3.7 ISOLATION VALVE INSTALLATION

A. Shut off valves shall be installed in the closed position and shall not be opened until the mainline piping has been pressurized and flushed.

B. Install isolation valves before each electric valve or group of electric valves. Install all isolation valves on a level crushed stone base. Install specified valve box over each isolation valve. See details.

3.8 QUICK COUPLING VALVE INSTALLATION

A. Install quick coupling valves where indicated on the drawings. Quick coupling valves shall be installed as per detail in 10-inch round valve box.

B. Quick coupling valves to be mounted on 1 inch PVC swing joints with brass insert. Minimum swing joint length to be 12 inches.

C. Quick coupling valves shall be stabilized with anti-rotation wing. Area around the wing and three quarters of the valve box shall be filled with crushed stone.

D. Height of quick couplers shall be set so that the key is easily useable with room left to get the operators fingers under the handle.

3.9 VALVE BOX INSTALLATION

A. Furnish and install a valve access box for each isolation gate valve, electric valve, grounding rod, grounding plate and wire splice as specified.

B. All valve access boxes shall be installed on a minimum 4-inch crushed stone base. Finish elevation of all boxes shall be at grade. All crushed stone to be supplied and installed before valve box. Crushed stone shall not be simply poured into previously installed valve boxes.

C. Valve boxes shall be installed neatly at all times. Boxes shall be parallel or perpendicular to hardscape edges and to other valve boxes installed in the same location. A sufficient amount of turf shall remain in place between each valve box and between valve boxes and hard-scapes.

D. Valve box extensions shall be provided as required on all valve boxes in order to install valve box covers at grade. This shall include air vacuum/relief valves.

E. Bricks, stones, etc. shall not be used to support valve boxes.

3.10 WIRING INSTALLATION

A. Power source for the controller shall be the existing controller power. All power wire from the existing power source to the controller shall be installed in conduit.

B. All wire shall be installed with no in-ground splices. All splices shall be at/in junction boxes, electric valves or controller enclosure.

C. Wiring shall be installed along with the mainline. Where wire passes under walkways or other paved or graveled areas, it shall be installed in PVC conduit, minimum 2 inch. Sufficient slack for expansion and contraction shall be maintained and wiring shall at no point be installed

tightly. Provide an additional 8 inches to 12 inches' slack at all changes of direction. Wiring in valve boxes shall be a sufficient length to allow the valve solenoid, splice and all connections to be brought above grade for servicing. This additional slack shall be coiled for neatness in the valve box.

D. All wire shall be laid in trenches and shall be carefully backfilled to avoid any damage to the wire insulation or wire conductors themselves. In areas of unsuitable material, the trench shall have a 2 inches' layer of sand or stone dust on the bottom before the wires are laid into the trench and backfilled. The wires shall have a minimum of 22 inches of cover. Wire not to be installed that day shall not be laid out.

E. Service wiring in connection with drawings and local codes for 24-volt service. All in-ground wire connections shall be waterproofed with 3M DBR/Y or equal splice kits. All splices shall be made in valve boxes (wire runs requiring splices between valve locations shall be provided and installed in splice box-valve box shall be used). Splice locations shall be shown on the Record Drawings.

3.11 CONTROLLER INSTALLATION

A. Install controller in stainless steel enclosure generally where shown on the drawings. Coordinate with Owner's Representative. Wire control wire and weather sensor into controller and set proper programs.

B. Wire controller to existing 120-volt electrical supply through minimum 1-inch conduit and sweeps.

C. Keys shall be turned over to Owner's Representative.

D. Install controller enclosure on 28-inch x 28-inch x 6-inch-deep concrete base. Concrete shall be 3,000 lb., 28-day strength.

3.12 WEATHER SENSOR INSTALLATION

A. Weather sensor on controller enclosure, where indicated on the details. Weather sensor shall be in direct contact with the weather and not in contact with the irrigation spray.

B. Install weather sensor wiring within 1/2-inch conduit where exposed.

C. Weather sensor shall be enclosed in stainless steel weather sensor guard.

3.13 GROUNDING INSTALLATION

A. Grounding rod shall be driven into the ground its full length within 8-feet of the controller and connected via a Cadweld connection to #6 solid, bare copper wire. The copper wire is to be installed in as straight a line as possible, and if it is necessary to make a turn or bend, it shall be done in a sweeping curve with a minimum radius of 8 inches and a minimum included angle of 90 degrees. There shall be no splices in the bare copper wire. The top of the ground rod shall be driven below the ground surface. A 4-inch grated cover as specified, set a minimum of 1-inch below grade, shall be placed over the ground rod and Cadweld connection for periodic maintenance. Cover shall be installed on a minimum of 6 inches of 4-inch ADS corrugated polyethylene, perforated drainage pipe. Plate shall be installed 36 inches below grade with 50 lbs of PowerSet ground enhancement material spread evenly below the plate and 50 lbs of

PowerSet ground enhancement material spread evenly above the plate for controller grounding in accordance with the manufacturer's requirements. Plate shall also be covered with a 4-inch grated cover as specified, set a minimum of 1-inch below grade, to facilitate drainage onto the plate. Cover shall be installed on a minimum of 36 inches of 4-inch ADS corrugated polyethylene, perforated drainage pipe.

B. Contractor must furnish a certified document to Owner's Representative the OHMS reading at controller grounding location.

3.14 CHECK/TEST/START-UP/ADJUST

A. Flushing:

1. After all piping, valves, sprinkler bodies, pipelines and risers are in place and connected, but prior to installation of sprinkler internals, open the control valves and flush out the lateral system under a full head of water.

2. Sprinkler internals shall be installed only after flushing of the system has been accomplished to the full satisfaction of the Owner's Representative.

3. Contractor shall also be responsible for flushing the entire system after installation is complete and will be responsible for any clogged nozzles until acceptance.

B. Testing:

1. Leakage test: test all lines for leaks under operating pressure as specified. Repair all leaks and re-test.

2. Coverage test: perform a coverage test in the presence of the Owner's Representative (notify Owner's Representative at least seven (7) days in advance of scheduled coverage test). Representative will determine if the water coverage is complete and adequate. Readjust sprinklers or sprinkler locations as necessary or directed to achieve proper coverage.

3. All testing shall be at no additional expense to the Owner.

3.15 CLEANING AND ADJUSTING

A. At the completion of the Work, all parts of the installation shall be thoroughly cleaned. All equipment, pipe, valves and fittings shall be cleaned of grease, metal cuttings and sludge, which may have accumulated by the operation of the system for testing.

B. Adjust sprinklers and valve boxes to grade as required, so that they will not be damaged by mowing operations.

C. Continue sprinkler coverage adjustment as required by settlement, etc., throughout the guarantee period.

D. Each control zone shall be operated for a minimum of 5 minutes and sprinklers checked for consistency of delivering water. Adjustments shall be made to sprinklers that are not consistent to the point that they match the manufacturer's standards. All sprinklers, valves, timing devices or other mechanical or electrical components, which fail to meet these standards, shall be rejected, replaced and tested until they meet the manufacturer's standards.

3.16 CLEAN UP

A. Upon completion of all installation Work, remove all leftover materials and equipment from the site in a safe and legal manner.

B. Remove all debris resulting from Work of this Section.

C. Re-grade, lightly compact, and replant around sprinklers where necessary to maintain proper vertical positioning in relation to established grade.

D. Fill depressions and eroded channels with sufficient soil mix to adjust grade to ensure proper drainage. Compact lightly, and replant filled areas in accord with drawings requirements.

3.17 ACCEPTANCE AND OPERATION

A. Furnish, in addition to the record drawings and operational manuals, copies of all available specification sheets and catalog sheets to Owner's designated representative responsible for the operation and maintenance of the irrigation system. Guarantee all parts and labor until the system is accepted.

END OF SECTION 32 84 00

SECTION 32 90 00
TOPSOIL AND SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Topsoil
   2. Seeding

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Section 31 10 00 – Site Preparation

B. Section 31 30 00 – Earthwork

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished graded topsoil except that sod needs to account for the sod thickness so that seed and sod are established in a flush condition.

B. Top Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

C. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

D. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.4 SUBMITTALS

A. All testing and submittals are at the contractors expense

B. Product data sheets , specifications, performance data, physical properties for the following:

C. Topsoil
   1. Dry samples:
      a. Existing soil – 1 gallon sample of the topsoil after amendments
      b. Proposed soil – 1 gallon sample
   2. Tests (all soils) conforming to specification requirements
   3. Particle size - Particle size analysis of the topsoil will be determined by ASTM F 1632, Particle Size Analysis conducted by a laboratory accredited by the American Association of Laboratory Accreditation. Test must be recent and approved prior to delivery of material to the site.
      a. Organic matter content – by loss on ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230F +/-9F

b. Nutrient analysis - Soil pH and nutrient analysis using the modified Morgan soil test extractant for soil available P, K, Ca and Mg using University of Connecticut, Department of Plant Science, Soil Nutrient Analysis Laboratory.
c. Soluble salt content measuring EC with a conductivity meter in a soil-water extract using a soil to solution ratio of 1:4.3.4. Organic matter content in the topsoil to be determined by loss of weight on ignition on an overdry sample.

