



Proactive by Design



SITE DRAINAGE IMPROVEMENT REPORT

LESLEY MANAGEMENT HARBORSIDE CONDOMINIUM
24 Lee Street
Marblehead, Massachusetts

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PREPARED FOR:
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TABLE OF CONTENTS

A.	GENERAL	1
1.	INTRODUCTION	1
2.	SURVEY AND INSPECTION PROCEDURES.....	1
a.	Documentation.....	1
b.	Non-Destructive Testing.....	2
B.	EXISTING CONDITIONS	2
1.	EXISTING SITE CONDITIONS & STRUCTURES	2
2.	EXISTING BUILDINGS & DRAINAGE PATTERNS.....	3
3.	PARKING AREAS, ACCESS DRIVE AND REMAINING SITE.....	4
4.	EXISTING SEAWALL.....	5
5.	EXISTING UTILITIES	5
C.	SUMMARY AND RECOMMENDATIONS	6
1.	SUMMARY OF CONDITIONS	6
2.	RECOMMENDATIONS.....	6
a.	SHORT-TERM IMPROVEMENT CONCEPTS.....	7
b.	LONG-TERM IMPROVEMENT CONCEPTS	10
c.	PERMITTING	13
 APPENDICES		
APPENDIX A	LIMITATIONS	
APPENDIX B	PHOTOGRAPHS	
APPENDIX C	FIGURES	
	FIGURE 1. LOCUS PLAN	
	FIGURE 2. EXISTING CONDITIONS	
	FIGURE 3. SHORT TERM DRAINAGE IMPROVEMENT CONCEPTS (1 OF 2)	
	FIGURE 4. SHORT TERM DRAINAGE IMPROVEMENT CONCEPTS (2 OF 2)	
	FIGURE 5. SHORT TERM DRAINAGE IMPROVEMENT CONCEPTS – TYPICAL DETAILS AND SECTION	
	FIGURE 6. LONG TERM DRAINAGE IMPROVEMENT CONCEPTS (1 OF 2)	
	FIGURE 7. LONG TERM DRAINAGE IMPROVEMENT CONCEPTS (2 OF 2)	
	FIGURE 8. LONG TERM DRAINAGE IMPROVEMENT CONCEPTS – TYPICAL DETAILS AND SECTION	



A. GENERAL

1. INTRODUCTION

On May 24 and June 13, 2018, GZA GeoEnvironmental, Inc. (GZA) performed a limited topographic survey, a visual inspection of the site features and assessment of surface drainage patterns at the existing harbor side condominiums at 24 Lee Street in Marblehead, Massachusetts (See **Figure 1 – Locus Plan**). The inspection was performed in accordance with the signed agreement received by GZA on January 31, 2018. The work was performed as a result of Owner's concerns with various drainage issues on the site including but not limited to the following; high groundwater levels in the lower parking area, drainage issues and sinkholes forming in the parking area behind the seawall, drainage issues along the north property line adjacent to the Boston Yacht Club, groundwater infiltration into Building C, a drainage issue between Building B and D, and a drainage issue west of Building D.

Topographic surveys were performed on May 24 and June 13, 2018 to supplement a prior survey of the general seawall area on August 3, 2016. The surveys included site features of the property within the apparent property lines including but not limited to; existing buildings, parking area, seawalls, stone walls, patios, stairways, visible utilities, underground utility paint marks, roof gutter down spouts, catch basins, manholes and general site features.

The visual inspection was limited to the accessible portions of the property site, accessible common area portions of the buildings, accessible decks and patios, roof drainage discharges, and visible utilities. Individual units within in the condominium complex were not entered. The main purpose was to assess the site upland areas and determine storm water drainage patterns to determine existing conditions and establish criteria for future improvements to address storm water drainage at the site. No utilities/building structures, seawalls, floats or gangways, or any other ancillary structures associated with the condominiums were included in the inspection scope of work for this project.

2. SURVEY AND INSPECTION PROCEDURES

Prior to conducting the field inspection work, GZA personnel reviewed available site information associated with the site to familiarize ourselves with the existing structures and to establish limits of the survey and site inspection.

A limited topographic survey was performed on the site, to supplement the prior survey of the general seawall area. Equipment utilized to perform the survey included a Topcon GTS-235W Total Station survey instrument, Spectra Precision Nomad 900B data collector field computer and glass reflector prisms. Elevation data obtained during the field surveys is based on RTK GPS observations of survey control points taken utilizing the MassDOT MaCORS Network. Supplemental field measurements of various site features were performed with hand tapes. The access covers to the sewer pump chamber were opened, observed, and visible pipe sizes and inverts were measured.

a. Documentation

The documentation resulting from the survey and site inspection included field notes, field measurements, electronic files from the survey data collector field computer and photographs that were taken of the general



conditions encountered. Select site inspection photographs are presented in **Appendix B** of this report. **Appendix C** of the report provides a drawing describing the conditions encountered.

b. Non-Destructive Testing

No destructive or non-destructive testing was performed during the site inspection.

B. EXISTING CONDITIONS

1. EXISTING SITE CONDITIONS & STRUCTURES

The site is an approximately 0.75 acre parcel located at 24 Lee Street in Marblehead, Massachusetts. The property is located in two zoning districts, Shoreline Central Residence (SCR) and Harborfront (HBR), as indicated on the latest Town of Marblehead Zoning Map, last revised May 2009. Improvements on the site include four (4) multi-story condominiums buildings, a covered parking area attached to one of the buildings, a small grassed area, several landscaped planting areas and a paved parking lot/driveway located landward of the granite block seawall fronting Marblehead Harbor. The seawall provides foreshore protection and support to the landside structures and features. Two seasonal aluminum gangways are connected to the seawall and provide access to two, 20-foot by 40-foot timber floats within the Harbor. The site was previously a boatyard in the late 1800s with seawalls and a marine railway, as observed in historic photographs.

Based on site visits conducted on May 24 and June 13, 2018, the condominium buildings appear to have been constructed and improved at different periods in time using different materials. The buildings are generally constructed of a combination of granite block, concrete and/or concrete foundations, with wood and steel framing. The exteriors of the buildings appear to be covered by wood shingles or clapboards, and in some instances painted cement block. The buildings have exterior decks attached to the structures and are supported by either timber or steel posts. Timber and stone masonry planters are located at various locations adjacent to the buildings and around the site.

The seawall also appears to have been constructed and reconstructed at different periods in time using different materials. The seawall is generally composed of granite stones of varying sizes from the exposed base of the seawall to approximately mean high water elevation. Above mean high water the seawall varies in construction type, composed of large granite blocks, mortared stones, cast-in-place concrete or cement block construction that all vary in height. A stone masonry planter was observed on the top of the seawall at the northern end of the parking lot in addition to a potted planter at the southeastern corner of the parking lot.

The underground utility services connections to the buildings, including natural gas, water, and sewer, appear to be fed from connections to existing utilities along Lee Street. Electricity to the buildings are provided by both underground and overhead service connections off existing utility poles along Lee Street. There are no drainage utilities within the paved parking areas at the site, or existing outfalls in the existing seawall. Storm water runoff from the site sheet flows off existing paved areas towards the existing seawall and into the adjacent harbor.

The observations below are based on observations of the existing buildings and site features, shown on **Figure 2 – Existing Conditions**, which is presented in **Appendix C**.



2. EXISTING BUILDINGS & DRAINAGE PATTERNS

The existing building structures at 24 Lee Street are denoted as Buildings A, B, C and D. The Site Plan in Appendix C differentiates the locations of these buildings and **Table 1** below describes the size and construction types of each building. The location of existing roof down spouts and drainage systems is shown on **Figure 2**.

Table 1 - Building Descriptions				
<i>Building</i>	<i>Approx. Footprint</i>	<i>Construction Type</i>	<i>Approx. First Floor El. (NAVD88)</i>	<i>Building Height</i>
A	±1600 SF	Wood Framed, Concrete Block and Concrete Walls	±32.0'	2 Stories
B	±3750 SF	Wood and Steel Framed, Concrete Block, Granite Block and Concrete Walls	±15.5'	3 Stories
C	±2850 SF	Wood Framed, Concrete Block, Granite Block and Concrete Walls	±11.5'	3 Stories
D	±3350 SF	Wood Framed, Granite Block and Concrete Walls	±12.0'	3 Stories

Building A

The Building A structure is located in the northwest corner of the property, and is approximately 67 feet long, 25 feet wide, with a footprint of approximately 1,600 square feet. The structure has two stories and contains two condominium units, see **Photographs 2, 3, 4 & 5**. The structure has exterior decks attached to the building which are either cantilevered or supported by timber posts. The structure has two enclosed parking spaces with garage doors under the eastern corner of the building. An attached covered parking area with two spaces on the eastern end connects with Building C.

Storm water runoff from the roof area of Building A is collected by gutters at the eaves along the northern and western sides of the building and is directed to four down spouts located on the northern side of the building. All four of these downspouts then discharge storm water runoff to the parking area of the adjacent parcel to the north (Boston Yacht Club). Storm water runoff from the roof area of the covered parking area sheet flows off the edges of the structure and onto the paved parking areas adjacent to the building.

Building B

The Building B structure is located in the western portion of the property, and is approximately 125 feet long, 29 feet wide, with a footprint of approximately 3,750 square feet. The structure has three stories and contains nine condominium units, see **Photographs 6, 7, 8, 10, 11, 12, 13 & 14**. The structure has exterior decks which are supported by galvanized steel framing members, and some of the decks have exterior access stairways. A portion of the building is connected to Building D on the western side. An exterior concrete stairway on the northern side of the building provides access to several of the upper units, as well as access to the grassed and landscaped areas to the west of the building. Several raised landscaping areas are located along the eastern portion of the building.



Storm water runoff from the roof area of Building B is collected by gutters at the eaves along the northern, eastern and western sides of the building, and are directed to seven downspouts located along the perimeter of the building. The downspouts near the northwestern corner and eastern midpoint of the building discharge into roof drain pipes near the building foundation. One downspout on the eastern side of the building discharges directly into the raised landscape bed adjacent to the building. The remaining four downspouts discharge to existing grades adjacent to the building foundation. A small field inlet to collect surface runoff is located in the paved walkway between Buildings B and D, see **Photograph 9**.

Building C

The Building C structure is located in the northeast corner of the property, and is approximately 68 feet long, 43 feet wide, with a footprint of approximately 2,850 square feet. The structure has three stories and contains eight condominium units see **Photographs 15 & 16**. The structure has exterior decks attached to the building which are either cantilevered or supported by timber posts. Raised landscaping beds are located near the eastern and southern portions of the building, and a lawn area with concrete patios is located on the eastern side, between the building and seawall. The structure is situated adjacent to the building on the property to the north, with only a 2 to 3-foot separation between the two structures.

