SURVEY OF THE FORMER CANADIAN RADIUM SITE MOUNT KISCO, WESTCHESTER COUNTY, NEW YORK

Prepared by:

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EXECUTIVE SUMMARY

The Westchester County Health Department (WCHD) requested assistance in providing an assessment of the potential radiological exposure to the employees of "Richard's Lumber and Building Material Center". The request was prompted by the recent release of the EPA report "Final Draft, Preliminary Assessment Report, Canadian Radium and Uranium Corp., Mt. Kisco, NY" regarding the residual radium contamination at the former "Canadian Radium and Uranium Corp." site. Part of "Richard's Lumber" is located at the Former Canadian Radium Site. In cooperation with the WCHD, staff from the Department of Health (DOH), Bureau of Environmental Radiation Protection (BERP) conducted a survey of the areas with known radioactive contamination, which are used by or accessible to the employees of "Richard's Lumber" in order to gather current data on the potential exposure levels prior to addressing employee concerns.

The survey, which was conducted on 9/9/93, was planned to address three areas of concern:

1. Surficial gamma exposure rates on Richard's property as compared to background measurements in the area.
2. Resuspension of radioactive particulates in the main building and in the lumber yard.
3. Radon and radon progeny levels in the building and yard.

Exposure rate measurements were conducted in the following seven general areas:

1. Stockade-fenced area used for building material storage;
2. Employee parking lot;
3. Roadway and grass areas surrounding the stockade fenced area;
4. Entranceway and main lumber yard;
5. Excavated old depot area;
6. Concrete apron/roadway by old depot;
7. Hedgerow next to apron/roadway;

Background measurements of surficial gamma, particulates and radon were made at the Mount Kisco Village Hall, located about a half-mile from the site.

The resulting dose assessment is as follows:

- Indoor areas, where employees and public spend most of their time, have background gamma ray exposure rates but elevated radon concentrations.
- The stockade-fenced area, where gamma ray exposure rates are elevated, is accessible to both workers and members of the public.
- Annual exposure to a worker, who stands at the hottest spot found during the survey (240 μR/hr) for one hour a day, results in an estimated dose of about 60 mrem/year above background. A person who spends eight hours per day in the stockade-fenced area, will receive an average annual dose of about 30 mrem/year above background. The actual annual dose to a worker at this site will depend on the amount of time they spend at various locations. The radiation dose limit to a member of the public under current regulations is 500 mrem/year. It should be noted, however, that this limit will be reduced to 100 mrem/year as of January 1st, 1994.
- Air samples indicate that the dose from resuspended radium is minimal.
- All indoor radon measurements conducted at the site indicate radon levels above the EPA guidelines for follow-up measurements.

Based on the survey results, we recommend the following actions:

- Employees can have access to all areas, but they should minimize their stay in the areas known to contain higher contamination.
- Construction at the site (including the installation of the propane tank) should be halted until the EPA assessment has been completed.
- Confirmatory radon measurements should be conducted to determine if mitigation measures are necessary.
- EPA should be requested to expedite the proposed site investigation.

1. INTRODUCTION

The Westchester County Health Department (WCHD) requested assistance in providing an assessment of the potential radiological exposure to the employees of "Richard's Lumber and Building Material Center". The request was prompted by the recent release of the EPA report "Final Draft, Preliminary Assessment Report, Canadian Radium and Uranium Corp., Mt. Kisco, NY" regarding the residual radium contamination at the former "Canadian Radium and Uranium Corp." site. In cooperation with the WCHD staff from the Department of Health (DOH), Bureau of Environmental Radiation Protection (BERP) conducted a survey of the areas with known radioactive contamination, which are used by or accessible to the employees of "Richard's Lumber" in order to gather current data on the potential exposure levels prior to addressing employee concerns.

2. BACKGROUND

The Canadian Radium and Uranium Corporation (Canadian Radium) is located at 69 Kisco Avenue, Mt. Kisco, Westchester County, New York. The site is approximately 0.85 acre in size, and is bordered by a Conrail railroad right-of-way to the east, the Richard's Home and Lumber Co. to the North, the Homarus, Inc. (a small business) to the west, and the St. Francis AME Zion Church to the southwest. Canadian Radium is located in a commercial area of Mt. Kisco with the nearest residence located approximately 200 feet to the east.

From 1943 to approximately 1966, Canadian Radium recovered uranium and other radioactive elements from uranium-bearing sludge and old instrument and watch dials for the federal government's Manhattan Engineering District (MED), also known as the Manhattan Project [EPA93]. In addition to uranium, radium, radium-D, radon, polonium, and actinium were recovered at this facility. Prior to the 1950's, Canadian Radium's primary product, uranium, was processed from uranium sludge. However, from the 1950's until closure, the majority of the radium was processed/recovered from instrument and watch dials.

In 1966, all recovery operations were discontinued, and in November and December 1966 the building was demolished and the site decontaminated. Demolition waste/debris and soil were disposed of at the Croton Point Sanitary Landfill, while materials too contaminated for disposal at the landfill were sealed in drums and disposed of by the Nuclear Diagnostic Laboratories of Peekskill, NY. During the 1966 cleanup it was determined that a portion of the south wall of the then James A. Haggerty Lumber and Millwork, Inc. property north of the site, across Railroad Avenue, was contaminated. The contaminated wall was covered with plaster until radiation levels were acceptable [EPA93].

Surveys conducted by the Department of Environmental Conservation (DEC), Westchester County Health Department and DOH, subsequent to the original decontamination and demolition of the former Canadian Radium Company in 1966, indicated that residual "hot spots" of radium existed in areas on the property formerly occupied by Canadian Radium.

The recent EPA report assigning this site a high priority for investigation and characterization under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (due to the possibility of exposure via the airborne and ground water pathway), and subsequent newspaper articles about the site, prompted several inquiries concerning possible health risks to employees working in and around the contaminated areas. As a result, the State DOH agreed to provide the employees of Richard's Lumber with information and explanations of the potential exposure to radiation from the residual radium "hot spots" and the risks associated with such exposure. In order to provide an assessment of the possible radiation exposure, a survey of the areas frequented by the employees was performed and background levels were measured off-site for comparison.

3. SITE CONDITIONS AND SURVEY

The survey, which was conducted on 9/9/93 was planned to address three areas of concern:

a) Surficial gamma exposure rates on Richard's property as compared to background measurements in the area.
b) Resuspension of radioactive particulates in the main building and in the lumber yard.
c) Radon and radon progeny levels in the building and yard.

The survey was conducted in cooperation with the Westchester County Health Department on 9/9/93. The following people conducted or were present during the survey:

Robert Alibozek (BERP staff)
William Wigley (BERP staff)
Desmond Gordon (BERP staff)
Neil DiBenedetto (WCHD staff)
Arthur Herdman (WCHD staff)
Carlos Torres (WCHD staff)
George Griffin (Richard's Lumber owner)
Richard Flynn (WC Legislator)
Mayor Roth

Background measurements of surficial gamma, particulates and radon were made at the Mount Kisco Village Hall, located about a half-mile from the site. A site map is provided as Figure 1.

On arrival at the Village Hall, a suitable location for the air sampling unit was established. A standard air sampling pump with a 2-inch glass fiber filter was installed in a housing along with an "E-Perm" radon detector (Photo#1). Surficial gamma exposure rate measurements at three locations on the Village Hall property were obtained at one meter above the ground using a Ludlum Model 19 microRoentgen meter. Background readings varied between 7 to 12 microR/hr. Readings made near the brick walls ranged from 12-15 microR/hr.

Westchester County Health Department staff conducted an independent survey using a Ludlum Model 19 meter.

Upon arrival at the site, it was apparent that areas previously part of the Canadian Radium Site were now being utilized by Richard's Lumber. Also, as a result of the urban

renewal, a new street had been constructed adjacent to the employee parking lot, through what used to be part of the former Canadian Radium site. (Photo#2) The former Canadian Radium site is now enclosed by a stockade fence and is used as a storage area for building materials. The current site layout is depicted in Figure 2. This area, approximately 30,000 sq.ft., is unpaved and is used routinely by employees in the course of their work (Photo#3).

An old train station depot which had previously been fenced and considered inaccessible, is now used as a storage facility by Richard's Lumber. At the time of the survey the fenced area, which was known to contain "hot spots", was being cleared, excavated to remove railroad ties, rails and tree stumps and graded for future paving with blacktop (Photo#4).

It was indicated at the time of the survey that additional excavation was planned for the hedgerow which begins on the north side of the new road and runs northward toward the old depot. Part of the hedgerow is fenced and runs parallel to the lumber storage shed on the main building property. An approximate 10 ft. unfenced strip abuts a concrete apron leading to the depot (Photo#5).

Exposure rate measurements were conducted in the following seven general areas:

1. Stockade-fenced area used for building material storage (Photo#3)
2. Employee parking lot (Photo#6)
3. Roadway and grass areas surrounding the stockade fenced area (Photos#7 and #8)
4. Entranceway and main lumber yard (Photos#9 & #10)
5. Excavated old depot area (Photos#4, #11, #12)
6. Concrete apron/roadway by old depot (Photos#13 & #14)
7. Hedgerow next to apron/roadway (Photo#5)

Gamma exposure rate measurements of the aforementioned areas were made using the Ludlum Model 19 microR meter at a height of one meter above the ground. Where possible, measurements were obtained in a straight line at approximately 10 yard (paces) intervals, with

the intention of obtaining a rough grid of the area being surveyed.

Additional readings were also taken in the main building at various locations in the store, offices and second floor.

A particulate air sampling unit was installed in the hallway of the employee entrance. The location of this unit was dictated in part by the availability of electrical power and the request by the lumber yard owner to minimize the noise generated by the pump.

A high volume cascade impactor unit was placed on the back platform of the old depot/storage area. While the stockade fenced area appeared to be the most heavily used by the employees, the lack of electrical power in the yard precluded us from choosing that site. The depot area was chosen because of the ongoing excavation in an area known to include contaminated "hot spots".

Radon measurements were made in the main building. "E-Perm" radon detectors were placed throughout the store and timed radon measurements were made using a passive cell/Pylon radon detector from Thursday 09/09/93 to Tuesday 09/14/93.

4. SURVEY RESULTS

4.1 Direct Exposure Results - Outdoors

Figures 3 through 9 depict the general areas surveyed and denote the exposure rates measured, in microRoentgen per hour (μR/hr) at each 10 yard interval. The drawings are not to scale and should only be used as a guide in evaluating the extent of the residual contamination levels within each general area.

Figure 3 and Photos 15 to 17 depict the stockade-fenced area used to store building

materials. Roughly a 30,000 sq.ft. area was surveyed. Elevated exposure rate measurements, more than 20 μR/hr above background, were found at several locations in the northern half of the area from the location of the plastic pipes to the entrance gate. Several "hot spots" were also found and are indicated by the readings enclosed in a box in the survey diagram. Typical readings in the yard range from 10-14 μR/hr in the southern half with spots giving elevated exposure rates. The highest measured exposure rate was 140 μR/hr. The highest areas found coincide with the location of the former Canadian Radium building, which was located in the northwest corner of the area and extended to the new roadway.

Figure 4 and Photo 6 show the employee parking lot, which is located at the southern side of the main Richard's building. Readings taken in this area show only a slight increase over typical background levels of 7-12 μR/hr, with the highest readings being 15-16 μR/hr along the south grassy area next to the roadway.

Figure 5 and Photos 7 and 8 show the roadway and grassy areas on three sides of the stockade-fenced area. No readings greater than 20 μR/hr above background were found, although levels measured in the northern end are up to 2 times higher than those in the southern portion.

Figure 6 and Photos 18 and 19 depict the main lumber yard, storage area and roadway which lies on the east and south sides of the main home improvement building. Three readings were also taken across Kisco Avenue opposite to the building near a rock wall (Photos 20 and 21). These readings ranged from 7-20 μR/hr. The lowest readings (7-8 μR/hr) were found at the northwest portion of the property. Most of the readings were in the range of 10-14 μR/hr. The two highest readings of 20 μR/hr were found next to a fenced hedgerow which runs from the roadway to the lumber storage shed (not shown, see Figure 8).

Figure 7 and Photos 4, 5 and 11 depict the formerly fenced old depot area which had been known to contain "hot spots". Ongoing excavation, tree removal and railroad tie/rails removal may have brought additional radium contamination to the surface as well as spread the

contamination over a larger area (Photos 22, 23 and 24). The entire area from the southern fence to the old depot building shows elevated readings, indicated by a box in the survey diagram (Figure 7), ranging from 24-170 μR/hr on the systematic survey. Additional "hot" areas may be found in the excavated area. The highest area found during this survey gave an exposure rate of 240 μR/hr. Photos 25 to 28 show changes at the site since the survey of 9/9/93.

Figure 8 and Photo 29 show the concrete pad/road which extends from the new roadway along the railroad tracks to the area located beyond the old depot. All the measurements appear to be within the normal background range of 7-12 μR/hr. The area on the north side of the depot is unpaved and leads to a fence and building at the extreme northern boundary of the Richard's property. No elevated readings were found in this area.

Figure 9 and Photo 30 show the narrow, approximately 10 ft. strip of soil, brush and debris which runs parallel to the fenced hedgerow and concrete apron from the new roadway to the fenced depot area. As shown, all measurements along this area show exposure rates well above background ranging from 50-130 μR/hr.

Anecdotal information supplied by the owner of Richard's Lumber about the demolition of an old building, formerly located at the northeast corner of what is now the stockade fenced area and the end of the new roadway, and the spreading of the debris along this area may explain these higher readings. There are plans to excavate the extreme southern end of this strip, next to the power pole and install a propane tank.

4.2 Direct Exposure Results - Indoors

The results of the main building survey are as follows:

1. Hallway - Location of air sampling unit - 8-9 μR/hr
2. Office - Millwork Sales - 10 μR/hr
3. Shipping and Receiving - 8-10 μR/hr

4. Kitchen Showroom	- 9-10 μR/hr
5. Loading Dock	- 7-8 μR/hr
6. Nail room	- 7-8 μR/hr
7. Mr. Griffin's Office (upstairs)	- 7-8 μR/hr
8. Outer Office Area (upstairs)	- 7-8 μR/hr
9. Outside Marini's Office (upstairs)	- 6-7 μR/hr
10. Stairwell Kisco Ave. (upstairs)	- 7-8 μR/hr
11. Store - Brooms	- 8-9 μR/hr
12. Front Entrance	- 7-8 μR/hr
13. Paint Section	- 7-8 μR/hr
14. Customer Service	- 6-7 μR/hr
15. Floor Molding	- 8-9 μR/hr

4.3 Radon Measurement Results

Two samples were collected at the Mount Kisco Town Hall, in order to determine the background Radon concentration to be used for comparison with the lumberyard measurements. All the Radon measurements conducted at Richard's Lumber indicate above background values. The results of the survey are presented in Table 1. The maximum value measured at Richard's Lumber was 9.8 pCi/l, and the average of the different detectors is about 8.1 pCi/l. The maximum value measured at the Town Hall was 0.9 pCi/l.

4.4 Airborne Radium Measurement Results

The air samples were analyzed to determine if any radium was present. The location of the air pumps is shown in Photos 31 and 32. The results indicate a radium concentration of less than 0.0001 pCi/m^3 in the air samples (the detection limit). The air sample filter from the hallway pump could not be analyzed due to the fact that it had what appeared to be a pencil hole.

5. EXPOSURE ASSESSMENT

Based on observations during the survey and the survey results, the following assessment can be made:

a) Indoor areas, where employees and public spend most of their time, have background gamma ray exposure rates but elevated radon concentrations.

b) The stockade-fenced area, where gamma ray exposure rates are elevated, is accessible to both workers and members of the public.

c) Annual exposure to a worker, who stands at the hottest spot found during the survey (240 μR/hr) for one hour a day, results in an estimated dose of about 60 mrem/year above background. A person who spends eight hours per day in the stockade-fenced area, will receive an average annual dose of about 30 mrem/year above background. The actual dose to individuals will depend upon the time they spend in various areas. The current limit for radiation dose to a member of the public is 500 mrem/year. It should be noted, however, that this limit will be reduced to 100 mrem/year as of January 1st, 1994.

d) Air samples indicate that the dose from resuspended radium is minimal. This is consistent with predictions made on the basis of the RESRAD computer code [DOE89], which was used to determine the contribution from the various pathways to the total dose. The dose calculation for Ra-226 indicated that the direct gamma pathway is the main contributor to the total dose, while the inhalation pathway contributes less than 10%.

e) All indoor radon measurements conducted at the site indicate radon levels above the EPA guidelines for follow-up measurements. Radon concentrations measured by two different detection systems were consistent with one another.

6. CONCLUSIONS AND RECOMMENDATIONS

Elevated gamma readings were found in three large areas, namely, the stockade-fenced area, the old depot, and the strip along the hedgerow. Since the total dose is a function of the duration of the exposure, the actual exposure to employees depends upon the areas they work and the time they spend in these areas. Two examples were used in Section 5 to estimate the dose to a worker at the site:

1) a worker who spends one hour per day at the point of highest measured exposure rate; and

2) a worker who spends eight hours a day at an exposure rate which is equal to the average of the values measured within the stockade-fenced area.

These were about 60 mrem per year and 32 mrem per year, respectively. These values can be put in perspective by comparing them to the average annual dose from natural sources of radiation (excluding radon) which is about 100 mrem per year. Employees can minimize their total dose by minimizing the time of exposure in areas known to have high contamination.

All the radon values measured were above the EPA action level for mitigation (4 pCi/l), with the maximum radon level measured at the site of 9.8 pCi/l. These results can be put in perspective by comparing them to the Mount Kisco Village results, which have an average concentration of 2.3 pCi/l for residential structures (with 32 homes tested) [DOH93], and a highest measured indoor radon concentration of 9.3 pCi/l. It is not known if there is radium contamination in the soil surrounding the foundation of the building that contributes to the indoor radon concentration.

Measurement of resuspended radium at the old depot/storage area showed no measurable radium activity, even though excavation of contaminated soil was taking place nearby. This might be due to the fact that the soil was damp due to rain at the time of the survey when excavation was taking place. Excavation of dry soil may lead to a different result. Also,

excavation, grading and removal of soil may result in spread of contaminated soil to clean areas. Thus, excavation of contaminated soil should be delayed until further characterization of the site is completed.

Based on the above conclusions, we recommend the following actions:

- Employees can have access to all areas, but they should minimize their stay in the areas known to contain higher contamination.
- Construction at the site (including the installation of the propane tank) should be halted until the EPA assessment has been completed.
- Confirmatory radon measurements should be conducted to determine if mitigation measures are necessary.
- EPA should be requested to expedite the proposed site investigation.

7. REFERENCES

[DOE89] A Manual for Implementing Residual Radioactive Material Guidelines, A Supplement to U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Surplus Facilities Management Program Sites, Argonne National Laboratory, June, 1989.