D. Seed
1. Seed mixes
2. Certification of grass seed and sod showing compliance with state and federal seed laws.

E. Fertilizer: MSDS and product data

F. Seeding Schedule: Indicating anticipated planting dates for each.

1.5 QUALITY ASSURANCE

A. The Owner reserves the right to require testing and reject for cause any material not meeting material specifications by tests in accordance with methods adopted by the Associate of Official Agricultural Chemists. Costs for these tests shall be borne by the Contractor.

B. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when seeding is in progress.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory such as the UMASS Agricultural Extension Service
1. Report suitability of topsoil for lawn growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

D. Acceptance of the lawn areas shall be established by the Landscape Architect in writing, following the completion of all maintenance work requirements as specified herein, and following the correction of all punch list deficiencies by the Contractor

E. Analysis and standards - Package standard products with manufacturer certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agricultural Chemists, wherever applicable.

1.6 CONFIRMATION OF GRADES AND ADJUSTMENTS:

A. As-built topographic shall be by a Licensed Land Surveyor.

B. Engineer's review of grades will be singular. Each subsequent review after the first will be at the contractors cost.

C. Deliverable:

1. As-built topography shall be provided to the Engineer as an Autodesk Civil 3D cadd file:

a. Drawing format 2013

b. Containing all the content required to compile triangulated irregular network surfaces (TIN Surface)

c. In the same horizontal and vertical datum as the construction documents

d. Be provided with the surface styles showing contours and triangles

1) Matching the contour interval of the construction plans.

2. Adobe portable document file (PDF) representing the content from 3.3.C.1

a. With a title block, legend, north arrow, scale, date, supplier of topography

b. At the scale equivalent to the construction documents

D. Adjustments: Contractor shall adjust grades meeting tolerances per 1.7 below at no additional cost to the contract.

1.7 TOLERANCES FOR GRADES

A. General: the Drawings indicate finished elevations. The grading to be performed consists of establishing finished grade elevations as shown on the Drawings.

B. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are indicted, or between such points and existing grades.

C. Shall be free from irregular surface changes, and as follows:

1. Topsoil shall be 6" depth minimum but not more than 8". Pay limit for topsoil is 6" depth. Topsoil placed at greater depths is at no additional cost to the contract.

2. Topsoil shall be within the construction document grades as follows:
   a. Equal to or 0.5% flatter than the grades shown
   b. Without depressions or high spots creating unintended undulations trapping water within the field of play. Depressions can be rectified in the topsoil layer up to 8" total topsoil depth. Topsoil in excess of 6" is at the contractors cost.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in new, sealed, containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging. Seed in damaged packaging is not acceptable.

B. Deliver sod moist and protected from wind damage

C. Deliver fertilizer in sealed waterproof bags showing weight, chemical analysis and name of manufacturer.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work to ensure that the work performed is scheduled to minimize damage to lawn areas.

1.10 MAINTENANCE SERVICE

A. Initial Lawn Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
   1. Seeded and sodded Lawns: 90 days from date of Substantial Completion.
      a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

1.11 PRODUCT WARRANTY

A. Warranty lawns until final acceptance.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Particle size - Particle size analysis of the topsoil will be determined by ASTM F 1632, Particle Size Analysis conducted by a laboratory accredited by the American Association of Laboratory Accreditation. Test must be recent and approved prior to delivery of material to the site and meet the following:
   1.

Sieve Size	Percent Passing
No. 10	85-100
No. 40	35-85
No. 200	10-35
<20µm	<5
No stones over 3/4 inch in diameter	

B. Organic matter content - by loss on ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230F +/-9F:
   1. 7% to 20%

C. Nutrient analysis - Soil pH and nutrient analysis using the modified Morgan soil test extractant for soil available P, K, Ca and Mg using University of Massachusetts, Agricultural Extension Service.

D. Soluble salt content measuring EC with a conductivity meter in a soil-water extract using a soil to solution ratio of 1:4.3.4. Organic matter content in the topsoil to be determined by loss of weight on ignition on an overdry sample.

E. Shall be free of clods, vegetative matter such as sod and wood, contaminants that affect plant growth, foreign material (concrete, glass, etc.) and environmental contaminants that include volatile organic compounds, total petroleum hydrocarbons, metal elements and pesticides that will impact reconstruction of the athletic fields and their surrounds.

F. Shall have a soil pH range of 6.4-7.0

G. Available phosphorus of greater than 5 lbs. per acre as determined by the modified Morgan extractant. If the soil pH and soil available phosphorus is below 6.4 and 5 .lbs. per acre

respectively, then agricultural limestone and fertilizer phosphorus are to be added to the topsoil to achieve the minimum above before reuse or delivery to the site.

H. The original source of the topsoil borrow shall be from an A or Ap horizon of a naturally occurring soil and not compounded by intentional mixing of component soils.

2.2 SEED AND SOD

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Species mix: State-certified seed of grass species, as follows:

a.	Gotham hard Fescue	10% by weight.
b.	Gladstone Kentucky Bluegrass	25% by weight.
c.	Shamrock Kentucky Bluegrass	25% by weight.
d.	Moonlight Kentucky Bluegrass	20% by weight.
e.	Prosperity Kentucky Bluegrass	20% by weight.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:
1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 decisiemens/m.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.5 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: 293 lbs. per acre of 15-15-15.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 142 lbs. per acre of 20-10-10.

2.6 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

2.7 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Test the topsoil and provide to UMASS Horticulture Lab for analysis and recommendations for athletic turf grass.

B. Spread soil amendments

C. Reverse tine till the site to subgrade depths.

D. Shape the topsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes in level areas.

E. Remove stones ¾ inch and larger.

F. Remove foreign materials, debris, weeds, undesirable plants, roots, branches, stones in excess of 1/2 inch in size. Remove subsoil contaminated with petroleum products, or other materials, which would inhibit healthy plant growth.

G. Scarify in areas where equipment is used for hauling and spreading topsoil and has compacted subsoil.

H. Test topsoil prior to grass establishment, amend again with low compaction equipment to avoid soil compaction.

3.2 SPREADING AND TREATING TOPSOIL

A. Equipment must be tracked or low pressure turf equipment for spreading topsoil or work conducted after placement of topsoil.

B. Topsoil is to be placed without compaction. Fine grading operations smooth and compact the topsoil adequately.

C. 6" depth tilling of the topsoil required to uncompact topsoil will be at no additional cost to the project.

D. Provide report and sample of amended topsoil prior to seeding

E. Fine grade topsoil, making changes in grade gradual, eliminating rough or low areas. Blend slopes into level areas. Manually spread topsoil close to trees, plants, and building to prevent damage. Fill depressions to ensure positive drainage.

F. Remove roots, weeds, rocks and foreign material while spreading.

G. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

H. Water to aid the dissipation of fertilizer.

3.3 SEEDING

A. Apply seed by mechanical slit seeder at a rate of 5 pounds per 1000 square feet evenly in two uniform applications. Direction of the second application shall be perpendicular to the first application.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain or snow, when ground is too dry, or during windy periods.

D. Immediately following seeding apply approved straw mulch to a thickness of 1/8 inch, keeping clear of trees.

E. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.4 LAWN MAINTENANCE

A. The Contractor is responsible for all mowing until final acceptance/turnover to owner.

B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.

C. Mow lawn as soon as top growth is tall enough to cut (3 inches). Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.

3.5 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:
1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.6 INSPECTION AND ACCEPTANCE

A. When landscape work is completed, including maintenance, Landscape Architect will, upon request, make an inspection to determine acceptability.

B. Final acceptance of seeded lawns is based on an established turf thickly uniform and well developed over 95% of the bed and ready for the Owner to use and occupy.

END OF SECTION 32 90 00

SECTION 32 94 00
TIMBER GUARD RAIL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Work under this Item shall consist of furnishing and installing notched wood post and rail fence at the location shown on the Contract Drawings and in accordance with the dimensions and details shown on the Contract Drawings, or as ordered by the Engineer.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations, components, materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

1.4 QUALITY ASSURANCE

A. Codes and Standards: All materials and construction methods shall conform to the following Massachusetts Department of Transportation – Highway Division documents: Standard Specifications for Highway and Bridges, unless otherwise specified herein.

B. Workmen: all workmen shall be thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

PART 2 - PRODUCTS

2.1 WOOD POSTS AND RAIL

A. Wood shall be of the sizes shown on the Contract Drawings.

B. All wood shall be pressure treated wood, shall be No. I KD or better Southern Yellow Pine.

C. Posts shall be nominal12"x12" and rails shall be nominal 5"x8".

D. All wood shall be No. 1 Southern Yellow Pine (Southern Pine Inspection Bureau Grading), or equal. All wood to be new, solid, sound and surface dry with a maximum moisture content of 19%. All wood shall be clearly marked with the official grading information.

2.2 FASTENERS

A. All fasteners, bolts, washers, and hex nuts shall be hot-dipped galvanized steel.

2.3 TREATMENT

A. Pressure treatment shall be ACQ in accordance with AWPA P-5, 0.60 pounds per cubic foot (9.6 kilograms/cubic meter) or Pentachlorophenol in accordance with AWPA P-9, Type B (L.P.G.), 0.50 pounds per cubic foot (8.0 kilograms/cubic meter).

