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Environmental Protection Technology Series

Soil Modification for Denitrification and Phosphate Reduction of Feedlot Waste

Office of Research and Development
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SOIL MODIFICATION FOR DENITRIFICATION AND PHOSPHATE REDUCTION OF FEEDLOT WASTE

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ABSTRACT

The efficiency of pilot-size Barriered Landscape Water Renovation Systems (BLWRS) to renovate flushed livestock waste was studied. The BLWRS is a modified permeable soil that has an aerobic zone for the filtering and oxidation of the waste and an anaerobic zone to which an energy source is added to create an environment for denitrification.

Two pairs of BLWRS 0.008 ha. in size were constructed using a polyvinyl barrier to create the anaerobic zone and contain the effluent. Flush waste from swine or dairy cattle were applied on each pair of BLWRS. The waste effluents and BLWRS soil were periodically analyzed for nutrients, oxygen demand and pathogens.

At manure loading rates of up to 122 t/ha. swine waste and 93 t/ha. of dairy waste, the BLWRS had an efficiency of 80% and 97% for nitrogen renovation, greater than 99% for phosphate and 93% for carbon. The oxygen demand dropped 50- to 100-fold. Under normal operating conditions, the pathogenic indicator organisms did not appear in the effluent.

The BLWRS has been shown to be an efficient system for renovating large quantities of livestock waste and should be tested on a commercial scale with continuous monitoring.

This report was submitted in fulfillment of Project Number 13040FYK by the Crop and Soil Sciences Department of Michigan State University under the partial sponsorship of the Environmental Protection Agency. Work was completed as of December 31, 1972.

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SECTION I

CONCLUSIONS

The BLWRS constructed, operated and studied in this project was very successful in renovating large quantities of livestock waste.

It was possible to apply between 9 to 18 mm of flush waste per day to BLWRS soils if they were rested one third of the time for the recovery of infiltration capacity. This amounted to swine waste applications of 122 t/ha. over 17 months and 93 t/ha. over 15 months for dairy waste. The physical characteristics of the soil govern the application rates.

The BLWRS aerobic environment was conducive to the oxidation of carbon (93% loss) and conversion of organic nitrogen and ammonia to nitrate nitrogen.

The BLWRS anaerobic environment with energy source was efficient in denitrifying the waste, reducing 176 kgr of nitrogen in waste on the Dairy BLWRS to 5.4 kgr in the effluent for a 97% renovation and 10 to 12 ppm nitrate in the effluent. The Swine BLWRS which were overloaded on several occasions had 386 kgr nitrogen added and were 80% efficient at renovations.

Phosphate renovation by the BLWRS soil was 99+% efficient. Once the soil becomes loaded with phosphate, a phosphate adsorption bed will need to be placed at the effluent end of the BLWRS, but to date the precipitation of phosphate as dicalcium phosphate at the surface and soil adsorption of the dilute phosphate leaching down have been very efficient. Under the present loading, the BLWRS soils will probably continue to function without leaks for 10 to 20 seasons.

Under normal operating conditions the BLWRS effluents did not have pathogenic indicators.

The reduction in BOD_5 and COD was 50- to 100-fold.

SECTION II

RECOMMENDATIONS

It is recommended that commercial size BLWRS be constructed and monitored to test the principle on a larger scale under farmer operation.

It is also recommended that the existing pilot BLWRS continue to operate in order to study the phosphate absorption, nitrification and denitrification, and recovery after overloading. These studies should include additions of tagged nitrogen, the addition of additional quantities of phosphate to one of the BLWRS to test the phosphate model, and work on a final phosphate absorber.

BLWRS should also be considered and tested as a means of renovating municipal effluents and sewage.

SECTION III

INTRODUCTION

Today almost everyone is aware of the enormity of the animal and human waste problem and the necessity of finding an efficient, inexpensive way to remove BOD, nitrogen and phosphate from waste water and return the water free from pollutants to the natural aquifers. Disposal of liquid wastes on the surface of the soil is an easy method of disposal, and studies of this method at Pennsylvania State University (8) have demonstrated that the adsorptive and filtering action of soil can be an effective and inexpensive way to renovate waste water. In this method, the quantity of waste must be limited so as not to overload the soil system. An overloaded system will cause nitrogen and phosphate to leach below the root zone and contaminate the subsurface water. For this method to be most effective, the nitrogen and phosphate must be fixed by the soil, by the native vegetation, or by crop plants which are marketed. Because of the limitations on plant removal in any one season, large land areas are required. The expense of land and its management, as well as land availability in many places, has forced the intensive spreading of waste on limited acreages with the possible pollution of water resource. There is need for a method of renovation which will be more efficient and not require such large areas of land and yet not be as expensive as conventional sewage treatment and disposal.

The problem of nitrogen in animal waste originates with the large quantities of nitrogen that comes from the atmosphere and is fixed naturally or fixed artificially to form fertilizers. This nitrogen is accumulated in crops and harvested. The harvested crops are fed to livestock but a large portion of the

accumulated nitrogen is left as waste in the feedlot. This nitrogenous waste is difficult to handle because of its bulk and often cannot economically compete with commercial fertilizer in crop production.

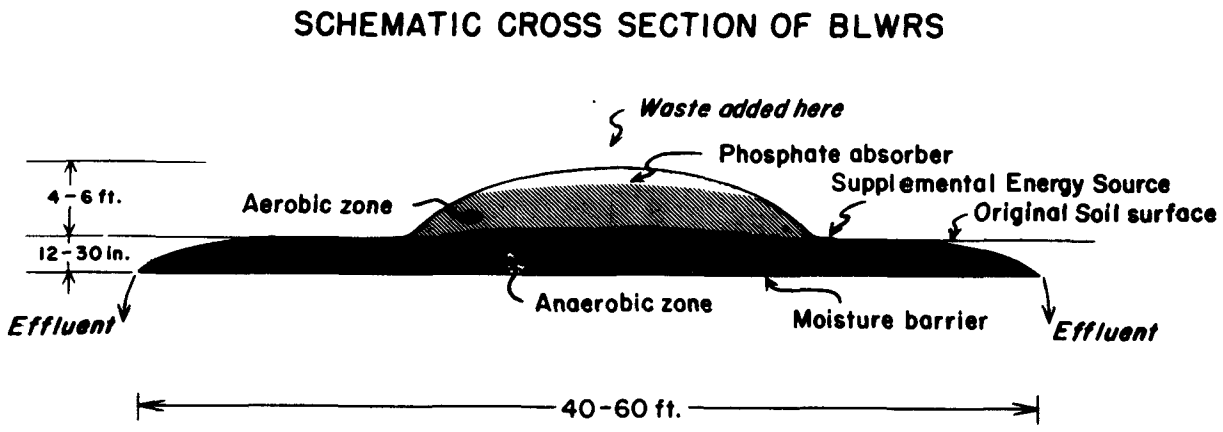
If nitrogenous waste are spread on forest or unharvested areas, quantities of nitrogen are recovered by the vegetation and stabilized into humus. There is a definite limit to the amount of nitrogen that can be recovered and stabilized on a given area in a season; therefore, extensive spreading of the waste is required. Once the nitrogen is stabilized, a change in the environment can cause the release of the stabilized nitrogen back into the environment. The best solution to the problem is denitrification of the waste which releases the nitrogen gas back to the atmosphere leaving the ecosystem in balance.

Phosphate and carbonaceous material are likewise accumulated in feedlots as wastes. The disposal of this carbon can best be accomplished by oxidation which returns the carbon dioxide to the atmosphere. Phosphate can be removed from the waste by fixation of precipitation with calcium, aluminum or iron.

Denitrification, organic matter decomposition, and phosphate fixation are all soil reactions. Whether or not they occur and the completeness and rate of these reactions all depend on the soil environment. Any one soil will probably not have the capacity to do all of these processes well and at the same time. Natural soils are either aerobic or anerobic and the distance that leaching waste water travels in the biologically active part of the soil is short. However, by an inexpensive modification of the permeable soil, it has been possible to form a series of soil environments through which waste waters can pass and in which these reactions proceed at a rapid rate. These modified soils

may go a long way toward renovating liquid feedlot wastes and returning the water, low in nitrogen, organic matter, and phosphate to the soil water aquifer.

The modified soil, called a Barriered Landscape Water Renovation System (BLWRS), is diagrammed in Figure 1. It consists of a mound of soil underlain by an impervious water barrier. The barrier extends beyond the mound out under the soil at the edges. On the top of the mound is placed a thin bed of limestone and/or slag. The waste water is spread on the top of the mound. As the water percolates down, the organic particles are filtered out and remain on the surface to decompose by oxidation. The filter bed removes the major portion of the phosphate. The soluble organics and other ions move into the aerobic soil zone where the ammonium ions are held on the exchange complex of the soil until they are nitrified to nitrate. Most of the soluble organic matter is oxidized in the highly active aerobic soil. All the nitrogen is converted to nitrate. The downward movement of the nitrified water is stopped by the water barrier and forced to move laterally through the anerobic soil perched on the barrier. In this zone, the nitrate is denitrified to nitrogen gas and evolved into the atmosphere if there is sufficient energy available. The renovated water then moves off the edges of the barrier into the deeper soil layers to the water table. The depth and dimensions of the barrier and the height of the mound depend on the soil texture. The BLWRS is designed to give the aerobic and anerobic soil zone lengths which, coupled with waste water application rates, give sufficient time to accomplish phosphate adsorption, nitrification, and denitrification. If more energy is needed for denitrification, molasses can be added in the anerobic zone, but other cheaper organic materials could also be used. The system is applicable to all permeable medium to coarse textured soils.



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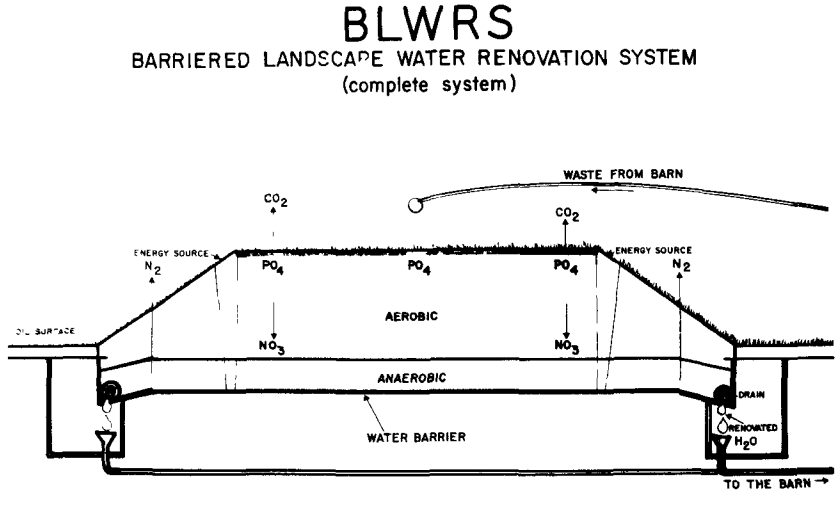

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Figure 1. Schematic cross sections of BLWRS.

The BLWRS method has the advantage that the barriered landscape can be engineered to a particular waste and a particular soil. It is relatively inexpensive to construct and would require a minimum of maintenance. It requires a much smaller area than is needed for the irrigation spreading systems and removes large amounts of the nitrogen, carbon, and most of the phosphate from a local environment.

The removal of phosphorus must be accomplished by precipitation or adsorption. Passing effluent through soil will effectively remove phosphorus, but the acreage necessary to denitrify the nitrogen component of waste materials is much less than that necessary to remove phosphorus. Thus, the system might overload with phosphorus without an additional method to remove phosphorus. This, theoretically, could best be accomplished with either iron or aluminum compounds. Laboratory studies have demonstrated the usefulness of limestone and slag for the removal of phosphate from the waste water systems.

Several small BLWRS were tested in the summer of 1969. One hundred ppm of nitrate has been continuously reduced to less than one ppm in the effluent water with small amounts of molasses added as an energy source. The spreading rate was 2.3 cm/day on a permeable soil.

In 1970 a larger BLWRS was tested using anerobic swine waste as a waste material (5). In three months of operation using an average of 1.9 cm waste per day the BLWRS removed over 99% of the nitrogen and phosphate. This amounted to the removal of over a ton of nitrogen in the three months.

SECTION IV

MATERIALS AND METHODS

CONSTRUCTION

Four BLWRS were established in the spring of 1971. One pair was located adjacent to the Swine Research Facility and the other pair adjacent to the Dairy Research Facility at Michigan State University. The BLWRS at the Swine Research Facility uses the waste material from a slatted floor, flush type, eighty-sow barn and the effluent is collected and reused for flushing. At the Dairy Facility the waste comes from a tank which collects the waste flushed from the holding pen floor at the milking parlor. Because this waste has some coarse material that is difficult to spread with our spreading system, the material is sieved and only the fine material is spread on the BLWRS while the coarse material is spread on the land with a vacuum wagon. At the Dairy it would also be possible to spread milkhouse waste. Two BLWRS were constructed at each site so that if one BLWRS would slow down it could be rested and the other used to accept the waste.

The BLWRS are 10.7 meters wide, 15.25 meters long, and 1.2 meters high in the aerobic zone which projects above the original soil surface and extends 0.6 meters below the surface for the anaerobic zone. The barrier was made of 30 mil polyvinyl sheeting which was turned up at the edges and sealed in the corners to form a complete basin as shown in Figure 2. The alternative B was used because of ease of fabrication.

At both sites, 60 cm of soil was excavated with a bulldozer. The bottoms were leveled and shaped for the collection at the ends. The barrier was installed.

Ten-cm, perforated, plastic drain tile were placed at each end. These were attached to 10-cm rigid plastic drain pipe which were sealed to the barrier and lead into the catchments. The BLWRS liners were then filled with fine sand (Table 1 and Figure 3) and shaped to the desired grade (Figure 1b). The fill sand at the Dairy BLWRS was taken from an adjacent hill. The fill sand for the Swine BLWRS was purchased and transported in because the sand on an adjacent hill was not available for aesthetic reasons. A 15 cm layer of surface soil was used to cover each BLWRS.

The effluent from each drain was measured by a one-liter tipping-bucket and counted electrically (Figure 4). Effluent was sampled at these drains for analysis. After the first several months, overflow devices were placed on each drain tile so that the anaerobic zone could be maintained and adjusted on the BLWRS when no waste was being applied. The excess effluent accumulated in the bottom of the catchbasin and was pumped to a tank and recycled into the flush tanks so that the water was continuously recycled. At times when there was excess effluent it was allowed to waste on the adjacent field. All of the effluent at the dairy barn was released on an adjacent field.

The flushed manure at both sites was pumped into a 6000-liter underground tank. Each of these tanks were stirred to keep the solids suspended. It was from these tanks that the samples of wastewater were taken after each new addition of waste. The waste was automatically sprayed on the top of the BLWRS with automatic booms each equipped with three spray nozzels (Figure 5). One of each pair of BLWRS could be sprayed at any one time. Adjustable time clocks that could be set for minute minimum intervals were used to start the boom and spraying. The boom would make one traverse across the BLWRS and stop. It took

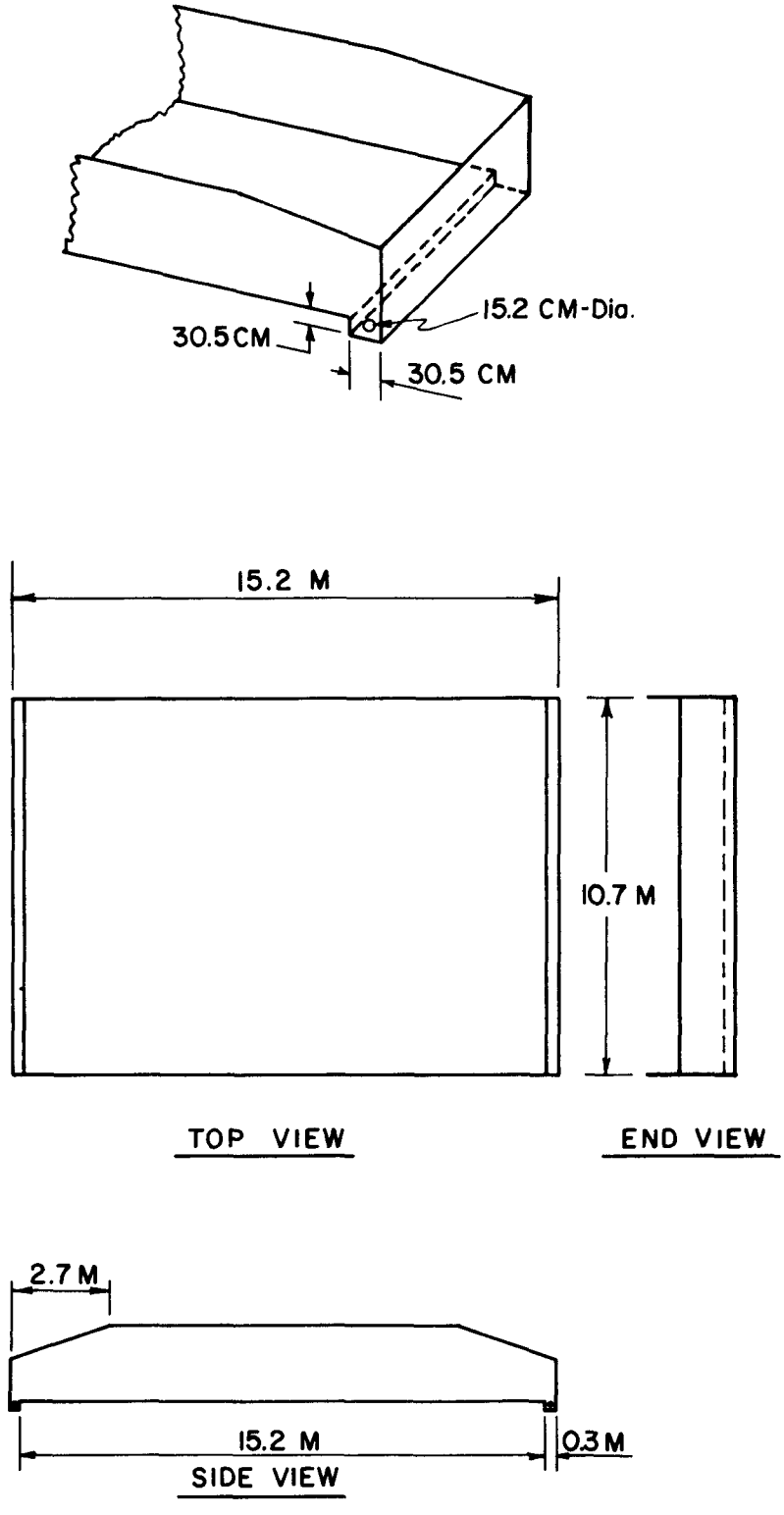


Figure 2. Drawings for the BLWRS, pit liners which were constructed of 30 mil polyvinyl sheeting according to alternate B.

Table 1. MECHANICAL COMPOSITION OF BLWRS SOILS

	Sand						Silt	Clay
	VC	C	M	F	VF	Total		
	percent							
Swine BLWRS								
Surface	4.8	7.6	18.8	38.2	10.3	79.7	12.9	7.4
Subsurface	1.0	4.2	17.1	54.4	15.4	92.1	5.5	2.4
Dairy BLWRS								
Surface	2.1	4.3	8.8	23.3	14.4	52.9	35.1	12.0
Subsurface	0.9	0.6	2.8	30.8	45.5	80.6	17.3	2.1

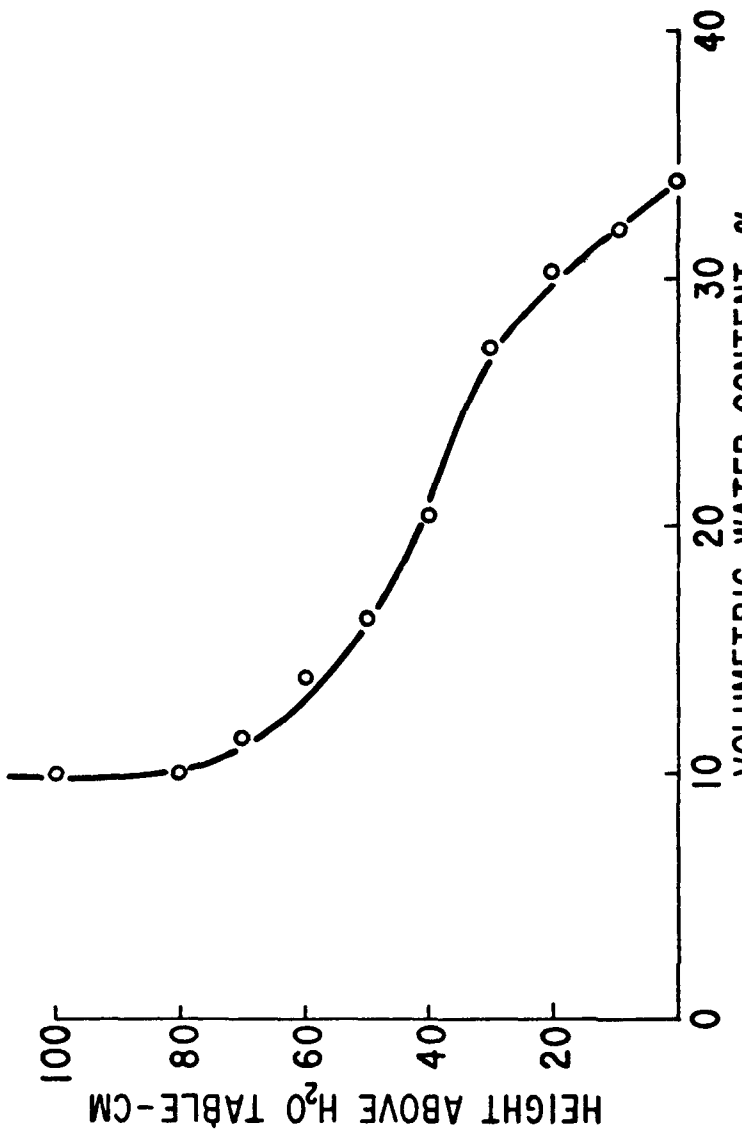


Figure 3. Soil moisture characteristic of BLWRS soil

200 seconds for the boom to traverse the BLWRS and 45 liters of waste was sprayed on each traverse.

Figure 6 shows overall views of each of the BLWRS installations. The energy source for feeding the denitrifying microbes was placed 3.66 meters from the end of each BLWRS (Figure 7). Every BLWRS had one 1.9-cm perforated aluminum conduit placed along the bottom at one end. This could be used to inject molasses into the anerobic zone at one side of each of the BLWRS. On the opposite end of one of each pair of BLWRS a 10-cm trench was dug and 1 part of corn was mixed with 5 parts of excavated soil and the trench was refilled. One end of one of each pair of BLWRS had no energy source and was used as a control or could be used in the future for the installation of a different energy source.

The surface of the Swine BLWRS was seeded to rye when it was started. This did not catch and the surfaces became sealed. The surface was then rototilled in September to increase infiltration and reseeded. The second year an attempt to establish quack grass by spreading stolons was attempted. None of these were entirely successful, but eventually a mixture of volunteer weeds covered the BLWRS and this is persisting quite well. In contrast, the surface soil on the Dairy BLWRS contained a lot of weed stolons and seed and rapidly produced a very good cover on the BLWRS. The sides and surroundings of the BLWRS were sodded using Bluegrass sod. The experience with the Swine BLWRS suggests that some time be allowed for the establishment of the vegetative cover before full-scale operation begins. A quack grass or mixed natural cover would be satisfactory. A good vegetative cover is essential for the maintenance of good infiltration.

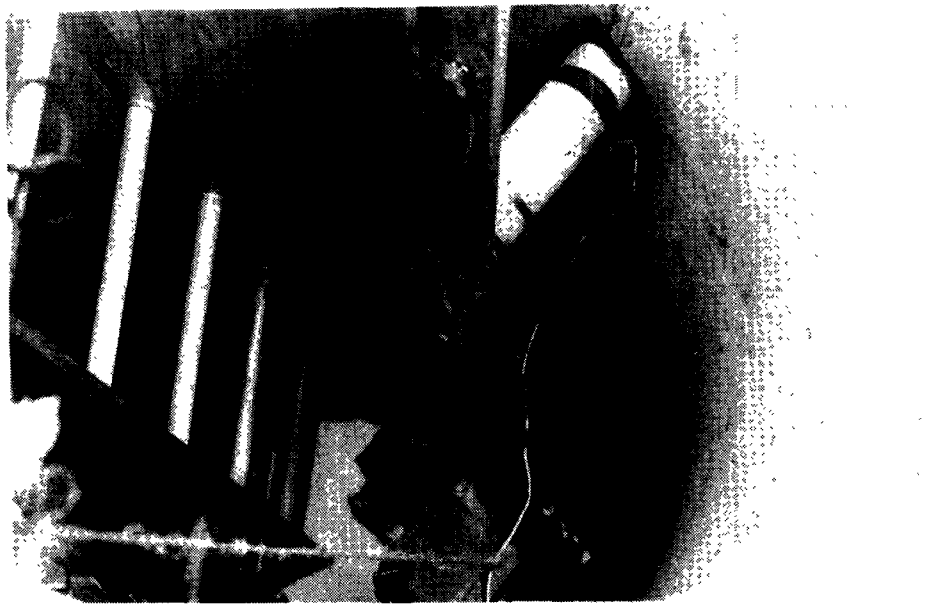


Figure 4. View into effluent catchbasin showing drain from BLWRS water overflow for anerobic zone control and tipping bucket for the measurement of effluent.

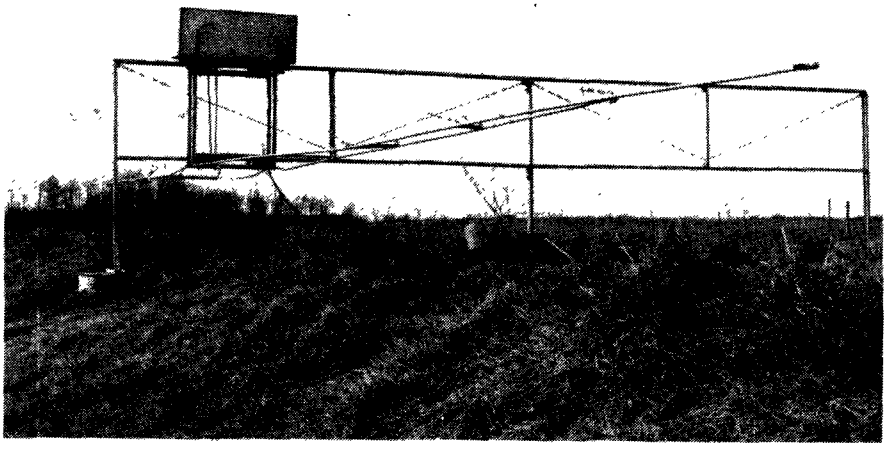
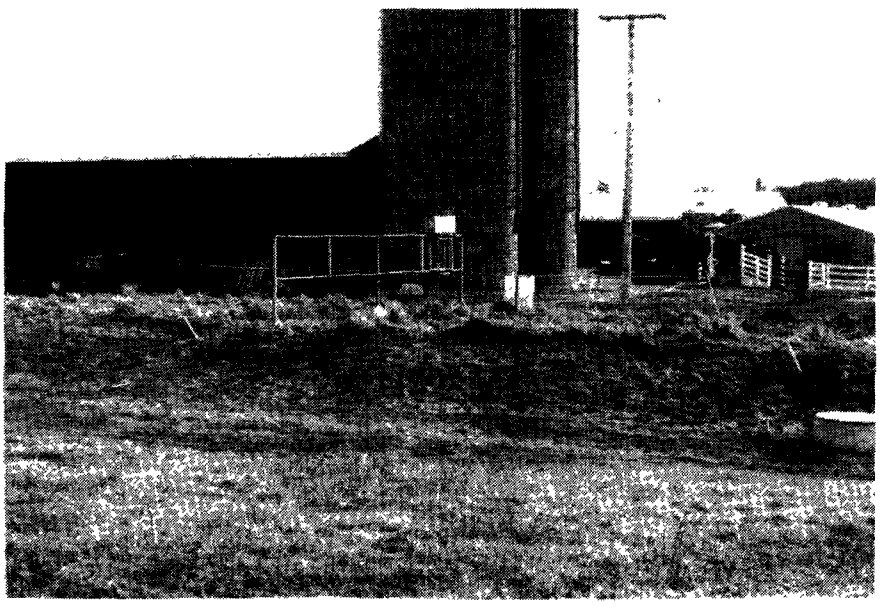


Figure 5. Mechanism for spraying waste on the BLWRS consisting of a track on which the drive mechanism is mounted, the boom and the spray nozzels.

Swine BLWRS



Dairy BLWRS

Figure 6. Overall views of each of the BLWRS.

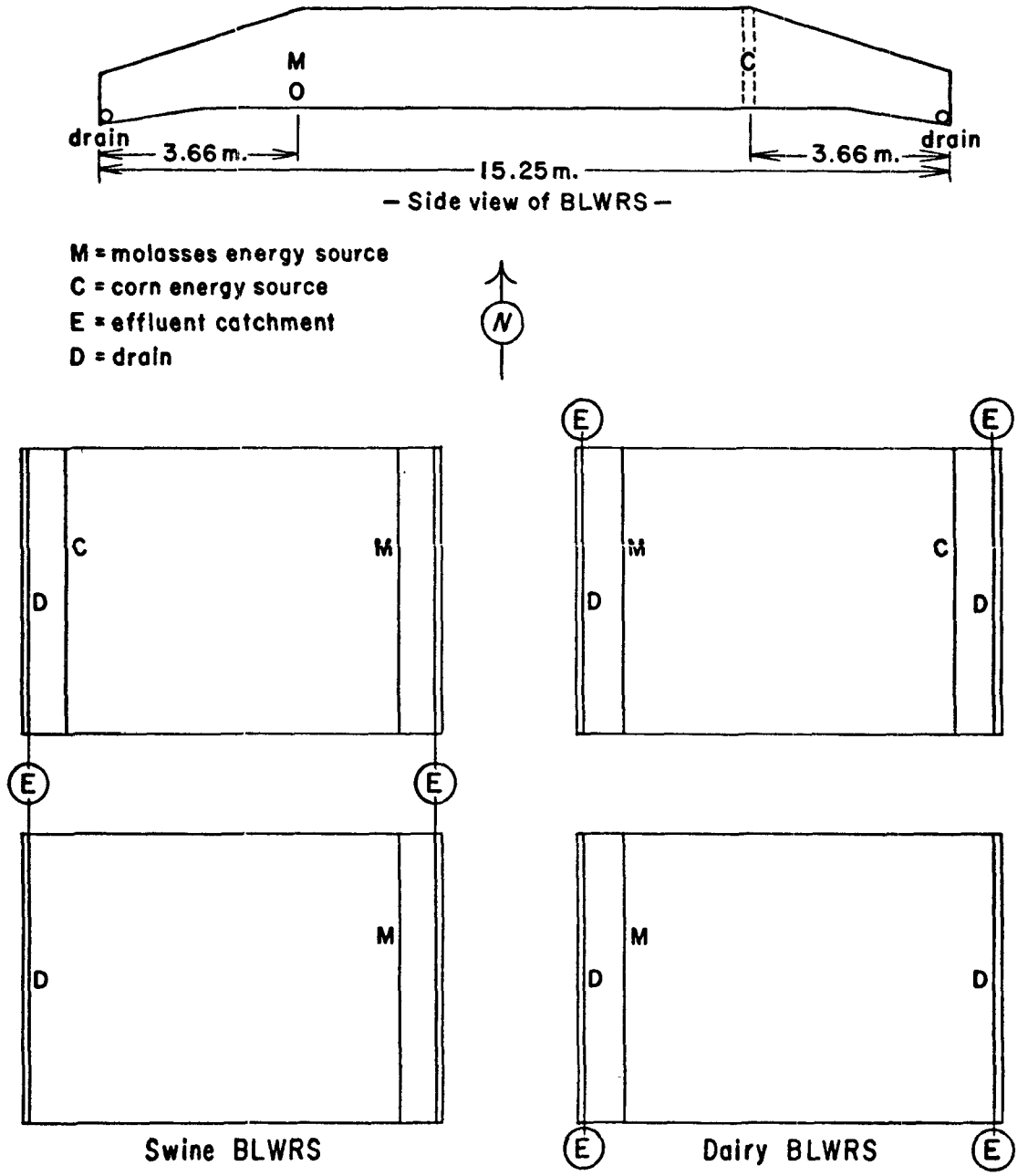


Figure 7. Location of energy sources and effluent catchments in each pair of BLWRS.

SECTION V

METHODS OF ANALYSIS

SAMPLING PROCEDURES

Samples of waste and effluent were taken for analysis twice a week and the amount of waste applied and effluent drained were measured each day. The time of the samplings were numbered consecutively throughout the period of the operation.

Waste samples were taken in 250-ml polyethylene bottles from the sampling part on the boom. The amount of waste applied was calculated from the number of passes of boom per day and the application rate that was checked periodically. These values were checked against the waste level in the holding tank.

Effluent samples were taken in one-liter polyethylene bottles at the tipping buckets at each drain tile. The amount of effluent drained each day was calculated from the number of tips of the bucket and the particular bucket calibration.

Soil water sample extraction in the unsaturated zone was attempted by using ceramic suction lysimeters. The fact that there was phosphate absorbtion by the ceramic cups and there was a possibility that the interior of each cup might have biological activity which could distort the quantities of nitrogen extracted during the extraction process caused the abandonment of this procedure. Subsequent soil water samples were taken from the saturated zone by taking sample from a 2.5-cm aluminum well after first draining the well and then sampling.

Soil samples were taken with a 2.5-cm stab auger in the surface 30 cm and then a 2.5-cm aluminum conduit pipe was used to extract the soil samples. In the wet and saturated zones a negative pressure was placed on the conduit to keep the sample in the tube.

Microbiological samples were taken in 125-ml sterilized glass bottles that were protected by aluminum foil wrappers.

All samples were taken immediately from the field and stored at 2° C. It was the practice to begin the nitrate and biological determinations on the same day as sampled to minimize any distortions caused by further biological activity.

CHEMICAL PROCEDURES

The chemical analyses were done with standard methods or modifications of these as follows:

Soil pH

Reagents: 1. Standard buffer solutions of pH 4.00, 7.00 and 10.00

Procedure: Place 10 grams of soil in a 50-ml plastic beaker and add 10 ml of distilled water. Stir intermittently for 20 minutes and read pH with a glass electrode and a pH meter (either Sargent direct drive or Orion 801 was used).

Waste and water pH

Procedure: Read directly without dilution by the same procedure given above.

Total Carbon

Reagents: 1. Tin Metal Accelerator, Leco Co.

2. Iron Chip Accelerator, Leco Co.

3. Carbon Steel Standards, Leco Co. (0.074% to 0.862% C).

Procedure: Grind soil samples in a SPEX Industries ball grinder to reduce the particle size. Weigh 50 to 100 mg of soil sample (depending on the carbon content) into ceramic cups. Add 0.8 g of each accelerator and mix. Place the sample in the furnace of Leco Carbon analyzer, ignite and read total carbon from the instrument.

CO_3 in Soils (4)

Reagents: n-Octyl Alcohol--Use a reagent-grade product.

Potassium Hydroxide Solution (ca. 2M KOH)

Hydrochloric Acid Solution (ca. 2M HCl)

Phenolphthalein Indicator -- Dissolve 0.05 g of phenolphthalein in 50 ml of 95% ethanol and add 50 ml of water.

Hydrochloric Acid Solution -- (ca. 1M HCl)

Bromocresol Green Indicator -- Dissolve 0.1 g of bromocresol green in 250 ml of ca. 0.0006 M NaOH.

Standard Hydrochloric Acid -- 0.1 N.

Procedure: Weigh a sample of finely ground (100 mesh) soil (not more than 8 g) containing up to 30 mg of inorganic C into an 8-oz square bottle, add one drop of n-octyl alcohol, and stopper the bottle with the assembly shown in the reference. A 5-ml beaker containing 5 ml of 2 M KOH is attached to the glass tube below the stopper by a rubber band so that the bottom of the beaker is about 5 mm above the lower end of the tube.

After stoppering the bottle with the assembly described, remove 50 ml of air from the bottle via the needle-puncture stopper with a 50-ml gas syringe. Then inject 20 ml of 2 M HCl into the bottle via the needle-puncture stopper with a hypodermic syringe and swirl the bottle gently for a few seconds to mix the contents. After allowing the bottle to stand at room temperature (20° - 25° C) for 16-24 hours, transfer the contents of the beaker with deionized water to a 125-ml Erenmeyer flask marked to indicate a volume of 50 ml and make the solution to the 50-ml mark by addition of deionized water. Add 0.3 ml of phenolphthalein indicator solution to the flask, titrate with 1M HCl until the pink color begins to fade and continue the titration with 0.1 N HCl until the phenolphthalein end-point (colorless) is reached. Then add 0.8 ml of bromocresol green indicator solution and titrate with standard 0.1 N HCl to the bromocresol green end-point. Calculate mg of inorganic carbon in the soil sample from (S-C) x 1.2, where S=ml of standard 9.1 N HCl required to titrate from the phenolphthalein end-point to the bromocresol green end-point and C=ml of standard 0.1 N HCl required for this titration in a control analysis performed exactly as described for the sample analysis but with no soil sample added to the bottle.

Total Nitrogen in Soil and Waste Water (3)

Reagents: 1. Sulfuric acid (H_2SO_4), concentrated.

2. Sodium Hydroxide (NaOH), approximately 10N: Place 4.2 kg of NaOH in a heavy-walled 10-liter Pyrex flask, add 4 liters

of water, and swirl the flask until the alkali is dissolved. Cool and allow to stand for several days to settle out Na_2CO_3, siphon the clear supernatant liquid into a large Pyrex bottle which contains about 1.5 liters of CO_2-free water and is marked to indicate a volume of 10 liters, and make the solution to 10 liters by addition of CO_2-free water. Mix well and protect from entry of atmospheric CO_2.

3. Boric acid-indicator solution: Place 80 g of pure boric acid (H_3BO_3) in a 5-liter flask marked to indicate a volume of 4 liters, add about 3,800 ml of water, and heat and swirl the flask until the H_3BO_3 is dissolved. Cool the solution and add 100 mls of methyl purple indicator (Fisher's) or add 2 drops of indicator just prior to titration.

4. Potassium sulfate-catalyst mixture: Prepare an intimate mixture of 100 g of K_2SO_4, 10 g of copper sulfate ($CuSO_4 \cdot 5H_2O$) and 1 g of Se. Powder the reagents separately before mixing, and grind the mixture in a mortar to powder the cake which forms during mixing.

5. Sulfuric (or hydrochloric acid (H_2SO_4 of HCl), 0.0 N standard.

Procedure: Place a sample containing about 1 mg of N in a dry micro-Kjeldahl flask, add 2 ml of water, and after swirling the flask for a few minutes, allow it to stand for 30 minutes. Then add 1.1 g of K_2SO_4-catalyst mixture and 3 ml of concentrated H_2SO_4 and heat the flask cautiously on the digestion stand. When the water has been removed and frothing has ceased, increase the heat until the digest clears, and

thereafter boil the mixture gently for 3 hours. Regulate the heating during this boiling so that the H_2SO_4 condenses about one-third of the way up the neck of the digestion flask.

After completion of digestion, allow the flask to cool and add about 20 ml of water (slowly and with shaking). Then swirl the flask to bring any insoluble material into suspension.

Place 5 mls of boric acid indicator in a 50-ml Erlenmeyer flask and place the flask under the condenser. Connect the micro-Kjeldahl flask to the distillation unit, add 15 mls of NaOH solution (reagent #2) and steam distill until 35 mls of volume is collected. Remove the 50-ml flask, disconnect the steam and rinse the tip of the condenser into the flask and titrate the ammonium present with 0.01 N acid from a 10-ml burette graduated at 0.01-ml intervals.

Extractable Ammonium

Reagents: 1. 2N KCl. Weigh 149.2 g KCl into a one-liter volumetric flask. Add distilled water to give one liter.

2. 0.1N NaOH. Weigh 4 g of NaOH pellets into a one-liter volumetric flask. Add distilled water to give one liter.

3. Sulfuric (or hydrochloric acid) (H_2SO_4 or HCl), 0.01N standard.

4. Boric acid-indicator solution: Place 80 g of pure boric acid (H_3BO_3) in a 5-liter flask marked to indicate a volume of 4 liters, add about 3,800 ml of water, and heat and swirl the flask until the H_3BO_3 is dissolved. Cool the solution

and add 100 mls of methyl purple indicator (Fisher's) or add 2 drops of indicator just prior to titration.

Procedure: (A) Weigh 10 g of moist soil into a 125-ml Erlenmeyer flask, add 50 ml of 2N KCl. Shake for 2 hours on a rotary shaker at 200 rpm. Filter through Whatman #42 filter paper. Pipette 10 mls of filtrate into Kjeldahl flask, attach to steam distillation apparatus, add 10 mls of 0.1N NaOH and steam distil the NH_3 into 5 ml of boric acid-indicator solution. Titrate to end-point with standard sulfuric acid.

(B) For waste water a 10-ml sample is used instead of the extraction step.

Water Soluble Nitrate

Reagents: 1. Saturated calcium sulfate ($CaSO_4$). Add slightly more than 2 g $CaSO_4$ per liter, shake thoroughly and allow to equilibrate overnight before using.

2. Standard nitrate. Weight 7.216 g of KNO_3 (previously dried for 24 hours at 105° C) into a one-liter volumetric flask and add distilled water to give one liter. Working standards of 1 to 50 ppm N are prepared by appropriate dilution of this standard with the calcium sulfate solution.

Procedure: (A) Weigh 20 g of freshly sampled soil into a 125-ml Erlenmeyer flask, add 50 mls of saturated calcium sulfate solution. Shake for ½ hour on a rotary shaker at 200 rpm. Decant liquid into a 50-ml beaker and measure nitrate content with a specific ion electrode. (Orion electrode for nitrate in conjunction with an Orion 801 meter is presently used in this laboratory).

Standardize the electrode and meter each time with known standards covering the range of nitrate that is in the samples being measured. Also recheck standards after each few analyses.

Moisture determinations are carried out simultaneously on the soils and the nitrate nitrogen values are reported on a dry wt. basis.

(b) For waste in water the extraction step is omitted.

Nitrate Analysis for Low Concentrations (10)

Reagents: 1. Bacteriods. Soybean nodules are collected, washed clean with distilled H_2O and blotted dry. Grind with cold mortar and pestle with K-succinate buffer (5 ml per g of nodules). Squeeze slurry through 4 layers of cheesecloth. Liquid centrifuge at 5,000 X g for 5 minutes (Sorvall RC-B rotor 0.25 r at 6.500 rpm). Discard the supernatant liquid. Resuspend pellet in the same number of ml of buffer and centrifuge again and discard supernatant liquid. Resuspend pellet in the same number of ml of buffer and freeze.

2. Potassium succinate buffer. Add 800 ml of distilled H_2O to 11.809 g (0.1 M) of succinic acid. Adjust pH value to 6.8 by conc. KOH solution. Make up to 1 liter.

