Preliminary Engineering Report
for
Wastewater Collection and Treatment Facilities
for
The Community of Millgrove
Blackford County, Indiana

Introduction - Purpose and Scope

The purpose of this Preliminary Engineering Report is to determine wastewater facility needs for the unincorporated community of Millgrove in Blackford County and cost effectively evaluate and compare various collection system and treatment options to serve the Town.

The scope of this Report is to: ❶ establish facility needs to provide wastewater collection and treatment for the service area, ❷ identify, establish and evaluate alternative methods for providing collection and treatment, ❸ determine the most cost-effective alternative, ❹ consider potential environmental impacts, ❺ review available funding sources, ❻ determine approximate monthly user charges, and ❼ provide a schedule for project implementation.

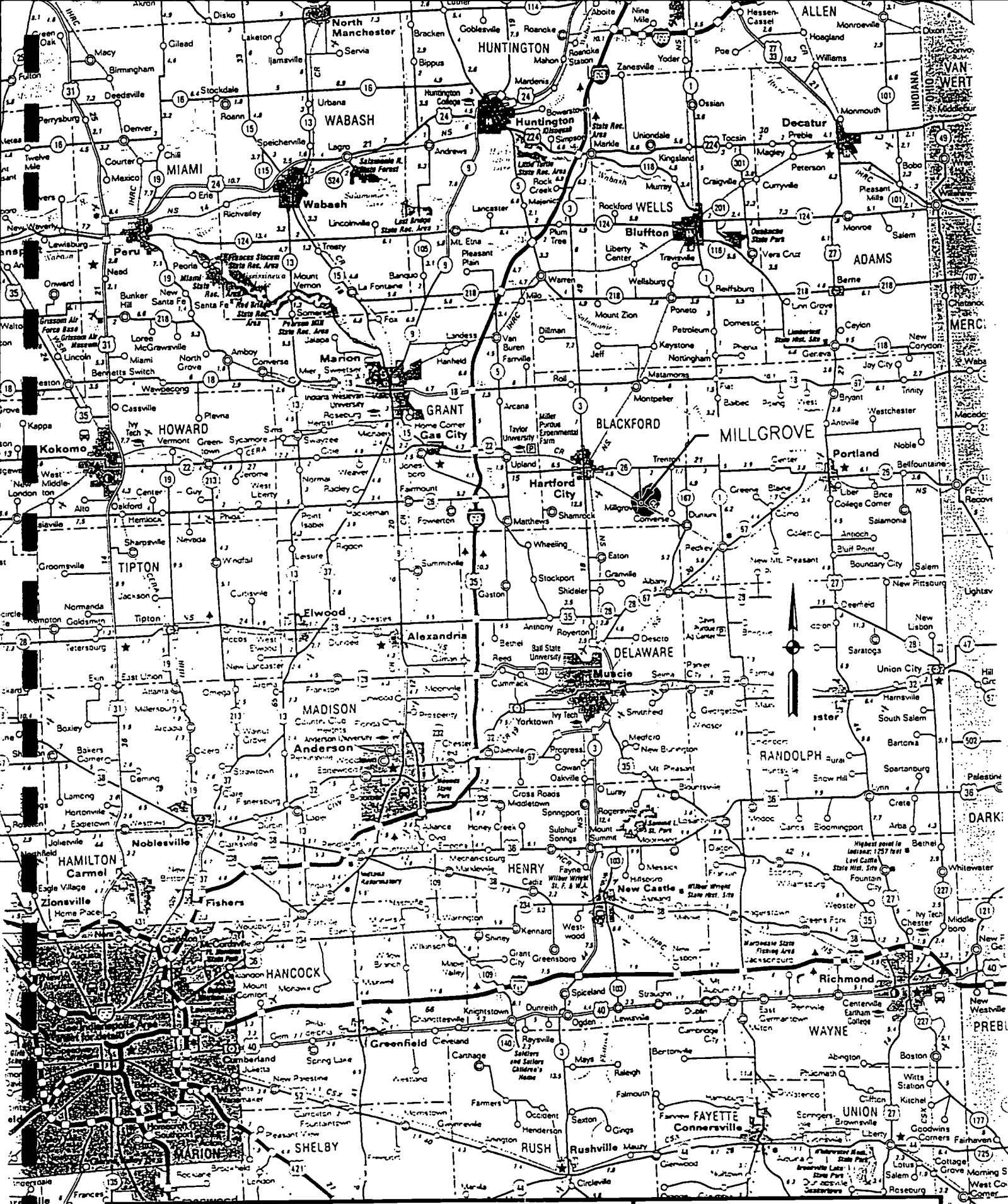
This Preliminary Engineering Report has been prepared for the purpose of presentation of the background data, quantifying and predicting wastewater flows and the various alternative solutions to the problems facing the community for wastewater collection and treatment. The results of a methodical engineering and planning study are presented in this Report for the use by the Blackford County Commissioners and the Millgrove Citizens Committee in their efforts to provide needed wastewater facilities for the service area.

This Report has been prepared in general conformance with Rural Development's Preliminary Engineering Report Guidelines for Wastewater Facilities - Instruction 1942-A, Guide 5, dated July 8, 1992.

