

**STATEN ISLAND MALL
STATEN ISLAND, NEW YORK
REMEDIAL ACTION WORK PLAN
FOR LOT 80 ONLY**

**OER Project Number 16EHAZ109R
Voluntary Cleanup Number: 16CVCP050R**

**Staten Island Mall
2655 Richmond Avenue
Staten Island, New York
Block 2400, Lot 80**

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LIST OF ACRONYMS

Acronym	Definition
AOC	Area of Concern
AS/SVE	Air Sparging/Soil Vapor Extraction
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Plan
C&D	Construction and Demolition
CEQR	City Environmental Quality Review
CFR	Code of Federal Regulations
CHASP	Construction Health and Safety Plan
COC	Contaminants of Concern
CQAP	Construction Quality Assurance Plan
CSOP	Contractors Site Operation Plan
DCR	Declaration of Covenants and Restrictions
ECs/ICs	Engineering Controls and Institutional Controls
ELAP	Environmental Laboratory Accreditation Program
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations Emergency Response
IRM	Interim Remedial Measure
MNA	Monitored Natural Attenuation
NOC	Notice of Completion
NYS DEC	New York State Department of Environmental Conservation
NYC DEP	New York City Department of Environmental Protection
NYC DOHMH	New York State Department of Health and Mental Hygiene
NYC OER	New York City Office of Environmental Remediation
NYC VCP	New York City Voluntary Cleanup Program
NYCRR	New York Codes Rules and Regulations
NYS DEC	New York State Department of Environmental Conservation
NYS DEC DER	New York State Department of Environmental Conservation Division of Environmental Remediation
NYS DOH	New York State Department of Health

LIST OF ACRONYMS

Acronym	Definition
NYS DOT	New York State Department of Transportation
ORC	Oxygen-Release Compound
OSHA	United States Occupational Health and Safety Administration
PCBs	Polychlorinated Biphenyls
PE	Professional Engineer
PID	Photo Ionization Detector
QEP	Qualified Environmental Professional
QHHEA	Qualitative Human Health Exposure Assessment
RAOs	Remedial Action Objectives
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan or Plan
RCA	Recycled Concrete Aggregate
RD	Remedial Design
RI	Remedial Investigation
RMZ	Residual Management Zone
SCOs	Soil Cleanup Objectives
SCG	Standards, Criteria and Guidance
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SSDS	Sub-Slab Depressurization System
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
USGS	United States Geological Survey
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VOC	Volatile Organic Compound

CERTIFICATION

I, David Bligh, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for designing the remedial program for the Staten Island Mall, 2655 Richmond Avenue, Staten Island, New York Site (Block 2400, Lot 80), OER number 16EHAZ109R. I certify to the following:

- I have reviewed this document and the Stipulation List, to which my signature and seal are affixed.
- Engineering Controls developed for this remedial action were designed by me or a person under my direct supervision and designed to achieve the goals established in this Remedial Action Work Plan for this site.
- The Engineering Controls to be constructed during this remedial action are accurately reflected in the text and drawings of the Remedial Action Work Plan and are of sufficient detail to enable proper construction.
- This Remedial Action Work Plan (RAWP) has a plan for handling, transport and disposal of soil, fill, fluids and other materials removed from the property in accordance with applicable City, State and Federal laws and regulations. Importation of all soil, fill and other material from off-Site will be in accordance with all applicable City, State and Federal laws and requirements. This RAWP has provisions to control nuisances during the remediation and all invasive work, including dust and odor suppression.

David Bligh

Name

090826

PE License Number

David J Bligh

Signature

12/21/15

Date



I, Frank Cherena, am a qualified Environmental Professional. I will have primary direct responsibility for implementation of the remedial program for the Staten Island Mall, 2655 Richmond Avenue, Staten Island, New York Site (Block 2400, Lot 80), site number 16EHAZ109R. I certify to the following:

- This Remedial Action Work Plan (RAWP) has a plan for handling, transport and disposal of soil, fill, fluids and other materials removed from the property in accordance with applicable City, State and Federal laws and regulations. Importation of all soil, fill and other material from off-Site will be in accordance with all applicable City, State and Federal laws and requirements. This RAWP has provisions to control nuisances during the remediation and all invasive work, including dust and odor suppression.

Frank Cherena

QEP Name

Frank Cherena

QEP Signature

12/21/15

Date

EXECUTIVE SUMMARY

GGP Staten Island Mall, LLC (GGP) is working with the NYC Office of Environmental Remediation (OER) in the New York City Voluntary Cleanup Program to investigate and remediate a 154,000-square foot site (Lot 80 only) located at 2655 Richmond Avenue in Staten Island, New York. A remedial investigation (RI) was performed to compile and evaluate data and information necessary to develop this Remedial Action Work Plan (RAWP). The remedial action described in this document provides for the protection of public health and the environment consistent with the intended property use, complies with applicable environmental standards, criteria and guidance and conforms with applicable laws and regulations.

Site Location and Background

The Site is located at 2655 Richmond Avenue in the New Springville section in Staten Island, New York and is identified as Block 2400 and Lot 80 on the New York City Tax Map. Figure 1 shows the Site location. The Site is approximately 154,000-square feet (Lot 80 only). A map of the Site boundary is shown in Figure 2. Currently, the Site is used for commercial retail business and contains parking for the Staten Island Mall, as well as a Macy's retail store. The Staten Island Mall is a retail space occupied by approximately 168 tenants (Block 2400, Lot 180). Abutting the Staten Island Mall are three "anchor" stores located adjacent to the main facility: Macy's (Block 2400, Lot 118); J.C. Penney's (Block 2400, Lot 210); and Sears (Block 2400, Lot 375). Lots 7, 20, 30, 70, 118, 140, 180, 190, 200, and 210 are not considered part of the Site; a separate document will be prepared to address Lots 7, 20, 30, 70, 118, 140, 180, 190, 200, and 210 at a later date. Lot 375 is also not considered part of the Site, and no improvements are planned as part of this redevelopment.

Summary of Redevelopment Plan

The proposed future use of the Site will consist of the construction of a new parking deck (Lot 80). The new parking deck will be constructed as a slab on grade structure. Localized excavations will occur for footings and for utility installation ranging from 4 to 6 feet below land surface (bls). Layout of the proposed Site development is presented in Figure 3. Proposed redevelopment plans are provided in Appendix A. The current zoning designation is C4-1 used

for commercial and office buildings. The proposed use is consistent with existing zoning for the Site.

Summary of Surrounding Property

Surrounding properties are primarily residential and commercial (retail). The Site is bounded to the north along Richmond Hill Road by residential properties; to the east across Marsh Avenue by Public School P.S. 58 and residential properties; to the south by Sears and across Platinum Avenue by a retail strip mall, and to the west across Richmond Avenue by the Fresh Kills Landfill. Nearby water bodies include the Springville Creek and Richmond Creek, located respectively to the west and south of the Site. These water bodies are interconnected and drain to the Fresh Kills.

Summary of Past Site Uses and Areas of Concern

Former Site uses include agricultural use with onsite greenhouses (1930s), an aircraft aviation school and civilian airport (1950s), a golf driving range surrounded by residential dwellings (1960s), a sewage treatment plant with a gasoline filling station and commercial retail stores (1970s), and a shopping mall (1970s to current). Nearby water bodies include the Springville Creek and Richmond Creek, located respectively to the west and south of the Site. These water bodies are interconnected and drain to the Fresh Kills.

Block 2400, Lot 80 is currently owned by GGP and was purchased in October 1980 from Thomas J. Hartigan, as a trustee of Twenty Seven Trust. According to the Ameristar Chain of Ownership Report Lot 80 was sold to Twenty Seven Trust by SIM Mall Inc. (an affiliate of GGP) in 1980. John J. Kelly sold Lot 180 to SIM Mall Inc. in February 1978. The ownership of Lot 80 has not changed since 1980.

The following Areas of Concern (AOCs) were anticipated at the Site:

- Potential presence of historic fill of an unknown origin;
- Potential impacts from pesticide usage, specifically insecticides, due to historic agricultural use and the presence of a greenhouse in the 1930's; and
- Potential contamination due to the historic airport runway and aviation school formerly located at the Site.

Summary of Work Performed under the Remedial Investigation

On behalf of GGP, Roux Associates, Inc., (Roux Associates) performed the following scope of work:

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Installed nine soil borings across the Site (Lot 80), and collected 18 soil samples for chemical analysis from the soil borings to evaluate soil quality;
3. Installed nine groundwater monitoring wells throughout the property to establish groundwater flow and collected one groundwater sample from the Site (Lot 80) for chemical analysis to evaluate groundwater quality;
4. Installed three soil vapor probes around Site perimeter (Lot 80) and collected three samples for chemical analysis.

Summary of Findings of Remedial Investigation

A RI was performed and the results are documented in a companion document called “Remedial Investigation Report, Staten Island Mall”, dated December 2015 (RIR).

1. Elevation of the Site ranges from approximately 31.52 feet above mean sea level on the west side to 54.41 feet above mean sea level on the east side.
2. Depth to groundwater was measured at 12.80 feet bls at the Site.
3. Groundwater flow is generally from east to west beneath the Site, toward Springville Creek and ultimately the Fresh Kill.
4. Depth to bedrock ranges from approximately 16 to 24 feet bls at the Site.
5. The stratigraphy of the Site, from the surface down, consists of 16 to 24 feet bls of silt and fine sand with a varying mixture of medium to coarse sand, gravel, clay, and cobble underlain by Serpentinite bedrock.
6. A total of 72 soil samples were collected for laboratory analysis from 38 soil borings during the 2013 Phase II ESA and 2015 RI and are summarized below. Soil/fill samples results were compared to New York State Department of Environmental Conservation (NYSDEC) Unrestricted Use Soil Cleanup Objectives and Restricted Residential Use Soil Cleanup Objectives (SCOs) as presented in 6NYCRR Part 375-6.8.

Lot 80: Soil samples were collected from nine soil borings installed on Lot 80. Soil/fill results showed no volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs) or pesticides were detected in any of the soil samples. Trace concentrations of several semivolatile organic compounds (SVOCs) including bis phthalate, benzo(a)pyrene, benzo(b)fluoranthene, and chrysene were detected in three soil borings.

Metals including chromium (max. 31.9 parts per million [ppm]), copper (max. 69 ppm) and nickel (max. 221 ppm) were detected at concentrations above Track 1 Unrestricted Use SCOs. There were no exceedances of Commercial Use SCOs in Lot 80 during the RI.

7. Nine groundwater samples collected from Lots 20, 80 and 180, and were compared to the NYSDEC Ambient Water Quality Standards and Guidance Values (AWQSGVs). The groundwater samples did not contain any exceedances of the AWQSGVs for VOCs, SVOCs, PCBs, and pesticides. Filtered and Unfiltered Metals were detected in groundwater above AWQSGVs at all monitoring well locations through the detections of magnesium and sodium groundwater samples. The detections ranged from 48,700 micrograms per Liter ($\mu\text{g/L}$) to 159,000 $\mu\text{g/L}$ for magnesium and 97,600 $\mu\text{g/L}$ to 631,000 $\mu\text{g/L}$ for sodium across the Site. The elevated detections of magnesium and sodium are likely from salt water intrusion from the nearby surface water bodies.
8. Thirteen soil vapor samples from Lots 20, 80 and 180 were collected, analyzed and compared to the regulatory guidance on soil vapor and indoor air quality as presented in Matrix 1 and Matrix 2 from the New York State Department of Health (NYSDOH) Center for Environmental Health (CEH) Bureau of Environmental Exposure Investigation (BEEI) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006. Several compounds including cis-1,2-dichloroethene (1,2-DCE) (detected at two samples, SV-13 and SV-14, at max. of 18.0 micrograms per meters cubed [ug/m^3]), tetrachloroethene (PCE) (detected in eleven points and ranged from 3.6 ug/m^3 to 3,900 ug/m^3 at SV-13). Trichloroethene (TCE) was detected at five points and ranged in concentrations from 1.4 ug/m^3 to 290 ug/m^3 (SV-13). Dichlorodifluoromethane was detected at eleven soil vapor samples at maximum of 5,700 ug/m^3 . Methyl-tertiary butyl ether (MTBE) was detected at six soil vapor samples at a maximum concentration of 680 ug/m^3 . Methane was detected at two soil vapor samples SV-3 (0.44 % volume by volume [v/v]) and SV-7 (22.0 % v/v). The concentrations of all chlorinated and petroleum related compounds were above the monitoring level ranges established within the NYSDOH Final Guidance on Soil Vapor Intrusion. Methane was only detected in the eastern parcel of Lot 180, and may be the result of decaying organic material that was observed within some silt layers during the RI.

Lot 80: There were no detections of matrices compounds above their corresponding indoor air concentrations.

Summary of the Remedial Action

The proposed remedial action achieves protection of public health and the environment for the intended use of the property. The proposed remedial action achieves all of the remedial action objectives established for the project and addresses applicable standards, criterion, and guidance; is effective in both the short-term and long-term and reduces mobility, toxicity and volume of

contaminants; is cost effective and implementable; and uses standards methods that are well established in the industry.

The proposed remedial action will consist of:

1. Preparation of a Community Protection Statement and performance of all required New York City Voluntary Cleanup Program (NYC VCP) Citizen Participation activities according to an approved Citizen Participation Plan.
2. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.
3. Selection of 6 NYCRR Part 375 Section 6.8 (b) Track 2 Residential SCOs.
4. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
5. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility(s).
6. Excavation and removal of soil/fill exceeding Track 2 Residential SCOs. Portions of the parking garage footprint will be excavated to a depth of approximately 6 feet below grade for development purposes. Approximately, 8000 tons of soil will be excavated and removed from this Site.
7. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a photoionization detector (PID). Appropriate segregation of excavated media on-Site.
8. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.
9. Registration of tanks and reporting of any petroleum spills associated with underground storage tanks (UST's) and appropriate closure of these petroleum spills in compliance with applicable local, State and Federal laws and regulations.
10. Transportation and off-Site disposal of all soil/fill material at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal facilities. Appropriate segregation of excavated media on-Site.
11. Collection and analysis of end-point samples to determine the performance of the remedy with respect to attainment of SCOs.

12. Demarcation of residual soil/fill in landscaped areas.
13. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
14. Construction of an engineered composite cover consisting of a four-inch thick asphalt layer with a 6-inch clean granular sub-base beneath all building areas, 4-inch poured concrete on a 6-inch sub-base in sidewalk areas, and one foot of clean soil in all open space and landscaped areas.
15. Construction and operation of an open air grade-level parking garage in conformance with NYC Building Code.
16. Performance of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
17. Dewatering, if needed, in compliance with city, state, and federal laws and regulations. Extracted groundwater will either be containerized for off-site licensed or permitted disposal or will be treated under a permit from New York City Department of Environmental Protection (NYCDEP) to meet pretreatment requirements prior to discharge to the sewer system.
18. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
19. Submission of a Remedial Action Report (RAR) that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, lists any changes from this RAWP, and describes all Engineering and Institutional Controls to be implemented at the Site.
20. If Track 2 Residential Use is not attainable, a Track 2 Restricted Residential Use or Track 2 Commercial remedial action will be used, with Site management only required if a Track 2 Commercial remedial action is not achieved. If a Track 2 Commercial Use remedial action is not achieved, submission of an approved Site Management Plan (SMP) in the RAR for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
21. If Track 2 Residential Use is not attainable, a Track 2 Restricted Residential Use or Track 2 Commercial remedial action will be used, with Site management only required if a Track 2 Commercial remedial action is not achieved. If a Track 2 Commercial Use remedial action is not achieved, the property will continue to be registered with an E-Designation at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual

contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

COMMUNITY PROTECTION STATEMENT

The NYC Office of Environmental Remediation (OER) provides governmental oversight for the cleanup of contaminated property in NYC. This Remedial Action Work Plan (“cleanup plan”) describes the findings of prior environmental studies, shows the location of identified contamination at the site, and describes the plans to clean up the site to protect public health and the environment.

This cleanup plan provides a very high level of protection for neighboring communities and also includes many other elements that address common community concerns, such as community air monitoring, odor, dust and noise controls, hours of operation, good housekeeping and cleanliness, truck management and routing, and opportunities for community participation. The purpose of this Community Protection Statement is to explain these community protection measures in non-technical language to simplify community review.

Project Information:

- Site Name: Staten Island Mall
- Site Address: 2655 Richmond Avenue, Staten Island, New York
- NYC OER Project Number: 16EHAZ109R

Project Contacts:

- OER Project Manager: William H. Wong, 212-341-0659
- Site Project Manager: David Bligh, 631-232-2600
- Site Safety Officer: Alex Benmerrouche, 631-232-2600
- Online Document Repository:
http://www.nyc.gov/html/oer/html/repository/RStaten_Island.shtml

REMEDIAL INVESTIGATION AND CLEANUP PLAN: Under the oversight of the NYC OER, a thorough study of this property (called a remedial investigation) has been performed to identify past property usage, to sample and test soils, groundwater and soil vapor, and to identify

contaminant sources present on the property. The cleanup plan has been designed to address all contaminant sources that have been identified during the study of this property.

IDENTIFICATION OF SENSITIVE LAND USES: Prior to selecting a cleanup, the neighborhood was evaluated to identify sensitive land uses nearby, such as schools, day care facilities, hospitals and residential areas. The cleanup program was then tailored to address the special conditions of this community.

QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT: An important part of the cleanup planning for the Site is a study to find all of the ways that people might come in contact with contaminants at the Site now or in the future. This study is called a Qualitative Human Health Exposure Assessment (QHHEA). A QHHEA was performed for this project. This assessment has considered all known contamination at the Site and evaluated the potential for people to come in contact with this contamination. All identified public exposures will be addressed under this cleanup plan.

HEALTH AND SAFETY PLAN: This cleanup plan includes a Construction Health and Safety Plan (CHASP) that is designed to protect community residents and on-Site workers. The elements of this RAWP are in compliance with applicable safety requirements of the United States Occupational Safety and Health Administration (OSHA). This RAWP includes many protective elements including those discussed below.

SITE SAFETY COORDINATOR: This project has a designated Site safety coordinator to implement the CHASP. The safety coordinator maintains an emergency contact sheet and protocol for management of emergencies. The Site safety coordinator is identified at the beginning of this Community Protection Statement.

WORKER TRAINING: Workers participating in cleanup of contaminated material on this project are required to be trained in a 40-hour hazardous waste operators training course and to take annual refresher training. This pertains to workers performing specific tasks including removing contaminated material and installing cleanup systems in contaminated areas.

COMMUNITY AIR MONITORING PLAN: Community air monitoring will be performed during this cleanup project to ensure that the community is properly protected from contaminants, dust and odors. Air samples will be tested in accordance with a detailed plan called the Community Air Monitoring Plan or CAMP. Results will be regularly reported to the NYC Office of Environmental Remediation. This cleanup plan also has a plan to address any unforeseen problems that might occur during the cleanup (called a ‘Contingency Plan’).

ODOR, DUST AND NOISE CONTROL: This **cleanup** plan includes actions for odor and dust control. These actions are designed to prevent off-Site odor and dust nuisances and includes steps to be taken if nuisances are detected. Generally, dust is managed by application of physical covers and by water sprays. Odors are controlled by limiting the area of open excavations, physical covers, spray foams and by a series of other actions (called operational measures). The project is also required to comply with applicable NYC noise control standards. If you observe problems in these areas, please contact the onsite Project Manager or NYC Office of Environmental Remediation Project Manager listed on the first page of this Community Protection Statement document.

QUALITY ASSURANCE: This **cleanup** plan requires that evidence be provided to illustrate that all cleanup work required under the plan has been completed properly. This evidence will be summarized in the final report, called the Remedial Action Report. This report will be submitted to the NYC Office of Environmental Remediation and will be thoroughly reviewed.

STORMWATER MANAGEMENT: To limit the potential for soil erosion and discharge, this cleanup plan has provisions for stormwater management. The main elements of the stormwater management include physical barriers such as tarp covers and erosion fencing, and a program for frequent inspection.

HOURS OF OPERATION: The hours for operation of cleanup will comply with the NYC Department of Buildings construction code requirements or according to specific variances issued by that agency. For this cleanup project, the hours of operation will conform to requirements of the NYC Department of Buildings.

SIGNAGE: While the cleanup is in progress, a placard will be prominently posted at the main entrance of the property with a laminated project Fact Sheet that states that the project is in the NYC Voluntary Cleanup Program and provides project contact names and numbers, and a link to the document repository where project documents can be viewed.

COMPLAINT MANAGEMENT: The **contractor** performing this cleanup is required to address all complaints. If you have any complaints, you can call the facility Project Manager or the NYC Office of Environmental Remediation Project Manager listed on the first page of this Community Protection Statement document, or call 311 and mention the Site is in the NYC Voluntary Cleanup Program.

UTILITY MARK-OUTS: To promote safety during excavation in this cleanup, the contractor is required to first identify all utilities and must perform all excavation and construction work in compliance with NYC Department of Buildings regulations.

SOIL AND LIQUID DISPOSAL: All soil and liquid material removed from the Site as part of the cleanup will be transported and disposed of in accordance with all applicable City, State and Federal regulations, and required permits will be obtained.

SOIL CHEMICAL TESTING AND SCREENING: All excavations will be supervised by a trained and properly qualified environmental professional. In addition to extensive sampling and chemical testing of soils on the Site, excavated soil will be screened continuously using hand-held instruments, by sight, and by smell to ensure proper material handling and management, and community protection.

STOCKPILE MANAGEMENT: Soil stockpiles will be kept covered with tarps to prevent dust, odor and erosion. Stockpiles will be frequently inspected. Damaged tarp covers will be promptly replaced. Stockpiles will be protected with silt fences. Hay bales will be used, as needed, to protect storm water catch basins and other discharge points.

TRUCKS AND COVERS: Loaded trucks leaving the Site will be covered in compliance with applicable laws and regulations to prevent dust and odor. Trucks will be properly recorded in

logs and records and placarded in compliance with applicable City, State and Federal laws, including those of the New York State Department of Transportation. If loads contain wet material that can leak, truck liners will be used. All transport of materials will be performed by licensed truckers and in compliance with applicable laws and regulations.

IMPORTED MATERIAL: All fill materials proposed to be brought onto the Site will comply with rules outlined in this cleanup plan and will be inspected and approved by a qualified worker located on the Site. Waste materials will not be brought onto the Site. Trucks entering the Site with imported clean materials will be covered in compliance with applicable laws and regulations.

EQUIPMENT DECONTAMINATION: All equipment used for cleanup work will be inspected and washed, if needed, before it leaves the Site. Trucks will be cleaned at a truck inspection station on the property before leaving the Site.

HOUSEKEEPING: Locations where trucks enter or leave the Site will be inspected every day and cleaned regularly to ensure that they are free of dirt and other materials from the Site.

TRUCK ROUTING: Truck routes have been selected to: (a) limit transport through residential areas and past sensitive nearby properties; (b) maximize use of city-mapped truck routes; (c) limit total distance to major highways; (d) promote safety in entry to highways; (e) promote overall safety in trucking; and (f) minimize off-Site line-ups (queuing) of trucks entering the property. Operators of loaded trucks leaving the Site will be instructed not to stop or idle in the local neighborhood.

FINAL REPORT: The results of all cleanup work will be fully documented in a final report (called the Remedial Action Report) that will be available for public review online. A link to the online document repository and the public library with Internet access nearest the Site are listed on the first page of this Community Protection Statement document.

LONG-TERM SITE MANAGEMENT: If long-term protection is needed after the cleanup is complete, the property owner will be required to comply with an ongoing Site Management Plan

that calls for continued inspection of protective controls, such as Site covers. The Site Management Plan is evaluated and approved by the NYC Office of Environmental Remediation. Requirements that the property owner must comply with are defined either in the property's deed or established through a city environmental designation registered with the Department of Buildings. A certification of continued protectiveness of the cleanup will be required from time to time to show that the approved cleanup is still effective.

1.0 INTRODUCTION

GGP Staten Island Mall, LLC is working with the NYC Office of Environmental Remediation (OER) in the New York City Voluntary Cleanup Program and/or in the “E” Designation Program to investigate and remediate a property located at 2655 Richmond Avenue in the New Springville section of Staten Island, New York (the “Site”). A RI was performed to compile and evaluate data and information necessary to develop this RAWP in a manner that will render the Site protective of public health and the environment consistent with the contemplated end use. This RAWP establishes remedial action objectives, provides remedial alternatives analysis that includes consideration of a permanent cleanup, and provides a description of the selected remedial action. The remedial action described in this document provides for the protection of public health and the environment, and complies with applicable environmental standards, criteria and guidance and applicable laws and regulations.

1.1 Site Location and Background

The Site is located at 2655 Richmond Avenue in the New Springville section in Staten Island, New York and is identified as Block 2400 and Lot 80 on the New York City Tax Map. Figure 1 shows the Site location. The Site is approximately 154,000-square feet (Lot 80 only). A map of the Site boundary is shown in Figure 2. Currently, the Site is used for commercial retail business and contains parking for the Staten Island Mall, as well as a Macy’s retail store. The Staten Island Mall is a retail space occupied by approximately 168 tenants (Block 2400, Lot 180). Abutting the Staten Island Mall are three “anchor” stores located adjacent to the main facility: Macy’s (Block 2400, Lot 118); J.C. Penney’s (Block 2400, Lot 210); and Sears (Block 2400, Lot 375). Lots 7, 20, 30, 70, 118, 140, 180, 190, 200, and 210 are not considered part of the Site; a separate document will be prepared to address Lots 7, 20, 30, 70, 118, 140, 180, 190, 200, and 210 at a later date. Lot 375 is also not considered part of the Site, and no improvements are planned as part of this redevelopment.

1.2 Redevelopment Plan

The proposed future use of the Site will consist of the construction of a new parking deck (Lot 80). The new parking deck will be constructed as a slab on grade structure. Localized excavations will occur for footings and for utility installation ranging from 4 to 6 feet bls. Layout of the proposed Site development is presented in Figure 3. Proposed redevelopment plans are

provided in Appendix A. The current zoning designation is C4-1 used for commercial and office buildings. The proposed use is consistent with existing zoning for the Site.

1.3 Description of Surrounding Property

Surrounding properties are primarily residential and commercial (retail). The Site is bounded to the north along Richmond Hill Road by residential properties; to the east across Marsh Avenue by Public School P.S. 58 and residential properties; to the south by Sears and across Platinum Avenue by a retail strip mall, and to the west across Richmond Avenue by the Fresh Kills Landfill. Nearby water bodies include the Springville Creek and Richmond Creek, located respectively to the west and south of the Site. These water bodies are interconnected and drain to the Fresh Kills.

Figure 2 shows the surrounding land usage.

1.4 Summary of Past Site Uses and Areas of Concern

Former Site uses include agricultural use with onsite greenhouses (1930s), an aircraft aviation school and civilian airport (1950s), a golf driving range surrounded by residential dwellings (1960s), a sewage treatment plant with a gasoline filling station and commercial retail stores (1970s), and a shopping mall (1970s to current). Nearby water bodies include the Springville Creek and Richmond Creek, located respectively to the west and south of the Site. These water bodies are interconnected and drain to the Fresh Kills.

Block 2400, Lot 80 is currently owned by GGP and was purchased in October 1980 from Thomas J. Hartigan, as a trustee of Twenty Seven Trust. According to the Ameristar Chain of Ownership Report Lot 80 was sold to Twenty Seven Trust by SIM Mall Inc. (an affiliate of GGP) in 1980. John J. Kelly sold Lot 180 to SIM Mall Inc. in February 1978. The ownership of Lot 80 has not changed since 1980.

The following AOCs were anticipated at the Site:

- Potential presence of historic fill of an unknown origin;
- Potential impacts from pesticide usage, specifically insecticides, due to historic agricultural use and the presence of a greenhouse in the 1930's; and

- Potential contamination due to the historic airport runway and aviation school formerly located at the Site.

1.5 Summary of Work Performed under the Remedial Investigation

On behalf of GGP, Roux Associates, Inc., (Roux Associates) performed the following scope of work:

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Installed nine soil borings across the Site (Lot 80), and collected 18 soil samples for chemical analysis were collected from the soil borings to evaluate soil quality;
3. Installed nine groundwater monitoring wells throughout the property to establish groundwater flow and collected one groundwater sample from the Site (Lot 80) for chemical analysis to evaluate groundwater quality;
4. Installed three soil vapor probes around Site perimeter (Lot 80) and collected three samples for chemical analysis.

1.6 Summary of Findings of Remedial Investigation

A RI was performed and the results are documented in a companion document called “Remedial Investigation Report, Staten Island Mall”, dated December 2015 (RIR).

1. Elevation of the Site ranges from approximately 31.52 feet above mean sea level on the west side to 54.41 feet above mean sea level on the east side.
2. Depth to groundwater was measured at 12.80 feet bls at the Site.
3. Groundwater flow is generally from east to west beneath the Site, toward Springville Creek and ultimately the Fresh Kill.
4. Depth to bedrock ranges from approximately 16 to 24 feet bls at the Site.
5. The stratigraphy of the Site, from the surface down, consists of 16 to 24 feet bls of silt and fine sand with a varying mixture of medium to coarse sand, gravel, clay, and cobble underlain by Serpentinite bedrock.
6. A total of 72 soil samples were collected for laboratory analysis from 38 soil borings during the 2013 Phase II ESA and 2015 RI and are summarized below. Soil/fill samples results were compared to NYSDEC Unrestricted Use SCOs and Restricted Residential Use SCOs as presented in 6NYCRR Part 375-6.8.

Lot 80: Soil samples were collected from nine soil borings installed on Lot 80. Soil/fill results showed no VOCs, PCBs or pesticides were detected in any of the soil samples. Trace concentrations of several SVOC including bis phthalate, benzo(a)pyrene,

benzo(b)fluoranthene, and chrysene were detected in three soil borings. Metals including chromium (max. 31.9 ppm), copper (max. 69 ppm) and nickel (max. 221 ppm) were detected at concentrations above Track 1 Unrestricted Use SCOs. There were no exceedances of Commercial Use SCOs in Lot 80 during the RI.

7. Nine groundwater samples collected from Lots 20, 80 and 180, and were compared to the NYSDEC AWQSGVs. The groundwater samples did not contain any exceedances of the AWQSGVs for VOCs, SVOCs, PCBs, and pesticides. Filtered and unfiltered metals were detected in groundwater above AWQSGVs at all monitoring well locations through the detections of magnesium and sodium groundwater samples. The detections ranged from 48,700 µg/L to 159,000 µg/L for magnesium and 97,600 µg/L to 631,000 µg/L for sodium across the Site. The elevated detections of magnesium and sodium are likely from salt water intrusion from the nearby surface water bodies.
8. Thirteen soil vapor samples from Lots 20, 80 and 180 were collected, analyzed and compared to the regulatory guidance on soil vapor and indoor air quality as presented in Matrix 1 and Matrix 2 from the NYSDOH CEH BEEI Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006. Several compounds including 1,2-DCE (detected at two samples, SV-13 and SV-14 at max. of 18.0 ug/m³), PCE (detected in eleven points and ranged from 3.6 ug/m³ to 3,900 ug/m³ at SV-13). TCE was detected at five points and ranged in concentrations from 1.4 ug/m³ to 290 ug/m³ (SV-13). Dichlorodifluoromethane was detected at eleven soil vapor samples at maximum of 5,700 ug/m³. MTBE was detected at six soil vapor samples at a maximum concentration of 680 ug/m³. Methane was detected at two soil vapor samples SV-3 (0.44 % volume by volume [v/v]) and SV-7 (22.0 % v/v). The concentrations of all chlorinated and petroleum related compounds were above the monitoring level ranges established within the NYSDOH Final Guidance on Soil Vapor Intrusion. Methane was only detected in the eastern parcel of Lot 180, and may be the result of decaying organic material that was observed within some silt layers during the RI.

Lot 80: There were no detections of matrices compounds above their corresponding indoor air concentrations.

For more detailed results, consult the RIR. Based on an evaluation of the data and information from the RIR and this RAWP, disposal of significant amounts of hazardous waste is not suspected at this site.

2.0 REMEDIAL ACTION OBJECTIVES

Based on the results of the RI, the following Remedial Action Objectives (RAOs) have been identified for this Site:

Soil

Prevent direct contact with contaminated soil.

Groundwater

Based on the results of the RI, no RAOs for groundwater are necessary for the Site.

Soil Vapor

Based on the results of the RI, no RAOs for soil vapor are necessary for the Site.

3.0 REMEDIAL ALTERNATIVES ANALYSIS

The goal of the remedy selection process is to select a remedy that is protective of human health and the environment taking into consideration the current, intended and reasonably anticipated future use of the property. The remedy selection process begins by establishing RAOs for media in which chemical constituents were found in exceedance of applicable standards, criteria and guidance values (SCGs). Remedial alternatives are then developed and evaluated based on the following ten criteria:

- Protection of human health and the environment;
- Compliance with SCGs;
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;
- Implementability;
- Cost effectiveness;
- Community acceptance;
- Land use; and
- Sustainability.

As required, a Track 1 Unrestricted Use scenario is evaluated for the remedial action. The following is a detailed description of the alternatives analyzed to address impacted media at the Site:

Alternative 1:

- Selection of NYSDEC 6NYCRR Part 375 Unrestricted Use (Track 1) SCOs.
- Removal of all soil/fill exceeding Track 1 Unrestricted Use SCOs throughout the Site and confirmation that Track 1 Unrestricted Use SCOs have been achieved with post-excavation end-point sampling. Based on the results of the RI, it is anticipated that a limited amount of additional excavation than that is proposed for the construction of the parking garage will be required to achieve Track 1 Unrestricted Use. No Engineering or Institutional Controls are required for a Track 1 cleanup.

Alternative 2:

- Selection of NYSDEC 6NYCRR Part 375 Residential Use (Track 2) SCOs.
- Removal of all soil/fill exceeding Track 2 Residential Use SCOs throughout the Site and confirmation that Track 2 Residential Use SCOs have been achieved with post-excavation endpoint sampling. Based on the results of the RI, this alternative has already been achieved. If soil/fill containing analytes at concentrations above Residential Use SCOs is encountered at the base of the excavation after removal of all soil required for construction of the parking garage is complete, additional excavation would be performed to ensure complete removal of soil/ fill that does not meet Track 2 Residential Use SCOs.
- Placement of a composite cover system over the entire Site to prevent exposure to remaining soil/fill.

Alternative 3:

- Removal of all soil/fill exceeding Track 2 Restricted Residential Use SCOs and confirmation that Track 2 Restricted Residential Use SCOs have been achieved with post-excavation end point sampling. Based on the results of the RI, Alternative 3 has already been achieved. However, if soil/fill containing analytes at concentrations above Track 2 Restricted Residential Use SCOs is encountered at the base of the excavation, additional excavation would be performed to meet Track 2 Restricted Residential Use SCOs.
- Placement of a composite cover system over the entire Site to prevent exposure to remaining soil/fill;

3.1 Threshold Criteria

Protection of Public Health and the Environment

This criterion is an evaluation of the remedy's ability to protect public health and the environment, and an assessment of how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, and implementation of Engineering Controls or Institutional Controls. Protection of public health and the environment must be achieved for all approved remedial actions.

Alternative 1 would be protective of human health and the environment by removing all soil/fill exceeding Track 1 Unrestricted Use SCO's and groundwater protection standards, thus eliminating potential for direct contact with contaminated soil/fill once construction is complete and eliminating the risk of contaminants leaching into groundwater.

Alternatives 2 and 3 would achieve comparable protections of human health and the environment by excavation and removal of most of the historic fill at the Site and by ensuring that remaining soil/fill on-Site meets Track 2 Residential or Restricted Residential Use SCO's, as well as by placement of Institutional and Engineering Controls, including a composite cover system. The composite cover system would prevent direct contact with any remaining on-Site soil/fill. If required, implementing Institutional Controls including a Site Management Plan would ensure that the composite cover system remains intact and protective of public health. Establishment of Track 2 Residential or Restricted Residential Use SCO's would minimize the risk of contamination leaching into groundwater.

For all Alternatives, potential exposure to contaminated soils or groundwater during construction would be minimized by implementing a Construction Health and Safety Plan, an approved Soil/Materials Management Plan, and CAMP.

3.2 Balancing Criteria

Compliance with Standards, Criteria and Guidance (SCGs)

This evaluation criterion assesses the ability of the alternative to achieve applicable standards, criteria and guidance.

Alternative 1 would achieve compliance with the remedial goals, chemical-specific SCGs and RAOs for soil through removal of soil to achieve Track 1 Unrestricted Use SCO's and Protection of Groundwater SCO's. While no soil vapor remedy is necessary based on the RI data, the parking garage proposed for Lot 80 (the only building proposed as part of the Site development) will be open to the air, allowing for sufficient air exchange.

Alternatives 2 and 3 would achieve compliance with the remedial goals, chemical-specific SCG's and RAOs for soil through removal of soil to meet Track 2 Residential or Restricted Residential Use SCO's. A Site Management Plan, if required, would ensure that these controls remained protective for the long term. While no soil vapor remedy is necessary based on the RI data, the parking garage proposed for Lot 80 (the only building proposed as part of the Site development) will be open to the air, allowing for sufficient air exchange.

Health and safety measures contained in the CHASP and CAMP will be implemented during Site redevelopment under this RAWP. For all Alternatives, focused attention on means and methods employed during the remedial action would ensure that handling and management of contaminated material would be in compliance with applicable SCGs. These measures will protect on-site workers and the surrounding community from exposure to Site-related contaminants.

Short-Term Effectiveness and Impacts

This evaluation criterion assesses the effects of the alternative during the construction and implementation phase until remedial action objectives are met. Under this criterion, alternatives are evaluated with respect to their short term effects during the remedial action on public health and the environment during implementation of the remedial action, including protection of the community, protection of onsite workers and environmental impacts.

Alternatives 1, 2, and 3 have similar short-term effectiveness during their implementation. All alternatives would result in short-term dust generation impacts associated with excavation, handling, load out of materials, and truck traffic. Short-term impacts could potentially be higher for Alternative 1 since excavation of greater amounts of historical fill material would take place. However, focused attention to means and methods during a Track 1 removal action, including community air monitoring and appropriate truck routing, would minimize the overall impact of these activities.

An additional short-term adverse impact and risks to the community associated with all remedial alternatives is increased truck traffic. Truck traffic will be routed on the most direct course using major thoroughfares where possible and flag persons will be used to protect pedestrians at Site entrances and exits.

The potential adverse impact to the community, workers and the environment for all alternatives would be minimized through implementation of control plans including a Construction Health and Safety Plan, a CAMP and a Soil/Materials Management Plan (SMMP), during all on-Site soil disturbance activities and would minimize the release of contaminants into the environment. All alternatives provide short-term effectiveness in protecting the surrounding community by

decreasing the risk of contact with on-Site contaminants. Construction workers operating under appropriate management procedures and a CHASP would provide protection from on-Site contaminants by using personal protective equipment would be worn consistent with the documented risks within the respective work zones.

Long-Term Effectiveness and Permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual contamination remaining at the Site after response objectives have been met, such as permanence of the remedial alternative, magnitude of remaining contamination, adequacy of controls including the adequacy and suitability of Engineering Controls/Institutional Controls (ECs/ICs) that may be used to manage contaminant residuals that remain at the Site and assessment of containment systems and ICs that are designed to eliminate exposures to contaminants, and long-term reliability of ECs.

Alternative 1 would achieve long-term effectiveness and permanence related to on-Site contamination by permanently removing all impacted soil/fill above Track 1 Unrestricted Use SCO's. Removal of on-Site contaminant sources will also prevent future groundwater contamination.

Alternatives 2 and 3 would provide long-term effectiveness by removing most on-Site contamination and attaining Track 2 Residential or Restricted Residential Use SCOs; installing a composite cover system across the Site; maintaining use restrictions; and establishing an SMP, if required, to ensure long-term management of ICs and ECs for the long term. The SMP, if required, would ensure long-term effectiveness of all ECs and ICs by requiring periodic inspection and certification that these controls and restrictions continue to be in place and are functioning as they were intended, assuring that protections designed into the remedy continue to provide the required level of protection.

Reduction of toxicity, mobility, or volume of contaminated material

This evaluation criterion assesses the remedial alternative's use of remedial technologies that permanently and significantly reduce toxicity, mobility, or volume of contaminants as their principal element. The following is the hierarchy of source removal and control measures that

are to be used to remediate a Site, ranked from most preferable to least preferable: removal and/or treatment, containment, elimination of exposure and treatment of source at the point of exposure. It is preferred to use treatment or removal to eliminate contaminants at a Site, reduce the total mass of toxic contaminants, cause irreversible reduction in contaminants mobility, or reduce of total volume of contaminated media.

Alternative 1 will permanently eliminate the toxicity, mobility, and volume of contaminants from on-Site soil by removing all soil in excess of Track 1 Unrestricted Use SCO's.

Alternatives 2 and 3 would remove remaining on-Site soil to meet Track 2 Residential or Restricted Residential Use SCO's, respectively. Based on the results of the RI, Alternative 3 has already been achieved.

Implementability

This evaluation criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation, including technical feasibility of construction and operation, reliability of the selected technology, ease of undertaking remedial action, monitoring considerations, administrative feasibility (e.g. obtaining permits for remedial activities), and availability of services and materials.

The techniques, materials and equipment to implement Alternatives 1, 2 and 3 are readily available and have been proven to be effective in remediating the contaminants present on the Site. They use standard equipment and technologies that are well established in the industry. The reliability of each remedy is also high. There are no special difficulties associated with any of the activities proposed.