Procedure: Add the following solutions in order: (a) 0.5 ml - 0.1 M K succinate buffer at pH 6.8, (b) 0.5 ml - extract (diluted if OD exceeds 0.4), (c) $\frac{0.1 \text{ ml}}{1.1 \text{ ml}}$ - bacterial suspension. Always

apply bacterial suspension last. Incubate at 45° C for 30 minutes. Stop reaction by 2 ml of 1% sulfanilamide 3 N HCl solution and develop color with 2 ml of 0.02% NED solution. Allow color to develop for 30 minutes, centrifuge for 30 minutes and read against reagent blank at 540 mμ. Run standard solution with samples each time.

Nitrite in Soils and Water

Reagents: 1. 1% sulfanilamide in 3N HCl.

2. 0.02% NED solution.

Procedure: Pipette 0.5 ml of sample (either soil extract or waste water) into a 10-ml test tube. Add 2 ml of 1% sulfanilamide in 3N HCl and 2 ml of 0.02% NED solution. Allow the color to develop for 30 minutes and read against reagent blank at 540 mμ.

Extractable P

Reagents: 1. Extracting solution. Add 15 ml of 1.0 N NH_4F and 25 ml of 0.5 N HCl and 460 ml of distilled water to prepare each 500 mls of extracting solution.

2. Ammonium molybdate-HCl-H_3BO_3 solution. Dissolve 100 g $(NH_4)_6MoO_{24}\cdot 4H_2O$ in 850 mls distilled water, filter and cool. Add 1700 mls concentrated HCl to 160 mls water, cool. Mix the two solutions slowly and add 100 g of boric acid.

3. Reducing agent mixture. Mix 10 g 1-amino-2-naphthol-4-sulfonic acid with 20 g sodium sulfite and 584 g sodium bisulfite, meta. Grind mixture to a fine powder with mortar and pestle.

4. Reducing solution. Dissolve 15.4 g of reagent no. 3 in 100 mls warm distilled water. Cool and filter.

5. Standard phosphate solution: Dilute 0.4393 g of oven-dry KH_2PO_4 to 1 liter in a volumetric flask with distilled water. Working standards are prepared by dilution of this 100 ppm P stock solution.

Procedure: Weigh 5 g of soil into a 125-ml Erlenmeyer and add 20 mls of extracting solution (reagent no. 1). Shake on a rotary shaker at 200 ppm for one minute, and filter the contents through Whatman No. 2 or 42 filter paper. (1 g of acid-washed activated charcoal is added if the filtrates are not clear).

Pipette a 5-ml aliquot of the filtrate into a 50-ml flask. Adjust pH to 3.0 using 2, 4 dinitrophenol as an indicator. Add 2 mls of ammonium molybdate solution and about 40 mls distilled water. Shake and add 2 mls of reducing solution and make to volume with distilled water. Mix and after 10 minutes but before 15 minutes measure the color photometrically using 660 mμ incident light.

Total Soil P

Reagents: 1. Sodium Carbonate

2. See Water soluble P.

Procedure: Mix 0.5 g of finely ground soil with 5 g of $NaCO_3$ in a platinum crucible. Heat gently with a mecker burner until melted and then heat until the crucible turns cherry red. Grasp the crucible with nicholchrome tongs and rotate to produce a thin even distribution of the melt on the side of

the crucible. Cool quickly by placing on a porcelain plate. Dissolve the melt in hydorchloric acid and determine the phosphorus content as outlined under methods of P in water.

Phosphorus in Waters (7)

Reagents: 2N H_2SO_4: Place approximately 500 mls of distilled water in a one-liter volumetric flask. Add slowly 57 mls concentrated H_2SO_4 and bring to volume with distilled water.

4N Na_2CO_3: 53 gms Na_2CO_3 are dissolved in a liter of distilled water (Note: NaCH of NH_4OH may also be used instead of Na_2CO_3).

2,4 - dinitrophenol indocator: Dissolve 0.25 g in 100 mls distilled water.

Sulfomolybdic Acid Solution: 25.0 g of c.p. ammonium molybdate, $(NH_4)_6MO_7O_{24}\cdot 4H_2O$ is dissolved in 200 ml of distilled water and warmed to 60° C. Filter if the solution contains sediment. Add to 475 ml distilled water in a 1-liter volumetric flask 275 ml of concentrated H_2SO_4. Cool both solutions -- then add the ammonium molybdate solution slowly to the H_2SO_4 solution. Finally, dilute to volume.

Chlorostannous Acid Reductant: Dissolve 25 gm $SnCl_2\cdot 2H_2O$ in 50 ml concentrated HCl (warm if necessary). Dilute to approximately 500 mls (with rapid stirring) with recently boiled distilled water.

1. Place 25 mls of Standard Solution of 25 mls of centrifuged water sample in a 50-ml volumetric flask.
2. Add 2-4 drops of 2, 4-dinitrophenol indicator and adjust

with 2N H_2SO_4 or 4N Na_2CO_3 until 1 drop of 4N Na_2CO_3 produces a yellow color.

3. Add 2 ml sulfomolybdic acid solution and dilute nearly to volume with distilled water. Mix thoroughly.
4. Add 0.2 ml of chlorostannous acid reductant and bring to volume with distilled water. Mix thoroughly.
5. After 5 minutes but not later than 10 minutes read the color photometrically with a 660 mμ filter.

Note: If the water solution is colored, prepare a blank for each sample by following steps 1, 2, and 3. Omit step 4. Use this to set the 0 level at 100% T.

Water Soluble Chloride

Reagents: 1. Saturated calcium sulfate ($CaSO_4$). Add slightly more than two g $CaSO_4$ per liter, shake thoroughly and allow to equilibrate overnight before using.

2. Standard Chloride. Weigh 2.101 g of KCl (Previously dried for 24 hours at 105° C) into a 1-liter volumetric flask and add distilled water to give 1-liter. Working standards of 1 to 100 ppm Cl are prepared by appropriate dilution of this standard with calcium sulfate solution.

Procedure: Weigh 20 g of air dried soil into a 125-ml Erlenmeyer flask and add 50 mls of saturated calcium sulfate solution. Shake for ½ hour on a rotary shaker at 200 rpm. Decant liquid into a 50-ml beaker and measure chloride content with a specific ion electrode. (Orion electrode for chloride in conjunction with Orion 801 meter is presently used in this laboratory).

Standardize the electrode and meter each time with known standards covering the range of chloride that is in the samples being measured. Also recheck standards after each few analyses.

Chloride Content of Water Samples (1)

Reagents: 1. Chloride-free water: If necessary glass distill.

2. Potassium chromate indicator: Dissolve 50 g K_2CrO_4 in a little distilled water. Add silver nitrate solution until a definite red precipitate is formed. Allow to stand 12 hr, filter and dilute filtrate to 1 liter with distilled water.

3. Standard silver nitrate solution; 0.0141 N: Dissolve 2.396 $AgNO_3$ in distilled water and dilute to 1 liter. Standardize against 0.014 N NaCl as described in procedure.

4. Standard sodium chloride solution, 0.0141 N: Dissolve 0.821 g of dried, reagent grade NaCl in redistilled water and dilute to 1 liter. This solution contains 0.5 mg Cl per ml.

Equipment: 8 each 250-ml Erlenmeyer flask

1 magnetic stirrer

1 25-ml burrett

Procedure: 1. Place 100 ml (or a suitable aliquot if Cl is high) in a 250-ml flask or 50 mls water extractable Cl from soil samples.

2. Adjust pH to 7.0 - 10.0. Add 1.0 ml K_2CrO_4 indicator solution. Titrate with standard silver nitrate solution to a pinkish-yellow endpoint. This means of consistent endpoint detection are left to the individual analyst.

3. Standardize the silver nitrate solution and establish the reagent blank by the above methods.

Calculations:

$$\text{mg/l Cl} = \frac{(\text{ml } AgNO_3 \text{ sample} - \text{ml } AgNO_3 \text{ blank}) \times \text{normality } AgNO_3 \times 35{,}460}{\text{ml sample}}$$

Amonium Acetate Extractable Cations

Reagents: 1. Ammonium acetate extracting solution: Dilute 114 ml of flacial acetic acid (99.5%) with water to a volume of approximately 1 liter. Then add 138 ml of concentrated ammonium hydroxide (NH_4OH), and add water to obtain a volume of about 1,980 ml. Check the pH of the resulting solution, add more NH_4OH as needed to obtain a reaction of pH 7, and dilute the solution to a volume of 2 liters with water.

2. Standard Solutions:

Calcium: Dry $CaCO_3$ at 105° C. Then weigh 2.497 g into a 1-liter volumetric flask, add 200 mls distilled water and 75 mls of 2 N HCl. Agitate until dissolved then dilute to volume with distilled water. Final solution = 1000 ppm Ca.

Magnesium: Clean magnesium ribbon with 0.1 N HCl and wash with distilled water. Dry at 105° C. Weigh 1,000 g into a 1-liter volumetric flask, add 90 mls 2N HCl and agitate until dissolved. Dilute to volume with distilled water. Final solution = 1000 ppm Mg.

Potassium: Dry KCl at 105° C. Then weigh 1.9066 into a 1-liter volumetric flask. Add 50 mls 2 NHCl and dilute to volume. Final solution = 1000 ppm K.

Sodium: Dry NaCl at 105° C. Then weigh 2.542 g into a 1-liter volumetric flask, add 50 mls of 2 N HCl and dilute to volume with distilled water. Final solution = 1000 ppm Na.

Procedure: (A) Weigh 5 g of soil into a 125-ml Erlenmeyer flask and add 50 ml of ammonium acetate extracting solution. Shake for one hour on a rotary shaker at 200 rpm, filter through Whatman No. 2 or equivalent paper, and determine Ca and Mg by comparison with standards on an atomic adsorption spectrophotometer and Na and K by comparison with standards on a flamephotometer. (B) In water samples the sample was read directly as above.

PHYSICAL PROCEDURES

The physical analyses were done with standard methods or modifications.

Mechanical composition - Hydrometer Method - Bouyoucos Procedure (2)

Weigh 100 g samples of coarse textured soils into clean dispersion cups. Add 100 ml of calgon solution (50 g calgon/liter) and disperse 6 min for coarse soils. Transfer the suspensions to the special cylinders and fill with distilled water to the proper mark with the hydrometer inserted. Set the cylinders on the laboratory bench and when they come to constant temperature, record the temperature and mix. Take hydrometer readings at 40 sec, 4 min and 2 hours.

Pass the suspension through a 300-mesh sieve to recover the sands. Dry sand and sieve with standard sieve on a standard shaker for 15 min. Weigh each sand fraction.

Bulk density

Undisturbed soil core samples 7.62 cm in diameter and 7.62 cm high were taken with a Uland core sampler in ten replicates. After the soil was trimmed to volume, the sample was oven dried, weighed and the bulk density calculated.

Soil Water Characteristic

The soil was placed in a 4-cm diameter tube 1 m long consisting of 2-cm long segments. The soil was saturated with water and allowed to drain several times. When it had reached a maximum consolidation by this procedure, it was saturated again by raising the watertable very slowly. The column was allowed to drain into a free-water surface maintained at the bottom. When drainage ceased, the column was sectioned and moisture contents determined by oven drying.

Weather measurement

Weather measurements were made by standard rain gauges on each site and at an official weather station less than 1.5 km away. Soil temperatures were made with thermistor thermometers installed in each pair of BLWRS.

Aeration measurements

Oxygen diffusion rates were made with 10 to 40 replications using platinum microelectrodes 4 mm long and 0.64 mm in diameter using the Erickson Oxygen Diffusion Meter. (9) Redox measurements were made *in situ* with similar platinum electrodes that were platinized and installed permanently. Measurements were made with a Orion portable pH meter with millivolt scale.

Soil gas samples were extracted with long, 18-guage, hypodermic needles and analyzed with a Carle gas chromatograph equiped with a molecular sieve column and micro-thermistor detector.

BIOLOGICAL PROCEDURES

Total Coliforms

The coliform tests were run according to the procedures given in "Standard Methods for the Examination of Water and Wastewater (1) using the multiple-

tube dilution technique with lauryl tryptose broth. Suitable dilutions of the samples were prepared and three portions in each of a decimal series of dilutions were inoculated into the broth. Tubes were incubated at 35° ± 0.5° C for 48 ± 3 hours. Most probable number indices were calculated and reported for these presumptive test results.

Fecal Coliforms

Transfers were made from all the tubes in the total coliform test that were positive in 24 hours into E C Medium by using a sterile loop of at least 3-mm diameter. The tubes were incubated in a water bath controlled to 44.5° ± 0.2° C for 24 ± 2 hours. Fecal coliform densities were determined by the Most Probable Number Method (1).

Streptococcal Group

Inasmuch as we were dealing with a known source of contamination and the question of human fecal was not significant, only the Presumptive step in the Standard Methods procedure for Fecal Streptococci was used. Three portions from each of a series of suitable decimal dilutions were inoculated into azide dextrose broth and incubated for 48 ± 3 hours at 35° ± 0.5° C and observed for turbidity. Indices were reported as the Most Probable Number.

Denitrifiers

The Denitrifiers were measures using the procedures of Flocht, D. D. and H. Joseph. (6)

SECTION VI

EXPERIMENTAL

SOIL CHARACTERISTICS

The mechanical composition of the BLWRS soils is given in Table 1 (page 12). The soils would be classified: Swine surface, loamy sand; Swine subsurface, fine sand; Dairy surface, very fine sandy loam; and Dairy subsurface, loamy very fine sand. The soil moisture characteristic is given in Figure 3. The bulk density was 1.64 with 62% solid and 38% porespace. These are quite permeable soils and were ideal for the experiment. The surface of the Dairy BLWRS might be an exception in that this very fine sandy loam would not allow the percolation of 25.4 mm of wastewater per day without slowing down appreciably. This soil operated better in the 17 mm per day range.

The chemical characteristics of the original BLWRS soils are given in Table 2. The phosphate isotherms from which the absorbtion capacity is calculated are shown in Figure 8. It should be noted that the subsoils are calcareous and that the surface soils do have some organic matter accumulation.

OPERATION

The Swine BLWRS was put into operation July 1, 1971, using the South BLWRS. The Dairy BLWRS became operational late August, 1971. Figure 9 summarizes the operation until December, 1972. Each line represents one of the four BLWRS. The solid bars above the line represent the amount of waste applied each day. The open bars represent the amount of precipitation each day. The solid bars directed below the line represent the amount of effluent draining from each BLWRS each day. The applied and drained figures are in millimeters of depth. Because the area of application of waste was only on the top and amounted to one-half the total area of the BLWRS, the waste application represents only

Table 2. CHEMICAL CHARACTERISTICS OF THE ORIGINAL BLWRS SOILS

	Swine		Dairy	
	Surface	Subsurface	Surface	Subsurface
pH	7.09	8.10	6.35	7.90
Total Carbon - ppm	9,800	10,000	12,800	26,800
Carbon as CO_3 - ppm	475	10,100	340	12,100
N as Org. N - ppm	625	49.8	1,099	71.3
N as NH_4 - ppm	2.35	1.57	3.14	3.14
N as NO_3 - ppm	77.5	1.09	100.3	2.95
P as PO_4 - ppm	23.10	20.16	44.23	10.34
Cl - ppm	Trace	0	Trace	0
K - ppm	85.5	14.8	181.7	13.6
Ca - ppm	1,158	2,919	1,379	2,985
Mg - ppm	119.5	51.1	163.4	71.5
Na - ppm	18.5	38.2	22.9	38.0
Maximum PO_4 absorbtion Capacity-mg P.100 g soil	6.68	5.00	4.17	4.59

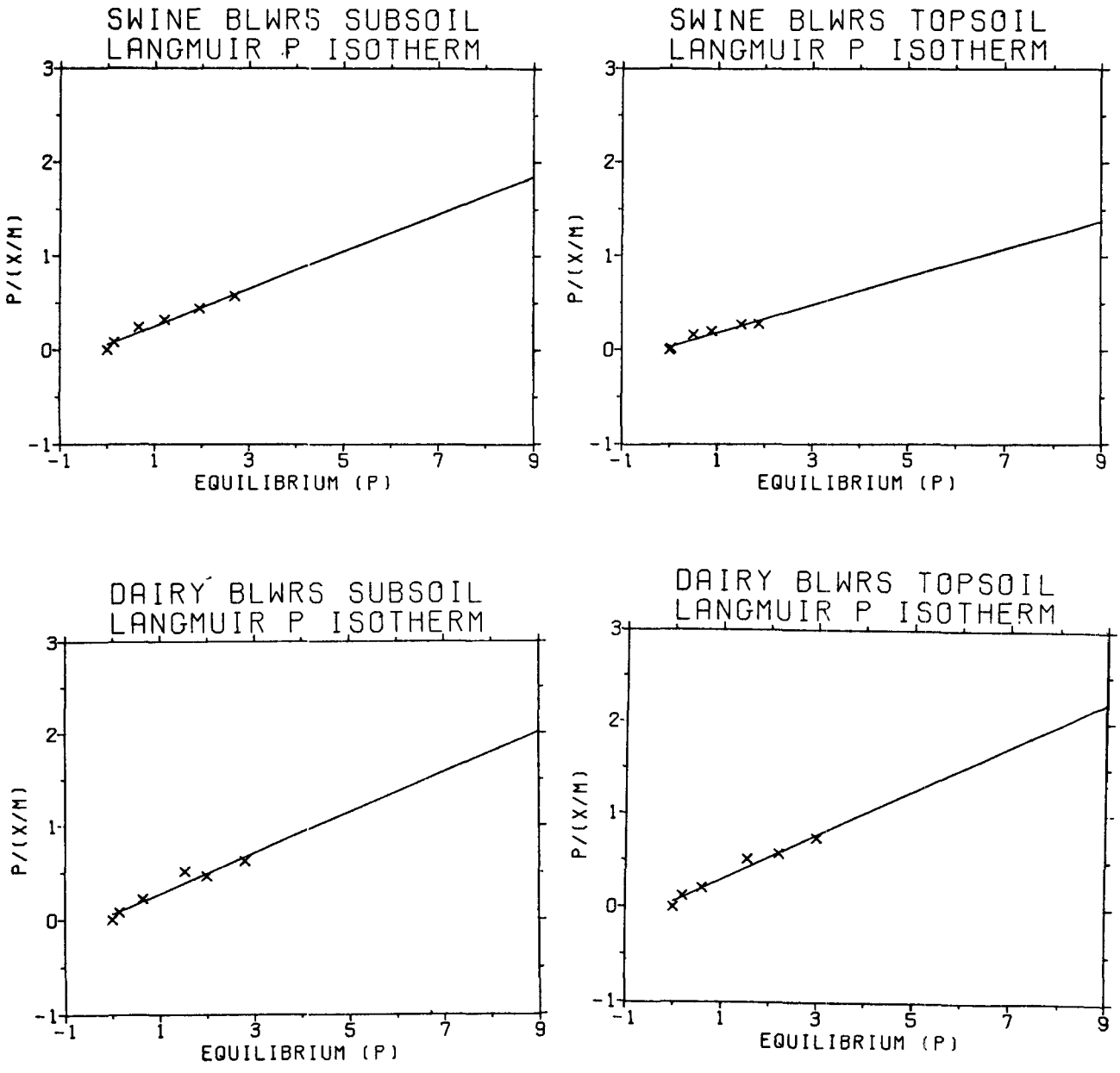


Figure 8. Phosphate absorbtion isotherms for BLWRS soils.

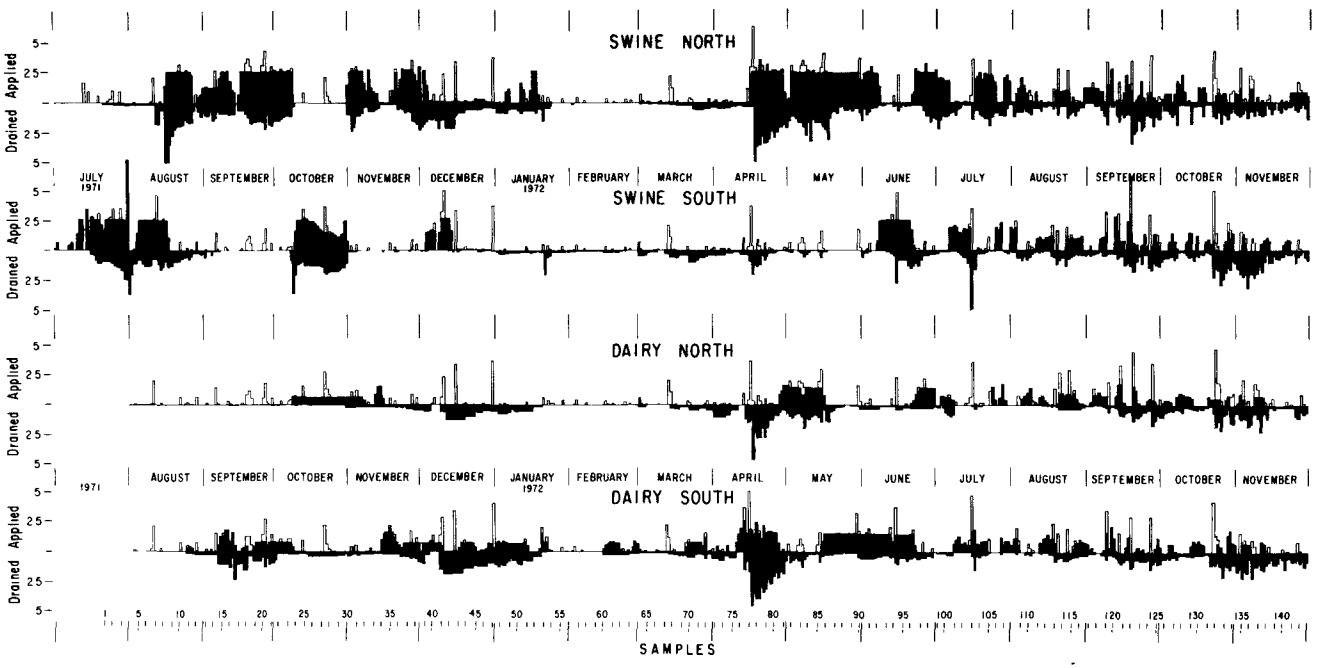


Figure 9. Chart showing the operation of the BLWRS.

half the volume of either precipitation or drainage. The lowest line indicates when each sample was taken and the number of each sample. The BLWRS effluents and wastes were sampled twice a week. The sample number and the sample location were used throughout the laboratory and are used in reporting the results of the analyses.

The goal was to apply as much waste as possible to each BLWRS but to avoid ponding on the surface which would cause anerobic surface conditions.

The wastes were usually applied on a particular BLWRS until there was reductions in infiltration rates and ponding. Then the practice was to change to the other BLWRS until the first one had dried sufficient to return to it. There were exceptions to this procedure; for instance, the Swine South flooded (overloaded) the night of July 30, 1971, because of a malfunctioning switch. Also, beginning in April, 1972, the Swine North was purposely loaded as hard and as long as possible to determine what would happen and how it would recover.

Table 3 summarizes the waste loading rates for each of the BLWRS.

Table 3. SUMMARY OF DAYS OF OPERATION AND WASTE LOADING ON THE SWINE AND DAIRY BLWRS FROM THE START OF THE EXPERIMENT THROUGH DECEMBER 1972.

	Swine			Dairy		
	North	South	Total	North	South	Total
Waste applied - mm	4144	2640	6784	977	2117	3094
Days operated	288	148	376	120	232	352
Application rate mm/day	18.2	17.8	18.0	8.1	9.1	8.8

Operationwise in each pair of BLWRS one of the pair received about two-thirds of the waste. If three BLWRS had been available, two could have been in operation all of the time with one resting, or if a large BLWRS could have had a solid set system with three sections, two could have operated while one rested.

There were 503 days and 450 days between the time of startup and project completion for the Swine and Dairy BLWRS, respectively. The large gap of non operation was the three-month winter period in which it was not possible to operate the BLWRS. Two attempts were made to cover the Swine BLWRS with an inexpensive plastic bubble but both failed due to adverse conditions of temperature and wind. Even though a space heater was tried, it was obvious that a large amount of heat would be necessary to keep the BLWRS operational all winter.

On the Dairy BLWRS, electric heat tapes and heating cables were used to allow some winter operation on days when the temperatures were slightly below freezing. This was partially successful but energy expensive. Also the heat was not sufficient to keep the BLWRS soil warm enough to allow for biological degradation of the waste and especially the denitrification reactions as will be shown later.

During the summer season, the effluent lagged behind the amount of waste applied causing some concern until evaporation was included in the calculation as illustrated in Table 4. At all times, the quantity of waste plus rainfall was less than the quantity of effluent plus evaporation which gives a value for potential output. Considering that the vegetation on the top of the

Table 4. WATER BUDGET FOR SWINE BLWRS, SUMMER 1972.

Month	June		July	
	North	South	North	South
	mm			
BLWRS				
Waste applied[a]	201	178	178	124
Rainfall	50	50	56	56
Total Input	251	228	234	180
Effluent	151	188	286	150
Evaporation	138	138	173	173
Potential Output	289	326	459	323

[a] Divided by two because only the top or half of the BLWRS area had waste applied to it.

BLWRS and the grass on the slopes could wilt and go dormant when under stress, it would then be possible to have less transpiration than the evaporation from the water surface of the standard pan.

NURTIENTS IN WASTE AND EFFLUENT

The nutrient concentrations and quantities in the waste and effluents are given in Tables 5, 6, 7 and 8 and summarized in Tables 9 and 10 in the text. At no time was nitrite detected in the waste so it is not reported. The percent solids and total carbon in selected samples are given in Tables 11 and 12.

The amount of dry wastes applied to the Swine North and Dairy South BLWRS amounts to 122 and 93 t/ha, respectively, with relatively little accumulation.

The amounts of carbon applied had an average 294 ppm and 516 ppm on the Swine and Dairy with an average in the effluent of 19 and 36 ppm or a renovation of 93.5% and 93%.

The nitrogen concentration data in Table 9 shows that the organic and ammonium nitrogen in the waste is oxidized and leaches from the BLWRS primarily as nitrate nitrogen. The concentration of nitrate in the effluent is lowest in the side of the BLWRS with the corn as an energy source (Swine NW, Dairy NE). It appears that not enough molasses was added to give sufficient energy for the denitrifiers in any of the treatments. The Swine SW which had the highest average nitrate concentration did not have an energy source. It must be remembered that the Swine BLWRS were driven very hard and the nitrate levels did not start to rise until the cool fall weather. In fact, the Dairy BLWRS usually had nitrate concentrations less than 10 ppm except during the

Table 5. NUTRIENT, BOD AND COD CONCENTRATIONS IN WASTES APPLIED TO BLWRS. NUTRIENTS EXPRESSED IN PPM.

Swine Waste

ORIGINAL DATA FOR SWINE BARN WASTES

SAMPLE	PH	ORGN	NO3	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
2	7,30	463,0	10,20	353,9	55,50	175,8	98,0	95,7	25,1			
4	7,80	359,3	7,99	336,2	21,80	116,6	88,0	85,4	33,8			
5	7,74	480,8	13,90	334,8	21,80	148,1	85,0	80,1	39,2			
6	7,50	351,9	14,60	333,4	45,60	111,1	76,2	91,4	44,7			
7	7,55	853,8	20,20	330,6	44,10	138,8	78,8	91,4	44,7			
8	7,45	401,3	11,60	344,5	67,70	157,3	88,8	179,1	58,4			4876,0
9	7,50	849,3	13,00	369,6	44,80	166,6	84,2	102,8	55,2			2968,0
10	7,54	242,3	23,80	339,0	38,60	157,3	76,2	110,2	60,2			2438,0
11	7,70	286,7	14,60	365,3	63,00	74,0	62,2	102,8	54,6		1335,0	2754,0
12	7,60	208,0	37,60	356,6	48,40	166,6	50,0	66,2	41,8		1264,5	2244,0
13	7,55	440,4	5,06	378,0	70,80	210,6	112,5	107,3	42,8		1636,2	2912,8
14	7,80	482,6	4,57	428,6	21,80	257,4	118,8	101,4	43,9			
15	8,00	451,4	5,82	400,8	21,20	269,1	105,0	115,9	43,8			
16	7,90	414,3	6,19	347,6	32,10	257,4	101,1	120,1	44,2			
17	8,00	472,5	8,26	409,7	36,80	187,2	92,5	101,8	43,6			1800,0
18	8,15	511,3	8,45	432,0	19,30	210,6	96,2	92,8	32,2		1368,3	1930,0
19	8,05	413,4	5,08	391,1	18,80	257,4	82,5	109,5	39,5		1321,3	1940,0
21	7,70	372,9	3,87	353,5	19,90	245,7	78,8	117,6	49,3			943,7
22	7,87	389,8	3,94	356,9	19,90	234,0	78,8	137,3	64,6		1220,0	1276,8
23	7,89	394,9	6,19	341,7	14,90	243,4	88,6	162,4	72,0			1384,2
24	7,99	426,1	5,75	349,3	14,10	262,1	96,0	84,0	53,9		1230,0	1276,8
25	7,95	502,1	5,47	428,6	14,40	262,1	98,5	123,6	47,8		1116,4	2128,0
26	7,93	502,1	9,96	432,0	12,80	234,0	130,0	110,8	40,0		1056,7	1915,0
27	8,17	518,9	8,97	427,8	11,50	234,0	145,0	105,0	35,2		924,9	2156,8
28	8,17	556,9	16,10	548,5	14,10	234,0	127,5	102,1	33,5		1043,7	2158,8
29	7,73	621,9	12,50	559,4	17,32	222,6	145,0	104,3	22,7		1280,4	2940,0
30	7,86	593,2	8,40	511,3	10,81	210,6	145,0	116,7	36,3		1160,2	3497,0
31	7,88	613,4	7,72	493,6	9,67	234,0	150,0	70,7	31,7		1115,9	3050,8
34	7,77	500,4	10,40	423,6	17,70	193,6	152,5	119,6	44,8		1916,8	3471,6
36	7,58	599,1	7,10	479,3	15,40	187,2	145,0	100,7	32,7		1018,0	1609,9
37	7,93	740,8	9,58	610,0	13,20	234,0	145,0	80,3	22,3		1497,0	3042,8
38	8,36	797,6	12,20	604,1	10,24	210,6	157,5	82,4	30,2		1489,9	2437,2
39	7,60	769,8	12,60	575,2	3,58	205,4	150,0	64,2	28,6		1445,0	2129,9
42	8,06	718,5	9,64	635,1	6,39	166,3	120,0	77,6	30,8		1222,0	2038,4
51	7,60	809,9	7,52	329,3	10,24	166,3	118,2	75,6	32,5		1211,9	2336,8
77	7,90	550,7	9,93	165,7	6,40	171,3	105,2	38,6	18,5		877,5	2182,0
78	7,90	596,6	6,41	116,5	3,63	146,8	101,5	43,3	21,4		787,5	1680,4
79	8,10	648,0	6,30	408,4	6,12	146,8	99,7	33,9	19,8		793,4	2352,0
80	8,74	120,3	6,27	473,7	14,13	171,3	102,2	38,0	25,2		1002,9	2244,8
81	8,74	514,8	6,30	441,6	4,17	146,8	101,2	34,5	20,9		885,0	1440,0
82	8,75	747,9	3,14	216,0	3,63	171,3	106,2	33,5	19,6		915,0	1618,4
83	8,49	623,9	4,24	293,0	4,17	195,7	118,8	45,3	31,0		872,0	1880,0
84	8,54	627,1	4,21	413,8	3,36	205,5	106,2	41,4	27,2		887,0	1200,0
85	8,29	494,5	3,62	210,1	6,69	171,3	98,5	64,5	35,9		730,4	2128,4
86	7,82	607,8	4,82	275,3	5,83	220,2	97,2	64,7	29,2		1014,9	2091,6
87	8,22	526,6	8,26	608,4	12,48	224,7	94,5	96,5	29,9		829,0	1749,6
88	8,14	486,0	3,99	598,8	7,67	195,7	92,2	54,3	30,6		888,9	1920,0
89	8,03	635,1	4,57	577,9	14,69	155,0	86,2	52,0	32,3		1255,5	1974,0
90	7,72	506,8	6,45	553,3	14,40	178,9	98,8	84,4	21,7		1225,4	1880,0
91	7,81	522,8	6,86	537,3	14,11	202,7	96,2	92,0	20,6		1091,2	2402,4
92	7,93	511,1	6,30	560,3	15,88	190,8	96,2	101,4	20,8		1270,8	2182,4
93	8,09	475,8	5,34	504,1	6,69	190,8	82,5	90,4	19,0		1165,7	1960,0
94	8,01	405,2	13,20	483,8	18,38	188,8	86,2	82,6	43,0		941,2	1968,0
95	8,01	490,8	11,20	481,2	19,69	188,8	80,0	80,3	38,6		1374,3	1944,0
96	7,97	469,4	22,40	455,5	16,49	177,0	82,5	72,6	35,5		1344,3	1645,6
97	7,62	506,8	8,45	494,0	20,02	200,6	80,0	87,1	47,6		1463,6	2868,0
98	7,75	528,2	17,70	505,7	18,70	236,0	112,5	119,1	55,0		1598,4	3617,6
99	8,01	542,1	8,62	548,5	10,25	247,8	113,7	107,8	49,6		1479,0	3369,6
100	7,57	623,3	2,65	568,8	8,17	306,8	136,2	119,5	49,6		1615,6	3914,4
101	7,47	650,1	3,49	572,0	15,28	247,8	153,8	144,6	55,6		1277,8	2610,4
102	7,38	504,7	12,60	443,2	20,02	259,6	102,5	150,2	62,4		1247,9	2558,4
103	7,23	519,6	2,05	422,9	37,11	294,4	95,0	198,4	109,8		1436,3	3273,6
104	7,40	464,0	2,03	368,3	34,20	153,3	90,0	209,7	83,3	210,0	1181,9	2624,4
105	7,37	410,6	6,41	360,9	10,59	117,9	97,5	134,5	70,9	205,0		2784,0
106	7,56	554,9	1,41	489,2	23,52	129,7	116,2	152,6	73,8	285,0		2475,2
107	7,41	554,9	4,30	474,0	31,48	176,9	123,2	198,0	83,4	290,0	1419,0	2668,0
108	7,52	553,8	5,40	479,0	25,72	176,9	131,8	187,2	88,3	305,0		
109	7,60	489,9	3,90	506,0	25,75	239,3	135,0	185,3	79,2	312,5		3642,0

Table 5.(continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN WASTES APPLIED TO BLWRS. NUTRIENTS EXPRESSED IN PPM.

Swine Waste

													3162,0
111	7,68	511,4	15,50	534,0	20,72	287,2	147,5	195,9	80,3	305,0			
112	7,65	571,8	10,60	534,0	17,48	263,2	140,0	190,6	70,3	300,0			3904,0
113	9,03	582,5	9,70	406,3	13,32	210,6	155,0	176,1	62,0	320,0			
114	7,34	446,3	5,50	387,5	10,59	257,4	153,7	172,2	62,3	325,0			
115	7,29	489,1	2,90	305,1	13,32	258,7	150,0	197,3	66,0	320,0			
116	7,13	548,7	4,00	480,4	10,59	284,7	142,5	180,1	59,8	310,0			
117	7,48	550,6	4,20	575,7	9,08	258,9	142,5	161,8	57,5	300,0			
118	7,87	513,9	4,70	565,5	8,95	284,7	135,0	159,2	59,5	280,0			
119	7,73	420,5	5,30	183,1	14,24	258,9	131,8	160,5	60,4	285,0	1134,0		
120	7,65	298,5	2,70	222,9	19,62	257,4	131,8	178,7	78,7	290,0	805,0		2976,0
121	9,09	446,3	2,40	406,0	21,69	233,0	127,5	168,8	58,6	305,0	1223,0		2952,0
122	7,45	474,9	4,00	445,0	24,62	257,4	150,0	150,9	57,1	315,0			2263,0
123	7,45	489,1	3,40	387,0	20,99	233,0	155,0	171,3	68,3	305,0			
124	9,09	548,7	3,70	387,0	8,68	258,9	142,5	126,6	51,4	305,0			1846,0
125	7,45	448,7	3,40	357,0	16,68	258,9	147,5	186,3	54,3	300,0	668,0		2173,0
126	7,74	550,6	4,60	461,0	16,37	258,9	148,2	177,1	47,3	313,0	653,0		2600,0
127	7,77	513,8	5,10	453,0	14,54	258,9	153,7	134,9	42,3	322,0	775,0		2916,0
128	7,94	420,4	4,10	305,0	7,84	232,4	130,0	112,6	54,0	250,0	550,0		2235,0
129	7,94	421,2	4,00	358,0	3,04	232,4	119,5	78,6	46,3	240,0	287,0		1888,0
130	7,41	495,7	7,40	423,0	15,20	322,9	116,2	104,3	47,7	243,1	482,0		2360,0
131	7,84	760,9	1,70	487,0	10,90	252,7	127,3	137,1	37,8	240,0	471,0		1862,0
132	7,77	524,0	1,60	473,0	10,28	243,4	125,7	104,3	35,9	256,8	471,0		1679,0
133	7,93	571,8	1,60	507,5	9,47	225,5	129,2	95,3	35,5	284,1	554,0		2156,0
134	7,91	549,1	1,70	484,7	11,54	182,3	119,8	89,0	31,4	249,5	554,0		1944,0
135	7,93	491,0	1,80	154,9	9,47	148,7	98,5	85,5	26,1	239,1	627,0		1142,0
136	7,70	495,7	3,40	434,5	9,87	153,5	96,2	94,4	30,6	239,4	612,0		1422,0
137	7,66	483,2	8,80	423,6	10,07	163,1	100,9	94,4	33,2	238,6			1593,0
141	7,75	397,7	2,70	363,2	7,34	143,9	89,2	89,0	33,6	205,7			
142	7,78	394,5	4,20	342,0	6,79	153,5	91,5	85,5	34,6	200,0			
143	7,83	382,8	3,20	337,3	5,37	153,5	95,5	101,5	35,5	212,5			

AVERAGE VALUES FOR SWINE WASTE								
ORGN	NO3	NH4	PO4	CL	NA	CA	MG	K
514,0	7,4	423,5	18,0	209,7	113,1	111,7	45,1	275,1

Table 5 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN WASTES APPLIED TO BLWRS. NUTRIENTS EXPRESSED IN PPM.

Dairy Waste

ORIGINAL DATA FOR DAIRY BARN WASTE

SAMPLE	PH	ORGN	NO3	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
10	7,35	417,8	53,20	447,5	39,00	360,9	127,5	107,9	38,2			
15	7,80	296,2	4,30	138,4	48,40	222,3	127,5	107,9	38,2			
16	7,70	273,4	5,00	205,9	49,20	210,6	112,5	110,1	44,6			
17	7,80	266,6	7,50	221,9	36,80	210,6	100,0	103,8	48,5			1420,0
19	8,05	253,1	4,40	205,9	31,40	187,2	92,5	89,2	35,4		917,6	1420,0
20	7,55	243,0	4,50	194,1	27,60	210,6	97,8	97,8	39,0		817,0	1550,0
21	7,74	156,9	2,30	179,7	11,70	163,8	96,5	80,1	31,0			
22	7,71	173,8	2,60	135,8	14,40	163,8	105,5	80,1	32,5			1489,6
23	8,05	165,4	3,10	129,9	20,50	126,4	110,0	78,0	30,6			1382,2
24	8,00	164,5	2,50	132,5	13,80	131,1	110,5	69,6	28,9			1170,4
26	7,37	275,1	9,40	289,4	53,20	234,0	152,5	132,3	57,4		1267,7	2553,6
27	7,26	354,4	10,40	335,8	71,50	234,0	175,0	150,7	53,9		1229,2	3085,8
28	7,71	399,3	10,00	292,0	44,60	234,0	170,0	145,8	39,7		1149,7	3136,0
29	7,51	315,6	13,20	305,4	62,80	215,6	175,0	175,3	53,8		1388,5	4508,0
30	7,51	385,6	10,90	296,2	32,73	256,5	156,5	149,9	40,8		1379,2	3576,8
33	7,95	354,4	11,00	256,5	26,61	210,6	125,0	136,1	34,5		1395,2	2840,4
34	7,33	270,5	6,29	199,9	40,92	215,6	120,5	138,4	59,0			2524,8
35	7,31	228,8	8,97	271,6	52,29	234,0	98,2	139,1	62,5		697,2	1976,0
37	7,50	174,7	4,84	113,9	35,63	292.6	75,0	127,6	60,6		587,5	1768,2
38	7,50	182,8	4,74	120,8	28,28	292.5	62,5	127,6	60,6		677,0	1802,3
39	7,60	198,9	4,81	110,1	34,65	317.5	50,0	135,8	57,2		729,0	2086,9
47	7,51	271,6	4,74	192,5	49,51	286.2	110,0	162,1	57,9		1788,5	3025,1
48	7,44	363,5	4,80	203,1	67,45	292.5	118,5	192,2	68,6		1256,0	3702,4
49	7,66	357,1	4,56	234,2	53,75	292.5	92,0	178,2	50,3		1327,9	3982,7
51	7,60	299,9	4,31	78,1	45,01	297.0	95,0	175,5	51,9		1081,7	3657,6
77	7,55	325,0	9,10	230,0	75,71	146,8	132,0	141.6	47,7		1970,5	3769,6
78	7,55	379,6	11,70	82,3	83,02	122,3	134,0	150.5	49,1		2360,0	4761,6
79	7,44	382,8	5,25	147,5	78,15	122,3	148,0	158.9	48,8		2063,0	4704,0
80	8,60	579,0	3,10	448,0	75,71	146,8	151,0	150.5	50,0		1194,0	1248,0
81	6,87	345,4	6,52	159,3	95,37	146,8	152,5	158.9	50,6		2436,6	5568,0
83	7,00	388,7	5,30	141,1	83,02	97,9	129,5	159,7	49,1		2043,8	4324,0
85	7,27	355,5	4,50	116,0	75,71	146,8	131,0	152.5	49,7		1524,8	4166,4
87	7,13	252,9	9,60	194,5	49,78	122,3	105,0	140.1	43,6		1311,7	2721,6
89	7,18	235,2	3,90	211,7	33,81	131,2	57,5	145,8	48,8		1477,2	2726,0
91	7,10	255,5	8,40	246,4	28,54	131,2	50,0	138,8	48,6		1287,4	3690,0
93	7.20	410,8	12,80	328,2	32,89	178,9	70,0	138,8	58,2		1626,3	2842,0
95	7,28	460,8	36,00	392,4	21,04	295,0	96,2	124,3	55,4		1835,9	3499,2
97	7,40	533,5	25,10	523,9	36,72	295,0	118,7	150,0	65,0		2277,2	4397,6
99	7,56	584,9	2,30	528,1	31,98	330,4	128,7	147,9	62,5		2841,9	4680,0
101	7,48	852,2	6,80	730,8	44,43	330,4	157,5	199,4	78,0		3186,2	5622,4
103	7,30	813,7	13,50	692,3	25,75	354,0	173,8	192,8	80,9		2896,4	5952,0
105	7,15	867,1	10,00	724,3	26,52	273,0	173,7	201,9	78,1	843,7	2862,9	6330,0
106	7,10	908,8	7,90	771,4	23,52	330,1	176,8	208,6	73,1	825,0	2773,1	5230,0
107	7,52	930,2	20,20	774,1	33,27	353,7	176,8	206,9	83,4	831,0		5330,0
108	7,47	911,0	27,90	784,8	32,37	318,3	179,7	213,7	89,0	910,0		
109	7,55	838,6	7,80	739,9	38,13	382,9	176,8	204,9	71,8	910,0		
111	7,34	764,0	53,20	630,6	41,35	406,9	171,2	264,0	80,1	825,0		
112	6,97	803,2	38,80	663,6	43,64	406,9	163,7	202,4	70,7	831,0		
113	7,09	748,3	23,40	681,0	43,64	374,5	171,2	205,7	73,2	850,0		
114	6,88	745,5	9,00	695,3	41,35	351,0	160,6	193,3	65,3	775,0		
115	7,08	803,2	6,60	670,3	32,37	388,3	166,2	203,2	62,7	806,0		
116	6,70	649,3	4,80	590,9	40,25	388,3	142,5	193,3	67,9	725,0		
117	6,78	956,2	7,60	562,4	43,02	336,2	135,0	182,7	64,6	700,0		
118	7,43	670,0	7,50	501,2	24,62	310,6	131,8	174,8	66,6	688,0		
119	7,52	409,5	7,60	154,8	18,29	318,4	131,8	178,7	63,5	688,0		
120	7,51	613,4	6,90	301,1	32,97	299,6	128,7	177,4	67,0	725,0		
121	7,50	640,8	7,50	562,4	22,76	313,7	133,7	148,0	50,2	785,0		
122	7,48	710,3	7,30	621,2	32,06	301,4	136,2	100,6	51,6	860,0		
123	7,43	715,5	5,80	698,3	35,83	310,6	136,2	197,4	60,4	883,0		
124	7,85	581,6	6,20	585,9	20,64	388,2	133,7	141,6	47,6	863,0		
125	7,93	731,0	7,20	466,2	19,96	310,6	132,5	161,9	48,6	845,0		
126	7,86	724,0	6,80	692,5	22,40	310,6	132,5	134,7	52,0	870,0		
127	7,63	730,3	6,50	661,5	25,77	310,6	132,5	146,1	53,7	840,0		
128	7,52	740,0	7,00	163,4	22,04	284,7	130,0	189,3	57,3	830,0		
129	7,72	752,2	7,20	651,0	22,94	284,7	127,5	118,9	54,4	830,0		
130	7,66	738,9	3,50	649,0	24,46	351,1	113,5	165,4	57,7	825,0		
131	7,36	735,0	3,70	627,1	20,73	325,7	127,6	160,1	57,0	830,0		
132	7,48	687,1	3,60	621,2	13,86	346,4	124,1	155,4	55,5	825,0		

Table 5 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN WASTES APPLIED TO BLWRS. NUTRIENTS EXPRESSED IN PPM.

