LOGANSPORT WASTEWATER TREATMENT PLANT

An architectural thesis project for the Ball State University College of Architecture & Planning

Monte Hoover

by Monte Hoover
Fall 1976 - Spring 1977
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   c. Student Objectives
   d. Project Description
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   d. Treatment Needs

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The problem of wastewater treatment is one that affects all our cities within the country. Wastewater is one environmental concern which man will have to deal with for many more years, until he can find a more suitable method of waste removal. Presently, the average American utilizes and discharges 60-75 gallons of water per day. Of this quantity, over 90% of the liquid goes back into the cities sewer systems where by definition it becomes wastewater. It will then require processing to allow its return back into our nation's water supply. Today, with our increasing concern for the environment it becomes essential to establish the quality of our wastewater treatment in order to provide a successful ecological balance.

The concern for wastewater treatment within the city of Logansport grew out of a concern for the pollution factor to the Wabash River in the late 50's. At that time they were extracting the water supply from the Eel River. As a result, the first major treatment plant was constructed in 1960. The facility was designed to handle approximately 6 mgd (million gallons per day) and constructed with the assumption that improvements would be made in 1969 to meet projected future demand.

The projected improvements were not made as expected and resulted in a hearing on October 17, 1971, by the Indiana Stream Pollution Control Board regarding the pollution level to the Wabash River. The State presented evidence to show that the treatment plant was hydraulically
overloaded and that the aquatic life downstream was being adversely affected by the discharge. The State found Logansport to be in violation of existing pollution standard levels and required immediate action towards improving the facility to meet pollution standards. It is with this concern that I present my thesis project:

Logansport Wastewater Treatment Plant
The Architecture Thesis Project is the culmination of four years of architectural design. These first four years serve as a training ground for the application of the architectural design methodologies and concepts. With the development of this architectural base the student is therefore prepared for the thesis project. The thesis project is a comprehensive development of a specific concern, from its inception to the final presentation documents. It should yield the student the opportunity to express his ability to successfully render a solution towards a realistic architectural concern. Of course the project is not identical to an office situation, but rather a close representation to an actual experience.

The type of project which a student selects should have a complexity which challenges his knowledge gained in the previous years. The project should involve an architectural design procedure similar to that experienced in a professional office. A procedure such as the following:

Project Proposal
Program Statement of clients needs
Schematic Alternatives to spatial priorities
Final Schematic Design of selective approach
Design Development of architectural concepts
Detail Design Development of total concept
Final Presentation of total architectural solution
The architectural profession within the last decade has had to analyze and define the scope of its knowledge due to the advancements of man's technological expertise. The architect can no longer be satisfied with solving an architectural/engineering problem by utilizing previous solutions. He must be innovative enough to solve challenging new problems with thoughtful new solutions.

The task of solving many of today's problems is not solely the responsibility of the architect or engineer, but is a union of their knowledge. This exhibits the fact why many professional firms are organized on the basis of both architectural and engineering personnel in-house.

Therefore, with my development of an architectural thesis project I desire to delve into a situation which requires both an architectural and engineering solution of equal complexity. Within the profession the architect is not always the project coordinator, but many times assumes the role of a consultant. Such is the case with an engineering oriented project.

For my thesis project I'm selecting a project which requires a strong engineering solution, but also an architectural solution responding to the building and environmental concerns. Such a project structure reflects many of today's methods of organization, therefore I feel it merits the importance of a thesis project.
The basis for the design of the Logansport Wastewater Treatment Plant is directly concerned with a new addition to the existing plant. The work of the wastewater treatment design will be completed by the project engineers. The architectural and environmental needs will be completed by an architectural consultant, which is my job.

The addition will be based on an increased design flow from 5.40 mgd to 9.0 mgd. Such an increase will require improvements and additions to the treatment tanks, to the building facilities, to the city sewer system and to the juxtaposition of the environment and the treatment functions.

The major concern for the consultant will be concentrated on the proposed building additions or improvements which includes administration, pumping station, chlorine equipment, grit chamber, operating galleries, digester-control, sludge processing, shipping/receiving, mechanical, maintenance and blower equipment areas. These spatial needs will be based on equipment sizing and operating requirements as determined by the program.
The main objective of the project is to meet the processing needs of the proposed addition so that the plant can handle the capacity of 9 mgd (million gallons per day). Next to the functional processing needs comes the architectural and environmental concerns for such a facility. This aspect of investigation is the real objective of my endeavors. To develop an aesthetic for the architectural and environmental potentials of a wastewater treatment plant.

Wastewater treatment has been and will most likely for years to come be a problem for our cities. Therefore, this situation creates a significant opportunity for the architectural profession because of the basic premise that they are not produced through a comprehensive design approach. They are the products of engineers and large construction firms, whose design attention is directed solely towards the treatment of the wastewater.