Cost effectiveness

This evaluation criterion addresses the cost of alternatives, including capital costs (such as construction costs, equipment costs, and disposal costs, engineering expenses) and site management costs (costs incurred after remedial construction is complete) necessary to ensure the continued effectiveness of a remedial action.

Costs associated with Alternative 1 could potentially be higher than Alternatives 2 or 3 if soil with analytes above Track 1 Unrestricted Use SCOs is encountered below the excavation depth required for development. Additional costs would include installation of additional shoring/underpinning, disposal of additional soil, and import of clean soil for backfill. However, long-term costs for Alternatives 2 and 3 may be higher than Alternative 1 based on implementation of a SMP, if required, as part of Alternatives 2 or 3.

The remedial plan would couple the remedial action with the redevelopment of the Site, lowering total costs. The remedial plan will also consider the selection of the most appropriate disposal facilities to reduce transportation and disposal costs during cleanup and redevelopment of the Site.

Community Acceptance

This evaluation criterion addresses community opinion and support for the remedial action. Observations here will be supplemented by public comment received on the RAWP.

This RAWP will be subject to a public review under the NYC VCP and will provide the opportunity for detailed public input on the remedial alternatives and the selected remedy. This public comment will be considered by OER prior to approval of this plan. The Citizen Participation Plan for the project is provided in Appendix B. Observations here will be supplemented by public comment received on the RAWP. Under all alternatives, the overall goals of the remedial program, to protect public health and the environment and eliminate potential contaminant exposures, have been broadly supported by citizens in NYC communities.

Land use

This evaluation criterion addresses the proposed use of the property. This evaluation has considered reasonably anticipated future uses of the Site and takes into account: current use and historical and/or recent development patterns; applicable zoning laws and maps; NYS Department of State's Brownfield Opportunity Areas (BOA) pursuant to section 970-r of the general municipal law; applicable land use plans; proximity to real property currently used for residential use, and to commercial, industrial, agricultural, and/or recreational areas; environmental justice impacts, Federal or State land use designations; population growth patterns

and projections; accessibility to existing infrastructure; proximity of the Site to important cultural resources and natural resources, potential vulnerability of groundwater to contamination that might emanate from the Site, proximity to flood plains, geography and geology; and current Institutional Controls applicable to the Site.

The current, intended, and reasonably anticipated future land use of the Site and its surroundings are compatible with the selected remedy of soil remediation. The proposed future use of the Site includes an open air three-deck parking garage in Lot 80. Following remediation, the Site will meet either Track 1 Unrestricted Use or Track 2 Residential or Track 2 Restricted Residential Use SCOs, all of which are protective of public health and the environment for its planned residential use. The proposed use is compliant with the property's zoning and is consistent with recent development patterns. The areas surrounding the site consist of residential properties to the north; to the east along Marsh Avenue is Public School P.S. 58 and residential properties; to the south along Platinum Avenue is a retail strip mall and to the west along Richmond Avenue the Fresh Kills Landfill is located.

The proposed development would clean up the property and make it safer, create new employment opportunities, and other economic benefits from land revitalization.

Temporary short-term project impacts are being mitigated through site management controls and truck traffic controls during remediation activities. Following remediation, the Site will meet either Track 1 Unrestricted Use SCOs or Track 2 Residential or Track 2 Restricted Residential Use SCOs, all of which are protective of public health and the environmental for its planned use.

The Site is not in close proximity to important cultural resources, including federal or state historic or heritage sites or Native American religious sites, natural resources, waterways, wildlife refuges, wetlands, or critical habitats of endangered or threatened species. The Site is located in an urban area and not in proximity to fish or wildlife and neither alternative would result in any potential exposure pathways of contaminant migration affecting fish or wildlife. The remedial action is also protective of groundwater natural resources. The Site does not lie in a Federal Emergency Management Agency (FEMA)-designated flood plain. All alternatives are equally protective of natural resources and cultural resources. Improvements in the current

environmental condition of the property achieved by all alternatives considered in this plan are consistent with the City's goals for cleanup of contaminated land.

Sustainability of the Remedial Action

This criterion evaluates the overall sustainability of the remedial action alternatives and the degree to which sustainable means are employed to implement the remedial action including those that take into consideration NYC's sustainability goals defined in PlaNYC: A Greener, Greater New York. Sustainability goals may include: maximizing the recycling and reuse of non-virgin materials; reducing the consumption of virgin and non-renewable resources; minimizing energy consumption and greenhouse gas emissions; improving energy efficiency; and promotion of the use of native vegetation and enhancing biodiversity during landscaping associated with Site development.

While Alternatives 2 and 3 would potentially result in lower energy usage based on reducing the volume of material transported off-Site, all remedial alternatives are comparable with respect to the opportunity to achieve sustainable remedial action. The remedial plan for either alternative would take into consideration the shortest trucking routes during off-Site disposal of historic fill and other soils, which would reduce greenhouse gas emissions and conserve energy used to fuel trucks. The New York City Clean Soil Bank program is available for reuse of any clean native soils under either alternative. A complete list of green remedial activities considered as part of the NYC VCP is included in a Sustainability Statement (Appendix C).

4.0 REMEDIAL ACTION

4.1 Summary of Preferred Remedial Action

The preferred remedial action alternative is Alternative 2, the Track 2 remedial action. The preferred remedial action achieves protection of public health and the environment for the intended use of the property. The preferred remedial action will achieve all of the remedial action objectives established for the project and addresses applicable SCGs. The preferred remedial action is effective in both the short-term and long-term and reduces mobility, toxicity and volume of contaminants. The preferred remedial action alternative is cost effective and implementable and uses standards methods that are well established in the industry.

The proposed remedial action will consist of:

1. Preparation of a Community Protection Statement and performance of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan.
2. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.
3. Establishment of Track 2 Residential SCOs.
4. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
5. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility(s).
6. Excavation and removal of soil/fill exceeding Track 2 Residential SCOs. Portions of the parking garage footprint will be excavated to a depth of approximately 6 feet below grade for development purposes. Approximately, 8,000 tons of soil will be excavated and removed from this Site.
7. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID. Appropriate segregation of excavated media on-Site.
8. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.
9. Registration of tanks and reporting of any petroleum spills associated with UST's and appropriate closure of these petroleum spills in compliance with applicable local, State and Federal laws and regulations.

10. Transportation and off-Site disposal of all soil/fill material at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal facilities. Appropriate segregation of excavated media on-Site.
11. Collection and analysis of end-point samples to determine the performance of the remedy with respect to attainment of SCOs.
12. Demarcation of residual soil/fill in landscaped areas.
13. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
14. Construction of an engineered composite cover consisting of a four-inch thick asphalt layer with a 6-inch clean granular sub-base beneath all building areas, 4-inch poured concrete on a 6-inch sub-base in sidewalk areas, and one foot of clean soil in all open space and landscaped areas.
15. Construction and operation of an open air grade-level parking garage in conformance with NYC Building Code.
16. Performance of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
17. Dewatering, if needed, in compliance with city, state, and federal laws and regulations. Extracted groundwater will either be containerized for off-site licensed or permitted disposal or will be treated under a permit from New York City Department of Environmental Protection (NYCDEP) to meet pretreatment requirements prior to discharge to the sewer system.
18. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
19. Submission of a RAR that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, lists any changes from this RAWP, and describes all Engineering and Institutional Controls to be implemented at the Site.
20. If Track 2 Residential Use is not attainable, a Track 2 Restricted Residential Use or Track 2 Commercial Use remedial action will be used, with Site management only required if a Track 2 Commercial Use remedial action is not achieved. If a Track 2 Commercial Use remedial action is not achieved, submission of an approved SMP in the RAR for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.

21. If Track 2 Residential Use is not attainable, a Track 2 Restricted Residential Use or Track 2 Commercial Use remedial action will be used, with Site management only required if a Track 2 Commercial Use remedial action is not achieved. If a Track 2 Commercial Use remedial action is not achieved, the property will continue to be registered with an E-Designation at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

4.2 Soil Cleanup Objectives and Soil/ Fill Management

Track 2 Residential SCOs are proposed for this project and SCO's are defined in 6 NYCRR Part 375, Table 6.8 Track 2 Residential Use. If these Track 2 SCO's are not achieved, Track 2 Restricted Residential, Track 2 Commercial, or Track 4 Site Specific SCO's will be utilized.

Soil and materials management on-Site and off-Site, including excavation, handling, and disposal, will be conducted in accordance with the Soil/Materials Management Plan in Appendix D. Discrete contaminant sources (such as hotspots) identified during the remedial action will be identified by GPS or surveyed. This information will be provided in the RAR.

Soil/Fill Excavation and Removal

The location of planned excavations is shown in Figure 3. The total quantity of soil/fill expected to be excavated and disposed off-Site is 8,100 tons (For lot 80 only). For each disposal facility to be used in the remedial action, a letter from the developer/QEP to the receiving facility requesting approval for disposal and a letter back to the developer/QEP providing approval for disposal will be submitted to OER prior to any transport and disposal of soil at a facility.

Disposal facilities will be reported to OER when they are identified and prior to the start of remedial action.

End-point Sampling

End-point samples will be analyzed for compounds and elements as described below utilizing the following methodology:

- Volatile organic compounds by EPA Method 8260;

- Semivolatile organic compounds by EPA Method 8270;
- Target Analyte List metals; and
- Pesticides/PCBs by EPA Method 8081/8082.

New York State ELAP certified labs will be used for all end-point sample analyses. Labs performing end-point sample analyses will be reported in the RAR. The RAR will provide a tabular and map summary of all end-point sample results and will include all data including non-detects and applicable standards and/or guidance values.

Confirmation End-point Sampling

Removal actions for development purposes under this plan will be performed in conjunction with confirmation end-point soil sampling. Nine confirmation samples will be collected from the base of the excavation at locations to be determined by OER. To evaluate attainment of Track 2 Residential Use, Restricted Residential Use or Commercial Use SCOs, analytes will include those for which SCOs have been developed according to analytical methods described above. If Track 1 Unrestricted Use SCOs are pursued, samples will be analyzed for VOCs, SVOCs, pesticides, PCBs and metals according to analytical methods described above.

Quality Assurance/Quality Control

Quality Assurance/ Quality Control (QA/QC) procedures will be used to provide performance information with regard to accuracy, precision, sensitivity, representation, completeness, and comparability associated with the sampling and analysis for this investigation. Field QA/QC procedures will be used to document that samples are representative of actual conditions at the Site and identify possible cross-contamination from field activities or sample transit. Laboratory QA/QC procedures and analyses will be used to demonstrate whether analytical results have been biased either by interfering compounds in the sample matrix, or by laboratory techniques that may have introduced systematic or random errors to the analytical process. QA/QC samples including field blanks, and trip blanks, and duplicates, will be collected and analyzed at rates in accordance with DER-10.

Import of Soils

A significant volume of imported soils is not anticipated with the exception of topsoil for planters, and recycled concrete aggregate (RCA), which will be imported in accordance with the Soil/Materials Management Plan. If required, import of other soils onto the property will be performed in conformance with the Soil/Materials Management Plan in Appendix D. Imported soil will meet the lower of:

- Track 1 Unrestricted Use or Track 2 Residential SCO's, and
- Groundwater Protection Standards in Part 375-6.8.

Soil is not anticipated to be imported to the Site for backfill or cover.

Reuse of Onsite Soils

Reuse of onsite soils already onsite will be performed in conformance with the Soil/Materials Management Plan in Appendix D. Reuse soils will meet the SCO's established for this project.

4.3 Engineering Controls

Engineering Controls will be employed in the remedial action to address residual contamination remaining at the site. The Site has one primary Engineering Control System:

1. Composite Cover System

Composite Cover System

Exposure to soil will be prevented by an engineered, composite cover system to be built on the Site. This composite cover system will be comprised of 4 inches of asphalt pavement underlain by 6 inches of clean sub-base material in the parking garage area, 4 inches of concrete underlain by 6 inches of clean sub-based material in sidewalk areas, and 1 foot of clean soil in open space areas.

The composite cover system will be a permanent engineering control. If necessary, the system will be inspected and its performance certified at specified intervals as required by this RAWP and the Site Management Plan. A Soil and Materials Management Plan will be included in the Site Management Plan, if required, and will outline the procedures to be followed in the event that the composite cover system and underlying residual soil/fill is disturbed after the remedial

action is complete. Maintenance of this composite cover system will be described in the Site Management Plan, if required, in the Remedial Action Report.

Vapor Barrier System

Based on the results of the RI, vapor mitigation is not required. As part of the Site development, there will be no occupied structures. The only structure to be built is a grade-level open air parking garage. However, construction and operation of an open air grade-level parking garage will be completed in conformance with NYC Building Code.

4.4 Institutional Controls

A Track 2 Residential Use remedial action is proposed and Institutional Controls are not required; however, if a Track 2 Residential Use remedial action is not attainable, a Track 2 Restricted Residential Use or Track 2 Commercial Use remedial action will be used, with Site management only required if a Track 2 Commercial Use remedial action is not achieved. If a Track 2 Commercial Use remedial action is not achieved, , Institutional Controls (IC's) will be incorporated in this remedial action to manage residual soil/fill and other media and render the Site protective of public health and the environment. These IC's define the program to operate, maintain, inspect and certify the performance of Engineering Controls and Institutional Controls on this property. Institutional Controls would be implemented in accordance with a Site Management Plan included in the final RAR. If Track 2 Residential Use is not attainable, a Track 2 Restricted Residential Use or Track 2 Commercial Use remedial action will be used, with Site management only required if a Track 2 Commercial Use remedial action is not achieved. If a Track 2 Commercial Use remedial action is not achieved, , Institutional Controls would be:

- Continued registration of the E-Designation for the property. This RAWP includes a description of all ECs and ICs and summarizes the requirements of the SMP which will note that the property owner and property owner's successors and assigns must comply with the approved SMP;
- Submittal of a SMP in the RAR for approval by OER that provides procedures for appropriate operation, maintenance, inspection, and certification of ECs and IC's. SMP will require that the property owner and property owner's successors and assigns will submit to OER a periodic written statement that certifies that: (1) controls employed at the Site are unchanged from the previous certification or that any changes to the controls were approved by OER; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. OER retains the right to enter the Site in order to evaluate the

continued maintenance of any controls. This certification shall be submitted at a frequency to be determined by OER in the SMP and will comply with RCNY §43-1407(1)(3).

- Vegetable gardens and farming on the Site are prohibited in contact with residual soil materials;
- Use of groundwater underlying the Site is prohibited without treatment rendering it safe for its intended use;
- All future activities on the Site that will disturb residual material must be conducted pursuant to the soil management provisions in an approved SMP;
- The Site will be used for commercial use and will not be used for a higher level of use without prior approval by OER.

4.5 Site Management Plan

Site Management is the last phase of remediation and begins with the approval of the Remedial RAR and issuance of the Notice of Completion (NOC) for the Remedial Action. The SMP describes appropriate methods and procedures to ensure implementation of all ECs and ICs that are required by this RAWP. The SMP is submitted as part of the RAR but, if required, will be written in a manner that allows its use as an independent document. Site Management continues until terminated in writing by OER. The property owner is responsible to ensure that all Site Management responsibilities defined in the Site Management Plan are implemented.

A Track 2 Residential Use remedial action is proposed and Site Management is not required. If a Track 2 Residential Use remedial action is not attainable, a Track 2 Restricted Residential Use or Track 2 Commercial Use remedial action will be used, with Site management only required if a Track 2 Commercial Use remedial action is not achieved. If a Track 2 Commercial Use remedial action is not achieved, Site Management will be required and will be the last phase of remediation. Site Management will begin with the approval of the RAR and issuance of the NOC for the Remedial Action. The SMP describes appropriate methods and procedures to ensure implementation of all ECs and ICs that are required by this RAWP. If required, the SMP is submitted as part of the RAR but will be written in a manner that allows its use as an independent document. Site Management continues until terminated in writing by OER. The property owner is responsible to ensure that all Site Management responsibilities defined in the SMP are implemented.

If required, the SMP would provide a detailed description of the procedures required to manage residual soil/fill left in place following completion of the remedial action in accordance with the Voluntary Cleanup Agreement with OER. This includes a plan for: (1) implementation of EC's and ICs; (2) operation and maintenance of EC's; (3) inspection and certification of IC's and EC's.

If required, site management activities and EC/IC certification will be scheduled by OER on a periodic basis to be established in the RAR and the SMP and will be subject to review and modification by OER. The SMP would be based on a calendar year and certification reports would be due for submission to OER by July 30 of the year following the reporting period.

4.6 Qualitative Human Health Exposure Assessment

The objective of the qualitative exposure assessment is to identify potential receptors and pathways for human exposure to the contaminants of concern (COC) that are present at, or migrating from, the Site. The identification of exposure pathways describes the route that the COC takes to travel from the source to the receptor. An identified pathway indicates that the potential for exposure exists; it does not imply that exposures actually occur.

Data and information reported in the RIR are sufficient to complete a Qualitative Human Health Exposure Assessment (QHHEA) for this project. As part of the NYC VCP process, a QHHEA was performed to determine whether the Site poses an existing or future health hazard to the Site's exposed or potentially exposed population. The sampling data from the RI were evaluated to determine whether there is any health risk under current and future conditions by characterizing the exposure setting, identifying exposure pathways, and evaluating contaminant fate and transport. This QHHEA was prepared in accordance with Appendix 3B and Section 3.3 (b) 8 of the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation.

Known and Potential Contaminant Sources

Based on the results of the RIR, the COCs are:

Soil: There were no exceedances of the Restricted Residential or Commercial Use or SCOs at the Site. The soil investigation detected only one soil sample exceeding the Unrestricted Use SCOs at SB-15 at six to eight feet bls, located in Lot 80, for chromium and nickel. Chromium

was detected at 31.9 mg/kg vs. a Residential Use SCO of 36 mg/kg. Nickel was detected at 221 mg/kg vs. a Restricted Residential Use SCO of 310 mg/kg. The current and proposed land use is commercial. Based on the results of the RI, all of the soil meets Restricted Residential Use SCOs.

Groundwater: Analytical results showed the presence of the metals magnesium and sodium exceeding AWQSGVs. Magnesium and sodium were detected at 82,700 µg/L and 182,000 µg/L, respectively. The elevated detections of magnesium and sodium are likely from salt water intrusion from the nearby surface water bodies.

Soil Vapor: Low-level detections of PCE were identified at several soil vapor points at the Site. PCE was detected at soil vapor points SV-2, SV-9 and SV-10 ranging from 0.45 ug/m³ to 0.74 ug/m³, which are below NYSDOH action levels.

Nature, Extent, Fate and Transport of Contaminants

Soil: There were no exceedances of the Restricted Residential or Commercial Use SCOs at the Site. The soil investigation detected only one soil sample exceeding the Unrestricted Use SCOs at SB-15 at six to eight feet bls, located in Lot 80, for chromium and nickel. Based on the nature of these contaminants, these compounds will not volatilize into soil vapor. In addition, based on the proposed construction for the future development (i.e., presence of asphalt pavement and aboveground parking deck), migration of these compounds into groundwater is unlikely.

Groundwater: Analytical results showed the presence of the magnesium and sodium exceeding AWQSGVs. The elevated detections of magnesium and sodium are likely from salt water intrusion from the nearby surface water bodies. No other detections above AWQSGVs were indicated by the groundwater analytical results.

Soil Vapor: PCE was detected in soil vapor ranging from 0.45 ug/m³ to 0.74 ug/m³. Carbon tetrachloride, trichloroethene, cis-1,2-dichloroethene, 1,1-dichloroethene, 1,1,1-trichloroethane and vinyl chloride were not detected at the Site (i.e., at soil vapor points SV-2, SV-9 and SV-10). PCE was not detected in groundwater at the Site. PCE was only detected at low concentrations

below NYSDOH action matrices in soil at a single soil boring (i.e., SB-31) with an estimated concentration of 0.67 ug/kg. The RI did not identify a specific source of the PCE.

Receptor Populations

On-Site Receptors: The Site is currently used as a parking lot and is capped with asphalt underlain with a sub-base. During construction, potential on-site receptors include construction workers, site representatives, and visitors. Under proposed future conditions, potential on-site receptors include mall workers and visitors.

Off-Site Receptors: Potential off-site receptors within a 500 foot radius of the Site include adult and child residents; commercial and construction workers; pedestrians; and trespassers based on the following land uses within 500 feet of the Site:

Commercial Businesses – existing and future

1. Residential Buildings – existing and future
2. Building Construction/ Renovation – existing and future
3. Pedestrians, Trespassers, Cyclists – existing and future
4. Schools – existing and future

Potential Routes of Exposure

Three potential primary routes exist by which chemicals can enter the body: ingestion, inhalation, and dermal absorption. Exposure can occur based on the following potential media:

- Ingestion of groundwater or fill/ soil;
- Inhalation of vapors or particulates; and
- Dermal absorption of groundwater or fill/ soil.

Potential Exposure Points

Current Conditions: The Site is currently capped with asphalt there are no potential exposure pathways from ingestion, inhalation, or dermal absorption of soil/ fill. Groundwater is not exposed at the Site. The Site is served by the public water supply and groundwater is not used at the site for potable supply and there is no potential for exposure. Because the Site is currently an open air parking lot, there is no potential for soil vapor to accumulate on-Site.

Construction/ Remediation Conditions: During the remedial action, onsite workers will come into direct contact with surface and subsurface soils as a result of on-Site construction and excavation activities. On-Site construction workers potentially could ingest, inhale or have dermal contact with exposed impacted soil and fill. Similarly, off-Site receptors could be exposed to dust and vapors from on-Site activities. Due to the depth of groundwater, direct contact with groundwater is not expected. During construction, on-Site and off-Site exposures to contaminated dust from on-Site will be addressed through the Soil/Materials Management Plan, dust controls, and through the implementation of the Community Air-Monitoring Program and a Construction Health and Safety Plan.

Proposed Future Conditions: Under proposed future remediated conditions, all soils in excess of Track 2 Residential SCOs will be removed. The Site will be fully capped, preventing potential direct exposure to soil and groundwater remaining in place. The Site is served by the public water supply, and groundwater is not used at the Site. There are no plausible off-Site pathways for oral, inhalation, or dermal exposure to contaminants derived from the Site.

Overall Human Health Exposure Assessment

There are potential complete exposure pathways that require mitigation during implementation of the remedy. There are no complete exposure pathways under future conditions after the Site is developed. This assessment takes into consideration the reasonably anticipated use of the Site, which includes a site-wide surface cover and an open air parking garage. During remedial construction, on-Site and off-Site exposures to contaminated dust will be addressed through dust controls, and through the implementation of the Community Air Monitoring Program, the Soil/Materials Management Plan, and a Construction Health and Safety Plan. Potential post-construction use of groundwater is not considered an option because groundwater in this area of New York City is not used as a potable water source. There are no surface waters in close proximity to the Site that could be impacted or threatened.

5.0 REMEDIAL ACTION MANAGEMENT

5.1 Project Organization and Oversight

Principal personnel who will participate in the remedial action include Frank Cherena (QEP) and David Bligh (Professional Engineer and Project Manager).

5.2 Site Security

Site access will be controlled by gated entrances to the fenced property. Site access will be controlled by DOB approved construction fence. For work areas of limited size, barrier tape will be sufficient to delineate and restrict access.

5.3 Work Hours

The hours for operation of cleanup will comply with the NYC Department of Buildings construction code requirements or according to specific variances issued by that agency. The hours of operation will be conveyed to OER during the pre-construction meeting.

5.4 Construction Health and Safety Plan

The CHASP is included in Appendix E. The Site Safety Coordinator is to be determined. Remedial work performed under this RAWP will be in full compliance with applicable health and safety laws and regulations, including Site and OSHA worker safety requirements and HAZWOPER requirements. Confined space entry, if any, will comply with OSHA requirements and industry standards and will address potential risks. The parties performing the remedial construction work will ensure that performance of work is in compliance with the CHASP and applicable laws and regulations. The CHASP pertains to remedial and invasive work performed at the Site until the issuance of the Notice of Completion.

All field personnel involved in remedial activities will participate in training required under 29 Code of Federal Regulations (CFR) 1910.120, such as 40-hour hazardous waste operator training and annual 8-hour refresher training. Site Safety Officer will be responsible for maintaining workers training records.

Personnel entering any exclusion zone will be trained in the provisions of the CHASP and will comply with all requirements of 29 CFR 1910.120. Site-specific training will be provided to

field personnel. Additional safety training may be added depending on the tasks performed. Emergency telephone numbers will be posted at the site location before any remedial work begins. A safety meeting will be conducted before each shift begins. Topics to be discussed include task hazards and protective measures (physical, chemical, environmental); emergency procedures; PPE levels and other relevant safety topics. Meetings will be documented in a log book or specific form.

An emergency contact sheet with names and phone numbers is included in the CHASP. That document will define the specific project contacts for use in case of emergency.

5.5 Community Air Monitoring Plan

Real-time air monitoring for VOCs and particulate levels at the perimeter of the exclusion zone or work area will be performed. Continuous monitoring will be performed for all ground intrusive activities and during the handling of contaminated or potentially contaminated media. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pit excavation or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be performed during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. Periodic monitoring during sample collection, for instance, will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well bailing/purging, and taking a reading prior to leaving a sample location. Depending upon the proximity of potentially exposed individuals, continuous monitoring may be performed during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence. Exceedences of action levels observed during performance of the CAMP will be reported to the OER Project Manager and included in the Daily Report.

VOC Monitoring, Response Levels, and Actions

VOCs will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background

conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown.
- All 15-minute readings must be recorded and be available for OER personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

If the downwind PM-10 particulate level is 100 ug/m^3 greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression

techniques provided that downwind PM-10 particulate levels do not exceed 150 ug/m³ above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 ug/m³ above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m³ of the upwind level and in preventing visible dust migration.
- All readings will be recorded and be available for OER personnel to review.

5.6 Agency Approvals

All permits or government approvals required for remedial construction have been or will be obtained prior to the start of remedial construction. Approval of this RAWP by OER does not constitute satisfaction of these requirements and will not be a substitute for any required permit.

5.7 Site Preparation

Pre-Construction Meeting

OER will be invited to attend the pre-construction meeting at the Site with all parties involved in the remedial process prior to the start of remedial construction activities.

Mobilization

Mobilization will be conducted as necessary for each phase of work at the Site. Mobilization includes field personnel orientation, equipment mobilization (including securing all sampling equipment needed for the field investigation), marking/staking sampling locations and utility mark-outs. Each field team member will attend an orientation meeting to become familiar with the general operation of the Site, health and safety requirements, and field procedures.

Utility Marker Layouts, Easement Layouts

The presence of utilities and easements on the Site will be fully investigated prior to the performance of invasive work such as excavation or drilling under this plan by using, at a minimum, the One-Call System (811). Underground utilities may pose an electrocution, explosion, or other hazard during excavation or drilling activities. All invasive activities will be performed in compliance with applicable laws and regulations including NYC Building Code to assure safety. Utility companies and other responsible authorities will be contacted to locate and

mark the locations, and a copy of the Mark-Out Ticket will be retained by the contractor prior to the start of drilling, excavation or other invasive subsurface operations. Overhead utilities may also be present within the anticipated work zones. Electrical hazards associated with drilling in the vicinity of overhead utilities will be prevented by maintaining a safe distance between overhead power lines and drill rig masts.

Proper safety and protective measures pertaining to utilities and easements, and compliance with all laws and regulations will be employed during invasive and other work contemplated under this RAWP. The integrity and safety of on-Site and off-Site structures will be maintained during all invasive, excavation or other remedial activity performed under the RAWP.

Dewatering

Limited dewatering may be required during construction to allow for the installation of foundation elements. All required permits will be obtained from NYSDEC and NYCDEP prior to any discharge of groundwater into the sewer system. If required, dewatering may consist of well point or pump systems, with water routed through settling tanks prior to discharge into the city storm sewer system depending on requirements set forth in the pending NYSDEC State Pollutant Discharge Elimination (SPDES) jurisdictional determination request..

Equipment and Material Staging

Equipment and materials will be stored and staged in a manner that complies with applicable laws and regulations.

Stabilized Construction Entrance

Steps will be taken to ensure that trucks departing the site will not track soil, fill or debris off-Site. Such actions may include use of cleaned asphalt or concrete pads or use of stone or other aggregate-based egress paths between the truck inspection station and the property exit. Measures will be taken to ensure that adjacent roadways will be kept clean of project related soils, fill and debris.

Truck Inspection Station

An outbound-truck inspection station will be set up close to the Site exit. Before exiting the Site, trucks will be required to stop at the truck inspection station and will be examined for evidence of contaminated soil on the undercarriage, body, and wheels. Soil and debris will be removed. Brooms, shovels and clean water will be utilized for the removal of soil from vehicles and equipment, as necessary.

Extreme Storm Preparedness and Response Contingency Plan

Damage from flooding or storm surge can include dislocation of soil and stockpiled materials, dislocation of site structures and construction materials and equipment, and dislocation of support of excavation structures. Damage from wind during an extreme storm event can create unsafe or unstable structures, damage safety structures and cause downed power lines creating dangerous site conditions and loss of power. In the event of emergency conditions caused by an extreme storm event, the enrollee will undertake the following steps for site preparedness prior to the event and response after the event.

Storm Preparedness

Preparations in advance of an extreme storm event will include the following: containerized hazardous materials and fuels will be removed from the property; loose materials will be secured to prevent dislocation and blowing by wind or water; heavy equipment such as excavators and generators will be removed from excavated areas, trenches and depressions on the property to high ground or removed from the property; an inventory of the property with photographs will be performed to establish conditions for the site and equipment prior to the event; stockpile covers for soil and fill will be secured by adding weights such as sandbags for added security and worn or ripped stockpile covers will be replaced with competent covers; stockpiled hazardous wastes will be removed from the property; stormwater management systems will be inspected and fortified, including, as necessary: clean and reposition silt fences, hay bales; clean storm sewer filters and traps; and secure and protect pumps and hosing.

Storm Response

At the conclusion of an extreme storm event, as soon as it is safe to access the Site, a complete inspection of the Site will be performed. A Site inspection report will be submitted to OER at

the completion of Site inspection and after the Site security is assessed. Site conditions will be compared to the inventory of Site conditions and material performed prior to the storm event and significant differences will be noted. Damage from storm conditions that result in acute public safety threats, such as downed power lines or imminent collapse of buildings, structures or equipment will be reported to public safety authorities via appropriate means such as calling 911. Petroleum spills will be reported to NYSDEC within 2 hours of identification and consistent with State regulations. Emergency and spill conditions will also be reported to OER. Public safety structures, such as construction security fences will be repaired promptly to eliminate public safety threats. Debris will be collected and removed. Dewatering will be performed in compliance with existing laws and regulations and consistent with emergency notifications, if any, from proper authorities. Eroded areas of soil including unsafe slopes will be stabilized and fortified. Dislocated materials will be collected and appropriately managed. Support of excavation structure will be inspected and fortified as necessary. Impacted stockpiles will be contained and damaged stockpile covers will be replaced. Stormwater control systems and structures will be inspected and maintained as necessary. If soil or fill materials are discharged off-Site to adjacent properties, property owners and OER will be notified and corrective measure plan designed to remove and clean dislocated material will be submitted to OER and implemented following approval by OER and granting of site access by the property owner. Impacted off-Site areas may require characterization based on Site conditions, at the discretion of OER. If onsite petroleum spills are identified, a QEP will determine the nature and extent of the spill and report to NYSDEC's spill hotline at 800-457-7362 within statutory defined timelines. If the source of the spill is ongoing and can be identified, it should be stopped if this can be done safely. Potential hazards will be addressed immediately, consistent with guidance issued by NYSDEC.

Storm Response Reporting

A Site inspection report will be submitted to OER at the completion of Site inspection. An inspection report established by OER is available on OER's website (www.nyc.gov/oer) and will be used for this purpose. Site conditions will be compared to the inventory of Site conditions and material performed prior to the storm event and significant differences will be noted. The Site inspection report will be sent to the OER project manager and will include the Site name, address, tax block and lot, site primary and alternate contact name and phone number. Damage

and soil release assessment will include: whether the project had stockpiles; whether stockpiles were damaged; photographs of damage and notice of plan for repair; report of whether soil from the Site was dislocated and whether any of the soil left the Site; estimates of the volume of soil that left the Site, nature of impact, and photographs; description of erosion damage; description of equipment damage; description of damage to the remedial program or the construction program, such as damage to the support of excavation; presence of onsite or off-Site exposure pathways caused by the storm; presence of petroleum or other spills and status of spill reporting to NYSDEC; description of corrective actions; schedule for corrective actions. This report should be completed and submitted to OER project manager with photographs within 24 hours of the time of safe entry to the property after the storm event.

5.8 Traffic Control

Drivers of trucks leaving the Site with soil will be instructed to proceed without stopping in the vicinity of the Site to prevent neighborhood impacts. The planned route on local roads for trucks leaving the Site is shown on Figure 4.

5.9 Demobilization

Demobilization will include:

- As necessary, restoration of temporary access areas and areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, temporary water management areas, and access area);
- Removal of sediment from erosion control measures and truck wash and disposal of materials in accordance with applicable laws and regulations;
- Equipment decontamination, and;
- General refuse disposal.

Equipment will be decontaminated and demobilized at the completion of all field activities. Investigation equipment and large equipment (e.g., soil excavators) will be washed at the truck inspection station as necessary. In addition, all investigation and remediation derived waste will be appropriately disposed.

5.10 Reporting and Record Keeping

Daily reports

Daily reports providing a general summary of activities for each day of active remedial work will be emailed to the OER Project Manager by the end of the following business day. Those reports will include:

- Project number and statement of the activities and an update of progress made and locations of excavation and other remedial work performed;
- Quantities of material imported and exported from the Site;
- Status of on-Site soil stockpiles;
- A summary of all citizen complaints, with relevant details (basis of complaint; actions taken; etc.);
- A summary of CAMP results noting all excursions. CAMP data may be reported;
- Photograph of notable Site conditions and activities.

The frequency of the reporting period may be revised in consultation with OER project manager based on planned project tasks. Daily email reports are not intended to be the primary mode of communication for notification to OER of emergencies (accidents, spills), requests for changes to the RAWP or other sensitive or time critical information. However, such information will be included in the daily reports. Emergency conditions and changes to the RAWP will be communicated directly to the OER project manager by personal communication. Daily reports will be included as an Appendix in the Remedial Action Report.

Record Keeping and Photo Documentation

Job-Site record keeping for all remedial work will be performed. These records will be maintained on-Site during the project and will be available for inspection by OER staff. Representative photographs will be taken of the Site prior to any remedial activities and during major remedial activities to illustrate remedial program elements and contaminant source areas. Photographs will be submitted at the completion of the project in the RAR in digital format (i.e. jpeg files).

5.11 Complaint Management

All complaints from citizens will be promptly reported to OER. Complaints will be addressed and outcomes will also be reported to OER in daily reports. Notices to OER will include the nature of the complaint, the party providing the complaint, and the actions taken to resolve any problems.

5.12 Deviations From The Remedial Action Work Plan

All changes to the RAWP will be reported to, and approved by, the OER Project Manager and will be documented in daily reports and reported in the Remedial Action Report. The process to be followed if there are any deviations from the RAWP will include a request for approval for the change from OER noting the following:

- Reasons for deviating from the approved RAWP;
- Effect of the deviations on overall remedy; and
- Determination with basis that the remedial action with the deviation(s) is protective of public health and the environment.

6.0 REMEDIAL ACTION REPORT

A RAR will be submitted to OER following implementation of the remedial action defined in this RAWP. The RAR will document that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The RAR will include:

- Information required by this RAWP;
- Text description with thorough detail of all engineering and institutional controls (if Track 1 remedial action is not achieved)
- As-built drawings for all constructed remedial elements;
- Manifests for all soil or fill disposal;
- Photographic documentation of remedial work performed under this remedy;
- Description of any changes in the remedial action from the elements provided in this RAWP and associated design documents;
- Tabular summary of all end point sampling results (including all soil test results from the RI for soil that will remain on site) and all soil/fill waste characterization results, QA/QC results for end-point sampling, and other sampling and chemical analysis performed as part of the remedial action;
- Account of the locations and characteristics of all soil or fill material removed from the Site including a map showing the location of these excavations;
- Full accounting of the disposal destination of all contaminated material removed from the Site. Documentation associated with disposal of all material will include transportation and disposal records, and letters approving receipt of the material;
- Account of the origin and required chemical quality testing for material imported onto the Site;
- Continue registration of the property with an E-Designation by the NYC Department of Buildings (if Track 2 Commercial Use remedial action is not achieved);
- The RAWP and RIR will be included as appendices to the RAR; and
- Reports and supporting material will be submitted in digital form and final PDF's will include bookmarks for each appendix.

Remedial Action Report Certification

I, David Bligh, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for implementation of the remedial program for the Staten Island Mall 2655 Richmond Avenue, Staten Island, New York Site (Block 2400, Lot 80), site number 16EHAZ109R. I certify to the following:

- I have reviewed this document, to which my signature and seal are affixed.
- Engineering Controls implemented during this remedial action were designed by me or a person under my direct supervision and achieve the goals established in the Remedial Action Work Plan for this site.
- The Engineering Controls constructed during this remedial action were professionally observed by me or by a person under my direct supervision and (1) are consistent with the Engineering Control design established in the Remedial action Work Plan and (2) are accurately reflected in the text and drawings for as-built design reported in this Remedial Action Report.
- The OER-approved RAWP dated [date] and Stipulations in a letter dated [date] were implemented and that all requirements in those documents have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.

Name

PE License Number

Signature

Date

PE Stamp

I, Frank Cherena, am a Qualified Environmental Professional. I had primary direct responsibility for implementation of the remedial program for the Staten Island Mall 2655 Richmond Avenue, Staten Island, New York Site (Block 2400, Lot 80) Site, site number 16EHAZ109R. I certify to the following:

- The OER-approved Remedial Action Work Plan dated [DATE] and Stipulations in a letter dated [DATE] were implemented and that all requirements in those documents have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.

QEP Name

QEP Signature

Date

7.0 SCHEDULE

The table below presents a schedule for the proposed remedial action and reporting. If the schedule for remediation and development activities changes, it will be updated and submitted to OER. Currently, a three month remediation period is anticipated.

Schedule Milestone	Weeks from Remedial Action Start	Duration (weeks)
OER Approval of RAWP	0	-
Fact Sheet 2 announcing start of remedy	0	-
Mobilization	1	2
Remedial Excavation	5	13
Demobilization	40	2
Submit Remedial Action Report	26	8



QUADRANGLE
LOCATION



SOURCE:
USGS; 1981, Arthur Kill, N.Y.-N.J.
7.5 Minute Topographic Quadrangle



Title:

SITE LOCATION MAP

STATEN ISLAND MALL EXPANSION
REMEDIAL ACTION WORK PLAN

Prepared for:

GGP STATEN ISLAND MALL, LLC

Remedial
REMEDIAL ENGINEERING, P.C.
ENVIRONMENTAL ENGINEERS

Compiled by: G.N.	Date: 11DEC15
Prepared by: B.H.C.	Scale: AS SHOWN
Project Mgr.: D.B.	Project No.: 1287.0007Y000
File: 1287.0007Y117.01.CDR	

FIGURE

1



Title:

SURROUNDING LAND USE

STATEN ISLAND MALL EXPANSION
REMEDIAL ACTION WORK PLAN

Prepared for:

GGP STATEN ISLAND MALL, LLC

Remedial

REMEDIAL ENGINEERING, P.C.
ENVIRONMENTAL ENGINEERS

Compiled by: L.D.

Date: 11DEC15

Prepared by: B.H.C.

Scale: AS SHOWN

Project Mgr.: D.T.B.