Dairy Waste

133	7.19	701.2	4.10	577.3	25.76	283.6	131.8	135.4	56.8	830.0
134	7.31	701.2	3.90	560.1	56.21	295.0	134.7	188.3	58.6	850.0
135	7.39	684.8	3.60	563.2	22.10	261.0	132.3	165.4	48.4	809.0
136	7.44	684.0	3.30	539.7	24.67	283.6	130.0	175.3	55.3	825.0
137	7.81	664.4	5.10	502.0	19.77	272.3	131.1	171.3	45.3	830.0

AVERAGE VALUES FOR DAIRY WASTE

ORGN	NO3	N44	PO4	CL	NA	CA	MG	K
514.2	9.6	403.4	38.5	240.9	128.7	606.3	55.5	817.6

Table 6. NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

NE Swine Effluents

ORIGINAL DATA FOR SWINE BARN EFFLUENT

SAMPLE	PH	ORGNI	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
7	7.22	0.9	14.4	0.0	0.7	0.09	7.4	7.5	52.4	23.6		1.1	38.3
8	7.28	2.5	12.[illegible]	0.0	0.1	0.09	9.2	5.5	55.5	24.9		5.0	21.2
9	7.48	1.5	5.1	0.0	0.3	0.00	5.5	3.2	46.8	19.5			31.8
10	7.28	1.9	2.4	0.0	0.3	0.05	5.5	3.3	54.4	21.8			10.6
11	7.32	1.8	1.7	0.1	0.0	0.019	5.6	4.0	62.1	22.5			15.3
12	7.60	2.0	3.1	0.0	0.2	0.015	26.2	9.3	82.5	39.7		2.4	10.2
13	7.70	1.4	0.7	0.0	0.2	0.034	26.2	10.2	82.4	38.6		3.5	26.5
14	7.70	0.8	0.9	0.0	0.2	0.031	29.0	11.8	95.4	46.2		3.3	33.1
15	8.15	1.9	1.9	0.0	0.2	0.022	37.4	18.4	102.7	53.2		6.0	39.5
16	7.65	1.2	2.[illegible]	0.0	0.1	0.018	41.2	19.3	108.5	55.2		6.6	46.1
17	7.35	1.5	2.6	0.0	0.1	0.020	53.2	17.5	112.4	57.8			30.8
18	7.50	2.4	3.3	0.0	0.5	0.030	74.9	20.0	115.7	62.1		8.7	43.1
19	7.30	1.9	6.4	0.2	0.4	0.020	117.9	21.4	137.5	62.4		8.8	25.8
20	7.56	0.8	54.4	0.3	0.3	0.030	147.0	22.0	256.0	58.0		5.5	25.8
21	7.90	0.2	134.1	0.9	0.1	0.020	170.4	24.0	288.5	83.0			26.6
22	7.56	0.2	214.9	1.9	0.5	0.050	182.6	46.0	388.3	103.0			26.6
23	7.18	0.3	198.6	1.4	1.0	0.020	178.8	76.5	531.8	110.0			26.6
24	7.21	0.4	180.6	1.5	0.7	0.030	175.7	87.0	521.8	110.6		2.5	31.9
25	7.68	0.5	225.9	1.3	0.8	0.020	170.4	104.0	371.7	109.4		.8	42.6
26	7.56	1.7	256.5	0.0	0.7	0.050	172.3	106.0	379.3	116.4		1.6	37.2
27	7.23	0.7	238.1	0.6	0.7	0.030	172.3	105.0	333.8	96.2		2.2	31.9
28	7.12	1.4	214.4	1.9	1.5	0.018	172.3	99.0	323.4	99.6		3.0	77.1
29	7.06	1.4	237.1	1.5	1.7	0.021	170.4	99.0	347.6	101.8		2.5	64.6
30	7.91	0.3	128.[illegible]	0.5	0.9	0.007	149.8	69.2	256.5	83.4		2.2	96.9
31	7.97	0.7	159.4	0.3	0.8	0.020	132.9	76.5	243.9	82.1		1.1	40.1
32	7.70	0.1	161.9	1.2	1.0	0.005	151.6	83.0	256.5	86.7		1.3	47.8
33	7.40	0.2	174.1	1.5	0.7	0.000	151.6	84.0	258.5	85.0		2.2	42.1
34	7.72	3.0	152.6	1.9	0.5	0.005	155.4	96.0	282.8	93.2		5.8	57.9
35	7.80	0.6	139.7	2.2	0.8	0.000	162.9	102.0	300.3	86.9		1.7	52.0
36	7.37	0.5	137.6	2.3	1.2	0.005	155.4	92.5	293.4	94.2		2.7	43.4
37	7.26	0.3	143.6	1.6	1.2	0.008	155.4	104.8	376.9	94.5		3.7	63.7
38	7.16	0.0	150.7	1.5	2.6	0.008	164.7	93.0	309.2	82.5		2.8	74.2
39	7.83	0.0	153.4	1.3	2.5	0.008	185.3	103.0	294.9	86.6		2.5	64.9
40	7.81	0.2	154.4	0.9	2.6	0.009	182.5	97.0	292.9	89.0		4.2	59.6
41	7.43	0.3	134.7	0.8	2.8	0.009	164.4	77.0	311.3	77.2		3.3	45.6
42	7.70	0.0	103.9	1.0	10.9	0.000	169.1	92.0	295.7	77.0		2.5	70.7
43	7.34	0.0	116.[illegible]	1.3	13.0	0.021	176.7	89.6	327.3	79.6		3.3	65.3
44	7.73	0.9	146.7	1.5	14.8	0.041	192.9	92.6	288.3	72.0		2.7	68.2
46	7.43	1.1	113.7	1.4	25.5	0.013	196.7	105.0	314.8	87.0		2.3	70.7
47	7.44	0.6	94.3	1.6	19.9	0.007	125.4	68.7	220.0	59.3		2.3	37.3
48	7.50	0.6	126.5	1.1	19.7	0.00[illegible]	169.2	90.0	325.5	81.1		1.2	49.9
49	7.45	0.4	126.5	1.2	19.9	0.00[illegible]	169.2	90.0	318.0	79.8		2.3	48.8
50	7.55	0.5	101.2	1.1	19.5	0.005	159.6	88.7	244.1	70.3		2.9	51.0
51	7.45	0.7	109.1	1.2	20.3	0.063	173.0	96.9	244.1	70.6		1.5	61.0
52	7.52	1.3	171.7	1.2	22.5	0.036	154.4	95.0	242.3	82.1		3.4	57.9
66	7.50	4.7	119.7	3.0	49.2	0.039	174.2	86.2	269.4	68.4		1.6	50.4
68	7.96	0.0	91.2	2.6	51.8	0.031	149.3	83.8	241.2	52.9		1.6	40.5
69	8.15	0.3	90.4	3.2	13.7	0.010	100.3	50.0	199.1	41.2		1.2	34.9
70	7.47	0.9	87.2	3.7	11.9	0.025	95.9	47.5	169.1	39.8		1.0	34.9
71	7.68	0.6	78.2	3.9	12.6	0.010	86.1	43.0	156.5	38.1		1.2	29.7
72	7.18	0.7	85.4	0.4	12.8	0.018	92.0	44.8	166.4	39.0		1.0	29.4
73	7.16	0.4	66.2[illegible]	0.4	13.7	0.018	88.1	44.2	165.1	38.5		1.0	29.4
74	8.11	0.9	70.3	0.4	9.4	0.024	82.2	40.5	143.6	33.6		.8	29.4
75	7.33	0.0	71.4	0.4	4.5	0.018	84.2	43.3	142.8	31.8		.6	47.6
76	7.37	0.4	72.2	0.4	8.6	0.038	84.2	43.0	147.4	27.3		.7	14.9
77	7.32	0.9	69.2	0.4	7.3	0.018	88.1	46.5	157.9	43.2		0.7	34.7
78	7.53	0.0	67.[illegible]	0.5	7.9	0.028	84.2	44.0	155.7	41.2		1.4	44.6
79	7.28	0.5	79.3	0.7	16.2	0.028	93.9	56.5	180.4	50.4		.9	44.1
80	7.00	0.3	111.4	1.0	19.0	0.044	137.0	75.0	235.2	61.1		1.1	53.7
81	7.41	0.7	96.8	0.8	21.6	0.038	146.8	75.3	249.2	76.3		2.4	33.6
82	7.09	0.5	90.3	1.1	28.0	0.027	164.4	78.2	273.0	74.2		1.4	47.6
83	6.99	1.2	124.6	2.2	34.4	0.033	164.4	79.6	373.9	76.8		3.7	61.1
84	7.15	0.1	147.5	4.6	50.5	0.018	135.1	84.1	383.5	72.7		2.6	70.0
85	7.16	0.3	127.8	9.7	66.6	0.012	129.2	96.0	352.5	71.2		2.4	64.5
86	7.62	1.6	120.1	14.4	88.2	0.09	146.8	93.5	309.8	66.9		5.0	89.6
87	7.35	1.2	162.2	13.5	106.0	0.021	160.5	93.5	322.6	64.2		6.5	111.8
88	7.32	5.2	129.[illegible]	18.9	112.0	0.031	177.9	98.0	241.3	67.6		9.0	124.8

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

NE Swine Effluents

89	7,23	2.8	112.7	15.6	114.0	0.027	174.6	103,7	278.7	65,6		8,1	79,9	
90	7,01	2.8	111.4	12.4	109.0	0.040	170.7	106,2	285.8	69,5		10.2	94,0	
91	7,05	3.8	108.7	14.4	113.0	0.0 7	176.5	110,0	284.1	65,0		5,2	101,6	
92	7,11	2.3	118.2	17.9	124.0	0.0 7	183.1	108,7	285.8	67,0		5,0	69,4	
93	7,07	2.6	108.2	13.8	110.0	0.0 9	181.2	110,5	286.9	70,1		5,1	68,6	
94	7,06	1.7	108.4	14.4	108.0	0.030	182.2	108,7	269.1	72,6		6,8	68,9	
95	7,29	3.2	100.-	15.4	116.0	0.016	186.9	100,0	282.4	70,6		4,3	77,8	
97	7,27	0.6	131.	12.8	80.6	0.0 4	187.9	97,5	275.7	72,4		5,1	76,5	
98	7,51	2.1	68.7	11.5	87.6	0.0 2	187.9	96,2	270.4	69,1		5,9	85,7	
99	5,94	2.8	62.9	10.7	123.0	0.049	186.0	95,0	274.4	69,8		5,7	112,3	
100	7,45	3.0	62.1	9.1	15.2	0.029	192.6	108,0	278.5	63,6		5,5	111,8	
101	7,27	4.1	110.1	15.4	127.0	0.0 0	191.6	125,0	306.9	71,6		3,5	90,4	
102	7,24	4.3	136.6	27.1	136.0	0.015	200.1	135,0	215.4	79,1		3,9	113,2	
103	7,11	4.1	102.5	15.2	136.0	0.021	177.7	107,5	182.6	62,1		5,2	84,3	
104	7,33	4.5	77.-	43.0	143.0	0.021	189.5	107,5	204.0	59,6		3.1	106,9	
105	7,30	2.6	165.8	19.5	145.0	0.019	201.8	116,2	291.4	64,3			134,4	
106	7,41	0.9	136.9	13.0	132.0	0.0 3	212.2	121,2	314.1	65,8			99,9	
107	7,49	1.1	256.4	66.4	138.0	0.0 2	218.8	128,8	322.5	69,5			105 8	
108	7,09	0.2	129.8	83.6	145.0	0.017	208.4	123,8	333.5	71,5				
109	5,94	1.4	141.6	112.0	158.0	0.040	224.0	131,9	403.7	62,0				
110	5,96	3.4	206.7	106.0	160.0	0.031	224.0	168,8	337.3	76,8				
111	7,71	0.5	234.5	109.0	158.0	0.039	218.3	135,0	400.0	62,8				
112	7,03	0.7	124.8	106.0	172.0	0.047	222.1	121,8	406.0	77,4				
113	7,09	0.9	242.	106.0	173.0	0.046	213.4	131,9	407.5	63,9			107,3	
114	5,95	1.0	274.8	97.3	168.0	0.053	217.2	135,0	430.4	59,6				
115	7,22	0.7	353.9	82.3	169.0	0.027	234.5	137,5	442.1	61,8			165,6	
116	7,10	0.0	263.9	78.4	153.0	0.022	258.9	133,0	487.8	89,5				
117	7,27	0.5	318.4	75.9	136.0	0.024	258.9	137,5	493.1	94,8	209,3		133,9	
118	6,97	1.0	366.1	71.1	139.0	0.024	263.0	133,0	505.4	88,6	198,7			
119	7,07	0.5	228.9	55.2	151.0	0.028	265.1	131,9	446.6	82,1	228,1	4,2	86,3	
120	7,07	0.0	315.9	41.2	131.0	0.028	279.6	135,0	473.9	88,9	212,5	3,7	114,0	
121	6,98	0.1	254.1	68.6	108.0	0.024	276.7	137,5	206.3	79,3	221,9	2,1	132,9	
122	7,35	0.1	413.-	62.0	126.0	0.058	277.5	136,2	296.8	78,3	234,4	3,8	113,1	
123	7,38	0.0	349.9	37.0	108.0	0.022	298.2	142,2	418.6	74,3	200,0	.4	111,7	
124	7,31	1.3	332.4	37.6	114.0	0.022	277.4	155,0	465.1	82,5	193,7	6,3	179,8	
125	7,38	0.5	321.4	2.7	120.0	0.017	298.2	145,0	661.7	73,1	190,6	97,3	256,8	
126	7,39	0.0	337.3	5.3	107.0	0.024	300.9	153,7	573.4	72,9	193,7	44,3	160,0	
127	7,42	0.1	361.-	2.4	89.0	0.017	289.9	147,5	312.5	73,1	178,1	15,7	116,6	
128	7,10	0.1	284.5	1.0	91.0	0.017	300.3	150,0	300.5	76,9	184,4	8,5	97,2	
129	7,42	0.1	223.1	2.2	63.0	0.013	298.2	136,2	433.4	68,6	162,5	4,3	84,9	
130	7,41	0.1	239.3	0.5	78.0	0.012	276.4	143,3	400.6	61,2	178,2	5,4	103,8	
131	7,25	0.3	345.8	0.5	77.0	0.017	276.4	139,1	494.4	57,7	174,4	5,3	73,5	
132	7,20	0.1	282.-	7.4	61.6	0.027	290.2	144,5	303.0	68,8	169,2	7,7	64,2	
133	7,01	0.0	239.4	0.5	52.7	0.0 7	278.3	146,9	328.6	63,9	174,9	5,3	68,6	
134	7,83	0.0	226.1	8.1	45.5	0.010	278.2	150,4	368.6	65,1	167,9	2,7	58,3	
135	7,83	0.0	226.1	8.1	39.8	0.010	278.2	150,4	368.6	65,1	172,5	2,6	28,5	
136	7,58	0.1	466.9	8.9	43.1	0.043	266.3	145,7	300.3	61,3	161,5	1,3	47,4	
137	7,14	0.3	552.9	5.4	36.9	0.014	251.9	141,0	362.4	64,0	167,4	7,8	59,7	
138	7,21	0.1	579.6	3.3	35.9	0.042	244.7	137,3	350.1	61,9	171,5			
141	7,39	0.5	173.4	3.1	29.6	0.014	220.7	130,0	367.5	60,3	165,9		58,5	
142	7,17	0.5	169.8	1.9	31.5	0.015	230.3	131,6	505.7	60,7	167,2		58,5	
143	7,10	0.6	266.8	2.7	31.5	0.021	232.7	132,0	469.8	58,8	170,5			
144	5,85	0.9	196.6	2.8	32.8	0.028	187,1	129,0	472.6	58,8	162,8			

AVERAGE VALUES FOR SWINE EFFLUENT

ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K
1.1	159,32	15,56	54,26	0.021	173,6	93.2	409,9	80,7	171.7

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

NW Swine Effluent

ORIGINAL DATA FOR SWINE BARN EFFLUENT
8

SAMPLE	PH	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
7	5,85	19,6	12,5	0,6	4,1	0,010	14,8	5,5	131,0	39,2			
8	5,90	2,9	3,2	0,1	7,3	0,040	9,2	5,2	132,0	35,5		100,0	233,2
9	7,20	2,2	0,6	0,0	6,1	0,030	5,5	5,6	132,0	36,6			360,4
10	7,00	2,3	0,8	0,1	9,0	0,060	4,6	5,7	133,1	36,6			455,8
11	7,10	2,9	1,3	0,0	9,6	0,040	28,1	5,8	131,1	35,5		360,0	306,0
12	7,15	4,9	2,9	0,0	11,5	0,010	46,3	6,0	132,4	35,6		438,0	408,0
13	7,15	3,5	1,3	0,0	6,6	0,020	11,2	5,5	132,7	37,4			
14	7,30	0,8	2,0	0,4	8,7	0,020	16,9	5,8	132,4	34,8		268,3	397,2
15	7,30	5,1	1,8	0,1	9,1	0,020	18,7	5,5	135,7	36,6		313,5	526,4
16	7,45	1,2	1,7	0,1	10,4	0,050	18,7	5,3	136,8	37,2		520,8	658,0
17	5,90	2,0	3,5	0,0	9,9	0,010	26,2	5,2	136,8	35,9			739,2
18	5,90	1,2	2,7	0,0	8,9	0,020	29,9	5,2	134,7	38,1		566,0	616,0
19	5,95	1,0	2,0	0,1	9,8	0,020	35,6	5,7	135,7	38,6		729,0	515,2
20	7,12	1,9	11,5	0,4	9,8	0,030	74,9	5,7	135,4	38,9		603,5	638,0
21	5,91	28,9	47,6	0,2	11,3	0,030	99,2	5,8	135,8	37,8		518,0	532,0
22	5,73	14,0	83,3	0,5	11,6	0,030	128,2	5,4	138,8	38,6		457,5	425,6
23	6,78	1,5	89,2	0,1	10,9	0,030	143,2	5,7	136,8	39,8			319,2
24	7,06	1,7	5,4	0,0	10,3	0,020	136,7	5,2	138,5	35,8		359,0	212,8
25	6,75	3,2	2,0	0,1	10,9	0,020	146,0	5,2	136,8	36,0		333,4	638,4
26	7,25	2,7	7,7	0,0	12,8	0,020	144,2	5,8	136,9	38,9		394,0	638,4
27	5,70	5,7	5,6	0,0	11,8	0,009	146,0	6,0	145,5	63,3		437,0	425,6
28	5,75	4,9	5,6	0,0	14,3	0,010	146,0	10,0	154,5	84,4		535,5	822,4
29	5,94	4,7	4,3	0,1	15,5	0,005	149,8	48,0	166,8	84,2		601,0	882,0
30	7,62	7,9	65,4	0,1	8,0	0,016	131,1	47,5	356,2	77,8		282,8	430,6
31	7,22	1,2	68,2	0,1	7,4	0,020	129,2	50,0	197,4	78,0		255,0	315,6
32	7,32	0,8	71,0	0,2	7,4	0,003	129,2	54,0	163,7	80,9		277,7	425,6
33	7,14	0,8	68,5	2,2	7,3	0,014	129,1	51,5	194,0	83,2		735,7	420,8
34	7,61	3,7	52,6	4,1	5,1	0,014	131,1	56,0	415,8	96,4		925,1	631,2
35	7,53	2,0	49,8	0,1	7,9	0,000	138,6	61,0	618,8	110,6		656,0	728,0
36	7,36	2,7	44,5	0,4	8,8	0,000	140,4	61,0	457,0	115,1		807,5	990,7
37	7,13	5,4	53,4	0,2	9,3	0,008	144,1	60,0	372,7	98,3		743,0	822,4
38	5,99	2,8	84,7	0,1	13,3	0,009	140,4	72,0	307,2	100,2		648,5	1236,9
39	7,49	1,3	83,6	0,1	17,1	0,014	152,1	78,0	312,3	92,1		535,0	819,2
40	7,30	1,1	116,0	0,1	16,5	0,014	138,8	70,5	358,7	88,5		576,5	876,9
41	7,27	1,5	111,8	0,2	13,8	0,020	120,7	61,0	329,2	84,5		449,2	624,0
42	7,06	0,2	103,9	0,4	15,6	0,010	134,9	70,0	258,5	87,9		471,9	873,6
43	7,85	2,1	107,8	0,5	14,8	0,020	140,6	70,0	259,2	89,0		328,3	693,6
44	7,61	2,1	135,1	0,4	12,8	0,060	153,9	82,5	377,0	93,0		263,5	544,9
46	7,23	2,8	76,9	0,3	11,3	0,051	155,9	78,7	278,6	87,2		218,3	249,6
47	7,31	2,4	80,1	3,9	11,9	0,056	115,9	63,2	282,6	71,6		199,3	248,6
48	7,48	1,3	84,1	0,2	10,1	0,000	133,0	70,5	308,4	77,1		179,2	208,8
49	7,45	1,3	69,8	0,3	9,2	0,002	142,6	71,2	316,9	80,1		186,8	173,4
50	7,55	1,0	69,8	0,2	9,0	0,002	136,9	73,7	262,2	88,4		156,5	153,0
51	7,52	2,9	73,8	2,1	9,0	0,050	138,8	78,7	259,5	84,4		177,9	193,8
52	7,55	1,3	127,7	0,1	10,9	0,050	156,3	78,1	224,5	85,5		146,9	223,5
69	7,60	7,1	25,2	1,0	13,3	0,003	163,9	71,2	346,6	93,3		185,5	448,2
70	7,11	7,7	28,3	0,6	13,3	0,039	174,2	76,2	300,0	82,6		45,5	199,2
71	7,27	8,1	76,7	0,8	13,9	0,016	168,3	74,0	310,4	86,1		34,0	248,0
72	7,29	10,3	78,0	0,2	9,6	0,021	162,5	73,0	304,1	82,1		71,9	196,0
73	7,10	5,6	54,6	0,3	13,9	0,019	158,5	72,0	291,8	80,1		60,5	196,8
74	7,44	3,0	50,2	0,5	8,8	0,019	158,5	69,8	245,7	81,2		23,3	98,0
75	7,10	2,4	47,4	0,3	8,6	0,018	160,5	73,0	297,9	83,0		8,2	188,0
76	7,09	2,8	63,3	0,3	7,9	0,016	172,2	74,5	305,4	87,9		15,8	64,5
77	7,19	2,8	33,9	0,1	9,0	0,015	166,4	76,0	296,6	87,3		42,8	124,0
78	7,23	5,6	30,7	0,4	5,8	0,023	137,0	63,2	297,7	85,8		184,4	322,4
79	5,96	6,7	23,2	6,2	7,7	0,028	166,4	71,2	384,3	108,3		562,1	735,0
80	5,85	9,5	39,6	2,5	10,1	0,014	160,5	80,2	388,2	109,4		721,2	1049,2
81	7,02	7,6	29,0	3,5	16,0	0,020	170,3	89,0	416,4	127,4		937,0	1104,0
82	5,96	7,8	31,4	1,6	14,1	0,012	174,2	102,0	335,4	104,5		505,5	761,6
83	5,98	11,2	39,6	2,5	21,2	0,003	185,9	120,0	464,2	128,3		723,5	1363,0
84	5,87	3,5	51,1	0,6	18,4	0,012	185,9	114,0	468,4	97,0		452,8	750,0
85	5,89	2,0	60,5	0,6	18,1	0,003	172,3	97,5	490,8	108,9		236,5	545,6
86	7,39	6,3	587,0	0,0	19,1	0,006	197,7	104,4	416,6	98,3		311,3	558,6
87	7,15	4,6	60,0	0,2	22,7	0,014	181,9	108,0	399,4	88,8		162,9	194,4
88	7,04	4,0	39,9	0,1	31,0	0,028	186,0	109,0	366,4	93,3		284,1	384,0
89	7,29	3,4	5,7	0,0	26,2	0,027	175,5	108,7	375,7	87,1		329,5	376,0
90	5,99	3,2	6,4	0,0	24,2	0,034	216,5	110,0	406,9	96,5		412,8	799,0

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

NW Swine Effluent

91	7,09	5,1	18,7	0,1	34,9	0,027	177,4	112,0	369,1	93,3		137,2	415,8
92	6,94	3,4	2,5	0,0	38,0	0,016	186,0	115,0	381,0	92,2		228,1	416,8
93	6,84	2,8	2,2	0,0	36,8	0,034	187,9	116,5	390,4	90,0		300,7	416,5
94	6,84	2,8	4,0	0,0	38,1	0,034	186,9	115,0	342,2	91,3		353,8	541,3
95	7,04	3,0	5,2	0,1	57,5	0,028	187,9	95,0	336,5	98,5		265,5	388,8
97	7,56	0,4	3,6	0,0	36,1	0,064	183,1	88,7	192,7	100,8		146,3	1816,4
98	7,45	3,6	7,2	0,2	43,2	0,040	185,0	91,2	273,1	107,5		191,2	333,2
99	7,03	3,0	6,9	0,1	46,0	0,020	182,2	91,2	331,3	98,1		133,5	187,2
100	7,51	1,9	17,5	4,9	47,9	0,038	184,0	92,5	327,9	90,3		163,4	184,4
101	7,54	5,1	29,6	1,3	58,9	0,030	178,4	107,0	359,8	99,6		140,1	175,7
102	7,24	4,3	26,6	0,9	81,8	0,029	185,0	135,0	107,1	78,7		65,3	113,2
103	6,93	3,6	25,1	4,6	62,1	0,018	172,3	100,0	183,4	89,1		149,3	267,8
104	7,42	4,7	18,9	0,2	55,9	0,021	167,9	110,0	186,5	83,3		81,9	175,0
105	7,26	3,6	24,0	1,4	59,0	0,023	163,1	105,0	329,4	86,7			192,0
106	7,42	3,0	21,1	0,2	68,2	0,002	166,9	107,5	331,4	93,4			452,2
107	7,24	5,8	21,7	1,0	63,7	0,012	171,6	107,5	346,4	91,7			225,4
108	7,07	3,6	13,7	0,1	63,5	0,031	168,8	105,0	347,1	118,1			
109	6,91	4,2	19,4	0,9	66,1	0,017	181,9	113,1	344,0	110,1			
110	6,94	4,1	8,8	0,2	59,7	0,026	178,0	116,2	357,3	88,5			
111	7,35	5,2	18,8	0,3	68,8	0,030	181,9	113,1	201,2	86,3			
112	7,18	4,2	4,8	0,3	63,8	0,030	189,5	105,0	362,4	85,6			
113	7,13	3,2	28,3	0,7	63,2	0,027	176,0	107,5	364,0	89,9			
114	7,00	2,5	9,9	1,5	75,1	0,039	181,6	116,2	347,3	89,2			
115	7,16	2,9	32,7	17,8	87,3	0,059	190,7	110,6	329,1	73,5			99,2
116	7,05	4,1	79,4	15,3	86,3	0,018	215,4	110,6	404,9	116,8			
117	7,19	3,4	25,7	10,0	86,8	0,014	165,7	116,8	392,2	112,1	100,0		74,4
118	7,33	2,9	53,5	21,8	90,2	0,011	209,2	118,8	381,8	113,8	111,2		
119	7,49	1,9	55,3	5,9	81,5	0,011	207,1	113,1	406,5	112,3	106,2	18,6	113,5
120	7,04	2,2	60,5	5,9	97,3	0,017	213,3	116,2	374,0	107,4	131,2	14,0	99,2
121	6,95	2,2	93,6	5,9	88,3	0,020	215,4	123,7	254,6	118,5	125,0	12,8	147,6
122	7,67	1,4	132,1	7,0	99,6	0,017	221,6	123,7	299,1	91,4	118,7	13,4	172,2
123	7,50	1,0	122,9	25,4	112,0	0,011	225,7	130,0	403,4	119,3	153,1	2,9	46,8
124	7,05	0,7	125,1	41,2	110,0	0,014	223,6	133,7	463,2	92,8	156,2	4,7	97,2
125	7,11	0,9	127,2	21,0	119,0	0,017	225,7	130,0	539,6	94,7	143,7	13,1	172,9
126	7,01	0,5	132,4	31,4	134,0	0,011	229,9	128,7	503,1	87,6	156,2	13,4	110,0
127	7,92	0,9	142,4	21,0	106,0	0,011	223,6	125,0	469,2	98,6	131,2	13,6	97,2
128	6,89	1,7	157,3	12,9	85,7	0,009	219,5	116,2	520,5	94,2	87,5	19,3	87,4
129	7,37	0,5	183,0	19,7	93,7	0,009	229,9	125,0	488,4	100,0	131,2	14,2	94,4
130	7,26	0,5	158,5	12,4	87,0	0,017	215,3	118,6	304,8	90,9	111,0	14,7	75,5
131	7,00	1,2	169,1	6,2	80,4	0,046	216,9	192,4	404,2	97,8	89,2	10,8	68,6
132	7,09	1,2	158,5	10,8	82,0	0,019	248,1	122,1	441,6	133,7	101,7	8,4	59,2
133	6,98	0,8	160,4	7,3	81,7	0,014	249,5	131,6	501,8	108,1	113,3		68,6
134	7,71	0,5	173,5	6,2	84,4	0,048	249,5	126,8	485,1	93,9	115,4	16,5	63,1
135	7,68	0,2	205,3	3,6	78,6	0,022	254,3	131,1	364,5	97,2	119,2	8,4	38,0
136	7,09	0,3	360,2	3,3	80,9	0,032	244,7	124,5	331,9	93,1	119,2		61,6
137	7,33	0,9	476,2	4,7	76,6	0,014	244,7	128,0	349,4	91,5	125,1	4,3	69,7
138	7,06	0,9	474,3	4,6	72,5	0,048	239,9	123,8	346,0	80,8	121,0		9,0
142	7,07	2,8	149,9	3,5	67,6	0,014	218,3	117,9	296,6	71,3	122,8		
143	7,00	0,6	234,6	5,3	62,8	0,042	215,9	119,8	294,0	68,6	111,5		
144	7,00	0,9	177,5	4,8	65,7	0,035	223,1	122,1	310,1	68,0	109,0		

AVERAGE VALUES FOR SWINE EFFLUENT

ORGN	NO3	N32	NH4	PO4	CL	NA	CA	MG	K
3,5	72,97	6,76	38,34	0,022	158,7	80,5	328,6	83,8	25,7

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

SE Swine Effluent

C ORIGINAL DATA FOR SWINE BARN EFFLUENT

SAMPLE	PH	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
1	7.30	1.1	1.0	0.1	0.1	0.012	5.5	5.5	62.5	25.4		4.4	22.0
2	7.35	2.4	2.8	0.1	0.1	0.025	11.1	6.8	67.4	26.6		5.2	33.0
3	7.50	0.1	3.8	0.2	0.1	0.017	24.1	8.5	70.2	28.3		6.0	44.0
4	7.35	0.1	7.5	0.4	0.1	0.024	46.3	8.3	72.5	28.6			33.0
5	7.80	2.4	7.5	0.1	0.1	0.024	48.1	10.0	72.2	32.8			40.5
6	7.28	2.8	13.3	0.1	0.1	0.040	66.6	12.8	76.8	45.2		5.2	39.4
7	7.30	2.1	24.8	1.3	0.2	0.020	88.8	12.6	86.4	43.7		5.6	42.8
8	7.36	1.6	67.0	1.5	0.2	0.010	138.8	15.5	88.5	48.3		7.8	42.4
9	7.75	0.4	65.8	3.9	0.3	0.021	144.3	13.8	93.6	46.0			53.0
10	7.50	1.3	69.6	6.5	0.2	0.013	144.3	18.3	96.0	52.2			58.3
11	7.75	1.3	105.5	5.8	0.2	0.017	151.6	19.6	95.5	48.9			30.6
12	7.80	2.5	99.4	8.5	0.1	0.011	155.4	25.5	97.7	51.8		2.8	35.7
13	7.80	0.3	85.7	3.6	0.2	0.014	157.3	26.4	97.5	52.0		2.4	53.0
16	7.35	0.5	71.4	3.3	0.3	0.014	104.8	29.3	102.0	55.6			59.2
18	7.30	1.7	40.4	1.8	1.2	0.020	138.5	36.5	134.7	60.6		2.4	49.3
19	7.35	1.9	27.8	1.4	1.2	0.030	138.5	36.5	170.5	58.2		2.2	32.2
20	7.72	1.2	31.8	1.2	0.8	0.010	139.5	39.5	162.5	58.2		1.9	32.3
21	7.65	1.2	46.5	1.2	0.5	0.020	142.3	45.0	203.6	66.6		2.3	42.6
22	7.43	1.5	44.3	1.5	0.5	0.020	155.4	50.5	239.5	75.3		2.5	37.2
23	7.04	0.2	85.0	2.0	0.7	0.030	161.0	75.3	320.7	75.3			53.2
24	7.35	1.2	75.4	0.6	0.1	0.030	168.5	70.5	340.9	77.2		5.5	62.9
25	7.45	0.7	123.6	0.7	0.5	0.020	168.5	82.6	301.4	79.0		5.5	53.2
26	7.75	0.8	146.9	0.0	1.0	0.020	149.8	88.8	292.4	92.0		8.4	58.5
27	7.57	0.5	156.0	0.0	1.7	0.020	146.0	91.8	266.7	81.6		4.7	47.1
28	7.27	0.0	216.8	0.0	0.0	0.030	134.8	102.0	292.4	92.0		7.2	86.1
29	7.27	1.7	236.2	2.5	2.4	0.026	119.8	102.0	371.7	89.0		3.0	29.4
30	7.89	0.3	158.9	1.2	1.0	0.005	117.9	86.0	297.3	82.9		3.0	80.7
31	7.55	0.2	205.6	0.8	0.7	0.005	115.1	82.0	285.5	80.0		2.4	52.6
32	7.28	0.2	226.3	0.9	0.5	0.167	110.5	85.5	291.5	80.3		4.6	53.2
33	7.03	0.1	193.3	0.7	0.5	0.017	110.5	84.0	289.5	81.2		3.3	54.0
34	7.70	0.3	187.5	0.8	0.3	0.003	112.3	94.5	345.5	90.3		3.3	64.1
35	7.45	0.3	180.1	1.0	0.7	0.009	114.2	93.0	327.6	83.5		2.3	31.2
36	7.18	0.3	135.0	1.2	0.7	0.016	104.8	83.0	345.5	86.4		3.3	26.9
37	7.15	0.2	223.6	1.2	1.2	0.005	110.4	93.0	370.0	86.1		4.8	36.0
38	7.02	0.2	170.7	0.9	0.2	0.008	110.4	92.8	373.4	88.5		3.4	42.3
39	7.88	0.6	175.4	1.0	0.3	0.016	108.3	81.0	340.0	85.8		3.6	34.8
40	7.41	0.2	236.0	1.0	1.1	0.014	113.1	86.0	432.2	95.7		4.6	53.8
41	7.44	0.2	294.7	0.8	1.3	0.020	115.9	81.0	389.7	98.9		3.3	27.1
42	7.15	0.4	186.6	1.1	1.5	0.027	121.6	83.0	371.0	77.8		3.8	43.7
43	7.12	0.4	208.2	1.5	1.5	0.027	125.4	83.0	402.6	93.0		1.4	36.7
44	7.61	0.9	218.4	2.1	1.1	0.030	133.0	88.7	373.4	88.5		1.6	44.0
46	7.28	0.8	189.1	2.2	2.1	0.065	129.2	95.7	389.2	97.2		1.7	35.4
47	7.40	0.6	188.7	2.3	1.7	0.042	133.0	89.5	388.0	91.0		1.7	31.1
48	7.45	0.9	164.1	2.9	1.9	0.000	134.9	82.5	380.8	85.8		1.3	31.2
49	7.55	0.2	144.1	0.8	0.6	0.010	117.8	75.0	325.5	73.2		1.3	22.4
50	7.52	0.3	229.2	5.1	1.9	0.018	140.1	85.0	315.1	79.8		5.6	45.9
51	7.35	0.5	141.4	0.0	1.1	0.018	129.2	76.2	277.1	72.7		2.3	43.7
52	7.40	0.4	215.4	1.8	0.9	0.020	114.4	73.1	255.8	73.5		1.8	32.5
53	7.45	0.3	194.0	1.8	1.5	0.020	110.6	68.8	262.2	75.0		0.9	17.2
56	7.55	0.1	197.0	2.4	0.6	0.040	104.3	76.2	306.1	78.9		1.0	30.0
57	7.55	0.1	204.2	2.5	0.5	0.016	105.5	79.4	330.7	97.5		0.8	32.0
60	7.68	0.2	174.6	2.8	0.9	0.010	101.6	67.5	315.2	75.0		1.6	41.0
61	7.73	0.7	194.4	19.4	0.6	0.012	93.9	71.2	280.6	71.9		1.3	51.7
62	7.52	3.2	215.1	37.7	1.3	0.007	135.1	76.2	312.8	86.2		2.0	42.8
63	7.33	3.2	200.1	29.6	1.5	0.047	119.4	66.9	315.2	76.2		2.7	38.1
64	7.44	4.1	196.6	23.0	1.5	0.050	121.4	67.5	315.2	85.3		2.5	47.6
65	7.07	4.3	191.0	40.1	1.7	0.020	121.4	72.5	355.3	90.6			
66	7.10	4.7	164.1	23.0	1.1	0.058	125.7	73.6	358.4	92.6		3.6	82.4
68	7.86	0.0	173.9	28.4	1.7	0.060	122.3	70.0	336.8	83.6		41.5	86.0
69	7.77	4.2	150.5	16.6	0.6	0.010	85.6	46.2	294.2	64.0		140.0	443.2
70	7.37	2.7	117.7	15.3	0.9	0.007	95.9	47.2	254.8	56.0		124.9	333.6
71	7.17	4.7	97.0	7.4	1.6	0.005	80.2	45.0	254.8	54.9		265.2	446.4
72	6.99	1.1	122.8	0.4	0.7	0.021	94.0	49.0	266.9	56.9		238.5	441.0
73	7.03	2.1	97.4	1.1	1.6	0.040	94.0	47.0	254.8	55.8		265.2	442.8
74	7.49	3.2	75.4	0.4	0.2	0.040	86.1	44.8	221.5	55.4		307.4	539.0
75	6.89	4.4	96.8	0.4	1.3	0.012	90.0	50.0	270.8	62.0		436.2	952.0
76	7.09	3.4	105.6	0.5	0.4	0.009	99.8	52.0	265.7	62.2		296.0	347.2