B. All wood to be dressed four sides (S4S). Ends of all members shall be pressure treated.

C. All lumber shall conform to Voluntary Product Standard PS-70 and be certified according to applicable standard grading and dressing rules and shall bear the official grade and/or trademark of the association under whose rules it is produced.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install wood post guide rail to comply with the Contract Drawings and Form 816.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacing's indicated on the Contract Drawings, in firm, undisturbed soil. Should rock or boulders be encountered in making the excavation, this material shall be removed so as to make a hole of sufficient size to set the posts to the normal depth as called for on the Contract Drawings.

C. Post Setting: Set posts at indicated spacing into firm, undisturbed soil.

D. The posts shall be spaced as shown on the Contract Drawings, set plumb and normally with the front face at a uniform distance from the edge of the travel way.

E. Soil at the bottom of the hole shall be thoroughly compacted so that the posts will have a stable foundation. The holes shall be backfilled with an approved material which shall be thoroughly compacted.

F. Railings: The wood railings shall be mounted on the post as shown on the Contract Drawings to anchor the rail to the posts. The rail members shall be accurately cut so as to provide even bearing over entire surface of joints. No shimming of any kind will be allowed in making joints nor will open joints be accepted. All exposed edges of member shall be chamfered.

END OF SECTION 32 94 00

SECTION 33 40 00
STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Work under this section includes providing all materials, equipment, and services necessary to furnish and deliver work of this Section as shown on the Drawings, as specified, and as required by job conditions including, but not limited to the following:

B. Yard Drains and Dry Wells

C. Storm drain pipe

D. Underdrain

1.2 RELATED SECTIONS

A. 31 22 00 Temporary Sediment and Erosion Controls

B. 31 30 00 Earthwork

1.3 SUBMITTALS

A. In accordance with the General Requirements, submit samples, materials certifications, manufacturer's product data and test reports as hereinafter required.

B. Product data for drainage pipe, gasket material, and any of the miscellaneous drainage items.

C. Shop drawings for yard drains, dry wells, including frames, and grates.

D. Product data and sample of filter fabric.

1.4 QUALITY ASSURANCE

A. Codes and Standards: All materials and construction methods shall conform to the following: Massachusetts Department of Transportation – Highway Division "Standard Specifications for Highway and Bridges, 1988 English Edition, and the Supplemental Specifications to the 1988 Standard Specifications for Highway and Bridges (Combined English and Metric Edition), and the Standard Special Provisions, latest revision and shall be used for materials compliance and execution of the work in this section.

B. Workmen: all workmen shall be thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

1.5 JOB CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Verify that storm drainage system may be installed in compliance with original design and referenced standards.

B. Locate existing storm sewerage system piping and structures that are to be abandoned and closed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide pipe and pipe fitting materials compatible with each other. Refer to plans for specific material to be used.

B. Manholes, Yard Drains and Dry Wells: shall conform to the drawings and Section M4.02.14 of the Standard Specifications for Highways and Bridges.

C. Yard Drain Frames and Grates: shall conform to the drawings for the specific frames and grates to be used, and Section 201.40 of the Standard Specifications for Highways and Bridges.

D. Smooth lined corrugated polyethylene pipe (SLCPP/HDPE) and perforated HDPE pipe shall conform to AASHTO M252 or M294, ADS-N12, Hancor Hi-Q, or approved equal.

E. Filter Fabric - Will be a non-woven geotextile fabric of polypropylene or polyester fibers, or a combination thereof, Miradrain 6000 by Mirafi, Inc. or an approved equal, Mirafini N140NF or approved equal for infiltration system.

F. Drainage Structure Backfill, Pipe Bedding and Crushed Stone for Underdrain – Granular materials in accordance with Section 31 30 00 Earthwork, Crushed Gravel.

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED STORM DRAINAGE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand or pea gravel to indicated level.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.2 INSTALLATION GENERAL

A. Drawings (plans and details) indicate the general location and arrangement of the underground storm drainage system piping. Install the piping as indicated, to the extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes or catch basins for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Install piping pitched down in direction of flow, at minimum slope of 1 percent, except where indicated otherwise.

3.3 MANHOLES

A. Install manholes and dry wells complete with accessories as indicated.

B. Set frames and covers to the elevations indicated on the drawings.

C. Place precast concrete manhole sections as indicated and install in accordance with ASTM C 891.

D. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.

3.4 YARD DRAINS

A. Construct yard drains to the sizes and at the locations indicated on the drawings.

B. Set frames and grates to elevations indicated on the drawings.

3.5 CONNECTIONS

A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirement specified for new work. Material surrounding existing underground structures shall be replaced in-kind, with like material properties and functionality.

B. Soil compaction must be a minimum of 98% of standard Proctor density (95% in single-grain sands). Compaction of stone shall be outlined in the manufacturer's current installation guidelines.

C. The Contractor shall ensure his operations in no way damage existing storm drainage facilities during connection operations. Damage occurring, as a result of the contractors operations or negligence, to any existing facility to remain, shall be repaired and/or replaced at no expense to the Owner.

END OF SECTION 33 40 00

METHOD 2 / METHOD 3 RISK CHARACTERIZATION

METHOD 2 / METHOD 3 RISK CHARACTERIZATION
Athletic Fields
Wolf Swamp Park
703 Wolf Swamp Road
Longmeadow, MA

May 18, 2020

Report prepared for:
Milone and MacBroom, Inc.
2 Commercial Drive
Suite 110
Bedford, NH 03110

COLLABORATIVE RISK SOLUTIONS LLC

36 Fairview Avenue

Scituate, MA 02066

Denise Kmetzo, DABT
Collaborative Risk Solutions LLC
36 Fairview Avenue
Scituate, MA 02066

May 18, 2020

Mr. C. Eric Teale, PE, LSP, LEP
Milone and MacBroom, Inc.
2 Commercial Drive
Suite 110
Bedford, NH 03110

RE: Method 2 / Method 3 Risk Characterization
Athletic Fields, Wolf Swamp Park, Longmeadow, MA

Dear Eric:

Collaborative Risk Solutions LLC is pleased to submit the Method 2 / Method 3 Risk Characterization to evaluate the soil conditions at the athletic fields at Wolf Swamp Park, located at 703 Wolf Swamp Road in Longmeadow, MA. This work was performed per my proposal dated March 24, 2020 and subsequent communications. I expect that the evaluation and conclusions provided in this report will meet your needs at this time.

I appreciate the opportunity to provide you with risk assessment services. Please do not hesitate to contact me if you have any questions or if I can be of further assistance.

Sincerely,

Denise Kmetzo, DABT

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TABLES

FIGURES

APPENDICES

On behalf of Milone and MacBroom, Inc. (MMI) and the Town of Longmeadow, Collaborative Risk Solutions LLC completed a characterization of risk associated with environmental conditions at the athletic fields operated by the Town of Longmeadow located at 703 Wolf Swamp Road, Longmeadow, Massachusetts (Study Area). The athletic fields are being renovated, and soil sampling conducted as part of the renovation project identified pesticides in soil at the fields. According to MMI, the pesticides present in soil are attributed to historical agricultural use of the property. A timeline of property usage of the athletic fields, based on MMI review of available USGS maps, aerial photographs, and discussion with Town of East Longmeadow officials, is as follows:

1934 – Property consists of wooded swamp land

1957 – Row crops are evident on the property with a swamp to the south and small wetland pockets near the western edge

1970 – Property appears to be used as a farmland with tilling patterns evident

1971 – Property continues to be used as farmland with tilling patterns evident

1977 – The Town of Longmeadow acquires the property of recreational purposes

1990 – Property use indicates the presence of baseball diamonds within the northeast and southwest portions of the property that are consistent with current athletic field locations

1997 – Similar to current property usage

1997-2016 – no significant changes to use of the property

Discussion with Town of Longmeadow officials is summarized as follows:

According to Mr. Al Laakso of the Conservation Commission, in 1964 the road from Wolf Swamp Road to Denslow Road (East Longmeadow) leading to Shaker Road was an unpaved dirt road. He remembers the farmland and recalls the crop was potatoes.

According to longtime resident and former Select Board member Ms. Arlene Miller, she recalls moving to Longmeadow in 1978 and the land was a large potato field at that time.

In summary, review of available historic use does not indicate the presence of any commercial or industrial usage on the property or adjoining the property. Based on discussion with the Town of Longmeadow, the prior agricultural use of the athletic fields consisted of potato farming. Accordingly, the presence of low level pesticide concentrations at the property has been identified by MMI as not reportable under the Massachusetts Contingency Plan (MCP). The historic data supports the presumption pesticides were applied in a manner consistent with labeling; therefore, the detected pesticides in the environment at the athletic fields are considered Anthropogenic Background, as defined by the MCP and documented in the regulations (310 CMR 40.0006).

While MMI has identified that environmental conditions are not regulated under the MCP, Collaborative Risk Solutions LLC conducted a risk characterization in general accordance with procedures outlined in the MCP (310 CMR 40.0900) and in a manner consistent with scientifically acceptable human health risk assessment practices established by the Massachusetts Department of Environmental Protection (MassDEP). The risk characterization relies upon analytical data and other information provided to Collaborative Risk Solutions LLC by MMI. The risk characterization was performed to understand whether a Condition of "No Significant Risk" in the context of the MCP exists for the athletic fields, which are referred to herein as the "Study Area". The risk characterization was not conducted as part of MCP response actions.

