PETROLEUM MANAGEMENT, INC.

Environmental Services Division

2138 Priest Bridge Ct., Suite 200 ♦ Crofton, Maryland 21114
Phone: (410) 354-0200 ♦ Fax: (410) 721-1390

April 23, 2019

Maryland Department of the Environment
Oil Control Program
Attn: Susan Bull
1800 Washington Blvd., Suite 620
Baltimore, MD 21230

RE: Limited Subsurface Investigation
Wiley H. Bates Middle School
701 Chase Street, Annapolis
Facility ID# 3200

Proposed Corrective Action Plan

Dear Ms. Bull,

Based on the information collected and presented in the Limited Subsurface Investigation Report dated April 22, 2019 for the above referenced site, Petroleum Management, Inc. (PMI) is pleased to submit the following proposed Corrective Action Plan for the Wiley H. Bates Middle School. Considering the localized Liquid Phase Hydrocarbon (LPH) accumulations at the NW exterior of the boiler room and its subsequent migration into adjacent storm drain piping, PMI is suggesting the installation of four (4) 4" recovery wells at the previous boring locations exhibiting or most likely to accumulate LPH to serve as a means to intercept LPH prior to storm drain entry, provide for vacuum recovery, and serve as future monitoring and sampling locations. The Plan will also provide for installation of six (6) additional 4" monitoring wells in the perimeter area of identified residual and dissolved phase contamination to serve as monitoring and sampling locations to document a declining dissolved phase contamination trend as source LPH is removed or identify any LPH migration should it occur.

Once all 4" recovery and monitoring wells are installed and developed, PMI proposes that a schedule of Enhanced Fluid Recovery (EFR) events, utilizing a vacuum truck, commence immediately and at least weekly to begin recovery of LPH from the exterior subgrade. Details of well construction, EFR events, well gauging, purging and sampling are as follows:

Well Installation & Construction

PMI will contract a MD Licensed Well Driller to obtain all necessary installation permits and provide all necessary equipment and materials required to complete installation of 4" recovery and monitoring wells per MDE design specifications (specs attached). Well installation will be completed using hollow-stem auger methods utilizing a CME-55 style rig or equipment of equivalent specifications. With groundwater depths in the target area previously gauged at 12-17 feet below the surface, each recovery and monitoring well will be completed to a minimum depth of 30-feet deep with 25-feet of slotted casing extending from the bottom to w/in 5-feet of the surface. 5-feet of solid casing will extend to the ground surface with a locking cap and flush-mount manhole cover installed to protect the installation. All well installation tooling will be decontaminated following use with all rinsate recovered in drum for disposal. All soil recovered from the well installations will be containerized in drums for disposal.

Previously completed soil borings B-15, B-17 and B-18 have been gauged on several occasions and have accumulated significant liquid phase hydrocarbons (4-19") at approximately 14-14.5 feet below the surface. Soil boring B-16, completed in the same area between B-15 and B-17, encountered refusal at the concrete pad of former USTs at 14-feet below the surface, prior to groundwater interface. Considering its location and with LPH identified in the immediate area, it is expected that LPH will be accumulated at this location as well once depth exceeds the existing concrete at 14-feet and groundwater is encountered. It is proposed that previous boring locations B-15, B-16, B-17 and B-18 be completed as 4" recovery wells to eliminate LPH accumulations using the EFR method. Once LPH is eliminated over time, these wells can serve as groundwater monitoring and sampling locations to document dissolved phase contamination trends. These proposed well locations will be re-designated at MW-1, MW-2, MW-3 and MW-4 upon completion.

Review of dissolved phase contamination data accumulated from soil borings previously completed as part of the Limited Subsurface Investigation for this site, it was determined that the extent of groundwater contamination exists in the exterior perimeter of completed borings B-14, B-19, B-20 and B-22. With contaminated soil confirmed at boring B-23 at or below the surrounding groundwater depths, it is likely that dissolved phase impact will exist at this extent as well and would serve as a useful monitoring well location. Information from soil boring B-24 has indicated that there is no LPH, dissolved phase or residual phase contamination along this exterior wall of the boiler room. A groundwater monitoring well at this location will provide confirmation that LPH and dissolved phase contamination remains isolated to the NW corner of the boiler room as previously identified. It is proposed that previous boring locations B-14, B-19, B-20, B-22, B-23 and B-24 be completed as 4" groundwater monitoring wells to serve as groundwater sampling locations to document dissolved phase contamination trends as the LPH source is reduced and eliminated. These proposed well locations will be re-designated at MW-5, MW-6, MW-7, MW-8, MW-9 and MW-10 upon completion.

Proposed LPH recovery and groundwater monitoring well locations are depicted on the attached Site Plan.

