PRELIMINARY ASSESSMENT

115871

SITE NO. 2
FIRESTONE TIRE AND RUBBER CO.
POTTSTOWN, PENNSYLVANIA

INTRODUCTION

Firestone Tire and Rubber Company owns and operates facilities in Pottstown, Pennsylvania which produces finished tires and plastic resins. Firestone began operations at this location in 1945 when they purchased the property from Jacobs Aircraft and Engine Company.

In 1942 Jacobs Aircraft and Engine Company operated a machine shop for the production of aircraft engines. During this time, they had dumped cutting oils and metal filings on site.

Since 1945, Firestone has landfilled tires, inert cloth and rubber, refinery wastes, pigments, zinc oxide, sulfur dioxide scrubber wastes, rubber flashing, and PVC sludge resins. Iron, manganese, aluminum, sulfates, and chlorides originating from the landfill and lagoons on the site have polluted the ground water and surface water in the area.

To remedy these water quality problems, Firestone has established a ground water recovery system of wells which purge the ground water near the lagoons and landfill so that no off-site migration of the ground water occurs.

The amounts of contaminants in the ground water and surface water is now within health standards as the Company continues to monitor the water quality in the area.

SITE DESCRIPTION

The Firestone Tire and Rubber Company, Pottstown Plant, is located in southeastern Pennsylvania approximately 50 km (30 mi) northwest of Philadelphia in Montgomery County.

The site occupies 100 ha (250 ac) within a meander loop of the Schuylkill River. The water of the Schuylkill River eventually reaches Philadelphia and the Atlantic Ocean.

Pottstown, a community of over 20,000 people lies a few kilometers (miles) upstream from the Firestone Plant. There are no domestic wells located in the meander loop occupied by Firestone, but residents in the area do use the ground water.

Firestone's old landfill area is located 45 to 90 m (50 to 100 yd) from the Schuylkill River. Both the new landfill area and the lagoons lie a few hundred meters (yards) from the Schuylkill River (see Figures 2-1 and 2-2).

The Schuylkill River is 0.6 to 1.5 m (2 to 4 ft) deep and 15 to 30 m (50 to 100 ft) wide (depending on seasonal variations) at the Firestone site. The site occupies 100 ha (250 ac) within a 1.5 km (1 mi) meander loop and is fairly flat with a small valley that will be filled in with the expansion of the landfill. The landfill itself is flat and possesses 45 degree banks. The Schuylkill River is 33 m (110 ft) above sea level, the top of the landfill is 45 m (150 ft) above sea level and the bottom of the landfill is 35 m (120 ft) above sea level. The river's 100 year frequency flood raises its level 10 m (30 ft) which floods the bottom of the landfill. This has occurred three times in recent years. The Schuylkill River eventually flows to Philadelphia and the Delaware River. The river serves both industry and people.

The subsurface consists of two distinct materials. Alluvium, 6 to 7.5 m (20 to 25 ft) thick, lies at the surface and consists of thin layers of silt, sand, or gravel. The water table levels in this material correlates closely with the river stage. There is little hydraulic gradient in this, the upper, or shallow flow system. The landfill and lagoons lie in this material.

Underlying the alluvium are the Lockatong Formation, a mudstone and shale, and the Brunswick Formation, a shale, siltstone, and sandstone. The bedrock is not horizontal but

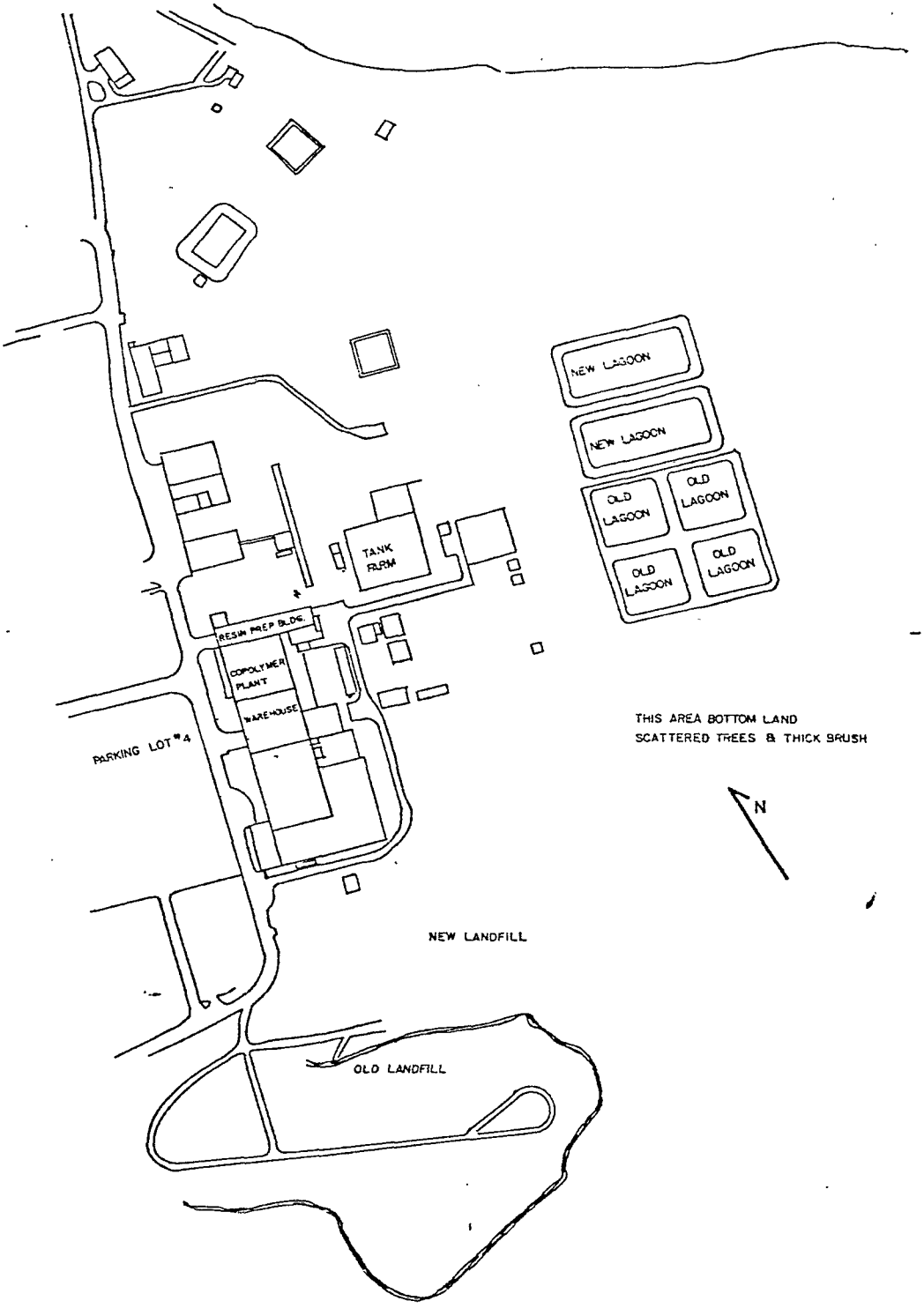


Figure 2-1. Partial map of the Firestone facility in Pottstown, PA.