Under the MCP, risk characterizations are performed in accordance with one of three methods. Method 1 and Method 2 risk characterizations use promulgated MCP standards to characterize potential risks and may be used at Sites where contamination is primarily limited to soil and/or groundwater; a Method 3 risk characterization quantitatively assesses risks, and can be used at any site. This risk characterization represents a combined Method 2 and Method 3 Risk Characterization, as described in the MCP (310 CMR 40.0942(1)(a)(1); 310 CMR 40.0942(1)(c)(1)). Human exposure is potentially complete via exposure to soil. However, as Method 1 Standards are not available for all contaminants of concern, a Method 2 Risk Characterization (M2RC) was selected to supplement Method 1 Standards. Because pesticides were detected in the shallowest 2 feet of soil and Environmental Receptors (grasses) may be present at the Study Area, a Method 3 Stage I Environmental Screening was selected to assess risk to the environment.

Risk Characterization Organization

The risk characterization is organized as follows:

- ***Study Area Information*** summarizes the Study Area location and use;
- ***Method 2 Human Health Risk Characterization*** evaluates potential exposures and risks. The M2RC describes the current and possible future Study Area Activities and Uses, groundwater and soil categories, Exposure Points, development of Method 2 Standards, Exposure Point Concentrations, and a comparison of Exposure Point Concentrations to MCP Method 1 and Method 2 Standards;
- ***Stage I Environmental Screening*** evaluates potential exposures to environmental receptors. The Stage I Environmental Screening evaluates habitat quality and conducts an effects-based screening if significant receptors are identified; and
- ***Safety Risk Characterization*** evaluates the potential for threats of physical harm or bodily injury to people.

1.0 STUDY AREA INFORMATION

Study Area information including the nature and extent of release was provided by MMI. Briefly, MMI performed representative sampling and analysis of the Study Area by eight shallow hand auger explorations at the location shown on the attached Sample Location Map. Given the Study Area history, pesticide usage would only be anticipated within the former agricultural area where potatoes were grown.

A total of 17 soil samples were obtained at depth intervals of 0 to 6 inches, 6 to 12 inches, 12 to 18 inches and 18 to 24 inches. Sampling was performed on March 12, 2020 and March 26, 2020, and retrieved soil samples were submitted to Complete Environmental Testing, Inc. of Stratford, Connecticut.

According to MMI, analytical results indicated the presence of low levels of pesticides consistent with prior agricultural uses of the Study Area consisting of arsenic, lead, endrin, heptachlor, heptachlor epoxide, endrin, dieldrin, endosulfan sulfate, 4,4-DDT and 4,4-DDE. Based on the soil analytical results, the pesticide concentrations generally decrease with depth which is consistent with the upper 1 to 2 feet of soil being tilled for potato plants.

The Study Area includes athletic fields located at Wolf Swamp Park, which is located in a mixed-use area of Longmeadow, Massachusetts. Surrounding land uses include commercial, industrial, recreational and residential. The Study Area includes numerous athletic playing fields, and is bounded by the edge of the fields. Adjacent parking areas and undeveloped areas are not included within the Study Area. Neighbors to the park include residences to the west; Wolf Swamp Road and Twin Hills Country Club (across the street) to the north; a power line easement, solar development and industrial facilities to the east; wetlands and residential properties to the west; and undeveloped land, including wetlands, to the south. There are no buildings at the Study Area, and the athletic field is planned to undergo near future renovations. The Study Area will remain as athletic fields. The nearest perennial surface water body is an unnamed pond located along Wolf Swamp Road and Denslow Road, approximately 500 feet east of the Study Area. In addition, wetlands are located approximately 50 feet south of the Study Area.

The Study Area has been developed as a recreational area post 1978. The Study Area was historically operated as a potato farm prior to 1957 and ceased operations after 1978. Pesticides were identified in soil during renovation planning activities; prompting the risk characterization.

The Study Area and sampling locations are depicted in the attached Figure 1.

1.1 Selection of Contaminants of Concern

Contaminants of Concern (COCs) include those chemicals that are assessed in the M2RC and Stage I Environmental Screening, and include constituents detected in soil which are present in the environment at concentrations greater than background (MassDEP, 1995). MMI provided analytical data to Collaborative Risk Solutions LLC to consider in the M2RC. MMI states that soil results conservatively represent current Study Area conditions, and are usable for risk assessment purposes. Soil amendment is planned, and clean material will be mixed with Study Area soil as part of renovation activities, which is expected to decrease Study Area soil concentrations. MMI noted that, while groundwater was not sampled, it is not expected to be impacted, due to the nature of the soil Contaminants of Concern. The COCs are expected to be strongly adsorbed to soil and not leach to groundwater, as indicated by their high soil adsorption coefficient (Koc) values. Therefore, for this M2RC, soil was identified as the sole medium of concern.

1.1.1 Soil

Soil data were collected and provided by MMI. Soil data considered in the M2RC include pesticide, herbicide, and metals results from samples collected in March 2020 within the Study Area. The attached Figure 1 provides soil sampling locations.

Soil data are presented in Table 1. Herbicides were not detected at the Study Area; a subset of pesticides were detected. P,P-dichlorodiphenyldichloroethylene (DDD), P,P-dichlorodiphenyltrichloroethane (DDT), arsenic, and lead were detected in every sample. A summary of Study Area soil sampling results and comparison to background is provided in Table 2. Constituents were eliminated from further evaluation if the maximum concentration of a soil constituent was lower than its natural soil concentration identified by MassDEP (MassDEP, 2002). Arsenic and lead were eliminated as COCs based upon this comparison. All other detected constituents were retained as COCs in the M2RC.

2.0 METHOD 2 RISK CHARACTERIZATION

The M2RC was completed in general accordance with the MCP (310 CMR 40.0982). The M2RC evaluates risk through documentation of Study Area use, classification of Study Area soil and groundwater categories, identification of Exposure Points, calculation of Method 2 Standards, derivation of Exposure Point Concentrations, and comparison to MCP Method 1 and Method 2 Standards. Each of these elements is described below.

2.1 Study Area Activities, Uses, and Receptors

The Study Area is currently an athletic field that is undergoing renovation planning. There are no buildings within the Study Area. The Study Area is partially fenced; however, the Study Area is accessible from an entrance from a parking lot on Wolf Swamp Road. There are currently no activities occurring on the Study Area, other than periodic trespassing and occasional sports.

The M2RC does not consider any prohibition of activities at the Study Area. The Study Area is being renovated for continued recreational use; however, for the purposes of this M2RC, no future activity or use is prohibited at the Study Area. Future use could therefore include recreational, residential, commercial, industrial, or institutional use.

2.2 Soil and Groundwater Categories

This section identifies and documents the soil and groundwater categories applicable to the Study Area, as described in 310 CMR 40.0930. These soil and groundwater categories are considered to be general indicators of the potential for exposure to oil and hazardous material (OHM) at the Study Area, and are used to identify relevant Method 1 and Method 2 Standards. The terminology OHM is used herein as it is the terminology used within the MCP in the derivation of Method 2 Standards.

2.2.1 Soil

The MCP specifies three soil categories (S-1, S-2, and S-3). Category S-1 soil represents the highest potential for exposure, and Category S-3 soil represents the lowest potential for exposure. The potential for exposure relies upon the nature of the receptors, frequency and intensity of Study Area use, and the accessibility of soil.

Currently, the Study Area is undergoing redevelopment. However, it is located within a public park, and therefore, the frequency of Study Area use is considered high for adults and children. The intensity of Study Area use is considered high for adults and children, who may engage in recreational sports at the field. Intensity of Study Area use is also considered high for adults performing excavation and renovation activities at the Study Area. Therefore, under both current and future (post-renovation and unrestricted use) conditions, the following soil categories apply:

S-1: Soil between 0 and 15 feet, as children and adults could be present at a high frequency and high intensity; and

S-3: Soil at depths greater than 15 feet across the Study Area, as soil is considered isolated.

2.2.2 Groundwater

While groundwater is not considered impacted at the Study Area, category identification is relevant for Method 2 risk characterization. The MassDEP has established three categories for groundwater, which relate to the types of groundwater exposures:

- GW-1 applies to groundwater assumed to be a potential source of drinking water;
- GW-2 applies to groundwater considered to be a potential source of vapors that could migrate into building air; and,
- GW-3 applies to groundwater that is assumed to discharge to surface water.

The Study Area is located within a medium-yield aquifer, and is therefore within a Potentially Productive Aquifer, which is considered a Potential Drinking Water Source Area. Because groundwater is considered a potential source of drinking water, it is classified as GW-1. There is currently no building present at the Study Area or within 30 feet of the Study Area boundary; therefore, groundwater is not currently GW-2. However, for the purposes of the M2RC, groundwater is considered as GW-2 to assess potential future construction of an occupied building. Groundwater is also classified as GW-3 as all groundwater is considered a potential source of discharge to surface water.

In summary, Study Area soil categories include S-1 and S-3 considering current and future use. Study Area groundwater is classified as GW-1 and GW-3 considering current use, and GW-1, GW-2 and GW-3 considering future use.