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

SE Swine Effluent

77	6,96	0,0	78,0	1,1	1,1	0,008	84,2	52,0	283,0	61,4		442,8	793,6
78	6,94	0,6	92,0	0,9	0,6	0,013	82,2	49,0	242,6	56,3		408,8	744,0
79	7,04	4,2	81,4	2,2	0,2	0,013	80,3	45,5	235,2	51,8		171,2	392,0
80	6,94	3,1	81,1	1,2	0,2	0,026	78,3	44,5	213,5	53,4		197,9	439,2
81	7,35	3,7	72,0	1,1	0,2	0,020	88,1	86,5	196,5	53,0		81,6	240,0
82	7,15	4,4	63,4	1,0	0,2	0,018	78,3	86,5	177,6	50,8		75,5	133,3
83	7,33	1,8	83,8	0,9	0,0	0,036	101,8	98,0	350,0	61,6		44,8	141,0
84	7,18	1,4	106,5	1,0	0,2	0,009	93,9	96,0	297,8	56,1		47,8	110,0
86	7,79	1,2	107,9	0,9	0,3	0,009	105,7	57,5	274,7	56,7		12,8	99,6
87	7,48	2,5	100,0	0,2	0,2	0,013	107,6	58,5	284,8	59,4		32,5	24,3
91	7,14	0,6	128,6	1,4	0,4	0,034	114,5	67,5	267,2	60,4		5,0	55,4
94	7,01	1,7	127,4	2,1	1,3	0,019	128,4	76,2	208,1	63,9		10,7	49,2
95	7,47	0,6	117,5	2,9	1,1	0,022	126,5	60,0	220,9	61,2		19,0	58,3
96	7,45	0,6	167,0	1,5	1,3	0,012	118,9	48,8	231,8	58,2		3,8	62,4
97	7,44	0,0	188,6	1,3	1,1	0,038	126,5	51,2	230,3	63,8		3,0	66,9
98	7,71	1,1	226,0	0,9	0,9	0,049	145,4	58,8	279,7	66,8		2,4	57,1
99	7,04	0,0	139,5	0,8	1,2	0,035	102,9	60,0	277,0	67,7		2,7	51,5
102	7,11	3,8	159,4	0,8	1,2	0,018	169,0	90,0	350,7	82,9		2,6	49,2
103	7,16	1,9	123,5	0,7	1,9	0,023	156,7	77,5	269,9	65,8		1,6	39,6
104	7,47	0,9	141,9	1,8	1,2	0,027	157,5	82,5	338,3	73,9		3,1	43,7
105	7,52	0,2	188,1	0,4	1,4	0,016	162,2	90,0	303,2	71,1			48,0
106	7,60	1,5	95,5	0,2	2,1	0,007	157,5	87,5	319,1	75,0			38,1
107	7,63	0,4	164,6	0,4	3,2	0,021	166,9	87,5	339,8	71,5			50,6
108	7,24	0,9	128,3	2,3	1,5	0,021	165,0	113,1	339,8	71,3			
109	6,87	1,6	117,2	2,0	1,1	0,020	183,8	95,0	379,3	65,5			
110	6,94	0,9	171,1	2,2	1,1	0,017	179,9	97,5	405,0	73,1			
111	7,27	0,4	176,6	2,5	2,0	0,024	172,3	97,5	394,8	70,0			
112	7,13	1,1	85,5	1,1	2,3	0,030	212,5	95,0	374,2	65,7			
113	7,05	1,7	227,2	2,0	4,1	0,008	170,4	97,5	379,3	73,1			34,1
114	6,90	0,6	224,5	1,9	3,6	0,018	168,5	105,0	379,3	74,0			
115	7,18	2,6	243,2	1,8	3,9	0,011	167,7	105,0	401,2	75,4			34,7
116	7,16	2,6	161,4	1,5	4,4	0,027	167,7	97,5	436,1	103,9			
117	7,29	3,1	200,0	1,1	1,1	0,027	165,7	105,0	428,1	101,3	15,6		24,8
118	7,30	0,6	264,5	1,4	0,4	0,024	178,1	105,0	455,1	108,5	21,3		
119	7,37	0,6	239,2	3,5	0,6	0,022	173,9	105,0	450,0	103,3	21,9		31,7
120	7,01	0,9	244,8	3,0	1,1	0,024	163,6	98,8	424,8	100,4	22,5		
121	6,94	0,8	239,9	3,5	0,3	0,011	167,7	100,0	233,9	98,7	24,4		44,2
122	7,50	0,4	268,0	1,7	0,2	0,017	180,2	105,0	304,7	108,0	21,9		44,2
123	7,67	0,4	160,0	1,3	0,7	0,017	169,8	102,5	364,5	98,4	18,8		53,4
124	7,54	0,4	170,0	4,9	3,1	0,011	184,3	100,0	606,9	93,5	41,3		48,6
125	7,19	0,5	158,2	1,1	1,9	0,018	161,5	96,2	531,7	100,6	26,3		59,2
126	7,49	0,8	159,3	2,9	1,9	0,013	186,4	98,7	553,3	92,3	21,3		75,0
127	7,36	0,6	158,8	1,4	2,9	0,011	205,0	110,0	417,0	94,5	50,0		145,0
128	7,09	0,6	156,7	3,3	2,0	0,011	196,7	97,5	459,4	90,5	32,5		136,0
129	7,31	0,5	152,4	0,1	1,4	0,013	200,9	102,5	488,4	87,2	31,3		66,0
130	7,20	1,4	107,5	0,3	1,2	0,002	191,9	100,7	399,9	117,9	25,4		118,0
131	7,23	1,3	171,0	0,1	2,3	0,038	196,6	107,3	412,1	90,9	33,3		63,7
132	7,24	0,3	266,4	0,4	2,3	0,014	248,1	109,5	313,4	98,2	56,7		172,0
133	7,03	2,3	134,1	0,4	1,3	0,017	196,7	119,1	313,4	99,6	50,6		208,0
134	7,72	1,1	154,8	3,4	1,7	0,012	201,5	105,1	345,3	94,8	28,9		208,0
135	7,63	0,3	169,9	0,4	1,1	0,017	196,7	108,0	320,0	93,4	32,7		
136	7,63	4,5	333,0	0,4	1,5	0,042	206,3	109,0	309,5	91,9	36,3		
137	7,57	10,0	429,9	1,8	0,5	0,049	215,9	117,6	357,6	95,2	41,7		179,0
138	7,47	0,9	354,6	1,5	1,6	0,060	203,9	108,8	355,5	89,5	40,4		64,2
142	7,42	1,3	154,7	1,1	2,8	0,007	201,5	106,2	364,5	90,6	62,8		
143	7,26	1,1	177,5	0,1	1,6	0,014	196,7	104,4	317,4	81,2	42,0		
144	6,95	0,5	168,0	0,7	1,7	0,009	199,1	104,4	322,6	86,6	34,0		

AVERAGE VALUES FOR SWINE EFFLUENT

ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K
1,4	150,63	6,70	1,11	0,022	135,2	74,3	297,9	74,7	36,7

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

SW Swine Effluent

ORIGINAL DATA FOR SWINE BARN EFFLUENT

SAMPLE	PH	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
1	7.30	1.1	7.0	0.1	0.0	0.014	7.4	5.2	56.5	21.2		3.6	16.5
2	7.00	1.2	8.3	0.1	0.0	0.017	8.3	6.5	56.6	22.0		3.9	22.0
3	7.45	0.1	10.9	3.0	0.0	0.020	32.7	5.5	58.5	35.5		5.0	27.5
4	7.15	0.8	37.5	2.3	0.0	0.019	84.5	7.5	57.7	34.1			49.6
5	7.24	1.7	41.5	1.2	0.0	0.018	72.2	8.2	69.3	42.1			45.4
6	7.10	1.8	39.0	1.0	0.2	0.010	83.3	10.4	69.9	42.0		1.5	27.8
7	7.10	2.1	44.5	0.2	0.2	0.000	596.2	11.5	83.2	44.2		1.5	31.9
8	7.18	0.4	56.0	2.5	0.2	0.005	144.4	13.2	88.3	48.4		5.0	58.3
9	7.20	0.6	83.3	5.1	0.0	0.029	144.4	22.1	89.0	48.5			30.6
10	7.40	1.7	63.9	5.5	0.2	0.018	157.3	28.2	90.0	46.1			42.4
11	7.50	2.5	95.8	6.4	0.2	0.052	161.0	30.1	90.5	43.8			
12	7.55	2.6	104.7	10.0	0.2	0.022	157.3	34.4	95.5	45.9		1.0	20.4
13	7.90	0.5	72.4	2.1	0.1	0.017	114.2	38.2	110.0	49.0		1.5	33.1
16	7.80	10.8	56.5	1.0	1.7	0.015	119.8	42.2	132.4	51.1			46.1
18	7.30	1.7	50.7	0.7	1.2	0.002	161.0	41.5	156.2	51.8		2.1	24.6
19	7.20	1.5	37.3	0.8	0.5	0.005	131.1	41.5	182.7	53.8		2.6	25.8
20	7.40	2.2	32.3	0.8	0.5	0.030	131.1	43.8	171.3	52.8		1.7	25.8
21	7.65	1.2	35.8	0.5	0.5	0.020	134.8	45.5	154.8	57.6		1.8	36.7
22	7.69	1.2	34.5	0.5	0.5	0.020	132.6	48.5	162.8	60.3		2.2	41.9
23	7.27	1.0	59.2	0.7	0.3	0.020	134.8	56.0	238.6	61.8			41.9
24	7.46	1.2	52.2	0.2	0.2	0.020	104.8	49.0	178.6	52.8		4.0	36.7
25	7.73	0.7	79.9	0.3	0.2	0.040	125.4	58.0	191.8	64.6		3.1	42.6
26	7.79	0.5	106.6	0.0	0.8	0.050	147.9	75.0	185.1	72.4		3.5	47.9
27	7.32	1.0	142.1	0.0	0.8	0.010	149.8	84.0	273.3	79.8		2.4	41.1
28	7.14	1.0	231.9	0.0	0.0	0.030	149.8	99.0	351.9	96.9		2.3	15.4
29	7.20	0.8	291.1	0.2	1.2	0.010	132.9	103.0	384.1	98.6		2.1	39.2
30	7.73	0.5	192.0	1.2	1.0	0.013	147.9	93.0	414.6	98.2		2.5	75.3
31	7.28	0.1	292.0	1.1	0.2	0.003	149.8	98.0	394.5	99.6		1.2	63.1
32	7.31	0.1	346.6	1.2	0.1	0.003	149.8	98.0	415.8	103.7		2.7	63.9
33	6.97	0.1	297.6	1.0	0.1	0.017	146.0	101.0	421.8	109.0		2.5	47.4
34	7.68	5.6	289.1	1.0	0.1	0.009	144.2	101.0	424.3	109.0		2.8	36.8
35	7.52	0.2	254.5	0.9	0.1	0.009	147.9	103.0	446.7	109.4		1.1	41.7
36	7.30	0.2	336.3	0.8	0.3	0.064	142.3	98.4	494.4	111.4		1.4	53.7
37	7.21	0.7	326.1	0.7	0.2	0.024	142.3	101.0	442.4	110.9		1.4	47.4
38	6.95	0.2	245.1	0.5	0.2	0.018	142.3	102.0	490.2	111.3		1.7	33.1
39	7.41	0.4	274.6	0.5	0.2	0.014	144.4	98.0	471.2	111.3		1.6	28.7
40	7.43	0.2	321.9	0.5	1.1	0.020	144.4	100.0	465.9	111.6		1.6	31.3
41	7.45	0.2	361.7	0.5	0.7	0.010	149.2	95.0	445.0	106.0		1.8	45.6
42	7.11	0.4	259.3	0.7	0.2	0.038	146.3	96.4	430.5	99.2		2.1	39.5
43	7.14	0.6	269.0	1.0	0.2	0.038	152.0	91.0	363.9	93.3		1.3	32.6
44	7.50	0.6	314.4	1.1	0.6	0.016	157.8	107.0	543.8	107.5		1.7	47.2
46	7.21	0.6	212.6	0.8	0.8	0.021	157.8	97.0	459.8	103.7		1.4	47.8
47	7.50	0.4	188.7	0.8	0.0	0.027	146.4	95.8	477.4	105.5		1.6	33.2
48	7.55	0.2	212.8	0.6	0.2		126.4	80.0	413.5	93.7		1.9	29.1
49	7.56	1.4	246.9	1.0	0.2	0.007	144.4	97.5	308.2	110.5		1.8	32.5
50	7.58	2.0	190.4	0.6	0.2	0.002	110.2	71.2	296.2	97.3		2.0	38.7
51	7.66	0.7	212.8	0.6	0.2	0.010	129.2	80.6	331.4	104.8		1.8	35.6
52	7.70	4.4	231.0	0.6	0.3	0.015	99.1	65.0	261.3	96.2		1.5	29.5
53	7.70	4.4	231.0	0.6	0.3	0.015	99.1	65.0	261.3	96.2		1.0	27.3
56	7.65	0.1	242.1	0.4	0.1	0.020	105.7	67.2	298.2	101.9		1.3	12.0
57	7.55	0.2	237.0	0.4	0.4	0.019	110.7	65.0	340.4	86.2		0.9	32.0
60	7.58	0.2	267.5	0.6	0.1	0.032	122.6	75.6	380.7	103.9		0.9	37.1
61	7.60	0.2	279.0	6.2	0.0	0.023	125.3	71.9	351.5	98.7		1.0	37.1
62	7.20	2.6	287.2	8.6	0.5	0.066	129.2	61.9	393.7	98.0		1.6	23.8
63	7.40	2.1	298.0	9.8	0.2	0.028	129.2	61.9	415.1	108.0		1.5	28.6
64	7.31	2.3	294.5	8.5	0.5	0.020	133.1	73.1	382.0	98.5		1.8	28.6
65	7.43	2.8	277.0	8.9	0.2	0.010	115.5	65.6	331.9	80.3		1.2	28.1
66	7.60	2.8	259.5	9.3	0.2	0.015	119.4	65.6	359.0	84.5		1.1	32.1
68	7.82	0.0	250.0	15.1	0.4	0.072	122.3	68.1	400.4	92.9		1.4	45.5
69	7.86	0.2	245.5	8.0	0.0	0.063	107.7	55.0	331.9	73.0		1.1	29.9
70	7.32	0.4	230.9	8.1	0.4	0.029	109.6	58.1	296.9	65.1		1.3	34.7
71	7.67	0.4	241.7	7.7	0.6	0.010	111.6	60.5	317.8	68.6		0.6	34.7
72	7.23	0.4	254.5	0.7	0.8	0.016	113.5	55.3	315.7	68.1		0.7	58.8
73	7.13	0.9	208.7	0.8	0.5	0.024	97.9	56.2	300.0	69.7		0.6	39.4
74	7.78	0.0	244.0	0.8	0.2	0.008	117.4	56.0	296.8	68.9		0.6	19.6
75	7.27	0.1	292.2	0.8	0.2	0.028	121.4	56.0	314.0	71.0		0.4	47.6
76	7.22	0.0	263.4	0.8	0.0	0.014	125.3	58.0	326.1	75.8		1.1	44.6

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

SW Swine Effluent

77	7.27	0.1	231.9	0.8	0.1	0.028	129.2	61.0	305.8	75.2		1.4	29.8
78	7.61	0.0	219.6	0.9	0.1	0.025	123.3	58.0	301.2	70.3		1.6	24.8
79	7.21	1.8	209.5	0.9	0.4	0.020	129.2	59.5	295.4	69.0		0.9	39.2
80	7.00	1.0	220.0	1.0	0.1	0.008	140.9	67.0	328.2	81.6		0.8	34.1
81	7.60	1.0	194.5	1.0	0.1	0.014	148.8	50.0	342.7	43.4		1.2	28.8
82	7.15	1.8	187.2	1.1	0.1	0.006	142.9	46.0	388.1	87.6		1.2	28.5
83	7.14	0.3	241.0	4.3	0.1	0.006	152.7	57.0	441.1	90.6		1.4	37.6
84	7.09	0.1	246.7	1.4	0.2	0.036	154.6	52.0	438.3	86.7		1.4	40.0
86	7.82	0.1	190.9	1.5	0.1	0.033	152.7	53.0	377.8	79.3		2.2	39.8
87	7.34	0.5	262.1	7.2	0.0	0.031	172.2	55.0	400.5	87.9		2.7	24.3
91	7.10	0.0	273.1	2.0	0.5	0.016	170.7	92.5	402.8	93.6		2.8	36.6
94	7.04	1.7	285.8	1.6	0.3	0.009	188.8	102.5	388.4	98.5		1.7	39.3
95	7.39	0.9	999.9	1.9	0.6	0.013	181.2	95.0	448.8	93.1		1.2	38.9
96	7.36	0.6	441.2	1.6	0.6	0.018	190.7	87.5	455.4	99.6		2.1	38.7
97	7.22	2.3	401.6	3.4	1.1	0.012	198.2	95.0	519.6	104.3		1.8	47.8
98	7.57	0.0	449.0	4.7	1.3	0.032	207.7	105.0	494.7	112.9		1.9	42.8
99	6.92	0.0	220.7	4.2	0.6	0.038	205.7	107.5	437.3	104.3		1.9	46.8
102	7.31	1.7	301.4	5.9	0.5	0.031	209.6	117.5	368.8	91.9		1.5	44.3
103	7.09	1.7	277.9	4.6	0.0	0.021	197.3	112.5	367.8	88.0		1.3	34.7
104	7.48	0.9	296.2	5.3	0.0	0.021	207.5	120.5	387.5	92.4		1.7	48.6
105	7.45	0.4	292.6	3.8	0.4	0.023	163.1	113.1	412.2	86.2			96.0
106	7.65	0.6	182.6	6.8	0.6	0.014	168.8	110.6	399.3	88.3			38.1
107	7.45	0.4	338.2	2.3	0.4	0.016	172.6	105.0	430.3	89.0			46.0
108	7.19	0.2	227.7	3.8	0.4	0.016	169.7	110.6	413.4	87.8			
109	6.86	1.1	188.1	3.8	0.4	0.026	170.4	118.8	444.9	113.3			
110	6.90	1.3	213.4	11.4	0.6	0.005	168.5	107.5	401.2	71.4			
111	7.35	0.6	242.0	11.4	1.3	0.015	164.6	107.5	426.6	76.0			
112	7.12	0.4	106.6	2.3	0.9	0.005	166.5	100.0	418.9	93.8			
113	7.24	1.1	249.8	9.9	1.3	0.024	151.7	105.0	398.3	71.6			
114	6.92	0.7	231.1	3.8	1.7	0.024	153.5	105.0	418.9	68.8			
115	7.16	0.9	242.2	6.0	1.3	0.018	164.8	102.2	400.0	63.5			34.7
116	7.19	1.1	163.1	0.1	2.0	0.011	171.9	100.0	437.1	100.2			
117	7.24	0.9	118.8	10.6	0.3	0.009	171.9	107.5	433.1	102.0	38.8		
118	7.18	1.3	245.7	19.5	2.2	0.008	171.9	102.2	443.2	103.3	34.4		
119	7.11	0.0	242.4	7.0	1.9	0.011	178.1	105.0	456.8	101.7	36.3	2.5	31.7
120	7.18	0.8	251.5	7.0	0.6	0.013	190.5	105.0	475.7	103.9	48.8	1.8	74.7
121	6.86	1.1	279.9	0.1	0.3	0.006	198.8	105.0	321.0	117.9	50.0		68.8
122	7.50	1.3	315.9	0.1	0.3	0.001	215.4	112.5	200.2	104.6	63.8	1.4	59.0
123	7.39	0.1	235.2	0.1	1.5	0.008	234.0	117.5	480.5	95.8	75.0	0.7	
124	7.62	0.1	250.8	7.0	2.0	0.011	236.1	116.2	722.0	127.5	75.6	0.5	43.7
125	7.11	7.8	247.6	7.0	2.7	0.013	240.2	113.7	644.1	107.5	93.5	1.5	64.2
126	7.25	4.7	262.1	6.9	2.5	0.011	252.6	123.7	603.3	90.9	97.5	1.7	50.0
127	6.93	1.3	288.2	16.5	2.6	0.009	256.8	125.0	689.9	88.7	107.5	1.3	63.1
128	6.95	1.9	290.1	15.2	0.1	0.009	248.5	120.0	636.1	77.4	78.8	1.3	34.0
129	7.39	0.5	318.8	12.4	2.7	0.009	260.9	122.5	613.8	87.0	110.0	0.2	47.2
130	7.49	1.6	246.4	13.1	2.0	0.007	252.7	123.5	611.2	81.4	112.5	0.1	51.9
131	7.04	1.1	239.1	8.6	1.6	0.017	304.2	125.0	432.4	107.7	101.7	0.6	53.9
132	7.31	0.5	248.0	6.9	0.1	0.009	238.7	122.0	347.4	81.5	101.3	0.2	44.2
133	6.98	1.4	224.5	5.0	2.7	0.027	225.5	125.7	326.6	79.5	114.8	0.6	53.9
134	7.76	0.3	218.2	5.0	2.0	0.012	223.1	123.5	309.5	73.6	113.6	0.3	38.8
135	7.58	0.5	206.0	5.0	1.6	0.038	232.7	125.0	318.7	71.8	113.4	1.2	19.0
136	7.61	2.6	392.7	5.0	2.8	0.021	225.5	125.0	335.2	76.5	123.9	1.0	37.9
137	7.72	0.8	478.1	4.5	2.5	0.042	225.5	122.0	385.4	68.8	121.6	7.9	44.8
138	7.47	0.6	478.1	4.0	2.5	0.042	232.7	121.3	333.2	92.4	129.5		
141	7.22	0.9	140.2	4.0	2.0	0.025	215.9	118.8	306.9	69.7	127.8		
142	7.23	0.9	162.8	3.4	2.7	0.028	211.1	126.4	273.8	65.5	126.7		
143	7.07	0.5	299.4	3.6	2.9	0.048	213.5	122.7	314.9	68.0	129.5		
144	6.90	0.5	219.5	3.6	2.8	0.026	223.1	126.4	321.3	69.0	132.8		

AVERAGE VALUES FOR SWINE EFFLUENT

ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K
1.1	226.74	7.37	0.71	0.012	161.3	81.9	349.0	82.9	119.7

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

NE Dairy Effluent

ORIGINAL DATA FOR DAIRY EFFLUENT

SAMPLE	PH	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
30	8,23	0,8	31,8	0,3	0,0	0,007	11,2	5,5	112,9	39,0		5,4	64,6
31	8,23	1,2	29,0	0,2	0,0	0,058	11,2	4,5	111,5	40,7		3,2	52,6
32	8,27	0,0	35,6	0,1	0,0	0,005	5,6	5,0	87,0	41,1		2,8	69,3
34	8,09	1,1	46,3	0,1	0,0	0,003	7,5	5,5	135,5	48,0		5,0	54,6
35	8,12	0,1	46,2	0,1	0,0	0,000	11,2	6,5	162,1	48,8		1,5	46,8
48	8,00	1,2	38,5	0,4	0,6	0,019	17,1	9,3	295,9	72,5		276,0	465,9
49	8,00	1,2	30,8	0,4	0,8	0,000	20,9	11,2	412,3	76,6		306,0	446,7
50	7,95	1,6	33,2	1,1	0,8	0,000	17,1	9,3	264,0	74,4		298,5	408,0
52	7,75	2,9	41,8	2,9	3,2	0,017	19,1	5,6	219,5	73,8		316,3	426,7
65	7,15	0,9	13,4	14,9	1,3	0,002	23,3	8,5	220,4	75,5		622,8	243,4
68	7,93	0,3	2,9	3,6	0,9	0,007	14,7	5,0	199,2	33,9		15,6	146,7
69	7,92	0,4	3,0	10,0	0,4	0,010	7,3	5,0	160,8	35,5		7,0	64,7
70	7,56	0,1	4,7	0,8	0,0	0,025	5,9	3,7	135,5	33,4		0,2	79,4
71	7,40	0,5	2,4	3,3	0,9	0,024	7,8	4,7	133,6	32,2		16,6	79,4
72	7,24	0,2	4,0	0,8	0,9	0,016	9,8	4,0	136,1	32,8		19,0	93,1
73	7,23	0,6	5,2	0,7	0,8	0,018	7,8	4,9	136,7	33,4		17,8	127,9
74	8,05	2,3	5,1	0,3	0,0	0,019	7,8	3,8	122,7	29,5		4,9	24,5
75	7,17	0,3	8,7	0,8	1,9	0,023	9,8	5,0	132,3	30,0		65,5	142,8
76	7,10	1,1	10,8	1,0	0,7	0,016	9,8	6,2	145,2	34,5		103,5	114,1
77	7,21	0,1	11,8	0,7	1,9	0,013	9,8	6,5	154,2	42,5		131,2	198,4
78	7,17	0,0	13,1	0,8	1,1	0,013	11,7	7,3	145,5	40,8		154,8	272,8
79	6,96	3,1	12,8	1,0	1,1	0,024	17,6	7,5	188,1	53,5		188,3	343,0
80	6,97	5,9	13,8	0,7	3,0	0,017	23,5	8,0	235,1	59,7		224,7	439,2
81	7,18	5,1	8,2	1,9	1,5	0,038	25,5	9,0	239,6	66,4		247,6	249,6
82	6,95	5,7	15,5	0,1	2,1	0,002	23,5	9,0	293,1	68,6		280,0	323,7
83	6,98	6,3	9,8	1,8	1,3	0,003	31,3	9,0	323,4	76,0		310,0	517,0
84	6,89	4,4	21,1	0,9	1,9	0,006	33,3	9,0	350,0	75,0		393,3	575,0
85	6,94	5,0	6,1	0,0	1,8	0,003	35,2	9,0	353,7	80,3		388,5	595,2
86	6,99	6,5	6,3	0,9	6,3	0,012	52,8	9,5	362,7	90,2		577,9	796,8
87	6,95	8,2	4,4	1,2	14,3	0,031	64,6	10,2	509,9	124,5		1374,4	1458,0
88	6,94	5,2	1,5	0,0	10,7	0,026	68,5	10,5	492,7	130,8		1449,3	1632,0
95	7,00	0,5	2,6	0,1	11,8	0,063	89,7	15,0	429,2	122,6		1385,2	1555,2
100	7,53	0,4	1,2	0,1	17,3	0,032	73,2	7,5	526,9	138,3		1495,8	2516,4
101	6,72	0,6	5,8	0,1	16,6	0,255	72,7	10,0	525,1	138,3		1323,6	2008,0
106	7,40	0,5	4,3	0,0	13,4	0,003	62,2	11,2	431,5	113,5		1	1428,0
107	6,99	0,5	2,6	0,0	11,8	0,025	54,2	12,2	442,7	113,8		-.J	1380,0
108	6,94	0,5	2,6	0,0	11,3	0,031	69,5	11,2	429,1	111,2		709,0	1444,0
109	6,84	5,3	6,8	0,1	10,3	0,023	67,0	12,5	393,0	97,2			
110	6,92	5,0	9,7	0,1	9,2	0,029	67,0	12,5	453,9	144,5			1
111	7,00	0,5	6,7	3,3	8,3	0,033	67,0	12,5	407,5	94,3			714,0
112	6,91	0,4	4,6	0,0	8,3	0,021	68,9	11,2	384,4	81,3			1
113	7,16	0,4	11,7	0,0	12,5	0,039	61,8	12,2	453,9	100,5			292,0
114	6,83	0,4	11,4	0,0	7,8	0,033	59,9	12,5	418,8	91,4			
115	6,74	0,4	4,1	0,1	6,7	0,021	63,2	11,2	352,2	74,6			297,0
116	6,33	0,3	2,3	0,0	6,3	0,022	78,7	8,0	426,4	98,7			
117	7,18	0,3	1,8	0,0	3,1	0,024	78,7	11,2	338,1	99,0	4,8		
118	6,80	0,4	2,0	0,1	6,3	0,028	78,7	11,2	322,9	88,3	5,0		
119	7,45	0,3	5,0	0,1	5,5	0,022	82,8	10,0	353,4	97,5	5,5	112,0	694,0
120	6,89	0,2	3,1	0,1	5,5	0,020	84,9	11,2	335,5	95,7	6,3	103,0	297,0
121	6,98	0,2	6,9	1,1	4,6	0,018	95,3	11,0	309,8	102,6	6,0	43,3	297,0
122	7,62	2,6	11,2	1,5	3,8	0,021	111,8	12,0	362,0	88,9	6,0	38,7	123,0
123	7,58	2,4	5,1	0,1	6,8	0,024	113,9	12,0	345,5	84,7	6,3	6,8	243,0
124	7,13	1,2	6,1	0,1	4,9	0,017	116,0	13,0	459,3	75,1	6,5	6,1	97,2
125	7,08	3,3	7,8	0,7	6,9	0,022	116,0	12,0	401,3	70,9	6,5	18,7	197,0
126	6,96	1,9	7,7	0,2	4,9	0,017	101,5	14,0	363,7	73,7	6,3	17,7	100,0
127	7,01	3,3	6,5	0,2	7,9	0,011	116,0	13,0	154,4	79,5	7,5		194,0
128	7,01	3,3	6,5	0,2	7,9	0,011	116,0	13,0	154,4	79,5	9,1		145,0
129	7,56	2,0	6,0	0,0	8,8	0,013	116,0	13,0	204,2	88,7	8,0		188,0
130	7,34	2,8	7,5	0,1	9,3	0,012	116,1	12,8	136,4	94,1	7,3		259,0
131	6,97	3,0	7,4	0,1	8,9	0,017	110,5	13,9	287,6	93,5	7,4		171,0
132	7,06	1,7	5,9	0,1	9,0	0,017	117,9	93,4	143,5	96,5	7,2		192,0
133	6,86	1,4	5,9	0,7	4,5	0,014	101,7	15,2	244,4	71,9	8,0		83,3
134	7,57	2,8	5,4	0,1	13,0	0,027	101,7	14,3	282,1	97,6	8,6		340.0
135	7,73	3,6	5,2	0,1	15,2	0,032	109,0	16,7	236,5	109,5	9,0		380.0
136	7,52	3,6	9,0	1,1	13,3	0,038	110,8	20,4	271,2	100,6	9,4		355.0
137	7,57	2,4	7,0	0,3	19,0	0,014	112,6	21,2	366,4	115,5	10,3		473.0
138	7,23	3,5	3,7	0,1	13,4	0,039	103,5	19,9	369,4	100,1	10,7		197.0

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

NE Dairy Effluent

141	7.09	4.4	3.8	0.2	15.6	0.071	107.1	19.9	321.3	101.2	11.1
142	7.29	3.9	5.6	0.1	16.3	0.042	110.8	20.7	298.7	95.9	11.2
143	5.72	4.2	1.9	0.1	24.6	0.008	117.9	20.8	356.0	108.5	13.5
144	5.84	3.8	9.6	0.1	19.6	0.020	125.9	22.3	331.3	102.1	12.6

144.6

AVERAGE VALUES FOR DAIRY EFFLUENT

ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K
2.1	10.53	1.77	6.62	0.024	61.3	11.9	292.3	80.6	8.0

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

NW Dairy Effluent

ORIGINAL DATA FOR DAIRY EFFLUENT

R SAMPLE	PH	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
29	7.24	2.4	4.5	0.2	0.9	0.007	5.6	7.5	105.5	38.8		1	63.7
30	9.22	1.0	4.4	0.1	0.0	0.010	5.6	4.5	89.1	23.4		10.1	86.1
31	7.94	1.9	3.3	0.1	0.0	0.000	0.0	4.5	81.6	23.5		8.9	117.0
32	7.53	1.5	2.8	0.1	0.0	0.000	0.0	5.0	87.0	23.8		10.9	79.8
34	7.55	0.0	5.5	0.0	0.0	0.000	0.0	4.5	103.0	26.5		11.4	69.4
35	7.98	0.2	8.1	0.2	0.0	0.000	22.5	5.0	157.4	56.0		11.6	136.2
48	7.60	1.6	10.9	0.2	0.8	0.033	3.8	5.5	90.0	20.6		2.3	45.8
49	7.75	1.5	13.1	0.1	0.8	0.049	3.8	7.0	96.0	21.7		2.1	27.4
50	7.80	1.0	11.3	0.1	0.6	0.045	5.7	5.0	0.0	0.0		1.9	25.4
52	7.85	1.2	28.4	0.0	0.6	0.066	5.7	0.6	127.7	28.4		2.1	32.5
65	7.53	0.7	6.9	1.1	0.1	0.012	9.8	5.0	82.4	15.7		1.3	23.4
68	8.02	0.2	6.4	1.1	0.6	0.010	4.9	5.3	71.4	13.1		1.3	20.2
69	8.03	0.2	5.5	0.7	0.0	0.010	4.9	4.0	71.4	13.9		0.3	24.9
70	7.53	0.3	1.2	0.6	1.1	0.012	7.8	4.3	73.5	15.4		6.3	19.8
71	7.63	0.4	3.9	0.7	0.9	0.027	5.9	4.0	73.5	14.6		1.1	19.8
72	7.52	0.6	4.6	0.0	0.7	0.021	5.9	3.8	79.0	16.6		0.9	24.5
73	7.36	0.4	4.0	0.0	0.6	0.011	5.9	4.5	79.0	17.5		1.0	14.8
74	7.86	0.4	6.4	0.0	0.9	0.021	5.9	4.3	70.6	15.4		9.1	49.0
75	7.49	0.2	4.8	0.0	0.2	0.016	5.9	3.8	69.9	15.4		1.5	28.6
76	7.38	0.2	5.4	0.0	0.4	0.038	7.8	4.0	69.9	15.4		2.2	5.0
77	7.76	0.2	5.0	0.0	0.2	0.020	7.8	5.0	82.4	18.3		1.4	19.8
78	7.72	1.1	4.4	0.0	0.0	0.023	7.8	5.5	88.2	19.3		1.6	26.8
79	7.39	1.6	3.3	0.0	0.0	0.028	7.8	5.0	81.1	20.9		1.3	24.5
80	7.22	2.5	3.1	0.1	0.0	0.044	7.8	5.5	81.1	22.1		1.2	34.1
81	7.69	2.9	2.6	0.1	0.0	0.038	7.8	6.0	88.6	24.8		0.6	24.5
82	7.41	1.8	2.0	0.1	0.0	0.030	7.8	6.0	109.0	24.8		1.0	28.5
83	7.36	1.2	1.9	0.1	0.8	0.040	5.9	6.0	135.5	26.2		1.5	25.5
84	7.32	1.6	2.4	0.1	0.0	0.027	7.8	6.0	135.0	28.8		1.7	20.0
85	7.56	1.6	2.2	0.2	0.0	0.056	9.8	6.0	122.1	26.5		0.3	19.8
86	7.71	1.2	2.4	0.3	0.0	0.021	17.6	6.3	132.1	30.1		0.5	29.9
87	7.33	2.0	5.4	0.4	0.0	0.033	19.6	7.0	143.6	30.1		1.3	34.0
88	7.52	1.8	2.7	0.7	0.0	0.054	23.5	6.3	126.0	31.4		1.9	24.0
95	7.71	0.1	0.7	0.1	0.9	0.009	25.5	2.5	141.9	32.6		8.5	102.1
100	7.87	0.1	0.3	0.1	0.6	0.026	24.5	3.8	122.7	30.2		283.2	186.4
101	7.64	0.2	1.8	0.1	0.5	0.009	15.1	5.0	123.9	31.3		12.2	50.2
106	7.77	1.9	1.4	0.0	0.4	0.014	22.6	9.4	142.7	36.6			90.4
107	7.32	1.5	0.9	0.0	0.7	0.028	19.8	8.0	125.0	34.2			96.6
108	7.42	1.7	1.3	0.0	0.4	0.028	18.9	8.0	141.2	34.8		17.6	78.0
109	7.04	1.9	4.4	0.1	0.6	0.017	3.1	10.0	164.4	33.5			117.0
110	7.11	3.4	6.4	0.0	0.6	0.026	28.7	10.0	151.7	32.4			121.0
111	7.48	2.2	5.1	0.0	0.5	0.018	28.7	7.2	173.3	34.6			117.0
112	7.00	0.3	2.8	0.0	1.3	0.024	28.7	7.2	157.4	33.6			
113	7.08	0.7	7.1	0.0	1.1	0.000	31.8	9.4	160.3	34.6			
114	5.82	1.6	4.5	0.0	0.9	0.018	35.6	10.0	164.6	35.1			
115	5.81	2.4	2.0	0.1	0.5	0.030	42.4	8.0	295.1	54.2			99.2
116	5.64	2.5	6.4	0.0	0.8	0.018	47.6	5.0	190.7	47.2			
117	7.21	2.2	2.4	0.0	0.2	0.021	45.6	9.4	197.8	42.7	1.0		69.4
118	7.06	1.3	1.9	0.0	0.1	0.022	47.6	9.4	212.2	49.0	2.0		
119	7.46	2.1	3.4	0.1	0.3	0.027	51.8	10.0	219.4	49.5	1.3	10.0	79.3
120	7.15	2.0	2.5	0.0	0.5	0.022	58.0	11.2	205.0	51.1	1.4	8.9	297.0
121	7.00	1.6	4.6	0.1	0.0	0.018	64.2	7.0	198.9	56.1	1.5	5.3	297.0
122	7.86	1.2	7.6	0.1	0.0	0.021	82.8	9.0	195.7	77.7	2.0	5.3	49.2
123	7.43	1.0	4.0	0.1	0.7	0.017	93.2	9.0	220.9	51.6	2.5	3.8	
124	7.69	2.4	7.8	0.1	0.0	0.017	84.9	10.0	295.5	53.9	2.0	1.3	38.8
125	7.17	1.4	9.2	0.1	0.8	0.022	101.5	10.0	307.1	50.4	2.0	3.7	29.6
126	7.14	0.9	9.4	0.1	0.7	0.017	107.7	10.0	302.1	57.3	2.3	1.9	40.0
127	7.11	1.3	10.1	0.1	0.1	0.017	101.5	9.0	135.2	56.6	2.1	1.4	43.7
128	7.48	1.6	15.1	0.1	0.0	0.013	101.5	10.5	136.4	56.9	2.8	1.7	58.3
129	7.59	1.7	18.5	0.1	5.3	0.017	103.5	10.0	218.3	54.4	2.0	1.5	37.6
130	7.70	2.0	15.2	0.1	0.2	0.022	95.5	9.0	129.2	56.7	2.0	1.0	37.7
131	7.15	4.1	18.6	0.1	0.1	0.019	97.4	9.4	158.1	58.2	2.0	0.7	39.2
132	7.48	2.5	23.2	0.1	0.2	0.032	99.2	10.9	162.9	58.4	2.0	1.7	34.5
133	7.06	2.2	17.9	0.2	0.7	0.059	90.8	13.7	267.2	59.3	2.3	1.7	34.5
134	7.86	1.6	26.1	0.2	0.2	0.012	83.5	16.2	167.9	62.0	1.8	0.6	34.0
135	7.92	1.9	34.1	0.2	0.6	0.032	85.3	20.5	194.0	61.0	1.9	0.9	19.0
136	7.83	1.4	63.1	0.2	1.3	0.049	105.5	25.9	205.4	62.5	2.0	1.5	33.1
137	7.64	4.1	107.3	0.2	0.8	0.050	127.1	30.4	248.4	64.6	2.1	1.1	

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

NW Dairy Effluent

138	7.66	1.6	145.8	0.2	1.1	0.050	150.7	37.8	257.7	71.5	2.5	1.1
141	7.17	0.8	51.0	0.2	0.5	0.044	148.9	40.0	244.4	68.7	2.0	
142	7.71	2.2	55.2	0.2	0.8	0.044	147.1	44.8	252.4	66.3	2.1	
143	7.05	0.8	100.4	0.2	0.8	0.028	175.9	47.2	282.8	73.9	2.0	
144	6.92	1.6	111.2	0.2	0.0	0.028	205.9	49.1	278.0	75.9	2.5	

AVERAGE VALUES FOR DAIRY EFFLUENT

ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K
1.4	15.13	0.30	0.50	0.025	45.5	10.4	152.1	38.5	2.7

Table 6 (continued). NUTRIENT, BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

SE Dairy Effluent

ORIGINAL DATA FOR DAIRY EFFLUENT

SAMPLE	PH	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
1	6.95	1.4	60.8	1.1		0.027	12.0	4.0	88.0	32.0			77.0
4	6.70	2.1	40.5	0.1	0.0	0.029	14.8	4.5	86.0	31.8			77.8
10	7.00	2.4	3.3	0.1	0.5	0.000	7.4	5.0	89.2	30.8		1.0	63.6
11	7.35	3.0	3.1	0.0	0.4	0.240	7.4	5.2	92.0	33.5		1.0	59.6
12	7.50	4.0	5.2	0.2	0.2	0.030	7.4	5.5	87.5	36.0		1.0	72.8
13	7.60	2.4	3.5	0.2	0.2	0.005	9.3	5.4	92.5	35.5		1.0	66.2
14	7.55	3.5	8.8	0.3	0.3	0.010	9.3	5.0	95.6	37.5		1.0	53.0
15	7.50	3.0	7.8	0.4	0.5	0.080	5.6	5.0	96.0	36.6		1.0	85.5
16	7.50	2.5	4.4	0.3	0.5	0.050	9.3	4.5	98.4	38.9		1.0	85.5
17	7.30	3.5	3.2	0.3	0.6	0.020	8.5	4.6	99.5	39.5		1.0	80.1
18	7.30	3.7	3.2	0.3	0.8	0.030	9.3	4.4	123.7	41.6		1.0	70.8
19	7.40	3.4	2.8	0.2	1.0	0.010	9.3	4.0	144.5	42.7		2.5	70.8
20	7.90	1.4	3.3	0.3	1.0	0.010	13.1	4.8	103.0	45.4		4.9	90.4
21	7.97	0.8	3.1	0.2	0.8	0.020	12.2	4.6	125.9	49.2		68.4	85.1
22	7.73	2.7	2.8	0.2	0.3	0.020	14.9	4.6	154.4	49.3		7.1	95.8
24	7.40	3.0	3.7	0.2	0.7	0.030	18.7	4.6	189.2	49.8		6.6	101.8
25	8.00	3.4	4.9	0.2	0.7	0.020	19.6	4.8	144.5	50.8		11.1	117.1
26	8.01	1.9	7.8	0.0	0.8	0.020	16.9	5.0	144.6	51.2		11.7	122.4
30	7.87	1.5	5.1	0.3	0.6	0.018	20.5	5.5	152.5	49.9		12.3	136.8
31	8.06	2.9	4.5	0.2	0.6	0.008	20.6	5.4	110.0	51.9		15.5	147.3
34	8.04	2.7	7.5	0.2	0.3	0.008	18.7	5.2	131.8	52.9		22.4	143.0
35	8.18	2.0	7.3	0.3	0.3	0.009	9.4	4.5	146.0	43.8		4.1	93.2
36	7.59	1.9	4.8	0.3	0.5	0.010	16.9	6.0	163.6	55.2		19.0	136.2
37	7.65	3.7	4.7	0.2	0.7	0.010	16.9	6.0	226.4	59.2		21.4	154.2
38	7.27	3.6	7.6	0.3	1.3	0.010	18.7	6.8	178.2	61.4		24.7	127.8
39	7.98	4.1	9.2	0.2	0.9	0.009	27.6	6.4	226.4	59.2		25.3	137.2
40	7.51	4.0	10.5	0.3	1.5	0.009	30.4	8.6	212.7	60.3		21.7	144.1
41	7.36	3.3	12.4	0.3	0.9	0.009	37.1	8.0	242.6	66.0		23.5	112.3
43	7.16	4.5	11.6	0.5	1.3	0.010	36.1	7.0	204.3	51.6		11.5	100.0
44	7.76	4.9	7.1	0.4	1.9	0.018	45.6	15.0	187.8	47.3		12.1	96.4
45	7.31	2.1	7.3	0.4	1.7	0.029	45.6	8.0	202.8	49.2		10.9	83.2
46	7.36	2.6	7.7	0.3	0.9	0.018	47.5	10.0	167.2	40.2		12.7	83.2
47	7.40	2.3	14.6	0.2	0.9	0.021	47.5	10.5	167.2	40.5		16.0	76.7
48	7.40	3.2	8.1	0.2	0.9	0.018	49.4	10.0	189.5	45.6		7.2	78.0
49	7.42	4.1	6.7	0.1	1.1	0.022	47.5	11.5	176.5	39.6		8.4	73.2
50	7.50	4.2	8.1	0.1	1.5	0.031	45.6	8.8	178.2	42.3		10.1	81.6
51	7.48	3.1	11.3	0.1	1.1	0.030	47.5	9.0	142.7	41.4		6.3	78.2
52	7.49	2.4	13.7	0.2	1.3	0.030	53.4	9.4	141.9	43.2		7.8	73.2
55	7.55	0.5	19.2	0.7	0.4	0.041	55.5	7.5	140.8	45.5		3.1	62.0
61	7.34	2.8	9.7	1.7	0.6	0.005	47.0	9.3	179.2	36.1		2.5	61.5
63	7.04	4.7	6.4	1.3	1.1	0.066	37.2	13.1	153.7	32.5		3.9	61.9
64	6.93	9.0	8.6	1.1	1.3	0.036	45.0	8.1	166.3	34.9		2.5	76.6
65	6.97	6.8	9.6	1.6	1.1	0.007	37.2	8.7	156.1	32.2		4.0	65.5
66	6.97	5.8	8.1	1.2	0.9	0.033	41.1	7.5	170.3	34.0		4.9	54.9
68	7.36	2.8	4.6	0.8	0.6	0.020	36.7	8.1	160.8	31.9		1.2	50.6
69	7.73	3.8	5.5	1.0	0.6	0.025	39.2	7.3	149.0	30.1		1.8	54.8
70	7.38	3.4	6.5	1.3	0.6	0.005	45.0	8.5	150.7	34.1		2.5	64.5
71	7.45	4.5	7.5	1.1	0.7	0.013	43.1	7.0	141.7	32.3		2.5	68.6
72	7.81	1.3	7.4	0.1	1.0	0.016	41.1	7.5	139.2	31.2		3.5	58.8
73	7.81	5.3	5.3	0.1	0.8	0.021	45.0	7.0	134.2	32.0		4.9	64.0
74	7.61	3.6	5.3	0.1	0.4	0.024	42.0	7.7	124.9	28.0		4.1	53.9
75	7.82	2.4	4.4	0.0	0.4	0.018	43.1	8.8	121.2	27.0		4.3	66.6
76	7.82	3.7	4.3	0.0	1.5	0.012	45.0	9.0	123.4	27.8		5.8	44.6
77	7.18	1.6	2.7	0.0	0.9	0.013	45.0	9.7	137.6	33.7		5.5	54.6
78	7.14	1.2	2.7	0.0	0.4	0.028	41.1	10.7	112.0	30.4		6.4	64.5
79	7.05	2.9	3.7	0.0	0.9	0.023	39.2	12.5	131.3	32.0		5.8	68.6
80	6.94	1.0	2.0	0.0	0.4	0.023	37.2	10.7	115.4	30.1		6.4	63.4
81	7.44	3.5	2.3	0.1	0.4	0.026	37.2	11.0	113.6	32.5		3.6	48.0
82	7.15	3.1	2.8	0.1	0.6	0.009	35.2	12.3	131.6	30.9		4.5	52.3
83	6.97	2.5	3.9	0.1	0.6	0.006	47.0	13.7	166.6	34.1		3.0	61.1
84	6.98	2.0	5.4	0.0	0.6	0.021	43.1	18.0	143.2	32.6		6.6	50.0
85	7.01	0.7	5.3	0.1	1.0	0.009	54.8	13.5	155.1	36.0		2.8	49.6
86	7.55	2.5	5.0	0.1	0.1	0.006	54.8	13.5	156.9	34.2		3.0	59.8
87	7.15	3.1	6.6	0.1	1.3	0.021	70.5	14.5	188.0	40.4		13.3	77.8
88	7.15	3.5	3.1	0.0	0.4	0.028	72.4	15.5	145.1	40.2		7.8	57.6
89	7.52	3.8	0.8	0.1	1.6	0.034	73.5	17.0	158.3	40.5		4.9	89.3
90	7.87	4.9	1.7	0.1	2.1	0.034	76.3	15.0	162.0	41.9		8.6	79.9