Engineers should continue to design the treatment processes, but architects should be involved in the siting of treatment plants for the most efficient use of land and minimal environmental disruption, the organizing of treatment forms to meet functional and aesthetic objectives and in the form and detailing development of the facilities themselves.

In evoking the design potential of a treatment plant the architect should first begin to reduce the number of elements a minimum and relate them to a strongly defined site circulation system.
Second, the minimal elements should be massed and organized on the site with simplicity and respect for site influences. Thirdly, the elements should be thoughtfully articulated to evoke an aesthetic down to the finest detail possible in the construction and utilization of building and treatment parts.

The very essence of the treatment process suggests a unique expression. There is the opportunity to express movement in terms of wastewater flow. There is the huge forms themselves which suggests architecture. Also, there is the treatment forms which when reduced to simplistic massing create a unique expression of solids and voids. Finally, the expression of earth which reinforces the basic premise that wastewater treatment is an environmental concern which deals with the protection of our water sources.

Therefore, the Logansport Wastewater Treatment Plant has been a case example for what I feel are the potentials for a wastewater treatment plant.

Specifically, the project should serve to environmentally help balance the ecological cycle of wastewater into the river. The final effluent should be suitable enough so that no pollution occurs at the point of discharge. Also, the sludge disposal should be considered for its possible agricultural use. It should either be utilized or completely broken down so that it doesn't require major dumping at a landfill.

The building objectives are that of developing a complete building mass rather than isolated masses. By designing a total enclosure I can
work towards making the project as totally self-sufficient as possible. My goal is to utilize energy sources within the plant, methane gas, and other available sources such as solar heat to bring the plant to a 60-75% efficiency from these sources alone.
wastewater treatment plant
Logansport, Indiana

The city of Logansport is the County seat of Cass County, Indiana and is situated approximately half-way between the state capitol, Indianapolis, and the city of South Bend, the population of the city is 19,255 (1973 Census), about one-half of the total population of the County.

Logansport is located at the junction of the Eel River with the Wabash River. The two rivers have, over the years, cut deep valleys with steep walls of bedrock, around which the city has developed. The bedrock layer is the most characteristic geological element of the area.

The city has a very firm industrial base and an excellent potential for further industrial development. A city-owned water utility treats and distributes water from the Eel River. A system of sanitary and combined sanitary storm sewers serve the entire incorporated area for removal of domestic waste. Storm water run off is, in many locations, directed overland by ditch or stream, otherwise it is carried by storm sewers to the rivers or by the combined sewer-system.
The location for the proposed and existing facilities of the Logansport Wastewater Treatment Plant is in the southwest sector of the city, just inside the city limits. The site is bordered to the east by the Penn Central Railroad and to the south by the Wabash River. The city limits follow the north and west property lines, adjoined by farmland around the perimeter of these edges. These boundaries are substantial enough to be outside the designated flood plain area to the west.

The site is relatively flat with average slopes not exceeding 5% grade. Drainage is not much of a problem as all contours slope to the river. The only real problem is watered sludge which is dumped periodically within the area in back of the existing facilities. Due to the nature of the sludge the vegetation within this area is totally destroyed and it now appears as brush.

The geology of the site is characterized by bedrock at a depth 3-8 feet deep over the entire site. The soils are all suitable for building, with the exception possibly of the sludge saturated soil to the rear of the site. However, this soil could be dried and reused.

The site is serviced by a roadway to the south which divides the plant from the river. The main access route is from the east as most of the traffic comes from the city.

The wind is an important consideration in the design of any wastewater treatment plant. The primary SW wind causes much of the
odors produced to flow towards the city.

Another concern is sunlight. The southern orientation of the site allows all the sunlight which is amply needed for processes and building heat.
Building Needs:

Administration
1. superintendents office
2. employees room

Laboratory

Pumping Station
1. equipment operating area
2. motor control area
3. wet well comminutor

Chlorine Equipment
1. feed
   storage

Operating Gallery

Grit Chamber

Sludge-Processing
1. sludge receiving/ wet well
2. equipment area

Digestor-Control
1. heat exchange area
2. gas compression area

Shipping/Receiving

Mechanical

Blower Equipment

Maintenance/Garage
<table>
<thead>
<tr>
<th>Spatial Requirements</th>
<th>19,728 s.f.</th>
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<tbody>
<tr>
<td>Administration</td>
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<tr>
<td>1. superintendents office</td>
<td>300 s.f.</td>
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<tr>
<td>2. employees room</td>
<td>360 s.f.</td>
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<table>
<thead>
<tr>
<th>Laboratory</th>
<th>480 s.f.</th>
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<table>
<thead>
<tr>
<th>Pumping Station</th>
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<tr>
<td>1. equipment operating area</td>
<td>1,400 s.f.</td>
</tr>
<tr>
<td>2. motor control area</td>
<td>100 s.f.</td>
</tr>
<tr>
<td>3. wet well/comminutor</td>
<td>600 s.f.</td>
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<table>
<thead>
<tr>
<th>Chlorine Equipment</th>
<th>400 s.f.</th>
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<tbody>
<tr>
<td>1. feed</td>
<td>220 s.f.</td>
</tr>
<tr>
<td>2. storage</td>
<td>180 s.f.</td>
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<table>
<thead>
<tr>
<th>Grit Chamber</th>
<th>1,400 s.f.</th>
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| Operating Gallery                         | s.f. according to circulation |