2.3 Exposure Points

As described in the MCP (310 CMR 40.0006), an Exposure Point is a location of potential contact between a human or environmental receptor and a release of oil and/or hazardous material. An Exposure Point may describe an area or zone of potential exposure, as well as a single discrete point. Exposure Points are described below, by medium.

2.3.1 Soil

For soil, Exposure Points are identified based upon the potential for exposure, and soil categories selected in Section 2.2.1. Soil impacts have been documented at grade to two feet below grade. Under current conditions, soils are classified as S-1 and S-3. The S-1 Exposure Point was identified as all impacted soil located in unpaved soil 0 to 15 feet bgs, which considers both current and future unrestricted conditions. Soils greater than 15 feet in depth were not included in any Exposure Point, as it is assumed that construction projects would not excavate to a depth greater than 15 feet, and soils are not impacted at depth.

Because Exposure Points only include impacted Study Area soil, and soil is impacted within the shallowest 2 feet, the effective Exposure Point at the Study Area is soil located 0 to 2 feet bgs. No hot spot was identified in soil, given the variability of pesticide concentrations throughout the Study Area and as maximum concentrations of all constituents are either below Method 1 S-1 Standards, or within ten times the average Study Area concentration.

2.4 Development of Method 2 Standards

The Method 2 approach was used to develop Method 2 Soil Standards for COCs for which no Method 1 Standard is available. Specifically, endosulfan sulfate and endrin ketone were detected in soil above background at three and eight locations respectively. Therefore, Method 2 S-1, S-2, and S-3 Soil Standards were developed for endosulfan sulfate and endrin ketone as described in 310 CMR 40.0984. Direct contact standards were developed. No leaching-based standards were developed as MMI notes that groundwater is not expected to be impacted as previously discussed. The development of the Method 2 Standards is provided, below.

2.4.1 Derivation of Method 2 Soil Standards

Method 2 Standards were derived for endosulfan sulfate and endrin ketone. MassDEP has not derived Method 1 Standards for these COCs; therefore, Method 2 Direct Contact Soil Standards were developed as described in the MCP (310 CMR 40.0984), using the following steps:

Step 1: Identify a background concentration in soil

Method 2 soil standard derivation considers Study Area-specific background, which was not characterized at the Study Area. Further, MassDEP does not provide background values for pesticides. Therefore, no background concentration was identified in soil.

Step 2: Calculate a concentration of the oil and/or hazardous material (OHM) associated with a Hazard Quotient (HQ) of 0.2 for each soil category

The equations to develop the concentration of OHM are provided in the MCP (310 CMR 40.0984(2)) and include the following:

Method 2 S-1 Direct Contact Standard:

$[OHM] = (RfD_{chronic} \times 0.2 \times C)/((RAF_{oral} \times 2.4\ mg/kg\text{-}day) + (RAF_{dermal} \times 21\ mg/kg\text{-}day))$

Method 2 S-2 Direct Contact Standard:

$[OHM] = (RfD_{chronic} \times 0.2 \times C)/((RAF_{oral} \times 0.27\ mg/kg\text{-}day) + (RAF_{dermal} \times 0.49\ mg/kg\text{-}day))$

Method 2 S-3 Direct Contact Standard:

$[OHM] = (RfD_{subchronic} \times 0.2 \times C)/((RAF_{oral} \times 1.2\ mg/kg\text{-}day) + (RAF_{dermal} \times 13\ mg/kg\text{-}day))$

Where:

[OHM]	The concentration of OHM being derived, in units of milligrams per kilogram soil (mg/kg)
RfD	The Reference Dose for the chemical, in units of milligrams contaminant per kilogram-day (mg/(kg x day))
RAF_{oral}	The Relative Absorption Factor applicable for oral soil exposures (dimensionless)
RAF_{dermal}	The Relative Absorption Factor applicable for dermal soil exposures (dimensionless)
C	Conversion factor (10+6 mg/kg)

Reference Doses (RfDs) for endosulfan sulfate and endrin ketone were not available from MassDEP or the USEPA Integrated Risk Information System. The Reference Doses (RfDs) for endosulfan sulfate were obtained from the USEPA Provisional Peer Reviewed Toxicity Values for Endosulfan Sulfate (USEPA, 2013). The provisional chronic RfD and provisional screening subchronic RfD were both obtained from this document. No toxicity information for endrin ketone was available from MassDEP, and the USEPA Provisional Peer Reviewed Toxicity Values for Endrin Ketone (USEPA, 2012) was referenced. USEPA noted that no toxicity data were available for endrin ketone to develop RfDs. Therefore, for the purposes of this M2RC, toxicity factors documented by MassDEP (MassDEP, 2014) for endrin were used to develop the Method 2 Standard for endrin ketone.

Relative absorption factors (RAFs) are factors used to adjust toxicity factors to reflect the absorption of OHM via Study Area exposures versus exposures in studies used to develop the toxicity factors. RAFs were selected from the reference that MassDEP used to identify RAFs in developing Method 1 Standards (OME, 2011). Because OHM-specific RAFs were not provided in the document for endosulfan sulfate or endrin ketone, default RAFs were selected for use. A default of 1 (100%) was used as the RAF_{oral}. A default value of 10% (or 0.1) was used as the RAF_{dermal}, per the recommendation for semi-volatile organic compounds (SVOCs) without substance-specific dermal absorption factors (OME, 2011). RfDs, RAFs, and [OHM] are provided in Table 3.

Step 3: Calculate a concentration of the oil and/or hazardous material (OHM) associated with an Excess Lifetime Cancer Risk equal to one-in-one million for each soil category

Step 3 calculates a concentration based upon cancer risk, and is only performed for OHM that are carcinogenic via the oral or dermal route of exposure. As described in the USEPA Provisional Peer Reviewed Toxicity Values for Endosulfan Sulfate (USEPA, 2013), endosulfan sulfate is "*Not Likely to be Carcinogenic to Humans*". There was inadequate data available to USEPA to develop a cancer descriptor for endrin ketone (USEPA, 2012); endrin is not assessed for carcinogenic potential as its weight of evidence characterization is Class D: *Not classifiable as to human carcinogenicity* (USEPA, 1989). Therefore, the Method 2 Standards considered non-cancer toxicity (derived in Step 2), but did not consider cancer risk.

As shown in Table 3, the Direct Contact Soil Standards derived in Step 2, above, are greater than background and were selected as the Method 2 Direct Contact Standards. Method 2 Standards also consider leaching potential; however, the leaching component of the soil standards can be modified or eliminated in Method 2 considering site-specific information. Generally, most pesticides adsorb to soil particles, become immobile, and do not leach to any significant degree. The Method 1 Soil Standards for the COCs with available Method 1 Standards equal Direct Contact Soil Standards, indicating that the pesticides are not anticipated to leach to a significant degree. Because leaching is not anticipated to be a significant transport pathway, Method 2 Soil Standards did not consider leaching potential, and equal the derived Method 2 Direct Contact Standards.

2.5 Exposure Point Concentrations

An Exposure Point Concentration (EPC) is the concentration of oil or hazardous material in a specific medium that a human or environmental receptor may contact at an Exposure Point. EPC development is described below, by medium.

2.5.1 Soil

Soil EPCs were calculated considering COCs in all soil samples, as pesticides were detected in all samples, and all samples are present in the shallowest 3 feet of soil.

The S-1 Exposure Point was identified as all impacted soil, which is present between 0 and 2 feet bgs. As shown in Table 4, EPCs were developed as the average soil concentration within the Exposure Point in accordance with the MCP (310 CMR 40.0926(3)(b)(1)). Specifically, for each COC, no data point used in the averaging is ten times greater than its Method 1 or Method 2

Standard, 75% of the data points used in the averaging procedure are less than the Method 1 or Method 2 Standard, and the arithmetic average is less than the Method 1 or Method 2 Standard.

A review of the Method 2 Standards noted that the endosulfan sulfate Method 2 S-3 Standard is lower than the Method 2 S-1 Standard. Therefore, the S-1 Exposure Point was also assessed using S-3 Standards. As shown in Table 5, EPCs were developed as the average soil concentration within the Exposure Point in accordance with the MCP (310 CMR 40.0926(3)(b)(1)). For all COCs, no data point used in the averaging is ten times greater than its Method 1 or Method 2 Standard, 75% of the data points used in the averaging procedure are less than the Method 1 or Method 2 Standard, and the arithmetic average is less than the Method 1 or Method 2 Standard.

2.6 Comparison to Method 2 Standards

To complete the M2RC, EPCs are compared to Method 2 Standards. For this M2RC, Method 1 Standards were used when available, and were supplemented with derived Method 2 Standards.

A condition of no significant risk of harm to human health, safety, public welfare, and the environment exists if no EPC is greater than the applicable MCP Method 1 or Method 2 Soil or Groundwater Standard (310 CMR 40.0988(2)). As shown in Tables 4 and 5, no soil EPC exceeds its applicable Method 2 Soil Standards. Therefore, a condition of no significant risk of harm to human health and public welfare exists at the Study Area.

3.0 STAGE I ENVIRONMENTAL SCREENING

A Method 3 Stage I Environmental Screening was completed in combination with the Method 2 Standards as pesticides were detected in the shallowest 2 feet of soil at the Study Area. A Stage I Environmental Screening (Stage I ES) involves a screening process, which identifies potentially significant exposure pathways and, if present, includes an effects-based screening. Collaborative Risk Solutions LLC did not complete a Study Area visit, and relied upon information provided by MMI regarding current conditions at the Study Area.

