOWING STATIC AND VARIABLE MESSAGING SIGNS, INCLUDING, STATION IDENTIFICATION SIGNS AND MARKER, REGULATORY SIGNS, CODE-REQUIRED SIGNS, INFORMATIONAL SIGNS, SYSTEM-WIDE SIGNS, AND SIGNS RELATED TO THE ART PROGRAM, SUCH AS PLAQUES; AND 3) PROVIDE A MINIMUM OF FOUR RENDERINGS TAKEN FROM EYE-LEVEL, AT MAJOR DECISIONMAKING POINTS FOR ACCESSIBLE CUSTOMERS AND ABLE-BODIED PATRONS THROUGH-OUT THE STATIONS, INCLUDING THE FOLLOWING: E) PASSIVE AND ACTIVE WAYFINDING; F) ANY OTHER VISUAL DISPLAY PROVISIONS RECOMMENDED BY THE PROPOSER; AND G) PLACEMENT OF OTHER VISUAL ELEMENTS, INCLUDING FARE COLLECTION SIGNAGE AND EQUIPMENT AND PROPOSED ARCHITECTURAL ELEMENTS.	B2) XXX-A-2010 SERIES B3) RENDERINGS ARE INCLUDED IN THE TECHNICAL PROPOSAL

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DRAWING COMPLIANCE MATRIX
SHEET 1 OF 2

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ISSUE	DATE	DESCRIPTION	BY	CHK'D	APP'D
0	09/28/2017	TECHNICAL PROPOSAL			