Enhanced Fluid Recovery (EFR)

The target well locations for the initial EFR event will be the areas of previously identified LPH accumulations at borings B-15 (MW-1), B-17 (MW-3) and B-18 (MW-4) as well as boring B-16 (MW-2) should LPH accumulate following well completion. Subsequent EFR events will include all wells that display measurable amounts of LPH during preliminary gauging. Prior to each scheduled EFR event, all monitoring wells in the target area (including all wells with no prior LPH accumulation) will be gauged with an oil/water interface probe to determine LPH existence and thickness.

During each EFR event, all wells subject to EFR will be connected to an extraction tube (stinger) that will extend no further than 12" below the LPH layer with the stinger attachment made to the top of the well casing with an air-tight seal. Each targeted EFR well will be manifolded to a vacuum truck line that will subject each well with sufficient vacuum to pull the LPH layer from the water surface. Each EFR attachment will have a clear sight-glass and valve to observe and adjust the recovery rate. Duration of each EFR event will be 2 continuous hours. Upon completion of the EFR event, the tank on the vacuum truck will be left undisturbed for 1-hour to allow for phase separation of the oil/water mixture. After this settling and separation period, the tank will be gauged with an oil/water interface probe to determine the recovered LPH thickness and then converted to gallons using the tank's calibration chart.

EFR events will continue on a weekly basis as long as any of the target wells continue to accumulate LPH. As LPH is eliminated from each of the target wells over time, these wells will be considered groundwater monitoring wells and will fall into the schedule of quarterly monitoring and sampling to document dissolved phase contamination trends in the impacted area. Following each EFR event, a gauging table and

completion report detailing the event and amount of LPH and water recovered will be completed for submittal to MDE.

Well Sampling & Groundwater Analysis

In the absence of any LPH accumulation, all monitoring wells completed in the identified dissolved phase impact area (MW-5, MW-6, MW-7, MW-8, MW-9, MW-10 and eventually MW-1, MW-2, MW-3 and MW-4) will be gauged, purged and sampled for groundwater analysis on a quarterly basis (every 3-months). Each groundwater sample retained will be submitted for laboratory analysis of TPH-DRO and TPH-GRO (EPA method 8015) and Total VOC (EPA method 8260). Following each quarterly sampling event, a completion report and summary of current and prior analysis results will be prepared for submittal to MDE.

LPH Mitigation at Storm Drain Outfall to Spa Creek

PMI has suggested that Anne Arundel County Public Schools (AACPS) continue to have Miller Environmental deploy, monitor and replace absorbent materials at the storm drain outfall to Spa Creek. It has also been suggested that absorbent materials be placed inside the storm drain piping upstream of manhole/Inlet No. 4 closer to the identified source area of LPH around the boiler room exterior. With absorbents in place closer to the source of LPH and with recovery wells and EFR events completed, it has also been suggested that a second "flush" of the down-gradient storm drain piping be completed to remove any residual or lingering LPH from the storm drain channel.

Target Remedial Endpoint

In addition to eliminating any further LPH migration to the storm drain outfall to Spa Creek, once LPH accumulations are eliminated at all MW locations and a declining trend of dissolved phase parameter concentrations can be documented for four (4) consecutive sampling quarters, a request will be made to MDE to review the case for closure.