Table 6 (continued). NUTRIENT BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

SE Dairy Effluent

91	7,87	3,4	6,3	0,2	1,2	0,027	72,5	17,5	140,8	35,3		6,7	92,4
92	6,98	3,0	6,9	0,1	1,2	0,009	68,7	22,5	150,9	44,1		6,8	64,5
93	6,98	3,0	5,5	0,2	1,3	0,009	76,3	21,2	158,2	41,7		6,1	78,4
94	8,94	4,5	7,5	0,1	1,9	0,003	70,8	22,5	132,2	39,5		8,5	98,4
95	7,05	5,3	6,2	0,1	1,8	0,028	74,6	21,0	138,4	39,8		5,8	82,6
96	7,10	2,1	10,2	0,1	1,7	0,023	71,7	17,5	138,0	39,8		5,6	67,8
97	7,23	3,0	8,5	0,1	2,1	0,032	76,5	15,0	155,1	45,7		6,6	81,3
98	7,71	2,6	5,3	0,1	2,1	0,023	73,6	22,5	142,6	53,2		7,6	71,4
99	6,86	2,1	2,4	0,1	2,1	0,043	83,1	17,5	151,8	41,9		8,4	88,9
103	6,97	3,2	0,5	0,1	2,9	0,015	73,2	20,0	153,9	44,3		2,5	119,8
104	7,68	3,6	4,8	0,1	1,6	0,027	72,6	25,0	146,5	37,5		7,2	92,3
105	7,55	4,1	6,7	0,2	2,1	0,016	74,5	25,0	167,3	43,6			118,2
106	7,22	2,3	1,4	0,0	2,2	0,017	77,3	21,2	172,0	45,7			123,8
107	7,32	2,5	1,6	0,0	3,0	0,031	79,2	21,2	172,7	46,9			143,6
108	7,02	2,8	1,7	0,0	2,8	0,031	77,8	23,1	184,7	45,7			144.0
109	6,82	3,3	5,0	0,2	2,3	0,008	86,1	31,2	170,4	40,2			127.0
110	6,88	3,4	6,2	0,1	2,1	0,023	86,1	29,7	182,0	45,7			111.0
111	6,64	0,9	6,0	0,0	3,1	0,036	91,9	25,0	177,6	53,6			147.0
112	6,87	4,8	4,5	0,0	2,8	0,024	91,9	23,1	210,1	41,1			
113	7,03	3,9	6,6	0,0	1,1	0,027	88,0	27,5	189,3	40,4			122.0
114	6,55	2,9	8,7	0,0	3,4	0,053	84,3	29,7	216,1	38,4			
115	6,66	2,6	2,4	0,0	3,4	0,036	90,1	27,5	195,2	39,9			124.0
116	6,54	2,6	1,8	0,0	3,6	0,027	95,3	25,0	219,4	57,7			
117	7,04	2,8	4,4	0,0	3,9	0,028	97,3	29,7	233,9	57,0	10,5		173.0
118	6,84	3,0	2,6	0,1	4,0	0,029	101,5	31,2	530,3	57,1	10,4		
119	7,12	3,2	2,4	0,0	3,3	0,024	97,3	31,2	207,4	53,8	10,3		163.0
120	7,10	3,3	2,9	0,1	3,3	0,027	103,5	31,2	238,7	59,4	11,0		297.0
121	6,82	3,3	5,9	0,1	4,1	0,030	103,5	32,0	208,2	68,6	10,3		297.0
122	6,93	3,5	9,0	0,1	3,3	0,028	107,6	34,5	160,1	71,8	10,6		123.0
123	7,14	2,0	2,8	0,1	3,3	0,024	116,0	37,0	217,2	61,1	10,8		
124	7,41	3,1	9,3	0,0	2,5	0,022	118,0	39,5	267,6	57,0	10,8		97.2
125	6,95	3,5	5,1	0,1	3,8	0,017	128,4	39,5	267,6	57,0	10,7		197.6
126	7,00	2,8	6,4	0,1	3,5	0,022	145,0	46,5	313,9	57,3	11,9		100.0
127	6,79	1,4	6,4	0,1	3,9	0,024	153,2	47,0	195,3	61,7	11,3		194.4
128	7,01	2,7	7,2	0,1	4,1	0,024	155,3	46,5	158,8	65,2	14,0		145.8
129	7,61	2,5	12,2	0,1	3,0	0,024	151,2	46,5	153,2	62,7	10,8		188.8
130	7,41	3,6	9,5	0,1	3,7	0,027	144,2	44,5	156,9	65,2	10,3		259.6
131	6,92	5,0	17,4	0,1	3,2	0,043	132,9	46,6	215,7	68,8	11,2		171.5
132	7,19	0,9	21,0	0,1	3,6	0,012	153,5	44,9	172,8	64,5	9,4		192.7
133	6,87	3,5	13,9	0,1	3,5	0,017	159,8	46,8	309,9	66,6	11,0		
134	7,79	3,1	19,3	0,1	2,8	0,027	163,4	51,1	216,9	63,6	9,0		
135	7,69	1,1	25,0	0,2	3,6	0,017	176,0	54,4	239,1	65,5	9,2		
136	7,61	3,1	124,6	0,2	3,6	0,056	239,7	74,9	286,3	83,3	11,1		
137	7,50	1,9	82,8	0,2	3,6	0,063	190,7	61,8	244,4	65,2	9,7		
138	7,21	1,7	105,2	0,3	4,2	0,042	214,3	64,2	256,4	69,4	10,3		
141	7,26	1,6	38,9	0,2	3,3	0,078	219,7	64,4	259,1	67,4	10,4		
142	7,35	2,5	83,1	0,3	4,1	0,000	228,8	68,4	265,8	70,6	11,6		
143	6,75	2,5	73,3	0,3	4,4	0,028	253,9	68,9	263,1	72,1	11,3		
144	6,74	2,7	70,1	0,3	4,2	0,042	265,9	73,7	279,4	77,4	12,0		

AVERAGE VALUES FOR DAIRY EFFLUENT

ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K
3,0	11,86	0,48	1,70	0,025	70,8	20,2	172,4	46,6	10,4

Table 6 (continued). NUTRIENT BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN PPM.

SW Dairy Effluent

ORIGINAL DATA FOR DAIRY EFFLUENT

T SAMPLE	PH	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
1	7.00	1.4	48.4	0.3	0.0	0.040	14.8	4.3	77.0	37.0			55.5
4	5.80	1.5	28.5	0.0	0.0	0.040	14.8	4.5	80.0	42.5			54.0
10	7.30	1.8	2.2	0.0	0.5	0.026	6.5	5.0	88.0	41.5		0.5	42.4
11	7.55	2.7	2..	0.0	0.5	0.025	5.6	5.0	88.5	38.0		0.5	53.0
12	7.38	5.1	7.	0.1	0.0	0.028	7.4	5.0	92.5	35.6		0.5	46.3
13	7.65	2.0	4.1	0.1	0.0	0.022	7.5	5.5	90.5	36.2		0.5	132.4
14	8.05	2.2	10.5	0.2	0.0	0.016	7.9	4.8	90.2	38.3		0.5	46.3
15	7.70	1.3	24.2	0.3	0.2	0.034	13.1	4.5	90.8	38.8		0.5	56.8
16	7.95	3.0	16.8	0.2	0.1	0.022	11.2	4.2	93.0	38.9		0.5	59.2
17	7.40	2.7	11.1	0.1	0.0	0.020	9.7	3.8	95.5	40.8		0.5	49.3
18	7.45	2.5	8.2	0.1	0.5	0.020	9.3	3.7	93.0	42.2		0.5	51.5
19	7.40	2.7	5.7	0.1	0.0	0.240	9.3	4.4	123.0	32.2			51.5
20	7.92	3.0	6.4	0.1	0.0	0.030	9.4	4.2	101.6	32.6			64.6
21	8.11	1.5	5.4	0.1	0.5	0.010	8.4	4.2	110.6	34.2		2.4	53.4
22	7.95	1.9	4.2	0.3	0.3	0.020	9.4	4.3	123.0	35.6		4.5	69.2
24	7.43	2.4	2.5	0.4	0.0	0.020	11.2	4.1	155.1	41.8		6.1	58.5
25	7.82	2.5	2.9	0.4	0.0	0.010	9.4	4.1	130.8	41.2		5.6	85.5
26	8.02	2.7	4.2	0..	0.3	0.040	11.2	3.8	99.3	39.3		5.8	85.1
30	8.20	2.2	5.0	0.2	0.3	0.016	9.4	4.4	85.0	40.3		5 7	94.7
31	8.19	2.2	3.4	0.2	0.6	0.0 3	11.2	4.2	66.2	41.5			
34	8.30	1.9	6.5	0.3	0.0	0.028	5.6	4.2	76.9	43.5			
35	7.95	1.2	4.5	0.1	0.0	0.0 5	5.6	4.7	101.6	25.8			
36	7.90	2.9	3.0	0.1	0.2	0.0 0	7.5	4.3	142.2	46.4			
37	7.85	2.0	3.1	0.2	0.2	0.0 5	7.5	4.2	136.2	46.0			
38	7.36	3.2	5.5	0.2	0.2	0.017	9.4	4.5	292.2	45.3			
39	7.59	3.4	6.7	0.1	0.0	0.010	10.1	4.2	170.7	45.6			
40	7.79	3.1	9.8	0.5	0.2	0.018	18.0	8.0	180.7	48.3			
41	7.41	2.2	11.1	0.3	0.2	0.020	22.8	5.5	165.8	43.6			
43	7.28	4.3	18.6	0.4	1.1	0.016	38.0	5.0	161.0	40.6			
44	7.82	2.3	39.0	0.4	0.6	0.029	55.1	5.5	163.7	42.0			
45	7.46	2.2	20.3	0.4	0.9	0.011	58.9	7.0	157.9	38.1			
46	7.45	2.3	20.3	0.4	0.4	0.033	65.6	6.3	157.1	37.1			
47	7.50	2.6	25.2	0.2	0.6	0.039	45.6	5.5	152.6	31.2			
48	7.55	2.1	20.5	0.1	0.2	0.036	60.8	10.5	144.7	33.4			
49	7.50	2.6	19.8	0.2	0.2	0.018	68.4	8.0	147.2	34.5			
50	7.52	3.7	17.0	0.2	0.2	0.011	62.7	8.0	132.3	34.4			
51	7.62	3.5	15.8	0.2	0.2	0.010	66.5	8.5	138.9	33.6			
52	7.62	2.7	25.6	0.2	0.2	0.018	72.4	11.2	148.0	32.7			
61	7.51	2.8	11.4	0.3	0.1	0.023	88.1	10.6	174.4	35.9			
63	7.05	5.0	9.5	0.8	0.6	0.0 7	78.3	10.0	172.7	35.9			
64	7.02	7.9	10.2	0.7	0.6	0.099	78.3	10.6	171.1	35.9			
65	7.00	4.7	8.5	4.5	0.6	0.015	62.6	8.5	143.7	31.9			
66	7.88	7.3	6.	3.4	0.6	0.028	62.6	9.0	160.8	31.9			
69	8.18	2.3	4.2	2.5	0.6	0.0 1	858.7	7.5	138.3	28.7			
69	7.95	3.2	5.1	1.3	0.4	0.0 5	51.4	7.2	118.8	25.6			
70	7.20	2.6	6.7	1.7	0.6	0.0 5	52.8	7.2	112.3	25.8			
71	7.42	4.7	4.6	1.3	0.7	0.0 2	14.9	0.6	117.7	27.4			
72	7.13	2.1	5.0	0.1	1.2	0.011	58.7	8.0	129.3	30.2			
73	7.02	1.3	4.4	0.1	0.7	0.013	66.6	10.0	133.6	32.2			
74	7.78	4.3	5.5	0.2	0.4	0.011	60.7	7.2	115.4	27.7			
75	7.06	2.6	6.0	0.2	0.5	0.018	52.8	7.2	115.4	27.3			
76	7.02	3.5	6.4	0.2	1.3	0.028	58.7	8.5	114.9	28.2			
77	7.26	1.0	5.3	0.5	0.4	0.015	52.8	9.0	112.0	32.2			
78	7.13	1.4	5.7	0.2	0.2	0.029	35.2	8.3	98.6	26.9			
79	7.09	2.0	5.8	0.4	0.2	0.023	45.0	9.7	114.7	32.3			
80	5.90	1.4	6.5	0.7	0.1	0.026	48.9	10.5	109.3	33.0			
81	7.61	4.6	6.5	1.5	0.2	0.032	50.9	12.0	118.8	37.7			
82	7.14	2.9	8.7	1.3	0.2	0.027	60.7	14.0	157.3	40.0			
83	7.06	2.2	10.1	1.8	0.9	0.040	60.5	16.3	175.4	40.4			
84	7.03	2.0	10.5	1.6	0.4	0.050	60.7	17.0	174.6	44.2			
85	7.12	2.9	7.	1.6	0.5	0.021	66.6	18.0	183.6	48.0			
86	7.77	1.4	5.	1.6	0.3	0.018	70.5	18.5	179.2	42.2			
87	7.33	0.8	5.9	1.8	1.1	0.021	74.4	21.5	188.9	44.1			
88	7.27	3.1	3.9	1.2	1.2	0.039	78.4	22.0	148.0	42.5			
89	7.25	3.0	2.7	0.2	0.8	0.034	75.4	27.5	162.0	43.4			
90	7.10	4.5	3.4	0.6	0.0	0.031	77.3	25.0	180.1	45.1			
91	7.07	2.8	3.8	0.3	1.5	0.027	77.3	28.7	165.7	40.8			

Table 6 (continued). NUTRIENT BOD AND COD CONCENTRATIONS IN BLWRS EFFLUENTS EXPRESSED IN RPM.

SW Dairy Effluent

92	7,06	2,8	4.1	0.4	0.5	0,0 9	79,2	30,0	158,2	43,1				
93	5,95	3,8	2.9	0.2	0.9	0.0 3	79,2	32,5	168,7	47,3				
94	7,01	4,9	3.6	0.4	0.6	0.0 3	83,1	30,5	141,2	44,3				
95	7,20	3,4	3.1	0.1	1.9	0.011	85,9	30,0	149,8	42,8				
96	7,18	1,6	9.2	0.1	1.3	0.015	89,7	28,0	155,1	43,2				
97	7,11	3,0	6.3	0.2	1.1	0.026	90,6	22,5	165,9	47,9				
98	7,94	2,3	8.	0.1	1.3	0.029	89,7	23,6	153,8	46,3				
99	5,97	2,1	3.	0.1	1.5	0.0 4	94,4	25,0	171,1	43,6				
103	5,95	3,4	0.6	0.1	2.9	0.047	87,3	31,0	157,6	43,1		5,0		
104	7,91	1,7	1.9	0.0	0.7	0.047	87,3	31,0	157,6	43,1		6,1		
105	7,76	2,3	4.9	0.1	1.3	0.014	83,0	31,2	171,2	43,4		1 ,6		
106	7,27	3,0	1.4	0.1	2.1	0.014	83,9	33,7	185,6	46,7		7,0	133,0	
107	7,24	2,6	1.4	0.0	1.9	0.028	89,6	33,7	187,2	46,7		11,3	154,0	
108	7,03	3,8	1.4	0.0	3.0	0.041	87,3	31,2	182,3	45,9			137,0	
109	5,90	3,0	4.5	0.1	2.8	0.023	93,8	35,0	189,3	38,1			126,0	
110	5,90	3,1	5.5	0.0	2.3	0.023	86,3	36,2	183,5	40,0			)	
111	7,47	1,7	5.6	0.1	1.9	0.033	93,8	33,7	213,1	41,0			)	
112	7,06	1,1	3.	0.1	3.0	0.034	97,6	29,7	183,5	40,6			82,9	
113	7,21	1,9	6.4	0.0	2.2	0.022	89,9	36,8	200,2	52,4				
114	5,63	2,8	4.8	0.1	2.0	0.030	89,9	37,5	212,2	54,7			99,2	
115	5,74	2,9	2.5	0.0	2.8	0.027	101,5	36,2	180,5	40,0				
116	5,44	3,0	1.5	0.2	2.0	0.028	101,5	39,3	209,8	49,0			94,2	
117	7,08	3,1	4.6	0.2	4.4	0.030	101,5	40,0	217,0	49,4	8,8			
118	5,92	3,6	2.5	0.2	1.4	0.024	101,5	40,0	221,8	51,5	8,5			
119	7,32	3,0	3.5	0.8	0.6	0.027	103,5	42,5	202,6	49,0	8,0	22,7	104,0	
120	7,06	3,0	4.7	0.0	0.6	0.028	103,5	40,0	185,9	49,2	9,4	22,7	148,0	
121	5,90	2,7	9.2	0.2	0.0	0.030	107,7	41,0	113,9	48,5	8,8	6,3	123,0	
122	3,10	2,0	18.5	1.5	0.6	0.028	122,2	44,0	339,3	61,5	9,0	6,3	93,4	
123	7,33	3,4	7.4	0.1	2.0	0.022	128,4	47,8	207,2	55,5	9,3	2,4	102,0	
124	7,67	2,3	8.4	0.5	1.7	0.024	142,9	51,0	288,5	57,3	9,3	1,9	77,7	
125	7,29	2,4	9.2	0.3	2.7	0.022	161,5	54,5	304,3	59,5	9,5	2,9	83,9	
126	7,10	1,9	10.5	0.2	2.3	0.022	163,6	57,0	291,4	60,0	10,0	3,9	80,0	
127	5,94	1,3	14.6	0.3	3.0	0.024	176,0	56,0	195,3	55,3	10,0	4,3	87,4	
128	7,19	1,4	11.2	0.2	2.0	0.022	190,5	63,0	156,9	61,3	11,3	4,4	72,9	
129	7,74	2,8	11.7	0.1	3.5	0.017	200,9	63,5	200,3	62,2	10,3	1,6	70,8	
130	7,72	3,6	25.1	0.7	2.4	0.012	190,9	59,1	182,7	62,2	9,2	1,7	80,0	
131	7,19	2,5	44.9	0.3	2.6	0.019	192,8	58,1	182,7	62,2	10,1	1,6	73,5	
132	7,48	1,4	64.1	0.1	2.0	0.012	219,1	70,1	194,0	70,9	9,2	3,0	64,2	
133	5,99	2,5	30.6	0.1	1.7	0.027	178,3	63,2	224,7	71,5	8,5	,5	78,4	
134	7,63	2,2	61.5	0.1	1.7	0.017	221,6	71,9	294,5	75,5	7,2	1,3	63,1	
135	7,92	3,3	94.8	0.1	2.3	0.035	254,3	89,2	256,4	82,2	8,7	1,6	38,0	
136	7,16	2,4	138.	0.1	2.2	0.044	259,7	92,8	312,8	81,1	9,2	1,6	61,6	
137	7,10	2,0	210.2	0.1	5.6	0.056	265,1	97,6	332,7	86,8	8,7		66,7	
138	7,40	1,9	253.8	0.2	2.8	0.056	292,4	109,5	384,4	87,3	8,7		54,3	
141	7,51	1,9	92.	0.1	2.0	0.014	267,0	104,8	360,4	86,1	8,7			
142	7,18	2,3	141.8	0.1	2.7	0.028	265,1	99,4	311,4	81,7	8,5			
143	5,93	1,7	144.7	0.2	2.8	0.042	303,9	107,2	319,8	63,8	9,0			
144	5,79	1,6	140.2	0.3	3.3	0.014	337,8	113,1	337,1	90,2	9,9			

AVERAGE VALUES FOR DAIRY EFFLUENT

ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K
2.7	28,02	0.43	1,17	0.025	91,1	26,3	168,4	45,3	9.7

Table 7. AMOUNTS OF NUTRIENTS APPLIED IN WASTES TO THE BLWRS EXPRESSED IN GRAMS.

Swine Waste

SWINE SAMPLE	BARNS, ORGN	SAMPLE E NO3	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
2	3942,8	85,49	3090,7	470,59	1490,6	830,9	811,4	212,8			
4	474,7	10,55	444,1	28,80	154,0	116,3	112,8	44,7			
5	3057,6	88,39	2129,1	138,63	941,7	540,5	509,4	249,3			
6	2983,8	123,79	2826,9	386,65	941,7	646,1	775,0	379,0			
7	5429,6	128,45	2102,4	280,45	882,7	501,1	581,2	284,3			
8	3395,1	98,14	2914,5	572,75	1331,0	751,3	1515,2	494,1			4876,0
9	5352,7	81,93	2329,4	282,35	1049,9	530,7	647,9	347,9			2968,0
10	2036,1	200,00	2848,7	324,37	1322,1	640,3	926,1	505,9			2438,0
11	1753,8	89,31	2234,6	385,37	452,9	380,5	628,8	334,0		1335,0	2754,0
12	238,6	43,13	409,0	55,51	194,1	57,3	75,9	47,9		1264,5	2244,0
13	1400,3	15,09	1201,9	225,12	669,6	357,7	341,2	136,1		1636,2	2912,8
14	2046,0	19,37	1917,1	92,42	1091,3	503,7	429,9	186,1			
15	2692,9	34,72	2391,9	126,47	1605,4	626,4	691,4	261,3			
16	2082,6	31,12	1747,3	161,36	1293,9	508,2	603,7	224,2			
17	1284,2	22,45	1113,5	100,02	508,8	251,4	276,7	118,5			1800,0
18	4296,6	71,01	3630,3	162,18	1769,7	808,4	779,8	270,6		1366,3	1930,0
19	2605,5	32,02	2464,9	118,49	1622,3	520,0	690,1	248,9		1321,3	1940,0
21	2350,2	24,39	2227,9	125,42	1548,8	496,6	741,2	310,7			943,7
22	3275,6	33,11	2999,2	167,23	1966,7	662,2	1153,8	542,9		1220,0	1276,8
23	2182,4	34,21	1888,4	82,35	1345,2	489,7	897,5	397,9			1383,2
24	3283,9	44,31	2692,0	108,67	2020,1	739,9	647,4	415,4		1230,0	1276,8
25	3193,0	34,79	2725,6	91,57	1666,9	626,4	786,0	304,0		1116,4	2128,0
26	3582,6	71,07	3082,4	91,33	1669,9	927,6	790,6	285,4		1056,7	1915,0
27	1983,8	34,23	1635,5	43,97	894,7	554,4	401,4	134,6		924,9	2158,8
28	2398,9	69,35	2362,8	60,74	1008,1	549,2	439,8	144,3		1043,7	2158,8
29	2671,7	53,73	2403,4	74,41	956,4	623,0	448,1	97,5		1280,4	2940,0
30	3662,1	51,85	3156,7	66,74	1300,2	895,2	720,5	224,1		1160,2	3497,0
31	3901,0	49,09	3139,0	61,49	1488,3	953,9	449,6	201,6		1115,9	3050,8
36	4036,5	47,84	3229,4	103,76	1261,5	977,0	678,5	220,3		1018,0	1609,9
37	4963,4	64,19	4087,0	88,44	1568,1	971,5	538,0	149,4		1497,0	3042,8
38	5383,4	82,34	4877,2	69,11	1421,4	1063,0	556,1	203,8		1489,9	2437,2
39	3584,3	58,65	2678,1	16,67	956,3	698,4	298,9	133,2		1445,0	2129,9
42	4145,0	55,61	3663,8	36,86	959,4	692,3	447,7	177,7		1222,0	2038,4
51	680,6	5,32	276,7	8,61	139,7	99,3	63,5	27,3		1211,9	2336,8
77	1959,3	35,33	589,6	22,77	609,4	374,3	137,4	65,8		877,5	2182,0
78	4245,8	45,62	829,1	25,83	1044,7	722,3	308,1	151,9		787,5	1686,4
79	3654,5	35,53	2303,4	34,52	828,0	562,3	191,0	111,8		793,4	2352,0
80	837,8	43,67	3299,3	98,41	1192,9	711,8	264,6	175,3		1002,9	2244,8
81	1455,7	17,81	1248,7	11,79	415,1	286,2	97,5	59,2		885,0	1440,0
82	2369,6	9,95	684,4	11,50	542,6	336,5	106,0	62,0		915,0	1618,4
83	3462,1	23,53	1625,9	23,14	1086,2	659,3	251,1	172,1		872,0	1880,0
84	4806,9	32,27	3171,9	25,76	1575,2	814,0	317,1	208,6		887,0	1200,0
85	2343,6	17,16	995,7	31,71	811,7	406,8	305,5	170,1		730,4	2128,4
86	4224,4	27,94	1913,3	40,52	1530,3	675,5	449,7	282,8		1014,9	2091,6
87	2368,0	37,14	2735,9	56,12	1010,5	425,0	254,3	134,5		829,0	1749,6
88	2194,5	13,02	2704,1	34,64	883,8	416,4	245,2	138,2		888,9	1920,0
89	2596,4	13,68	2362,5	60,05	633,7	352,4	212,6	132,0		1255,5	1974,0
90	2486,3	31,64	2714,4	70,64	877,4	484,7	414,0	106,5		1225,4	1880,0
91	2190,9	23,75	2251,5	59,13	849,4	403,1	385,5	86,3		1091,2	2402,4
92	2820,6	34,77	3092,3	87,64	1052,9	530,9	559,6	114,8		1270,8	2182,4
93	2771,8	31,11	2936,7	38,97	1111,4	480,6	526,6	110,7		1165,7	1960,0
94	1905,1	62,05	2274,5	86,41	887,6	405,3	388,3	202,2		941,2	1968,0
95	2106,6	43,03	2065,6	84,32	810,4	343,4	344,7	165,7		1374,3	1944,0
96	2782,4	132,73	2700,1	97,75	1049,2	489,0	430,4	210,4		1344,3	1645,6
97	2589,9	43,13	2524,4	102,31	1025,0	408,8	445,1	245,2		1463,6	2868,0
98	3131,0	104,92	2997,7	110,85	1398,9	666,9	706,0	326,0		1598,4	3617,6
99	1606,7	25,55	1625,7	30,32	734,4	337,0	319,5	147,0		1479,0	3369,6
100	4013,6	17,06	3662,4	52,60	1975,4	877,0	769,4	319,4		1615,6	3914,4
101	3056,2	15,41	2689,2	71,84	1164,9	723,1	679,8	261,4		1277,8	2610,4
102	2888,4	72,11	2536,6	114,58	1485,7	586,6	859,7	357,1		1247,9	2558,4
103	2336,8	9,22	1901,8	166,88	1323,9	427,2	892,2	493,8		1436,3	3273,6
104	3272,4	14,32	2597,3	241,18	1080,9	634,7	1478,8	587,4	1480,9	1181,9	2624,4
105	2182,1	34,07	1918,0	56,28	626,6	518,2	714,8	376,8	1089,5		2784,0
106	3743,2	9,51	3299,9	158,65	874,8	783,8	1029,3	497,8	1922,4		2475,2
107	2779,0	21,53	2373,8	157,55	885,7	617,0	991,6	417,7	1452,3	1419,0	2668,0
108	3509,5	34,22	3035,2	162,98	1120,7	835,2	1186,2	559,5	1932,7		
109	2048,8	15,34	2120,3	107,90	1002,7	565,7	776,5	331,9	1309,5		3642,0
111	784,0	23,75	818,6	31,76	440,3	226,1	300,3	123,1	467,6		3162,0

Table 7.(continued). AMOUNTS OF NUTRIENTS APPLIED IN WASTES TO THE BLWRS EXPRESSED IN GRAMS.

Swine Waste

112	1928,6	35,75	1801,0	58,95	887,7	472,2	642,8	237,1	1011,8		
113	1607,4	25,77	1121,2	36,76	581,2	427,7	485,9	171,1	883,0		3904,0
114	1414,0	17,43	1227,7	33,55	815,6	487,0	545,6	197,4	1029,7		
115	1099,7	5,52	686,0	29,95	581,6	337,3	443,6	148,4	719,5		
116	1850,6	13,49	1620,2	35,72	960,3	480,6	607,4	201,7	1045,5		
117	1350,6	11,30	1412,1	22,27	635,0	349,5	396,9	141,0	735,9		
118	1365,6	12,49	1502,7	23,78	756,6	358,7	423,0	158,1	744,0		
119	1117,4	14,08	486,5	37,84	687,9	350,2	426,5	160,5	757,3	1134,0	0,0
120	1272,7	11,59	956,8	84,22	1105,1	565,8	767,1	337,8	1244,8	805,0	2976,0
121	684,2	3,63	622,4	33,25	357,2	195,5	258,8	89,8	467,6	1223,0	2952,0
122	1650,4	13,90	1546,3	85,55	894,6	521,2	524,4	198,4	1094,6	0,0	2263,0
123	449,9	3,13	356,0	19,31	214,3	142,6	157,6	62,8	280,5		.1
124	616,8	4,15	435,1	9,76	291,1	160,2	142,3	57,8	342,9		1846,0
125	550,3	4,17	437,8	20,46	317,5	180,9	228,5	66,6	367,9	668,0	2173,0
126	844,2	7,05	706,7	25,10	396,8	227,2	271,5	72,2	479,8	653,0	2600,0
127	945,2	9,38	833,4	26,75	476,2	282,8	248,2	77,8	592,4	775,0	2916,0
128	988,3	9,64	717,0	18,43	546,2	305,6	264,7	126,9	587,7	550,0	2235,0
129	774,9	7,36	658,6	5,59	427,5	219,8	144,6	85,2	441,5	287,0	1888,0
130	1317,3	19,66	1124,0	40,39	858,0	308,8	277,2	120,8	646,0	482,0	2360,0
131	1088,7	2,43	696,8	15,60	361,6	182,1	196,2	54,1	343,4	471,0	1862,0
132	963,9	2,94	870,2	18,91	447,8	231,2	191,9	66,0	472,4	471,0	1679,0
133	935,1	2,62	829,9	15,49	368,7	211,3	155,8	58,1	464,6	554,0	2156,0
134	1234,6	3,82	1089,8	25,95	409,9	269,4	200,1	70,6	561,0	554,0	1944,0
135	903,3	3,31	285,0	17,42	273,6	181,2	157,3	48,0	439,9	627,0	1142,0
136	911,9	5,25	799,3	18,16	282,4	177,0	173,7	56,3	440,4	612,0	1422,0
137	395,1	7,20	346,3	8,23	133,4	82,5	77,2	27,1	195,1		1593,0
141	731,6	4,97	668,2	13,30	264,8	164,1	163,7	61,8	378,4		
142	967,7	10,30	838,9	16,66	376,6	224,4	209,7	84,9	490,6		

SUMS FROM SWINE BARNS, E

TOTAL AMOUNT OF NUTRIENTS IN SAMPLE

TOTAL ORGN	TOTAL NO3	TOTAL NH4	TOTAL PO4	
2,096773+005	3,116044+003	1,732981+005	7,519224+003	
TOTAL CL	**TOTAL NA**	**TOTAL CA**	**TOTAL MG**	**TOTAL K**
8,397243+004	4,431158+004	4,399374+004	1,834892+004	2,604420+004

Table 7.(continued). AMOUNTS OF NUTRIENTS APPLIED IN WASTES TO THE BLWRS EXPRESSED IN GRAMS.

Dairy Waste

DAIRY SAMPLE	BARNS, SAMPLE J ORGN	NO3	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
15	1045,0	15,17	488,3	170,75	784,3	449,8	380,7	134,8			
16	1034,9	13,93	779,4	186,24	797,2	425,8	416,8	168,8			
17	41,4	1,16	34,4	5,71	32,7	15,5	16,1	7,5			1420,0
19	398,6	5,93	324,2	49,45	294,8	145,7	140,5	55,7		917,6	1420,0
20	457,2	8,47	365,2	51,92	396,2	184,0	184,0	73,4		817,0	1550,0
21	286,9	4,21	328,5	21,39	299,5	176,4	146,4	56,7			
22	423,7	5,34	331,0	35,10	399,3	257,2	195,3	79,2			1489,6
23	302,4	5,67	237,5	37,48	231,1	201,1	142,6	55,9			1382,2
24	458,9	5,97	369,6	38,50	365,7	308,3	194,2	80,6			1170,4
26	670,6	22,91	705,5	129,69	570,5	371,8	322,5	139,9		1267,7	2553,6
27	647,9	19,01	613,9	130,72	427,9	320,0	275,5	98,5		1229,2	3085,8
28	970,9	24,38	711,8	108,72	570,5	414,4	355,4	96,8		1149,7	3136,0
29	577,0	24,13	558,4	114,82	394,2	320,0	320,5	98,4		1388,5	4508,0
30	705,0	19,93	541,5	59,84	469,0	286,1	274,1	74,6		1379,2	3576,8
33	269,6	3,37	195,2	20,25	160,2	95,1	103,6	26,2		1395,2	2840,4
34	1143,8	25,60	845,2	173,02	911,6	509,5	585,2	249,5			2524,8
35	862,7	33,82	1024,0	197,14	882,3	370,2	524,4	235,6		697,2	1976,0
37	319,4	3,85	208,2	65,14	535,0	137,1	233,3	110,8		587,5	1768,2
38	445,6	11,55	294,5	68,94	715,0	152,4	311,1	147,7		677,0	1802,3
39	363,6	8,79	201,3	63,35	580,5	91,4	248,3	104,6		729,0	2088,9
47	399,9	5,98	283,5	72,90	421,4	162,0	238,7	85,3		1788,5	3025,1
48	886,1	11,70	495,1	164,43	713,0	288,9	468,5	167,2		1256,0	3702,4
49	652,9	8,34	428,2	98,27	543,0	168,2	325,8	92,0		1327,9	3982,7
51	488,1	7,02	127,1	73,26	756,6	154,6	285,7	84,5		1081,7	3657,6
77	1230,4	34,45	870,6	286,39	555,7	499,7	536,0	180,6		1970,5	3769,6
78	1724,1	53,15	373,8	377,11	555,7	608,7	683,2	225,0		2360,0	4761,6
79	2173,4	29,81	837,5	443,73	694,6	840,3	854,0	277,2		2083,0	4704,0
81	2091,6	39,49	964,8	577,61	889,1	923,6	962,4	306,5		2436,6	5568,0
83	2353,9	32,10	854,6	502,81	592,7	784,3	967,2	297,4		2043,8	4324,0
85	1211,2	15,33	395,2	257,93	500,1	446,3	519,5	169,3		1524,8	4166,4
87	1531,5	53,14	1178,0	301,49	740,7	635,9	848,5	264,1		1311,7	2721,6
89	1513,5	25,10	1362,3	217,37	844,0	370,0	809,5	314,0		1477,2	2726,0
91	1547,7	50,87	1492,3	172,85	794,4	302,8	840,6	294,5		1287,4	3696,0
93	2488,0	77,52	1987,7	199,20	1083,2	424,0	840,6	352,5		1626,3	2842,0
95	2703,8	211,22	2302,3	123,45	1730,7	564,4	729,3	325,0		1835,9	3499,2
97	2423,5	114,01	2379,7	166,80	1339,9	539,2	681,4	292,3		2277,2	4397,6
99	3542,2	13,93	3198,4	193,69	2001,0	779,5	895,8	378,5		2841,9	4680,0
101	1245,1	9,94	1067,8	64,92	482,7	230,1	291,3	114,0		3186,2	5622,4
103	3123,1	51,82	2657,3	98,84	1358,7	667,1	740,0	310,5		2896,4	5952,0
105	2133,6	24,60	1782,1	65,25	671,6	427,4	496,8	192,2	2075,9	2862,9	6336,0
106	1290,1	11,21	1095,0	33,39	468,6	251,0	296,1	105,8	1171,1	2773,1	5236,0
107	2806,4	60,94	2335,4	100,37	1067,1	533,4	624,2	251,6	2507,0		5336,0
108	5665,5	173,52	4880,9	201,32	1979,8	1117,6	1329,1	553,5	5659,5		
109	1457,1	13,55	1285,5	66,25	665,3	307,2	356,0	124,7	1581,1		
111	1327,4	92,43	1095,6	71,84	707,0	297,5	458,7	139,2	1433,4		
112	3283,7	158,69	2712,9	178,41	1663,5	669,2	827,4	289,0	3397,2		
113	1759,0	55,01	1600,8	102,58	880,2	402,4	483,2	172,1	1998,1		
114	2133,4	25,79	1989,7	118,33	1004,6	459,6	553,2	186,9	2217,8		
115	1559,7	12,88	1301,6	62,86	754,0	322,7	394,6	121,8	1565,1		
116	1791,7	13,23	1630,6	111,07	1071,5	393,2	533,4	187,4	2000,6		
117	586,3	4,66	344,9	26,38	206,2	82,8	112,0	39,6	429,3		
118	1780,4	19,95	1331,8	65,42	825,4	350,2	464,5	177,0	1828,2		
119	1088,0	20,20	411,3	48,60	846,1	350,2	474,9	168,7	1828,2		
120	2633,0	99,62	1292,5	141,52	1286,1	552,4	761,5	287,6	3112,1		
121	982,5	11,50	862,2	34,89	480,9	205,0	226,9	77,0	1203,4		
122	2468,1	25,37	2158,6	111,41	1047,4	473,3	349,6	179,3	2988,4		
123	659,1	5,34	642,3	32,96	285,7	125,3	181,6	55,6	812,2		
124	653,9	5,97	658,7	23,20	436,5	150,3	159,2	53,5	970,2		
125	896,6	8,83	571,8	24,48	381,0	162,5	198,6	59,6	1036,3		
126	1109,9	10,42	1061,6	34,34	476,2	203,1	206,5	79,7	1353,8		
127	1343,4	11,95	1216,9	47,41	571,5	243,8	268,8	98,8	1545,3		
128	1739,5	15,45	384,1	51,31	669,3	305,6	445,0	134,7	1951,1		
129	1383,8	13,25	1197,6	42,20	523,8	234,6	218,7	100,1	1526,9		
130	1963,4	9,30	1724,6	65,00	933,0	301,6	439,5	153,3	2192,3		
131	1051,6	5,29	897,3	29,66	466,0	182,6	229,1	81,6	1187,6		
132	1264,1	5,62	1142,8	25,30	637,3	228,3	249,1	102,1	1517,7		
133	1146,7	5,70	944,0	42,12	463,8	215,5	221,4	92,9	1357,3		
134	1576,7	8,77	1259,4	126,39	663,3	302,9	423,4	131,8	1911,2		

Table 7 (continued). AMOUNTS OF NUTRIENTS APPLIED IN WASTES TO THE BLWRS EXPRESSED IN GRAMS.