[DOH93] New York State Department of Health, Radon Detector Distribution Program, 5/26/93.

[EPA93] Final Draft, Preliminary Assessment Report, Canadian Radium and Uranium Corp., Mt. Kisco, New York, Environmental Protection Agency, Prepared under Work Assignment No. 019-2JZZ, Contract No. 68-W9-0051, Report # Y095-PA, 3/16/93.

TABLE 1 Results of the Radon Test

LOCATION	TYPE OF TEST	
	E-Perm Detector (pCi/l)	Passive Radon Detector (pCi/l)
Inside Pump House at the Town Hall	0.5	
Police Station, Town Hall	0.9	
Office #1, Richard's Lumber	9.8	8.2
Show Room, Richard's Lumber	6.3	
Storage/Sale Floor, Richard's Lumber	8.4	

FIGURES

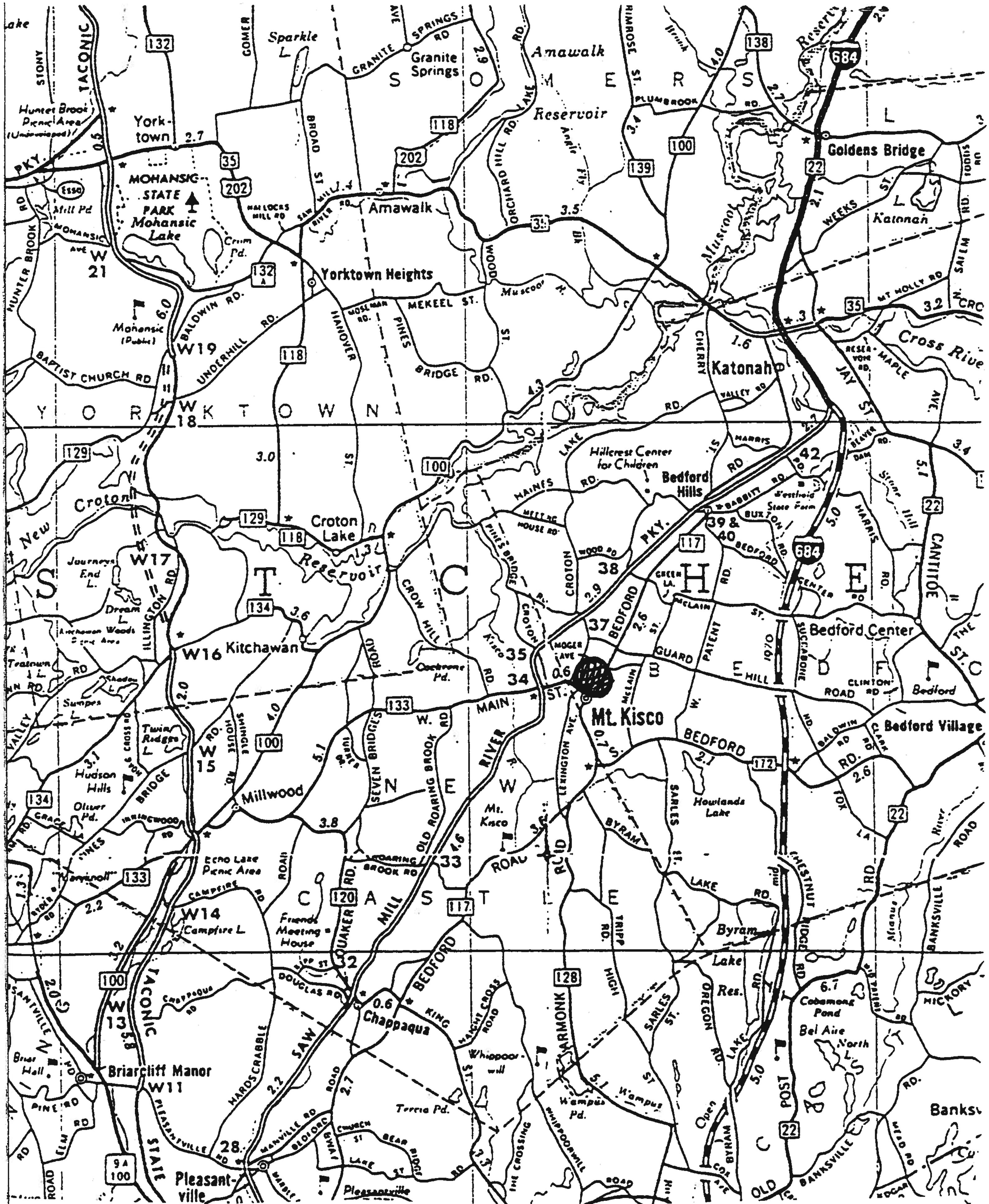

FIGURE 1
SITE MAP

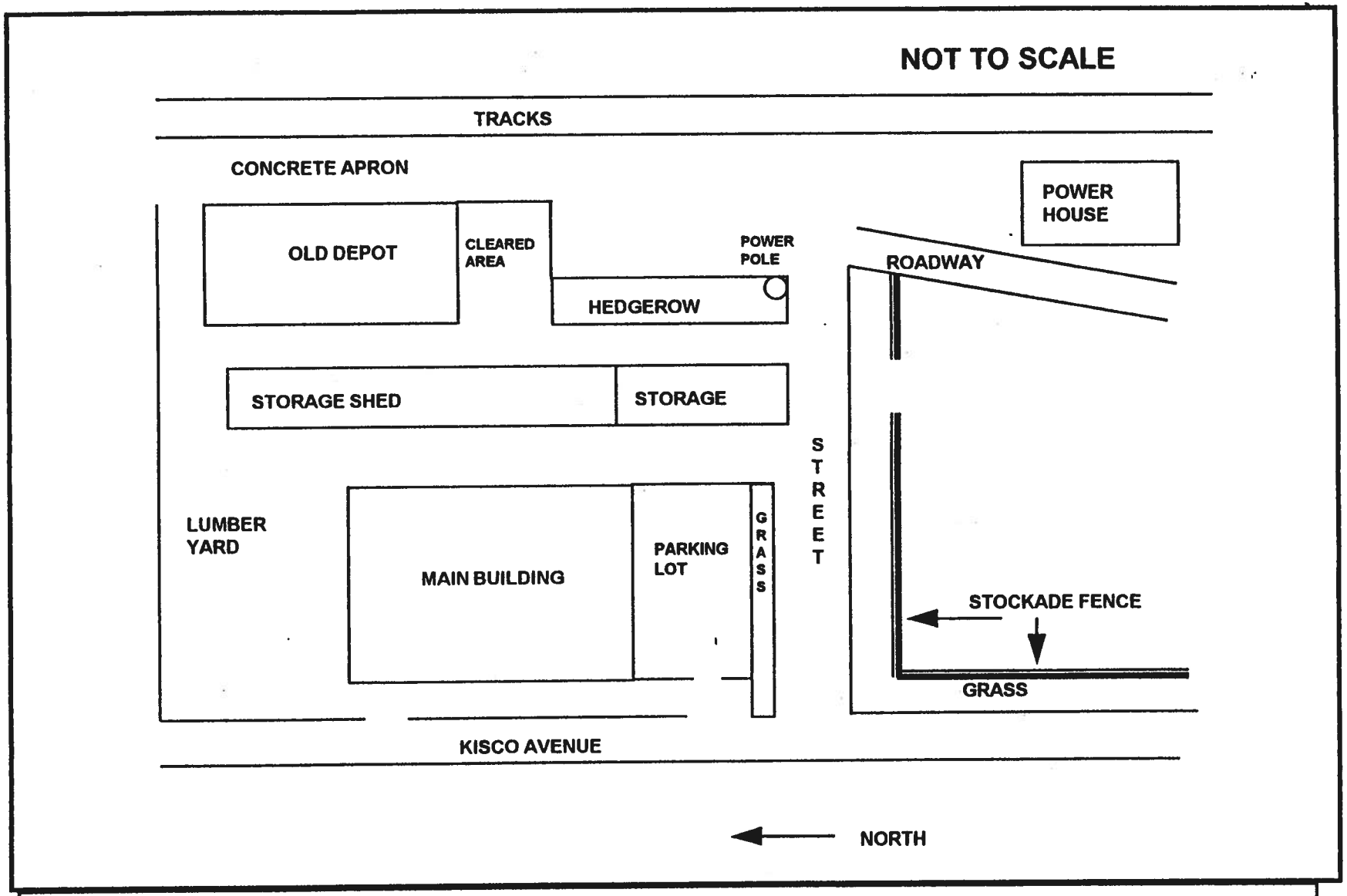

FIGURE 2 SITE LAYOUT

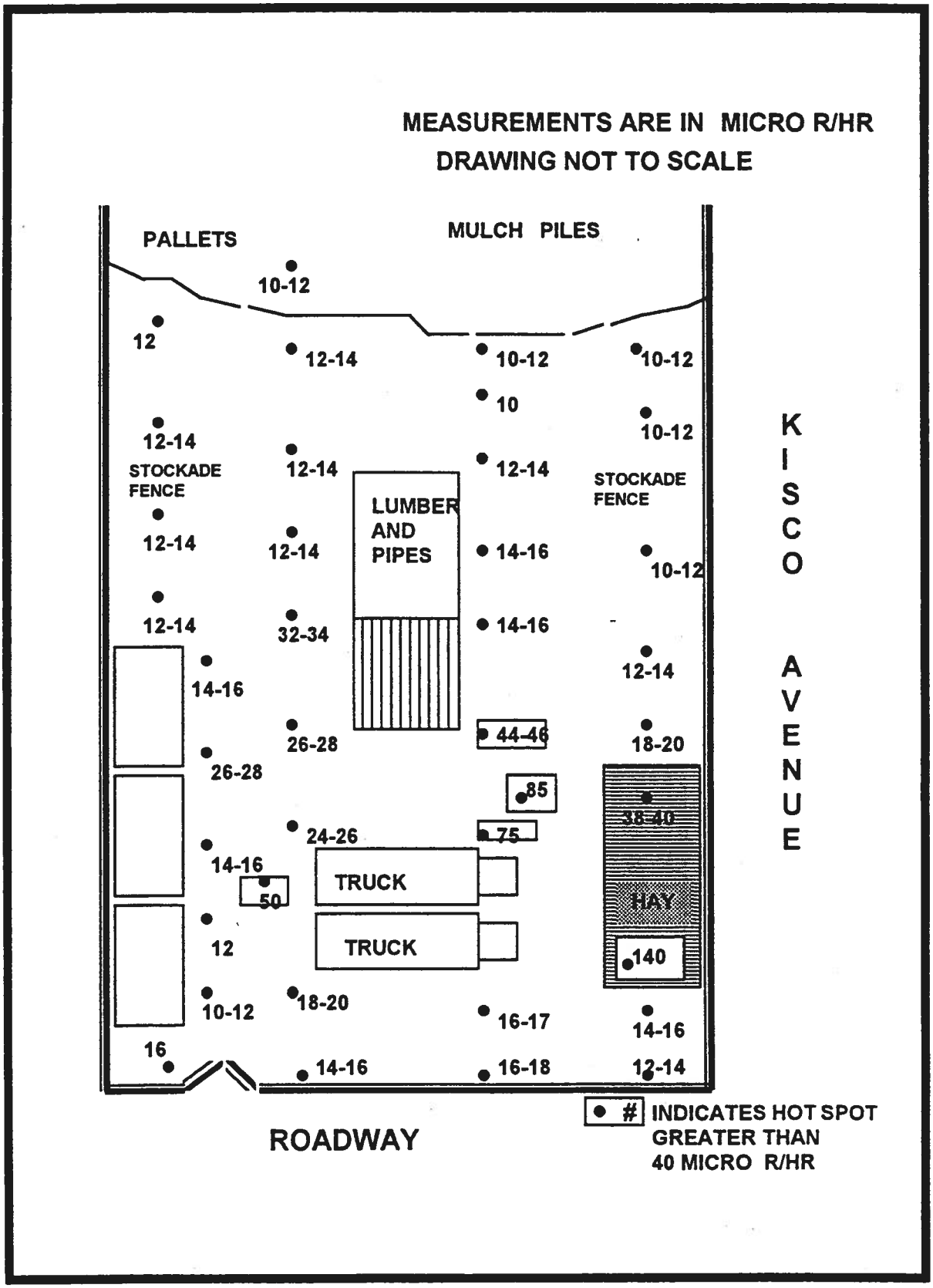

FIGURE 3
STOCKADE-FENCED AREA USED TO STORE BUILDING MATERIAL

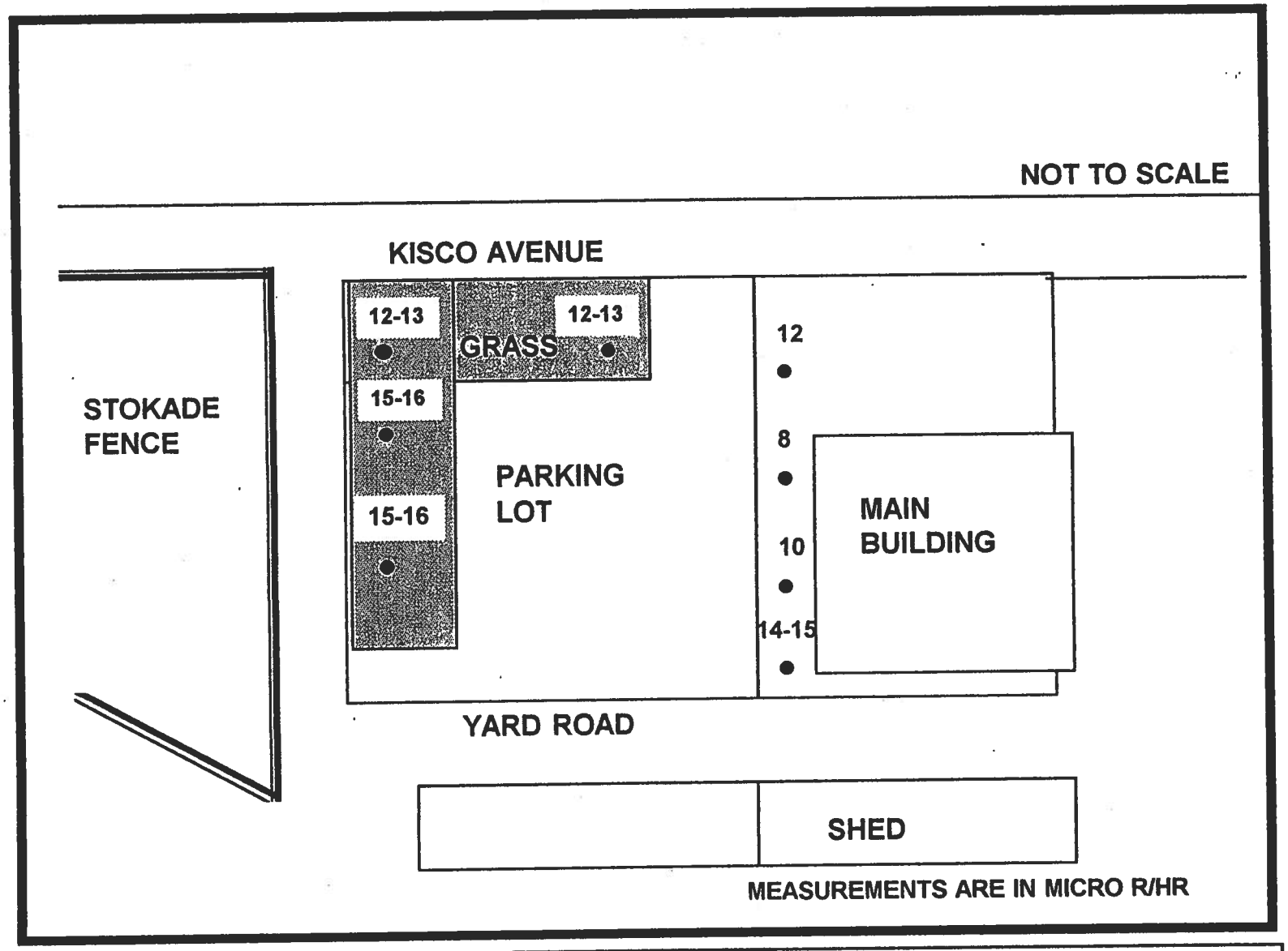

FIGURE 4
EMPLOYEE PARKING LOT

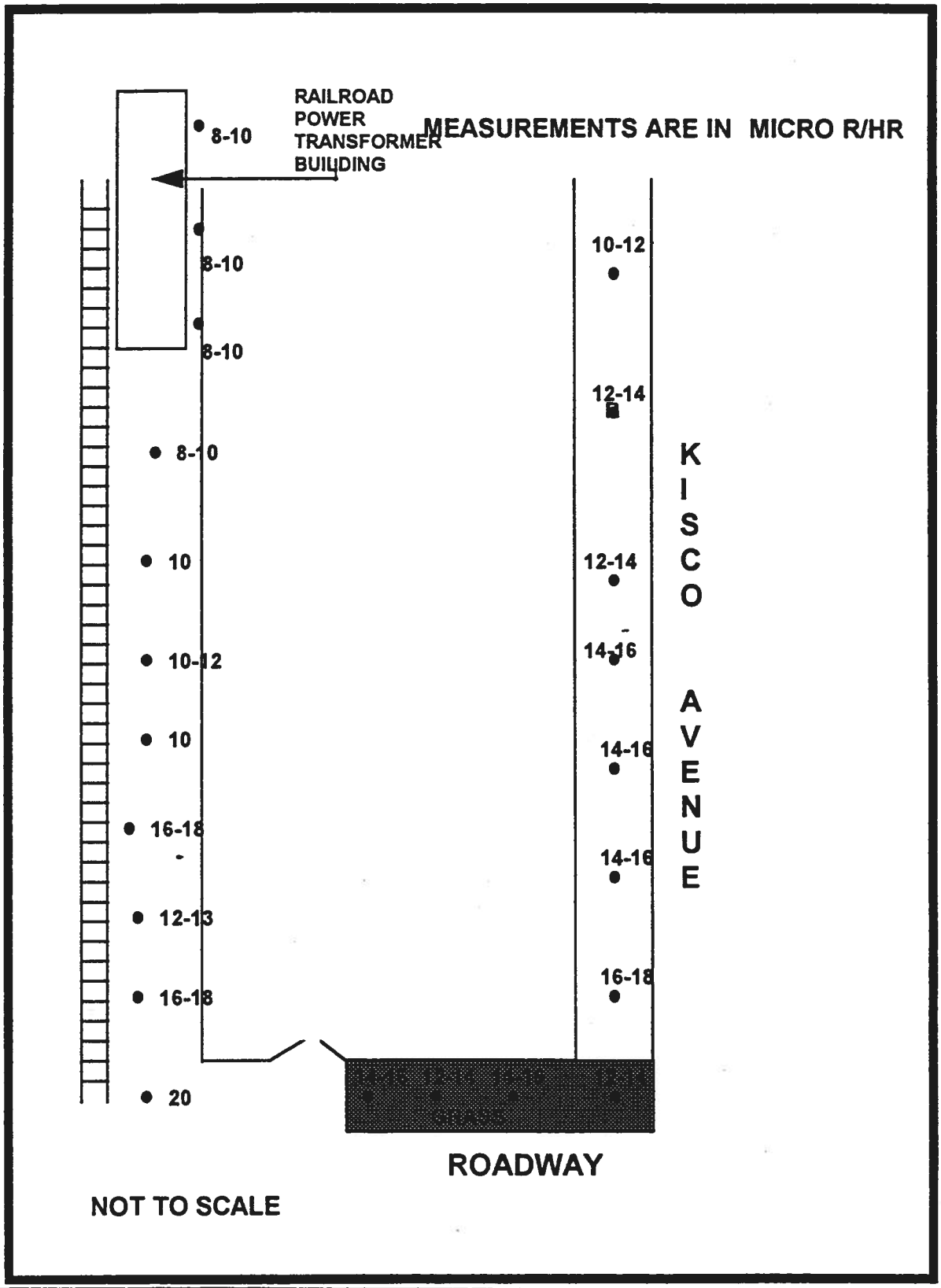

FIGURE 5
ROADWAY AND GRASSY AREAS

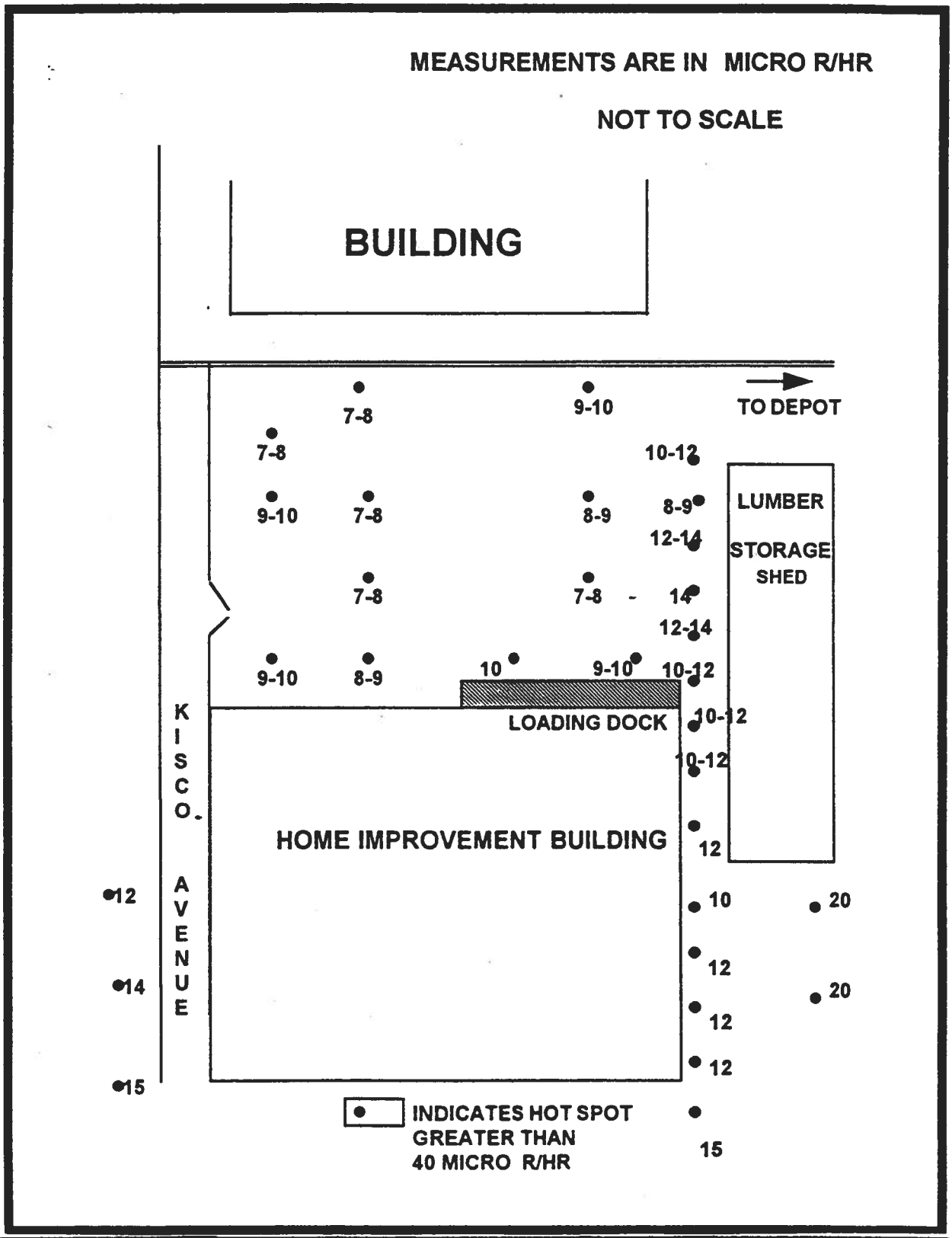

FIGURE 6
MAIN LUMBERYARD, STORAGE AREA AND ROADWAY NEXT TO HOME IMPROVEMENT BUILDING

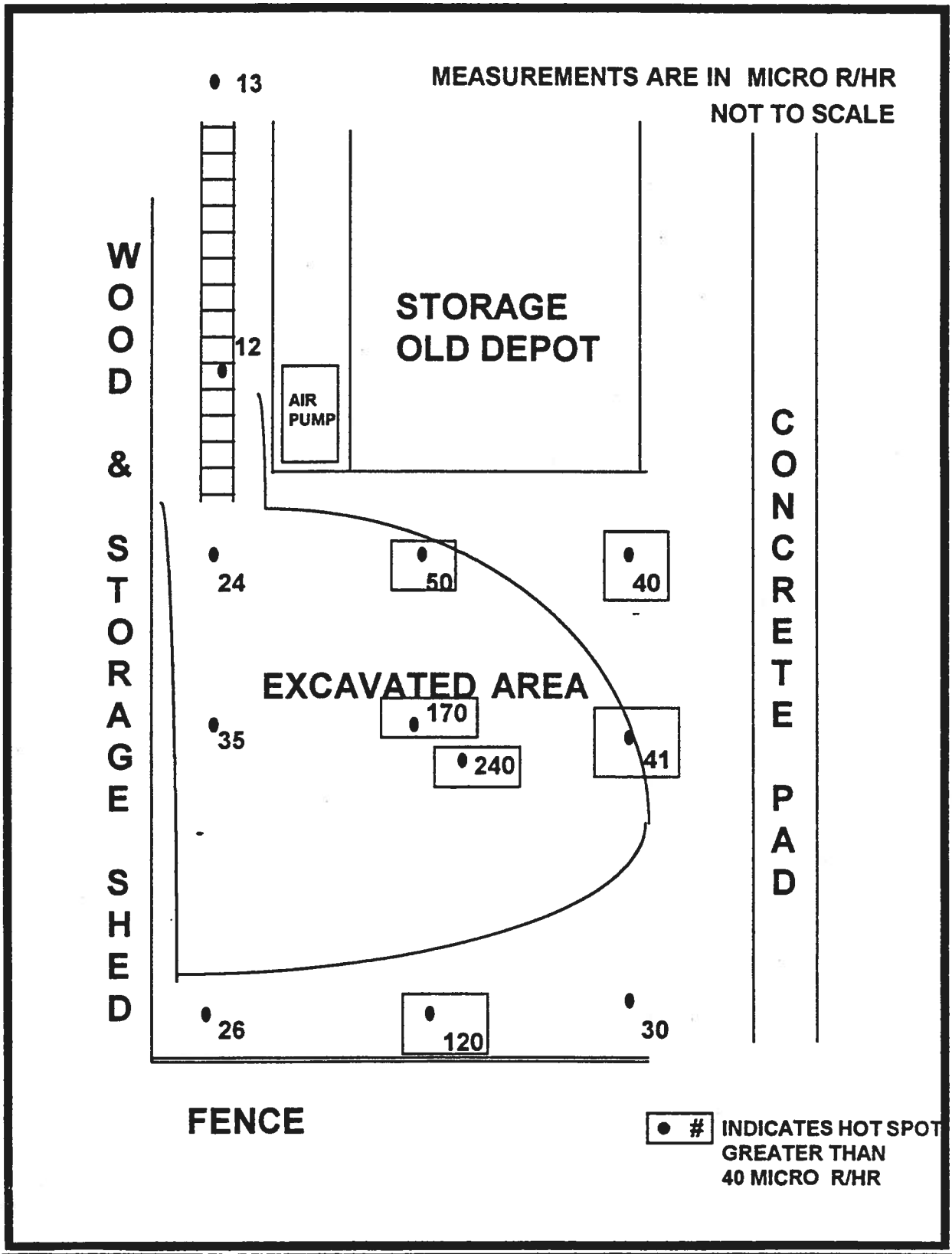

FIGURE 7
FORMERLY FENCED OLD DEPOT AREA

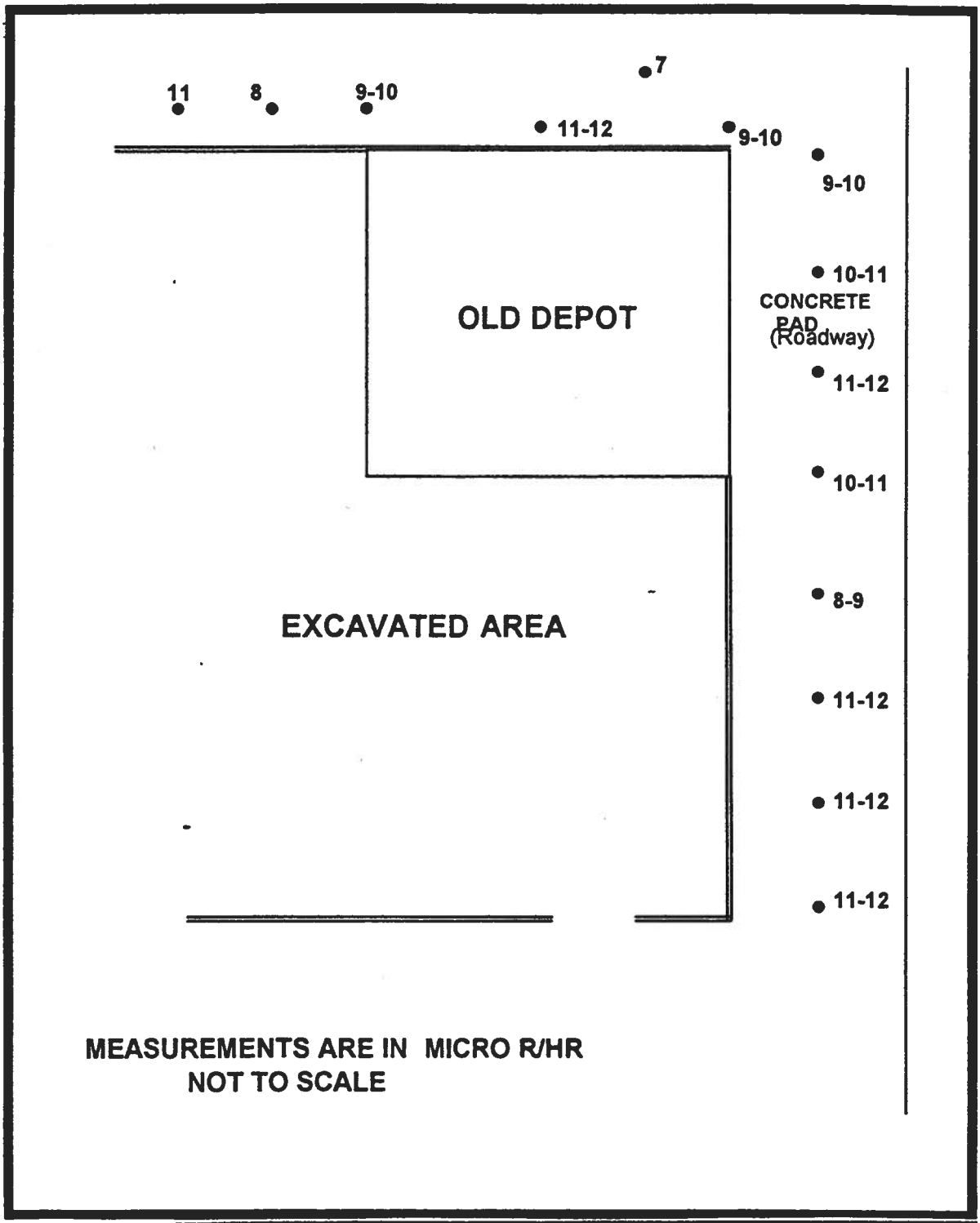

FIGURE 8