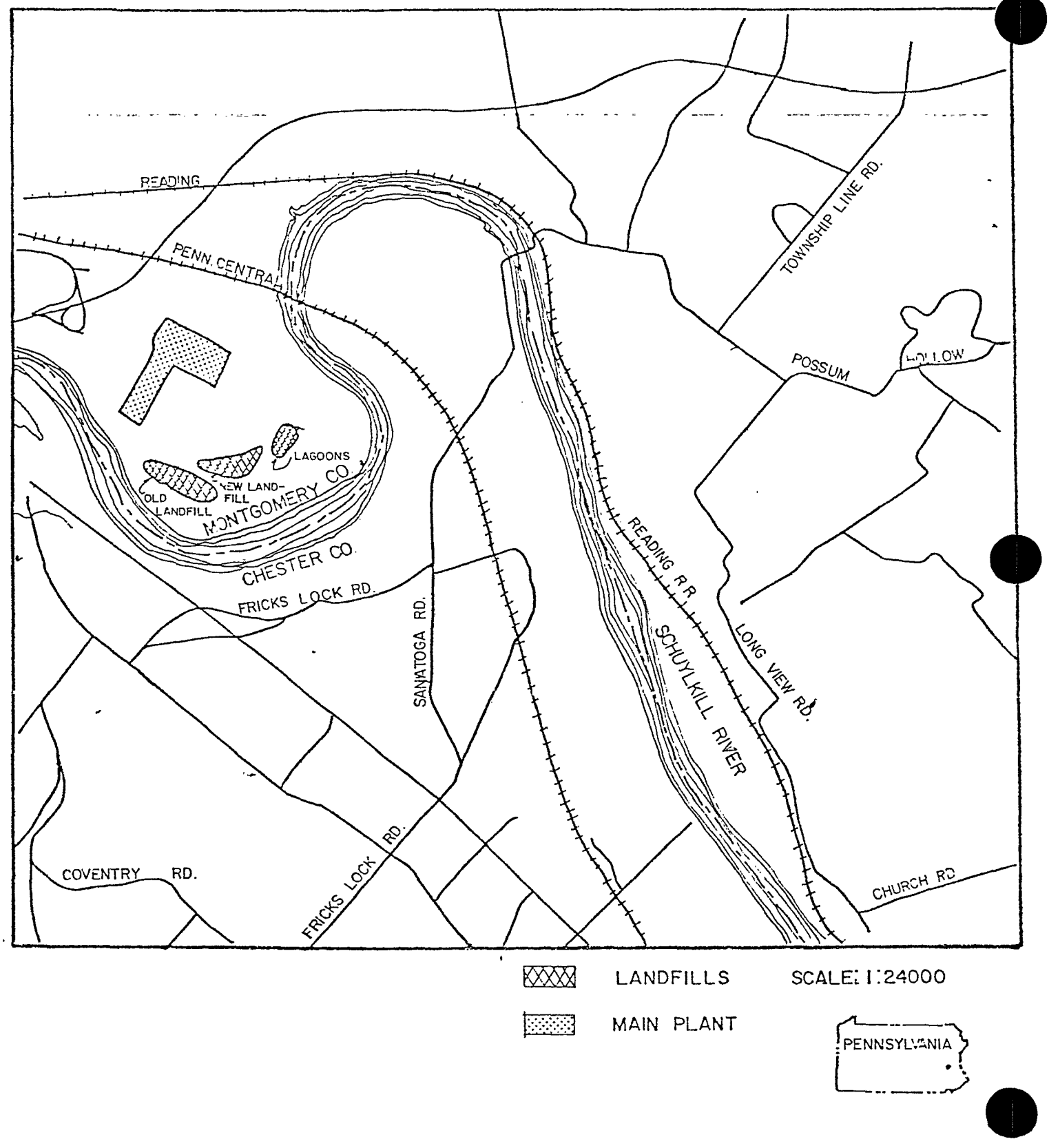


Figure 2-2. Site location of Firestone Tire and Rubber Company Pottstown, PA.[2]

dips approximately 30 degrees to the southeast (see Figure 2-3 and 2-4). Ground water in this, the lower or deep flow system, occurs along joints and bedding planes of the Brunswick Formation. The deep wells used for process water and potable water extend down through this system. There is some communication or recharge from the shallow ground water to the deep ground water. Therefore, the Schuylkill River, the alluvium aquifer, and the bedrock aquifer are not independent of each other.

The area around Firestone is hilly and well drained. Elevations range from 33 m (110 ft) to over 90 m (300 ft) as seen in Figure 2-4.

The vegetation on the Firestone site consists of grasses and some hardwood trees. The trees grow along the river banks and in the small valley. Native grass has been planted on the landfill and other areas disturbed by man.

Pottstown receives about 100 cm (43 in.) per year of precipitation. Approximately 81 cm (32 in.) of snow falls per year. Therefore, most of the precipitation falls as rain which is spread out fairly evenly year round. No frost can be expected from early April to late October. The winds average 15 km/hr (9.3 mph) from the west. The temperature averages about 10°C (51°F) year round with a summer average of about 22°C (72°F) and a winter average of about -3°C (26°F).

SITE OPERATIONS AND HISTORY

At Pottstown, Firestone operates both a tire manufacturing plant and a chemical plant which produces plastic resins. They are proceeding with plans to close their tire plant. However, the chemical plant will remain in operation.

Firestone employs nearly 2,400 people to produce 450,000 kg (1 million lbs) of finished tires per day. Both the number of employees and the amount of tires produced have been declining as closure continued. Manufacturing of tires is a labor-

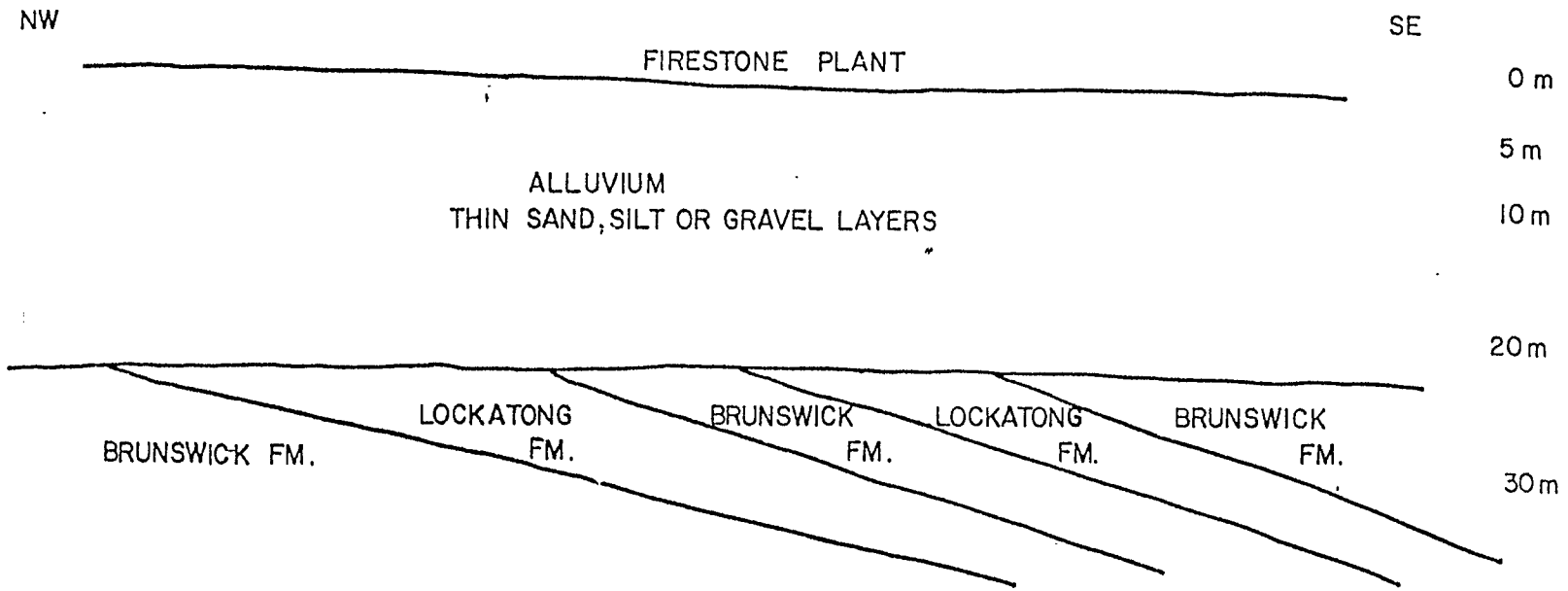


Figure 2-3. Rough Geologic Cross Section of the material underlying the Firestone plant.