Project Planning Area

Location

The unincorporated Community of Millgrove is located in southeastern Blackford County approximately 6 miles southeast of Hartford City, the County Seat, as shown in **Figure No. 1.** Big Lick Creek passes south of the community approximately 1 mile. The project planning area basically consists of the built-up area. The Philadelphia, Baltimore and Washington Railroad crosses diagonally through the service area.



COMMONWEALTH ENGINEERS, INC.

MILLGROVE, INDIANA
PRELIMINARY ENGINEERING REPORT
PROJECT LOCATION MAP
FIGURE NO. 1

Topography, Hydrology and Soils

The topography of the area is gently rolling. As indicated previously, Big Lick Creek provides the natural drainage for the service area. Topography elevations range from 930' to 940' above sea level. The topography of the planning area can be seen on **Figure No. 2**. The Flood Plain Map is identified as **Figure No. 3**.

Groundwater supplies most of the water needed in the County. Groundwater is drawn from a layer of sand and gravel below at a depth of approximately 150 feet. This layer is below glacial till. Wells drilled into this layer generally supply adequate quantities of water. Wetlands in the Millgrove area are shown on **Figure No. 5**.

Blackford County is cold in the winter but quite hot in the summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by Spring and minimizes drought during Summer on most soils. In the winter the average temperature is 28°F and the average daily minimum temperature is 21°F. In the summer, the average temperature is 72°F, and the average daily maximum temperature is 84°F. The total annual precipitation is 36.36 inches. Of this, approximately 21 inches, or 60 percent, usually falls in April through September.

The type of soils found within the planning area are shown in **Figure No. 4** which was taken from the Soil Survey of Blackford and Jay Counties, Indiana. Detailed descriptions of the various soils can be found in the Soil Survey and the Appendix of this Report.

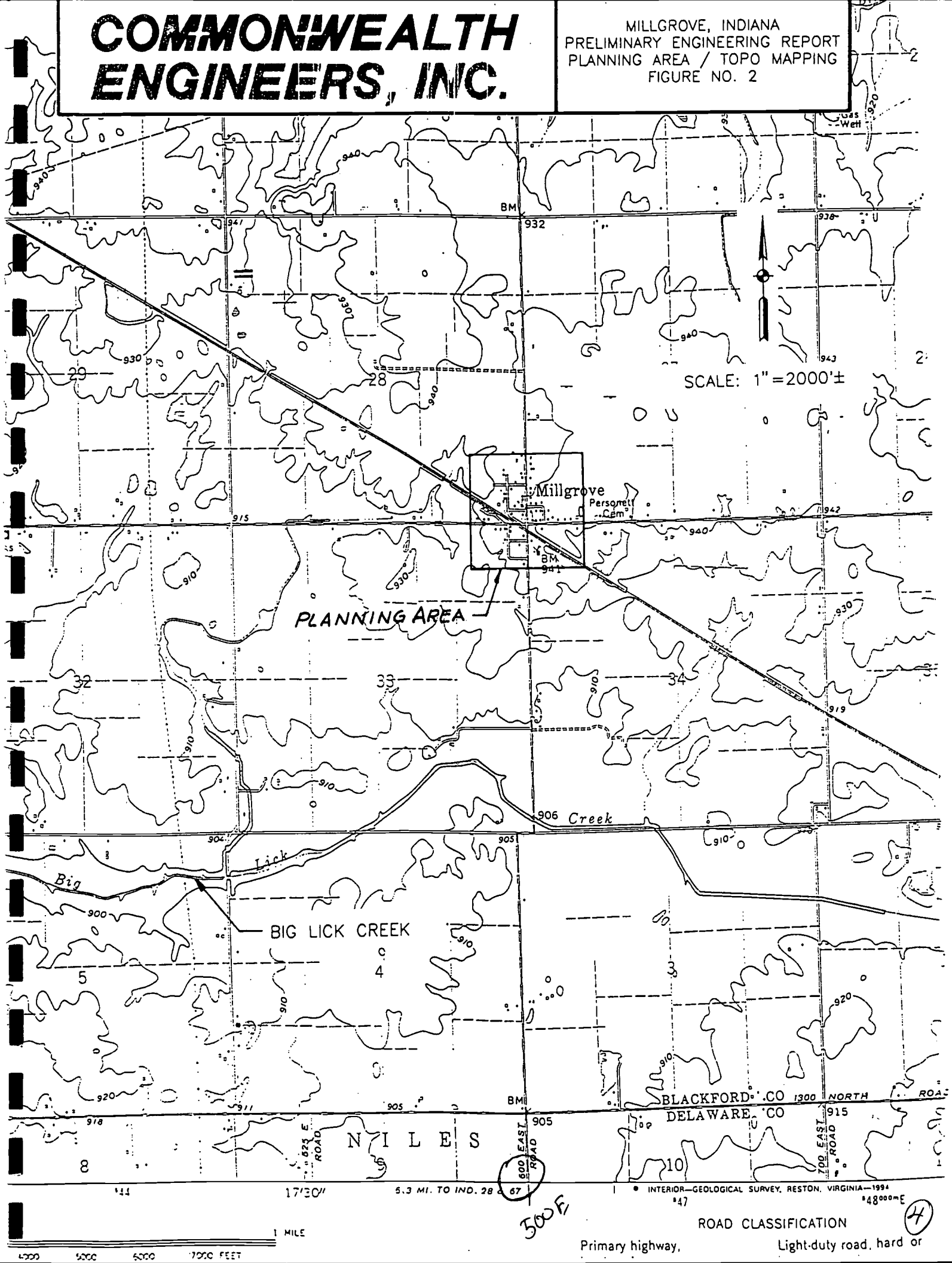
There are three (3) main soil associations in the immediate service area of Millgrove. These associations are the Blount, Glynwood and the Pewamo. Within the planning area, there are two (2) other associations, the Bono and the Martinsville.