CONCRETE PAD/ROAD FROM NEW ROADWAY TO OLD DEPOT

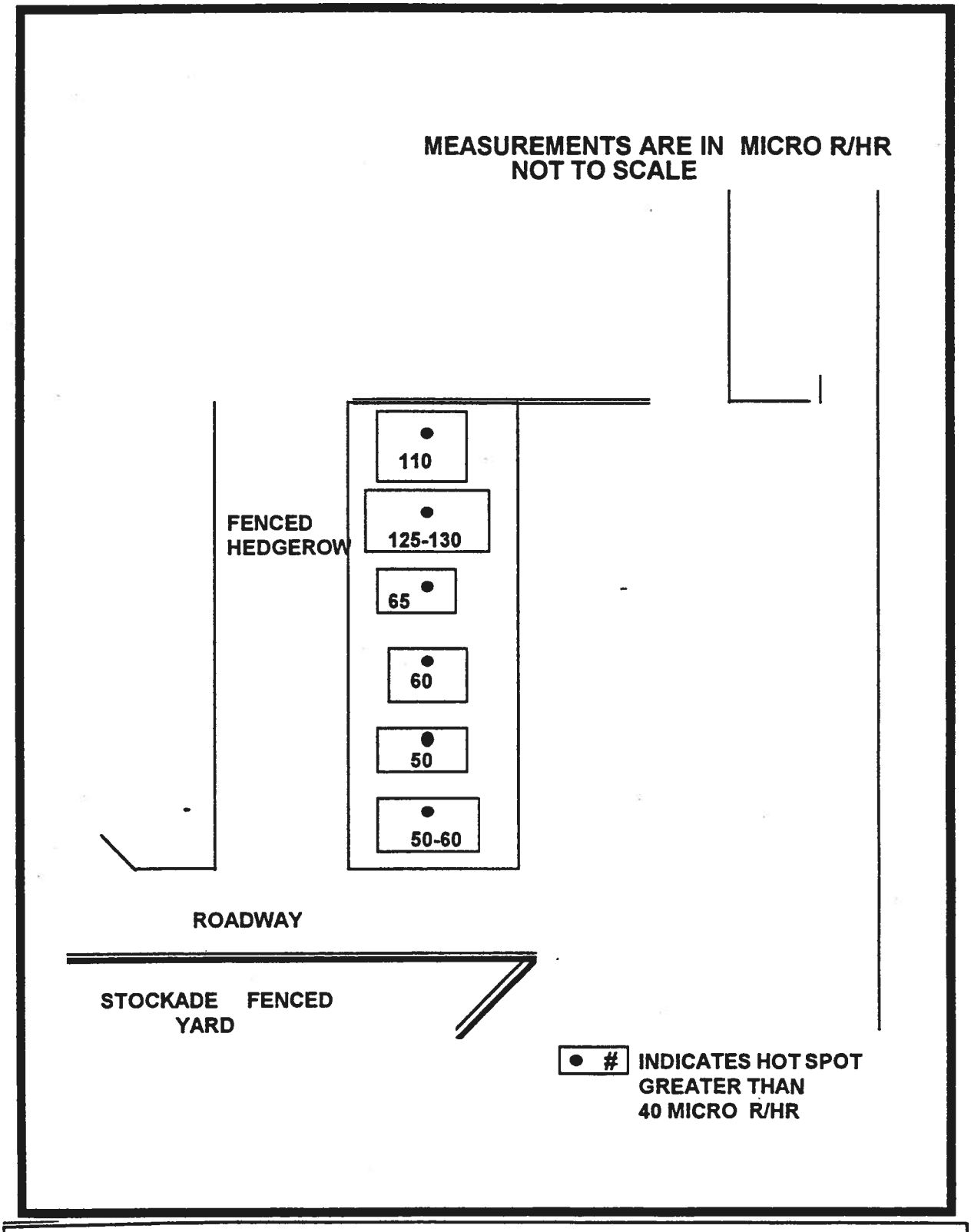

FIGURE 9
SOIL STRIP PARALLEL TO FENCED HEDGEROW AND CONCRETE APRON

PHOTOS

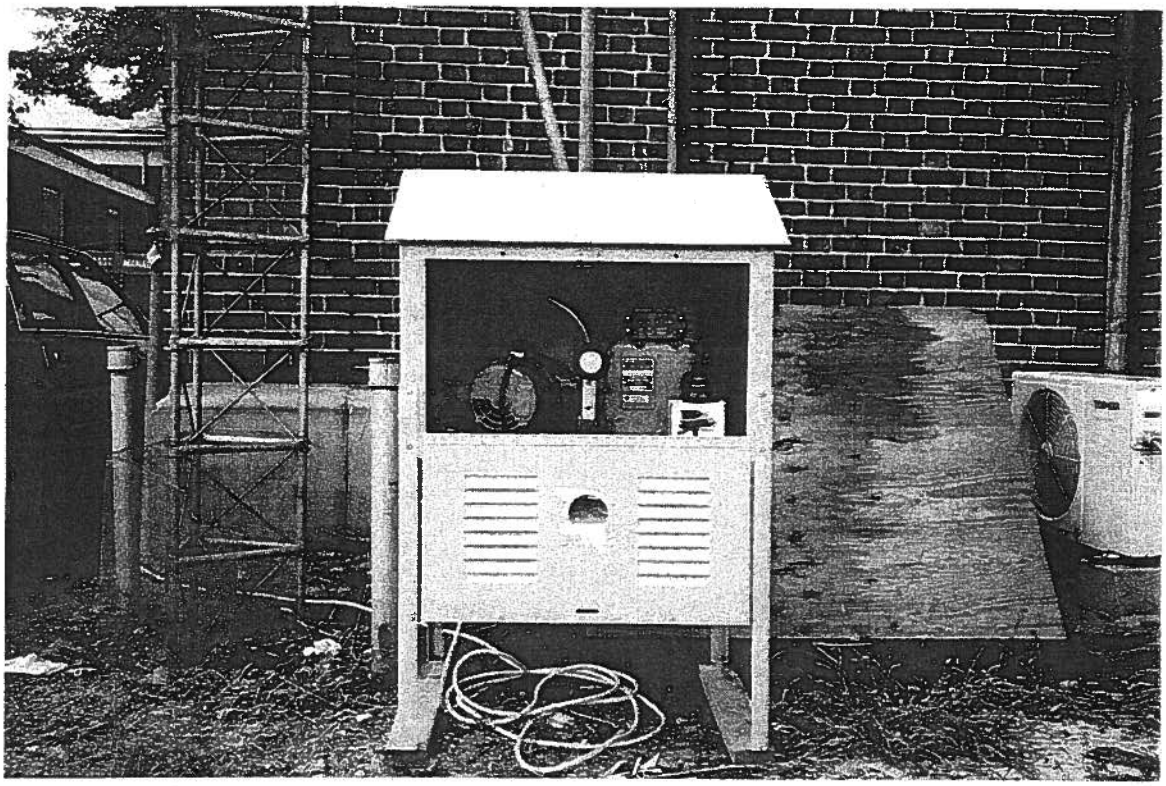

PHOTO 1 Air Sampling Pump with an E-Perm Radon Detector

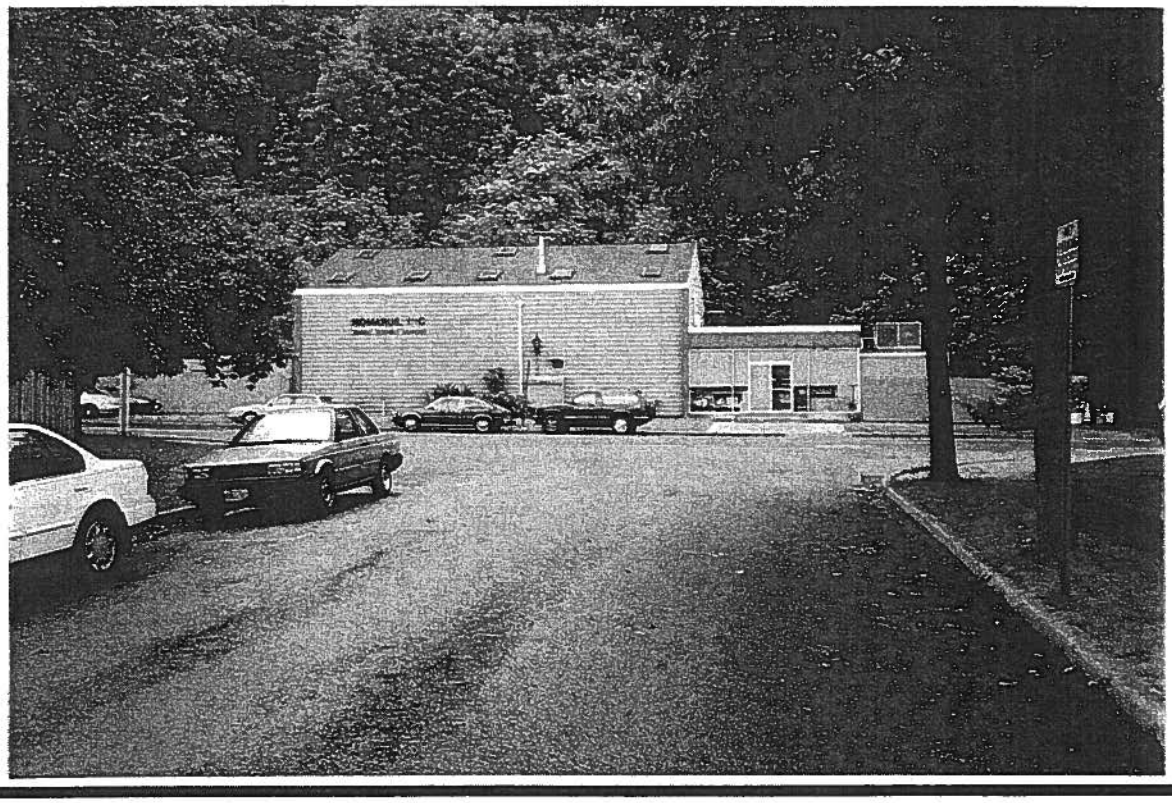

PHOTO 2 Street Adjacent to Employee Parking Lot

PHOTO 4 Excavated Old Depot Area

PHOTO 3 Stockade-Fenced Area Used for Building Material Storage

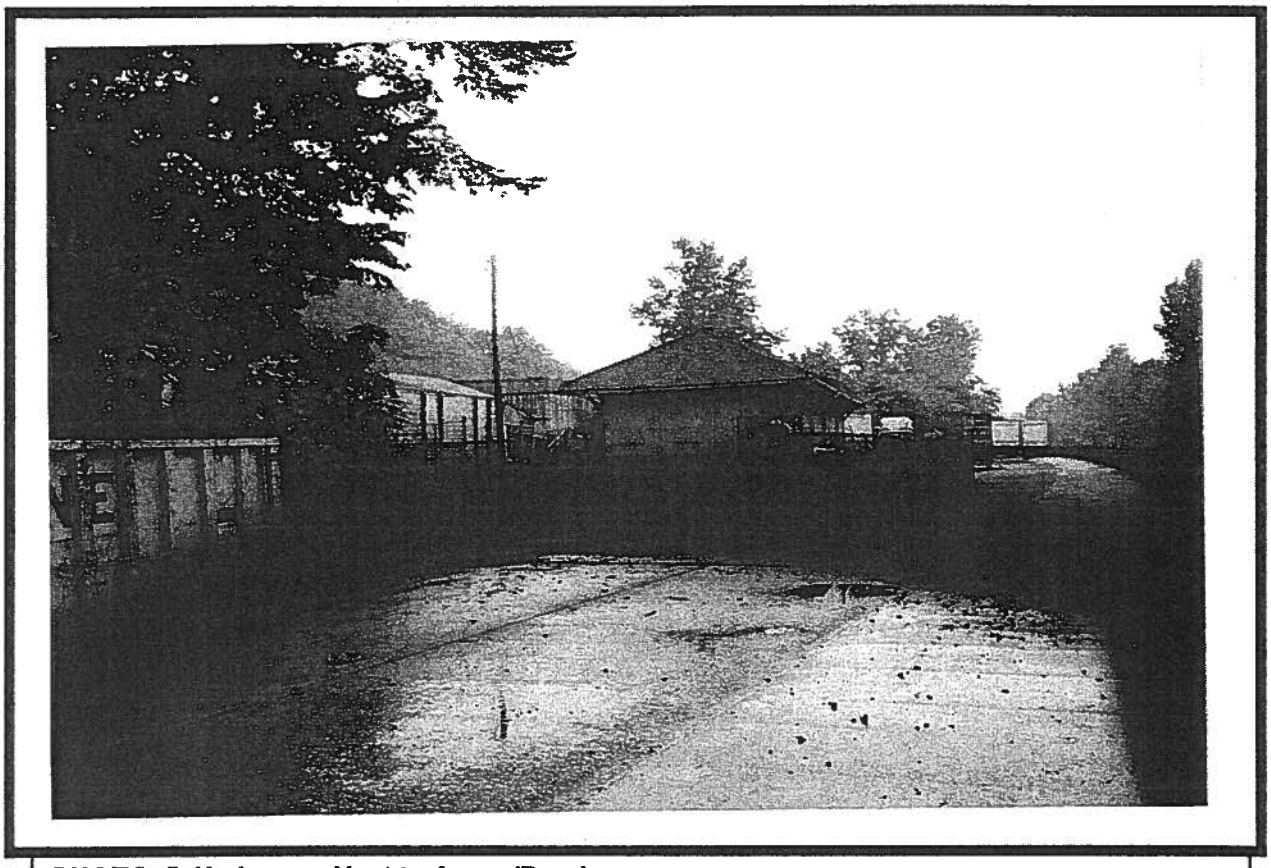

PHOTO 5 Hedgerow Next to Apron/Roadway

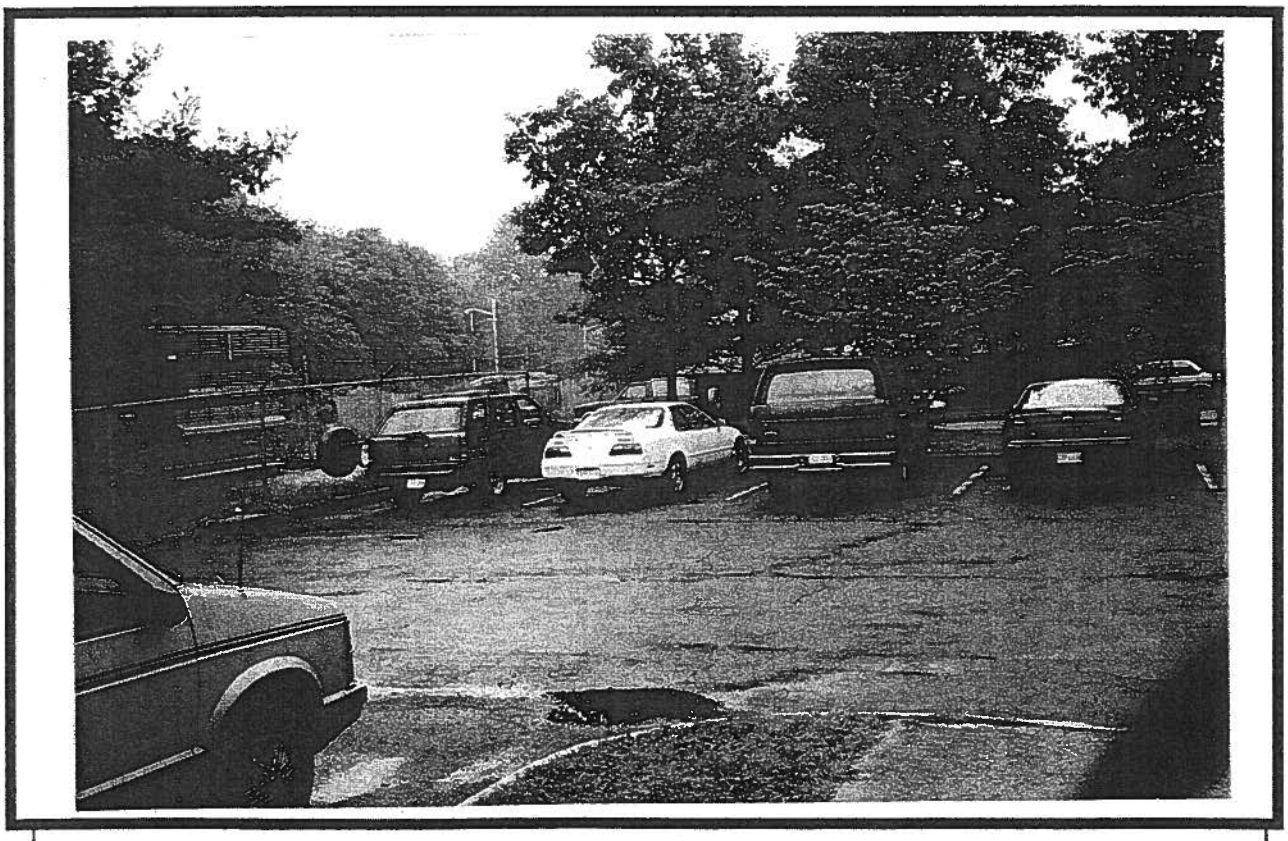

PHOTO 6 Employee Parking Lot

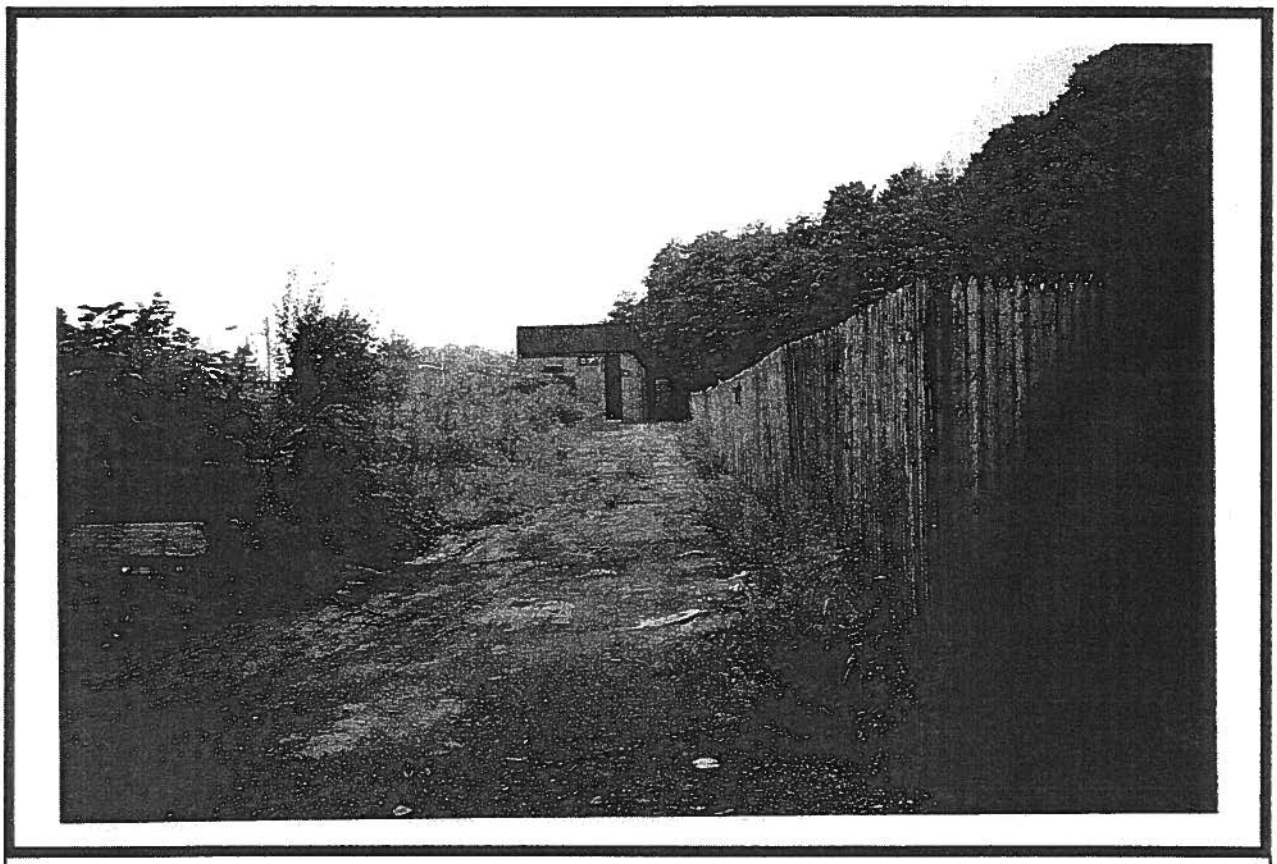

