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PLAN OF ACTION FIELD PROGRAM TO DETERMINE THE PRESENCE OF  
HYDROCARBONS IN THE SUBSURFACE AT TRUMBO POINT ANNEX NAS KEY WEST FL  
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GERAGHTY AND MILLER INC

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PLAN-OF-ACTION

FIELD PROGRAM TO DETERMINE THE PRESENCE  
OF HYDROCARBONS IN THE SUBSURFACE  
AT TRUMBO POINT ANNEX,  
NAVAL AIR STATION,  
KEY WEST, FLORIDA

Prepared for

DEPARTMENT OF THE NAVY  
SOUTHERN DIVISION  
Naval Facilities Engineering Command

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INTRODUCTION

This plan-of-action has been prepared in response to a request by the FDER (Florida Department of Environmental Regulation) to enter Navy property to investigate the possibility of a petroleum hydrocarbon leak from the bulk fuel storage facility at Trumbo Point Annex, Naval Air Station, Key West, Florida. The FDER became concerned about this site when hydrocarbons were detected in recovery wells installed at a Chevron terminal nearby. These hydrocarbons were not handled or stored by Chevron and the FDER has assumed that these hydrocarbons originated from an off-site source. The Navy's fuel storage facility is located approximately 970 ft (feet) north of the Chevron terminal and adjacent to City Electric which also stores fuel oil (see Figure 1). The Navy indicated to the FDER that they would conduct their own investigation into the presence or absence of hydrocarbons at their bulk site.

On January 25, 1985, a representative from Geraghty & Miller, Inc., (G&M) conducted a site visit to inspect the storage facility at Trumbo Point Annex. During the visit, background information of the facility was obtained including a copy of the final report for the hydrogeologic investigation conducted at the Chevron facility. Also, a report entitled, "Engineering Survey of Condition of POL Pipelines from Trumbo Point Annex to Truman Annex, Key West, Florida", was obtained. This survey was submitted in January