Storm water runoff from the roof area of Building C is collected by gutters at the eaves along the eastern, western and southern sides of the building, and are directed to six downspouts located along the perimeter of the building. Two downspouts on the western side of the building discharge directly into the raised landscape bed adjacent to the building. The remaining four downspouts discharge to existing grades adjacent to the building foundation.

Building D

The Building D structure is located in the southern corner of the property, and is approximately 85 feet long, 45 feet wide, with a footprint of approximately 3,350 square feet. The structure has three stories and contains six condominium units see **Photographs 8, 9 & 10**. The structure has exterior decks attached to the building which are either cantilevered or supported by timber posts, and some of the decks have exterior access stairways. Portions of the exterior decks project seaward past the existing granite block seawall that supports the building foundation. A small grassed and landscaped area is located along the southwestern side of the building, and raised landscaping beds are located on the western portion of the building.

Storm water runoff from the roof area of Building D is collected by gutters at the eaves along the eastern and western sides of the building and is directed to seven downspouts located along the perimeter of the building. Two downspouts on the western side and one downspout on the northern side of the building discharge directly into the raised landscape bed adjacent to the building. Two downspouts near the southwestern corner of the building discharge into a roof drain pipe near the building foundation. The remaining two downspouts discharge to existing grades adjacent to the building foundation.

3. PARKING AREAS, ACCESS DRIVE AND REMAINING SITE

The main parking area for the condominium association is located in the southwestern portion of the property, and is generally bounded by the existing granite block seawall, Building B, C and D, see **Figure 2**. It is constructed of asphalt pavement with areas of gravel, and can accommodate parking for approximately twenty vehicles. Ten of the spaces are located directly adjacent to the existing granite block seawall, six space are located west of Building B, and the remaining four spaces are located south of Building C.



A smaller asphalt parking area is located inland of the main parking area, and to the west of Building C. This parking area is adjacent to the raised landscaping area, and accommodates approximately four spaces, marked for compact cars.

The parking areas are accessed by an asphalt drive that intersects with Lee Street near the southwestern corner of Building A. The access drive is generally twenty feet wide from Lee Street to the smaller parking area west of Building C. The access drive narrows to approximately ten feet wide between Buildings B and C, when travelling to the main parking area. The access drive slopes down from the intersection with Lee Street to the main parking area, with an elevation change of approximately twenty-two feet.

Storm water runoff from the paved access drive and parking areas sheet flows over the paved surfaces in a southeasterly direction towards the existing granite block seawall. There is a low spot in the southeastern corner of the seawall, near the southern gangway, where runoff flows into Marblehead Harbor. No existing subsurface collection system components for storm water within the paved access drive or parking areas were observed.

The rear yards (western side) of Buildings B and D abut steep slopes and bedrock from properties along Gregory Street. Buildings on the abutting properties are elevated approximately 20-feet above the rear yard grades, and several down spouts from these buildings appear to discharge storm water onto the slopes.

4. EXISTING SEAWALL

The condition of the existing seawall structures at 24 Lee Street was reviewed previously by GZA, and summarized in a Seawall Condition Assessment Report dated February 2017. The report provided detailed descriptions of the seawall conditions and recommendations for repairs. The report indicated that in general, the condition of the seawall was observed to be in overall fair condition with isolated areas of the structures in poor condition.

5. EXISTING UTILITIES

Electric services to the buildings are provided through connections to existing utility poles located on Lee and Gregory Streets, see **Figure 2**. Electricity appears to be provided to Building A and C via underground conduits to the existing utility pole located near northwest corner of Building A. Electricity appears to be provided to Building B via overhead wire that runs between #4 and #8 Gregory Street up to the existing utility line along Gregory Street. Electric service to Building D could not be determined from visible exterior connections, but it is believed that the building is serviced through a connection from Building B.

Sanitary sewerage from the buildings on the property is directed to a pump chamber that is located in the main parking area, just north of Building D. Record information provided by the Marblehead Sewer Department indicate that the pump chamber was installed in 1969. Pumps in the chamber discharge to a 4" cast iron force main that travels approximately 200 feet under the access drive to connect to an existing sewer manhole on Lee Street. Record information and field measurements indicated that the top of the sewer force main pipe is approximately 24 to 30 inches below finish grades. Individual connections from each building to the pump chamber could not be determined at this time.

Based on record information provided by the Marblehead Water Department (MWD), domestic water service for Building D is provided by a 1-1/4" line off the existing 8" water main on Lee Street, which installed in 1951. Record information from the MWD appears to indicate that domestic water service for Building C is provided by an



upgrade to the Building D water service to a 2" line, and splitting off the new line near Building C, which was performed in 1958. Domestic water service for Building A appears to be provided by a connection to the existing 8" water main on Lee Street.

MWD indicated that a 2" fire service line was recently installed at the property, which provides fire protection water supply for Building B. The fire service line is connected to the existing 8" water main on Lee Street, and was located based on observed patching of the pavement within the access drive. Patching of pavement to Building C appears to indicate that water service improvements may also have been performed at the time of the fire service line installation.

Natural gas service appears to be provided to the buildings on the property. Based on paint markings on the existing pavement at the time of the survey, a service line from a gas main on Lee Street connects to Building A on the southern side of the building. In addition, a single service line appears to be installed under the access drive, with spurs off the service connecting to western side of Building C, the eastern side of Building B, and the western side of Building D. The size and depth of installation of the service lines could not be determined at this time.

C. SUMMARY AND RECOMMENDATIONS

1. SUMMARY OF CONDITIONS

The general condition of the buildings and parking area was observed to be in fair condition, with some areas of the asphalt parking areas to be in poor condition. The current locations of several of the down spouts are directing storm water directly adjacent to building foundations, which likely contributes to water infiltration into Building C. In addition, current down spout locations could present trip hazards and or present slip potentials during freezing conditions. Storm water runoff from adjacent properties may also be contributing to drainage issues on the site.

The information contained within this report is based on the conditions observed at the time of inspection. The report is for general condition assessment purposes only and is not sufficient, in and of itself, to prepare construction documents for rehabilitation/repair work. Existing conditions are subject to change.

2. RECOMMENDATIONS

In accordance with our scope of services, we have developed two categories of drainage improvement concepts for consideration which could mitigate the drainage and infiltration issues observed during our inspection.

The Short-Term Improvement Concepts (0 to 5-year recommendations) consider the necessary, short-term improvements to the site to mitigate the immediate drainage concerns, and to provide additional information on existing drainage features and components. The short-term improvements would be considered temporary, involve minimal disturbance to existing grades, and would incorporate materials that could be modified or adjusted in the field to address observed performance of the improvements. Short-term work involves cost-effective improvements based on conditions observed with consideration toward limiting disruption to the site, permitting requirements and budgetary costs.



The Long-Term Improvement Concepts (5 to 10-year recommendations) will consider the results of the short-term improvements, and if necessary modify the improvements, and attempt to make the drainage improvements permanent to the site. The long-term improvements also consider coordinating repairs with improvements to the seawalls, and permitting issues and constraints associated with the proposed improvements. Long-term improvements would include excavations, and would need to be coordinated around existing underground utilities currently servicing the buildings on the property. Long-term drainage improvements could be coordinated with other potential site improvements, such as seawall and parking lot repairs, as necessary.

It is recommended that, at a minimum, Short-Term Improvement work should be performed in the near future. It is also recommended that continued periodic monitoring of the existing structures, as well as short-term and long-term improvements be performed to estimate their effectiveness in addressing the existing drainage issues at the site.

Preliminary construction budget estimates presented below were prepared assuming multiple tasks are combined and performed at the same time, i.e all Short-Term Improvements are performed at the same time. Additional cost may be incurred realized if each task is performed individually. Installation of subsurface drainage piping also assumes that excavated material would be suitable for reuse as backfill. Additional contingency for ledge or obstruction removal, if encountered, should also be considered. In addition, placement of permanent underground drain piping in close proximity to the existing buildings may required specific pipe materials, which may increase costs. As permit requirements may vary for each activity, potential costs associated with permitting efforts are not included at this time.

a. SHORT-TERM IMPROVEMENT CONCEPTS

The following items include recommended maintenance and short-term repair concepts that could be performed to immediately mitigate some of the drainage issues noted previously. Descriptions of the short-term improvements and estimated construction costs are presented below.

1) Building A

Short-term improvements to Building A, see **Figure 3** in **Appendix C**, would involve addressing the buildings down spout discharge locations. Currently, the down spouts from Building A discharge onto the adjacent property to the north, which has reportedly raised concerns from the owner of the adjacent property.

The down spout closest to Lee Street could be rerouted and extended by adding additional lengths of above grade downspout extension to the side of the building to discharge near the sidewalk adjacent to Lee Street, similar to the neighboring buildings along Lee Street. The remaining down spouts could be combined by adding additional lengths of downspout extension to the side of the building to discharge into the existing gutter that is installed under the timber deck on the eastern side of the building. The existing gutter could be modified to pitch towards the property, and a new down spout could be installed near the south east corner of the building, to discharge storm water onto the paved access drive. The use of low-profile or retractable down spout extension could be utilized to minimize potential trip hazards.

The preliminary budgetary cost estimate for this level of repair is expected to range between approximately **\$2,500** and **\$4,000**.



2) Building B

Short-term improvements to Building B, see **Figures 3 & 4 in Appendix C**, would involve addressing the building's down spout discharge locations. Currently, the down spouts from the building discharge to existing grades near the foundation of the existing building or into roof drain pipes near the building foundation. The current location of the down spouts may be contributing to issues with water ponding between Buildings B and D.

The down spouts in the northeast corner and at the eastern midpoint of the building could be extended by adding additional lengths of above grade downspout extension to discharge further away from the building foundation. The use of low-profile or retractable down spout extension could be utilized to minimize potential trip hazards. The down spouts in the southeast and southwest corners of the building could be combined and extended by adding additional lengths of above grade downspouts to connect with the existing roof drain pipe near the southwest corner of Building D.

The existing down spouts that discharge to roof drain pipes near the northwest corner and eastern midpoint of the building could be left in place, however, the roof drain pipes should be inspected to verify their integrity and final discharge location. This inspection could be accomplished by video camera inspection, dye-testing, or other non-destructive methods. Inspection of the existing roof drain pipe near the southwest corner of Building D should also be performed prior to making additional piping connections.