<table>
<thead>
<tr>
<th>Digester-Control</th>
<th>1,400 s.f.</th>
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</thead>
<tbody>
<tr>
<td>1. heat exchange area</td>
<td>800 s.f.</td>
</tr>
<tr>
<td>2. gas compression area</td>
<td>600 s.f.</td>
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<tr>
<th>Shipping/Receiving</th>
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<tr>
<th>Mechanical</th>
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<table>
<thead>
<tr>
<th>Maintenance</th>
<th>4,000 s.f.</th>
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<table>
<thead>
<tr>
<th>Blower Equipment</th>
<th>2,000 s.f.</th>
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<tbody>
<tr>
<td>16,440 s.f.</td>
<td>1,644 s.f.</td>
</tr>
<tr>
<td>1,544 s.f.</td>
<td>19,728 s.f.</td>
</tr>
</tbody>
</table>

Circulation 10%
Operating Gallery 10%
**Description:**
A semi-private space for the housing of administrative office needs associated with the plant superintendent.
He is the highest ranking personnel in the plant whose job it is for the supervision of personnel and the management of office needs.

**Equipment:**
Office desk and equipment, filing system, conference table and associated needs, and switchboard for intercom system.

**Electrical:**
Provide needed power for normal electrical service and for plant intercom switchboard.
Provide ample service for possible interior expansion of office.

**Mechanical:**
Provide suitable heating & cooling needs for steady comfort temperature of 68°-72°F.
Air conditioning to be provided within this space.

**Structural:**
Insure isolation against plant noises and equipment vibrations.
Location will be an important priority.

**Support Spaces:**
Possible reception area, additional office storage, future office expansion

**Special Considerations:**
It will be necessary to move all existing office equipment to a newly designed space located closely to the public & employee entrance.

Superintendents Office........................................ 300 s.f.
description:
A space where employees can go for their personal needs.
Included in such an area will be locker facilities, shower/toilet facilities
and a lounging area.

equipment:
20 Lockers, 2 shower stalls, 2 toilets, 2 urinals,
2 lavatories, lounging chairs and tables.

electrical:
Provide normal service

mechanical:
Provide an adequate ventilation system.
Provide hot/cold water supply, locate hot water heater close.

structural:
Isolate from plant noises and equipment vibrations

support spaces:
Janitors closet nearby

special considerations:
Should be located convenient to plant functions.
No present existing spaces exists.

Employees Room ............................................. 360s.f.
description:
The laboratory is concerned with the prescribed handling of many samples daily according to a set schedule. It is with these tests that the plant performance is determined. The lab may also be used for research to enhance the betterment of its operation.

equipment:
32' of worktable surface, refrigerator, incubator, fume hood, (8) sampling sinks, emergency shower & eye wash

electrical:
Circuitry should be installed for 110 and 220 volt usage. Outlets should be installed above work table heights.

mechanical:
Appropriate ventilation should be provided with fume hoods integrated within the system. Temperature control for a comfort range of 68°-72°. Air conditioning should also be provided.

structural:
Isolate against plant noises and equipment vibrations.

support spaces:
Ample storage space

special considerations:
Should be located for easy access to plant treatment facilities. Limit exposure to direct sunlight. Allow circulation access of 5 ft. around work areas. Retain existing laboratory and add additional space on to it.
description:
A large area which houses the equipment necessary for the pumping of incoming raw sewage.

equipment:
7 pumps for the pumping of influent, 3 wet well pumps, 4 sewage samplers pumps (2 future), pressure tank & compressors.

electrical:
Electrical services for pumps provided through floor.

mechanical:
Proper ventilation from odors and the lack of natural ventilation.

structural:
Below grade construction for this equipment area.
Insure structural stability against equipment vibrations.
Allow opening to ground level for equipment removal.

support spaces:
Janitors storage

special considerations:
Allow 3-5 feet circulation space around each piece of equipment.
Building design will be multi-story since the inlet sewer is below grade.
Provide opening for vertical access of equipment.
Retain operating area within existing building.

Equipment Operating Area.................................1400s.f.
description:
As an area for the instrumentation panels needed to operate the pumps & motors within the Equipment Operating Area.

equipment:
Instrumentation Panels and Gauges

electrical:
Provide conveniently location of plant power source to motor control panels. Allow for quick maintenance and adequate protection.

mechanical:
Normal mechanical service

structural:
Integrate within existing structure either above or below grade

support spaces:
Shaft wall for electrical service

special considerations:
location above grade would allow for easier employee access.