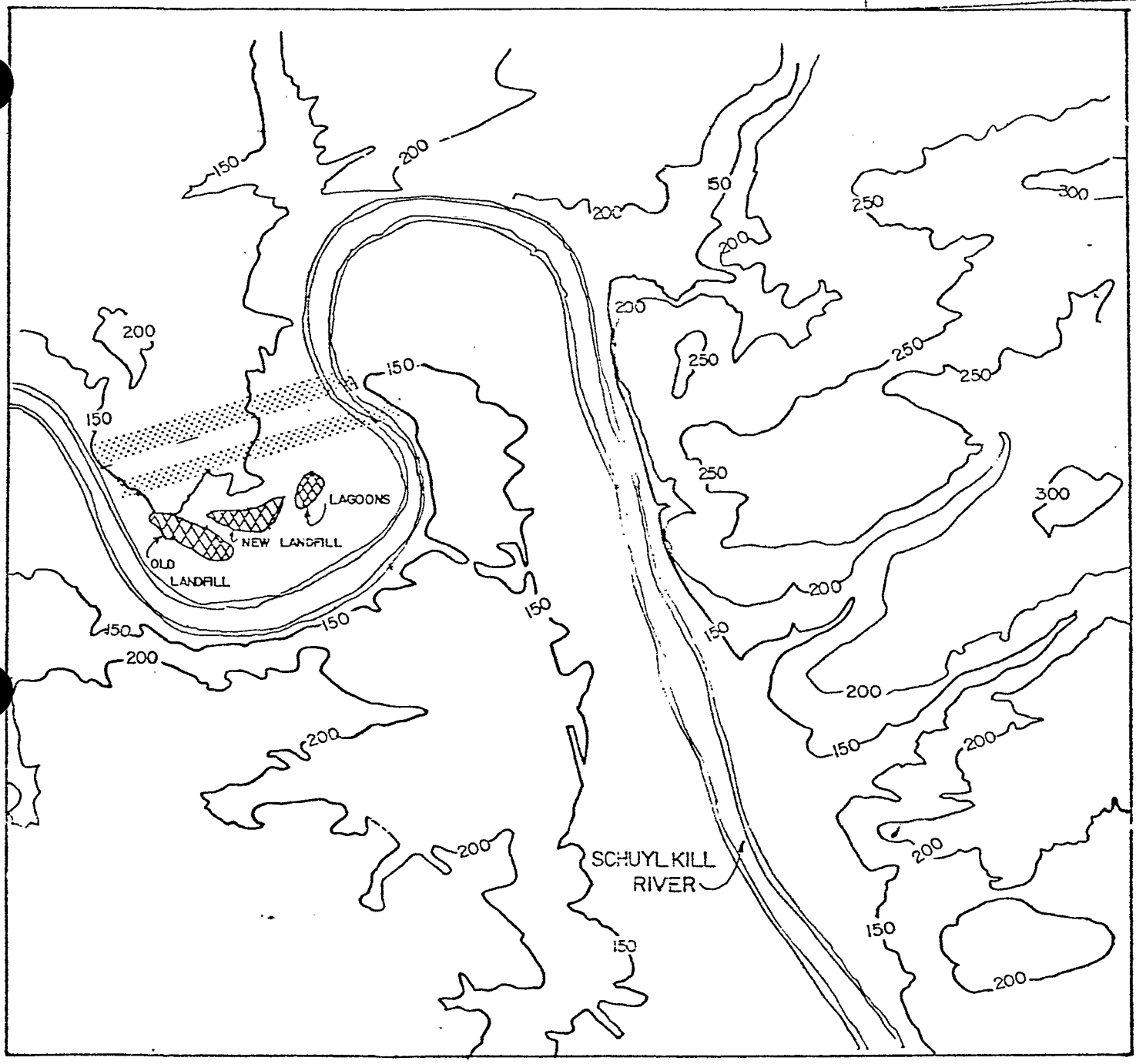


Figure 2-4. Location and partial geologic map for Firestone's Pottstown, Pennsylvania plant.[2]

intensive process. There are approximately 600 people employed in Firestone's chemical plant.

Both the tire and the chemical plant contribute to the landfill. In early 1971, an average of 36 metric tons (33 tons) of refuse was landfilled per day. The majority of refuse was factory trash and paper. The following is a list of typical landfill refuse:

- Tires
- Refining Waste
- Paper
- Carbon Black
- Polyethylene
- Miscellaneous Compounding Agents or Dust from Cleanups (includes sulfur and zinc oxides)
- Lagoon wastes (including calcium carbonate, calcium hydroxide, and PVC resin)
- Wastewater Treatment Sludge
- Metal Banding and Strappings
- Inert Cloth and Rubber
- Rubber Flashing
- Oily Rags
- Polyvinyl Chloride (PVC) film
- Clay
- Talc
- Boiler Fly Ash
- Synthetic Polymer Fabric
- Wooden Pallets
- Oil/Water Emulsions
- Styrene Latex Coagulant
- Sulfur Dioxide Sludge
- Floor and Roadway Sweepings
- Fiber Drums

The landfill also received vinyl chloride sludges from their seepage lagoons. An outside contractor works full time to dispose of the wastes. This system is estimated to cost only half the price as that which would be incurred in disposing the wastes off-site.

Two lagoons are used by the chemical plant. They are lined and the sludge is removed to the landfill. Wastewater is the only material added to the lagoons.

Firestone also has a demonstration plant for the removal of sulfur dioxide and fly ash from the exhaust gas of boilers fired either with high sulfur oil or coal. They also are

participating in a project to landfill the waste sludge (calcium sulfite dihydrate and sodium sulfate) that results from the scrubbing plant. The demonstration plant was designed to process approximately 12 million m^3 per minute (10,000 acre-feet per minute) of exhaust gas from either of two 30 million kg-calories per hour (120 million BTU per hour) industrial boilers. They can be fired with oil or coal. A high sulfur oil (2.0 to 2.5 percent) is used for testing. The removal plant operates twenty-four hours per day, five days per week.

The plant consists basically of two operations:

1. A scrubbing loop where the sulfur laden stack gas is contacted with the scrubbing solution in a venturi scrubber.
2. A regeneration system where sulfur is removed as a sludge from the solution by precipitation and then the scrubbing solution regenerated for re-use.

In 1942 Jacobs Aircraft Engine Company operated a machine shop and defense plant for the production of aircraft engines as part of the war effort. Cutting oil wastes, metal filings, etc. were placed in an open dump on the site.

Firestone Tire and Rubber Company bought the plant in 1945 and began tire production soon afterwards. They continued the use of the open dump through the early 1960's converting it to a landfill accepting vinyl resins, factory trash, rubber (tires, etc.), etc. The landfill was originally 5 ha (13 ac) in size. They also used seepage lagoons for their PVC waste. They used three deep wells in the early 1960's to supply water for process uses.

POLLUTION

At first, the landfill and lagoon operations were considered environmentally adequate by the Pennsylvania Department of Environmental Resources. Subsequent monitoring of wells and

the Schuylkill River indicated the contamination. The following contaminants and their concentrations were detected in the ground water in 1972 by placing monitoring wells around the landfill:

- 185 ppm iron
- 20 ppm manganese
- 10 ppm aluminum
- 140 ppm sulfates

Because of the interconnection of aquifers and the Schuylkill River, there was a threat of pollution to both the deep aquifer and the Schuylkill River.