The preliminary budgetary cost estimate for this level of repair ranges between approximately **\$3,000** and **\$5,000**. Cost would also be dependent on the level of effort required during the inspection of existing underground piping to determine the final discharge locations of the pipes.

3) Building C

Short-term improvements to Building C, see **Figure 3**, would involve addressing the building down spout discharge locations. Currently, the down spouts from the building discharge to existing grades near the foundation of the existing building. In addition, the down spouts near the northeast and northwest corners of building discharge to a small area that separates the building with the existing structure on the property to the north. Also, the down spouts on the western side of the building discharge directly into a raised planting bed, which may be contributing to reported groundwater infiltration in the building.

The down spout in the northeast corner of the building could be extended by adding additional lengths of above grade downspout extension to the side of the covered garage wall to discharge further away from the building foundation on the adjacent property. Also, the two down spouts that discharge into the existing raised landscaping bed could be extended with additional lengths of above grade downspout extension beyond the retaining wall, to discharge onto the adjacent paved parking area. In addition, the downspout in the southeast corner of the building could be extended utilizing above grade piping to discharge to the adjacent harbor. Finally, the two existing down spouts in the northeast corner of the building could be combined and extended with additional lengths of above grade downspouts to discharge to the adjacent harbor. The use of low-profile or retractable downspout extension could be utilized to minimize potential trip hazards.

The preliminary budgetary cost estimate for this level of repair is expected to range between approximately **\$2,000** and **\$3,000**.



4) Building D

Short-term improvements to Building D, see **Figure 4**, would involve addressing the building down spout discharge locations, and the field inlets located in the paved walkway between Building B and D. Currently, the down spouts from the building discharge to existing grades near the foundation of the existing building or into roof drain pipes near the building foundation. Also, the three down spouts near the northwestern corner of the building discharge directly into a raised planting beds that are adjacent to the building foundation. The current outlet locations of the down spouts may be contributing to issues with water ponding between Buildings B and D.

The existing down spouts that discharge to roof drain pipes near the southwest corner of the building could be left in place, however, the roof drain pipes should be inspected to verify their integrity and final discharge location. This inspection could be accomplished by video camera inspection, dye-testing, or other non-destructive methods. Inspection of the existing roof drain pipe near the southwest corner of Building D should also be performed prior to making additional piping connections.

The down spouts in the northeast corner of the building could be extended by adding additional lengths of above grade downspout extension to discharge to an existing field inlet located in the paved walkway between Building B and D. The use of low-profile or retractable down spout extension could be utilized to minimize potential trip hazards. In addition, the existing paved walkway near the southeast corner of Building B should be investigated for the presence of an existing field inlet. The field inlets should also be inspected to confirm their final discharge locations prior to directing additional discharges to them.

The two existing down spouts on the east side of the building could be combined and extended with additional lengths of above grade downspout extension to discharge to the adjacent harbor. The use of low-profile or retractable down spout extension could be utilized to minimize potential trip hazards.

The preliminary budgetary cost estimate for this level of repair ranges between approximately **\$3,000** and **\$5,000**. Cost would also be dependent on the level of effort required during the inspection of existing underground piping to determine the final discharge locations of the pipes.

5) Site and Parking Areas

Short-term improvements to parking areas, see **Figure 4**, would involve addressing sinkhole and settled areas of the paved areas in the main parking area near the existing granite block seawall. Currently, portions of the existing pavement that showed signs of settlement or sinkhole formation were removed, and the area was filled and regraded with what appears to be reclaimed bituminous concrete pavement millings. Other short-term improvements to the site include investigation of existing irrigation systems and underground utilities for leaks, and monitoring of down spouts on adjacent properties for discharge impacts to the property.

To address sinkholes and settlement observed in the main parking area, crushed stone and filter fabric could be installed at the landward face of the seawall along the perimeter of the parking lot and seawall interface, see Typical Detail on **Figure 5** in **Appendix C**. This may limit the migration of fine grained material through the seawall. This would likely be accomplished by excavating along the landward side of the granite block seawall. At the time of the installation of the crushed stone and filter fabric, test pits could be performed to assess the approximate elevation of the bedrock for future seawall re-build options. The area of the sink holes could also be excavated at this time as well. Repairs to the sinkholes



could include replacement of existing soil with a more permeable soil with less fine grained material as well as installation of filter fabric. Archive photographs show a marine railway along the face of the wall in the late 1800s. The presence of abandoned railway structures may limit or impede excavation work within this area. Disturbed areas of the paved parking lot could be repaired with new asphalt pavement, or processed gravel if additional improvements to the adjacent seawalls are anticipated to be performed in the near future.

The existing irrigation system in the raised landscaping beds could be inspected for leaks, which could be contributing to additional water issues, as well as being an additional expenditure for higher water bills. Water services to the individual buildings could also be inspected for leaks through static pressure testing. The main service could be temporarily shut off at the connection to the watermain on Lee Street, and pressure gauge could be installed just past the water meter in each building. A loss in pressure could indicate a leak in the service line that could be contributing to groundwater issues.

A low-pressure air test of the sewer force main could be conducted to inspect the line for potential leaks. Air bladders and pressure gauges could be installed at the sewer pump connection and at the sewer manhole in Lee Street to test the line. The sewer pump chamber could be manually pumped down to allow for storage during the testing procedure.

The installation of rain barrels at down spout locations on each building could also be considered. The rain barrels could be a storage source for rain water, which could then be utilized by maintenance or residents for irrigation of landscaping areas and flower beds. These rain barrels could help to offset cost currently incurred for irrigation by municipal water sources.

During the site inspections, it was noted that down spouts on the eastern end the building on the adjacent property at 8 Gregory Street discharge to a ledge face near the southwestern portion of Building D. It is possible that these discharges are also contributing to the water ponding issues between Buildings B and D. After the initial short-term repairs for Building B and D are completed, this condition should be re-examined.

The preliminary budgetary cost estimate for site and parking area repairs are anticipated to range between approximately **\$25,000** and **\$35,000**, however difficulty of excavation due to the presence of abandoned railway structures may increase this cost. Contractor mobilization costs would be in addition to this estimate.

b. LONG-TERM IMPROVEMENT CONCEPTS

The following items include recommended maintenance and long-term repair concepts that could be performed to mitigate some of the drainage issues noted previously. These concepts would improve on, and make permanent, some of the short-term improvement concepts, if implemented. This work would require equipment and machinery, and likely both land and barge-based equipment. Descriptions of the improvements and estimated construction costs are included below. Contractor mobilization costs and other incidental costs for these work items would likely range between approximately **\$5,000** and **\$10,000**.

1) Building A

Based on observations of the performance of the short-term improvements implemented for Building A, long-term improvements would involve making permanent the adjustments made in the short-term to



the roof drainage system, see **Figure 6** in **Appendix C**. In addition, long-term improvement to Building A could include installation of subsurface PVC drain piping from the new down spout location at the south east corner of the building. The new drain piping would be installed below the paved access drive and parking areas, and terminate at the seaward face of the granite block seawall. The new drain piping could be combined with drain piping from the other building which are also redirecting roof runoff. The new drain piping would be for the collection of roof runoff only, as it is considered adequately “treated” under the Massachusetts Department of Environmental Protection storm water standards.

The preliminary budgetary cost estimate for this level of repair is expected to range between approximately **\$3,000** and **\$5,000**.

2) Building B

Based on observations of the performance of the short-term improvements implemented for Building B, long-term improvements would involve making permanent the adjustments made in the short-term to the roof drainage system, see **Figure 6 & 7** in **Appendix C**. In addition, long-term improvement to Building B could include installation of subsurface PVC drain piping. The new drain piping would be for the collection of roof runoff only, as it is considered adequately “treated” under the Massachusetts Department of Environmental Protection storm water standards.

The down spouts in the northeast corner and at the eastern midpoint of the building could be connected to subsurface PVC drain piping installed below the paved parking areas, and terminate at the seaward face of the seawall. The new drain piping could be combined with drain piping from other buildings which are redirecting roof runoff.

The down spouts in the southeast and southwest corners of the building could be connected to subsurface PVC drain piping installed below existing grades between the building and chain link fence. The new drain piping could then be extended to connect with the existing roof drain pipe near the southwest corner of Building D.

The existing down spouts that discharge to roof drain pipe near the northwest corner and eastern midpoint of the building could be left in place, pending the results of the pipe inspection performed in the short-term improvements. The down spout at eastern midpoint of the building could also be connected to new drain piping installed as part of the long-term improvements to Building D, but the potential interference with the existing gas service should be considered.

The preliminary budgetary cost estimate for this level of repair is expected to range between approximately **\$7,000** and **\$10,000**.

3) Building C

Based on observations of the performance of the short-term improvements implemented for Building C, long-term improvements would involve making permanent the adjustments made in the short-term to the roof drainage system. In addition, long-term improvement to Building C could include installation of subsurface PVC drain piping, see **Figure 6**. The new drain piping would be for the collection of roof runoff only, as it is considered adequately “treated” under the Massachusetts Department of Environmental Protection storm water standards.



The down spout in the northeast corner of the building, the two down spouts that discharge into the existing raised landscaping bed and the down spout in the southeast corner of the building could be connected to subsurface PVC drain piping installed below the paved parking areas, and terminate at the seaward face of the concrete block wall. The new drain piping could be combined with drain piping from other buildings which are redirecting roof runoff.

The two existing down spouts in the northeast corner of the building could be connected to subsurface PVC drain piping installed below the concrete pads, and terminate at the seaward face of the concrete block wall.

In the existing raised landscaping bed on the western side of the building, the existing material along the building foundation wall could be removed, and a waterproof membrane installed. A PVC subdrain system, with weep holes installed in the retaining wall could be installed prior to replacing landscaping material.

The preliminary budgetary cost estimate for this level of repair would range between approximately **\$4,000** and **\$6,000**.

4) Building D

Based on observations of the performance of the short-term improvements implemented for Building D, long-term improvements would involve making permanent the adjustments made in the short-term to the roof drainage system. In addition, long-term improvement to Building D could include installation of subsurface PVC drain piping, see **Figure 7**. The new drain piping would be for the collection of roof runoff only, as it is considered adequately “treated” under the Massachusetts Department of Environmental Protection storm water standards.

The existing down spouts that discharge to roof drain pipes near the southwest corner of the building could be left in place, pending the results of the pipe inspection performed in the short-term improvements. The two existing down spouts in the east side of the building could be left in the short-term improvement condition, as they would be under the existing deck of the building, and relatively protected from disturbance.