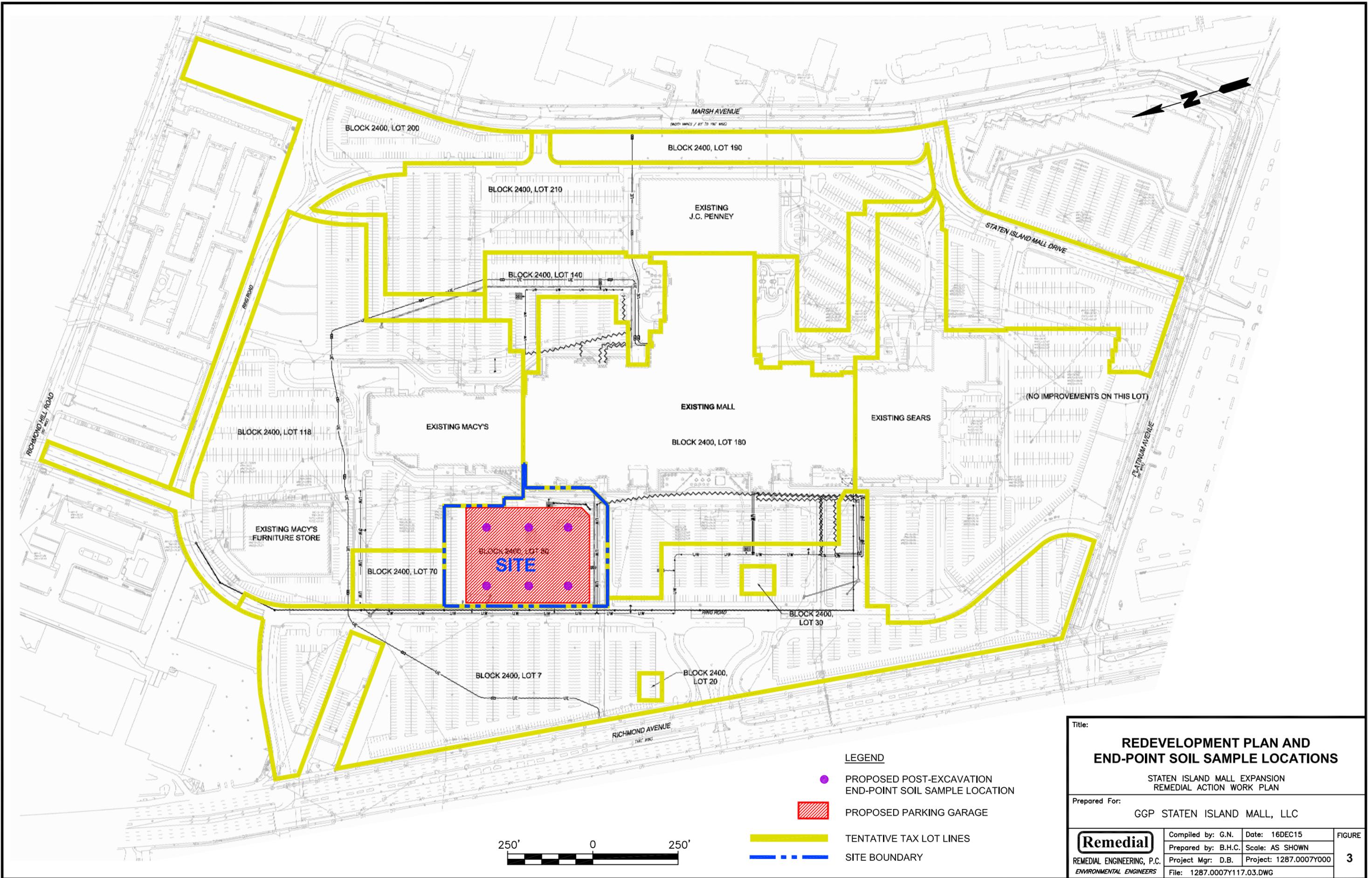
Project No.: 1287.0007Y000

File: 1287.0007Y117.02.CDR

FIGURE

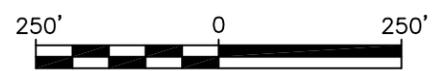
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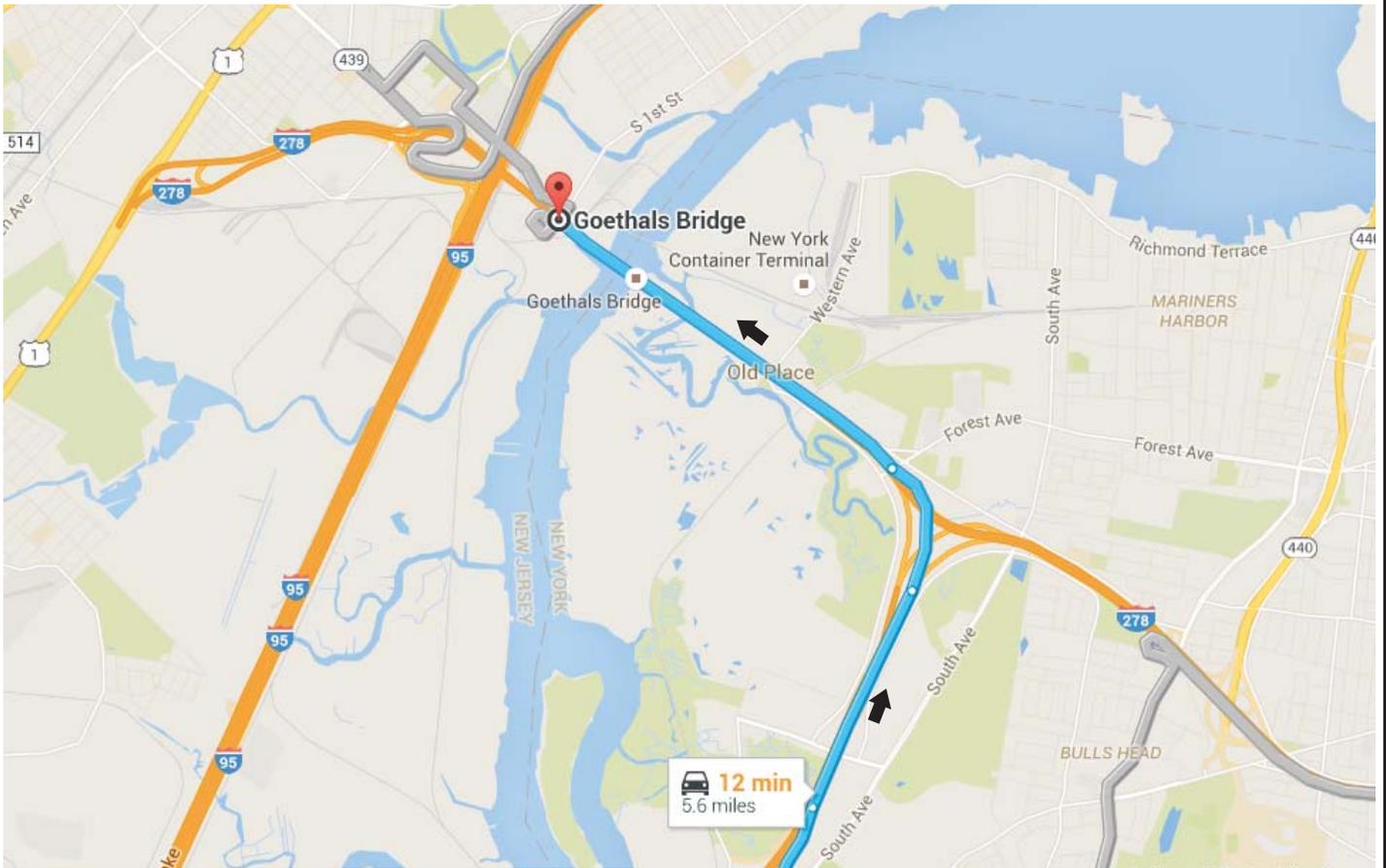
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Title: REDEVELOPMENT PLAN AND END-POINT SOIL SAMPLE LOCATIONS			
STATEN ISLAND MALL EXPANSION REMEDIAL ACTION WORK PLAN			
Prepared For: GGP STATEN ISLAND MALL, LLC			
Remedial REMEDIAL ENGINEERING, P.C. ENVIRONMENTAL ENGINEERS	Compiled by: G.N.	Date: 16DEC15	FIGURE 3
	Project Mgr: D.B.	Scale: AS SHOWN	
File: 1287.0007\117.03.DWG		Project: 1287.0007Y000	

- LEGEND**
- PROPOSED POST-EXCAVATION
END-POINT SOIL SAMPLE LOCATION
 - PROPOSED PARKING GARAGE
 - TENTATIVE TAX LOT LINES
 - SITE BOUNDARY





DIRECTIONS

Staten Island Mall

2655 Richmond Avenue, Staten Island, NY 10314

Get on NY-440 N/W Shore Expy from Richmond Ave and Travis Ave

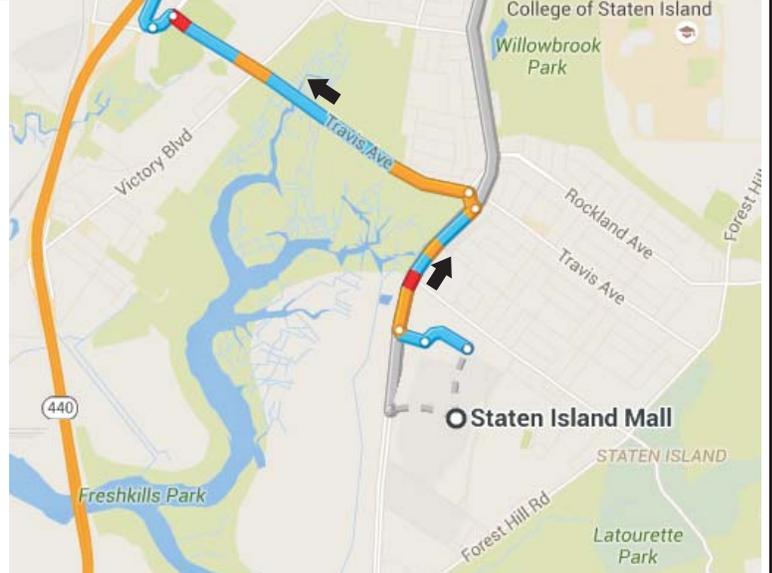
1. Head northwest 8 min (2.6 mi)
2. Turn right toward Richmond Ave 0.2 mi
3. Slight right onto Richmond Ave 0.1 mi
4. Turn left onto Draper Pl 0.5 mi
5. Slight left onto Travis Ave 331 ft
6. Turn left onto South Ave 1.3 mi
7. Use the right lane to merge onto NY-440 N/W Shore Expy via the ramp to I-278 479 ft

Continue on NY-440 N/W Shore Expy. Drive to I-278 W

8. Merge onto NY-440 N/W Shore Expy 3 min (2.6 mi)
9. Use the left lane to take the Interstate 278 W/Staten Island Expy W exit toward Goethals Br 0.9 mi
10. Merge onto I-278 W 0.5 mi

Goethals Bridge

Goethals Road North, Staten Island, NY 10303



Title:

OUTBOUND TRUCK ROUTE

STATEN ISLAND MALL EXPANSION REMEDIAL ACTION WORK PLAN

Prepared for:

GGP STATEN ISLAND MALL, LLC

Remedial

REMEDIAL ENGINEERING, P.C.
ENVIRONMENTAL ENGINEERS

Compiled by: L.D.

Prepared by: B.H.C.

Project Mgr.: D.T.B.

File: 1287.0007Y117.02.CDR

Date: 16DEC15

Scale: AS SHOWN

Project No.: 1287.0007Y000

FIGURE

4

APPENDIX A
PROPOSED DEVELOPMENT PLANS

BUILDING CODE ANALYSIS

STATEN ISLAND MALL PARKING GARAGE

1. BUILDING CODE: 2008 NEW YORK CITY BUILDING CODE

2. USE AND OCCUPANCY CLASSIFICATION:

- A. OPEN PARKING GARAGE: USE GROUP S-2, SPECIAL (406.3)

3. CONSTRUCTION TYPE: (602.2)

- A. OPEN PARKING STRUCTURE: TYPE 1B

4. BUILDING HEIGHT AND AREA LIMITATIONS (Table 406.3.5):

- A. MAX. BUILDING HEIGHT/AREA:
 - 1. OPEN PARKING GARAGE (S-2):
 - TYPE OF CONSTRUCTION: 1B -
 - AREA PER TIER = UNLIMITED
 - HEIGHT (IN TIERS) = 12 TIERS

5. FIRE RESISTANCE RATED CONSTRUCTION AND PROTECTION REQUIREMENTS:

- A. MINIMUM RATINGS FOR TYPE 1B CONSTRUCTION
 - 1. BUILDING STRUCTURE (TABLE 601):
 - HOURS BUILDING ELEMENT
 - 2.....STRUCTURAL FRAME (COLUMNS & GIRDERS)
 - 2.....INTERIOR BEARING WALLS
 - 2.....EXTERIOR BEARING WALLS
 - 2.....FLOOR CONSTRUCTION (SLAB & BEAMS)
 - 1.....ROOF CONSTRUCTION (SLAB & BEAMS)
 - 2. NON-BEARING WALLS (602.2, TABLE 602):
 - HOURS BUILDING ELEMENT
 - 0.....INTERIOR NON-BEARING WALLS
 - 0.....EXTERIOR NON-BEARING WALLS
 - 0.....FIRE SEPARATION DISTANCE OVER 30 FT

6. FIRE PROTECTION REQUIREMENTS:

GENERAL NOTE: ALL FIRE PROTECTION EQUIPMENT, PROPOSED LOCATIONS AND APPLICABILITY OF REFERENCED CODES ARE SUBJECT TO THE REVIEW OF THE FIRE OFFICIAL(S) HAVING JURISDICTION.

A. SPRINKLER SYSTEM:

- 1. OPEN PARKING GARAGE - NOT REQUIRED (903.2.9). OPEN PARKING STRUCTURE IS NOT LOCATED BENEATH OTHER OCCUPANCY GROUPS

B. STANDPIPE SYSTEM:

- 1. OPEN PARKING GARAGE SHALL BE EQUIPPED WITH A DRY STANDPIPE SYSTEM COMPLYING WITH NFPA 14 (406.3.9, 905.2, 905.3.1, EXCEPTION 3).

7. MEANS OF EGRESS:

- A. DESIGN OCCUPANT LOAD (1004.1, TABLE 1004.1.2)
 - 1. PARKING GARAGES: 200 S.F./OCCUPANT (GROSS)
 - 2. ACCESSORY STORAGE/MECHANICAL: 300 S.F./OCCUPANT (GROSS)
- B. EGRESS WIDTH (1005.1, TABLE 1005.1)
 - 1. OCCUPANCIES, OTHER - 0.3 INCHES PER OCCUPANT FOR STAIRWAY WIDTH.
 - 2. OCCUPANCIES, OTHER - 0.2 INCHES PER OCCUPANT FOR DOOR WIDTH.
- C. CEILING HEIGHT (1003.2, 1003.3.3)
 - 1. NOT LESS THAN 7 FEET SIX INCHES (7'-6") EXCEPT AT STAIRWAYS OR PROTRUDING OBJECTS.
 - 2. HEADROOM AT PROTRUDING OBJECTS TO BE 84 INCHES (7'-0") MINIMUM.
 - 3. PROVIDE BARRIERS FOR HEADROOM LESS THAN 80 INCHES (6'-8").
 - 4. STAIRWAY HEADROOM(1009.2) TO BE 84 INCHES (7'-0") MINIMUM.
- D. GUARDS (1012) - REQUIRED AT ALL OPEN-SIDED AREAS MORE THAN 30 INCHES ABOVE THE FLOOR OR GRADE BELOW.
 - 1. HEIGHT: 42 INCHES
 - 2. STRENGTH AND ATTACHMENT REQUIREMENTS (1607.7.1).
- E. ACCESSIBLE MEANS OF EGRESS - NOT LESS THAN TWO (1007.1).
 - 1. OPEN EXIT STAIRWAYS PERMITTED.
- F. MEANS OF EGRESS COMPONENTS (1019.1, EXCEPTION 5)
 - 1. DOORS - 32 INCHES MINIMUM CLEAR OPENING WIDTH (1008.1.1).
 - a. DIRECTION OF SWING: DOORS TO SWING IN DIRECTION OF EGRESS TRAVEL FOR OCCUPANCY LOADS OVER 50 (1008.1.2).
 - b. DOOR HARDWARE
 - 1) HEIGHT: 34 TO 48 INCHES (1008.1.8.2).
 - 2) PANIC HARDWARE (1008.1.9):
 - a) NOT REQUIRED FOR S-2 OCCUPANCY.
 - 2. STAIRWAYS - 44 INCHES MINIMUM WIDTH (1009.1), WITH ONE HANDRAIL PROJECTION.
 - a. LANDINGS - WIDTH EQUAL TO STAIRWAY WIDTH OR GREATER.
 - b. HANDRAILS:
 - 1) HEIGHT: 34 TO 38 INCHES (1009.11.1).
 - 2) STRENGTH AND ATTACHMENT REQUIREMENTS (1607.7.1).
 - 3) MAXIMUM PROJECTION INTO REQUIRED STAIR WIDTH NOT TO EXCEED 4.5 INCHES (1009.11.7).

8. EXIT ACCESS:

- 1) ARRANGEMENT: MINIMUM SEPARATION DISTANCE EQUAL TO ONE-HALF THE OVERALL DIAGONAL DIMENSION OF THE AREA BEING SERVED (1014.2).
- 2) MAX. TRAVEL DISTANCE (1015, TABLE 1015.1):
 - 1. S-2 OCCUPANCY (PARKING GARAGES, WITHOUT SPRINKLERS): 200 FT.

9 - MEANS OF EGRESS:

TABLE 1004.1.2: MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

PARKING GARAGES = 200 GROSS FLOOR AREA IN S.F. PER OCCUPANT

CALCULATION FOR NUMBER OF OCCUPANTS BY LEVEL:

FLOOR LEVEL	GROSS AREA	OCCUPANTS
GRADE LEVEL	180,850 SF	904
SECOND LEVEL	180,850 SF	904
THIRD LEVEL	176,650 SF	883

WITHOUT SPRINKLER SYSTEM

STAIRWAYS	0.3 INCHES
OTHER EGRESS COMPONENTS	0.2 INCHES

1003.2.3 EGRESS WIDTH

TABLE 1005.1: EGRESS WIDTH PER OCCUPANT SERVED

STAIRS

TYPICAL FLOOR - 904 OCCUPANTS
904/6 EXITS = 151 OCCUPANTS PER EXIT
151 x 0.3 = 45.3 INCHES EXIT WIDTH REQUIRED
48" MIN. CLEAR WIDTH PROVIDED

DOORS

TYPICAL FLOOR - 904 OCCUPANTS
904/6 EXITS = 151 OCCUPANTS PER EXIT
151 x 0.2 = 30.2 INCHES EXIT WIDTH REQUIRED
36" WIDE EXIT DOORS PROVIDED

1003.3.1 HEADROOM MINIMUM REQUIRED = 84 INCHES IN NON-VEHICLE AREAS.

1007.3, EXCEPTION 4 ACCESSIBLE MEANS OF EGRESS-EXIT STAIRWAY:
AREA OF REFUGE NOT REQUIRED IN EXIT WAYS SERVING OPEN PARKING GARAGES

1007.4 ELEVATORS ARE NOT REQUIRED TO BE ACCESSED FROM AN AREA OF REFUGE OR HORIZONTAL EXIT IN OPEN PARKING GARAGES (EXCEPTION #1).

1009.3 STAIR RISERS & TREADS
STAIR RISER HEIGHTS SHALL BE 7 INCHES MINIMUM.
STAIR TREAD DEPTHS SHALL BE 11 INCHES MINIMUM.
1009.4 STAIRWAY LANDINGS - THE WIDTH OF LANDINGS SHALL NOT BE LESS THAN THE WIDTH OF STAIRWAYS THEY SERVE.

1012.3 OPENING LIMITATIONS: OPEN GUARDS SHALL HAVE BALUSTERS OR ORNAMENTAL PATTERNS SUCH THAT A 4-INCH-DIAMETER SPHERE CANNOT PASS THROUGH ANY OPENING UP TO A HEIGHT OF 34 INCHES. FROM A HEIGHT OF 34 INCHES TO 42 INCHES ABOVE THE ADJACENT WALKING SURFACES, A SPHERE 8 INCHES IN DIAMETER SHALL NOT PASS.

SECTION 1015 EXIT ACCESS TRAVEL DISTANCE

TABLE 1015.1: EXIT ACCESS TRAVEL DISTANCE
OCCUPANCY S-2 WITHOUT SPRINKLER SYSTEM = 200 FEET MAXIMUM.
MAXIMUM TRAVEL DISTANCE PROVIDED = ___ FEET

SECTION 1019: NUMBER OF EXITS AND CONTINUITY

1019.1 OPEN PARKING STRUCTURES SHALL NOT HAVE LESS THAN TWO (2) EXITS FROM EACH PARKING TIER. SIX (6) EXITS PROVIDED FROM EACH TIER.

11. CODE SIGNAGE REQUIREMENTS:

- A. EGRESS SIGNAGE
 - 1. EXIT SIGNS: PROVIDE ILLUMINATED EXIT SIGNS AT ALL EXIT DOORS (1011.1).
 - a. EXIT SIGNS NOT REQUIRED AT AREAS REQUIRING ONLY ONE EXIT (1011.1.1)
 - b. ACCESS TO EXITS SHALL BE SIGNED WHERE EXIT IS NOT IMMEDIATELY VISIBLE (100 FT MAX. SPACING) (1011.1).
- B. ACCESSIBILITY SIGNAGE (1110, ADAAG)
 - 1. ACCESSIBLE PARKING SPACES.
 - 2. ACCESSIBLE ENTRANCES.
 - a. DIRECTIONAL SIGNAGE TO BE PLACED AT INACCESSIBLE ENTRANCES/EGRESS (1010.2.1).
- C. ELEVATOR SIGNAGE
 - 1. EMERGENCY SIGNS (3002.3).
 - 2. ACCESSIBILITY SIGNAGE (1110, ADAAG).

12. ACCESSIBILITY

- A. REQUIREMENTS PER CHAPTER 11, ADDAG.
- B. PARKING FACILITIES - SPECIAL REQUIREMENTS (1106).

13. SPECIAL REQUIREMENTS FOR OPEN PARKING STRUCTURE

- A. PARKING STRUCTURE IS CLASSIFIED AS AN OPEN PARKING GARAGE (406.3.2).
 - 1. OPENINGS (406.3.3.1) THE EXTERIOR SIDE OF THE STRUCTURE SHALL HAVE OPENINGS EQUAL TO 50 PERCENT OF THE PERIMETER WALLS. THE AGGREGATE LENGTH OF OPENINGS CONSIDERED TO BE PROVIDING NATURAL VENTILATION SHALL CONSTITUTE A MINIMUM OF 40 PERCENT OF THE PERIMETER TIER. INTERIOR WALLS SHALL BE AT LEAST 20 PERCENT OPEN.
 - 2. ENCLOSURE IS NOT REQUIRED FOR VERTICAL OPENINGS (406.3.11).

14. STRUCTURAL DESIGN:

- A. REQUIREMENTS PER NYCBC CHAPTERS 16 THROUGH 26.
- B. SEE STRUCTURAL DRAWINGS FOR ADDITIONAL CODE INFORMATION.

15. ELECTRICAL SYSTEMS:

- A. REQUIREMENTS PER NYCBC CHAPTER 27.
- B. SEE ELECTRICAL DRAWINGS FOR ADDITIONAL CODE INFORMATION.

16. MECHANICAL SYSTEMS:

- A. REQUIREMENTS PER NYCBC CHAPTER 28.
- B. SEE MECHANICAL DRAWINGS FOR ADDITIONAL CODE INFORMATION.

17. PLUMBING SYSTEMS:

- A. REQUIREMENTS PER NYCBC CHAPTER 29.
- B. SEE PLUMBING DRAWINGS FOR ADDITIONAL CODE INFORMATION.

18. ELEVATOR SYSTEMS:

- A. REQUIREMENTS PER NYCBC CHAPTER 30.
- B. FIRE-RESISTANCE RATING OF ELEVATOR EQUIPMENT ROOM SHALL MATCH THE SHAFT RATING PER (3006.4)

PROJECT:
**STATEN ISLAND MALL
PARKING GARAGE**
STATEN ISLAND, NEW YORK

DRAWING TITLE:
BUILDING CODE NOTES

SEAL & SIGNATURE:

DATE: DESIGN DEVELOPMENT: 05-19-14

PROJECT NO: 10-13147-1

DRAWING BY:

DESIGNED BY:

DRAWING NO:

A-002.0

CAD PATH: FILE # OF

I S S U E

NO.	DESCRIPTION	DATE

OWNER
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Chicago, IL 60606
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Fax:

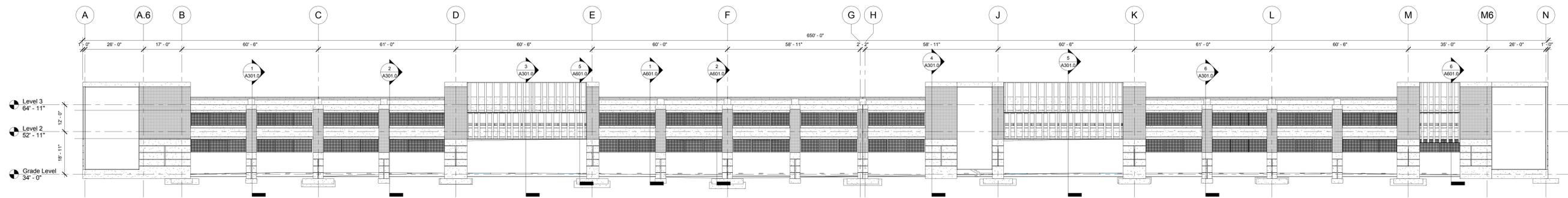
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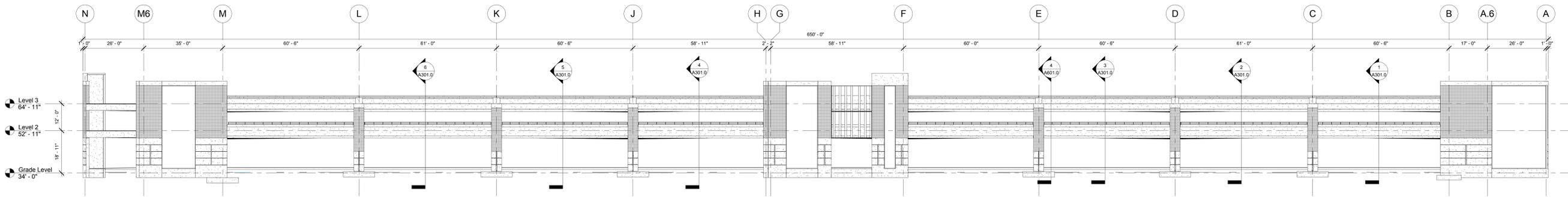
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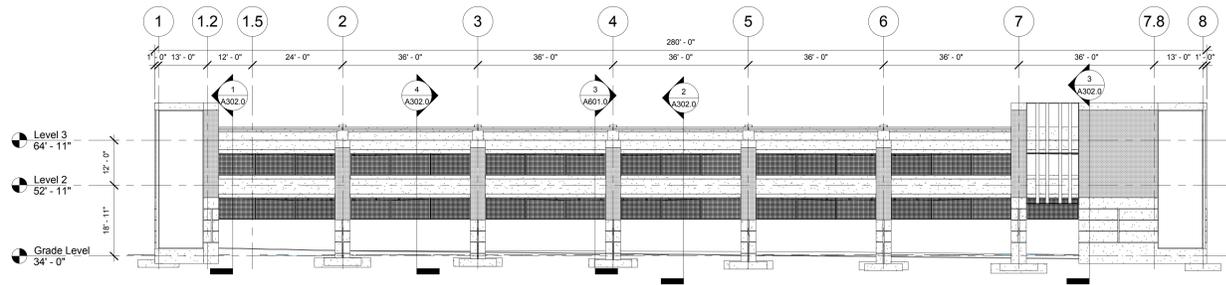
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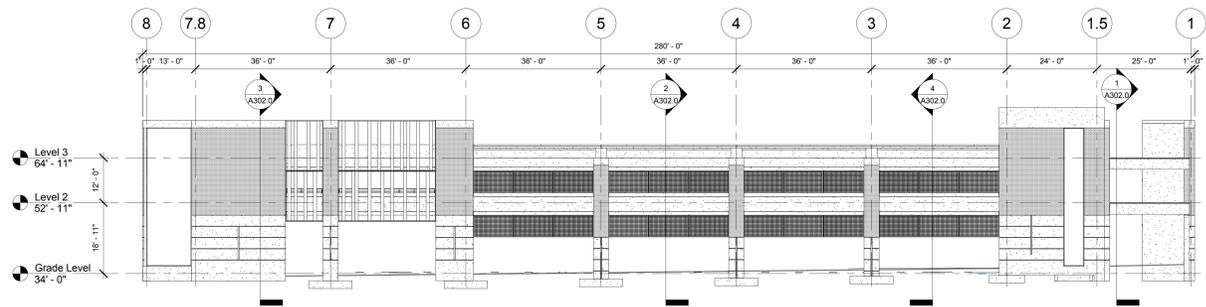
1 WEST ELEVATION
A201.0 SCALE: 1/16" = 1'-0"



2 EAST ELEVATION
A201.0 SCALE: 1/16" = 1'-0"



3 NORTH ELEVATION
A201.0 SCALE: 1/16" = 1'-0"



4 SOUTH ELEVATION
A201.0 SCALE: 1/16" = 1'-0"

PROJECT:
**STATEN ISLAND MALL
PARKING GARAGE**
STATEN ISLAND, NEW YORK

BUILDING ELEVATIONS

DATE/DESIGN DEVELOPMENT	MM 19, 2014
PROJECT NO.	10-13147-1
DRAWING BY: Author	
DESIGNED BY: Designer	
DRAWING NO.	A201.0
CAD PATH:	
FILE #	07

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LANDSCAPE ARCHITECTURE

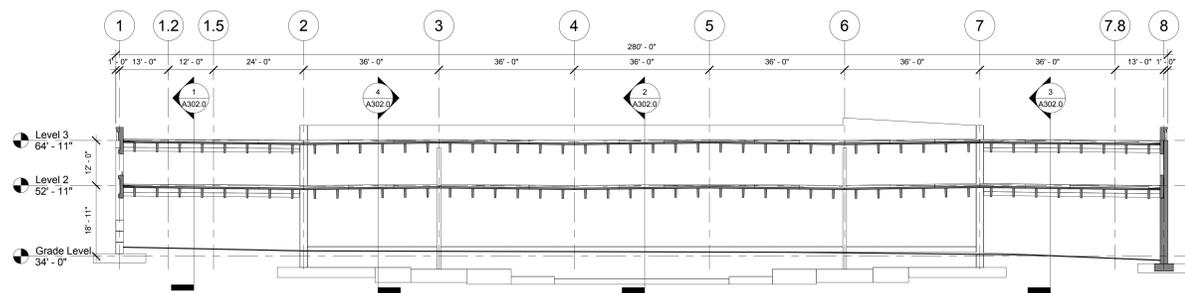
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MEP ENGINEERS

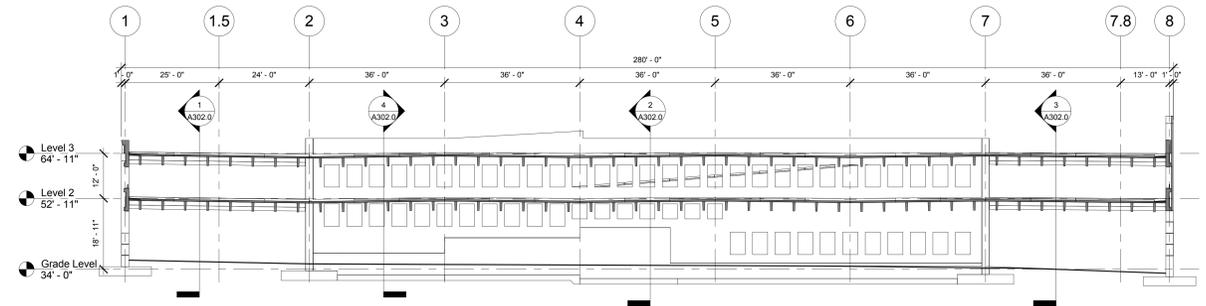
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I . S . S . U . E

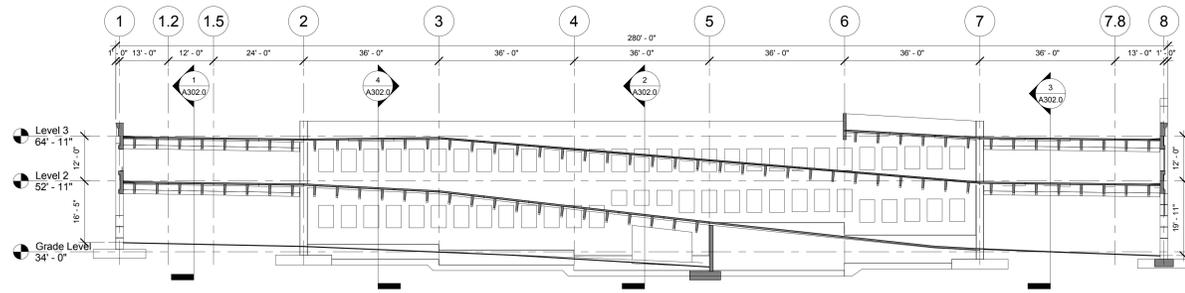
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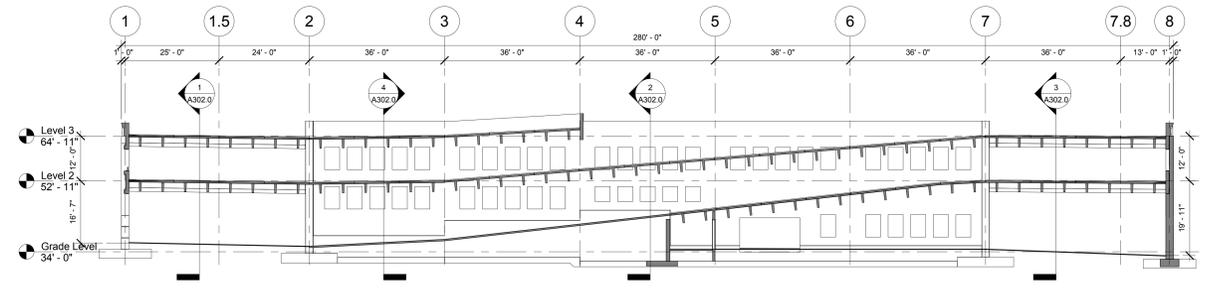
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A301.0 SCALE: 1/16" = 1'-0"



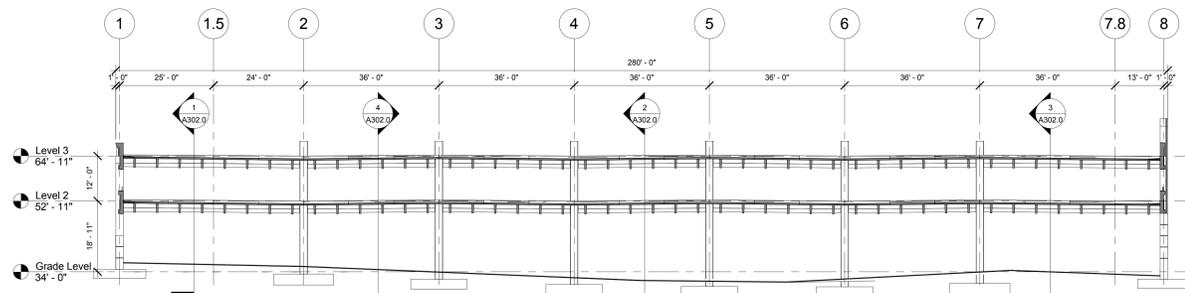
5 BUILDING SECTION BET. COL. J & K
A301.0 SCALE: 1/16" = 1'-0"



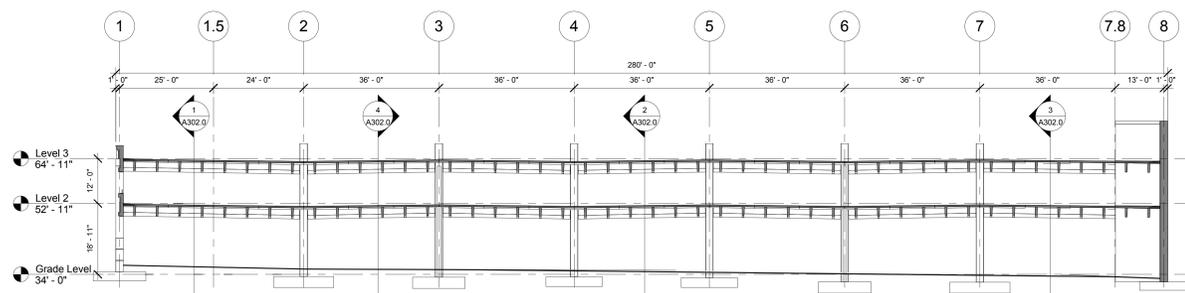
2 BUILDING SECTION @ NORTH RAMP
A301.0 SCALE: 1/16" = 1'-0"



6 BUILDING SECTION @ SOUTH RAMP
A301.0 SCALE: 1/16" = 1'-0"



3 BUILDING SECTION BET. COL. D & E
A301.0 SCALE: 1/16" = 1'-0"



4 BUILDING SECTION BET. COL. H & J
A301.0 SCALE: 1/16" = 1'-0"

PROJECT:
**STATEN ISLAND MALL
PARKING GARAGE**
STATEN ISLAND, NEW YORK

DRAWING TITLE:
BUILDING SECTIONS

SEAL & SIGNATURE

DATE/DESIGN DEVELOPMENT: MAY 19, 2014

PROJECT NO.: 10-13147-1

DRAWING BY: Author

DESIGNED BY: Designer

DRAWING NO.:

A301.0

CAD PATH:

FILE # 07

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I . S . S . U . E

NO.	DESCRIPTION	DATE

GENERAL NOTES

- ALL NOTES GIVEN ON THESE DRAWINGS ARE SUPPLEMENTAL TO THE PROJECT SPECIFICATIONS AND ARE NOT INTENDED TO REPLACE THEM IN THE EVENT OF AN APPARENT CONFLICT BETWEEN THE NOTES AND THE PROJECT SPECIFICATIONS, THE CONTRACTOR MUST OBTAIN CLARIFICATION IN WRITING FROM THE ARCHITECT/ENGINEER.
- ALL DESIGN AND CONSTRUCTION SHALL BE DONE IN ACCORDANCE WITH THE MOST STRINGENT OF THE GOVERNING CODE, THE LATEST EDITION OF THE CITY, STATE AND LOCAL CODES AND ALL OTHER PERTINENT CODES, REGULATIONS AND ORDINANCES.
- DRAWINGS ARE NOT TO BE USED FOR SHOP DETAILING OR FOR CONSTRUCTION UNLESS SPECIFICALLY INDICATED STAMPED BY THE ARCHITECT/ENGINEER FOR DETAILING OR FOR CONSTRUCTION. THESE DRAWINGS ARE NOT TO BE REPRODUCED FOR THE PURPOSE OF USING THEM AS SHOP DETAIL DRAWINGS.
- STRUCTURAL DRAWINGS ARE INTENDED TO BE USED ALONG WITH CIVIL, ARCHITECTURAL, MECHANICAL & ELECTRICAL DRAWINGS. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE REQUIREMENTS OF ALL DRAWINGS IN TO THEIR SHOP DRAWINGS AND WORK.
- NO OPENING OTHER THAN THOSE SHOWN ON DESIGN DRAWINGS AND APPROVED SHOP DRAWINGS SHALL BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT/ENGINEER.
- ALL OPENINGS ARE GENERALLY NOT SHOWN ON THE STRUCTURAL DRAWINGS. REFER TO ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWINGS FOR LOCATIONS AND DIMENSIONS OF THOSE OPENINGS. PROVIDE REINFORCING AROUND OPENINGS PER TYPICAL DETAILS SHOWN ON STRUCTURAL DRAWINGS.
- NO CHANGE IN SIZE AND DIMENSION OF STRUCTURAL MEMBERS SHALL BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT/ENGINEER.
- DO NOT SCALE THESE DRAWINGS, USE DIMENSIONS SHOWN ON THE DRAWINGS.
- THE STRUCTURE IS DESIGNED FUNCTION AS A UNIT UPON COMPLETION. BASED ON THE CONTRACTOR'S CONSTRUCTION METHOD AND SEQUENCING OF CONSTRUCTION, THE CONTRACTOR SHALL RETAIN A LICENSED PROFESSIONAL ENGINEER TO DESIGN LATERAL SUPPORT SYSTEM REQUIRED TO RESIST LATERAL LOADS AND FOR OVERALL STABILITY OF THE STRUCTURE UNTIL COMPLETION. THE CONTRACTOR SHALL FURNISH AND PROVIDE THE NECESSARY BRACING AND SUPPORTS DURING CONSTRUCTION AND IS RESPONSIBLE FOR THE OVERALL STABILITY OF THE STRUCTURE UNTIL COMPLETION.
- THE CONTRACTOR IS RESPONSIBLE FOR LIMITING THE AMOUNT OF CONSTRUCTION LOAD IMPOSED UPON STRUCTURAL FRAMING. CONSTRUCTION LOAD SHALL NOT EXCEED THE CAPACITY OF THE FRAMING AT THE TIME THE LOADS ARE IMPOSED.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATELY SHEETING, SHORING AND UNDERPINNING AGAINST EXISTING STRUCTURES AS REQUIRED SO THAT THEY ARE NOT DAMAGED BY THIS CONSTRUCTION.
- THE CONTRACTOR'S CONSTRUCTION AND/OR ERECTION SEQUENCES SHALL RECOGNIZE AND CONSIDER THE EFFECTS OF THERMAL MOVEMENTS OF STRUCTURAL ELEMENTS.
- MINIMUM HEADROOM CLEARANCE IN THE GARAGE SHALL BE 8'-2" AT GRADE AND 7'-6" ABOVE GRADE. THE CONTRACTOR SHALL MEASURE CLEAR HEIGHT BELOW ALL BEAMS BEFORE PLACING CONCRETE. THE CONTRACTOR SHALL NOTIFY IN WRITING THE ARCHITECT/ENGINEER IMMEDIATELY IF CLEAR HEIGHT IS LESS THAN INDICATED ON THE DRAWINGS.