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SECTION #	PROPOSAL COMPONENT	SUBMISSION SECTION DETAIL	SHEETS
A5.2.5	VEHICLE MAINTENANCE FACILITY	2) PROVIDE ARCHITECTURAL DRAWINGS AT AN APPROPRIATE SCALE TO CLEARLY SHOW THE DESIGN, INCLUDING THE FOLLOWING: A) A CONTEXT PLAN (SCALE 1:1000); B) A SITE PLAN (SCALE 1:500) SHOWING THE FOLLOWING: I) AT-GRADE AND BELOW-GRADE FOOTPRINTS OF ALL STRUCTURES, TOGETHER WITH ATGRADE BUILDING INGRESS AND EGRESS LOCATIONS; II) BUILDING SETBACKS TO THE CLOSEST POINT TO THE FUTURE PROPERTY LINES POSTLAND DEDICATIONS (I.E., FRONT, REAR, AND INTERIOR/EXTERIOR YARD SETBACKS); AND III) ANY DIMENSIONS OR SETBACKS REQUIRED TO DEMONSTRATE COMPLIANCE WITH VOLUME 2 TECHNICAL PROVISIONS, SECTION 7.0 AND EXHIBIT 2C; C) FLOOR PLANS; D) INTERIOR AND EXTERIOR BUILDING ELEVATIONS; E) COLOR RENDERINGS OF THREE-DIMENSIONAL EXTERIOR VIEWS; F) KEY BUILDING SECTIONS (SCALE 1:200 THROUGH THE ENTIRE VMF); G) ADDITIONAL DETAILS AND SECTIONS AT AN APPROPRIATE SCALE TO SHOW THE GENERAL ARRANGEMENT OF THE FACILITY, INCLUDING, SECTIONS AND DETAILS THROUGH THE MAIN SHOP SPACE, PIT AREAS WITH UNDER-VEHICLE ACCESS, LIMITS OF OVERHEAD CRANE TRAVEL, AND ANY OTHER SPECIAL CONDITIONS; AND	2A) SHEET MAF-A-2000 2B) SHEET MAF-A-2010 2C) SHEET MAF-A-2020 2D) SHEET MAF-A-3000 2E) SHEET MAF-A-0000 2F) SHEET MAF-A-4000 2G) SHEETS MAF-A-2020 AND MAF-A-4000
A5.2.5	VEHICLE MAINTENANCE FACILITY	B) MECHANICAL, ELECTRICAL, AND PLANT 2) PROVIDE ELECTRICAL DRAWINGS, INCLUDING THE FOLLOWING: A) ELECTRICAL SITE LAYOUT SHOWING LOCATION OF INCOMING ELECTRICAL SERVICES, SWITCHGEAR, AND DUCT BANKS TO EACH BUILDING, SUBSTATION, AND TRACTION POWER SUBSTATION; B) SINGLE LINE DIAGRAM, PRELIMINARY SIZING OF EQUIPMENT AND FEEDERS TO PROVIDE A CLEAR UNDERSTANDING OF THE ELECTRICAL DISTRIBUTION, AND EMERGENCY AND CRITICAL POWER SYSTEMS C) LOCATION POINTS FOR TIE-IN TO LOCAL ELECTRICAL UTILITY; AND D) RISER DIAGRAMS FOR FIRE ALARM AND MISCELLANEOUS SYSTEMS; AND 3) PROVIDE MECHANICAL DRAWINGS TO INDICATE THE DESIGN INTENT OF ALL BUILDING SERVICES MECHANICAL SYSTEMS (HVAC, FIRE PROTECTION, PLUMBING, AND DRAINAGE).	B2A) SHEETS RTP-TP8001, SYS-TP-0033 , VMF-E-2001, MAF-A-2010 B2B) SHEET VMF-E-2001 B2C) SHEET VMF-E-2001 , MAF-A-2010 B2D) SHEET VMF-E-2002 B3) SHEET VMF-M-2003
A5.2.5	VEHICLE MAINTENANCE FACILITY	C) INDUSTRIAL PROCESS AT VEHICLE MAINTENANCE FACILITY 2) PROVIDE DRAWINGS SHOWING THE PROPOSER'S APPROACH DEMONSTRATING HOW THE DESIGN FOR THE VMF WILL CONFORM TO THE REQUIREMENTS OF VOLUME 2 TECHNICAL PROVISIONS, SECTION 10.0, INCLUDING THE FOLLOWING: A) SITE PLANS AT A SCALE OF 1:500 SHOWING THE PROPOSED PERIMETER SECURITY SYSTEM, PROPOSED ACCESS POINTS, AND ANY OTHER SECURITY SYSTEMS PLANNED FOR THE FACILITY SECURITY; AND B) THE PROPOSED TRACK THROUGHOUT THE VMF, INCLUDING, SPECIAL TRACK WORK, THE YARD AREAS AND WITHIN MAINTENANCE BUILDINGS, AND THE CONNECTIONS TO THE MAIN LINE TRACK; INCLUDING THE FOLLOWING: I) TRACK CONSTRUCTION DETAILS FOR EACH TRACK TYPE PROPOSED; II) DIAGRAMMATIC REPRESENTATION DEMONSTRATING THE AVOIDANCE OF A SINGLE POINT OF FAILURE; AND III) THE PROPOSED LIMITS FOR EACH TRACK TYPE.	C2A) SHEET MAF-A-2010 C2B) SHEETS VMF-C-0001 TO VMF-C-0003 C2BI) THIS ITEM IS DISCUSSED IN THE TECHNICAL PROPOSAL C2BII) SHEET VMF-E-2002 TRACK ALIGNMENT PROVIDES FOR DUPLICATIVE ROUTES TO YARD, THEREFORE PRECLUDES A SINGLE POINT OF FAILURE C2BIII) THIS ITEM IS DISCUSSED IN THE TECHNICAL PROPOSAL
A5.2.5	VEHICLE MAINTENANCE FACILITY	D) BUILDING STRUCTURES AT THE VEHICLE MAINTENANCE FACILITY 2) PROVIDE AT A SCALE OF 1:200 REPRESENTATIVE STRUCTURAL DRAWINGS, INCLUDING STRUCTURAL FRAMING AND FOUNDATION DRAWINGS AND DETAILS TO DESCRIBE THE INTENDED SYSTEMS AND INTEGRATION WITH THE ARCHITECTURAL AND OTHER SYSTEMS, AT AN APPROPRIATE SCALE TO COMMUNICATE THE DESIGN INTENT, INCLUDING THE FOLLOWING: A) SUPPORT OF EXCAVATION SYSTEMS; B) FOUNDATIONS, FLOOR, ROOF, AND STRUCTURAL FRAMING SYSTEMS, INCLUDING MATERIALS AND SPANS; C) COLUMN SPACING AND LAYOUT; D) THE DRAINAGE AND WATERPROOFING SYSTEM; E) A DEMONSTRATION THAT ALL STRUCTURES CAN BE CONSTRUCTED WITHIN THE LANDS, INCLUDING CONSIDERATION FOR ANY TEMPORARY STRUCTURES AND SHORING THAT MAY BE REQUIRED; AND F) DESIGN TO MITIGATE FROST HEAVE FOR TEMPORARY AND PERMANENT STRUCTURES.	D2A) SUFFICIENT AREA IS AVAIALBLE TO SLOPE BACK EXCAVATION FOR PITS, FOOTINGS, AND GRADE BEAMS. D2B) SHEET VMF-S-4010 D2C) SHEET VMF-S-4010 D2D) SHEET VMF-M-2003 (WATERPROOFING DISCUSSED IN TECHNICAL PROPOSAL D2E) SHEET MAF-A-2010 D2F) SHEET VMF-S-4010 (BUILDING IS FOUNDED ON DEEP FOUNDATIONS AND BOTTOM OF PILE CAPS ARE BELOW FROST
A5.2.6	CIVIL AND GUIDEWAY	B) THE PROPOSER SHALL PROVIDE CONTINUOUS PLAN AND PROFILE ALIGNMENT DRAWINGS ALONG THE PROJECT CORRIDOR, INCLUDING THE FOLLOWING: 1) PLANS AT NO LESS THAN 1:1000 SCALE, SHOWING THE ALIGNMENTS WITH HORIZONTAL AND VERTICAL CURVE DATA AND LOCATIONS OF KEY FEATURES, SUCH AS, SPECIAL TRACK WORK, TURNOUTS, CROSSOVERS, STORAGE TRACKS, EMBANKMENT GRADING, AND OTHER KEY FEATURES; 2) PROFILES SHOWING GRADIENT AND CURVE DATA WITH THE FOLLOWING SCALES: A) SCALE RATIO OF NO LESS THAN 5H:1V; AND B) THE VERTICAL SCALE BEING NO LESS THAN 1:500; 3) TTYPICAL GUIDEWAY SECTIONS SHOWING ALL TRACK, SYSTEM, AND CIVIL ELEMENTS FOR EACH GUIDEWAY TYPE, INCLUDING, DRAINAGE PROVISIONS, CATENARY ELEMENTS, WALKWAYS AND CLEARANCE ENVELOPES, CONDUIT PROVISIONS, INTEGRATION WITH THE VEHICLE ENVELOPE, AND ANY ADDITIONAL INFORMATION TO DEMONSTRATE THAT THE GUIDEWAY DESIGN IS AN INTEGRATED DESIGN; AND 4) TYPICAL GUIDEWAY SECTIONS AT EACH INTERSECTION CONFIGURATION TYPE; AND	B1) SHEETS 000-C-0001 TO 000-C-0028 B2) TRACK PROFILES ARE VERY SIMILAR TO THE PROFILES PROVIDED BY THE MBTA IN THE RFP DOCUMENTS. THESE HAVE BEEN EXCLUDED HERE. PROFILES WILL BE OPTIMIZED DURING FINAL DESIGN TO REFLECT THE REVISED BRIDGE CLEARANCE OF 17'-9" B3) SHEET LEV-S-3000 B4) SHEET LEV-S-3000
A5.2.6	CIVIL AND GUIDEWAY	C) THE PROPOSER SHALL PROVIDE CONTINUOUS PLAN AND PROFILE DRAWINGS ALONG THE PROJECT CORRIDOR CLEARLY DEFINING THE COMMUNITY PATH, INCLUDING THE FOLLOWING: 1) PLANS AT NO LESS THAN 1:1000 SCALE; AND 2) PROFILES SHOWING GRADIENT AND CURVE DATA WITH SCALE RATIO OF NO LESS THAN 5H:1V.	C1) SHEETS 000-C-0001 TO 000-C-0028 C2) THE PATH PROFILE IS VERY SIMILAR TO THE PROFILE PROVIDED BY THE MBTA IN THE 100% RFP DOCUMENTS AND ATC3. THE PROFILE WILL BE OPTIMIZED DURING FINAL DESIGN.
A5.2.7	DRAINAGE AND STORMWATER MANAGEMENT	B) THE PROPOSER SHALL PROVIDE STORMWATER MANAGEMENT DRAWINGS AT A SCALE OF 1:500, INCLUDING THE FOLLOWING: 1) MINOR AND MAJOR (OVERLAND) FLOWS FOR THE ENTIRE SITE; AND 2) STORMWATER MANAGEMENT FACILITIES FOR BOTH QUANTITY AND QUALITY.	SHEETS 000-C-0001 TO 000-C-0037 SHEETS VMF-C-0001 TO VMF-C-0003 DRAINAGE IS ALSO DISCUSSED IN THE TECHNICAL PROPOSAL.
A5.2.9	UTILITIES	C) THE PROPOSER SHALL PROVIDE PERMANENT AND TEMPORARY RELOCATION/PROTECTION PLANS FOR ALL UTILITY WORK TO DEMONSTRATE VERTICAL AND HORIZONTAL CLEARANCES, POTENTIAL ISSUES AND PROPOSED SOLUTIONS, SITE CONDITIONS, AND PROPOSED WORKS. COMPOSITE UTILITIES DRAWINGS FOR EXISTING AND PROPOSED UTILITIES SHALL INCLUDE THE FOLLOWING: 1) PLAN DRAWINGS (SCALE NO LESS THAN 1:500); 2) PROFILE DRAWINGS (SCALE HORIZONTAL 1:200, VERTICAL 1:100); AND 3) KEY SECTIONS AT A SUITABLE SCALE TO CONVEY PROPOSER'S INTENT.	C1) SHEETS 000-C-0001 TO 000-C-0028 C2) PROFILES ARE VERY SIMILAR TO THE PROFILES PROVIDED BY THE MBTA IN THE RFP DOCUMENTS AND THEREFORE HAVE BEEN EXCLUDED HERE. PROFILES WILL BE OPTIMIZED DURING FINAL DESIGN C3) SHEETS SCB-S-2001 AND BRB-S-2001