Motor Control Area ........................................... 100s.f.
Description:
Receiving pit for influent of raw sewage, consisting of screening solids and the lifting of sewage up to the Grit Chamber for settling.

Equipment:
- Wet well intake areas to pumps,
- Comminutors or bar screens

Electrical:

Mechanical:

Structural:
- Below grade construction

Support Spaces:
- Provide accessway down into pit

Special Considerations:
- An exterior location away from critical winds.
- Allow access into pit for frequent cleaning of the bar screens and intakes.
- Allow for future expansion of additional wet wells but locate pit in existing location.

Wet Well/Comminutor: .............................................600s.f.
description:
This is designed to be the supply piping area for the chlorine gas to the Chlorine Contact Chamber

equipment:
Evaporator, analyzer, 2 chlorinators, chlorine scale

electrical:
Normal electrical service

mechanical:
Insure suitable ventilation with exhaust at floor level due to density of chlorine fumes. Provide air change every 3 minutes. Maintain minimum temperature of 70°F provided most suitable by a hot water heating system.

structural:
Insure proper fireproofing

support spaces:

special considerations:
Visual access to the inside by some type of observation window. Isolate from equipment & vibration and any flammable objects. Feed should be close to storage.

Chlorine Feed.........................................................220s.f.
**Description:**
Storage area for chlorine cylinders used in the Chlorine Contact Chamber and supplies by the chlorine feed equipment.

**Equipment:**
Cylinder hoist, 8-12 cylinders in stock

**Electrical:**

**Mechanical:**
Ensure suitable ventilation from chlorine fumes

**Structural:**
Ensure proper fireproofing

**Support Spaces:**
Shipping/receiving access for cylinders

**Special Considerations:**
Location should be above grade due to the weight of the gas and for convenient movement of cylinders

Chlorine Storage .......................................................... 180s.f.
description:
Enclosed circulation pathways along treatment processing tanks and service pathways within enclosed structure to handle materials movement.
Designed to provide protection for the workers from the weather.

equipment:

electrical:
Provide appropriate lighting system for working at night outside and for lighting open areas on the inside

mechanical:
Provide both forced and natural ventilation

structural:
Develop a structural frame to enclose pathways outside so that it is flexible and can be transparent.
The inside will become part of overall building frame.

support spaces:
A service core for running all service needs to workers and processes in the form of plumbing.

special considerations:
Provide circulation width of at least 5 ft.
Make it so that it is not a permanent total enclosure outside.
description:
A processing function which is designed for the settling out of grit and sand from the incoming influent.

equipment:
Grit chamber tank, settling equipment, grit waste conveyor

electrical:
Provide service for motor equipment

mechanical:
Provide ventilation either forced or natural for the removal of hydrogen sulfide odors and high humidity.

structural:
Provide some type of enclosure unifying it structurally with existing buildings.

support spaces:
Grit waste storage

special considerations:
The existing grit chamber is sufficient to handle an additional flow. Provide a structural enclosure for equipment protection and for housing worker operations.

Grit Chamber........................................................................................................1400s.f.
description:
An equipment area which is concerned with the receiving & pumping of sludge from the primary and secondary settling tanks to the anaerobic digestors.

equipment:
8 Wet well pumps, 2 thickened sludge pumps, 2 scum ejectors

electrical:
Provide service for equipment needs

mechanical:
Provide normal heating needs

structural:
Below grade construction for wet wells provide support pads for pumps

support spaces:

special considerations:
Consideration for multi-story construction

Sludge Receiving/Wet Well.................................600s.f.
description:
An equipment space for the locating of sludge filtration equipment and for the needs of final sludge treatment before discharge.

equipment:
3 Vacuum filters, 3 Filtrate pumps, Chemical Mixing Unit, Sludge Drier

electrical:
Provide service for equipment needs

mechanical:
Provide normal heating needs

structural:
Provide adequate structural support to prevent equipment vibrations.

support spaces:
Decomposed sludge disposal area

special considerations:
Locate equipment needs close to operating sludge digestors
Provide convenient disposal point for decomposed sludge

Equipment Area.................................................................800s.f.
description:
Equipment area for digestor heating units and sludge pumps. The space also houses the process control piping for sludges.

equipment:
Sludge heating units, sludge pumps, sampling sinks, instrumentation

electrical:
Provide normal service for equipment needs

mechanical:
Provide a piping service gallery for sludge piping needs.
Provide heat source with heating capacity of 900-950°F.
Provide adequate ventilation and exhaust.

structural:
Digestor tank walls usually made up of 12" thick concrete
Space between digestor walls serves conveniently as main gallery space for equipment.

support spaces:
Gas storage and piping gallery
Sludge piping gallery
Janitors closet

special considerations:
Utilized digestor walls as a building wall provide access to rooftop & digestor top

Heat Exchange Area..................................................800s.f.
**Description:**
This area is closely related with the heat exchange area. It is comprised of equipment needed for extraction of methane gas from the digestors. The compressors extract the gas then pipe it to a pressure tank, then storage.