Dairy Waste

135	1259.7	5.62	1036.1	40.66	480.1	243.4	304.3	89.8	1488.3
136	1677.7	9.09	1323.8	60.51	695.8	318.9	430.0	139.6	2023.6
137	1222.2	9.38	923.5	36.37	500.9	241.2	315.1	84.3	1526.9

SUMS FROM DAIRY BARNS. U

TOTAL AMOUNT OF NUTRIENTS IN SAMPLE

TOTAL ORGN	TOTAL NO3	TOTAL NH4	TOTAL PO4	
9.844920+004	2.020073+003	7.550990+004	8.344084+003	
TOTAL CL	**TOTAL NA**	**TOTAL CA**	**TOTAL MG**	**TOTAL K**
5.022228+004	2.527587+004	3.092079+004	1.132919+004	5.937711+004

Table 8. AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

NE Swine Effluents

SWINE BARNS, CALCULATED DATA

SAMPLE	ORGN	NO3	NO2	NH4	PO4	Cl	NA	CA	MG	K	BOD	COD
8	53.9	258.7	0.2	1.7	0.190	194.5	116.3	1173.2	526.3		5.0	21.2
9	7.1	24.9	0.1	1.7	0.000	26.9	15.7	229.0	95.4			31.8
10	6.6	8.4	0.1	1.3	0.017	19.0	11.4	137.7	75.2			10.6
11	3.7	3.4	0.1	0.0	0.038	11.3	8.1	125.7	45.5			15.3
12	2.7	4.1	0.0	0.2	0.007	35.1	12.5	110.5	53.2		2.4	10.2
13	1.7	0.9	0.0	0.2	0.043	33.1	12.9	104.0	48.7		3.5	26.5
14	0.9	1.0	0.0	0.2	0.035	32.4	13.2	106.5	51.5		3.3	33.1
15	1.3	1.1	0.0	0.1	0.014	24.6	12.1	67.5	34.9		6.0	39.5
16	1.5	2.5	0.0	0.1	0.010	53.2	24.9	140.2	71.4		6.6	46.1
17	1.0	1.7	0.0	0.0	0.013	35.3	11.6	74.6	38.4			30.8
18	3.4	4.7	0.0	0.7	0.043	106.3	28.4	164.3	88.2		8.7	43.1
19	3.5	12.0	0.3	0.3	0.038	221.7	40.2	258.5	117.3		8.8	25.8
20	2.4	154.9	0.7	1.0	0.085	418.4	62.0	728.7	165.1		5.5	25.8
21	0.4	348.3	2.4	0.2	0.051	436.2	61.4	738.5	212.5			26.6
22	0.5	572.2	5.0	1.4	0.133	486.0	122.5	1033.8	274.2			26.6
23	0.6	330.5	2.4	1.7	0.033	297.6	127.3	885.0	183.1			26.6
24	0.3	135.9	0.9	0.4	0.018	103.1	51.0	306.1	64.9		2.5	31.9
25	0.0	0.2	0.0	0.0	0.000	0.1	0.1	0.3	0.1		0.8	42.6
26	0.0	0.4	0.0	0.0	0.000	0.4	0.2	0.8	0.2		1.6	37.2
27	0.0	1.2	0.0	0.0	0.000	1.0	0.6	1.9	0.5		2.2	31.9
28	0.0	1.1	0.0	0.0	0.000	0.8	0.5	1.6	0.5		3.0	77.1
29	0.0	0.7	0.0	0.0	0.000	0.5	0.3	1.0	0.3		2.5	44.6
30	0.6	245.9	1.0	1.7	0.013	287.8	133.0	492.8	160.2		2.2	96.9
31	1.1	256.7	0.5	1.3	0.033	217.4	125.1	398.9	134.3		1.1	40.1
32	0.1	216.7	1.5	1.3	0.004	193.6	105.9	327.4	110.7		1.3	47.8
33	0.2	127.4	1.1	0.5	0.002	111.0	61.5	174.6	62.2		2.2	42.1
34	0.7	56.9	0.5	0.1	0.001	37.4	23.1	69.1	22.5		5.8	57.9
35	0.1	25.3	0.4	0.2	0.000	29.5	18.5	54.4	15.8		1.7	52.0
36	0.5	127.9	2.1	1.1	0.003	139.9	83.3	264.2	84.8		2.7	43.4
37	0.4	159.1	1.9	1.3	0.009	175.7	118.5	426.3	136.9		3.7	63.7
40	0.5	328.6	1.9	5.6	0.019	385.9	205.2	619.6	188.3		4.2	59.6
41	0.5	198.3	1.1	4.1	0.013	234.7	109.9	444.4	110.2		3.3	45.6
44	1.0	178.8	1.9	18.0	0.050	235.2	112.9	351.4	88.7		2.7	48.2
46	0.8	38.7	1.1	19.8	0.010	153.4	81.9	245.5	67.8		2.3	70.7
47	0.4	55.2	1.0	11.6	0.004	73.4	40.2	128.7	34.7		2.3	37.3
48	1.1	217.5	1.9	33.8	0.000	291.0	154.8	560.0	139.5		1.2	49.9
49	0.3	96.2	0.9	15.1	0.000	128.6	68.4	241.7	60.7		2.3	48.8
50	0.5	94.9	1.0	18.3	0.005	149.7	83.2	228.9	65.9		2.9	51.0
51	0.6	84.9	0.9	15.8	0.049	134.6	75.4	191.3	55.0		1.5	61.0
52	1.3	181.2	1.3	23.7	0.038	162.8	100.2	255.5	86.6		3.4	57.9
66	0.1	2.8	0.1	1.1	0.001	4.0	2.0	6.2	1.6		1.6	50.4
69	0.1	25.7	0.9	3.9	0.003	28.5	14.2	56.5	11.7		1.2	34.9
70	0.3	33.5	1.4	4.6	0.010	36.9	18.3	65.8	15.3		1.0	34.9
71	0.4	56.1	2.8	9.0	0.007	61.8	30.8	112.3	27.3		1.2	29.7
72	0.7	77.9	0.4	11.7	0.016	84.0	40.9	151.3	35.6		1.0	29.4
73	0.2	29.1	0.2	6.0	0.008	38.7	19.4	72.6	16.9		1.0	29.4
74	0.8	54.7	0.4	8.7	0.022	75.6	37.3	132.2	30.9		0.8	29.4
75	0.2	25.1	0.1	3.0	0.013	29.2	14.9	51.0	9.5		0.7	14.9
77	0.3	23.8	0.1	2.5	0.006	30.3	16.0	54.4	14.9		0.7	34.7
79	1.9	232.6	2.4	57.7	0.100	334.8	201.3	642.9	179.7		0.9	44.1
80	1.3	451.5	4.0	77.0	0.178	555.3	304.0	958.1	247.5		1.1	53.7
81	0.8	131.7	0.9	22.7	0.040	154.2	79.1	261.7	80.2		2.4	33.6
82	2.3	381.9	4.9	110.4	0.114	695.4	330.8	1154.8	313.9		1.4	47.6
83	1.9	197.1	3.4	54.5	0.052	260.1	125.9	591.6	121.6		3.7	61.1
84	0.4	538.5	17.3	169.4	0.068	506.9	315.7	1439.6	272.8		2.6	70.0
85	0.7	234.7	21.6	139.5	0.027	287.8	213.9	785.3	158.5		2.4	64.5
86	6.4	478.9	57.4	351.7	0.036	585.3	372.8	1235.3	267.0		5.0	89.6
87	1.7	238.7	19.7	154.7	0.031	234.2	136.4	470.7	93.6		6.5	111.8
88	1.9	67.7	6.9	41.1	0.011	65.2	35.9	88.6	24.8		9.0	124.8
89	2.5	131.9	14.1	107.0	0.024	157.7	93.7	251.8	59.3		8.1	79.9
90	3.7	148.7	16.6	145.5	0.053	227.8	141.8	381.5	92.8		10.2	94.0
91	4.5	127.4	16.8	132.4	0.008	206.8	128.9	332.9	76.2		5.2	101.6
92	2.3	117.5	17.8	127.3	0.007	182.0	108.1	284.1	66.6		5.0	69.4
93	0.8	32.3	4.1	37.6	0.003	54.4	33.1	86.1	21.0		5.1	68.6
94	0.5	29.3	3.9	29.4	0.008	49.7	29.0	73.3	19.8		6.8	68.9
95	1.6	50.8	7.8	56.9	0.008	94.9	50.8	143.4	35.9		4.3	77.8

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

NE Swine Effluents

97	0.1	28.8	2.8	17.7	0.001	41.3	21.4	60.6	15.9		5.1	76.5
98	3.4	110.2	18.5	140.5	0.003	301.3	154.3	433.7	110.8		5.9	85.7
99	6.2	140.7	23.9	275.2	0.110	416.1	212.6	614.0	156.2		5.7	112.3
100	7.7	158.7	23.2	38.8	0.074	492.2	276.0	711.8	162.5		5.5	111.8
101	5.7	155.4	21.7	179.2	0.000	270.5	176.4	433.1	101.1		3.5	90.4
102	4.0	127.4	25.3	126.9	0.014	186.7	125.9	201.0	73.8		3.9	113.2
103	1.4	35.4	5.2	44.8	0.007	61.3	37.1	63.0	21.4		5.2	84.3
104	9.1	156.5	87.2	290.2	0.043	384.7	218.2	414.0	121.0		3.1	106.9
105	5.5	350.2	41.2	306.3	0.021	426.3	245.5	615.6	135.8			174.4
106	1.8	228.5	27.9	283.0	0.006	454.9	259.9	673.4	141.1			99.9
107	1.6	334.4	99.5	206.9	0.003	328.0	193.1	528.4	104.2			105.8
108	0.1	32.9	21.2	36.8	0.004	52.9	31.4	84.6	18.1			
109	1.8	136.4	146.7	206.9	0.052	293.3	172.7	529.6	81.2			
110	5.6	335.1	171.9	259.4	0.053	363.2	273.7	546.9	124.5			
111	0.5	217.5	101.1	146.5	0.036	202.4	125.2	370.9	58.2			
112	0.6	137.7	91.4	148.4	0.041	191.6	105.1	345.1	66.8			
113	0.5	131.5	66.3	108.3	0.029	133.6	82.6	255.1	40.0			107.3
114	0.8	217.7	73.5	127.0	0.040	164.2	102.0	325.3	45.1			
115	1.0	520.3	121.7	249.9	0.040	346.8	213.3	653.8	91.4			163.6
117	0.1	44.8	11.0	19.9	0.003	37.6	20.0	71.7	13.8	30.4		133.9
118	0.5	154.9	32.0	49.1	0.011	118.4	59.9	227.6	39.9	89.5		
119	0.8	339.9	94.0	257.2	0.048	451.6	224.7	760.8	139.9	388.6	4.2	96.3
121	0.2	358.2	98.7	155.2	0.034	397.7	197.6	296.5	114.0	318.8	2.1	132.8
122	0.2	1038.3	162.4	329.9	0.152	726.4	356.5	777.0	205.0	613.5	3.8	113.1
123	0.0	521.4	55.1	160.9	0.033	444.3	211.9	623.7	110.7	298.0	0.4	111.7
124	2.8	748.4	84.6	255.7	0.050	624.6	349.0	1047.2	185.7	436.1	6.3	179.8
125	1.2	835.9	7.0	312.1	0.044	775.5	377.1	1720.9	190.1	495.7	97.3	256.8
126	0.1	455.5	10.4	208.3	0.047	585.7	299.2	1115.2	141.9	377.1	44.3	160.0
127	0.0	27.5	0.2	8.1	0.002	26.5	13.5	28.5	6.7	16.3	15.7	116.6
128	0.3	749.5	2.7	246.1	0.046	812.1	405.7	812.6	208.0	498.7	6.5	97.2
129	0.0	5.3	0.0	1.4	0.000	6.7	3.1	9.7	1.5	3.7	4.3	84.9
130	0.1	158.2	0.4	59.8	0.009	212.0	109.9	307.3	46.9	136.7	5.4	103.8
131	0.1	144.1	0.2	36.3	0.008	130.3	65.6	233.0	27.2	82.2	5.3	73.5
132	0.2	334.5	10.3	86.2	0.038	406.1	202.2	424.0	96.3	236.8	7.7	64.2
133	0.1	390.5	0.8	86.0	0.011	453.9	239.6	536.0	104.2	285.3	3.3	68.6
134	0.1	358.2	12.5	74.5	0.015	430.9	233.0	571.0	100.8	260.1	2.7	58.3
135	0.1	636.5	22.8	112.1	0.028	783.3	423.5	1037.8	183.3	485.7	2.6	28.5
136	0.1	441.9	12.2	59.3	0.059	366.1	200.3	495.3	84.3	222.0	1.3	47.4
137	0.6	1028.2	10.1	68.4	0.026	466.6	261.2	671.3	118.6	310.1	7.8	59.7
138	0.1	711.1	4.0	43.4	0.051	296.0	166.1	423.5	74.9	207.5		
141	0.3	98.9	1.7	16.9	0.008	125.9	74.2	2485.7	34.4	94.6		58.5
142	0.4	154.5	1.6	27.3	0.013	199.6	114.1	438.4	52.6	144.9		58.5

SUMS OF A

TOTAL ORGN	TOTAL NO3	TOTAL NO2	TOTAL NH.	TOTAL PO4
2.376219+002	2.504613+004	2.218081+003	8.391276+003	3.454815+000

TOTAL K	TOTAL NA	TOTAL CA	TOTAL MG	TOTAL K
2.758293+004	1.453056+004	5.978896+004	1.268090+004	6.516212+003

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

NW Swine Effluents

SWINE BARNS, CALCULATED DATA

B SAMPLE	ORGN	N03	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
8	78,6	34,9	2,7	196,6	1,077	247,8	140,1	3555,3	956,2		100,0	233,2
9	11,8	3,3	0,1	32,8	0,161	29,6	30,1	709,3	196,7			360,4
10	7,2	2,3	0,3	28,5	0,190	14,7	18,1	422,1	116,1			455,8
11	5,8	2,5	0,0	19,0	0,079	55,5	11,5	259,3	70,2		360,0	306,0
12	6,8	4,0	0,1	16,1	0,014	64,7	8,4	184,9	49,7		438,0	408,0
13	4,7	1,8	0,0	8,8	0,027	15,0	7,4	177,9	50,1			-1,0
14	2,4	5,7	1,1	25,2	0,058	48,8	16,8	383,3	100,8		268,3	397,2
15	6,9	2,4	0,2	12,4	0,027	25,6	7,5	185,5	50,0		313,5	526,4
16	2,0	2,9	0,1	17,6	0,085	31,7	9,0	231,9	63,1		520,8	658,0
17	1,5	2,5	0,0	7,5	0,008	19,9	4,0	104,0	27,3			739,2
18	1,8	4,2	0,0	13,8	0,031	46,4	8,1	208,8	59,1		566,0	616,0
19	2,1	4,3	0,1	20,0	0,041	72,8	11,7	277,5	78,9		729,0	515,2
20	5,0	31,2	1,0	26,5	0,081	203,3	15,5	367,5	105,6		603,5	638,0
21	66,9	110,4	0,4	26,2	0,070	230,1	13,5	314,9	87,7		518,0	532,0
22	31,9	139,9	1,0	26,4	0,068	292,3	12,3	316,5	88,0		457,5	425,6
23	2,0	118,2	0,2	14,2	0,039	186,5	7,4	178,2	51,8			319,2
24	0,7	2,4	0,0	4,5	0,009	60,1	2,3	60,9	15,8		359,0	212,8
30	10,6	37,4	0,2	10,7	0,021	175,1	63,5	475,9	103,9		282,8	430,6
31	1,4	30,3	0,1	8,7	0,024	152,0	58,8	232,3	91,8		255,0	315,6
32	0,7	35,2	0,2	5,9	0,002	102,3	42,8	129,7	64,1		277,7	425,6
33	0,4	32,4	1,1	3,4	0,007	61,1	24,4	91,9	39,4		735,7	420,8
34	0,5	7,5	0,6	0,7	0,002	19,0	8,1	60,2	14,0		925,1	631,2
35	0,2	5,5	0,0	0,9	0,000	15,2	6,7	67,8	12,1		656,0	728,0
36	0,8	14,0	0,1	2,8	0,000	44,1	19,2	143,7	36,2		807,5	990,7
37	2,4	23,9	0,1	4,1	0,004	64,2	26,7	106,1	43,8		743,0	822,4
38	5,0	138,5	0,2	24,0	0,016	254,5	130,5	556,9	181,6		648,5	1236,9
39	2,0	131,9	0,1	27,0	0,022	239,9	123,1	492,7	145,3		535,0	819,2
40	1,9	232,7	0,2	28,8	0,024	242,4	123,2	626,7	154,6		576,5	876,9
41	2,1	158,0	0,2	19,0	0,028	166,3	84,0	453,5	116,4		449,2	624,0
42	0,6	310,9	1,1	46,7	0,030	403,6	209,4	773,4	263,0		471,9	873,6
43	2,3	115,4	0,5	15,8	0,021	150,5	74,9	277,4	95,3		328,3	693,6
44	2,2	137,5	0,4	13,1	0,061	156,6	84,0	383,6	94,6		263,5	544,9
46	1,8	49,1	0,2	7,2	0,033	99,5	50,2	177,9	55,7		218,3	249,6
47	1,2	38,4	1,9	5,7	0,027	55,6	30,3	135,4	34,3		199,3	248,6
48	1,2	77,9	0,2	9,3	0,000	123,0	65,2	285,2	71,3		179,2	208,0
49	0,6	34,3	0,2	4,5	0,001	69,5	34,7	154,4	39,0		186,8	173,4
50	0,6	40,8	0,1	5,2	0,001	79,9	43,0	193,1	51,6		156,5	153,0
51	1,3	32,5	0,9	4,0	0,022	61,3	34,8	114,6	37,3		177,9	193,8
52	0,8	32,7	0,1	7,1	0,032	101,3	50,6	145,5	55,4		146,9	223,5
69	0,6	2,1	0,1	1,1	0,000	13,4	5,8	28,3	7,6		185,5	448,2
70	1,3	4,5	0,1	2,2	0,006	28,4	12,4	49,0	13,5		45,5	199,2
71	5,5	52,0	0,6	9,4	0,011	114,2	50,2	210,6	58,4		34,0	248,0
72	8,6	58,3	0,2	8,1	0,018	136,0	61,1	254,5	66,7		71,9	196,0
73	2,1	20,9	0,1	5,3	0,007	60,6	27,5	111,6	30,6		60,5	196,8
74	2,0	33,3	0,3	5,8	0,013	105,1	46,3	162,9	53,9		23,3	98,0
75	0,7	13,7	0,1	2,5	0,005	46,5	21,1	86,3	24,0		8,2	188,0
76	0,9	21,1	0,1	2,6	0,005	57,4	24,9	101,9	29,3		15,8	64,5
77	0,8	9,0	0,0	2,4	0,004	44,3	20,2	79,0	23,3		42,8	124,0
78	17,3	95,5	1,1	18,0	0,072	426,3	196,6	926,2	267,0		184,4	322,4
79	11,4	39,3	10,4	13,0	0,047	282,2	120,8	651,7	163,7		562,1	735,0
80	32,4	134,7	8,6	34,2	0,048	546,0	272,8	1320,4	372,1		721,2	1049,2
81	13,2	50,4	6,1	27,9	0,035	295,8	154,6	723,2	221,3		937,0	1104,0
82	10,3	41,5	2,1	18,7	0,016	230,9	135,2	444,6	138,5		505,5	761,6
83	9,6	33,3	2,2	10,1	0,003	158,6	102,3	395,9	109,4		723,5	1363,0
84	3,8	55,3	0,6	19,9	0,013	201,3	123,4	507,0	105,0		452,8	750,0
85	3,4	131,4	1,0	30,3	0,005	288,7	163,4	822,6	182,5		236,5	545,6
86	2,4	221,7	0,0	7,2	0,002	74,7	39,4	197,3	57,1		311,3	558,6
87	7,8	131,5	0,4	38,4	0,024	307,9	182,8	676,0	150,3		162,9	194,4
88	2,1	20,7	0,1	16,1	0,015	96,4	56,5	189,9	48,4		284,1	384,0
89	0,9	1,3	0,0	6,7	0,007	44,9	27,8	96,2	22,3		329,5	376,0
90	0,3	0,7	0,0	2,6	0,004	23,2	11,8	43,6	10,3		412,8	799,0
91	2,9	10,3	0,1	19,5	0,015	99,3	62,7	206,7	52,2		137,2	415,8
92	0,4	0,3	0,0	5,0	0,002	24,4	15,1	50,0	12,1		228,1	416,8
93	0,1	0,1	0,0	1,3	0,001	6,5	4,0	13,4	3,1		300,7	416,5
94	0,1	0,1	0,0	1,4	0,001	6,9	4,2	12,6	3,4		353,8	541,3
95	0,4	0,9	0,0	8,7	0,004	28,3	14,3	50,6	14,8		265,5	388,8

Table 9 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

NW Swine Effluents

97	0,0	0,0	0,0	0,2	0,000	1,0	0,5	1,1	0,6		146,3	1816,4
98	1,0	2,0	0,0	11,9	0,011	51,1	25,2	75,4	29,7		191,2	333,2
99	0,8	1,8	0,0	12,0	0,005	47,5	23,8	86,4	25,6		133,5	187,2
100	1,0	14,5	4,1	40,1	0,032	154,0	77,4	274,4	75,6		163,4	184,4
101	0,9	5,2	0,2	10,4	0,005	31,4	18,8	63,3	17,5		140,1	175,7
102	1,5	36,0	0,3	28,6	0,010	64,7	47,2	37,4	27,5		65,3	113,2
103	0,5	3,2	0,6	7,9	0,002	21,8	12,6	23,2	11,3		149,3	267,8
104	1,1	4,2	0,1	12,6	0,005	37,7	24,7	41,9	18,7		81,9	175,0
105	0,8	5,3	0,3	13,0	0,005	36,0	23,2	72,7	19,1			192,0
106	2,4	17,2	0,2	55,6	0,002	136,1	87,6	270,2	76,1			452,2
107	2,9	10,8	0,5	31,8	0,006	85,7	53,7	172,9	45,8			225,4
108	0,*	1,5	0,0	7,4	0,004	19,6	12,2	40,3	13,7			
109	2,3	10,4	0,5	35,5	0,009	97,6	60,7	184,6	59,1			
110	0,5	1,1	0,0	7,2	0,003	21,4	13,9	42,9	10,6			
111	2,1	7,5	0,1	27,8	0,012	73,3	45,6	81,1	34,8			
112	1,1	1,2	0,1	16,4	0,008	48,7	27,0	93,1	22,0			
113	0,4	4,0	0,1	9,0	0,004	24,9	15,2	51,5	12,7			
114	1,1	4,3	0,6	32,3	0,017	78,0	49,9	149,2	38,3			99,:
115	1,2	13,7	7,5	36,7	0,025	80,1	46,5	138,2	30,9			
116	2,0	38,5	7,5	42,0	0,009	104,8	53,8	196,9	56,8			74,4
117	0,1	0,8	0,3	2,6	0,000	4,9	3,5	11,6	3,3	3,0		
118	0,3	4,8	1,9	8,1	0,001	18,7	10,6	34,2	10,2	10,0		
119	0,3	8,8	0,9	12,9	0,002	32,8	17,9	64,4	17,8	16,8	18,6	113,5
120	0,7	19,4	1,9	31,2	0,005	68,4	37,3	120,0	34,5	42,1	14,0	99,2
121	0,6	28,2	1,7	24,7	0,006	60,3	34,6	71,3	33,2	35,0	12,8	147,6
122	0,4	36,1	1,9	27,3	0,005	60,6	33,8	818,3	25,0	32,5	13,4	172,2
123	0,6	75,2	15,5	68,5	0,007	138,1	79,6	246,0	73,0	93,7	2,9	48,8
124	0,3	50,0	16,5	44,0	0,006	89,5	53,5	185,3	37,1	62,5	4,7	97,2
125	0,6	85,3	14,0	79,5	0,011	150,8	86,8	360,5	63,3	96,0	13,1	172,9
126	0,2	43,2	10,2	43,7	0,004	75,0	42,0	164,2	28,6	51,0	13,4	110,0
127	0,1	15,3	2,0	9,9	0,001	20,9	11,7	43,9	9,2	12,3	13,6	97,2
128	0,1	8,1	0,7	4,4	0,000	11,2	5,9	26,6	4,8	4,5	19,3	87,4
129	0,2	70,3	7,5	35,8	0,003	87,9	47,8	186,8	38,2	50,2	14,2	94,4
130	0,1	26,5	2,1	14,6	0,003	36,2	19,9	51,2	15,3	18,6	14,7	75,5
131	0,0	6,2	0,2	3,0	0,002	8,0	7,1	14,9	3,6	3,3	10,8	68,6
132	1,1	145,5	9,9	75,3	0,017	227,9	112,1	405,6	122,8	93,4	8,4	59,2
133	0,5	121,0	5,5	61,7	0,011	188,2	99,3	378,5	81,6	85,5	0,0	68,6
134	0,1	23,0	0,8	11,2	0,006	33,1	16,8	64,4	12,5	15,3	16,5	63,1
135	0,0	58,4	1,1	23,5	0,007	76,1	39,2	109,1	29,1	35,7	8,4	38,0
136	0,4	443,3	4,0	99,7	0,039	301,4	153,4	408,9	114,7	146,9	0,0	61,6
137	1,0	435,0	4,8	78,0	0,014	249,2	130,4	325,8	93,2	127,4	4,3	69,7
138	0,8	407,1	3,9	62,2	0,041	205,9	106,3	297,0	69,4	103,9		9,0
142	2,1	112,1	2,6	50,6	0,010	163,3	88,2	221,9	53,3	91,9		

SUMS OF 8

TOTAL ORGN	TOTAL NO3	TOTAL NO2	TOTAL NH4	TOTAL PO4
4,568390+002	6,489148+003	1,930192+002	2,515940+003	3,278297+000
TOTAL CL	**TOTAL NA**	**TOTAL CA**	**TOTAL MG**	**TOTAL K**
1,219259+004	5,868156+003	2,974998+004	7,947147+003	1,451686+003

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

SE Swine Effluents

SWINE BARNS, CALCULATED DATA

C

SAMPLE	ORGN	NO3	NO2	NH4	PO4	Cl	Na	Ca	Mg	K	BOD	COD
1	1,4	1,3	0,1	0,1	0,015	6,8	6,8	77,8	31,6		4,4	22,0
2	4,6	5,4	0,2	0,1	0,048	21,4	13,1	150,2	51,4		5,2	33,0
3	0,3	7,5	0,3	0,1	0,033	47,3	16,7	158,0	55,6		6,0	44,0
4	0,4	21,0	1,1	0,3	0,067	129,3	23,2	202,6	79,9			33,0
5	2,9	9,1	0,1	0,1	0,029	58,4	12,1	87,7	39,8			40,5
6	4,6	21,9	0,1	0,1	0,066	109,3	21,0	126,1	74,2		5,2	39,4
7	3,5	44,2	2,2	0,3	0,033	147,4	20,9	143,4	72,5		5,6	42,8
8	2,7	111,2	2,5	0,3	0,017	230,3	25,7	146,8	80,1		7,8	42,4
9	0,6	137,8	6,4	0,4	0,034	236,5	22,6	153,4	75,4			53,0
10	1,8	95,8	8,9	0,2	0,018	198,7	25,2	142,2	71,9			58,3
11	0,8	57,2	3,7	0,1	0,011	96,6	12,5	60,8	31,1			30,6
12	0,8	33,0	2,8	0,0	0,004	51,6	8,5	32,4	17,2		2,8	35,7
13	0,1	29,0	1,2	0,1	0,005	53,2	8,9	33,0	17,6		2,4	53,0
16	0,0	0,3	0,0	0,0	0,000	0,4	0,1	0,4	0,2			59,2
19	0,0	0,1	0,0	0,0	0,000	0,5	0,1	0,7	0,2		2,2	32,2
20	0,0	0,4	0,0	0,0	0,000	1,7	0,5	2,0	0,7		1,9	32,3
21	0,0	0,0	0,0	0,0	0,000	0,1	0,0	0,2	0,1		2,3	42,6
22	0,1	1,5	0,1	0,0	0,001	5,2	1,7	8,0	2,5		2,5	37,2
23	0,0	1,9	0,0	0,0	0,001	3,5	1,6	7,0	1,6			53,2
24	4,1	253,8	2,1	0,2	0,105	589,5	246,7	1192,7	270,1		5,5	62,9
25	1,1	213,0	1,1	0,8	0,033	276,7	135,6	494,9	129,7		5,5	53,2
26	1,7	315,2	3,0	2,0	0,042	311,2	184,5	607,5	191,1		8,4	58,5
27	0,9	271,3	3,0	2,9	0,035	253,9	159,7	483,9	141,9		4,7	47,1
29	3,7	315,9	5,4	5,2	0,057	261,7	222,8	811,8	194,4		3,0	29,4
30	0,6	292,2	2,2	1,9	0,009	216,9	158,1	546,7	152,4		3,0	80,7
31	0,0	0,9	0,0	0,0	0,000	0,5	0,3	1,1	0,3		2,4	52,6
32	0,0	5,1	0,0	0,0	0,004	2,5	1,9	6,6	1,8		4,6	53,2
33	0,0	1,4	0,0	0,0	0,000	0,8	0,6	2,0	0,6		3,3	54,0
34	0,0	1,9	0,0	0,0	0,000	1,1	1,0	3,5	0,9		3,3	64,1
35	0,0	1,4	0,0	0,0	0,000	0,9	0,7	2,5	0,6		2,3	31,2
36	0,0	0,5	0,0	0,0	0,000	0,5	0,4	1,6	0,4		3,3	26,9
37	0,0	5,7	0,0	0,0	0,000	2,8	2,4	9,5	2,2		4,8	36,0
38	0,0	3,1	0,0	0,0	0,000	2,0	1,7	6,7	1,6		3,4	42,3
39	0,0	2,9	0,0	0,0	0,000	1,8	1,3	5,6	1,4		3,6	34,8
40	0,0	1,5	0,0	0,0	0,000	0,7	0,5	2,7	0,6		4,6	53,8
41	0,0	1,9	0,0	0,0	0,000	0,7	0,5	2,4	0,6		3,3	27,1
42	0,1	25,4	0,2	0,2	0,004	16,5	11,3	50,5	10,6		3,8	43,7
43	0,0	8,1	0,1	0,1	0,001	4,9	3,2	15,7	3,6		1,4	36,7
44	0,1	16,5	0,2	0,1	0,002	10,0	6,7	28,2	6,7		1,6	44,0
46	0,1	13,4	0,2	0,2	0,005	9,1	6,8	27,5	6,9		1,7	35,4
47	0,0	10,1	0,1	0,1	0,002	7,1	4,8	20,8	4,9		1,7	31,1
48	0,3	51,0	0,9	0,6	0,000	42,0	25,7	118,4	26,7		1,3	31,2
49	0,1	35,9	0,2	0,2	0,002	29,3	18,7	81,0	18,2		1,3	22,4
50	0,1	56,9	1,5	0,6	0,005	40,3	24,5	90,6	23,0		5,6	45,9
51	0,1	14,0	0,0	0,1	0,002	12,8	7,5	27,4	7,2		2,3	43,7
52	0,1	32,5	0,3	0,1	0,003	17,2	11,0	38,6	11,1		1,8	32,5
53	0,2	126,2	1,2	1,0	0,013	71,9	44,8	170,6	48,8		0,9	17,2
56	0,0	23,4	0,3	0,1	0,005	12,4	9,1	36,4	9,4		1,0	30,0
57	0,0	7,9	0,1	0,0	0,001	4,0	3,0	12,6	3,7		0,8	32,0
60	0,1	42,1	0,8	0,2	0,003	27,4	18,2	85,0	20,2		1,6	41,0
61	0,1	19,2	1,9	0,1	0,001	9,3	7,0	27,7	7,1		1,3	51,7
62	0,4	28,3	5,0	0,2	0,001	17,7	10,0	41,1	11,3		2,0	42,8
63	0,0	1,7	0,3	0,0	0,000	1,0	0,6	2,7	0,7		2,7	38,1
64	0,1	6,7	0,8	0,1	0,002	4,2	2,3	10,8	2,9		2,5	47,6
65	4,0	179,2	37,7	1,6	0,019	113,9	68,0	333,4	85,0		699,0	262,1
66	0,7	25,8	3,6	0,2	0,009	19,7	11,6	56,3	14,5		3,6	82,4
69	2,4	36,5	9,5	0,4	0,006	49,2	26,5	169,0	36,8		140,0	443,2
70	1,5	54,1	8,3	0,5	0,004	52,2	25,7	158,7	30,5		124,9	333,6
71	4,4	31,3	7,0	1,5	0,005	75,9	42,6	241,1	51,9		265,2	446,4
72	0,8	90,0	0,3	0,5	0,016	71,2	37,1	202,1	43,1		238,5	441,0
73	1,0	44,5	0,5	0,7	0,018	43,0	21,5	116,5	25,5		265,2	442,8
74	2,4	58,9	0,3	0,2	0,030	64,9	33,8	167,0	41,8		307,4	539,0
75	1,2	26,3	0,1	0,3	0,003	24,4	13,6	73,5	16,8		436,2	952,0
76	0,4	11,9	0,1	0,0	0,001	11,3	5,9	30,0	7,0		290,0	347,2
78	0,9	129,3	1,3	0,9	0,018	115,6	68,9	341,0	79,2		408,8	744,0
79	3,8	74,7	2,0	0,2	0,012	73,7	41,8	215,9	47,5		171,2	392,0

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

SE Swine Effluents

80	1.6	41.9	0.6	0.1	0.013	40.4	22.9	110.0	27.5		197.9	439.2
81	0.4	7.9	0.1	0.0	0.002	9.7	9.6	21.7	5.9		81.6	240.0
82	0.4	6.2	0.1	0.0	0.002	7.6	8.4	17.3	4.9		75.5	133.3
83	0.2	9.5	0.1	0.0	0.004	11.7	11.3	40.3	7.1		44.8	141.0
84	0.6	42.5	0.4	0.1	0.004	37.5	38.3	118.8	22.4		47.8	110.0
86	0.2	17.9	0.1	0.1	0.001	17.4	9.5	45.3	9.3		12.8	99.6
87	0.0	0.6	0.0	0.0	0.000	0.7	0.4	1.8	0.4		32.5	24.3
91	0.2	36.5	0.4	0.1	0.010	32.6	19.2	76.0	17.2		5.0	55.4
94	0.2	11.5	0.2	0.1	0.002	11.6	6.9	18.8	5.8		10.7	49.2
95	0.5	94.0	2.3	0.8	0.018	101.2	48.0	176.7	49.0		19.0	58.3
96	0.2	38.1	0.5	0.4	0.004	37.8	15.5	73.7	18.5		3.8	62.4
98	0.8	157.8	0.7	0.6	0.036	107.9	43.7	207.7	49.6		2.4	57.1
102	0.5	19.3	0.1	0.1	0.002	20.6	11.0	42.8	10.1		2.6	49.2
103	1.2	78.0	0.4	1.2	0.014	96.4	47.7	166.0	40.5		1.6	39.6
104	3.4	550.9	7.1	4.6	0.107	622.5	326.1	1337.2	292.1		3.1	43.7
105	0.0	28.9	0.1	0.2	0.002	23.2	12.9	43.4	10.2			48.0
107	0.0	3.7	0.0	0.1	0.000	3.8	2.0	7.7	1.6			50.6
108	0.1	18.5	0.3	0.2	0.003	23.7	16.3	48.9	10.3			-1.0
109	0.6	42.7	0.7	0.4	0.007	67.0	34.6	138.3	23.9			-1.0
110	0.7	121.1	1.6	0.8	0.012	127.3	69.0	286.5	51.7			-1.0
111	0.1	40.2	0.6	0.5	0.005	39.3	22.2	89.9	15.9			-1.0
112	0.1	7.4	0.1	0.2	0.003	18.5	8.3	32.6	5.7			-1.0
113	0.5	59.9	0.5	1.1	0.002	44.9	25.7	100.0	19.3		34.1	34.1
114	0.4	159.5	1.4	2.7	0.014	127.2	79.3	286.4	55.9			-1.0
115	1.8	157.2	1.2	2.7	0.008	115.3	72.2	275.7	51.8		34.7	34.7
116	0.9	50.1	0.5	1.5	0.009	55.6	32.3	145.1	34.4			-1.0
117	0.8	51.5	0.3	0.3	0.007	42.6	27.0	110.2	26.1	4.0	24.8	24.8
118	0.2	58.5	0.4	0.1	0.006	46.1	27.2	117.8	28.1	5.5		-1.0
119	0.1	41.9	0.6	0.1	0.004	30.4	18.4	78.7	18.1	3.8	31.7	31.7
120	0.4	136.4	1.3	0.5	0.010	71.1	42.9	184.6	43.6	9.8		-1.0
121	0.6	139.8	2.9	0.3	0.009	139.7	83.3	194.8	62.2	20.3	41.8	44.2
122	0.6	399.2	2.6	0.3	0.025	268.4	156.4	453.9	160.9	32.6	44.2	44.2
123	0.3	120.4	1.0	0.5	0.013	127.8	77.1	274.3	74.1	14.1	53.4	53.4
124	0.2	99.8	2.9	1.8	0.006	107.8	58.5	354.9	54.7	24.1	48.6	48.6
125	0.3	99.5	0.7	1.2	0.011	101.7	60.6	334.9	63.4	16.5	59.2	59.2
126	0.3	55.2	1.0	0.6	0.005	64.6	34.2	191.9	32.0	7.4	75.0	75.0
127	0.1	27.4	0.2	0.5	0.002	35.4	19.0	72.0	16.3	8.6	145.0	145.0
128	0.1	31.5	0.7	0.4	0.002	39.6	19.6	92.5	18.2	6.5	136.0	136.0
129	0.0	9.8	0.0	0.1	0.001	13.0	6.6	31.5	5.6	2.0	66.0	66.0
130	0.2	14.9	0.0	0.2	0.000	26.6	13.9	55.3	16.3	3.5	118.0	118.0
131	0.1	9.0	0.0	0.1	0.002	10.4	5.7	21.8	4.8	1.8	63.7	63.7
132	0.1	38.5	0.1	0.8	0.005	82.6	36.4	104.3	32.7	18.9	172.0	172.0
133	0.4	24.5	0.1	0.2	0.003	36.1	21.9	57.5	18.3	9.3	208.0	208.0
134	0.0	1.3	0.0	0.0	0.000	1.7	0.9	3.0	0.8	0.2	114.0	208.0
135	0.1	46.4	0.1	0.3	0.005	53.7	29.5	87.3	25.5	8.9	48.7	8.0
136	0.9	56.9	0.1	0.3	0.008	41.4	21.9	62.1	18.4	7.3		-1.0
137	8.0	341.3	1.5	0.4	0.039	171.4	93.4	283.9	75.6	33.1		179.0
138	0.1	30.3	0.2	0.2	0.009	29.0	15.9	90.6	12.7	5.7		64.2
142	0.0	3.5	0.0	0.1	0.000	4.7	2.5	8.5	2.1	1.5		-1.0

SUMS OF C

	TOTAL ORGN	TOTAL NO3	TOTAL NO2	TOTAL NH4	TOTAL PO4
C	9,293534+001	9,127602+003	1,864907+002	6,051002+001	1,534400+000
	TOTAL CL	TOTAL NA	TOTAL CA	TOTAL MG	TOTAL K
C	8,847168+003	4,513071+003	1,804789+004	4,016157+003	3,215001+002

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

SW Swine Effluents

SWINE BARNS, CALCULATED DATA

SAMPLE	ORGN	NO3	NO2	NH4	PO4	Cl	Na	Ca	Mg	K	BOD	COD
1	1,1	7,2	0,1	0,0	0,014	7,6	5,4	38,3	21,9		3,6	16,5
2	1,9	13,3	0,1	0,0	0,027	13,4	10,5	91,1	35,4		3,9	22,0
3	0,2	21,0	5,8	0,0	0,039	63,0	10,6	112,7	68,4		5,0	27,5
4	3,3	138,1	9,6	0,0	0,078	345,0	30,6	235,6	139,2			49,6
5	2,6	52,4	1,8	0,0	0,027	108,5	12,3	104,1	63,3			45,4
6	4,7	131,0	2,5	0,5	0,026	215,7	26,9	181,0	108,8		1,5	27,8
7	5,2	110,5	0,6	0,4	0,000	1480,0	28,5	206,5	109,7		1,5	31,9
8	1,1	178,8	8,0	0,6	0,016	460,9	42,1	281,9	154,5		5,0	58,3
9	1,1	143,5	8,7	0,0	0,050	249,0	38,1	193,5	83,6			30,6
10	2,7	97,8	8,4	0,3	0,028	240,7	43,2	137,7	70,6			42,4
11	2,0	76,7	5,1	0,1	0,042	128,9	24,1	72,5	35,1			
12	1,1	44,5	4,2	0,1	0,009	66,9	14,6	40,6	19,5		1,0	20,4
13	0,4	31,3	1,5	0,1	0,012	81,0	27,1	78,0	34,7		1,5	33,1
18	0,0	0,1	0,0	0,0	0,000	0,2	0,1	0,2	0,1		2,1	24,6
19	0,0	0,0	0,0	0,0	0,000	0,1	0,0	0,1	0,0		2,6	25,8
23	0,0	0,1	0,0	0,0	0,000	0,2	0,1	0,3	0,1			41,9
24	4,1	131,7	0,8	0,6	0,070	364,8	170,6	621,8	183,8		4,0	36,7
25	0,9	132,8	0,4	0,2	0,051	161,4	74,6	246,8	83,1		3,1	42,6
26	1,1	219,9	0,0	1,7	0,103	305,1	154,7	381,8	149,3		3,5	47,9
27	1,7	233,4	0,0	1,4	0,016	246,0	138,0	448,8	131,1		2,4	41,1
28	3,0	736,7	0,0	0,0	0,091	456,5	301,7	1072,4	295,3		2,3	15,4
29	1,7	576,3	0,5	2,3	0,020	263,0	203,8	700,0	195,1		2,1	39,2
30	0,8	322,5	2,0	1,7	0,022	248,5	156,2	696,6	185,0		2,5	75,3
31	0,0	1,0	0,0	0,0	0,000	0,5	0,3	1,4	0,4		1,2	63,1
32	0,0	7,7	0,0	0,0	0,000	3,3	2,2	9,2	2,3		2,7	63,9
33	0,0	1,9	0,0	0,0	0,000	0,9	0,6	2,7	0,7		2,5	47,4
36	0,0	0,7	0,0	0,0	0,000	0,3	0,2	1,1	0,2		1,4	53,7
37	0,0	0,9	0,0	0,0	0,000	0,4	0,3	1,3	0,3		1,4	47,4
39	0,0	2,3	0,0	0,0	0,000	1,2	0,8	4,0	1,0		1,6	28,7
40	0,0	0,9	0,0	0,0	0,000	0,4	0,3	1,3	0,3		1,6	31,3
42	0,0	11,5	0,0	0,0	0,002	6,6	4,3	19,3	4,5		2,1	39,5
43	0,0	8,5	0,0	0,0	0,001	4,9	2,9	11,7	3,0		1,3	32,6
44	0,0	16,4	0,1	0,0	0,001	8,2	5,6	28,3	5,6		1,7	47,2
46	0,0	16,2	0,1	0,1	0,002	12,0	7,4	35,1	7,9		1,4	47,8
47	0,0	8,5	0,0	0,0	0,001	6,7	4,4	21,8	4,8		1,6	33,2
48	0,0	40,2	0,1	0,0	0,189	23,9	15,1	78,1	17,7		1,9	29,1
49	0,2	30,3	0,1	0,0	0,001	17,7	11,9	57,8	13,5		1,8	32,5
50	0,3	30,1	0,1	0,0	0,000	17,4	11,3	46,9	15,4		2,0	38,7
51	0,0	9,7	0,0	0,0	0,000	5,9	3,7	15,1	4,8		1,8	35,6
52	0,4	20,4	0,1	0,0	0,001	8,8	5,7	23,1	8,5		1,5	29,5
53	3,2	157,4	0,4	0,2	0,011	71,8	47,1	189,3	69,7		1,0	27,3
56	0,0	22,1	0,0	0,0	0,002	9,6	6,1	27,2	9,3		1,3	12,0
57	0,0	7,4	0,0	0,0	0,001	3,5	2,0	10,7	2,7		0,9	32,0
60	0,0	12,4	0,0	0,0	0,001	5,7	3,5	17,6	4,8		0,9	37,1
61	0,0	2,2	0,0	0,0	0,000	1,0	0,6	2,8	0,8		1,0	37,1
62	0,0	3,1	0,1	0,0	0,001	1,4	0,7	4,2	1,0		1,6	23,8
63	0,0	4,7	0,2	0,0	0,000	2,0	1,0	6,5	1,7		1,5	28,6
64	0,1	6,3	0,2	0,0	0,000	2,8	1,6	8,2	2,1		1,8	26,6
65	0,4	39,7	1,3	0,0	0,001	16,5	9,4	47,5	11,5		1,2	28,1
66	0,3	30,0	1,1	0,0	0,002	13,8	7,6	41,4	9,8		1,1	32,1
69	0,0	32,9	1,1	0,0	0,008	14,4	7,4	44,5	9,8		1,1	29,9
70	0,2	112,2	4,0	0,2	0,014	53,3	28,2	144,3	31,6		1,3	34,7
71	0,4	256,2	8,4	0,7	0,011	122,9	66,6	350,1	75,6		0,6	34,7
72	0,4	223,8	0,6	0,7	0,014	99,8	48,6	277,6	59,9		0,7	58,8
73	0,4	91,3	0,3	0,2	0,010	42,8	24,6	131,2	30,5		0,6	39,4
75	0,0	78,3	0,3	0,1	0,009	37,7	17,4	97,5	22,1		0,4	47,6
77	0,0	38,0	0,1	0,0	0,005	21,2	10,0	50,1	12,3		1,4	29,8
78	0,0	344,4	1,3	0,1	0,039	191,7	90,2	468,3	109,3		1,6	24,8
79	1,7	228,5	0,9	0,5	0,021	138,5	63,8	316,8	74,0		0,9	39,2
80	0,6	144,5	0,7	0,1	0,005	92,6	44,0	215,6	53,6		0,8	34,1
81	0,1	24,3	0,1	0,0	0,002	18,5	6,2	42,7	5,4		1,2	28,8
82	0,4	44,8	0,3	0,0	0,001	34,2	11,0	92,9	21,0		1,2	28,5
83	0,0	7,9	0,1	0,0	0,000	5,0	1,9	14,5	3,0		1,4	37,6
84	0,0	79,8	0,4	0,1	0,012	50,0	16,8	141,8	28,0		1,4	40,0
86	0,0	50,1	0,4	0,0	0,009	40,0	13,9	99,1	20,8		2,2	39,8
94	0,3	48,5	0,3	0,1	0,002	32,0	17,4	85,9	16,7		1,7	39,3