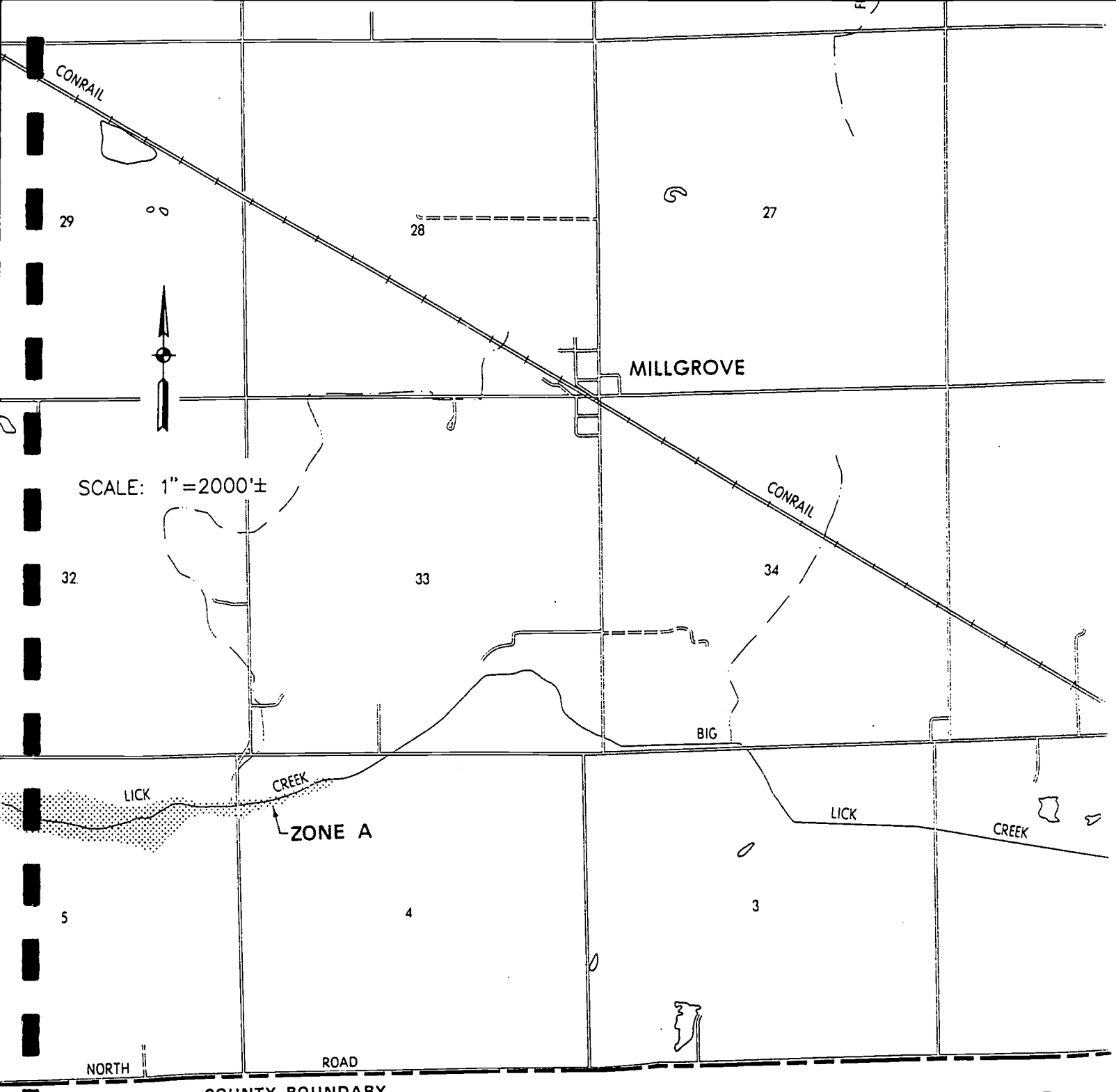
The Blount - Glynwood - Pewamo soils are nearly level to moderately sloping, moderately well drained to poor drained, loamy, silty and clayey soils formed in glacial time. For septic tank and absorption field systems, the Blount soil is rated severe due to wetness and slow percolation, the Glynwood is rated severe for the same reasons and the Pewamo is rated severe due to ponding and slow percolation. Only the Martinsville has a slight rating for septic systems.

It is not expected that there will be any detrimental long-term impacts to the soils or groundwater from the addition of sewers to the area. In fact, the removal of individual on-site disposal systems should improve soils quality. Short-term impacts only relate to excavation for sewer installation and plant construction. Appropriate erosion control and surface restoration methods will be required during construction.

COMMONWEALTH ENGINEERS, INC.