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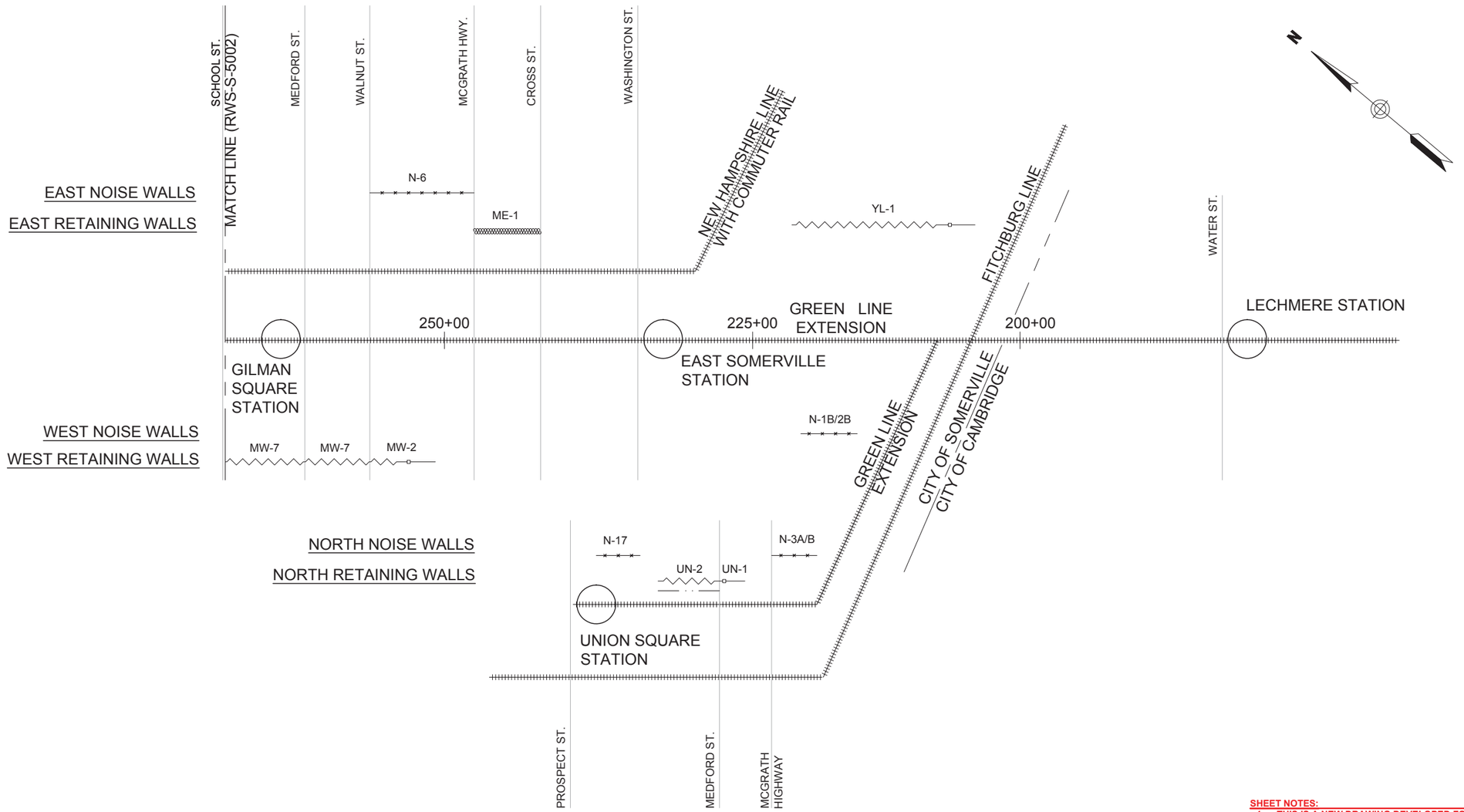

KEY

- STAND-ALONE NOISE WALL
- MOUNTED NOISE WALL
- SPL (SOLDIER PILE AND LAGGING)
- MPB (MODULAR PRECAST BLOCK)
- EPS (EXPANDED POLYSTYRENE)
- MICROPILE
- TRACKS