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

SW Swine Effluents

95	1.6	1840.9	3.5	1.2	0.024	333.6	174.9	826.3	171.4		1.2	38.9	
96	1.3	915.7	3.3	1.3	0.037	395.8	181.6	945.2	206.7		2.1	38.7	
97	4.1	697.5	5.8	1.8	0.021	344.3	165.0	902.6	181.2		1.8	47.8	
102	0.5	96.4	1.9	0.2	0.010	67.1	37.6	118.0	29.4		1.5	44.3	
103	1.5	243.0	4.0	0.0	0.018	172.5	98.4	321.5	76.9		1.3	34.7	
104	1.4	458.3	8.4	0.0	0.033	328.0	190.5	612.7	146.1		1.7	48.6	
105	0.2	124.3	1.6	0.2	0.010	69.3	48.0	175.0	36.6			96.0	
106	0.0	8.8	0.3	0.0	0.001	8.2	5.4	19.3	4.3			38.1	
107	0.0	8.7	0.1	0.0	0.000	4.4	2.7	11.0	2.3			46.0	
108	0.1	131.4	1.7	0.2	0.007	75.6	49.3	184.1	39.1				
109	0.7	128.4	2.6	0.3	0.018	116.3	81.1	303.7	77.3				
110	1.4	240.1	12.9	0.7	0.006	189.6	120.9	491.4	80.3				
111	0.2	58.8	3.2	0.4	0.004	46.8	30.6	121.3	21.6				
112	0.1	25.9	0.6	0.2	0.001	40.5	24.3	101.8	22.8				
113	0.6	126.2	5.0	0.6	0.012	76.6	53.0	201.2	36.1				
114	1.0	312.7	5.1	2.3	0.032	207.7	142.1	566.8	93.0			34.7	
115	0.9	239.0	6.0	1.2	0.018	162.6	100.9	394.7	62.7				
116	0.8	114.9	0.1	1.4	0.008	121.1	70.5	305.2	70.6				
117	0.5	57.0	6.0	0.2	0.005	96.9	60.6	244.1	57.5	21.8			
118	0.8	138.7	12.2	1.4	0.005	107.5	63.9	277.3	64.6	21.5			
120	0.5	130.0	4.2	0.4	0.008	113.6	62.6	283.7	62.0	29.1	1.8	74.7	
121	0.5	130.0	0.0	0.1	0.003	92.4	48.8	149.1	54.8	23.2		68.8	
122	2.9	723.4	0.1	0.7	0.003	493.2	257.6	498.4	239.5	146.0	1.4	59.0	
123	0.1	247.2	0.1	1.5	0.008	245.9	123.5	505.0	100.7	78.8	0.7	-1.0	
124	0.1	329.7	9.2	2.7	0.014	310.3	152.8	949.1	167.6	99.4	0.5	43.7	
125	13.8	435.0	12.3	4.7	0.023	422.1	199.8	1131.6	168.9	164.5	1.5	64.2	
126	9.3	516.2	13.5	4.8	0.022	497.5	243.6	1188.1	179.0	192.0	1.7	50.0	
127	1.3	235.1	16.9	2.7	0.009	262.9	128.0	706.3	90.8	110.1	1.3	63.1	
128	0.6	38.5	4.6	0.0	0.003	75.8	36.6	194.0	23.6	24.0	1.3	34.0	
129	0.2	141.5	5.5	1.2	0.004	115.8	54.4	272.5	38.6	48.8	0.2	47.2	
130	1.3	230.8	10.7	1.6	0.006	206.0	100.7	498.2	66.3	91.7	0.1	51.9	
131	0.3	75.8	2.7	0.5	0.005	96.5	39.6	137.1	34.1	32.2	0.6	53.9	
132	1.3	634.0	18.9	0.4	0.025	658.4	336.5	958.2	224.8	279.4	0.2	44.2	
133	3.1	439.3	10.9	5.8	0.059	491.5	274.0	711.8	173.3	250.2	0.6	53.9	
134	0.7	492.7	11.3	4.4	0.027	503.7	278.9	698.8	166.2	256.5	0.3	38.8	
135	1.6	717.1	17.4	5.7	0.132	810.1	435.2	1109.5	250.0	394.8	1.2	19.0	
136	7.7	1150.3	14.6	8.3	0.062	660.5	366.1	981.8	224.1	362.9	1.0	37.9	
137	1.4	840.4	7.8	4.4	0.074	396.4	214.4	677.4	120.9	213.7	7.9	44.8	
138	1.1	817.2	6.8	4.3	0.072	397.7	207.3	569.5	157.9	221.4			
142	0.4	77.5	1.6	1.3	0.013	100.5	60.2	130.3	31.2	60.3			

SUMS OF D

	TOTAL ORGN	TOTAL NO3	TOTAL NO2	TOTAL NH4	TOTAL PO4
D	1.173051+002	2.198596+004	3.578947+002	9.113457+001	1.939725+000
	TOTAL C.I	TOTAL NA	TOTAL CA	TOTAL MG	TOTAL K
D	1.771781+004	8.024618+003	3.075844+004	7.483083+003	3.393116+003

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

NE Dairy Effluents

DAIRY BARNS, CALCULATED DATA

Q

SAMPLE	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
30	0.3	12.9	0.1	0.0	0.003	4.5	2.2	45.7	15.8		5.4	64.6
31	0.4	8.8	0.1	0.0	0.018	3.4	1.4	33.9	12.4		3.2	52.6
34	0.4	18.8	0.0	0.0	0.001	3.0	2.2	54.9	19.5		5.0	54.6
35	0.0	14.3	0.0	0.0	0.000	3.4	2.0	49.2	14.8		1.5	46.8
48	1.8	58.5	0.6	0.9	0.029	26.0	14.1	449.7	110.2		276.0	465.9
49	1.0	25.5	0.3	0.6	0.000	17.3	9.3	341.0	63.4		306.0	446.7
50	1.5	31.6	1.0	0.7	0.000	16.3	8.8	251.2	70.8		298.5	408.0
52	1.9	27.1	1.9	2.1	0.011	12.3	3.6	142.1	47.8		316.3	426.7
76	5.9	59.7	5.4	3.7	0.089	54.2	34.3	803.3	190.9		103.5	114.1
77	0.1	8.2	0.5	1.3	0.009	6.8	4.5	107.7	29.7		131.2	198.4
78	0.1	30.5	1.8	2.5	0.030	27.3	17.0	338.7	95.0		154.8	272.8
79	5.7	23.5	1.8	2.0	0.044	32.5	13.8	347.3	98.8		188.3	343.0
80	10.4	28.5	1.2	5.3	0.030	41.6	14.2	416.7	105.8		224.7	439.2
81	3.2	5.1	1.2	0.9	0.024	15.8	5.6	148.6	41.2		247.6	249.6
82	3.7	10.1	0.1	1.4	0.001	15.3	5.8	190.4	44.6		280.0	323.7
83	6.2	9.5	1.8	1.3	0.003	30.7	8.8	317.4	74.6		310.0	517.0
84	8.2	39.5	1.6	3.6	0.011	62.3	16.9	655.6	140.5		393.3	575.0
85	5.8	7.1	0.0	2.1	0.003	41.0	10.5	411.6	93.4		388.5	595.2
86	12.3	11.9	1.7	11.9	0.023	99.8	18.0	685.6	170.5		577.9	796.8
87	5.7	3.0	0.9	9.9	0.021	44.5	7.0	351.5	85.8		1374.4	1458.0
88	1.1	0.5	0.0	2.3	0.006	14.6	2.2	96.6	27.9		1449.3	1672.0
100	0.0	0.1	0.0	1.2	0.002	5.3	0.5	37.9	9.9		1495.8	2516.4
101	0.2	1.7	0.0	5.0	0.077	21.8	3.0	157.6	41.5		1323.6	2008.0
107	0.0	0.0	0.0	0.0	0.000	0.1	0.0	0.5	0.1			1380.0
110	0.0	0.0	0.0	0.0	0.000	0.0	0.0	0.3	0.1			
114	0.0	0.0	0.0	0.0	0.000	0.1	0.0	0.5	0.1			
115	0.0	0.1	0.0	0.2	0.001	1.5	0.3	8.5	1.8			297.0
116	0.2	1.2	0.0	3.2	0.011	40.4	4.1	218.9	50.7			
117	0.0	0.1	0.0	0.1	0.001	2.7	0.4	11.5	3.4	0.2		
118	0.0	0.0	0.0	0.1	0.000	1.0	0.1	4.0	1.1	0.1		
119	0.1	1.1	0.0	1.1	0.005	17.4	2.1	74.3	20.5	1.2	112.0	694.0
120	0.1	0.9	0.0	1.7	0.006	25.8	3.4	101.9	29.1	1.9	103.0	297.0
121	0.1	5.3	0.8	3.5	0.014	73.4	8.5	238.8	79.1	4.6	43.3	297.0
122	3.0	12.9	1.7	4.3	0.024	128.8	13.8	416.8	102.4	6.9	38.7	123.0
123	2.0	4.3	0.1	5.7	0.020	96.0	10.1	291.1	71.4	5.3	6.8	243.0
124	1.2	6.3	0.1	5.0	0.018	119.5	13.4	473.3	77.4	6.7	6.1	97.2
125	3.4	8.1	0.7	7.1	0.023	120.1	12.4	415.5	73.4	6.7	18.7	197.0
126	1.4	5.7	0.2	3.6	0.013	75.0	10.3	268.8	54.5	4.6	17.7	100.0
127	1.0	1.9	0.0	2.3	0.003	33.5	3.8	44.6	23.0	2.2		194.0
128	1.5	3.3	0.1	3.7	0.005	53.9	6.0	71.7	36.9	4.2		145.0
129	0.5	1.5	0.0	2.3	0.003	30.8	3.4	54.2	23.5	2.1		198.0
130	1.5	3.9	0.0	4.8	0.006	60.0	6.6	70.5	48.7	3.8		259.0
131	0.4	1.0	0.0	1.2	0.002	15.6	2.0	40.5	13.2	1.0		171.0
132	3.2	10.3	0.1	16.5	0.031	216.8	171.8	263.9	177.5	13.2		192.0
133	1.6	6.5	0.8	5.0	0.016	112.7	16.9	270.9	79.7	8.9		93.3
134	2.1	4.1	0.1	9.9	0.020	77.1	10.8	213.7	73.9	6.5	340.0	
135	2.4	3.5	0.0	10.1	0.021	72.5	11.1	157.3	72.8	6.0	380.0	
136	3.2	7.9	1.0	11.8	0.034	97.8	18.0	239.4	88.8	8.3	355.0	
137	3.2	9.5	0.3	26.1	0.019	155.1	29.2	504.8	159.1	14.1	473.0	
138	1.5	1.5	0.0	5.9	0.015	45.8	8.8	103.5	44.3	4.7	197.0	
141	1.4	1.2	0.0	5.1	0.025	34.8	6.5	104.4	32.9	3.6	144.0	
142	1.5	2.1	0.0	6.3	0.016	42.5	7.9	114.6	36.8	4.3		

SUMS OF Q

	TOTAL ORGN	TOTAL NO3	TOTAL NO2	TOTAL NH4	TOTAL PO4
Q	1.206290+002	5.629927+002	2.854470+001	2.495152+002	8.161080-001
	TOTAL CL	TOTAL NA	TOTAL CA	TOTAL MG	TOTAL K
Q	2.596623+003	6.327293+002	1.199577+004	3.307940+003	1.473570+002

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

NW Dairy Effluents

DAIRY BARNS, CALCULATED DATA

R

SAMPLE	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
29	0.7	1.4	0.0	0.3	0.002	1.7	2.5	32.1	11.8			63.7
30	0.4	1.9	0.0	0.0	0.004	2.3	1.8	36.1	9.5		10.1	86.1
31	0.6	1.0	0.0	0.0	0.000	0.0	1.4	24.8	7.1		8.9	117.0
32	0.6	1.1	0.0	0.0	0.000	0.0	2.0	35.2	9.6		10.9	79.8
35	0.0	2.5	0.1	0.0	0.000	6.8	1.5	47.8	17.0		11.6	136.2
48	2.4	16.5	0.3	1.2	0.050	5.8	8.4	136.8	31.3		2.3	45.8
49	1.2	10.9	0.1	0.6	0.041	3.1	5.8	79.4	17.9		2.1	27.4
50	0.9	10.3	0.1	0.5	0.043	5.4	4.8	0.0	0.0		1.9	25.4
52	0.8	18.4	0.0	0.4	0.043	3.7	0.4	82.7	18.4		2.1	32.5
77	0.1	1.5	0.0	0.1	0.006	2.3	1.5	24.6	5.5		1.4	19.8
78	0.9	3.9	0.0	0.0	0.020	6.7	4.7	75.6	16.5		1.6	26.8
79	1.2	2.4	0.0	0.0	0.020	5.6	3.6	58.5	15.1		1.3	24.3
80	2.0	2.5	0.1	0.0	0.036	6.3	4.4	65.5	17.9		1.2	34.1
81	0.7	0.5	0.0	0.0	0.009	1.9	1.4	21.0	5.9		0.6	24.5
82	0.5	0.3	0.0	0.0	0.008	2.1	1.6	28.9	6.6		1.0	28.5
83	0.5	0.9	0.0	0.3	0.017	2.5	2.5	37.1	11.0		1.5	23.5
84	1.0	1.4	0.1	0.0	0.016	4.7	3.6	61.2	17.3		1.7	20.0
85	0.7	1.0	0.1	0.0	0.024	4.2	2.6	53.0	11.5		0.3	19.8
86	0.6	1.2	0.1	0.0	0.011	9.1	3.2	68.1	15.5		0.5	29.9
87	0.8	2.2	0.2	0.0	0.014	8.1	2.9	59.0	12.4		1.3	34.0
88	0.5	0.9	0.2	0.0	0.016	7.0	1.9	37.5	9.3		1.9	24.0
95	0.0	0.0	0.0	0.1	0.001	1.6	0.2	8.9	2.0		8.5	102.1
100	0.0	0.0	0.0	0.0	0.002	1.8	0.3	9.1	2.2		283.2	186.4
101	0.0	0.4	0.0	0.1	0.002	3.3	1.1	27.3	6.9		12.2	50.2
109	0.0	0.0	0.0	0.0	0.000	0.0	0.0	0.1	0.0			117.0
113	0.0	0.1	0.0	0.0	0.000	0.3	0.1	1.5	0.3			
114	0.1	0.2	0.0	0.0	0.001	1.7	0.5	7.7	1.6			
115	0.2	0.1	0.0	0.0	0.002	2.9	0.6	20.5	3.8			99.2
116	0.4	1.0	0.0	0.1	0.003	7.6	0.8	50.4	7.5			
117	0.0	0.0	0.0	0.0	0.000	0.7	0.1	3.1	0.7			69.4
118	0.0	0.0	0.0	0.0	0.000	0.9	0.2	4.1	0.9			
119	0.0	0.1	0.0	0.0	0.000	0.9	0.2	3.8	0.9		10.0	79.3
120	0.4	0.5	0.0	0.1	0.004	11.3	2.2	40.0	10.0	0.3	8.9	297.0
121	0.1	0.3	0.0	0.0	0.001	4.2	0.5	12.9	3.7	0.1	5.3	297.0
122	0.6	3.5	0.0	0.0	0.010	39.2	4.3	92.7	36.8	0.9	5.3	49.2
123	0.5	2.0	0.0	0.4	0.009	47.6	4.6	112.7	26.3	1.3	3.8	
124	1.4	4.7	0.0	0.0	0.010	50.9	6.0	177.2	32.3	1.2	1.3	38.8
125	0.9	5.9	0.1	0.5	0.014	64.7	6.4	195.9	32.2	1.3	3.7	29.6
126	0.5	5.1	0.1	0.4	0.009	58.0	5.4	162.8	30.9	1.2	1.9	40.0
127	0.3	2.5	0.0	0.0	0.004	26.3	2.3	35.0	14.7	0.6	1.4	43.7
128	0.4	3.3	0.0	0.0	0.003	23.7	2.5	51.9	13.3	0.6	1.7	58.3
129	0.3	3.1	0.0	0.9	0.003	17.3	1.7	36.4	9.1	0.3	1.5	37.6
130	0.3	2.2	0.0	0.0	0.003	13.7	1.3	18.6	8.2	0.3	1.0	37.7
131	0.4	1.5	0.0	0.0	0.002	8.5	0.8	13.7	5.1	0.2	0.7	39.2
132	1.1	9.9	0.0	0.1	0.014	42.3	4.6	69.4	24.9	0.9	1.7	34.5
133	1.2	9.9	0.1	0.4	0.032	49.8	7.5	146.4	32.5	1.2	1.7	34.5
134	2.1	35.7	0.2	0.2	0.016	114.2	22.1	229.5	84.8	2.5	0.6	34.0
135	1.9	34.7	0.2	0.6	0.033	86.8	20.8	197.3	62.0	1.9	0.9	19.0
136	2.3	133.3	0.3	2.1	0.080	172.8	42.4	336.3	102.3	3.2	1.5	33.1
137	5.5	145.0	0.2	1.1	0.068	171.7	41.1	335.6	87.3	2.8	1.1	
138	1.3	117.3	0.1	0.9	0.040	120.9	30.3	206.7	57.4	2.0	1.1	
141	0.3	16.8	0.1	0.2	0.014	48.9	13.1	80.3	22.6	0.7		
142	2.8	71.0	0.3	1.0	0.057	189.3	57.7	324.9	85.3	2.7		

SUMS OF R

	TOTAL ORGN	TOTAL NO3	TOTAL NO2	TOTAL NH4	TOTAL PO4
R	4.474485+001	8.770846+002	3.899296+000	1.949024+001	8.726014-001

	TOTAL CL	TOTAL NA	TOTAL CA	TOTAL MG	TOTAL K
R	1.855049+003	4.419843+002	4.080033+003	1.236007+003	3.075053+001

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

SE Dairy Effluents

DAIRY BARNS, CALCULATED DATA

SAMPLE	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
11	0.10	0.10	0.01	0.0	0.005	0.1	0.1	1.9	0.7		1.0	59.6
12	0.02	0.03	0.01	0.0	0.000	0.0	0.0	0.5	0.2		1.0	72.8
13	0.01	0.01	0.01	0.0	0.000	0.0	0.0	0.4	0.1		1.0	66.2
14	0.02	0.05	0.00	0.0	0.000	0.0	0.0	0.5	0.2		1.0	53.0
15	0.05	0.13	0.01	0.0	0.001	0.1	0.1	1.5	0.6		1.0	85.5
16	0.12	0.21	0.02	0.0	0.002	0.4	0.2	4.7	1.9		1.0	85.5
17	0.02	0.02	0.00	0.0	0.000	0.1	0.0	0.6	0.2		1.0	80.1
18	0.04	0.03	0.00	0.0	0.000	0.1	0.0	1.3	0.4		1.0	70.8
19	0.01	0.01	0.01	0.0	0.000	0.0	0.0	0.4	0.1		2.5	70.8
20	0.01	0.03	0.00	0.0	0.000	0.1	0.0	0.9	0.4		4.9	90.4
21	0.02	0.17	0.00	0.0	0.000	0.2	0.1	2.7	1.1		68.4	85.1
22	0.04	0.04	0.00	0.0	0.000	0.2	0.1	2.1	0.7		7.1	95.8
24	0.02	0.03	0.00	0.0	0.000	0.1	0.0	1.5	0.4		6.6	101.8
25	0.02	0.03	0.00	0.0	0.000	0.1	0.0	0.9	0.3		11.1	117.1
26	0.02	0.16	0.00	0.0	0.000	0.1	0.0	1.1	0.4		11.7	122.4
30	0.61	2.00	0.10	0.2	0.007	7.9	2.1	51.2	19.3		12.3	136.8
31	0.61	1.00	0.05	0.1	0.002	4.4	1.2	23.6	11.1		15.5	147.3
34	0.50	1.33	0.03	0.1	0.001	3.3	0.9	23.4	9.4		22.4	143.0
35	0.33	1.21	0.05	0.1	0.001	1.5	0.7	23.5	7.1		4.1	93.2
36	0.50	1.31	0.10	0.1	0.003	4.6	1.6	44.4	15.0		19.0	136.2
37	1.40	1.72	0.10	0.2	0.004	6.2	2.2	83.1	21.7		21.4	154.2
38	2.40	5.00	0.20	0.8	0.007	12.3	4.4	116.6	40.2		24.7	127.8
39	2.60	5.83	0.10	0.5	0.006	17.5	4.1	143.6	37.5		25.3	137.2
40	0.22	0.50	0.01	0.1	0.001	1.7	0.5	11.9	3.4		21.7	144.1
41	2.00	7.50	0.20	0.5	0.005	22.6	4.9	147.8	40.2		23.5	112.3
43	6.22	16.10	0.64	1.8	0.014	50.0	9.7	283.0	71.5		11.5	100.0
44	7.13	12.30	0.64	2.8	0.026	66.1	21.7	272.2	68.6		12.1	96.4
45	1.51	5.20	0.31	1.2	0.020	32.1	5.6	142.6	34.6		10.9	83.2
46	1.65	4.92	0.28	0.5	0.012	30.6	6.4	107.5	25.9		12.7	83.2
47	1.01	6.30	0.10	0.4	0.009	20.5	4.5	72.1	17.5		16.0	76.7
48	3.80	9.53	0.20	1.0	0.021	58.2	11.8	223.0	53.7		7.2	78.0
49	2.40	4.30	0.10	0.6	0.013	28.0	6.8	104.1	23.3		8.4	73.2
50	3.50	6.74	0.10	1.2	0.026	38.0	7.3	148.3	35.2		10.1	81.6
51	2.01	7.33	0.10	0.7	0.019	30.8	5.8	92.5	26.8		6.3	78.2
52	1.11	6.63	0.10	0.6	0.013	23.5	4.1	62.5	19.0		7.8	73.2
76	14.72	17.01	0.12	6.1	0.047	178.1	35.6	488.2	110.0		5.8	44.6
77	0.76	1.23	0.01	0.4	0.006	20.5	4.4	62.7	15.4		5.5	54.6
78	1.68	3.50	0.03	0.6	0.037	54.1	14.1	147.3	40.0		6.4	64.5
79	3.50	2.04	0.05	1.0	0.028	47.0	15.0	157.7	38.4		5.8	68.6
80	1.40	2.84	0.10	0.6	0.033	52.8	15.2	163.9	42.7		6.4	63.4
81	2.60	1.70	0.10	0.3	0.019	27.4	8.1	83.5	23.9		3.6	48.0
82	2.60	2.35	0.10	0.5	0.008	29.5	10.3	110.2	25.9		4.5	52.3
83	1.05	1.70	0.00	0.3	0.003	20.0	5.8	70.9	14.5		3.0	61.1
84	1.24	3.30	0.02	0.4	0.013	26.3	11.0	87.5	19.9		6.6	50.0
85	0.22	1.53	0.03	0.3	0.003	15.8	3.9	44.8	10.4		2.8	49.6
86	1.00	1.93	0.03	0.0	0.002	21.2	5.2	60.7	13.2		3.0	59.8
87	0.25	0.53	0.00	0.1	0.002	5.6	1.2	15.0	3.2		13.3	77.8
88	0.30	0.30	0.00	0.0	0.002	6.2	1.3	12.3	3.4		7.8	57.6
89	0.02	0.01	0.00	0.0	0.000	0.3	0.1	0.8	0.2		4.9	89.3
90	0.20	0.10	0.01	0.1	0.001	2.8	0.6	6.0	1.5		8.6	79.9
91	0.72	1.33	0.04	0.2	0.006	15.3	3.7	29.7	7.5		6.7	92.4
92	1.01	2.34	0.05	0.4	0.003	23.3	7.6	51.1	14.9		6.8	64.5
93	0.50	0.90	0.04	0.2	0.001	12.3	3.4	25.6	6.7		6.1	78.4
94	0.92	1.54	0.02	0.4	0.001	14.5	4.6	27.1	8.1		8.5	98.4
95	2.03	2.40	0.04	0.7	0.011	28.4	8.0	52.7	15.2		5.8	82.6
96	0.80	3.82	0.03	0.6	0.009	26.8	6.5	51.6	14.9		5.6	87.8
97	0.60	1.80	0.03	0.4	0.007	16.1	3.2	32.7	9.6		6.6	81.3
98	0.70	1.40	0.02	0.6	0.006	19.1	5.9	37.1	13.8		7.6	71.4
99	0.30	0.33	0.01	0.2	0.006	11.6	2.4	21.1	5.8		8.4	88.9
103	0.01	0.01	0.00	0.0	0.000	0.1	0.0	0.3	0.1		2.5	119.0
104	0.70	0.90	0.02	0.3	0.005	13.7	4.7	27.5	7.1		7.2	92.3
105	0.40	0.51	0.02	0.2	0.001	6.8	2.3	15.3	4.0			115.2
106	0.00	0.02	0.00	0.0	0.000	1.2	0.3	2.6	0.7			123.8
107	0.01	0.02	0.00	0.0	0.000	1.1	0.3	2.5	0.7			143.6
108	0.01	0.00	0.00	0.0	0.000	0.0	0.0	0.1	0.0		144.0	
109	0.14	0.10	0.01	0.1	0.000	1.9	0.7	3.9	0.9		127.0	

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

SE Dairy Effluents

110	0.14	0.30	0.00	0.1	0.001	3.6	1.2	7.6	1.9		111.0
111	0.01	0.21	0.00	0.1	0.001	3.2	0.9	6.1	1.8		147.0
112	0.11	0.10	0.00	0.0	0.000	1.3	0.3	2.9	0.6		122.0
113	0.30	0.53	0.00	0.1	0.002	7.1	2.2	15.3	3.3		
114	0.80	2.50	0.01	1.0	0.015	23.8	8.4	61.1	10.9		124.0
115	0.60	0.60	0.00	0.9	0.009	22.4	6.8	48.4	9.9		
116	0.50	0.40	0.00	0.7	0.005	18.9	5.0	43.5	11.4		
117	0.20	0.34	0.00	0.3	0.002	7.6	2.3	18.2	4.4	0.8	173.0
118	0.20	0.20	0.00	0.3	0.002	7.7	2.4	40.4	4.3	0.8	
119	0.20	0.20	0.01	0.3	0.002	7.5	2.4	16.0	4.2	0.8	163.0
120	0.50	0.43	0.01	0.5	0.004	15.3	4.6	35.4	8.8	1.6	297.0
121	1.00	1.40	0.02	1.2	0.009	31.4	9.7	63.1	20.8	3.1	297.0
122	1.64	4.30	0.04	1.6	0.013	51.0	16.4	75.9	34.0	5.0	93.4
123	0.61	0.90	0.02	1.0	0.007	36.0	11.5	67.5	19.0	3.3	
124	1.32	4.02	0.02	1.1	0.010	51.0	17.1	115.6	24.6	4.6	77.7
125	1.60	2.34	0.10	1.7	0.008	58.8	18.1	122.6	26.1	4.9	83.9
126	0.80	1.80	0.04	1.0	0.006	40.5	13.0	87.8	16.0	3.3	80.7
127	0.23	1.03	0.02	0.6	0.004	24.6	7.6	31.4	9.9	1.8	87.4
128	0.20	0.53	0.00	0.3	0.002	11.4	3.4	11.6	4.8	1.0	72.9
129	0.40	2.10	0.02	0.5	0.004	24.3	7.5	24.6	10.1	1.7	72.0
130	0.15	0.40	0.00	0.2	0.001	5.9	1.6	6.4	2.7	0.4	80.2
131	0.53	1.83	0.01	0.3	0.005	14.0	4.9	22.7	7.2	1.2	73.5
132	0.62	13.84	0.10	2.4	0.008	101.2	29.6	113.9	42.5	6.2	64.2
133	2.05	8.35	0.10	2.1	0.010	94.9	27.8	184.0	39.5	6.5	
134	2.51	15.50	0.10	2.3	0.022	131.0	41.0	173.8	51.0	7.2	
135	1.10	24.43	0.15	3.5	0.017	175.4	53.6	235.6	64.5	9.1	
136	3.44	136.80	0.22	4.0	0.061	263.1	82.2	314.3	91.4	12.2	
137	0.10	3.01	0.01	0.1	0.002	6.9	2.2	8.9	2.4	0.4	
138	1.61	98.02	0.30	3.9	0.039	199.7	59.8	238.9	64.7	9.6	
141	1.20	30.10	0.20	2.5	0.060	170.0	49.8	200.4	52.1	8.0	
142	1.53	50.30	0.21	2.5	0.000	139.8	41.8	162.4	43.1	7.1	

SUMS OF 8

	TOTAL ORGN	TOTAL NO3	TOTAL NO2	TOTAL NH4	TOTAL PO4
S	1.132172+002	7.127240+002	6.175971+000	7.460698+001	8.817555-001
	TOTAL CL	**TOTAL NA**	**TOTAL CA**	**TOTAL MG**	**TOTAL K**
S	3.430613+003	9.705935+002	7.189402+003	1.898974+003	1.240543+002

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

SW Dairy Effluents

DAIRY BARNS, CALCULATED DATA

SAMPLE	ORGN	NO3	NO2	NH4	PO4	CL	NA	CA	MG	K	BOD	COD
11	0.10	0.1	0.0	0.0	0.001	0.2	0.1	2.6	1.1		0.5	53.0
12	0.10	0.1	0.0	0.0	0.000	0.1	0.1	1.0	0.4		0.5	46.3
13	0.01	0.0	0.0	0.0	0.000	0.1	0.0	0.7	0.3		0.5	132.4
14	0.02	0.1	0.0	0.0	0.000	0.1	0.0	0.9	0.4		0.5	46.3
15	0.01	0.5	0.0	0.0	0.001	0.3	0.1	2.1	0.9		0.5	56.8
16	0.20	0.9	0.0	0.0	0.001	0.6	0.2	5.1	2.1		0.5	59.2
17	0.02	0.1	0.0	0.0	0.000	0.1	0.0	0.8	0.3		0.5	49.3
18	0.03	0.1	0.0	0.0	0.000	0.1	0.1	1.3	0.6		0.5	51.5
19	0.02	0.0	0.0	0.0	0.002	0.1	0.0	1.1	0.3			51.5
20	0.04	0.1	0.0	0.0	0.000	0.1	0.1	1.5	0.5			64.6
21	0.04	0.1	0.0	0.0	0.000	0.2	0.1	2.6	0.8		2.4	53.4
22	0.05	0.1	0.0	0.0	0.001	0.2	0.1	3.1	0.9		4.5	69.2
24	0.02	0.0	0.0	0.0	0.000	0.2	0.1	2.3	0.6		6.1	58.5
25	0.03	0.0	0.0	0.0	0.000	0.1	0.0	1.4	0.5		5.6	85.5
26	0.03	0.1	0.0	0.0	0.001	0.2	0.1	0.8	0.6		5.8	85.1
30	0.70	1.3	0.1	0.1	0.005	2.8	1.3	25.5	12.1		5.7	94.7
31	0.40	0.5	0.0	0.1	0.001	2.1	0.8	12.4	7.7			
34	0.21	0.7	0.0	0.0	0.003	0.6	0.5	8.6	4.9			
35	0.12	0.4	0.0	0.0	0.000	0.6	0.5	10.0	2.5			
36	0.54	0.5	0.0	0.0	0.000	1.4	0.8	26.8	8.7			
37	0.60	0.9	0.0	0.0	0.001	2.2	1.2	40.5	13.7			
38	1.90	3.2	0.1	0.1	0.010	5.5	2.6	171.3	26.6			
39	2.40	4.5	0.1	0.0	0.011	11.2	2.9	118.6	31.7			
40	0.20	0.5	0.0	0.0	0.001	1.2	0.5	11.6	3.1			
41	1.81	9.2	0.3	0.2	0.017	18.9	4.6	137.3	36.1			
43	7.80	33.8	0.8	1.9	0.029	69.0	9.1	292.5	73.8			
44	4.40	72.8	0.8	1.0	0.054	102.9	10.3	305.5	78.4			
45	2.02	19.1	0.4	0.8	0.010	55.3	6.6	148.2	35.8			
46	2.50	21.3	0.4	0.5	0.035	69.0	6.6	165.2	39.0			
47	2.20	21.5	0.1	0.5	0.033	39.0	4.7	113.5	26.7			
48	2.80	26.5	0.1	0.3	0.047	78.7	13.6	187.3	43.2			
49	0.82	6.3	0.1	0.1	0.006	21.8	2.5	46.9	11.0			
50	3.40	15.3	0.2	0.2	0.010	56.5	7.2	119.1	31.0			
51	2.30	10.1	0.1	0.1	0.006	42.4	5.4	88.6	21.4			
52	0.44	4.1	0.0	0.0	0.003	11.7	1.8	23.	5.3			
76	14.0	25.5	1.0	5.2	0.112	235.3	34.1	460.4	113.0			
77	0.82	2.5	0.1	0.2	0.007	26.2	4.5	55.6	16.0			
78	3.90	15.5	0.4	0.4	0.079	95.7	22.6	268.0	73.1			
79	5.13	14.7	1.0	0.5	0.058	113.7	24.5	289.8	81.6			
80	3.70	17.2	1.8	0.3	0.069	129.7	27.8	289.7	87.5			
81	6.30	8.8	2.1	0.2	0.044	69.3	16.3	161.7	51.3			
82	4.30	12.9	2.0	0.3	0.040	89.9	20.7	233.0	59.2			
83	1.80	7.9	1.4	0.7	0.031	47.6	12.8	137.9	31.8			
84	2.01	10.4	1.6	0.4	0.050	60.1	16.8	172.9	43.8			
85	1.01	2.3	0.6	0.2	0.007	23.4	6.3	64.5	16.9			
86	0.95	3.4	1.1	0.2	0.012	48.1	12.6	122.2	28.8			
87	0.15	0.9	0.2	0.1	0.002	8.1	2.3	20.5	4.8			
88	0.41	0.9	0.2	0.0	0.005	10.3	2.9	19.5	5.6			
89	0.20	0.2	0.0	0.1	0.003	6.1	2.2	13.0	3.5			
90	1.00	0.7	0.1	0.0	0.007	16.6	5.4	38.7	9.7			
91	1.40	1.9	0.1	0.3	0.013	38.2	14.2	81.9	20.2			
92	1.60	2.6	0.2	0.3	0.005	46.8	17.7	93.4	25.4			
93	0.90	0.7	0.0	0.2	0.001	18.1	7.4	38.5	10.8			
94	1.40	1.3	0.1	0.2	0.001	23.4	8.6	59.7	12.5			
95	2.60	2.4	0.1	0.7	0.008	65.7	22.9	114.6	32.7			
96	0.70	3.9	0.1	0.5	0.006	38.2	8.5	66.0	18.4			
97	1.50	3.2	0.1	0.5	0.013	45.5	11.3	83.3	24.0			
98	1.50	5.3	0.1	0.8	0.018	56.3	14.5	96.6	29.1			
99	0.60	0.3	0.0	0.4	0.001	26.3	7.0	47.4	12.2			
103	0.00	0.1	0.0	0.0	0.001	1.2	0.4	2.1	0.6			
104	1.00	1.1	0.0	0.4	0.027	49.3	17.5	89.0	24.3		2.0	
105	0.40	0.8	0.0	0.2	0.002	14.1	5.3	29.0	7.4		6.1	
106	0.10	0.3	0.0	0.0	0.000	1.6	0.6	3.5	0.9		10.6	
107	0.20	0.1	0.0	0.1	0.002	6.3	2.4	13.2	3.3		7.0	133.0
109	0.10	0.1	0.0	0.1	0.001	2.6	1.0	5.3	1.1	---		137.0
110	0.40	0.5	0.0	0.3	0.003	9.8	4.1	20.9	4.6			126.0

Table 8 (continued). AMOUNTS OF NUTRIENTS IN THE EFFLUENTS FROM BLWRS EXPRESSED IN GRAMS.

SW Dairy Effluents

111	0,1 0	0.4	0.0	0.1	0.002	7.0	2.5	16,0	3,1			
112	0,0 0	0.0	0.0	0.0	0.000	1.4	0.4	2,6	0,6			82.9
113	0,0 0	0.0	0.0	0.0	0.000	0.1	0.0	0,1	0,0			
114	2,0 0	3.7	0.0	1.5	0.023	68.5	28.6	161,8	41,7			99.2
115	1,9 0	1.5	0.0	1.8	0.018	66.2	23.6	117,8	26,1			
116	1,7 0	0.7	0.1	0.9	0.013	47.4	18.3	97,9	22,9			
117	0,7 0	1.1	0.0	1.0	0.007	24.2	9.5	51,8	11,8	2.1		94.2
118	0,0 0	0.0	0.0	0.0	0.000	0.1	0.0	0,1	0,0			
119	0,9 0	1.1	0.2	0.2	0.008	31.2	12.8	61,1	14,8	2.4	22,7	104.0
120	1,2 0	1.9	0.0	0.3	0.012	42.8	16.5	76,9	20,3	3.9	22,7	148.0
121	2,1 0	7.3	0.2	0.0	0.024	86.0	32.7	90,9	58,7	7.0	6,3	123.0
122	2,5 0	23.2	1.9	0.8	0.035	153.5	55.3	426,4	77,3	11.3	6,3	93.4
123	0,7 1	1.5	0.0	0.4	0.005	27.0	10.1	43,6	11,7	1.9	2,4	102.0
124	2,6 1	9.3	0.6	1.9	0.027	157.9	56.3	318,7	63,3	10.2	1,9	77.7
125	2,2 1	8.5	0.3	2.5	0.020	150.0	50.6	282,5	55,2	8.8	2,9	83.9
126	1,6 0	8.9	0.2	2.0	0.019	138.7	48.3	247,1	50,9	8.5	3,9	80.0
127	0,6 0	6.9	0.1	1.4	0.011	82.7	26.3	91,7	26,0	4.7	4,3	87.4
128	0,6 0	5.1	0.1	0.9	0.010	87.4	28.9	72,0	28,1	5.2	4,4	72.9
129	0,7 0	3.0	0.0	0.9	0.004	51.7	16.3	51,6	16,0	2.6	1,6	70.8
130	1,0 0	6.8	0.2	0.7	0.003	51.6	16.0	49,4	16,8	2.5	1,7	80.0
131	0,3 0	5.1	0.0	0.3	0.002	21.8	6.6	20,6	7,0	1.1	1,6	73.5
132	1,9 2	37.3	0.2	2.8	0.016	298.3	95.4	264,1	96,5	12.6	3,0	64.2
133	2,7 0	32.5	0.1	1.8	0.029	189.8	67.4	239,6	76,2	9.1	0,5	78.4
134	3,1 4	37.9	0.2	2.5	0.024	316.5	102.7	420,7	107,9	10.3	1,3	63.1
135	5,1 4	147.8	0.2	3.7	0.055	396.4	139.1	399,8	128,2	13.6	1,6	38.0
136	4,2 4	248.8	0.3	3.9	0.079	468.3	167.3	564,0	146,2	16.6	1,6	61.6
137	3,4 4	354.3	0.2	9.5	0.094	446.9	164.5	560.7	146,3	14.7		66.7
138	1,4 0	358.5	0.2	4.1	0.081	424.7	159.0	528.3	126,8	12.7		54.3
141	1,7 0	84.5	0.1	1.9	0.013	245.6	96.4	331,5	79,2	8.0		
142	2,2 1	135.4	0.1	2.5	0.027	253.1	94.9	297,3	78,0	8.1		

SUMS OF T

	TOTAL ORGN	TOTAL NO3	TOTAL NO2	TOTAL NH4	TOTAL PO4
T	1,503265+002	2,332080+003	2,427210+001	7,668499+001	1,637768+000

	TOTAL CL	TOTAL NA	TOTAL CA	TOTAL MG	TOTAL K
T	6,997018+003	2,206893+003	1,182578+004	5,068210+003	1,967451+002

Table 9. SUMMARY OF THE AVERAGE NUTRIENT CONCENTRATION IN BLWRS WASTES AND EFFLUENTS - DECEMBER 1972.

	Org N	NO_3	NO_2	NH_4	PO_4	Cl	Na	Ca	Mg	K
					ppm					
Swine Waste	514	7.4		423	18.0	208.7	113.1	111.7	45.1	275.1
Effluent										
NE	1.1	159.3	15.6	54.3	0.02	173.6	93.2	409.9	80.7	171.7
NW	3.5	72.9	6.8	38.3	0.02	158.7	80.5	328.6	83.8	25.7
SE	1.4	150.6	6.7	1.1	0.02	135.2	74.3	297.9	74.7	36.7
SW	1.1	226.7	7.4	0.7	0.01	161.0	81.9	349.0	82.9	119.7
Dairy Waste	514.2	9.6		403.4	38.5	240.9	128.7	606.3	55.5	817.6
Effluent										
NE	2.1	10.5	1.8	6.6	0.02	61.3	11.7	292.3	80.6	8.0
NW	1.4	15.1	0.3	0.5	0.02	48.5	10.4	152.1	38.5	2.7
SE	3.0	11.9	0.5	1.7	0.02	70.8	20.2	172.4	46.6	10.4
SW	2.7	20.2	0.4	1.1	0.02	91.1	26.3	162.4	45.3	9.7

Table 10. SUMMARY OF TOTAL NUTRIENTS IN BLWRS WASTES AND EFFLUENTS THROUGH DECEMBER 1972.

	Org N	NO_3	NO_2	NH_4	PO_4	Cl	Na	Ca	Mg	K
	kg									
Swine Waste	209.7	3.1		173.3	7.5	84.0	44.3	44.0	18.3	26.0
Effluent										
NE	0.2	25.0	0.2	8.4	0.003	27.0	14.5	59.8	12.7	6.5
NW	0.4	6.5	0.2	2.5	0.003	12.2	5.9	29.7	7.9	1.4
SE	0.09	9.1	0.2	0.06	0.002	8.8	4.5	18.0	4.8	3.2
SW	0.12	22.0	0.3	0.01	0.002	17.7	8.0	30.8	7.5	3.4
Total	0.81	62.6	0.9	11.6	0.010	65.7	32.9	138.3	51.2	14.5
Dairy Waste	98.4	2.0		75.5	8.3	50.2	25.3	30.9	11.3	59.4
Effluent										
NE	0.12	0.56	0.030	0.25	0.008	2.6	0.6	12.0	3.3	0.15
NW	0.04	0.88	0.004	0.01	0.009	1.8	0.4	4.7	1.2	0.03
SE	0.11	0.71	0.006	0.07	0.009	1.8	0.4	4.7	1.2	0.03
SW	0.15	2.33	0.020	0.07	0.002	7.0	2.2	11.8	3.0	0.20
Total	0.42	4.48	0.06	0.40	0.028	13.2	3.6	33.2	8.7	0.41

Table 11. PERCENT TOTAL SOLIDS IN WASTE THAT WAS APPLIED TO THE BLWRS.

Date	Swine Waste	Dairy Waste
July 1971	0.22	
August	0.36	0.26
September	0.33	0.23
October	0.24	0.315
November	0.31	0.395
December		0.385
March 1972		0.44
April	0.24	0.45
May	0.28	0.49
June	0.29	0.48
July	0.28	0.58
August	0.30	0.64
September	0.33	0.50
October	0.33	0.49
November	0.30	0.53
Average	0.30	0.44

Table 12. TOTAL CARBON IN EFFLUENT AND WASTE FROM BLWRS IN PPM.