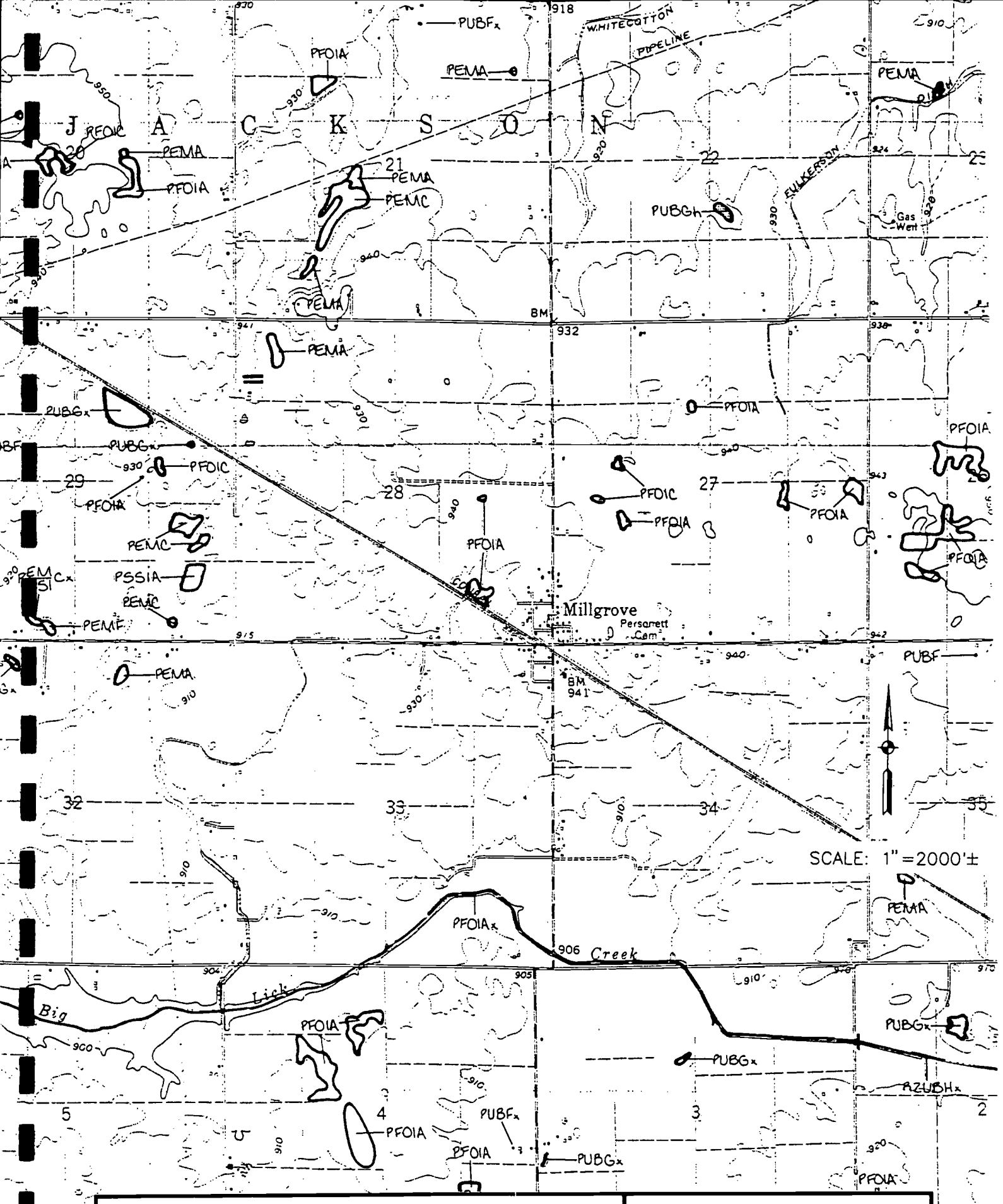
MILLGROVE, INDIANA
PRELIMINARY ENGINEERING REPORT
PLANNING AREA / TOPO MAPPING
FIGURE NO. 2





COMMONWEALTH ENGINEERS, INC.

MILLGROVE, INDIANA
PRELIMINARY ENGINEERING REPORT
FLOOD PLAIN MAP
FIGURE NO. 3



COMMONWEALTH ENGINEERS, INC.

MILLGROVE, INDIANA
PRELIMINARY ENGINEERING REPORT
WETLAND MAP
FIGURE NO. 5

Wildlife Habitats

The issue of habitat preservation for rare and endangered species has become a critical concern over the past several years. The drainage of marshes and the conversion of grassland to row cropping has been the primary cause of species decimation or endangerment in many portions of Indiana. These activities, of course, occurred years ago in the subject area — long before protection of rare or threatened species became an issue of prominence with the public and governmental agencies.

Currently, wildlife habitats in the project area can only be found in wooded areas, the stream banks, and in low laying marsh areas. Rare or endangered species of plant and animal life are not known to exist in this area.

If any project were to develop, construction would occur on sites previously disturbed. Most of the construction will occur in road right-of-ways and permanent easements directly next to existing roadways. Treatment plant construction will most likely occur in an unwooded area similar to areas currently for farming or pasture land. Therefore, habitat disruption would be minimal and archaeological investigations would only be required in previously undisturbed sites.

Land Use, Population Trends and Wastewater Flow Projections

Land use within the proposed service area is almost totally residential with one (1) church in the community. Land surrounding the service area is predominantly agricultural.