DESIGN CRITERIA

- CODES AND SPECIFICATIONS:
 - A. 2008 NEW YORK CITY BUILDING CODE
 - B. ACI BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE, ACI 318-08
 - C. ASCE MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES, ASCE 7-02
 - D. AISC 335-89/91, SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, ALLOWABLE STRESS DESIGN AND PLASTIC DESIGN (1989)
 - E. AISC SPECIFICATION FOR LOAD & RESISTANCE FACTOR DESIGN (1999)
 - F. AMERICAN DISABILITIES ACT ACCESSIBILITY GUIDELINES.
- DESIGN LOADS:
 - DEAD LOAD:
 - A. TYPICAL PRECAST CONCRETE SUPPORTED FRAMING LEVEL
 - A1 FLOOR DECK SELF WEIGHT
 - A2 GIRDERS AND BEAMS SELF WEIGHT
 - A3 COLUMNS SELF WEIGHT
 - A4 SPANDREL COLUMNS SELF WEIGHT
 - 2.2 LIVE LOAD (OCCUPANCY LOAD, PASSENGER VEHICLES ONLY, UND.):
 - A. GARAGE ROOF LEVEL:
 - GROUND SNOW LOAD P_g=30 PSF
 - DESIGN SNOW LOAD (ROOF LEVEL) P_f=22.7 PSF
 - SNOW EXPOSURE FACTOR C_e = 0.9
 - SNOW IMPORTANCE FACTOR I_s = 1.0
 - SNOW THERMAL FACTOR C_t = 1.2
 - DRIFTING SNOW PER 2008 NEW YORK CITY BUILDING CODE AND ASCE MIN. DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES, ASCE 7-02.
 - MIN. DESIGN LOAD AT GARAGE ROOF LEVEL (SNOW AND OCCUPANCY) 62.7 PSF
 - B. TYPICAL PARKING LEVEL 40 PSF
 - C. STAIRS, LANDINGS AND LOBBIES 100 PSF
- 2.3 WIND LOAD PER 2008 NEW YORK CITY BUILDING CODE AND ASCE 7-02 (MIN. DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES)
 - BASIC WIND SPEED (3 SECONDS GUST) 110 MPH
 - WIND IMPORTANCE FACTOR I = 1.0
 - WIND EXPOSURE C
 - INTERNAL PRESSURE COEFFICIENT AS PER ASCE-7, SECTION 6
 - EXTERNAL PRESSURE COEFFICIENT AS PER ASCE-7, SECTION 6
- 2.4 SEISMIC LOADS
 - A. SEISMIC LOADS PER BUILDING CODE OF NEW YORK STATE, 2007 AND ASCE 7-02. (MIN. DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES)
 - B. SEISMIC SITE CLASS C (PRELIMINARY GEOTECHNICAL ENGINEERING STUDY PREPARED BY LANGAN ENGINEERING DATED 12/6/2013)
 - C. SEISMIC USE GROUP I
 - D. SEISMIC IMPORTANCE FACTOR I_p = 1.0
 - E. MAPPED SPECTRAL RESPONSE ACCELERATION (FOR SHORT PERIOD) 0.2 SEC. S_s=36.5%
 - F. MAPPED SPECTRAL RESPONSE ACCELERATION (FOR 1 SECOND PERIOD) S₁=7.1%
 - G. SITE COEFFICIENT F_a (FOR SITE CLASS C) 1.21
 - H. SITE COEFFICIENT F_v (FOR SITE CLASS C) 1.7
 - I. SEISMIC DESIGN CATEGORY B
 - J. BASIC SEISMIC FORCE RESISTING SYSTEM BEARING WALL SYSTEM; ORDINARY REINFORCED CONCRETE SHEAR WALLS.
 - K. RESPONSE MODIFICATION FACTOR R=4.0
 - L. DEFLECTION AMPLIFICATION FACTOR C_d=4.0
 - M. SYSTEM OVERSTRENGTH FACTOR 0.25
 - N. SEISMIC ANALYSIS PROCEDURE EQUIVALENT LATERAL FORCE

CONCRETE NOTES

- ALL CONCRETE WORK SHALL CONFORM TO THE REQUIREMENTS OF ACI 318 AND ACI 301. THESE DOCUMENTS SHALL BE AVAILABLE IN THE FIELD OFFICE.
- EXCEPT WHERE OTHERWISE INDICATED, CONCRETE TYPES AND MINIMUM 28-DAY COMPRESSIVE STRENGTHS SHALL BE AS FOLLOWS:
 - A. SLAB-ON-GRADE 5,000 PSI REGULAR WEIGHT
 - B. FOOTINGS, GRADE BEAMS, PADS, RETAINING AND FOUNDATION WALLS 4,000 PSI REGULAR WEIGHT
 - C. TYPICAL FLOOR AND ROOF FRAMING 5,000 PSI REGULAR WEIGHT
 - D. COLUMNS 5,000 PSI REGULAR WEIGHT
 - E. STAIRS, LANDINGS & ELEVATOR TOWER WALLS 5,000 PSI REGULAR WEIGHT
 - F. ALL CONC. TOPPING/WASHES OVER PRECAST CONC. 5,000 PSI REGULAR WEIGHT
- ALL CONCRETE EXPOSED TO WEATHER AND/OR FREEZE-THAW SHALL BE AIR ENTRAINED WITH MINIMUM 6% AIR CONTENT.
- CEMENT SHALL CONFORM TO ASTM C150 TYPE I OR TYPE III. USE ONLY ONE BRAND OF CEMENT FOR ALL EXPOSED TO VIEW CONCRETE. AGGREGATES SHALL CONFORM TO ASTM C39 (REGULAR WEIGHT). ALL CONCRETE SHALL CONTAIN AN APPROVED WATER REDUCING ADMIXTURE. NO CALCIUM CHLORIDE SHALL BE USED IN ANY CONCRETE.
- ALL REINFORCEMENT BARS SHALL CONFORM TO ASTM A615, GRADE 60, UNLESS OTHERWISE NOTED ON THE DRAWINGS. WHERE WELDING OF REINFORCEMENT BARS IS REQUIRED, USE STEEL BARS CONFORMING TO ASTM A706, GRADE 60, UNLESS NOTED OTHERWISE. ALL WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185. REFER TO SPECIFICATIONS FOR REINFORCING TO BE EPOXY COATED.
- PROVIDE EPOXY COATED REINFORCEMENT IN ACCORDANCE WITH ASTM A775 AS FOLLOWS:
 - A. ALL REINFORCEMENT IN THE UPPER 3" OF THE SLAB INCLUDING BUT NOT LIMITED TO SLAB AND BEAM/ GIRDER TOP BARS, BEAM/ GIRDER STIRRUPS, POST-TENSIONING ANCHORAGE ZONE REINFORCEMENT AND SUPPORT BARS.
 - B. ALL PARAPET WALL REINFORCEMENT AND ALL UPTURNED BEAM REINFORCEMENT.
- ALL CONCRETE REINFORCEMENT SHALL BE DETAILED, FABRICATED, LABELED, SUPPORTED AND SPACED IN FORMS AND SECURED IN PLACE IN ACCORDANCE WITH THE PROCEDURES AND REQUIREMENTS OUTLINED IN THE LATEST EDITION OF THE MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES, ACI 315. BAR SUPPORTS IN CONTACT WITH EXPOSED SURFACES SHALL BE PLASTIC TIPPED.
- ALL 135° HOOKS SHALL BE MINIMUM 6d. ALL OTHER HOOKS SHALL BE STANDARD ACI 90° OR 180° HOOKS.
- SHOP DRAWINGS SHOWING REINFORCEMENT DETAILS, INCLUDING STEEL SIZES, SPACING AND PLACEMENT SHALL BE SUBMITTED TO THE ARCHITECT / ENGINEER FOR REVIEW PRIOR TO FABRICATION.
- THE CONTRACTOR SHALL SUBMIT DETAILED DRAWINGS SHOWING THE LOCATIONS OF ALL CONSTRUCTION JOINTS, REVEALS, CURBS, SLAB DEPRESSIONS, SLEEVES, OPENINGS, ETC.
- ALL REINFORCEMENT SPLICES SHALL CONFORM TO THE REQUIREMENTS OF ACI 318, LATEST EDITION, BUT IN NO CASE SHALL BE LESS THAN 45 BAR DIAMETERS, UNLESS NOTED OTHERWISE. ALL WELDED WIRE FABRIC SHALL BE LAPPED TWO (2) FULL MESH PANELS AND TIED SECURELY. WHERE REQUIRED, DOWELS SHALL MATCH SIZE AND NUMBER OF MAIN REINFORCING, UNLESS NOTED OTHERWISE.
- ALL WALLS AND STRUCTURAL SLABS SHALL BE REINFORCED WITH AT LEAST #4@12" EACH WAY, EACH FACE, UNLESS NOTED OTHERWISE. ALL SLABS-ON-GRADE SHALL BE REINFORCED WITH AT LEAST ONE (1) LAYER OF 6"x6"-W@2'x2' W/W.F. UNLESS NOTED OTHERWISE. PROVIDE ONE (1) LAYER OF 6"x6"-W@4'x4' W/W.F. CONTINUOUS IN ALL CONCRETE FILLS OVER THE STRUCTURAL SLAB, UNLESS NOTED OTHERWISE.
- ADDITIONAL BARS SHALL BE PROVIDED AROUND ALL FLOOR AND WALL OPENINGS, AS SHOWN ON DETAILS.
- EACH SUBCONTRACTOR SHALL PROVIDE THEIR REQUIREMENTS FOR SLEEVES IN CONCRETE FORMWORK. SLEEVE LOCATIONS AND SIZES SHALL BE SUBMITTED TO AND APPROVED BY THE ARCHITECT/ENGINEER PRIOR TO PLACEMENT. SLEEVE INSTALLATION SHALL BE COORDINATED BY THE GENERAL CONTRACTOR AND PROVIDED BY RESPECTIVE SUBCONTRACTORS. NO CORING OF THE CONCRETE WORK WILL BE ALLOWED WITHOUT AN EXPRESSED WRITTEN CONSENT OF THE ARCHITECT/ENGINEER.
- PLACE ALL SLABS-ON-GRADE WITH AN APPROVED PATTERN AND SEQUENCE OF CONSTRUCTION AND CONTROL JOINTS TO MINIMIZE SHRINKAGE CRACKS. THE MAXIMUM SPACING BETWEEN JOINTS SHALL BE 15 FEET. A SUGGESTED ARRANGEMENT AND DETAILS ARE SHOWN ON THE DRAWINGS.
- DESIGN OF FORMWORK FOR CONCRETE SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE DESIGN SHALL INCLUDE ALL FORCES ACTING UPON FORMWORK BEFORE, DURING AND AFTER CONCRETE PLACEMENT. THE CONTRACTOR'S PROFESSIONAL ENGINEER REGISTERED IN THE STATE WHERE THE WORK IS PERFORMED, SHALL DESIGN ALL FORMWORK AND ASSOCIATED SHORING, BRACING AND ANCHORAGE.
- CONCRETE TESTING WILL BE PERFORMED BY THE OWNER'S TESTING LABORATORY IN ACCORDANCE WITH ACI 301 SUBSECTION 1.6, EXCEPT AS FOLLOWS: FOR COMPRESSIVE STRENGTH TESTS A SET OF SPECIMENS FOR POST-TENSIONED STRUCTURES SHALL CONSIST OF SIX (6) SPECIMENS. FOR ALL OTHER STRUCTURES A SET OF SPECIMENS SHALL CONSIST OF FOUR (4) SPECIMENS. TAKE ONE SET OF SPECIMENS FOR EACH 100 CUBIC YARDS OR 5000 SQ. FT. OF FLOOR OR WALL SURFACE AREA (WHICHEVER IS LESS), OR FRACTION THEREOF FOR EACH CONCRETE CLASS PLACED IN ANY ONE DAY. FOR POST-TENSIONED STRUCTURES TEST ONE (1) SPECIMEN JUST PRIOR TO STRESSING (USUALLY AT 3 DAYS), TEST ONE (1) SPECIMEN AT 7 DAYS, TWO (2) SPECIMENS AT 28 DAYS, AND KEEP ONE IN RESERVE.

FOUNDATION NOTES

- THE FOUNDATION DESIGN IS BASED ON THE PRELIMINARY GEOTECHNICAL ENGINEERING STUDY DATED DECEMBER 6, 2013, PREPARED BY LANGAN ENGINEERING & ENVIRONMENTAL SERVICES, N.J. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REVIEW THE GEOTECHNICAL REPORT PRIOR TO BIDDING. ALL WORK SHALL BE DONE PER THE RECOMMENDATIONS GIVEN IN THE GEOTECHNICAL INVESTIGATION REPORT.
- THE FOUNDATION DESIGN OF THE GARAGE STRUCTURE IS BASED ON A SHALLOW FOUNDATION SYSTEM USING AN ALLOWABLE SOIL BEARING PRESSURE OF 2 TONS PER SQ. FT. - AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER IN THEIR REPORT DATED DECEMBER 6, 2013. INDIVIDUAL SPREAD FOOTINGS OR CONTINUOUS STRIP FOOTINGS SHALL BE FOUNDED ON THE BENE NATIVE SAND. NEW COMPACTED FILL PLACED TO PROPOSED FOOTING SUBGRADE, OR COMPACTED EXISTING FILL.
- THE SOIL SUBGRADE FOR ALL FOOTINGS AND SLABS SHALL BE INSPECTED AND APPROVED BY THE OWNER'S GEOTECHNICAL ENGINEER PRIOR TO PLACING FOUNDATION CONCRETE OR CONCRETE SLABS.
- THE NATURAL SOIL SUBGRADE UNDER ALL FOOTINGS AND SLABS SHALL BE PREPARED AS INDICATED IN THE PROJECT SPECIFICATIONS AND THE GEOTECHNICAL INVESTIGATION AND REPORT. THIS PREPARATION SHALL BE OBSERVED AND APPROVED BY THE OWNER'S GEOTECHNICAL ENGINEER. THE BOTTOM OF GENERAL EXCAVATION SHALL BE COMPACTED BY SEVERAL PASSES OF A HEAVY VIBRATORY ROLLER, 20 TON MINIMUM STATIC WEIGHT, APPROVED BY THE OWNER'S GEOTECHNICAL ENGINEER.
- ALL UNSUITABLE FILL, CLAY, OR ANY OTHER SOFT, EXCESSIVELY YIELDING, OR ORGANIC MATERIAL SHOULD BE REMOVED FROM THE EXCAVATION TO REACH MEDIUM DENSE SAND OR STRATIFIED SAND CLAY DEPOSITS, AND REPLACED WITH CONTROLLED INERT GRANULAR FILL APPROVED BY THE OWNER'S GEOTECHNICAL ENGINEER. UNDERCUTS SHOULD EXTEND LATERALLY ON A 20% (1V) SLOPE A MINIMUM OF 6' AWAY FROM THE EDGE OF FOOTING.
- ALL WELL GRADED GRANULAR MATERIAL FOR CONTROLLED FILLS DEEMED ACCEPTABLE BY THE OWNER'S GEOTECHNICAL ENGINEER SHALL BE PLACED IN LIFTS NOT EXCEEDING 8 INCHES IN LOOSE THICKNESS, AND COMPACTED TO A MINIMUM OF 95 PERCENT OF MAXIMUM DRY DENSITY AS DETERMINED BY THE MODIFIED PROCTOR TEST (ASTM D1557).
- NO FOOTINGS OR SLABS SHALL BE PLACED INTO OR AGAINST SUBGRADE CONTAINING FREE WATER. FROST OR ICE SHOULD WATER OR FROST ENTER A FOOTING EXCAVATION AFTER SUB GRADE APPROVAL. THE SUBGRADE SHALL BE RE-INSPECTED BY THE OWNER'S GEOTECHNICAL ENGINEER AFTER REMOVAL OF WATER OR FROST.
- ALL FOOTINGS SUBGRADES AS REQUIRED AND ALL SLAB SUBGRADES INCLUDING PIT SLABS, ALL BACKFILL AROUND AND ABOVE ALL FOUNDATION ELEMENTS, FOOTINGS, CAPS, MATS AND PITS, SHALL BE COMPACTED TO MINIMUM 95 PERCENT OF MAXIMUM DRY DENSITY BASED ON LABORATORY DESIGNATION ASTM D1557.
- THE CONTRACTOR SHALL PROVIDE ALL NECESSARY MEASURES TO PREVENT ANY FROST OR ICE FROM PENETRATING ANY FOOTING OR SLAB SUBGRADE BEFORE AND AFTER PLACEMENT OF CONCRETE AND UNTIL SUCH SUBGRADES ARE FULLY PROTECTED BY THE PERMANENT BUILDING STRUCTURE.
- THE CONTRACTOR SHALL LOCATE CONSTRUCTION JOINTS IN THE CONTINUOUS STRIP FOOTINGS SUCH THAT THE MAXIMUM LENGTH OF THE CONCRETE PLACEMENT DOES NOT EXCEED 60 FEET. PLACE CONTROL/CONSTRUCTION JOINTS IN WALLS AS SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL UTILIZE A CONSTRUCTION SEQUENCE/PATTERN SUCH THAT THE EFFECT OF SHRINKAGE IS MINIMIZED. THE CONTRACTOR SHALL SUBMIT A PROPOSED SEQUENCE TO THE ARCHITECT/ENGINEER FOR REVIEW.
- THE CONCRETE FOR EACH ISOLATED FOOTING SHALL BE PLACED IN ONE (1) CONTINUOUS PLACEMENT.
- THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR LOCATING, PROTECTING AND MAINTAINING IN SERVICE ALL EXISTING UTILITIES. ANY DAMAGE TO THE EXISTING UTILITIES CAUSED BY THE CONTRACTOR SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE AUTHORITY HAVING JURISDICTION AND AT NO COST TO THE OWNER.
- THE CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER IN THE EVENT ANY EXISTING UTILITIES, UTILITY STRUCTURES OR ANY OBSTRUCTION INTERFERES WITH THE PROPER INSTALLATION OF THE FOUNDATION WORK.
- ALL EXTERIOR FOOTINGS SHALL BE CONSTRUCTED BELOW THE FROST DEPTH OF AT LEAST 4'-0" BELOW THE LOWEST ADJACENT GRADE.
- ALL EXTERIOR WALLS SHALL BE PROVIDED WITH OUTSIDE DRAINAGE MEDIA (SUCH AS MIRABRAIN OR EQUIVALENT) AND CONNECTED TO THE PERIMETER DRAIN, WHENEVER REQUIRED. THE WALLS SHALL BE WATER PROOF/DAMP PROOF.
- SEE PLUMBING DRAWINGS FOR DRAINAGE SYSTEM AND SPECIAL GRANULAR FILL MATERIALS.
- SEE ARCHITECTURAL DRAWINGS FOR ALL WATERPROOFING AND DAMP PROOFING DETAILS.
- ALL ELEVATIONS ARE REFERENCED TO U.S.G.S.
- THE CONTRACTOR SHALL EXERCISE DUE CARE AND CAUTION WORKING IN THE AREAS ADJOINING EXISTING CONSTRUCTION TO REMAIN. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR PROVIDING AND MAINTAINING MEASURES PROTECTING EXISTING CONSTRUCTION. ANY AND ALL DAMAGES TO THE EXISTING CONSTRUCTION CAUSED BY THE CONTRACTOR'S MEANS AND METHODS AND/OR CONTRACTOR'S FAILURE TO PROVIDE PROTECTION SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE AUTHORITY HAVING JURISDICTION AND AT NO COST TO THE OWNER.
- SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

STRUCTURAL PRECAST CONCRETE NOTES

- ALL STRUCTURAL PRECAST CONCRETE SHALL BE DESIGNED FOR THE SPAN AND LOADING CONDITIONS SHOWN ON THE DRAWINGS BY OR UNDER THE DIRECT SUPERVISION OF A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF NEW YORK. ALL DESIGN CALCULATIONS, INCLUDING THE ANALYSIS AND DESIGN FOR BOTH LATERAL AND GRAVITY LOADS AND THE DESIGN OF ALL ELEMENTS AND CONNECTIONS SHALL BE SUBMITTED TO THE ARCHITECT/ENGINEER FOR REVIEW PRIOR TO THE START OF FABRICATION.
- DETAILED AND CHECKED SHOP DRAWINGS SHOWING ALL STRUCTURAL AND ARCHITECTURAL ELEMENTS, DETAILS AND CONNECTIONS SHALL BE SUBMITTED TO THE ARCHITECT/ENGINEER FOR REVIEW PRIOR TO THE START OF FABRICATION.
- THE PRECAST CONCRETE MANUFACTURER SHALL BE RESPONSIBLE FOR FULL COORDINATION OF ALL ARCHITECTURAL, MECHANICAL, ELECTRICAL AND PLUMBING DETAILS AS THEY AFFECT THE PRECAST COMPONENTS.
- THERE SHALL BE NO FIELD CUTTING OF PRECAST ELEMENTS WITHOUT THE PRIOR REVIEW OF THE ARCHITECT/ENGINEER AND THE SUBSEQUENT WRITTEN CONSENT OF THE PRECAST CONCRETE MANUFACTURER.
- ALL DETAILING, SPECIFICATIONS AND PLACING OF REINFORCING BARS SHALL CONFORM TO THE BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE, ACI 318 AND THE MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES, ACI 315, LATEST EDITIONS.
- SEE ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR SPECIAL ARCHITECTURAL CONCRETE REQUIREMENTS TO INCLUDE LOCATION, MIX, DESIGN, FORMWORK, FINISH, ETC.
- THE CONTRACTOR SHALL COORDINATE PRECAST, CAST-IN-PLACE AND MASONRY WORK WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS AND PROVIDE ALL NECESSARY INSERTS, REGLETS, ETC. REQUIRED.
- CONCRETE FOR THE PRECAST ELEMENTS SHALL ATTAIN A MINIMUM OF F_c'=5,000 PSI COMPRESSIVE STRENGTH AT TWENTY-EIGHT (28) DAYS.
- ALL REINFORCEMENT SHALL CONFORM TO ASTM A615, GRADE 60, UNLESS NOTED OTHERWISE.
- REINFORCEMENT STEEL BARS WELDED TO STEEL INSERTS AND STRUCTURAL SHAPES SHALL CONFORM TO ASTM A615, GRADE 40 OR ASTM A706, GRADE 60, AND WELDING SHALL CONFORM TO AWS D14 "STRUCTURAL WELDING CODE-REINFORCING STEEL", LATEST EDITION. ALL WELDMENTS SHALL RECEIVE TWO (2) COATS OF PRIMER.
- ALL WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
- ALL PRESTRESSING STEEL SHALL CONFORM TO ASTM A416 (MINIMUM TENSILE STRENGTH OF 270 KSI).
- ALL EMBEDS AND ALL CONNECTIONS SHALL BE GALVANIZED STEEL. REMOVE GALVANIZING AT ALL WELD LOCATIONS, WHERE WELDING IS REQUIRED. AFTER STEEL IS GALVANIZED, APPLY MINIMUM OF TWO COATS OF ZINC RICH PAINT TO ALL WELDED CONNECTIONS AFTER REMOVAL OF THE SLAG.
- DRY PACK GROUT UNDER COLUMN BASE PLATES SHALL BE OF THE NON-SHRINK, NON-FERROUS TYPE WITH MINIMUM F_c' = 6,000 PSI 28-DAY COMPRESSIVE STRENGTH.
- ALL PRECAST SPANDREL PANELS SHALL BE GRAVITY SUPPORTED FROM COLUMN TO COLUMN. NO PROVISION HAS BEEN MADE TO SUPPORT THEM ON SLAB OR BEAM.
- GENERAL CONTRACTOR TO VERIFY SIZE AND LOCATION OF ALL ELEVATOR KNOCKOUTS AND ELEVATOR EMBEDS WITH PRECAST MANUFACTURER.
- PRECAST UNITS SHALL BE ERECTED WITHOUT EXCEEDING TOLERANCE LIMITS. SPECIFIED IN PCI MNL-127.
- PRECAST CONCRETE TO BE DESIGNED FOR THERMAL LOADS.
- SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

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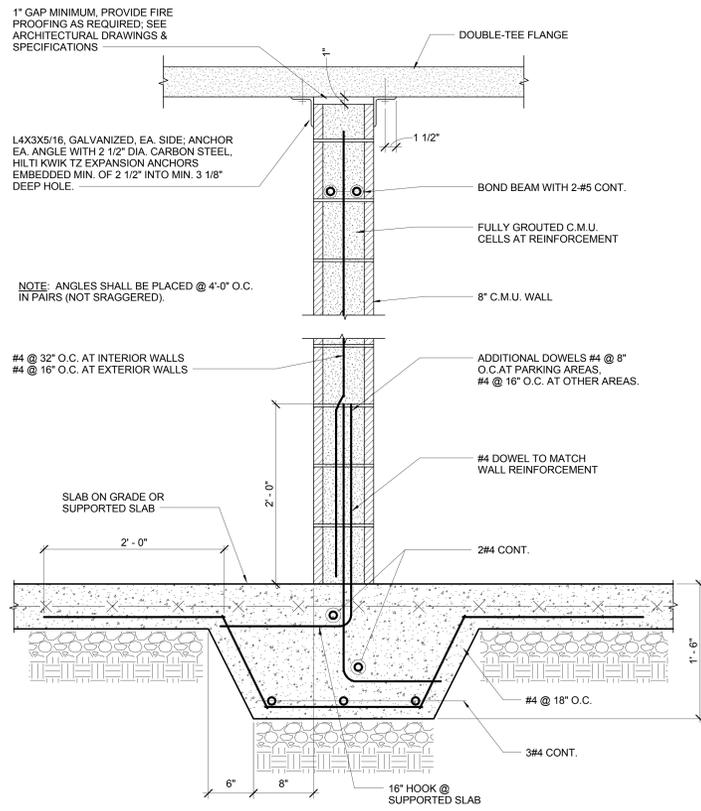
PROJECT: **STATEN ISLAND MALL PARKING GARAGE**
STATEN ISLAND, NEW YORK

DRAWING TITLE: **GENERAL NOTES**

LINTEL NOTES AND SCHEDULE

- MASONRY LINTELS LISTED FOR THE RANGE OF ROUGH MASONRY OPENING IN THE SCHEDULE BELOW APPLY TO NON-LOAD BEARING WALLS ONLY.
- LINTELS IN MASONRY WALLS SHALL BE PROVIDED FOR ALL OPENINGS AS INDICATED ON THE STRUCTURAL AND ARCHITECTURAL DRAWINGS. IN ADDITION, LINTELS ARE REQUIRED FOR ANY MECHANICAL, ELECTRICAL, OR PLUMBING OPENING IN A MASONRY WALL WITH A WIDTH GREATER THAN 12 INCHES.
- LINTELS SHALL HAVE A MINIMUM BEARING OF 8" FOR SPANS UP TO 8'-0" AND 16" FOR SPANS GREATER THAN 8'-0". UNLESS NOTED, THEY SHALL BE OF THE SIZES LISTED BELOW.
- C.M.U. OPENINGS MAY BE SPANNED WITH EITHER A STEEL LINTEL OR MASONRY LINTEL BLOCK, AT THE CONTRACTOR'S OPTION.
- ALL LINTEL MEMBERS EXCEPT SINGLE ANGLES AND UNLESS NOTED OTHERWISE, SHALL BE CENTERED IN PLAN ON SUPPORTED MASONRY TO MINIMIZE EFFECT OR TORSION.
- PLATE IN STEEL LINTEL SHALL BE WELDED AT BOTTOM OF RESPECTIVE STEEL SHAPE WITH 1/4" INTERMITTENT FILLET WELDS @ 12" O.C. PROVIDE CONTINUOUS 1/4"x2'-0" WELD ALONG COVER PLATE AT EITHER END ON EACH SIDE OF STEEL LINTEL.
- PLATE WIDTH SHALL BE 1" LESS THAN THE ACTUAL WIDTH OF MASONRY.

CMU	SPAN	STEEL LINTEL	MASONRY LINTEL
4" WALL	4'	L3 1/2x3 1/2x5/16	
	4' - 6"	L5x3 1/2x3/8	
	6' - 8"	L6x3 1/2x3/8	
6" WALL	4'	WT8	8" LINTEL BLOCK w/1-#4
	4' - 6"	WT5x15	8" LINTEL BLOCK w/2-#5
	6' - 8"	WT7x11	16" LINTEL BLOCK w/2-#5
8" WALL	4'	2-L3 1/2x3 1/2x5/16	8" LINTEL BLOCK w/2-#4
	4' - 6"	2-L5x3 1/2x3/8	16" LINTEL BLOCK w/2-#4
	6' - 8"	2-L6x3 1/2x3/8	16" LINTEL BLOCK w/2-#5
10" WALL	4'	2-L3 1/2x3 1/2x5/16	8" LINTEL BLOCK w/2-#4
	4' - 6"	2-L4x3x3/8	16" LINTEL BLOCK w/2-#4
	6' - 8"	WT8x18 +3/8" PL	16" LINTEL BLOCK w/2-#5
12" WALL	4'	3-L3 1/2x3 1/2x5/16	8" LINTEL BLOCK w/2-#4
	4' - 6"	3-L5x3 1/2x3/8	16" LINTEL BLOCK w/2-#4
	6' - 8"	WT8x24 +3/8" PL	16" LINTEL BLOCK w/2-#5
CAVITY WALL	4'	W8x24 +3/8" PL	8"x16" LINTEL BLOCK w/2-#5 EA.
	6' - 8"	W12x26 +3/8" PL	
	8' - 12"	W12x26 +3/8" PL	



1 TYP. NON-LOAD BEARING C.M.U. WALL DETAIL

- NOTES**
- THIS DETAIL NEED NOT BE USED WHEN THE SUBJECT WALL IS PLACED BETWEEN INTEGRALLY BUILT INTERSECTING SIMILAR WALLS AND THE RESULTING HORIZONTAL SPAN DOES NOT EXCEED 36" T, WHERE T IS THE NOMINAL WALL THICKNESS.
 - THE FOLLOWING INFORMATION SHALL BE USED WITH THIS DETAIL FOR INFORMATION PARTITIONS WITH THE MAXIMUM WIND PRESSURE OF 5 PSF AND NOT SUBJECT TO VEHICULAR (PASSENGER CAR) IMPACT.

NOMINAL WALL THICKNESS	MAXIMUM CONNECTION SPACING							
	WALL HEIGHT (FEET)							
4"	9	12	15	18	21	24		
6"	4'-0"	4'-6"	4'-0"	4'-0"	3'-6"			
8"	7'-0"	6'-6"	5'-6"	5'-0"	4'-6"	4'-0"		

- EXTERIOR MASONRY WALLS SUBJECT TO VEHICULAR IMPACT AND WIND LOADS IN EXCESS OF 5 PSF SHALL BE REINFORCED. TOPS OF SUCH WALLS MAY NOT BE BRACED FOR WALL HEIGHTS NOT EXCEEDING RESPECTIVE LIMITS FOR CANTILEVER WALLS IN SCHEDULES BELOW, WHEN BRACED AT TOP AND BOTTOM IN ACCORDANCE WITH DETAIL 1, THIS DRAWING, HEIGHT OF SUCH WALLS SHALL NOT EXCEED THE FOLLOWING LIMITS:
8" THICK - 20'-0"
10" THICK - 22'-0"
12" THICK - 24'-0"

NOMINAL WALL THICKNESS, T	VEHICULAR IMPACT - WALL HEIGHT, MAX (FT)							
	CANTILEVER				BRACED			
8"	#5@16"				#5@16"			
10"	#5@24"	#5@24"			#5@24"	#5@24"		
12"	#5@32"	#5@32"	#5@32"	#5@32"	#5@32"	#5@32"	#5@32"	

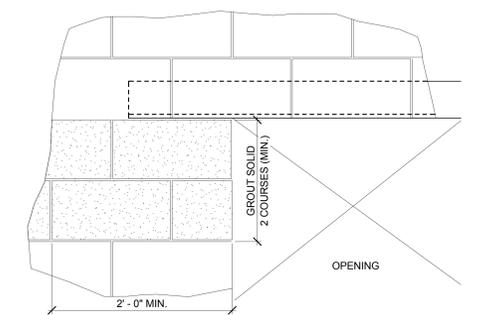
- THE FOLLOWING REINFORCEMENT INFORMATION SHALL APPLY TO EXTERIOR CMU WALLS SUBJECT TO WIND OR VEHICULAR (PASSENGER CAR) IMPACT AS APPLICABLE. THE MOST STRINGENT OF THE APPLICABLE CONDITIONS SHALL APPLY.

NOMINAL WALL THICKNESS, T	WIND LOAD 20 PSF - WALL HEIGHT, MAX (FT)							
	CANTILEVER				BRACED			
8"	#4@24"				#5@32"			
10"	#4@32"	#4@24"			#5@40"	#5@32"		
12"	#4@40"	#4@32"	#4@24"	#4@24"	#5@40"	#5@32"	#5@32"	

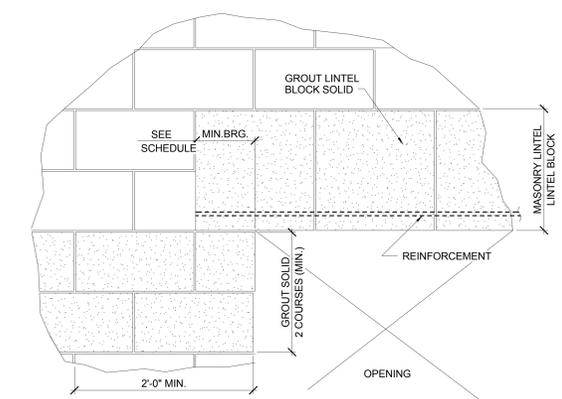
- TOP OF WALL BRACING CONNECTIONS FOR EXTERIOR MASONRY WALLS SUBJECT TO VEHICULAR IMPACT AND WIND LOADS, WHEN REQUIRED, SHALL NOT BE SPACED FURTHER APART THAN 5'-0".

- ALL EXTERIOR MASONRY WALLS SUBJECT TO VEHICULAR IMPACT AT PARKING AREAS OR DRIVE ISLES, SHALL BE FULLY GROUTED FROM THE BEARING UP TO A HEIGHT OF 2'-8" (a) ABOVE FINISHED FLOOR.

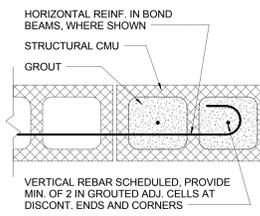
- PROVIDE 1" GAP JOINT BETWEEN MASONRY WALLS AND CONCRETE WALLS, COLUMNS AND BEAMS, U.N.O. FILL JOINT WITH BACKER ROD AND SEALANT, UNLESS NOTED OR SHOWN OTHERWISE.



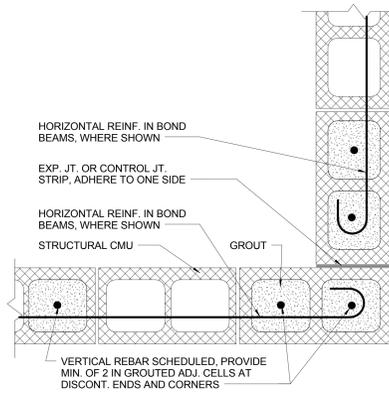
2 BEARING DETAIL STEEL LINTEL IN CMU WALL



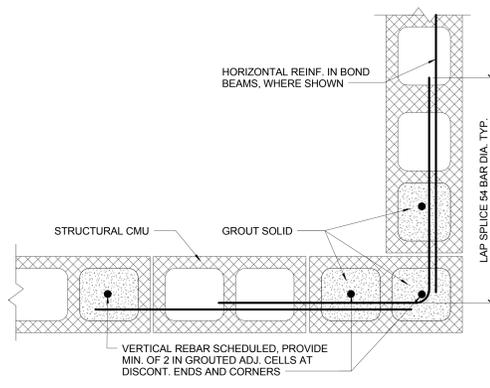
3 BEARING DETAIL MASONRY LINTEL IN CMU WALL



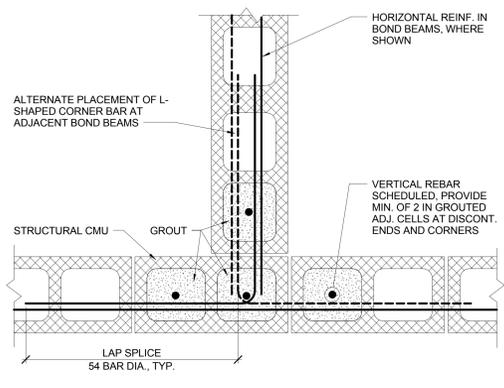
4 TYP. DETAIL DISCONT. END OF CMU WALL



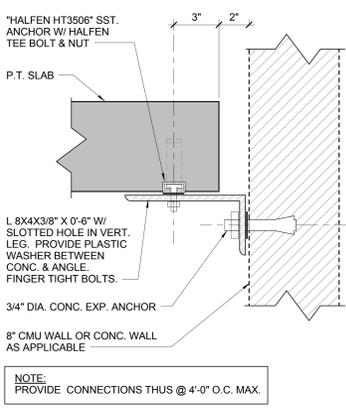
5 DISCONT. WALLS TYPICAL DETAIL CMU WALL CORNER



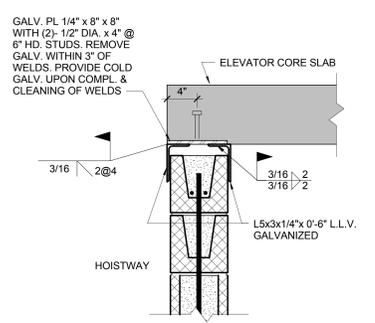
6 CONT. WALLS CMU WALL CORNER



7 TYPICAL DETAIL CMU WALL INTERSECTION



8 LATERAL SUPPORT @ SLAB EDGE DETAIL



9 TYPICAL SECTION AT ELEVATOR CORE

PROJECT:
**STATEN ISLAND MALL
PARKING GARAGE**
STATEN ISLAND, NEW YORK

DRAWING TITLE:
TYPICAL MASONRY DETAILS

DATE/REVISION DEVELOPMENT	MM 19, 2014
PROJECT NO.	10-13147-1
DRAWING BY:	J.S.
DESIGNED BY:	Designer
DRAWING NO.:	S003.0
CAD PATH:	0P
FILE #	

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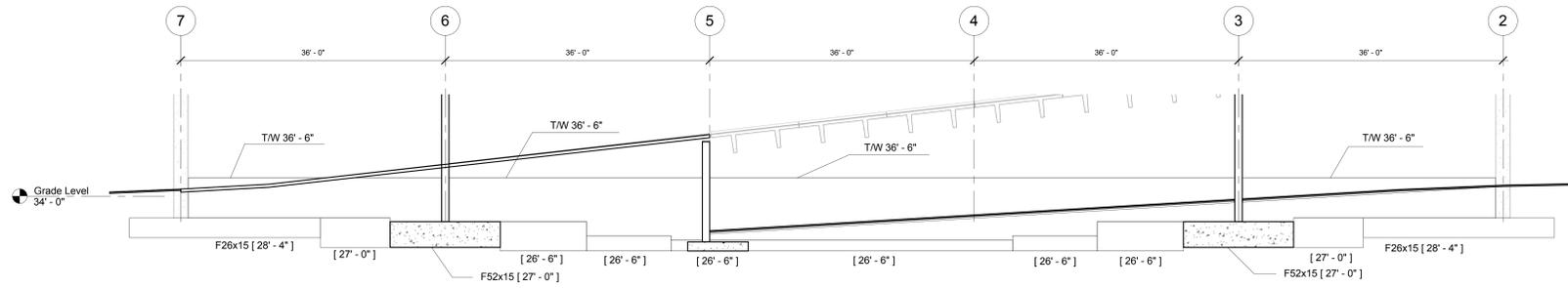
ARCHITECTS/ENGINEERS
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River Drive Center 1
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Elmwood Park, NJ 07407
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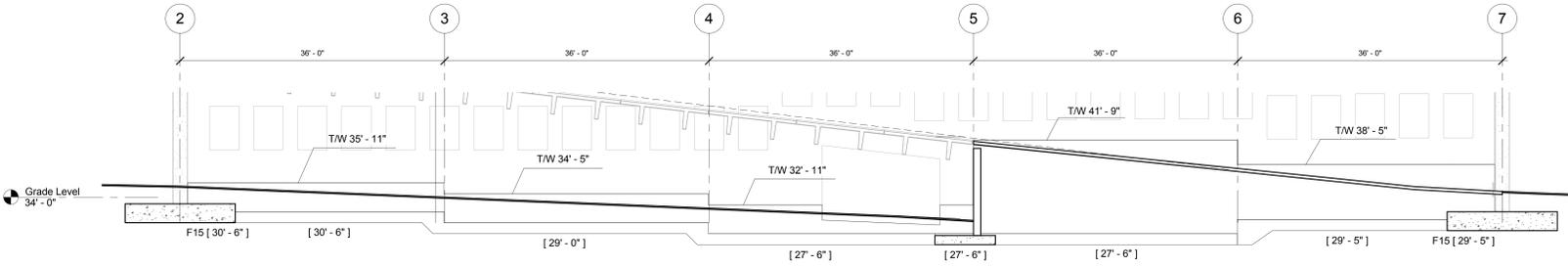
LANDSCAPE ARCHITECTURE
LEE WEINTRAUB
LANDSCAPE ARCHITECTURE, LLC
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Fax: 914.965.6546

MEP ENGINEERS
DAGHER ENGINEERING, PLLC
29 Broadway
New York, NY 10006
Tel: 212.480.2591
Fax: 212.480.2654

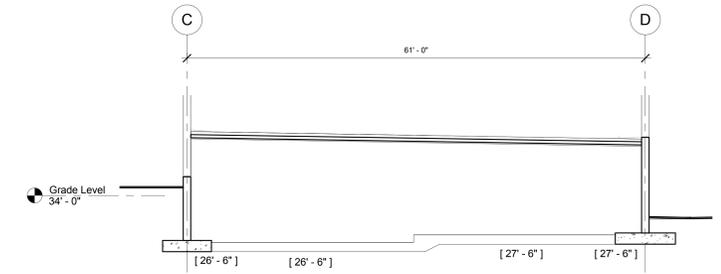
NO.	DESCRIPTION	DATE



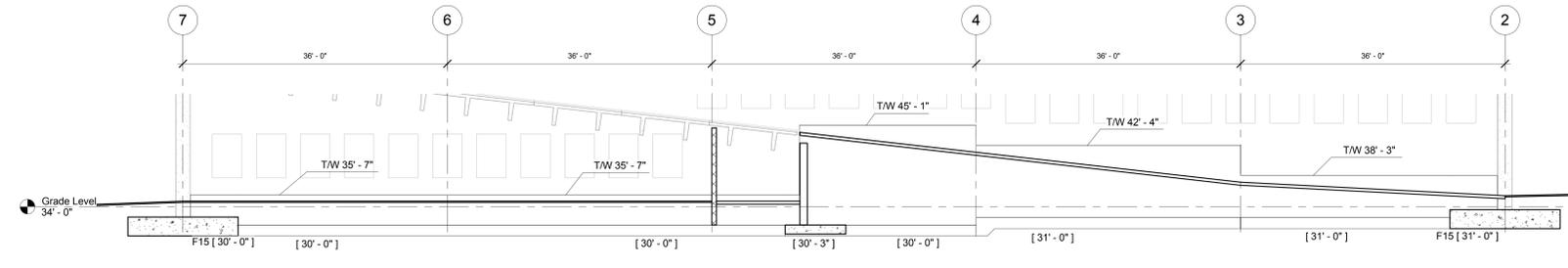
1 LINE C FOUNDATION ELEVATION
 \$102.0 SCALE: 1/8" = 1'-0"



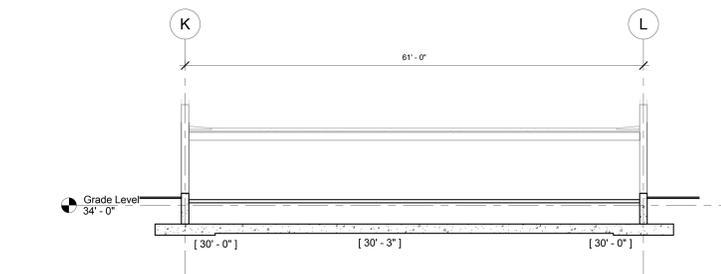
2 LINE D FOUNDATION ELEVATION
 \$102.0 SCALE: 1/8" = 1'-0"



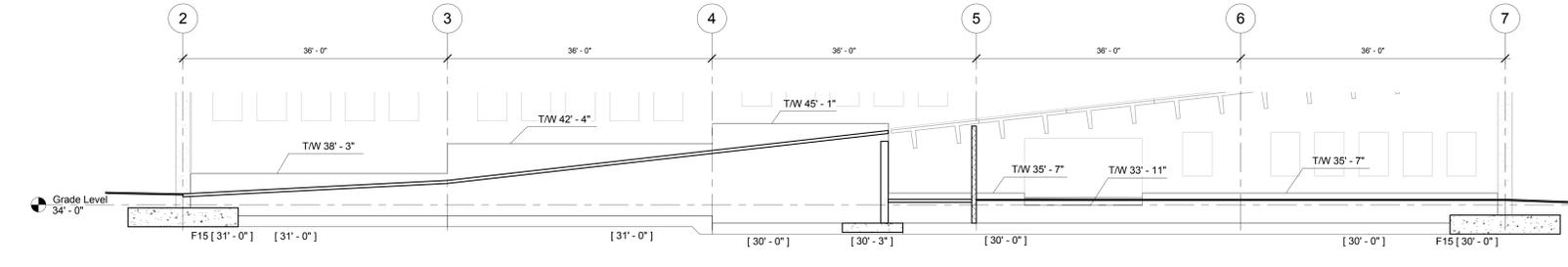
3 LINE 5 FOUNDATION ELEVATION
 \$102.0 SCALE: 1/8" = 1'-0"



4 LINE K FOUNDATION ELEVATION
 \$102.0 SCALE: 1/8" = 1'-0"



6 LINE 4.7 FOUNDATION ELEVATION
 \$102.0 SCALE: 1/8" = 1'-0"



5 LINE L FOUNDATION ELEVATION
 \$102.0 SCALE: 1/8" = 1'-0"

PROJECT:
**STATEN ISLAND MALL
 PARKING GARAGE**
 STATEN ISLAND, NEW YORK

FOUNDATION ELEVATIONS

SEAL & SIGNATURE		DATE/REVISION DEVELOPMENT	MM 19, 2014
		PROJECT NO.	10-13147-1
		DRAWING BY:	Author
		DESIGNED BY:	Designer
		DRAWING NO.	\$102.0
CAD PATH:		FILE #	07

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 Tel: 212.480.2591
 Fax: 212.480.2654

I. S. S. U. E		
NO.	DESCRIPTION	DATE

APPENDIX B
CITIZEN PARTICIPATION PLAN

The NYC Office of Environmental Remediation and GGP Staten Island Mall, LLC have established this Citizen Participation Plan because the opportunity for citizen participation is an important component of the NYC Voluntary Cleanup Program. This Citizen Participation Plan describes how information about the project will be disseminated to the Community during the remedial process. As part of its obligations under the NYC VCP, GGP Staten Island Mall, LLC will maintain a repository for project documents and provide public notice at specified times throughout the remedial program. This Plan also takes into account potential environmental justice concerns in the community that surrounds the project Site. Under this Citizen Participation Plan, project documents and work plans are made available to the public in a timely manner. Public comment on work plans is strongly encouraged during public comment periods. Work plans are not approved by the NYC Office of Environmental Remediation (OER) until public comment periods have expired and all comments are formally reviewed. An explanation of cleanup plans in the form of a public meeting or informational session is available upon request to OER's project manager assigned to this Site, William Wong, who can be contacted about these issues or any others questions, comments or concerns that arise during the remedial process at (212) 788-8841.