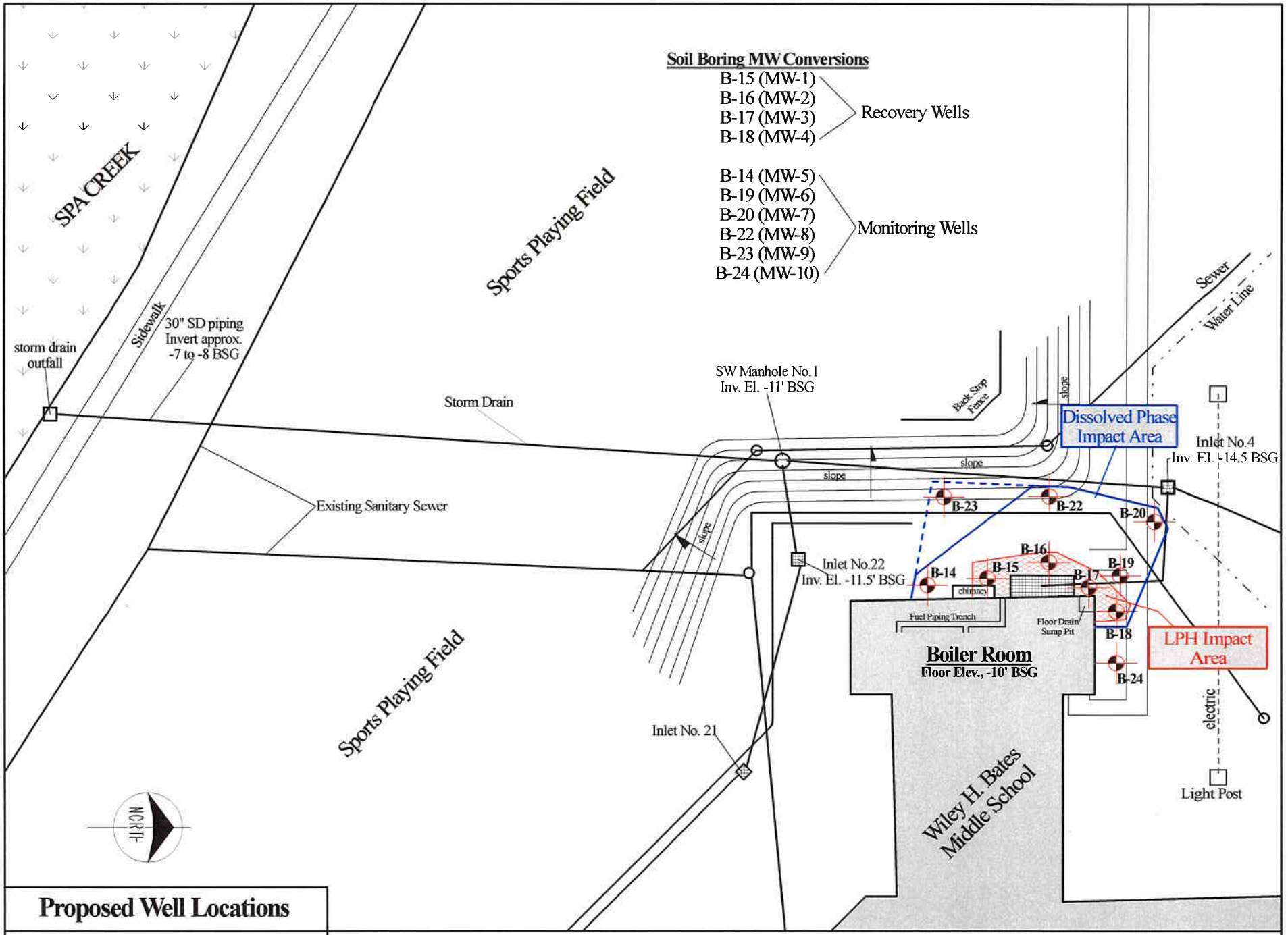
Field activities can be scheduled w/in 30 days of Work Plan approval pending favorable weather conditions and issuance of County Health Department well permits. Arrangements will be made to allow equipment access as necessary and to minimize damage and restoration of the target area. Please review this scope of work for acceptance by the Administration. If there are any questions or concerns in regards to this scope, please contact the project manager to discuss or make any appropriate changes.

Thank you for your attention to this case.

W. Scott Alexander
Environmental Projects Manager

Enc.

cc: *Mr. Christopher Williams*
Environmental Issues Program Manager
Anne Arundel County Public Schools
9034 Fort Smallwood Rd.
Pasadena, MD 21122



Proposed Well Locations

Petroleum Management, Inc.
5218 Curtis Avenue
Curtis Bay, MD 21226
410-354-0200

Job Name:	Wiley H. Bates Middle School - Corrective Action Plan
Location:	701 Chase Street, Annapolis, MD 21401
Drawn By: WSA	**Scale:** 1" = 50' **Date:** 04/23/2019

Appendix (C)

Oil Control Program
Summary of Specifications for the Design and Installation of Groundwater Monitoring Wells

- A Maryland-licensed well driller, in accordance with pertinent State and local laws and regulations, must install all wells. The Waste Management Administration's Oil Control Program (OCP) has final approval of the proposed location and design of each well.

- All monitoring well casings and screens must be constructed of 4-inch, inner-diameter pipe composed of Schedule 40 Polyvinyl chloride (PVC), Teflon (PFE), or stainless steel joined using threaded couplings. NO SOLVENTS, GLUES, OR LUBRICANTS SHALL BE USED IN THE CONSTRUCTION OF THE WELL.

- The monitoring well must be constructed with screen with a minimum slot size of 0.02 inch and a maximum slot size of 0.025 inch. The screen must be placed at least 10 feet below the detected water table, and 10 feet above the water table, at a minimum. In some cases, for shallow water table conditions, the (10 feet above the water table) requirement cannot be met. In this instance, the screen may be extended to within 2 feet of the ground surface to allow for a proper surface seal. For deeper wells and/or when the exact water table is not certain, additional screen lengths may be necessary. Drilling contractors should be prepared with appropriate amounts of screen and materials at the job site to deal with unforeseen requirements.