**Equipment:**
Gas compressors, gas meters, gas pressure tank

**Electrical:**
Provide normal service for equipment needs

**Mechanical:**
Provide adequate ventilation from gas odors
Provide piping gallery for gas

**Structural:**
Construct within or as a part of the two digestor walls

**Support Spaces:**
Gas piping gallery
Gas storage tank

**Special Considerations:**
Isolate gas piping for protective purposes
Locate gas services near outside storage or relocate existing storage tank.

Gas Compression Area: 600 sq ft
Treatment Needs

- Wet Well/Raw Sewage Lift Pumps: 3 existing
- Grit Chamber: existing
- Primary Flow Splitter: existing
- Primary Settling: 2 existing, 2 proposed, 2 future
- Aeration Flow Splitter: proposed
- Aeration: 2 existing, 6 proposed, 6 future
- Final Flow Splitter: proposed
- Secondary Settling/Final Clarifiers: 2 existing, 3 proposed, 3 future
- Chlorine Contact Tank: 1 existing, 1 proposed
- Sludge Thickening Tank: 1 proposed, 1 future
- Anaerobic Digestion Tank: 2 existing, 2 proposed, 2 future
Due to the future needs of the city of Logansport, the existing Logansport Wastewater Treatment Plant is being expanded to provide hydraulic flow through the existing and proposed facilities while increasing the capacity to provide complete primary and secondary treatment of 9.0 mgd (million gallons of wastewater per day), with future expansion capabilities to 12.0 mgd. Design considerations are based on a 9.0 mgd raw sewage influent which consists of domestic and industrial wastewater from within the city. The industrial wastewater consists of almost 4.0 mgd, which is received primarily from the Wilson-Sinclair Co., a hog slaughtering processing and packing house. The remaining influent consists primarily of domestic wastes which are discharged by a system of sanitary and combined sanitary-storm sewers. The hydraulic flow demand of the above wastes is the real basis of design for the proposed addition so it is imperative to illustrate this process design criteria.

Hydraulic Flow Data

<table>
<thead>
<tr>
<th>Source</th>
<th>MGD (Millions Gallons Per Day)</th>
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<tbody>
<tr>
<td>Residential</td>
<td>3.2</td>
</tr>
<tr>
<td>Wilson-Sinclair Co.</td>
<td>2.0</td>
</tr>
<tr>
<td>Other Industrial</td>
<td>1.6</td>
</tr>
<tr>
<td>State Hospital</td>
<td>0.4</td>
</tr>
<tr>
<td>Future Residential</td>
<td>0.5</td>
</tr>
<tr>
<td>Future Industrial</td>
<td>1.3</td>
</tr>
<tr>
<td>Total Design Flow</td>
<td>9.0 mgd</td>
</tr>
</tbody>
</table>

*Based on 22 days work per month and 30 days of residential flow per month.
Schematic Flow Diagram

wastewater treatment plant

Legend
--- Existing
--- Proposed

Chlorine Contact Chamber

3.375

Final Clarifiers

Flow Splitter

Aeration Tanks

1.125
1.125
1.125
1.125
1.125

Flow Splitter

Primary Settling Tanks

2.65
2.65

Flow Splitter

Unbalanced Flows

Net Well - Max. Capability

Pumping Grit Chamber - Max. Capability

To Wabash River

9.0

6.25

2.25

9.0,000,000

Flow (MGD)
The wastewater flow of 9.0 mgd will enter the treatment plant through the existing 48" influent pipe. After passing through the existing comminuter, where large solids are ground to a smaller size, the liquid enters the existing wetwell, located beneath the control area. The raw sewage lift pumps lift the wastewater to the grit chamber, where inorganic sand and grit are settled. A parshall flume measures the flow rate and conducts it to the primary influent channel. Then the wastewater will flow over weirs of lengths proportional to the areas of the primary settling tanks to provide a uniform surface loading of the tanks. Pipes with submerged outlets will carry the liquid to the primaries.

The effluent from the new primaries will be collected in an aerated channel and conveyed to the aeration flow splitter where it will be joined by the effluent of the existing primaries. The effluent of the existing primary may be directed to the flow splitter or directly to the existing aeration tanks through the use of stop plates in the effluent. At the aeration flow splitter, another series of weirs divides the total flow to load the two existing and six proposed aeration tanks equally.