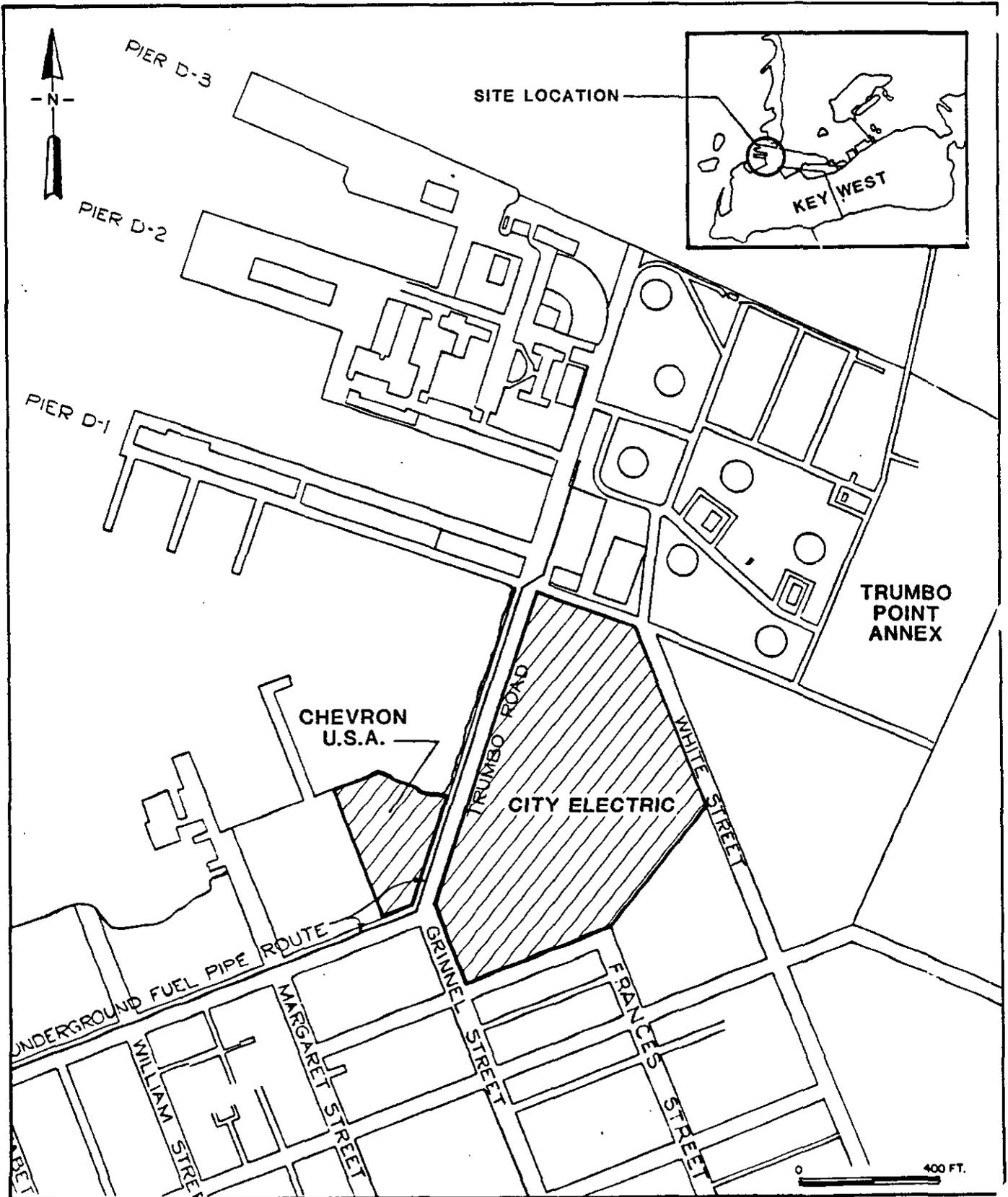


Figure 1. Location Map Showing Trumbo Point Annex Fuel Facility and Underground Fuel Pipeline.

1983 by NDE Technology, Inc., and states that, "Overall, the inspection/survey results indicate that the POL lines, 10-inch fuel oil and 8-inch diesel oil lines, from Trumbo Point Annex to Pump Station No. 54 at Truman Annex are in acceptable condition." The location of the underground fuel pipe is also shown in Figure 1.

Based on this information, this field program is proposed to determine the presence or absence of hydrocarbons in the subsurface, the program will be divided into three (3) tasks in order to evaluate the present situation within the Navy's property at Trumbo Point Annex. Task 1 will include a review of existing data and preparation of technical specifications and contract documents for the field investigation; Task 2 is the field investigation in which site-specific hydrogeologic information will be collected; and Task 3 will consist of data analysis to assist in predicting potential environmental impacts, presence of any contaminant migration pathways and design of abatement alternatives consistent with applicable federal and state regulations.

## DESCRIPTION OF THE PROBLEM

### Basic Considerations

The assessment will center upon the detection of petroleum hydrocarbons not native to the shallow ground waters in Key West, Florida. Because these hydrocarbons are

immiscible with water, a different approach than the more conventional ground-water contamination cases will be required to determine the extent of contamination.

When dealing with immiscible fluids such as diesel, the detection methodology is somewhat different because an immiscible fluid is either present or absent at a given location. Essentially, the hydrocarbon will occur as a discrete body on top of the local ground-water system. It is therefore entirely possible that the movement of the subsurface oil slick can be somewhat different than the movement of the local ground-water system. Thus, obtaining information on local ground-water flow systems most likely will only partially aid in predicting the extent, direction, and rate of movement of the subsurface oil slick.

The approach used in determining the extent of hydrocarbons in the subsurface is to drill boreholes to just below the water table. Continuous split-spoon samples of the sediments are collected and are analyzed visually, by smell or with ultraviolet light (hydrocarbon fluorescence), for the presence of hydrocarbons.

#### Location of the Hydrocarbon Sources

The study site is located in an area which was "built" from the dredge and fill operations conducted by the Navy. The water-table, reportedly found within a few feet of land surface at the site, is contained in the shallow limestone

fill material. This semi-consolidated material is conducive for the movements of free hydrocarbons within the fill matrix. Initially, petroleum hydrocarbons seeps primarily downward under the influence of gravity. During this seepage phase, capillary forces produce some lateral migration of the hydrocarbon. Downward movement of hydrocarbon ceases when it is fully adsorbed onto the soil or when the seepage front reaches the water table or impermeable boundary; generally, the free hydrocarbon will not penetrate below the water table. As liquid hydrocarbon accumulates on the water table, it spreads laterally, initially under the influence of ground-water flow gradients and later in response mainly to capillary forces. Capillary spreading becomes very slow and eventually a relatively stable condition is attained in which only a thin layer of free hydrocarbon fluid may remain. Upon reaching the water table, the hydrocarbon will begin to "pancake", generally spreading along the path of least resistance.