The down spouts in the northwest corner of the building could be connected to subsurface PVC drain piping installed below the paved parking areas, and terminate at the seaward face of the concrete block wall. The new drain piping could be combined with drain piping from other buildings which are redirecting roof runoff.

The preliminary budgetary cost estimate for this level of repair would range between approximately **\$3,000** and **\$5,000**.

5) Site and Parking Areas

Long-term improvements to parking areas could involve installation of a subsurface drainage system to collect and treat storm water runoff from the parking areas, and regrading of the main parking lot, see **Figure 7**. In addition, addressing sinkholes and settled areas of landscaped areas landward of the granite block seawall area near Building B could be considered. This work could be coordination with reconstruction of the granite block seawalls.



The installation of a subsurface drainage system, comprised of a precast concrete catch basin and precast concrete storm water treatment unit, could be considered to be installed in the main parking area. The paved parking area could be regraded to direct storm water to the catch basin, and minimize the amount of water that would sheet flow over the existing granite block seawall and into the harbor. The presence of abandoned railway structures may limit or impede excavation work within this area, and may impact the final placement of the structures. A new outfall pipe could be installed from the treatment unit under the paved parking area to the face of the existing granite block seawall.

The preliminary budgetary cost estimate for this level of repair is expected to range between approximately **\$50,000** and **\$70,000**, however difficulty of excavation due to the presence of abandoned railway structures may increase this cost. Contractor mobilization costs would be in addition to this estimate.

Budgetary cost estimates for repairs are further summarized as follows:

Drainage Improvement Repair Concepts	Preliminary Budgetary Cost Estimate Range
A. Short-Term Improvement Concepts	
1. <i>Building A</i>	\$2,500 to \$4,000
2. <i>Building B</i>	\$3,000 to \$5,000
3. <i>Building C</i>	\$2,000 to \$3,000
4. <i>Building D</i>	\$3,000 to \$5,000
5. <i>Site and Parking Areas</i>	\$25,000 to \$35,000
Total Short-Term Improvements	\$35,500 to \$52,000
B. Long-Term Improvement Concepts	
1. <i>Mobilization</i>	\$5,000 to \$10,000
2. <i>Building A</i>	\$3,000 to \$5,000
3. <i>Building B</i>	\$7,000 to \$10,000
4. <i>Building C</i>	\$4,000 to \$6,000
5. <i>Building D</i>	\$3,000 to \$5,000
6. <i>Site and Parking Areas</i>	\$50,000 to \$70,000
Total Long-Term Improvements	\$72,000 to \$106,000
Total Short and Long-Term Improvements	\$107,500 to \$158,000

c. PERMITTING

Regulatory authorization from the Department of Environmental Protection (DEP), Marblehead Conservation Commission, Old and Historic Marblehead Districts Commission, Massachusetts DEP Chapter 91, United States Environmental Protection Agency (US EPA) and the U.S. Army Corps of Engineers (USACE) would likely be required to perform some or all of the work or improvements at the site. Depending on the type of work, this may involve filing for new permits/authorizations or coordination with regulatory agencies prior to the start of the work.



Generally, work involving short-term improvements that do not involve excavation will not require additional permits. Work involving some of the long-term improvements may be permissible due to maintenance and repairs to existing structures with minimal impacts to resource areas.

Permitting new drainage structures with point discharges to the harbor, may be challenging for a number of reasons. Further inquiry with the regulatory agencies would be advised for some of the long-term improvements prior to filing permits.

DRAFT



Appendix A – Limitations



APPENDIX A

VISUAL INSPECTION LIMITATIONS

1. The observations described in this report were made under the conditions stated herein. The conclusions presented in the report were based solely on the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints. Engineering and design calculations were not performed as a part of the assessment of the existing conditions.
2. In reviewing this Report, it should be realized that the reported condition of the site features is based on observations of field conditions during the course of this study along with data made available to GZA GeoEnvironmental, Inc. (GZA). The observations of conditions reflect only the situation present at the specific moment in time the observations were made, under the specific conditions present. It may be necessary to reevaluate the recommendations of this report when subsequent phases of evaluation or repair and improvement provide more data.
3. This report has been prepared for the exclusive use of the Lesley Management Harborside Condominium for specific evaluation purposed in accordance with generally accepted inspection practices. No other warranty, expressed or implied, is made.
4. This inspection report has been prepared for this project by GZA. This report is for the Lesley Management Harborside Condominium's evaluation and management purposes only and is not sufficient, in and of itself, to prepare construction documents or an accurate bid.
5. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.
6. Unless otherwise stated, our cost estimates are only for comparative and general planning purposes. These estimates may involve approximate quantity evaluations. Note that these quantity estimates are not intended to be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in this Report. Further, since we have no control over either when the work will take place or the labor and material costs required to plan and execute the anticipated work, our cost estimates were made by relying on our experience, the experience of others, and other sources of readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.
7. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.



Appendix B – Photographs



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 1	Date: 2016		
Direction Photo Taken: Aerial			
Description: Aerial image of the site (Bing Maps).			

Photo No. 2	Date: 05/24/18	
Direction Photo Taken: East		
Description: View of access drive and southwest corner of Building A from Lee Street.		

5/24/18, 4:24 PM



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 3	Date: 05/24/18		
Direction Photo Taken: East			
Description: View of northwest corner of Building A from Lee Street.			

Photo No. 4	Date: 06/13/18	
Direction Photo Taken: South		
Description: View of northeast corner of Building A from adjacent property to the north.		



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 5	Date: 05/24/18	 5/24/18, 4:23 PM	
Direction Photo Taken: West			
Description: View of southeast corner of Building A from parking area near Building C.			

Photo No. 6	Date: 05/24/18	 5/24/18, 4:23 PM
Direction Photo Taken: South		
Description: View of north side of Building B from the parking area near Building C.		



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 7	Date: 05/24/18		
Direction Photo Taken: North			
Description: View of northeast corner and portion of east side of Building B from the main parking area.			
Photo No. 8	Date: 05/24/18		
Direction Photo Taken: South			
Description: View of passage way between Building B and D from the main parking area.			



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 9	Date: 05/24/18		
Direction Photo Taken: North			
Description: View of passageway between Buildings B and D from inside the passageway.			

Photo No. 10	Date: 05/24/18		
Direction Photo Taken: South			
Description: View of passageway between Buildings B and D from inside the passageway.			



Photographic Log

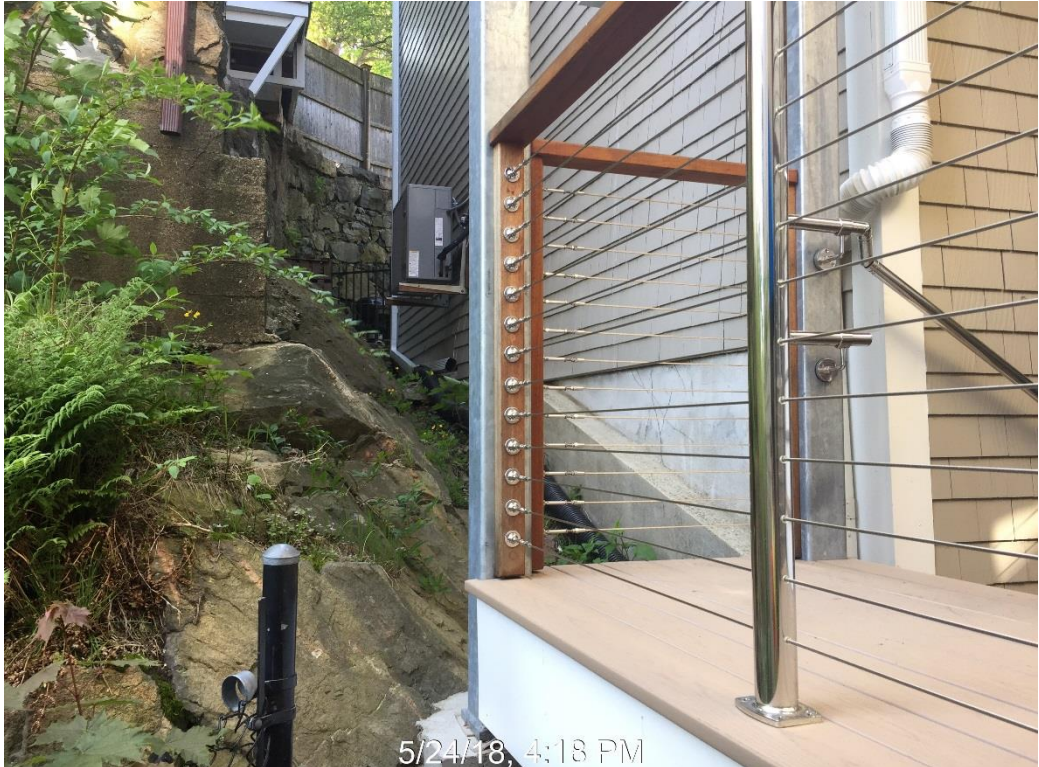
Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 11	Date: 05/24/18		
Direction Photo Taken: West			
Description: View of southeast corner and south side of Building B.			

Photo No. 12	Date: 05/24/18
Direction Photo Taken: South	
Description: View of southwest corner and portion of west side of Building B from the rear yard of the building.	



5/24/18, 4:28 PM



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 13	Date: 05/24/18		
Direction Photo Taken: North			
Description: View of a portion of the west side of Building B from the rear yard of the building.			

5/24/18, 4:28 PM

Photo No. 14	Date: 06/13/18	
Direction Photo Taken: South		
Description: View of northwest corner of Building B from the exterior concrete access stairway.		

6/13/18, 10:59 AM



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 15	Date: 05/24/18	 5/24/18, 4:23 PM	
Direction Photo Taken: East			
Description: View of the southwest corner and portion of western side of Building C from the access drive.			

Photo No. 16	Date: 05/24/18	 5/24/18, 4:19 PM
Direction Photo Taken: North		
Description: View of the southern side of Building C from the main parking area.		



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 17	Date: 05/24/18		
Direction Photo Taken: North			
Description: View of the north east corner and portion of the eastern side of Building C from the existing granite block seawall.			

Photo No. 18	Date: 06/13/18	
Direction Photo Taken: South		
Description: View of northwest corner of Building C from adjacent property to the north.		



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 19	Date: 05/24/18		
Direction Photo Taken: South			
Description: View of northern side of Building D from the main parking area.			

5/24/18, 4:21 PM

Photo No. 20	Date: 06/13/18	
Direction Photo Taken: North		
Description: View of the northeast corner and portion of the east side of Building D from the existing granite block seawall.		