The effluent of the existing aeration tanks will be directed through the existing channel to the two existing secondary settling tanks, where submerged inlets will divide the flow evenly among the two tanks. The new aeration tanks will discharge to an aerated channel conveying the flow to the secondary flow splitter. Here, equal length weirs will split the 6.75 mgd design flow equally to the two circular secondary clarifiers.
Secondary effluent from the existing units will flow through the existing channel to the existing chlorine contact tank influent, a vertical drop pipe. Effluent from the new clarifiers will be conveyed by a single pipe to a point adjacent to the existing drop pipe.

After passing through the chlorine contact tank, the treated wastewater will flow over a weir to the existing outfall flume and channel. The existing 36" outfall sewer will be extended to the main channel of the Wabash River to provide better mixing and dilution of the effluent with the river water.
1. Primary energy input
   - Building HVAC
   - Treatment process
   - Sludge disposal

2. Secondary energy input
   - Treatment process
   - Sludge disposal
   - Building HVAC
   - Sludge disposal
treatment process

3. Electrical service
   - Building & processing electrical
   - Methane gas
   - Solar radiation

Energy Needs:
- Building HVAC
- Sludge disposal
- Heating
- Treatment process
- Electrical
1. Building HVAC

- Heating
- Heating system
- Direct solar radiation

- Building enclosure

- Air conditioning system
- Cooling
- Natural ventilation
Sludge Disposal

Primary treatment
Secondary treatment
Sludge Thickening Tank
Sewage Treatment Plant
Outside gas source
Pathways by predator
Use gas
3. Treatment Process

hot water heating system

direct solar radiation

treatment processing

primary • aeration • secondary
Building Process Electrical

City Electrical Service

- Freshwater Electrical
  - Equipment
- Building Electrical
  - Equipment & Lighting
Total Plant Energy System

Energy Needs:
1. building hvac
2. sludge disposal
3. building equipment electrical

Methane Gas

- sludge disposal
- building hvac

Secondary Energy Input

Electrical Service

- building equipment electrical
1. Building HVAC

- Air conditioning system
- Heating system
- Building enclosure
- Natural ventilation
- Cooling
2. Sludge Disposal

- Primary treatment
- Sludge
- Sludge thickening tank
- Secondary treatment
- Sludge

- Sludge aeration windrows
- Anaerobic digesters 95°C
- Methane
- Methane by-product
- Outside gas source
- Methane gas for digestion
- Methane gas for building, HVAC, and electrical
- Gas storage

methane gas from digester → generator → city electrical service

- equipment electrical
- building electrical
methane collection schematic

incoming sludge

anaerobic digester

methane gas

digester heaters

heating balers

building heating

decomposed sludge
solar collection schematic
<table>
<thead>
<tr>
<th>Month</th>
<th>Tmax</th>
<th>Tavg</th>
<th>Heating Degree days DD/Mo</th>
<th>Cooling Degree days DD/Mo</th>
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<tr>
<td>August</td>
<td>79</td>
<td>72</td>
<td>12</td>
<td></td>
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<tr>
<td>September</td>
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Sources:
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Source: 1 Source: 2

Sources:

1. House Beautiful "Climate Control Guide"
2. Climatic Atlas of United States
3. ASHRAE
LOCATION: Logansport, Indiana  Population 20,000
CLIMATE: Temperate
LATITUDE: 42° North
BUILDING AREA: 21,200 s.f.
   270,000 c.f.

BUILDING HEAT LOSS

| WALL:    | Composite metal wall panel | 1 hr fire rating | u = 0.05 |
| ROOF:   | Steel deck w/built up roof |                    | u = 0.16 |
| FLOOR:  | Concrete slab              |                    | 2 BTU/s.f. |
| GLASS:  | Double pane insulating     |                    | u = 0.70 |

INfiltration:

s.f. \times u \times \Delta t

| WALL:    | 10,000 s.f. \times 0.05 \times 70| 35,000 |
| ROOF:   | 21,200 s.f. \times 0.16 \times 70| 237,440 |
| FLOOR:  | 21,200 s.f. \times 2 BTU/s.f. | 42,400 |
| GLASS:  | 1,950 s.f. \times 0.65 \times 70| 89,000 |
| INfiltration: | 0.018(70)(270,000)| 340,200 |

Main Building Mass
Blower Building

1. Building HVAC
   app. 1,000,000 BTU/hr heat loss

Digestor Energy Needs

requires 7 BTU/hr/capita

20,000 \times 7 \text{ BTU/hr} = 140,000 \text{ BTU/hr}

2. Sludge Disposal Heating

Maximum Design Energy Needs = 140,000 BTU/hr
Minimum Design Energy Needs = 200,000 BTU/hr
**Methane Collection**

avg. daily collection = 6 cu. ft. of gas/capita/day

heat value of methane = 600 BTU/cu. ft.