A house count within the limits of Millgrove revealed a total of 41 existing residential units, one (1) church and six (6) vacant properties. Assuming 2.7 persons per household and the church as an equivalent single family dwelling unit, the current population equivalent is 42 x 2.7 or 113 people.

It is proposed to design the facilities for 55 single family dwelling units or a total future of flow of 13200 GPD based on a design factor of 240 GPD per equivalent dwelling unit, which meets current Indiana Department of Environmental Management (IDEM) standards. Thus, a 30% growth factor is being proposed. Although this figure may be a little high for a rural community, in real numbers, it only translates to 13 more homes, 6 of which as previously discussed, are vacated.

Organic loading to the treatment facilities consist of biochemical oxygen demand (BOD), suspended solids (SS), and ammonia (NH_3-N). Theoretical values are used for each based on the flow rate and the nature of the wastewater generated. All of the wastewater generated for the Millgrove project will be of a domestic or residential nature. IDEM recommends the following parameters for domestic wastewater:

BOD - 220 mg/l
SS - 220 mg/l
NH_3-N - 10 mg/l

Existing Facilities / Need for Project

Currently the community of Millgrove utilizes septic tank technology as a means of wastewater disposal. As discussed previously, the primary soils in the Millgrove area are Blount, Glynwood or the Pewamo. All of these soils are rated severe for septic tank / absorption field use. This is due to a combination of wetness, i.e. the seasonal high water table is 24 inches, and slow permeability with a limiting layer approximately 42 to 45 inches below the surface. In addition, small lot sizes do not allow enough space for adequately sized finger systems. This is a very common problem in small communities throughout Indiana. Generally, the only solution is to provide a centralized collection system which transports the wastewater to a treatment plant.

Faulty septic systems can have a detrimental effect on local ditches and streams. Untreated sewage flows into surface waters can cause disease and breed insects such as mosquitos. A letter from the Blackford County Health Department is included in the Appendix to the Report and attests to the problems in Millgrove.

Development and Evaluation of Alternatives

This section will present the various options that are available to the community for wastewater collection and treatment.

The selection of potential alternatives for wastewater collection and treatment include no action, regionalization or decentralization. As the name implies, the no action alternative assumes that for whatever the reason or justification, no action is taken. The term regionalization describes the concept of connecting two or more discrete, geographically separated areas to a single wastewater treatment plant. Decentralization is the opposite of regionalization. Decentralization involves providing a separate wastewater treatment plant for a particular community. Decentralization includes both conventional and alternative treatment technology and could include multiple plants for a single community.

This Preliminary Engineering Report will examine the following described alternatives:

No Action

As indicated above, this alternative assumes that no action is taken by the community in regards to the implementation of the project. Obviously, if this action is taken, wastewater

problems within the community will not be abated. Soils within the Millgrove area are not amenable to septic tank / absorption field systems as conventionally built. The only method of upgrading existing systems would be to construct elevated sand mounds for each residence. This is not only an expensive capital cost but requires the need for substantial land area. And, even it constructed, there is no guarantee that these systems will continually work following septic tanks. Individual elevated mound systems cost between $8,000 - $12,000 to construct, excluding land requirements.

Regionalization

As indicated above, regionalization describes the concept of connecting two or more discrete, geographically separate areas to a single plant. For small rural communities, regionalization can be cost effective when the distance separating the pumping town from the treating town is less than 3 to 5 miles.

The closest treatment facility to Millgrove is the plant in Hartford City. The Hartford City plant is located on the City's southeast side and discharges to Little Lick Creek. Assuming that land (easements) could be acquired along the existing railroad right-of-way, the pumping distance from Millgrove to Hartford City is approximately 6 miles.

In addition to the obvious collection system costs and the pumping station and force main costs, the Millgrove project would have to purchase treatment capacity from Hartford City.

Although the option of regionalization with Hartford City does not appear to be cost effective at first glance, a cost analysis will be performed for this alternative.

Decentralization

This Preliminary Engineering Report will cost effectively evaluate three (3) decentralization system/plant options. These are described as follows:

Conventional Gravity Sewer / Package Treatment Plant

Under this alternative, the collection system will consist of the conventional gravity sewer system utilizing a minimum 8-inch sewer laid to a grade that provides gravity service from a house to a central collection point, i.e. pumping station. Manholes are provided every 400 feet and at every change of direction, pipe slope and pipe size. Pump stations and/or individual home pumping units (grinder pumps) are required where sewers get excessively deep.

For Millgrove, the conventional gravity sewer design layout is shown on **Plate No. 1**. As shown, under the proposed design one (1) main pump station is required and

located on the east side of Town. This station would pump all flow to the treatment plant.

Under this alternative, the proposed method of treatment is an extended aeration package plant to be located as shown on **Plate No. 2**. The plant would discharge to Big Lick Creek. As indicated above, this plant capacity would be 13200 GPD and designed similar to that used by many rural school districts.

The package plant is a mechanically oriented treatment system requiring pumps, blowers or mechanical aerators, mechanical scrapers and concrete or steel tankage. The design is based upon the activated sludge process which uses a controlled bacterial action for removal of pollutants. This option will require disinfection to kill disease organisms prior to discharge to Big Lick Creek. The most common method of disinfection is chlorination. To reduce chlorine's toxicity, de-chlorination facilities will also be required. For smaller plants, sulphur dioxide is considered the most cost effective method. This mechanical plant option will also require the treatment and disposal of generated sludge. The most popular and cost effective method of sludge treatment and disposal is aerobic digestion followed by liquid land application.