The landfill was accepting nearly 27 metric tons (30 tons) of refuse per day in 1970. Firestone applied for a new permit to operate a sanitary landfill in 1970. The permit was granted in July 1971, but it was withheld until August 1973 because of permit infractions and revisions. It was the first industrial land disposal permit issued by the State's Division of Solid Waste Management.

Firestone received a variance for a pilot plant process to remove sulfur dioxide and fly ash from the boiler stacks. They also received permission to landfill the wastes from the sulfur dioxide scrubber system in late 1973. Wastes from the scrubber process included:

- Calcium Sulfite Dihydrate
- Lime Residues
- Fly Ash
- Sodium Sulfate

From the seepage lagoons the sludge was mixed with dirt and landfilled. Operations using the scrubber system began in February 1975. This was an experimental one-year operation in cooperation with the State. A permit for continued operation of the scrubber processing and disposal facility was granted in September 1977.

REMEDIAL ACTION

The Bureau of Water Quality Management ordered use of the seepage lagoon be discontinued in early 1974. Four earth lined seepage lagoons containing high concentrations of chlorides and sulfates had been used by Firestone.

Two new lagoons were built in early 1974. They were lined with a multi-layered rubber liner developed by Firestone. The old lagoons were dredged of their sludge which was landfilled. These lagoons now receive the sulfur dioxide scrubber wastes before the resultant sludge is landfilled and wastes from their chemical plant (PVC resins). They lie in the flood area of a hundred year flood but otherwise they have no discharge and, therefore, do not affect the ground water.

In 1974 Firestone sought permission to expand their landfill. They needed a leachate control system. Lining the expanded landfill to isolate it from the ground water flow system was determined to be more expensive than flow manipulation. It was also determined that it would be impractical to attempt to line the existing landfill. Therefore, Firestone began a ground water recovery system of 22 wells as seen in Figures 2-5 and 2-6. The extracted water could be used for processing and potable uses.

Three wells, used for potable water, draw a total of 570 l/minute (150 gal/minute). They are 60 m to 120 m (200 to 400 ft) deep. Five wells are used for process water which is deionized previous to use in the polymerization process. These wells draw 370 to 750 l/minute (100 to 200 gal/minute) each. The five wells form a large cone of depression beneath the seepage lagoons and the landfill. Recharge from the alluvium aquifer is drawn to this large cone of depression. Therefore, the pollutants entering the shallow flow system (alluvium aquifer) is also drawn down and does not flow to the Schuylkill River. Water from the Schuylkill River enters the alluvium aquifer as recharge. Flow manipulation has altered the original

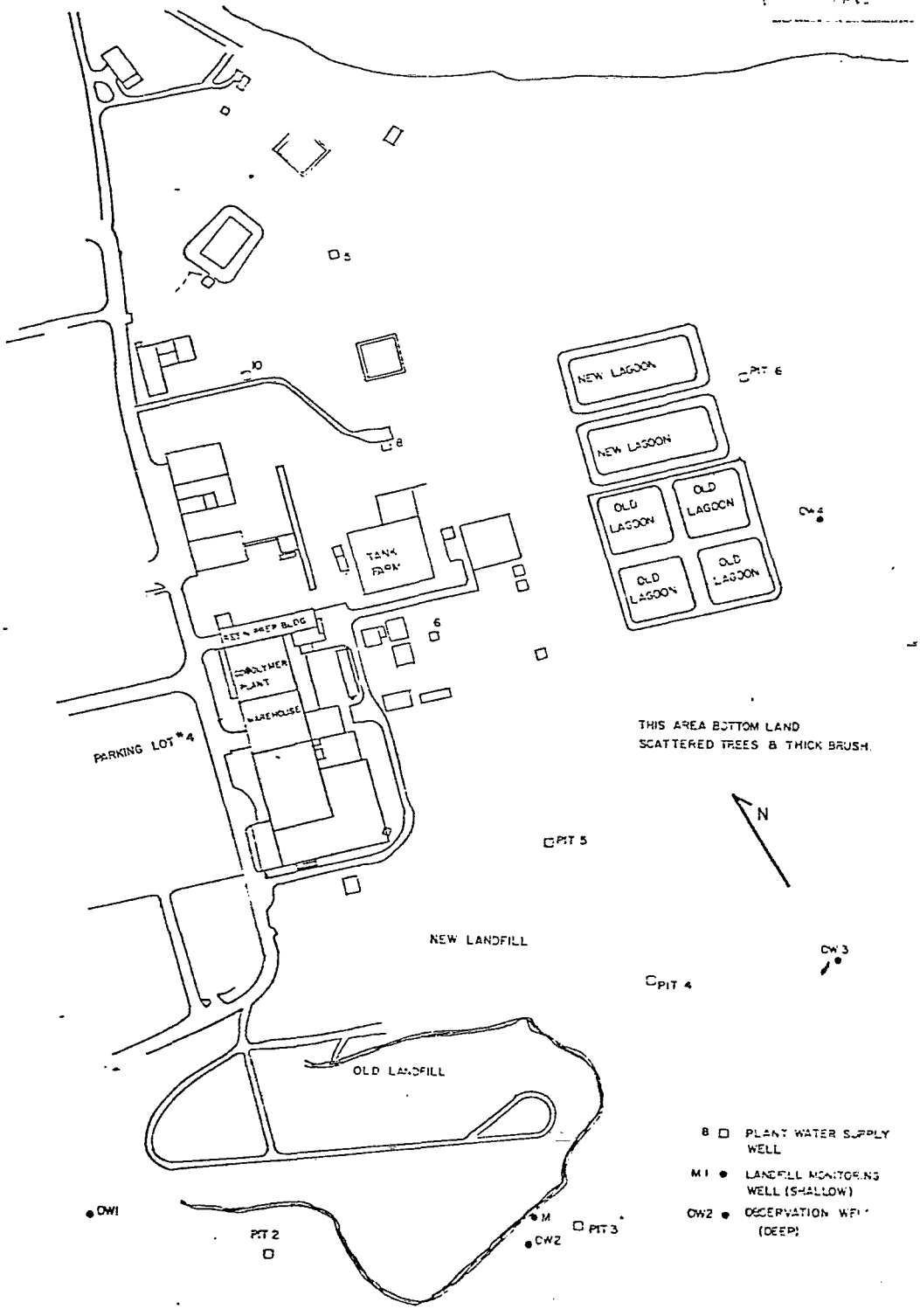


Figure 2-5. Partial map of the Firestone plant showing some wells and pits used for remedial action.