6/13/18, 11:30 AM



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 21	Date: 05/24/18		
Direction Photo Taken: South			
Description: View of the southeast corner and portion of the eastern side of Building D from the main parking area.			

5/24/18, 4:20 PM

Photo No. 22	Date: 06/13/18	
Direction Photo Taken: South		
Description: View of the southeast corner of Building D from the existing granite block seawall.		

6/13/18, 11:30 AM



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 23	Date: 06/13/18		
Direction Photo Taken: West			
Description: View of the southern side of Building D from the pier on the adjacent property to the south.			

Photo No. 24	Date: 06/13/18	
Direction Photo Taken: East		
Description: View of the southern side of Building D from the rear yard of the building.		



Photographic Log

Client Name: Lesley Management		Site Location: 24 Lee Street Marblehead, MA	Project No. 18.0173596.00
Photo No. 25	Date: 05/24/18		
Direction Photo Taken: South			
Description: View of the southwest corner of Building D from the rear yard of the building.			
Photo No. 26	Date: 06/13/18		
Direction Photo Taken: North			
Description: View of the western side of Building D from the rear yard of the building.			



Appendix C – Figures

Figure 1. Locus Plan

Figure 2. Existing Conditions

Figure 3. Short Term Drainage Improvement Concepts (1 of 2)

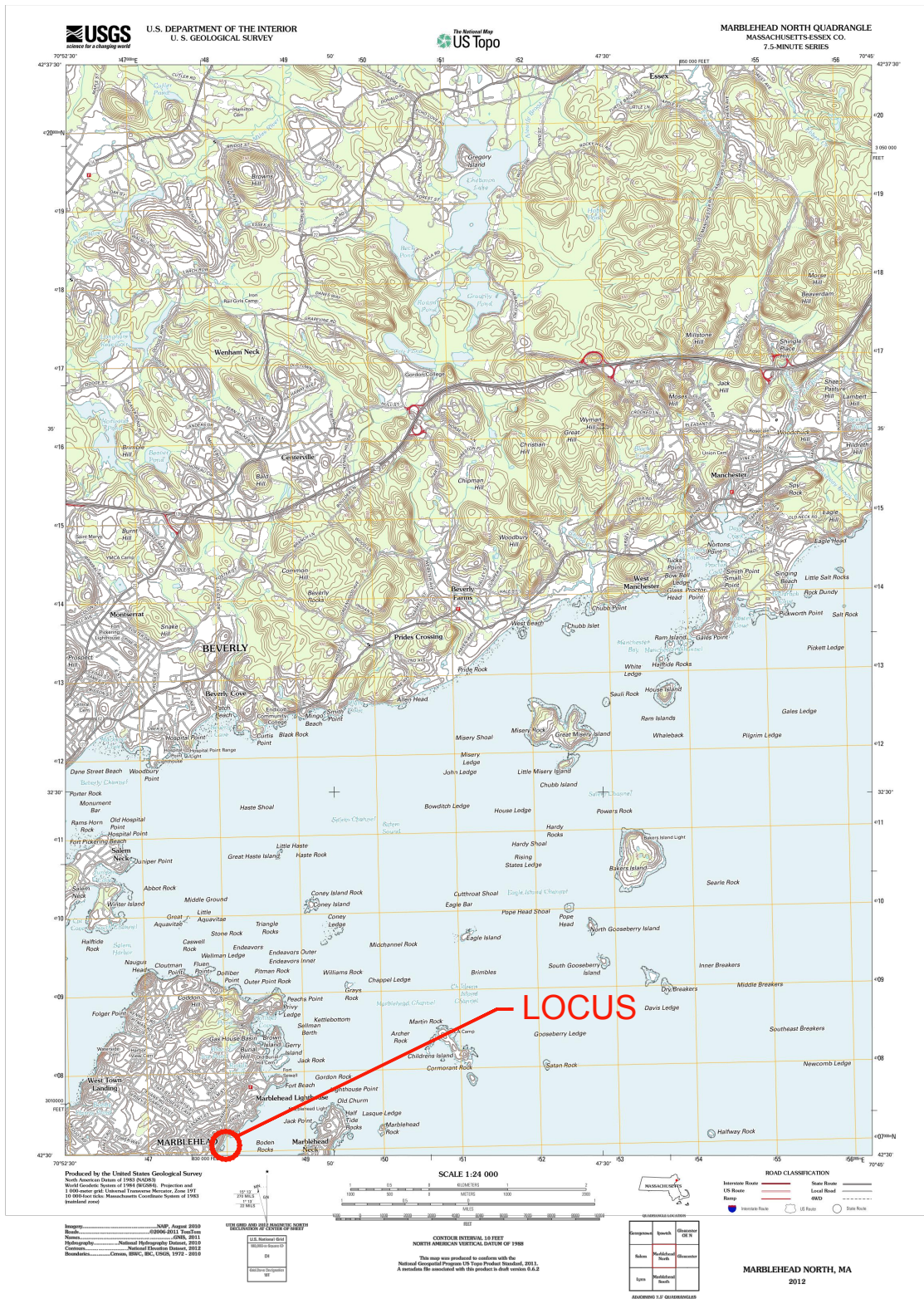
Figure 4. Short Term Drainage Improvement Concepts (2 of 2)

Figure 5. Short Term Drainage Improvement Concepts – Typical Details and Section

Figure 6. Long Term Drainage Improvement Concepts (1 of 2)

Figure 7. Long Term Drainage Improvement Concepts (2 of 2)

Figure 8. Long Term Drainage Improvement Concepts – Typical Details and Section



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LESLEY MANAGEMENT HARBORSIDE CONDOMINIUMS
24 LEE STREET
MARBLEHEAD, MASSACHUSETTS

LOCUS PLAN

PREPARED BY:

GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:

LESLEY MANAGEMENT
24 LEE STREET
MARBLEHEAD, MASSACHUSETTS 01945

PROJ MGR: DAS

REVIEWED BY: PJW

CHECKED BY: ABB

DESIGNED BY: DAS

DRAWN BY: LT/RKT

SCALE: AS SHOWN

DATE: FEBRUARY, 2017

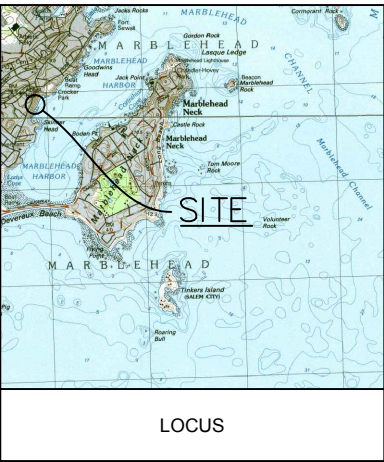
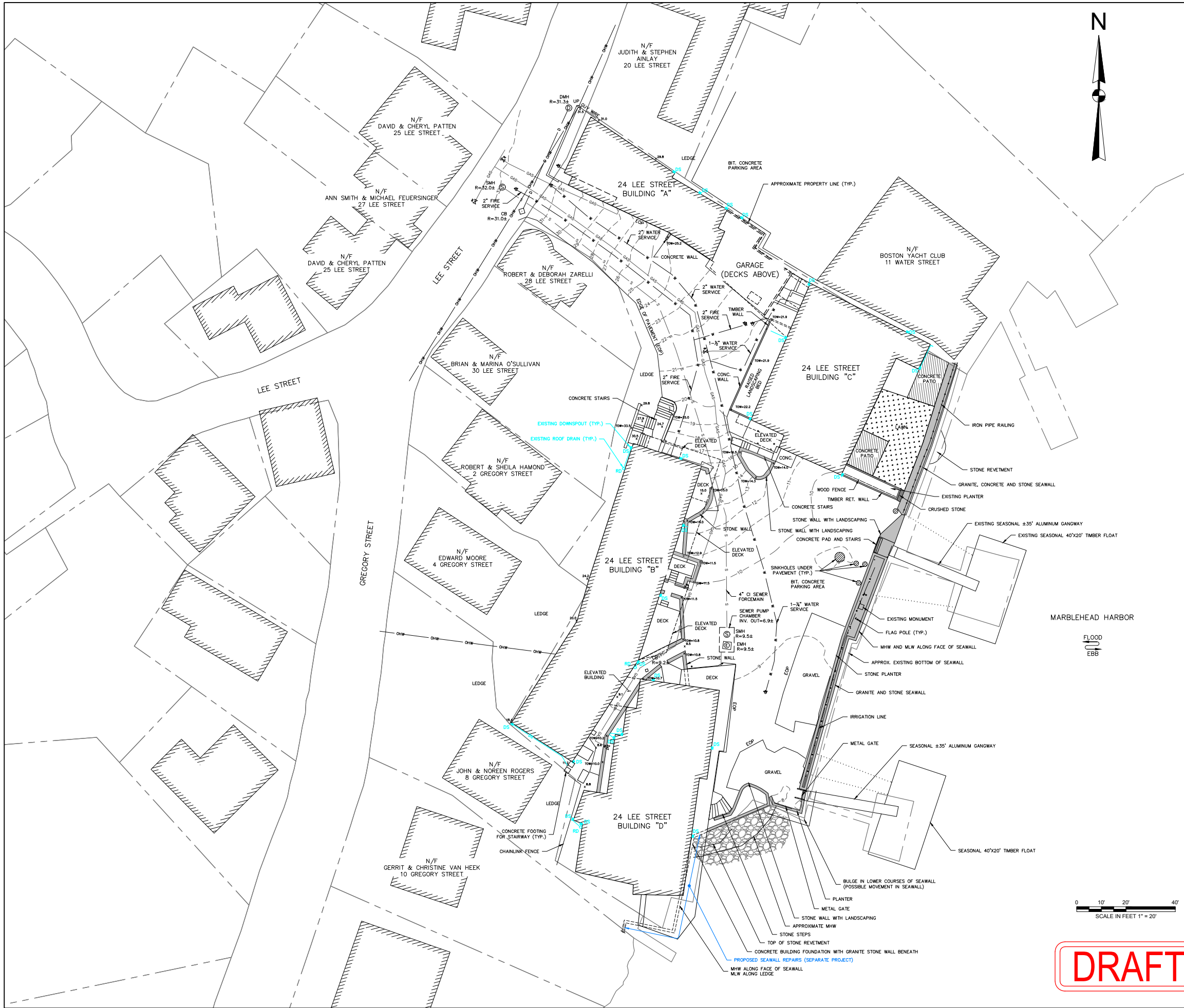
PROJECT NO. 18.0172708.00

REVISION NO.