PROJECT CONTACT LIST: OER has established a Site Contact List for this project to provide public notices in the form of fact sheets to interested members of the Community. Communications will include updates on important information relating to the progress of the cleanup program at the Site as well as to request public comments on the cleanup plan. The Project Contact List includes owners and occupants of adjacent buildings and homes, principal administrators of nearby schools, hospitals and day care centers, the public water supplier that serves the area, established document repositories, the representative Community Board, City Council members, other elected representatives and any local BOA grantee organizations. Any member of the public or organization will be added to the Site Contact List on request. A copy of the Site Contact List is maintained by OER's project manager. If you would like to be added to the Project Contact List, contact NYC OER at (212) 788-8841 or by email at brownfields@cityhall.nyc.gov.

REPOSITORIES: A document repository is maintained online. Internet access to view OER's document repositories is available at public libraries. This document repository is intended to house, for community review, all principal documents generated during the cleanup program including RI plans and reports, Remedial Action work plans and reports, and all public notices and fact sheets produced during the lifetime of the remedial project. The library nearest the Site is:

Todt Hill-Westerleigh Public Library
2550 Victory Boulevard, Staten Island, New York 10314
(718) 494-1642
Sunday – 1:00PM to 5:00PM
Monday, Wednesday and Thursday – 10:00AM to 7:00 PM
Tuesday – 11:00AM to 8:00PM
Friday and Saturday – 10:00AM to 5:00PM

DIGITAL DOCUMENTATION: NYC OER requires the use of digital documents in our repository as a means of minimizing paper use while also increasing convenience in access and ease of use.

ISSUES OF PUBLIC CONCERN: There are no specific issues of concern to stakeholders proximate to the project Site.

PUBLIC NOTICE AND PUBLIC COMMENT: Public notice to all members of the Project Contact List is required at three major steps during the performance of the cleanup program (listed below) and at other points that may be required by OER. Notices will include Fact Sheets with descriptive project summaries, updates on recent and upcoming project activities, repository information, and important phone and email contact information. All notices will be reviewed and approved by OER prior to distribution and mailed by the Enrollee. Public comment is solicited in public notices for all work plans developed under the NYC Voluntary Cleanup Program. Final review of all work plans by OER will consider all public comments. Approval will not be granted until the public comment period has been completed.

CITIZEN PARTICIPATION MILESTONES: Public notice and public comment activities occur at several steps during a typical NYC VCP project. These steps include:

- **Public Notice of the availability of the RIR and RAWP and a 30-day public comment period on the RAWP:** Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the availability of the RIR and RAWP and the initiation of a 30-day public comment period on the RAWP. The Fact Sheet summarizes the findings of the RIR and provides details of the RAWP. The public comment period will be extended an additional 15 days upon public request. A public meeting or informational session will be conducted by OER upon request.
- **Public Notice announcing the approval of the RAWP and the start of remediation:** Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the approval of the RAWP and the start of remediation.
- **Public Notice announcing the completion of remediation, designation of Institutional and Engineering Controls and issuance of the Notice of Completion:** Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the completion of remediation, providing a list of all Institutional and Engineering Controls implemented for to the Site and announcing the issuance of the Notice of Completion.

APPENDIX C
SUSTAINABILITY STATEMENT

This Sustainability Statement documents sustainable activities and green remediation efforts planned under this remedial action.

Reuse of Clean, Recyclable Materials and Reduced Consumption of Non-Renewable Resources: Reuse of clean, locally-derived recyclable materials reduces consumption of non-renewable virgin resources and can provide energy savings and greenhouse gas reduction.

An estimate of the quantity (in tons) of clean, non-virgin materials (reported by type of material) reused under this plan will be quantified and reported in the RAR.

REDUCED ENERGY CONSUMPTION AND PROMOTION OF GREATER ENERGY EFFICIENCY: Reduced energy consumption lowers greenhouse gas emissions, improves local air quality, lessens in-city power generation requirements, can lower traffic congestion, and provides substantial cost savings.

Best efforts will be made to quantify energy efficiencies achieved during the remediation and will be reported in the Remedial Action Report (RAR). Where energy savings cannot be easily quantified, a gross indicator of the amount of energy saved or the means by which energy savings was achieved will be reported.

CONVERSION TO CLEAN FUELS: Use of clean fuel improves NYC's air quality by reducing harmful emissions.

An estimate of the volume of clean fuels used during remedial activities will be quantified and reported in the RAR.

RECONTAMINATION CONTROL: Recontamination after cleanup and redevelopment is completed undermines the value of work performed, may result in a property that is less protective of public health or the environment, and may necessitate additional cleanup work later

or impede future redevelopment. Recontamination can arise from future releases that occur within the property or by influx of contamination from off-Site.

An estimate of the area of the Site that utilizes recontamination controls under this plan will be reported in the RAR in square feet.

STORMWATER RETENTION: Stormwater retention improves water quality by lowering the rate of combined stormwater and sewer discharges to NYC's sewage treatment plants during periods of precipitation, and reduces the volume of untreated influent to local surface waters.

An estimate of the enhanced stormwater retention capability of the redevelopment project will be included in the RAR.

LINKAGE WITH GREEN BUILDING: Green buildings provide a multitude of benefits to the city across a broad range of areas, such as reduction of energy consumption, conservation of resources, and reduction in toxic materials use.

The number of Green Buildings that are associated with this brownfield redevelopment property will be reported in the RAR. The total square footage of green building space created as a function of this brownfield redevelopment will be quantified for residential, commercial and industrial/manufacturing uses.

PAPERLESS VOLUNTARY CLEANUP PROGRAM: GGP Staten Island Mall, LLC is participating in OER's Paperless Voluntary Cleanup Program. Under this program, submission of electronic documents will replace submission of hard copies for the review of project documents, communications and milestone reports.

LOW-ENERGY PROJECT MANAGEMENT PROGRAM: GGP Staten Island, Mall, LLC is participating in OER's low-energy project management program. Under this program, whenever possible, meetings are held using remote communication technologies, such as videoconferencing and teleconferencing to reduce energy consumption and traffic congestion associated with personal transportation.

TREES AND PLANTINGS: Trees and other plantings provide habitat and add to NYC's environmental quality in a wide variety of ways. Native plant species and native habitat provide optimal support to local fauna, promote local biodiversity, and require less maintenance.

An estimate of the land area that will be vegetated, including the number of trees planted or preserved, will be reported in square feet in the RAR.

APPENDIX D
SOIL/MATERIALS MANAGEMENT PLAN

1.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed under the supervision of a Qualified Environmental Professional and will be reported in the final remedial report. Soil screening will be performed during invasive work performed during the remedy and development phases prior to issuance of final signoff by OER.

1.2 Stockpile Methods

Excavated soil from suspected areas of contamination (e.g., hot spots, USTs, drains, etc.) will be stockpiled separately and will be segregated from clean soil and construction materials. Stockpiles will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be inspected daily, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by OER. Excavated soils will be stockpiled on, at minimum, double layers of 8-mil minimum sheeting, will be kept covered at all times with appropriately anchored plastic tarps, and will be routinely inspected. Broken or ripped tarps will be promptly replaced.

All stockpile activities will be compliant with applicable laws and regulations. Soil stockpile areas will be appropriately graded to control run-off in accordance with applicable laws and regulations. Stockpiles of excavated soils and other materials shall be located at least of 50 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

1.3 Characterization of Excavated Materials

Soil/fill or other excavated media that is transported off-Site for disposal will be sampled in a manner required by the receiving facility, and in compliance with applicable laws and regulations. Soils proposed for reuse on-Site will be managed as defined in this plan.

1.4 Materials Excavation, Load-Out, and Departure

The PE/QEP overseeing the remedial action will:

- oversee remedial work and the excavation and load-out of excavated material;
- ensure that there is a party responsible for the safe execution of invasive and other work performed under this work plan;
- ensure that Site development activities and development-related grading cuts will not interfere with, or otherwise impair or compromise the remedial activities proposed in this RAWP;
- ensure that the presence of utilities and easements on the Site has been investigated and that any identified risks from work proposed under this plan are properly addressed by appropriate parties;
- ensure that all loaded outbound trucks are inspected and cleaned if necessary before leaving the Site;
- ensure that all egress points for truck and equipment transport from the Site will be kept clean of Site-derived materials during Site remediation.

Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

Open and uncontrolled mechanical processing of historical fill and contaminated soil on-Site will not be performed without prior OER approval.

1.5 Off-Site Materials Transport

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 NYCRR Part 364. If loads contain wet material capable of causing leakage from trucks, truck liners will be used. Queuing of trucks will be performed on-Site, when possible in order to minimize off Site disturbance. Off-Site queuing will be minimized.

Outbound truck transport routes are described in the remedial report. This routing takes into account the following factors: (a) limiting transport through residential areas and past sensitive sites; (b) use of mapped truck routes; (c) minimizing off-Site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to

highways; and (f) overall safety in transport. To the extent possible, all trucks loaded with Site materials will travel from the Site using these truck routes. Trucks will not stop or idle in the neighborhood after leaving the project Site.

1.6 Materials Disposal Off-Site

The following documentation will be established and reported by the PE/QEP for each disposal destination used in this project to document that the disposal of regulated material exported from the Site conforms with applicable laws and regulations: (1) a letter from the PE/QEP or Enrollee to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is regulated material generated at an environmental remediation Site in New York City under a governmental remediation program. The letter will provide the project identity and the name and phone number of the PE/QEP or Enrollee. The letter will include as an attachment a summary of all chemical data for the material being transported; and (2) a letter from each disposal facility stating it is in receipt of the correspondence (1, above) and is approved to accept the material. These documents will be included in the final remedial report.

The Remedial Action Report will include an itemized account of the destination of all material removed from the Site during this remedial action. Documentation associated with disposal of all material will include records and approvals for receipt of the material. This information will be presented in the final remedial report.

All impacted soil/fill or other waste excavated and removed from the Site will be managed as regulated material and will be disposed in accordance with applicable laws and regulations. Historic fill and contaminated soils taken off-Site will be handled as solid waste and will not be disposed at a Part 360-16 Registration Facility (also known as a Soil Recycling Facility).

Waste characterization will be performed for off-Site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the final remedial report. A manifest system for off-Site transportation of exported materials will be employed. Manifest information will be reported in the final remedial report.

Hazardous wastes derived from on-Site will be stored, transported, and disposed of in compliance with applicable laws and regulations.

If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e., clean soil removed for development purposes), including transport to a Part 360-16 Registration Facility, a formal request will be made for approval by OER with an associated plan compliant with 6NYCRR Part 360-16. This request and plan will include the location, volume and a description of the material to be recycled, including verification that the material is not impacted by site uses and that the material complies with receipt requirements for recycling under 6NYCRR Part 360. This material will be appropriately handled on-Site to prevent mixing with impacted material.

1.7 Materials Reuse On-Site

Soil and fill that is derived from the Site that meets the SCOs established in this plan may be reused on-Site. The SCOs for on-Site reuse are listed in Section 4.2 of this cleanup plan. ‘Reuse on-Site’ means material that is excavated during the remedy or development, does not leave the property, and is relocated within the same property and on land with comparable levels of contaminants in soil/fill material, compliant with applicable laws and regulations, and addressed pursuant to the NYC VCP agreement subject to Engineering and Institutional Controls. The PE/QEP will ensure that reused materials are segregated from other materials to be exported from the Site and that procedures defined for material reuse in this remedial plan are followed. The expected location for placement of reused material is shown in Section 4.2.

Organic matter (wood, roots, stumps, etc.) or other waste derived from clearing and grubbing of the Site will not be buried on-Site. Soil or fill excavated from the site for grading or other purposes will not be reused within a cover soil layer or within landscaping berms.

1.8 Demarcation

After completion of hotspot removal and any other invasive remedial activities, and prior to backfilling, the top of the residual soil/fill will be defined by one of three methods: (1) placement of a demarcation layer. The demarcation layer will consist of geosynthetic fencing or equivalent material to be placed on the surface of residual soil/fill to provide an observable reference layer. A description or map of the approximate depth of the demarcation layer will be provided in the

SMP; or (2) a land survey of the top elevation of residual soil/fill before the placement of cover soils, pavement and associated sub-soils, or other materials or structures or, (3) all materials beneath the approved cover will be considered impacted and subject to site management after the remedy is complete. Demarcation may be established by one or any combination of these three methods. As appropriate, a map showing the method of demarcation for the Site and all associated documentation will be presented in the RAR.

This demarcation will constitute the top of the site management horizon. Materials within this horizon require adherence to special conditions during future invasive activities as defined in the Site Management Plan.

1.9 Import of Backfill Soil From Off-Site Sources

This Section presents the requirements for imported fill materials to be used below the cover layer and within the clean soil cover layer. All imported soils will meet OER-approved backfill and cover soil quality objectives for this Site. Imported soils will not exceed groundwater protection standards established in Part 375. Imported soils for Track 1 remedial action projects will not exceed Track 1 SCO's.

A process will be established to evaluate sources of backfill and cover soil to be imported to the Site, and will include an examination of source location, current and historical use(s), and any applicable documentation. Material from industrial sites, spill sites, environmental remediation sites or other potentially contaminated sites will not be imported to the Site.

The following potential sources may be used pending attainment of backfill and cover soil quality objectives:

- Clean soil from construction projects at non-industrial sites in compliance with applicable laws and regulations;
- Clean soil from roadway or other transportation-related projects in compliance with applicable laws and regulations;
- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the regulations of NYSDEC.

- All materials received for import to the Site will be approved by a PE/QEP and will be in compliance with provisions in this remedial plan. The final remedial report will report the source of the fill, evidence that an inspection was performed on the source, chemical sampling results, frequency of testing, and a Site map indicating the locations where backfill or soil cover was placed.
- All material will be subject to source screening and chemical testing.
- Inspection of imported fill material will include visual, olfactory and PID screening for evidence of contamination. Materials imported to the Site will be subject to inspection, as follows:
 - Trucks with imported fill material will be in compliance with applicable laws and regulations and will enter the Site at designated locations;
 - The PE/QEP is responsible to ensure that every truck load of imported material is inspected for evidence of contamination; and
 - Fill material will be free of solid waste including pavement materials, debris, stumps, roots, and other organic matter, as well as ashes, oil, perishables or foreign matter.

Composite samples of imported material will be taken at a minimum frequency of one sample for every 500 cubic yards of material. Once it is determined that the fill material meets imported backfill or cover soil chemical requirements and is non-hazardous, and lacks petroleum contamination, the material will be loaded onto trucks for delivery to the Site.

RCA will be imported from facilities permitted or registered by NYSDEC. Facilities will be identified in the final remedial report. A PE/QEP is responsible to ensure that the facility is compliant with 6NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported from compliant facilities will not require additional testing, unless required by NYSDEC under its terms for operation of the facility. RCA imported to the Site must be derived from recognizable and uncontaminated concrete. RCA material is not acceptable for, and will not be used as cover material.

1.10 Fluids Management

All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable laws and regulations. Liquids discharged into the New York City sewer system will receive prior approval by New York City Department of

Environmental Protection (NYC DEP). The NYC DEP regulates discharges to the New York City sewers under Title 15, Rules of the City of New York Chapter 19. Discharge to the New York City sewer system will require an authorization and sampling data demonstrating that the groundwater meets the City's discharge criteria. The dewatering fluid will be pretreated as necessary to meet the NYC DEP discharge criteria. If discharge to the City sewer system is not appropriate, the dewatering fluids will be managed by transportation and disposal at an off-Site treatment facility.

Discharge of water generated during remedial construction to surface waters (i.e. a stream or river) is prohibited without a SPDES permit issued by NYSDEC.

1.11 Stormwater Pollution Prevention

Applicable laws and regulations pertaining to stormwater pollution prevention will be addressed during the remedial program. Erosion and sediment control measures identified in this remedial plan (silt fences and barriers, and hay bale checks) will be installed around the entire perimeter of the remedial construction area and inspected once a week and after every storm event to ensure that they are operating appropriately. Discharge locations will be inspected to determine whether erosion control measures are effective in preventing significant impacts to receptors. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by OER. All necessary repairs shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence toe anchor will be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

1.12 Contingency Plan for Unknown Contamination Sources

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to OER's Project Manager. Petroleum spills will be reported to the NYSDEC Spill Hotline. These findings will be included in the daily report. If previously unidentified contaminant sources are found during on-Site remedial excavation or development-related excavation, sampling will be

performed on contaminated source material and surrounding soils and reported to OER. Chemical analytical testing will be performed for TAL metals, TCL volatiles and semi-volatiles, TCL pesticides and PCBs, as appropriate.

1.13 Odor, Dust, and Nuisance Control

Odor Control

All necessary means will be employed to prevent on- and off-Site odor nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) use of foams to cover exposed odorous soils. If odors develop and cannot otherwise be controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-Site disposal; and (e) use of chemical odorants in spray or misting systems.

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. OER will be notified of all odor complaint events. Implementation of all odor controls, including halt of work, will be the responsibility of the PE/QEP's certifying this remedial plan.

Dust Control

Dust management during invasive on-Site work will include, at a minimum:

- Use of a dedicated water spray methodology for roads, excavation areas and stockpiles.
- Use of properly anchored tarps to cover stockpiles.
- Exercise extra care during dry and high-wind periods.
- Use of gravel or RCA on egress and other roadways to provide a clean and dust-free road surface.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and corrected. Work will not resume until all nuisance dust emissions have been abated. OER will be notified of all dust complaint events. Implementation of all dust controls, including halt of work, will be the responsibility of the PE/QEP's responsible for certifying this remedial plan.

Other Nuisances

Noise control will be exercised during the remedial program. All remedial work will conform, at a minimum, to NYC noise control standards.

Rodent control will be provided during Site clearing and grubbing and during the remedial program, as necessary, to prevent nuisances.

APPENDIX E
CONSTRUCTION HEALTH AND SAFETY PLAN

October 6, 2015

**CONSTRUCTION
HEALTH AND SAFETY PLAN**

**Staten Island Mall
2655 Richmond Avenue
Staten Island, New York**

Prepared for

**GGP STATEN ISLAND MALL, LLC
110 N. Wacker Drive
Chicago, Illinois 60606**

ROUX ASSOCIATES, INC.

Environmental Consulting & Management



209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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FIGURE

1. Hospital Route Map

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- B. Cold Stress Guidelines
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APPROVALS

By their signature, the undersigned certify that this Construction Health and Safety Plan (CHASP) is approved and will be utilized at the project Site located at 2655 Richmond Avenue, Staten Island, New York.

Office Health and Safety Manager

Date

Site Health and Safety Officer

Date

1.0 INTRODUCTION

This Site-specific Construction Health and Safety Plan (CHASP) has been prepared in accordance with 29 CFR 1926.62 OSHA guidelines. It addresses all activities to be performed during the implementation of the Soil Materials Management Plan (SMMP) at 2655 Richmond Avenue, Staten Island, New York, (Site). The CHASP will be implemented by the Site Health and Safety Officer (SHSO) during SMMP implementation at the Site. This CHASP attempts to identify all potential hazards at the Site; however, Site conditions are dynamic and new hazards may appear constantly. Personnel must remain alert to existing and potential hazards as Site conditions change and protect themselves accordingly.

Compliance with this CHASP is required of all Roux Associates personnel who perform work governed by the SMMP at the Site. The content of this CHASP may change or undergo revisions based upon additional information made available to health and safety personnel, monitoring results, or changes in the technical scope of work. Any changes proposed must be reviewed and approved by the General Superintendent, and the Office Health and Safety Manager (OHSM), and SHSO implementing the changes to the CHASP. All subcontractors are required to prepare and implement their own CHASPs that adhere to the requirements specified in Roux Associates' CHASP.

1.1 Scope of Work

The proposed Site redevelopment includes the construction of an exterior gas room adjacent to an active mall (Staten Island Mall). In addition, localized excavation will be completed to accommodate the installation of utilities and footings.

1.2 Emergency Numbers

Provided below is a list of telephone numbers for use in the event of an emergency onsite.

1.2.1 Emergency Phone Numbers

Emergency Medical Service	911
<u>Police</u> : New York City Police Department (NYPD)	911
<u>Hospital</u> : Staten Island University Hospital North	(718) 226-9000
National Response Center	(800) 424-8802

Poison Control Center (800) 222-1222
 CHEMTREC (800) 262-8200
Fire: New York City Fire Department (FDNY) 911
 New York City Office of Emergency Management 911
 Center for Disease Control (800) 232-4636
 USEPA (Region II) (212) 637-4050
 NYSDEC Emergency Spill Response (800) 457-7362

1.2.2 Project Management/Health and Safety Personnel

Title	Contact	Phone	Cell
Project Principal	Frank Cherena	631-232-2600	631-445-0357
Project Manager	David Bligh	631-232-2600	631-379-2281
Office Health and Safety Manager	Joseph Gentile	(856) 423-8800	(610) 844-6911
Site Environmental Health and Safety Officer	TBD		

1.2.3 Other Important Phone Numbers

New York City Emergency Response Team 911
 Project Field Office TBD

1.2.4 Directions to Staten Island University Hospital North

Staten Island University Hospital North
 475 Seaview Avenue
 Staten Island, NY 10305

1. Head north on Richmond Avenue for 0.5 miles
2. Turn right onto Richmond Hill Road (1.6 miles)
3. Continue onto Arthur Kill Road (2.2 miles)
4. Turn left onto Richmond Road (1.1 miles)

5. Turn right to stay on Richmond Road (0.3 miles)
6. Turn left to stay on Richmond Road (0.8 miles)
7. Turn right onto Midland Avenue (0.5 miles)
8. Turn left onto Hylan Boulevard (0.8 miles)
9. Turn right onto Seaview Avenue (0.5 miles)
10. Turn left to arrive at Staten Island University Hospital North, 475 Seaview Avenue, Staten Island, New York 10305

Directions to the hospital are included in Figure 1.

1.3 Emergency Equipment

Emergency Equipment to be kept on Site:

- First Aid Kits
- Twenty pound Type ABC Fire Extinguisher (at least two)
- Absorbent Boom Emergency Spill Equipment
- Absorbent Pads
- Air Horns
- Oil Dry
- Eye Wash

2.0 HEALTH AND SAFETY STAFF

This section briefly describes all Site personnel and their health and safety responsibilities relating to the excavation work to be implemented at the Site. All personnel are responsible for ensuring compliance with the CHASP.

2.1 Office Health and Safety Manager (OEHSM) – Joseph Gentile

- Implements the components of the CHASP related to exposure to Site contaminants and air monitoring.
- Performs or oversees Site-specific training and approves revised or new safety protocols or field operations.
- Coordinates revisions of this CHASP with Project Superintendent.
- Responsible for the development of new task safety protocols and procedures and resolution of any outstanding safety issues which may arise during the conduction of site work.
- Reviews and approves all health and safety training and medical surveillance records for personnel and subcontractors.

2.2.Site Health and Safety Officer (SEHSO) – TBD

- Directs and coordinates environmental and air monitoring-related health and safety activities.
- Ensures that Site workers utilize proper respiratory protection and other PPE as required to prevent exposure to Site contaminants.
- Conducts initial onsite specific training, prior to personnel and/or subcontractors commencing work.
- Performs periodic safety briefings.
- Completes and maintains environmentally related Accident Report Forms.
- Ensures that Site workers comply with the environmental components of the CHASP.
- Immediately notifies the OHSM of all accidents, who will then communicate to the designated representative the tasks completed, the next day's planned activities, any third party issues, changes of work plans and/or changes in level of PPE.
- Maintains contact with subcontractors and Site workers.
- Conducts real time air monitoring within each work zone for VOCs and Particulates.

- Determines upgrade or downgrade of respiratory protection and other PPE used to prevent exposure to Site contaminants based on Site conditions and/or real time monitoring results.
- Ensures that monitoring instruments are calibrated daily or as manufacturer's instructions determine.
- Reports to the OHSM to provide summaries of field operations and progress.
- Assists in preparing and maintaining health and safety field log books, daily safety logs, training logs, air monitoring result reports, and weekly safety report.

The responsibilities of the SHSO may be performed by the same individual at times during the project depending on the specific tasks being performed and provided the individual fulfilling those responsibilities has the proper qualifications and experience to perform both roles.

2.3 Roux Associates Field Personnel

- Report any unsafe or potentially hazardous conditions to the SHSO.
- Maintain knowledge of the information, instructions, and emergency response actions contained in the CHASP.
- Comply with rules, regulations, and procedures as set forth in this CHASP and any revisions that are instituted.
- Prevent admittance to work Site by unauthorized personnel.

3.0 SITE BACKGROUND

This section provides a brief summary of the history and physical description of the Site.

3.1 Site Description and Setting

The Site is located in the New Springville section of Staten Island, New York and is identified as Block 2400 and tentative Lot 180 on the New York City Tax Map. The Site is 625,642-square feet and is bounded by additional mall parking and shops to the north, a Sears store and parking lot to the south, additional mall shops and parking to the east, and parking to the west. Currently, the Site is used for commercial retail business and contains the Staten Island Mall, a retail space occupied by approximately 168 tenants.

As described previously, the planned improvement of the Site entails the construction of an exterior gas room adjacent to an active mall (Staten Island Mall), along with localized excavation for utility and footing installation.

3.2 Site History

Site uses include agricultural use with onsite greenhouses (1930s), an aircraft aviation school (1950s), a golf driving range surrounded by residential dwellings (1960s), commercial retail stores (1970s), and ultimately a shopping mall (1980s). Nearby water bodies include the Springville Creek and Richmond Creek, located respectively to the west and south of the Site. These water bodies are interconnected and drain to the Fresh Kills.

3.3 Summary of Environmental Conditions

The following environmental work plans and reports were developed for the Site:

- Phase I Environmental Site Assessment, August 2013, prepared by Leggette, Brashears & Graham, Inc.
- Draft Phase II Environmental Site Assessment, prepared by Roux Associates, Inc.

The Phase I Environmental Site Assessment (ESA) revealed no evidence of Recognized Environmental Conditions (RECs) in connection with the Site. Prior to its development, the larger mall property [aside from that currently occupied by the main mall building] was divided into eight separate parcels occupied by: the Staten Island Airport and Aviation School; a golf driving range (Kusker Chas Driving Range); a produce-packaging business; agricultural acreage; a farmers market; and residential dwellings. Based on the EDR-City Directories and aerial photographs, Janet's Charcoal Drive Inn Movie Theater was located south of the Site. The oldest known structures on the larger mall property were located at the northwest corner, and were used as a produce-packaging operation and residential dwellings. These structures were present from 1937 or earlier, and remained at the Site until construction of the Mall in the early 1970s. The Staten Island Airport and Aviation School, located in the eastern portion of the Site, was constructed sometime between 1937 and 1950. According to the Sanborn Maps, the lot occupied by the Staten Island Airport in 1950 was used as a golf driving range in 1962.

Roux Associates conducted a Phase II ESA in 2013.

No volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), or polychlorinated biphenyls (PCBs) were detected in the soil samples above the New York State Department of Environmental Conservation (NYSDEC) 6 New York Codes, Rules and Regulations (NYCRR) Sub-Part 375-6.8(a) (Unrestricted Use Soil Cleanup Objectives [SCOs]) or Sub-Part 375-6.8(b) (Commercial Use SCOs). Metals and pesticides were detected at concentrations exceeding Unrestricted Use SCOs; however, all detections of these analytes were below Commercial Use SCOs. The elevated presence of metals in the subsurface soil is likely attributable to portions of the Site being underlain by historic fill, while the elevated concentration of pesticides, specifically insecticides, is likely attributable to the historic agricultural use of the Site in the 1930's. No VOCs, SVOCs, metals (except manganese and sodium), pesticides, or PCBs were detected in the groundwater samples above NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (AWQSGVs). The detections of manganese and sodium in groundwater are likely attributable to saltwater influence from nearby Staten Island Kill. VOCs in soil vapor were either not detected or detected at concentrations below their respective guidance values (as compared to the New York State Department of Health Guidance for Evaluating Soil Vapor Intrusion in the State of New

York, dated October 2006). Methane was detected at all soil vapor sampling locations and may be attributable to the Site being underlain by former marsh land. At one location, methane was detected above its lower explosive limit (LEL).

4.0 WASTE DESCRIPTION/CHARACTERIZATION

This section provides a brief summary of the wastes that are potentially present at the Site.

4.1 General

The following information is presented in order to identify the types of materials that may be encountered at the Site. The detailed information on these materials was obtained from:

- Sax's Dangerous Properties of Industrial Materials – Lewis Eight Edition
- Chemical Hazards of the Workplace – Proctor/Hughes
- Condensed Chemical Dictionary – Hawley
- Rapid Guide to Hazardous Chemical in the Workplace – Lewis 1990
- NIOSH Pocket Guide to Chemical Hazards – 1996
- ACGIH TLV® Values and Biological Exposure Indices – OSHA 29 CFR 1910.1000

4.2 Chemical Data Sheets

The following is a listing of chemicals that may potentially be present in soils and groundwater at the Site based on previous soil sampling results and historic operations conducted at or adjacent to the Site. The Summary of Toxicological Data for the compounds listed below is provided in Table 1. The Summary of Toxicological Data provides information such as the chemicals characteristics, health hazards, protection, and exposure limits.

VOCs	SVOCs/PAHs	Metals
Benzene	Acenaphthylene	Arsenic
Ethylbenzene	Anthracene	Barium
Toluene	Naphthalene	Chromium
Xylene	Pyrene	Lead
2-Butanone (MEK)	Indeno(1,2,3-cd)pyrene	Mercury
2-Methylnaphthalene	Benzo(a)anthracene	Selenium
	Benzo(a)pyrene	
	Benzo(b)fluoranthene	
	Benzo(g,h,i)perylene	
	Benzo(k)fluoranthene	

VOCs	SVOCs/PAHs	Metals
	Bis(2-ethylhexyl)phthalate	
	Carbazole	
	Chrysene	
	Dibenzo(a,h)anthracene	
	Dibenzofuran	
	Fluoranthene	
	Fluorene	

4.2.1 Contaminants of Concern

Soil and groundwater contaminants that may be encountered during excavation and foundation construction activities include both organic and inorganic compounds. The chemical hazards posed by the Site are VOCs, SVOCs and metals.

- Waste Types

Liquid	<input checked="" type="checkbox"/>	Solid	<input checked="" type="checkbox"/>	Gas	<input type="checkbox"/>
Sludge	<input type="checkbox"/>	Semi-Solid	<input type="checkbox"/>	Other (describe)_____	

- Waste Characteristics

Corrosive	<input type="checkbox"/>	Ignitable	<input checked="" type="checkbox"/>	Volatile	<input checked="" type="checkbox"/>
Radioactive	<input type="checkbox"/>	Inert	<input type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>

- Waste Containment

Pit	<input type="checkbox"/>	Pond	<input type="checkbox"/>	Sedimentation trap	<input type="checkbox"/>
Lake	<input type="checkbox"/>	Process Vessel	<input type="checkbox"/>	Tank	<input checked="" type="checkbox"/>
Piping	<input checked="" type="checkbox"/>	Drum	<input checked="" type="checkbox"/>	Other	<input type="checkbox"/>

5.0 HAZARD ASSESSMENT

The potential to encounter chemical hazards is dependent upon the work activity performed (intrusive versus non-intrusive) and the duration and location of the work activity. Such hazards could include inhalation and/or skin contact with chemicals/gases that could cause: dermatitis, skin burns, being overcome by vapors or asphyxiation.

Physical hazards that may be encountered during Site work include: heat and cold stress, exposure to excessive noise, loss of limbs, being crushed, head injuries, punctures, cuts, falls, electrocution, bruises, and other physical hazards due to motor vehicle operation, heavy equipment, and power tools.

Biological hazards may exist during Site activities. These hazards include exposure to insect bites/stings and blood borne pathogens.

Note: Hazard assessment is documented in section 5.4

5.1 Chemical Hazards

The potential for personnel and subcontractors to be exposed to chemical hazards may occur during excavation activities.

For chronic and acute toxicity data, refer to Summary of Toxicological Data in Table 1 for further details on compound characteristics.

5.1.1 Exposure Pathways and Assessment

Exposure to these compounds during ongoing activities may occur through inhalation of contaminated dust particles, inhalation of VOCs, SVOCs, and metals and by way of dermal absorption and accidental ingestion of the contaminant by either direct or indirect cross-contamination activities.

Inhalation of contaminated dust particles (VOCs, SVOCs, and metals) can occur during adverse weather conditions (high or changing wind directions) or during operations that may generate airborne dust such as excavation and loading of contaminated soils. Dust control measures such as applying water to roadways and excavations will be implemented where visible dust is generated in accordance with

the remediation work plans. Where dust control measures are not feasible or effective, respiratory protection will be used (see Section 9.2.2 for monitoring procedures and action levels).

5.1.2 Operational Action Levels

A decision-making protocol for an upgrade in levels of protection and/or withdrawal of personnel from an area based on atmospheric hazards is outlined in Table 2.

5.1.3 Additional Precautions

Dermal absorption or skin contact with chemical compounds is possible during intrusive activities at the Site. The use of PPE in accordance with Section 8.2 and strict adherence to proper decontamination procedures should significantly reduce the risk of skin contact.

The potential for accidental ingestion of potentially hazardous chemicals is expected to be remote when good hygiene practices are used.

5.2 Physical Hazards

A variety of physical hazards may be present during Site activities. These hazards include typical construction activities: operation of motor vehicles and heavy equipment, the use of power and hand tools, roping and rigging of steel sheeting, walking on objects, tripping over objects, working on surfaces which have the potential to promote falling, skin burns, crushing of fingers, toes, limbs, head injuries caused by falling objects, temporary loss of one's hearing and loss of eyesight. The referenced hazards are not unique and are generally familiar to most workers at construction sites.

5.2.1 Noise

Noise is a potential hazard associated with operation of heavy equipment, power tools, pumps, and generators. High noise equipment operators will be evaluated at the discretion of the SHSO. Employees with an 8-hour time weighted average exposure exceeding 85 dBA will be included in a hearing conservation program in accordance with 29 CFR 1910.95 and 1926.52.

It is mandated that employees working around heavy equipment or using power tools that produce noise levels exceeding 90 dBA are to wear hearing protection that shall consist of earplugs or protective earmuffs.

5.2.2 Heat Stress

Heat stress is a significant potential hazard associated with the use of protective equipment in a hot weather environment. The human body is designed to function at a certain internal temperature. When metabolism or external sources (fire or hot summer day) cause the body temperature to rise, the body seeks to protect itself by triggering cooling mechanisms. The SHSO will monitor the air temperature (as described later in this section) to determine potential adverse effects the weather can cause onsite personnel. Excess heat is dissipated by two means:

- Changes in blood flow to dissipate heat by convection, which can be seen as “flushing” or reddening of the skin in extreme cases.
- Perspiration, which is the release of water through skin and sweat glands. While working in hot environments, evaporation of perspiration is the primary cooling mechanism.

Protective clothing worn to guard against chemical contact effectively stops the evaporation of perspiration. Thus the use of protective clothing increases heat stress problems.

The major disorders due to heat stress are heat cramps, heat exhaustion, and heat stroke. Heat cramps are painful spasms that occur in the skeletal muscles of workers who sweat profusely in the heat and may drink large quantities of water, but fail to replace the body’s lost salts or electrolytes. Drinking water while continuing to lose salt tends to dilute the body’s extracellular fluids. Soon, water seeps by osmosis into active muscles and causes pain. Muscles fatigued from work are usually most susceptible to cramps.

Extreme weakness or fatigue, dizziness, nausea, and headache characterize heat exhaustion. In serious cases, a person may vomit or lose consciousness. The skin is clammy and moist, complexion pale or flushed, and body temperature normal or slightly higher than normal. The treatment is to rest in a cool place and replacement of body water lost by perspiration. Mild cases may recover spontaneously with this treatment; severe cases may require care for several days. There are no permanent effects.

Heat stroke is a medical emergency. It is a very serious condition caused by the breakdown of the body’s heat-regulating mechanisms. The skin is very dry and hot with red mottled or bluish appearance. Unconsciousness, mental confusion, and/or convulsions may occur. Without quick and adequate treatment, the result can be death or permanent brain damage. As a first aid treatment, the person should be moved to a cool place. Body heat should be reduced artificially, but not too rapidly,

by soaking the person's clothes in water and fanning them. Then, obtain professional emergency care.