Daily Collection:

20,000 x 6 cu. ft. = 120,000 cu. ft./day

120,000 cu. ft./day x 600 BTU/cu. ft. = 72,000,000 BTU/day

heat conversion efficiency = 60%

72,000,000 BTU/day x .60 = 43,200,000 BTU/day

or 1,800,000 BTU/hr

*methane supplies all of heating needs so solar is not feasible*

**Surplus Energy**

<table>
<thead>
<tr>
<th>Month</th>
<th>Energy (BTU/hr)</th>
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<td>1,000,000</td>
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<tr>
<td>December</td>
<td>600,000</td>
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**Yearly Total** = 14,700,000 BTU/hr
Yearly Total 14,700,000 BTU/hr

Conversion to Electricity

1Kw-hr = 3413 BTU
14,700,000 BTU's = 4307 Kw-hr

Which can probably supply about 50% of the electrical needs for the plant considering efficiency in conversion.

The whole plant needs no solar energy source because the alternate energy source of methane can supply almost all the plants energy needs. Not only the methane but energy conservation measures such as capturing blower exhaust heat can help to achieve 100% efficiency.
Friday
September 17, 1976

Memo:
Critic W/Mr. Paul Laseau
Mr. Stan Geda

Memorandum of Critic with Professors Laseau and Geda

Re: Proposal for Wastewater Plant

Investigate closely the approach to the problem within the context of an architect. It was best advised to not try to do an engineering design but maintain my assumed role as an Architectural Consultant. I should work with the engineers solution and analyze the concerns which are evident to man, ecology, the city and any other aspect of our environment which concerns itself with a Sewage Treatment Plant.

Find out information concerning why the engineer has designed it the way he has. Also, find important environmental issues such as topography, vegetation, soils, sewage flows, wind, noise, drainage, flood plain and others.

Suggested was the idea of preparing an environmental impact study delving into the ecology. This should be a prelude to a program. Key aspect is balance of man & nature.

Note: I must remember that I'm not doing the project engineering but as the role of the Architectural Consultant caring for the needs of man and of our environment.
Criteria For Spatial Qualities:

1. design a facility that displays a public image for the city.

2. exhibit an architectural statement which expresses an industrial image rather than to hide the true function behind a typical multi-use facade

3. create an environmental space which displays a visual playground of curious forms

4. create an environment which enhances a union between mechanical functions and environmental concerns: context of processing tanks with ground orientation of the plant to the river

5. create an environment which stimulates human curiosity towards both the visual forms and the mechanical functions.

6. allow use and access to be oriented to the people as well as serving functional needs

7. priority elements:
   - people
   - processing
   - environment
Concept 3

1. process containment
   a. massing of all the elements together into one solid form

2. people control
   a. restrict freedom of people due to centralization of all elements together

3. environmental mass
   a. one solid visual form
Concept 2

1. process loop sequence
   a. process elements are organized to create a loop due to the sequence of processing treatment

2. people semi-control
   a. limitation on the access of people to various process elements

3. environmental linear mass
   a. massing of elements linearly to create the necessary sequence of flow; loop arrangement
Concept 1

1. separation of process functions
   a. processing elements become individual elements of form
   b. people can read elements by associating with forms.

2. people pathways
   a. people/service circulation becomes varied spatial path

3. environmental sculpture
   a. earth becomes important visual form as well as serving to direct circulation
   b. large earth masses become environmental sculpture as well as architectural form.
Schematic presentation of a wastewater treatment plant.
Jury Comments:

Adams
1. more development of the use of methane
2. better integration of parts with site
3. questionable use of one large roof concept

Geda
1. good understanding of "parts" and how they relate
2. use of sludge from area where watered sludge has been dumped on the soil
3. what will be done with sludge from digestors

Wyman
1. Large roof concept is not convincing
2. simply the association of forms, too many things happening
3. too much planning done up to this point get more into the technology and architectural potential
4. develop a "clean machine" architecturally
5. good graphic presentation
6. good verbal/technical presentation
Design Development Change to Concept 2

1. more of a linear massing.
2. future expansion will run horizontally with road
3. retain varied pathway for people
4. mounding around tanks will become a massing sculpture
1. Building needs respond to site influences on building form.
2. Massing of building into one form...
Spatial Development

Logansport
Jury Comments:

Adams:
1. Investigate closely the use of methane & solar;
   do some calculations
2. Work on wall section detailing

Geda
1. Central space is not well thought out
   for people and circulation
2. Put together sketches on mounding details
End detail of round secondary treatment tank.
primary treatment tank

treatment tank connection of primary & secondary proposed tanks

secondary treatment tank
Jury Comments:

Adapt
1. Methane will now supply all of energy needs and solar is not needed
2. What about building HVAC? More detailed

Code
1. More work needed on central area
2. Linear mass bonding works good

llustration
1. Need more building overhang
2. Do some sketches for proportions & details
3. Refine to a nice aesthetic
Sketches of Control Area and Overall Site
Color-Tone Housing Studies
Wednesday
September 15, 1976

Memorandum of Meeting with

Bob Taylor

Engineers at Shambaugh & Co., Indianapolis

Re: Processing Design of Wastewater Treatment Plants

I made contact with Shambaugh & Co. through Bob Haggerty, a fellow architecture student. They supplied me with information pertaining to the engineering process of sewage treatment. I received a sketch of the processing they used on a New Buffalo, Michigan District Sewage Treatment Plant. Mr. Taylor also explained the steps of how the influent comes in, goes through the condenser, primary clarifiers, aeration tanks, secondary clarifiers and then to the chlorine tank before the effluent is expelled.