FIGURE

1

SHEET NO. 1 OF 2

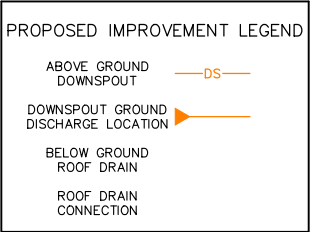


LEGEND	
CONTOUR	—15—
SPOT GRADE	x 5.0
WATER SHUT OFF	⊕
WATER VALVE	⊗
WATER LINE	—W—
UTILITY POLE	⊕
OVERHEAD WIRES	—OHW—
DRAIN MANHOLE	⊕
CATCH BASIN	□
DRAIN LINE	—D—
SEWER MANHOLE	⊕
SEWER LINE	—S—
GAS VALVE	⊗
GAS LINE	—G—
DOWNSPOUT	⊗ DS
ROOF DRAIN	⊗ RD
STONE WALL	—
APPROX. PROP. LINE	---

- GENERAL NOTES:**
- EXISTING TOPOGRAPHIC AND UTILITY INFORMATION BASED ON RTK GPS AND TOTAL STATION FIELD SURVEYS BY GZA GEOENVIRONMENTAL, INC. (GZA) ON AUGUST 3, 2016 AND MAY 24, 2018 AND REPRESENTS CONDITIONS AT THE TIME OF THE SURVEY.
 - PROPERTY LINES SHOWN ARE APPROXIMATE AND BASED ON TOWN OF MARBLEHEAD ASSESSORS PROPERTY INFORMATION SHAPEFILE OBTAINED FROM THE OFFICE OF GEOGRAPHIC INFORMATION (MassGIS), COMMONWEALTH OF MASSACHUSETTS INFORMATION TECHNOLOGY DIVISION INFORMATION DATABASE.
 - VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 1988). VERTICAL ELEVATIONS ARE BASED ON RTK GPS OBSERVATIONS MADE ON AUGUST 3, 2016 USING THE MassDOT MacORS NETWORK.
 - UTILITY INFORMATION SHOWN IS BASED ON BOTH FIELD SURVEY AND THE LATEST PLANS OF RECORD. THE LOCATIONS OF ALL STRUCTURES AND UTILITIES ARE APPROXIMATE AND SHALL BE VERIFIED BY CONTRACTOR PRIOR TO CONSTRUCTION. AT LEAST 72 HOURS PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY, IN WRITING, ALL UTILITIES SERVING THE SITE AND CALL 'DIG SAFE' 811.
 - THE ENGINEER SHALL BE NOTIFIED OF ANY DISCREPANCIES WHICH WILL AFFECT SITE DESIGN. NO CHANGES IN THE FIELD SHALL BE MADE WITHOUT PRIOR NOTIFICATION OF THE DESIGN ENGINEER.

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HARBORSIDE CONDOMINIUMS 24 LEE STREET MARBLEHEAD, MASSACHUSETTS			
EXISTING CONDITIONS			
PREPARED BY:  GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: LESLIE MANAGEMENT, INC. MARBLEHEAD, MASSACHUSETTS	
PROJ MGR: MAG	REVIEWED BY: PJW	CHECKED BY: ABB	FIGURE
DESIGNED BY:	DRAWN BY: MAG	SCALE: AS SHOWN	2
DATE: NOVEMBER 2018	PROJECT NO. 18.0173596	REVISION NO.	SHEET NO.



CONTOUR	— 15 —
SPOT GRADE	x 5.0
WATER SHUT OFF	⊕ 50
WATER VALVE	WV
WATER LINE	— W —
UTILITY POLE	⌋
OVERHEAD WIRES	— OHW —
DRAIN MANHOLE	⊙
CATCH BASIN	□
DRAIN LINE	— D —
SEWER MANHOLE	⊙
SEWER LINE	— S —
GAS VALVE	GV
GAS LINE	— G —
DOWNSPOUT	⊠ DS
ROOF DRAIN	○ RD
STONE WALL	▬
APPROX. PROP. LINE	— · — · —

DRAFT



NOTES:
1. SEE SHEET 1 FOR GENERAL NOTES.

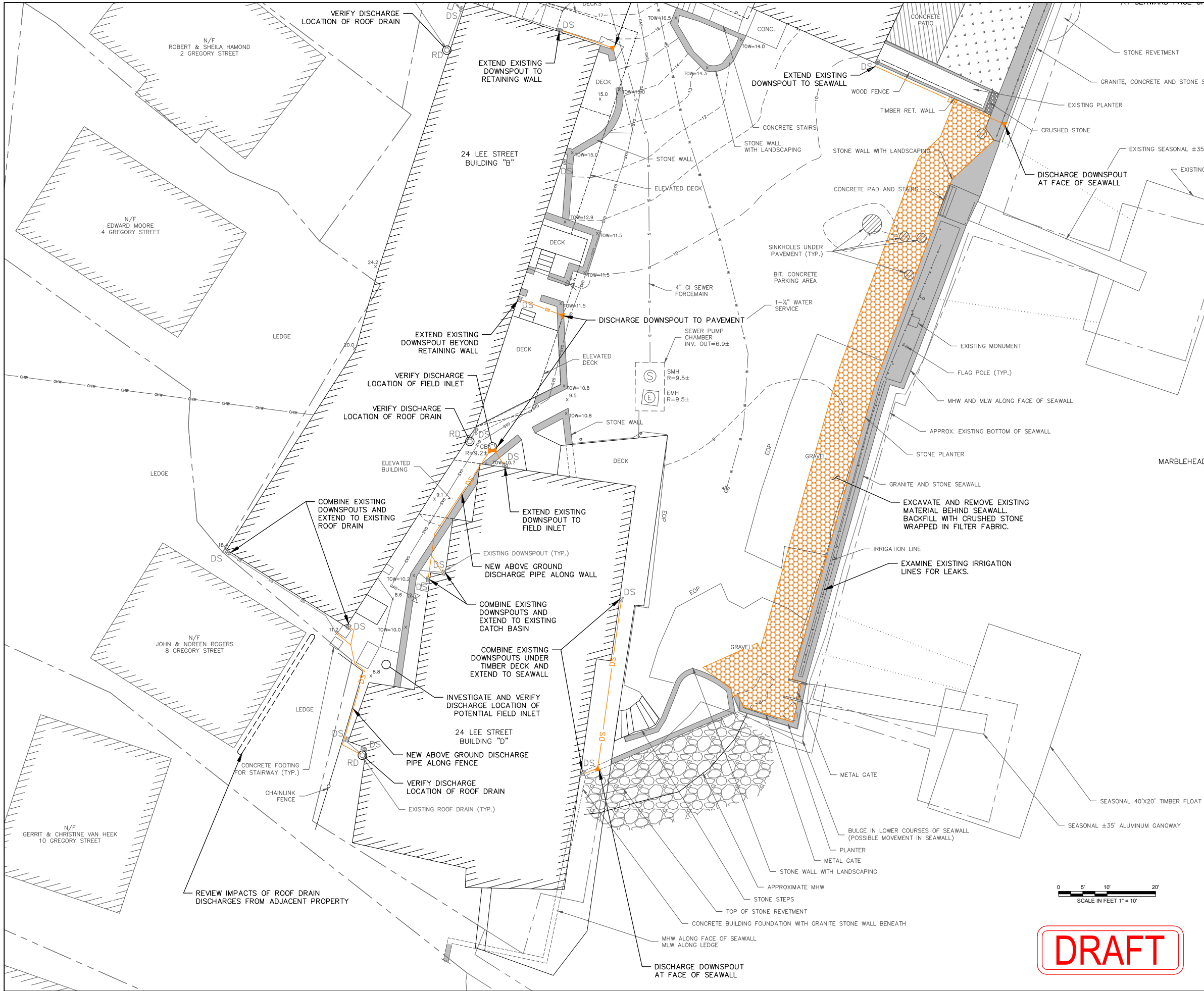
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HARBORSIDE CONDOMINIUMS
24 LEE STREET
MARBLEHEAD, MASSACHUSETTS

SHORT TERM DRAINAGE IMPROVEMENT CONCEPTS
(1 OF 2)

PREPARED BY:  GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: LESLIE MANAGEMENT, INC. MARBLEHEAD, MASSACHUSETTS	
PROJ MGR: MAG DESIGNED BY: DATE:	REVIEWED BY: PJW DRAWN BY: MAG PROJECT NO. 18.0173596	CHECKED BY: ABB SCALE: AS SHOWN REVISION NO.	FIGURE 3 SHEET NO.

© 2018 - GZA GeoEnvironmental, Inc. CZA-18.0173596 - Lee St Drainage Improvements-CAD\Drawings\18.0173596 - drainage improvement concepts - november 2018 - DRAFT.dwg [SHORT 2] November 07, 2018 - 2:39pm matthew.groschedl



PROPOSED IMPROVEMENT LEGEND

- ABOVE GROUND DOWNSPOUT — DS —
- DOWNSPOUT GROUND DISCHARGE LOCATION — DS —
- BELOW GROUND ROOF DRAIN — RD —
- ROOF DRAIN CONNECTION — RD —

LEGEND

- CONTOUR — 15 —
- SPOT GRADE — x 5.0 —
- WATER SHUT OFF — W —
- WATER VALVE — W —
- WATER LINE — W —
- UTILITY POLE — U —
- OVERHEAD WIRES — OHW —
- DRAIN MANHOLE — D —
- CATCH BASIN — C —
- DRAIN LINE — D —
- SEWER MANHOLE — S —
- SEWER LINE — S —
- GAS VALVE — G —
- GAS LINE — G —
- DOWNSPOUT — DS —
- ROOF DRAIN — RD —
- STONE WALL — S —
- APPROX. PROP. LINE — - - -

NOTES:
1. SEE SHEET 1 FOR GENERAL NOTES.

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HARBORSIDE CONDOMINIUMS 24 LEE STREET MARBLEHEAD, MASSACHUSETTS			
SHORT TERM DRAINAGE IMPROVEMENT CONCEPTS (2 OF 2)			
PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: LESLIE MANAGEMENT, INC. MARBLEHEAD, MASSACHUSETTS	
PROJ MGR: MAG	REVIEWED BY: PJW	CHECKED BY: ABB	FIGURE 4 SHEET NO.
DESIGNED BY:	DRAWN BY: MAG	SCALE: AS SHOWN	
DATE: NOVEMBER 2018	PROJECT NO. 18.0173596	REVISION NO.	