The background information indicates that the water table in this area fluctuates with the tidal cycles. Water-table fluctuations can reduce the amount of free hydrocarbon on the water table. As the water table rises and falls, free gasoline is adsorbed onto and/or trapped between soil particles. Once adsorbed onto soil particles, the hydrocarbons cannot be readily removed by water flooding or flushing. Naturally occurring bacteria in the ground may

slowly remove the hydrocarbon by utilizing it as a carbon source in their metabolism.

Possible Migration of Hydrocarbons

When the local ground-water system contains immiscible fluids such as fuel oil and diesel, a first approximation of the direction of the movement of the contaminant plume can be obtained by analyzing the ground-water flow system. Generally, the direction of ground-water flow can be estimated by analyzing the topographic relief. This area is very flat, occurring only a few feet above mean sea level, therefore, an examination of the water-table elevations should provide the direction of shallow ground-water flow. The flow direction may change depending on the surge of water either ingressing or egressing during the tidal cycles. This investigation is focused primarily on the lateral movement of free petroleum hydrocarbons through the semi-consolidated limestone fill material to potential discharge points such as nearby Key West Bight.

PROPOSED SCOPE OF WORK

The proposed scope-of-work for the project is divided into three major tasks as follows:

Task 1: Review Existing Data and Prepare Drilling Specifications

Task 1 involves the collection and review of pertinent published and unpublished literature and data on the physical setting of the study site. Geologic logs of borings drilled on site for foundation purposes will be reviewed, if available, in order to make a preliminary determination of the geologic setting of the site. This will be supplemented by a review of the existing literature to determine the stratigraphy of the sediments. The existing site-specific information also will be used to determine the occurrence and movement of ground water and surface water in the area.

The location of all buried lines and cables owned by the Navy will be identified. This information will be used to determine the location of preferential migration pathways and potential obstacles during on-site drilling activities. Drilling contracts and technical specifications will be prepared by Geraghty and Miller's Inc., staff.

Task 2. On-Site Field Investigation

During the field investigation, approximately twenty-five (25) exploratory borings will be drilled to

depths of from 8 to 10 ft to detect the presence or absence of free hydrocarbons floating on the water table as shown in Figure 2. Approximately eight (8) of these borings will be converted to monitor wells for purposes of obtaining ground-water levels and hydrocarbon thicknesses.

Members of Geraghty & Miller, Inc., staff will supervise the monitor-well installations; determine the borehole locations and make location and depth adjustments in the field as new data becomes available; observe the construction of the monitor wells; collect geologic samples; and conduct a ground-water level monitoring program. Ground-water levels will be referenced to a common datum by a site survey to determine horizontal flow directions and hydraulic gradients. Additionally, water-quality samples will be collected from installed monitor wells and analyzed in the field for specific conductance.

Task 3. Analyze Data, Predict Impacts, and Design Abatement Alternatives

The data collected during the field investigation will be analyzed to determine the location, magnitude, rate, and direction of migration of any plumes of contaminated ground water or free hydrocarbons identified at the study site. Based on this analysis, the most economical and environmentally feasible alternative to comply with applicable state and federal regulations can be developed. All of the findings of the first two tasks will be summarized