- The diameter of the boring must exceed the diameter of the well by at least 4 inches (e.g., a 4-inch well must be installed in a hole at least 8 inches in diameter).

- The annular space of all wells shall be packed with #2 Moiré Sand to at least 2 feet above the well screen. At least 2 feet of bentonite pellets must be placed above the sand. In cases where the groundwater is shallow (0 to 3 feet below grade), it is not possible to place 2 feet of the sand above the screen, and 2 feet of bentonite. In these situations, and only these, no less than 6 inches of each must be placed in the well.

- The annular space above the bentonite must be grouted with Portland cement or Portland cement/bentonite slurry to the top of the well, or the bottom of the vault.

- The well must be protected from damage by an outer vault, usually a 12-inch x 6-inch or 12-inch x 12-inch steel manhole.

- A locking, watertight cap must seal the well.

- All wells must be properly developed. Any water produced from a monitoring well must be properly treated prior to discharge.

- All wells must be properly tagged with the well permit number clearly visible.

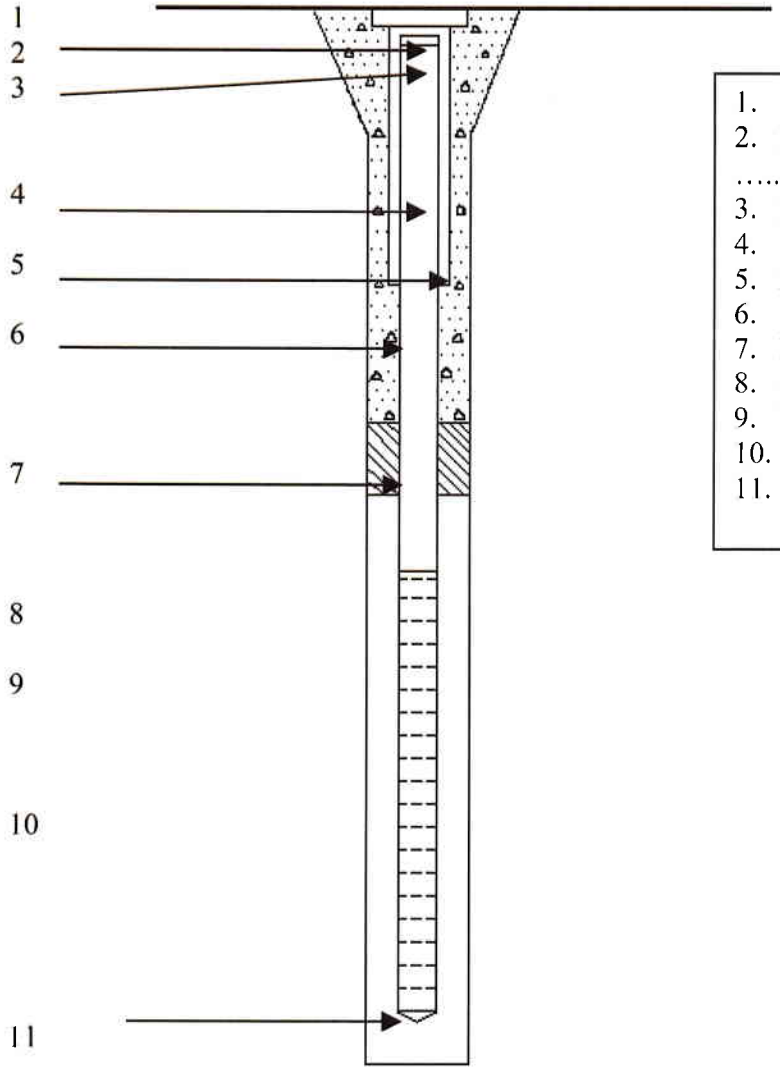
- Well completion reports must be fully completed for each well installed, and a copy of the well completion report forms must be submitted to the OCP within 30 days of the well installation.

- The OCP must be notified at least 3 working days prior to any drilling.

- Any changes to the construction of the wells must be approved in writing from the OCP prior to implementation of the changes in construction.

- Any wells that are to be abandoned must be abandoned in accordance to regulation COMAR 26.04.04.11. Casing must be removed if possible, and the entire well and gravel pack must be completely filled with Portland cement grout from the base of the former boring to the ground surface.

- The authority for the above is COMAR 26.04.04.07M(6), "Observations Wells." The Approving Authority may specify special construction standards for wells installed for the sole purpose of monitoring water quality or water levels.



1. Ground Surface
2. Flush Mount Steel Cap
…..Labeled "Do not fill"
3. Locking Cap
4. Steel Casing
5. Four inch PVC
6. Grout
7. Bentonite Seal
8. Sand Pack
9. Well Screen
10. Water Table
11. End Cap

Typical Monitoring Well Design