Steps that can be taken to reduce heat stress are:

- Acclimate the body. Allow a period of adjustment to make further heat exposure endurable.
- Drink more liquids to replace the body water lost during sweating.
- Take frequent breaks to rest and recover from the effects of heat stress.
- Wear personal cooling devices. These are two basic designs: units with pockets for holding frozen packets and units that circulate fluid from a reservoir through tubes to different parts of the body. Both designs can be in the form of a vest, jacket, or coverall. Some circulating units also have a cap for cooling the head.
- Wear long cotton underwear under chemical protective clothing. The cotton will absorb perspiration and will hold it close to the skin. This will provide the body with the maximum cooling available from the limited evaporation that takes place beneath chemical resistant clothing. It also allows for rapid cooling of the body when the protective clothing is removed.

Heat stress is a significant hazard associated with using protective equipment in hot weather environments. Local weather conditions may produce a situation that requires restricted work schedules in order to protect employees.

Appendix A contains procedures for heat stress; these will be used as a guideline and to provide additional information.

5.2.3 Cold Stress

Cold temperatures are a significant potential hazard. Examples of cold temperature hazards are frostbite and hypothermia.

Frostbite is the most common injury resulting from exposure to cold. The extremities of the body are most often affected. The signs of frostbite are:

- The skin turns white or grayish-yellow
- Pain is sometimes felt early but subsides later. Often there is no pain.

- The affected parts feel intensely cold and numb.

Hypothermia is characterized by shivering, numbness, drowsiness, muscular weakness, and a low internal body temperature when the body feels extremely cold. This can lead to unconsciousness and death. With both frostbite and hypothermia, the affected areas need to be warmed quickly. Immersion in warm water is an effective means of warming the affected areas quickly. In such cases, medical assistance will be sought.

To prevent these effects from occurring, persons working in the cold should wear adequate clothing and reduce the time spent in the cold area. The SHSO will monitor this and determine the appropriate time personnel should spend in adverse weather conditions.

Additional information about Cold Stress Control Guidelines is provided in Appendix B.

5.2.4 Lockout/Tagout

The remediation contractor will develop a lockout/tagout plan in the event of the repair of electrical, pneumatic, hydraulic and/or mechanical systems, per OSHA requirements under 29 CFR 1910.147.

5.2.5 Excavation and Construction Safety

All excavation and construction work will be accomplished in strict conformance with 29 CFR 1926 .650 – 652. Site and safety controls will be implemented as specified in Appendix C to ensure both the safety of the person(s) excavating and all general personnel. This will apply to all related activities including shoring, steel cutting and welding, formwork construction, and rebar installation and pouring of concrete. Appendix C details the following items required for conducting excavation and associated construction work at the Site:

- Completion of the Subsurface Work Authorization form;
- Planning of the excavation;
- Establishment of excavation protection and support systems; and
- Heavy equipment Safety.

5.2.6 Confined Space Entry

The remediation contractor and its subcontractor's personnel will not be permitted to enter confined spaces at any time until the space has been thoroughly evaluated and all provisions of 29 CFR 1910.146 are satisfied.

5.3 Biological Hazards

The biological hazards, which have the potential to cause adverse health effects, are from exposure to domestic flies, mosquitoes, insects, and blood borne pathogens.

5.3.1 Insect Stings

Stings from insects are often painful, cause swelling, and can be fatal if a severe allergic reaction such as anaphylactic shock occurs. If a sting occurs, the stinger should be scraped out of the skin, opposite of the sting direction. The area should be washed with soap and water followed by an ice pack.

Those individuals susceptible to bee stings must notify the SHSO prior to entering the site and should carry on their person their own medication. If the victim has a history of allergic reaction, s/he should be taken to the nearest medical facility. If the victim has medication to reverse the effects of the sting, it should be taken immediately.

If the victim experiences a severe reaction, a constricting band should be placed between the site of the sting and the heart. The site should be kept below the heart, if possible. A physician should be contacted immediately for further instructions.

5.3.2 Bloodborne Pathogens

The majority of the occupational tasks onsite will not involve a significant risk of exposure to blood, blood components, or body fluids. The highest risk of acquiring any bloodborne pathogen for employees onsite will be following an injury. When administering first aid care, there are potential hazards associated with bloodborne pathogens that cause diseases such as Human Immunodeficiency Virus (HIV), Hepatitis A (HAV), Hepatitis B (HBV), Hepatitis C (HCV), or the Herpes Simplex Virus (HSV). An employee who has not received the appropriate certifications and been trained in bloodborne pathogens should never perform first aid and/or CPR.

In order to minimize any potential pathogen exposure, all employees should use the hand washing facilities on a regular basis. The decontamination area will provide an adequate supply of water, soap, and single use towels for hand washing. Additionally, the following universal precautions should be followed to prevent further potential risk:

- Direct skin or mucous membrane contact with blood should be avoided.
- Open skin cuts or sores should be covered to prevent contamination from infectious agents.
- Body parts should be washed immediately after contact with blood or body fluids that might contain blood, even when gloves or other barriers have been used.
- Gloves and disposable materials used to clean spilled blood shall be properly disposed of in an approved hazardous waste container.
- First aid responders shall wear latex or thin mil nitrile gloves when performing any procedure risking contact with blood or body substances.
- Safety glasses will be worn to protect the eyes from splashing or aerosolization of body fluids.
- A CPR mask will be worn when performing CPR to avoid mouth-to-mouth contact.
- Work (i.e., cut-resistant) gloves will be worn to minimize the risk of injury to the hands and finger when working on all equipment with sharp or rough edges.
- Never pick up broken glass or possible contaminated material with your unprotected hands.

5.4 Hazard Assessment

Task	Hazards	Risk of Exposure
Mobilization/Demobilization	Inhalation/Skin Contact	Low
	Heat Stress/Cold Stress	Low
	Noise	Moderate
	Physical Injury	High
Decontamination/Dewatering	Inhalation/Skin Contact	Moderate
	Heat Stress/Cold Stress	Moderate
	Physical Injury	Moderate
	Noise	Moderate
Earthwork/Drilling	Inhalation/Skin Contact	Low
	Heat Stress/Cold Stress	Moderate
	Noise	Moderate
	Physical Injury	Moderate

Task	Hazards	Risk of Exposure
Sheeting and Shoring	Inhalation/Skin Contact	Moderate
	Heat Stress/Cold Stress	Moderate
	Noise	High
	Physical Injury	High
Excavating	Struck by	Safe work zone with clearance; Inspection by competent person
	Ground Stability	
Trucking	Hearing Loss	Ear Protection
	Struck by	Traffic control by flagmen
Formwork Installation	Contamination/Decontamination	(wash down)
	Falls	All personnel will be 100% fall protected at a height of 6' or more
Rebar Installation	Impalement	All rebar with impalement potential will be properly protected
Concrete Installation	Burns	All personnel will wear proper attire (long sleeves, long pants, boots, gloves)
	Eye Damage	All personnel will utilize eye protection when working with concrete

General Conditions:

1. Hard hats will be worn at all times;
2. Eye protection will be worn at all times;
3. Steel (or composite)-toed and shanked safety boots will be worn at all times; and
4. Hearing protection will be used when required.

All other safety requirements are as per OSHA 1926 – NYDOB – NYDOT

6.0 TRAINING

This section details the training requirement for all personnel working on the Site. Visitors onsite must be made aware of the hazards onsite in a Site-specific safety briefing and sign a statement indicating that they will comply with the applicable requirements of this CHASP

6.1 Site-Specific Training

Prior to commencement of field activities, the and SHSO will provide Site-specific training to all personnel assigned to the Site for remedial/construction activities. Site personnel will receive training that will specifically address the activities, procedures, monitoring, and equipment for Site operations. It will include Site and facility layout, hazards, first aid equipment locations and emergency services at the Site, and will highlight all provisions contained within this CHASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

6.2 Onsite Safety Meetings

Daily safety tailgate meetings will be presented each morning to discuss potential safety concerns for the upcoming activities. At a minimum, at least one formal safety meeting will be conducted daily, or when a new crew begins work, by the appropriate field supervisors or foremen for all workers. Copies of the daily safety meetings will be provided to the PM and onsite Owner's Representative.

The meetings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety audits by the remediation contractor or other involved parties.

6.3 First Aid and CPR

The SHSO will identify those individuals having first aid and CPR certifications in order to ensure that emergency medical treatment is available during field activities. Their training will be consistent with the requirements of the American Red Cross and/or American Heart Association. Certification and appropriate training documentation will be kept with the Site personnel records.

6.4 Additional Training

The OEHSM may require additional or specialized training throughout the project. Such training may include the safe operation of heavy or power tool equipment or hazard communication training or other topic, as deemed appropriate.

Visitors onsite must be made aware of the hazards onsite in a Site-specific safety briefing and sign a statement indicating that they will comply with the applicable requirements of this CHASP.

7.0 SITE CONTROL, PERSONAL PROTECTIVE EQUIPMENT, AND COMMUNICATIONS

This section provides a detailed description of the Site control measures, PPE, and communications procedures to be implemented at the Site.

7.1 Site Control

Should grossly contaminated material, according to New York State Department of Environmental Conservation DER-10 Guidance, be encountered onsite, a four-zone approach will be employed in order to prevent the spread of contamination from the disturbed areas onsite and to protect non-remediation (non-trained) workers from exposure to hazardous materials. The four-zones include the EZ, the CRZ, the RZ, and the Support Zone (SZ). A stepped remedial approach will be managed and the zones modified as the work progresses. Each of the areas will be defined through the use of control barricades and/or construction/hazard fencing. A clearly marked delineation between the zones will be maintained. Signage will be posted to further identify and delineate these areas.

7.1.1 Exclusion Zone

All areas where excavation and handling of contaminated materials take place are considered the EZ. This zone will be clearly delineated by hay bales or construction fence. Safety tape may be used as a secondary delineation within the EZ. The zone delineation markings may be opened in areas for varying lengths of time to accommodate equipment operation or specific construction activities. The SEHSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy (co-worker).
- Appropriate PPE,
- Medical authorization,
- Training certification, and
- A need to be within the Zone.

Occasional visitors within this area of the Site are addressed in Sections 1.0 and 6.9.

7.1.2 Contamination Reduction Zone

A CRZ is established between the EZ and the SZ. The CRZ contains the Contamination Reduction Corridor (CRC) and provides an area for decontamination of personnel and equipment. The CRZ will be used for general Site entry and egress, in addition to access for heavy equipment and emergency support services. Personnel are not allowed in the CRZ without:

- A buddy (co-worker),
- Appropriate PPE,
- Medical authorization,
- Training certification and
- A need to be within the Zone.

Occasional visitors within this area of the Site are addressed in Sections 1.0 and 6.9.

7.1.3 Remediated Zone

A Remediated Zone (RZ) is established in portions of the Site where the remediation has been completed and only general construction work remains to be performed. Setup of the RZ consists of implementing several measures designed to reduce the risk of workers' exposure and prevent non-trained workers from entering the non-remediated zone. Non-trained workers will work only in areas where the potential for exposure has been minimized by installing a 3-inch concrete slab (mud mat), a minimum 6 mil vapor barrier, and/or the installation of a minimum six inches of clean fill over any potentially impacted soils in the RZ. The RZ will then be separated from the non-remediated zone by installing and maintaining temporary plywood or other construction fences along the boundary between the two zones. If potentially impacted material is uncovered in the RZ, all non-trained workers will be removed and the SEHSO will assess the potential risks. If, at any other time the risk of exposure increases while non-trained workers are present in the RZ, the non-trained workers will be removed. Air monitoring for the presence of VOCs will be conducted in the RZ, as well as at the fence line of the non-remediated zone as required by the SEHSO.

7.1.4 Support Zone

The SZ is an uncontaminated area that will be the field support area for Site operations. The SZ will contain the temporary office trailers and provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples. Meteorological conditions will be observed and noted from this zone, as well as those factors pertinent to heat and cold stress.

7.2 Personal Protective Equipment

Provided below is a description of the basic PPE requirements for onsite workers.

7.2.1 General

The level of respiratory protection worn by field personnel will be enforced by the SEHSO. Levels of respiratory protection for general operations are provided below and are defined in this section. Levels of respiratory protection may be upgraded at the discretion of the SEHSO. All decisions on the level of respiratory protection will be based upon a conservative interpretation by the SEHSO of the information provided by air monitoring results, environmental results, and other appropriate information. Any changes in the level of respiratory protection shall be recorded in the health and safety field logbook.

7.2.2 Personal Protective Equipment Specifications

Although not anticipated, any tasks requiring Level B PPE will utilize the following equipment:

- Positive-pressure, full facepiece, self-contained breathing apparatus (SCBA) or positive-pressure, supplied air respirator with escape SCBA (NIOSH approved)
- Disposable coveralls (Tyvek, Poly-coated Tyvek or Saranex)
- Gloves, inner: latex or nitrile
- Gloves, outer: nitrile or neoprene
- Chemical resistant boots over the work boots.
- Steel (or composite-) toed, steel (or composite-) shanked work boots
- Hard hat

- Hearing protection (as needed)
- Boot covers (as needed)

For tasks requiring Level C PPE, the following equipment may be used in any combination:

- Full-face, air-purifying, canister-equipped respirators (NIOSH approved) utilizing Organic Vapor/Acid Gas and P-100 filters (half-face if approved by the SEHSO)
- Disposable coveralls (Tyvek, Poly-coated Tyvek or Saranex) as required
- Gloves, inner: latex or nitrile as required
- Gloves, outer: nitrile or neoprene as required
- Chemical resistant boots over the work boots as required
- Steel (or composite)-toed, steel (or composite)-shanked work boots
- Hard hat
- Hearing protection (as needed)
- Safety glasses (if half-mask is utilized)
- Boot covers (as needed)

The Minimum level of PPE for entry onto the Site is Level D PPE. The following equipment shall be used:

- Work uniform (long pants, sleeved shirt)
- Hard hat
- Steel (or composite)-toed, steel (or composite)-shanked work boots
- Safety glasses
- Boot covers (as needed)
- Hearing protection (as needed)
- Reflective safety vest or high visibility outerwear (if allowed by the client)

Modified Level D PPE consists of the following:

- Regular Tyvek coveralls (Poly-coated Tyvek as required)

- Outer gloves: leather, cotton, neoprene or nitrile (as required)
- Inner gloves: latex or nitrile (doubled) as required.
- Chemical resistant boots over work boots (as required).
- Steel (or composite)- toed, steel (or composite)-shanked work boots
- Hard hat
- Safety glasses
- Hearing protection as needed
- Reflective safety vest or high visibility outerwear (if allowed by the client)

7.2.3 Initial Levels of Protection

Levels of protection for the proposed scope of work may be upgraded or downgraded depending on measurement from direct-reading instruments or personal monitoring. The following are the initial levels of protection that shall be used for each planned field activity:

Activity	Initial level of PPE
Mobilization/Demobilization	D
Decontamination/Dewatering	D
Excavation	D/C (Based on Monitoring)
Sheeting/Shoring	D
Asphalt and Concrete Work	D
Earthwork	D
Site Restoration	D

7.3 Communications

While working in level C/B respiratory protection, personnel may find that communication becomes more difficult to accomplish. Distance and space further complicate this. In order to address this problem, electronic instruments, mechanical devices, or hand signals will be used as follows:

Telephones – Mobile telephones will be carried by designated personnel for communication with emergency support services/facilities. Separate hard-wired telephone lines will be established in the field office trailers or management office located in the mall onsite.

Radios – Two-way radios will be utilized onsite for communication between field personnel in areas where visual contact cannot be maintained and where hand signals cannot be employed.

Air Horn – Available as posted in the Site trailer. An additional air horn will be located in the SZ to alert field personnel to an emergency situation. The emergency signal will be three (3) sharp blasts of the air horn.

Hand Signals – This communication method will be employed by members of the field team, along with use of the buddy system. Signals become especially important when in the vicinity of heavy moving equipment and when using Level B respiratory equipment. The signals shall become familiar to the entire field team before Site operations commence and will be reinforced and reviewed during site-specific training.

Signal:	Meaning:
Hand gripping throat	Out of air; can't breathe
Grip partner's wrist	Leave area immediately; no debate
Hands on top of head	Need assistance
Thumbs up	OK; I'm all right; I understand
Thumbs down	No; Unable to understand you, I'm not all right

8.0 MONITORING PROCEDURES

This section is provided as a description of the monitoring procedures that will be implemented while performing the remediation and foundation construction activities at the Site.

8.1 General

Ambient air monitoring will be conducted in the various work areas by the SEHSO during all intrusive tasks. Monitoring will be performed to verify the adequacy of respiratory protection, to aid in Site layout, and to document the level of potential worker exposure. If air monitoring in these areas indicates the presence of potentially hazardous materials, control measures will be implemented in accordance with the remediation contractor's work plans. All monitoring instruments shall be operated by qualified personnel only and will be calibrated daily prior to use or more often, as necessary. No intrusive activity will be performed without the presence of the SEHSO or designated approved substitute and without air monitoring. When a "remediated zone" has been established, additional monitoring will be conducted within this area to confirm that non-trained workers are not exposed to potentially harmful hazardous materials that could potentially migrate from within the EZ. Air monitoring will be performed in conjunction with the OSHA 29 CFR1926.62 lead in construction air monitoring protocols.

8.2 Exclusion Zone Monitoring

8.2.1 Instrumentation

The following monitoring instruments supplied by the SEHSO will be available for use during field operations as necessary. There will be a minimum of one of each piece of equipment at the Site at all times:

- Photoionization Detector (PID) with 10.6 EV probe or Flame Ionization Detector (FID) or equivalent.
- Multi-Gas Meter: Combustible Gas Indicator (CGI)/Oxygen (O₂)/Hydrogen Sulfide (H₂S)/Carbon Monoxide (CO) Meter, (e.g., MSA TriGas meter) – for Confined Space Entry, or when the SEHSO deems necessary.

A PID shall be used to monitor VOCs in active work areas, during intrusive activities. VOCs shall also be measured upwind of the work areas to determine background concentrations.

A CGI/O₂ meter shall be used to monitor for combustible gases and oxygen content prior to entry to the excavation and confined spaces or when the SEHSO deems necessary.

A particulate monitor shall be used to measure concentrations of dust and particulate matter.

Calibrations shall be made and recorded daily and included in the daily air monitoring report. This record will be specific to work area monitoring. All instruments shall be calibrated before and after each daily use in accordance with the manufacturer's specifications.

8.2.2 Action Levels

Action levels for the upgrading of PPE requirements in the CHASP will apply to all Site work during remediation and foundation construction activities at the Site. Action levels (provided in Table 2) are for known contaminants using direct reading instruments in the Breathing Zone (BZ) for VOCs and particulates, and at the source for combustible gases. The BZ will be determined by the SEHSO but is typically 4 to 5 feet above the work area surface or elevation.

8.2.3 Monitoring During Field Activities

Intrusive Operations – Continuous Personnel Breathing Zone Air Monitoring will be performed by the SEHSO during implementation of all intrusive activities at the Site. The highest reading will be recorded on the daily air-monitoring log every 30 minutes during intrusive activities. Real-time monitoring for all onsite activities will be accomplished as follows (prior to the start of daily activities an upwind background reading will be taken and recorded):

- Monitoring of VOCs in and around the work zones.

The frequency of monitoring may be modified by the OEHSM after consultation with the Project Manager. The rationale for any modification must be documented in the CHASP.

A PID and/or FID-equipped organic vapor meter will be utilized to monitor the BZ.

Excavation/Confined Space Operations – Monitoring will be performed during all excavations. A PID and/or FID shall be utilized to monitor the breathing zone when in the area being excavated. A CGI/O₂ meter shall be used to monitor the confined space for the presence of combustible gases/oxygen deficiency, CO, and H₂S.

9.0 SAFETY CONSIDERATIONS

This section provides a detailed description of the general Site safety considerations, as well as the safety procedures for certain specific activities.

9.1 General

In addition to the specific requirements of this CHASP, common sense should be used at all times.

The following general safety rules and practices will be in effect at the Site.

- All open excavations, trenches, and obstacles will be properly barricaded in accordance with Site needs and requirements. Proximity to traffic ways, both pedestrian and vehicular, and location of the open excavation, trench, or obstacle will determine these needs.
- All excavation and other Site work will be planned and performed with consideration for underground utilities.
- Smoking and ignition sources in the vicinity of potentially flammable or contaminated material are strictly prohibited.
- Drilling, boring, and use of cranes and drilling rigs, erection of towers, movement of vehicles and equipment, and other activities will be planned and performed with consideration for the location, height, and relative position of aboveground utilities and fixtures, including signs, lights, canopies, buildings and other structures and construction, and natural features such as trees, boulders, and terrain.
- When working in areas where flammable vapors may be present, particular care shall be exercised with tools and equipment that may be sources of ignition. All tools and equipment provided must be properly classified for the area and bonded and/or grounded utilized.
- Approved and appropriate safety equipment (as specified in this CHASP), such as eye protection, hard hats, foot protection, hand protection and respirators, must be worn in areas where required. In addition, eye protection must be worn when sampling soil or water that may be contaminated.
- All site personnel may be called upon to use respirator protection in some situations. Fit testing will be necessary for all persons using respirators. The criteria for facial hair will be determined by the SEHSO. In general, the guideline is that facial hair cannot interfere with the fit of the respirator.
- No smoking, eating, chewing tobacco, gum chewing, applying cosmetics or drinking will be allowed outside the SZ.
- Contaminated tools and hands must be kept away from the face.
- Personnel must use personal hygiene safe guards (washing up) prior to eating, drinking and smoking and at the end of the shift.

- All soil or groundwater samples collected from the Site must be treated and handled as though the samples are contaminated.
- Persons with long hair and/or loose-fitting clothing that could become entangled in power equipment must take adequate precautions.
- Horseplay is prohibited in the work area.
- Work while under the influence of intoxicants, narcotics, or controlled substances is strictly prohibited.

9.2 Posted Signs

Danger signs will be posted where an immediate hazard exists. Caution signs will be posted to warn against potential hazards and to caution against unsafe practices. Traffic control methods and barricades will be used as needed. Wooden stakes and flagging tape or equally effective material will be used to demarcate all restricted areas.

9.3 Intrusive Operations

The SHSO will be present during all intrusive work activities. Intrusive work is defined as any work being conducted in an area of known contamination that may disturb the impacted material and/or expose the worker to the contaminants. S/He will ensure that appropriate monitoring, levels of protection, and safety procedures are followed. All personnel will keep at least two feet from the edge of the excavation and out of the swing radius of excavation equipment.

The proximity of water, sewer, electrical lines, and other subsurface utilities will be identified prior to intrusive operations. Properly sized containment systems will be utilized and consideration of the potential volume of liquid or waste disposed during Site operations will be discussed with the Site Superintendent to minimize the quantity of stored aqueous materials. Emergency evacuation procedures and the location of safety equipment will be established prior to start-up operations. The use of protective clothing, especially hard hats, boots, safety glasses and gloves, will be mandatory during excavation and other heavy equipment work.

9.4 Dewatering Sampling

Sampling personnel must wear prescribed protective clothing and equipment, including eye protection, chemical and cut-resistant (for glassware) gloves and splash aprons (where

appropriate) when sampling soils and liquids. Sample bottles are to be labeled prior to sampling to ease decontamination. Personnel must be aware of the location of emergency equipment, including spill containment materials prior to sampling. Personnel are to practice contamination avoidance at all times, as well as to utilize the buddy system and maintain communications with the SEHSO.

9.5 Sample Handling

Personnel responsible for handling of samples will wear the prescribed level of protection. Samples are to be identified as to their hazard and packaged as to prevent spillage or breakage. Any unusual sample conditions shall be noted. Laboratory personnel and all field personnel shall be advised of sample hazard levels and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or including a written statement with the samples reviewing lab safety procedures in handling in order to assure that the practices are appropriate for the suspected contaminants in the sample.

9.6 Heavy Equipment Decontamination

Equipment will be dry decontaminated in the EZ first. This shall consist of the gross removal of the contaminated material from the augers, buckets, wheels, blades, etc. using hand tools. If wet decontamination is required, the equipment will be taken to the designated decontamination pad. Personnel performing the decontamination of equipment shall use the prescribed level of protection. Initially, this task usually employs modified Level D as described in Section 8.2.2. The equipment decontamination shall be restricted to authorized personnel only. Special consideration will be given to wind speed and direction. Downwind areas are to be kept free of personnel to avoid unnecessary exposure to potential airborne contamination.

10.0 DECONTAMINATION AND DISPOSAL PROCEDURES

This section details the specific decontamination and waste disposal procedures to be implemented at the Site during the remediation/foundation construction phase.

10.1 Contamination Prevention

Contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

Personnel

- Do not walk through areas of obvious or known contamination
- Do not directly handle or touch contaminated materials
- Make sure that there are no cuts, tears, or other signs of damage to the PPE
- Fasten all closures in suits; cover with tape, if necessary
- Particular care should be taken to protect any skin injuries
- Stay upwind of airborne contaminants
- Do not carry cigarettes, cosmetics, gum, etc. into contaminated areas

Sampling/Monitoring

- When required by the SEHSO, cover instruments with clear plastic, leaving openings for sampling ports.
- Bag sample containers prior to emplacement of sample material

Heavy Equipment

- Care should be taken to limit the amount of potentially impacted material that comes in contact with heavy equipment (e.g., tires, augers).
- If contaminated tools are to be placed on non-contaminated equipment for transport to a decontamination area, plastic should be used to keep the equipment clean.
- Dust control measures, including water misting, will be used on roads inside the Site boundaries, as described in the remediation work plans.

10.2 Personnel Decontamination

All personnel shall pass through an outlined decontamination procedure when exiting the EZ at each location. The procedure is outlined in Appendix D. A field wash for equipment and PPE shall be set-up and maintained for all persons exiting the EZ. The system will include a wash and rinse for all disposable clothing and boots worn in the EZ. As necessary, equipment and facilities will be available for personnel to wash their hands, arms, neck, and face before entering the SZ.

10.3 Equipment Decontamination

All potentially contaminated equipment used at the Site will be decontaminated to prevent contaminants from leaving the Site. Heavy equipment will be decontaminated at the decontamination pad and inspected by the SEHSO or designated individual before it leaves the Site. The decontamination area will provide for the containment of all wastewater from the decontamination process. Respirators, airline and any other PPE that comes in contact with contaminated materials shall pass through a field wash on the decontamination pad and a final, thorough decontamination at the end of the day. All decontamination rinse water will be collected and managed in accordance with the procedures for handling of water during dewatering, as per the Technical Specifications.

10.4 Decontamination During Medical Emergencies

If emergency life-saving first aid and/or medical treatment are required, normal decontamination procedures may need to be abbreviated or omitted. The Site SEHSO or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances and/or medical personnel. Outer garments are then removed at the medical facility. No attempt will be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material, which could aggravate the injury or poses a hazard to emergency response personnel. For minor medical problems (ambulatory) or injuries, the normal decontamination procedures will be followed. Note that heat stroke requires immediate treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of

heat stress require prompt attention and removal of protective clothing immediately. Unless the victim is obviously contaminated, decontamination should be omitted or minimized and treatment begun immediately.

10.5 Disposal Procedures

A system of segregating all waste will be developed by the SEHSO.

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left onsite. All potentially contaminated materials (e.g., clothing, gloves, etc.) will be bagged or drummed as necessary, labeled, and segregated for disposal. All non-contaminated materials shall be collected and bagged for appropriate disposal as domestic waste.

11.0 EMERGENCY PLAN

Prior to the start of work, the emergency plan, outlined in this section, will be understood by the remediation contractor and all subcontractors. The emergency plan will be available for use at all times during Site work. The plan provides the phone numbers for the fire, police, ambulance, hospital, poison control centers, and directions to the hospital from the Site. This information is to be found in Section 1.2 of the CHASP and shall be conspicuously posted in the job's construction Site trailer.

Various individual Site characteristics will determine preliminary actions taken to assure that this emergency plan is successfully implemented in the event of a Site emergency. Careful consideration must be given to the proximity of neighborhood housing or places of employment and to the relative possibility of Site release of vapors that could affect the surrounding community.

The Site Superintendent shall serve as the emergency coordinator. The emergency coordinator shall make contact with local fire, police, and other emergency units prior to beginning work onsite. In these contacts, the emergency coordinator will inform the emergency units about the nature and duration of work expected at the Site and the type of contaminants and possible health or safety effects of emergencies involving the contaminants. At this time, the emergency coordinator and the emergency response units shall make necessary arrangements to be prepared for any emergencies that could occur.

The emergency coordinator shall implement the contingency plan whenever conditions at the Site warrant such action. The coordinator will be responsible for coordination of the evacuation, emergency treatment, transport of Site personnel as necessary, and notification of emergency response units and the appropriate management staff.

In cases where the Site Superintendent is not available, the or SHSO shall serve as the emergency coordinator.

The SEHSO, during an emergency, will perform air monitoring as needed, as well as lend assistance and provide health and safety information to responding emergency personnel.

Site Personnel will endeavor to keep non-essential personnel away from the incident until the appropriate emergency resources arrive. At that time, the responders will take control of the Site. Site personnel may be asked to lend assistance to emergency personnel such as during evacuations, help with the injured, etc.

11.1 Evacuation

Evacuation procedures will be discussed prior to the start of work and periodically during safety meetings. In the event of an emergency situation such as a fire or explosion, an air horn or other appropriate device will be sounded for three (3) sharp blasts, indicating the initiation of evacuation procedures. The emergency evacuation route shall be clearly posted in the crew's, contractor's, and all other office trailers. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SHSO, or Site Superintendent must ensure that access for emergency equipment is provided and that all spark-producing equipment has been shut down once the alarm has been sounded. All Site personnel will assemble in the SZ or nearest safe location. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency.

11.2 Personnel Injury

Emergency first aid shall be applied onsite as appropriate. If necessary, the individual shall be decontaminated and transported to the nearest hospital. The SHSO will supply medical data sheets to medical personnel and complete the accident reports in accordance with Section 13.5 of the CHASP.

The ambulance/rescue squad shall be contacted for transport as necessary in an emergency. However, if the situation requires transport of an injured party by other means, the injured person shall be escorted to the hospital. A map to this facility is shown in Figure 1.

11.3 Accident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

Contact	Office	Cell
General Superintendent	TBD	
Safety Supervisor	TBD	
Site Safety Officer	TBD	
Owners Representative	TBD	
Owner's Onsite Representative	TBD	

Written confirmation of verbal reports is to be submitted within 24 hours. The report forms entitled "Accident Report" and "Accident Investigation Report" (Appendix E) are to be used for this purpose. All project representatives contacted by telephone are to receive a copy of this report. If the employee involved is not an employee of the remedial contractor, his employer shall receive a copy of the report.

For reporting purposes, the term accident refers to fatalities, lost-time injuries, restricted duty, medical treatment, spills, or exposure to hazardous materials (radioactive materials, toxic materials, explosive, or flammable materials), fire, explosion, property damage, or potential occurrence of the above (i.e., near losses).

Any information released from the health care provider, which is not deemed confidential patient information, is to be attached to the appropriate form. Any medical information, which is released by patient consent, is to be filed in the individual's medical record and treated as confidential.

11.3 Personnel Exposure

Skin and Eye Contact:

Use copious amounts of soap and water. Wash/rinse affected area thoroughly, and then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination.

<u>Inhalation:</u>	Move to fresh air and/or, if necessary, decontaminate/transport to hospital.
<u>Ingestion:</u>	Decontamination and transport to emergency medical facility.
<u>Puncture Wound or Laceration:</u>	Decontamination and transport to emergency medical facility.

11.4 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO, or Site Superintendent will determine if work can continue without adversely affecting the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries;
- Potential for cold stress and cold-related injuries;
- Treacherous weather-related conditions;
- Limited visibility and;
- Electrical storm potential.

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lightning. Observe daily weather reports and evacuate if necessary in case of inclement weather conditions.

12.0 LOGS, REPORTS AND RECORD KEEPING

The following is a summary of required health and safety logs, reports, and record keeping for this project.

12.1 Daily Operations Log

A daily operations log shall be completed by the SHSO and Site Superintendent, with a copy provided to the owner's onsite representative. The original will be kept in the project file. See Appendix F.

12.2 Training Records

The employer keeps training records. The subcontractor employer must provide verification of training/certifications to the SEHSO. The SEHSO will keep a log of personnel meeting appropriate training/certifications for Site work. The log will be kept in the project file. The remediation contractor will maintain medical records in accordance with 29 CFR 1910.20.

12.3 Onsite Log

The or SHSO will keep a log of onsite personnel daily. A copy of these logs will be given to the Project Coordinator and owner's onsite representative upon request. Originals will be kept in the project file.

12.4 Exposure Records

Any personal monitoring results, associated laboratory reports, calculations, and air sampling data sheets are part of an employee exposure record. These records will be managed by the remediation contractor in accordance with 29 CFR 1910.20 and 29 CFR 1926.62.

12.5 Accident Reports

An accident report and investigation report must be completed following procedures given in Appendix E. The originals will be sent to the General Superintendent for maintenance. Copies will be distributed as stated. A copy of all completed forms will be kept in the project file.

12.6 OSHA Form 300

An OSHA Form 300 (Log of Occupational Injuries and Illnesses) will be kept at the Site. All recordable injuries or illnesses will be entered onto this form. At the end of the project, the original will

be sent to the owner's representative for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA Form 300 for their company.

12.7 Training Logs

The Training Logs will be completed by the SHSO and submitted to the Site Superintendent prior to allowing personnel onsite.

12.8 Daily Safety Logs

The Daily Safety Log form in Appendix F will be completed daily by the SHSO and submitted to the Project Manager and/or owner's onsite representative.

12.9 Air Monitoring Log

The Air Monitoring Log form in Appendix G will be completed by the SHSO and submitted to the Project Manager.

12.10 Weekly Safety Reports

The Weekly Safety Reports in Appendix H will be completed by the SHSO and submitted to the Project Manager.

12.11 Close-Out Safety Report

At the completion of the work, the General Superintendent will submit a closeout Safety Report that will include all logs and reports generated during the project. The report will be signed and dated by the SHSO and submitted to the Project Manager.

13.0 SANITATION AT TEMPORARY WORK STATIONS

Provisions shall be made for access to portable sanitary systems. Provisions are required for the removal of accumulated waste products within those units.

If a commercial/industrial laundry is used to clean or launder clothing that is potentially contaminated, they shall be informed in writing of the potential harmful effects of exposure to hazardous substances related to the affected clothing.

Personnel and subcontractors assigned to the Site shall follow decontamination procedures described in the CHASP or as directed by the SHSO. This will generally include, at a minimum, an overview of site hazards, site-specific training related to their work, and site-specific training in cleanup, personal hygiene requirements, and the donning/doffing of protective equipment/clothing.

SEHSO CERTIFICATION OF HOSPITAL DIRECTIONS

Name of SEHSO:

Date:

This is to certify that on _____, I personally drove the route to Staten Island University Hospital North as listed in the CHASP. The Map Routing and Directions were/were not as listed in the plan. Listed below were conditions that resulted in different directions.

TBD
Site Environmental Health and Safety Officer

1. Toxicological, Physical and Chemical Properties of Compounds Potentially Present at the Site
2. Action Levels for Worker Breathing Zone

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Asbestos	1332-21-4	TWA 0.1f/cc	Ca (ND)	TWA 0.1 fiber/cm ³	Inhalation; ingestion; skin and/or eye contact	Asbestosis (chronic exposure), dyspnea, interstitial fibrosis, restricted pulmonary function, finger clubbing, irritation eyes, [potential occupational carcinogen]	Respiratory system, eyes	White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite), fibrous, odorless solids. BP: decomposes
Benzene	71-43-2	1.6 mg/m ³ 0.5 ppm	Ca (ND)	1 ppm	Dermal; inhalation ingestion	CNS depression Hematopoietic depression Dermatitis	CNS blood skin eyes resp system bone marrow	Liquid (solid below 42°F) BP: 80.093°C flammable LEL: 1.4% UEL: 8.0%
Chromium (VI)	7440-47-3	0.05 mg/m ³ (water soluble) 0.01 mg/m ³ (insoluble)	(ND)	None	Dermal; inhalation; ingestion	Nasal and lung tumors Sensory irritant	lungs eyes skin	Red, rhombic crystals
Diesel Fuel	68334-30-5	100 mg/m ³	NA	NA	Dermal; inhalation	Resp irritation Dizziness, nausea Skin disorders Liver disorders	lungs CNS skin liver	Light amber liquid Fl.Pt = >100°F LEL = 0.6% UEL = 7.0%
Ethylbenzene	100-41-4	434 mg/m ³ 100 ppm (may lower to 20 ppm)	800 ppm (10% LEL)	435 mg/m ³ 100 ppm	Dermal; inhalation; ingestion	Sensory irritant CNS depressant Narcosis Hematological disorders	eyes skin CNS respiratory system blood	Liquid aromatic odor BP: 277°F Fl.P: 59°F LEL: 1.2% UEL: 7.0%
Fuel Oil	68476-33-5	NA	None	NA	Dermal; inhalation; ingestion	Skin cancer Liver damage Blood disorders	skin liver bone marrow	Dark liquid LEL = 1.0% UEL = 3.0% Fl.Pt = >140°F

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Gasoline	8006-61-9	300 ppm 890 mg/m ³ carcinogen	carcinogen	900 mg/m ³ 300 ppm	Dermal; inhalation; ingestion	CNS depression Sensory irritant Dermatitis Pulmonary Edema	CNS eyes skin resp system	Liquid, aromatic Fl.Pt = -50°F
Kerosene	8008-20-6	200 mg/m ³	NA	NA	Dermal; inhalation	Eye/skin irritation Resp. irritation Dizziness, nausea	eyes skin resp. system CNS	yellow to white oily liquid Fl.Pt = >100-162°F LEL = 0.7% UEL = 5.0%
Lead	7439-92-1	0.05 mg/m ³	700 100 mg/m ³	0.05 mg/m ³	Dermal; inhalation; ingestion	Abdominal pain CNS depressant Anemia Nephropathy Reproductive effects	GI tract CNS blood kidneys	Metal - soft gray BP: 3164°F
Mercury vapor (Elemental)	7439-97-6	0.025 (skin)	28 mg/m ³	0.05 (skin)	Dermal; inhalation; ingestion	Tremor Insomnia Chest pain GI disturbance Eye irritant Skin irritant	skin resp system CNS kidneys eyes	Silver, white, odorless liquid BP = 674°F
Petroleum hydrocarbons (Petroleum distillates)	8002-05-9	N/A	1,100 ppm	2,000 mg/m ³ 500 ppm	Dermal; inhalation; ingestion	CNS depressant Respiratory irritant Dried/cracked skin	CNS respiratory tract skin	Colorless liquid BP: 86-460°F UEL: 5.9% LEL: 1.1% flammable
Slop Oil	68477-26-9	NA	NA	NA	Dermal	Eye irritation Skin irritation	eyes skin	Dark liquid Fl.Pt = >300°F LEL = 0.6% UEL = 7.0%
Toluene	108-88-3	75 mg/m ³ 20 ppm	500 ppm	200 ppm	Dermal; inhalation; ingestion	CNS depression Liver damage Kidney damage Defatting of skin	CNS liver kidney skin	Liquid benzene odor BP: 110.4°C flammable LEL: 1.2% UEL: 7.1%

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Xylene(s)	1330-20-7	434 mg/m ³ 100 ppm	900 ppm	435 mg/m ³ 100 ppm	Dermal; inhalation; ingestion	Sensory irritant Blood dyscrasia Bronchitis CNS depression	CNS eyes skin GI tract blood liver kidneys	Liquid Aromatic odor BP: 138.5° flammable LEL: 1.1% UEL: 7.0%

Notes:

- Ca – Carcinogen
- TLV – Threshold Limit Value, as 8-hr. time-weighted averages (ACGIH)
- IDLH – Immediately Dangerous to Life and Health (OSHA)
- PEL – Permissible Exposure Level (OSHA)
- PPM – Parts per million
- mg/m³ – milligrams per cubic meter
- Fl. Pt. – Flash point
- LEL – Lower Explosive Level
- UEL – Upper Explosive Level
- BP – Boiling Point
- NA – Not Available
- ND – Not Determined

References:

2010 TLVs® and BEIs®. American Conference of Governmental Industrial Hygienists.
 Hawley's Condensed Chemical Dictionary, Sax, N. Van Nostrand and Reinhold Company, 11th Edition, 1987.
 Occupational Safety and Health Administration, 1993. General Industry Air Contaminant Standard (2a CFR 1910.1000).
 Proctor, N.H., J.P. Hughes and M.L. Fischman, 1989. Chemical Hazards of the Workplace. Van Nostrand Reinhold. New York.
 Sax, N.I. and R.J. Lewis, 1989. Dangerous Properties of Industrial Materials. 7th Edition. Van Nostrand Reinhold. New York.
 U.S. Department of Health and Human Services, 1997. NIOSH Pocket Guide to Chemical Hazards.

TABLE 2

ACTION LEVELS FOR WORKER BREATHING ZONE

<u>Instrument</u>	<u>Action Level *</u>	<u>Level of Respiratory Protection/Action</u>
PID	0 to <5 ppm (one minute sustained)	Level D *
PID	>5 to <50 ppm (one minute sustained)	Level C (Utilize Air Purifying Respirator)
PID	>50 to <100 ppm (one minute sustained)	Level B
PID	>100ppm	Stop work** (ventilate, apply foam)
Dust Monitor	0 – 1.0 mg/m ³ , 5-minute average	Level D
Dust Monitor	>1.0 to 5.0 mg/m ³ , 5-minute average	Level D – Institute dust suppression measures
Dust Monitor	>5.0 to 50 mg/m ³ , 5-minute average	Level C – Institute dust suppression measures

Note: Action levels are based on above background levels.