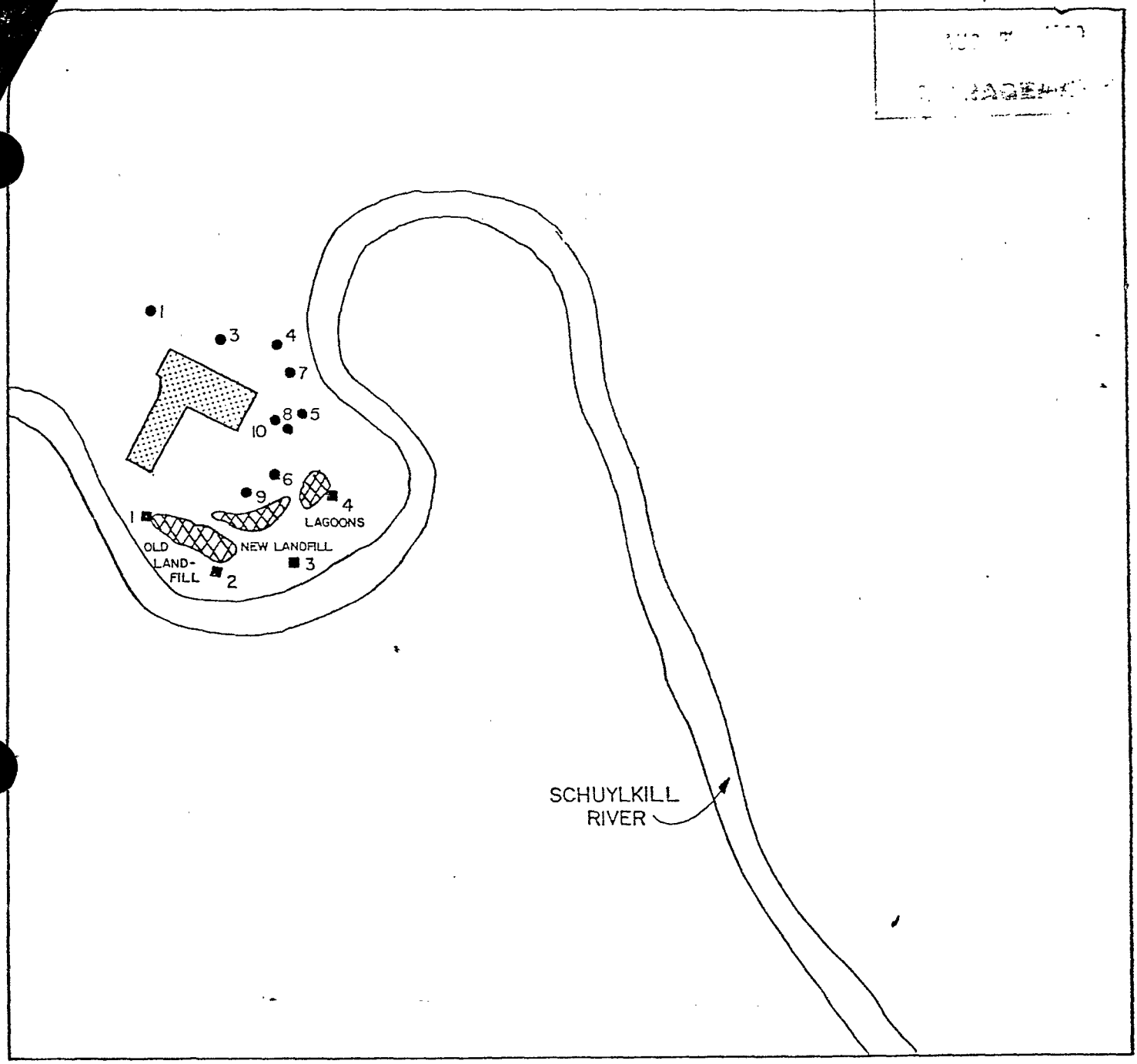


Figure 2-6. Location map of Firestone showing some wells for remedial action.[2]

flow pattern of the alluvium aquifer which recharges both the bedrock (deep flow system) and the Schuylkill River. Fourteen wells are used for monitoring. This recovery system has been effective in controlling off-site migration of pollutants.

The data represented on the graphs in Figures 2-7 through 2-11 illustrate the problem of the pollution to the ground water as well as the effectiveness of the use of the recovery wells. No graphs illustrating iron or phosphate contamination are included. Early sampling for iron was affected by contamination by the iron casings in the wells. Phosphate and manganese data was too sketchy to indicate consistant contamination or trends.

Firestone paid $250,000 for a hydrogeologic study to determine the best means of leachate control and for the placement of the recovery and monitoring wells.

No future expansion of the recovery wells is planned although Firestone will continue to draw water. After Firestone discontinues their tire manufacturing plant, less material will be landfilled. Their chemical plant will continue use of the seepage lagoons and landfill. Therefore, the recovery system should be adequate to control the water flow system and the migration of pollutants. Monitoring will continue on a quarterly basis.

CONCLUSIONS

Firestone has attempted, through several types of remedial action, to control leachate migration from their Pottstown facility. There has been a threat of contamination to the ground water (a two aquifer system) and to the surface water (Schuylkill River).

Firestone converted their open dump to a landfill in the early 1960's. This helped control surface conditions (blowing litter, etc.). No data is available to determine whether this influenced the leachate entering the ground water, soil, or the Schuylkill River.

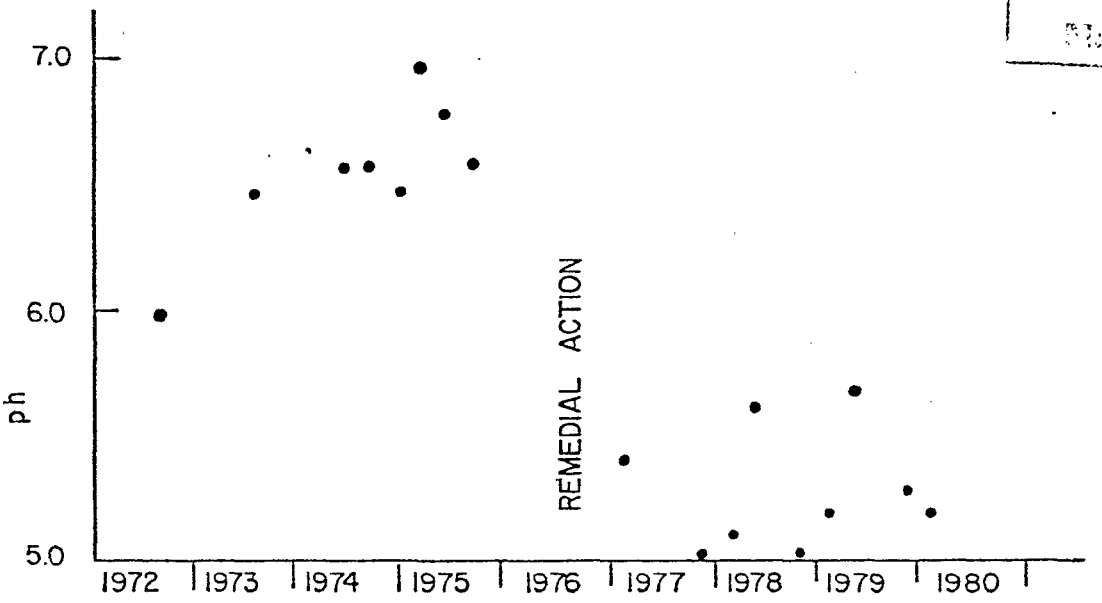


Figure 2-7. Ground water pH before and after the use of the recovery wells.

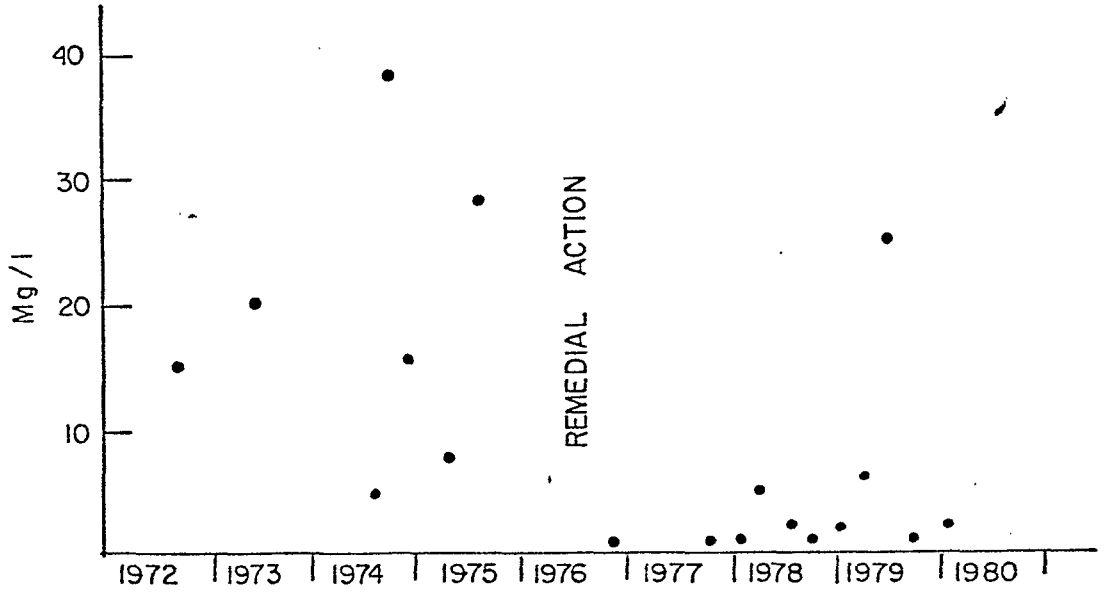


Figure 2-8. Five day BOD in the ground water before and after the use of recovery wells.