The closest open surface water body to the Study Area is a pond located approximately 500 feet northeast of the Study Area. In addition, wetlands are located south of the Study Area. Numerous certified vernal pools are located southeast of the Study Area, as shown in the attached Phase I Site Assessment Map.

Collaborative Risk Solutions understands from MMI that there is no visible evidence of current or potential exposure of Environmental Receptors to contamination from the surface soil to surface water, sediment, or wetlands, and that there is no record of current or past impacts of OHM from the Site on environmental receptors. No site conditions that represent "readily apparent harm" as described in the MCP (310 CMR 40.0995(3)(b)(1)) have been reported by MMI as present at the Study Area.

Potential aquatic exposures are evaluated to determine whether they could result in potentially significant exposure. Groundwater was not sampled at the Study Area, and COCs are not anticipated to be present in groundwater. Since groundwater is not anticipated to be impacted, contaminants are unlikely to be transported at significant concentrations to surface water, and the potential aquatic exposure is ruled out as a potentially significant exposure.

Potential terrestrial exposures may be evaluated considering site size and location characteristics adopted by MassDEP as screening criteria (MassDEP, 1996). A habitat quality evaluation determines the extent to which the Study Area is connected to other open land, and the potential for effects on areas of special concern. If no areas of special concern are affected and the impacted area is not sufficient to support a balanced terrestrial community, then the need for further assessment may be ruled out. The Study Area includes athletic fields which are developed and maintained. Landscaped and maintained athletic fields are not considered as habitat by MassDEP; therefore, the Study Area is not considered a terrestrial habitat. The Study Area is connected to open land. As reported by MMI, the perimeter of the Study Area is wooded with a closed canopy of trees. The uplands are contiguous with the field elevation for a short distance to the south, then a fairly steep hill descends approximately 3 feet into a palustrine forested wetland corridor, that parallels the south side of the athletic fields. Hydrology within this wetland would likely be categorized as seasonally flooded, as water likely persists in some areas through a portion of the growing season but is expected to dry by the end of the season. MMI noted some pooling area that may provide potential vernal pool habitat. Certified vernal pools are also present southeast of the Study Area. The potential for impacts to environmental receptors relies upon the potential transport of OHM from the Study Area to the woodland, wetland, and vernal pool habitats. According to MMI, overland transport/erosion of shallow soils into habitats is not considered a potential migration pathway based on surface topographic observations, vegetative growth that would prevent erosion, and surface water drainage patterns at the Study Area that are away from specialized habitats such as vernal pools. As described previously, leaching is not anticipated, and therefore groundwater movement is not anticipated to transport pesticides to surface water or vernal pool habitats.

The Study Area is not a terrestrial or avian habitat, and the Study Area is not identified as an Area of Critical Environmental Concern, a Natural Heritage Estimated Habitat of Rare Wildlife, or a Priority Habitat of Rare Species. No vernal pool, wetland, or wooded area is present at the Study Area. Based on the Stage I Environmental Screening, because contamination is limited to the Study Area and potential significant exposures were ruled out, a condition of No Significant Risk to the environment exists at the Study Area.

The risk of harm to the environment is also characterized by comparing the concentration of each COC to the Upper Concentration Limit in Soil and Groundwater, as described in 310 CMR 40.0996 (310 CMR 40.0995(5)). As shown in Table 5, average concentrations of constituents in soil are less than Upper Concentration Limits.

4.0 UNCERTAINTY ANALYSIS

Information is presented herein on the uncertainty associated with the risk characterization, including information gaps and steps taken to counter the gaps.

The risk characterization considered results from samples collected during March 2020 from numerous samples located throughout the Study Area. There is some uncertainty with the nature and extent of contamination, as samples were collected from shallow sampling points. However, concentrations generally decreased with depth, and samples collected between 18 and 24 inches below grade demonstrated a decrease in concentration from shallower samples. The uncertainty with respect to soil samples is not anticipated to be significant in terms of the M2RC, as the area of greatest human exposure was sampled. There is some uncertainty with potential concentrations within the edges of the Study Area that abut areas of potential environmental exposure.

Groundwater sampling was not conducted, and therefore, there is uncertainty with respect to potential groundwater impacts.

The Method 2 Soil Standards for endrin ketone relied upon endrin toxicity, as toxicity information specific to endrin ketone was not identified.

The uncertainties noted above for soil sampling result in uncertainties with respect to the environmental risk characterization. The Stage I Environmental Screening relies upon the assumption that only the Study Area is impacted, and that impacts have not been transported to additional habitats, such as vernal pools. If the Study Area impacts additional media such as sediment or surface water, the conclusions of the Stage I Environmental Screening may not be valid.

5.0 CHARACTERIZATION OF RISK TO SAFETY

An evaluation of the risk of harm to safety is completed to determine whether conditions at the Study Area related to a release of OHM may pose a threat of physical harm or bodily injury to people, and is conducted in combination with the M2RC (310 CMR 40.0981). Conditions at the Study Area are evaluated below with respect to each of these potential safety impacts:

- The presence of rusted or corroded drums or containers, open pits, lagoons or other dangerous structures;
- Any threat of fire or explosion, including the presence of explosive vapors resulting from a release of oil and/or hazardous material;
- Any uncontained materials which exhibit the characteristics of corrosivity, reactivity or flammability described at 310 CMR 40.0347; and,
- Conditions relative to applicable or suitably analogous safety standards.

Collaborative Risk Solutions LLC did not complete a Study Area visit. According to MMI, no dangerous structures were observed at the Study Area, and there is no threat of fire or explosion due to the presence of Study Area constituents. No uncontained corrosive, reactive or flammable materials are present relative to the presence of detected constituents. No applicable or suitably analogous safety standard was identified relative to the presence of COCs in at the Study Area. Based upon the information provided by MMI, a condition of No Significant Risk of harm to safety exists at the Study Area.

6.0 CONCLUSIONS

The M2RC conclusions are as follows:

1. A condition of No Significant Risk of harm to human health, public welfare, and the environment exists, as:
    a. No Soil Exposure Point Concentration is greater than its applicable Method 1 or Method 2 Soil Standard.
    b. Based on the high soil adsorption coefficient (Koc) values of the COCs, groundwater is not expected to be impacted; therefore, no Groundwater Exposure Point Concentration is greater than its applicable Method 1 or Method 2 Groundwater Standard.
    c. A Stage I Environmental Screening did not identify any potentially significant environmental exposure at the Study Area.
2. A condition of No Significant Risk of harm to safety exists at the Study Area (310 CMR 40.0960).

7.0 LIMITATIONS

The analysis and calculations provided in this report are based solely on the services provided pursuant to the proposal provided to MMI on March 24, 2020. Collaborative Risk Solutions LLC shall not be held liable for the existence of any condition, the discovery of which would have required the performance of services not expressly identified within the proposal.

This work is dependent upon the analytical data and information provided to Collaborative Risk Solutions LLC by MMI. Collaborative Risk Solutions LLC did not independently verify the accuracy or completeness of the data tables, information, or materials received from MMI during the performance of services, and Collaborative Risk Solutions LLC makes no warranty or guarantee of accuracy.

8.0 REFERENCES

Massachusetts Department of Environmental Protection (MassDEP) 1995. Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan, Interim Final Policy. WSC/ORS 95-141. July.

Massachusetts Department of Environmental Protection (MassDEP) 2002. Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil. Bureau of Waste Site Cleanup, Boston, MA. May 23.

Massachusetts Department of Environmental Protection (MassDEP) 2014. Numerical Standards Spreadsheets. Key spreadsheet: MCP GW2 alpha.xlsx.

Ontario Ministry of the Environment (OME) 2011. Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario. PIBS 7386e01. April 15.

United States Environmental Protection Agency (USEPA) 2012. Provisional Peer Reviewed Toxicity Values for Endrin Ketone (CASRN 53494-70-5). EPA/690/R-12/015F. Superfund Health Risk Technical Support Center. National Center for Environmental Assessment. Office of Research and Development. 7-12-2012.

United States Environmental Protection Agency (USEPA) 2013. Provisional Peer Reviewed Toxicity Values for Endosulfan Sulfate (CASRN 1031-07-8). EPA/690/R-13/011F. Superfund Health Risk Technical Support Center. National Center for Environmental Assessment. Office of Research and Development. 8-14-2013.