TYPICAL FLEXIBLE DOWNSPOUT EXTENSION
NOT TO SCALE



TYPICAL FLIP-UP DOWNSPOUT EXTENSION
NOT TO SCALE



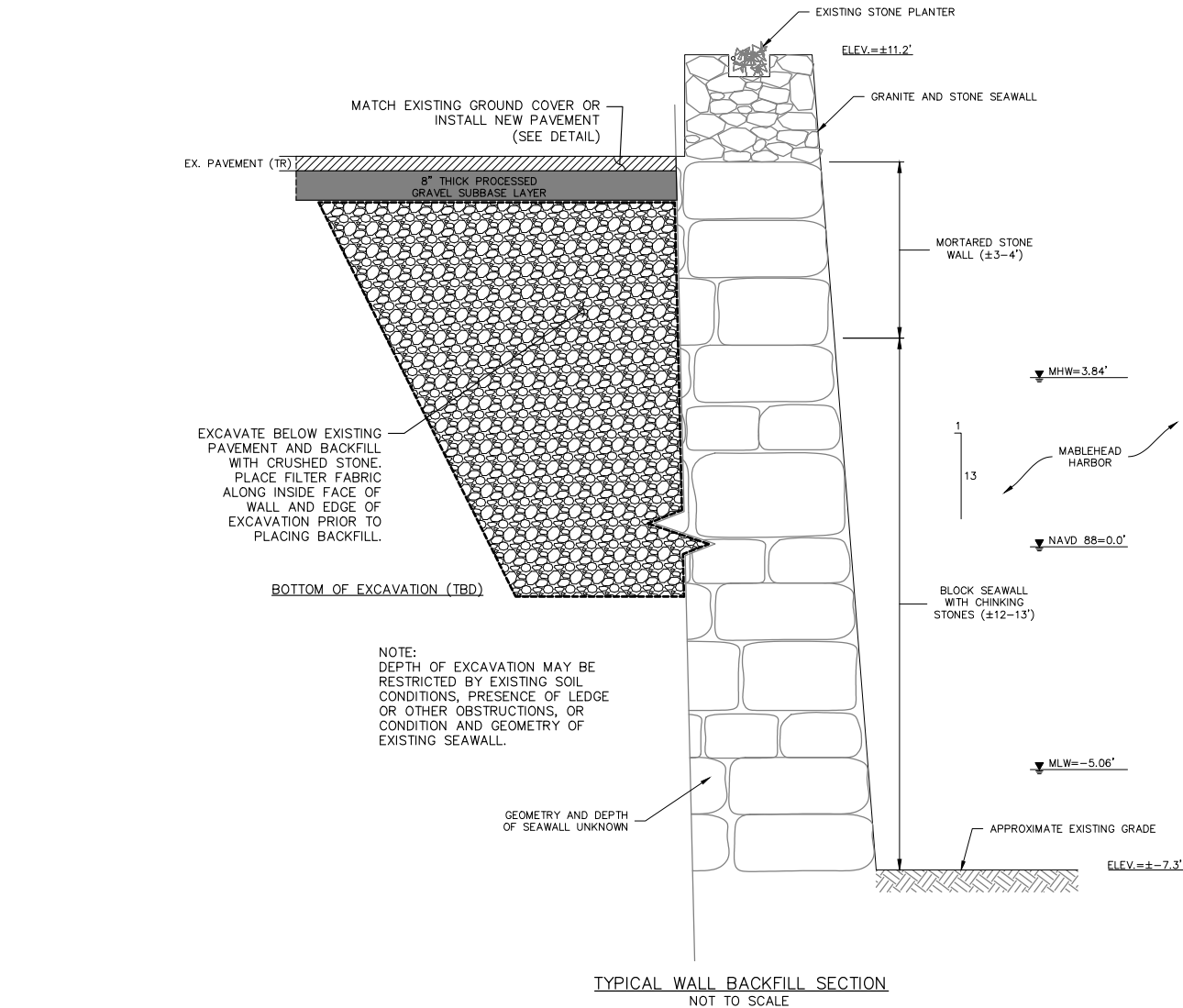
TYPICAL RETRACTABLE DOWNSPOUT EXTENSION
NOT TO SCALE



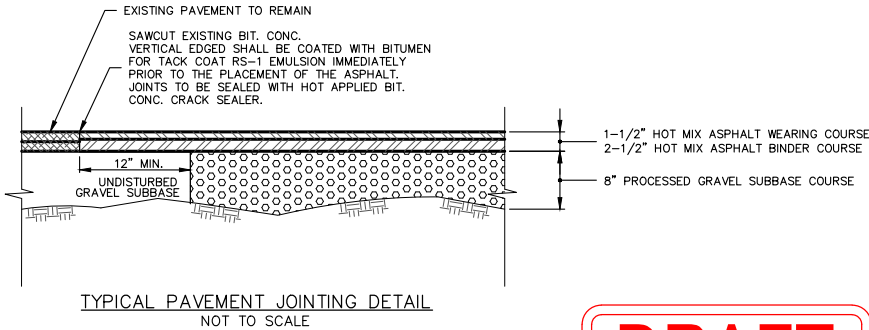
TYPICAL LOW-PROFILE DOWNSPOUT EXTENSION
NOT TO SCALE



TYPICAL RAIN BARREL
NOT TO SCALE



TYPICAL WALL BACKFILL SECTION
NOT TO SCALE



TYPICAL PAVEMENT JOINTING DETAIL
NOT TO SCALE

NOTES:
1. SEE SHEET 1 FOR GENERAL NOTES.

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HARBORSIDE CONDOMINIUMS 24 LEE STREET MARBLEHEAD, MASSACHUSETTS			
SHORT TERM DRAINAGE IMPROVEMENT CONCEPT TYPICAL DETAILS AND SECTION			
PREPARED BY:  GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: LESLIE MANAGEMENT, INC. MARBLEHEAD, MASSACHUSETTS	
PROJ MGR: MAG	REVIEWED BY: PJW	CHECKED BY: ABB	FIGURE
DESIGNED BY:	DRAWN BY: MAG	SCALE: AS SHOWN	5
DATE: NOVEMBER 2018	PROJECT NO. 18.0173596	REVISION NO.	SHEET NO.

DRAFT

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PROPOSED IMPROVEMENT LEGEND	
ABOVE GROUND DOWNSPOUT	—DS—
DOWNSPOUT GROUND DISCHARGE LOCATION	◀
BELOW GROUND ROOF DRAIN	—RD—
ROOF DRAIN CONNECTION	○

LEGEND	
CONTOUR	—15—
SPOT GRADE	x 5.0
WATER SHUT OFF	⊕
WATER VALVE	⊗
WATER LINE	—W—
UTILITY POLE	⊕
OVERHEAD WIRES	—OHW—
DRAIN MANHOLE	⊕
CATCH BASIN	□
DRAIN LINE	—D—
SEWER MANHOLE	⊕
SEWER LINE	—S—
GAS VALVE	⊗
GAS LINE	—G—
DOWNSPOUT	⊗ DS
ROOF DRAIN	○ RD
STONE WALL	▬
APPROX. PROP. LINE	- - -

DRAFT



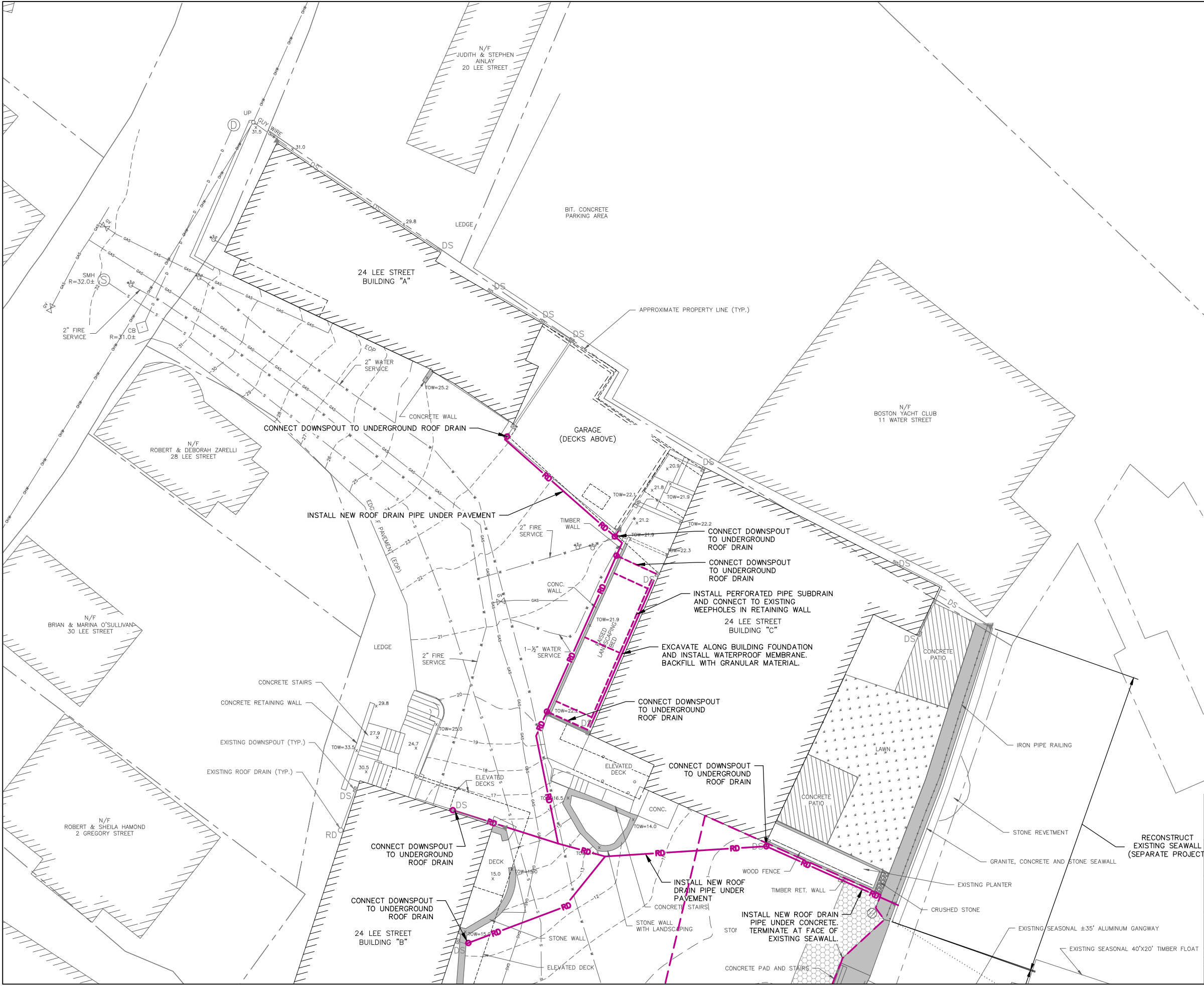
NOTES:
1. SEE SHEET 1 FOR GENERAL NOTES.