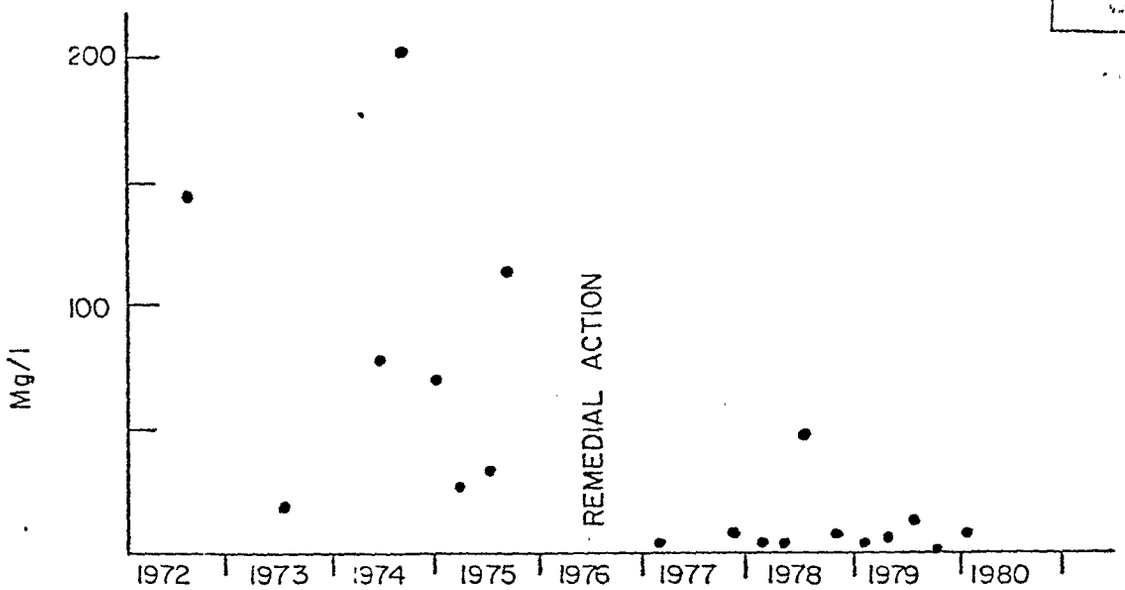


Figure 2-9. Chloride concentrations in the ground water before and after the use of recovery wells.

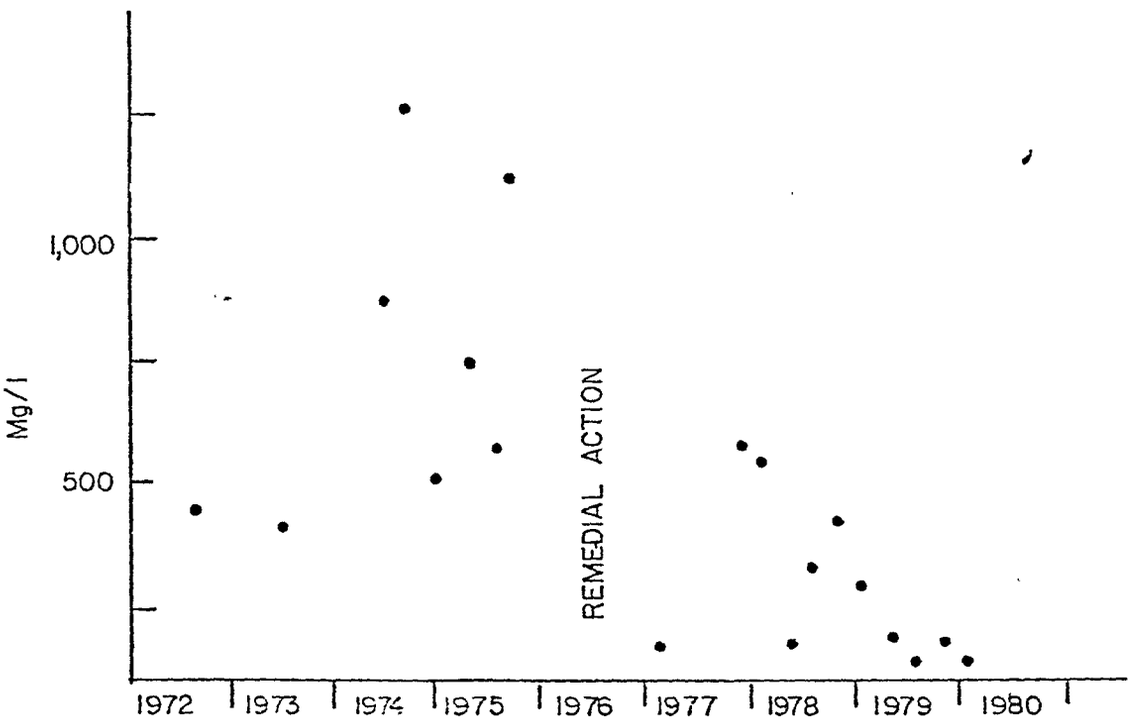


Figure 2-10. Concentration of total solids in the ground water before and after the use of the recovery wells.

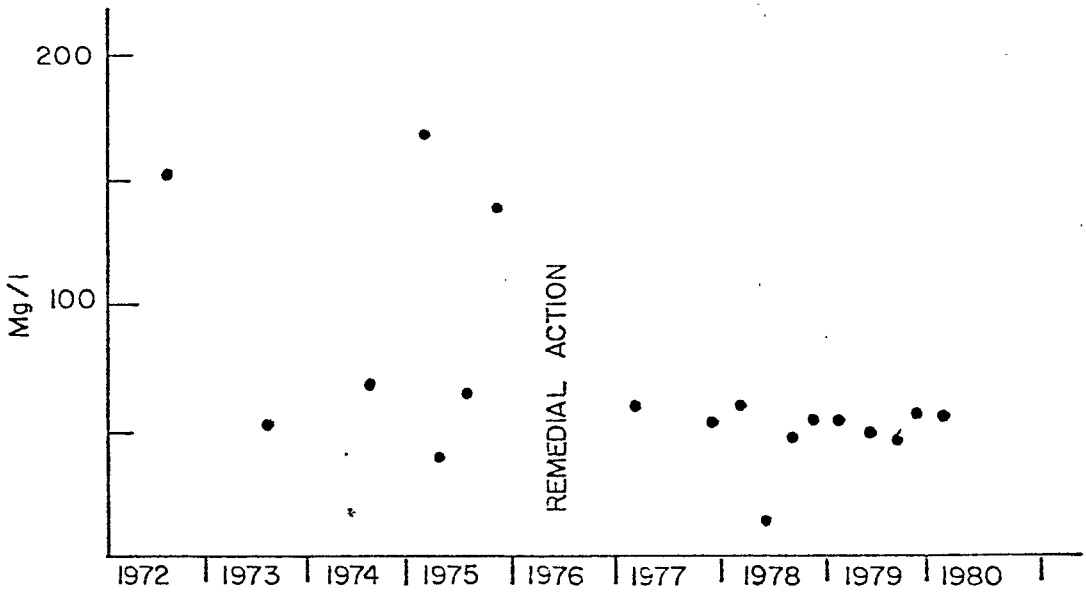


Figure 2-11. Sulfate concentrations in the ground water before and after the use of the recovery wells.