Sample Number	130	131	132	133	134	135	136	137
Swine Effluent								
North BLWRS								
East (A)	18	12	16	16	60	8	26	16
West (B)	18	38	16	8	26	<2	<2	<2
South BLWRS								
East (C)	<2	26	<2	24	44	8	24	4
West (D)	<2	40	4	58	18	12	52	8
Swine Waste (E)	276	294	290	274	508	410	160	140
Dairy Effluent								
North BLWRS								
East (Q)	88	44	48	26	68	78	26	
West (R)	34	18	16	28	36	38	16	
South BLWRS								
East (S)	74	44	34	34	16	4	28	
West (T)	54	46	20	26	42		10	
Dairy Waste (U)	506	534	564	608	566	434	400	

winter when denitrification slows.

Phosphate concentrations on all BLWRS was at the 0.02 ppm level which is the natural leachate from these soils. The phsophate absorption capacity of the soil is removing all the soluble phosphate from the system.

The recycling of the effluent at the Swine Barns for reflushing is causing a buildup of NaCl. This is dispersing the organics on the surface of the Swine BLWRS and reducing the infiltration rates.

Calcium and magnesium are leaching from the BLWRS soils but these are not polluting.

The amounts of nutrients added in waste and drained from the BLWRS are summarized in Table 10. The total nitrogen added in waste was 386 kg and 176 kg for the Swine and Dairy BLWRS with effluents containing 76 and 5.4 kg for a renovation efficiency of 80% and 97%. The corn energy source excelled the others in renovation efficiency. The average rate of nitrogen applied in the wastes amounted to 23.8 t/ha. for the Swine and 10.8 t/ha. for the Dairy BLWRS during their operation to December 1972.

Phosphate renovation efficiencies for the Swine BLWRS was 99.9% and for the Dairy BLWRS 99.4%. Actually, eventually the BLWRS sill reach their absorptive capacities but until then they are extremely efficient at removing phosphate. Part of this is due to the fact that even though the wastes have phosphate concentrations of 18 and 38 ppm these are reduced to 5 to 7 ppm by the precipitation of dicalcium phosphate. This precipitate accumulates in the surface

soil. The remaining soluble phosphate is absorbed on the soil. The average rate of phosphate application was 461 and 510 kg/ha.

The BOD_5 and COD analyses are reported in Tables 5, 6, 7 and 8, pages 44 to 81. The swine waste had an average BOD concentration of 1131 mg/l and an average COD of 2328 mg/l while the dairy waste was 1637 mg/l and 3356. The average BOD_5 and COD values of the effluents from the corn energy source of all the BLWRS was 290 mg/l and 433 mg/l while the other sides of the BLWRS had average BOD_5 of 18.9 mg/l and COD of 78.3 mg/l. This indicates that too much energy was available in the corn source and a less reactive organic source would be preferred. If the corn effluents are excluded, the BOD_5 and COD renovation of the BLWRS were 98.6% and 97.3% which is very good.

CHANGES IN THE SOIL

The original chemical analysis of the soil is reported in Table 2, page 37. Subsequent analyses were made on samples collected October 20, 1971, and November 1, 1972, all reported in Tables 13 and 14.

Nitrate nitrogen shows a depletion in the surface soil over the amount that was originally there although the second sampling shows the content building up in the surface soils. At all depths below the surface soil there is an increase in nitrate which should be expected in these aerobic soils that have been heavily loaded with nitrogenous waste.

Ammonium nitrogen had a slight increase in the 0-5 cm depths but a depletion in the rest of the profile down to the anaerobic zones where in the North Swine and South Dairy there was an increase in ammonium. These were the heavily driven BLWRS of each pair.

Table 13. CHEMICAL COMPOSITION OF NORTH SWINE BLWRS SOIL, OCTOBER 20, 1971, IN PPM

Sample	Top of BLWRS N as NO_3 1	N as NO_3 2	N as Organic N 1	N as Organic N 2	P as PO_4 1	P as PO_4 2	Cl 1	Cl 2
Depth								
0-3	8.74	10.035	1,080.8	487.7	95.70	60.49	190	190
3-6	7.95	5.50	140.1	111.38	15.52	14.29	480	240
6-9	9.12	3.29	91.13	83.53	3.16	4.88	430	810
9-12	7.10	3.49	79.31	86.06	6.68	6.58	240	570
12-15	4.36	2.91	118.31	70.87	4.19	3.94	430	240
15-18	3.49	2.30	47.25	106.31	4.96	4.79	520	1,240
18-24	3.03	2.00	42.19	42.19	1.73	1.74	570	760
24-30	2.30	2.57	40.50	43.87	2.00	5.42	710	570
30-36	3.32	3.52	47.25	54.00	1.54	4.44	2,000	760
36-42	5.02	2.55	40.50	57.37	1.87	3.63	330	860
42-48	6.99	2.56	30.38	55.68	2.57	4.02	330	520
48-54	6.87	4.28	27.00	52.31	0.71	11.77	530	430
54-60	6.75	3.88	62.44	45.56	2.00	7.10	430	520
60-66	6.47		87.75		2.72		330	

Table 13 (continued). CHEMICAL COMPOSITION OF NORTH SWINE BLWRS SOIL, OCTOBER 20, 1971, IN PPM.

Sample	Ends of BLWRS							
	N as NO_3		N as Organic N		P as PO_4		Cl	
	East	West	East	West	East	West	East	West
Depth								
0-3	0.527	102.94	157.78	0.513	4.11	3.39	100	280
3-6	0.504	89.44	59.06	0.478	2.29	4.11	140	280
6-9	0.533	64.12	43.87	0.491	2.21	3.01	380	330
9-12	0.564	55.69	55.69	0.518	2.29	0.59	190	50
12-15	0.527	54.00	65.81	0.572	5.41	2.29	430	380
15-18	0.522	45.56	33.75	0.705	2.00	1.21	280	100
18-21	0.539	48.93	52.31	0.735	1.605	0.84	240	900
21-24	0.560	116.44	43.87	0.746	1.74	0.71	380	280
24-27		64.13		1.486		2.72		660
27-30	12.72	52.31	79.31	5.540	3.34	2.86	380	280
30-33	20.14	40.50	45.56	4.88	2.08	0.71	380	240
33-36	20.07		57.37		2.43			

Table 14. CHEMICAL ANALYSIS OF SOIL SAMPLES TAKEN FROM SWINE BLWRS, NOVEMBER 1, 1972, IN PPM. TWO SAMPLES TAKEN, ONE FROM THE NORTH AND ONE FROM THE SOUTH BLWRS.

Depth	N as NO_3[a]		N as NH_4[a]		North Swine BLWRS N as	Org N	Total	C	P as	PO_4
	N	S	N	S	N	S	N	S	N	S
0-1"	14.83	60.87	7.06	1.57	1,740.6	604.0	15600	13100	337.5	327.7
1-2"	20.87	51.74		Tr.	343.5	280.8	13000	13200	129.5	95.8
2-4"	8.30	18.21	1.17	Tr.	134.9	142.7	14100	12800	25.7	60.0
4-6"	13.73	20.57	Tr.	Tr.	141.2	111.4	12800	14100	12.4	33.4
6-8"	5.69	9.27	0.78	Tr.	147.5	83.1	16000	11100	3.74	19.5
8-10"	5.67	12.22	1.57	Tr.	106.7	70.6	15900	12300	7.52	10.3
10-12"	5.99	16.42	3.13	1.57	120.8	64.3	16800	13600	4.00	5.6
1-1½'	23.42	13.55	1.57	Tr.	125.5	111.4	13300	12800	6.92	14.6
1½-2'	9.53	12.68	Tr.	Tr.	140.78	95.7	15400	10100	5.76	20.5
2-2½'	8.76	7.28	3.13	Tr.	150.2	125.5	14100	11600	1.13	13.2
2½-3'	25.29	22.45	1.57	2.35		130.2	14100	11100	2.34	11.6
3-3½'	25.39	17.55	2.35	1.57	51.8	95.7	15400	13200	2.26	13.2
3½-4'	13.36	16.64	2.35	3.13	51.8	83.1	13300	14100	2.26	10.7
4-4½'	23.42	21.27	1.57	2.35	64.3	64.3	13300	12800	2.26	11.1
4½-5'	28.71	23.33	Tr.	0.78	205.5	62.7	14100	11600	2.84	14.9
5-5½'	49.80	47.46	7.84	10.78	147.84	31.4	15800	11500	5.5	4.4
5½-6'	42.96	2.78	19.61	13.33	92.5	65.9	13800	11600	7.5	5.5

[a] on wet basis

Table 14 (continued). CHEMICAL ANALYSIS OF SOIL SAMPLES TAKEN FROM SWINE BLWRS, NOVEMBER 1, 1972, IN PPM. TWO SAMPLES TAKEN, ONE FROM THE NORTH AND ONE FROM THE SOUTH BLWRS.

Depth	South Swine BLWRS									
	N as NO_3[a]		N as NH_4[a]		N as Org N		Total C		P as PO_4	
	N	S	N	S	N	S	N	S	N	S
0-1"	19.17	93.04	7.06	5.49	1,554.6	1,171.9	12400	13400	458.3	442.2
1-2"	24.06	41.62	5.88	4.71	662.0	817.3	13100	11300	236.6	25.4
2-4"	27.73	27.23	0.78	3.13	315.3	549.1	12800	08500	200.04	60.8
4-6"	11.82	17.87	0.78	1.57	202.4	216.5	15100	11600	108.52	85.5
6-8"	21.27	14.86	2.35	1.57	244.7	133.3	16100	11100	97.28	65.2
8-10"	14.60	12.68	5.49	Tr.	94.1	89.4	12400	11400	36.84	27.9
10-12"	5.59	13.35	1.57	Tr.	97.3	108.2	11100	13200	17.56	14.9
1-1½'	34.35	14.97	0.78	Tr.	106.7	90.9	11600	10300	10.7	8.3
1½-2'	34.23	12.22	0.78	0.78	116.1	70.6	13100	11900	14.9	5.5
2-2½'	24.01	14.06	1.57	Tr.	98.8	89.4	11900	11300	16.8	11.1
2½-3'	28.14	17.35	0.78	0.78	75.3	80.0	09400	11600	16.8	10.7
3-3½'	22.97	20.26	1.57	0.78	98.8	54.9	12300	11400	17.7	7.5
3½-4'	24.28	23.23	0.78	Tr.	119.2	61.2	11100	12800	17.2	17.2
4-4½'	28.67	45.98	Tr.	Tr.	73.7	90.9	13200	12400	9.9	13.2
4½-5'	38.37	44.15	Tr.	Tr.	64.3	87.5	12800	11900	13.2	9.9
5-5½'	36.04	43.18	3.13	Tr.	61.2	70.6	14200	10400	7.5	6.7
5½-6'	36.04	44.15	1.57	0.78	62.7	111.2	12400	10300	2.9	11.1

[a] on wet basis

Table 14 (continued). CHEMICAL ANALYSIS OF SOIL SAMPLES TAKEN FROM DAIRY BLWRS, NOVEMBER 1, 1972, IN PPM. TWO SAMPLES TAKEN, ONE FROM THE NORTH AND ONE FROM THE SOUTH BLWRS.

Depth	N as NO_3 [a]		N as NH_4 [a]		North Dairy BLWRS N as Org N		Total	C	P as PO_4	
	N	S	N	S	N	S	N	S	N	S
0-1"	30.75	201.20	5.49	9.42	1,322.5	1,490.3	11100	11000	307.2	229.0
1-2"	7.90	124.08		8.62		1,320.9	12800	12800	304.0	53.7
2-4"	4.61	64.57	1.57	2.35	272.9	346.7	10300	11400	35.2	42.5
4-6"	4.10	37.67	0.78	1.57	255.7	175.7	11100	10400	23.4	23.4
6-8"	3.42	24.19	2.35	Tr.	152.2	117.6	11600	11600	9.1	14.1
8-10"	3.32	18.68	Tr.	0.78	302.8	167.8	10800	12800	7.5	7.5
10-12"	4.98	17.85	1.57	Tr.	72.2	145.9	11300	13200	7.5	7.5
1-1½'	7.32	35.64	3.13	7.84	177.3	133.3	10300	11400	17.7	17.7
1½-2'	9.72	24.55	3.92	0.78	145.9	117.6	11100	13800	15.1	9.9
2-2½'	9.94	34.23	Tr.	0.78	166.3	120.8	11400	10300	13.7	7.7
2½-3'	20.41	49.32	1.57	0.78	169.4	133.3	8200	10800	10.7	9.1
3-3½'	36.04	51.36	1.57	0.78	180.4	119.2	7000	11100	14.1	9.1
3½-4'	28.93	40.19	5.49	2.35	163.2	108.2	9400	10300	14.9	9.1
4-4½'	36.41	41.01	0.78	Tr.	98.8	109.8	7400	9600	11.1	
4½-5'	31.03	47.71	5.49	0.78	152.2	117.8	9800	7100	11.1	9.9
5-5½'	13.60	32.26	1.57	0.78	106.7	106.7	7600	6200	14.9	9.9
5½-6'	22.72	9.61	0.78	0.78	120.8	125.5	8100	5800	5.9	10.3

[a] on wet basis

Table 14 (continued). CHEMICAL ANALYSIS OF SOIL SAMPLES TAKEN FROM DAIRY BLWRS, NOVEMBER 1, 1972 IN PPM. TWO SAMPLES TAKEN, ONE FROM THE NORTH AND ONE FROM THE SOUTH BLWRS.

Depth	South Dairy BLWRS									
	N as NO_3 [a]		N as NH_4 [a]		N as Org N		Total C		P as PO_4	
	N	S	N	S	N	S	N	S	N	S
0-1"	49.25	85.74	29.81	17.26	1,871.6	1,634.7	11000	18300	343.5	377.0
1-2"	42.96	46.25	5.49	3.13	999.3	520.8	9500	13200	81.1	90.6
2-4"	24.58	32.20	4.71	1.17	279.2	236.9	8100	11600	52.2	53.0
4-6"	20.13	36.85	3.92	1.57	183.5	175.7	4100	11100	33.4	35.2
6-8"	19.55	45.24	2.35	4.71	155.3	136.5	6100	11400	15.9	32.9
8-10"	17.43	33.66	Tr.	0.78	163.2	188.2	8300	9800	11.6	25.4
10-12"	15.09	21.83	0.78		166.3	133.3	4100	9600	14.1	11.6
1-1½'	18.91	19.65	3.92	0.78	149.0	139.6	3400	8500	10.7	14.5
1½-2'	16.91	20.64	1.57	2.35	258.8	294.9	3300	6100	15.0	12.8
2-2½'	14.93	21.51	1.57	1.57	134.9	294.9	6600	3900	16.8	16.8
2½-3'	24.10	26.86	1.57	3.13	180.4	192.9	4200	4100	15.9	15.9
3-3½'	44.44	36.41	Tr.	1.57	97.3	130.2	0800	2400	9.9	16.8
3½-4'	49.43	39.40	0.39	0.78	174.1	216.5	2300	2800	10.7	12.4
4-4½'	38.38	34.67		3.92	123.9	287.1	2600	2400	10.7	11.6
4½-5'	17.16	24.53	4.71	4.71	183.5	324.7	4100	4200	12.8	17.7
5-5½'	2.11	18.63	3.92	10.98	310.6	302.8	4200	4100	14.1	19.5
5½-6'	1.81	37.33	6.27	18.82	260.4	376.5	3500	2900	12.8	9.9

[a] on wet basis

Organic nitrogen increased in the 0-2 cm depth but decreased in the rest of the surface soil compared to what was originally there. There was an increase in organic nitrogen at greater depths. This increase amounted to a four-fold increase in several samples in the South Dairy.

Althoughthe accumulation of organic matter was only visable to a depth of 2 or 3 cm, there seemed to be an accumulation of carbon throughout the Swine BLWRS and a depletion of carbonate in the Dairy BLWRS. There should be more studies partitioning the organic and carbonate carbon in these soils.

The phosphate profiles that are developed in these soils are very interesting. Phosphate contents of the 0-5 cm soil is in excess of the maximum phosphate absorption indicating a precipitation of phosphate probably as dicalcium phosphate in these surface soils. This would be accomplished by the calcium in the waste or in the soil. Immediately below the zone of precipitation there is a zone of absorption on the soil complex which is saturated. This occurs 5 to 20 cm deep depending on which profile is considered. Below the zone of absorption the phosphate content is at the phosphate content of the original soil. These data are being used to develop a model of phosphate movement in soils.

MICROBIOLOGICAL ANALYSIS

Following the last application of waste in November of 1972 to the BLWRS at the North Swine site, soil cores were taken and analyzed for the population of total anaerobes, denitrifiers, coliforms, fecal coliforms and fecal streptococci. Data in Table 15 shows that the largest populations of both anaerobes and denitrifiers were in the surface soil, while the lowest populations were in the samples from the three anaerobic sites. It is probable that both

Table 15. NUMBERS OF ANAEROBES AND DENITRIFIERS FOUND IN NORTH SWINE BLWRS SOIL COLLECTED IN NOVEMBER 1972.

Sample site and depth	Microorganisms/g oven dry soil x 10^{-6}		
	Anaerobes	Denitrifiers	% of anaerobes as denitrifiers
Center, 0-5 cm	340	100 (190)[a]	30
Center, 10-15 cm	36	7.2	19
Center, near barrier[b]	42	11	26
West slope, near barrier[b]	36	3.6	11
East slope, near barrier[b]	3	1.1	33

[a] Population of microorganisms that reduced nitrate only to nitrite resulting in nitrite accumulation.

[b] Samples collected from anaerobic zone.

nitrification and denitrification were extensive at the surface, but within microenvironments where favorable conditions for each process were prevalent. The importance of such microenvironments is easily visualized if one considers the likelihood of oxygen gradients within aggregates or near surfaces of particles, the availability of organic residue, and the fact that denitrification is commonly a microaerophilic process. Though the denitrifier population was one to two orders of magnitude lower in the anaerobic zone, it does not mean that denitrification was not important in these zones. The denitrifier biomass was sufficient enough to carry out significant denitrification, providing nitrate and available organic materials were present. Also, the denitrifier population was not assayed in the soils on the slopes at the particular sites where additional organic matter was added; the populations could have been much higher in these locations. The denitrifiers appeared to represent an important, but not major, percentage of the total anaerobic population.

It was also noted that in the surface soil the population of organisms that reduced nitrate only as far as nitrite exceeded those that denitrified the nitrate to nitrogen gas. This may explain the higher levels of nitrite found in the effluent waters during the later periods of operation.

The population of pathogenic indicator organisms determined in the same soil samples is shown in Table 16. It can be readily seen that even in the surface soil the populations have dropped several orders of magnitude below those of the added waste. In all samples, except the surface soil, the coliform population was similar to that found for native soil coliforms present prior to the first waste application. If one considers the high volume of waste

Table 16. POPULATIONS OF PATHOGEN INDICATORS FOUND IN NORTH SWINE BLWRS SOIL COLLECTED IN NOVEMBER 1972.

Sample site and depth	Microorganisms/100 g oven dry soil[c]		
	Coliforms	Fecal coliforms	Fecal streptococci
In applied waste[a]	1.6×10^7	1.6×10^6	6.3×10^7
Soil before waste application	1,000	<3	50
Center, 0-2"	14,000	4	93,000
Center, 4-6"	1,100	4	240
Center, near barrier[b]	640	<3	9,300
West slope near barrier[b]	1,100	<3	9,300
East slope near barrier[b]	240	<3	240

[a] Values are organisms/100 ml of waste material applied.
[b] Samples collected from anerobic zone.
[c] Soils were 18.5, 7.5, 13, 15 and 14% water, respectively; therefore, on a liquid basis the population values would be nearly an order of magnitude higher.

applied and the filtering action of the soil which should retain most of the waste microorganisms at the surface, it is apparent that these pathogenic indicator organisms do not survive very long in this soil system. The drastic decline in the fecal coliforms indicates either that their survival in soil was minimal or that they are still present but have lost their ability to ferment lactose at 45° C after prolonged exposure to the soil environment.

The coliform composition of the swine and dairy waste added is shown in Table 17 and summarized in Table 18. The fecal coliforms comprised one-half of the total coliforms in the swine waste and about 40 percent in the dairy waste. There were more fecal streptococci relative to the coliforms in the dairy waste than in the swine waste. Most important, however, is the tremendous reduction in population of all indicator organisms in the BLWRS effluent water as shown in Table 19. The limited survivability and the filtering action of the soil appear to have prevented transport and contamination of the effluent water with these three indicator organisms. We must point out, however, that under overloaded (spring) or winter conditions, the indicator organisms did appear in the effluent water as shown in Table 20. Direct contamination of the effluent water by the runoff over the soil surface did occur on several occasions when the system was purposely being overloaded in order to establish the operating limits. Thus, we cannot be certain whether or not any of the contamination that occurred was via movement through the soil. It is apparent, however, that even when large populations of coliforms and fecal streptococci were found in the effluent, fecal coliforms were absent. As mentioned in relation to the discussion of Table 16, this could be due either to a loss of the ability of coliforms to ferment lactose at 45° C and/or to the growth of the coliforms (but not the fecal coliforms) in the terminal

Table 17. MICROBIOLOGICAL DETERMINATIONS OF THE WASTE APPLIED TO THE BLWRS.

Swine Waste			
Sample number	Coliform	Fecal Coli	Fecal Strept.
112	2.4×10^7	4.3×10^5	1.5×10^8
120	2.4×10^7	9.3×10^6	1.5×10^8
126	1.5×10^5	2.3×10^5	2.4×10^7
130	3.9×10^7	3.9×10^6	2.4×10^7
134	2.3×10^6	2.3×10^6	4.3×10^7
136	9.3×10^5	9.3×10^5	2.2×10^7

Dairy Waste			
Sample number	Coliform	Fecal Coli	Fecal Strept.
112	1.5×10^6	1.5×10^6	9.3×10^7
114	2.4×10^7	9.3×10^5	4.3×10^7
120	4.3×10^4	9.3×10^7	2.4×10^7
126	9.0×10^4	9.0×10^4	2.4×10^7
130	4.3×10^6	4.6×10^6	2.4×10^7
134	2.3×10^6	4.6×10^6	8.3×10^7
136	9.3×10^5	4.3×10^5	2.4×10^8

Table 18. MICROBIAL COMPOSITION OF WASTE AND EFFLUENT UNDER NORMAL OPERATING CONDITIONS.

Sample[a]	Organisms/100 ml (MPN)		
	Coliform	Fecal coli	Fecal streptococci
Swine waste added	1.6×10^7	0.8×10^7	6.3×10^7
Effluent from swine site	100	<3	200
Dairy waste added	2.8×10^6	1.1×10^6	7.7×10^7
Effluent from dairy site	50	<3	100

[a] Averages of all samples collected except effluent samples omitted following overloaded periods.

Table 19. MICROBIAL COMPOSITION OF THE EFFLUENT FROM THE EAST END OF THE NORTH SWINE BLWRS.

Sample Number	Organisms/100 ml (MPN) Coliform	Fecal Coli	Fecal Streptococci
8	2,400	3	0
10	23	3	4
12	39	4	23
14	43	3	15
18	21	3	3
20	240	3	7
22	240	3	23
24	240	3	3
26	7	3	43
28	43	3	24
30	240	3	240
32	2,400	3	240
34	24,000	3	4,600
38	110,000	9	23
40	1,100	3	23
42	43,000	4	240
44	70,000	3	23
46	93,000	3	93
48	75,000	3	23
50	240,000	3	23
52	9,300	3	23
78	150	3.10	9
80	240	4	23
82	700	3	430
84	240	93	2,400
86	430	93	2,400
88	2,400	2,300	2,300
90	240	36	93,000
92	700	3	2,400
94	430	0	4,300
98	240	9	240
100	93	443	430
102	3	3	43
104	93	3	3,900
106	240	4	430
108	240	4	43
110	43	9	43
112	240	15	93
114	240	9	23
118	240	3	93
120	240	3	23
122	460	3	240
124	9,500	3	210
126	0	3	93
130	1,200	3	93
134	240	3	43
136	3	3	23

Table 19 (continued). MICROBIAL COMPOSITION OF THE EFFLUENT FROM THE WEST END OF THE NORTH SWINE BLWRS.

Sample Number	Organisms/100 ml (MPN) Coliform	Fecal Coli	Fecal Streptococci
8	11,000	43	24,000
10	11,000,000,000	7,500	24,000,000
12	15,000	75	24,000
14	46,000	930	1,500
18	230	3	75
20	75	3	240
22	240	3	93
24	200,000	15	240
26	240,000	4	23
28	15,000	3	230
30	150	3	230
32	210	30	3
34	750	3	90
38	2,000	3	93
40	460	3	240
42	240,000	3	11,000
44	430,000	3	4,300
46	1,100,000	3	4,600
48	240,000	3	1,100
50	46,000	3	240
52	24,000	3	240
78	1,500	3	930
80	43,000	3	4,300
82	43,000	3	9,300
84	230,000	3	1,500
86	24,000	3	2,400
88	1,500	3	2,300
90	93,000	3	700
92	23,000	3	2,100
94	4,300	0	1,500
98	2	0	240
100	150	3	430
102	3	3	930
104	3	3	43
106	9	3	24
108	23	4	24
110	15	3	430
112	4	4	240
114	3	3	430
118	93	3	2,400
120	43	3	240
122	23	3	1,100
124	93	3	930
126	240	3	43
130	240	3	23
134	23	3	93
136	23	3	93

Table 19 (continued). MICROBIAL COMPOSITION OF THE EFFLUENT FROM THE EAST END OF THE SOUTH SWINE BLWRS .

Sample Number	Organisms/100 ml (MPN) Coliform	Fecal Coli	Fecal Streptococci
3	43	3	240
4	21	3	23
6	1,100	3	43
8	200,000	75	39
10	24,000	23	23
12	2,400	3	240
20	3,900	3	240
22	43,000	3	3,900
24	93	3	43
26	43	3	23
28	240	3	43
30	23	3	64
32	200	3	43
40	23	3	23
42	93	3	23
44	40	3	23
46	240	3	23
48	93	3	23
50	43	3	93
52	43	3	23
78	70	3	240
80	43	3	240
82	43	3	240
84	3	0	93
86	23	3	240
94	9	0	43
96	210	3	240
98	93	3	240
102	43	3	9,300
104	430	460	930
106	23	3	9
108	23	4	43
110	23	3	230,000
112	7	3	43
114	93	3	39
118	93	3	43
122	93	3	23
124	240	3	93
126	43	3	23
130	240	3	93
134	4	3	23

Table 19 (continued). MICROBIAL COMPOSITION OF THE EFFLUENT FROM THE WEST END OF THE SOUTH SWINE BLWRS.

Sample Number	Organisms/100 ml (MPN) Coliform	Fecal Coli	Fecal Streptococci
2	460,000	3	23
3	1,100	9	23
6	43	43	120
8	21,000,000	46,000	240,000,000
10	7,500	4	23
12	150	4	15
20	240	3	150
22	75	3	93
24	75	4	23
26	23	3	9
28	43	3	23
30	39	3	23
32	93	3	23
40	7	3	23
42	240	3	23
44	1,100	3	23
46	240	3	23
48	93	3	23
50	460	3	23
52	430	3	23
78	15	3	23
80	43	3	43
82	43	3	93
84	23	3	2,400
86	23	3	230
94	43	0	240
96	44	4	93
98	75	3	430
102	240	3	930
104	240	3	15,000
106	11	3	23
108	93	3	23
110	23	3	4
112	240	23	110
114	930	3	23
118	93	3	43
120	93	3	240
122	93	3	23
124	93	3	93
126	93	3	4
130	43	3	3
134	240	3	23
136	23	3	23

Table 19 (continued). MICROBIAL COMPOSITION OF THE EFFLUENT FROM THE EAST END OF THE NORTH DAIRY BLWRS .

Sample Number	Organisms/100 ml (MPN) Coliform	Fecal Coli	Fecal Streptococci
30	4	3	4
32	23	3	43
48	93	3	93
50	9	3	23
52	23	3	23
78	23	3	7
80	430	3	3
82	93	3	43
84	23	3	23
86	93	3	150
88	3	0	23
100	3	0	23
106	3	3	4
108	3	3	9
110	3	3	23
112	3	3	23
114	3	3	7
118	3	3	4
120	3	3	6
122	4	3	23
124	3	3	23
126	3	3	4
130	23	3	23
134	15	3	3
136	9	3	3

Table 19 (continued). MICROBIAL COMPOSITION OF THE EFFLUENT FROM THE WEST END OF THE NORTH DAIRY BLWRS.

Sample Number	Organisms/100 ml (MPN) Coliform	Fecal Coli	Fecal Streptococci
30	75	3	43
32	93	3	93
48	2,400	3	43,000
50	4,600	3	9,300
52	390	3	4.30
78	93	3	930
80	93	3	430
82	150	3	24,000
84	93	3	2,400
86	0	3	4,300
88	3	0	930
100	150	4	240
106	3	3	240
108	3	4	23
110	3	3	43
112	4	3	23
114	3	3	2
118	150	3	21
120	15	3	93
122	9	3	1,100
124	15	3	150
126	9	3	23
130	3	3	4
134	4	3	23
136	6	3	1,100

Table 19 (continued). MICROBIAL COMPOSITION OF THE EFFLUENT FROM THE EAST END OF THE SOUTH DAIRY BLWRS.

Sample Number	Organisms/100 ml (MPN) Coliform	Fecal Coli	Fecal Streptococci
4	21	3	3
6	43	3	9
10	15	3	5
12	20	3	43
14	11	3	7
18	9	3	3
20	9	3	3
22	4	3	4
24	3	3	7
26	9	3	23
30	3	3	23
104	9	3	23
106	3	3	9
108	3	3	23
110	3	3	43
112	4	4	23
114	3	3	40
118	3	3	23
120	3	3	9
122	4	3	23
124	3	3	43
126	23	3	3
130	23.60	3	3
134	23	3	2
136	9	3	23

Table 19 (continued). MICROBIAL COMPOSITION OF THE EFFLUENT FROM THE WEST END OF THE SOUTH DAIRY BLWRS.

Sample Number	Organisms/100 ml (MPN) Coliform	Fecal Coli	Fecal Streptococci
4	21	3	3
6	150	3	23
10	43	3	4
12	3	3	23
14	43	3	23
18	4	3	3
20	3	3	9
22	3	3	23
24	3	3	23
26	4	3	23
30	23	3	23
34	93	3	430
40	9	0	23
44	3	0	9
46	3	0	3
48	3	3	23
50	3	3	9
52	3	3	14
78	43	3	3
80	9	3	3
82	0	3	43
84	9	3	7
86	23	3	9
88	3	0	3
90	3	0	9
92	3	0	93
94	0	0	43
96	0	0	240
98	3	0	23
104	3	3	240
106	3	3	23
108	3	3	23
110	3	3	23
112	4	4	240
118	0	0	240
120	3	3	23
121	3	3	23
122	3	3	93
124	3	3	23
126	3	3	23
128	0	6,666	66,600
134	3	0	3

Table 20. MICROBIAL COMPOSITION OF EFFLUENT FROM SWINE BLWRS WHEN SYSTEM WAS OVERLOADED .

Sample	Organisms/100 ml (MPN) Coliform	Fecal coli	Fecal streptococci
Waste added	1.6×10^7	0.8×10^7	6.3×10^7
Effluent A-winter[a]	3.4×10^4	<3	60
Effluent A-spring	7.4×10^2	420	5.9×10^4
Effluent B-winter	2.6×10^5	<3	2.7×10^2
Effluent B-spring	6.3×10^4	<3	1.7×10^3

[a] A = side with no carbon added; B = side with corn added; winter, Nov. 30 - Jan. 18; spring, April 18 - June 13.

portions of the system. The former explanation is supported by the fact that the fecal streptococci were also present in the effluent (assuming that they, like the fecal coliforms, would be less likely to proliferate in the effluent). The latter explanation is supported by the fact that the side with the organic matter contained more coliforms in the effluent than the side without. The BOD analysis suggested that the corn-containing side was leaking available organic matter which could have supported growth of coliforms.

SOIL ENVIRONMENTAL STUDIES

The soil environmental studies included soil temperature, oxygen diffusion rate, oxidation-reduction potentials and soil gas analyses. The amount of data collected from these studies is so voluminous that only parts of the data are reported for the purpose of illustrating the influence of the environment of the BLWRS on the performance of the BLWRS in the renovation of waste.

Soil temperatures reported in Table 21 show that by November 1 the soil temperatures in the anaerobic zone reached 10° C or lower. At the same time the concentration of nitrate in the effluents increased greatly probably due to the reduced efficiency of the denitrifiers at this temperature and below. This reduction in denitrification capacity is a reason for not attempting to overrate the BLWRS during cold weather even if spreading and infiltration of wastewater could be achieved.

Oxidation-reduction potential measurements for part of the summer of 1972 are shown in Table 22. During the early part of the spring and summer the North BLWRS had been loaded very heavily with waste. This caused the surface soil down to 30 cm to have some negative redox potentials. This could cause denitrification in this portion of the BLWRS. In contrast, the South BLWRS

Table 21. AIR AND SOIL TEMPERATURES ON BLWRS - DEGREES CENTIGRADE.

Position	In air	At surface	At depths in soil			
			30 cm	60 cm	90 cm	150 cm
Swine BLWRS North						
8-4-72	25	25	19	19	19	16
9-15-72	22	18	17	17	18	16
9-20-72	21	16	17	17	17	16
9-28-72	16	18	15	16	17	16
10-12-72	17	13	14	15	15	15
10-19-72	2	1	5	10	11	13
10-25-72	5	4	8	9	10	12
11- 1-72	10	5	7	8	9	11
11- 9-72	8	6	7	8	9	11
12-21-72	2	2	3	3	6	9
Dairy BLWRS North						
8-4-72	29	26	18	18	18	16
9-15-72	22	18	16	17	17	16
9-20-72	19	17	18	18	17	17
9-28-72	16	18	16	16	17	16
10-12-72	17	13	15	16	15	15
10-19-72	2	2	5	9	12	13
10-24-72	13	6	6	8	9	11
11- 1-72	11	11	5	8	9	10
11- 9-72	11	8	6	7	8	9
12-21-72	2	3	3	3	6	8

Table 22. OXIDATION - REDUCTION POTENTIAL MEASUREMENTS MADE IN THE SWINE BLWRS DURING THE SUMMER OF 1972 IN MILLIVOLTS.

	North BLWRS				South BLWRS			
Date	6/28	7/5	7/28	8/1	6/28	7/5	7/28	8/1
Depth								
15 cm	100	60	230	90	185	160	130	210
	-70	-60	70	15	218	180	140	180
	110	60	120	-90				
30 cm	91	-460	-200	-440	180	190	240	250
	80		-320	-440	260	260		
90 cm	38		250	220				
	50		190	210				
120 cm	-62	40	205	210	20	120	165	230
	-70	0	160	155	160	170	180	230
150 cm	-120		-60	-120	-150	-140	-20	-120
	-140		15	-20	-170	-180	-40	-40
180 cm	-160	-150	-30	-50	-160	-170	-105	-80
	-140	-60	-42	-40	-100	-130	-60	-40

was less heavily loaded and had positive redox potentials until the water table and anaerobic zone was reached at 150 cm deep. Even though the North BLWRS had negative potentials at depths to 30 cm,there was an aerobic zone between the surface and the deep anaerobic zone at the bottom. This zone might be considered to be a zone for the oxidation of reduced substances in percolating water but the fact that there was considerable ammonium nitrogen in the effluent at this time indicates that it was not sufficient to oxidize or there was not sufficient time to convert ammonium to nitrate.

Some oxygen diffusion rate data is presented in Table 23 to illustrate how these rates changed with time and varied over the surface and at depth in the BLWRS depending on the waste loading schedule and rates. When oxygen diffusion rates are above 35 they are adequate for aerobic respiration of plant roots and microbes. In the BLWRS soils the oxygen diffusion rates often increased with depth which is not normal for the usual static soil systems but is due to the large amount of organic matter and biological activity in the surface and the fact that the soil surface is often saturated for periods during waste loading.

The differences in oxygen diffusion rates on the Swine North July 5 and 6 are due to the fact that this BLWRS had been loaded for a week up to the 5th and then in one day the BLWRS drained sufficiently to go from an oxygen deficit to a condition of sufficient oxygen.

The data reported for July 21 shows that there is variation from place to place on the top of the BLWRS during loading with some areas deficient and some sufficient depending on micro relief. This data also shows that the

Table 23. AVERAGE OXYGEN DIFFUSION RATES ON THE BLWRS AT SEVERAL DEPTHS AND ON VARIOUS DATES IN 1972.

		Depth-cm		
		2.5	7.5	15
			O.D.R.	
Swine North	7/5	32	32	36
Swine North	7/6	46	54	55
Swine North	7/21	30	48	60
		24	23	24
		25	27	24
Dairy South	7/21	59	45	57
		32	25	36

Swine North which had been loaded very heavily was generally deficient over the surface in contrast to the Dairy South which had a lesser loading rate.

Soil gas composition in the Swine BLWRS at various depths during the period of time are given in Table 24. The most interesting observation is the fact that gaseous composition of the BLWRS soils change so rapidly after the application of waste commences or ceases. The extremely low values of oxygen concentration and high values of carbon dioxide that are developed with waste application are usually not encountered in normal soils.

Prior to the time period reported the North Swine BLWRS had been loaded heavily for two weeks and during the period continued with alternate three days resting and three days loading. The South BLWRS had just the opposite cycle. The North BLWRS had extremely low oxygen concentration, 1.4% being the lowest, and high carbon dioxide concentrations, 18.5% being the highest. This was due to the heavy loading prior to this period. Even during the three-day rest periods there was only minor recovery. After the application ceased on August 1 the North BLWRS did almost recover within the next four days. The South BLWRS, in contrast, had not been heavily loaded and did not have the residue of waste at the surface nor was it as wet. The oxygen and carbon dioxide concentrations on this BLWRS responded to the three-day application and three-day rest periods very rapidly and almost recovered to a normal condition during the rest period. The concentrations never reached the extremes of those on the heavily loaded BLWRS.

This environmental data can help explain some of the problems that develop when the BLWRS are overloaded and how these are related to less efficient

Table 24. PERCENT OXYGEN AND CARBON DIOXIDE AT VARIOUS DEPTHS IN THE SWINE BLWRS FOR A PERIOD DURING THE SUMMER OF 1972.

Date	7/24	7/25	7/27	7/28	7/29	7/30	7/31	8/1	8/3	8/4
North Swine BLWRS										
Percent oxygen										
Depth-cm										
7.5	2.97	4.55	4.81	1.40	2.47	4.63	3.45	4.60	4.50	19.1
12.5	3.55	4.40	8.20	2.16	3.37	5.98	3.60	6.32	5.60	19.0
25	2.99	3.57	8.73	1.64	5.26	6.30	5.84	7.81	4.70	17.5
37.5	4.02	4.10	9.69	1.76	6.00	7.40	4.00	8.25	5.20	16.2
60	6.63	3.64	8.95	2.52			8.07	8.20	5.30	17.1
90	7.33	6.50	8.50	3.48			8.48	8.32		16.9
Percent carbondioxide										
7.5	16.0	21.0	15.5	15.7	18.5	17.5	17.0	16.3	14.4	2.70
12.5	10.9	13.8	11.7	16.1	17.1	16.6	13.3	14.1	15.1	3.11
25	14.7	14.9	11.5	16.1	16.3	15.6	13.0	14.0	15.8	4.10
37.5	14.7	13.8	10.9	18.1	14.1	13.8	12.5	13.0	15.2	5.03
60	13.5	13.8	11.4	16.2			11.1	13.6		5.14
90	9.89	12.0	11.9	18.1			10.2	12.3		5.32
South Swine BLWRS										
Percent oxygen										
Depth-cm										
7.5	20.6	21.0	11.6	4.99	20.3	21.0	21.8	13.3	4.08	21.2
12.5	19.3	21.2	12.5	7.04	17.1	19.3	21.2	16.2	12.3	18.4
25		20.6	15.4	8.90	15.6	18.8	20.1	18.4	11.9	17.0
37.5	19.8	20.0	16.2	10.6	15.0	18.5	18.2	20.3	15.3	15.4
60	18.4	19.7	17.3	13.7			18.6	21.7	11.7	14.3
90	18.3	19.8	18.1	13.9			17.0	22.1	13.4	
Percent carbondioxide										
7.5	1.75	1.38	10.1	16.4	2.92	1.53	1.11	8.92	15.4	2.90
12.5	2.38	2.11	9.64	13.7	5.28	2.54	1.77	6.05	9.14	3.94
25		2.92	6.96	12.0	6.75	3.64	3.43	4.01	8.31	5.22
37.5	4.05	3.40	5.74	10.4	7.33	4.46	4.52	2.94	7.08	5.90
60	5.27	4.75	5.20	6.16			3.84	1.71	7.34	6.19
90	6.15	3.37	4.66	5.55			5.04	2.21	6.10	

renovation of the waste. It seems reasonable that shorter cycles of three days to a week would be best to maintain the aerobic zone for maximum decomposition of the organic matter and oxidation of nitrogen to the nitrate form. Actually, observations of the conditions on the surface of the BLWRS such as the ponding on the surface that persists for a long period after the application ceases is a good visual means of determining when the application rate should be reduced or the BLWRS allowed to rest.

SECTION VIII

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SELECTED WATER RESOURCES ABSTRACTS

INPUT TRANSACTION FORM

1. Report No. 2.

W

SOIL MODIFICATION FOR DENITRIFICATION AND PHOSPHATE REDUCTION OF FEEDLOT WASTE

5. Report Date

6.

8. Performing Organization Report No.

Erickson, A. E., et al.

Crop and Soil Sciences Department
Michigan State University
East Lansing, Michigan 48824

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13040 FYK

13. Type of Report and Period Covered

12. Sponsoring Organization **U. S. Environmental Protection Agency**

Environmental Protection Agency report number, EPA-660/2-74-057, June 1974

The efficiency of pilot-size Barriered Landscape Water Renovation Systems (BLWRS) to renovate flushed livestock waste was studied. The BLWRS is a modified permeable soil that has an aerobic zone for the filtering and oxidation of the waste and an anaerobic zone to which an energy source is added to create an environment for denitrification.

Two pairs of BLWRS 0.008 ha. in size were constructed using a polyvinyl barrier to create the anaerobic zone and contain the effluent. Flush waste from swine or dairy cattle were applied on each pair of BLWRS. The waste effluents and BLWRS soil were periodically analyzed for nutrients, oxygen demand and pathogens.

At manure loading rates of up to 122 t/ha. swine waste and 93 t/ha. of dairy waste, the BLWRS had an efficiency of 80% and 97% for nitrogen renovation, greater than 99% for phosphate and 93% for carbon. The oxygen demand dropped 50- to 100-fold. Under normal operating conditions, the pathogenic indicator organisms did not appear in the effluent.

The BLWRS has been shown to be an efficient system for renovating large quantities of livestock waste and should be tested on a commerical scale with continuous monitoring.

17a Descriptors

Hogs, Dairy industries, Denitrification, Aerobic treatment, Anaerobic conditions, Soil treatment, Waste treatment

17b Identifiers

Barriered landscape water renovation systems, Organic matter decomposition, Phosphate fixation

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