PHOTO 7 Roadway and Grass Areas Surrounding the Stockade Fenced Area

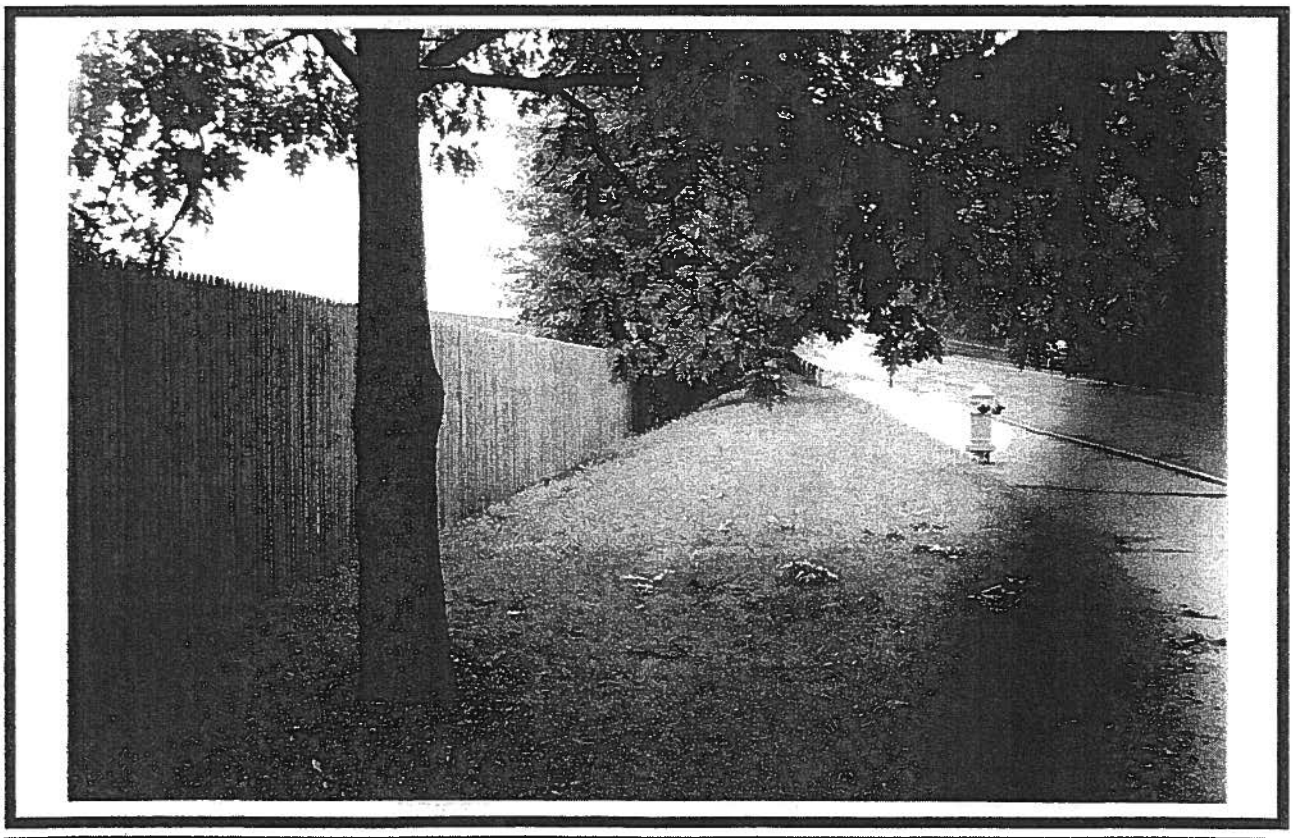

PHOTO 8 Roadway and Grass Areas Surrounding the Stockade Fenced Area

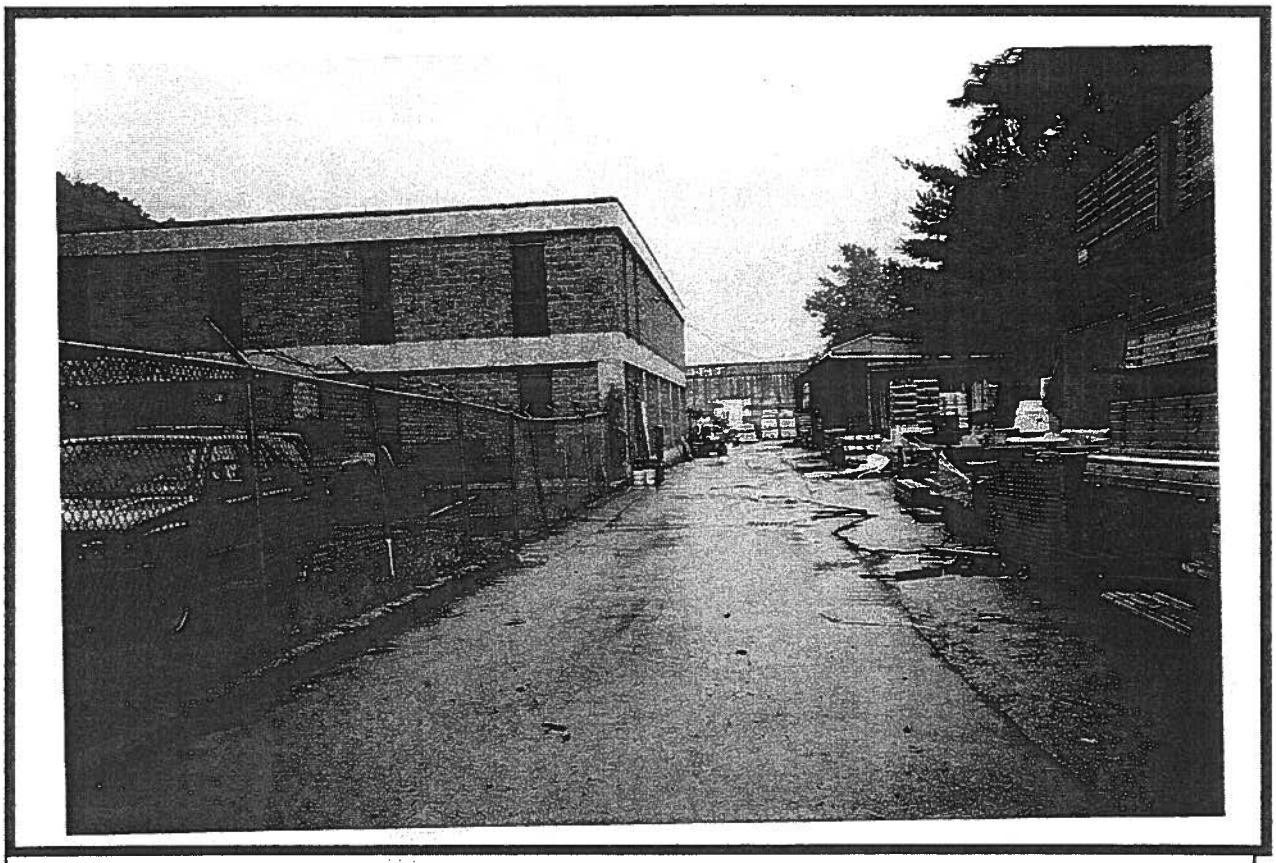

PHOTO 9 Entranceway and Main Lumber Yard

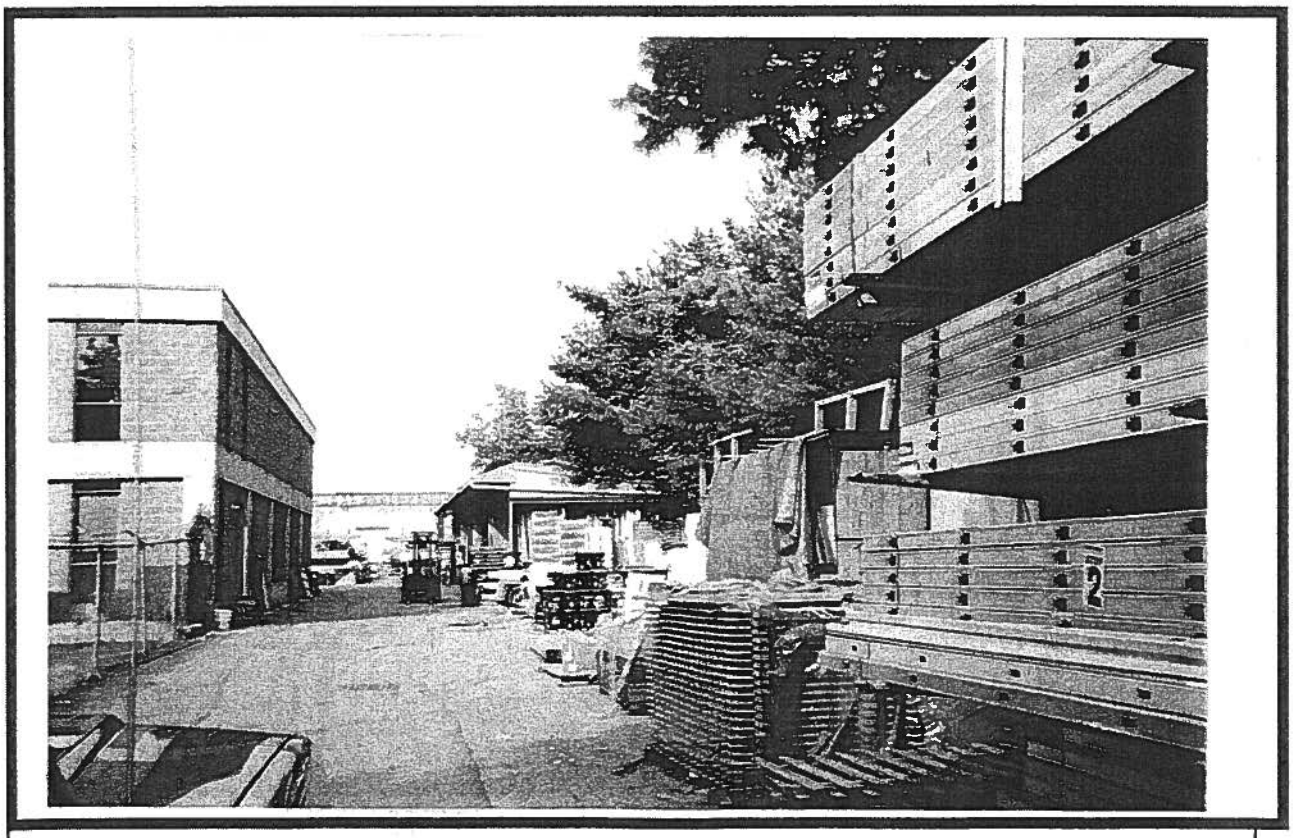

PHOTO 10 Entranceway and Main Lumber Yard

PHOTO 11 Excavated Old Depot Area

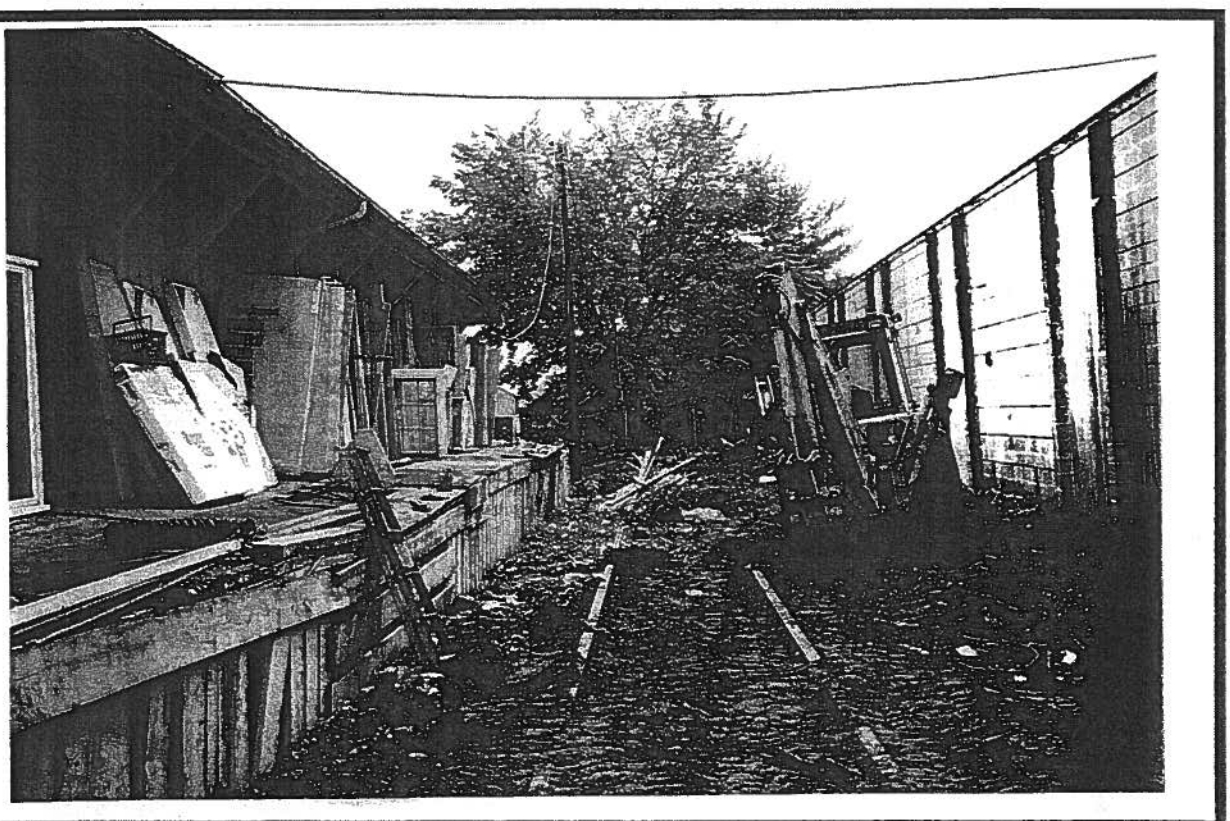

PHOTO 12 Excavated Old Depot Area

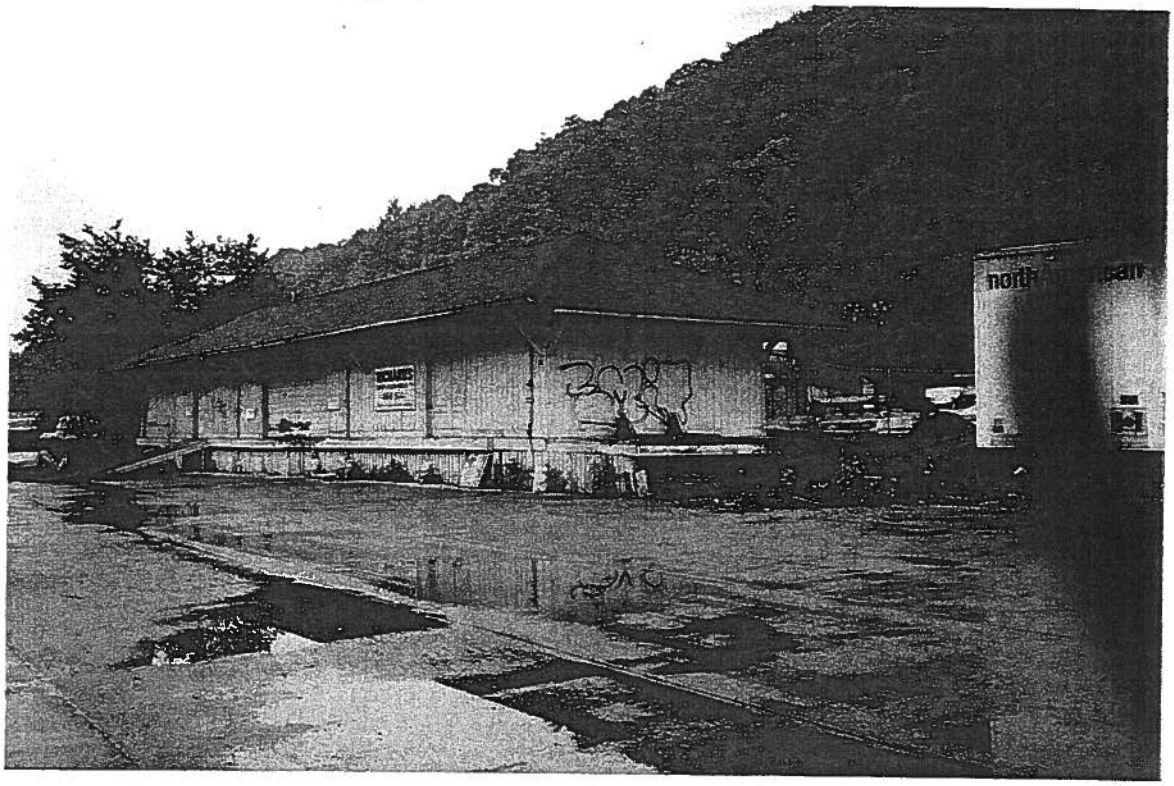

PHOTO 13 Concrete Apron/Roadway by Old Depot

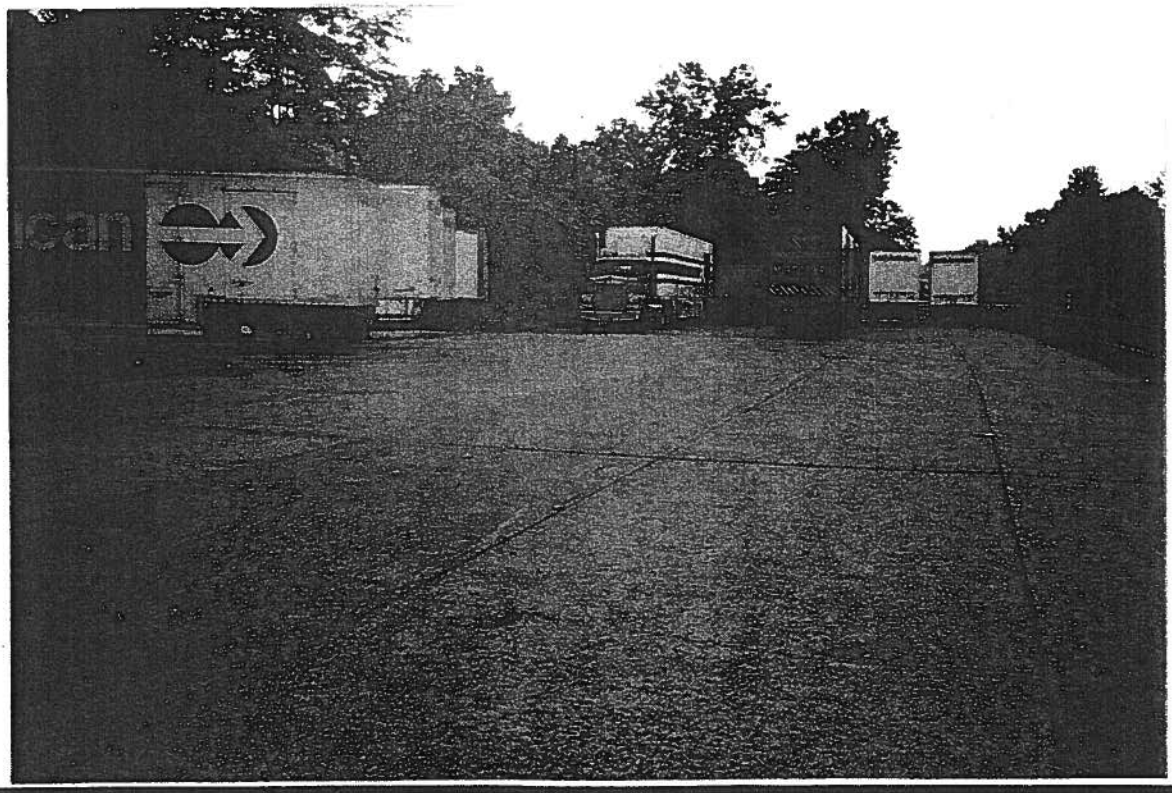

PHOTO 14 Concrete Apron/Roadway by Old Depot