TABLES

TABLE 1
SITE SOIL DATA
703 Wolf Swamp Road, Longmeadow, MA

Sample ID	HA-1 (0 - 6 in)	HA-1 (6 - 12 in)	HA-2 (0 - 6 in)	HA-2 (6 - 12 in)	HA-2 (12 - 18 in)	HA-2 (18 - 24 in)	HA-3 (0 - 6 in)	HA-3 (6 - 12 in)	HA-4 (0 - 6 in)	HA-4 (6 - 12 in)	HA-5 (0 - 6 in)	HA-5 (6 - 12 in)	HA-6 (0 - 6 in)	HA-6 (6 -12 in)	HA-6 (12 -18 in)	HA-6 (18 -24 in)	HA-7 (0 - 6 in)	HA-7 (6 - 12 in)	HA-7 (12 - 18 in)	HA-7 (18 - 24 in)	HA-8 (0 - 6 in)
Date	3/12/20	3/12/20	3/12/20	3/12/20	3/26/20	3/26/20	3/12/20	3/12/20	3/12/20	3/12/20	3/12/20	3/12/20	3/12/20	3/12/20	3/26/20	3/26/20	3/12/20	3/12/20	3/26/20	3/26/20	3/12/20
Total Metals (mg/kg)																					
Total Arsenic	6	9.2	4.8	10	--	--	5.1	5.5	3.7	3.4	5.5	5.1	14	14	--	--	10	10	--	--	12
Total Lead	13	11	35	15	--	--	11	12	28	23	11	11	17	14	--	--	13	15	--	--	11
Pesticides (mg/kg)																					
4,4-DDD	ND<0.0012	ND<0.0012	ND<0.0011	ND<0.0011	ND<0.0012	ND<0.0012	ND<0.0012	ND<0.0012	0.018	0.035	ND<0.0012	ND<0.0012	ND<0.0012	ND<0.0012	0.0043	ND<0.0011	ND<0.0012	ND<0.0012	ND<0.0011	ND<0.0010	ND<0.0012
4,4-DDE	0.54	0.97	0.13	0.7	0.25	0.046	0.57	0.59	0.12	0.15	0.28	0.59	1.2	1	0.17	0.0079	0.92	0.88	0.37	0.059	0.64
4,4-DDT	0.5	1.6	0.14	1.1	0.47	0.086	0.68	0.78	0.088	0.093	0.27	0.83	1.3	1.2	0.41	0.01	1	1.2	0.61	0.084	0.74
4,4-Methoxychlor	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
alachlor	ND<0.059	ND<0.059	ND<0.056	ND<0.057	ND<0.061	ND<0.060	ND<0.060	ND<0.059	ND<0.060	ND<0.058	ND<0.062	ND<0.061	ND<0.060	ND<0.060	ND<0.058	ND<0.056	ND<0.061	ND<0.060	ND<0.057	ND<0.052	ND<0.061
Aldrin	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
alpha-BHC	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
beta-BHC	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
Chlordane	ND<0.035	ND<0.036	ND<0.034	ND<0.034	ND<0.037	ND<0.036	ND<0.036	ND<0.035	ND<0.036	ND<0.035	ND<0.037	ND<0.036	ND<0.036	ND<0.036	ND<0.035	ND<0.034	ND<0.037	ND<0.036	ND<0.034	ND<0.031	ND<0.037
Delta-BHC	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
Dieldrin	0.031	0.069	0.019	0.089	0.029	0.0058	0.044	0.046	0.015	0.02	0.02	0.052	0.1	0.086	0.018	ND<0.0011	0.071	0.084	0.046	0.0076	0.055
Endosulfan I	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
Endosulfan II	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
Endosulfan sulfate	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	0.019	0.017	ND<0.0058	ND<0.0056	0.02	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
Endrin	0.02	0.074	0.012	0.085	ND<0.0061	ND<0.0060	0.025	0.028	ND<0.0060	ND<0.0058	0.0092	0.032	0.043	0.04	ND<0.0058	ND<0.0056	0.05	0.059	0.024	ND<0.0052	0.025
Endrin aldehyde	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
Endrin ketone	ND<0.0059	0.0	ND<0.0056	0.023	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	0.012	0.011	ND<0.0058	ND<0.0056	0.015	0.021	0.0073	ND<0.0052	ND<0.0061
Gamma-BHC	ND<0.0059	ND<0.0059	ND<0.0056	ND<0.0057	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0059	ND<0.0060	ND<0.0058	ND<0.0062	ND<0.0061	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
Heptachlor	ND<0.0059	0.0	ND<0.0056	0.0061	ND<0.0061	ND<0.0060	0.007	0.0078	ND<0.0060	ND<0.0058	ND<0.0062	0.0076	ND<0.0060	ND<0.0060	ND<0.0058	ND<0.0056	ND<0.0061	ND<0.0060	ND<0.0057	ND<0.0052	ND<0.0061
Heptachlor epoxide	0.029	0.1	0.033	0.084	0.035	0.0074	0.071	0.08	ND<0.0060	ND<0.0058	0.023	0.075	0.072	0.06	0.013	ND<0.0056	0.039	0.044	0.037	0.0067	0.057
Toxaphene	ND<0.12	ND<0.12	ND<0.11	ND<0.11	ND<0.12	ND<0.12	ND<0.12	ND<0.12	ND<0.12	ND<0.12	ND<0.12	ND<0.12	ND<0.12	ND<0.12	ND<0.12	ND<0.11	ND<0.12	ND<0.12	ND<0.11	ND<0.10	ND<0.12
Herbicides by EPA Method 8151A (mg/kg)																					
2,4,5-Trichlorophenoxyacetic acid (2,4,5	--	--	ND<0.023	ND<0.023	--	--	--	--	ND<0.024	ND<0.024	--	--	ND<0.024	ND<0.024	--	--	--	--	--	--	ND<0.025
2,4-D	--	--	ND<0.11	ND<0.12	--	--	--	--	ND<0.12	ND<0.12	--	--	ND<0.12	ND<0.12	--	--	--	--	--	--	ND<0.12
2,4-DB	--	--	ND<0.23	ND<0.23	--	--	--	--	ND<0.24	ND<0.24	--	--	ND<0.24	ND<0.24	--	--	--	--	--	--	ND<0.25
3,5-Dichlorobenzoic acid	--	--	ND<0.023	ND<0.023	--	--	--	--	ND<0.024	ND<0.024	--	--	ND<0.024	ND<0.024	--	--	--	--	--	--	ND<0.025
dalapon	--	--	ND<0.57	ND<0.58	--	--	--	--	ND<0.60	ND<0.59	--	--	ND<0.61	ND<0.61	--	--	--	--	--	--	ND<0.62
dicamba	--	--	ND<0.023	ND<0.023	--	--	--	--	ND<0.024	ND<0.024	--	--	ND<0.024	ND<0.024	--	--	--	--	--	--	ND<0.025
dichloroprop	--	--	ND<0.11	ND<0.12	--	--	--	--	ND<0.12	ND<0.12	--	--	ND<0.12	ND<0.12	--	--	--	--	--	--	ND<0.12
Dinoseb	--	--	ND<0.023	ND<0.023	--	--	--	--	ND<0.024	ND<0.024	--	--	ND<0.024	ND<0.024	--	--	--	--	--	--	ND<0.025
Picloram	--	--	ND<0.023	ND<0.023	--	--	--	--	ND<0.024	ND<0.024	--	--	ND<0.024	ND<0.024	--	--	--	--	--	--	ND<0.025
Silvex	--	--	ND<0.023	ND<0.023	--	--	--	--	ND<0.024	ND<0.024	--	--	ND<0.024	ND<0.024	--	--	--	--	--	--	ND<0.025
4-Nitrophenol	--	--	ND<0.11	ND<0.12	--	--	--	--	ND<0.12	ND<0.12	--	--	ND<0.12	ND<0.12	--	--	--	--	--	--	ND<0.12
pentachlorophenol	--	--	ND<0.029	ND<0.029	--	--	--	--	ND<0.030	ND<0.030	--	--	ND<0.031	ND<0.030	--	--	--	--	--	--	ND<0.031

Notes:
1. Values reported in milligrams per kilogram (mg/kg)
2. < = Not detected at the detection limit shown
3. Soil data were provided electronically by Milone & MacBroom, who notes that in the event that a sample was rerun at a dilution and the resulting concentration was higher than the original result, the higher of the two concentrations was reported.

TABLE 1
SITE SOIL DATA
703 Wolf Swamp Road, Longmeadow, MA

Sample ID	HA-8 (6 - 12 in)	HA-8 (12 - 18 in)	HA-8 (18 - 24 in)
Date	3/12/20	3/26/20	3/26/20
Total Metals (mg/kg)			
Total Arsenic	12	--	--
Total Lead	12	--	--
Pesticides (mg/kg)			
4,4-DDD	ND<0.0012	ND<0.0012	ND<0.0011
4,4-DDE	0.91	0.041	0.0083
4,4-DDT	1.5	0.074	0.011
4,4-Methoxychlor	ND<0.0059	ND<0.0058	ND<0.0056
alachlor	ND<0.059	ND<0.058	ND<0.056
Aldrin	ND<0.0059	ND<0.0058	ND<0.0056
alpha-BHC	ND<0.0059	ND<0.0058	ND<0.0056
beta-BHC	ND<0.0059	ND<0.0058	ND<0.0056
Chlordane	ND<0.036	ND<0.035	ND<0.033
Delta-BHC	ND<0.0059	ND<0.0058	ND<0.0056
Dieldrin	0.09	0.0049	ND<0.0011
Endosulfan I	ND<0.0059	ND<0.0058	ND<0.0056
Endosulfan II	ND<0.0059	ND<0.0058	ND<0.0056
Endosulfan sulfate	ND<0.0059	ND<0.0058	ND<0.0056
Endrin	0.059	ND<0.0058	ND<0.0056
Endrin aldehyde	ND<0.0059	ND<0.0058	ND<0.0056
Endrin ketone	0.016	ND<0.0058	ND<0.0056
Gamma-BHC	ND<0.0059	ND<0.0058	ND<0.0056
Heptachlor	0.0065	ND<0.0058	ND<0.0056
Heptachlor epoxide	0.1	ND<0.0058	ND<0.0056
Toxaphene	ND<0.12	ND<0.12	ND<0.11
Herbicides by EPA Method 8151A (mg			
2,4,5-Trichlorophenoxyacetic acid (2,4,5	ND<0.024	--	--
2,4-D	ND<0.12	--	--
2,4-DB	ND<0.24	--	--
3,5-Dichlorobenzoic acid	ND<0.024	--	--
dalapon	ND<0.60	--	--
dicamba	ND<0.024	--	--
dichloroprop	ND<0.12	--	--
Dinoseb	ND<0.024	--	--
Picloram	ND<0.024	--	--
Silvex	ND<0.024	--	--
4-Nitrophenol	ND<0.12	--	--
pentachlorophenol	ND<0.030	--	--