In 1974 and 1975, Firestone removed sludge from their seepage lagoons, placed the sludge in their landfill, and built two new lined lagoons. They also initiated a ground water recovery system which manipulated the flow of ground water to prevent migration of pollutants off-site. These two actions occurred close enough in time and location to make it necessary to assess their effectiveness simultaneously.

Both the supporting data and the Pennsylvania Department of Environmental Resources indicate that there is no off-site migration of pollutants. It is predicted that the threat of contamination to the ground water and to the Schuylkill River will lessen with the closure of the tire manufacturing plant.

The cost of the hydrogeologic study and the recovery wells ($250,000) as a preventative measure is much less than the cost of extensive cleanup of migrating pollutants which could have appeared in the ground water of the Schuylkill River.

REFERENCES

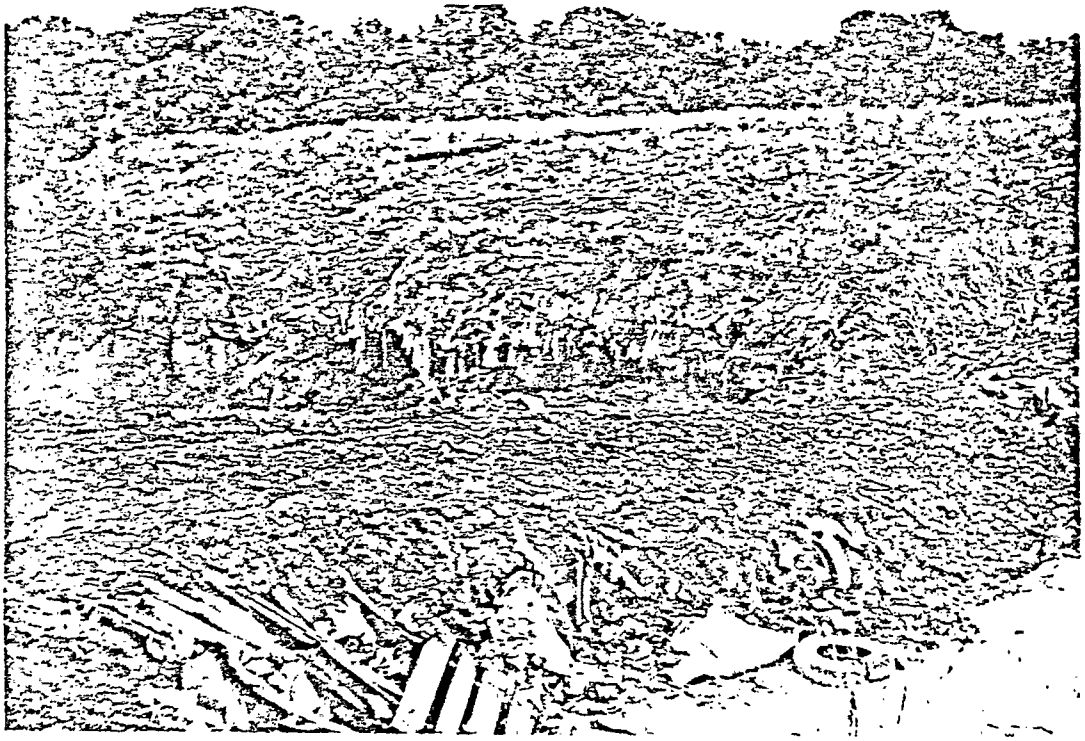
1. Martin and Martin, Inc., and Todd Giddings and Associates, 1975. Report to Department of Environmental Resources on Hydrogeology of the Existing Landfill, Proposed Landfill, and Sludge Lagoons: The Firestone Tire and Rubber Company, Pottstown, Pennsylvania.

2. Pennsylvania Geological Survey, Pennsylvania Geological Survey Report W-22.

APPENDIX 2

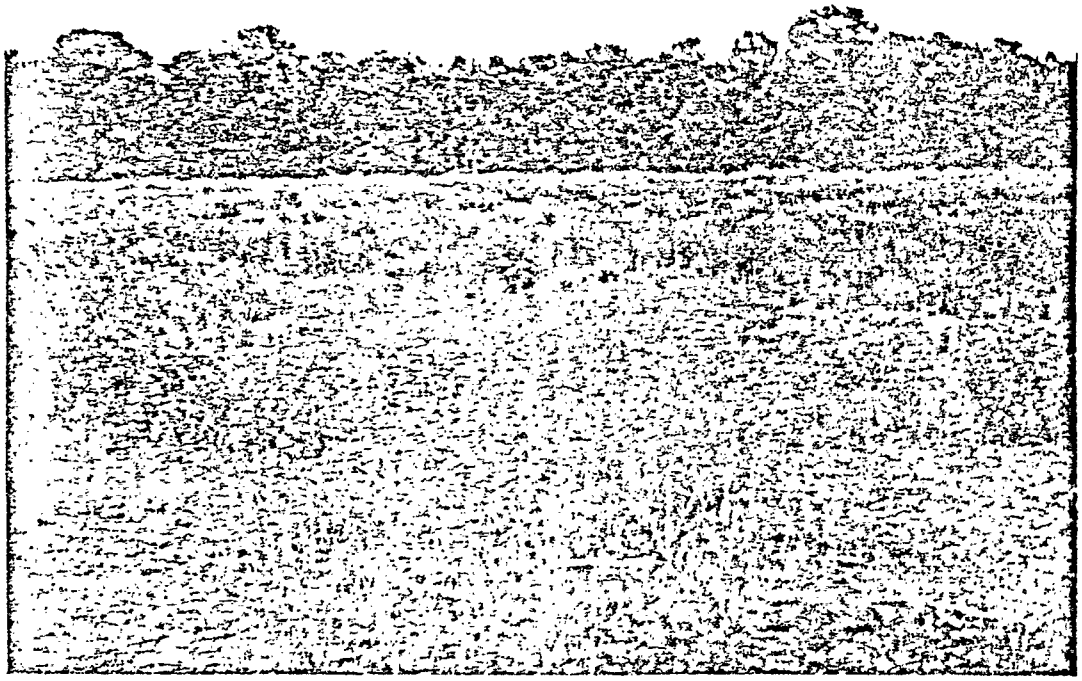
FIRESTONE TIRE AND RUBBER COMPANY
POTTSTOWN, PENNSYLVANIA

View of part of the old landfill; note access road and trees (which border the river) in the background. The surface water is the result of a recent rainfall.