GREEN LINE EXTENSION
SCHEMATIC LAYOUT OF CORRIDOR WALLS

NOT TO SCALE

NOTES:

1. SEE SHEETS RWS-S-5001 THRU RWS-S-5003 FOR WALL TYPICAL SECTIONS & DETAILS.

SHEET NOTES:

1. **THIS IS A NEW DRAWING DEVELOPED FOR THIS TECHNICAL PROPOSAL RESPONSE.**

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GREEN LINE EXTENSION DESIGN-BUILD PROJECT
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GREEN LINE EXTENSION
CORRIDOR WALL SCHEMATIC
SHEET 1 OF 2

SCALE: NONE	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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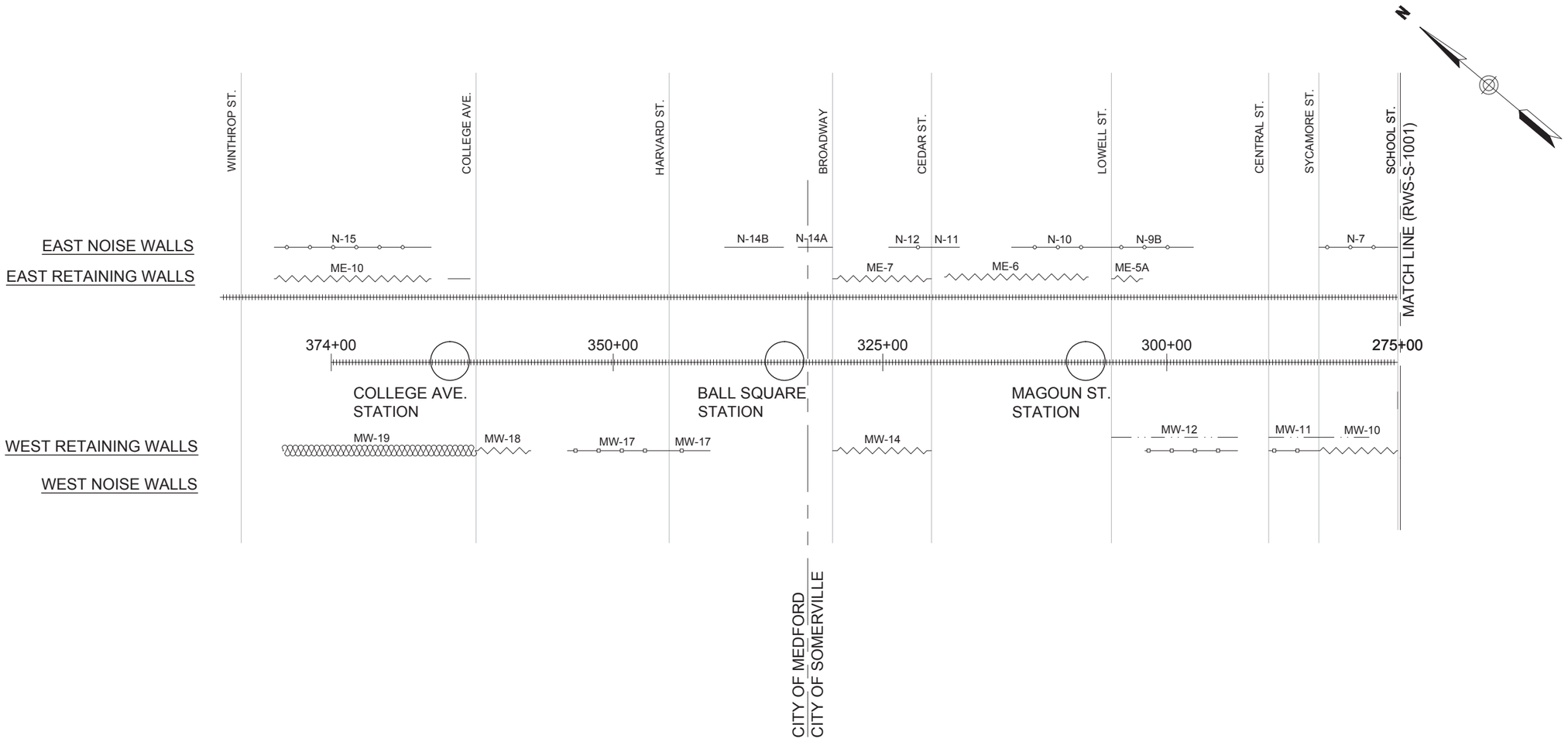

KEY

- STAND-ALONE NOISE WALL
- MOUNTED NOISE WALL
- SPL (SOLDIER PILE AND LAGGING)
- MPB (MODULAR PRECAST BLOCK)
- EPS (EXPANDED POLYSTYRENE)
- SN (SOIL NAIL)
- TRACKS

GREEN LINE EXTENSION
SCHEMATIC LAYOUT OF CORRIDOR WALLS

NOT TO SCALE

NOTES:

1. SEE SHEETS RWS-S-5001 THRU RWS-S-5003 FOR WALL TYPICAL SECTIONS & DETAILS.

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GREEN LINE EXTENSION
CORRIDOR WALL SCHEMATIC
SHEET 2 OF 2

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SCALE: NONE	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 28SEPT2017	RAK	RAK		SHEET: RWS-S-1002	