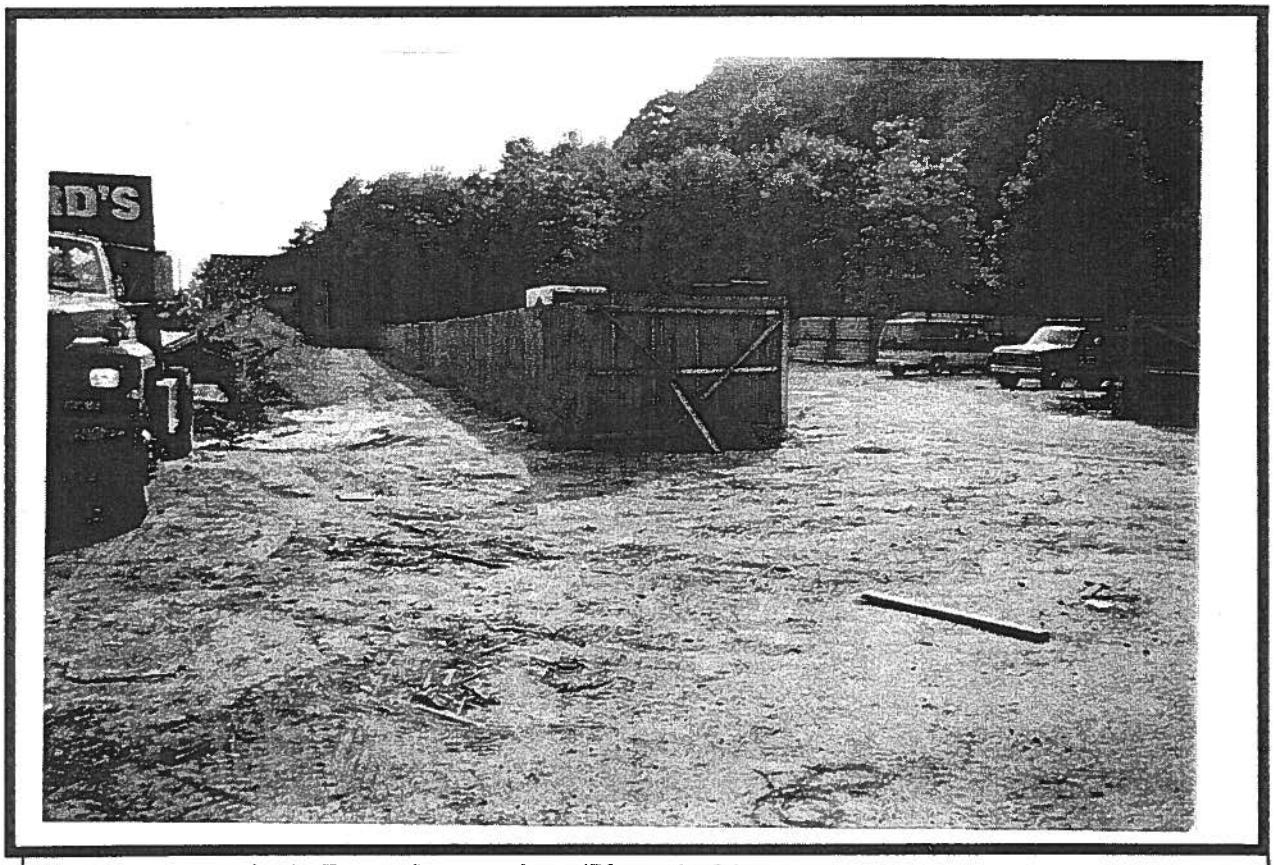

PHOTO 15 Stockade Fence Storage Area (Photo 1 of 2

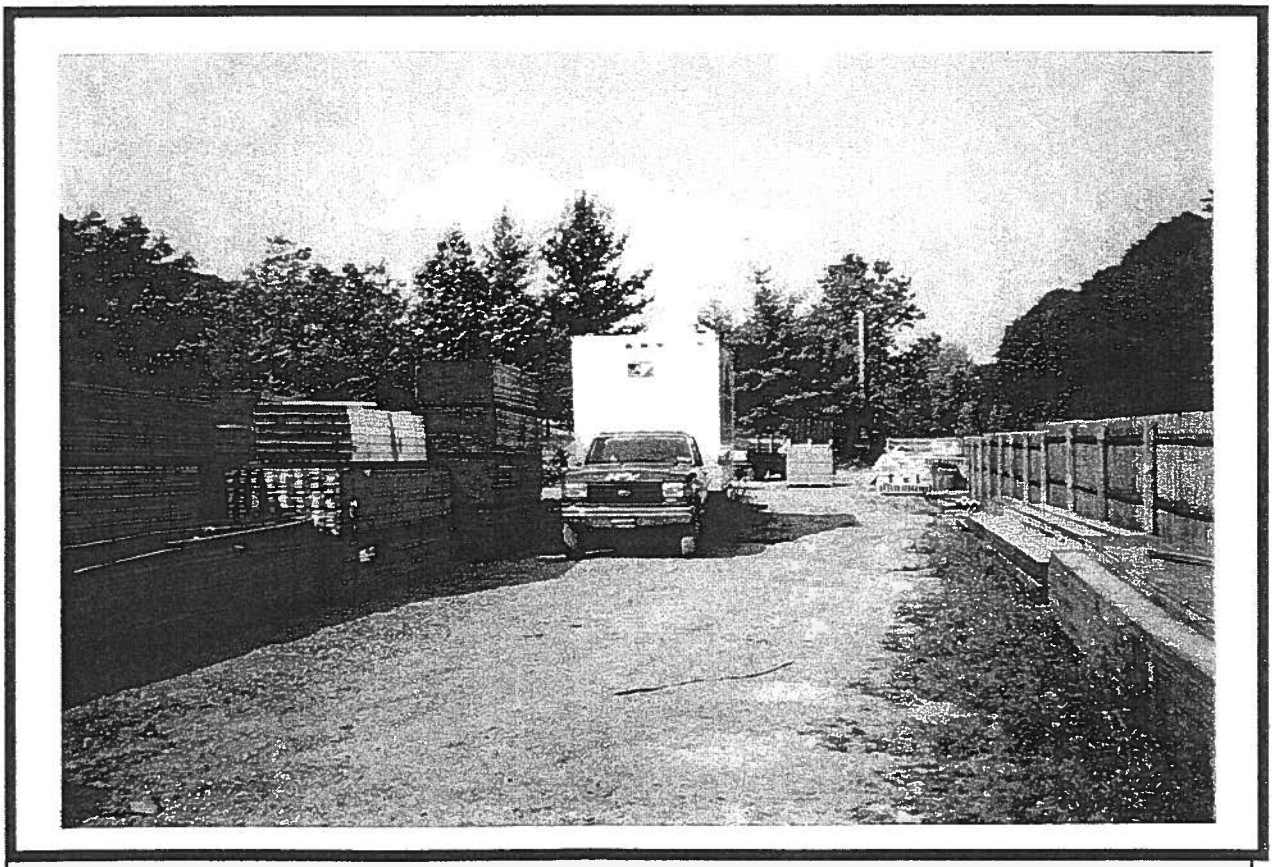

PHOTO 16 Stockade Fence Storage Area (Photo 2 of 2)

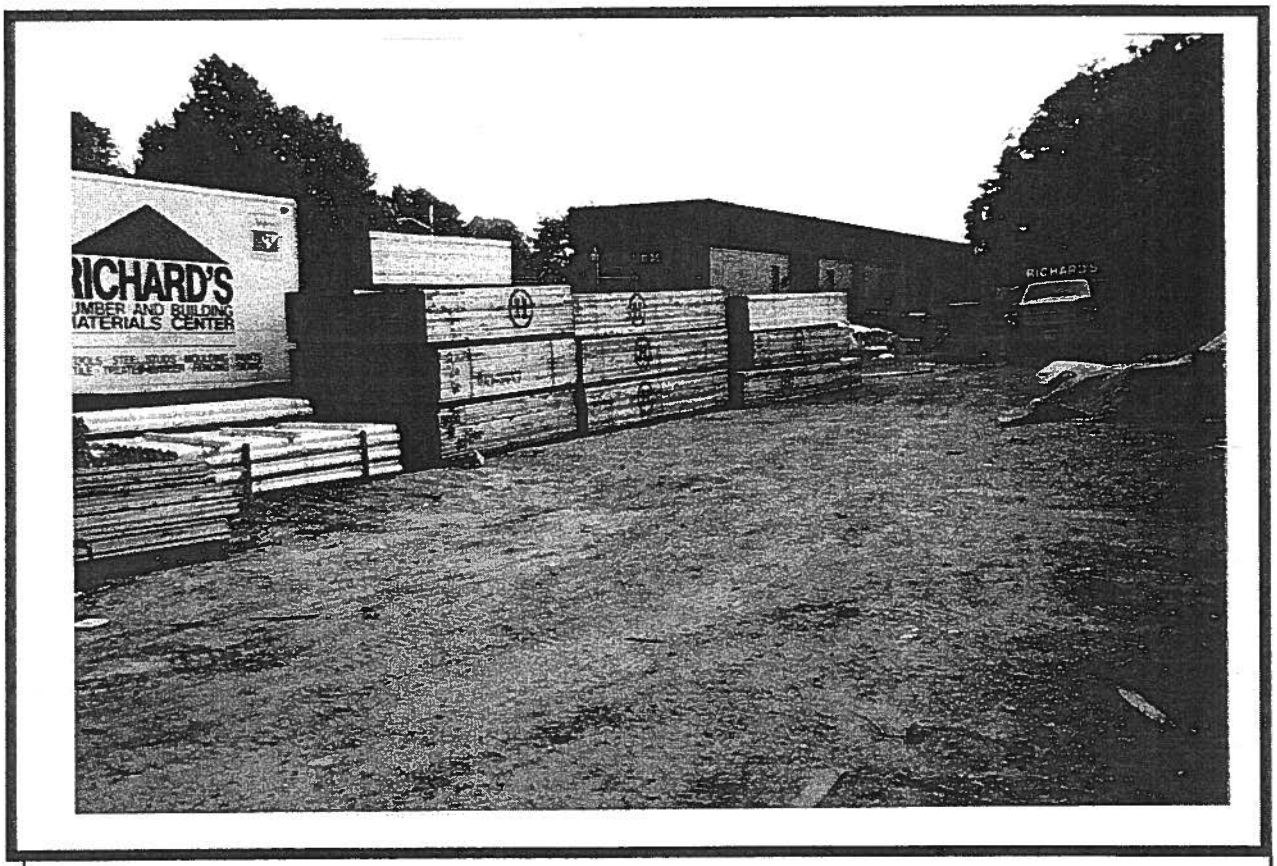

PHOTO 17 Stockade Fence Storage Area

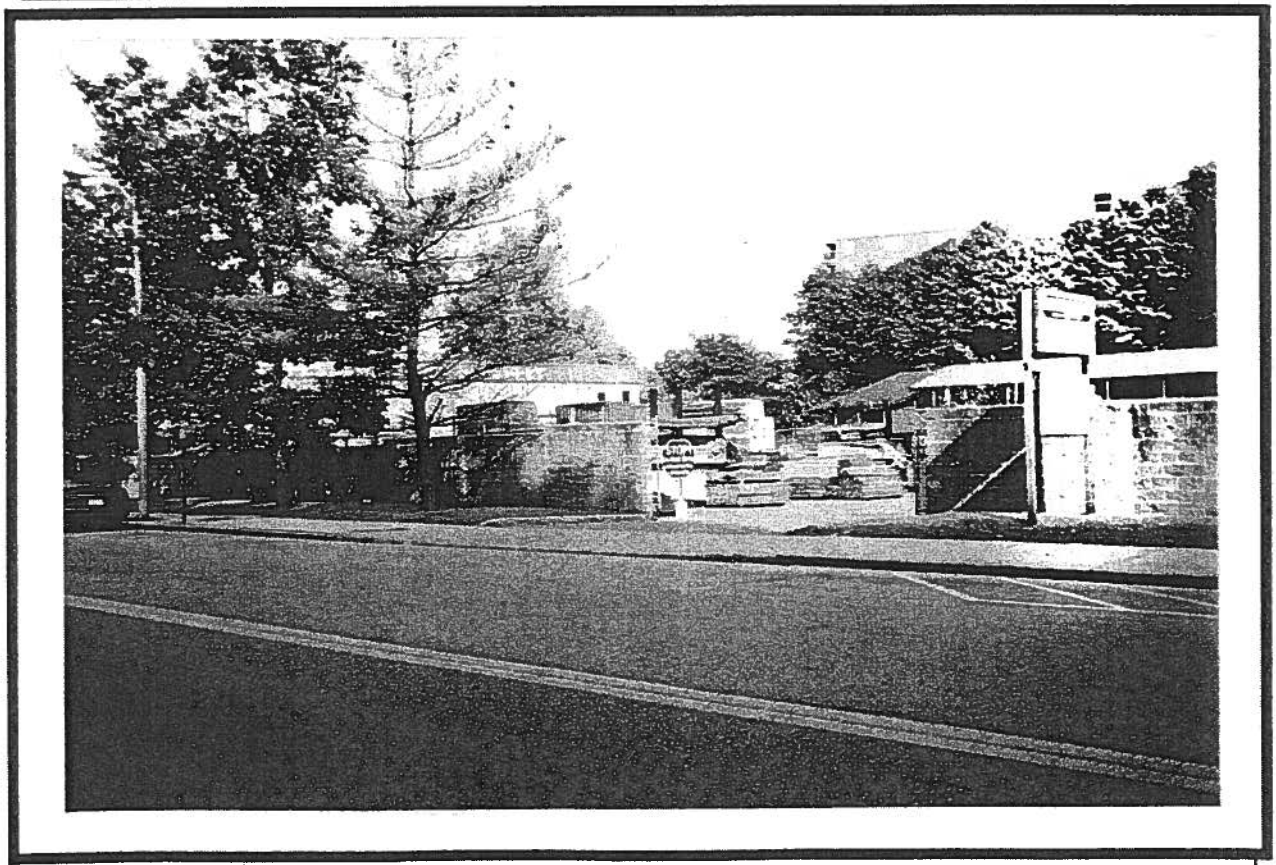

PHOTO 18 Richard's Main Lumber Yard North Side of Building (Photo 1 of 2)

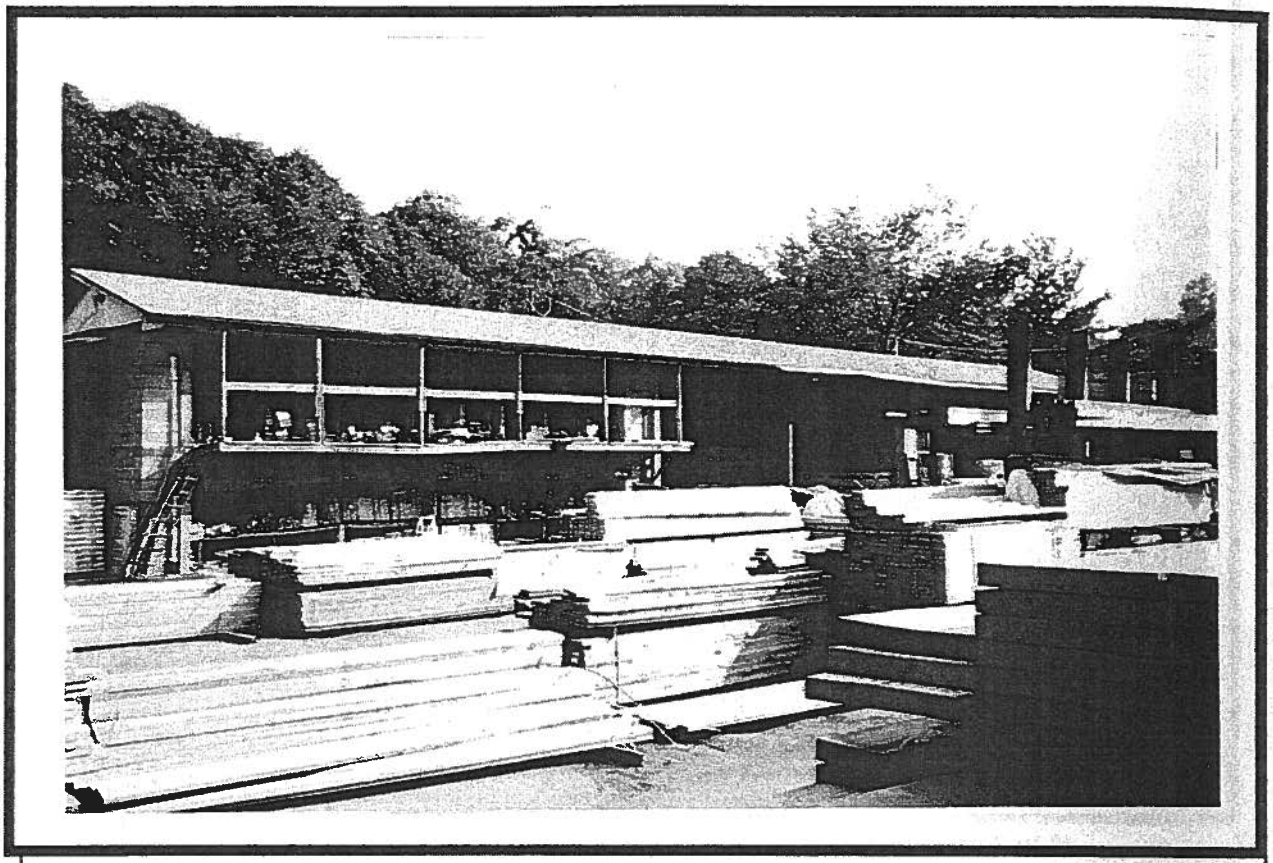

PHOTO 19 Richard's Main Lumber Yard North Side of Building (Photo 2 of 2)

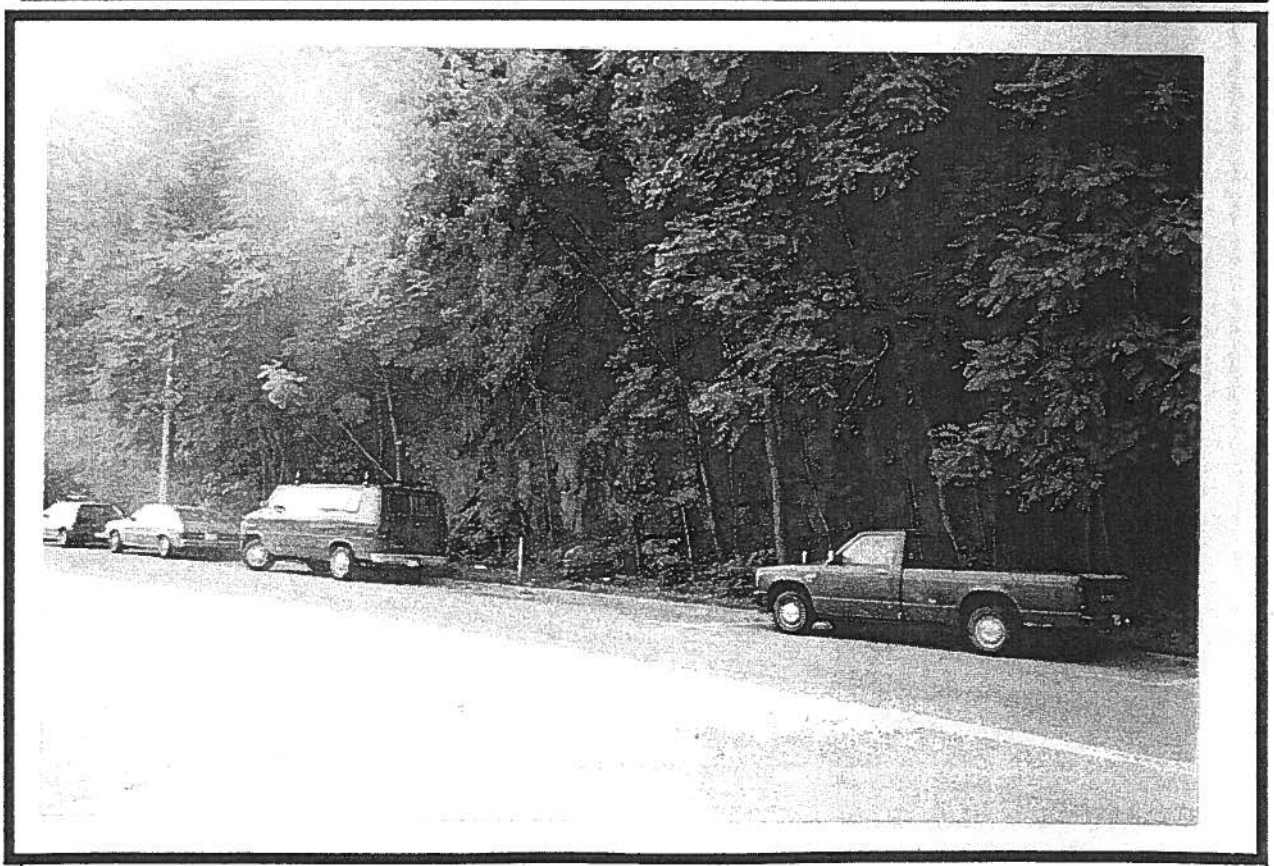

PHOTO 20 Rock Wall Across the Street (Kisco Ave) from Richard's (Photo 1 of 2)