In general, most mechanical type treatment processes do not represent realistic, cost effective alternatives for the waste treatment needs of small, developed rural areas like Millgrove. The need for constant operator attention, annual sludge disposal and increased chemical and energy costs, increases the financial burden on the users.

Again, although this option does not appear to be cost effective, a monetary analysis will be performed.

Conventional Gravity Sewer / Waste Stabilization Lagoon

Under this alternative, the collection system design and layout will be the same as above. All flow generated by the Town will be pumped to a waste stabilization lagoon plant located as shown on **Plate No. 2**.

Under this option, the waste stabilization lagoon is a non-mechanical treatment process which uses the uncontrolled processes of nature, i.e. wind and sun to remove wastewater pollutants. Obviously, lagoons require much more land than a similar sized mechanical plant. This option uses multiple lagoons (ponds) which retain the wastewater for a minimum of 90 days. The removal of sludge is minimized and usually not necessary for at least 20 years. Under this option, each lagoon would have approximately 1.75 acres of water surface with a total site area

of 6-8 acres. The Indiana Department of Environmental Management (IDEM) regulations require the lagoons to be located at least 1/4 mile from the nearest residence. Additionally, in order to meet IDEM's 10:1 dilution ratio requirements, more storage may be required to hold wastewater during stream low flows. In addition, IDEM regulations require a 4' separation from the bottom of the lagoons to the seasonal high water table. If this cannot be met, a perimeter drain will be required. This the case at Millgrove.

A cost effective analysis will be considered on this option.

Septic Tank Effluent Pumping / Constructed Wetland and Elevated Sand Mound

The Septic Tank Effluent Pump (STEP) collection system combines the elements of the small diameter gravity sewer and low pressure grinder pump systems. The design uses septic tanks serving one or two home combinations to remove the solids and grease from the wastewater prior to introduction into the low pressure collection system. This allows the use of smaller pressure mains. Small effluent pumps (1/2 - 3/4 HP) are located either in the septic tanks or separate pump pits. Power for the pumps must come from the individual residences. The proposed STEP system layout for Millgrove is shown on **Plate No. 3**. As noted, two (2) separate STEP systems are proposed, one north and one south of the railroad. Flow from the septic tanks is pumped to the north or south plant site.

Under this option, it is proposed to construct two (2) separate wetland systems. The north plant would have a capacity of 9360 GPD and the south plant would have a capacity of 3840 GPD. The plant sites are shown on **Plate No. 3**.

A constructed wetland is a man-made gravel bed planted with wetland plant species, including bulrushes, reeds and cattails. These man-made facilities recreate the complex biological pollutant removal processes which occur in natural wetlands. They are relatively simple and inexpensive to construct and operate. They usually require less land area than stabilization lagoons. A constructed wetlands can provide treatment of wastewater with little or no energy usage, no chemical and very few operational and maintenance requirements. These treatment systems are particularly effective for areas with wide variations in seasonal flow as their treatment efficiency does not decrease with low flows.

There are several types of soil absorption systems available for the disposal of treated wastewater. These include the common trench type leach fields (finger systems), elevated sand mounds or infiltration basins. The selection of which type to be used is primarily dependent on three factors: ❶ soil characteristics, ❷ size of the system (design wastewater flows), and ❸ regulatory requirements.

There are two (2) major soil types within the project area that can be used for soil absorption. They are named Blount and Glynwood and are similar in nature. They are generally poorly drained soils consisting of clay loams and silty clay loams. Due to their lack of permeability and seasonal high water table, elevated sand mounds will be required based upon current regulations.

The preliminary design parameters and sizing data for the two (2) separate constructed wetland / elevated mound systems is in the Appendix to the Report. These parameters are based upon the current IDEM policy document entitled "Constructed Wetland Wastewater Treatment Facilities Guidance", a copy of which is also included in the Appendix to the Report.

A general schematic diagram and typical process plan for the wetland plant layout are shown in **Figure Nos. 6** and **7**.

Preliminary Cost Estimates

This section of the Report presents estimates of the project capital costs and the operation and maintenance costs for the above referenced selected alternatives. The project capital costs include both the construction and non-construction costs.

Obviously, one of the most important keys for the successful implementation of any wastewater collection and treatment alternative will be the lowest possible capital and operation and maintenance costs. The cost effective analysis for each alternative will be based upon determining the present worth cost which will be the capital cost plus the present worth of the annual operation and maintenance, minus the salvage value costs over a 30 year period. The present worth costs were determined by using a discount rate of 6 ½ %.