PLOTTED: 09/27/17 11:09PM BY: KADAMA
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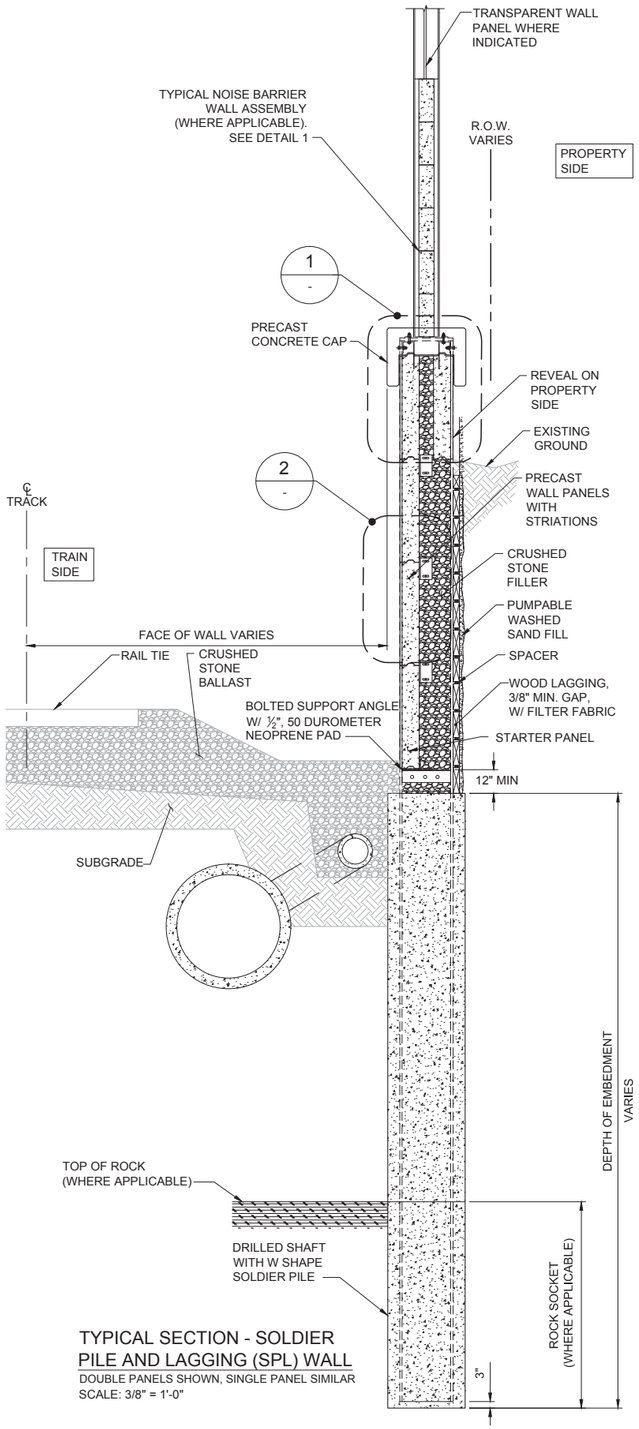
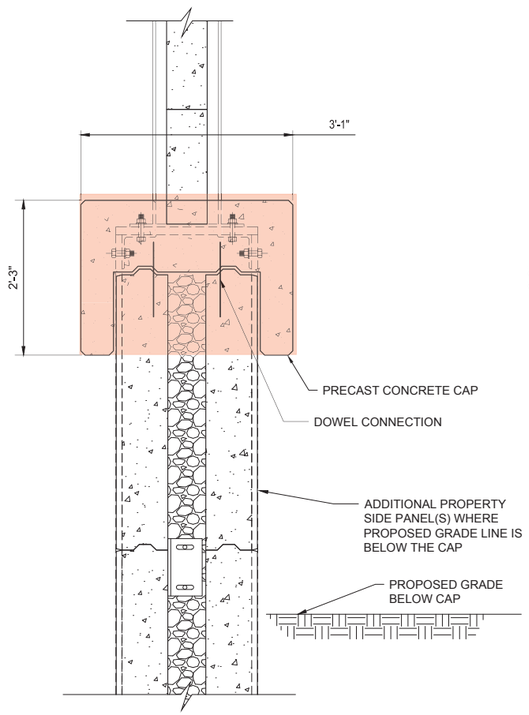


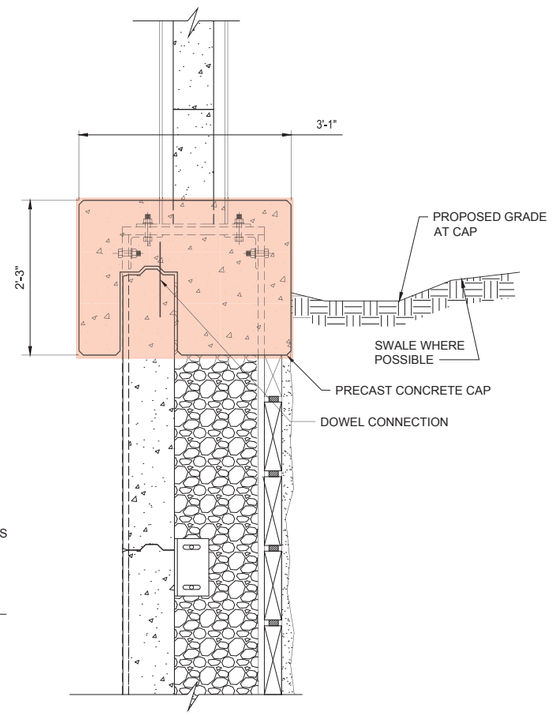
TYPICAL SECTION - SOLDIER PILE AND LAGGING (SPL) WALL

DOUBLE PANELS SHOWN, SINGLE PANEL SIMILAR

SCALE: 3/8" = 1'-0"



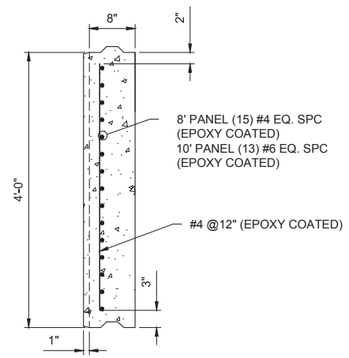
DOUBLE PANEL



SINGLE PANEL

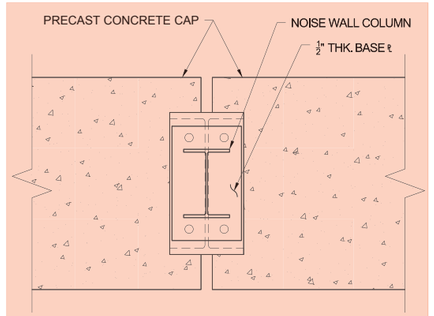
1 - DETAIL - NOISE WALL CAP

SCALE: 1"=1'-0"



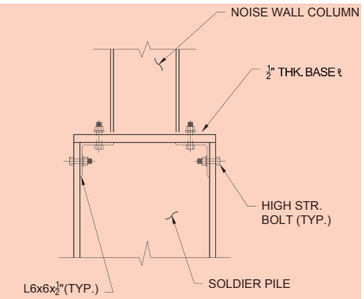
2 - DETAIL - TYPICAL 4'-0" BY 10'-0" AND 8'-0" PRE CAST RETAINING WALL PANEL

SCALE:1"=1'-0"



PRECAST CAP PLAN

SCALE: 3/8"=1'-0"



NOISE WALL CONNECTION

NOTE: CONCRETE LAGGING PANELS AND CAP NOT SHOWN FOR CLARITY.