* Instrument readings will be taken in the breathing zone (BZ) of the Site Workers, unless otherwise indicated.

** Suspend work in immediate area. Conduct air monitoring periodically to determine when work can continue. Implement mitigative measures.

1. Emergency Route to Hospital



Staten Island Mall
2655 Richmond Ave, Staten Island, NY 10314



1. Head **north** on **Richmond Ave**
About 52 secs
go 0.5 mi
total 0.5 mi
2. Turn **right** onto **Richmond Hill Rd**
About 4 mins
go 1.6 mi
total 2.1 mi
3. Continue onto **Arthur Kill Rd**
go 338 ft
total 2.2 mi
4. Turn **left** onto **Richmond Rd**
About 3 mins
go 1.1 mi
total 3.3 mi
5. Turn **right** to stay on **Richmond Rd**
About 1 min
go 0.3 mi
total 3.6 mi
6. Turn **left** to stay on **Richmond Rd**
About 2 mins
go 0.8 mi
total 4.4 mi
7. Turn **right** onto **Midland Ave**
About 1 min
go 0.5 mi
total 4.9 mi
8. Turn **left** onto **Hylan Blvd**
About 2 mins
go 0.8 mi
total 5.7 mi
9. Turn **right** onto **Seaview Ave**
About 1 min
go 0.5 mi
total 6.2 mi
10. Turn **left**
About 1 min
go 0.2 mi
total 6.4 mi
11. Turn **left**
go 207 ft
total 6.4 mi
12. Turn **right**
go 49 ft
total 6.4 mi
13. Turn **right**
Destination will be on the left.
go 144 ft
total 6.5 mi

hospital



Title:			
HOSPITAL ROUTE MAP			
CONSULTANT'S HEALTH & SAFETY PLAN			
Prepared for:			
GENERAL GROWTH PROPERTIES			
 ROUX ASSOCIATES, INC. Environmental Consulting & Management	Compiled by: M.A.	Date: 18OCT13	FIGURE 1
	Prepared by: B.H.C.	Scale: AS SHOWN	
	Project Mgr.: M.A.	Project No.: 1287.0007Y000	
	File: 1287.0007Y114.01.CDR		

- A. Heat Stress Guidelines
- B. Cold Stress Guidelines
- C. Excavation Check List and Procedures
- D. Example Decontamination Station Layout
- E. Accident Investigation Report
- F. Daily Safety Logs
- G. Air Monitoring Log
- H. Weekly Safety Report

Heat Stress Guidelines

Protecting Workers from Heat Stress

Heat Illness

Exposure to heat can cause illness and death. The most serious heat illness is heat stroke. Other heat illnesses, such as heat exhaustion, heat cramps and heat rash, should also be avoided.

There are precautions your employer should take any time temperatures are high and the job involves physical work.

Risk Factors for Heat Illness

- High temperature and humidity, direct sun exposure, no breeze or wind
- Low liquid intake; previous heat illnesses
- Heavy physical labor
- Waterproof clothing
- No recent exposure to hot workplaces

Symptoms of Heat Exhaustion

- Headache, dizziness, or fainting
- Weakness and wet skin
- Irritability or confusion
- Thirst, nausea, or vomiting

Symptoms of Heat Stroke

- May be confused, unable to think clearly, pass out, collapse, or have seizures (fits)
- May stop sweating

To Prevent Heat Illness, Your Employer Should

- Provide training about the hazards leading to heat stress and how to prevent them.
- Provide a lot of cool water to workers close to the work area. At least one pint of water per hour is needed.



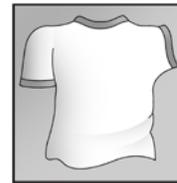
For more complete information:

- Schedule frequent rest periods with water breaks in shaded or air-conditioned areas.
- Routinely check workers who are at risk of heat stress due to protective clothing and high temperature.
- Consider protective clothing that provides cooling.



How You Can Protect Yourself and Others

- Know signs/symptoms of heat illnesses; monitor yourself; use a buddy system.
- Block out direct sun and other heat sources.
- Drink plenty of fluids. Drink often and BEFORE you are thirsty.
- Avoid beverages containing alcohol or caffeine.
- Wear lightweight, light colored, loose-fitting clothes.
- Be aware that poor physical condition, some health problems (such as high blood pressure or diabetes), pregnancy, colds and flu, and some medications can increase your personal risk. If you are under treatment, ask your healthcare provider.



What to Do When a Worker is Ill from the Heat

- Call a supervisor for help. If the supervisor is not available, call 911.
- Have someone stay with the worker until help arrives.
- Move the worker to a cooler/shaded area.
- Remove outer clothing.
- Fan and mist the worker with water; apply ice (ice bags or ice towels).
- Provide cool drinking water, if able to drink.

IF THE WORKER IS NOT ALERT or seems confused, this may be a heat stroke. CALL 911 IMMEDIATELY and apply ice as soon as possible.

If you have any questions or concerns, call OSHA at 1-800-321-OSHA.

For more complete information:



U.S. Department of Labor

www.osha.gov (800) 321-OSHA



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OSHA Technical Manual

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SECTION III: CHAPTER 4

HEAT STRESS

Contents:

- I. **Introduction**
- II. **Heat Disorders and Health Effects**
- III. **Investigation Guidelines**
- IV. **Sampling Methods**
- V. **Control**
- VI. **Personal Protective Equipment**
- VII. **Bibliography**

- Appendix III:4-1 Heat Stress: General Workplace Review**
Appendix III:4-2 Heat Stress-Related Illness/Accident Follow-Up
Appendix III:4-3 Measurement of Wet Bulb Globe Temperature

For problems with accessibility in using figures and illustrations in this document, please contact the Office of Science and Technology Assessment at (202) 693-2095.

I. INTRODUCTION.

Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress in employees engaged in such operations. Such places include: iron and steel foundries, nonferrous foundries, brick-firing and ceramic plants, glass products facilities, rubber products factories, electrical utilities (particularly boiler rooms), bakeries, confectioneries, commercial kitchens, laundries, food canneries, chemical plants, mining sites, smelters, and steam tunnels.

Outdoor operations conducted in hot weather, such as construction, refining, asbestos removal, and hazardous waste site activities, especially those that require workers to wear semipermeable or impermeable protective clothing, are also likely to cause heat stress among exposed workers.

A. CAUSAL FACTORS.

1. Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. However, even the type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.
2. It is difficult to predict just who will be affected and when, because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

B. DEFINITIONS.

1. The American Conference of Governmental Industrial Hygienists (1992) states that workers should not be permitted to work when their deep body temperature exceeds 38°C (100.4°F).
2. **Heat** is a measure of energy in terms of quantity.

3. A **calorie** is the amount of heat required to raise 1 gram of water 1°C (based on a standard temperature of 16.5 to 17.5°C).
4. **Conduction** is the transfer of heat between materials that contact each other. Heat passes from the warmer material to the cooler material. For example, a worker's skin can transfer heat to a contacting surface if that surface is cooler, and vice versa.
5. **Convection** is the transfer of heat in a moving fluid. Air flowing past the body can cool the body if the air temperature is cool. On the other hand, air that exceeds 35°C (95°F) can increase the heat load on the body.
6. **Evaporative cooling** takes place when sweat evaporates from the skin. High humidity reduces the rate of evaporation and thus reduces the effectiveness of the body's primary cooling mechanism.
7. **Radiation** is the transfer of heat energy through space. A worker whose body temperature is greater than the temperature of the surrounding surfaces radiates heat to these surfaces. Hot surfaces and infrared light sources radiate heat that can increase the body's heat load.
8. **Globe temperature** is the temperature inside a blackened, hollow, thin copper globe.
9. **Metabolic heat** is a by-product of the body's activity.
10. **Natural wet bulb (NWB) temperature** is measured by exposing a wet sensor, such as a wet cotton wick fitted over the bulb of a thermometer, to the effects of evaporation and convection. The term natural refers to the movement of air around the sensor.
11. **Dry bulb (DB) temperature** is measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources.

II. HEAT DISORDERS AND HEALTH EFFECTS.

- A. **HEAT STROKE** occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of work load and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protests, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

- B. **HEAT EXHAUSTION.** The signs and symptoms of heat exhaustion are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment and given fluid replacement. They should also be encouraged to get adequate rest.

- C. **HEAT CRAMPS** are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused by both too much and too little salt. Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution ($\pm 0.3\%$ NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Recent studies have shown that drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

- D. **HEAT COLLAPSE** ("Fainting"). In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable. To prevent heat collapse, the worker should gradually become acclimatized to the hot environment.

- E. **HEAT RASHES** are the most common problem in hot work environments. Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.
- F. **HEAT FATIGUE.** A factor that predisposes an individual to heat fatigue is lack of acclimatization. The use of a program of acclimatization and training for work in hot environments is advisable. The signs and symptoms of heat fatigue include impaired performance of skilled sensorimotor, mental, or vigilance jobs. There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

III. INVESTIGATION GUIDELINES.

These guidelines for evaluating employee heat stress approximate those found in the 1992-1993 ACGIH publication, *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

A. EMPLOYER AND EMPLOYEE INTERVIEWS.

1. The inspector will review the OSHA 200 Log and, if possible, the OSHA 101 forms for indications of prior heat stress problems.
2. Following are some questions for employer interviews: What type of action, if any, has the employer taken to prevent heat stress problems? What are the potential sources of heat? What employee complaints have been made?
3. Following are some questions for employee interviews: What heat stress problems have been experienced? What type of action has the employee taken to minimize heat stress? What is the employer's involvement, i.e., does employee training include information on heat stress? (Appendix III:4-1 lists factors to be evaluated when reviewing a heat stress situation, and Appendix III:4-2 contains a follow-up checklist.)

B. WALKAROUND INSPECTION. During the walkaround inspection, the investigator will: determine building and operation characteristics; determine whether engineering controls are functioning properly; verify information obtained from the employer and employee interviews; and perform temperature measurements and make other determinations to identify potential sources of heat stress. Investigators may wish to discuss any operations that have the potential to cause heat stress with engineers and other knowledgeable personnel. The walkaround inspection should cover all affected areas. Heat sources, such as furnaces, ovens, and boilers, and relative heat load per employee should be noted.

C. WORK-LOAD ASSESSMENT.

1. Under conditions of high temperature and heavy workload, the CSHO should determine the work-load category of each job (Table III:4-1 and Figure III:4-1). Work-load category is determined by averaging metabolic rates for the tasks and then ranking them:
 1. Light work: up to 200 kcal/hour
 2. Medium work: 200-350 kcal/hour
 3. Heavy work: 350-500 kcal/hour
2. *Cool Rest Area:* Where heat conditions in the rest area are different from those in the work area, the metabolic rate (M) should be calculated using a time-weighted average, as follows:

Equation III: 4-1. Average Metabolic Rate

$$Average_M = \frac{(M_1)(t_1) + (M_2)(t_2) + \dots + (M_n)(t_n)}{(t_1) + (t_2) + \dots + (t_n)}$$

where: M = metabolic rate

t = time in minutes

In some cases, a videotape is helpful in evaluating work practices and metabolic load.

FIGURE III:4-1. ACTIVITY EXAMPLES

- Light hand work: writing, hand knitting
- Heavy hand work: typewriting
- Heavy work with one arm: hammering in nails (shoemaker, upholsterer)
- Light work with two arms: filing metal, planing wood, raking the garden
- Moderate work with the body: cleaning a floor, beating a carpet
- Heavy work with the body: railroad track laying, digging, barking trees

Sample Calculation: Assembly line work using a heavy hand tool

Walking along	2.0 kcal/min
Intermediate value between heavy work with two arms and light work with the body	3.0 kcal/min
Add for basal metabolism	1.0 kcal/min
Total:	6.0 kcal/min

Source: ACGIH 1992.

TABLE III:4-1. ASSESSMENT OF WORK

<i>Body position and movement</i>		<i>kcal/min*</i>	
Sitting		0.3	
Standing		0.6	
Walking		2.0-3.0	
Walking uphill		add 0.8 for every meter (yard) rise	
Type of work	Average kcal/min	Range kcal/min	
Hand work			
Light	0.4	0.2-1.2	
Heavy	0.9		
Work: One arm			
Light	1.0	0.7-2.5	
Heavy	1.7		
Work: Both arms			
Light	1.5	1.0-3.5	
Heavy	2.5		
Work: Whole body			
Light	3.5	2.5-15.0	
Moderate	5.0		
Heavy	7.0		
Very heavy	9.0		
* For a "standard" worker of 70 kg body weight (154 lbs) and 1.8m ² body surface (19.4 ft ²).			

Source: ACGIH 1992.

IV. SAMPLING METHODS.

- A. **BODY TEMPERATURE MEASUREMENTS.** Although instruments are available to estimate deep body temperature by measuring the temperature in the ear canal or on the skin, these instruments are not sufficiently reliable to use in compliance evaluations.
- B. **ENVIRONMENTAL MEASUREMENTS.** Environmental heat measurements should be made at, or as close as possible to, the specific work area where the worker is exposed. When a worker is not continuously exposed in a single hot area but moves between two or more areas having different levels of environmental heat, or when the environmental heat varies substantially at a single hot area, environmental heat exposures should be measured for each area and for each level of environmental heat to which employees are exposed.
- C. **WET BULB GLOBE TEMPERATURE INDEX.**

- 1. Wet Bulb Globe Temperature (WBGT) should be calculated using the appropriate formula in [Appendix III:4-2](#). The

WBGT for continuous all-day or several hour exposures should be averaged over a 60-minute period. Intermittent exposures should be averaged over a 120-minute period. These averages should be calculated using the following formula:

Equation III:4-2. Average Web Bulb Globe Temperature (WBGT)

$$Average_{WBGT} = \frac{(WBGT_1)(t_1) + (WBGT_2)(t_2) + \dots + (WBGT_n)(t_n)}{(t_1) + (t_2) + \dots + (t_n)}$$

For indoor and outdoor conditions with no solar load, WBGT is calculated as:

$$WBGT = 0.7NWB + 0.3GT$$

For outdoors with a solar load, WBGT is calculated as

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
 NWB = Nature Wet-Bulb Temperature
 DB = Dry-Bulb Temperature
 GT = Globe Temperature

2. The exposure limits in Table III:4-2 are valid for employees wearing light clothing. They must be adjusted for the insulation from clothing that impedes sweat evaporation and other body cooling mechanisms. Use Table III:4-3 to correct Table III:4-2 for various kinds of clothing.
 3. Use of Table III:4-2 requires knowledge of the WBGT and approximate workload. Workload can be estimated using the data in Table III:4-1, and sample calculations are presented in Figure III:4-1.
- D. **MEASUREMENT.** Portable heat stress meters or monitors are used to measure heat conditions. These instruments can calculate both the indoor and outdoor WBGT index according to established ACGIH Threshold Limit Value equations. With this information and information on the type of work being performed, heat stress meters can determine how long a person can safely work or remain in a particular hot environment. See Appendix III:4-2 for an alternate method of calculation.

TABLE III:4-2. PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUE

Work/rest regimen	----- Work Load* -----		
	Light	Moderate	Heavy
Continuous work	30.0°C (86°F)	26.7°C (80°F)	25.0°C (77°F)
75% Work, 25% rest, each hour	30.6°C (87°F)	28.0°C (82°F)	25.9°C (78°F)
50% Work, 50% rest, each hour	31.4°C (89°F)	29.4°C (85°F)	27.9°C (82°F)
25% Work, 75% rest, each hour	32.2°C (90°F)	31.1°C (88°F)	30.0°C (86°F)

*Values are in °C and °F, WBGT.

These TLV's are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38°C (100.4° F). They are also based on the assumption that the WBGT of the resting place is the same or very close to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time-weighted average should be used (consult the ACGIH 1992-1993 *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (1992).

These TLV's apply to physically fit and acclimatized individuals wearing light summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLV's in Table III:4-2 must be reduced by the corrections shown in Table III:4-3.

Source: ACGIH 1992.

E. OTHER THERMAL STRESS INDICES.

1. The Effective Temperature index (ET) combines the temperature, the humidity of the air, and air velocity. This index has been used extensively in the field of comfort ventilation and air-conditioning. ET remains a useful measurement technique in mines and other places where humidity is high and radiant heat is low.
2. The Heat-Stress Index (HSI) was developed by Belding and Hatch in 1965. Although the HSI considers all environmental factors and work rate, it is not completely satisfactory for determining an individual worker's heat stress and is also difficult to use.

TABLE III-4-3. WBGT CORRECTION FACTORS IN °C

Clothing type	Clo* value	WBGT correction
Summer lightweight working clothing	0.6	0
Cotton coveralls	1.0	-2
Winter work clothing	1.4	-4
Water barrier, permeable	1.2	-6

*Clo: Insulation value of clothing. One clo = 5.55 kcal/m²/hr of heat exchange by radiation and convection for each degree °C difference in temperature between the skin and the adjusted dry bulb temperature.

Note: Deleted from the previous version are trade names and "fully encapsulating suit, gloves, boots and hood" including its clo value of 1.2 and WBGT correction of -10.

Source: ACGIH 1992.

V. CONTROL.

Ventilation, air cooling, fans, shielding, and insulation are the five major types of engineering controls used to reduce heat stress in hot work environments. Heat reduction can also be achieved by using power assists and tools that reduce the physical demands placed on a worker.

However, for this approach to be successful, the metabolic effort required for the worker to use or operate these devices must be less than the effort required without them. Another method is to reduce the effort necessary to operate power assists. The worker should be allowed to take frequent rest breaks in a cooler environment.

A. ACCLIMATIZATION.

1. The human body can adapt to heat exposure to some extent. This physiological adaptation is called acclimatization. After a period of acclimatization, the same activity will produce fewer cardiovascular demands. The worker will sweat more efficiently (causing better evaporative cooling), and thus will more easily be able to maintain normal body temperatures.
2. A properly designed and applied acclimatization program decreases the risk of heat-related illnesses. Such a program basically involves exposing employees to work in a hot environment for progressively longer periods. NIOSH (1986) says that, for workers who have had previous experience in jobs where heat levels are high enough to produce heat stress, the regimen should be 50% exposure on day one, 60% on day two, 80% on day three, and 100% on day four. For new workers who will be similarly exposed, the regimen should be 20% on day one, with a 20% increase in exposure each additional day.

B. FLUID REPLACEMENT. Cool (50°-60°F) water or any cool liquid (except alcoholic beverages) should be made available to workers to encourage them to drink small amounts frequently, e.g., one cup every 20 minutes. Ample supplies of liquids should be placed close to the work area. Although some commercial replacement drinks contain salt, this is not necessary for acclimatized individuals because most people add enough salt to their summer diets.

C. ENGINEERING CONTROLS.

1. **General ventilation** is used to dilute hot air with cooler air (generally cooler air that is brought in from the outside). This technique clearly works better in cooler climates than in hot ones. A permanently installed ventilation system usually handles large areas or entire buildings. Portable or local exhaust systems may be more effective or practical in smaller areas.
2. **Air treatment/air cooling** differs from ventilation because it reduces the temperature of the air by removing heat (and sometimes humidity) from the air.
3. **Air conditioning** is a method of air cooling, but it is expensive to install and operate. An alternative to air conditioning is the use of chillers to circulate cool water through heat exchangers over which air from the ventilation system is then passed; chillers are more efficient in cooler climates or in dry climates where

evaporative cooling can be used.

4. **Local air cooling** can be effective in reducing air temperature in specific areas. Two methods have been used successfully in industrial settings. One type, cool rooms, can be used to enclose a specific workplace or to offer a recovery area near hot jobs. The second type is a portable blower with built-in air chiller. The main advantage of a blower, aside from portability, is minimal set-up time.
5. Another way to reduce heat stress is to increase the air flow or **convection** using fans, etc. in the work area (as long as the air temperature is less than the worker's skin temperature). Changes in air speed can help workers stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air) and the rate of evaporation. Because this method does not actually cool the air, any increases in air speed must impact the worker directly to be effective.

If the dry bulb temperature is higher than 35°C (95°F), the hot air passing over the skin can actually make the worker hotter. When the temperature is more than 35°C and the air is dry, evaporative cooling may be improved by air movement, although this improvement will be offset by the convective heat. When the temperature exceeds 35°C and the relative humidity is 100%, air movement will make the worker hotter. Increases in air speed have no effect on the body temperature of workers wearing vapor-barrier clothing.

6. **Heat conduction** methods include insulating the hot surface that generates the heat and changing the surface itself.
7. Simple engineering controls, such as shields, can be used to reduce radiant **heat**, i.e. heat coming from hot surfaces within the worker's line of sight. Surfaces that exceed 35°C (95°F) are sources of infrared radiation that can add to the worker's heat load. Flat black surfaces absorb heat more than smooth, polished ones. Having cooler surfaces surrounding the worker assists in cooling because the worker's body radiates heat toward them.

With some sources of radiation, such as heating pipes, it is possible to use both insulation and surface modifications to achieve a substantial reduction in radiant heat. Instead of reducing radiation from the source, shielding can be used to interrupt the path between the source and the worker. Polished surfaces make the best barriers, although special glass or metal mesh surfaces can be used if visibility is a problem.

Shields should be located so that they do not interfere with air flow, unless they are also being used to reduce convective heating. The reflective surface of the shield should be kept clean to maintain its effectiveness.

D. ADMINISTRATIVE CONTROLS AND WORK PRACTICES.

1. Training is the key to good work practices. Unless all employees understand the reasons for using new, or changing old, work practices, the chances of such a program succeeding are greatly reduced.
2. NIOSH (1986) states that a good heat stress training program should include at least the following components:
 - Knowledge of the hazards of heat stress;
 - Recognition of predisposing factors, danger signs, and symptoms;
 - Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
 - Employee responsibilities in avoiding heat stress;
 - Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
 - Use of protective clothing and equipment; and
 - Purpose and coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs.
3. Hot jobs should be scheduled for the cooler part of the day, and routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.

E. WORKER MONITORING PROGRAMS.

1. Every worker who works in extraordinary conditions that increase the risk of heat stress should be personally monitored. These conditions include wearing semipermeable or impermeable clothing when the temperature exceeds 21°C (69.8°F), working at extreme metabolic loads (greater than 500 kcal/hour), etc.
2. Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.
3. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.
4. The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (P_1) with the pulse rate taken at 2.5 minutes (P_3) after the rest break starts. The two pulse rates can be interpreted using Table III:4-4.
5. Oral temperature can be checked with a clinical thermometer after work but before the employee drinks water. If the oral temperature taken under the tongue exceeds 37.6°C, shorten the next work cycle by one third.
6. Body water loss can be measured by weighing the worker on a scale at the beginning and end of each work day.

The worker's weight loss should not exceed 1.5% of total body weight in a work day. If a weight loss exceeding this amount is observed, fluid intake should increase.

F. **OTHER ADMINISTRATIVE CONTROLS.** The following administrative controls can be used to reduce heat stress:

- Reduce the physical demands of work, e.g., excessive lifting or digging with heavy objects;
- Provide recovery areas, e.g., air-conditioned enclosures and rooms;
- Use shifts, e.g., early morning, cool part of the day, or night work;
- Use intermittent rest periods with water breaks;
- Use relief workers;
- Use worker pacing; and
- Assign extra workers and limit worker occupancy, or the number of workers present, especially in confined or enclosed spaces.

TABLE III:4-4. HEART RATE RECOVERY CRITERIA

Heart rate recovery pattern	P ₃	Difference between P ₁ and P ₃
Satisfactory recovery	<90	--
High recovery (Conditions may require further study)	90	10
No recovery (May indicate too much stress)	90	<10

VI. **PERSONAL PROTECTIVE EQUIPMENT.**

A. **REFLECTIVE CLOTHING**, which can vary from aprons and jackets to suits that completely enclose the worker from neck to feet, can stop the skin from absorbing radiant heat. However, since most reflective clothing does not allow air exchange through the garment, the reduction of radiant heat must more than offset the corresponding loss in evaporative cooling. For this reason, reflective clothing should be worn as loosely as possible. In situations where radiant heat is high, auxiliary cooling systems can be used under the reflective clothing.

B. **AUXILIARY BODY COOLING.**

1. Commercially available **ice vests**, though heavy, may accommodate as many as 72 ice packets, which are usually filled with water. Carbon dioxide (dry ice) can also be used as a coolant. The cooling offered by ice packets lasts only 2 to 4 hours at moderate to heavy heat loads, and frequent replacement is necessary. However, ice vests do not encumber the worker and thus permit maximum mobility. Cooling with ice is also relatively inexpensive.
2. **Wetted clothing** is another simple and inexpensive personal cooling technique. It is effective when reflective or other impermeable protective clothing is worn. The clothing may be wetted terry cloth coveralls or wetted two-piece, whole-body cotton suits. This approach to auxiliary cooling can be quite effective under conditions of high temperature and low humidity, where evaporation from the wetted garment is not restricted.
3. **Water-cooled garments** range from a hood, which cools only the head, to vests and "long johns," which offer partial or complete body cooling. Use of this equipment requires a battery-driven circulating pump, liquid-ice coolant, and a container.

Although this system has the advantage of allowing wearer mobility, the weight of the components limits the amount of ice that can be carried and thus reduces the effective use time. The heat transfer rate in liquid cooling systems may limit their use to low-activity jobs; even in such jobs, their service time is only about 20 minutes per pound of cooling ice. To keep outside heat from melting the ice, an outer insulating jacket should be an integral part of these systems.

4. **Circulating air** is the most highly effective, as well as the most complicated, personal cooling system. By directing compressed air around the body from a supplied air system, both evaporative and convective cooling are improved. The greatest advantage occurs when circulating air is used with impermeable garments or double cotton overalls.

One type, used when respiratory protection is also necessary, forces exhaust air from a supplied-air hood ("bubble hood") around the neck and down inside an impermeable suit. The air then escapes through openings in the suit. Air can also be supplied directly to the suit without using a hood in three ways:

- by a single inlet;
- by a distribution tree; or
- by a perforated vest.

In addition, a vortex tube can be used to reduce the temperature of circulating air. The cooled air from this tube can be introduced either under the clothing or into a bubble hood. The use of a vortex tube separates the air stream into a hot and cold stream; these tubes also can be used to supply heat in cold climates. Circulating air, however, is noisy and requires a constant source of compressed air supplied through an attached air hose.

One problem with this system is the limited mobility of workers whose suits are attached to an air hose. Another is that of getting air to the work area itself. These systems should therefore be used in work areas where workers are not required to move around much or to climb. Another concern with these systems is that they can lead to dehydration. The cool, dry air feels comfortable and the worker may not realize that it is important to drink liquids frequently.

- C. **RESPIRATOR USAGE.** The weight of a self-contained breathing apparatus (SCBA) increases stress on a worker, and this stress contributes to overall heat stress. Chemical protective clothing such as totally encapsulating chemical protection suits will also add to the heat stress problem.

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APPENDIX III:4-1. HEAT STRESS: GENERAL WORKPLACE REVIEW.

NOTE: Listed below are sample questions that the Compliance Officer may wish to consider when investigating heat stress in the workplace.

WORKPLACE DESCRIPTION.

- A. Type of business
- B. Heat-producing equipment or processes used
- C. Previous history (if any) of heat-related problems
- D. At "hot" spots:
 - Is the heat steady or intermittent?
 - Number of employees exposed?
 - For how many hours per day?
 - Is potable water available?
 - Are supervisors trained to detect/evaluate heat stress symptoms?

ARE EXPOSURES TYPICAL FOR A WORKPLACE IN THIS INDUSTRY?

- A. Weather at Time of Review
- B. Temperature
- C. Humidity
- D. Air velocity
- E. Is Day Typical of Recent Weather Conditions?
(Get information from the Weather Bureau)
- F. Heat-Reducing Engineering Controls

- G. Ventilation in place?
- H. Ventilation operating?
- I. Air conditioning in place?
- J. Air conditioning operating?
- K. Fans in place?
- L. Fans operating?
- M. Shields or insulation between sources and employees?
- N. Are reflective faces of shields clean?

WORK PRACTICES TO DETECT, EVALUATE, AND PREVENT OR REDUCE HEAT STRESS.

- A. Training program?
- B. Content?
- C. Where given?
- D. For whom?
- E. Liquid replacement program?
- F. Acclimatization program?
- G. Work/rest schedule?
- H. Scheduling of work (during cooler parts of shift, cleaning and maintenance during shut-downs, etc.)
- I. Cool rest areas (including shelter at outdoor work sites)?
- J. Heat monitoring program?
- K. Personal Protective Equipment
- L. Reflective clothing in use?
- M. Ice and/or water-cooled garments in use?
- N. Wetted undergarments (used with reflective or impermeable clothing) in use?
- O. Circulating air systems in use?
- P. First Aid Program
- Q. Trained personnel?
- R. Provision for rapid cool-down?
- S. Procedures for getting medical attention?
- T. Transportation to medical facilities readily available for heat stroke victims?
- U. Medical Screening and Surveillance Program
- V. Content?
- W. Who manages program?
- X. Additional Comments

(Use additional pages as needed.)

APPENDIX III: 4-2. HEAT STRESS-RELATED ILLNESS OR ACCIDENT FOLLOW-UP.

- A. Describe events leading up to the episode.
- B. Evaluation/comments by other workers at the scene.
- C. Work at time of episode (heavy, medium, light)?
- D. How long was affected employee working at site prior to episode?
- E. Medical history of affected worker, if known.
- F. Appropriate engineering controls in place?
- G. Appropriate engineering controls in operation?
- H. Appropriate work practices used by affected employee(s)?
- I. Appropriate personal protective equipment available?
- J. Appropriate personal protective equipment in use?
- K. Medical screening for heat stress and continued surveillance for signs of heat stress given other employees?
- L. Additional comments regarding specific episode(s): (Use additional pages as needed.)

APPENDIX III: 4-3. MEASUREMENT OF WET BULB GLOBE TEMPERATURE.

Measurement is often required of those environmental factors that most nearly correlate with deep body temperature and other physiological responses to heat. At the present time, the Wet Bulb Globe Temperature Index (WBGT) is the most used technique to measure these environmental factors. WBGT values are calculated by the following equations:

Equation III:4-4. Indoor or Outdoor Wet Bulb Globe Temperature Indexes (WBGI) Indoor or outdoors with no solar load

$$WBGT = 0.7NWB + 0.3GT$$

Outdoors with solar load

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

- where:
- WBGT = Wet Bulb Globe Temperature Index
 - NWB = Natural Wet-Bulb Temperature
 - DB = Dry-Bulb (air) Temperature
 - GT = Globe Thermometer Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer. The measurement of environmental factors shall be performed as follows:

1. The range of the dry and the natural wet-bulb thermometers should be -5°C to $+50^{\circ}\text{C}$, with an accuracy of $\pm 0.5^{\circ}\text{C}$. The dry bulb thermometer must be shielded from the sun and the other radiant surfaces of the environment without restricting the airflow around the bulb. The wick of the natural wet bulb thermometer should be kept wet with distilled water for at least one-half hour before the temperature reading is made. It is not enough to immerse the other end of the wick into a reservoir of distilled water and wait until the whole wick becomes wet by capillarity. The wick must be wetted by direct application of water from a syringe one-half hour before each reading. The wick must cover the bulb of the thermometer and an equal length of additional wick must cover the stem above the bulb. The wick should always be clean, and new wicks should be washed before using.
2. A globe thermometer, consisting of a 15 cm (6-inch) in diameter hollow copper sphere painted on the outside with a matte black finish, or equivalent, must be used. The bulb or sensor of a thermometer (range -5°C to $+100^{\circ}\text{C}$ with an accuracy of $\pm 0.5^{\circ}\text{C}$) must be fixed in the center of the sphere. The globe thermometer should be exposed at least 25 minutes before it is read.
3. A stand should be used to suspend the three thermometers so that they do not restrict free air flow around the bulbs and the wet-bulb and globe thermometer are not shaded.
4. It is permissible to use any other type of temperature sensor that gives a reading similar to that of a mercury thermometer under the same conditions.
5. The thermometers must be placed so that the readings are representative of the employee's work or rest areas, as appropriate.

Once the WBGT has been estimated, employers can estimate workers' metabolic heat load (see Tables III:4-1 and III:4-2) and use the ACGIH method to determine the appropriate work/rest regimen, clothing, and equipment to use to control the heat exposures of workers in their facilities.

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HEAT STRESS

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I. INTRODUCTION.

Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress in employees engaged in such operations. Such places include: iron and steel foundries, nonferrous foundries, brick-firing and ceramic plants, glass products facilities, rubber products factories, electrical utilities (particularly boiler rooms), bakeries, confectioneries, commercial kitchens, laundries, food canneries, chemical plants, mining sites, smelters, and steam tunnels.

Outdoor operations conducted in hot weather, such as construction, refining, asbestos removal, and hazardous waste site activities, especially those that require workers to wear semipermeable or impermeable protective clothing, are also likely to cause heat stress among exposed workers.

A. CAUSAL FACTORS.

1. Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. However, even the type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.
2. It is difficult to predict just who will be affected and when, because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

B. DEFINITIONS.

1. The American Conference of Governmental Industrial Hygienists (1992) states that workers should not be permitted to work when their deep body temperature exceeds 38°C (100.4°F).
2. **Heat** is a measure of energy in terms of quantity.

3. A **calorie** is the amount of heat required to raise 1 gram of water 1°C (based on a standard temperature of 16.5 to 17.5°C).
4. **Conduction** is the transfer of heat between materials that contact each other. Heat passes from the warmer material to the cooler material. For example, a worker's skin can transfer heat to a contacting surface if that surface is cooler, and vice versa.
5. **Convection** is the transfer of heat in a moving fluid. Air flowing past the body can cool the body if the air temperature is cool. On the other hand, air that exceeds 35°C (95°F) can increase the heat load on the body.
6. **Evaporative cooling** takes place when sweat evaporates from the skin. High humidity reduces the rate of evaporation and thus reduces the effectiveness of the body's primary cooling mechanism.
7. **Radiation** is the transfer of heat energy through space. A worker whose body temperature is greater than the temperature of the surrounding surfaces radiates heat to these surfaces. Hot surfaces and infrared light sources radiate heat that can increase the body's heat load.
8. **Globe temperature** is the temperature inside a blackened, hollow, thin copper globe.
9. **Metabolic heat** is a by-product of the body's activity.
10. **Natural wet bulb (NWB) temperature** is measured by exposing a wet sensor, such as a wet cotton wick fitted over the bulb of a thermometer, to the effects of evaporation and convection. The term natural refers to the movement of air around the sensor.
11. **Dry bulb (DB) temperature** is measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources.

II. HEAT DISORDERS AND HEALTH EFFECTS.

- A. **HEAT STROKE** occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of work load and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protests, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

- B. **HEAT EXHAUSTION.** The signs and symptoms of heat exhaustion are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment and given fluid replacement. They should also be encouraged to get adequate rest.

- C. **HEAT CRAMPS** are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused by both too much and too little salt. Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution ($\pm 0.3\%$ NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Recent studies have shown that drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

- D. **HEAT COLLAPSE** ("Fainting"). In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable. To prevent heat collapse, the worker should gradually become acclimatized to the hot environment.

- E. **HEAT RASHES** are the most common problem in hot work environments. Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.
- F. **HEAT FATIGUE.** A factor that predisposes an individual to heat fatigue is lack of acclimatization. The use of a program of acclimatization and training for work in hot environments is advisable. The signs and symptoms of heat fatigue include impaired performance of skilled sensorimotor, mental, or vigilance jobs. There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

III. INVESTIGATION GUIDELINES.

These guidelines for evaluating employee heat stress approximate those found in the 1992-1993 ACGIH publication, *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

A. EMPLOYER AND EMPLOYEE INTERVIEWS.

- 1. The inspector will review the OSHA 200 Log and, if possible, the OSHA 101 forms for indications of prior heat stress problems.
- 2. Following are some questions for employer interviews: What type of action, if any, has the employer taken to prevent heat stress problems? What are the potential sources of heat? What employee complaints have been made?
- 3. Following are some questions for employee interviews: What heat stress problems have been experienced? What type of action has the employee taken to minimize heat stress? What is the employer's involvement, i.e., does employee training include information on heat stress? (Appendix III:4-1 lists factors to be evaluated when reviewing a heat stress situation, and Appendix III:4-2 contains a follow-up checklist.)

B. WALKAROUND INSPECTION. During the walkaround inspection, the investigator will: determine building and operation characteristics; determine whether engineering controls are functioning properly; verify information obtained from the employer and employee interviews; and perform temperature measurements and make other determinations to identify potential sources of heat stress. Investigators may wish to discuss any operations that have the potential to cause heat stress with engineers and other knowledgeable personnel. The walkaround inspection should cover all affected areas. Heat sources, such as furnaces, ovens, and boilers, and relative heat load per employee should be noted.

C. WORK-LOAD ASSESSMENT.

- 1. Under conditions of high temperature and heavy workload, the CSHO should determine the work-load category of each job (Table III:4-1 and Figure III:4-1). Work-load category is determined by averaging metabolic rates for the tasks and then ranking them:
 - 1. Light work: up to 200 kcal/hour
 - 2. Medium work: 200-350 kcal/hour
 - 3. Heavy work: 350-500 kcal/hour
- 2. *Cool Rest Area:* Where heat conditions in the rest area are different from those in the work area, the metabolic rate (M) should be calculated using a time-weighted average, as follows:

Equation III: 4-1. Average Metabolic Rate

$$Average_M = \frac{(M_1)(t_1) + (M_2)(t_2) + \dots + (M_n)(t_n)}{(t_1) + (t_2) + \dots + (t_n)}$$

where: M = metabolic rate

t = time in minutes

In some cases, a videotape is helpful in evaluating work practices and metabolic load.

FIGURE III:4-1. ACTIVITY EXAMPLES

- Light hand work: writing, hand knitting
- Heavy hand work: typewriting
- Heavy work with one arm: hammering in nails (shoemaker, upholsterer)
- Light work with two arms: filing metal, planing wood, raking the garden
- Moderate work with the body: cleaning a floor, beating a carpet
- Heavy work with the body: railroad track laying, digging, barking trees

Sample Calculation: Assembly line work using a heavy hand tool

Walking along	2.0 kcal/min
Intermediate value between heavy work with two arms and light work with the body	3.0 kcal/min
Add for basal metabolism	1.0 kcal/min
Total:	6.0 kcal/min

Source: ACGIH 1992.

TABLE III:4-1. ASSESSMENT OF WORK

<i>Body position and movement</i>		<i>kcal/min*</i>	
Sitting		0.3	
Standing		0.6	
Walking		2.0-3.0	
Walking uphill		add 0.8 for every meter (yard) rise	
Type of work	Average kcal/min	Range kcal/min	
Hand work			
Light	0.4	0.2-1.2	
Heavy	0.9		
Work: One arm			
Light	1.0	0.7-2.5	
Heavy	1.7		
Work: Both arms			
Light	1.5	1.0-3.5	
Heavy	2.5		
Work: Whole body			
Light	3.5	2.5-15.0	
Moderate	5.0		
Heavy	7.0		
Very heavy	9.0		
* For a "standard" worker of 70 kg body weight (154 lbs) and 1.8m ² body surface (19.4 ft ²).			

Source: ACGIH 1992.

IV. SAMPLING METHODS.

- A. **BODY TEMPERATURE MEASUREMENTS.** Although instruments are available to estimate deep body temperature by measuring the temperature in the ear canal or on the skin, these instruments are not sufficiently reliable to use in compliance evaluations.
- B. **ENVIRONMENTAL MEASUREMENTS.** Environmental heat measurements should be made at, or as close as possible to, the specific work area where the worker is exposed. When a worker is not continuously exposed in a single hot area but moves between two or more areas having different levels of environmental heat, or when the environmental heat varies substantially at a single hot area, environmental heat exposures should be measured for each area and for each level of environmental heat to which employees are exposed.
- C. **WET BULB GLOBE TEMPERATURE INDEX.**

- 1. Wet Bulb Globe Temperature (WBGT) should be calculated using the appropriate formula in [Appendix III:4-2](#). The

WBGT for continuous all-day or several hour exposures should be averaged over a 60-minute period. Intermittent exposures should be averaged over a 120-minute period. These averages should be calculated using the following formula:

Equation III:4-2. Average Web Bulb Globe Temperature (WBGT)

$$Average_{WBGT} = \frac{(WBGT_1)(t_1) + (WBGT_2)(t_2) + \dots + (WBGT_n)(t_n)}{(t_1) + (t_2) + \dots + (t_n)}$$

For indoor and outdoor conditions with no solar load, WBGT is calculated as:

$$WBGT = 0.7NWB + 0.3GT$$

For outdoors with a solar load, WBGT is calculated as

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

- where:
- WBGT = Wet Bulb Globe Temperature Index
 - NWB = Nature Wet-Bulb Temperature
 - DB = Dry-Bulb Temperature
 - GT = Globe Temperature

2. The exposure limits in Table III:4-2 are valid for employees wearing light clothing. They must be adjusted for the insulation from clothing that impedes sweat evaporation and other body cooling mechanisms. Use Table III:4-3 to correct Table III:4-2 for various kinds of clothing.
 3. Use of Table III:4-2 requires knowledge of the WBGT and approximate workload. Workload can be estimated using the data in Table III:4-1, and sample calculations are presented in Figure III:4-1.
- D. **MEASUREMENT.** Portable heat stress meters or monitors are used to measure heat conditions. These instruments can calculate both the indoor and outdoor WBGT index according to established ACGIH Threshold Limit Value equations. With this information and information on the type of work being performed, heat stress meters can determine how long a person can safely work or remain in a particular hot environment. See Appendix III:4-2 for an alternate method of calculation.