TABLE 2
SOIL SUMMARY AND SELECTION OF CONTAMINANTS OF CONCERN
703 Wolf Swamp Road, Longmeadow, MA

Analyte	Number Detected	Number Analyzed	Frequency of Detection	Minimum Detected Concentration	Average Concentration	Maximum Detected Concentration	MassDEP Natural Background Concentration	Selected as a Contaminant of Concern
Metals (mg/kg)								
Total Arsenic	16	16	100%	3.4	8.1	14	20	
Total Lead	16	16	100%	11	16	35	200	
Pesticides (mg/kg)								
4,4-DDD	3	24	13%	0.0043	0.0029	0.035		X
4,4-DDE	24	24	100%	0.0079	0.46	1.2		X
4,4-DDT	24	24	100%	0.010	0.62	1.6		X
Dieldrin	22	24	92%	0.0049	0.042	0.1		X
Endosulfan sulfate	3	24	13%	0.017	0.005	0.02		X
Endrin	15	24	63%	0.0092	0.025	0.085		X
Endrin ketone	8	24	33%	0.0073	0.0074	0.025		X
Heptachlor	6	24	25%	0.0061	0.0040	0.0078		X
Heptachlor epoxide	19	24	79%	0.0067	0.040	0.1		X

Notes:

1. All values reported in mg/kg = milligrams per kilogram

2. For the purposes of statistical analysis, average concentrations were calculated using one-half of the detection limit as a surrogate value if a contaminant was not detected in a sample.

3. MassDEP natural background soil concentrations were obtained from MassDEP Technical Update: Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil. Office of Research and Standards, May 2002. The lead background conentration was updated in 2014. If blank, no background value is available.

4. X = Selected as a Contaminant of Concern (COC). Analytes without a listed natural background concentration and analytes present at a concentration greater than natural background were selected as COCs.

TABLE 3
METHOD 2 SOIL STANDARDS DERIVATION
703 Wolf Swamp Road, Longmeadow, MA

Contaminant of Concern	$RfD_{chronic}$ (mg/kg-day)	$RfD_{subchronic}$ (mg/kg-day)	RAF_{oral} (unitless)	RAF_{dermal} (unitless)	Conversion Factor (C) (mg/kg)	S-1 Direct Contact Soil Standard (mg/kg)	S-2 Direct Contact Soil Standard (mg/kg)	S-3 Direct Contact Soil Standard (mg/kg)	MassDEP Concentration in "Natural" Soil (mg/kg)
Pesticides									
Endosulfan sulfate	6.00E-03	3.00E-03	1	0.1	1E+06	3E+02	4E+03	2E+02	Not available
Endrin ketone	3.00E-04	3.00E-04	1	0.1	1E+06	1E+01	2E+02	2E+01	Not available

Notes:

1. The Reference Doses (RfDs) for endosulfan suflate equals the provisional chronic RfD and provisional screening subchronic RfD provided in Provisional Peer Reviewed Toxicity Values for Endosulfan Sulfate, Superfund Health Risk Technical Support Center, August 2013. The RfDs for endrin ketone equal the MassDEP values for endrin (MassDEP, 2014).
2. Oral and dermal relative absorption factors (RAFs) are default values for SVOCs, based upon the Ontario Ministry of the Environment's 2011 Report: Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario. PIBS 7386e01, April 15, 2011.
3. S-1 Direct Contact Soil Standard: the concentration of the oil and/or hazardous material was derived using the following equation:
$[OHM]_{S-1} = (RfD_{chronic} \times 0.2 \times C)/((RAF_{oral} \times 2.4) + (RAF_{dermal} \times 21))$.
4. S-2 Direct Contact Soil Standard: the concentration of the oil and/or hazardous material is derived using the following equation:
$[OHM]_{S-2} = (RfD_{chronic} \times 0.2 \times C)/((RAF_{oral} \times 0.27) + (RAF_{dermal} \times 0.49))$.
5. S-3 Direct Contact Soil Standard: the concentration of the oil and/or hazardous material is derived using the following equation:
$[OHM]_{S-3} = (RfD_{subchronic} \times 0.2 \times C)/((RAF_{oral} \times 1.2) + (RAF_{dermal} \times 13))$.
6. The background endosulfan sulfate and endrin ketone values were assumed to be non detect.
7. mg/kg = milligram per kilogram

TABLE 4
METHOD 2 EPC SELECTION AND STANDARD COMPARISON – S-1 EXPOSURE POINT
703 Wolf Swamp Road, Longmeadow, MA

Contaminant of Concern	Method 2 Direct Contact Standards S-1	Maximum	Maximum Exceeds 10X the Lowest Standard?	75th Percentile	75th Percentile Exceeds the Lowest Standard?	Exposure Point Concentration (EPC)	EPC Exceeds the Lowest Standard?
Pesticides (mg/kg)							
4,4-DDD	8	0.035	No	0.0006	No	0.0029	No
4,4-DDE	6	1.2	No	0.75	No	0.46	No
4,4-DDT	6	1.6	No	1.0	No	0.62	No
Dieldrin	0.08	0.10	No	0.07	No	0.042	No
Endosulfan sulfate	300	0.020	No	0.0031	No	0.0049	No
Endrin	10	0.085	No	0.041	No	0.025	No
Endrin ketone	10	0.025	No	0.011	No	0.0074	No
Heptachlor	0.30	0.0078	No	0.0039	No	0.0040	No
Heptachlor epoxide	0.10	0.10	No	0.071	No	0.040	No

Notes:

1. Method 2 Standards equal Method 1 Standards, when available. Method 2 Standards were derived for endosulfan sulfate and endrin ketone, as shown in Table 3.
2. All soil samples were included in the Exposure Point. Statistics considered one-half of the detection limit for non-detect samples. The EPC equals the arithmetic average concentration, in accordance with the MCP (310 CMR 40.0926(3)(b)(1)).

TABLE 5
METHOD 2 EPC SELECTION AND STANDARD COMPARISON – S-3 EXPOSURE POINT
703 Wolf Swamp Road, Longmeadow, MA

Contaminant of Concern	Method 2 Direct Contact Standards S-3	Maximum	Maximum Exceeds 10X the Lowest Standard?	75th Percentile	75th Percentile Exceeds the Lowest Standard?	Exposure Point Concentration (EPC)	EPC Exceeds the Lowest Standard?
Pesticides (mg/kg)							
4,4-DDD	60	0.035	No	0.00060	No	0.0029	No
4,4-DDE	60	1.2	No	0.75	No	0.46	No
4,4-DDT	60	1.6	No	1.0	No	0.62	No
Dieldrin	3	0.10	No	0.07	No	0.042	No
Endosulfan sulfate	20	0.020	No	0.0031	No	0.0049	No
Endrin	20	0.085	No	0.041	No	0.025	No
Endrin ketone	20	0.025	No	0.011	No	0.0074	No
Heptachlor	10	0.0078	No	0.0039	No	0.0040	No
Heptachlor epoxide	1	0.10	No	0.071	No	0.040	No

Notes:

1. Method 2 Standards equal Method 1 Standards, when available. Method 2 Standards were derived for endosulfan sulfate and endrin ketone, as shown in Table 3.
2. All soil samples were included in the Exposure Point. Statistics considered one-half of the detection limit for non-detect samples. The EPC equals the arithmetic average concentration, in accordance with the MCP (310 CMR 40.0926(3)(b)(1)).

TABLE 6
SOIL COMPARISON TO UPPER CONCENTRATION LIMITS
703 Wolf Swamp Road, Longmeadow, MA

Analyte	Average Concentration in Soil	Soil Upper Concentration Limit
Metals (mg/kg)		
Total Arsenic	8.1	500
Total Lead	15.8	6,000
Pesticides (mg/kg)		
4,4-DDD	0.0029	600
4,4-DDE	0.46	600
4,4-DDT	0.62	600
Dieldrin	0.042	30
Endosulfan sulfate	0.0049	1,000
Endrin	0.025	200
Endrin ketone	0.0074	1,000
Heptachlor	0.0040	100
Heptachlor epoxide	0.040	10

Notes:
1. All soil values reported in milligrams per kilogram.
2. The average soil concentration was calculated using one-half of the detection limit as a surrogate value if a contaminant was not detected in a sample.
3. Upper Concentration Limits were obtained at 310 CMR 40.0996.
4. Only constituents detected at least once are shown in the above table.

FIGURE