NOTES:

1. ARCHITECTURAL STRIATION PATTERN SHALL FOLLOW MASSDOT STANDARD DETAILS.

NOT FOR CONSTRUCTION

ISSUE	DATE	DESCRIPTION	BY	CHK'D	APP.
0	09/28/2017	TECHNICAL PROPOSAL			

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

GREEN LINE EXTENSION DESIGN-BUILD PROJECT
MBTA CONTRACT NO. E22CN07
SOMERVILLE/MEDFORD, MASSACHUSETTS

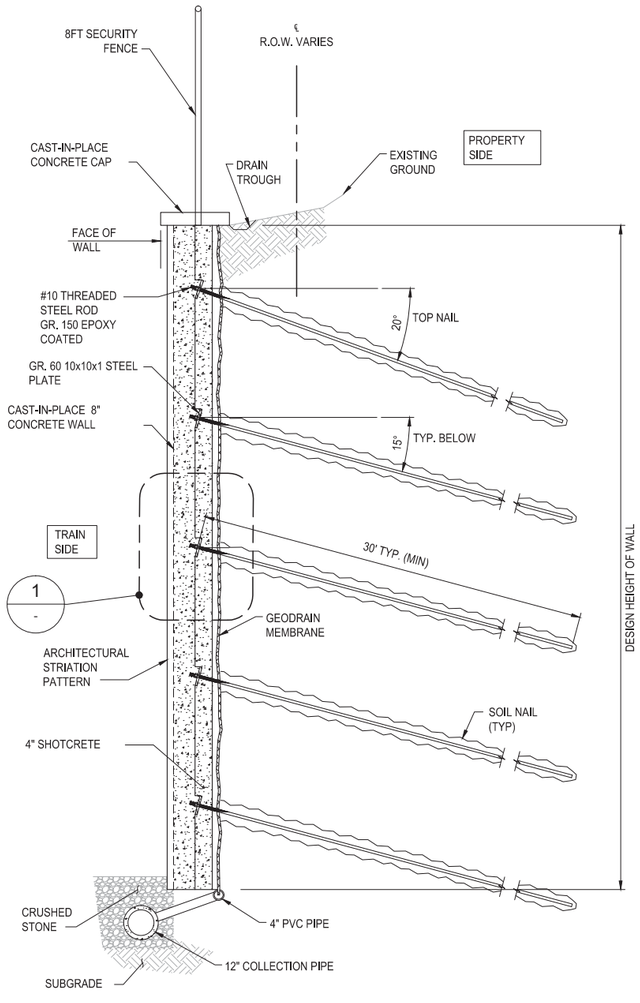
RETAINING WALL DETAILS
SOLDIER PILE AND LAGGING (SPL)

GLP Green Line Partners
Lane • SI • Judlau • LMH-CMC JV

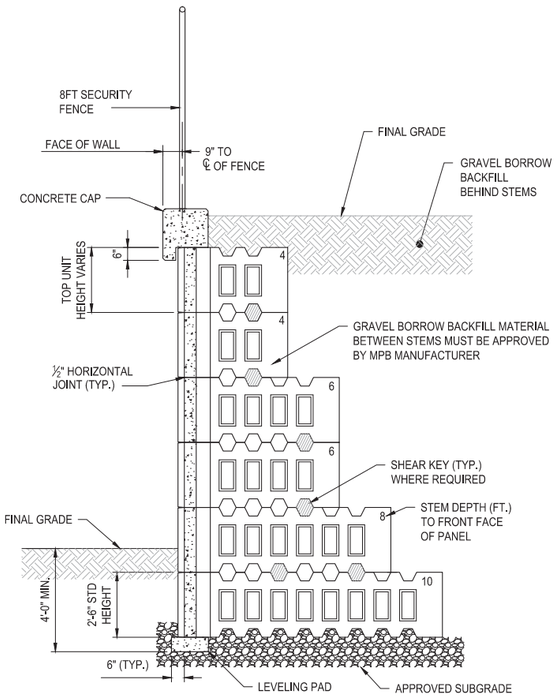
WSP

SCALE: AS NOTED	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 28SEPT2017	AK	RAK	HR	SHEET: RWS-S-5001	

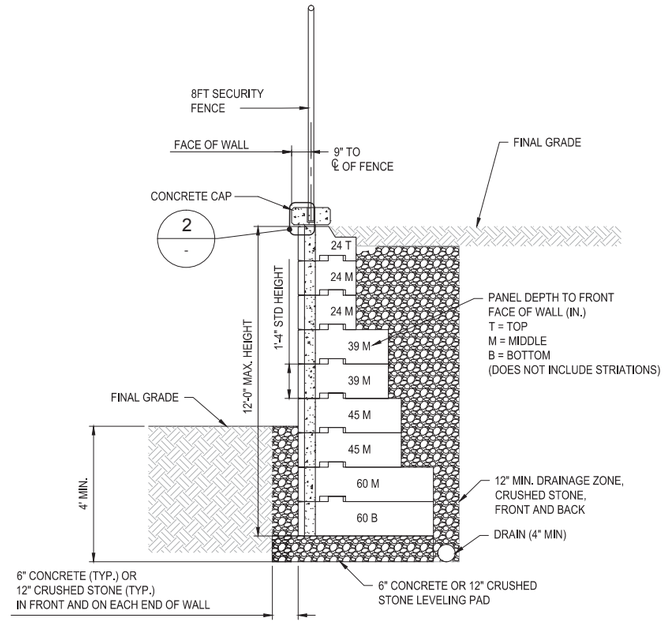
PLOTTED: 09/21/17 11:27PM BY:KADAMRA
DRAWING: C:\BIM\WSP-PB-JOS-TPK-02\WSP__RAVI.KADAM\DM5056707\RWL-01-5001_SPL.DWG [RWS-S-5001] 09/21/17 11:16PM