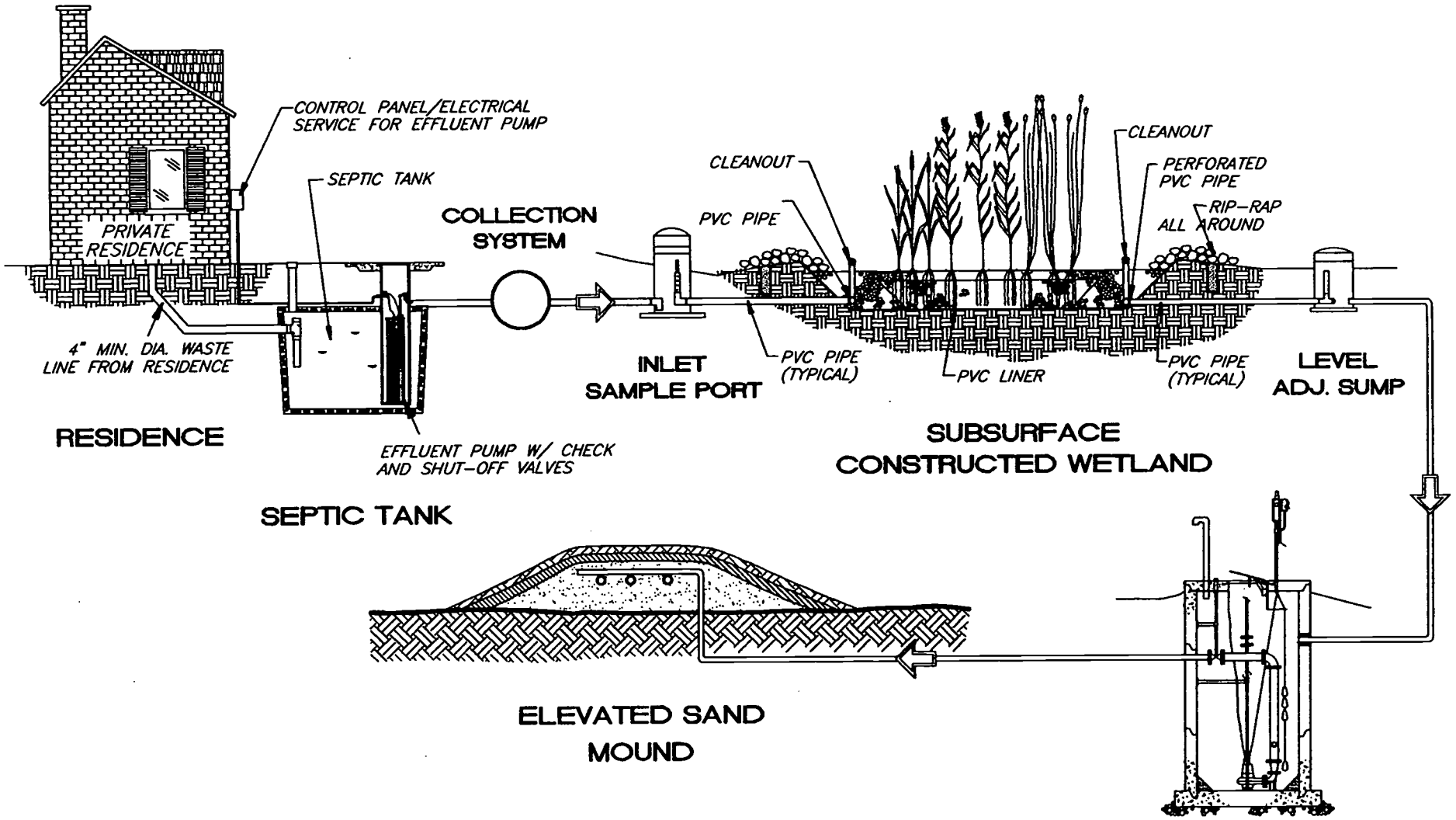
The following basic assumptions were used in estimating costs for the collection system and treatment plant alternatives:

① Where possible, sewer lines whether gravity or pressure would be placed in existing road rights-of-way, eliminating the expense of easements.

② The circuit to provide power to the pumping facilities under the STEP collection system would be provided by the building owner(s). In addition, the property owner(s) would pay for the power usage for the STEP systems.

③ The building owner would pay the costs for the sewer lateral from the building to the point of connection. For the gravity sewer this would be the public right-of-way and for the STEP system this would be the septic tank.