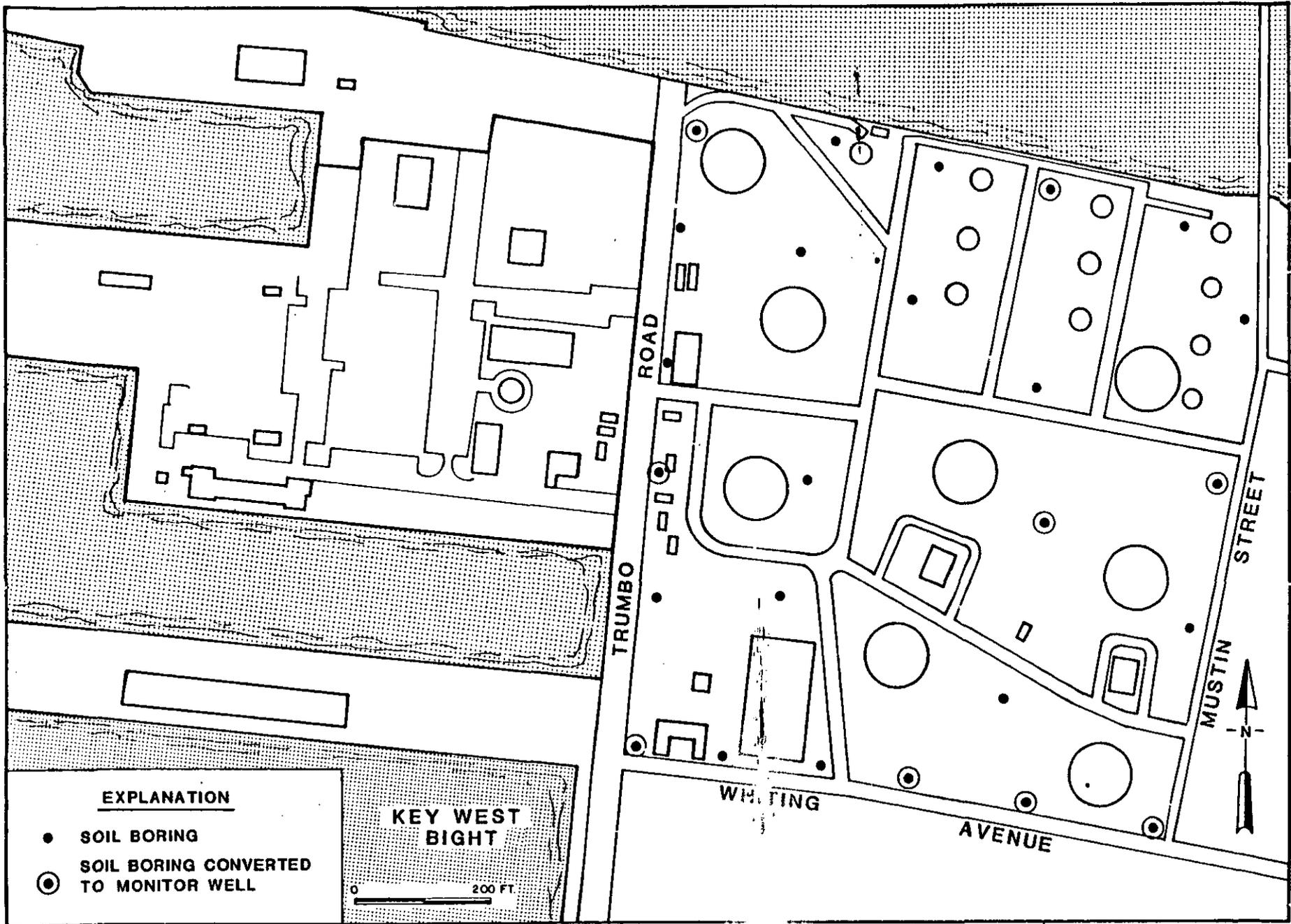


Figure 2. Location Map Showing Appropriate Locations for Proposed Soil Borings and Monitor Wells.

in tables, graphs and figures and submitted in a letter report for review. Upon finalization of the report, it may be submitted to local, state, and federal regulators for their review and comment.

#### PROJECT STAFFING

The project team for each of the above work items will consist of staff members from Geraghty & Miller, Inc.'s Tampa office who will be assisted, as needed, by senior staff advisors from Geraghty & Miller, Inc.'s other offices. Mr. L. Palmer, a registered professional engineer in the State of Florida will be Principal-in-Charge and will be responsible for the overall execution of the project. Mr. Fred A. Seguiti will be project manager and will be responsible for the day-to-day project execution. The field operations will be supervised by staff hydrogeologists who will be present to oversee all drilling and sampling operations.

#### CLOSING COMMENTS

Because this investigation is a venture into the subsurface, the proposed level of work is based on a somewhat hypothetical perception of the magnitude of the problem. Therefore, Geraghty & Miller, Inc., has over the years developed a mode of operation (especially in ground-water contamination studies), in which close contact is maintained with the client, in order to avoid last minute surprises with

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regard to project execution. It is hoped that a similar working pattern can be established during this investigation.

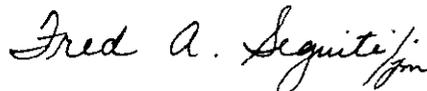
On behalf of Geraghty & Miller, Inc., we want to express our great appreciation for the selection of the firm to perform these ground-water investigations, and we want to assure you that the projects will be executed by qualified personnel and in accordance with the highest professional standards.

Respectfully submitted,

GERAGHTY & MILLER, INC.



Peter L. Palmer, P.E.  
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