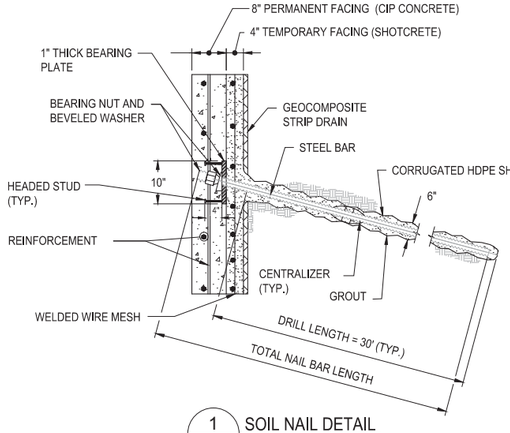
TYPICAL SOIL NAIL WALL
SCALE: 3/8" = 1'-0"



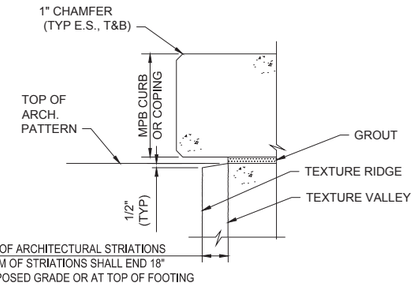
TYPE T (MPB) WALL WITH CAP - TYPICAL
SECTION DRAWN IS BASED ON T-WALL
SCALE: 3/8" = 1'-0"



TYPE A (MPB) WALL WITH CAP - TYPICAL
SECTION DRAWN IS BASED ON SHEA
SCALE: 3/8" = 1'-0"



1 - SOIL NAIL DETAIL
SCALE: N.T.S



2 - TYPICAL BANDING STRIP AT TOP OF MPB WALLS
SCALE: N.T.S.

NOTES:

1. DIMENSIONS OF MPB WALLS ARE APPROXIMATE .

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ISSUE	DATE	DESCRIPTION	BY	CHK'D	APP.
0	09/28/2017	TECHNICAL PROPOSAL			

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
GREEN LINE EXTENSION DESIGN-BUILD PROJECT
MBTA CONTRACT NO. E22CN07
SOMERVILLE/MEDFORD, MASSACHUSETTS

RETAINING WALL DETAILS MODULAR PRECAST BLOCK (MPB) AND SOIL NAIL (SN)

GLX | massDOT Massachusetts Department of Transportation | GLP Green Line Partners Lane • SI • Judlau • LMH-CMC JV | WSP

SCALE: AS NOTED	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 28SEPT2017	AK	RAK	HR	SHEET: RWS-S-5002	

PLOTTED: 09/21/17 11:30PM BY: KADAMRA
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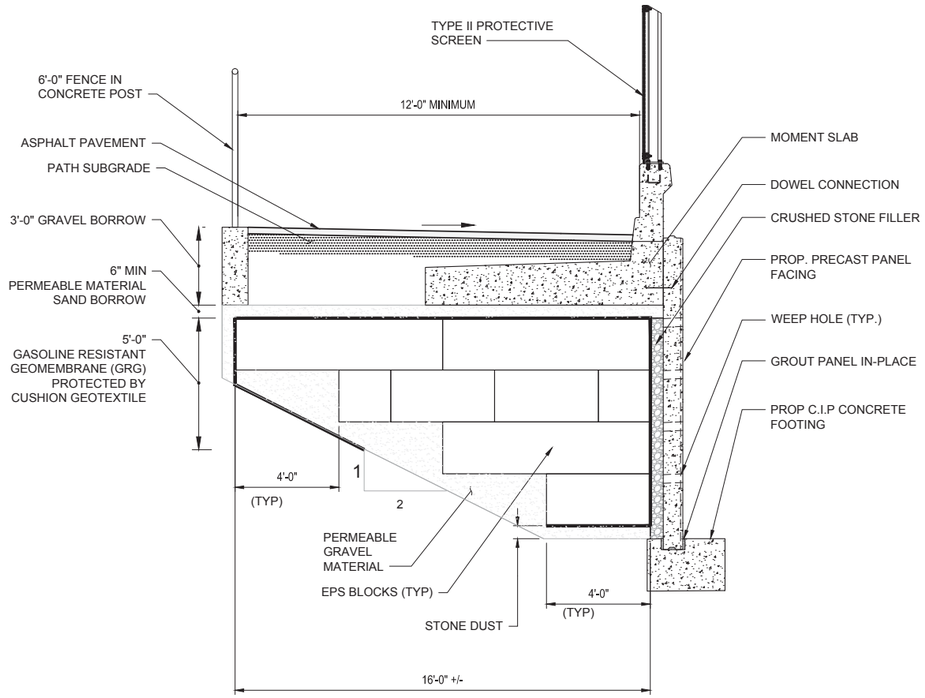
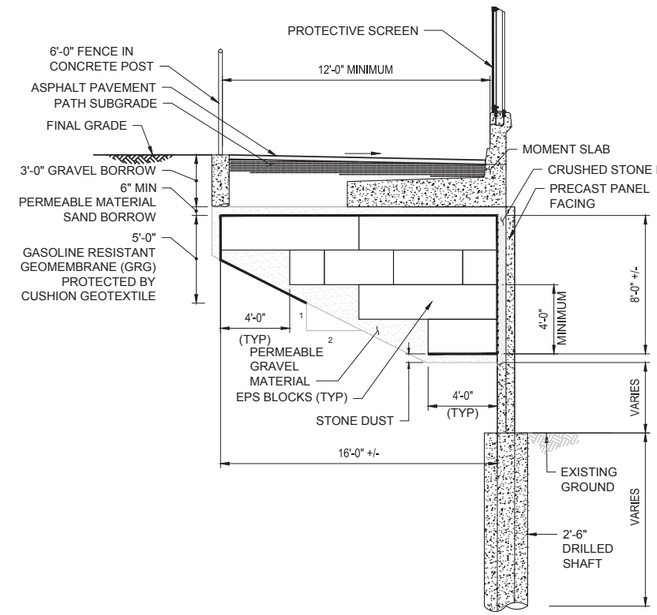