They also supplied me with some information on cost and on flow capacity of most typical plants. As well as the verbal information they also supplied me with 3 pamphlets explaining sewage treatment as well as plant design.
Thursday

September 16, 1976

Memorandum of Meeting with Robert Hinnick, City Engineer
and Harold Gordon, Sewage Plant Superintendent.

Re: Proposed Design of New Sewage Treatment Plant

I contacted the City Engineer and we discussed the idea of an addition to the Sewage Plant. He supplied me with the background information to this type of project in addition to the Preliminary Engineering Report which discusses the city's plans for the addition.

We visited the plant where I received a tour explaining the process of the existing plant. Presently the plant is set up for a 6 MGD capacity but will soon be expanded to hold 9 MGD.
Monday:

September 20, 1976

Memorandum of Meeting with Logansport City Engineer,
County Surveyor, Soil Conservation Service Office, and
Indiana Department of Natural Resources.

Re: Procuring Maps for Sewage Treatment Plant

Today's visit to Logansport was for the purpose of obtaining
maps of the county and city scale. I first visited the City
Engineer's office to obtain city maps and also to get some information
as to the proposed processing design for the sewage plant as prepared
by Clyde E. Williams & Associates.

Next I visited the County Surveyor where he gave me some county
maps and information as to the bedrock level throughout the county.

Finally within Logansport I went to the Soil Conservation Service
where I gained information on the soils of the area as well as some
aerial photos. They also gave me some more information on the
situation with bedrock.

My last stop for the day was in Indianapolis where I went to the
State Office Building to obtain a topography map from the Department
of Natural Resources.
Thursday
October 21, 1976

Memo: Meeting with Clyde E. Williams & Assoc. Inc. Engineers
South Bend, Indiana

%Keith Fujiwara

Re: Concerning Logansport Wastewater Treatment Plant

We discussed much of the design input involved with the Logansport plant. The environmental problems with the new plant and some of the processes, such as the new sludge disposal facilities.

They also supplied me with a complete set of drawings on the work in engineering involved. These drawings are of a vital asset to me as an Architectural Consultant because I must know the design concepts of the project engineers.

I was surprised to find that this job was the largest wastewater treatment project which they had ever undertaken. Most of their work is in the range of 1 million gallons but Logansport utilizes a capacity of 9 million gallons. Quite a project for even a big firm such as this.

The meeting proved very successful from a resource standpoint and also from a public relations standpoint.

Huntz Hoover
Oct. 21, 1976
September 23, 1975

Mills E. McLean and Associates, Inc.
1902 North 6th Street
North Platte, Nebraska 69101

Dear Mr. McLean:

My name is Hazel Hoover and I am an Architectural Thesis Student from Bell State University. Presently, I am working on my thesis project which is involved with the addition to the Laramie River Valley Treatment Plant. My involvement with the project doesn't pertain to the sewage treatment design, but rather to the architectural work involved with building feasibility. Also, I am very much concerned with the ecology of such a facility and I'm considering an environmental impact study.

I particularly chose such a project for my thesis work because it involves an engineering solution as well as an architectural solution. Projects of this type where architects must work closely with engineers, are becoming more necessary today. I find this type of project to be good preparation for college prior to my profession I want to work in. I hope that you would find it opportune to be working closely with an architectural profession.

My purpose in writing you is to present a request of obtaining a set of plans to work with. I should have the plans by this time. However, the current weather has delayed the completion of the plans. I have sent a letter to the town meeting, and I am particularly interested in the plans for the building. I would like to see it in progress and I am sure of the work since it will have already been reviewed by the planning board. If this is not feasible with your time may you could give some information as to how I may desire to work on the project. If this is not feasible with your time may you could give some information as to how I may desire to work on the project.

My primary interest in the project is to utilize your knowledge of the town and some of your services as an engineer. This is the type of experience I desire to see the architect in the consultation rather than the architect's decision. I hope that you can be of assistance to me because it would be a nice contribution to the union of higher education and to the professional career of engineering. I hope you can find time to help me.

Thank you,

Hazel Hoover

Please reply to:

Hazel Hoover
615 Riverside
Muncie, Indiana 47303