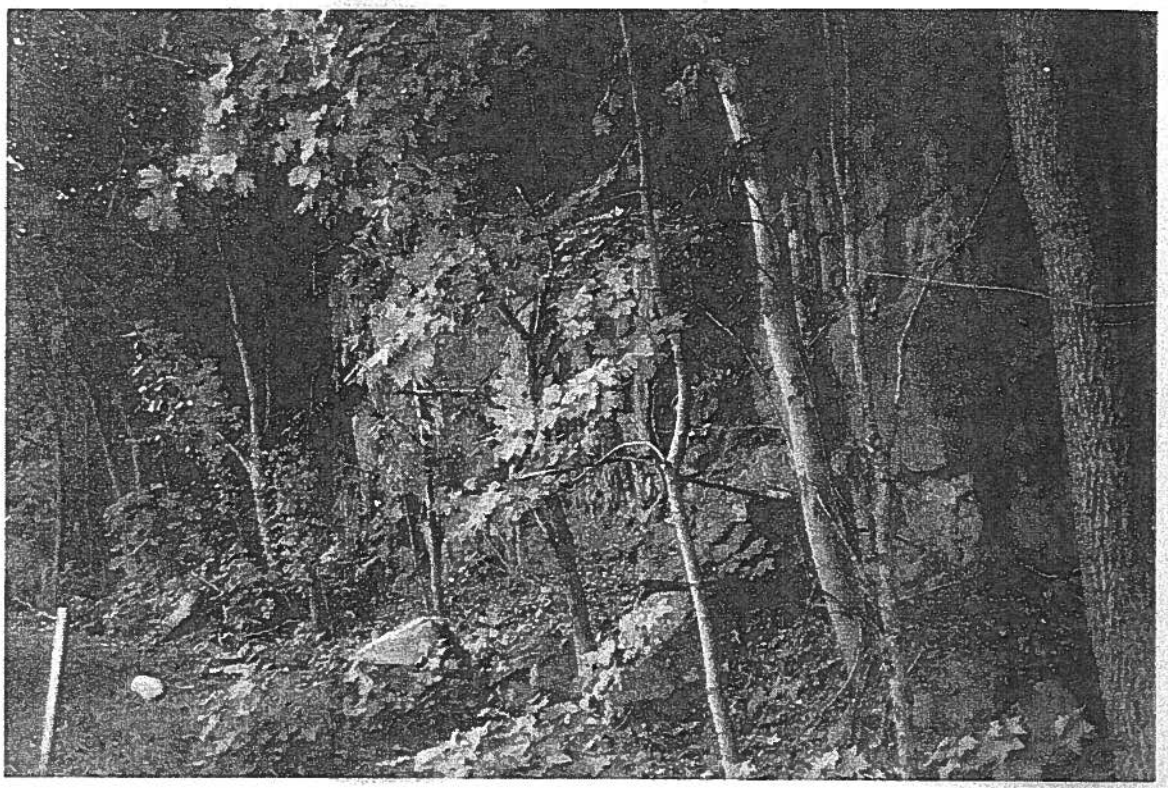

PHOTO 21 Rock Wall Across the Street (Kisco Ave) from Richard's (Photo 2 of 2)

PHOTO 22 Railroad Tracks Bordering East Side of Property, Possibly Contaminated (Photo 1 of 3)

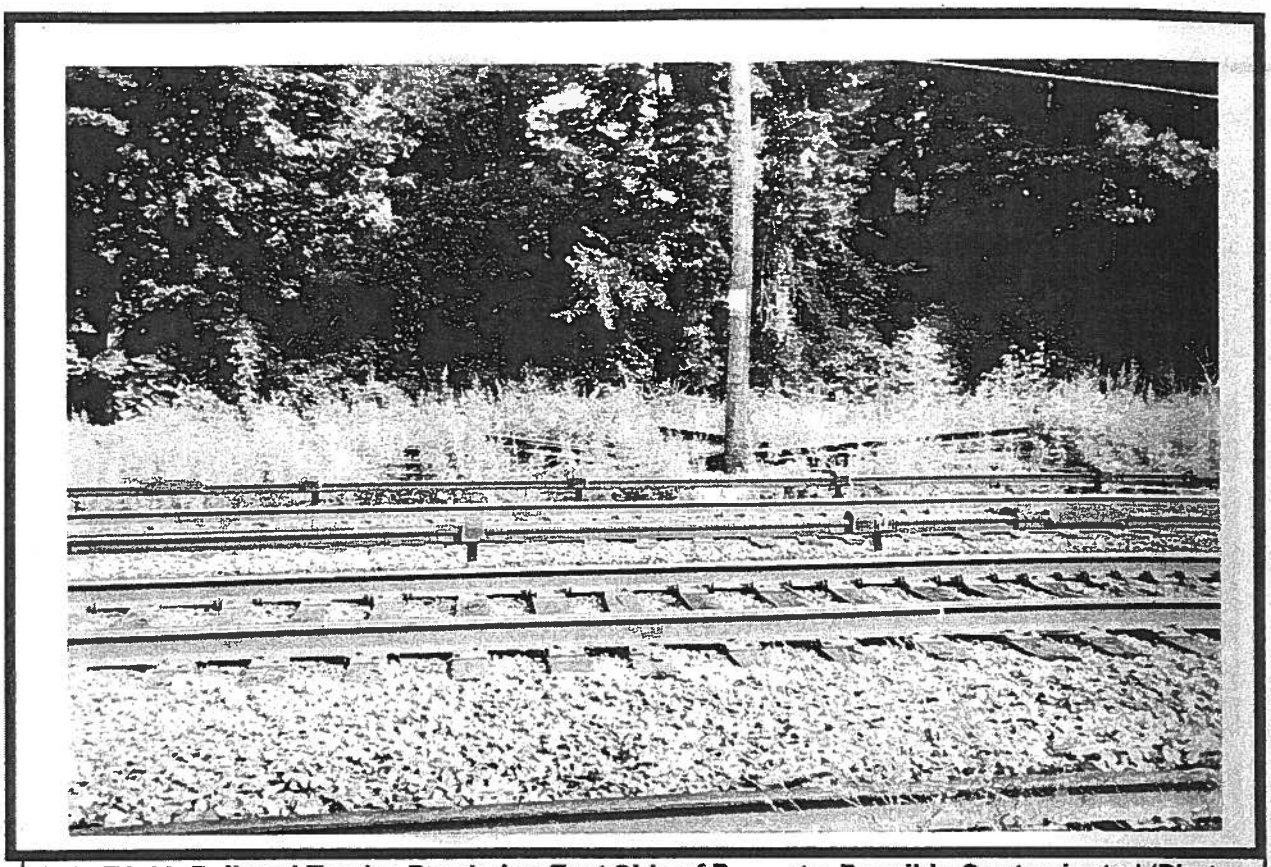

PHOTO 23 Railroad Tracks B ordering East Side of Property, Possibly Contaminated (Photo 2 of 3)

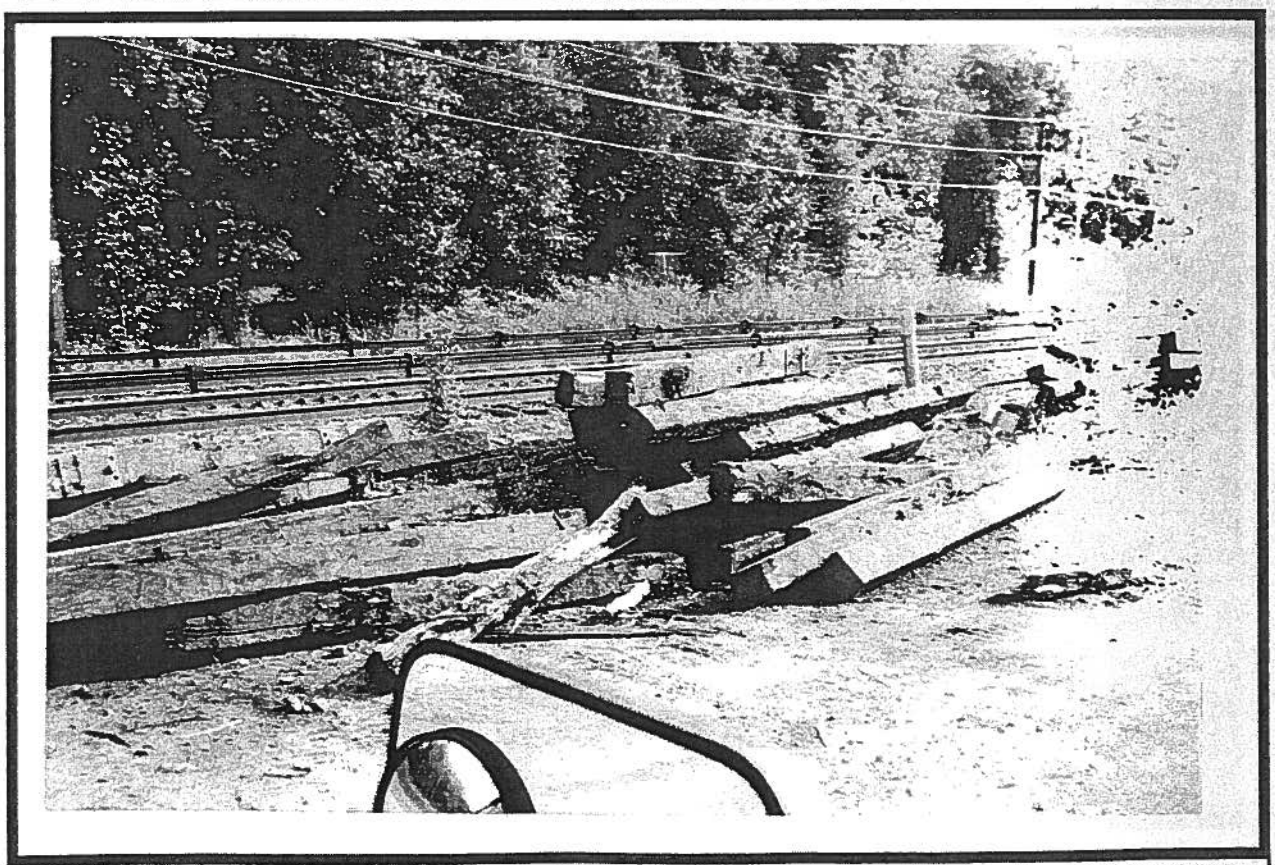

PHOTO 24 Railroad Tracks B ordering East Side of Property, Possibly Contaminated (Photo 3 of 3)

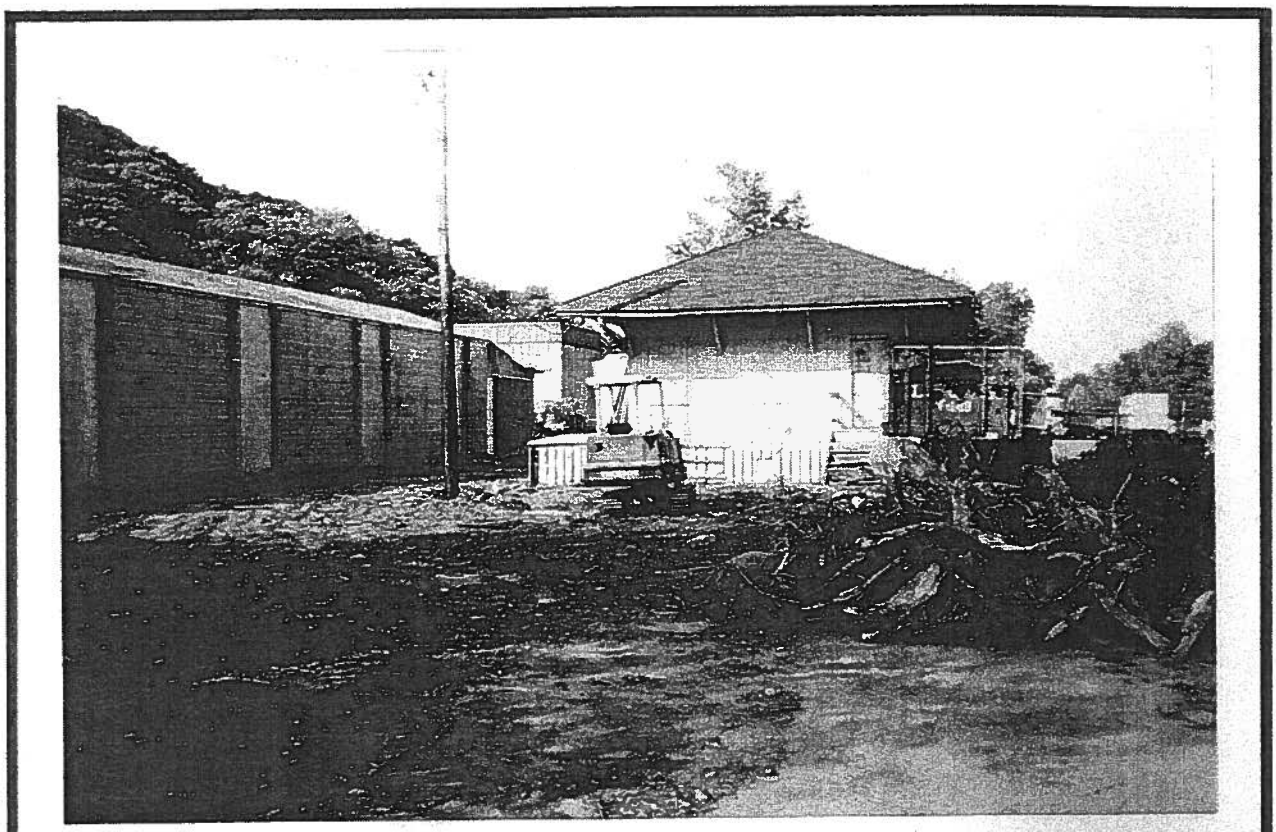

PHOTO 25 Old Depot Excavated Area. Changes Shown Since 9/9/93 Photos (Photo 1 of 4)

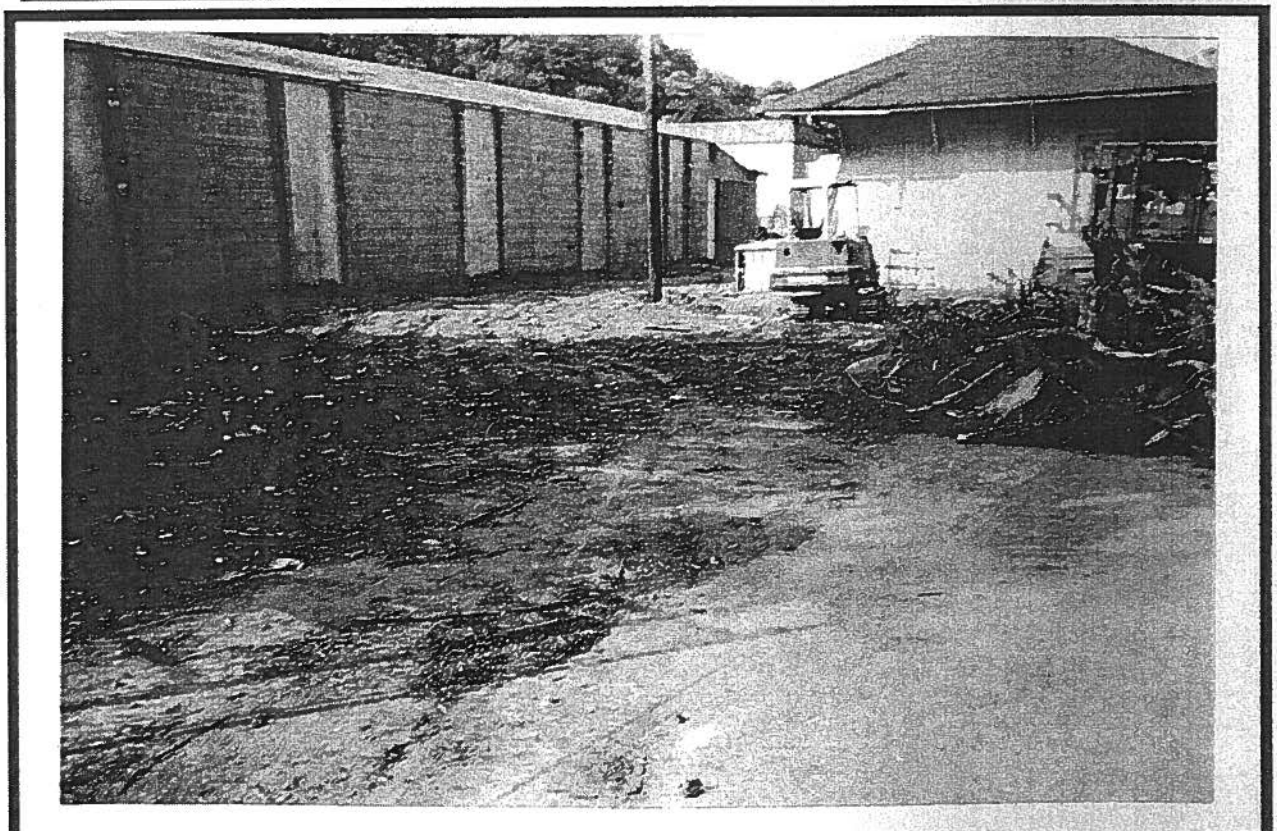

PHOTO 26 Old Depot Excavated Area. Changes Shown Since 9/9/93 Photos (Photo 2 of 4)

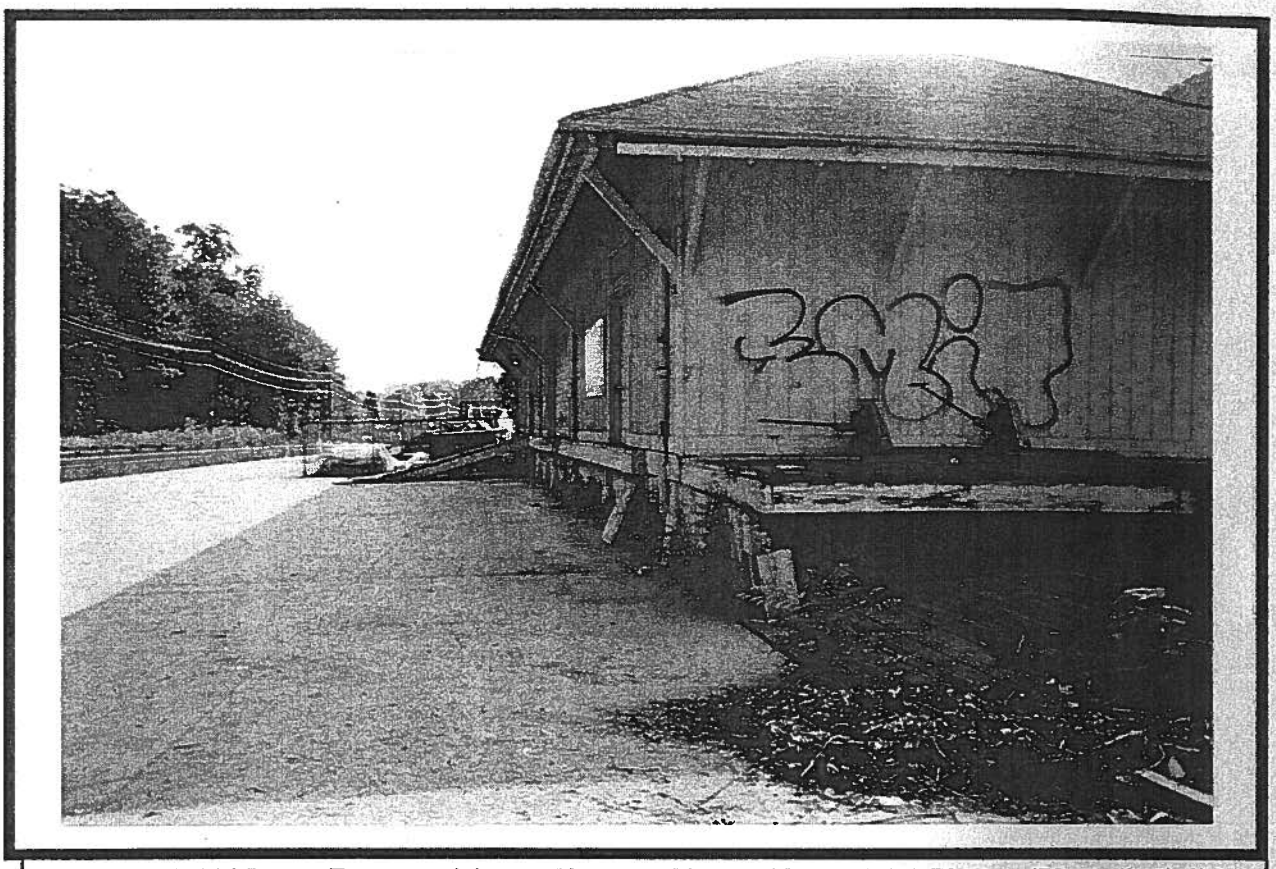

PHOTO 27 Old Depot Excavated Area. Changes Shown Since 9/9/93 Photos (Photo 3 of 4)