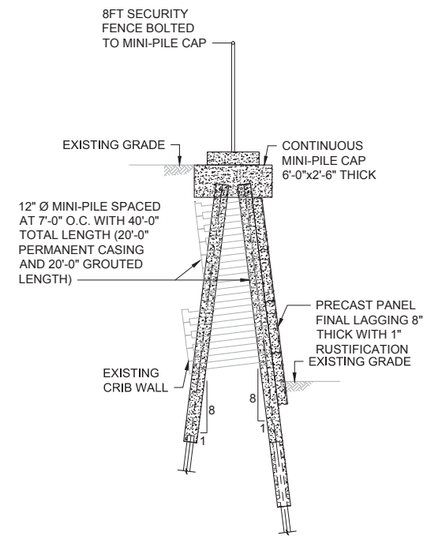
TYPICAL EPS PATH SUPPORT SECTION

SCALE: 3/8" = 1'-0"



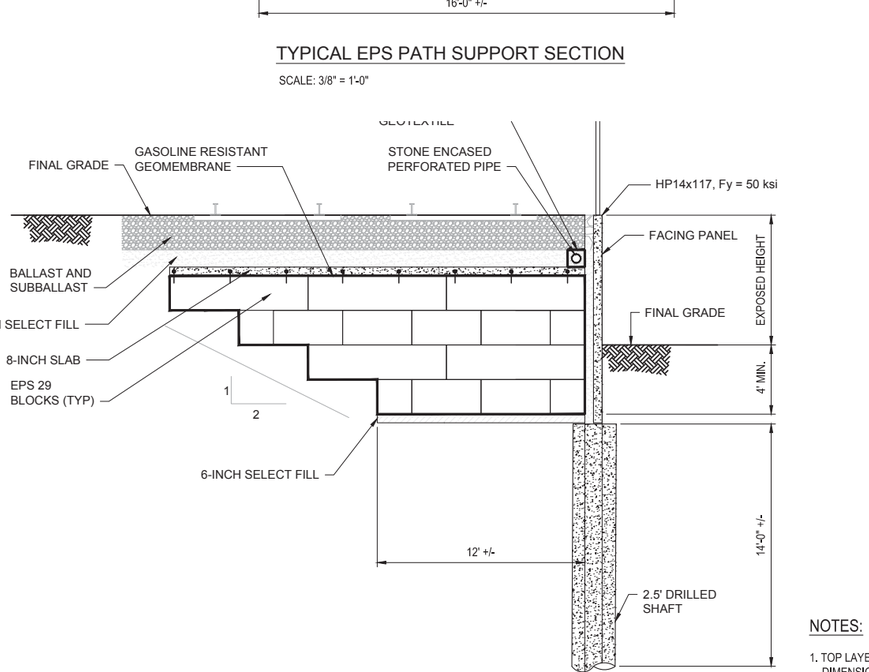
EPS WITH SPL PATH SUPPORT SECTION

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



MICRO PILE WALL DETAIL

SCALE: 3/16" = 1'-0"

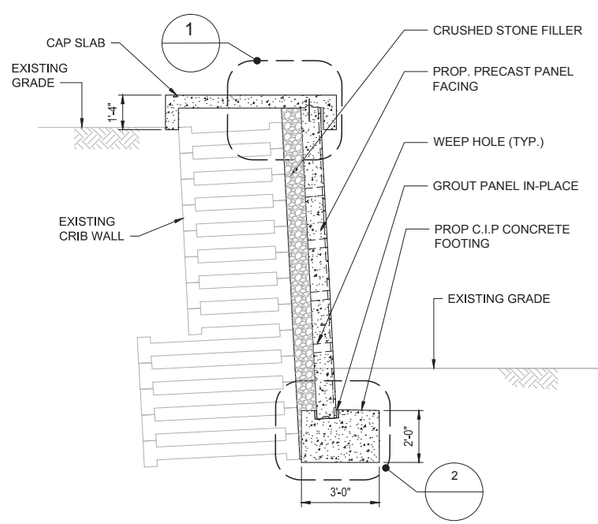


TYPICAL EPS RAIL SUPPORT SECTION

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

SHEET NOTES:

1. **THIS IS A NEW DRAWING DEVELOPED FOR THIS TECHNICAL PROPOSAL RESPONSE.**



TYPICAL CRIB WALL REHABILITATION SECTION

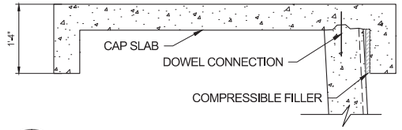
SCALE: 3/8" = 1'-0"

NOTES:

1. TOP LAYER OF EPS BLOCKS MUST BE FULL-HEIGHT BLOCK WITH THE LONG DIMENSION ORIENTED PERPENDICULAR TO THE TRAFFIC.

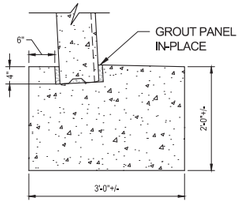
ABBREVIATIONS:

EPS - EXPANDED POLY STYRENE
C.I.P - CAST IN PLACE



1 - CRIB WALL REHABILITATION TOP DETAIL

SCALE: 3/4"=1'-0"



2 - CRIB WALL REHABILITATION BOTTOM DETAIL

SCALE: 3/4"=1'-0"

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

GREEN LINE EXTENSION DESIGN-BUILD PROJECT
MBTA CONTRACT NO. E22CN07
SOMERVILLE/MEDFORD, MASSACHUSETTS

RETAINING WALL DETAILS EPS SUPPORT, MICRO PILE WALL AND CRIB WALL REHABILITATION

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ISSUE	DATE	DESCRIPTION	BY	CHK'D	APP.
0	09/28/2017	TECHNICAL PROPOSAL			

SCALE: AS NOTED	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 28SEPT2017	AC	RAK	HR	SHEET: RWS-S-5003	

PLOTTED: 09/21/17 11:37PM BY:KADAMRA
DRAWING: C:\BWS\WSP-PB-US-FW-02\WSP---RAM\KADAM\DM5056707\RW-01-5001_SPL.DWG [EPS-S-5003 WALL SECTION] 09/21/17 11:35PM