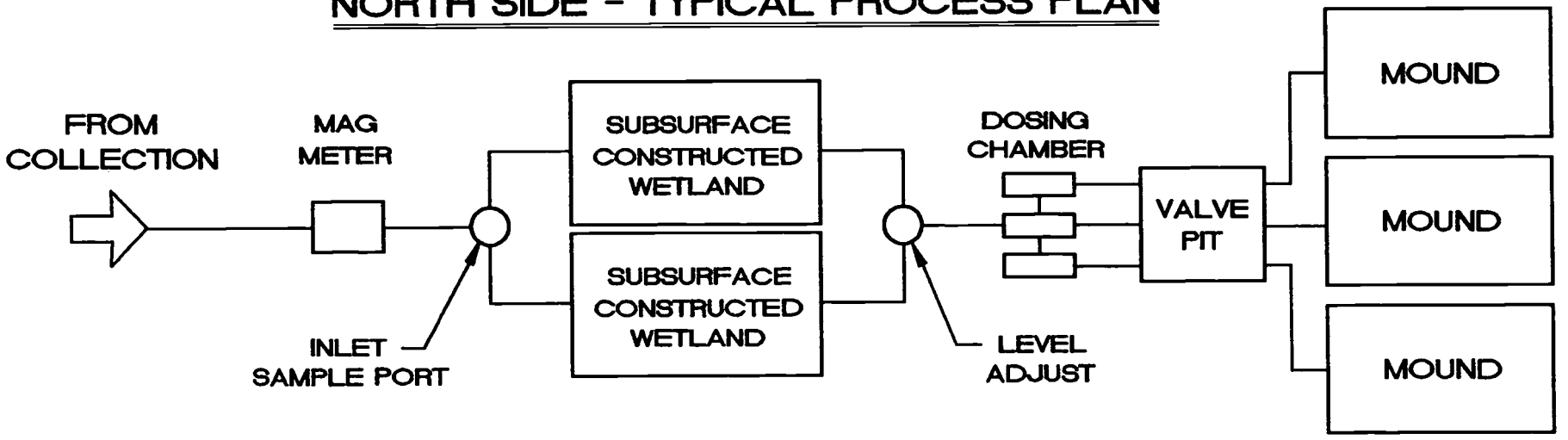
GENERAL SCHEMATIC



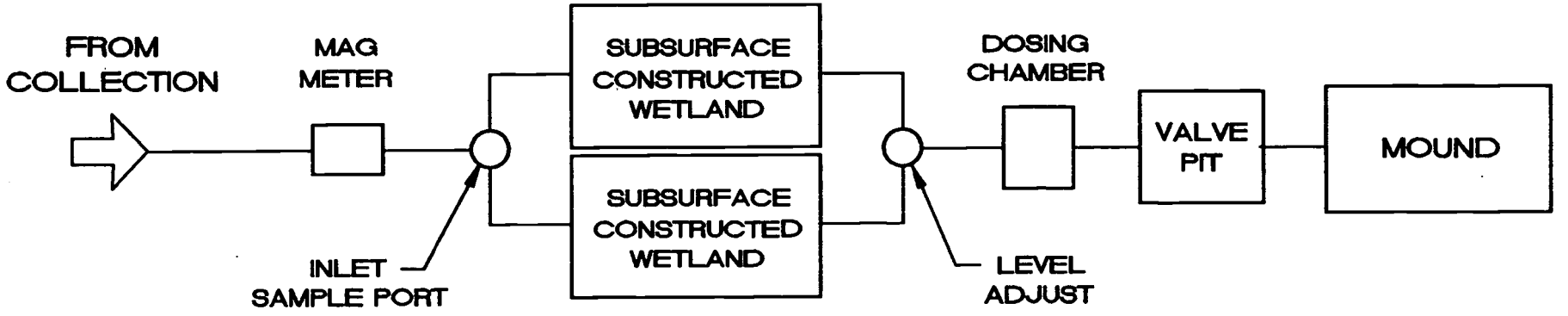
J. F. New & Associates, Inc.
706 Roosevelt Road
Walkerton, Indiana 46574
219-586-3400 fax 219-586-3446
3955 Eagle Creek Parkway
Suite E
Indianapolis, Indiana 46254
317-388-1982 fax 317-388-1986
Permitting • Delineations • Mitigation Design • Wetland Nursery • Natural Systems for Wastewater Treatment Engineering

FIGURE NO. 6

NORTH SIDE - TYPICAL PROCESS PLAN



SOUTH SIDE - TYPICAL PROCESS PLAN



J. F. New & Associates, Inc.
708 Roosevelt Road
Walkerton, Indiana 46574
219-586-3400 fax 219-586-3446
3955 Eagle Creek Parkway
Suite E
Indianapolis, Indiana 46254
317-388-1982 fax 317-388-1986
Permitting • Delineations • Mitigation Design • Wetland Nursery • Natural Systems for Wastewater Treatment Engineering

FIGURE NO. 7

④ Any easement required for on-site STEP facilities would be granted by the homeowners at no cost.

⑤ All sewers whether conventional gravity or the STEP system are designed to serve the ground level structures only by gravity. The property owners will be responsible for the cost of pump facilities to provide sewer service to any basements.

⑥ Under the regionalization option, it will be assumed that the Hartford City plant has the capacity to treat the Millgrove flow. Relative to capital and O & M expenses, it will be assumed that the capital cost for purchasing capacity is $550 per residential unit and the O & M cost is $1.79 per 100 ft^3 treated.

⑦ For the three (3) decentralization plant options, i.e. mechanical plant, lagoon, and constructed wetland, it will be assumed that the community will sub-contract for their certified operator services and laboratory services, since this is part-time work. The plant capital costs will not include the expense of any on-site building or laboratory facilities.

The construction and non-construction cost breakdown for each of the four (4) previously described alternatives are shown in the following tables:

Table No. 1 - Conventional Gravity Sewer System with Regionalization with Hartford City

Table No. 2 - Conventional Gravity Sewer System with Package Plant

Table No. 3 - Conventional Gravity Sewer System with Waste Stabilization Lagoon

Table No. 4 - Septic Tank Effluent System (STEP) with Constructed Wetland / Elevated Sand Mound

The estimated annual operation and maintenance costs for each of the above alternatives are shown in **Table No. 5**.

Table No. 6 summarizes the alternative costs and presents the cost effective analysis.

As shown in **Table No. 6**, the most cost effective alternative by a narrow margin is the STEP system with the constructed wetland / elevated sand mound plant. This option is approximately 4% more cost effective based on the total present worth than the gravity sewer and waste stabilization lagoon option.