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HARBORSIDE CONDOMINIUMS
24 LEE STREET
MARBLEHEAD, MASSACHUSETTS

LONG TERM DRAINAGE IMPROVEMENT CONCEPTS
(1 OF 2)

PREPARED BY:  GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: LESLIE MANAGEMENT, INC. MARBLEHEAD, MASSACHUSETTS	
PROJ MGR: MAG	REVIEWED BY: PJW	CHECKED BY: ABB	FIGURE 6 SHEET NO.
DESIGNED BY:	DRAWN BY: MAG	SCALE: AS SHOWN	
DATE: NOVEMBER 2018	PROJECT NO. 18.0173596	REVISION NO.	

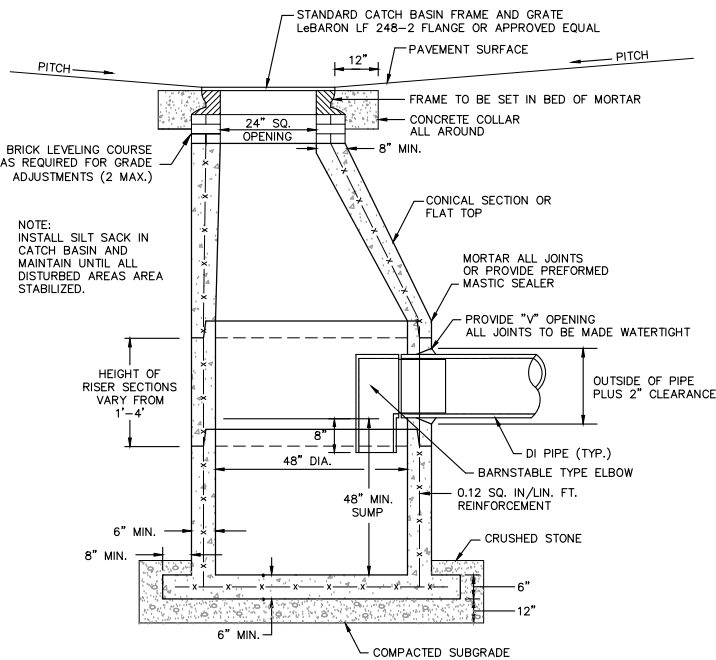


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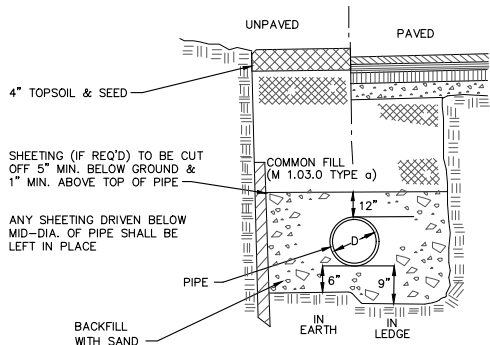
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TYPICAL DOWNSPOUT/ROOF DRAIN SYSTEM
NOT TO SCALE



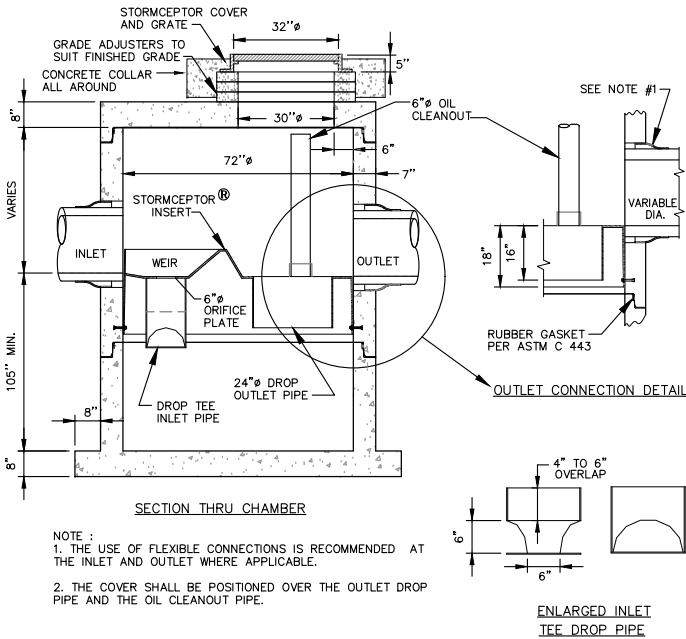
PRECAST CONCRETE CATCH BASIN
NOT TO SCALE



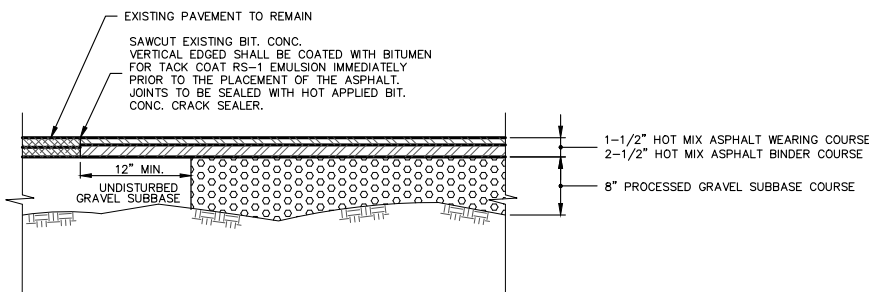
TYPICAL PIPE TRENCH DETAIL
NOT TO SCALE



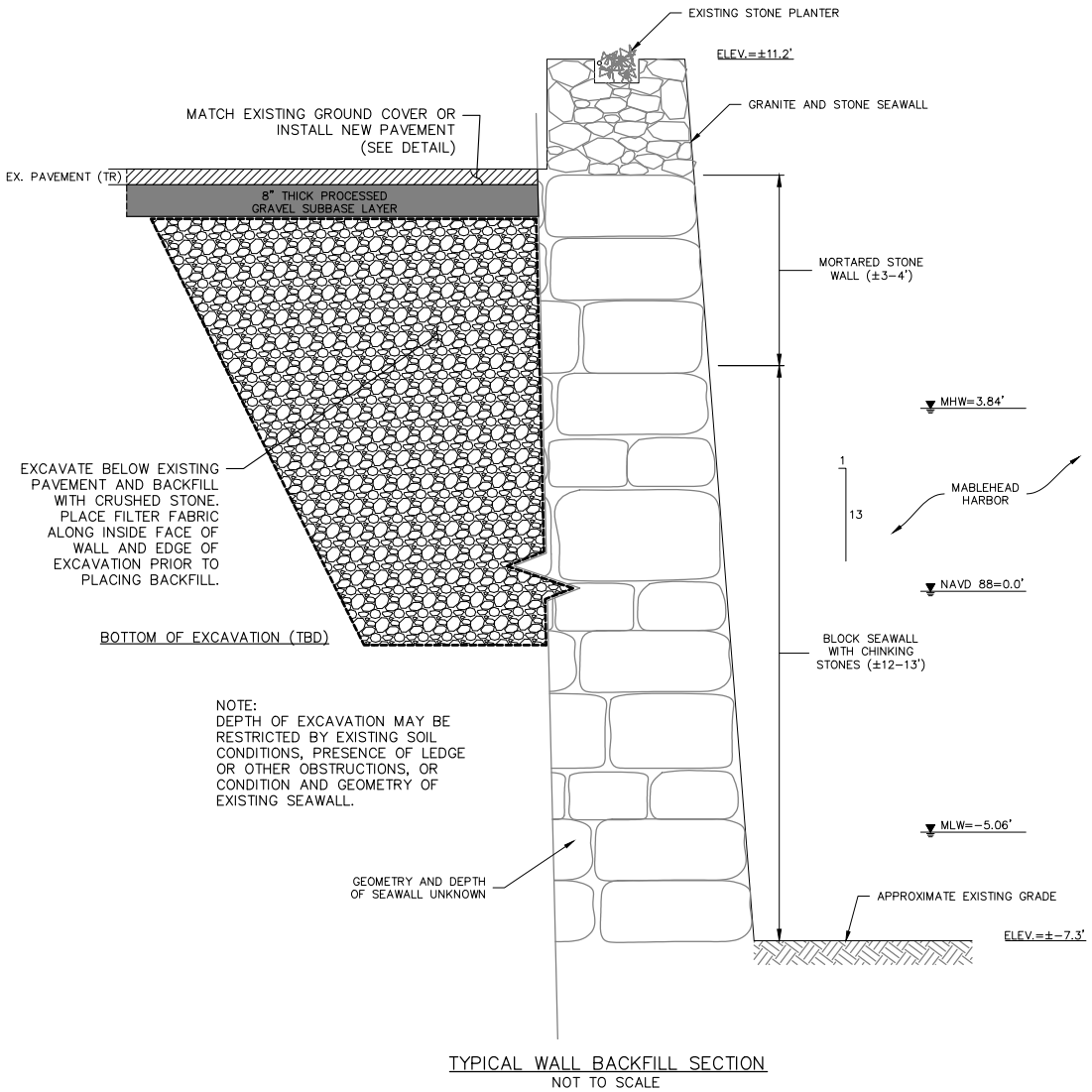
TYPICAL DOWNSPOUT DEBRIS SCREEN
NOT TO SCALE



PRECAST CONCRETE STORMWATER TREATMENT UNIT
NOT TO SCALE



TYPICAL PAVEMENT JOINTING DETAIL
NOT TO SCALE



TYPICAL WALL BACKFILL SECTION
NOT TO SCALE

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NOTES:
1. SEE FIGURE 2 FOR GENERAL NOTES.

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**LONG TERM DRAINAGE IMPROVEMENT CONCEPT
TYPICAL DETAILS AND SECTION**

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: LESLIE MANAGEMENT, INC. MARBLEHEAD, MASSACHUSETTS	
PROJ MGR: MAG	DESIGNED BY: MAG	REVIEWED BY: PJW	CHECKED BY: ABB
DATE: NOVEMBER 2018	PROJECT NO. 18.0173596	DRAWN BY: MAG	SCALE: AS SHOWN
		REVISION NO.	FIGURE 8
		SHEET NO.	