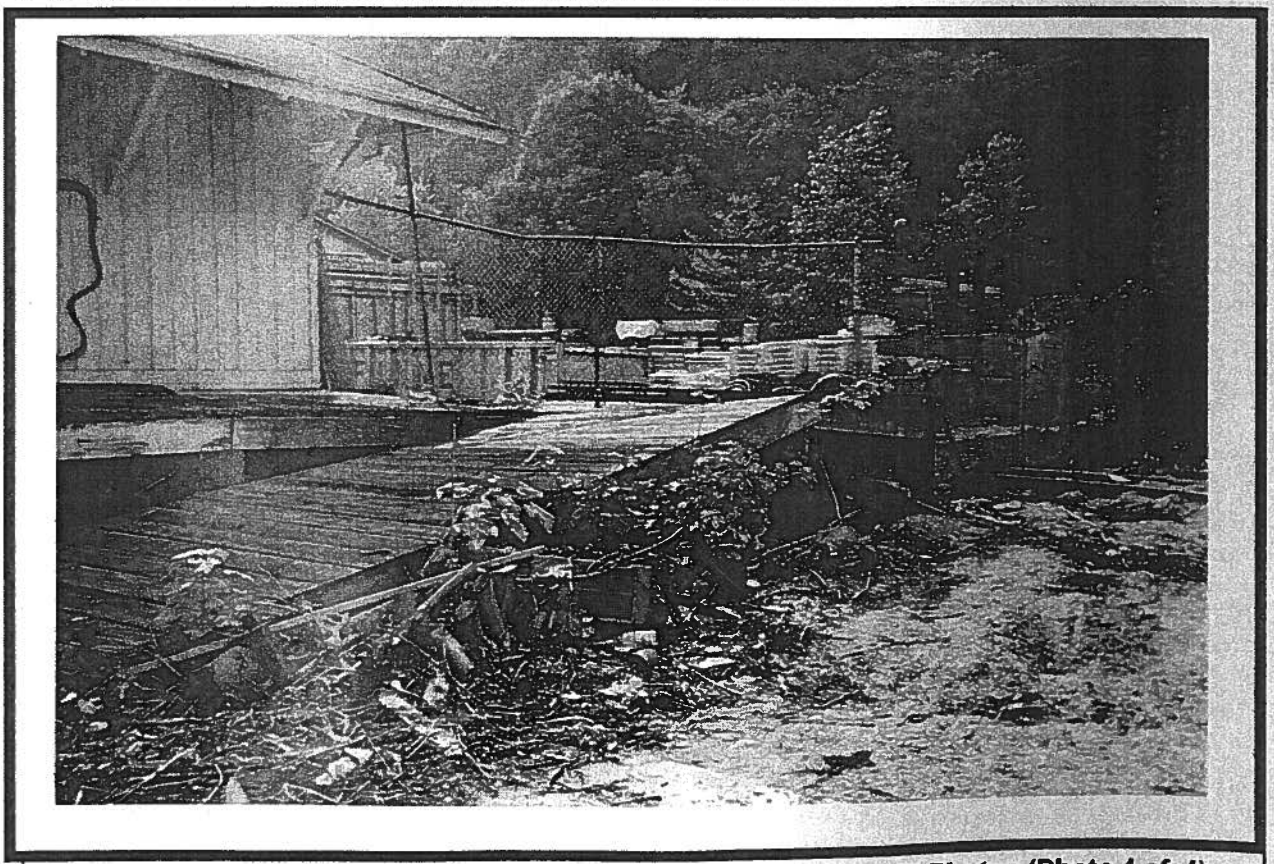

PHOTO 28 Old Depot Excavated Area. Changes Shown Since 9/9/93 Photos (Photo 4 of 4)

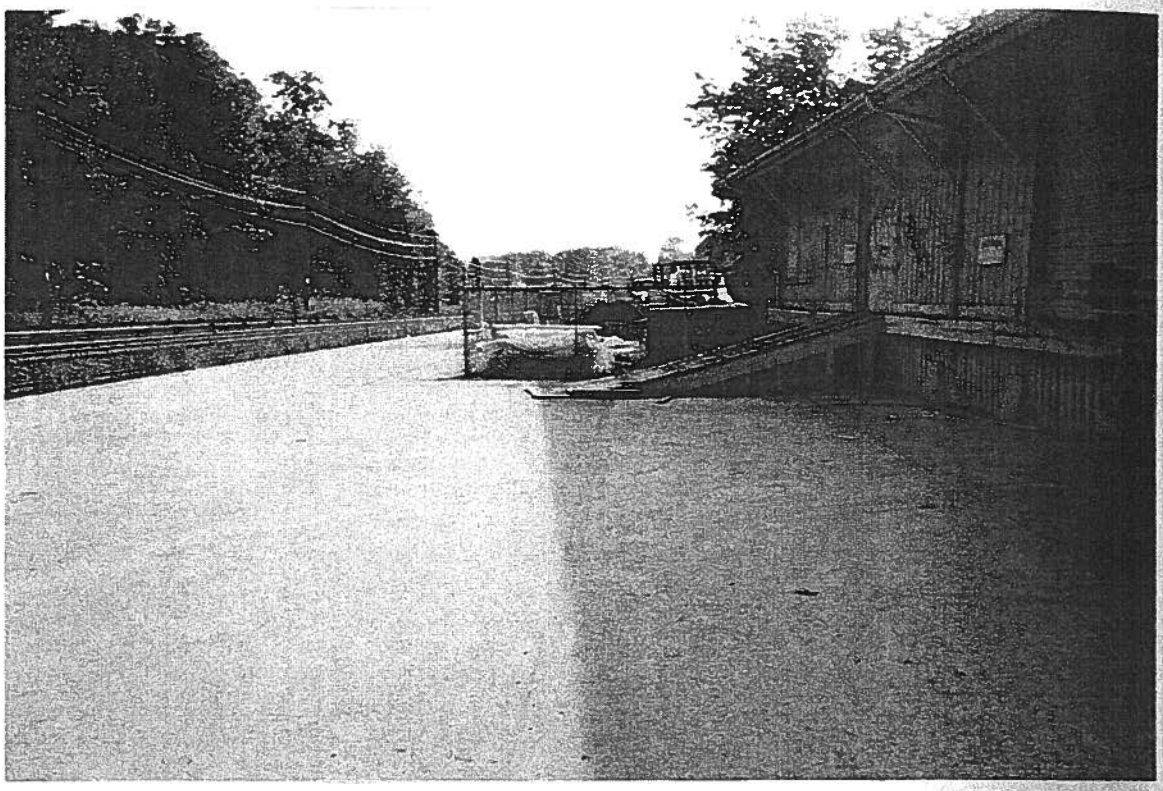

PHOTO 29 Concrete Pad/Road from New Roadway to Old Depot

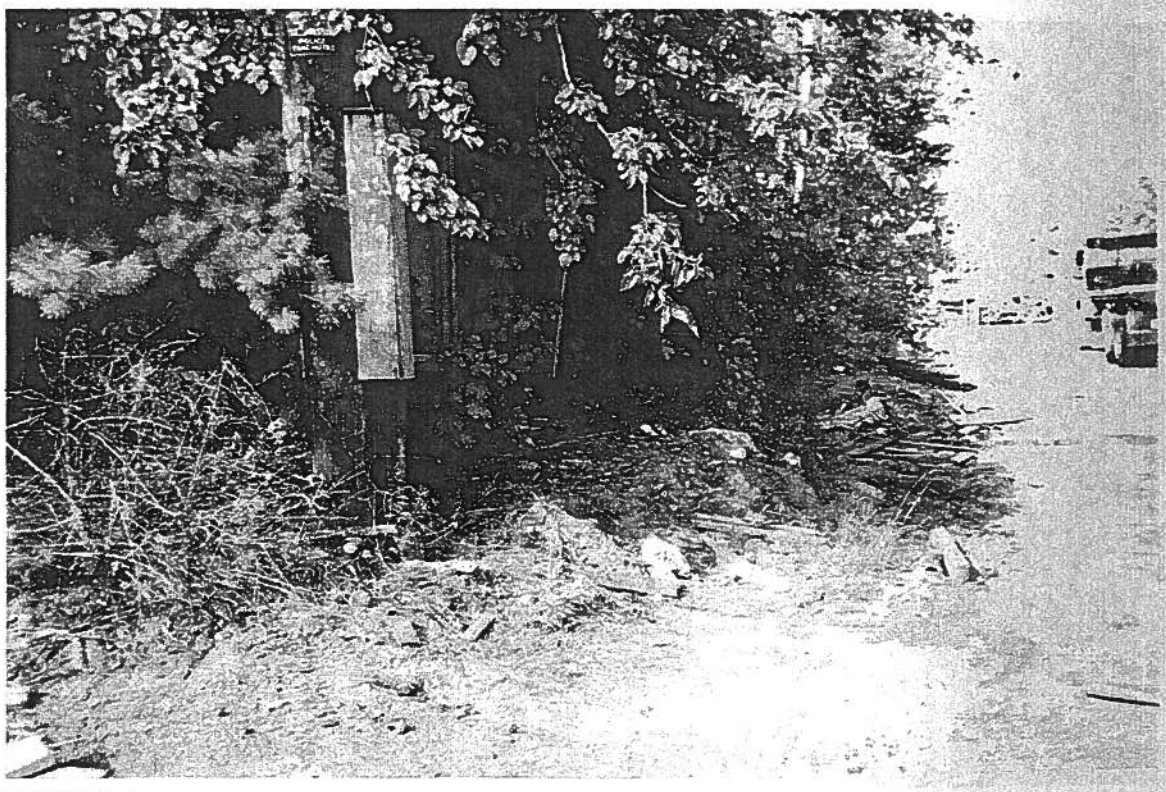

PHOTO 30 Soil Strip Parallel to Fenced Hedgerow and Concrete Apron

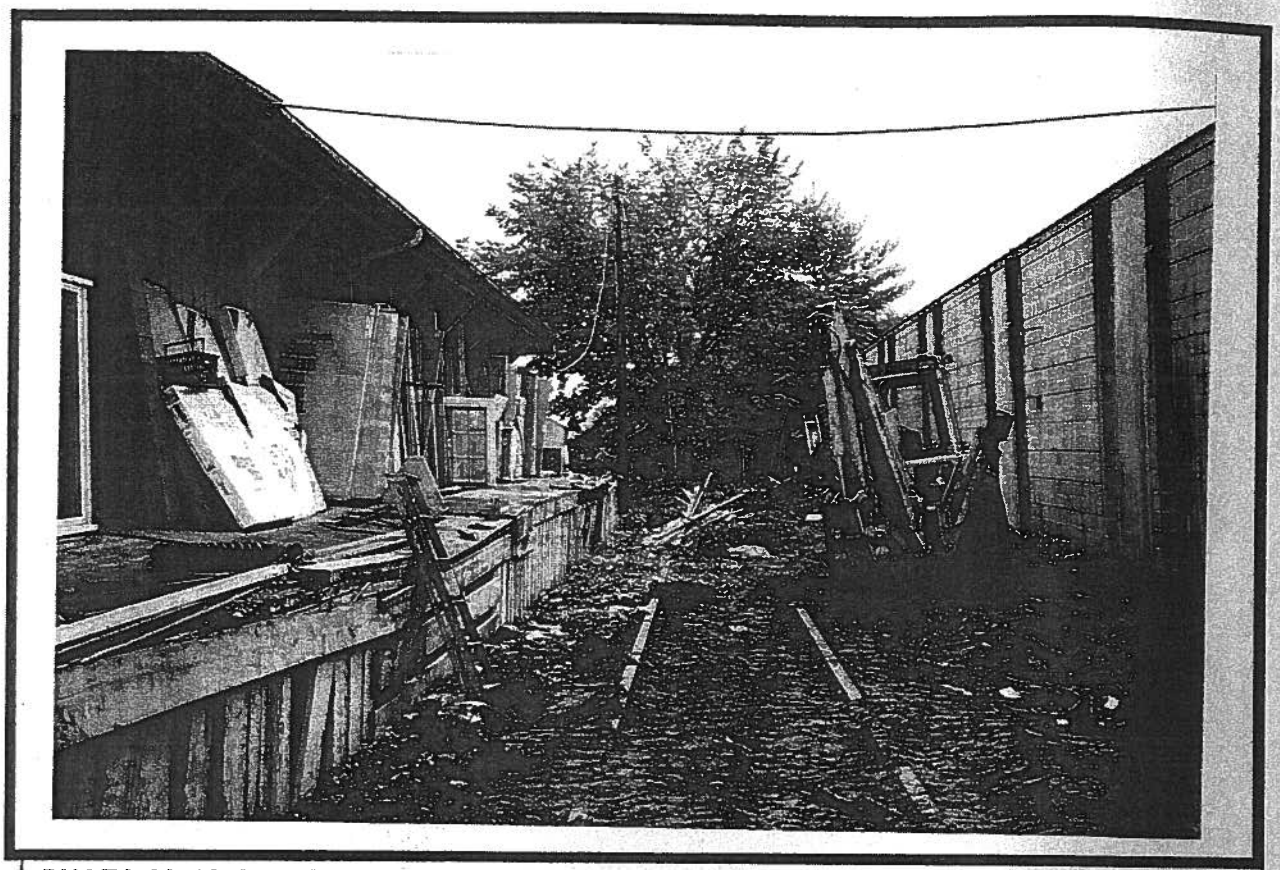

PHOTO 31 Air Sample Location (Photo 1 of 2)

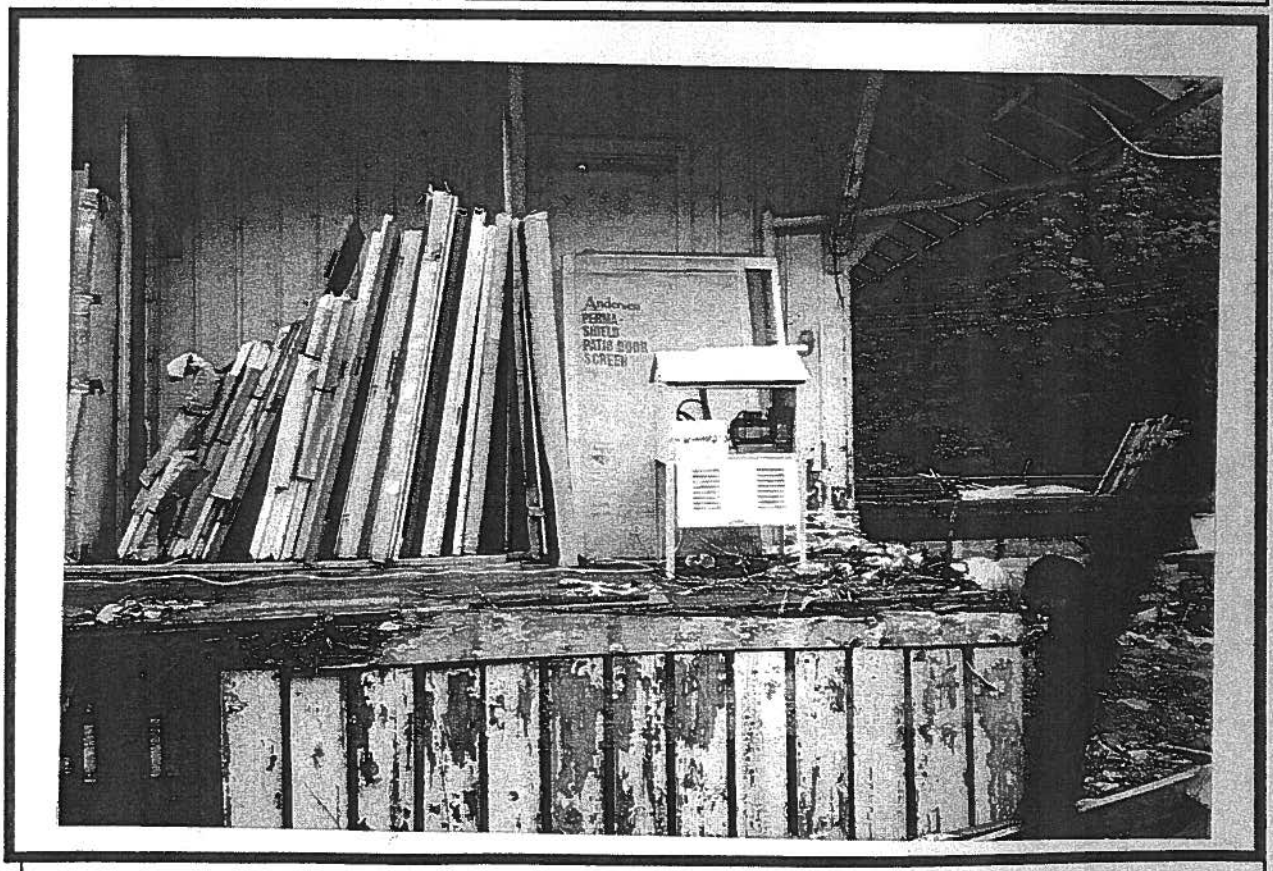

PHOTO 32 Air Sample Location (Photo 2 of 2)