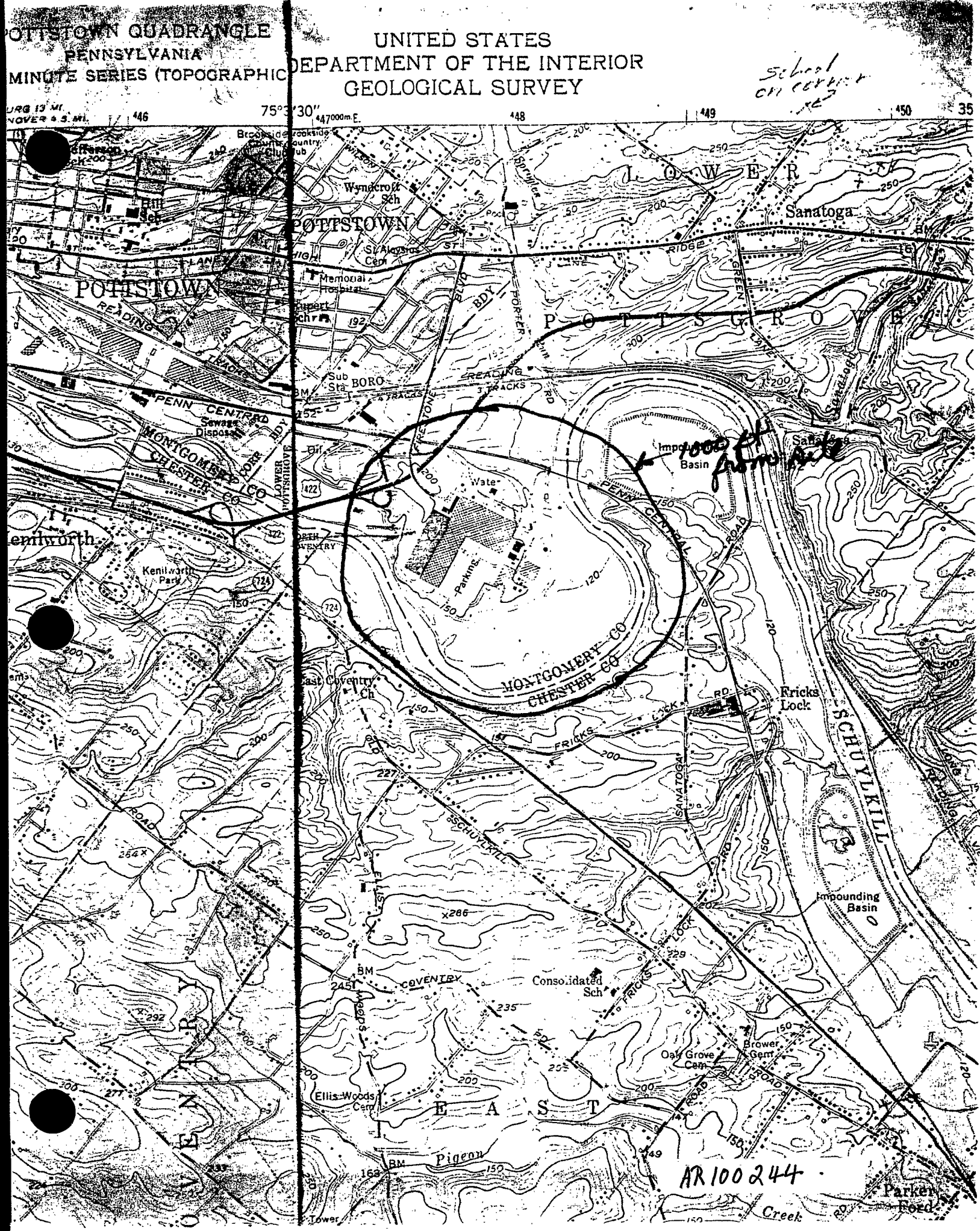


View of the edge of the old ~~lagoon~~ LANDFILL. The final cover and vegetation are quickly established.

View from the old ~~lagoon~~ LANDFILL looking toward the proposed area for the new ~~lagoon.~~ LANDFILL



View of the old ~~lagoon~~ LANDFILL's final cover and vegetation. Numerous deer tracks were seen.


OTTSTOWN QUADRANGLE
PENNSYLVANIA
MINUTE SERIES (TOPOGRAPHIC
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
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1000 ft from Ace
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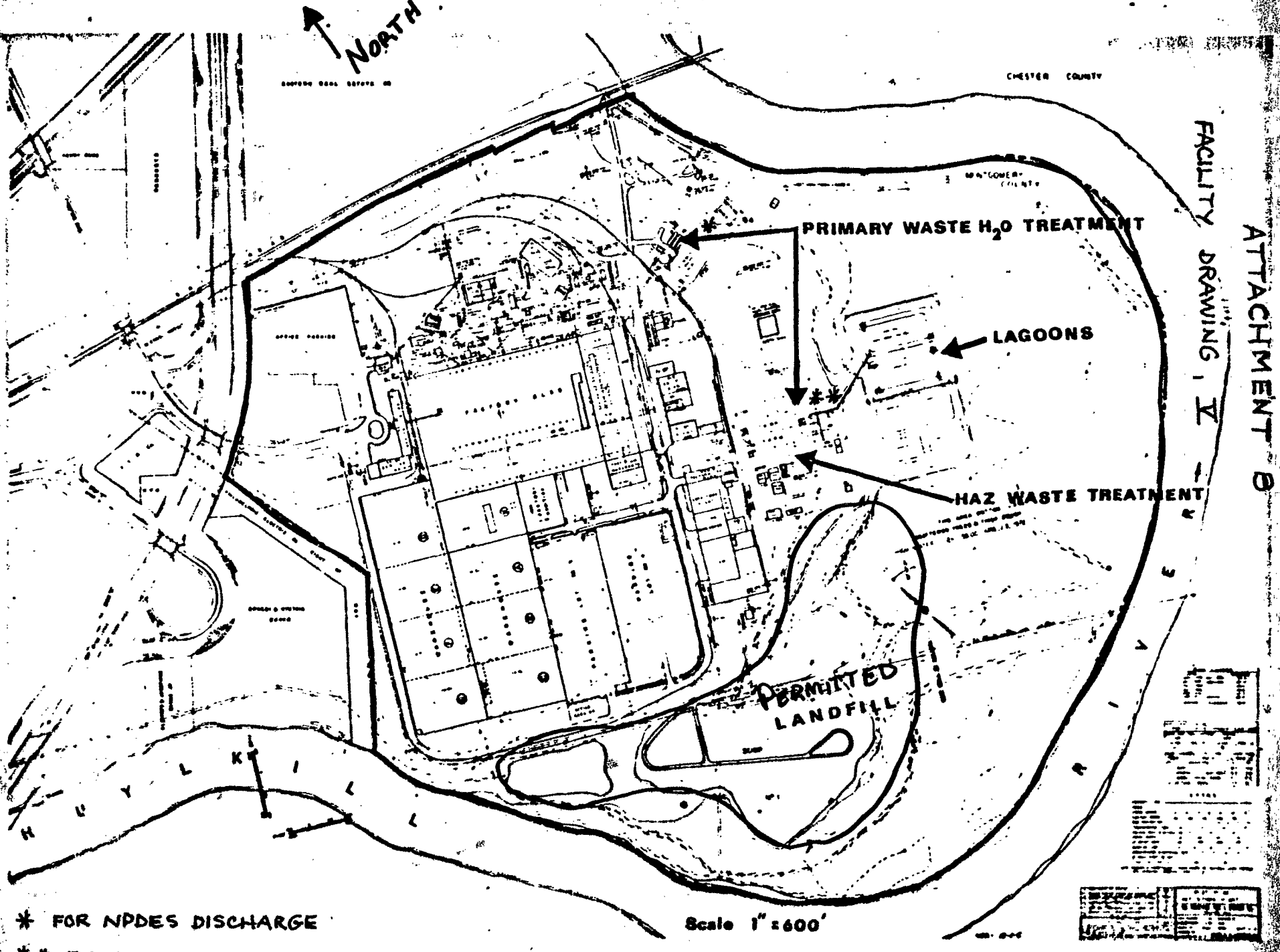
POTTSTOWN
LOWER POTTSGROVE
EAST COVENTRY
Sanatoga
Wynecroft Sch
St Aloysius Cem
Memorial Hospital
Rupert Sch
Sub Sta
BORO
Water
Parking
Impounding Basin
Fricks Lock
Consolidated Sch
Oak Grove Cem
Brower Cem
Ellis Woods Cem
Pigeon Creek
Kenilworth Park
Penn Central
Reading
Schuylkill
Fricks Lock Road
Sanatoga Road
Ridge Pike
Porter Blvd
Lower Pottsgrove Twp
Montgomery Co
Chester Co

ATTACHMENT B

FACILITY DRAWING, V



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