TABLE III:4-2. PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUE

Work/rest regimen	----- Work Load* -----		
	Light	Moderate	Heavy
Continuous work	30.0°C (86°F)	26.7°C (80°F)	25.0°C (77°F)
75% Work, 25% rest, each hour	30.6°C (87°F)	28.0°C (82°F)	25.9°C (78°F)
50% Work, 50% rest, each hour	31.4°C (89°F)	29.4°C (85°F)	27.9°C (82°F)
25% Work, 75% rest, each hour	32.2°C (90°F)	31.1°C (88°F)	30.0°C (86°F)

*Values are in °C and °F, WBGT.

These TLV's are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38°C (100.4° F). They are also based on the assumption that the WBGT of the resting place is the same or very close to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time-weighted average should be used (consult the ACGIH *1992-1993 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (1992).

These TLV's apply to physically fit and acclimatized individuals wearing light summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLV's in Table III:4-2 must be reduced by the corrections shown in Table III:4-3.

Source: ACGIH 1992.

E. OTHER THERMAL STRESS INDICES.

1. The Effective Temperature index (ET) combines the temperature, the humidity of the air, and air velocity. This index has been used extensively in the field of comfort ventilation and air-conditioning. ET remains a useful measurement technique in mines and other places where humidity is high and radiant heat is low.
2. The Heat-Stress Index (HSI) was developed by Belding and Hatch in 1965. Although the HSI considers all environmental factors and work rate, it is not completely satisfactory for determining an individual worker's heat stress and is also difficult to use.

TABLE III:4-3. WBGT CORRECTION FACTORS IN °C

Clothing type	Clo* value	WBGT correction
Summer lightweight working clothing	0.6	0
Cotton coveralls	1.0	-2
Winter work clothing	1.4	-4
Water barrier, permeable	1.2	-6

*Clo: Insulation value of clothing. One clo = 5.55 kcal/m²/hr of heat exchange by radiation and convection for each degree °C difference in temperature between the skin and the adjusted dry bulb temperature.

Note: Deleted from the previous version are trade names and "fully encapsulating suit, gloves, boots and hood" including its clo value of 1.2 and WBGT correction of -10.

Source: ACGIH 1992.

V. CONTROL.

Ventilation, air cooling, fans, shielding, and insulation are the five major types of engineering controls used to reduce heat stress in hot work environments. Heat reduction can also be achieved by using power assists and tools that reduce the physical demands placed on a worker.

However, for this approach to be successful, the metabolic effort required for the worker to use or operate these devices must be less than the effort required without them. Another method is to reduce the effort necessary to operate power assists. The worker should be allowed to take frequent rest breaks in a cooler environment.

A. ACCLIMATIZATION.

1. The human body can adapt to heat exposure to some extent. This physiological adaptation is called acclimatization. After a period of acclimatization, the same activity will produce fewer cardiovascular demands. The worker will sweat more efficiently (causing better evaporative cooling), and thus will more easily be able to maintain normal body temperatures.
2. A properly designed and applied acclimatization program decreases the risk of heat-related illnesses. Such a program basically involves exposing employees to work in a hot environment for progressively longer periods. NIOSH (1986) says that, for workers who have had previous experience in jobs where heat levels are high enough to produce heat stress, the regimen should be 50% exposure on day one, 60% on day two, 80% on day three, and 100% on day four. For new workers who will be similarly exposed, the regimen should be 20% on day one, with a 20% increase in exposure each additional day.

B. FLUID REPLACEMENT. Cool (50°-60°F) water or any cool liquid (except alcoholic beverages) should be made available to workers to encourage them to drink small amounts frequently, e.g., one cup every 20 minutes. Ample supplies of liquids should be placed close to the work area. Although some commercial replacement drinks contain salt, this is not necessary for acclimatized individuals because most people add enough salt to their summer diets.

C. ENGINEERING CONTROLS.

1. **General ventilation** is used to dilute hot air with cooler air (generally cooler air that is brought in from the outside). This technique clearly works better in cooler climates than in hot ones. A permanently installed ventilation system usually handles large areas or entire buildings. Portable or local exhaust systems may be more effective or practical in smaller areas.
2. **Air treatment/air cooling** differs from ventilation because it reduces the temperature of the air by removing heat (and sometimes humidity) from the air.
3. **Air conditioning** is a method of air cooling, but it is expensive to install and operate. An alternative to air conditioning is the use of chillers to circulate cool water through heat exchangers over which air from the ventilation system is then passed; chillers are more efficient in cooler climates or in dry climates where

evaporative cooling can be used.

4. **Local air cooling** can be effective in reducing air temperature in specific areas. Two methods have been used successfully in industrial settings. One type, cool rooms, can be used to enclose a specific workplace or to offer a recovery area near hot jobs. The second type is a portable blower with built-in air chiller. The main advantage of a blower, aside from portability, is minimal set-up time.
5. Another way to reduce heat stress is to increase the air flow or **convection** using fans, etc. in the work area (as long as the air temperature is less than the worker's skin temperature). Changes in air speed can help workers stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air) and the rate of evaporation. Because this method does not actually cool the air, any increases in air speed must impact the worker directly to be effective.

If the dry bulb temperature is higher than 35°C (95°F), the hot air passing over the skin can actually make the worker hotter. When the temperature is more than 35°C and the air is dry, evaporative cooling may be improved by air movement, although this improvement will be offset by the convective heat. When the temperature exceeds 35°C and the relative humidity is 100%, air movement will make the worker hotter. Increases in air speed have no effect on the body temperature of workers wearing vapor-barrier clothing.

6. **Heat conduction** methods include insulating the hot surface that generates the heat and changing the surface itself.
7. Simple engineering controls, such as shields, can be used to reduce radiant **heat**, i.e. heat coming from hot surfaces within the worker's line of sight. Surfaces that exceed 35°C (95°F) are sources of infrared radiation that can add to the worker's heat load. Flat black surfaces absorb heat more than smooth, polished ones. Having cooler surfaces surrounding the worker assists in cooling because the worker's body radiates heat toward them.

With some sources of radiation, such as heating pipes, it is possible to use both insulation and surface modifications to achieve a substantial reduction in radiant heat. Instead of reducing radiation from the source, shielding can be used to interrupt the path between the source and the worker. Polished surfaces make the best barriers, although special glass or metal mesh surfaces can be used if visibility is a problem.

Shields should be located so that they do not interfere with air flow, unless they are also being used to reduce convective heating. The reflective surface of the shield should be kept clean to maintain its effectiveness.

D. ADMINISTRATIVE CONTROLS AND WORK PRACTICES.

1. Training is the key to good work practices. Unless all employees understand the reasons for using new, or changing old, work practices, the chances of such a program succeeding are greatly reduced.
2. NIOSH (1986) states that a good heat stress training program should include at least the following components:
 - Knowledge of the hazards of heat stress;
 - Recognition of predisposing factors, danger signs, and symptoms;
 - Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
 - Employee responsibilities in avoiding heat stress;
 - Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
 - Use of protective clothing and equipment; and
 - Purpose and coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs.
3. Hot jobs should be scheduled for the cooler part of the day, and routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.

E. WORKER MONITORING PROGRAMS.

1. Every worker who works in extraordinary conditions that increase the risk of heat stress should be personally monitored. These conditions include wearing semipermeable or impermeable clothing when the temperature exceeds 21°C (69.8°F), working at extreme metabolic loads (greater than 500 kcal/hour), etc.
2. Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.
3. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.
4. The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (P_1) with the pulse rate taken at 2.5 minutes (P_2) after the rest break starts. The two pulse rates can be interpreted using Table III:4-4.
5. Oral temperature can be checked with a clinical thermometer after work but before the employee drinks water. If the oral temperature taken under the tongue exceeds 37.6°C, shorten the next work cycle by one third.
6. Body water loss can be measured by weighing the worker on a scale at the beginning and end of each work day.

The worker's weight loss should not exceed 1.5% of total body weight in a work day. If a weight loss exceeding this amount is observed, fluid intake should increase.

F. **OTHER ADMINISTRATIVE CONTROLS.** The following administrative controls can be used to reduce heat stress:

- Reduce the physical demands of work, e.g., excessive lifting or digging with heavy objects;
- Provide recovery areas, e.g., air-conditioned enclosures and rooms;
- Use shifts, e.g., early morning, cool part of the day, or night work;
- Use intermittent rest periods with water breaks;
- Use relief workers;
- Use worker pacing; and
- Assign extra workers and limit worker occupancy, or the number of workers present, especially in confined or enclosed spaces.

TABLE III:4-4. HEART RATE RECOVERY CRITERIA

Heart rate recovery pattern	P ₃	Difference between P ₁ and P ₃
Satisfactory recovery	<90	--
High recovery (Conditions may require further study)	90	10
No recovery (May indicate too much stress)	90	<10

VI. **PERSONAL PROTECTIVE EQUIPMENT.**

A. **REFLECTIVE CLOTHING**, which can vary from aprons and jackets to suits that completely enclose the worker from neck to feet, can stop the skin from absorbing radiant heat. However, since most reflective clothing does not allow air exchange through the garment, the reduction of radiant heat must more than offset the corresponding loss in evaporative cooling. For this reason, reflective clothing should be worn as loosely as possible. In situations where radiant heat is high, auxiliary cooling systems can be used under the reflective clothing.

B. **AUXILIARY BODY COOLING.**

1. Commercially available **ice vests**, though heavy, may accommodate as many as 72 ice packets, which are usually filled with water. Carbon dioxide (dry ice) can also be used as a coolant. The cooling offered by ice packets lasts only 2 to 4 hours at moderate to heavy heat loads, and frequent replacement is necessary. However, ice vests do not encumber the worker and thus permit maximum mobility. Cooling with ice is also relatively inexpensive.
2. **Wetted clothing** is another simple and inexpensive personal cooling technique. It is effective when reflective or other impermeable protective clothing is worn. The clothing may be wetted terry cloth coveralls or wetted two-piece, whole-body cotton suits. This approach to auxiliary cooling can be quite effective under conditions of high temperature and low humidity, where evaporation from the wetted garment is not restricted.
3. **Water-cooled garments** range from a hood, which cools only the head, to vests and "long johns," which offer partial or complete body cooling. Use of this equipment requires a battery-driven circulating pump, liquid-ice coolant, and a container.

Although this system has the advantage of allowing wearer mobility, the weight of the components limits the amount of ice that can be carried and thus reduces the effective use time. The heat transfer rate in liquid cooling systems may limit their use to low-activity jobs; even in such jobs, their service time is only about 20 minutes per pound of cooling ice. To keep outside heat from melting the ice, an outer insulating jacket should be an integral part of these systems.

4. **Circulating air** is the most highly effective, as well as the most complicated, personal cooling system. By directing compressed air around the body from a supplied air system, both evaporative and convective cooling are improved. The greatest advantage occurs when circulating air is used with impermeable garments or double cotton overalls.

One type, used when respiratory protection is also necessary, forces exhaust air from a supplied-air hood ("bubble hood") around the neck and down inside an impermeable suit. The air then escapes through openings in the suit. Air can also be supplied directly to the suit without using a hood in three ways:

- by a single inlet;
- by a distribution tree; or
- by a perforated vest.

In addition, a vortex tube can be used to reduce the temperature of circulating air. The cooled air from this tube can be introduced either under the clothing or into a bubble hood. The use of a vortex tube separates the air stream into a hot and cold stream; these tubes also can be used to supply heat in cold climates. Circulating air, however, is noisy and requires a constant source of compressed air supplied through an attached air hose.

One problem with this system is the limited mobility of workers whose suits are attached to an air hose. Another is that of getting air to the work area itself. These systems should therefore be used in work areas where workers are not required to move around much or to climb. Another concern with these systems is that they can lead to dehydration. The cool, dry air feels comfortable and the worker may not realize that it is important to drink liquids frequently.

- C. **RESPIRATOR USAGE.** The weight of a self-contained breathing apparatus (SCBA) increases stress on a worker, and this stress contributes to overall heat stress. Chemical protective clothing such as totally encapsulating chemical protection suits will also add to the heat stress problem.

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APPENDIX III:4-1. HEAT STRESS: GENERAL WORKPLACE REVIEW.

NOTE: Listed below are sample questions that the Compliance Officer may wish to consider when investigating heat stress in the workplace.

WORKPLACE DESCRIPTION.

- A. Type of business
- B. Heat-producing equipment or processes used
- C. Previous history (if any) of heat-related problems
- D. At "hot" spots:
 - Is the heat steady or intermittent?
 - Number of employees exposed?
 - For how many hours per day?
 - Is potable water available?
 - Are supervisors trained to detect/evaluate heat stress symptoms?

ARE EXPOSURES TYPICAL FOR A WORKPLACE IN THIS INDUSTRY?

- A. Weather at Time of Review
- B. Temperature
- C. Humidity
- D. Air velocity
- E. Is Day Typical of Recent Weather Conditions?
(Get information from the Weather Bureau)
- F. Heat-Reducing Engineering Controls

- G. Ventilation in place?
- H. Ventilation operating?
- I. Air conditioning in place?
- J. Air conditioning operating?
- K. Fans in place?
- L. Fans operating?
- M. Shields or insulation between sources and employees?
- N. Are reflective faces of shields clean?

WORK PRACTICES TO DETECT, EVALUATE, AND PREVENT OR REDUCE HEAT STRESS.

- A. Training program?
- B. Content?
- C. Where given?
- D. For whom?
- E. Liquid replacement program?
- F. Acclimatization program?
- G. Work/rest schedule?
- H. Scheduling of work (during cooler parts of shift, cleaning and maintenance during shut-downs, etc.)
- I. Cool rest areas (including shelter at outdoor work sites)?
- J. Heat monitoring program?
- K. Personal Protective Equipment
- L. Reflective clothing in use?
- M. Ice and/or water-cooled garments in use?
- N. Wetted undergarments (used with reflective or impermeable clothing) in use?
- O. Circulating air systems in use?
- P. First Aid Program
- Q. Trained personnel?
- R. Provision for rapid cool-down?
- S. Procedures for getting medical attention?
- T. Transportation to medical facilities readily available for heat stroke victims?
- U. Medical Screening and Surveillance Program
- V. Content?
- W. Who manages program?
- X. Additional Comments

(Use additional pages as needed.)

APPENDIX III: 4-2. HEAT STRESS-RELATED ILLNESS OR ACCIDENT FOLLOW-UP.

- A. Describe events leading up to the episode.
- B. Evaluation/comments by other workers at the scene.
- C. Work at time of episode (heavy, medium, light)?
- D. How long was affected employee working at site prior to episode?
- E. Medical history of affected worker, if known.
- F. Appropriate engineering controls in place?
- G. Appropriate engineering controls in operation?
- H. Appropriate work practices used by affected employee(s)?
- I. Appropriate personal protective equipment available?
- J. Appropriate personal protective equipment in use?
- K. Medical screening for heat stress and continued surveillance for signs of heat stress given other employees?
- L. Additional comments regarding specific episode(s): (Use additional pages as needed.)

APPENDIX III: 4-3. MEASUREMENT OF WET BULB GLOBE TEMPERATURE.

Measurement is often required of those environmental factors that most nearly correlate with deep body temperature and other physiological responses to heat. At the present time, the Wet Bulb Globe Temperature Index (WBGT) is the most used technique to measure these environmental factors. WBGT values are calculated by the following equations:

Equation III:4-4. Indoor or Outdoor Wet Bulb Globe Temperature Indexes (WBGI) Indoor or outdoors with no solar load

$$WBGT = 0.7NWB + 0.3GT$$

Outdoors with solar load

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
 NWB = Natural Wet-Bulb Temperature
 DB = Dry-Bulb (air) Temperature
 GT = Globe Thermometer Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer. The measurement of environmental factors shall be performed as follows:

1. The range of the dry and the natural wet-bulb thermometers should be -5°C to $+50^{\circ}\text{C}$, with an accuracy of $\pm 0.5^{\circ}\text{C}$. The dry bulb thermometer must be shielded from the sun and the other radiant surfaces of the environment without restricting the airflow around the bulb. The wick of the natural wet bulb thermometer should be kept wet with distilled water for at least one-half hour before the temperature reading is made. It is not enough to immerse the other end of the wick into a reservoir of distilled water and wait until the whole wick becomes wet by capillarity. The wick must be wetted by direct application of water from a syringe one-half hour before each reading. The wick must cover the bulb of the thermometer and an equal length of additional wick must cover the stem above the bulb. The wick should always be clean, and new wicks should be washed before using.
2. A globe thermometer, consisting of a 15 cm (6-inch) in diameter hollow copper sphere painted on the outside with a matte black finish, or equivalent, must be used. The bulb or sensor of a thermometer (range -5°C to $+100^{\circ}\text{C}$ with an accuracy of $\pm 0.5^{\circ}\text{C}$) must be fixed in the center of the sphere. The globe thermometer should be exposed at least 25 minutes before it is read.
3. A stand should be used to suspend the three thermometers so that they do not restrict free air flow around the bulbs and the wet-bulb and globe thermometer are not shaded.
4. It is permissible to use any other type of temperature sensor that gives a reading similar to that of a mercury thermometer under the same conditions.
5. The thermometers must be placed so that the readings are representative of the employee's work or rest areas, as appropriate.

Once the WBGT has been estimated, employers can estimate workers' metabolic heat load (see Tables III:4-1 and III:4-2) and use the ACGIH method to determine the appropriate work/rest regimen, clothing, and equipment to use to control the heat exposures of workers in their facilities.

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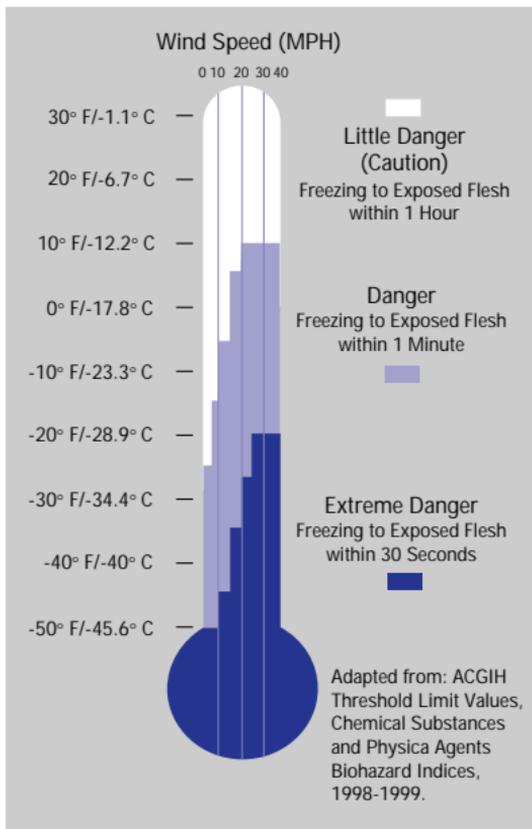
Cold Stress Guidelines

THE COLD STRESS EQUATION

LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS

When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result.

Hypothermia can occur when *land temperatures* are **above** freezing or *water temperatures* are below 98.6°F/37°C. Cold-related illnesses can slowly overcome a person who has been chilled by low temperatures, brisk winds, or wet clothing.



FROST BITE

What Happens to the Body:

FREEZING IN DEEP LAYERS OF SKIN AND TISSUE; PALE, WAXY-WHITE SKIN COLOR; SKIN BECOMES HARD and NUMB; USUALLY AFFECTS THE FINGERS, HANDS, TOES, FEET, EARS, and NOSE.

What Should Be Done: (land temperatures)

- Move the person to a warm dry area. Don't leave the person alone.
- Remove any wet or tight clothing that may cut off blood flow to the affected area.
- **DO NOT** rub the affected area, because rubbing causes damage to the skin and tissue.
- **Gently** place the affected area in a warm (105°F) water bath and monitor the water temperature to **slowly** warm the tissue. Don't pour warm water directly on the affected area because it will warm the tissue too fast causing tissue damage. Warming takes about 25-40 minutes.
- After the affected area has been warmed, it may become puffy and blister. The affected area may have a burning feeling or numbness. When normal feeling, movement, and skin color have returned, the affected area should be dried and wrapped to keep it warm. **NOTE:** If there is a chance the affected area may get cold again, do not warm the skin. If the skin is warmed and then becomes cold again, it will cause severe tissue damage.
- Seek medical attention as soon as possible.

HYPOTHERMIA - (Medical Emergency)

What Happens to the Body:

NORMAL BODY TEMPERATURE (98.6°F/37°C) DROPS TO OR BELOW 95°F (35°C); FATIGUE OR DROWSINESS; UNCONTROLLED SHIVERING; COOL BLUISH SKIN; SLURRED SPEECH; CLUMSY MOVEMENTS; IRRITABLE, IRRATIONAL OR CONFUSED BEHAVIOR.

What Should Be Done: (land temperatures)

- Call for emergency help (i.e., Ambulance or Call 911).
- Move the person to a warm, dry area. Don't leave the person alone. Remove any wet clothing and replace with warm, dry clothing or wrap the person in blankets.
- Have the person drink warm, sweet drinks (sugar water or sports-type drinks) if they are alert. **Avoid drinks with caffeine** (coffee, tea, or hot chocolate) or alcohol.
- Have the person move their arms and legs to create muscle heat. If they are unable to do this, place warm bottles or hot packs in the arm pits, groin, neck, and head areas. **DO NOT** rub the person's body or place them in warm water bath. This may stop their heart.

What Should Be Done: (water temperatures)

- Call for emergency help (Ambulance or Call 911). Body heat is lost up to 25 times faster in water.
- **DO NOT** remove any clothing. Button, buckle, zip, and tighten any collars, cuffs, shoes, and hoods because the layer of trapped water closest to the body provides a layer of insulation that slows the loss of heat. Keep the head out of the water and put on a hat or hood.
- Get out of the water as quickly as possible or climb on anything floating. **DO NOT** attempt to swim unless a floating object or another person can be reached because swimming or other physical activity uses the body's heat and reduces survival time by about 50 percent.
- If getting out of the water is not possible, wait quietly and conserve body heat by folding arms across the chest, keeping thighs together, bending knees, and crossing ankles. If another person is in the water, huddle together with chests held closely.

How to Protect Workers

- Recognize the environmental and workplace conditions that lead to potential cold-induced illnesses and injuries.
- Learn the signs and symptoms of cold-induced illnesses/injuries and what to do to help the worker.
- Train the workforce about cold-induced illnesses and injuries.
- Select proper clothing for cold, wet, and windy conditions. Layer clothing to adjust to changing environmental temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin (polypropylene).
- Take frequent short breaks in warm dry shelters to allow the body to warm up.
- Perform work during the warmest part of the day.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Use the buddy system (work in pairs).
- Drink warm, sweet beverages (sugar water, sports-type drinks). Avoid drinks with caffeine (coffee, tea, or hot chocolate) or alcohol.
- Eat warm, high-calorie foods like hot pasta dishes.

Workers Are at Increased Risk When...

- They have predisposing health conditions such as cardiovascular disease, diabetes, and hypertension.
- They take certain medication (check with your doctor, nurse, or pharmacy and ask if any medicines you are taking affect you while working in cold environments).
- They are in poor physical condition, have a poor diet, or are older.

Excavation Check List and Procedures

Daily Excavation Safety Checklist

Company		Date	
Project Name		Approx. Temp.	
Project Location		Approx. Wind Dir.	
Job Number		Safety Rep	
Excavation Depth & Width		Soil Classification	
Protective System Used			
Activities In Excavation			
Competent Person			

Excavation > 4 feet deep? ___ Yes ___ No If YES, fill out a Confined Space Permit **PRIOR** to ANY person entering the excavation.

NOTE: Trenches over 4 feet in depth are considered excavations. Any items marked **NO** on this form **MUST** be remediated prior to any employees entering the excavation.

YES	NO	N/A	DESCRIPTION
GENERAL			
			Employees protected from cave-ins & loose rock/soil that could roll into the excavation
			Spoils, materials & equipment set back at least 2 feet from the edge of the excavation.
			Engineering designs for sheeting &/or manufacturer's data on trench box capabilities on site
			Adequate signs posted and barricades provided
			Training (toolbox meeting) conducted w/ employees prior to entering excavation

YES	NO	N/A	DESCRIPTION
UTILITIES			
			Utility company contacted & given 24 hours notice &/or utilities already located & marked
			Overhead lines located, noted and reviewed with the operator
			Utility locations reviewed with the operator, & precautions taken to ensure contact does not occur
			Utilities crossing the excavation supported, and protected from falling materials
			Underground installations protected, supported or removed when excavation is open
WET CONDITIONS			
			Precautions taken to protect employees from water accumulation (continuous dewatering)
			Surface water or runoff diverted /controlled to prevent accumulation in the excavation
			Inspection made after every rainstorm or other hazard increasing occurrence
HAZARDOUS ATMOSPHERES			
			Air in the excavation tested for oxygen deficiency, combustibles, other contaminants
			Ventilation used in atmospheres that are oxygen rich/deficient &/or contains hazardous substances
			Ventilation provided to keep LEL below 10 %
			Emergency equipment available where hazardous atmospheres could or do exist
			Safety harness and lifeline used
			Supplied air necessary (if yes, contact safety department)

YES	NO	N/A	DESCRIPTION
ENTRY & EXIT			
			Exit (i.e. ladder, sloped wall) no further than 25 feet from ANY employee
			Ladders secured and extend 3 feet above the edge of the trench
			Wood ramps constructed of uniform material thickness, cleated together @ the bottom
			Employees protected from cave-ins when entering or exiting the excavation

Keep 1 copy of each daily excavation checklist on site for the project duration, and forward the original to the safety director

Example Decontamination Station Layout

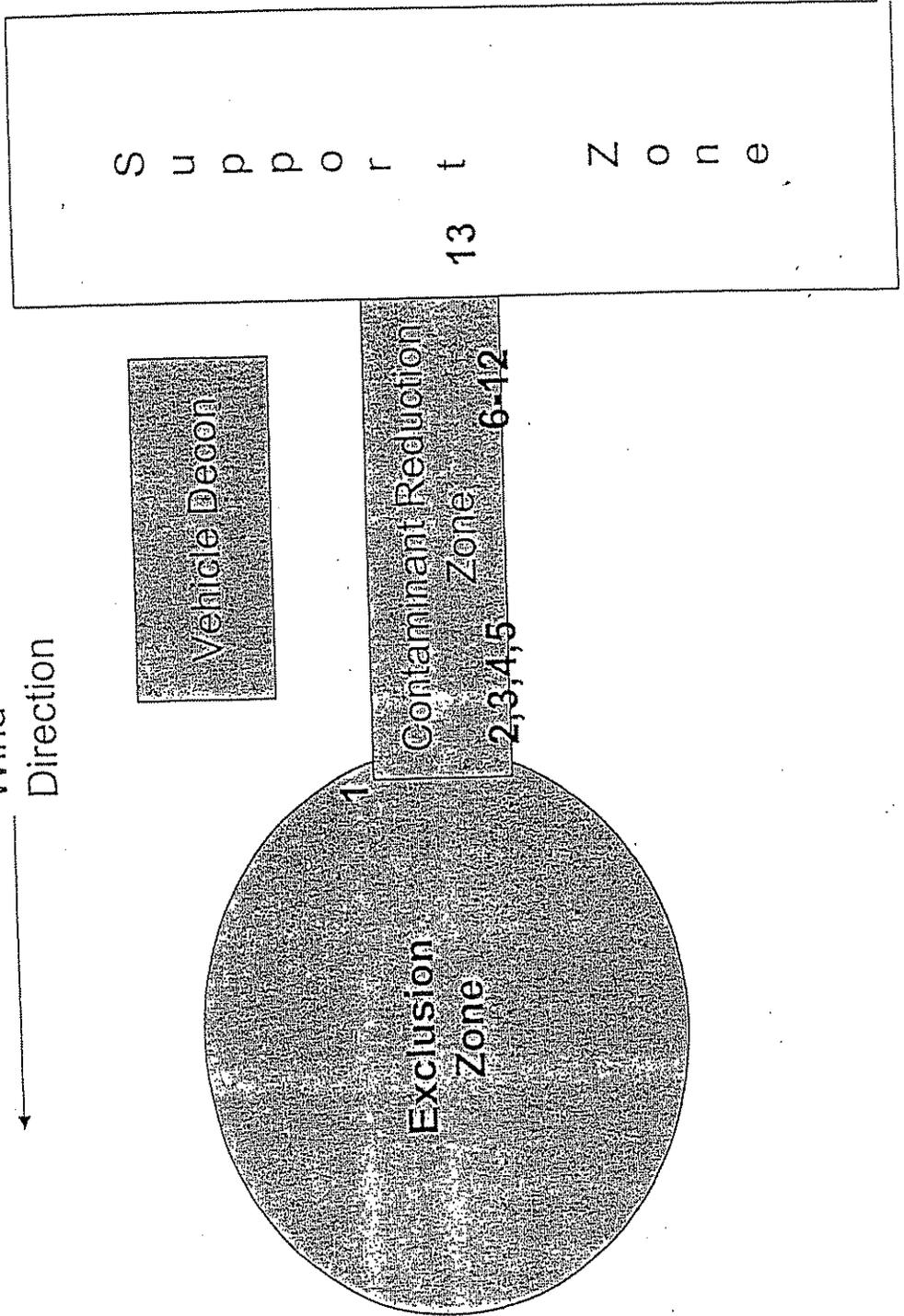
TABLE I

PERSONNEL DECONTAMINATION PLAN

Step 1	Segregated Equipment Drop
Step 2	Cover Boot and Glove Wash
Step 3	Cover Boot and Glove Rinse
Step 4	Cover Boot Removal
Step 5	Cover Glove Removal
	- - - - - HOTLINE - - - - -
Step 6	Suit and Boot Wash - Disposable
Step 7	Suit and Boot Rinse - Disposable
Step 8	Suit Removal
Step 9	Boot Removal
Step 10	Respirator Removal
Step 11	Inner Glove Wash and Rinse
Step 12	Inner Clothing Removal
Step 13	Re-Dress

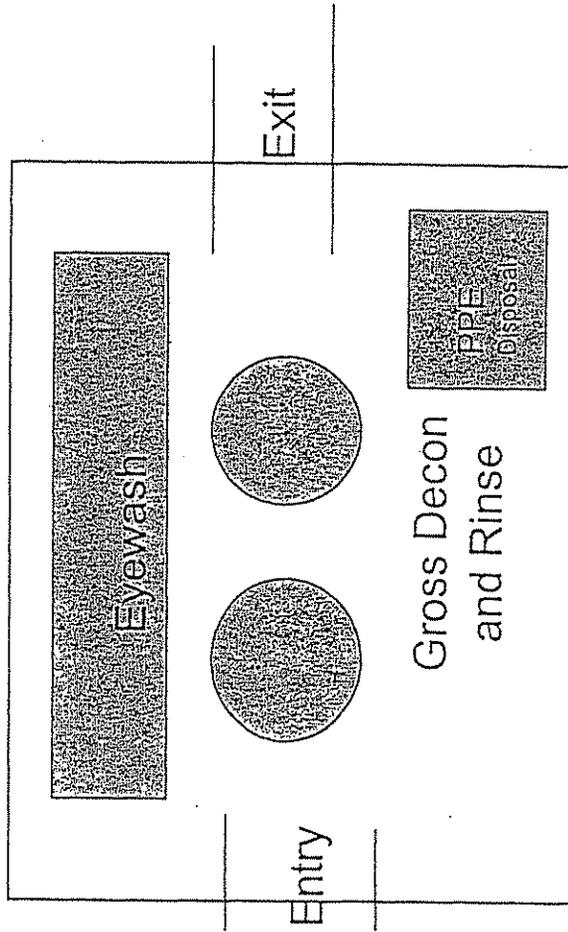
Decontamination Plan

Wind
Direction



Decontamination

Basic Personnel Decontamination Station



Accident Investigation Report

ACCIDENT REPORT

Joe Gentile, Corporate Health and Safety Manager

Cell: (610) 844-6911; Office: (856) 423-8800; Office FAX: (856) 423-3220; Home: (484) 373-0953

PART 1: ADMINISTRATIVE INFORMATION

Project #: _____ Project Name: _____ Project Location (street address/city/state): _____ Client Corporate Name / Contact / Address / Phone #: _____ _____ _____ _____		Immediate Verbal Notifications Given To: Corporate Health & Safety <input type="checkbox"/> Yes <input type="checkbox"/> No Office Health & Safety <input type="checkbox"/> Yes <input type="checkbox"/> No Office Manager <input type="checkbox"/> Yes <input type="checkbox"/> No Project Principal <input type="checkbox"/> Yes <input type="checkbox"/> No Project Manager <input type="checkbox"/> Yes <input type="checkbox"/> No Client Contact <input type="checkbox"/> Yes <input type="checkbox"/> No	REPORT STATUS (time due): <input type="checkbox"/> Initial (24 hr) <input type="checkbox"/> Final (5-10 days) Date: _____ Date: _____ Accident Report Delivered To: Corporate Health & Safety <input type="checkbox"/> Yes <input type="checkbox"/> No Office Health & Safety <input type="checkbox"/> Yes <input type="checkbox"/> No Office Manager <input type="checkbox"/> Yes <input type="checkbox"/> No Project Principal <input type="checkbox"/> Yes <input type="checkbox"/> No Project Manager <input type="checkbox"/> Yes <input type="checkbox"/> No
		REPORT TYPE: <input type="checkbox"/> Loss <input type="checkbox"/> Near Loss Estimated Costs: \$ _____	
OSHA CASE # Assigned by Corporate Health & Safety if Applicable: _____		Corporate Health & Safety Confirmed Final Accident Report <input type="checkbox"/> Yes <input type="checkbox"/> No	
DATE OF INCIDENT: _____	TIME INCIDENT OCCURRED: _____ <input type="checkbox"/> AM <input type="checkbox"/> PM	INCIDENT LOCATION – City, State, and Country (If outside U.S.A.) _____	

INCIDENT TYPES: (Select most appropriate if Loss occurred.)
 From lists below, please select the option that best categories the incident. When selecting an injury or illness, also indicate the severity level.

<input type="checkbox"/> INJURY -----Severity Level----- <input type="checkbox"/> Fatality <input type="checkbox"/> First Aid <input type="checkbox"/> Medical <input type="checkbox"/> Restricted Work <input type="checkbox"/> Lost Time Treatment	<input type="checkbox"/> ILLNESS OTHER INCIDENT TYPES <input type="checkbox"/> Spill / Release <input type="checkbox"/> Misdirected Waste <input type="checkbox"/> Consent Order <input type="checkbox"/> NOV Material involved: _____ Quantity (U.S. Gallons): _____ <input type="checkbox"/> Property Damage <input type="checkbox"/> Exceedance <input type="checkbox"/> Motor Vehicle <input type="checkbox"/> Fine / Penalty	
---	---	--

ACTIVITY TYPE (Check most appropriate one.) <input type="checkbox"/> Decommissioning <input type="checkbox"/> Geoprobe <input type="checkbox"/> Sampling <input type="checkbox"/> Demolition <input type="checkbox"/> Motor Vehicle <input type="checkbox"/> System Start-up <input type="checkbox"/> Dewatering <input type="checkbox"/> Operations/ Maintenance <input type="checkbox"/> Trenching <input type="checkbox"/> Drilling <input type="checkbox"/> AST/UST Removal <input type="checkbox"/> Excavation <input type="checkbox"/> Pump/Pilot Test <input type="checkbox"/> Other _____ <input type="checkbox"/> Gauging <input type="checkbox"/> Rigging/Lifting	INJURY TYPE (Check all applicable.) <input type="checkbox"/> Abrasion <input type="checkbox"/> Occupational Illness <input type="checkbox"/> Amputation <input type="checkbox"/> Puncture <input type="checkbox"/> Burn <input type="checkbox"/> Rash <input type="checkbox"/> Cold/Heat Stress <input type="checkbox"/> Repetitive Motion <input type="checkbox"/> Inflammation <input type="checkbox"/> Sprain/Strain <input type="checkbox"/> Laceration <input type="checkbox"/> Other _____	BODY PART AFFECTED (Check all applicable.) <input type="checkbox"/> Respiratory <input type="checkbox"/> Shoulder <input type="checkbox"/> Face <input type="checkbox"/> Neck <input type="checkbox"/> Arm <input type="checkbox"/> Leg <input type="checkbox"/> Chest <input type="checkbox"/> Wrist <input type="checkbox"/> Knee <input type="checkbox"/> Abdomen <input type="checkbox"/> Hand/Fingers <input type="checkbox"/> Ankle <input type="checkbox"/> Groin <input type="checkbox"/> Eye <input type="checkbox"/> Foot/Toes <input type="checkbox"/> Back <input type="checkbox"/> Head <input type="checkbox"/> Other _____
---	---	--

I. PERSON(S) DIRECTLY / INDIRECTLY INVOLVED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Directly/Indirectly Involved in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:
1)				
2)				

II. PERSONS INJURED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Injured in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:	Description of Injury:
1)					
2)					

III. PROPERTY DAMAGED IN INCIDENT (Attach additional information as necessary/applicable.)

Property Damaged:	Property Location:	Owner Name, Address & Phone #:	Description of Damage:	Estimated Cost:
1)				\$

Accident Report – Page 2

2)				\$
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IV. WITNESSES TO INCIDENT (Attach additional information as necessary/applicable.)

Witness Name:	Address:	Phone #:
1)		
2)		

PART 2: WHAT HAPPENED AND INCIDENT DETAILS

PROVIDE FACTUAL DESCRIPTION OF INCIDENT (e.g., describe loss/near loss, injury, response / treatment).

I. AUTHORITIES/GOVERNMENTAL AGENCIES NOTIFIED (Attach additional information as necessary/applicable.)

Authority/Agency Notified:	Name/Phone #/Fax # of Person Notified:	Address of Person Notified:	Date & Time of Notification:	Exact Information Reported/Provided:

II. PUBLIC RESPONSES TO INCIDENT (if applicable)

Response/Inquiry By: (check one)	Entity Name:	Name/Phone # of Respondent/ Inquirer:	Address of Entity/Person:	Date & Time of Response/Inquiry:
<input type="checkbox"/> Newspaper <input type="checkbox"/> Television <input type="checkbox"/> Community Group <input type="checkbox"/> Neighbors <input type="checkbox"/> Other				

Describe Response/Inquiry:

Roux/Remedial Response:

(Check all that apply.) (Attach photos, drawings, etc. to help illustrate the incident.)

ATTACHED INFORMATION: Photo Sketches Vehicle Acord Form Police Report Other

Name(s) of person(s) who prepared Initial and Final Report:	Title(s):	Phone number(s):

PART 3: INVESTIGATION TEAM ANALYSIS

CONCLUSION: WHY IT HAPPENED (LIST CAUSAL FACTORS AND CORRESPONDING ROOT CAUSES)

(Root Causes: Lack of knowledge or skill, Doing the task according to procedures or acceptable practices takes more time or effort, Short-cuts or not following acceptable practices is reinforced or tolerated, Not following procedures or acceptable practices did not result in an accident, Lack of or inadequate procedures, Inadequate communications of expectations regarding procedures or acceptable practices, Inadequate tools or equipment, External Factors)

ROOT CAUSE(S) AND SOLUTION(S): HOW TO PREVENT INCIDENT FROM RECURRING

CAUSAL FACTOR	ROOT CAUSE	SOLUTION(S) [Must Match Root Cause(s)]		PERSON RESPONSIBLE	AGREED DUE DATE	ACTUAL COMPLETION DATE
		#	Solution(s)			
		1				
		2				
		3				

INVESTIGATION TEAM:

PRINT NAME	JOB POSITION	DATE	SIGNATURE

No One Gets Hurt!

Daily Safety Logs

DATE: _____

TAILGATE SAFETY MEETING

Project Manager: _____ Project Name: _____
Site Supervisor: _____ Project Number: _____
Safety Officer: _____ Project Location: _____
Type of Work to be Done: _____

SITE SAFETY INFORMATION:

Weather: _____

Chemical Hazards: _____

Physical Hazards: _____

Protective Clothing/Equipment _____

Exclusion Zone PPE Level(s) _____

Location of Fire Extinguishers _____

Location of First Aid Kit(s) _____

Evacuation Rally Assembly Area: _____

Hospital _____ Phone: _____

Hospital Address _____

* Dial 9-1-1 & Notify supervisor, safety officer & project manager for emergency medical accidents/incidents

ATTENDEES

Name Printed

Signature

Meeting Conducted By: _____

Name Printed

Signature

Air Monitoring Log

Weekly Safety Report

APPENDIX H

WEEKLY SAFETY REPORT

Job Name: _____ Job #: _____

Week of: _____ Days Without Lost Time Injury: _____

Describe any recordable incidents or accidents: _____

What actions were taken to prevent such incidents or accidents from occurring again: _____

Was training conducted addressing the incident? Y N What date? _____

What level of PPE is currently in place? _____

Has PPE been upgraded or downgraded? _____

Have Perimeter Air Monitoring action limits been exceeded? _____

What action was taken to mitigate the exceedance? _____

Have personal air monitoring limits been exceeded? _____

What actions were taken? _____

List any problems with air monitoring equipment: _____

Write a summary of work completed during the week: _____

Write a summary of proposed work for the coming week: _____

Summarize any safety issues that are outstanding: _____

HSO Name: _____ HSO Signature: _____